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DEPARTMENT OF THE ARMY FIELD MANUAL

FIELD ARTILLERY COMMUNICATIONS

HEADQUARTERS, DEPARTMENT OF THE ARMY

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FIELD ARTILLERY COMMUNICATIONS

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CHAPTER 1

INTRODUCTION

1. Purpose and Scope

This manual is a guide for commanders, staff officers, and personnel concerned with field artillery communication. The purpose is to provide, in a detailed but nontechnical explanation, the basic knowledge required in the application and employment of efficient field artillery communication. Throughout this manual the term "artillery" means "field artillery."

2. Application

a. Unless otherwise specified, this, manual is equally applicable to nuclear or to nonnuclear warfare.

b. Principles in this manual are also generally applicable to the new divisional organizations (ROAD). Upon finalization of the communication systems for ROAD, appropriate changes to this manual will be distributed.

c. This manual should be used in conjunction with applicable field manuals and technical manuals. Appropriate references are indicated throughout this manual and in appendix I.

3. Changes or Comments

Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be 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 forwarded direct to Commandant, U. S. Army Artillery and Missile School, Fort Sill, Okla.

4. References

Appropriate publications pertaining to communications are listed in appendix I.

5. Definitions

A glossary of terms commonly used in artillery communications is given in appendix II.

6. Symbols

A list of abbreviations and symbols used in this manual are shown in appendix III.

CHAPTER 2

GENERAL

Section I. GENERAL

7. Introduction

The ability of artillery to render effective fire support depends on efficient communication. The artillery commander must rely on his communication system in controlling elements of his command, in gathering information and distributing intelligence, and in coordinating the fires of his units. Responsibility for communication rests with the commander at each echelon. The commander exercises this responsibility through his staff communication officer, who prepares communication plans and orders and directs and supervises the installation, operation, and maintenance of the communication system. The training of organic personnel in the use of the various communication means is also the responsibility of the communication officer. In addition, he supervises communication security within the unit, assumes responsibility for the on-line and off-line cryptographic equipment, and supervises the electronic countermeasure activities of the unit.

8. Area Communication Systems

The area communication system, installed by the Signal Corps, is used to augment artillery communication systems and as an alternate means of communication. In short, the area system offers a means for expeditiously establishing a wire network between artillery elements when the length of lines required is beyond the capabilities of the units to establish or maintain. When the primary use of the area system is the handling of logistic and administrative traffic, artillery units sometimes use the area system on a common-user basis. However when the artillery uses the area system as a means for transmitting fire control traffic, sole-user circuits are provided. The artillery communication officer must be provided with early information of impending displacements in order to complete the necessary liaison with the agency responsible for displacing the area system stations. For detailed information on operation of area systems, see appropriate field manuals in the 11-series.

9. Priority of Installation

In the establishment of artillery communication systems, priority of installation is given to elements of the system concerned with fire support and fire direction. During movements and in the initial phase of position occupation, reliance is placed on radio, but wire circuits are installed to parallel radio channels as soon as the situation permits.

10. Communication Planning

Communication planning is a continuous operation which begins with the commander's estimate of the situation. This phase of planning is conducted concurrently with operational planning, and is coordinated with the planning of the other staff officers. Communication planning follows the normal phases of staff planning described in FM 101–5. Communication plans include all details necessary to clarify and coordinate the signal activities of the affected units, such as wire recovery, radio retransmission, and sole-user circuits.

Section II. COMMUNICATION IN ASSEMBLY AREAS

11. General

In assembly areas, all echelons receive information concerning contemplated operations and make their plans accordingly. Staff conferences are held for coordination of effort. Command posts are organized so that communication and personnel requirements may be held to a minimum.

12. Tactical Application of Communication

During the occupation of the concentrated area, communication is provided as follows:

a. Message centers are established and operated by each headquarters. Messengers are stationed at each message center and scheduled messenger service may be provided if the volume of traffic warrants.

b. Wire installations are held to a minimum within the concentration area.

c. Radio stations generally are silenced or restricted except for warning nets. All radio sets are serviced and tested on channels prescribed for the planned operation by the SOI and SSI.

d. All signal equipment is inspected for operating condition and adequacy. Equipment shortages are replenished.

e. Training is continued and intensified. Emphasis is placed on requirements for the particular operation being planned.

f. Prearranged message codes are prepared and distributed.

Section III. COMMUNICATION DURING MARCHES AND HALTS

13. Communication During Marches

a. During marches, communication facilities are used for column control and for contact with reconnaissance and security parties and with supported and higher units.

b. A march message center is established by each headquarters in one of the leading vehicles of the column. Normally, messengers are used between march units and within groups and serials of individual march units.

c. Wire communication is impractical; however, wire teams may precede the column to the future area to install wire communications, remain behind to recover wire from the old area, or both.

d. If radio communication is not prohibited for security reasons, each artillery unit operates on its command/fire direction channel. All vehicular radios operate on this channel for rapid dissemination of information and orders. Battalion commanders and separate battery commanders operate also in the next higher headquarters command/fire direction net, FM. Divisional light aircraft and artillery reconnaissance and security parties maintain radio communication with the marching columns.

14. Communication During Halts

During temporary halts, communication is maintained as during the march. The use of messengers and radio (if not restricted) is continued.

Section IV. COMMUNICATION DURING THE ATTACK, REORGANIZATION, AND PURSUIT

15. General

a. When the supported force is committed, the artillery must be ready to provide continuous support. Meteorological messages, warning orders, and other preparatory information are disseminated to the units as rapidly as possible. Consequently, the communication system must be developed rapidly to accomplish these missions.

b. In certain stages of an engagement, control of the artillery may be decentralized. To give the force commander a mass of firepower with which to influence the action, however, centralized control is resumed as soon as the situation permits.

16. Command Posts

To effect the necessary centralization of command, artillery command posts are established to coordinate all the artillery fires of the force. Continuous communication is maintained between the command posts of the artillery and of the supported units. Initial installations may be expanded into more elaborate systems. For example, during the preparation for the attack of an organized position, time is usually available to permit a more detailed communications installation.

17. Displacement of Command Posts

a. In making a displacement, using wire communication, the general plan indicated in FM

6–20–1 is followed. Regardless of whether or not displacement is accomplished by echelon, communications must be maintained with the command post of the supported unit throughout.

b. Since displacement by echelon presents many difficulties, communication plans made before the attack include the possibility that all means of communication other than radio may be temporarily impractical. The primary consideration in this situation is that communication must be maintained between the forward and rear echelons, as well as with the forward observers and liaison officers. Ordinarily, displacing echelons of an artillery battalion use the battalion command/fire direction channel.

18. Tactical Application of Communication During the Attack

The artillery commander prescribes to what extent the wire and radio systems of the units are to be developed in any tactical situation. Initially, communication is by radio and messenger, but wire communication is provided as rapidly as possible. Although speed is essential during the development of the attack, communication security is vital. Since radio traffic is a source of information to the enemy, it is held to a minimum. Messages sent by radio are brief, and the rules of communication security are observed. (See ch. 5, and ACP 122-series, and FM 32–5.) Maximum use is made of authorized codes. (See ch. 14 for typical wire systems and radio nets.)

19. Communication During Reorganization

a. After an attack has reached its objective or has been stopped short of the objective, the force commander may decide to continue the attack, to withdraw, or to defend. In any event, forces are regrouped to fit the new plan of action, and communication systems are reorganized and altered to fit the new plans.

b. The reorganization phase is critical for artillery communication. Artillery support is continuous, to protect the supported units and to assist in stopping counterattacks. Artillery communication officers maintain existing communication systems and prepare to extend or modify them as soon as a new decision is made. Radio nets continue in operation.

c. In preparation for a displacement, communication officers insure that signal equipment is salvaged, serviced, and repaired, and they assist in the redistribution of equipment within the units.

20. Communication During Pursuit

a. The artillery is usually attached to the unit making the pursuit. The maintenance of communication is more difficult because of the speed of the operation and increased distances between units. Reliance must be placed on radio communication.

b. Rapid movement requires rapid and frequent displacement. Maintenance of contact between units and between a unit's advance and rear command posts requires message center personnel, messengers, other communication personnel, and appropriate signal equipment at each installation.

c. When an artillery unit displaces by echelon, the first echelon includes radio sets for communication in command and fire direction radio nets. Messengers with transportation are maintained as needed at message centers. Aircraft may be used for drop and pickup service.

Section V. COMMUNICATION DURING DEFENSE

21. General

a. In a prepared defense, enough time is available for the planning and installation of a complete wire system. Radio may not be utilized initially, but all nets are established and operators maintain listening watch. Wire communication is provided for liaison officers and forward observers. Duplicate circuits should be established, using different wire routes if possible. Wire is installed to alternate positions to facilitate early communication if these positions are occupied.

b. Particular attention is given to the maintenance and improvement of wire circuits. Wire

routes that afford maximum natural cover and concealment are selected regardless of distance. Wire is installed with great care, and improvement of the wire system is continuous.

22. Lateral Communication

Lateral circuits should be established between units to provide coordination and alternate circuits for emergencies. Authority to use commercial or other circuits already in existence is obtained from the division signal officer.

Section VI. COMMUNICATION DURING RETROGRADE MOVEMENTS

23. General

Communication procedures during retrograde movements generally are similar to those used in forward displacements. The artillery communication officer obtains information regarding routes of withdrawal on which he bases the withdrawal communication plan.

24. Planning Communication

The communication officer is prepared to submit a plan for using existing communication facilities to the best advantage during the withdrawal. On receipt of the necessary information for the plan of withdrawal, he plans the communication system to be used by subordinate units. The plans include—

a. Provisions for strict regulation of radio operation which may include silencing certain stations or establishing dummy stations, as needed, for deception.

b. A plan for the most effective use of existing wire circuits.

25. Communication During Displacements

a. Communication personnel continue the operation of existing systems while preparing for displacement.

b. If the situation permits, wire not required by units is recovered. When time does not permit complete recovery, the abandoned wire lines should be cut in several places.

c. Radio listening silence is normally maintained during retrograde movements. For the purposes of deception and with approval of higher headquarters, the normal level of radio traffic may be maintained at the old position.

d. All practical means of communication are used. Existing wire circuits between the old and new positions are used. Messenger service is available at all times.

CHAPTER 3

DUTIES OF COMMUNICATION PERSONNEL

26. General

The tables of organization and equipment (TOE), from the highest echelon of artillery to battery level, authorizes communication personnel whose primary duties are to install, operate, and maintain communication systems. With few exceptions, artillery units of battalion-size and larger are authorized a communication officer as a member of the commander's special staff.

27. Communication Platoons

a. General. Each artillery battalion and higher headquarters is authorized a communication platoon organized as shown in figure 1.

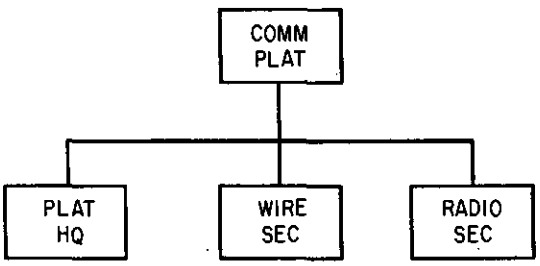


Figure 1. Organization of the communication platoon.

b. Platoon Headquarters. The communication platoon headquarters generally consists of the assistant communication officer, who commands the platoon; the communication chief radio mechanics, an agent and the message center personnel. In units that are not authorized an assistant communication officer, the communication chief is in charge of the platoon. In units that are not authorized a communication officer, the communication platoon commander has a dual function as communication officer and platoon commander.

c. Wire Section. The wire section includes a section chief, wire teams, and switchboard operators, the number depending on the type of unit.

d. Radio Section. The radio section includes a section chief and sufficient radio operators and radio teletypewriter operators to operate the equipment organic to the section.

28. Communication Personnel in Other Sections

In some units, radio and radio teletypewriter operators are assigned to sections other than the communication platoon. Although each operator functions in the section to which he is assigned, the radio chief should supervise his training and performance.

29. Battery Communication Sections

The battery communication section generally consists of a communication chief, wire teams, and switchboard operators, the number depending on the type of unit.

30. Duties of the Communication Officer

a. The communication officer is a member of the commander's special staff. Although staff officers may prepare and transmit orders to subordinate units, they do so only as representatives of, and in the name of, the commander. The scope of this authority is determined by the commander's policy.

b. As a representative of the commander, the communication officer has the following responsibilities:

(1) *Reconnaissance*—Assists the S3 and the headquarters battery commander in selecting the location of the command post and its major elements.

(2) *Plans*—Plans the communication system within the unit with attached and supported units; plans displacements.

(3) *Direction and supervision*—Directs and supervises the installation, operation, and maintenance of the communication system of the unit.

(4) *Administration*—

(*a*) Prepares communication SOP, prearranged message codes, and the communication portions of orders and extracts pertinent portions of the SOI.

(*b*) Submits reports, line route maps, etc., to higher headquarters.
(*c*) Advises the commander on important communication matters.
(*d*) Advises the S4 on supply matters pertaining to signal equipment.

(5) *Liaison*—Contacts communication officer of superior, subordinate, reinforced, and adjacent units to coordinate and to improve communication.

(6) *Training*—Plans and supervises all communication training in the unit.

(7) *Inspections*—Conducts technical inspections of signal equipment.

31. Duties of Assistant Communication Officer

The duties of the assistant communication officer are as follows:

a. General—Assists the communication officer in all his functions.

b. Direction and Supervision—Exercises direct supervision over the installation, operation, and maintenance of all communication installed by headquarters battery.

c. Administration—As executive officer of headquarters battery, assists headquarters battery commander in battery administration.

d. Training—Conducts the training of the communication platoon.

32. Relationship Between Headquarters Battery Commander, Communication Officer, and Assistant Communication Officer

a. The assistant communication officer acts as assistant to both the communication officer and the headquarters battery commander.

b. The headquarters battery commander and the communication officer must cooperate on such matters as—

(1) Assignment of communication personnel.
(2) Training of communication personnel.
(3) Supply and maintenance of equipment.
(4) Selection of installations within the command post.
(5) Use of communication personnel.

33. Duties of Communication Chief

a. Takes personal charge of the installation of all communication means established by his unit and supervises its operation and maintenance.

b. Assists in the conduct of instruction and in the training of the communication platoon or section.

c. Keeps himself informed of all communication aspects of artillery operations.

d. When appropriate, performs duties of assistant communication officer.

e. Coordinates all communication within the command post.

f. Supervises message center operations.

g. Supervises and coordinates, under the direction of the communication officer, organizational maintenance of signal equipment within the battalion.

34. Duties of Chief Message Clerk and/or Senior Message Clerk (Battalion and Higher Headquarters)

a. Installs and operates message center.

b. Keeps message center records.

c. Trains and supervises message clerk and messengers.

d. Processes messages delivered to message center.

e. Encodes and decodes messages.

f. Enciphers and deciphers messages.

g. Plans and reconnoiters wire routes.

35. Duties of Message Clerk (Code Clerk)

Performs all duties required of senior message clerk.

36. Duties of Wire Section Chief

a. Reconnoiters wire routes.

b. Prepares line route map.

c. Takes personal charge of the installation, operation, and maintenance of all wire installed by the wire section.

d. Trains wire section personnel.

e. Replaces communication chief in his absence.

f. Supervises and coordinates organizational maintenance of wire equipment within the unit.

g. Performs other duties as required.

37. Duties of Wire Team Chief

a. Selects wire routes.

b. Assists in the preparation of line route maps.

c. Installs and maintains wire lines.

d. Trains wiremen and telephone and switchboard operators.

e. Performs other duties as required.

38. Radio Section Chief

a. Selects location of the elements of the radio and panel station.

b. Organizes the radio system at the command post.

c. Trains members of the radio section.

d. Reports to message center any change in the status of radio communication.

e. Assists communication chief in supervising organizational maintenance of radio equipment with the unit.

f. Performs other duties as required.

CHAPTER 4

MEANS AND PRINCIPLES OF COMMUNICATION

Section I. MEANS OF COMMUNICATION

39. General

Within field artillery units, the means of communication available are radio, wire, messenger, visual, and sound. The composition of the means in each unit depends on the personnel, equipment, and transportation provided by its table of organization and equipment and by the unit or higher commander. The various means of communication have different capabilities and limitations and, consequently, they are employed so that they complement each other and so that total dependence is not placed upon any one means. The reliability of communication systems is greatly increased by the use of all the means available. However, the failure of one, or all, available electronic means does not relieve a commander of his communication responsibility. In brief, the means employed in a given situation are generally those that provide the maximum reliability, flexibility, security, and speed with a minimum of effort and materiel.

40. Wire Communication

a. General. Wire is one of the artillery's principal means of communication and includes the use of field telephone cables, cable assemblies, wire laying and recovery equipment, battery-operated and sound-powered telephones, switchboards, teletypewriters, and associated equipment. It affords person-to-person conversation with break-in operation (capability of interrupting the conversation). Wire generally affords more security than radio communication, but the security of classified information is never assured when transmitted in the clear. The decision to establish wire communication depends on the need for it, the time available to install and use it, and the capability to maintain it. The supply of wire on hand, the expected resupply, and future needs are also considered. Wire communication can be used over most terrain and in most situations. Tables of organization and equipment provide units with equipment to install and maintain their wire communication systems. For the employment of wire communication in various units, see chapter 14.

b. Range. Using a battery-operated telephone, the planning range of field wire circuits is from 22 to 35 kilometers (14 to 22 miles). Using sound-powered telephones, the range is 5 to 16 kilometers (4 to 10 miles). In short, the range of wire communication varies, depending principally on the weather and the condition of the wire. Wet weather, poor splices, and damaged insulation reduce the range appreciably.

c. Time Required for Installation. More time is required to install wire communication than for any other means, depending mainly on the length of the line and the method of laying (vehicle, aircraft, or man-pack) other factors to be considered in estimating the installation time are the personnel available, their training, the terrain, routes, weather, and visibility.

d. Installation.

(1) Wire lines are usually laid by wire teams. One man on foot can lay a short wire line by using a wire dispenser or light reeling equipment. Across bodies of water or unusually difficult terrain, wire may be laid from dispensers attached to light aircraft or attached to a rocket and fired over an obstacle. For details on laying wire from a dispenser, see TM 11–2240.

(2) A wire line is generally laid on the ground parallel to a road with 15- to 20-percent slack. Lines may be strung overhead in areas such as command posts where it is impracticable to bury the lines or leave them lying on the ground. In crossing roads, wire is buried, constructed overhead, or

placed under bridges and through culverts. Areas in which wire is likely to be damaged by traffic or enemy fire are avoided. Part of a wire team lays the wire and the remainder of the team policies it (throws it off the road, makes road crossings, etc.). The laying of a line is not delayed for policing however, except at critical points.

e. Switchboards. Switchboards are used to increase the flexibility of the wire systems and to reduce the number of wire lines needed. The line capacities of the switchboards vary.

f. Use of Telephones. Telephones are reserved for occasions when there is a need for discussion and speed. To insure that calls will be brief and to facilitate the entry of messages in the unit or staff journal, the essential parts of a message should be reduced to writing before a conversation begins. During critical periods the use of telephones may be restricted to designated personnel, except for emergency calls.

g. Use of Teletypewriter. In some artillery units teletypewriters are used in wire or radio circuits to transmit messages. This equipment furnishes both parties a written record of the messages exchanged.

41. Radio Communication

a. General. Since radio is a principal means of communication, a sufficient number of radios are provided to make radio communication available to all commanders and key staff officers. Additional radios are provided for command posts, for fire control, and for other uses. All radio sets issued within the field artillery are capable of voice operation. Radios are also provided for communication between aircraft and from air to ground. The types of radio equipment organic to artillery units is discussed in chapter 13. For the employment of radio communication in various units, see chapter 14.

b. Capabilities and Limitations. Radio communication is subject to natural interference (static), interference from other radio stations, and deliberate interference (jamming) by unfriendly forces. Its reliability depends largely on the skill of the operators. The tactical situation and the characteristics of the radio sets dictate their employment. The most important characteristics of the radio sets used in field artillery units are shown in chapter 13. To be capable of operating together, radio sets must have a common or overlapping frequency range, be of the same type of modulation, and transmit and receive the same type of signal, and the stronger set must be kept within the transmitting range of the weaker set. The operating ranges shown in chapter 13 are for average conditions; the ranges obtained may be more or less, depending on the skills of the operators, the weather, the terrain, the interference, and the locations from which the sets are operated. Powerlines and steel structures close to operating sites reduce operating ranges.

42. Messenger Communication

a. General.

(1) Messenger communication is a supplementary means available to all units. The efficiency of messenger service depends on the selection and training of the individuals who serve in this capacity.

(2) Messenger communication is the most secure of all the means of transmission. It is flexible and reliable; its speed depends on the mode of travel, which may be by foot, motor vehicle, or aircraft. It is the only means available within field artillery units for transmitting maps and documents. Messenger service has some limitations, however. It is vulnerable to enemy action in forward areas and does not afford person-to-person conversation.

(3) Messengers are used when security dictates or when delivery by messenger is faster than other means. Messenger service is an effective means for delivering long messages over short distances.

b. Types of Messenger Service. Scheduled messenger service is established when locations are fixed and the amount of traffic warrants a fixed schedule. Special messengers are employed whenever required by the urgency of the message. Messenger relay posts may be estab-

lished when messages are carried frequently between the same points or units and when, because of the distance, difficulties of terrain, or hostile activity, other messenger service is ineffective.

43. Visual Communication

a. General. Visual communication is a supplementary means of communications that is available to all units. Visual signals in field artillery units are generally limited to panels, arm-and-hand signals, and other prearranged visual signals, such as the maneuver of aircraft. These visual means are suitable for transmitting prearranged messages rapidly over short distances. However, these visual signals are easily misunderstood. They are vulnerable to interception and the enemy may use similar signals to deceive or to create confusion. Their use is restricted during periods of poor visibility or when line-of-sight locations are not available; in addition, they may be prohibited for security reasons.

b. Panels. Two general types of panels are issued for communication with aircraft: marking and identifying panels and panels for transmitting messages. Marking and identifying panels are made in bright fluorescent colors. They may be used to mark positions and identify units as friendly. Black and white sets of panels for transmitting messages are issued for use on light and dark backgrounds, respectively. They are used to transmit brief messages or to identify a particular unit. The combined panel system and panel recognition code, which is included in the unit SOI and FM 21–60, is used for this type of visual communication.

44. Sound Communication

Sound is also a supplementary means of communication that is available to all units. Sound signals are transmitted by whistles, bugles, horns, gongs, klaxons, weapons, and other noisemaking devices. They are used chiefly to attract attention, transmit prearranged messages, and spread alarms; they are kept simple to prevent misunderstanding. They serve as a rapid means of communication over short distances. On the other hand sound signals are very vulnerable to interception, and their use may be prohibited for security reasons. Their range and reliability are greatly reduced by battle noise.

45. Integration of Wire and Radio Communication Systems

Wire and radio have been discussed as two separate and distinct means of communication. In operations, they may be closely integrated by using radio-wire integration equipment and radio relay equipment. For details pertaining to remote control equipment and the interconnection of radio and wire systems, see TM 11–486-series. For procedure to be used with radio/wire integration, see chapter 10.

Section II. PRINCIPLES OF COMMUNICATION—ESTABLISHMENT AND RESPONSIBILITY

46. General

The responsibility for the establishment of communication at various echelons of command is defined in AR 105–15 and in paragraphs 47 through 51 below, but variations may occur depending on the tactical mission of a unit.

47. Superior to Subordinate

The commander of a higher echelon or superior unit is responsible for the establishment and maintenance of communications to a unit of a lower echelon or a subordinate unit. Attached units are considered subordinate to the command to which attached.

48. Supporting to Supported

The commander of a supporting unit is responsible for the establishment and maintenance of communications to the supported unit.

49. Reinforcing to Reinforced

The commander of a unit reinforcing the fires of another artillery unit is responsible for the establishment and maintenance of communications to the reinforced unit.

50. Lateral Communication

Responsibility for the establishment of lateral communication between adjacent units may

be fixed by the next higher commander or may be established in the standing operating procedure (SOP). In the absence of specific orders fixing the responsibility, the commander of the unit on the left is responsible for establishing communication with the unit on the right.

51. Internal Communications

The commanding officer of each unit is responsible for the installation, maintenance, and operation of the internal communications of his command.

52. Maintenance

Effective maintenance requires the close coordination and joint participation of all units concerned. If communication is disrupted, its reestablishment is the joint duty of all units affected, although the responsibility remains with the unit that is responsible for installing the line.

53. Practical Application of Principles of Communication

a. The principles set forth in paragraphs 47 through 52 clearly define the responsibility for establishing and maintaining communications. Such responsibility cannot be delegated but can be transferred from one commander to another when so ordered by a higher commander.

b. The installation of communications is not necessarily accomplished by the unit of the responsible commander. It often becomes necessary for the responsible commander to delegate the actual installation of communications to subordinate units. Such practice is not a deviation from established principles, since only the physical installation is delegated, not the command responsibility.

CHAPTER 5

COMMUNICATION SECURITY

Section I. GENERAL

54. Definition

Communication security is the protection resulting from all measures designed to deny unauthorized persons information of value which might be derived from a study of our communications. Communication security includes transmission security, cryptographic security, and physical security. For complete details concerning communication security, see the appropriate AR's, JANAP's, ACP's, and FM 32–5.

55. Responsibility

a. Communication security is a command responsibility. However, every individual engaged in the preparation of material for transmission or the actual transmission of material is responsible for compliance with procedures governing preparation, transmission, and safeguarding of communications.

b. In carrying out his communication security responsibilities, the commander is normally assisted by the intelligence officer, who plans, coordinates and exercises staff supervision over security matters within the command, and by the communication officer. To fulfill his responsibility for communication security, the commander may—

(1) Maintain a continuous control system to account for classified information, equipment, and material.

(2) Conduct periodic and thorough inspections to determine the adequacy of physical security measures for the protection of classified information and cryptographic equipment and material and to insure that cryptosystems are properly used.

(3) Develop adequate emergency plans including emergency destruction plans.

(4) Consider communication security requirements in all operation planning.

(5) Take remedial action to eliminate causes of communication security violations.

c. Responsibility rests with each person to assist the commander in fulfilling his task. The security consciousness of the individual is an important factor, since communication systems cannot overcome the effect of carelessness. Discussion of classified information with unauthorized personnel, or in inappropriate places, constitutes a great hazard to security. Therefore, it is the responsibility of the individual to report any apparent violation of, or weakness in, communication security to his superior.

56. Security Classification

Security classification is based on the degree of danger to national security which would result from unauthorized disclosure of military or official information. The classification system establishes a standard of care for handling, storage, and dissemination of information belonging to each classification. Security classifications are discussed in detail in AR 380–5 and AR 380–6.

57. Security Measures

Security measures for the protection of military information, equipment, and material include defense against capture, salvage, theft, espionage, observation, photography, interception, direction finding, traffic analysis, cryptoanalysis, and imitative deception. High standards in training will preclude carelessness and laxity of personnel. It is of utmost importance that all personnel remain alert at all times to provide adequate protection of defense information, equipment, and material.

Section II. CRYPTOGRAPHIC SECURITY

58. Definition

Cryptographic security is that part of communication security which deals with the proper use of authorized codes, cipher devices, and machines used for encrypting and decrypting messages. For detailed information of handling cryptographic material, see AR 380-40, AR 380-41, AR 380-46, and KAG-1B/TSEC. The following cryptographic systems are available to most artillery units:

a. Prearranged Message Code. The prearranged message code may be prepared at any echelon by the unit communication officer for use within that unit. Such codes must be prepared in accordance with approved instructions to prevent their being compromised. For further information on the preparation of such codes, see KAG-21/TSEC.

b. Operations Code. The operations code is prepared at division or higher level by the signal officer and is used extensively throughout the command, down to and including battalion headquarters.

c. Map Reference and Numeral Cryptosystems. Map reference and numeral cryptosystems are tactical codes used to encode and decode map coordinates and other numbers.

d. Cipher Machine TSEC/KL-7. The cipher machine TSEC/KL-7 is a mechanical ciphering machine designed for rapid off-line encipherment and decipherment of messages.

e. Cipher Machine TSEC/KW-9. The cipher machine TSEC/KW-9 is an electronic-mechanical machine designed for on-line encryption and decryption of messages.

59. Need for Cryptosecurity

a. Army regulations require that in actual combat all classified messages be transmitted in cryptograhic form unless the urgency of the message does not permit encrypting and the enemy will not have sufficient time to act upon the information contained in the message. (The exception to this rule concerns messages classified TOP SECRET; they are *never* transmitted in the clear.) In order to send a classified message in the clear, such transmission must be authorized by the commanding officer or his authorized representative. Since practically all classified messages will be encoded or enciphered, thorough knowledge of military cryptography is of particular importance to military personnel.

b. The rule in *a* above does not apply to messages which are not normally encrypted, such as enemy contact reports. Nonnuclear fire missions are normally transmitted in clear text. The speed required and the number of personnel involved prohibit encrypting these messages if fire on given targets is to be delivered in time. In this type of message, the enemy does not have time to act upon the information contained in the message, and there is insufficient time for encoding.

60. Compromise, Loss, or Possible Compromise

a. An essential part of cryptosecurity is the prompt reporting of possible or actual compromise of cryptomatter. Such prompt action is necessary so that cryptomaterial determined to have been compromised may be withdrawn from further use and information encrypted with the compromised systems may be reviewed and necessary action taken. This report should contain as much of the following information as is applicable:

(1) Nature of violation.
(2) Identity (publication, system, or equipment).
(3) Length of message(s).
(4) Date-time group.
(5) Means of transmission.
(6) Originator and addressee.

b. In the event of loss or physical compromise subsequent to the initial report, a thorough investigation will be made and a complete report will be sent through appropriate channels to the controlling authority for the cryptomaterial concerned.

61. Clearance of Personnel

No person is entitled to knowledge or possession of classified material solely by virtue of

his grade. Such material will be entrusted only to those individuals whose official or government duties require such knowledge. All persons whose duties require access to classified material must be cleared to receive classified information.

Section III. PHYSICAL SECURITY

62. Definition

Physical security is that portion of communication security pertaining to the physical measures necessary to safeguard classified communication equipment and material from access by unauthorized persons. For details on safeguarding, distributing, and accounting for cryptomaterial, see AR 380–40 and AR 380–41 and KAG–1B/TSEC.

63. Need for Physical Security

a. Unsuspected physical compromise is far more serious than known loss. If an undisclosed compromise occurs and the cryptosystem continues in use, an enemy may be able to decrypt all traffic sent in that system. Protection against physical compromise can be accomplished by observing the following precautions:

(1) Proper handling by all personnel concerned.

(2) Adequate storage when not being used.

(3) Complete destruction when required.

b. Effective physical security insures the maximum protection of classified material from production to destruction.

64. Routine Destruction of Classified Material

Certain nonregistered, classified material is destroyed when directed by competent authority. All such material will be destroyed by burning, if possible.

65. Emergency Destruction of Classified Material

As far as humanly possible, classified material will not be permitted to fall into enemy hands. In general, emergency destruction should be carried out as follows:

a. Superseded cryptomaterial still on hand should be destroyed as soon as any doubt arises as to its physical safety.

b. Reserve cryptomaterial should be destroyed as soon as danger threatens. If the danger fails to materialize, the reserve cryptomaterial should be replaced.

c. Effective cryptomaterial must be retained for use as long as practicable. Cryptomaterial with wide distribution will be destroyed first; the system with the most limited distribution will be retained until the danger is imminent.

Section IV. TRANSMISSION SECURITY

66. Definition

Transmission security includes all measures designed to protect transmissions from interception, traffic analysis, and imitative deception by the enemy.

67. Means of Transmission

Users of communication systems should select the means most appropriate to the delivery of messages in accordance with the specified precedence and security requirements. Means and types of transmissions available are—

a. Messenger.
b. Mail.
c. Approved wire circuits.
d. Nonapproved wire circuits.
e. Visual.
f. Sound.
g. Radio.

Note. For more information concerning the means of transmission listed in *a* through *g* above, see FM 32–5 and ACP 122 (B).

68. Message Preparation

a. Transmission security within a command can be greatly enhanced when personnel directly concerned with message preparation are familiar with the fundamentals of transmission security. Such personnel include—

(1) Message originator—the commander by whose authority messages are sent.

(2) Writer—the person who prepares a message.

b. Although all messages are sent in the name of the commander, few are likely to be written by him personally. It is, therefore, of utmost importance that a commander insure that the message writers within his command know the principles of communications security. For details pertaining to message preparation, see chapter 7. In fulfilling his responsibilities, the writer must consider the following:

(1) Only communications that require rapid transmission for the accomplishment of a military objective are prepared for transmission by electrical means.

(2) Messages prepared for transmission by electrical means should be short and concise.

(3) Each message should be assigned the proper precedence, depending on the importance of the message and requirements for rapid delivery. Improper precedence can cause overloaded communication facilities and increase the possibility of transmission security violations.

69. Radio Intelligence

Radio intelligence consists of all measures taken by the enemy to obtain intelligence from our radio communications. *Strict radio silence is the primary defense against radio intelligence.*. Interception and direction finding can be made more difficult by—

a. Avoiding unauthorized transmission and unnecessary testing, thus decreasing the opportunities for direction finding.

b. Using a combination of transmitters, antenna, and power to produce minimum wave propagation and emission intensity consistent with reliable communications.

c. Use of the broadcast method of transmitting traffic whenever possible in preference to the receipt method.

d. In the absence of a prearranged plan, concealing the instructions to shift frequency by encryption.

e. Accurate transmitter adjustment, adherence to authorized frequency, and maintenance of strict circuit discipline.

70. Operator Training

Operating and maintenance personnel must be trained to recognize and avoid the following practices which endanger communication security:

a. Violation of radio silence.

b. Unofficial conversation between operators.

c. Transmitting in a directed net without permission.

d. Excessive repetitions of prosigns or operating signals.

e. Use of plain language in place of applicable prosigns or operating signals.

f. Use of unauthorized prosigns.

g. Incorrect and unauthorized procedure.

h. Identification of unit locations.

i. Failure to maintain radio watches on designated frequencies and at prescribed times.

j. Identification of individuals belonging to an organization.

k. Transmitting at speeds beyond the capabilities of receiving operators.

l. Use of excessive transmitting power.

m. Consuming excessive time in tuning, testing, changing frequency, or adjusting equipment.

n. Improper use of call signs.

71. Jamming

Enemy jamming is the transmission of disturbing radio signals to interfere with the reception of the desired signal. The effects sought by the enemy are to disrupt our system and deny its use to our forces. Techniques employed to minimize the effects of jamming are called antijamming. The term "electronic countercountermeasures" (eccm) includes antijamming.

a. All radio frequencies are vulnerable to jamming, and the enemy will jam radio reception whenever it is advantageous. To accomplish this, he will select the frequencies to be jammed, tune a transmitter to that frequency, and transmit a strong signal to obscure reception of the desired signal.

b. There are two sources of interfering signals, external and internal. If the disturbance

heard in the receiver can be eliminated or substantially reduced by grounding or disconnecting the receiving antenna, it may be assumed that the trouble is being caused by some external source. If the disturbance remains unchanged when the antenna is disconnected or grounded, the set is not functioning properly. If interference is caused by some external source, a further check must be made to determine whether the cause is enemy jamming or accidental interference.

c. In most instances, antijamming measures will go beyond the efforts of operators. The enemy can jam all radio circuits. Therefore, until jam-proof equipment and techniques are developed, all possible steps must be taken to minimize the effects of enemy jamming. It is imperative that radio operators continue to operate their set during enemy jamming attacks. The skill of the radio operator determines his ability to work effectively through jamming. He should remain calm and persist in applying the proper antijamming techniques and procedures. Most current radio relay equipment has been designed with built-in antijamming features.

d. A prompt, accurate, and complete report of enemy jamming is important, since an enemy jamming attack is usually part of a well-organized plan and frequently precedes important tactical maneuvers. The reports from the individual radio operators, which frequently provide intelligence on the extent and importance of enemy action, are normally compiled at division or corps headquarters by electronic warfare personnel. Properly correlated jamming information may serve as a warning of impending enemy action in a sector or on a broad front.

72. Telephone Security

It is most important for users of the telephone to understand the relative security inherent to different types of circuits. Even if the circuits are cleared for transmission of classified material, they must still be used with extreme care. Just as the chain is as strong as its weakest link, it is the weakest part of the overall telephone circuit that determines the security of the overall circuit. When an overall telephone connection contains weak links (such as a simple two-wire telephone circuit near the front, a simple two-wire circuit among unfriendly inhabitants, or a radio link circuit in a telephone system employed under similar conditions) there is no signal communications security even though the major part of the overall circuits is secure. For this reason, a high degree of telephone discipline must be observed by telephone users in a system.

73. Monitoring

Radio monitor stations set up by central control agencies under area or higher commands are a vital factor in attaining the most effective overall circuit discipline and operator efficiency. Violations of transmission security and cryptosecurity and deviations from prescribed procedures may be discovered by monitoring and reported to the stations responsible, together with suitable references, instructional material, and log excerpts.

CHAPTER 6

SIGNAL ORDERS AND INSTRUCTIONS

74. The Operation Order

a. General. The operation order is a means by which a commander directs his organization in an operation. In some cases, because of a time limitation, it may be impossible to prepare complete written signal estimates and plans. Therefore, it sometimes becomes necessary that the signal portion of the operation order (par. 5) be prepared on the basis of the communication officer's estimate and plan. The signal portion is normally issued orally. The signal portion of the operation order must be issued in sufficient time to permit the installation of the required communication systems before the beginning of the action concerned. For details on paragraphs 1, 2, and 3 of the operation order, see FM 101–5.

b. Paragraph 4, Administration and Logistics. Details of signal supply and repair may be included in this paragraph, as follows:

(1) Special priority of signal troops or vehicles on roads.
(2) Locations of signal depots.
(3) Signal distribution points.
(4) Special instructions concerning the issue of signal supplies.

c. Paragraph 5, Command and Signal. The extent of the communication instructions and information contained in paragraph 5 of the operation order depends on the decision of the unit commander. Paragraph 5 may contain as a minimum the index number and issue number of the SOI which is in effect, or it may be expanded to include reference to the signal annex (if one is included) or to repeat important instructions of the signal annex or SOI. It may also contain other matters of importance that are deemed necessary or desirable by the commander; e.g., location of subordinate command posts, axis of signal communication, location of advance message centers, and restrictions on use of equipment and pyrotechnics.

75. Signal Annex

The signal annex to an operation order is prepared when the signal instructions are too voluminous to be included in paragraph 5 of the operation order. It is based on the signal plan and is made as short as possible by referencing routine signal instructions contained in the standing operating procedures. The signal annex, which follows the format of the operation order, includes information and instructions that directly affect signal support. A signal annex becomes a part of the commander's operation order, even though it may be distributed at a different time. A comprehensive SOP and SOI–SSI will minimize the need for a signal annex.

76. Standing Operating Procedure

An SOP is a set of instructions giving the procedure to be followed by a particular unit for the performance of the operations, both tactical and administrative, that the commander desires to be routine.

a. Purpose of a Signal Standing Operating Procedure. The purpose of a signal standing operating procedure is to —

(1) Gain speed and precision in operations by standardizing the operating methods, procedures, and techniques.
(2) Simplify and perfect the training of all personnel.
(3) Reduce the number and length of signal orders.
(4) Simplify staff planning.
(5) Facilitate control and coordination of effort at all levels of command .
(6) Promote teamwork.
(7) Enable all members to understand what the rest of the unit will do under certain circumstances.
(8) Reduce the number of minor decisions to be made by the commander and his subordinates.

b. Form and Content. Signal SOP's are prepared in accordance with the format described and illustrated in FM 101–5. In addition, a checklist for preparation of an artillery unit SOP is shown in FM 6–20–2. The content of the signal SOP will depend on the desires of the

commanding officer, the recommendations of the communication officer, the SOP of the next higher headquarters, and the state of training of the command.

c. Flexibility. A signal SOP must be revised from time to time as the training of the unit progresses in order to eliminate superfluous details and to insure the development of concise, final instructions suitable for contemplated operations.

d. Use of the Signal SOP. The signal SOP should have widespread distribution within the unit. All key operating personnel should know the signal SOP of the unit since it affects not only communication personnel but also users of the communication systems.

77. Signal Operation Instructions

a. General. The signal operation instructions (SOI) consist of technical instructions, subject to frequent change, that are required in the employment of signal communication. The SOI is generally prepared and issued by the signal officer at a headquarters of division level and above. Radio frequencies and call signs may be assigned to corps artillery and division artillery in blocks, and the communication officer of these units will be required to prepare an extract SOI assigning frequencies and call signs to subordinate units. Units authorized retransmission equipment should be assigned frequencies suitable for retransmission.

b. Distribution. Distribution of the signal operation instructions is made to subordinate units, next higher headquarters, and the headquarters of adjacent commands. Certain items of the SOI, should be extracted and given wide distribution within the unit.

c. Classification. Each portion of the SOI is classified according to its content, as prescribed by AR 380–5 and AR 380–6. The classification is marked or stamped at the top and bottom of each page of the classified portion. The assembled SOI is assigned the same classification as the portion with the highest classification.

d. Security. SOI's include information that is of particular value to the enemy because it could serve as a means gaining additional intelligence. Therefore, the complete SOI of any echelon should not be taken forward of the command post of the echelon to which it is issued. When an SOI or an extract is compromised, the fact must be reported and the SOI must be replaced immediately. For information concerning the storage of classified material, see AR 380–5. A record should be maintained of all extracted portions of an SOI, and personnel within units should be instructed to destroy these items if capture is imminent.

78. Standing Signal Instructions

The standing signal instructions (SSI) contain operating instructions, not subject to frequent change, that are required in the employment of signal communications throughout the issuing command. It includes instructions that explain the various procedures to be followed in using the individual items of the SOI. When no SSI is published, these instructions are incorporated in the SOI.

a. Distribution. Items of the standing signal instructions receive the same distribution as SOI items. The signal officer may make additional distribution, when necessary.

b. Classification. Security classifications are held to a minimum to permit wider distribution and ease of handling.

79. Routine Signal Orders

To insure coordination of signal communications throughout the command, it is necessary from time to time to issue routine signal orders. These orders are prepared by the staff signal officer and contain information and instructions of general and more than temporary interest. The following subjects might be covered in routine signal orders:

a. Changes in allowances of equipment.

b. Correction of abuses in the use of equipment and services.

c. Deficiencies in training and operations.

d. Standing operating procedure.

e. Supply and maintenance instructions.

CHAPTER 7

THE FIELD MESSAGE

80. General

a. In field artillery units, messages are usually prepared on DA Form 11–170 (message book M–210–( )). The procedures given in this chapter apply when the message book M–210–( ) is used and also when no message book is available and the writer must improvise a message form. For purposes of illustration, the form used in this chapter is a message blank from the message book M–210–A. The basic rules of message preparation and the description of elements to be entered on a message will apply to any message form.

b. Message writing is not confined to commanders or staff officers. All military personnel, regardless of grade or position, are authorized to write field messages.

c. This chapter describes procedures for composing a tactical message, but does not go into detail on the makeup of the text. The text of the message must be brief, clear, and accurate and must be written so that the reader knows exactly what the writer meant to say.

81. Basic Rules for Preparing Messages

In the preparation of a message—and this includes writing the text-certain rules must be followed.

a. Writing. Each word must be printed in block letters. (An exception is the signature which must be written in longhand.)

b. Abbreviations. Abbreviations should be used wherever possible, but clarity must never be sacrificed for brevity. Authorized abbreviations for joint use are contained in JANAP 169, and authorized abbreviations for Army use are contained in AR 320–50. The writer is cautioned to avoid the use of abbreviations appearing on the back cover of the M–210 message book. Approximately one-fourth of these are incorrect or obsolete.

c. *Punctuation.* Punctuation should not be used unless necessary for clarity. When punctuation is necessary, the punctuation symbol itself is used: The asterisk (*), number mark (#), and commercial symbol for at (@) will not be used. The letter "X" may be used when exact punctuation is not essential but separation of the text is needed for clarity.

d. Repetition. A word may be repeated to prevent errors. It is *not* repeated solely for the purpose of emphasis. An example in which repetition serves a legitimate purpose is as follows: MIYAZAKI REPEAT MIYAZAKI (to minimize the possibility of mistaken identity or incorrect spelling).

e. Numbers. Numbers may be written as numerals, or the digits may be spelled out individually. For example, 227 may be written as 227 or as TWO TWO SEVEN. But 200 if spelled out should be spelled out literally—TWO HUNDRED. On the other hand, 17,000 should be spelled out as ONE SEVEN THOUSAND.

f. Isolated Letters. The phonetic alphabet, is used for each isolated letter. Route A, for example, must appear as ROUTE ALFA. The initials of a person's name, however, are never given the phonetic alphabet equivalent.

g. Spacing. If possible, the text should be written on every other line of the message form.

82. Message Book, DA Form 11–170 (M–210–A)

a. A message consists of three parts—heading, text, and ending. The heading consists of the precedence, security classification, message number, complete date, and addressee. The text consists of the basic message and includes any required additional addressee and originator designations, references, and special handling instructions. The ending consists of the official designation of sender, the classification, the time signed, and the signature and grade of the writer.

b. The forms contained in the M–210–A message book are arranged in sets of three, interleaved with carbon paper, thus permitting every message to be prepared in triplicate. In writing a message which is to be routed through message center, one copy more than the number

of addressess will be sent to message center. A copy of each message written should be retained by the writer.

c. The message form is used whether the message is to be transmitted by electrical means or carried by messenger.

83. Procedures for Writing the Message

Filling in the message form involves 10 steps as discussed in paragraphs 84 through 93 and shown in figure 2.

84. Precedence

The assignment of precedence to a message is the responsibility of the originator. To the writer, precedence means the required speed of delivery to the addressee. The writer determines the precedence on the basis of the contents of the message and the time factor involved. He must select the lowest adequate precedence. To communication personnel, precedence means the relative order of handling and delivery. To the addressee, precedence indicates the order in which he notes or reads a message. The six precedence designations are shown in figure 3. The precedence will not be taken for granted; one of the authorized designations will be used.

85. Number

The writer's message number is entered in the space provided after the abbreviated word "No." There are no regulations concerning the assignment of this number; each command specifies its own procedures.

THESE SPACES FOR MESSAGE CENTER ONLY

TIME FILED	MSG CEN NO.	HOW SENT
		Emergency

MESSAGE (SUBMIT TO MESSAGE CENTER IN DUPLICATE) PRECEDENCE

No. 5 DATE 21 June 61

To CO 1st How Bn 17 Arty

(Classification)

For S3

PLAN SIERRA EFFECTIVE 220130Z

Authorized to be sent in the clear
William C. Shepard, Capt

(Classification)

CG 1st Inf Div Arty
OFFICIAL DESIGNATION OF SENDER

1415 Z
TIME SIGNED

Albin Stevens Lt. Col S3
SIGNATURE AND GRADE OF WRITER

Figure 2. Completed field message.

86. Date

The date, the month (abbreviated), and the year, in that order is entered in the space provided after the word "Date."

87. Official Designation of the Addressee

The official designation of the addressee is entered in the space provided after the word "TO." The addressee is the commander of the organization to which the message is sent.

88. Security Classification

AR 380–5 requires that the security classification be indicated at the top and bottom of a classified item. The proper security classification—TOP SECRET, SECRET, CONFIDENTIAL, CONFIDENTIAL-MODIFIED HANDLING AUTHORIZED, or UNCLASSIFIED —will be entered above and below the text of the message. Circle the classification to separate it from other elements of the message.

a. The originator is responsible for the security classification of the message (originator is identified as the sender in the M210–A message form), but the writer is responsible for determining the proper security classification of the message in the name of the originator. No assumptions can be made about security. The writer must separately and independently designate the security classification of each message.

b. The message center will not accept a message that has not been identified and marked with its security classification. This applies to both tactical and administrative messages. If speed is so essential that the time required for encryption and decryption cannot be taken and the transmitted information cannot be acted upon by the enemy in time to influence current operations, a message of any classification except TOP SECRET may be sent in the clear. However, only the commanding officer or his authorized representative can authorize transmission in the clear.

89. Text

The text of a message must be clear, accurate, and brief. As few words as clarity will permit will be used in the message. Conjunctions, prepositions, and articles, such as *a, and, but, for, in, on,* and *the,* should be eliminated unless essential to the meaning. The text of a message consists of two parts, the internal instructions and the body.

a. Internal Instructions. The internal instructions may consist of any required additional addressee and originator designations (par. 82) and will begin on the first line of the body of the message form. The word "for" will be used to indicate that the message should be delivered to a specific office or individual at the location addressed. It is followed by an abbreviated title of the person or office within the agency, command, or installation for whom the message is intended.

b. Body. The body of the text will follow the internal instructions.

90. Official Designation of Sender

Enter the official designation of the originator in the appropriate block. The originator is identified as the sender in the M–210–A message form. In other words, the originator is the commander (designated by title and organization) by whose authority the message is sent. He must be distinguished from the writer, who composes the text. The writer and originator may or may not be the same person.

91. Time Signed

The writer will enter the time he signed the message. If he signs the message on the same day shown in the date block, he will enter only the hour, minute, and zone suffix. If the two dates differ, he will enter the complete date-time group to show the day of the month, the hour, and the zone suffix.

a. A sample date-time group is 211415Z. The first two digits (21) indicate the 21st day of the current month. (Two digits are always shown, even for days prior to the tenth, by using a zero before the digit. For example, the seventh day would be shown as Ø7). The second pair of digits (14) indicate the hour, and the last pair (15) indicate the minutes after the hour; Z is a suffix indicating the time zone.

b. The TIME SIGNED block should bear a time zone suffix to indicate the time zone used. The theater commander may authorize the local zone suffix for messages that will not leave the

Precedence designation	Example of use	Order of handling
FLASH (Z)	Reports of initial enemy contact.	Ahead of all other messages. Messages of lower precedence will be interrupted.
EMERGENCY (Y)	Amplifying reports of initial enemy contact.	Ahead of all other messages of lower precedence. Messages of lower precedence will be interrupted.
OPERATIONAL IMMEDIATE (O)	Operations order affecting current operations.	Ahead of all other messages of lower precedence. Messages of lower precedence will be interrupted.
PRIORITY (P)	Troop movements. Normally the highest precedence assigned to administrative traffic.	Ahead of all other messages of lower precedence, except that routine messages being transmitted will not be interrupted unless they are exceptionally long.
ROUTINE (R)	Messages not of sufficient urgency to justify a higher precedence which must be delivered without delay.	After all messages of higher precedence.
DEFERRED (M)	Messages justifying transmission by rapid meons but which admit the delay necessary for prior transmission of higher precedence messages.	After all messages of higher precedence.

Figure 3. Precedence designations.

time zone in which the theater is located. In other instances, the theater commander may require the use of Greenwich mean time.

92. Signature and Grade of Writer

A block is provided for the writer to sign his name and grade.

93. Authorized to be Sent in the Clear

Each classified message to be transmitted in the clear must be authorized separately by the commanding officer or his representative. This authorization is indicated by the statement "authorized to be sent in the clear" followed by the signature and grade of the authorizing person. This statement is circled to separate it from the other elements of the message. If no signature appears, the message will be encrypted prior to transmission by electrical means.

CHAPTER 8

MESSAGE CRYPTO CENTER OPERATION

Section I. GENERAL

94. General

The message center of a headquarters is the agency that receives, transmits, and delivers messages. The message center for a headquarters of an artillery unit is operated by organic communication personnel. The unit commander is authorized to establish a message center operating procedure which will best meet the needs of his unit while still conforming to specific requirements established by his higher headquarters. Simplicity and speed are the results desired in formulating an operating procedure for the message center. However, security will not be sacrificed to gain simplicity and speed.

95. Organization

a. The tables of organization and equipment (TOE) for artillery units provide for personnel to operate a message center. These personnel are—

(1) *Chief message clerk and/or senior message clerk.* The chief and/or senior message clerk supervises all activities of the message center to include cryptography, receipt, transmission, and delivery of all messages processed through the message center.

(2) *Message clerk.* The duties of the message clerk are the same as those of the senior message clerk. He will normally act as code clerk when both he and the senior message clerk are present in the message center.

(3) *Messenger or agent.* The messenger or agent assists in the operation of the message center. His main duty is to pick up and deliver messages as required.

b. Although not specifically provided by TOE, certain other personnel are required by duty assignment to work in the message center and should be trained in message center procedures. These personnel are—

(1) *Messengers.* Assigned personnel are detailed as messengers.

(2) *Means operators.* Radio and teletypewriter operators are trained in cryptography to assist in processing messages requiring encryption or decryption when message center personnel are not available and to insure 24-hour operation.

96. Forms and Equipment

Efficient message center operation is dependent on certain forms, publications, and equipment. Its operation may be simplified by using the minimum required recording procedures and the maximum communication facilities available to the unit. The required forms are listed in *a* through *c* below. These forms facilitate message handling and are used when available.

a. Message Book, DA Form 11–170. The message book provides a set of blank message forms for writing or recording messages. It is normally referred to as message book M–210.

b. Joint Message Form, DD–173. The joint message form is used for messages originating within a headquarters for transmission over the on-line crypto facilities of a communication center. When a message requires more than one page, continuation sheets are used (DD Form 173–1, Joint Message Form—Continuation Sheet).

c. Communication Center Delivery List, DA Form 11–39. The communication center delivery list may be used as a receipt form when the messenger has more than one message to deliver on one trip. The senior message clerk normally routes the messenger for speed and ease of delivery. However, the precedence of the message may determine the routing.

COMMUNICATION STATUS LOG			DATE
UNIT	TIME ZONE	PAGE NO.	NO. OF PAGES

UNITS TO WHICH CONNECTED	AM RAD		FM RAD		TT		TEL		VHF		REMARKS
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	

Figure 4. Communication status log.

97. Files and Records

Elaborate records must be avoided. However, pertinent classified and unclassified publications governing the operation of mechanical and electro-mechanical cipher devices (TSEC/KL–7 and TSEC/KW–9) and the control of associated material must be on hand. All message center personnel must be familiar with the instructions included in these publications and responsible commanders must insure strict compliance with these directives. Additional records that may be required are listed in *a* through *f* below.

a. Live File. The duplicate clear text copy or skeleton copy of each outgoing message processed by the message center is placed in the live file. This copy remains in the live file until a receipt is obtained from the receiving headquarters. It is then indorsed and placed in the dead file.

b. Dead File. The dead file consists of the duplicate copies of all receipted outgoing messages and completed receipt forms. This file is turned over to the S1 or other designated person by the communication officer at frequent intervals (usually daily) so that messages may be included in the unit journal or other official records of the headquarters.

c. Message Clerk's File. The message clerk retains on file the original clear text copy of each outgoing cryptogram and the original cryptographed copy of each incoming cryptogram. Care must be taken to insure that the clear text and the cryptographed copy of a single message are never filed together. These

(INCOMING)
(OUTGOING)

MESSAGE CENTER LOG | DATE

UNIT | PAGE NO. | NO OF PAGES

MESSAGE CENTER NUMBER	TIME FILED	MEANS	PREC	DATE/TIME	CRYPT	G R COUNT	CLEARED TO/FROM	TIME OF RECEIPT	REMARKS

Figure 5. Message center log.

files are disposed of as directed by the communication officer.

d. Operator's File. The file kept by the radio and teletypewriter operators will contain a copy of each message sent or received. The file will be disposed of as directed by the communications officer.

e. Communication Status Log. The Communication Status Log (DA Form 2150–R) is a record maintained by the message center which shows the current availability of all means of communication used by the message center. It is used to determine the best available routing for messages. The operators of the various communication facilities keep the message center informed of the status of communication with other units. The Communication Status Log DA Form 2150–R (fig. 4) will be reproduced locally on 8- by 10½-inch paper.

f. Message Center Log. The Message Center Log (DA Form 2151–R) is a daily chronological record of all messages handled by the message center. A separate log is maintained for incoming and outgoing messages. The logs are closed as of 2400 hours daily. Any message not yet receipted for must be checked to insure that the message has been received by the addressee. When all messages have been cleared, the log is placed in the dead file. The message center log DA Form 2151–R (fig. 5) will be reproduced locally on 8- by 10½-inch paper.

Section II. HANDLING OUTGOING MESSAGES

98. Outgoing Messages by Special Messenger (Clear Text)

a. Origin. The outgoing message is prepared by the writer and submitted to the message center in sufficient copies to provide one more than the number of addressees.

b. Processing. The message center enters the *time filed, message center number,* and *how sent* in the spaces provided on all copies of the message form. The duplicate is placed in the live file. A delivery list (fig. 6) is prepared when the original is ready for delivery.

c. Dispatch of Messages. The delivery list and the messages for delivery are given to the messenger. Prior to dispatch, the messenger should be instructed concerning—

(1) The route to follow.
(2) The importance of the message (if applicable).
(3) Whether or not to wait for an answer to the message.
(4) Other information concerning the delivery of the message.

d. Message Center Log Entry. After dispatching the messenger, the senior message clerk uses the duplicate copy to record the message in the outgoing message center log.

e. Delivery of the Message. When the special messenger arrives at the addressee's unit, he delivers the message to the message center and obtains the signature of the message center clerk on the delivery list. Prior to departing, the messenger inquires if there are any messages for his unit.

f. Recording Receipt of Message. When the delivery list (receipt) is returned to the message center, the duplicate copy of the message is removed from the live file, and the time of the receipt and the message clerk's initials are entered and circled. The receipt is attached to the duplicate copy, and both are placed in the dead file. The outgoing log entry pertaining to the message is closed by entering the time of delivery in the time of receipt column.

99. Outgoing Message by Electrical Means (Encrypted)

a. Origin. The message is prepared by the originator and submitted to the message center in sufficient copies to provide one more than the number of addressees.

b. Processing. The message clerk enters the *time filed, message center number,* and *how sent* in the spaces provided on the copies of the message. The original copy of the message is given to the message clerk for encrypting. The duplicate copy is used by the senior message clerk for entering the message in the outgoing message log; then the duplicate copy is placed in the live file.

c. Cryptographing. The message text is encrypted by the message clerk, using the cipher

COMMUNICATION CENTER DELIVERY LIST

DELIVERIES TO			DATE		
Staff Message Control			08 March 61		
MESSAGE CENTER NR	SIGNATURE	TIME OF DELIVERY	MESSAGE CENTER NR	SIGNATURE	TIME OF DELIVERY
501					
502	T. Jones SP 3	0807Z			
503					
CHECKED BY				AT	

DA FORM 1 SEPT 54 11-39 EDITION OF 1 OCT 49 WILL BE USED UNTIL EXHAUSTED GPO 880453

Figure 6. Communication center delivery list.

machine TSEC/KL–7, TSEC/KW–9, or, in emergency, the operations code. The TSEC/KL–7 encrypted text is entered on a message form together with the time filed, *message center number*, *how sent*, and *date-time group*. Radio call signs or routing indicators are placed on the message in lieu of the clear designation of the originator and addressee. The proper authenticators and group count are also placed on the message, which is then sent to the means operator for transmission. The clear text original copy is placed in the message clerk's file. Worksheets, tapes, and other material related to the message are destroyed by burning. The senior message clerk is notified of the group count and this information is entered on the outgoing message log.

d. Transmission. The message is transmitted by the means operator to the addressee. When the addressee's station receipts for the message, the means operator places his initials and the time of receipt on the message. The message center is notified of the time of receipt, and the message is placed in the operator's file.

e. Recording the Receipt. On receiving the time of receipt from the means operator, the message clerk removes the duplicate clear text copy from the live file, indorses it, completes the entry in the outgoing message log, and files the copy in the dead file.

Section III. HANDLING INCOMING MESSAGES

100. Incoming Message by Messenger

a. Receipt of Message. On receiving a message delivered by a special or scheduled messenger, the senior message clerk signs the receipt form and indicates the time received.

b. Processing. The senior message clerk makes the proper entries in the incoming message log, prepares a delivery list, and dispatches the message or messages to the addressee or appropriate staff officer. When the receipt is returned to the message center, the time of clearance is entered in the incoming message log.

101. Incoming Message by Electrical Means

a. Receipt. The means operator copies the incoming message in triplicate on the message form. After receipting for the message to the transmitting station, the means operator places his initials and time of receipt on the message. The triplicate copy is placed in the operator's file, and the original and duplicate copies are forwarded to the message center.

b. Processing. The message clerk decrypts the message and copies the clear text version on a message form. The originator and addressee are determined from the radio call sign and entered on the clear text version. Authentication is checked and noted on the message form with the time of receipt by the means operator and the initials of the person who decrypted the message. The original encrypted copy is placed in the message clerk's file. The clear text copy is delivered and recorded in the incoming message log as indicated in paragraph 100*b*. All worksheets, tapes, and extra copies of the message are destroyed by burning.

102. Garrison and Field SOP

The commander must be assured that all message center personnel are familiar with the operational procedures of his message center. To aid the commander in this respect the communication officer prepares a garrison SOP and and a field SOP for message center operations.

CHAPTER 9

RADIOTELEPHONE PROCEDURE—CONDUCT OF FIRE

103. General

Radiotelephone procedure is used by all branches and services for command, operations, and administration. The artillery, however, also uses its communication system for conduct of fire. A specific radiotelephone procedure known as the "short phrase-repeat back" method is used for this purpose. Although this conduct of fire procedure may be modified according to the type of fire mission, the basic procedure remains unchanged.

104. Deviations From Normal Procedure

The radiotelephone procedure for the adjustment of artillery fire deviates from the normal communication procedure outlined in ACP 125 and allied publications. Specific deviations are—

a. Limited use of procedure words and divergence from the normal message format. New meanings are given to some procedure words. For example, the word OVER indicates the end of this transmission; another station is expected to transmit next. The word WAIT indicates the end of this transmission, but the same station is expected to transmit next.

b. Extensive use of clear or modified clear text.

c. Automatic read-back without the transmission instructions "read back."

d. Elimination of call signs after identities have been established and when no confusion will result. Under certain circumstances, when identification is required, transmissions are identified by the use of call sign suffix numbers only.

105. Automatic Read-Back Method of Transmission

To facilitate the transmission of firing data and to minimize requests for repetition, transmission may be made in short phrases. Each phrase is repeated by the receiving operator exactly as it was received. The length of each phrase or the number of elements of firing data included in each transmission should be commensurate with established procedure and the training and experience of the operators. To insure accuracy, the transmitting and receiving operators must be familiar with the sequence of the elements of firing data.

106. Net Organization

a. The number of frequency modulated (FM) channels allotted to a howitzer battalion of the infantry division is standardized at three. These three channels will be assigned as a command/fire direction net (CF), fire direction net 1 (F1), and fire direction net 2 (F2). Since the command/fire direction channel is not primarily intended for fire direction, it will not be discussed further in this chapter. The howitzer battalion of the armored division is authorized three fire direction channels. Each battery operates on a separate fire direction channel, which includes a base set at battalion, a liaison officer, and four forward observers.

b. Stations normally concerned with the conduct of fire are—

(1) Each forward observer and air observer.

(2) The liaison officer.

(3) The base sets in the battalion fire direction center (FDC).

(4) Each battery fire direction center (FDC).

c. A fire mission may be conducted by using any combination of radio and wire communication of activities. This discussion will include examples of fire missions conducted by each of the following methods:

(1) A fire mission is sent by radio to the battalion fire direction center and the commands are sent to one battery by wire.

(2) A fire mission is sent by radio to the battalion fire direction center and the commands are sent to two batteries by radio.

107. Sequence of Short Phrase-Repeat Back Transmission

a. Initial Fire Request. The radiotelephone operator for a forward observer (ARMFUL 31) calls the F1 base set operator (ARMFUL 9) in the battalion fire direction center. This call is made on fire direction net 1 (F1) to inform the battalion fire direction center that he has a fire mission.

Forward observer's operator	ARMFUL 9, THIS ARMFUL 31, FIRE MISSION, OVER.
F1 base set operator	ARMFUL 31, THIS IS ARMFUL 9, SEND YOUR MISSION, OVER.

If fire direction net 1 is being used for another mission, the battalion S3 may direct the forward observer to change to fire direction net 2. Having been directed to send his mission, the radiotelephone operator for the forward observer transmits the initial fire request in short phrases, omitting call signs when only one mission is being sent on that channel.

Forward observer's operator	COORDINATES 4322, OVER.
F1 base set operator	COORDINATES 4322, OVER.
Forward observer's operator	3445, OVER.
F1 base set operator	3445, OVER.
Forward observer's operator	AZIMUTH 800, OVER.
F1 base set operator	AZIMUTH 800, OVER.
Forward observer's operator	TWO MACHINEGUNS, FUZE VT, WILL ADJUST, OVER.
F1 base set operator	TWO MACHINEGUNS, FUZE VT, WILL ADJUST, WAIT—

b. Correction of Errors. If any error is made during the transmission or read-back of any element, the operator announces CORRECTION and repeats the correct version of the element in error.

Forward observer's operator	COORDINATES 4322, OVER.
F1 base set operator	COORDINATES 4233, OVER.
Forward observer's operator	CORRECTION, COORDINATES 4322, OVER.
F1 base set operator	CORRECTION, COORDINATES 4322, OVER.

c. Battalion Fire Order. After the initial fire request is received, the battalion S3 issues the battalion fire order, pertinent parts of which are transmitted to the forward observer. This is read back by the forward observer's operator.

F1 base set operator	ALFA, .4 VOLLEYS, CONCENTRATION BRAVO JULIETT 386, OVER.
Forward observer's operator	ALFA, 4 VOLLEYS, CONCENTRATION BRAVO JULIETT 386, OVER.

d. Fire Commands to the Battery. Wire communication will be used when it is available to transmit the fire commands to the battery. These commands are transmitted as data is produced.

Computer A at bn (by wire)	BATTERY ADJUST, SHELL HE, LOT HOTEL, CHARGE 5, FUZE QUICK, CENTER ONE ROUND, BATTERY 4 ROUNDS, VT IN EFFECT.
Telephone operator at Btry A (by wire)	BATTERY ADJUST, SHELL HE, LOT HOTEL, CHARGE 5, FUZE QUICK, CENTER ONE ROUND, BATTERY 4 ROUNDS, VT IN EFFECT.

Computer A at bn (by wire)	DEFLECTION 2765.
Telephone operator at Btry A (by wire)	DEFLECTION 2765.
Computer A at bn (by wire)	QUADRANT 381.
Telephone operator at Btry A (by wire)	QUADRANT 381.
When the pieces fire, the recorder reports.	
Telephone operator at Btry A (by wire)	ON THE WAY.
Computer A at bn (by wire)	ON THE WAY.
F1 base set operator	ON THE WAY, OVER.
Forward observer's operator	ON THE WAY, WAIT—LEFT 100, DROP 200, OVER.
F1 base set operator	LEFT 100, DROP 200, WAIT—
Computer A at bn (by wire)	DEFLECTION 2784.
Telephone operator at Btry A (by wire)	DEFLECTION 2784.
Computer A at bn (by wire)	QUADRANT 365.
Telephone operator at Btry A (by wire)	QUADRANT 365—ON THE WAY.
Computer A at bn (by wire)	ON THE WAY.
F1 base set operator	ON THE WAY, OVER.
Forward observer's operator	ON THE WAY, WAIT—ADD 100, OVER.
F1 base set operator	ADD 100, WAIT—
Computer A at bn (by wire)	DEFLECTION 2787.
Telephone operator at Btry A (by wire)	DEFLECTION 2787.
Computer A at bn (by wire)	QUADRANT 373.
Telephone operator at Btry A (by wire)	QUADRANT 373—ON THE WAY.
Computer A at bn (by wire)	ON THE WAY.
F1 base set operator	ON THE WAY, OVER.
Forward observer's operator	ON THE WAY, WAIT—LEFT 20, DROP 50, FIRE FOR EFFECT, OVER.
F1 base set operator	LEFT 20, DROP 50, FIRE FOR EFFECT, WAIT—
Computer A at bn (by wire)	FUZE VT, BATTERY 4 ROUNDS, DEFLECTION 2788.
Telephone operator at Btry A (by wire)	FUZE VT, BATTERY 4 ROUNDS, DEFLECTION 2788.
Computer A at bn (by wire)	TIME 21.0, QUADRANT 369.
Telephone operator at Btry A (by wire)	TIME 21.0, QUADRANT 369— FIRING FOR EFFECT.
Computer A at bn (by wire)	FIRING FOR EFFECT.
F1 base set operator	FIRING FOR EFFECT, OVER.
Forward observer's operator	FIRING FOR EFFECT, OVER.
Telephone operator at Btry A (by wire)	ROUNDS COMPLETE.
Computer A at bn (by wire)	ROUNDS COMPLETE.
F1 base set operator	ROUNDS COMPLETE, OVER.
Forward observer's operator	ROUNDS COMPLETE, WAIT— END OF MISSION, MACHINEGUNS SILENCED, 8 CASUALTIES, OVER.
F1 base set operator	END OF MISSION, MACHINEGUNS SILENCED, 8 CASUALTIES, OUT.
Computer A at bn (by wire)	END OF MISSION, CONCENTRATION BRAVO JULIETT 386.
Telephone operator at Btry A (by wire)	END OF MISSION, CONCENTRATION BRAVO JULIETT 386.

e. Fire Commands to Both Batteries by Radio. When wire communication with the batteries is not available, the fire commands will be transmitted by radio. Fire direction net 1 will be used by the F1 base set, the forward observer, and the adjusting battery. Fire direction net 2 will be used by the F2 base set and the nonadjusting battery. In the following example, the forward observer has sent his initial fire request, and the S3 has decided to mass the battalion on this target.

F1 base set operator	BATTALION, 4 VOLLEYS, CONCENTRATION BRAVO JULIETT 387, OVER.
Forward observer's operator	BATTALION, 4 VOLLEYS, CONCENTRATION BRAVO JULIETT 387, OVER.

(Fire commands are sent to each firing battery as they are produced. Since the batteries do not know on which channel they will receive their fire commands, both listen on fire direction net 1 and fire direction net 2. Normally, however, the nonadjusting battery will receive commands on fire direction net 2. Commands can then be sent simultaneously without interference. In the howitzer battalions of the armored division, each battery will receive fire commands on its own fire direction net.)

F1 base set operator	29, FIRE MISSION, OVER.
Btry A F1 radio operator	29, FIRE MISSION, OVER.
F2 base set operator	49, FIRE MISSION, OVER.
Btry B F2 radio operator	49, FIRE MISSION, OVER.
F1 base set operator	BATTERY ADJUST, SHELL HE, LOT HOTEL, CHARGE 5, FUZE QUICK, OVER.
Btry A F1 radio operator	BATTERY ADJUST, SHELL HE, LOT HOTEL, CHARGE 5, FUZE QUICK, OVER.
F1 base set operator	CENTER ONE ROUND, BATTERY 4 ROUNDS, VT IN EFFECT, OVER.
Btry A F1 radio operator	CENTER ONE ROUND, BATTERY 4 ROUNDS, VT IN EFFECT, OVER.
F1 base set operator	DEFLECTION 2765, OVER.
Btry A F1 radio operator	DEFLECTION 2765, OVER.
F1 base set operator	QUADRANT 381, OVER.
Btry A F1 radio operator	QUADRANT 381, OVER.

While these commands are being sent, commands are also being sent to the nonadjusting battery.

F2 base set operator	BATTERY ADJUST, SHELL HE, LOT XRAY YANKEE, CHARGE 4, FUZE VT, OVER.
Btry B F2 radio operator	BATTERY ADJUST, SHELL HE, LOT XRAY YANKEE, CHARGE 4, FUZE VT, OVER.
F2 base set operator	BATTERY 4 ROUNDS, DO NOT LOAD, OVER.
Btry B F2 radio operator	BATTERY 4 ROUNDS, DO NOT LOAD, OVER.
F2 base set operator	DEFLECTION 2382, OVER.
Btry B F2 radio operator	DEFLECTION 2382, OVER.
F2 base set operator	TIME 16.0, QUADRANT 230, OVER.
Btry B F2 radio operator	TIME 16.0, QUADRANT 230, OVER.
Btry A F1 radio operator	ON THE WAY, OVER.

Forward observer's operator	ON THE WAY, WAIT—LEFT 100, DROP 100, OVER.
F1 base set operator	LEFT 100, DROP 100, WAIT—DEFLECTION 2784, OVER.
Btry A F1 radio operator	DEFLECTION 2784, OVER.
F1 base set operator	QUADRANT 373, OVER.
Btry A F1 radio operator	QUADRANT 373, WAIT—ON THE WAY, OVER.
Forward observer's operator	ON THE WAY, WAIT—ADD 50, FIRE FOR EFFECT, OVER.
F1 base set operator	ADD 50, FIRE FOR EFFECT, WAIT—FUZE VT, BATTERY 4 ROUNDS, DEFLECTION 2778, OVER.
Btry A F1 radio operator	FUZE VT, BATTERY 4 ROUNDS, DEFLECTION 2778, OVER.
F1 base set operator	TIME 21.0, QUADRANT 369, OVER.
Btry A F1 radio operator	TIME 21.0, QUADRANT 369, WAIT—

While the fire-for-effect commands were being sent to the adjusting battery on fire direction net 1, fire commands were also being sent to the nonadjusting battery on fire direction net 2.

F2 base set operator	BATTERY 4 ROUNDS, DEFLECTION 2395, OVER.
Btry B F2 radio operator	BATTERY 4 ROUNDS, DEFLECTION 2395, OVER.
F2 base set operator	TIME 15.0, QUADRANT 219, OVER.
Btry B F2 radio operator	TIME 15.0, QUADRANT 219, WAIT—
Btry A F1 radio operator	ALFA FIRING FOR EFFECT, OVER.
Forward observer's operator	ALFA FIRING FOR EFFECT, OVER.
Btry B F2 radio operator	BRAVO FIRING FOR EFFECT, OVER.
F2 base set operator	BRAVO FIRING FOR EFFECT, OVER.

The forward observer must know when the first battery starts firing for effect. If the nonadjusting battery fired first, this would be reported to the observer by the F1 base set operator. The batteries report when they have completed firing for effect.

Btry A F1 radio operator	ALFA ROUNDS COMPLETE, OVER.
F1 base set operator	ALFA ROUNDS COMPLETE, WAIT—
Btry B F2 radio operator	BRAVO ROUNDS COMPLETE, OVER.
F2 base set operator	BRAVO ROUNDS COMPLETE, WAIT—
F1 base set operator	BATTALION ROUNDS COMPLETE, OVER.
Forward observer's operator	BATTALION ROUNDS COMPLETE, WAIT —END OF MISSION, MACHINEGUNS SILENCED, 8 CASUALTIES, OVER.
F1 base set operator	END OF MISSION, MACHINEGUNS SILENCED, 8 CASUALTIES, CONCENTRATION BRAVO JULIETT 387, OVER.
Btry A F1 radio operator	END OF MISSION, CONCENTRATION BRAVO JULIETT 387, OUT.
F2 base set operator	END OF MISSION, CONCENTRATION BRAVO JULIETT 387, OVER.
Btry B F2 radio operator	END OF MISSION, CONCENTRATION BRAVO JULIETT 387, OUT.

108. Sequence of Transmission for Special Situations

The flexibility of conduct of fire procedure permits its modification to meet special situations.

a. Fire for Effect, Precision Fire. The radio-telephone procedure used in the fire-for-effect portion of a precision fire mission is similar to that used in adjustment except, to avoid possible confusion, the terminating word will be eliminated when sensings are transmitted.

F1 base set operator	ON THE WAY, OVER.
Forward observer's operator	ON THE WAY, WAIT—SHORT, LEFT.
F1 base set operator	SHORT, LEFT—OBSERVE TIME REGISTRATION, ON THE WAY, OVER.
Forward observer's operator	OBSERVE TIME REGISTRATION, ON THE WAY, WAIT—AIR.
F1 base set operator	AIR—ON THE WAY, OVER.
Forward observer's operator	ON THE WAY, WAIT—GRAZE.
F1 base set operator	GRAZE—OBSERVE 3 ROUNDS, OVER.
Forward observer's operator	OBSERVE 3 ROUNDS. OVER.
F1 base set operator	ON THE WAY, OVER.
Forward observer's operator	ON THE WAY, OVER.
F1 base set operator	ROUNDS COMPLETE, OVER.
Forward observer's operator	ROUNDS COMPLETE, WAIT—AIR, AIR, GRAZE.

b. Simultaneous Missions. Situations may arise in which it is necessary to send two or more fire missions simultaneously on the same radio channel. Under these conditions, it becomes necessary that the forward observer's operators identify their transmissions by preceding them with their station call sign suffix numbers. The base set operator directs his transmissions to the observer concerned by preceding his transmissions with the observer's call sign suffix number.

Forward observer 1 operator	31, LEFT 100, DROP 200, OVER.
F1 base set operator	31, LEFT 100, DROP 200, WAIT—
Forward observer 2 operator	32, DROP 50, FIRE FOR EFFECT, OVER.
F1 base set operator	32, DROP 50, FIRE FOR EFFECT, WAIT—31, ON THE WAY, OVER.
Forward observer 1 operator	31, ON THE WAY, WAIT—31, ADD 100, OVER.
F1 base set operator	31, ADD 100, WAIT—32, FIRING FOR EFFECT, OVER.

This same principle is applied when it is necessary to send fire commands to two batteries on the same radio channel.

F1 base set operator	29, FUZE VT, BATTERY 4 ROUNDS, DEFLECTION 2788, OVER.
Battery A radio operator	29, FUZE VT, BATTERY 4 ROUNDS, DEFLECTION 2788, OVER.
F1 base set operator	29, TIME 21.0, QUADRANT 369, OVER.
Battery A radio operator	29, TIME 21.0, QUADRANT 369, WAIT—
F1 base set operator	49, BATTERY 4 ROUNDS, DEFLECTION 2790, OVER.
Battery B radio operator	49, BATTERY 4 ROUNDS, DEFLECTION 2790, OVER.
F1 base set operator	49, QUADRANT 311, OVER.

Battery B radio operator	49, QUADRANT 311, WAIT—
Battery A radio operator	29, FIRING FOR EFFECT, OVER.

c. Use of SPLASH. In the conduct of some fire missions, 5-second SPLASH warnings are transmitted from the fire direction center to the observer.

F1 base set operator	ON THE WAY, OVER.
Forward observer's operator	ON THE WAY, OVER.
F1 base set operator	SPLASH, OVER.
Forward observer's operator	SPLASH, WAIT—

d. Relay Procedure. When direct radio contact between the forward observer and the fire direction center cannot be established because of distance, terrain, etc., and when automatic retransmission is not feasible, the following relay procedure will be used. This relay may be accomplished by the artillery liaison officer.

Forward observer's operator	ARMFUL 36, THIS IS ARMFUL 31, FIRE MISSION, OVER.
Liaison officer's operator	ARMFUL 9, THIS ARMFUL 36, FIRE MISSION FROM ARMFUL 31, OVER.
F1 base set operator	ARMFUL 36, THIS IS ARMFUL 9, SEND YOUR MISSION, OVER.
Liaison officer's operator	SEND YOUR MISSION, OVER.
Forward observer's operator	COORDINATES 4322, OVER.
Liaison officer's operator	COORDINATES 4322, OVER.
F1 base set operator	COORDINATES 4322, OVER.
Liaison officer's operator	31, OVER.

This last transmission (31, OVER) made by the liaison officer's operator indicates that the preceding short phase has been read back correctly and the forward observer's operator may send the next short phase. The remainder of the fire request is sent in this manner. The mission continues as follows:

F1 base set operator	ON THE WAY, OVER.
Liaison officer's operator	ON THE WAY, OVER.
Forward observer's operator	ON THE WAY, WAIT—LEFT 20, DROP 50, FIRE FOR EFFECT, OVER.
Liaison officer's operator	LEFT 20, DROP 50, FIRE FOR EFFECT, OVER.
F1 base set operator	LEFT 20, DROP 50, FIRE FOR EFFECT, WAIT—FIRING FOR EFFECT, OVER.
Liaison officer's operator	FIRING FOR EFFECT, OVER.
Forward observer's operator	FIRING FOR EFFECT, OVER.
F1 base set operator	ROUNDS COMPLETE, OVER.
Liaison officer's operator	ROUNDS COMPLETE, OVER.
Forward observer's operator	ROUNDS COMPLETE, WAIT—END OF MISSION, MACHINEGUNS SILENCED, 8 CASUALTIES, OVER.
Liaison officer's operator	END OF MISSION, MACHINEGUNS SILENCED, 8 CASUALTIES, OVER.
F1 base set operator	END OF MISSION, MACHINEGUNS SILENCED, 8 CASUALTIES, OUT.
Liaison officer's operator	END OF MISSION, OUT.

The last transmission made by the liaison officer's operator is necessary to inform the forward observer that no further transmissions are required.

CHAPTER 10

RADIO/WIRE INTEGRATION PROCEDURE

109. General

Most artillery headquarters are authorized radio/wire integration equipment (AN/GSA–7). This equipment can be connected into any switchboard SB–22 to provide communication from an FM radio system into the wire system. Since the radio set control AN/GSA–7 is not technically capable of being operated directly into the SB–86/P switchboard, it will be necessary to provide switchboards SB–22/PT between the radio/wire integration station and a switchboard SB–86/P installation.

110. Use

a. The use of the radio/wire integration system should be limited to instances in which communication cannot be established in the normal manner over either FM radio or wire circuits.

b. The switchboard operator is the key to this system and must be thoroughly trained. He must have a complete list of radio call words and suffix numbers and telephone directory names and numbers if this system is to operate in a satisfactory manner.

c. The radio/wire integration system may be used—

(1) To provide voice communication between mobile combat elements and elements in the rear area.

(2) To provide a unit with temporary telephone service until wire can be installed.

(3) To connect two switchboards and to span a break in a wire line between units.

111. Procedure

a. Normal radiotelephone procedure will be used when any part of the transmission is sent over the radio portion of the system. Normal telephone or switchboard procedure will be used between the switchboard operator and the telephone user before the wire and radio circuits are interconnected and after they are disconnected. Radio call words and telephone directory names are listed in the SOI–SSI.

Note. The radio call words and suffix numbers and the telephone directory names and numbers which are to be used in the following examples are fictitious.

b. In the following example, the call originates at a telephone.

(1) The calling party (KENNEL 2) asks the switchboard operator (KENNEL OPERATOR) for the battalion commander (KENNEL 6).

Calling party KENNEL 6

(2) The switchboard operator will repeat the telephone directory name and number exactly as it was given him by the calling party.

Switchboard operator KENNEL 6

Note. At this time the switchboard operator will try to place this call over wire. For this example, we will assume that the called party does not answer.

(3) The switchboard operator must now notify the calling party that the called party does not answer.

Switchboard operator THIS IS THE KENNEL OPERATOR —K E N N E L 6 DOES NOT ANSWER.

(4) The calling party decides that he will try to communicate with the called party using the radio/wire integration system. He will then ask the switchboard operator for the radio/wire integration station. Figure 7 illustrates the utilization of radio/wire integration facilities to connect the telephone of the division artillery commander and the radio in the battalion commander's vehicle.

Calling party KENNEL RADIO/WIRE INTEGRATION STATION.

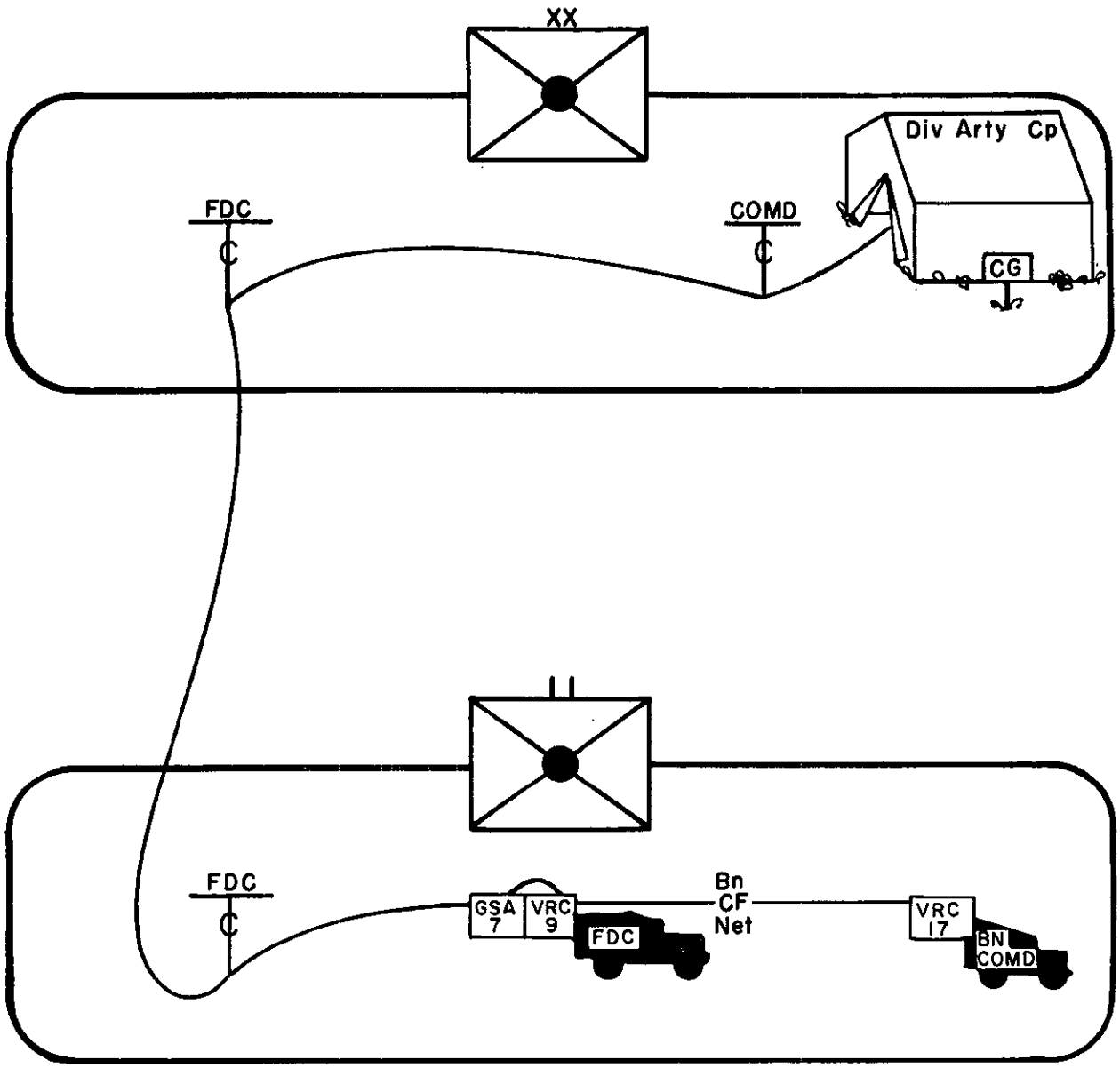


Figure 7. Type utilization of radio/wire integration system.

(5) Before the switchboard operator connects the calling party with the radio/wire integration station, the following information will be given.

Switchboard operator — KENNEL RADIO/WIRE INTEGRATION STATION. USE YOUR RADIO CALL WORD AND SUFFIX NUMBER AND STRICT RADIOTELEPHONE PROCEDURE. WHEN YOU HEAR THE RUSHING SOUND YOU ARE ON THE AIR.

Note. It may be necessary for the switchboard operator to give the calling party the radio call words and suffix numbers.

(6) When the switchboard operator plugs

the calling party into the line pack of the radio set control AN/GSA-7, a rushing sound will be heard. When the calling party hears the rushing sound he can make his initial call.

Calling party: BUGLER 1, THIS IS BUGLER 5, OVER.

(7) The conversation between BUGLER 1 and BUGLER 5 will be made using normal radiotelephone procedure. When the conversation has been completed, both stations will ring off.

(8) When the station(s) ring off, the switchboard operator will come back on the circuit to see if either station wishes to talk to anyone else.

Switchboard operator: THIS IS BUGLER CONTROL, OVER.

(9) If neither station answers, the switchboard operator can then break down the call. If one of the stations answers the call, the switchboard can then break down the part not concerned.

c. The following is an example of a call originating at a radio.

(1) The calling party (CADRE 1) wishes to talk with the division artillery S2 (CADRE 5). Using the 1600-cycle switch on the RT-67, the calling party sends out a signal not exceeding 2 seconds. It is possible that more than one switchboard could have a radio set control AN/GSA-7 on this same frequency and several switchboards would have drops to fall; in this event, the calling party would wait approximately 5 seconds and then make the initial call to the control station (switchboard) with which he wishes to talk.

Calling party: CADRE CONTROL, THIS IS CADRE 1, OVER.

(2) When the switchboard operator (CADRE CONTROL) hears this call, he answers. All other switchboard operators break down the call.

Switchboard operator: CADRE 1, THIS IS CADRE CONTROL, OVER.

(3) When the calling party hears this transmission he will then ask the switchboard operator to connect him to the party with whom he wishes to speak.

Calling party: CADRE CONTROL, THIS IS CADRE 1. GIVE ME CADRE 5 OVER.

(4) To inform the calling party that he has received the call and will comply. The switchboard operator transmits as follows:

Switchboard operator: CADRE 1, THIS IS CADRE CONTROL, WILCO, WAIT (OUT)—

(5) The switchboard operator, without interconnecting the radio and telephone circuits, calls the desired party by telephone, using his telephone directory name and number. He tells the called party that he has a radio call for him.

Switchboard operator: KAPOK 2, THIS IS THE KAPOK OPERATOR. I HAVE A CALL FOR YOU OVER RADIO FROM KAPOK 6. USE YOUR RADIO CALL WORD AND SUFFIX NUMBER AND STRICT RADIOTELEPHONE PROCEDURE. WHEN YOU HEAR THE RUSHING SOUND YOU ARE ON THE AIR. MAKE THE INITIAL CALL.

(6) When the called party hears the rushing sound, he then makes his initial call.

Called party: CADRE 1, THIS IS CADRE 5, OVER.

(7) The calling party transmits his message and the conversation ends. Both parties ring off if possible.

(8) When the station(s) ring off, the switchboard operator will come back on the air to see if either station wishes to talk to anyone else.

Switchboard operator: THIS IS CADRE CONTROL, OVER.

(9) If neither station answers, the switchboard operator can then break down the call. If one of the stations answers the call, the switchboard operator can then break down the part not concerned.

CHAPTER 11

TELEPHONE AND SWITCHBOARD PROCEDURE

112. General

In order to effectively utilize the wire communication available to a unit, all persons who use this means of communication must be familiar with the proper procedure and techniques involved in its operation, including the telephone directory, field telephone, and switchboard.

113. Telephone Directory

The purpose of the military telephone directory is to simplify and expedite communication in a field telephone system. The telephone directory consists of two parts, directory names and directory numbers, both of which are found in the units SOI–SSI. Telephone directory names are assigned to army organizations normally equipped with switchboards. They are changed when there is a possibility of confusion with directory names of other divisions or units or for security reasons. Command and staff officers and installations *not* normally equipped with a switchboard are assigned a telephone directory number. The military telephone directory is prepared by the signal officer of the division or of a higher echelon, as part of the SOI–SSI.

a. Directory Names. Directory names of all major units in a division begin with the same letter. Separate battalions and batteries are assigned separate directory names. Units at battery level will use the directory name of their battalion plus the suffix ALFA, BRAVO, or CHARLIE. A separate battery may be assigned a directory name or may be assigned a telephone number as a suffix to the directory name of its parent unit. Directory names should not be used alone but always in conjunction with the appropriate directory number or echelon of the installation being called.

b. Directory Numbers. Telephone directory numbers, once assigned, are not changed. To prevent confusion, the same number is prescribed for similar officers and offices throughout the command. A complete list is published in the unit SSI. Telephones not assigned a directory number are identified by an appropriate abbreviation or word description of the installation.

114. Telephone Operation

The telephone is used to provide personal contact between two or more individuals. Conversations should be as short as possible. Written messages should not be transmitted by telephone unless it is unavoidable.

a. Classification of Calls. There are two types of telephone calls, *urgent* and *routine*.

(1) An urgent call is one that is given precedence over existing circuits to the extent that it warrants interruption of a connection already made. However, one urgent call will not normally interrupt another urgent call already in progress. Urgent calls are reserved for reports containing information which may materially affect plans or change a course of action such as initial contact with the enemy, amplifying or subsequent enemy contact reports, and artillery fire missions. Normally, only personnel designated by the commander are authorized to place urgent calls; however, in an emergency, anyone may place an urgent call.

(2) Routine calls have no precedence but are handled in the order received by the operator. Routine calls constitute the bulk of the traffic handled over a military wire system. They may contain routine information, which, although important, does not require special handling. All personnel using the military telephone system are authorized to place routine calls.

b. Placing Calls. In placing a telephone call, the calling party must be familiar with, or refer to, the telephone directory. Switchboard operators should not be required to look up tele-

phone directory names and numbers for the calling party.

(1) In placing an urgent call, the calling party initiates the call, using the operating phrase URGENT CALL FOR, then announces the called party's telephone directory name and number followed by the operating phrase THIS IS and his official designation. Consequently, to place an urgent call from the liaison officer, 1st Howitzer Battalion, 3d Artillery, to the battalion commander the switchboard operator announces URGENT CALL FOR KENNEL SIX. THIS IS KENNEL NINE.

(2) In placing a routine call, the calling party announces to the switchboard operator the directory name and number of the called party. Consequently, to place a routine call from the commanding officer of battery A, 1st Howitzer Battalion, 17th Artillery, to the battalion S3, the switchboard operator announces KENNEL THREE. A call for an unlisted telephone, such as the battalion OP, 1st Howitzer Battalion, 3d Artillery, would be announced to the switchboard operator as KENNEL OP.

c. Response. In response to telephone calls, the answering party should state the directory name and number of the telephone and his official designation; for example KENNEL SIX, SPEAKING: KENNEL THREE, SPEAKING: or KENNEL THREE, OPERATOR SPEAKING.

d. Conversations. The procedure in person-to-person conversations, other than that used in placing and answering the call, follows no particular pattern of operating words and phrases. The parties connected use normal conversational language. To obtain maximum benefit from the military telephone system, however, person-to-person conversations should be well thought-out before the call is placed. The use of prepared notes is recommended.

e. Oral Messages. The transmission of an oral message differs from person-to-person conversation in that the persons transmitting and receiving the message are usually neither the originator nor addressee. An oral message normally is not written on the prescribed message form or submitted to the message center for transmission, but, since a third person is involved, operating words and phrases are used. For example—

(1) After the calling and called parties have been connected, the phrase MESSAGE FOLLOWS is used by the transmitting operator to alert the receiving operator that a message which requires recording is about to follow.

(2) Words and phrases, such as READ BACK, I READ BACK, THAT IS CORRECT, WRONG, SAY AGAIN, I SAY AGAIN, ROGER, OVER, OUT, etc., are used by both parties where applicable.

(3) Assume that the S3, 1st Howitzer Battalion, 3d Artillery, tells his operations sergeant to call the commanding officer of Battery A and give him the following information: HAVE SURVEY DETAIL CONSISTING OF FOUR MEN AND ONE VEHICLE REPORT TO POINT XRAY at 132ØS. The operations sergeant, using the S3 phone, rings the switchboard operator and says KRAGSHOT SIX.

(4) The switchboard operator puts the call through, and the battery commander's operator answers KRAGSHOT SIX, OPERATOR SPEAKING.

(5) The operations sergeant then transmits: THIS IS KENNEL THREE, OPERATIONS SERGEANT SPEAKING, MESSAGE FOLLOWS, READ BACK, HAVE SURVEY DETAIL CONSISTING OF FOUR MEN AND ONE VEHICLE REPORT TO POINT XRAY AT 132Ø SIERRA, OVER.

(6) The receiving operator at KRAGSHOT SIX transmits I READ BACK, HAVE SURVEY DETAIL CONSISTING OF FOUR MEN AND ONE VEHICLE REPORT TO POINT XRAY AT 132Ø SIERRA, OVER.

(7) The message is read back correctly, and the operations sergeant transmits THAT IS CORRECT, OUT.

115. Switchboard Operating Phrases

The switching central which provides the wire system with flexibility and is the heart of the wire system. It is of primary importance that all switchboard operators and communication personnel use a standardized procedure and method in operating the switchboard. A complete list of words and phrases to be used by operators, for all types of operations, are published in ACP 134 (A). A partial list of the more commonly used operating phrases are—

a. KENNEL OPERATOR—In answering an incoming call, the switchboard operator announces his telephone directory name followed by the word "operator."

b. KENNEL SIX—On receiving the number from the calling party, the switchboard operator repeats the telephone directory name and number exactly as it was given him by the calling party.

c. WHAT NUMBER PLEASE—Phrase used by the operator to request repetition of a number which he has not understood.

d. THE LINE IS BUSY—Phrase used by the operator to report that a local telephone, for which he has received a call, is already in use or that all trunks to a desired central are in use.

e. KENNEL SIX, URGENT CALL—On receiving an urgent call, the switchboard operator repeats the telephone directory name and number followed by the phrase URGENT CALL.

f. KRAGSHOT DOES NOT ANSWER—Phrase used by the operator to inform the calling party that the called telephone central (KRAGSHOT) does not answer.

g. I WILL RING AGAIN—Phrase used by an operator when, in supervising a connection, he is informed that the called party did not answer.

h. WHAT IS YOUR NUMBER PLEASE—Phrase used by an operator if, after supervising a connection, he is given a new number to call by one of the parties but is unable to identify the calling party.

i. HAVE YOU FINISHED—Phrase used by the operator in supervising a connection. He repeats the challenge if no reply is heard.

j. CONFERENCE CALL, KENNEL FIVE, KENNEL THREE, KENNEL TWO, I WILL CALL YOU BACK—Phrases used by the operator to indicate that he has understood correctly the numbers given him by the calling party and that, after completing the calls, he will call the originator back as requested.

k. CONFERENCE CALL, KENNEL FIVE, KENNEL THREE, KENNEL TWO, ONE MOMENT PLEASE—Phrases used by the operator to indicate that he has understood correctly the number given him, and to hold the calling party on the line while the connection is being completed.

l. CONFERENCE CALL FOR YOU, ONE MOMENT PLEASE—Phrases used by the operator to inform the called party that he has a conference call for him and that there will be a delay in completing the connection.

m. YOUR CONFERENCE CALL, GO AHEAD, PLEASE—Phrase used by the operator to inform the calling party that the connection is complete and conversation may begin.

CHAPTER 12

TRAFFIC DIAGRAM AND LINE ROUTE MAP

116. Definition of a Traffic Diagram

A traffic diagram is an illustration showing the number of telephones or teletypewriter circuits existing between switching centrals of a wire system. Long local circuits may also be shown.

a. Preparation. A traffic diagram at battalion level or lower normally is prepared by the switchboard operator and maintained by the operator(s) on duty. At division artillery level or higher, the diagram is normally prepared and maintained by the wire chief. In units equipped with the switchboard SB–22/PT, the traffic diagram is drawn on the yellow strip on the outside of the switchboard cover. Circuits will be tested and determined to be in operating condition before they are recorded on the traffic diagram.

b. Purpose. The traffic diagram is used by the switchboard operator to route calls by the most direct route. A traffic diagram also shows alternate routes if direct routes are busy or out of service.

c. Security. Local security measures will determine the extent of information that will be placed on traffic diagrams.

117. Constructing a Traffic Diagram

Switching centrals are indicated by the appropriate directory name enclosed within a large circle on the traffic diagram (fig. 8). Unit designations may be shown by symbols when security is not jeopardized. Telephones, where shown, are represented by a small circle with an identifying abbreviated designation.

a. Trunk circuits are indicated by single lines drawn between the switching centrals.

b. Local circuits are represented by single lines drawn between the appropriate symbols; e.g., a unit directory name enclosed within a large circle represents a switching central, and a small circle identified by the abbreviated designation represents a telephone.

c. The number of channels available is indicated by a number placed along the line between switching centrals. Simplex circuits and phantom circuits are included as channels only when the switchboard operator can control these circuits; e.g., when the phantom or simplex circuit is terminated through a repeating coil and a line pack.

d. When possible, systems connecting higher, lower, and adjacent units should be included in the diagram.

e. Marginal information is not included in a traffic diagram. However, if a copy of the traffic diagram is to be forwarded to higher headquarters, the copy forwarded should include the following:

(1) Name of diagram.
(2) Unit designation of the originator.
(3) The date and time of preparation.
(4) Authentication. (The communication officer or his authorized representative must sign the traffic diagram to properly authenticate it.)

f. Figure 8 represents a type traffic diagram which was prepared by the 1st Howitzer, Battalion, 3d Artillery, and forwarded to higher headquarters.

118. Line Route Map

a. Definition. A line route map is a map, map substitute, or overlay, suitably titled, on which the actual or projected routes of wire circuits are shown. The line route map does not show the actual connection at the switching central.

b. Uses. The line route map is used principally to report the physical location of wire circuits actually installed on the ground, to direct the installation of the wire system, to facilitate the maintenance of the wire system, and to direct the recovery of wire.

c. Preparation. The battalion line route map is prepared in duplicate by the communication officer. The firing battery line route map is prepared by the battery wire chief or the reconnaissance and survey officer.

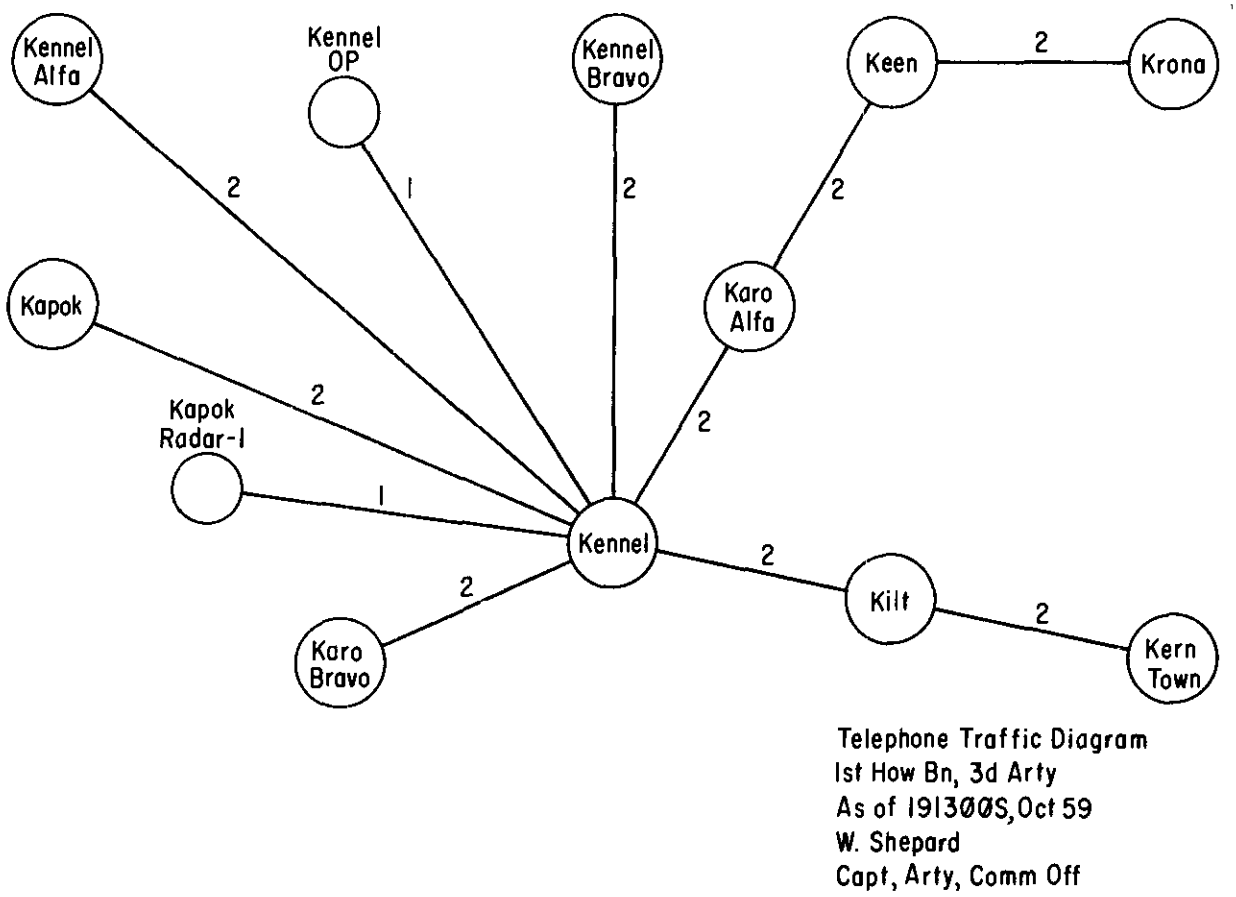


Figure 8. Type traffic diagram.

d. Disposition. One copy of the line route map will be sent to the next higher headquarters, and one copy will be posted at the switchboard of the originating headquarters.

e. Construction. The line route map should contain only lines, symbols, and notations necessary for clarity. Each headquarters or establishment served by the wire system is shown by the authorized military symbol. Switching centrals, which are part of the wire system, are shown by the authorized military symbol, and telephones are represented by a small circle. Telephone lines are represented by a single line drawn along the exact route over which the circuit is installed. Local circuits are also represented by a single line drawn along the exact route over which the circuit is installed. However, only long locals are shown. The number of physical circuits installed along a particular route is indicated by a number placed next to the line. Simplex and phantom circuits are not shown on the line route map. Field wire circuits indicated on the line route map are laid on the ground unless otherwise indicated. Overhead circuits or underground circuits will be shown by their appropriate symbol. Every line route map prepared on overlay paper must include two orientation points taken from the map from which the overlay was made. The following information will be placed on the line route map whenever space is available.

(1) Name of map. (Line route map.)

(2) The designation of the unit preparing the line route map.

(3) The date and time of preparation.

(4) Title and scale of map.

(5) Authentication. (Normally authenticated by the unit communication officer).

f. Security. Line route maps normally will not be taken into forward areas. Maintenance crews will carry only the extracts which pertain

to their particular mission; such extracts will not include unit designations.

g. Type Line Route Map. Figure 9 shows a type line route map prepared by the 1st Howitzer Battalion, 8th Artillery.

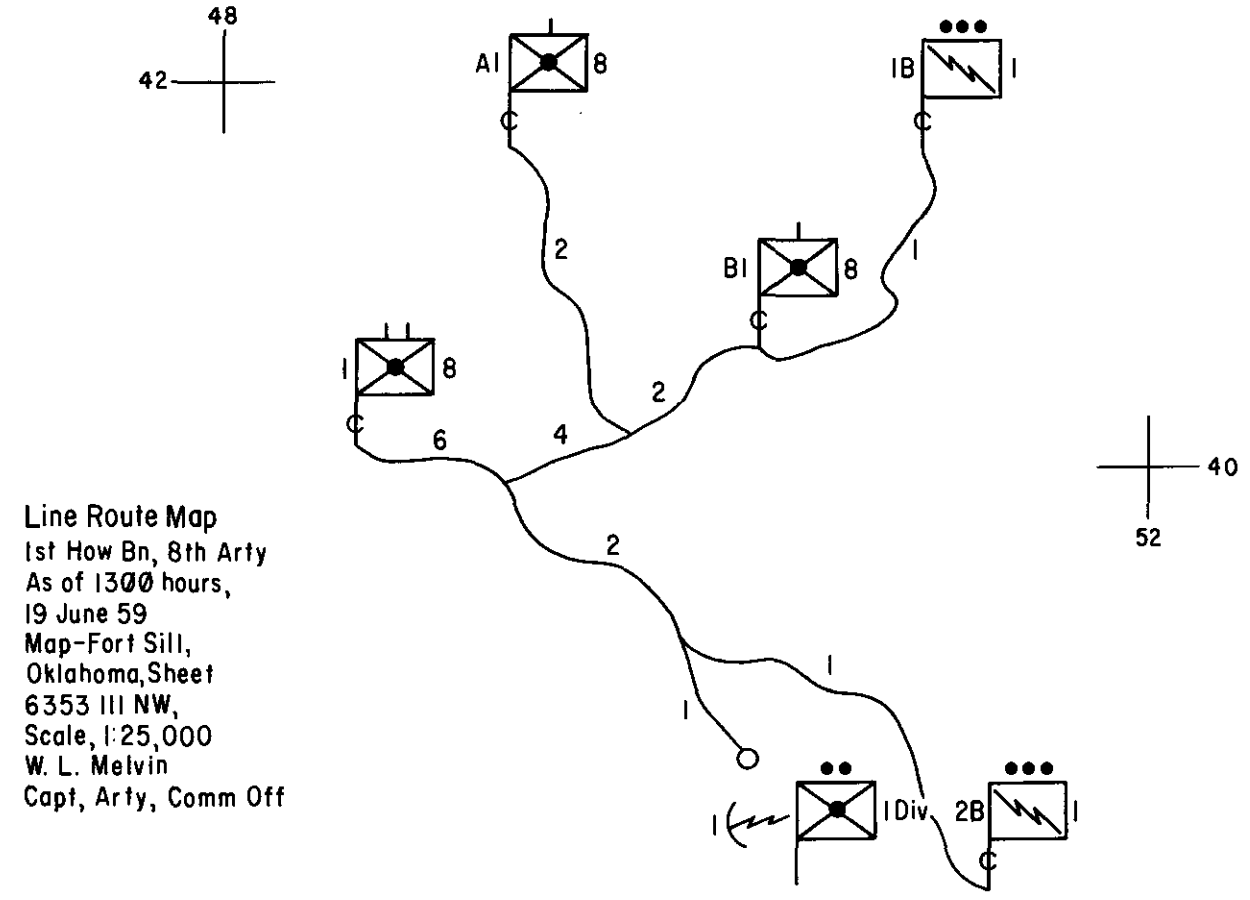


Figure 9. Type line route map.

CHAPTER 13

COMMUNICATION EQUIPMENT

Section I. INTRODUCTION

119. General

This chapter contains general information concerning communication equipment used in field artillery units. For detailed information pertaining to this equipment and equipment not included in this chapter, see the appropriate 11-series technical manuals.

120. Wire Equipment

Wire equipment consists of signal equipment necessary to install, operate, and maintain a unit wire system, to include teletypewriter equipment.

121. Radio Equipment

Radio equipment consists of signal equipment necessary to install, operate, and maintain unit radio nets, to include radio-teletypewriter equipment.

Section II. WIRE EQUIPMENT

122. General

This section contains general information concerning the characteristics of wire equipment used by artillery units. For operating instructions and detailed information pertaining to this equipment, see the appropriate technical manuals of the 11-series. For detailed information concerning field wire techniques, see FM 24-20.

123. Telephone Cable WD-1/TT

Telephone cable WD-1/TT (fig. 10) consists of two twisted, individually insulated, conductors having the following characteristics:

a. American wire gage (AWG) nr 23 (each conductor).

b. Four tinned-copper strands and three galvanized-steel strands.

c. Inner insulation of polyethylene and outer insulation jacket of nylon.

d. Tensile strength of approximately 200 pounds (both conductors).

e. Weight of 48 pounds per mile.

f. Direct current (dc) loop resistance of 200 to 234 ohms per mile at 70° Fahrenheit (F).

g. Signal loss at one kilocycle (kc) at 68° F. of 2.5 decibels (db) per mile under wet conditions or 1.5 decibels per mile under dry conditions.

124. Five-Pair Cable

a. Telephone assembly cable CX-162/G consists of five pairs of rubber-insulated, color-coded, Nr 19 AWG, tinned, solid-copper conductors. Cotton cord is used in the center and as a filler between pairs. A cotton yarn separator is applied over the assembled conductors, and black, vulcanized or synthetic rubber is molded around the outside to form the cable jacket. The cable is equipped with a connector on each end.

b. The five-pair cable is furnished in ½-mile, 1,000-, 500-, 200-, 100-, and 12-foot lengths. The 12-foot length of five-pair cable, telephone cable assembly CX-163/G (fig. 11), has a connector at one end which connects to cable assembly CX-162/G; at the other end, the individual cable conductors are separated to permit connection to binding posts.

c. To facilitate installation and to eliminate large numbers of field wire circuits, five-pair cable is used in congested areas where concentration of communication circuits is required. It is particularly useful for installing circuits from a wire-head, or patching panel, to the switchboard in a command post or as a distribution cable for local circuits.

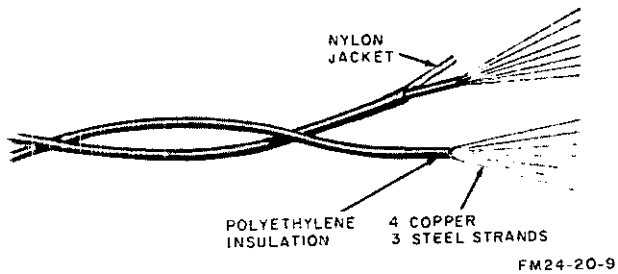


Figure 10. Telephone cable.

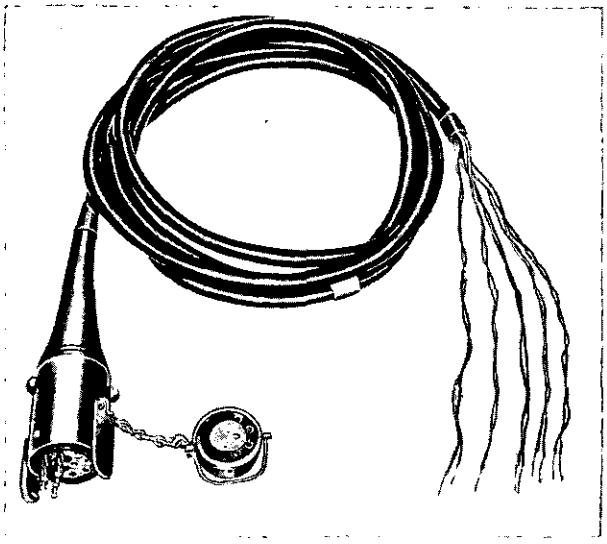


Figure 11. Telephone cable assembly CX–163/G.

125. Spiral-Four Cable

a. General. Spiral-four cable is normally used to provide a four-wire transmission line for a carrier communication system. It also can be used for long-distance voice-frequency circuits. Detailed information concerning cable assemblies using spiral-four cable (telephone cable WF–8/G) is contained in TM 11–381.

b. Telephone Cable Assembly CX–1065/G. The cable assembly consists of approximately one-fourth mile (1,280 to 1,360 feet) of spiral-four cable (telephone cable WF–8/G) fitted at each end with a universal connector. A pair of conductors connect the male contacts of the connector at one end of the female contacts of the connector on the other end. The steel braid is connected to the connector case at each end. Two or more of these assemblies are joined to form a transmission line of any required length. The cable assembly is supplied on cable reel DR–15–B (fig. 12). The storage compartment on the reel holds both connectors plus about 12 feet of the inner end of the cable.

c. Cable Assembly XC–1512/U special purpose, electrical (fig. 13). This assembly is a cable stub and consists of 12 feet of spiral-four cable (telephone cable WF–8/B) fitted at one

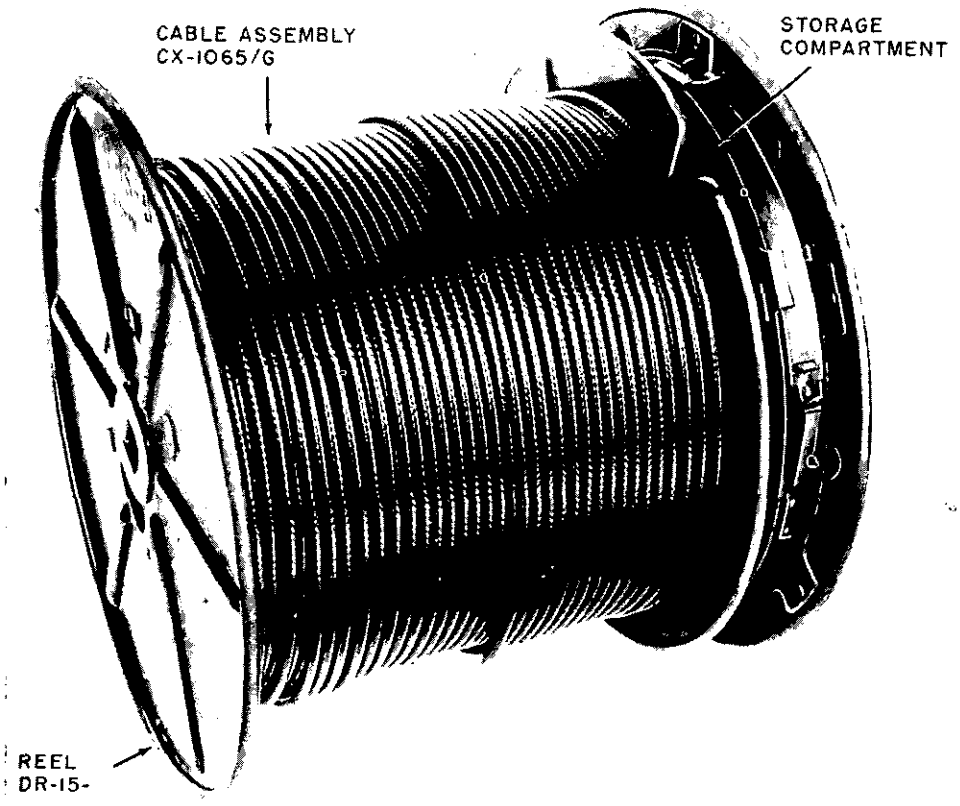


Figure 12. Telephone cable assembly CX–1065/G, wound on cable reel DR–15.

end with a universal connector. The four conductors and steel braid are separated at the other end, allowing the spiral-four cable to be connected to terminal equipment not equipped with universal connectors. The assembly weighs 2 pounds and contains a pair of 6- millihenry loading coils which decrease the cable attenuation on the 0- to 20-kilocycle frequency range. The end caps should be kept screwed on the loading coil when it is not in use to protect the faces from moisture, dirt, and damage.

(1) A nylon yarn braid covers the open ends of the steel braid. The steel braid termination is made at the top of the nylon braid for ease of identification.

(2) The conductors are bared about three-fourths of an inch and tinned. The tinned ends prevent fraying of the conductor strands and provide a good electrical connection.

126. Telephone Cable Splicing Equipment

Field telephone cable splices can be made with either telephone cable splicing kit MK–356( )/G or tool kit TE–33. (Nomenclature followed by ( ) refers to all models of the item of equipment.)

a. Telephone Cable Splicing Kit MK–356( )/G. Telephone cable splicing kit MK–356( )/G (fig. 14), is designed for rapidly splicing telephone cable WD–1/TT (standard splice). The kit consists of splicing tool TL–582( )/U, 4 magazines, 1 bag, and 200 splicing connectors (sleeves). It is 12 inches long and weighs approximately 3½ pounds.

(1) Splicing tool TL–582( )/U has three basic parts—the head assembly, the cutter assembly, and the handle assembly.

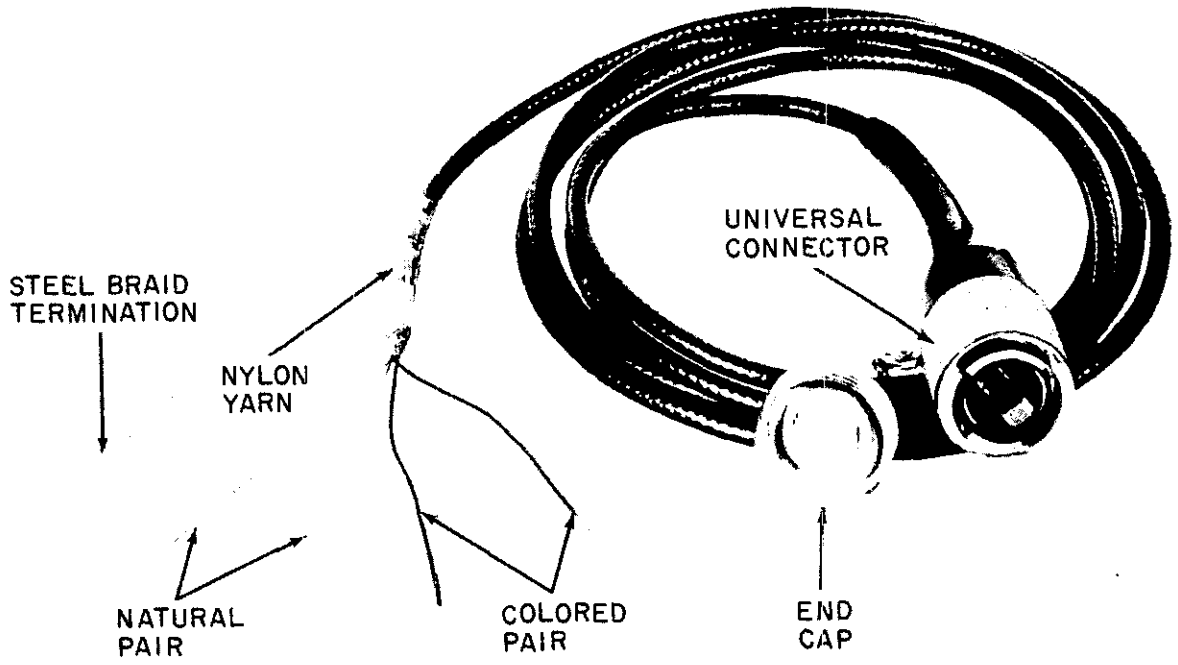


Figure 13. Telephone cable assembly CX–1512/U, special purpose, electrical.

(*a*) The head assembly is composed of the magazine housing, the wire guide, the wire holder, and the crimping chamber (indenter and anvil).

(*b*) The cutter assembly, mounted on the left handle of the tool, has a wire guide, a wire stop, and an upper and a lower cutting blade. The hinged cutting blades are closed by a coil spring when not in use. Each blade has a groove for stripping insulation from telephone cable WD–1/TT.

(*c*) The handle assembly includes the handles and a ratchet. The ratchet prevents the tool from opening until the wire is spliced. This feature insures that the operator will not make a low-tensile-strength splice.

(2) The magazine holds 10 connectors or sleeves. It has a spring, a follower, and a retaining slide for locking the connectors in place.

(3) The bag provides a means of carrying the splicing tool and four magazines.

(4) The splice connector assembly is made up of three concentric sleeves: a copper outer sleeve, a plastic intermediate insulator, and a copper insert. The copper insert insures tensile strength and conductor connection; the plastic insulator provides a waterproof seal, with the aid of pressure maintained by the outer sleeve; and the plastic insulator is belled at each end to form a funnel-like opening for the insertion of the bared wire. The spliced connector assembly produces a waterproof splice without the use of tape.

b. Tool Equipment TE–33. Tool equipment TE–33 (fig. 15) also is used for making tele-

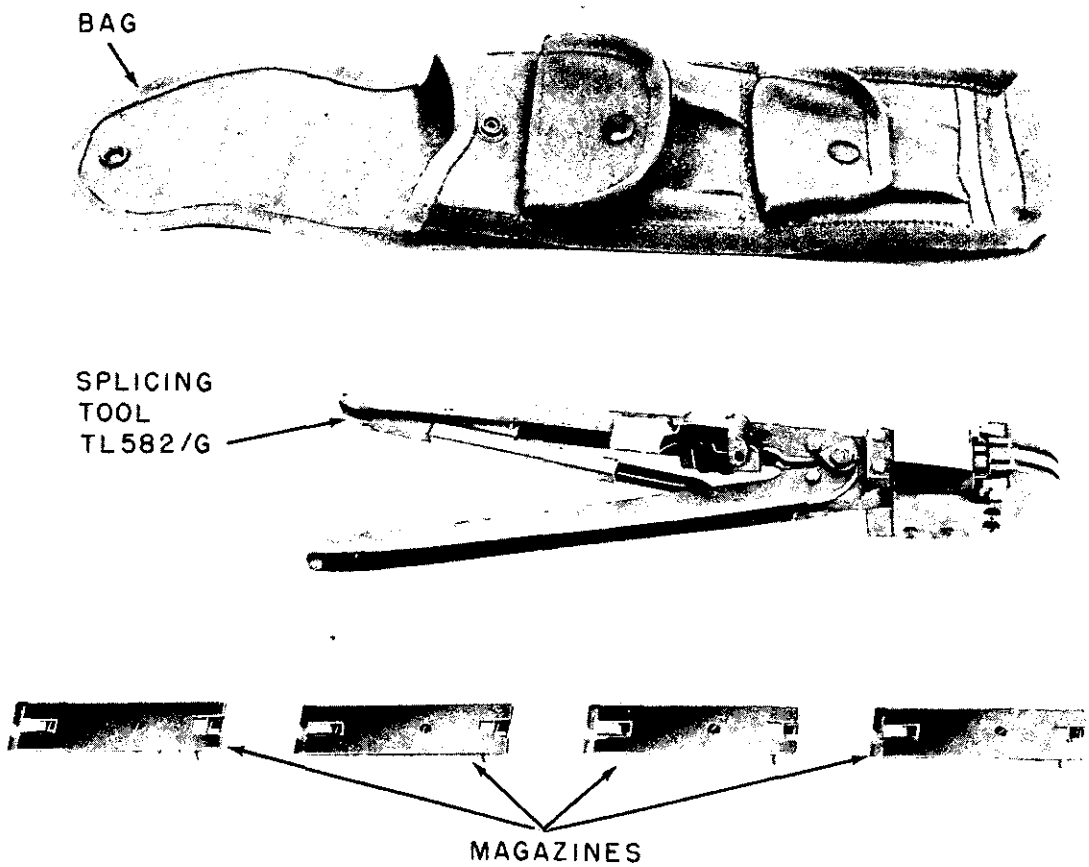


Figure 14. Telephone cable splicing kit, MK–356( )/G.

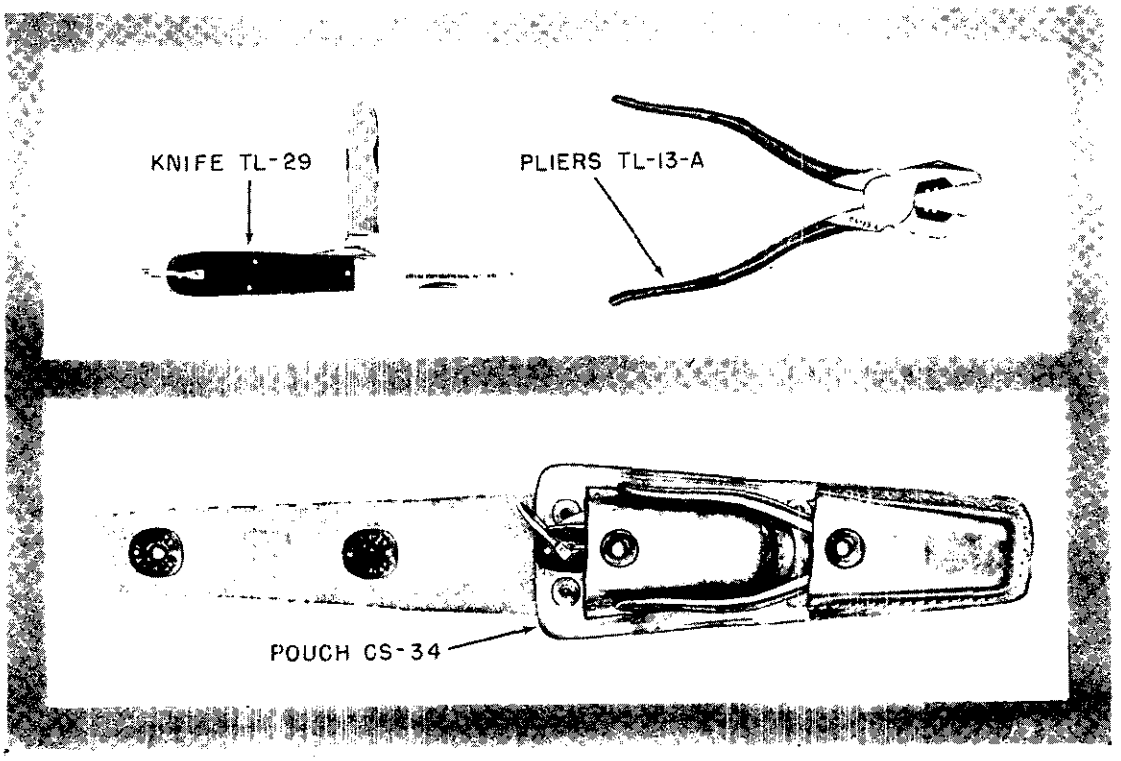


Figure 15. Tool equipment TE–33.

phone cable splices. It consists of holder, carrying, lineman's pliers CS–34; pliers TL–13–A; and electricians knife TL–29. Two types of insulating tapes can be used in making telephone cable splices—electrical insulation tape TL–636/U (black polyethylene), used in tropical and temperate zones, and electrical insulation tape TL–600–U (white polyethylene), used in the Arctic zone and during cold weather in temperate zones. Tape TL–83 (friction) may be used for added protection of the splice. To improve the splice mechanically and electrically, a small gage, softdrawn copper wire (known as seizing wire) may be used. (Seizing wire may be obtained from the copper conductors in a piece of telephone cable).

127. Telephone Cable Reels

The three types of reels (fig. 16) available for use with telephone cable and cable assemblies are as follows:

a. Cable reel DR–5 is a metal, spool-type container used to store, transport, lay, or recover telephone cable WD–1/TT. It will hold 2½ miles of telephone cable WD–1/TT and can be mounted on cable reeling machine, engine driven, RL–207 or cable reeling maching hand, RL–31–( ).

b. Cable reel RL–159/U is a metal, spool-type container used to store, transport, lay, or recover telephone cable WD–1/TT. It will hold 1 mile of cable and can be mounted on cable reel-

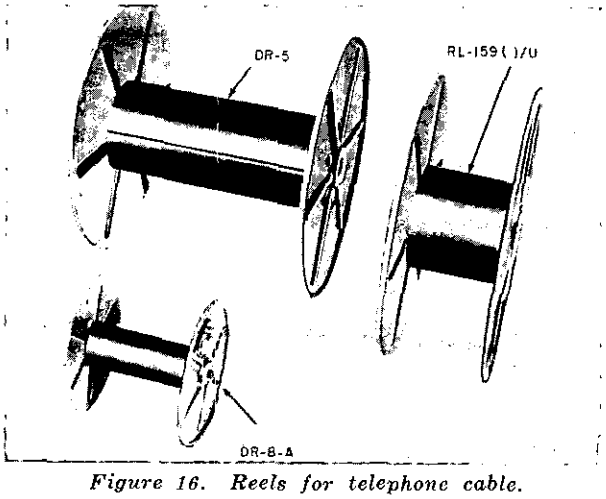


Figure 16. Reels for telephone cable.

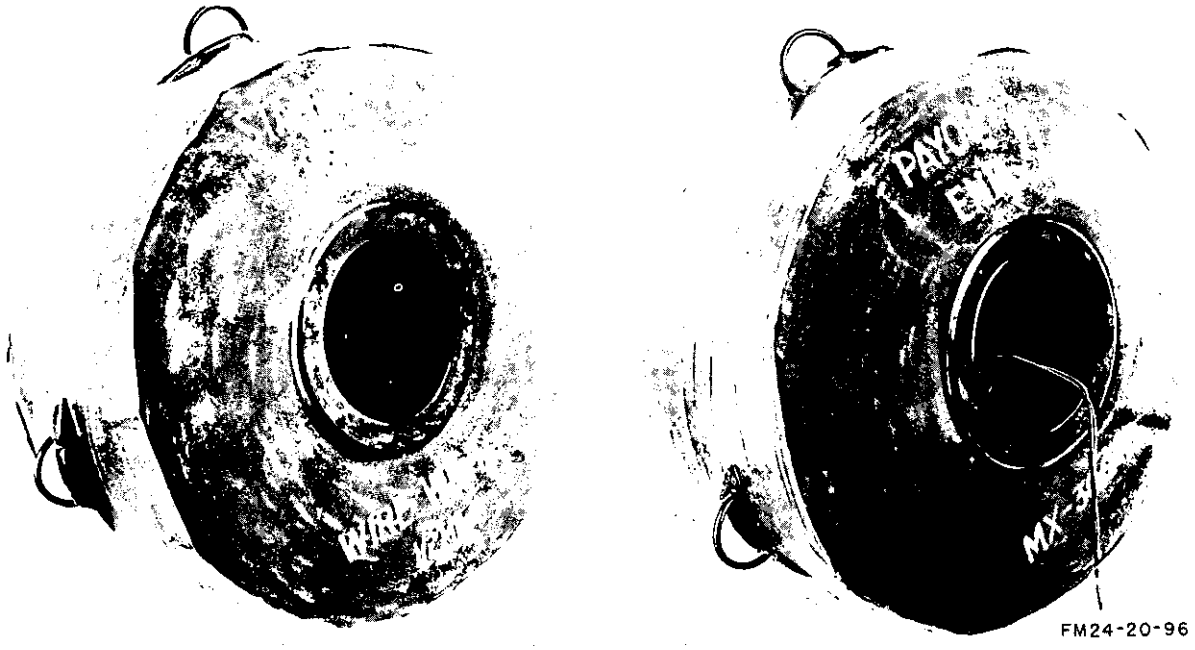


Figure 17. Wire dispenser MX-306A/G.

ing machine, engine driven, RL-200; cable reeling machine, hand, RL-31-( ); cable reeling machine motor driven, RL-172/G, or cable reeling machine, hand, RL-27-( ).

c. Cable reel DR-8-( ) is a metal container used to lay or recover telephone cable. It will hold one fourth mile of telephone cable WD-1/TT and can be mounted on cable reeling machine, hand, RL-39-( ).

128. Wire Dispenser MX-306( )/G

a. Wire dispenser MX-306( )/G (fig. 17) is a cylindrical canvas and tape container that holds approximately one-half mile of telephone cable WD-1/TT. The telephone cable of two or more dispensers may be prespliced in tandem when it is necessary to lay more than one-half mile of wire without stopping to make a splice.

b. The dispenser has many useful features:

(1) It is portable.

(2) It will pay out cable at high speeds from land and amphibious vehicles or from fixed-wing and rotary-wing aircraft.

(3) It will function at speeds up to 100 miles per hour.

(4) It lays the cable flat on the surface of the ground without spirals or kinks.

c. No special mounting devices are necessary if a single dispenser is used to lay the cable. If several dispensers are connected in tandem, however, a means must be provided to support and aline the dispensers one behind the other. Before the cable within the dispensers is laid, after connection in tandem, it should be tested for continuity. For more detailed information, refer to TM 11-2240.

129. Cable Reeling Machine, Hand

Cable reeling machine, hand, RL-27-( ) (fig. 18) is a simple axle designed for laying and recovering telephone cable. The axle is a machined-steel bar (2½ feet long) with two knurled handles, one of which can be removed to mount cable reel RL-159/U on the axle. It is equipped with roller bearings and a removable crank for rewinding the cable. The reeling machine can be carried by two men or it can be placed on some improvised mounting.

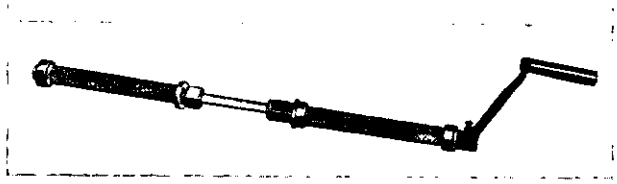


Figure 18. Cable reeling machine, hand RL-27-( ).

130. Cable Reeling Machine, Hand RL-31-( )

a. Cable reeling machine hand RL-31-( ) (fig. 19), is a lightweight, portable, folding A-frame of steel tubing used for paying out and recovering telephone cable and cable assemblies. The reeling machine is equipped with the following features:

(1) A *brake unit* for controlling the speed of the reels as the cable is payed out.

(2) A *crank* for winding the cable on the reels.

(3) A *carrying strap* for carrying the reeling maching litter style.

(4) A *divided axle* for use when two reels are mounted on the reeling machine. This axle allows either reel to operate independently of the other. (When the divided axle is used, two cranks and two brakes are necessary for operation. This equipment is issued with the reel unit).

b. The reeling machine has a capacity of one cable reel DR-5, one cable reel DR-15, or two cable reels RL-159/U. Cable reels DR-15 are used with cable assemblies.

131. Cable Reeling Machine, Motor-Driven RL-172( )/G

Cable reeling machine, motor-driven RL-172( )/G (fig. 20), which weighs approximately 100 pounds, is used to pay out and recover telephone cable. The reeling machine which is equipped with cable reel RL-159( )/U, is normally mounted vertically on the tailgate of a truck but also may be operated from a horizontal position on the bed of the truck.

a. The reel is driven by a 24-volt, dc motor. Power for the motor is furnished by the battery of the vehicle in which reel is mounted.

b. A handcrank is provided for manual operation.

c. The reeling machine is designed for one-man operation and is equipped with controls

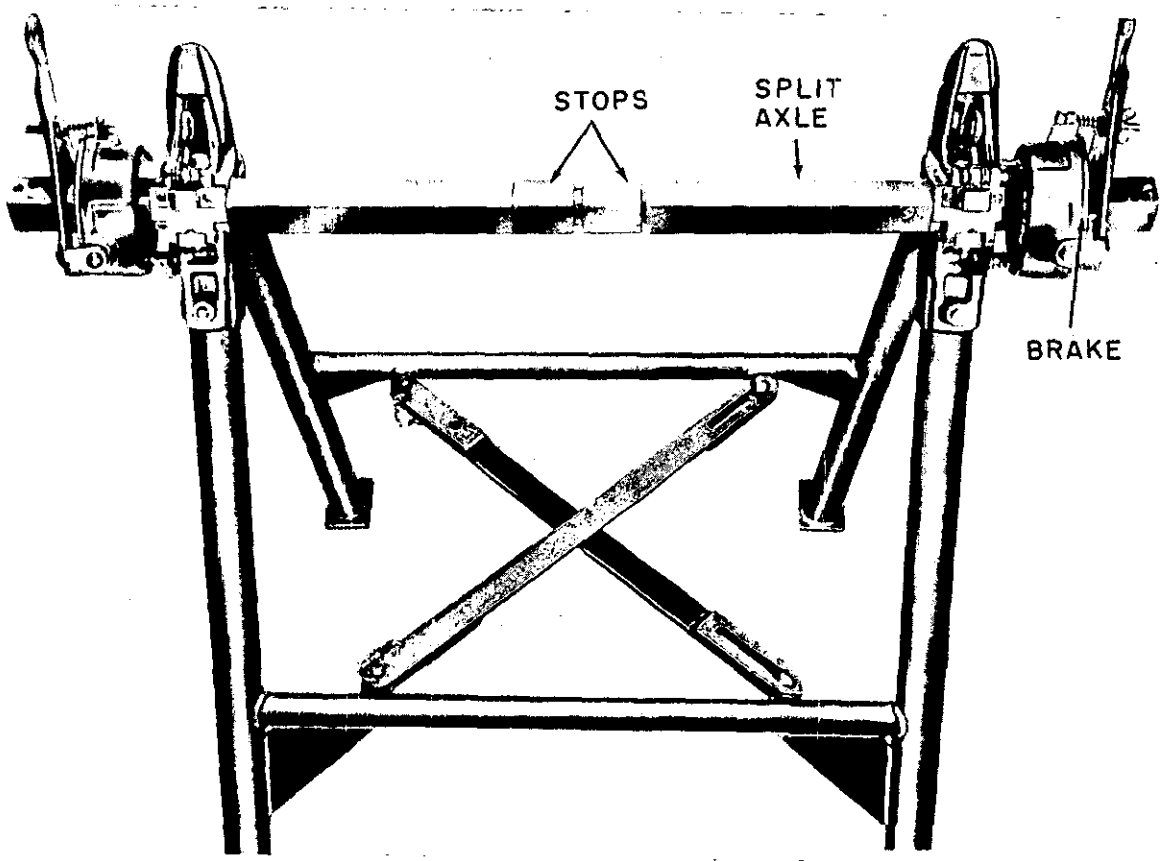


Figure 19. Cable reeling machine, hand RL-31-( ).

for starting, stopping, and reversing the movement of the reels.

d. The wire can be payed out or reeled in from either the back or the front of the reel. The speed of the reel can be controlled, (varying from 0 to 300 revolutions per minute (rpm)) by using the braking mechanism and changing the pressure on the control handle.

e. The reeling machine has a capacity of one cable reel RL–159/U.

132. Cable Reeling Machine, Engine Driven RL–207–( )

a. Cable reeling machine RL–207–( ) is a transportable, wire-laying and wire-recovery machine driven by a gasoline engine. This reel unit is usually vehicular-mounted, but it can be operated on the ground.

(1) The reeling machine has a capacity of two cable reels DR–5, two cable reels DR–15–( ), or four cable reels RL–159/U.

(2) The wire can be payed out or recovered from any reel singly or from all reels simultaneously.

(3) Brakes are provided to prevent backlash.

(4) A gasoline engine furnishes the power to operate the reel unit for recovering the wire.

(5) The reeling machine can be operated by a hand crank when necessary.

b. For complete details on the operation and maintenance of the unit, refer to the appropriate 11-series technical manual.

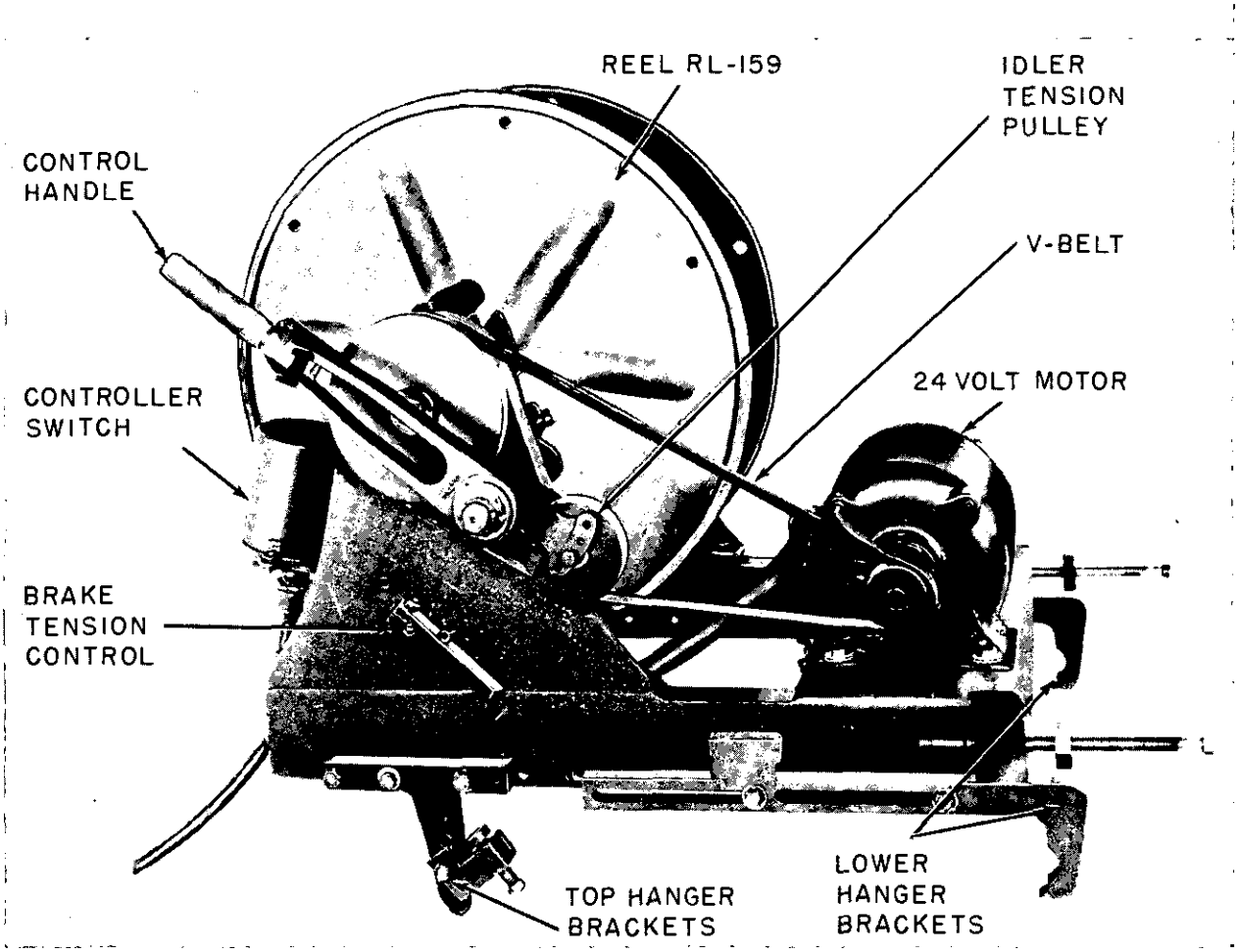


Figure 20. Cable reeling machine, motor-driven RL–172( )/G.

133. Wire Pike MC–123

Wire pike MC–123 consists of a two-section pole, joined by metal fittings. The top section terminates in a hook, fitted with a roller, which is used by a wireman to lay or recover telephone cable from a truck. As the cable is laid, the hook is used to guide the cable along the side of the road. For cable recovery, it provides an even feed and guides the cable to the reeling machine.

134. Climbers LC–240/U

a. General. Climbers LC–240/U (fig. 21) are adjustable, lightweight, metal climbers. The length of the climbers can be adjusted from 14¾ inches to 19½ inches to conform to different leg sizes. Climbers LC–240/U consist of two leg irons, 2-inch and 3-inch interchangeable gaffs, leather fastening straps, and climber pads. The 2-inch gaffs are used for climbing poles or trees with thin bark, and the 3-inch gaffs are used for climbing trees with thick bark.

b. Adjustment. To adjust the leg irons, the two leg-iron screws are removed, the slide assembly is moved on the leg iron to the desired length, and the leg iron screws are inserted in the nearest screw holes, and secured.

c. Gaff Removal. To remove the gaffs, the two gaff retaining screws are released, and the gaff is moved downward toward the stirrup and lifted out of the retaining slot. This procedure is reversed to replace the gaffs.

d. Gaff Sharpening. At present, no gage is available to check the gaffs of climbers LC–240/U. A new gaff may be used as a guide to sharpen dull gaffs. (Gaffs should be sharpened only when replacement gaffs are not available.)

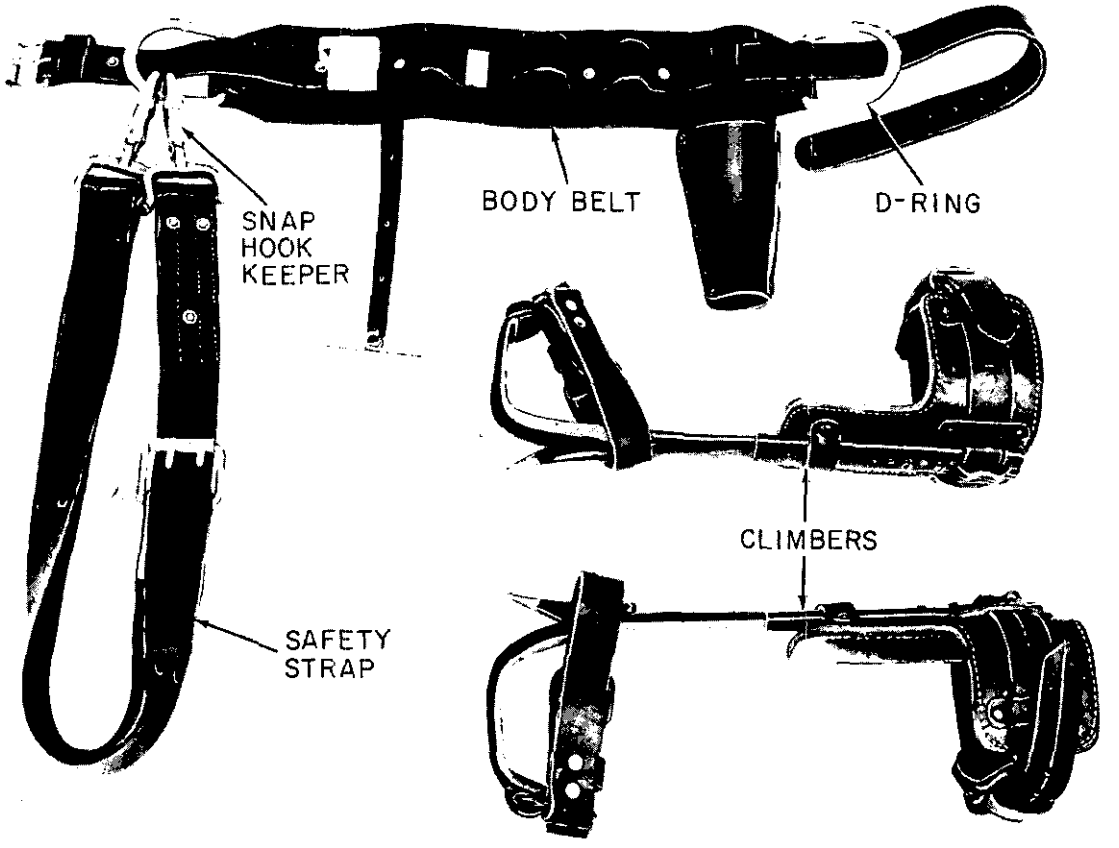


Figure 21. Climbing equipment.

135. Lineman's Belt LC-23/( )

Lineman's belt LC-23-( ) (fig. 21) consists of a leather belt and an adjustable leather safety strap. The body belt is supplied in various sizes, according to the distance in inches between the D-rings. Safety straps are furnished in 61-, 68-, and 70-inch lengths.

136. Field Telephones, General

a. Field telephone sets are portable, self-contained equipments designed for field use. These sets combine durable construction with portability. The selection of a specific field telephone depends on the length and type of circuit and the type of switchboard to be used.

b. The two principal types of field telephones are sound-powered and battery-powered.

(1) In a sound-powered telephone, the transmitter unit generates the electrical energy. The sound waves created by the voice of the speaker strike the transmitter unit and are converted directly into electrical energy. The receiver unit of the distant telephone reconverts this electrical energy to the original sound waves. Sound-powered telephones, which have a shorter voice range than battery-powered telephones, can be used with, or in place of, local-battery telephones. However, sound-powered telephones cannot be used in common-battery systems.

(2) In a local battery-powered telephone, small dry-cell batteries contained inside the telephone are the source of transmission power. When a local battery-powered telephone is used in a common-battery system, dry-cell batteries inside the telephone may not (depending on the equipment) be necessary. Field telephones contain hand-operated magnetos or ringing generators for signaling. The incoming ringing signals are indicated audibly by a bell or buzzer, or visually by a light or silent signal device.

c. The talking ranges of the principal field telephones are summarized in the following table:

Field telephones	Talking distances, using Telephone Cable WD-1/TT (nonloaded)*	
	Wet conditions (miles)	Dry conditions (miles)
TA-1( )/PT	4	4
TA-312/PT	14	22
TA-264/PT:		
With amplifiers	28	44
Without amplifiers	14	22

* The above distances are approximate, since talking range is also affected by the following factors: number and quality of splices, weather conditions, number of switching centrals and test stations, noise cross talk, and other interference in a circuit.

137. Telephone Set TA-1( )/PT

a. Telephone set TA-1( )/PT (fig. 22) is a sound-powered equipment, providing facilities for talking and signaling without batteries. The approximate talking and signaling range of the TA-1( )/PT is from 4 to 10 miles over telephone cable WD-1/TT. This telephone set can be used to advantage in forward areas, in switched networks having magneto signaling switchboards, in closed nets, and in point-to-point circuits.

b. The telephone handset contains sound-powered transmitter and receiver units, a hand generator that is operated by a lever-type switch, and a push-to-talk switch. The user can receive either visual or audible-level signaling indications during operation.

c. To install the telephone, the field wire conductors are connected to the binding posts on the terminal block at the end of the cord.

d. To signal the distant telephone, the generator lever is depressed and then released. To silence the audible signal, the switch at the back of the set is turned to OFF. The volume of the audible signal can be controlled by turning the switch to various settings between OFF and LOUD.

e. To talk to the distant station, the push-to-talk switch is depressed. It is possible to hear the distant party faintly if he tries to interrupt while the push-to-talk switch is depressed, but it is necessary to release the switch to hear him clearly.

f. For further information, refer to TM 11-5805-243-12.

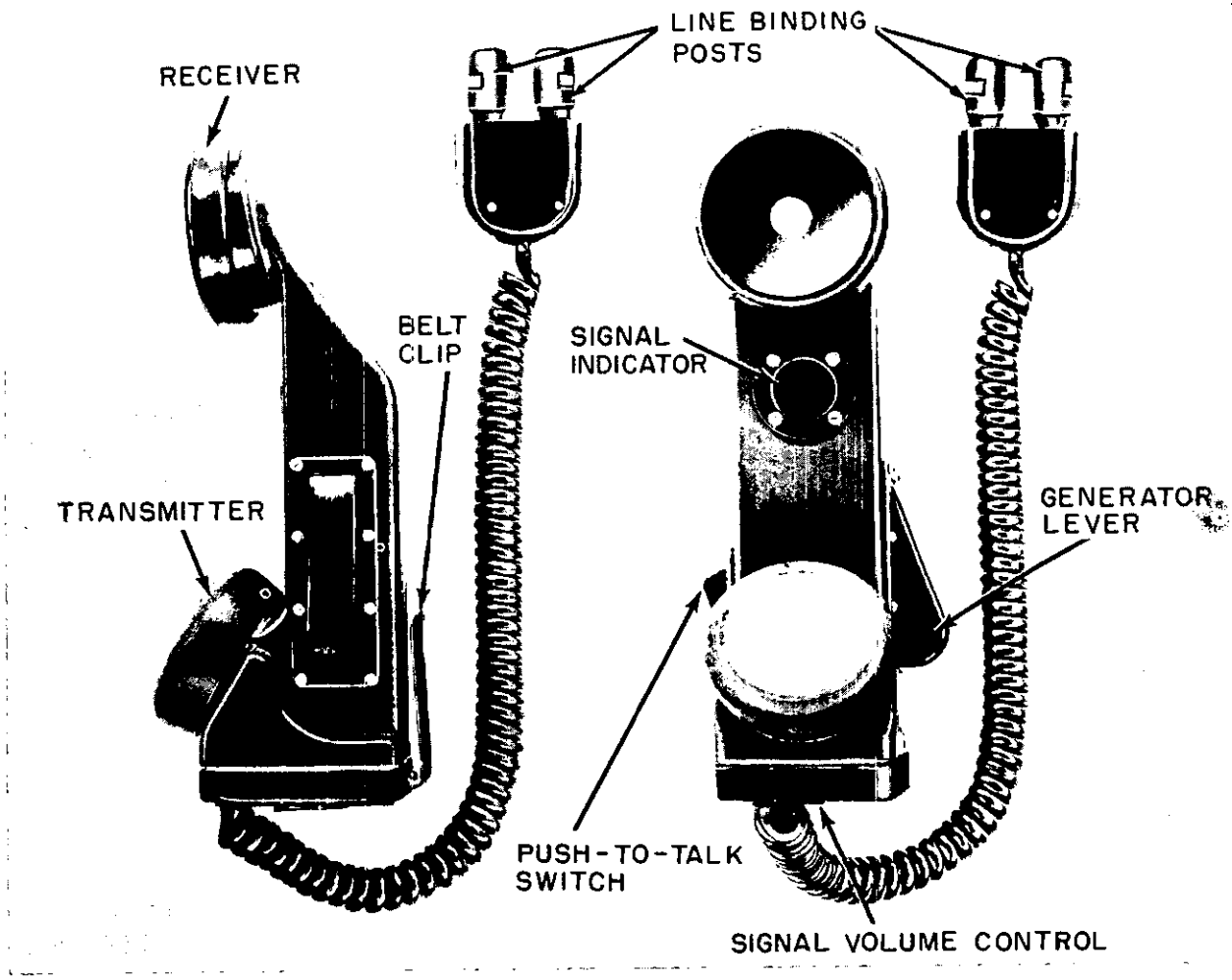


Figure 22. Telephone set TA–1( )/PT.

138. Telephone Set TA–312/PT

a. Telephone set TA–312/PT (fig. 23) is used as a local-battery (LB) or common-battery (CB) manual telephone. It may also be arranged for operation as a local-battery telephone using common battery signaling (CBS).

b. Telephone set TA–312/PT can be used under all outdoor conditions or as a desk or wall-mounted telephone. A receptacle is provided for connecting a handset-headset, which may be used in place of the handset provided. In addition, the telephone set can be used to control remotely operated radio equipment.

c. For more detailed information, refer to TM 11–2155.

139. Telphone Set TA–264/PT

a. Telephone set TA–264/PT (fig. 24) is a portable battery-powered field equipment designed for use on long field wire lines. Vacuum-tube amplifiers in both the transmitting and receiving circuits of the telephone make communication possible over distances greater than can be obtained with other field telephone sets. When the amplifiers are in use, communication is on a one-way reversible basis. The incoming ringing signal can be indicated audibly or visually.

b. Telephone set TA–264/PT cannot be used in common-battery systems connected to switchboards or over telephone carrier derived circuits.

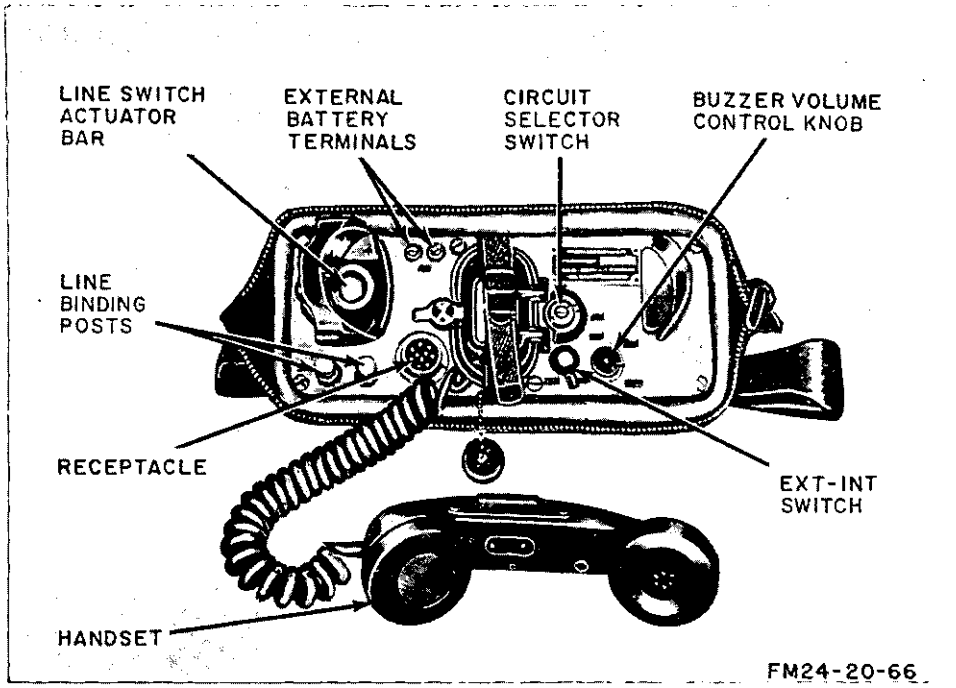


Figure 23. Telephone set TA-312/PT.

c. For further information, refer to TM 11-2059.

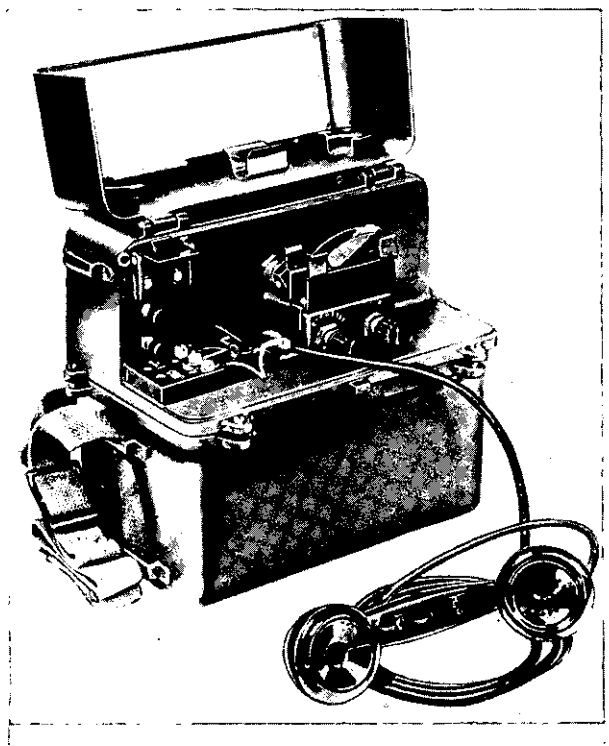


Figure 24. Telephone set TA-264/PT.

140. Manual Telephone Switchboards, General

Manual telephone switchboards are designed for use in several types of operation; e.g., common-battery, local-battery, and common-battery signaling/local-battery operation. Some field switchboards are designed specifically for one type of operation. Others are designed for all three types of operation.

a. Field telephone switchboards are manually operated equipments, constructed to withstand rough handling and designed for quick, simple installation.

b. In a common-battery system, the source of electrical energy for speech and ringing signals is located at the switchboard telephone central. In a local battery system, this source of electrical energy is a component part of the telephone set. In the other system (CB signaling/LB operation), the source of power for speech is part of the telephone set; the power for signaling the switchboard is located at the switchboard.

141. Manual Telephone Switchboard SB-993( )/GT

a. Manual telephone switchboard SB-993 ( )/GT (fig. 25) is a light, portable local-battery switching equipment normally used in company-size units. It consists of a plug holder and seven two-pronged adapter plugs U-184( )/GT in a case. A field telephone is required for the operator's use. The SB-993( )/GT may be used as an emergency field replacement for any local battery switchboard.

b. Each adapter plug U-184( )/GT consists of a neon glow lamp, two binding posts, two plugs, and two jacks, all molded together in a translucent plastic housing. The plugs serve as the thumbscrew ends of binding posts to which incoming lines are connected. The plugs may be inserted into the jacks of another adapter plug U-184( )/GT to establish a connection between two lines.

c. Several adapter plugs U-184( )/GT can be connected in tandem for conference connections (several separate parties conversing at the same time).

d. An incoming ringing signal lights the neon lamp in the switchboard plug connected to the line for the duration of the signal. There is no audible signal when the neon lamp lights unless the switchboard operator's telephone is connected to that line. Thus, the operator must always be alert for an incoming signal.

142. Manual Telephone Switchboard SB-22/PT

a. Manual telephone switchboard SB-22/PT (fig. 26) is a single-position field equipment, used primarily in field wire systems. It is small, lightweight, portable, and immersion-proof, and it requires no special mounting equipment for operation.

b. The switchboard is equipped for interconnecting local-battery telephone lines, voice-frequency teletypewriter circuits, and remote-control circuits for radio communication. Each switchboard has a maximum capacity for switching either 12 field telephones, 12 voice-frequency teletypewriter circuits, 12 remote-control circuits, or a combination of these facilities. A capacity of 29 circuits can be obtained by stacking two switchboards and replacing the operator's pack of one switchboard with five additional line packs. The SB-22/PT obtains operating power from four batteries BA-30.

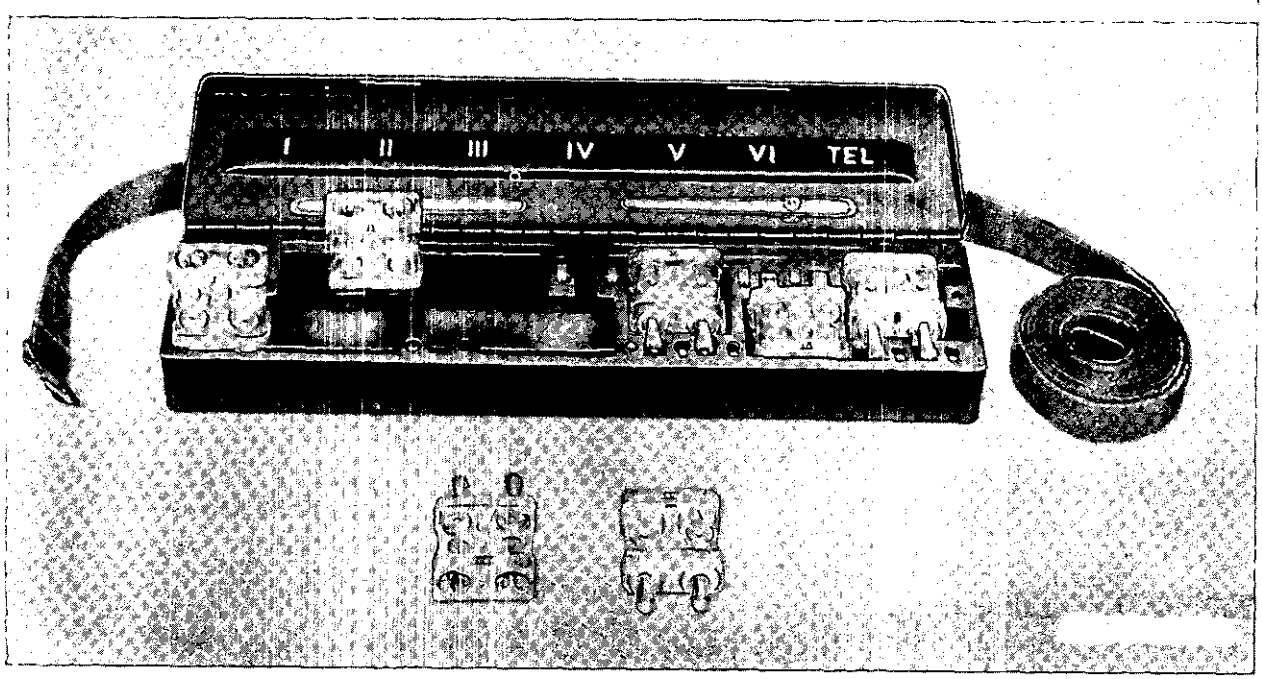


Figure 25. Manual Telephone Switchboard SB-993( )/GT.

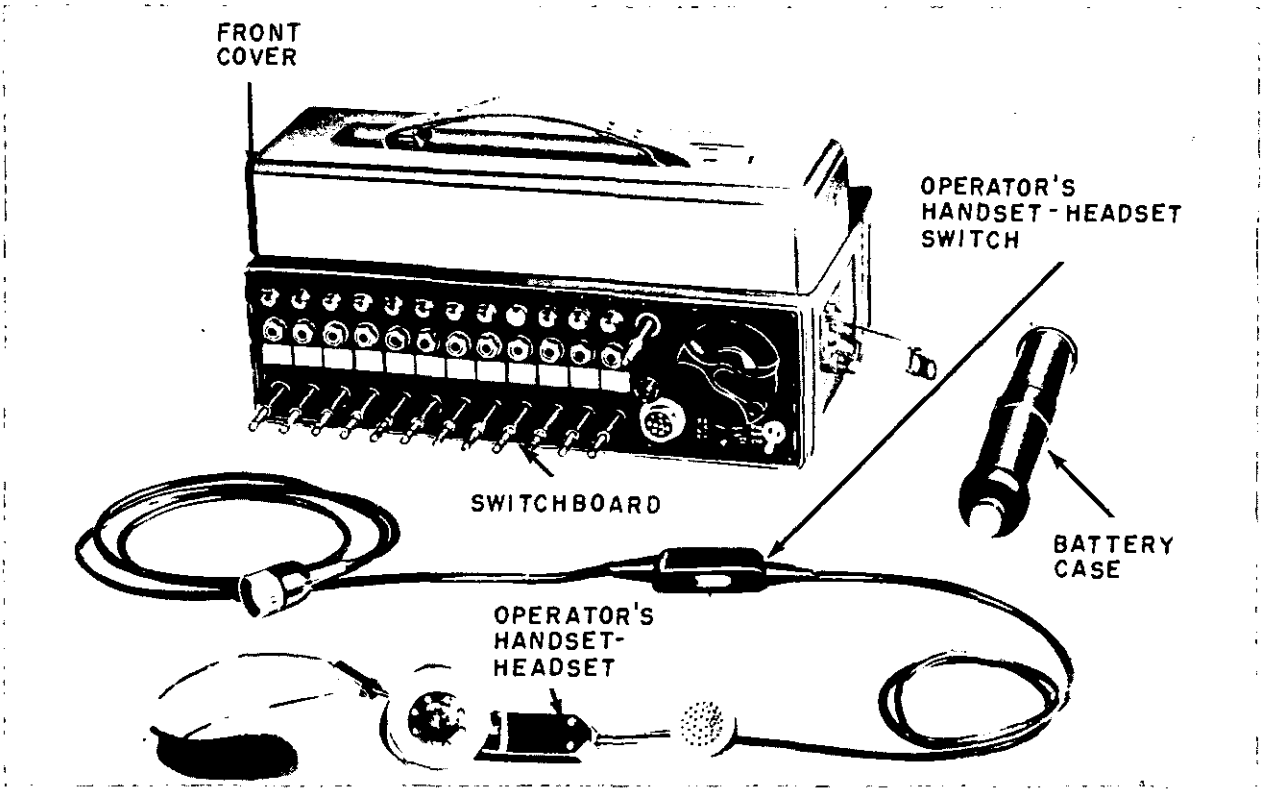


Figure 26. Manual telephone switchboard SB-22/PT.

c. For detailed information, refer to TM 11-2202.

143. Terminal Telephone Switchboard SB-86/P

a. Terminal telephone switchboard SB-86/P (fig. 27) is a portable, single-position field equipment used primarily in the field telephone cable system. The component parts of the switchboard can be rapidly assembled or dismantled during tactical employment. Switchboard SB-86/P can be used to interconnect voice-frequency teletypewriter circuits.

b. Terminal telephone switchboard SB-86/P consists of a portable jack field section, switchboard assembly TA-207/P, manual telephone switchboard section SB-248/P, and power supply PP-990/G.

(1) The jack field section has a capacity of 30 complete line circuits. In addition, it contains the line signals, designation strips, panel lamps, and switches necessary for operation of the switchboard. A second jack field can be stacked on the first to increase the capacity of the switchboard to 60 line circuits.

(2) The switchboard section consists of 8 replaceable groups: 16 answering cords and 16 calling cords.

c. Local-battery or common-battery signaling can be selected by using a switch associated with each line circuit. There are also two common-battery line circuits to be used with common-battery switchboards.

d. The cord circuits of the switchboard do not supply battery power to the distant telephone for speech transmission; therefore, only local battery telephones or telephones designed for common battery signaling can be used with this switchboard.

e. For further information, refer to TM 11-2134.

144. Teletypewriter Sets, General

a. A teletypewriter is an electromechanical machine for the transmission and reception of

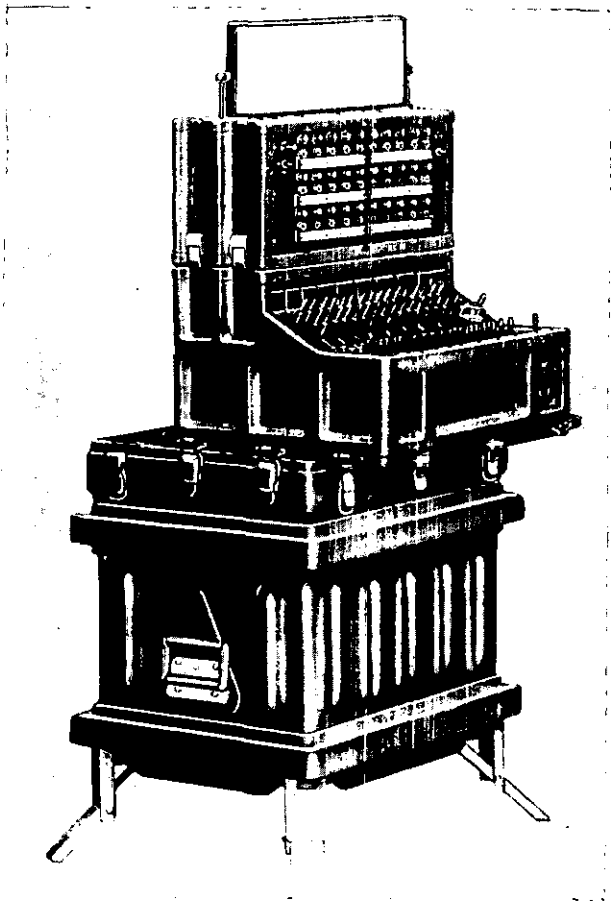


Figure 27. Terminal telephone switchboard SB-86/P.

coded electrical impulses that are converted into a recorded message. Messages are recorded by either of two methods—typed page copy (page-printing teletypewriters) or code perforations on tape (reperforators). Some teletypewriters that record messages by code perforations on tape also record the typewritten characters on the same tape (typing reperforators). Teletypewriter messages are transmitted manually by typing the message on a keyboard or by transmitting automatically from perforated tape in a transmitter-distributor.

b. A teletypewriter uses both alternating-current (ac) and direct-current (dc) power for its operation. Direct-current power must be used for the line current.

c. When a centralized power source is not available, a small engine-generator unit furnishes the power for the teletypewriter.

d. Tactical teletypewriter sets are equipped with carrying cases, power supplies, and necessary accessories, such as paper, perforating tape, printing ribbons, and a supply of spare parts.

145. Teletypewriter Set AN/PGC-1

a. Teletypewriter set AN/PGC-1 (fig. 28) is a lightweight, portable, page-printing, sending and receiving set that is designed for field use. It consists of a standard communication teletypewriter (Teletypewriter TT-4( )/TG) and Case CY-694A/PGC-1.

b. Teletypewriter TT-4( )/TG is capable of sending and receiving standard teletypewriter start-stop, five-unit code impulses at the speeds of 60, 66, 75, or 100 words per minute, depending on the motor-drive gear set used. It is designed for dc neutral or voice frequency operation over wire lines or as dc or voice-frequency operation over telephone carrier systems. The carrier systems may operate over spiral-four cable or radio relay carrier systems. Operation with either 20- or 60-milliampere dc line current is made possible by using a changeover switch.

c. Teletypewriter TT-4 ( )/TG is not equipped to supply dc power for the line current, and this power must be supplied by some external source. To operate the teletypewriter

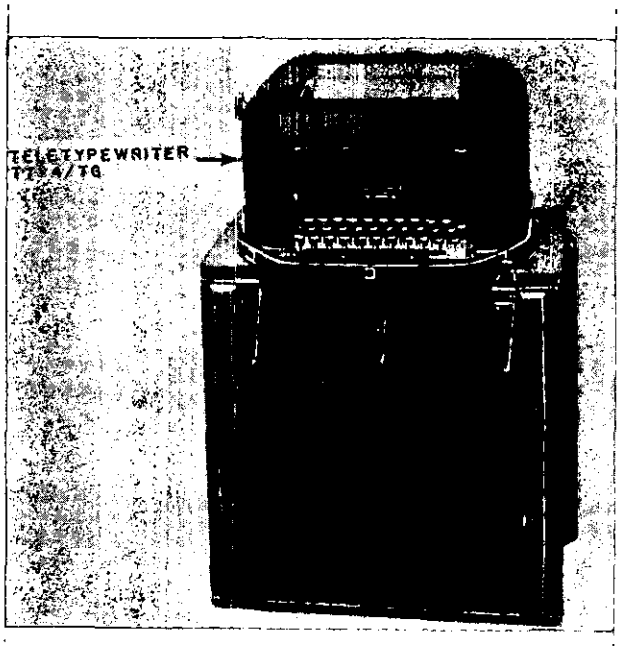


Figure 28. Teletypewriter set AN/PGC-1.

universal motor, a power source of 105- to 125-volts ac or dc is required.

d. For more detailed information, refer to TM 11-5815-206-12.

146. Terminal Board TM-184

a. Terminal board TM-184 (fig. 29) is a block of insulating material, on which are mounted 28 insulation-piercing binding posts and 4 mounting holes. This terminal board can terminate seven pairs of telephone cable.

b. To connect a cable to the terminal board, remove about one-half inch of insulation from the end of the wire to be connected. Unscrew the knob on the binding post as far as possible and insert the end of the cable into the slot, so that the cable projects through the binding post.

c. As an alternate method, remove about 1 inch of insulation from the cable. Cut another 1-inch strip of insulation and move it to the end of the bared wire. Double the bared portion, and insert it into the slot of the binding post. Tighten the knob firmly with the fingers, clamping the wires securely in the slot. To avoid stripping the threads on the binding posts, do not use pliers to tighten or unscrew the knob.

d. Terminal boards mounted in the open and subject to the effects of weather must be protected. Since no prescribed cover is provided covers must be improvised from suitable wooden boxes or salvaged canvas by personnel installing the terminal boards.

147. Repeating Coils

a. A repeating coil is an audio-frequency transformer (usually with a 1 to 1 winding ratio) which transfers energy from one electrical circuit to another and permits the formation of simplex and phantom circuits for additional teletypewriter or telephone channels. The coils consist of two balanced windings. One winding—the line side—is connected to line terminals. The other winding—the switchboard side—is connected to switchboard terminals. When a telephone is used in place of a switchboard, these windings are connected to the telephone, and the line side of the coil is tapped at midpoint. This tap, called the leg, provides a means of forming simplex and phantom circuits.

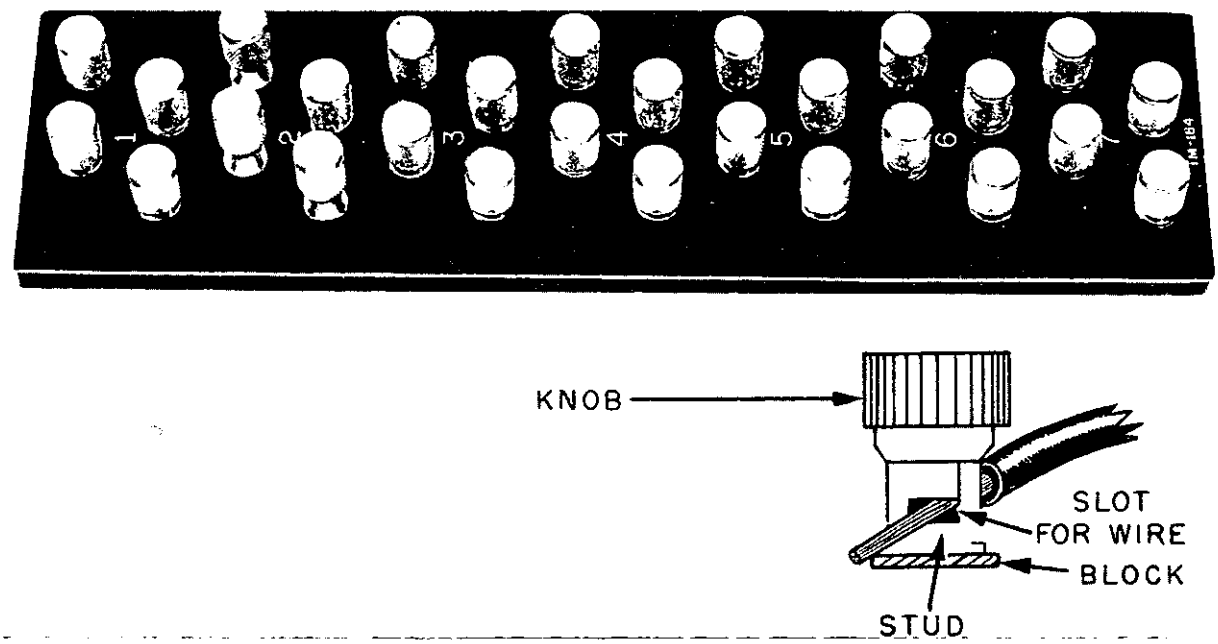


Figure 29. Terminal board TM-184.

b. Telephone coil, repeating C–161 (fig. 30) is a ring-through transformer with a 1 to 1 winding ratio. The line-side winding of this transformer is tapped at the center for simplex- or phantom-circuit operation. The LINE binding posts are connected directly to the line; the SWITCHBOARD binding posts are connected to the line terminals on a switchboard or telephone; and the TELEG. binding posts are connected to one line terminal of a teletypewriter (except in a phantom circuit, in which it is connected to the switchboard binding posts of the phantom line).

c. Additional circuits can be obtained from existing metallic circuits with repeating coils. These circuits are as follows:

(1) A *simplex circuit* is defined as a ground-return telephone or telegraph circuit superimposed on (added to) a single, full-metallic circuit to obtain an additional circuit.

(2) A *phantom circuit* is obtained from two full-metallic circuits to provide an additional telephone or telegraph circuit.

(3) A *simplexed-phantom circuit* combines the principles of both simplex and phantom circuits to obtain a fourth circuit.

d. For further information concerning repeating coils, see TM 11–678.

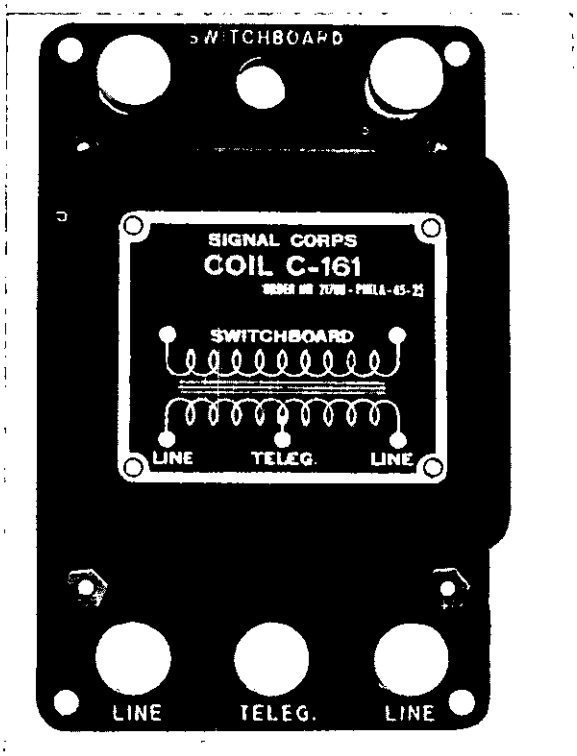


Figure 30. Telephone Coil Repeating C–161.

Section III. RADIO EQUIPMENT

148. General

This section contains general information concerning the characteristics of the major items of radio equipment used by field artillery units. For operating instructions and detailed information pertaining to this equipment, see the appropriate 11-series technical manuals. For type radio nets, see chapter 14. For detailed information on field radio techniques see FM 24–18.

149. Radio Set AN/GRR–5

a. General. Radio receiving set AN/GRR–5 is an amplitude modulated receiver which may be operated in a field, vehicular, or fixed installation. It consists of receiver R–174/URR and power supply PP–308/URR, plus necessary cables and accessories required for operation.

b. Type of Reception. The AN/GRR–5 will receive continuous wave (CW), modulated continuous wave (MCW), or voice signals.

c. Frequencies. The overall frequency coverage of the AN/GRR–5 ranges from 1.5 to 18.0 megacycles in four bands.

d. Method of Calibration. The receiver is equipped with a built-in crystal frequency oscillator for calibration, with calibration points every 200 kilocycles throughout the frequency range.

e. Presets. The AN/GRR–5 features continuous tuning throughout its frequency range, with facilities available for mechanically presetting 10 channels.

f. Antenna. A four-section mast antenna or any suitable long-wire antenna may be used.

g. Power. The power input for AN/GRR–5

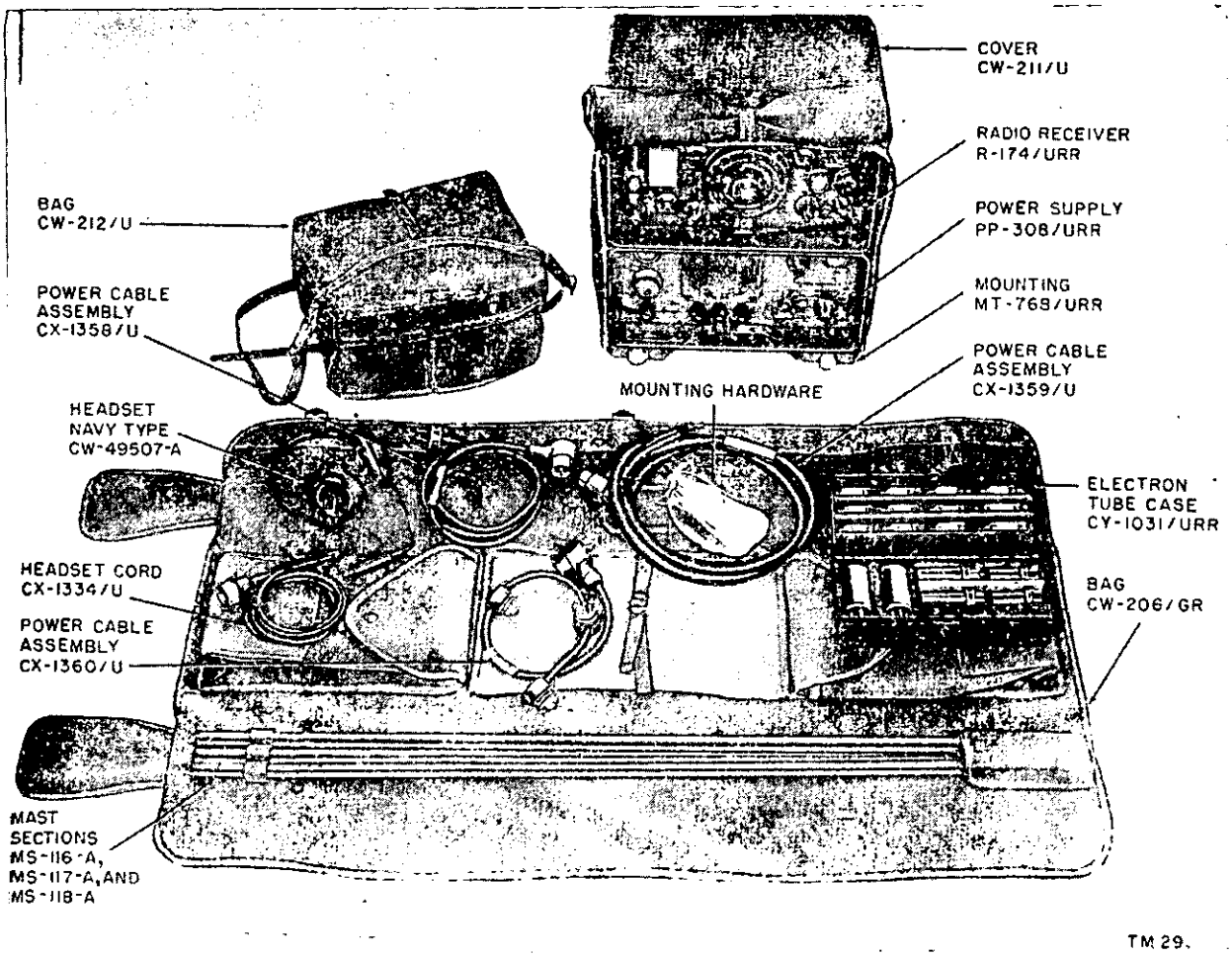


Figure 31. Radio Set AN/GRR–5.

may be furnished by any one of the following sources:

(1) Dry batteries.
(2) Storage batteries, 6-, 12- or 24-volt.
(3) Commercial power (115-volt alternating current).

h. References. For complete details on the operation and maintenance of the AN/GRR–5, refer to TM 11–295.

150. Radio Set AN/GRC–19

a. General. Radio set AN/GRC–19 (fig. 32) is a medium power, amplitude-modulated radio used for transmitting and receiving voice, radiotelegraph (CW), and radioteletype frequency-shift keying (FSK) signals. Extra equipment, which is not supplied as part of this radio set, is required for radioteletype service.

b. Range. Radio set AN/GRC–19 can be operated from a moving vehicle. While the vehicle is moving, the radio has a transmission range of 50 miles for voice and radioteletype and 75 miles for radiotelegraph. While the radio is stationary, the transmission range is 150 to 1,500 miles, depending on the terrain, frequency, antenna, time of day or night, season of the year, and atmospheric conditions.

c. Frequencies. The frequencies of the transmitter and receiver of the AN/GRC–19 are as follows:

(1) Transmitter—from 1.5 to 20.0 megacycles in 10 bands.
(2) Receiver—from 0.5 to 32.0 megacycles in 32 bands.

d. Presets. The transmitter operating frequency can be selected manually or automat-

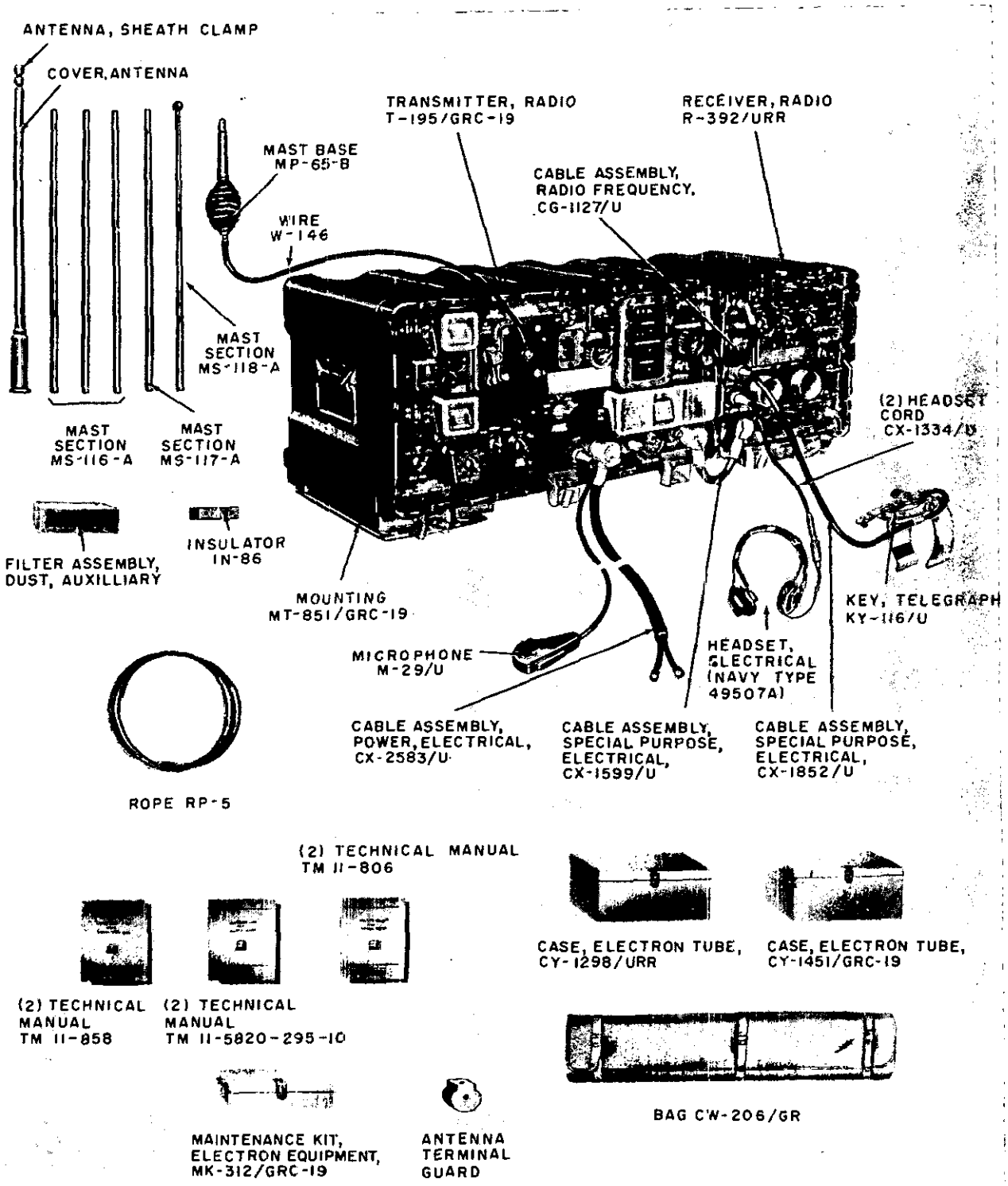


Figure 32. Radio set AN/GRC-19.

ically by any one of seven preset channels. There are no preset channels on the receiver.

e. Power Input. Input voltage is from 22 to 30 volts direct current (dc).

f. Antenna. Radio AN/GRC–19 is also equipped with a 15-foot whip antenna. Antenna group AN/GRA–12 may be used although it is not a component of the radio set.

g. Type of Installation. The AN/GRC–19 is designed for a mobile or semi-fixed installation.

h. Remote Control. Remote control of the transmitter (from distances up to 75 feet) is possible when the transmitter is used with transmitter control C–822/GRC–19 and a special purpose cable. The remote control unit turns the transmitter on and off and selects the type of service and the preset channels from the remote control position.

i. Other Component Parts. Other component parts of the AN/GRC–19 are the—

(1) Necessary antenna installation equipment.
(2) Telegraph key, microphones, headsets, and spare parts.

j. Reference. For complete details concerning the operation and maintenance of the AN/GRC–19, refer to TM 11–274.

151. Radio Teletypewriter Set AN/GRC–46

a. The radio teletypewriter set AN/GRC–46 (fig. 33) consists of an assembly of transmitting, receiving, and teletypewriter equipment arranged in a shelter and mounted on a vehicle. The AN/GRC–46 can provide either separate or simultaneous transmissions and reception of voice and radioteletype signals. In addition to the same transmitter and receiver used by the AN/GRC–19 radio, the AN/GRC–46 is equipped with a modulator, a frequency-shift converter, a teletypewriter-reperforator, a teletypewriter, and an interconnecting box. All of the components are mounted in a shelter which has electric lights, a heater, a ventilation system, and blackout blinds. Although designed primarily for use in a ¾-ton truck, the radio may be installed in any vehicle that is large enough to accommodate the shelter and that has a suitable electrical power system.

b. For detailed information concerning the operation and maintenance of the AN/GRC–46, refer to TM 11–5815–series.

152. Radio Teletypewriter Set AN/VRC–29

The radio teletypewriter set AN/VRC–29 has the same components and characteristics as the AN/GRC–46 except that, in the AN/VRC–29, the components are not located in a shelter but are installed in an armored utility vehicle M59 or in a 2½-ton truck.

153. Radio Set AN/VRC–24

a. General. The radio set AN/VRC–24 (fig. 34) is an ultra high frequency, amplitude-modulated, voice communications equipment, which is used for vehicular ground-to-air communications. It may also be used as a retransmission device for radio set AN/VRC–14.

b. Technical Characteristics of Radio Teletypewriter AN/VRC–24.

(1) *Frequency range*—225.0 to 399.9 megacycles.
(2) *Communication channels*—1750.
(3) *Preset channels*—19.
(4) *Power source*—24 volts direct current.
(5) *Operating range*—depends on the line of sight or on the altitude of the aircraft.
(6) *Antenna*—a ten inch vehicular antenna is provided with the set.
(7) *Type modulation*—Amplitude.
(8) *Operation*—local or remote.

154. Radio Sets AN/PRC–8, –9, and –10

a. General. Radio sets AN/PRC–8, –9, and –10 (fig. 35) are issued to armor, artillery, and infantry units, respectively. Artillery units supporting armored or infantry are also issued radio sets of the armored and infantry series. These radio sets are versatile, since they may be operated from a pack, ground, aircraft, or vehicular installation. They are basically identical—internally they differ in the equipment which determines the frequency of the radio signals transmitted and received; externally they differ in the calibration of the tuning dial. (For individual frequency ranges, see *d*(3) below.)

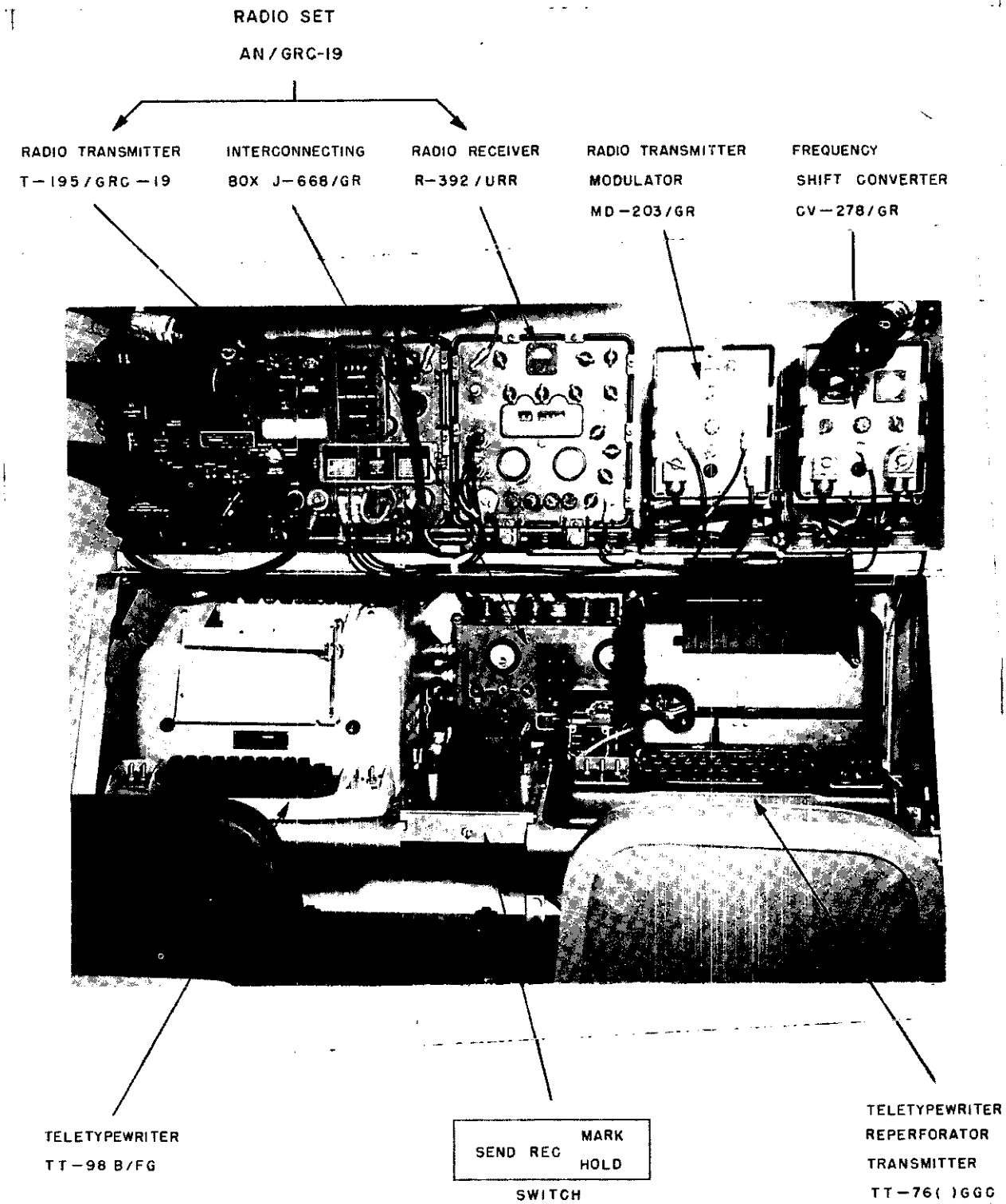


Figure 33. Radio teletypewriter set AN/GRC-46.

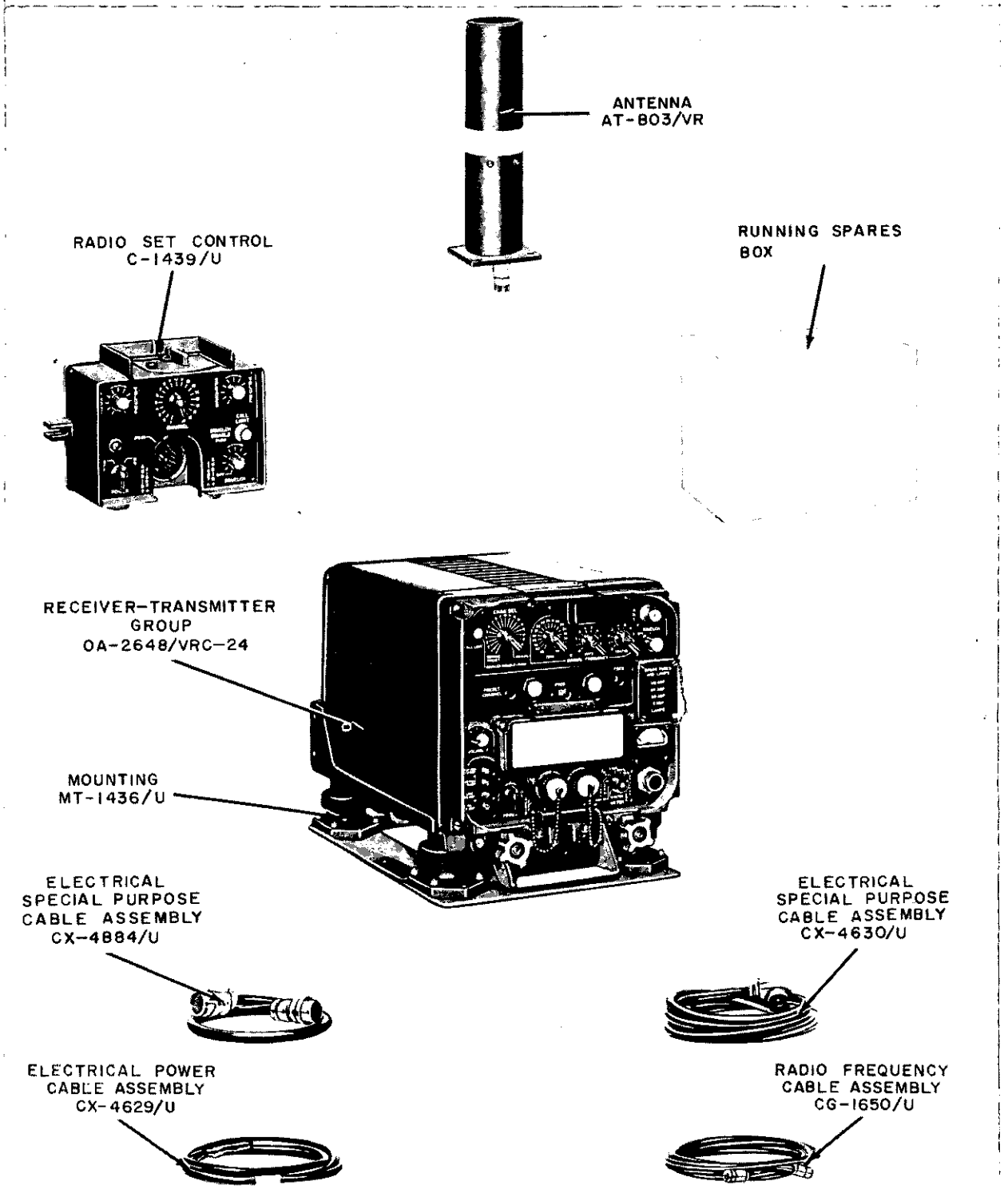


Figure 34. Radio set AN/VRC-24.

b. Frequency Overlap. A 1-megacycle overlap in frequency coverage between radio sets AN/PRC–8 and AN/PRC–9 provides 10 channels for communication between armor and artillery units. A similar overlap between radio sets AN/PRC–9 and AN/PRC–10 provides 10 channels for communication between artillery and infantry units.

c. Calibration. Continuously tunable throughout the frequency range, each set is equipped with a 1-megacycle crystal for calibration. Calibration is accomplished at each whole megacycle appearing on the dial. On later models, the AN/PRC–8A, AN/PRC–9A, and AN/PRC–10A, calibration checkpoints are indicated by red markers on the dial. The markers are 2.15 megacycles apart.

d. General Characteristics of Radio Sets AN/PRC–8, –9, and –10.

(1) *Emission—Voice* (frequency modulated).

(2) *Rated transmission range*—5 miles or 8 kilometers.

(3) *Frequency range*—AN/PRC–8 (armor): 20.0–27.9 megacycles; AN/PRC–9 (artillery): 27.0–38.9 megacycles; AN/PRC–10 (infantry): 38.0–54.9 megacycles.

(4) *Power supply*—Dry battery BA–279/U (operating life approximately 20 hours) or battery BA–2279/U (for arctic operation).

(5) *Weight*—26 pounds.

e. Major Components of Radio Sets AN/PRC–8, –9, and –10.

(1) *For manpack operation:*

(*a*) Radio receiver-transmitter RT–174/PRC–8, RT–175/PRC–9, or RT–176/PRC–10.

(*b*) Case CY–744/PRC.

(*c*) Antenna AT–271/PRC.

(*d*) Antenna AT–272/PRC.

(*e*) Antenna spring section AB–129/PR.

(*f*) Belt suspenders M–1945.

(*g*) Bag CW–216/PR.

(*h*) Carrying harness ST–120/PR.

(*i*) Handset H–33/PT.

(2) *Vehicular installation kit:*

(*a*) Amplifier-power supply AM–598/U.

(*b*) Appropriate antenna and connections (TM 11–612 or Supply Bulletin SB 11–131).

f. Installations.

(1) *Pack.* For pack installation, radio sets AN/PRC–8, –9, and –10 are fastened to the carrying harness ST–120/PR. The set is placed on the operator's back and the carrying harness is fastened to a combat or cartridge belt. Dry battery BA–279/U (or BA–2279/U) and antenna AT–272/PRC are also necessary for-manpack operation.

(2) *Ground.* For ground installation, the radio set is placed upright on the ground with U-shaped runners on the battery case extended to provide stability. The dry battery is the power supply, and the long antenna AT–271/PRC is used to obtain greater transmission range.

(3) *Vehicular.* The amplifier power supply AM–598/U is necessary for vehicular installations. The antenna for vehicular installation of radio set AN/PRC–9 (artillery) consists of one mast section MS–116, one mast section MS–117, and one mast section AB–24.

g. Reference. For additional information on radio sets AN/PRC–8, –9, and –10, see TM 11–612.

155. Radio Set AN/VRC–9

Radio set AN/VRC–9 (fig. 36) is a medium-power, voice-operated, frequency-modulated, two-way radio designed for communication between moving or stationary-vehicles. This artillery radio set is used in unit fire direction centers and by individuals who heed only one receiver-transmitter. The armored version of this set is the AN/VRC–8; the infantry version is the AN/VRC–10.

a. Components. The principal components of the AN/VRC–9 are—

(1) Receiver-transmitter RT – 67/GRC (set 1).

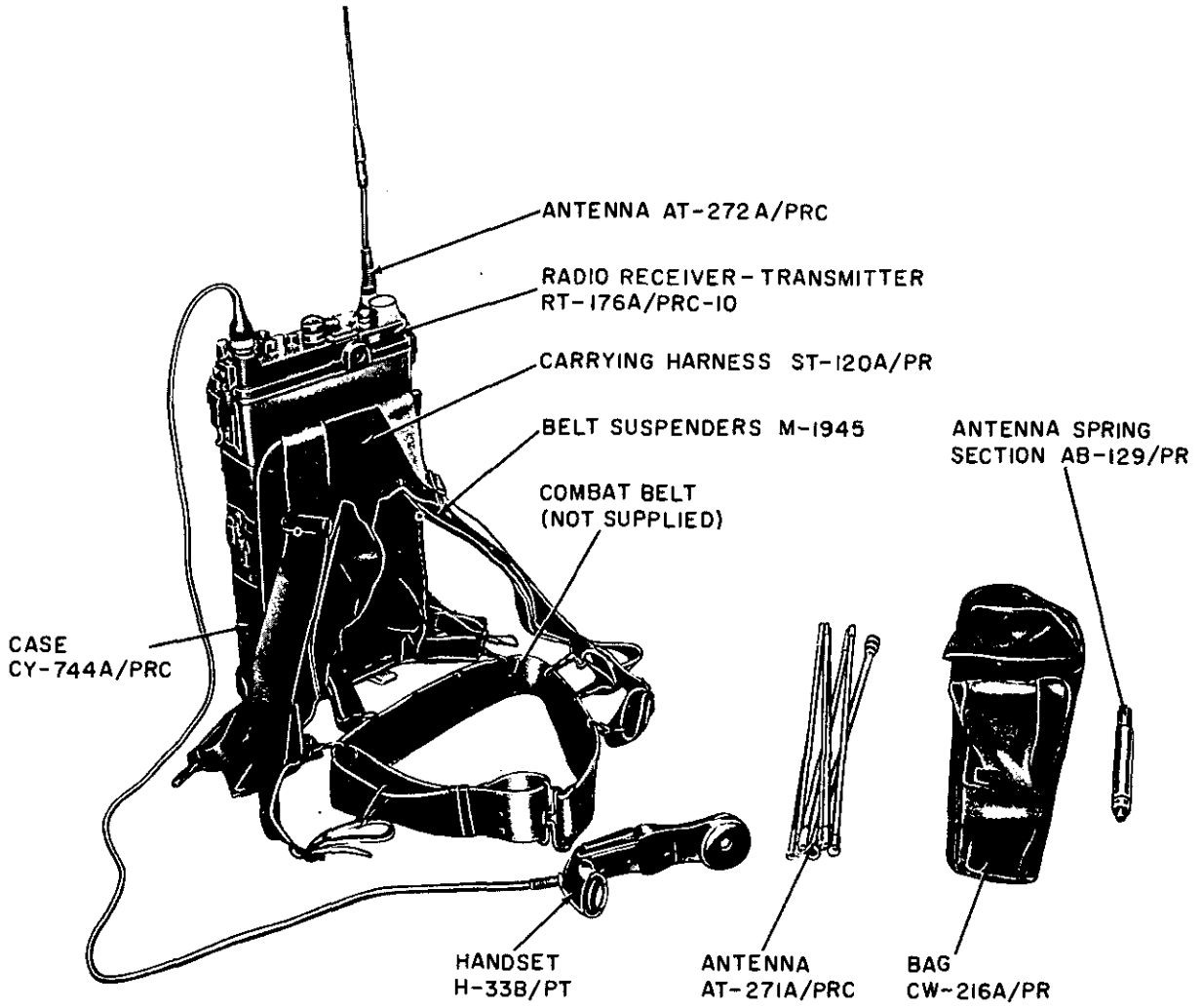


Figure 35. Radio sets AN/PRC–8, –9, and –10.

(2) Power supply PP–109/GR or PP–112/GR.

(3) Mounting MT–299/GR.

(4) Control box C–375/VRC.

b. Installation. Radio set AN/VRC–9 can be installed and operated in any military vehicle which is equipped with either a 12- or 24-volt ignition system, but because of the differences in the vehicles detailed instructions for the exact location of components, routing of cables, placement of antennas etc., will be limited. For specific details of installation, reference should be made to the instructions supplied with the installation units for the vehicle.

c. General Characteristics of Radio Set AN/VRC–9.

(1) *Emission*—Voice and 1,600-cycle ringing signal (frequency modulated).

(2) *Rated transmission range*—10 to 15 miles, or 16 to 24 kilometers.

(3) *Frequency range*—RT–66/GRC (armor): 20.0–27.9 megacycles; RT–67/GRC (artillery): 27.0–38.9 megacycles; RT–68/GRC (infantry): 38.0–54.9 megacycles.

(4) *Number of operating channels*—RT–66/GRC (armor); 80 channels; RT–67/GRC (artillery): 120 channels;

RT-68/GRC (infantry): 170 channels.

(5) *Tuning*—Detent or continuous tuning with facilities for preselecting two of the operating channels.

(6) *Power supply*—Power supplies PP-109/GR and PP-112/GR are vibrator-type power supplies that derive power from a 12-volt and a 24-volt storage battery, respectively. The power units are designed specifically to provide operating power for receiver-transmitter RT-66/GRC, RT-67/GRC, or RT-68/GRC.

d. Additional Information. For additional information concerning radio set AN/VRC-9, see TM 11-286.

156. Radio Set AN/VRC-17

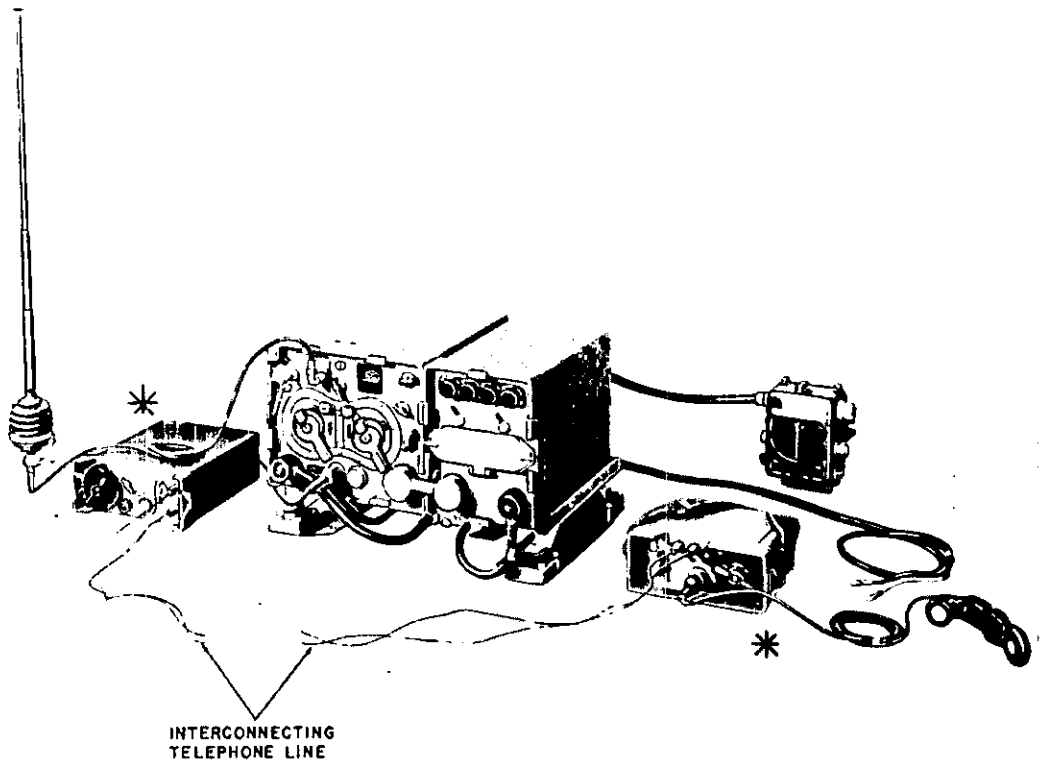
Radio set AN/VRC-17 (fig. 37) employs the same components and provides the same facilities as radio set AN/VRC-9 (par. 155) with the following exceptions: The mounting of radio set AN/VRC-17 is larger in order to accommodate auxiliary receiver R-109/GRC. This receiver duplicates the frequency coverage of the receiver-transmitter RT-67/GRC (set 1). The addition of another radio receiver makes it possible to monitor two channels simultaneously from control box C-375, or the receiver may be operated independently at its own front panel. Since the characteristics, capabilities, and operation of the receiver-transmitter RT-67/GRC (set 1) are described in paragraph 155, only receiver R-109/GRC will be discussed in this paragraph.

a. The general characteristics of receiver R-109/GRC are as follows:

(1) *Frequency range*—27.0-38.9 megacycles.

(2) *Number of operating channels*—120.

(3) *Type of reception*—Voice and 1,600



✳ NOT COMPONENTS

Figure 36. Radio set AN/VRC-9.

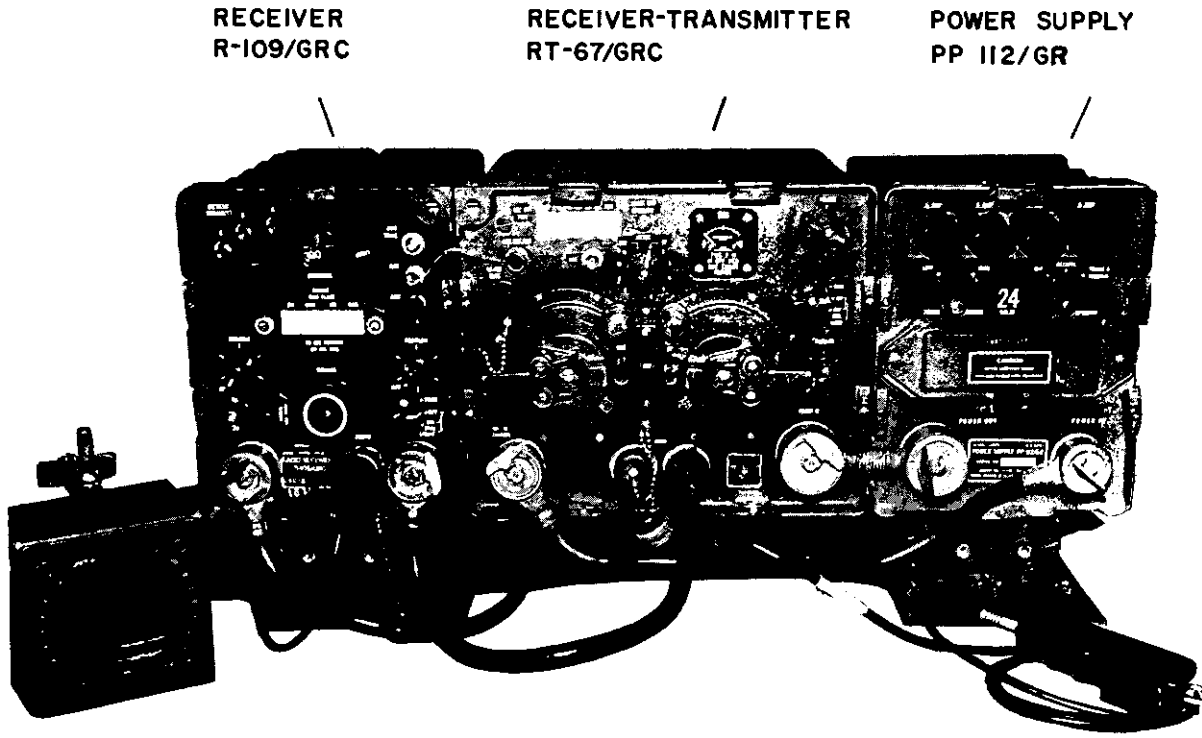


Figure 37. Radio set AN/VRC-17.

cycle ringing tone (frequency-modulated).

(4) *Tuning*—Continuous tuning with facilities available for presetting any three of the operating channels.

(5) *Power supply*—Internally installed. Power supply PP-448/GR, 6 volts; PP-281/GR, 12 volts; and PP-282/GRC, 24 volts.

b. For further information pertaining to radio set AN/VRC-17, see TM 11-611.

157. Radio Set AN/VRQ-2

To assemble radio set AN/VRQ-2 (fig.38), the major components of radio set AN/VRC-9 (par. 155) are doubled. The technical characteristics and operational capabilities of receiver-transmitters RT-67/GRC are identical to those of radio set AN/VRC-9 the components differing from those found in the AN/VRC-9 are mounting MT-298/GR and a retransmission unit, control C-435/GRC. The terms "set 1" and "set 2" are used to distinguish between the two identical receiver-transmitters. Set 1 refers to the left-hand receiver-transmitter and power supply; set 2 refers to the right-hand receiver-transmitter and power supply.

a. The capabilities of radio set AN/VRQ-2 are as follows:

(1) *To monitor or transmit on two frequencies.* Monitoring or transmitting on two frequencies with two receiver-transmitters RT-67/GRC (set 1 and set 2) is accomplished in the same manner as with one receiver-transmitter. For operation, see paragraph 155.

(2) *Automatic retransmission.* Automatic retransmission is defined as the capability of the radio set to operate as an automatic relay station, receiving signals on one receiver-transmitter and automatically retransmitting the same signal on the other receiver-transmitter. In order to effect automatic retransmission, the retransmission

unit control C–435/GRC must be installed in the mounting bracket.

(3) *Duplex operation.* The retransmission unit C–435/GRC provides the switching circuits required for duplex operation. Duplex operation is the capability of the radio set for simultaneous communication in two directions. For duplex operation, turn the AUTO SWITCH to the DUPLEX position. This action turns on set 1 and keys it continuously, set 2 then acts as a receiver only.

(4) *Remote operation.* See paragraph 160.

(5) *Remote power control.* See paragraph 160.

b. For further information pertaining to radio-set AN/VRQ–2, see TM 11–287.

158. Radio Sets AN/VRC–30 and AN /VRC–35

a. General.

(1) Radio sets AN/VRC–30 and AN/VRC–35 (fig. 39) were designed for ground-to-air communication between the forward air controller on the ground and the aircraft in close support of ground troops. These radio sets are normally installed in a ¼-ton truck.

(2) Radio sets AN/VRC–30 and AN/VRC–35 can be used to communicate with any of our present frequency modulated radio sets within the frequency range of 27.0 to 38.9 megacycles and/or with any of the amplitude-modulated sets within the frequency range of 225.0 to 399.9 megacycles.

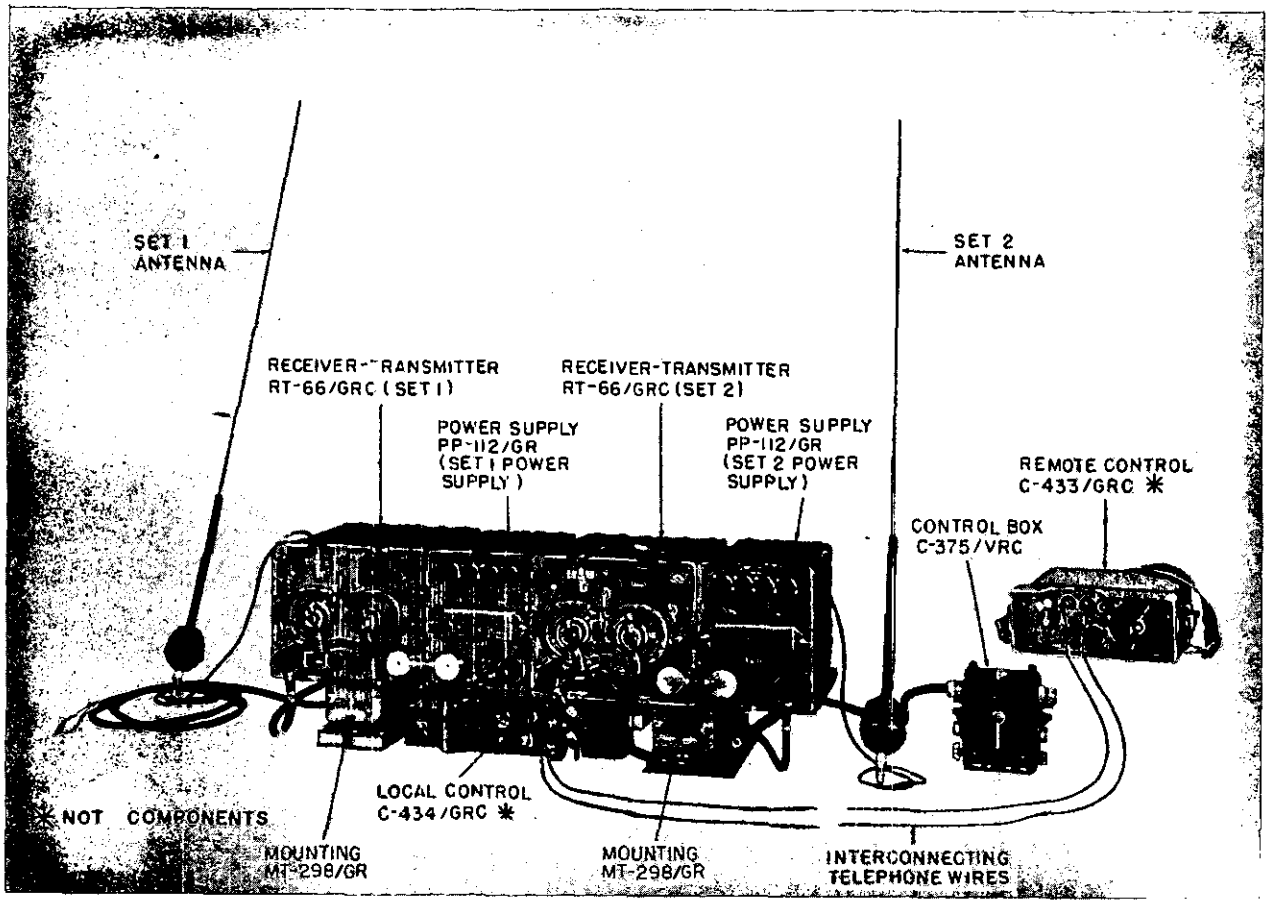


Figure 38. Radio set AN/VRQ–2.

(3) The frequency-modulated components of radio sets AN/VRC–30 and AN/VRC–35 are the same. The amplitude-modulated component of radio set AN/VRC–30 is radio set AN/ARC–27, the amplitude modulated component for radio set AN/VRC–35 is radio set AN/VRC–24.

(4) When communication is required with aircraft equipped with very high frequency (VHF) equipment radio set AN/TRC–7 may be issued for use in the AN/VRC–30 installations. Radio set AN/TRC–7 operates in the frequency range of 100 to 156 megacycles. Power for operation is furnished by battery BA–70 (BA–2070 for arctic-operations) or by hand generator G–3/TRC–7.

b. Components. The major components of radio set AN/VRC–30, illustrated in figure 39 are—

(1) Radio set AN/VRC–14.
(2) Radio set AN/PRC–9 ( ).
(3) Radio set AN/ARC–27.
(4) Control C–435/GRC.
(5) Antennas, microphones, headsets, spare parts, and necessary cordage.

c. Employment of Equipment.

(1) Radio set AN/VRC–14 furnishes a voice radio circuit between the forward air controller and the air liaison officer at division headquarters. This set is also used to receive communication from the forward air controller when he is using radio set AN/PRC–9 ( ) away from the vehicle and to retransmit his messages to aircraft through radio set AN/ARC–27.

(2) Radio set AN/PRC–9 ( ) furnishes voice radio communication to the air controller when he is on foot and away from the vehicle.

(3) Radio set AN/ARC–27 furnishes voice communication to aircraft in the ultra high frequency band.

d. Technical Characteristics of Radio Set AN/ARC–27. (Since the technical characteristics of the AN/VRC–14 are basically the same as those shown for the AN/VRC–9 in

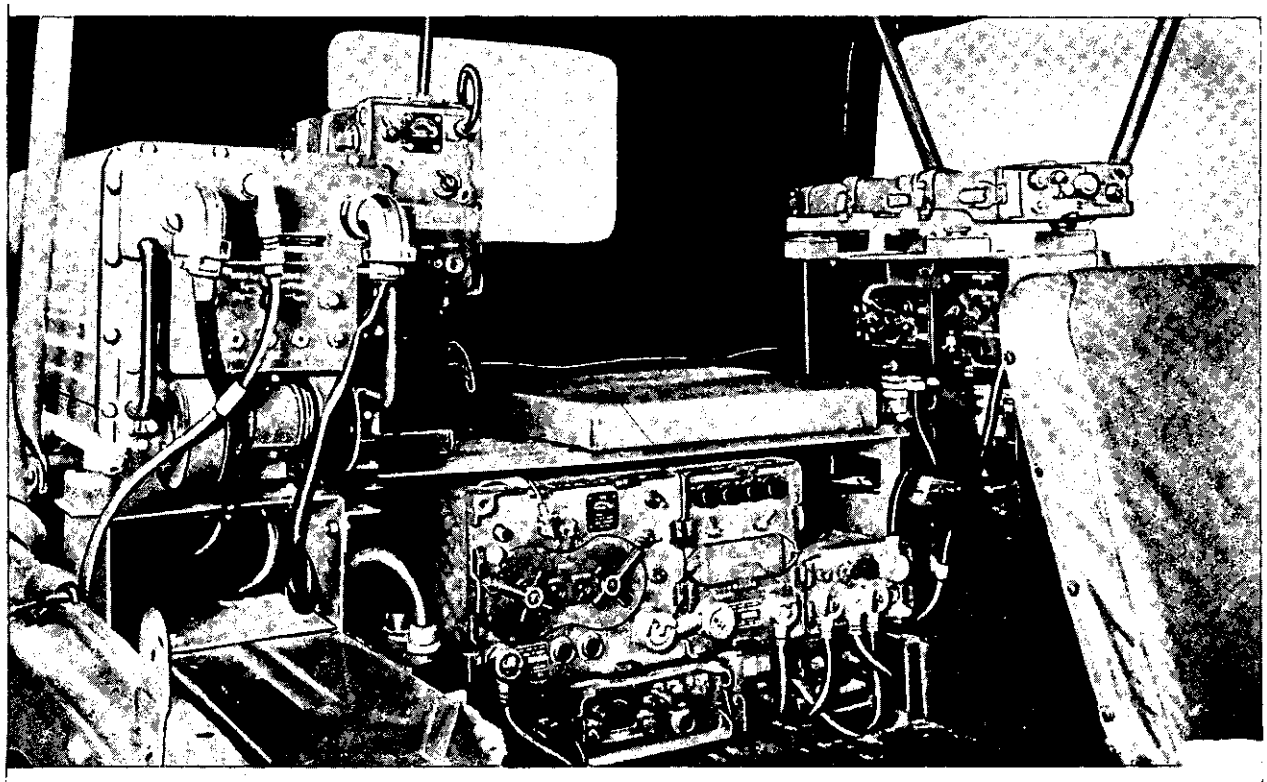


Figure 39. Radio set AN/VRC–30.

paragraph 155 and the AN/PRC-9 as discussed in paragraph 154, only the AN/ARC-27 will be discussed in this paragraph.)

(1) *Frequency range*—225.0 to 399.9 megacycles.
(2) *Preset channels*—18.
(3) *Type emission*—Voice, tone.
(4) *Frequency range guard receiver*—238.0 to 248.0 megacycles.
(5) *Antenna*—UHF broadband type.
(6) *Power source*—27 volts direct current.
(7) *Power supply*—Dynamotor.

159. Radio Repeater Set AN/VRC-38

a. General. The radio repeater set AN/VRC-38 retransmits a signal from an AM radio (radio set AN/GRC-19) to an FM radio (radio set AN/VRC-9) or vice versa. This set operates from a mobile installation to act as a relay station extending the range of radio set AN/VRC-30 or its replacement radio set AN/VRC-35.

b. Components. The radio repeater set AN/VRC-38 consists mainly of the following components:

(1) Radio set AN/GRC-19 (par. 150).
(2) Radio set AN/VRC-9 (par. 155).
(3) Control unit C-435( )/GRC.

160. Control Group AN/GRA-6

The primary purpose of control group AN/GRA-6 is to permit the location of the radio sets to gain the line of sight which is necessary because of high operating frequencies. Control group AN/GRA-6 (fig. 40) is intended for use with frequency-modulated radios for voice emission only, but it can be used with all FM radios issued to the artillery except radio set AN/PRC-6. It may also be used to remote the voice portion of the AN/GRC-19 and AN/GRC-46. Dependable operation, using standard telephone cable, may be expected through the rated range of 5 miles.

a. Components. The principal components of the AN/GRA-6 are—

(1) Local control (C-434/GRC).
(2) Remote control (C-433/GRC).
(3) Handset H-33/PT.
(4) Bag CW-189/GR.
(5) Loudspeaker LS-166/U.
(6) Interconnecting box J-654/G.

b. Capabilities. Capabilities of the AN/GRA-6 are to permit—

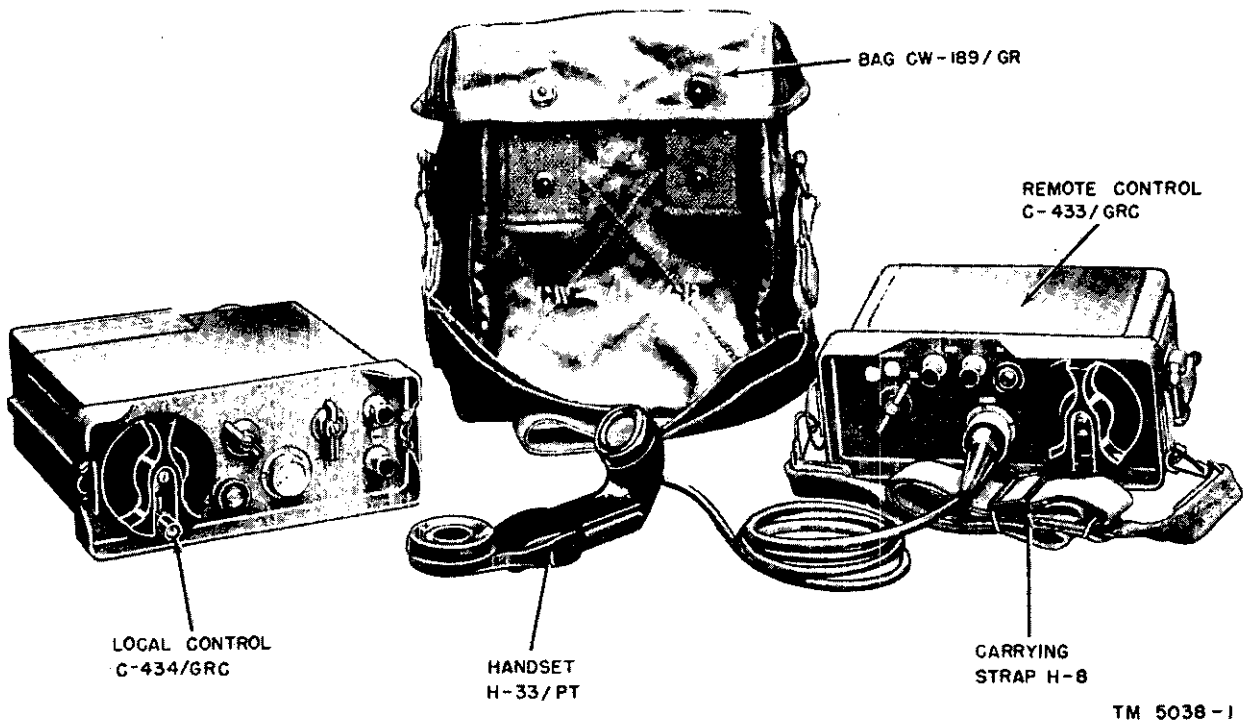


Figure 40. Control group AN/GRA-6.

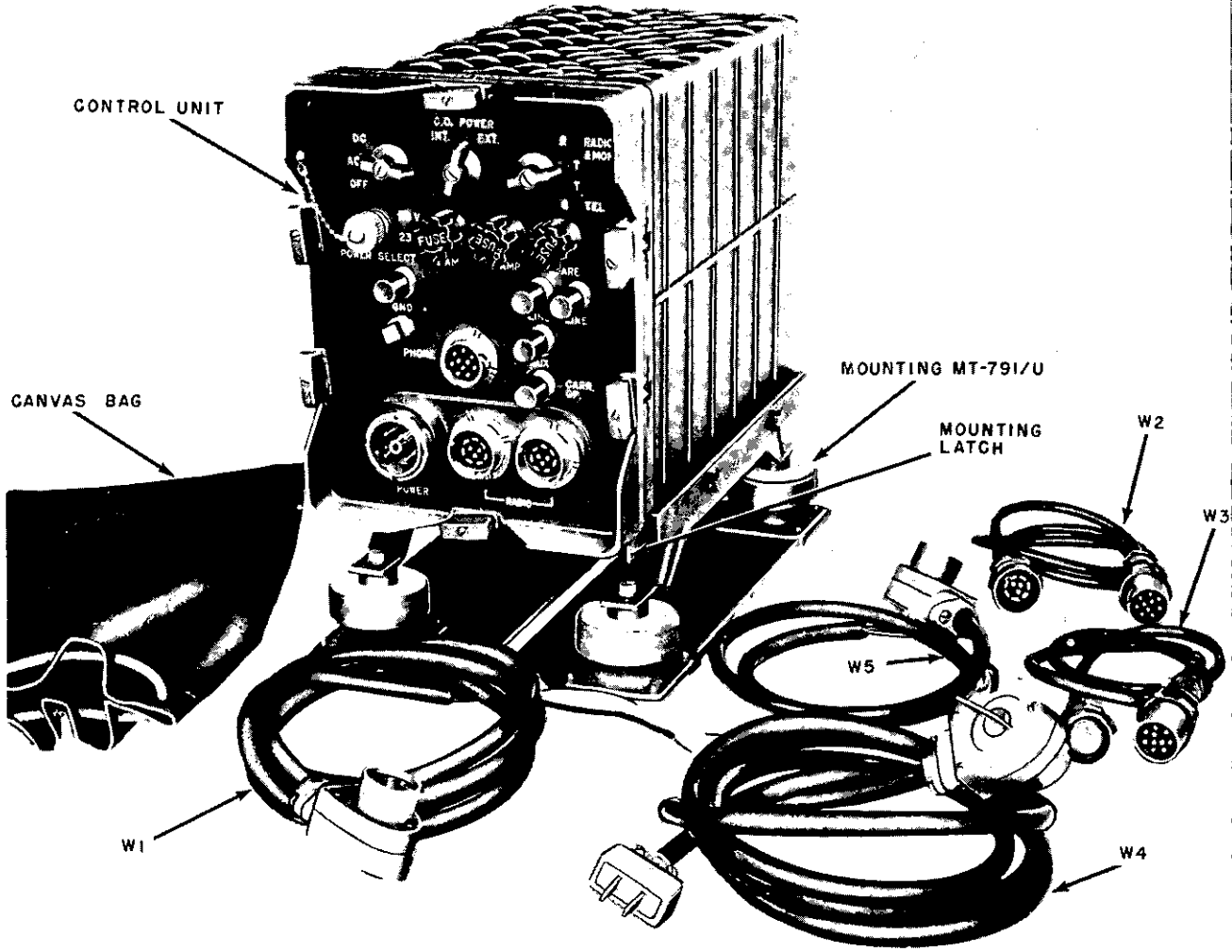


Figure 41. Radio set control AN/GSA-7.

(1) Telephone communication between the local and remote control units (anytime the two units are interconnected by field wire).

(2) Local push-to-talk operation (AN/PRC–9, AN/VRC–9, AN/VRC–17, and AN/VRQ–2).

(3) Remote push-to-talk operation (AN/PRC–9, AN/VRC–9, AN/VRC–17, and AN/VRQ–2).

(4) Remote power control (AN/VRQ–2 and AN/PRC–9).

161. Radio Set Control AN/GSA–7

Radio set control AN/GSA–7 (fig. 41) is a small, lightweight electronic switching device for use in integrated wire radio systems. It is also used to interconnect radio transceivers, or transmitters and receivers, with local-battery telephone equipment on a push-to-talk basis. Two radio set controls can be used to interconnect two push-to-talk radio sets for retransmission (automatic relay). These controls permit the operator to listen or talk to both ends of the circuit or talk to both ends of the circuit or to signal in either direction. The equipment can be operated from the ground or a stationary vehicle. Typical systems utilizing the AN/GSA–7 are shown in figure 42.

162. Antenna Group RC–292

Antenna group RC–292 (fig. 43) is a modified ground plane antenna designed to increase the transmission range of FM radio sets operating over a frequency range of 20 to 70 megacycles. The sections of the supporting base raise the antenna 30 feet above the surface of the ground increasing the line-of-sight distance to the horizon. The vertical element above the mast base is the antenna, and the three ground plane elements are installed at a 142° angle to the antenna to act as the counterpoise. The antenna group is connected to the radio set by a 68-foot coaxial cable. This equipment provides a radiation pattern that is omnidirectional in the horizontal plane. The length of the antenna and ground plane elements must be preadjusted to the desired frequency range as shown in the following chart:

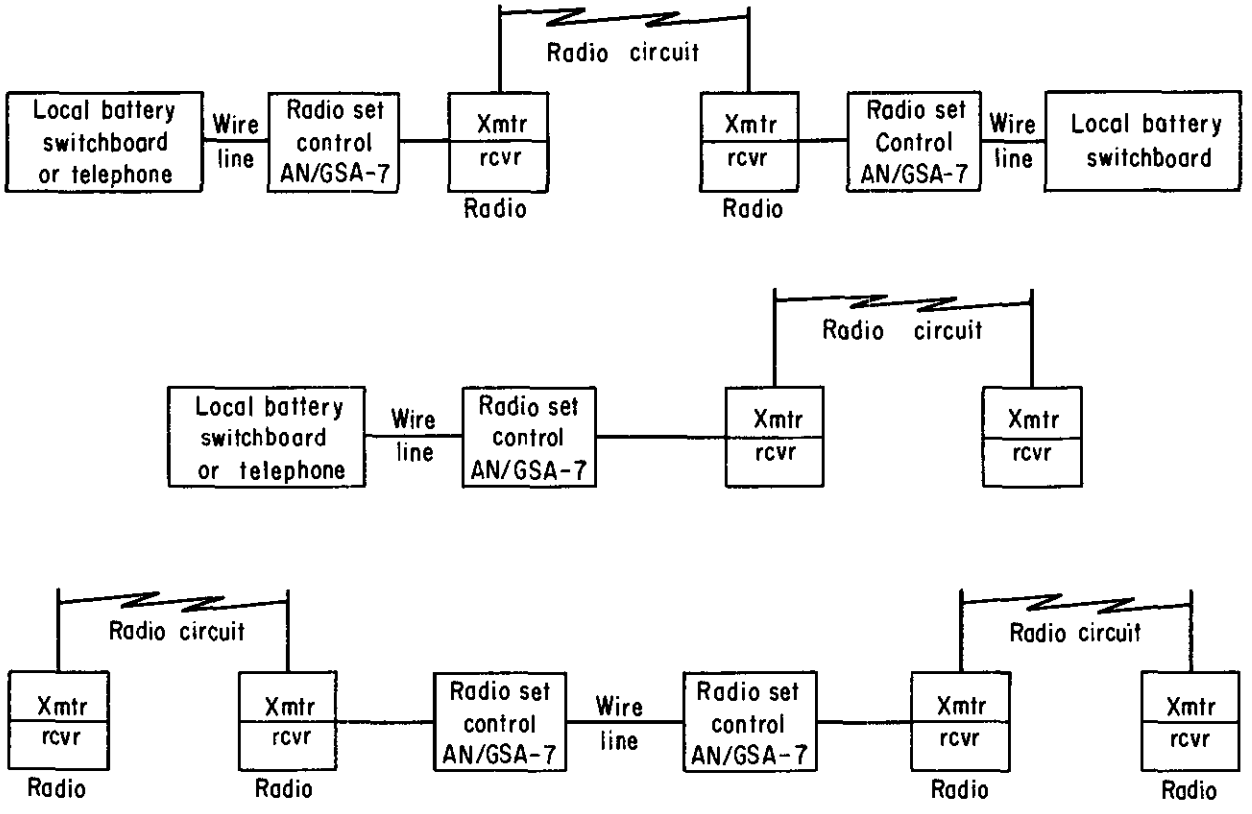


Figure 42. System application of radio set control AN/GSA–7.

Chart I. Antenna and Ground Plane Element Preadjustment

Operating frequency	Antenna sections required	Types of sections used				Ground-plane sections required	Types of ground plane sections			
		AB-21/GR	AB-22/GR	AB-23/GR	AB-24/GR		AB-21/GR	AB-22/GR	AB-23/GR	AB-24/GR
20 mc to 27.9 mc	6	3	1	1	1	18	3	1	1	1
27 mc to 38.9 mc	4	1	1	1	1	15	2	1	1	1
38 mc to 54.9 mc	3	1	1	1	0	12	1	1	1	1
54 mc to 70 mc	2	1	1	0	0	9	1	1	1	0

163. Field Expedients

a. Whip Antennas. When a whip antenna is mounted on a vehicle, the mass of the vehicle affects the operation of the antenna. This is particularly true of an antenna mounted on a ¼-ton truck. A ¼-ton vehicle with a whip antenna mounted on its left rear side will transmit its strongest signal in a line running from the antenna through the right front side of the vehicle. An antenna mounted on the right rear side will transmit its strongest signal across the left front of the vehicle (fig. 44). A vehicle oriented for best reception is normally in the best position for transmission.

b. Improvised Antennas.

(1) *Improvised elevated antenna.* An elevated antenna (fig. 45) can be constructed from materials readily available in a field artillery unit. The standard vehicular antenna complete with bracket and mast base may be raised to a desired height, on poles. The antenna may be connected to the radio set with standard telephone cable. The guy lines, with insulators properly installed, can be used as the ground plane or counterpoise.

(2) *Wave antenna.* The wave antenna (fig. 46) a type of long wire antenna, is easily constructed with telephone cable and any supports available, such as trees or bushes. The wave antenna is most effective over poor or high-resistance soil. This antenna is directional off the terminated end, and compares to the RC-292 in its ability to increase transmission range. The terminating resistor makes the antenna nonresonant so that its impedance does not vary with frequency, but concentrates the radiated energy in one direction. The value of resistance is not critical, but its power rating should be large enough to handle one-fourth to one-half the total transmitted power.

(3) *Vertical half rhombic antenna.* The vertical half-rhombic antenna (fig. 47) is more efficient than a whip antenna and is also directional off the terminated end. This antenna works best over good soil, and its gain increases with size. When the limiting factor in the size of the antenna is available mast height, use a leg length as indicated in the formula.

$$L = \frac{H^2 f}{222} + \frac{56}{f}$$

Where f is the frequency in megacycles, H is the mast height in meters and L is the leg length in meters. The example, figure 47 is worked out for a mast height of 10 meters and a frequency of 30 megacycles.

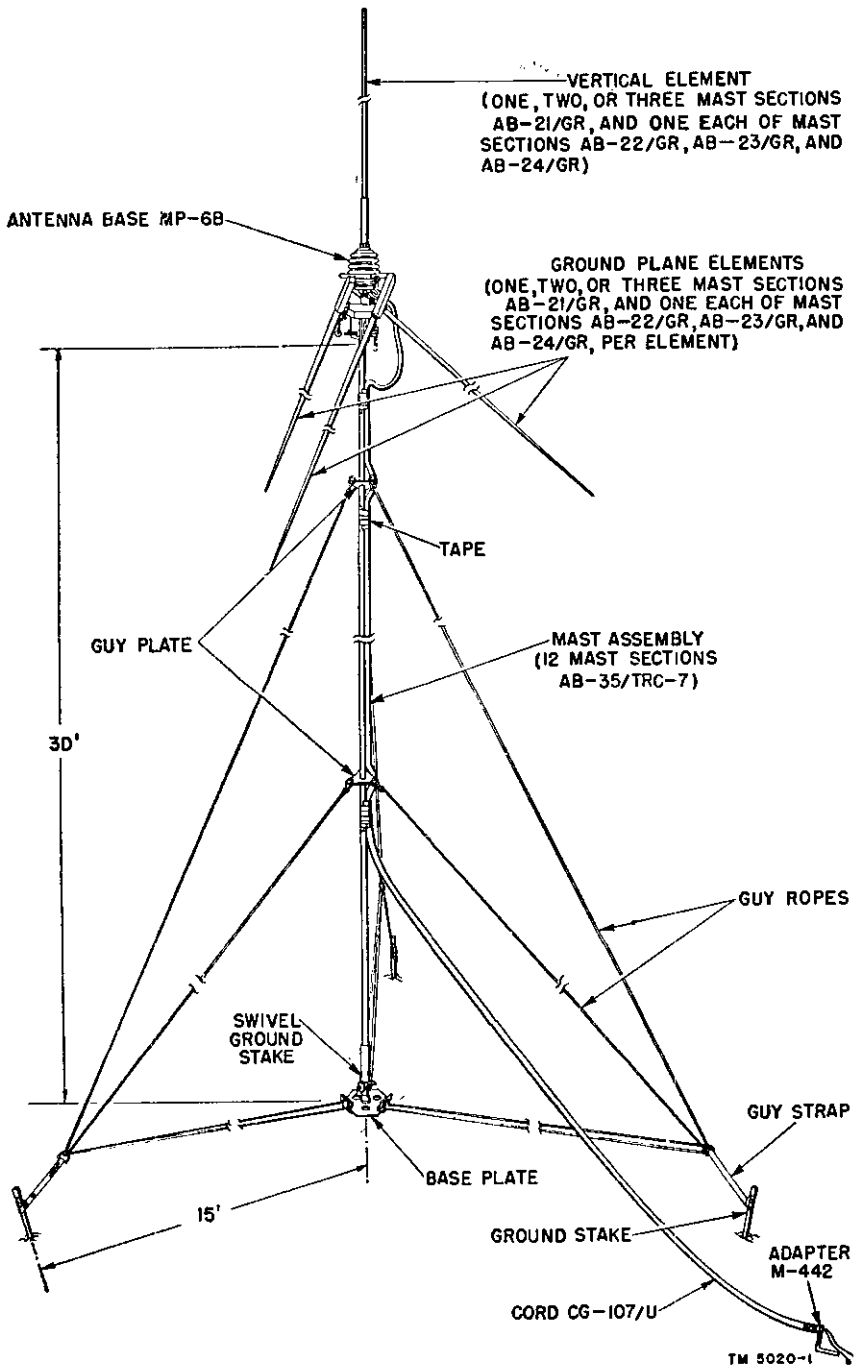


Figure 43. Antenna group RC-292.

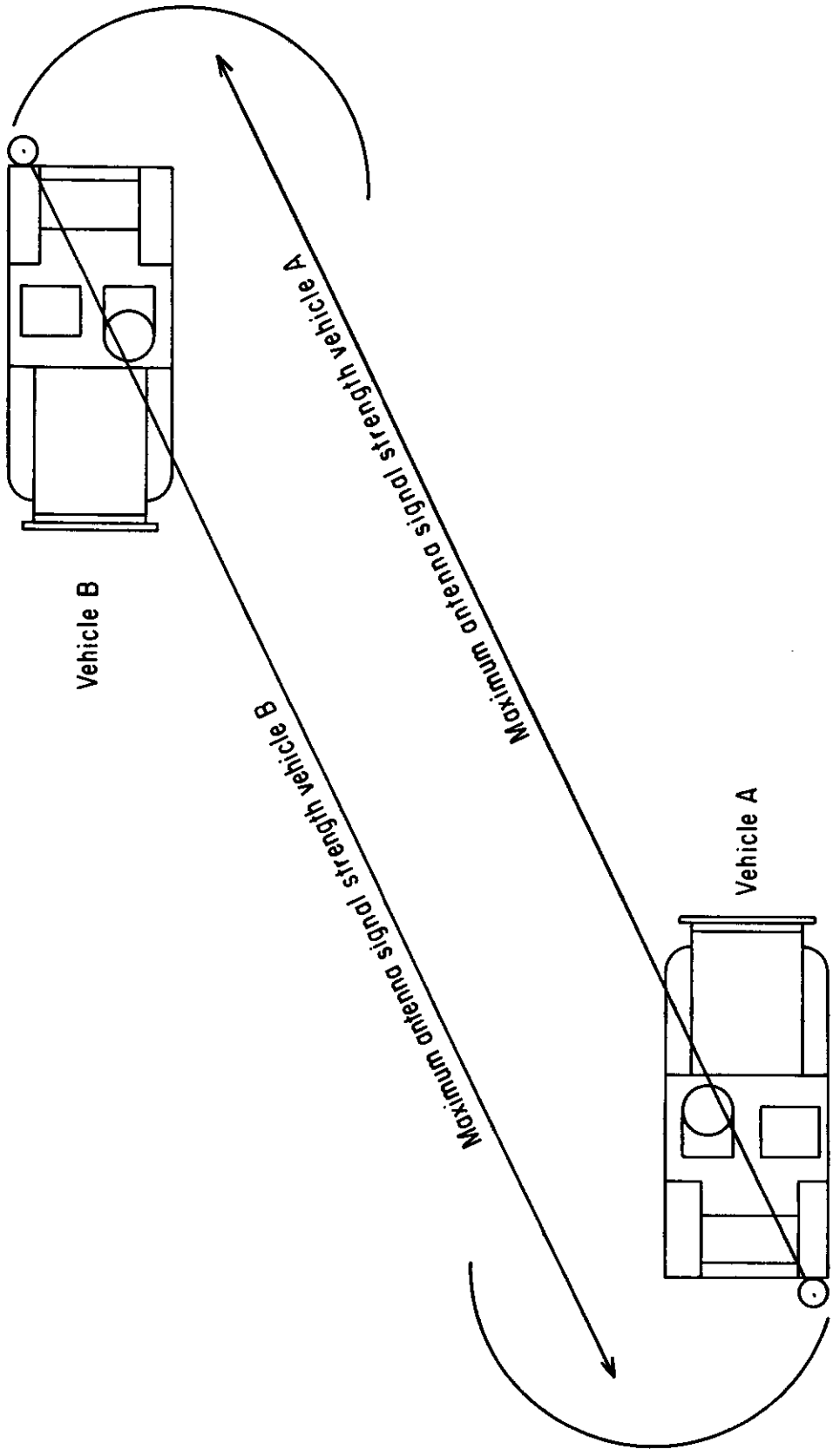


Figure 44. Siting of vehicular-mounted radios.

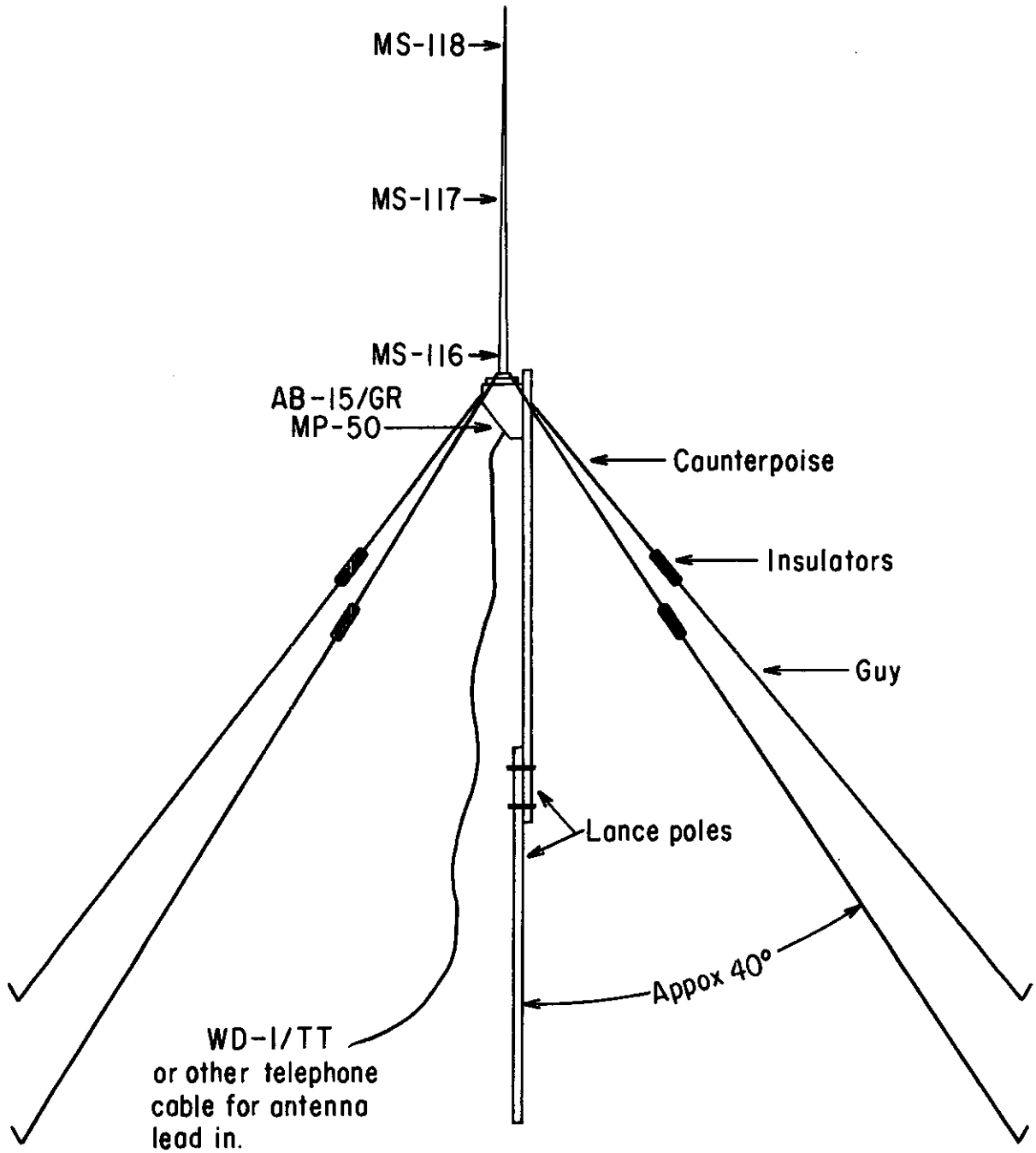


Figure 45. Improvised elevated antenna.

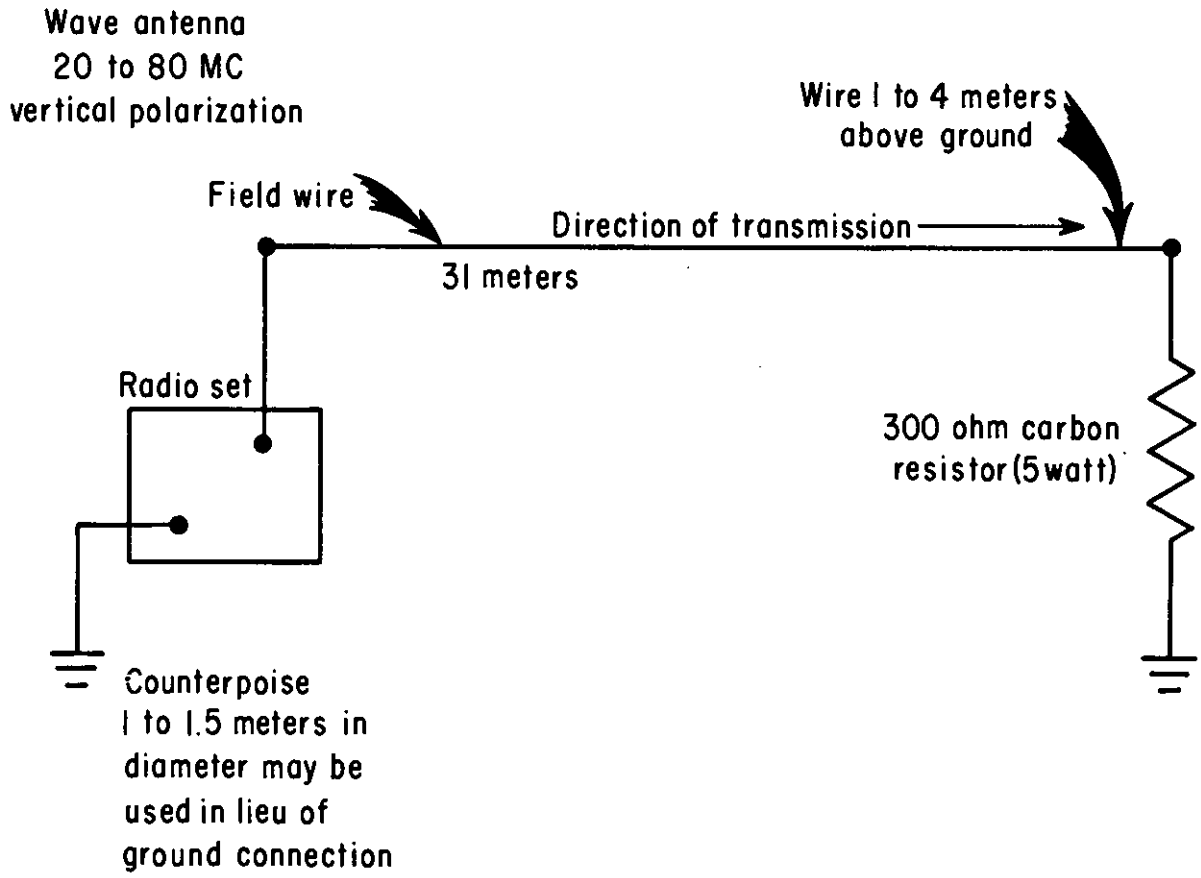


Figure 46. Wave antenna.

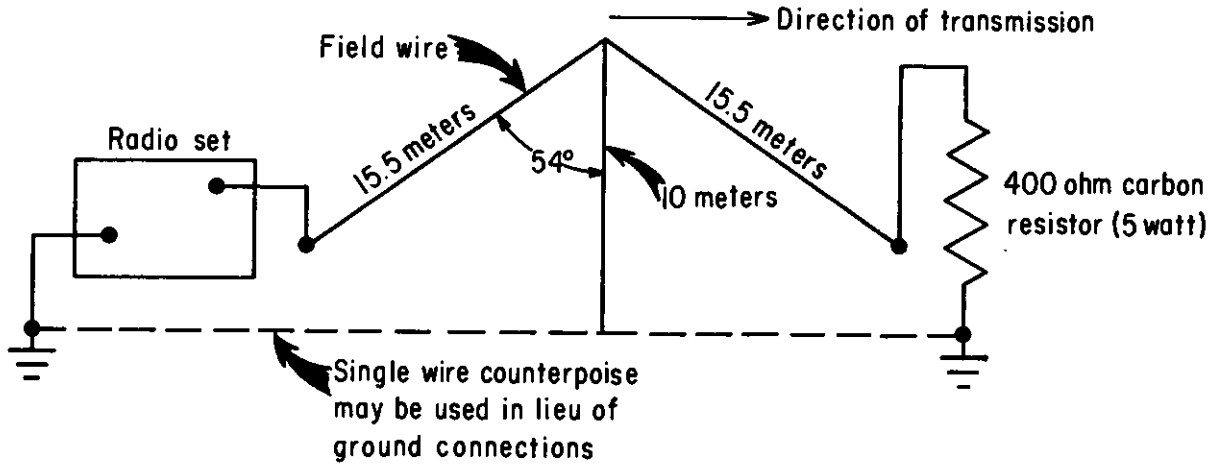


Figure 47. Vertical half rhombic-antenna.

CHAPTER 14

COMMUNICATION SYSTEMS

Section I. COMMUNICATION REQUIREMENTS

164. General

The communication requirements for field artillery units are based on the organization and mission of the unit concerned. The communication systems of the units must be designed to meet these requirements.

165. Communication Requirements Army Artillery

The communication requirements of army artillery include facilities for—

a. Tactical control and administrative supervision.

b. Fire control.

c. Exchange of information and intelligence.

d. Receipt of warnings.

e. Communication with close support high performance aircraft.

166. Communication Requirements, Corps Artillery

a. Internal Requirements. The internal communication requirements of corps artillery include facilities for—

(1) Tactical control and administrative supervision.
(2) Fire control.
(3) Exchange of information and intelligence.
(4) Dissemination of meteorological data.
(5) Coordination of survey.

b. External Requirements. The external communication requirements of corps artillery include facilities for—

(1) Receipt of tactical administrative control.
(2) Receipt of warnings.
(3) Requesting additional fire support from army artillery and coordination of fire support with army artillery.
(4) Communication with close support aircraft.

167. Communication Requirements, Division Artillery

a. Internal Requirements. The internal communication requirements of the division artillery headquarters include facilities for—

(1) Tactical control and administrative supervision.
(2) Fire control.
(3) Collection of information.
(4) Dissemination of meteorological data.
(5) Dissemination of intelligence.
(6) Coordination of survey.

b. External Requirements. The external communication requirements of the division artillery headquarters include facilities for—

(1) Receipt of tactical and administrative orders from division.
(2) Requesting additional fire support from corps artillery and coordination of fire support with corps artillery.
(3) Exchanging information and intelligence.
(4) Receipt and transmission of warnings.
(5) Receipt of air defense warnings.
(6) Communication with close support aircraft.
(7) Receipt of accurate time.

168. Communication Requirements, Artillery Group

a. Internal Requirements. The internal communication requirements of the artillery group include facilities for—

(1) Tactical control and administrative supervision.
(2) Fire control.
(3) Collection of information.
(4) Dissemination of intelligence.

b. External Requirements. The external communication requirements of the artillery group include facilities for—

(1) Receipt of tactical orders and admin-

istrative supervision from higher headquarters.
(2) Receipt of fire missions from higher headquarters.
(3) Exchange of information and intelligence.
(4) Receipt of fire missions from the reinforced unit, if applicable.
(5) Receipt of warnings.
(6) Communication with high performance aircraft.

169. Communication Requirements, Artillery Missile Battalion: Redstone

a. Internal Requirements. The internal communication requirements of the Redstone battalion are those necessary for internal command and administration of the battalion, to include facilities for—

(1) Tactical and administrative control.
(2) Fire direction.
(3) Dissemination of intelligence.

b. External Requirements. The external communication requirements of the Redstone Battalion are those necessary for communication with higher headquarters, to include facilities for—

(1) Receipt of administrative supervision and tactical orders from higher headquarters.
(2) Receipt of fire missions from higher headquarters.
(3) Exchange of information and intelligence.
(4) Receipt of warnings.
(5) Receipt of accurate time.

170. Communication Requirements, Artillery Battalions

a. General. The communication requirements of the artillery battalions are generally the same. However, the organization and the assigned missions will vary with the type of battalion. This paragraph will indicate normal requirements of the artillery battalion. Deviations from these requirements will be indicated under the communication system of the unit concerned. The requirements for separate batteries are basically the same as for battalions.

b. Internal Requirements. The internal communication requirements of the artillery battalion are those necessary for the internal command and administration of the battalion, to include facilities for—

(1) Tactical and administrative control.
(2) Fire direction.
(3) Collection of information.
(4) Dissemination of intelligence and warnings.

c. External Requirements. The external communication requirements of the artillery battalions are those necessary for communication with higher headquarters and adjacent units to include facilities for—

(1) Receipt of tactical orders and administrative supervision.
(2) Receipt of fire missions from higher headquarters.
(3) Exchange of information and intelligence.
(4) Receipt of warnings.
(5) Receipt of meteorological data.
(6) Coordination of survey.
(7) Receipt of fire missions from the reinforced unit when applicable.

Section II. COMMUNICATION SYSTEM, ARMY ARTILLERY

171. General

Telephone and teletypewriter communication from army artillery to its subordinate units and to corps artillery is provided by the area communication system.

172. Communication Requirements

The communication requirements for army artillery are shown in paragraph 165.

173. Internal Radio Nets

a. General. The army artillery internal radio system must provide the commander with facilities for tactical control, administrative supervision, fire control and exchange of information and intelligence. The army artillery operates two internal AM nets. Type radio nets for army artillery are shown in figure 48.

b. Army Artillery Command/Fire Direction

Net, AM, RATT (CF). The army artillery command/fire direction net provides communication for tactical control and administrative supervision of subordinate units and for the exchange of information and intelligence. This net is also used for coordination of artillery fires with corps artillery.

c. Aircraft Control Net, AM. The aircraft control net provides ground-to-air communication with organic aircraft.

174. External Radio Nets

The army artillery operates in two external nets, and, in addition, the army signal battalion supplies the personnel and equipment to operate in a third net.

a. Army Command Net, AM, RATT. The army signal battalion provides the personnel and equipment for operation in this net to provide communication between army and army artillery for transmitting commands and exchanging information and intelligence.

b. Air Force Tactical Air Observation Net, AM. The army artillery operates in the air force tactical air observation net for communication with Air Force reconnaissance aircraft on reconnaissance and surveillance missions in support of army artillery.

c. Warning Net, AM. The army artillery fire direction center monitors a warning net to receive air defense warnings and warnings of airborne, nuclear, chemical, and biological attacks.

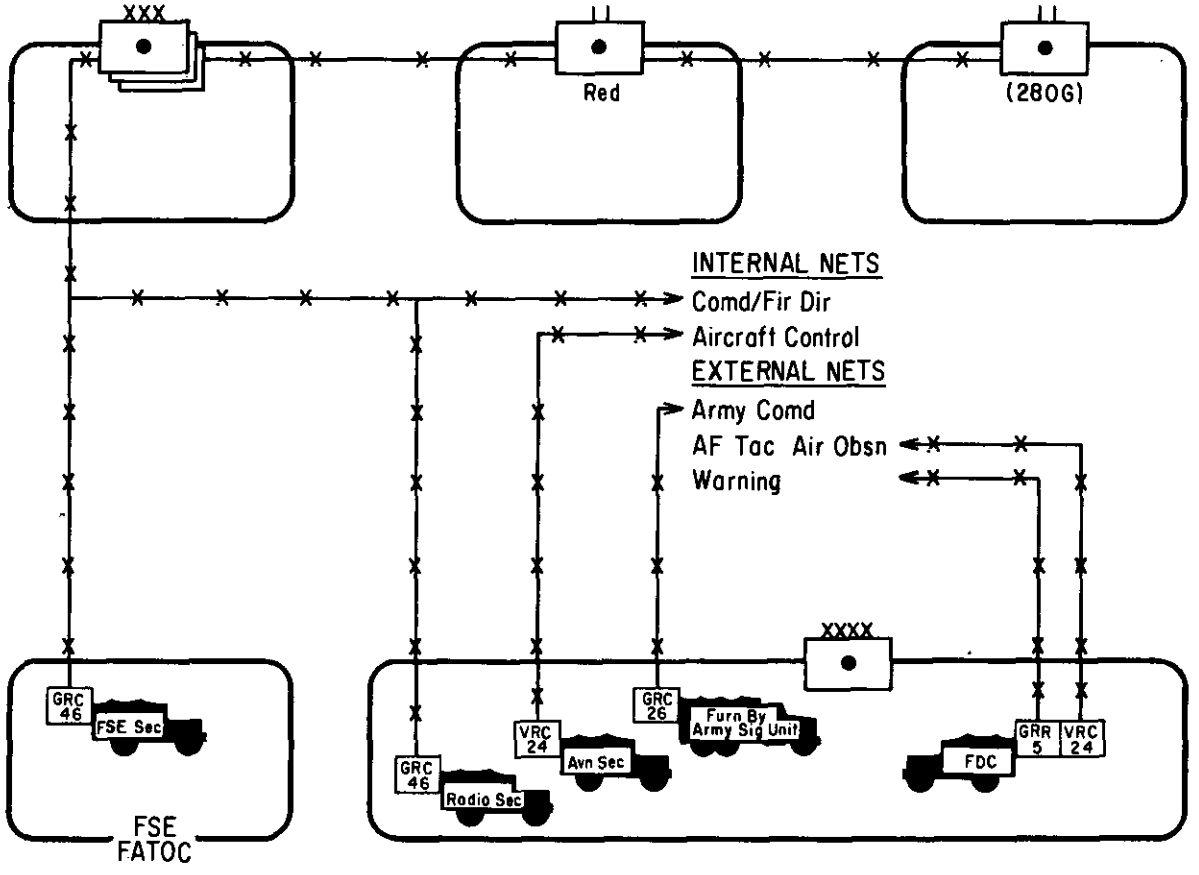


Figure 48. Type radio nets, army artillery.

Section III. COMMUNICATION SYSTEM, CORPS ARTILLERY

175. General

The corps signal battalion provides multichannel communication facilities for the headquarters and the major subordinate units of corps artillery and for division artillery headquarters. The signal battalion also operates a radio teletypewriter station in a corps command net and a teletypewriter terminal with switching facilities at corps artillery headquarters. For a detailed discussion of the facilities provided by the corps signal battalion, see FM 11-92.

176. Communication Requirements

The communication requirements for corps artillery are shown in paragraph 166.

177. Wire System

a. General. The wire system of corps artillery consists of circuits to higher, adjacent, and subordinate units and the necessary locals within the command post. To add flexibility to the wire system, separate command and fire direction center switchboards are installed. A type radio carrier and wire system for corps artillery is shown in figure 49.

b. Teletypewriter Circuit. A teletypewriter circuit connects the corps artillery headquarters with corps headquarters. The teletypewriter equipment is installed and operated by the corps signal battalion and normally is located in the corps message center.

c. Installation of Wire Circuits. The corps artillery is authorized six wire teams. These wire teams should install the lines to the field artillery target acquisition battalion and the field artillery searchlight battery. They will also install local circuits in the headquarters area and trunk circuits to units not furnished radio terminal equipment. However, the actual employment of these teams will depend on the situation and the availability of radio terminal equipment from the corps signal battalion.

178. Internal Radio Nets

a. General. The corps artillery internal radio system must provide the commander with facilities for tactical control, administrative supervision, fire control, and exchange of information and intelligence. The corps artillery headquarters operates one FM net and four AM nets and is authorized a frequency for a second FM channel.

b. Corps Artillery Command/Fire Direction Net, FM (CP). The corps artillery command/fire direction net, FM, provides communication with elements of the staff, airborne, aircraft, and subordinate units that are within range of FM equipment for tactical control and exchange of information and intelligence. It may also be used for transmission of nonnuclear fire missions. A type corps artillery command/fire direction net, FM is shown in figure 50.

c. Corps Artillery Command/Fire Direction Net, AM, RATT (CF). The corps artillery command/fire direction net, AM, provides communication for tactical control of units immediately subordinate to corps artillery and for control of all nuclear fires of units attached to corps artillery and held under corps artillery control. This net is the primary means of disseminating meteorological data to firing units under corps artillery control. A type command/fire direction net, AM, is shown in figure 51.

d. Corps Artillery Fire Direction Net, AM, RATT (F). The corps artillery fire direction net, AM, links corps artillery headquarters and the division artillery headquarters for coordination of artillery fires. This net is also used by the division artilleries to request additional fire support from corps artillery. A type fire direction net is shown in figure 52.

e. Corps Artillery Liaison Net, AM. The corps artillery liaison net provides communication between the corps artillery fire direction center and the liaison officers at the division artilleries and adjacent corps artillery. A type liaison net is shown in figure 52.

f. Corps Artillery Meteorological Net, AM (M). The corps artillery meteorological net, AM, is used by the field artillery target acquisition battalion and the division artilleries to transmit meteorological data. Meteorological data is transmitted on a schedule established by the net control station (field artillery target acquisition battalion). This net is also used to

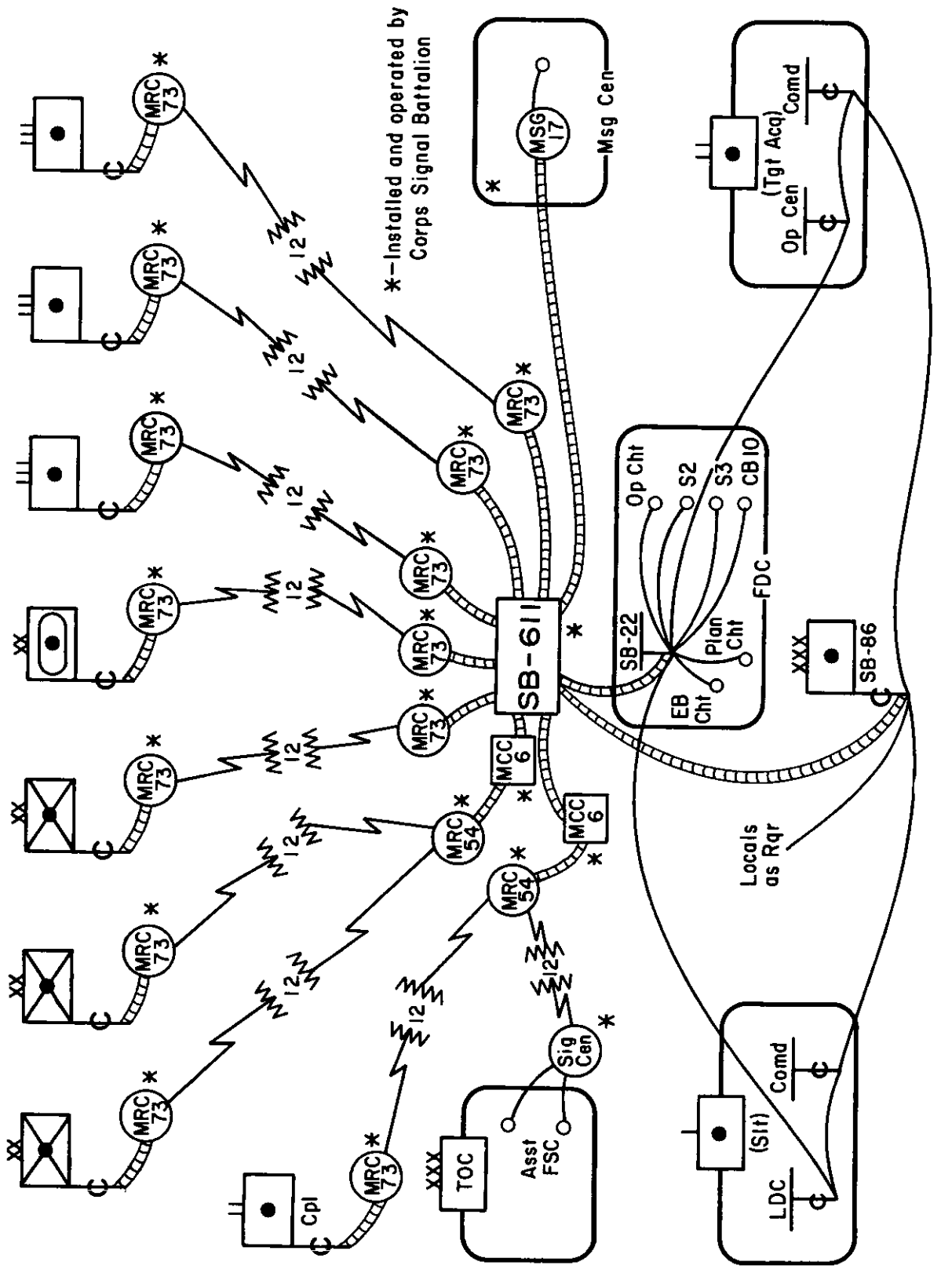


Figure 49. Type radio carrier and wire system, corps artillery.

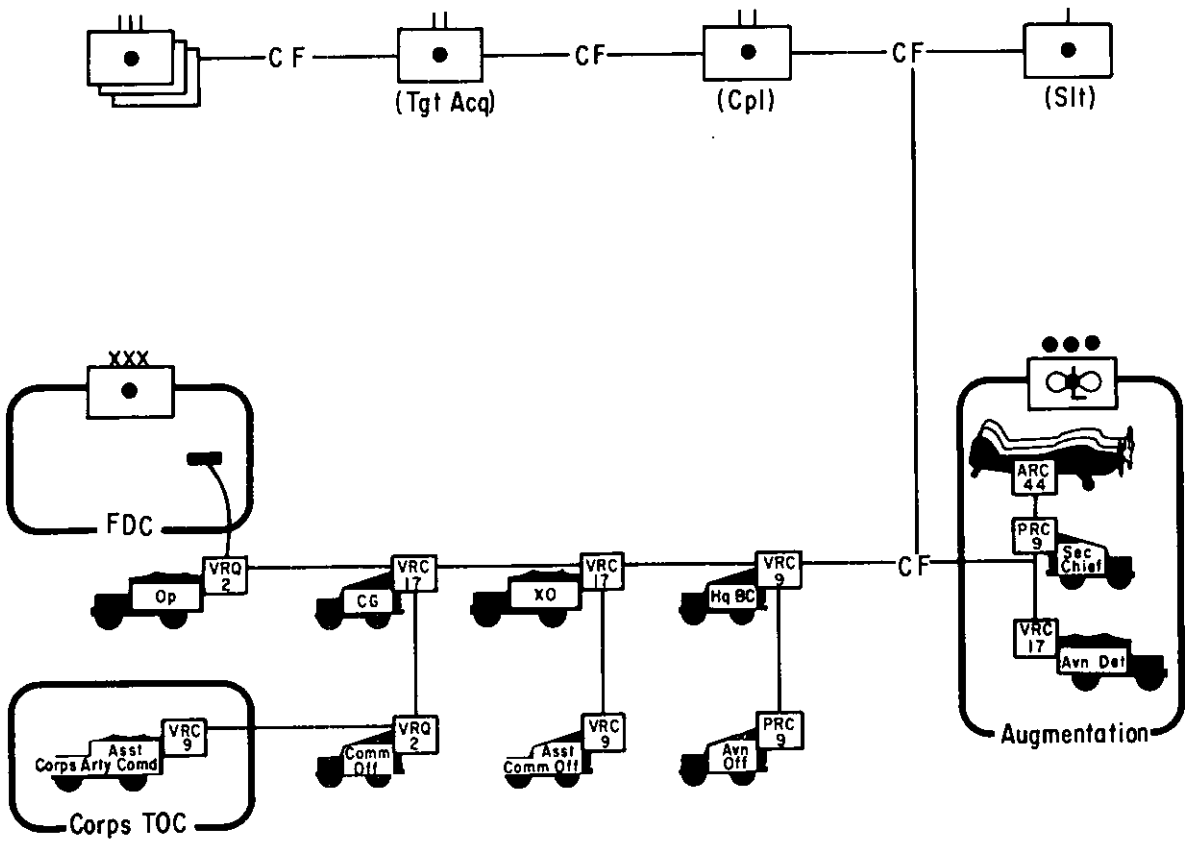


Figure 50. Type command/fire direction net, FM, corps, artillery.

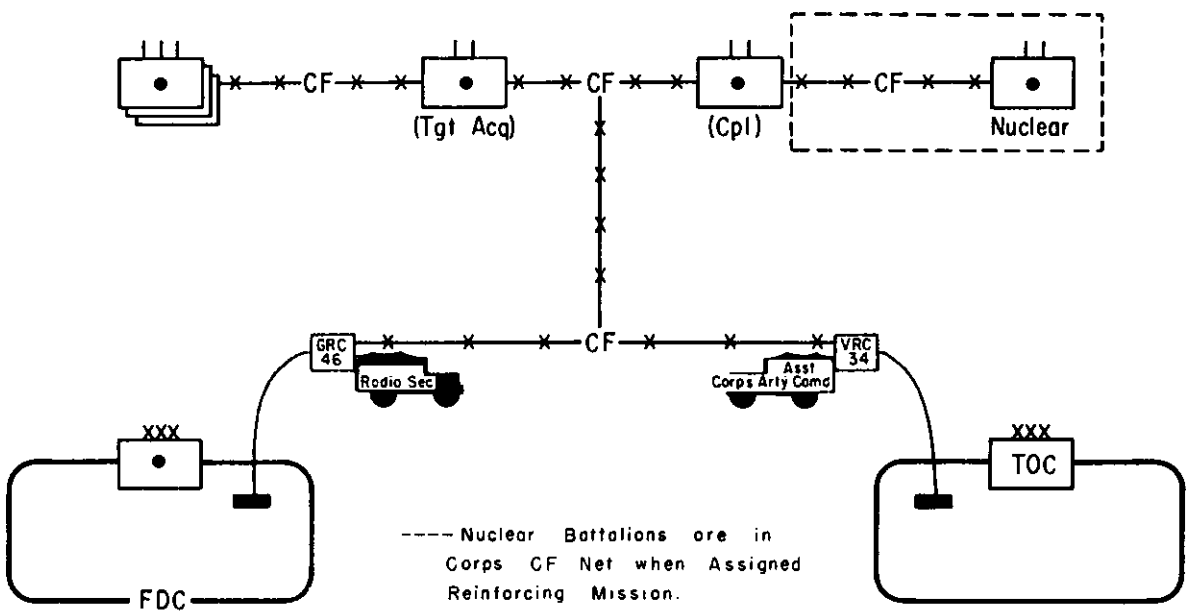


Figure 51. Type command/fire direction net, AM, corps artillery.

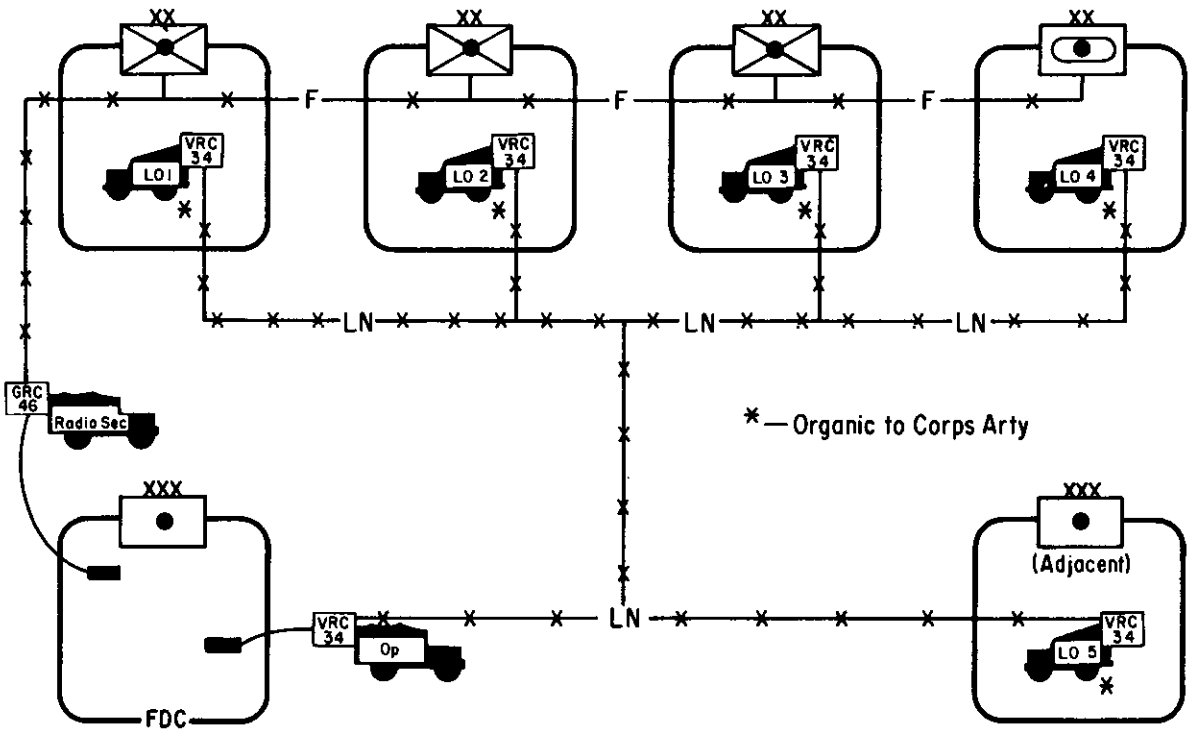


Figure 52. Type fire direction net and liaison net, corps artillery.

coordinate radiosonde frequencies and schedule soundings. A type meteorological net is shown in figure 53.

g. Corps Artillery Survey Channel, FM (S). Corps artillery may be allocated one frequency modulated (FM) channel to be used as a survey channel, thereby reducing the required number of frequencies. This channel is common to all artillery survey sections within the corps artillery sector and provides locally for radio communication within or between these sections. Although this channel is usually referred to as the corps artillery survey net, operation as a coordinated net is neither intended nor feasible. If interference exists between units, normal radio discipline will prevent confusion. Since corps artillery does not have a survey section, the headquarters will not use this channel.

179. External Radio Nets

The corps artillery headquarters operates in four external radio nets, AM, and the corps signal battalion provides personnel and equipment to operate in a fifth net. Type external radio nets are shown in figure 54.

a. Corps Command Net 2, AM, RATT. The corps command net 2, AM, is used by the corps headquarters for tactical control and administrative supervision over corps artillery and certain other corps units. The corps signal battalion supplies to corps artillery a radio set with operators to enter this net.

b. Army Artillery Command/Fire Direction, AM, RATT (CF). The army artillery command/fire direction net, AM, is used by army artillery to exercise tactical control and administrative supervision over subordinate units and to transmit fire missions to subordinate units. This net is also used between army artillery and corps artillery to exchange information and intelligence and to coordinate artillery fires.

c. Warning Net, AM. The corps artillery fire direction center will monitor an appropriate warning net to receive conditions of air defense warnings and warnings of airborne, nuclear, chemical and biological attacks. Information pertinent to elements of corps artillery should be retransmitted over corps artillery internal communication system.

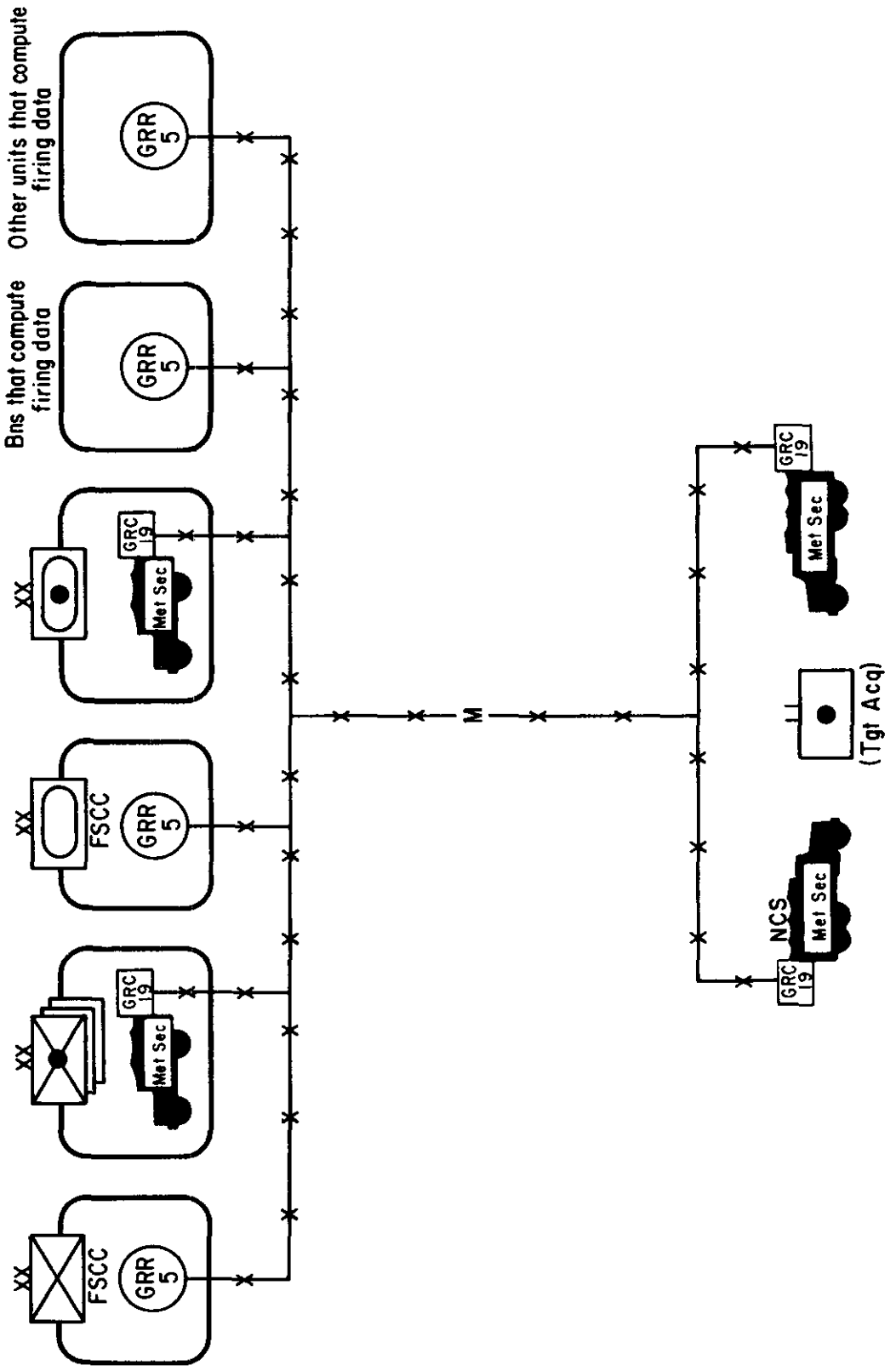


Figure 53. Type meteorological net, corps artillery

d. Air Force Tactical Air Observation Net, AM. Corps artillery operates in the Air Force tactical air observation net, AM, for communication with high performance aircraft locating nuclear targets and reporting the effects of fire on these targets.

e. Air Force Tactical Air Direction Net, AM. The air liaison officer (located at corps tactical operations center) operates in the Air Force tactical air direction net, AM, by utilizing the amplitude-modulated (AM) component of a radio set furnished to him by corps artillery. This net gives the air liaison officer a radio link with high performance aircraft that may be conducting air strikes in the corps area.

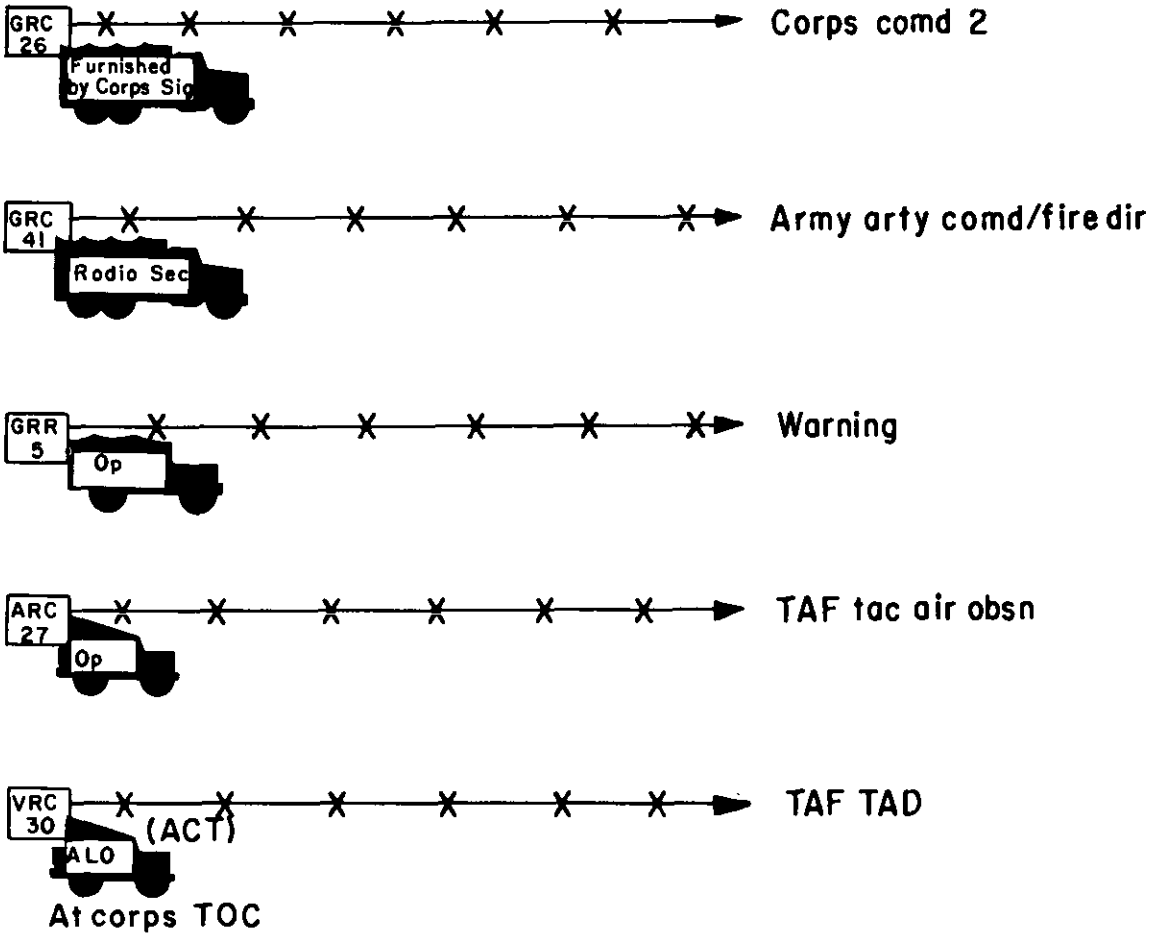


Figure 54. Type external radio nets, corps artillery.

Section IV. COMMUNICATION SYSTEM, ARTILLERY GROUP

180. General

The communication system of the artillery group will vary with the tactical mission assigned to the group. For details concerning the tactical employment of the group, see FM 6-20-1 and FM 6-( ), U.S. Army Missile Command (Medium) (when published).

181. Communication Requirements

The communication requirements for an artillery group are shown in paragraph 168.

182. Wire System

The wire of the artillery group system parallels and augments the radio nets of the group. The extent of the group wire system will depend on the length of time a position is occupied and on the tactical situation. If the group is reinforcing a division artillery, the communication officer may arrange with the corps artillery communication officer to have the circuits over the carrier system patched through to division artillery. Also, it may be necessary for certain

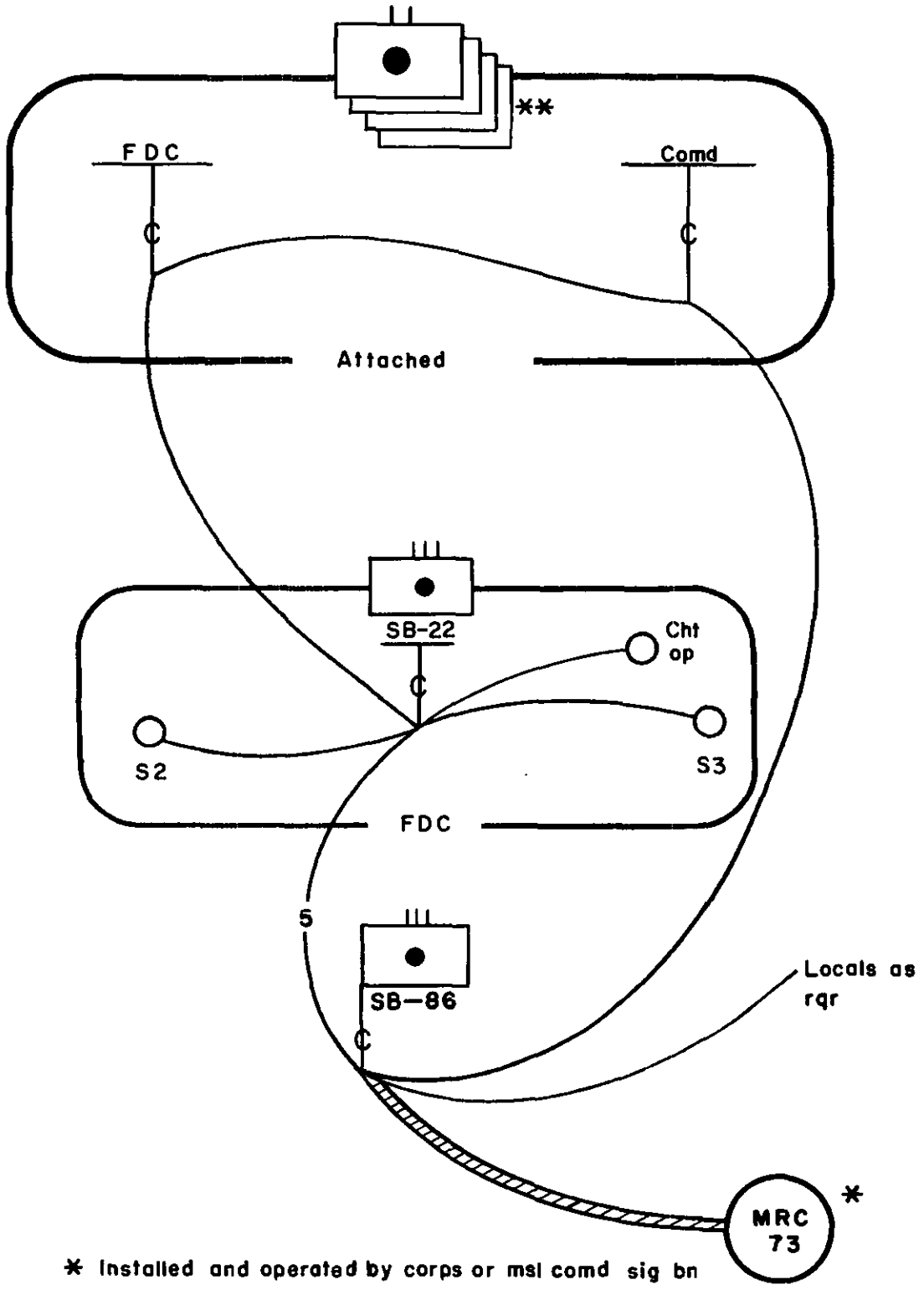


Figure 55. Type wire system, field artillery group.

attached units to install the lines between their unit and group headquarters. A type wire system for a group is shown in figure 55.

183. Internal Radio Nets

a. General. To meet its internal communication requirements, the artillery group headquarters will utilize one frequency modulated (FM) channel and one amplitude modulated (AM) channel. A command/fire direction net, FM, and a command/direction net, AM, will be established over these channels. Type internal radio nets for a field artillery group are shown in figure 56.

b. Group Command/Fire Direct Net, FM, (CF). The group command/fire direction net, FM, provides communication with elements of the staff, airborne aircraft, and subordinate units for tactical control, administrative supervision, exchange of information and intelligence. This net may also be used for transmission of firing data.

c. Group Command/Fire Direction Net, AM, RATT (CF). The group command/fire direction net, AM, is used for transmission of fire missions to subordinate units. It is also used for tactical control and administrative supervision of subordinate units and for exchange of information and intelligence, and dissemination of meteorological data to firing units under group artillery control.

184. External Radio Nets, Artillery Group Attached to Corps Artillery

To meet its external communication requirements when attached to corps artillery, the artillery group will operate in the nets shown in figure 57 and discussed in *a* through *e* below.

a. Corps Artillery Command/Fire Direction Net, FM (CF). The corps artillery command/fire direction net, FM, is a direct radio channel between the group commander and the commanding general of corps artillery. In addition, the group fire direction center operates a full-time station in this net to handle operational traffic between the two units.

b. Corps Artillery Command/Fire Direction Net, AM, RATT (CF). The group operates in the corps artillery command/fire direction net, AM, to receive tactical control, administrative

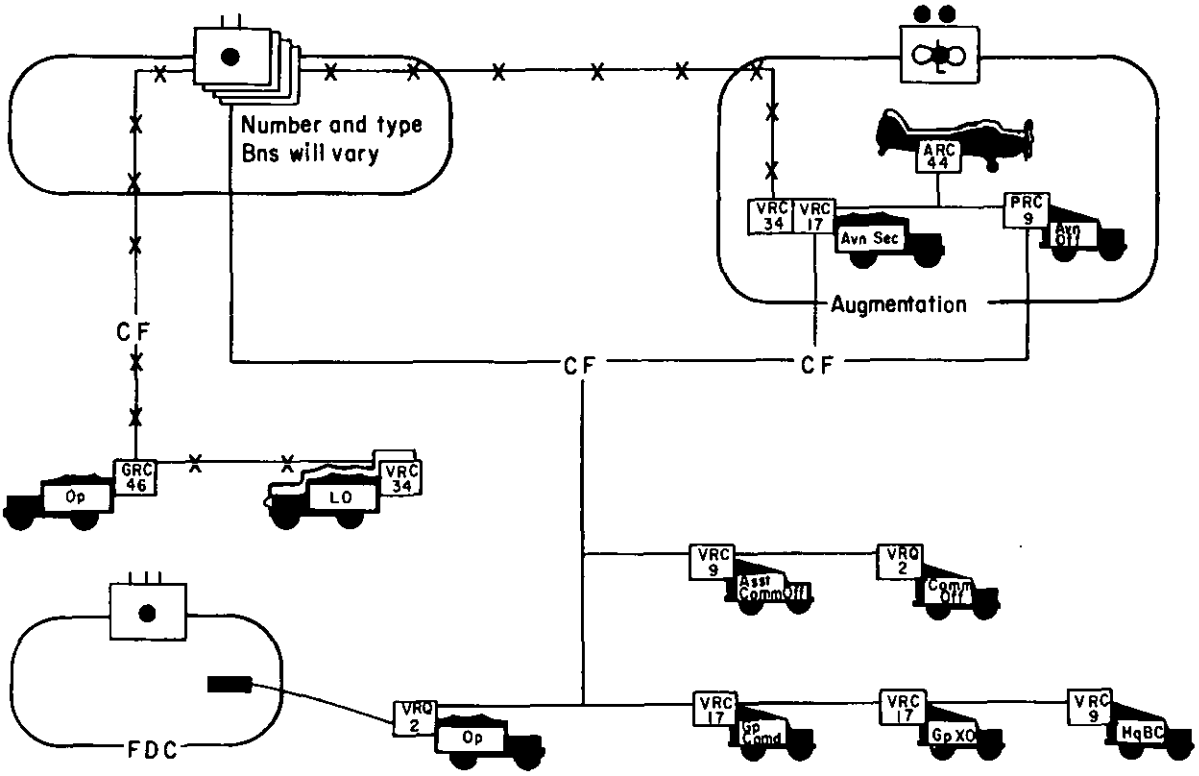


Figure 56. Type internal radio nets, artillery group.

supervision and fire missions from corps artillery. This net may also be used by the group for the exchange of information and intelligence.

c. Division Artillery Command/Fire Direction Net, AM, RATT (CF). If the group has a mission of reinforcing a division artillery the group will operate in the reinforced division artillery command/fire direction net to receive requests for fire.

d. Division Warning Net, AM. The group headquarters will normally be in a division area and will monitor the division warning net to receive warnings of air, airborne, nuclear, chemical and biological attacks. Information received should be retransmitted over the group internal communication system.

e. Air Force Tactical Air Observation Net. The group fire direction center operates a radio set in the tactical air observation net for the purpose of adjusting heavy artillery fire (by high performance aircraft). This net may also be utilized by higher headquarters to communicate with high performance aircraft for reporting the location of nuclear targets and for reporting the effect of fires on these targets.

185. External Radio Nets, Artillery Group Missile Command (Medium)

The external radio nets for an artillery group missile command (medium) are shown in figure 58 and discussed in *a* through *d* below.

a. Missile Command Command/Operations Net, FM (CO). The missile command command/operation net provides a direct radio channel between the group commander and the commander of the missile command. The group fire direction center operates a full-time station in this net to handle operational traffic between the two units.

b. Missile Command Command/Fire Direction Net, AM, RATT (CF). The missile command command/fire direction net is used by the missile command for transmission of fire missions to subordinate units. Nuclear missions may be transmitted direct to battalions with group monitoring only.

c. Missile Command Command/Intelligence Net, AM, RATT (CI). The group operates in

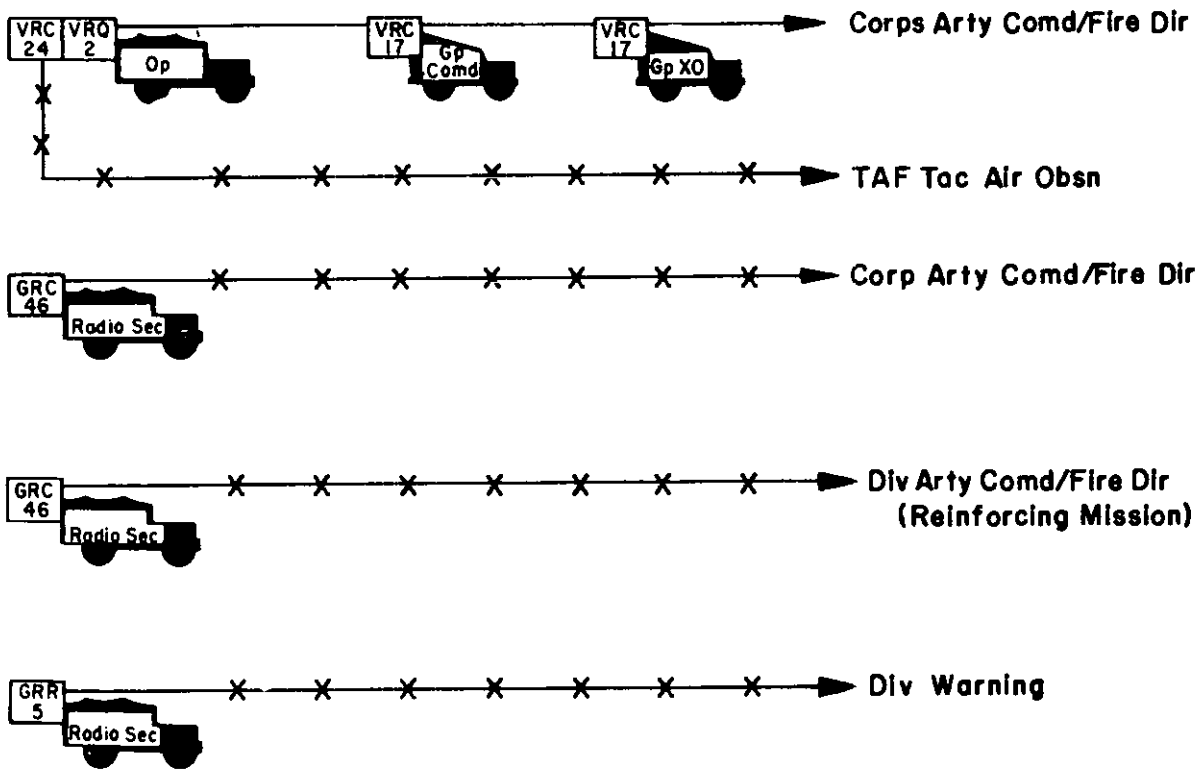


Figure 57. Type external radio nets, field artillery group, attached to corps artillery.

this net to receive operational control from the missile command and to receive intelligence.

d. Warning Net. The group will monitor an appropriate warning net, possibly a special net established by the missile command, to receive warnings of air, ground, armor, nuclear, biological, and chemical attacks and other information of an urgent operational nature.

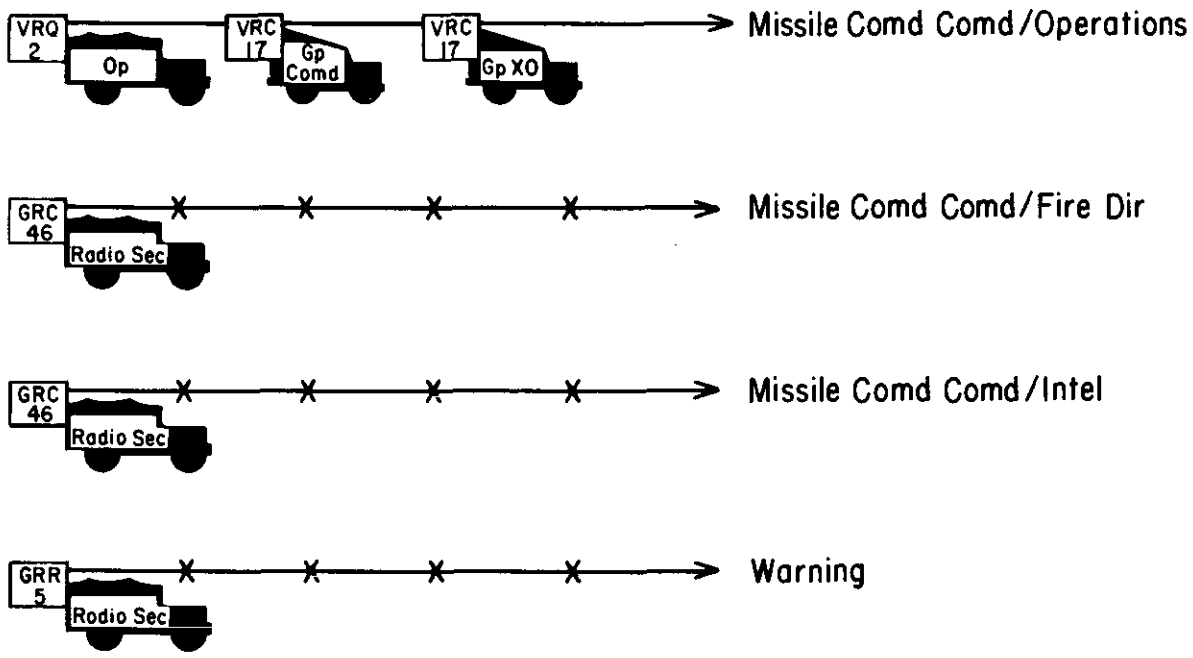


Figure 58. Type external nets, artillery group missile command (medium).

Section V. COMMUNICATION SYSTEM ARTILLERY MISSILE BATTALION, REDSTONE

186. General

The artillery missile battalion is responsible for installing communication facilities to its subordinate elements (missile batteries, ordnance company, and engineer company), and the subordinate elements are responsible for their internal communications. However, since the wire laying capabilities of the subordinate units are limited, battalion wire teams assist them in the installation of wire circuits after the priority circuits have been installed to the missile batteries. When the missile batteries are deployed at considerable distances from the battalion headquarters, it may be necessary to request equipment and personnel from army signal units for a direct radio link to the missile batteries. Communication may also be established with the batteries by requesting sole-user circuits routed through the army area communication system.

187. Communication Requirements

The communication requirements for the Redstone battalion are as shown in paragraph 169.

188. Wire System

a. General. The wire system of the Redstone battalion consists of circuits to higher, adjacent and subordinate units and the necessary local circuits within the command post. To add flexibility to the wire system, separate command and fire direction center switchboards are installed. A type wire system for a Redstone battalion is shown in figure 59.

b. Teletypewriter Circuits. The battalion is authorized two teletypewriter sets to be used in the message center for administrative traffic and in the fire direction center for fire missions and operational traffic. These circuits may be routed over the area system, wire lines, or point-

to-point communication channels to army artillery.

189. Internal Radio Nets

a. General. The artillery missile battalion, Redstone, uses two radio frequencies for internal control. Type internal radio nets for a Redstone battalion are shown in figure 60.

b. Battalion Command/Fire Direction Net, FM (CF). The command/fire direction net, FM, provides communication with the staff and with army aircraft supporting the battalion. This net will also be used to control subordinate units when they are within FM range.

c. Battalion Command/Fire Direction Net, AM, RATT (CF). The command/fire direction net, AM, is used by the battalion to exercise tactical and administrative control over subordinate elements and to transmit fire missions to the missile batteries.

190. External Radio Nets

To meet its external communication requirements, the Redstone battalion will operate in, or listen to, three external AM nets. Type external nets are shown in figure 61.

a. Army Artillery Command/Fire Direction Net, AM (CF). The battalion operates in the army artillery command/fire direction net to receive tactical orders, administrative supervision, and fire missions. This net is also used for exchange of information and intelligence.

b. Warning Net, AM. The Redstone battalion will receive conditions of air defense warnings and warnings of airborne, nuclear, chemical and biological attacks over an appropriate warning net. Pertinent information should be retransmitted over the internal communication system.

c. Time Signal Net, AM. The battalion survey section operates a radio set in the theater time signal net to receive accurate time for survey purposes.

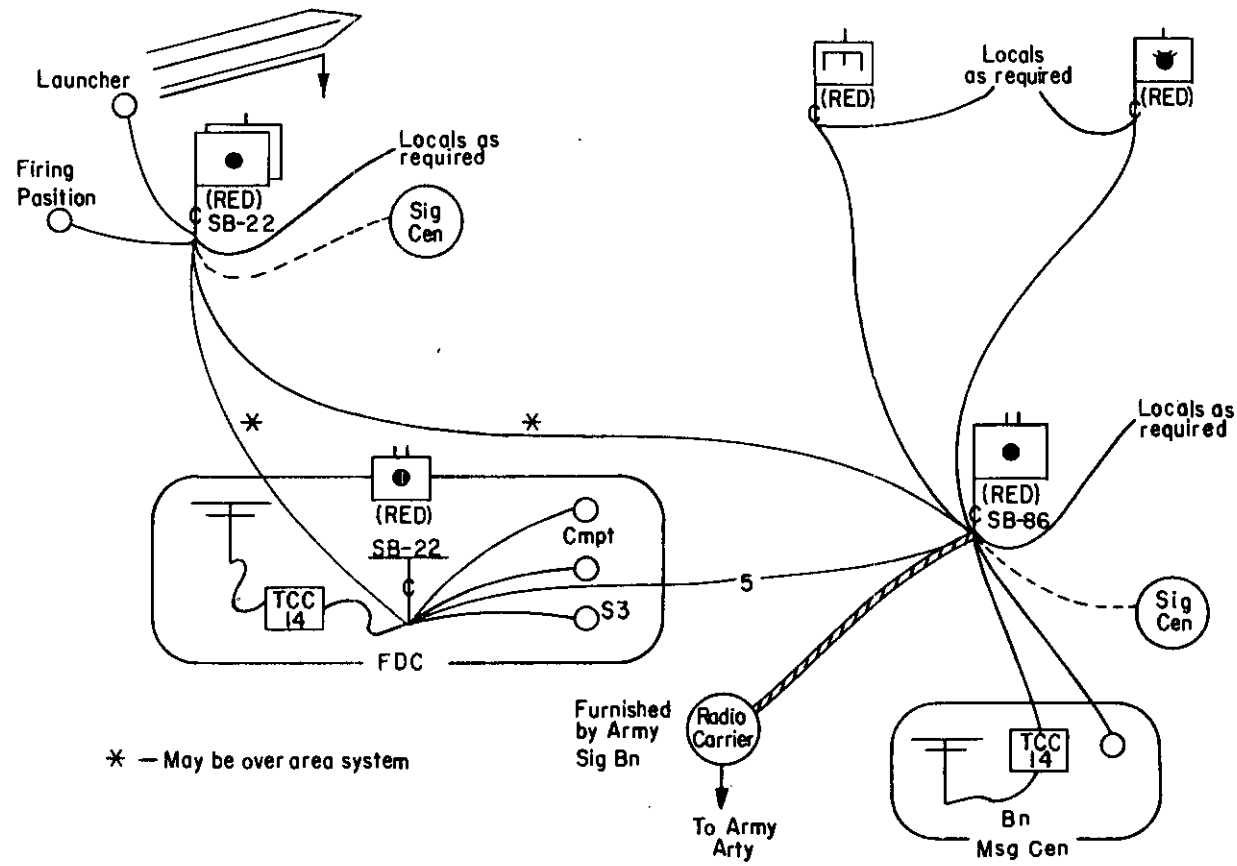


Figure 59. Type wire system, artillery missile battalion, Redstone.

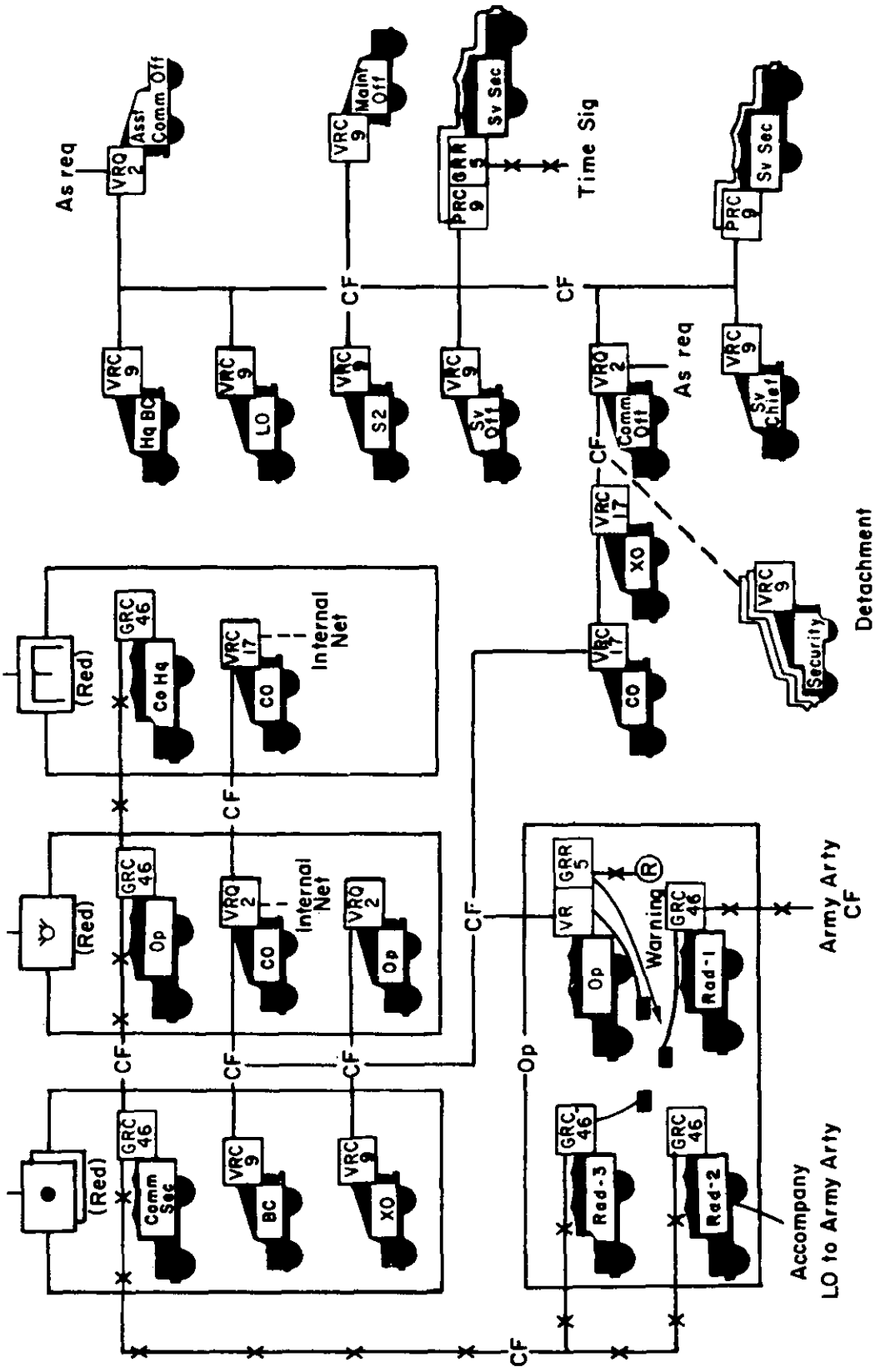


Figure 60. Type internal radio nets, artillery missile battalion, Redstone.

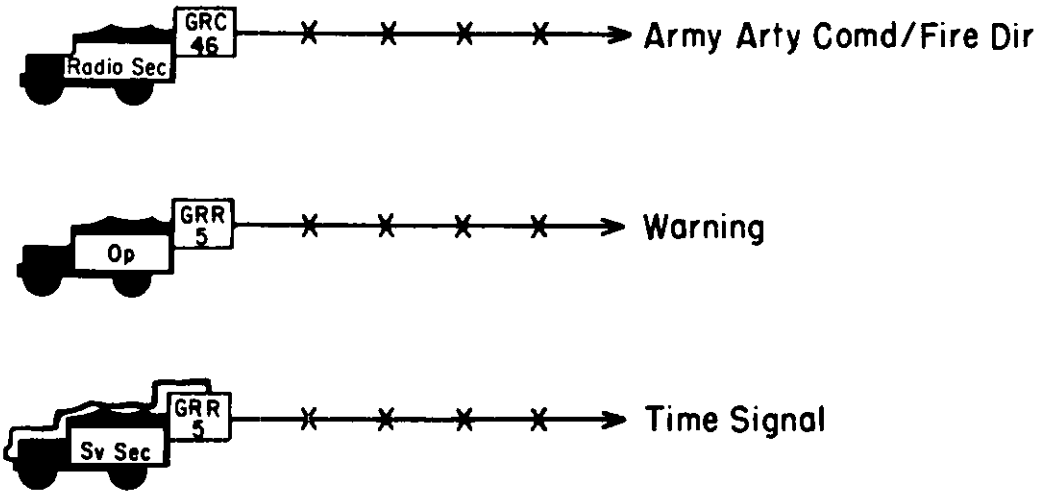


Figure 61. Type external radio nets, artillery missile battalion, Redstone.

Section VI. COMMUNICATION SYSTEM, ARTILLERY 280-MM GUN BATTALION

191. General

The communication system of an artillery 280-mm gun battalion varies depending on the method of employment. Battalions may be retained under army artillery control with all batteries placed under battalion control or with individual batteries attached to a corps artillery. Other methods of employment may be utilized, but only the communication systems for the two methods mentioned will be discussed in this section.

192. Communication Requirements

The communication requirements for the battalion are as shown in paragraph 170.

193. Wire System

a. General. The extent of the battalion wire system will depend on the length of time a position is occupied and the tactical situation. A type wire system for the battalion is shown in figure 62. If the batteries are separately controlled by corps artillery they will receive circuits from corps artillery rather than from battalion as shown in figure 62. The corps signal battalion may also send carrier equipment to the battery, thus eliminating the requirement for the battery to connect into an area signal center.

b. Teletypewriter Circuit. The battalion is authorized a teletypewriter set which may be used for communication with higher headquarters either by wire or over the area communication system.

194. Battalion Internal Radio Nets

a. General. To meet its internal communication requirements, the battalion utilizes four FM channels and one AM channel. These channels will be used to establish a battalion command/fire direction net, FM; a battalion command/fire direction net, AM; and a command/fire direction net, FM, in each gun battery. The battery radio nets are discussed in paragraph 19.6. Type radio nets for a field artillery gun battalion, 280-mm, are shown in figure 63.

b. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net, FM, provides communication with elements of the staff, airborne aircraft, and subordinate units for tactical and administrative control and exchange of information and intelligence. This net may also be used for transmission of fire missions.

c. Battalion Command/Fire Direction Net, AM (CF). The battalion command/fire direction net, AM, is used to transmit fire missions to the batteries. It may also be used for tactical and administrative control of the batteries and for exchange of information and intelligence.

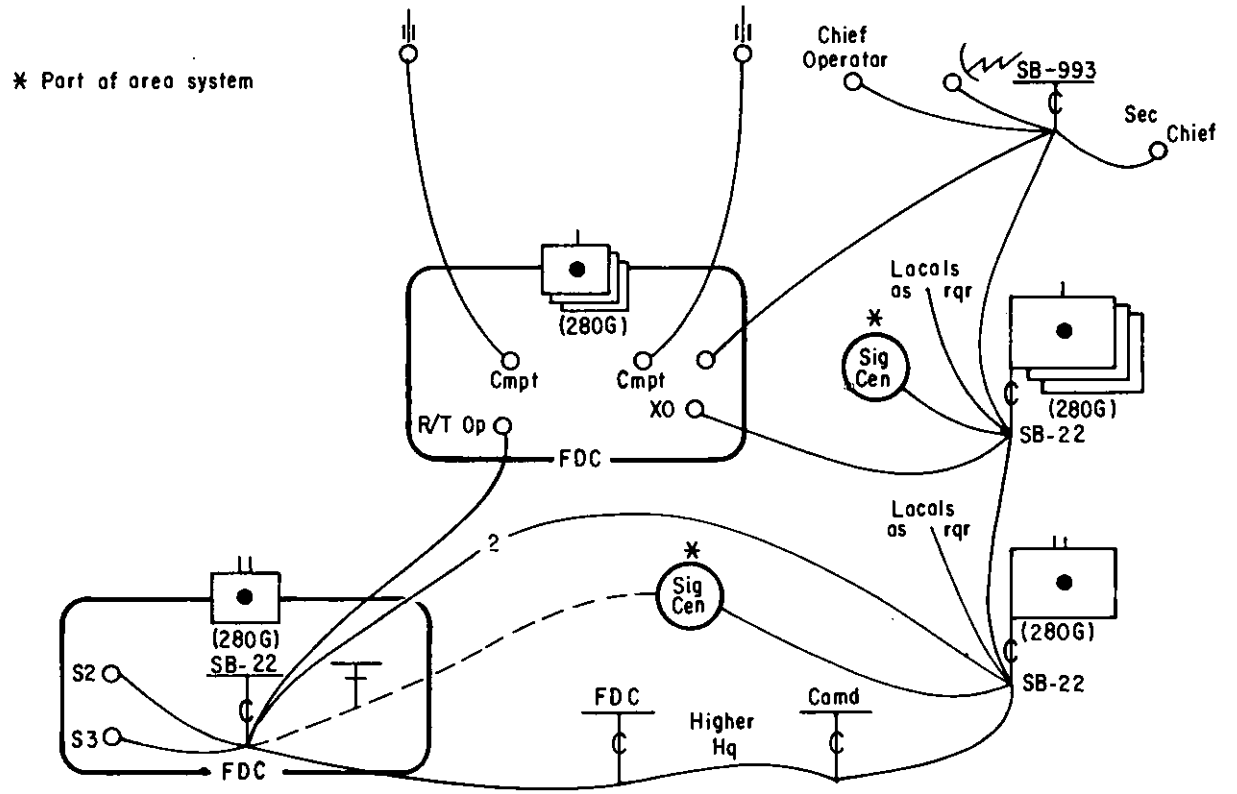


Figure 62. Type wire system, artillery gun battalion, 280-mm.

195. Battalion External Radio Nets

To meet its external communication requirements the battalion operates in the external radio nets discussed in *a* and *b* below and shown in figure 63.

a. Higher Headquarters Command/Fire Direction Net, AM, RATT (CF). The battalion operates in this net to receive tactical orders, administrative supervision, fire missions from higher headquarters and dissemination of meteorological data. Information and intelligence may also be exchanged over this net.

b. Warning Net, AM. The battalion fire direction center will monitor an appropriate warning net to receive various types of warnings. Information pertinent to elements of the battalion should be retransmitted over internal communication systems.

196. Battery Radio Nets

The 280-mm gun battery operates on internal net and operates in or monitors the external nets necessary to accomplish its mission. Type radio nets for a 280-mm gun battery are shown in figure 64.

a. Battery Command/Fire Direction Net, FM (CF). The battery command/fire direction is used by the battery commander for tactical and administrative control, dissemination of intelligence, and transmission of firing data.

b. External Radio Nets. In addition to the battalion nets the batteries operate in the following external nets:

(1) *Warning net, AM.* The batteries monitor an appropriate warning net to receive various types of warnings. Pertinent information received should be retransmitted over internal communication systems.

(2) *Corps artillery meteorological net, AM (M).* The battery fire direction center monitors the corps artillery meteorological net to receive meteorological data.

(3) *Corps artillery survey channel, FM (S).* The survey section operates in

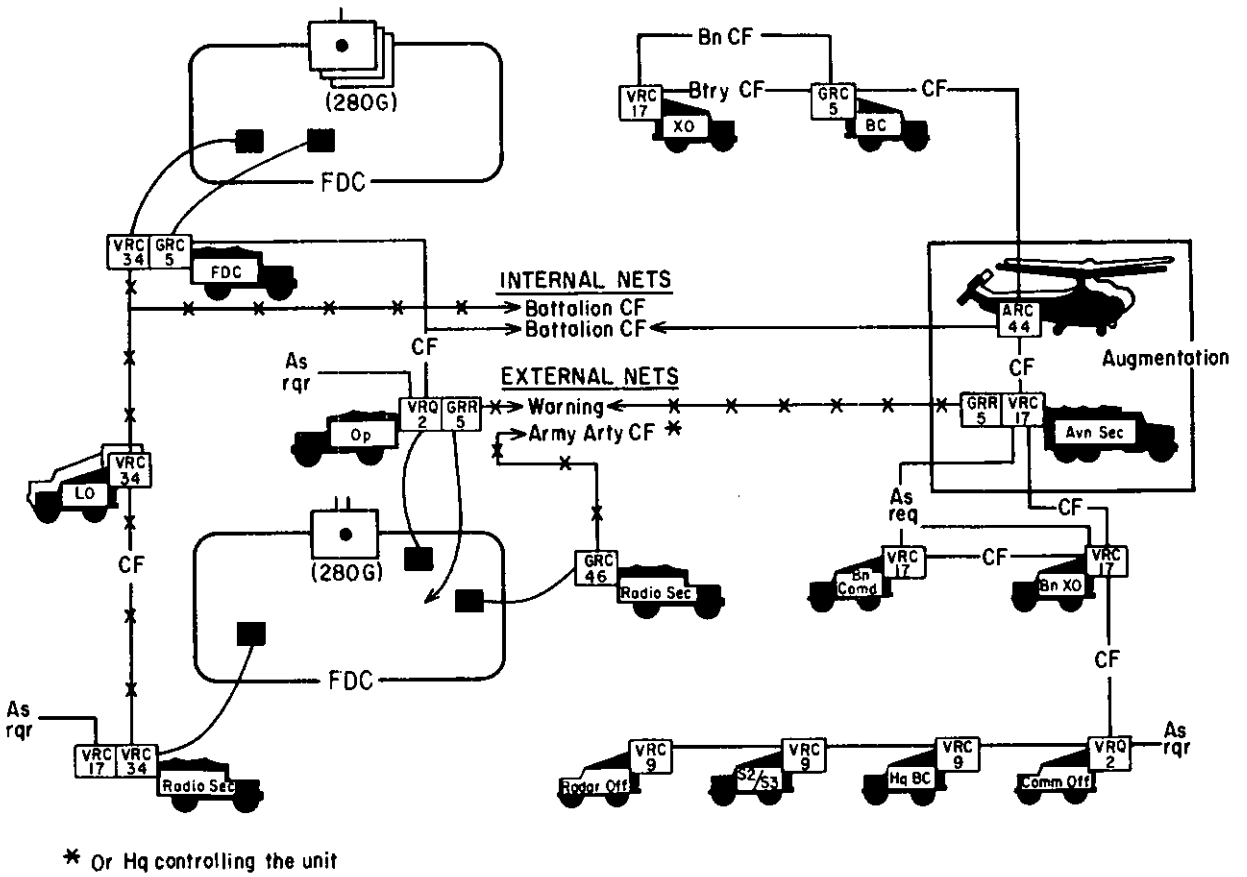


Figure 63. Type radio nets, artillery gun battalion, 280-mm.

the corps artillery survey net for communication within the section and for communication with other survey elements.

(4) *Corps artillery command/fire direction net, FM (CF).* If the battery is attached to corps artillery, it will operate in this net in lieu of the battalion command/fire direction net, FM.

(5) *Corps artillery command/fire direction net, AM (CF).* If the battery is attached to corps artillery, it will operate in this net in lieu of the battalion command/fire direction net, AM.

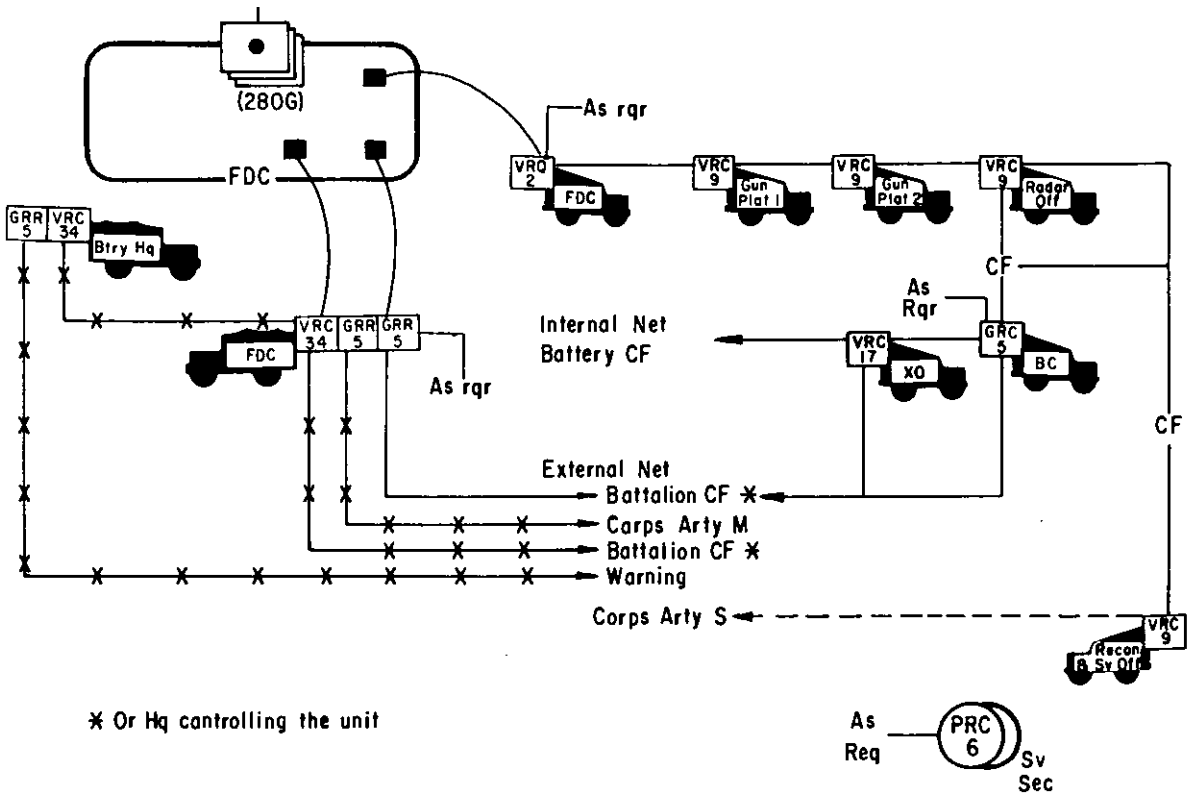


Figure 64. Type radio nets, artillery gun battery, 280-mm.

Section VII. COMMUNICATION SYSTEM ARTILLERY TARGET ACQUISITION BATTALION

197. General

The dispersion of the artillery target acquisition battalion on the battlefield requires maximum utilization of the area communication system between the battalion headquarters and the batteries in lieu of wire. A minimum of one sole-user circuit from the battalion to each battery is desirable.

198. Internal Communication Requirements

The internal communication requirements for the target acquisition battalion include facilities for—

a. Tactical and administrative control.

b. Collection of information and dissemination of intelligence.

c. Collection of hostile target information.

199. External Communication Requirements

The external communication requirements for the target acquisition battalion include facilities for—

a. Receipt of tactical orders and administrative supervision from corps artillery.

b. Exchange of information and intelligence.

c. Receipt of warnings.

d. Dissemination of survey information.

e. Dissemination of meteorological data.

f. Dissemination of hostile target information.

200. Battalion Wire System

A type wire system for the field artillery target acquisition battalion is shown in figure 65. The wire section in the headquarters battery will install the local circuits in the command

post area and the circuits necessary to connect the battalion headquarters to the nearest area signal center. The unit SOP should establish responsibility for providing wire communication to elements of the medium endurance drone platoon. Since this platoon will be operating in the forward area, it may depend on the communication facilities of the other artillery units or on the area system for communication with its parent battalion. Also the location of the meteorological sections may compel them to depend on other artillery units or on the area system for wire communication.

201. Battery Wire System

A type wire system for a field artillery target acquisition battery is shown in figure 66. The priority wire lines for the battery wire teams are the lines from the sound command post to the sound observation posts and from the flash command posts to the flash observation posts. Of equal importance are the circuits from these command posts to the battery operations center or forward switchboard. Battery wire teams will also install circuits from the battery operations center to the forward switchboard(s). The forward switchboard(s) should be located as far forward as local security will permit. One or more forward switchboards may be installed depending on the tactical dispersion of the unit. In addition wire communication for the counterbattery radar sections may be provided by installing circuits into the forward switchboard or to the nearest major artillery unit.

202. Battalion Internal Radio Nets

a. General. To meet its internal communication requirements the target acquisition battalion operates two internal nets, one AM net and one FM net.

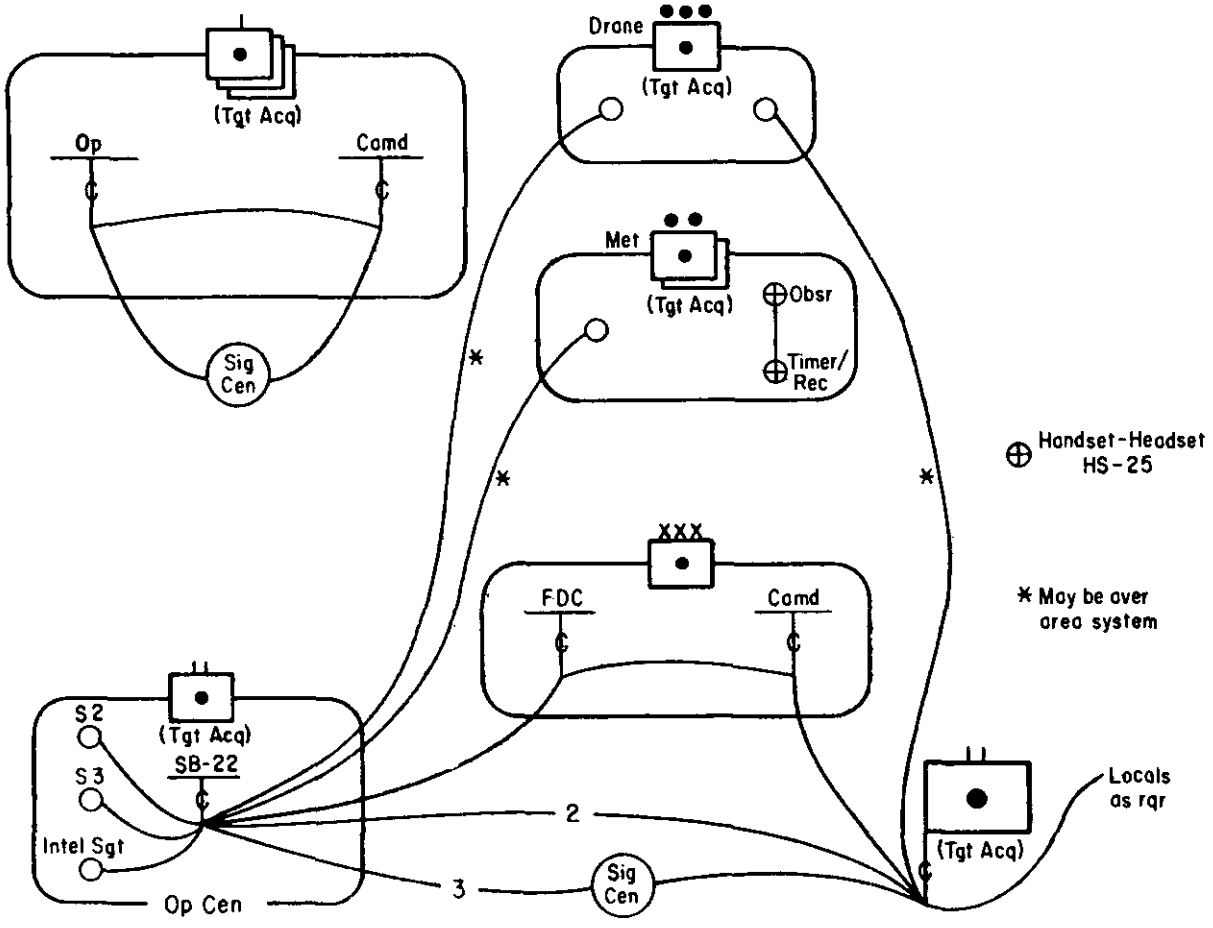


Figure 65. Type wire system, artillery target acquisition battalion.

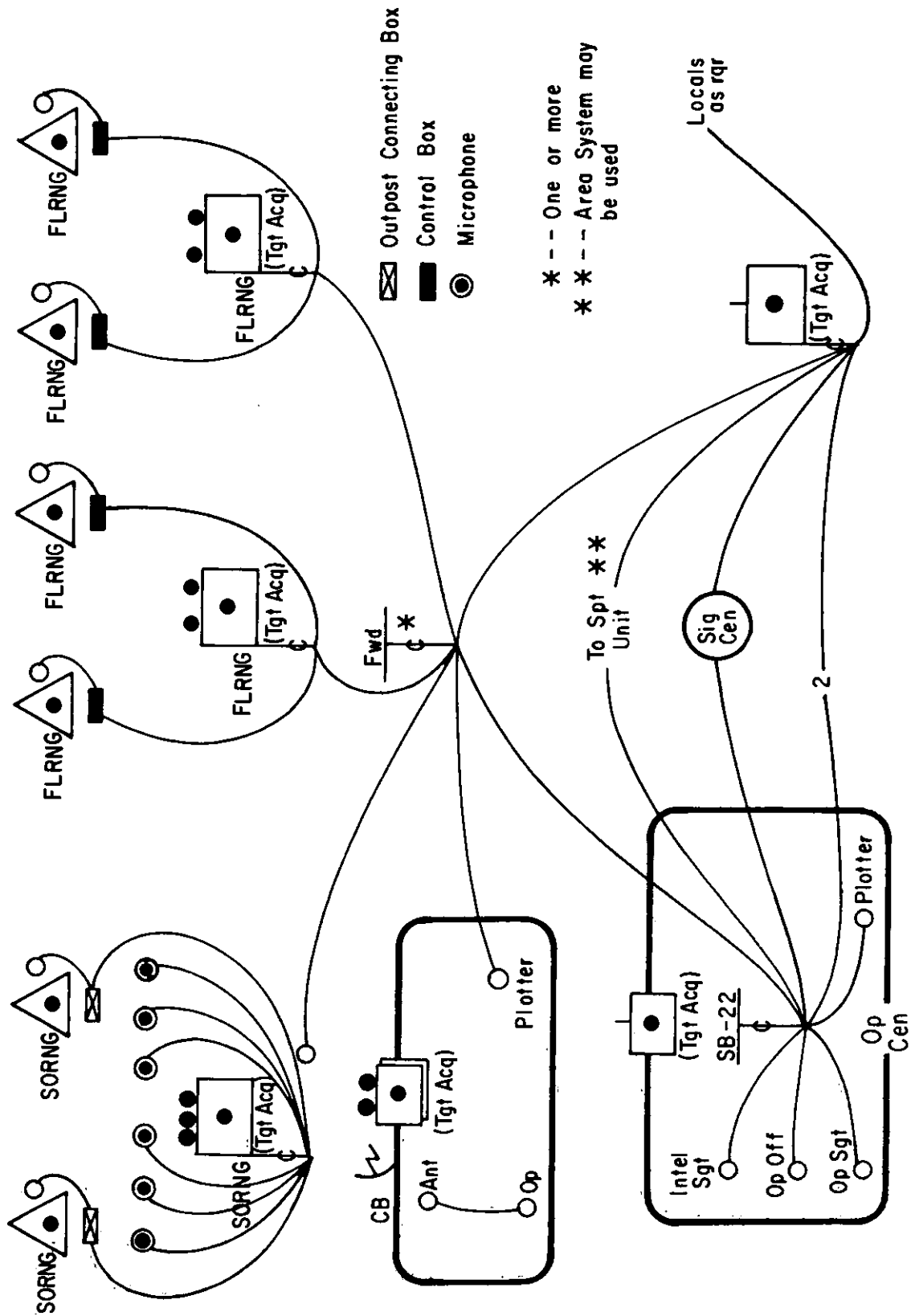


Figure 66. Type wire system, artillery target acquisition battery.

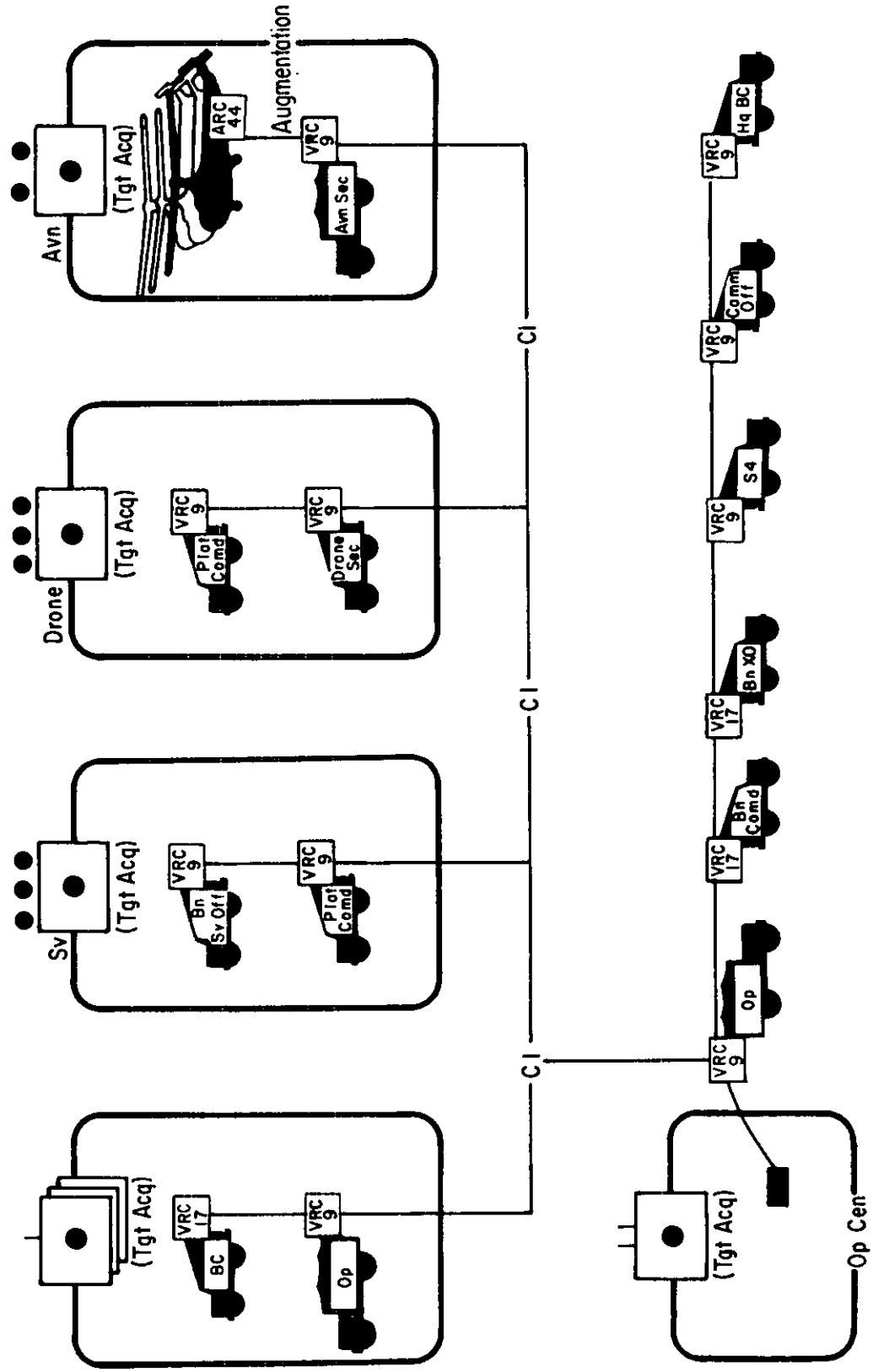


Figure 67. Type command/intelligence net, FM, artillery target acquisition battalion.

b. Battalion Command/Intelligence Net, FM (CI). The battalion command/intelligence net, FM, will be used by the commander for communications with his staff, with airborne aircraft, and with the subordinate elements that are within the range capability of the equipment. A type command/intelligence net is shown in figure 67.

c. Battalion Command/Intelligence Net, AM, RATT (CI). The battalion command/intelligence net, AM, provides a radioteletype link between the battalion and its batteries. This net may be used for tactical control and exchange of information and intelligence and may also be used for transmission of battlefield information from the drone platoon to the battalion operations center when the corps artillery command/fire direction net, AM, is overloaded. A type command/intelligence net, AM, is shown in figure 68.

203. Battalion External Radio Nets

To meet its external communication requirements, the target acquisition battalion operates in the external radio nets discussed in *a* through *f* below and shown in figure 69.

a. Corps Artillery Command/Fire Direction Net, FM (CF). The corps artillery command/fire direction net, FM, provides a direct radio channel between the battalion and its higher headquarters.

b. Corps Artillery Command/Fire Direction Net, AM, RATT (CF). The corps artillery command/fire direction net, AM, provides a radioteletype link between the target acquisition battalion and corps artillery, and between the drone platoon and corps artillery. Target information obtained by the drone platoon may be transmitted to the battalion over an internal net and pertinent information retransmitted to corps artillery.

c. Corps Artillery Meteorological Net, AM (M). The target acquisition battalion will operate the net control station in the corps artillery meteorological net. Each division artillery will have an operating station in this net. All units having a requirement for meteorological data will monitor the net to obtain pertinent data from the nearest transmitting station.

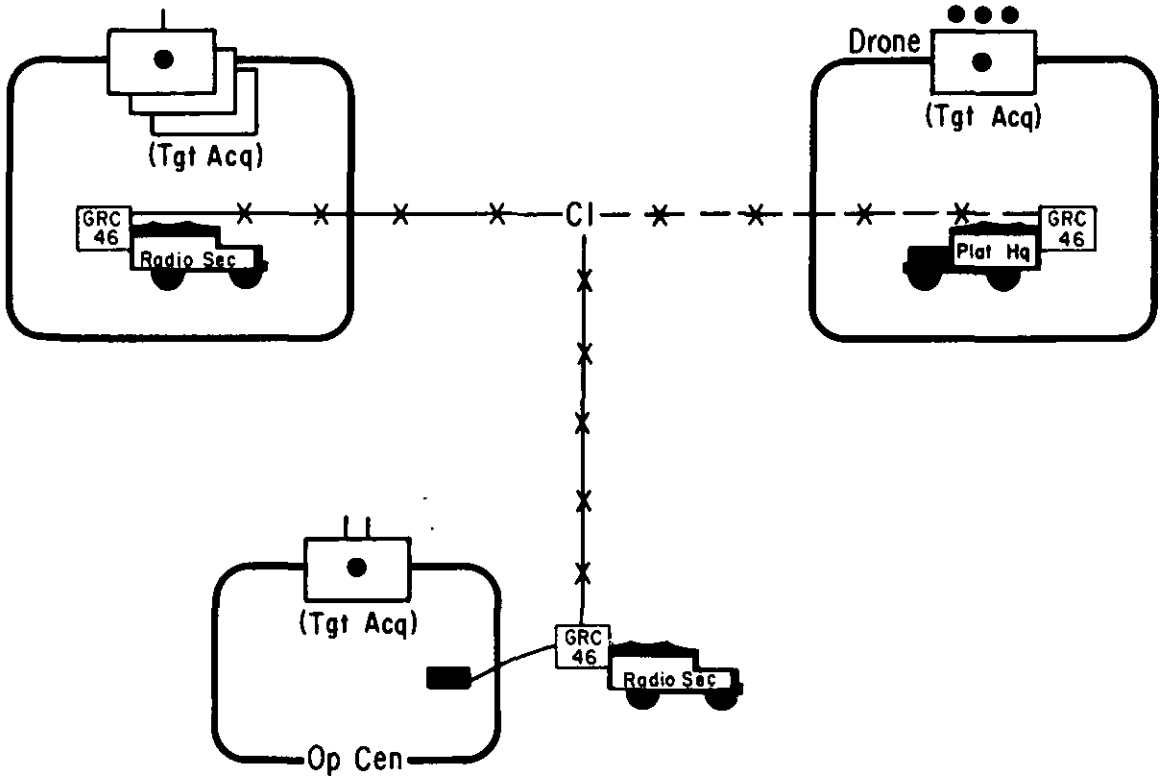


Figure 68. Type command/intelligence net, AM, artillery target acquisition battalion.

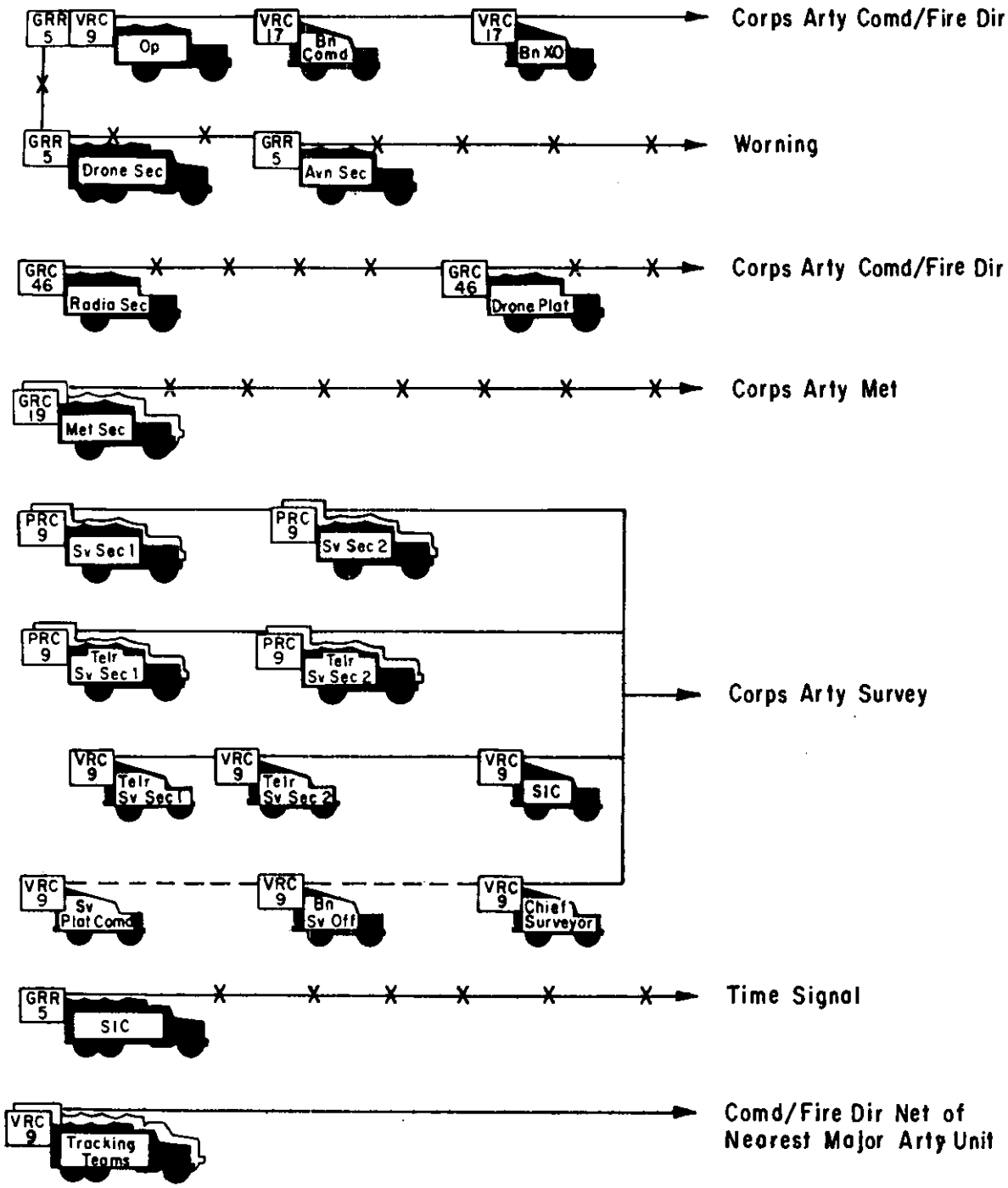


Figure 69. Type external radio nets, artillery target acquisition battalion.

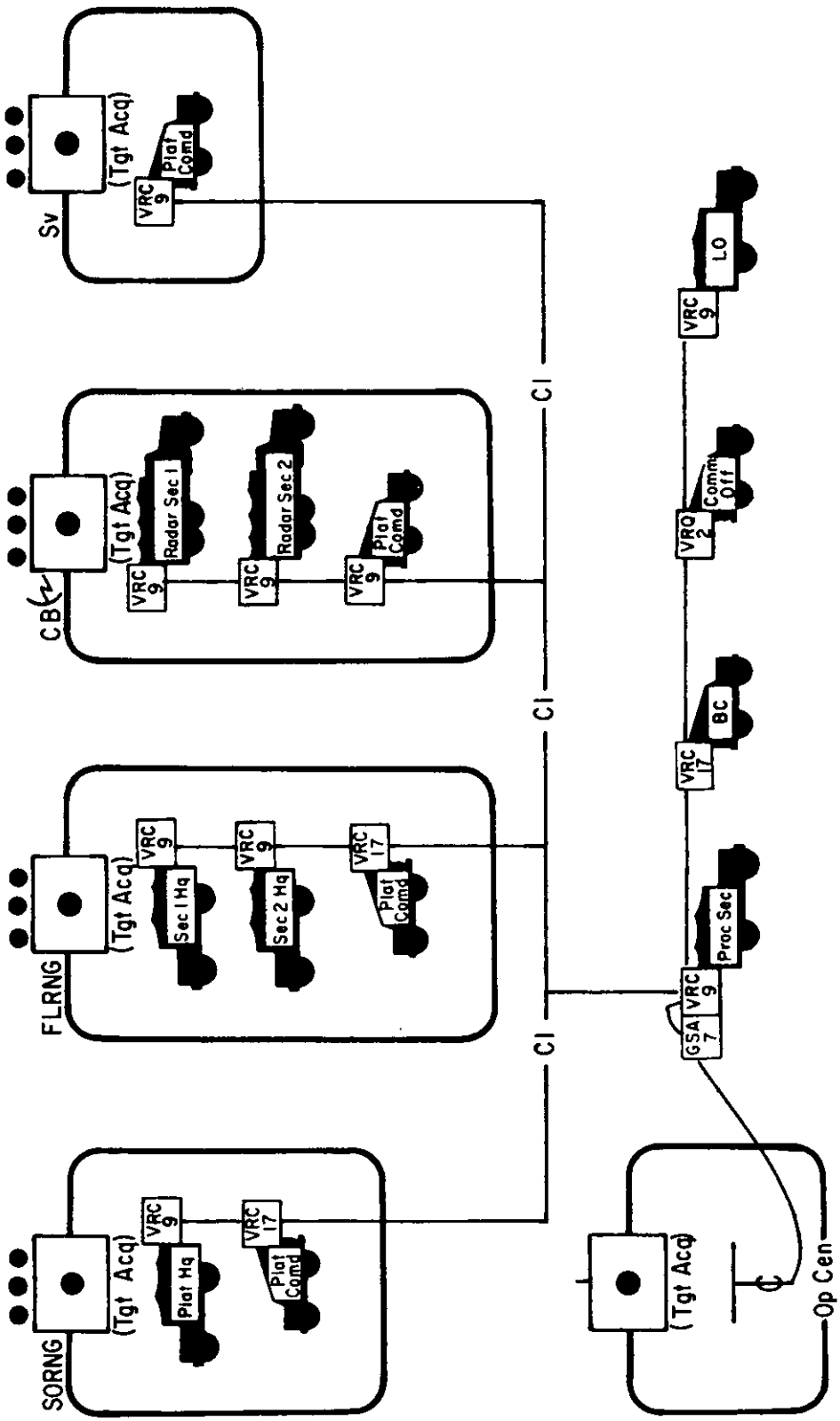


Figure 70. Type command/intelligence net, FM, artillery target acquisition battery.

d. Corps Artillery Survey Channel, FM (S). Survey sections within the target acquisition battalion will use the corps artillery survey net for internal communication and for communication with other unit survey elements. This net will also be used by the survey information center for receipt and transmission of survey information.

e. Warning Net, AM. The target acquisition battalion will monitor an appropriate warning net to receive air defense warnings and warnings of airborne, nuclear, chemical, and biological attacks. Information received which is pertinent to the battalion should be retransmitted over the battalion internal communication system.

f. Time Signal Net, AM. Each theater of operation will normally broadcast accurate time on a prescribed schedule. The survey information center monitors this net and transmits correct time to interested survey parties.

204. Battery Radio Nets

a. General. Each target acquisition battery operates three internal radio nets and will operate in external nets as necessary to accomplish its mission.

b. Battery Command/Intelligence Net, FM (CI). The battery command/intelligence net, FM, will be used by the commander for communication with elements of the battery. The battery is equipped with an automatic retransmission capability to extend the range capability of its FM equipment. A type battery command/intelligence net is shown in figure 70.

c. Sound Ranging Net, FM (R). The sound platoon leader will use the sound ranging net to control the operations of the sound ranging observation posts. The observation posts will also use this net for transmission of information to the platoon command post. A type sound ranging net is shown in figure 71.

d. Flash Ranging Net, FM (T). The flash ranging net will be used by the observation posts to transmit information to the section command posts. It will also be used by the platoon leader to control flash ranging operations. A type flash ranging net is shown in figure 71.

e. External Nets. External radio nets for the target acquisition battery are as follows (fig. 72):

(1) *Battalion command/intelligence net, FM (CI).*

(2) *Battalion command/intelligence net, AM, RATT (CI).*

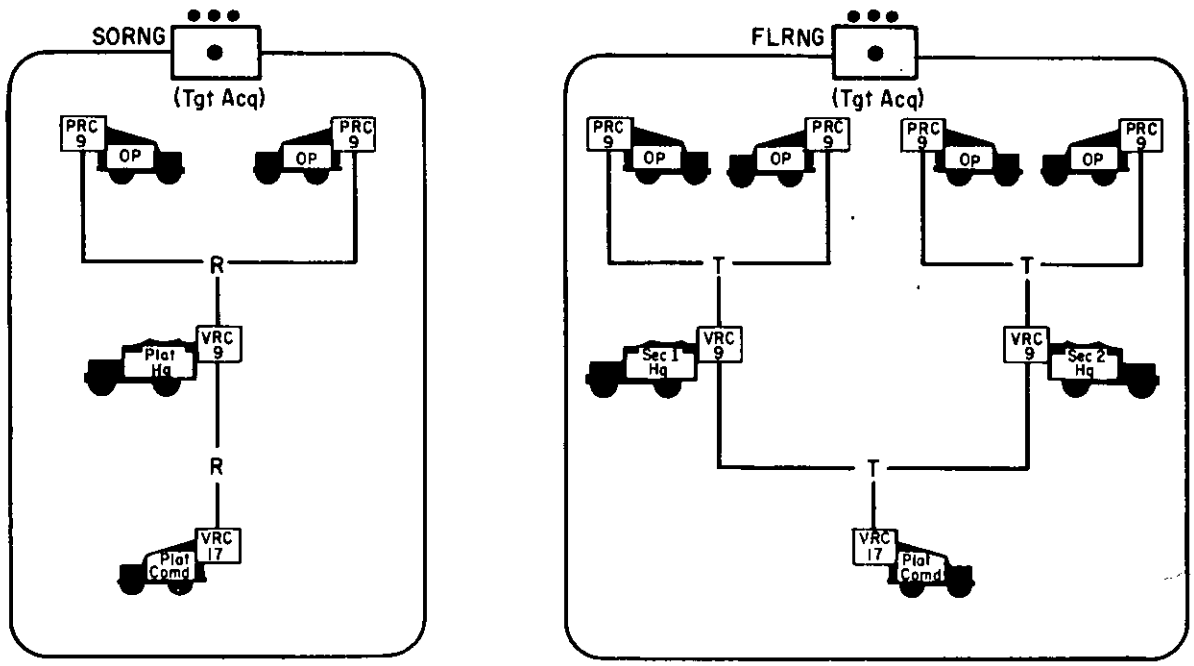


Figure 71. Type sound ranging (R) and flash ranging (T) nets, field artillery target acquisition battery.

(3) *Corps artillery survey channel, FM (S).*
(4) *Warning net, AM.*
(5) *Division artillery command/fire direction net or artillery group command/fire direction net, FM (CF).* The target acquisition battery may be attached to either a division artillery or a field artillery group. In this event, the battery commander and the operations center may change from the battalion command/intelligence net to the command/fire direction net of the unit to which attached.
(6) *Division artillery command/fire direction, AM, RATT, or artillery group*

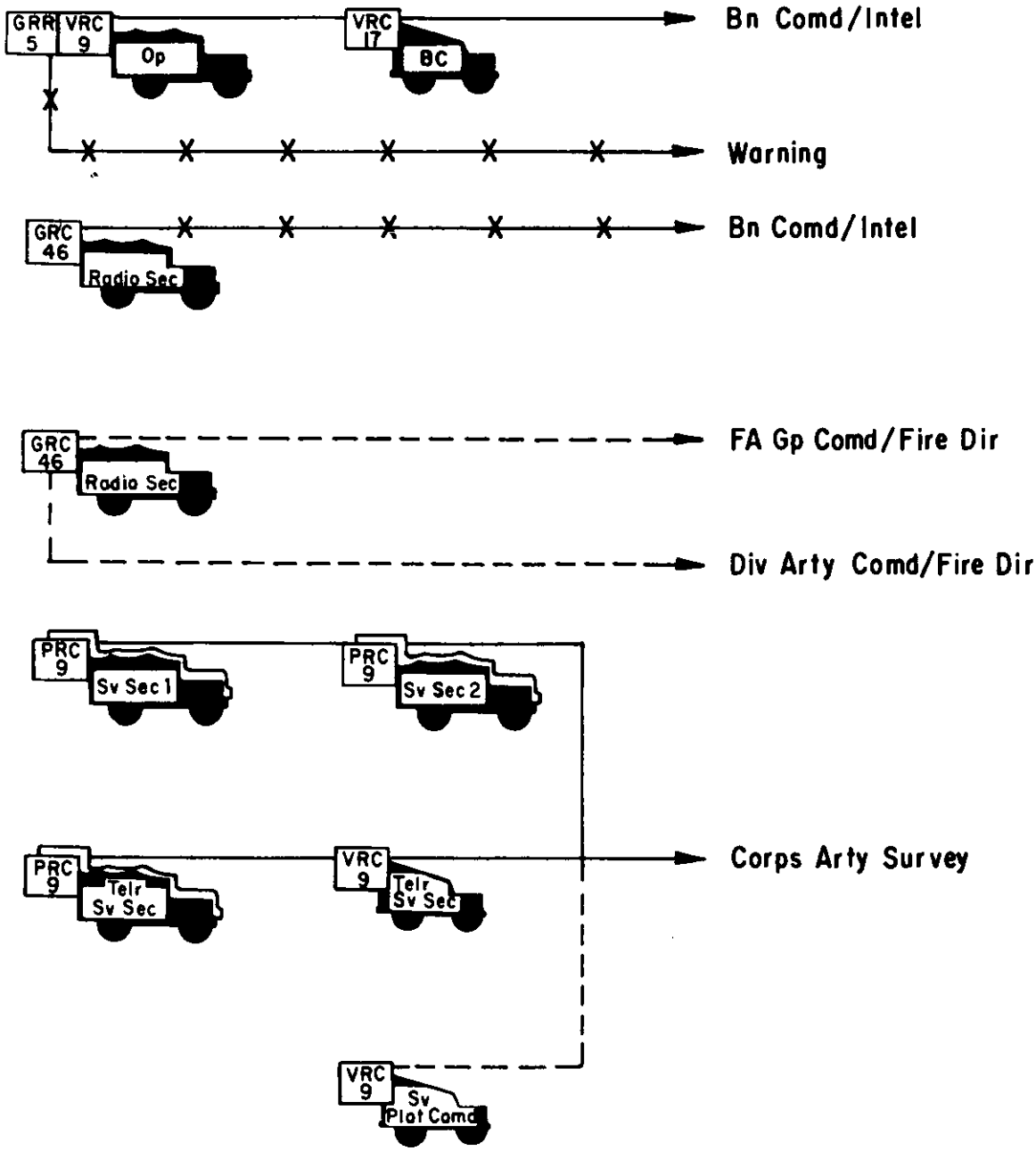


Figure 72. Type external radio nets, artillery target acquisition battery.

command/fire net, AM, RATT (CF). Each battery is equipped with a radio-teletypewriter set to operate in the command/fire direction net of the unit to which attached.

Section VIII. COMMUNICATION SYSTEM, ARTILLERY MISSILE BATTALION, CORPORAL

205. General

The internal communication system of the Corporal battalion varies depending on the deployment of the battalion. If the battery control center (AN/GTW–1) is located in the battalion fire direction center, the length of the wire lines between the battalion command switchboard and the fire direction center may be increased. If the battery control center is located outside the fire direction center, the battalion FDC may be located some distance from the firing elements.

206. Communication Requirements

The communication requirements for the Corporal battalion are as shown in paragraph 170, except that this unit has no internal requirement for collection of information.

207. Wire System

The extent of the battalion wire system will depend on the length of time the unit remains in a position. In addition, wire communication in alternate positions must be considered. The cable system discussed in paragraph 208 is used extensively within the firing battery, and to add flexibility to the system, separate command and fire direction switchboards are installed. A type wire and cable system for the battalion is shown in figure 73.

208. Cable System

a. Nineteen-conductor signal cables provide communication circuits within the guidance platoon and to the battery control center. (Other cables within the battery carry data in addition to providing communications.) The cables are issued as part of the guidance platoon equipment and are installed by guidance platoon personnel. They are also issued as part of the firing station and are installed by firing platoon personnel. Cable connections are as follows:

(1) From the battery control center AN/GTW–1 to the computer (19-conductor).
(2) From the computer to the doppler and the radar (19-conductor).
(3) From the radar to the antenna group.
(4) From the firing panel of each firing platoon to the terminal box.
(5) From the firing panel to the firing station.
(6) From the firing station to the launcher.

b. The conductors in the 19-conductor cables are utilized as follows:

(1) Eight conductors are for the four-station (computer, radar, doppler, and battery control center) all-master intercommunicating system.
(2) Two conductors are for the four-station (computer, radar, doppler, and battery control center) telephone party line. This line allows these four stations to communicate with each other simultaneously during the firing count down.
(3) Two conductors are for the four-station (computer, radar, doppler, and battery control center) one-master (battery control center) speaker system. This speaker system is used primarily for the countdown from the fire direction center to the computer, radar, and doppler.
(4) Two conductors are for the ready-hold light circuit. This circuit is used by the computer, radar, and doppler sections to indicate to the battery control center when they are ready for a missile to be fired.
(5) Two conductors comprise the portion of the circuit carrying the takeoff signal from the launcher to the computer.
(6) One conductor is a ground.
(7) Two conductors are spares.

209. Internal Radio Net

a. General. To meet its internal communication requirements, the Corporal battalion operates one internal radio net. A type internal radio

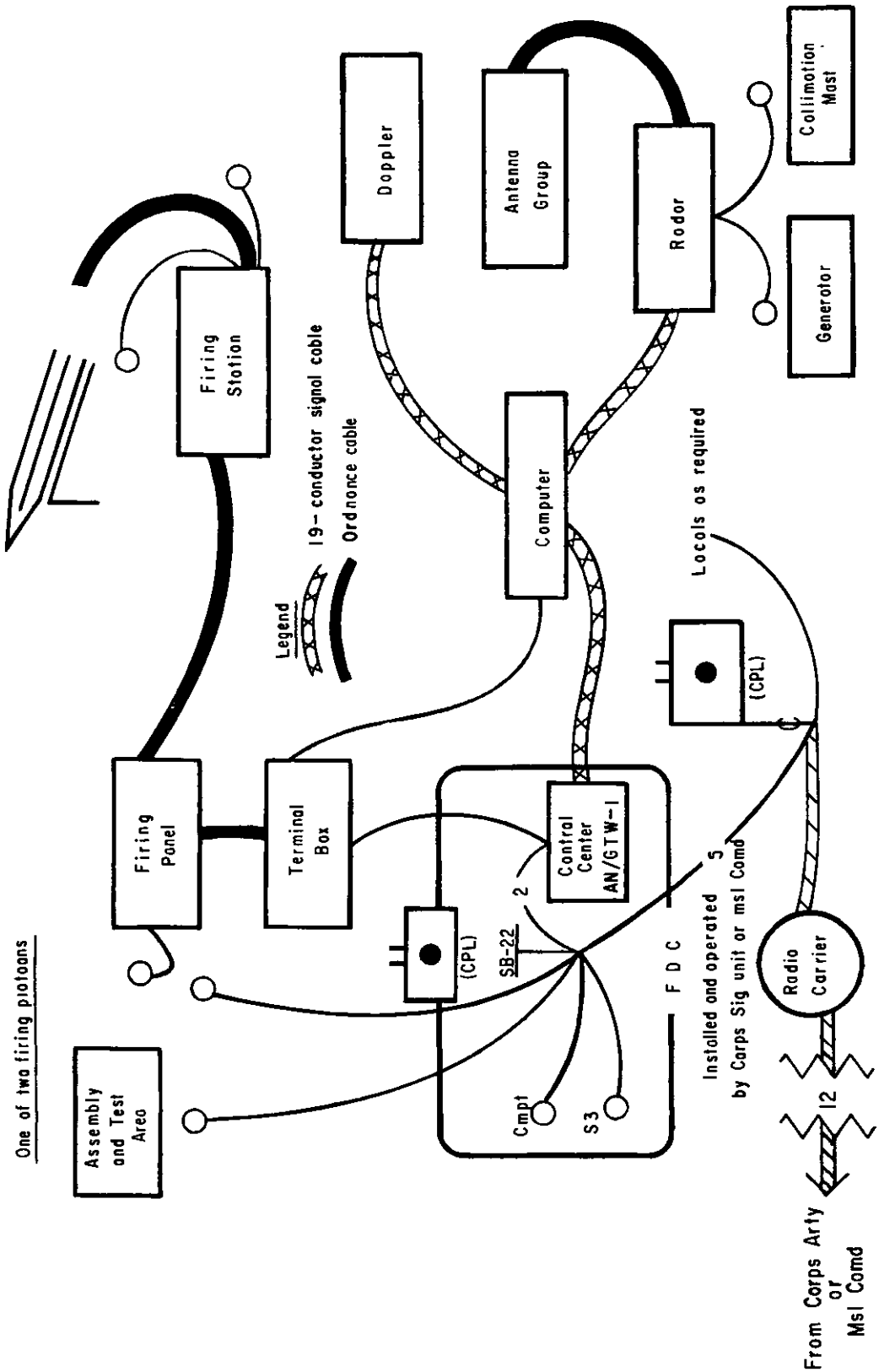


Figure 73. Type wire and cable system, artillery missile battalion, Corporal.

net for the Corporal battalion is shown in figure 74.

b. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net provides communication within the battalion headquarters and with subordinate units. It is also used for internal communication within the firing battery.

210. External Radio Nets, Corporal Battalion, Attached to Corps Artillery

To meet its external communication requirements when attached to corps artillery, the Corporal battalion will operate in, or listen to, the external radio nets necessary to accomplish its mission. Type external nets are shown in figure 75.

a. Corps Artillery Command/Fire Direction Net, FM (CF). The corps artillery command/fire direction net, FM, provides a direct radio channel between the battalion commander and the corps artillery commanding general. In addition the battalion fire direction center operates a full-time station in this net to handle operational traffic between the two units.

b. Corps Artillery Command/Fire Direction Net, AM, RATT (CF). The battalion operates in the corps artillery command/fire direction net to receive tactical control, administrative supervision meteorological data, intelligence, and fire missions from corps artillery.

c. Corps Artillery Survey Channel, FM (S). The battalion survey personnel will use the corps artillery survey net for communication with other survey elements.

d. Warning Net, AM. The Corporal battalion will monitor an appropriate warning net to receive warnings of impending air, airborne, nuclear, chemical and biological attacks. Information pertinent to elements of the battalion should be retransmitted over the battalion internal communication system.

e. Corps Artillery Meteorological Net, AM (M). The battalion fire direction center monitors the corps artillery meteorological net to receive meteorological data from the field artillery target acquisition battalion.

The external nets for the Corporal battalion, missile command (medium) are shown in figure 76.

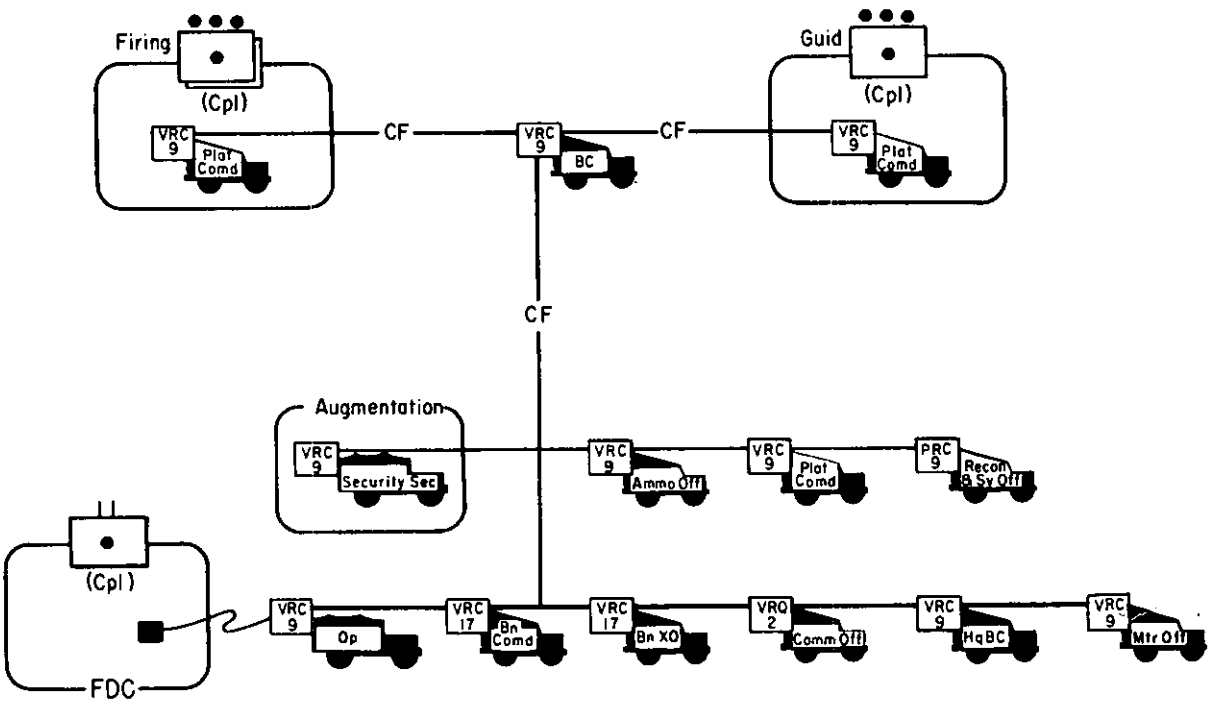


Figure 74. Type command/fire direction net, artillery missile battalion, Corporal.

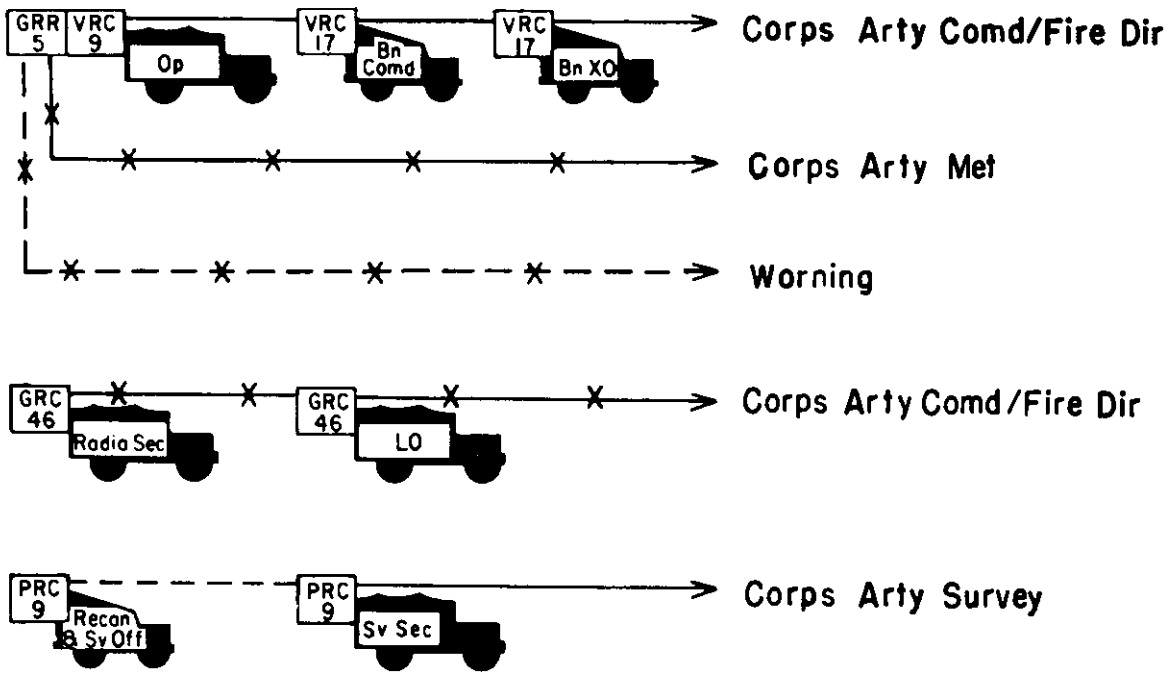


Figure 75. Type external nets, artillery missile battalion Corporal, attached to corps artillery.

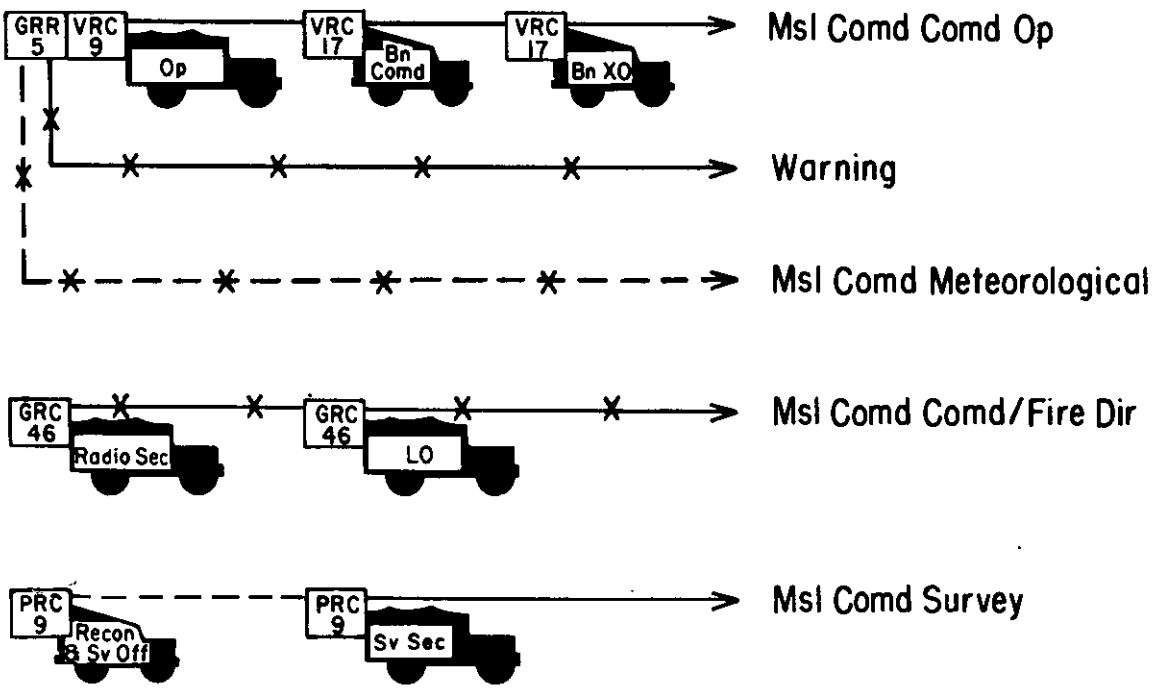


Figure 76. Type external radio nets, artillery missile battalion, Corporal missile command (medium).

211. External Radio Nets, Corporal Battalion, Missile Command (Medium)

The external nets for the Corporal battalion, missile command (medium) are shown in figure 76.

a. Missile Command Command/Operations, Net, FM (CO). The missile command command/operations net provides a direct radio channel between the battalion commander and the commander of the missile command. The battalion fire direction center operates a full-time station in this net to handle operational traffic between the two units.

b. Missile Command Command/Fire Direction Net, AM, RATT (CF). The battalion operates in the missile command command/fire direction net to receive meteorological data and fire missions from the missile command. This net also provides a radio channel between the battalion and the battalion liaison officers at the missile command.

c. Missile Command Command/Intelligence Net, AM, RATT (CI). The battalion operates in the missile command command/intelligence net to receive operational control and intelligence from the missile command.

d. Missile Command Survey Channel, FM (S). Battalion survey personnel will use the missile command survey channel for communication with the section and with other survey elements.

e. Missile Command Meteorological Net, AM (M). The battalion monitors the missile command meteorological net to receive meteorological data from the target acquisition battalion.

f. Warning Net. The battalion will monitor an appropriate warning net for receipt of various types of warnings and other information of an urgent operational nature.

Section IX. COMMUNICATION SYSTEM, ARTILLERY MISSILE BATTALION, LACROSSE, SELF-PROPELLED

212. General

The communication system of the Lacrosse battalion varies with its assignment and tactical mission. If the unit has a reinforcing mission, it will operate in a reinforced unit net and in the nets of the corps artillery. When it is attached to an artillery group the battalion will operate in the group radio nets and the corps artillery command/fire direction net, AM.

213. Communication Requirements

The communication requirements for the Lacrosse battalion are as shown in paragraph 170.

214. Wire System

a. General. The extent of the Lacrosse battalion wire system will depend on the length of time a unit occupies a position. To add flexibility to the system, the Lacrosse battalion establishes separate fire direction center and command switchboards. A forward switchboard may also be established to reduce the number of long wire circuits from the fire direction center to the guidance stations. A type wire system is shown in figure 77.

b. Installation of Wire Circuits. Establishing the wire system within the Lacrosse battalion requires the cooperation and active support of all elements of the battalion. The five wire teams normally install the following circuits:

(1) From battalion command switchboard to battalion fire direction center.

(2) To the reinforced unit fire direction center switchboard and to the reinforced unit command switchboard if applicable. (Circuits may be routed over the area system.)

(3) To all prepared firing positions and to the two assembly sections.

(4) From battalion fire direction center to the forward switching central.

(5) From the forward switching central to the guidance sections.

(6) Local lines within the command post area.

(7) A line to the nearest signal center.

215. Internal Radio Nets

To meet its internal communication requirements, the Lacrosse battalion operates two in-

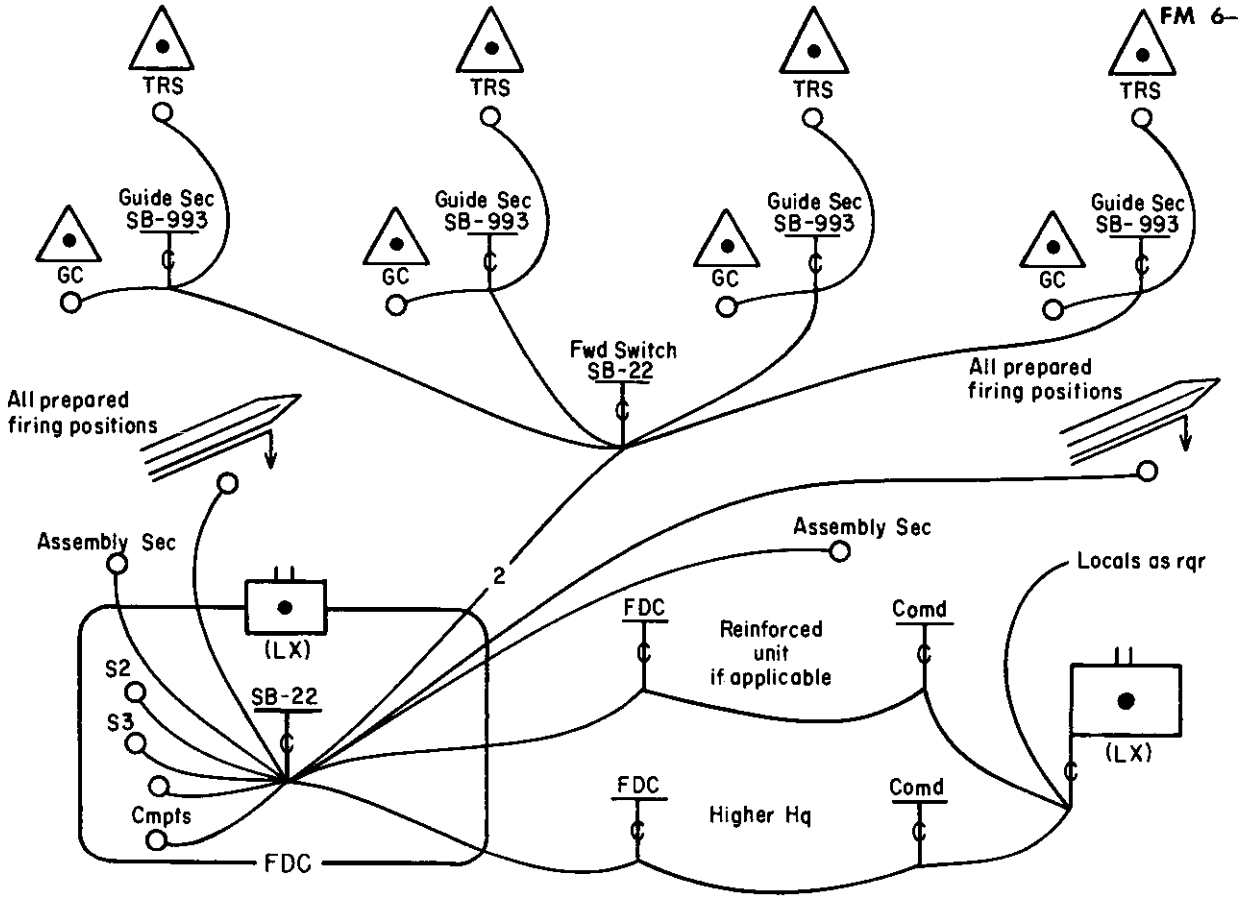


Figure 77. Type wire system, field artillery missile battalion, Lacrosse, self-propelled.

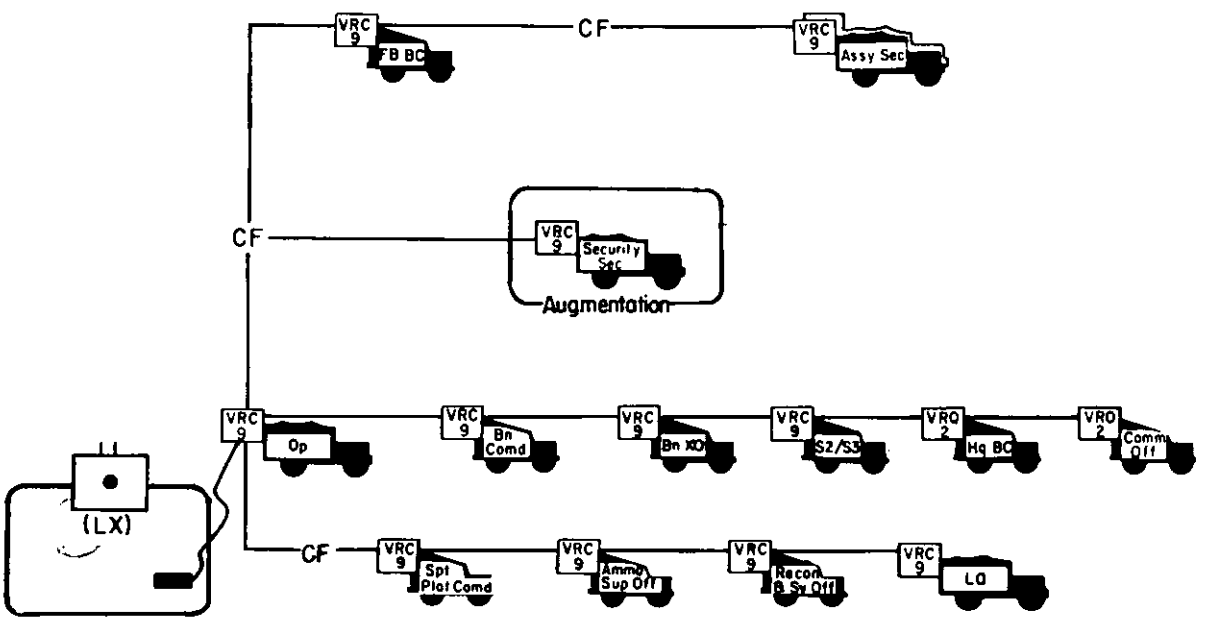


Figure 78. Type command/fire direction net, FM field artillery missile battalion, Lacrosse, self-propelled.

ternal radio nets, a command/fire direction net and a fire direction net.

a. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net is used for internal command, control, and administration of the battalion and, if required, for fire direction. Stations or individuals that may operate in this net are shown in figure 78.

b. Battalion Fire Direction Net, FM (FM). The battalion fire direction net, FM, is used to transmit fire control information to the fire direction center, guidance station, firing sections, and other sections, as required. Stations that may operate in this net are shown in figure 79.

216. External Radio Nets, Lacrosse Battalion Attached to A Field Artillery Group

To fulfill its external communication requirements when attached to a field artillery group, the Lacrosse battalion will operate in or listen to nets as listed in *a* through *f* below. Stations or individuals that may be required to operate radios in these nets are shown in figure 80.

a. Artillery Group Command/Fire Direction Net, FM (CF). The battalion will operate in the group command/fire direction net to receive command and fire direction control from the group headquarters.

b. Artillery Group Command/Fire Direction Net, AM, RATT (CF). The battalion will operate in the group command/fire direction net to receive command control, exchange information and intelligence and receive meteorological data.

c. Corps Artillery Command/Fire Direction Net, AM, RATT (CF). The corps artillery command/fire direction net, AM, is used by corps artillery for control of nuclear fires. The Lacrosse battalion has a nuclear capability and therefore, monitors this net to receive fire missions and operates in this net as required.

d. Division Warning Net, AM. The battalions monitor a division warning net to receive vari-

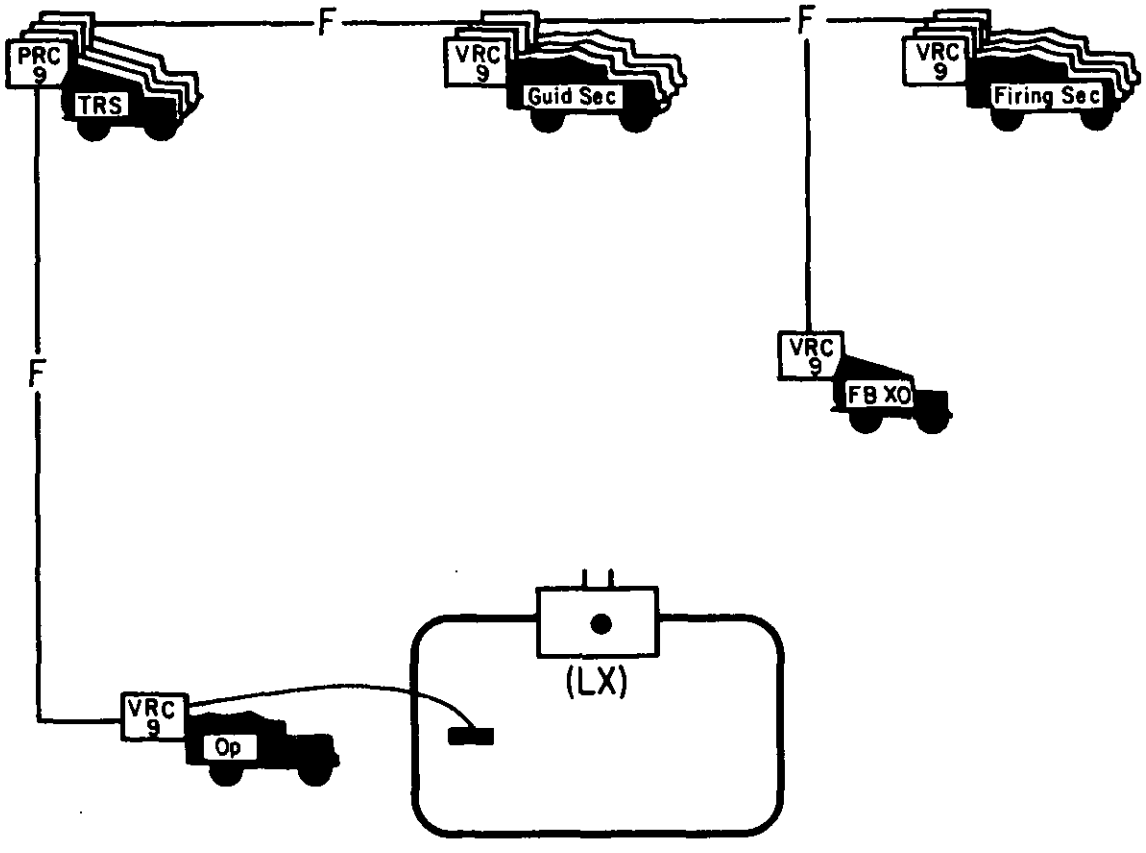


Figure 79. Type fire direction net, field artillery missile battalion, Lacrosse, self-propelled.

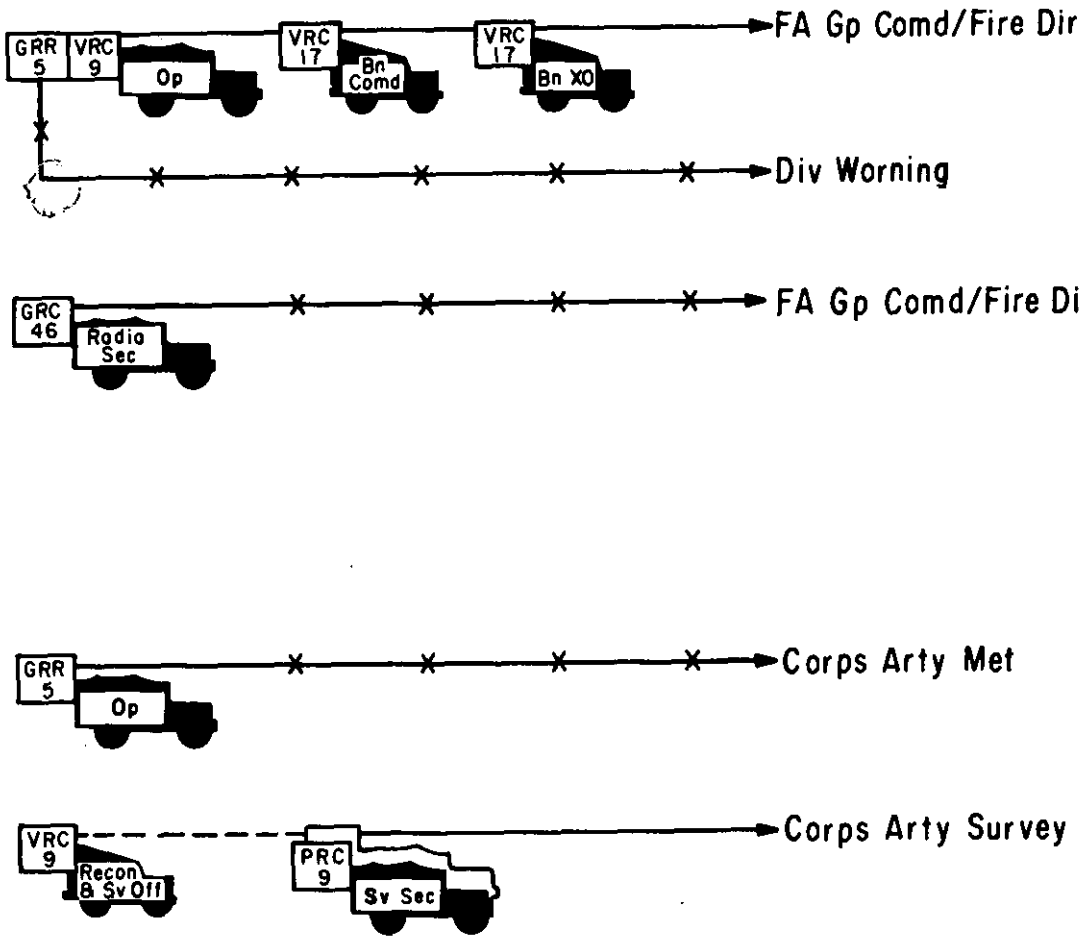


Figure 80. External radio nets, field artillery missile battalion, Lacrosse, attached to a field artillery group.

ous types of warnings. Warnings that are pertinent to the battalion should be retransmitted over the internal communication systems.

e. Corps Artillery Survey Channel, FM (S). Survey personnel within the battalions utilize the corps artillery survey channel for communication with other survey elements.

f. Corps Artillery Meteorological Net, AM (M). Battalions monitor this net to receive meteorological data. In addition, division artilleries and the field artillery target acquisition battalion transmit meteorological data over this net on an established schedule.

217. External Radio Nets, Reinforcing Mission

When the Lacrosse battalion has reinforcing mission, it operates in external nets as discussed in *a* through *d* below and as shown in figure 81.

a. Corps Artillery Command/Fire Direction Net, FM (CF). The corps artillery command/fire direction net; FM, provides a direct communication link between the battalion commander and the commanding general of corps artillery. The battalion fire direction center operates a full-time station in this net for operational traffic.

b. Corps Artillery Command/Fire Direction Net, AM, RATT (CF). The Lacrosse battalion operates in the corps artillery command/fire direction net, AM, to receive and administrative supervision from corps artillery, to exchange information and intelligence, and to receive fire missions and meterological data.

c. Division Artillery Command/Fire Direction Net, AM, RATT (CF). The battalion will operate in the reinforced division artillery command/fire direction net, AM, to provide the

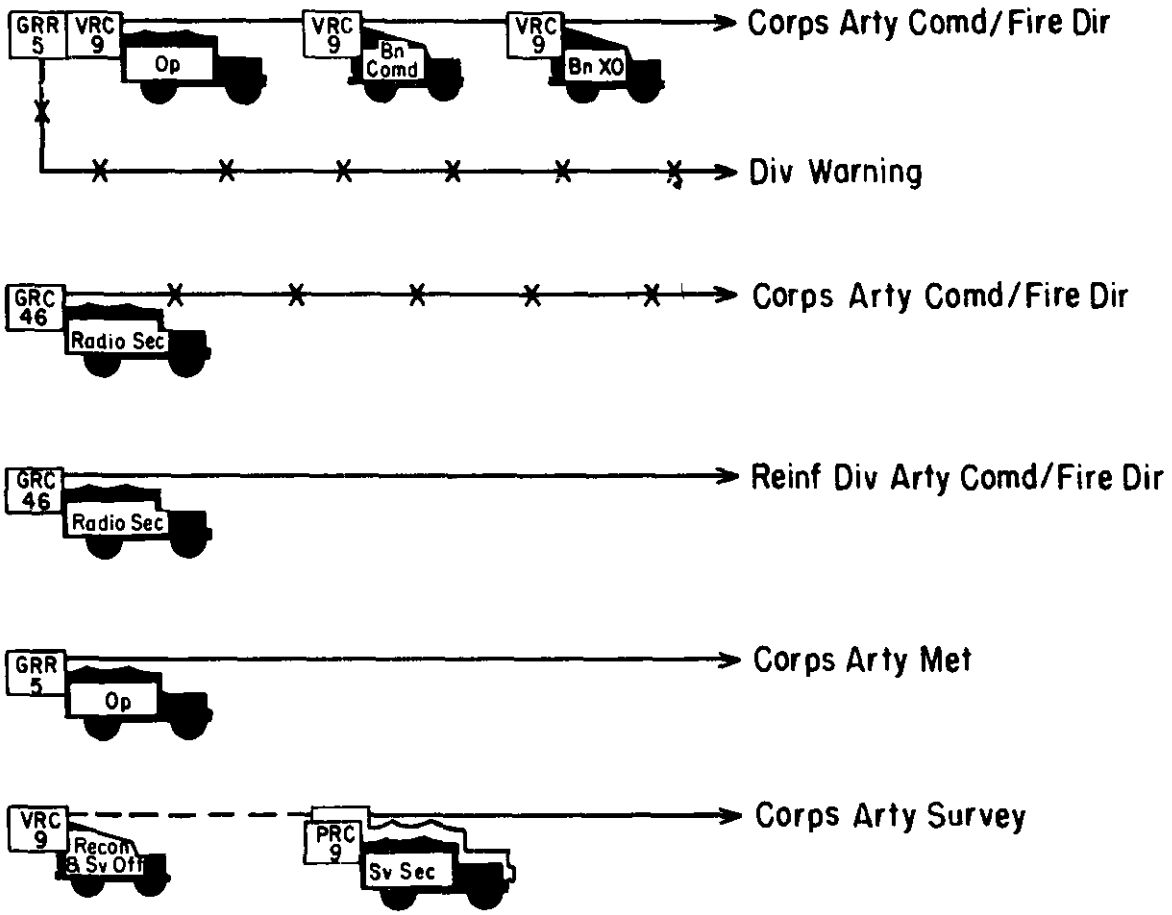


Figure 81. External radio nets, artillery missile battalion, Lacrosse, reinforcing mission.

continuous communication necessary for immediate response to fire requests from division artillery.

d. Other Nets. Other nets in which the Lacrosse battalion will operate are shown in paragraph 216*d* and *e*.

Section X. COMMUNICATION SYSTEM, ARTILLERY MISSILE BATTALION, HONEST JOHN ROCKET, SELF-PROPELLED

218. General

The communication system of the Honest John battalion varies with its assignment and tactical mission. If the unit has a reinforcing mission, it operates in the nets of the reinforced unit and in the corps artillery nets . When the battalion is attached to an artillery group it operates in the group radio nets and in the corps artillery command/fire direction net, AM.

219. Communication Requirements

The communication requirements for the Honest John battalion are as shown in paragraph 170 except that this battalion has no internal requirement for collection of information.

220. Wire System

a. General. The extent of the battalion wire system depends on the deployment of the battalion and the situation. This unit normally occupies a tactical assembly area and, from this area, prepares several firing positions, to include a complete installation of wire. The unit may leave the fire direction center in the assembly area and install wire from this area to firing

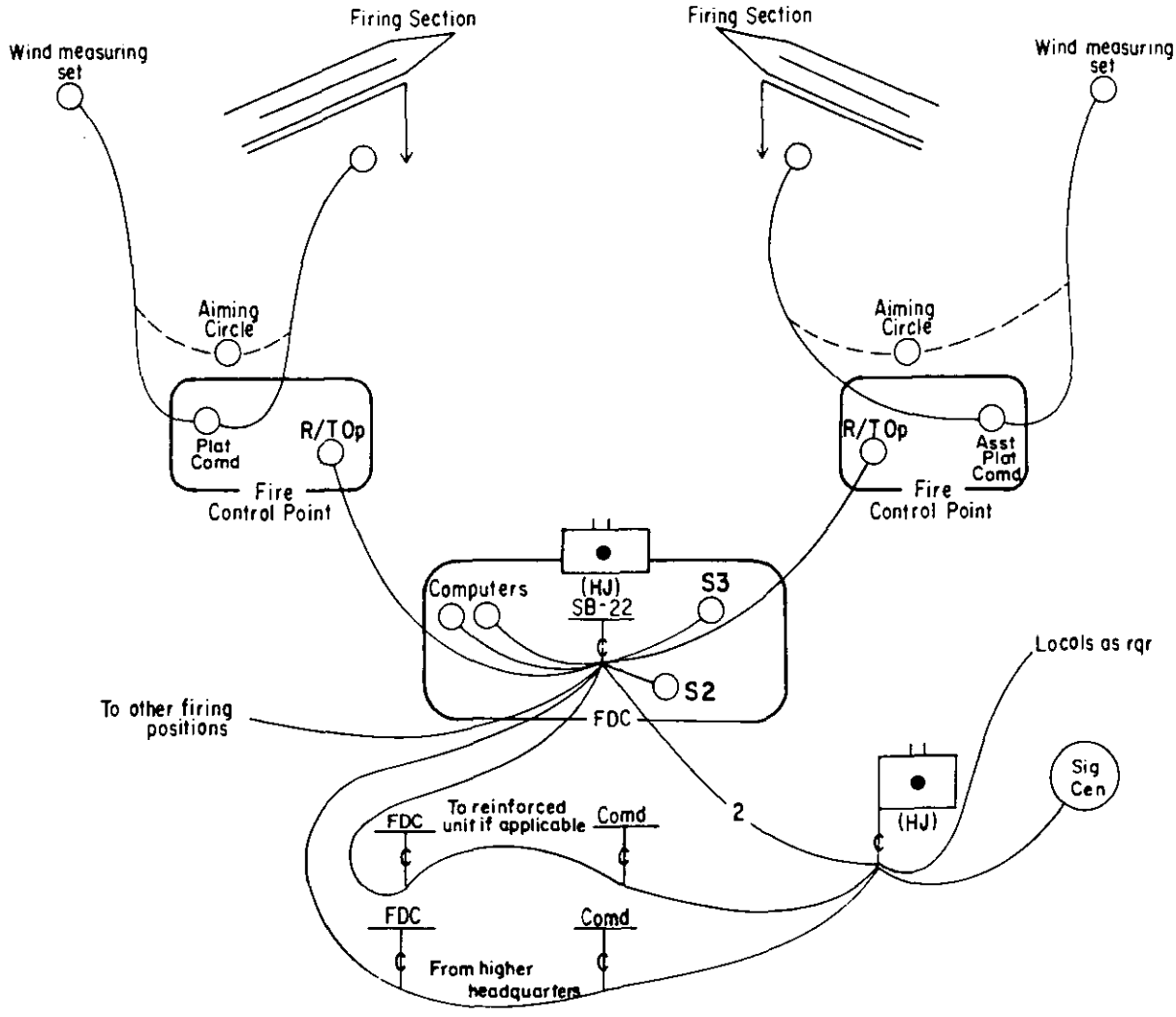


Figure 82. Type wire system, field artillery missile battalion, Honest John rocket, self-propelled.

positions, or it may establish a fire direction center in the firing positions. To add flexibility to the system, separate command and fire direction center switchboards are installed.

b. Installation of Wire Circuits. The Honest John battalion is authorized four wire teams. Since the battalion prepares several firing positions, the utilization of the wire teams depends on the tactical situation and the mission assigned to the battalion. The unit should continue to improve its wire system by installing additional circuits over alternate routes. A type wire system for this battalion is shown in figure 82.

221. Internal Radio Net

a. General. To fulfill internal communication requirements, the Honest John battalion operates one internal radio net. Sufficient radio equipment is provided to issue a radio to each firing section. Retransmission facilities are also provided to extend the range capability of the FM equipment.

b. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net is used by the battalion commander and the battery commander to exercise command and control of their respective units. It also

provides facilities for transmission of fire missions from the battalion fire direction center to the firing positions. A type command/fire direction net for this battalion is shown in figure 83.

222. External Radio Nets, Honest John Battalion Attached to An Artillery Group

When the Honest John battalion is attached to an artillery group it operates in or monitors the nets as discussed in *a* through *f* below and shown in figure 84.

a. Artillery Group Command/Fire Direction Net, FM (CF). The artillery group command/fire direction net, FM, provides a direct radio channel between the battalion commander and the artillery group commander. In addition, the battalion fire direction center operates a full-time station in this net to handle operational traffic between the battalion and higher headquarters.

b. Artillery Group Command/Fire Direction Net, AM, RATT (CF). Battalions attached to a group operate in the artillery group command/fire direction net, AM, to receive tactical orders, administrative supervision, fire missions, and meteorological data. This net may also be used for exchange of information and intelligence.

c. Division Warning Net, AM. The battalion monitors a division warning net to receive warnings of impending attacks. Warnings that are pertinent to the battalion should be transmitted over the internal communication system.

d. Corps Artillery Survey Channel, FM (S). Battalion survey personnel will use this channel for communication within the section and with other survey elements.

e. Corps Artillery Meteorological Net, (M). The battalion monitors the corps artillery meteorological net to receive meteorological data. In addition division artilleries and the artillery target acquisition battalion transmit meteorological data on an established schedule over this net.

223. External Radio Nets, Honest John Battalion Reinforcing Mission

When the Honest John battalion has a reinforcing mission it operates in external nets as

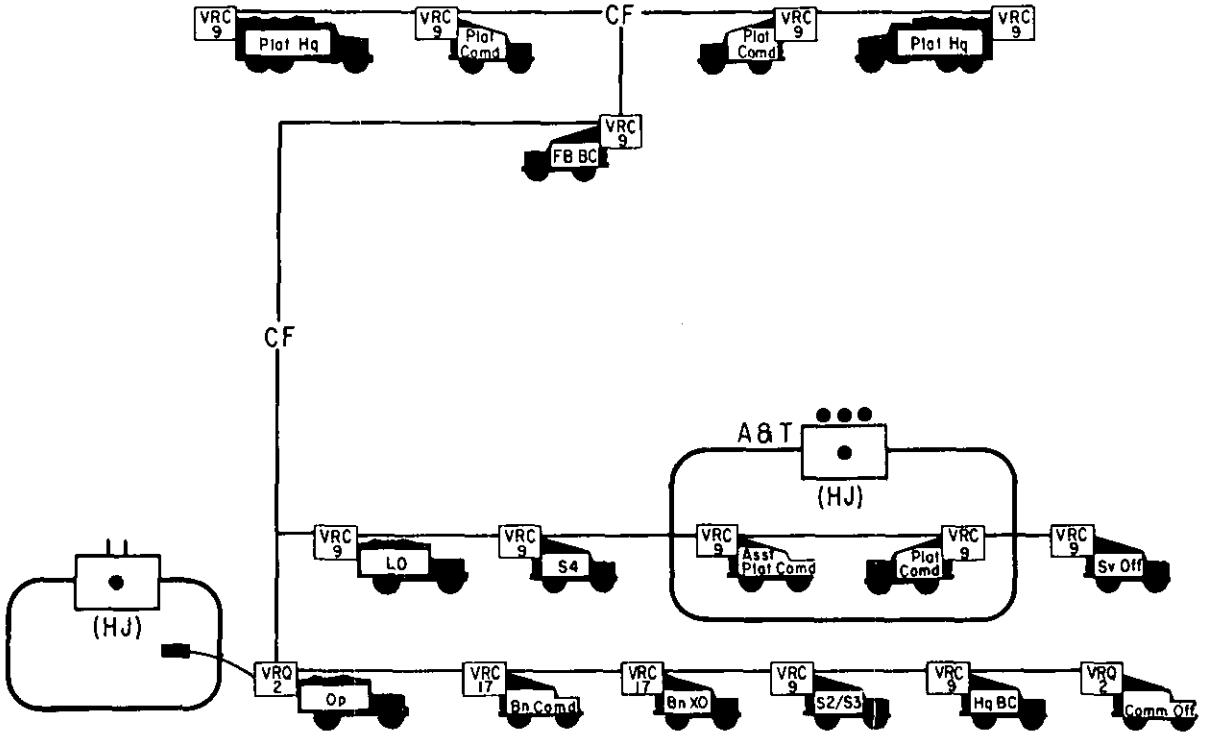


Figure 83. Type command/fire direction net, FM, artillery missile battalion, Honest John rocket, self-propelled.

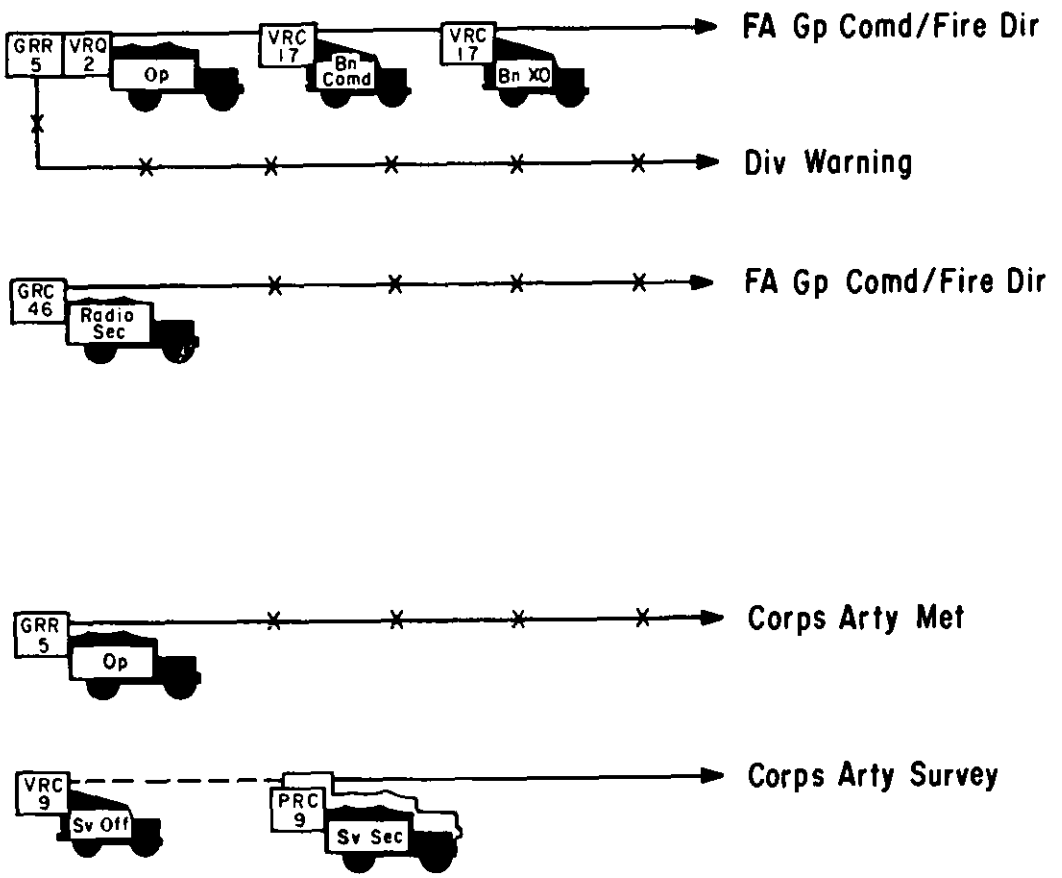


Figure 84. Type external radio nets, artillery missile battlion, Honest John rocket, self-propelled, attached to an artillery group.

discussed in *a* through *d* below and as shown in figure 85.

a. Corps Artillery Command/Fire Direction Net, FM (CF). Corps artillery command/fire direction net, FM, provides a direct communication link between the battalion commander and the commanding general of corps artillery. The battalion fire direction center operates a full-time station in this net for operational traffic

b. Corps Artillery Command/Fire Direction Net, AM, RATT (CF). The Honest John battalion operates in the corps artillery command/fire direction net, AM, to receive tactical orders and administrative supervision from corps artillery, to exchange information and intelligence, and to receive fire missions and meteorological data.

c. Division Artillery Command/Fire Direction Net, AM, RATT (CF). The battalion with a mission of reinforcing a division artillery, operates in the command/fire direction net of the reinforced division artillery to receive requests for fire.

d. Other Nets. Other nets in which the battalion will operate are as shown in paragraph 224*d*, *e*, and *f*.

224. External Radio Nets, Honest John Battalion, Organic To A Missile Command (Medium)

An Honest John battalion that is organic to a missile command (medium) is normally attached to an artillery group and operates in group nets as indicated in paragraph 222. Other external nets in which the Honest John battalion are discussed in *a* through *d* below and shown in figure 86.

a. Missile Command Command/Fire Direction Net, AM, RATT (CF). This net is used by the missile command for control of nuclear fires. The Honest John battalion has a nuclear capability and, therefore, monitors the missile com-

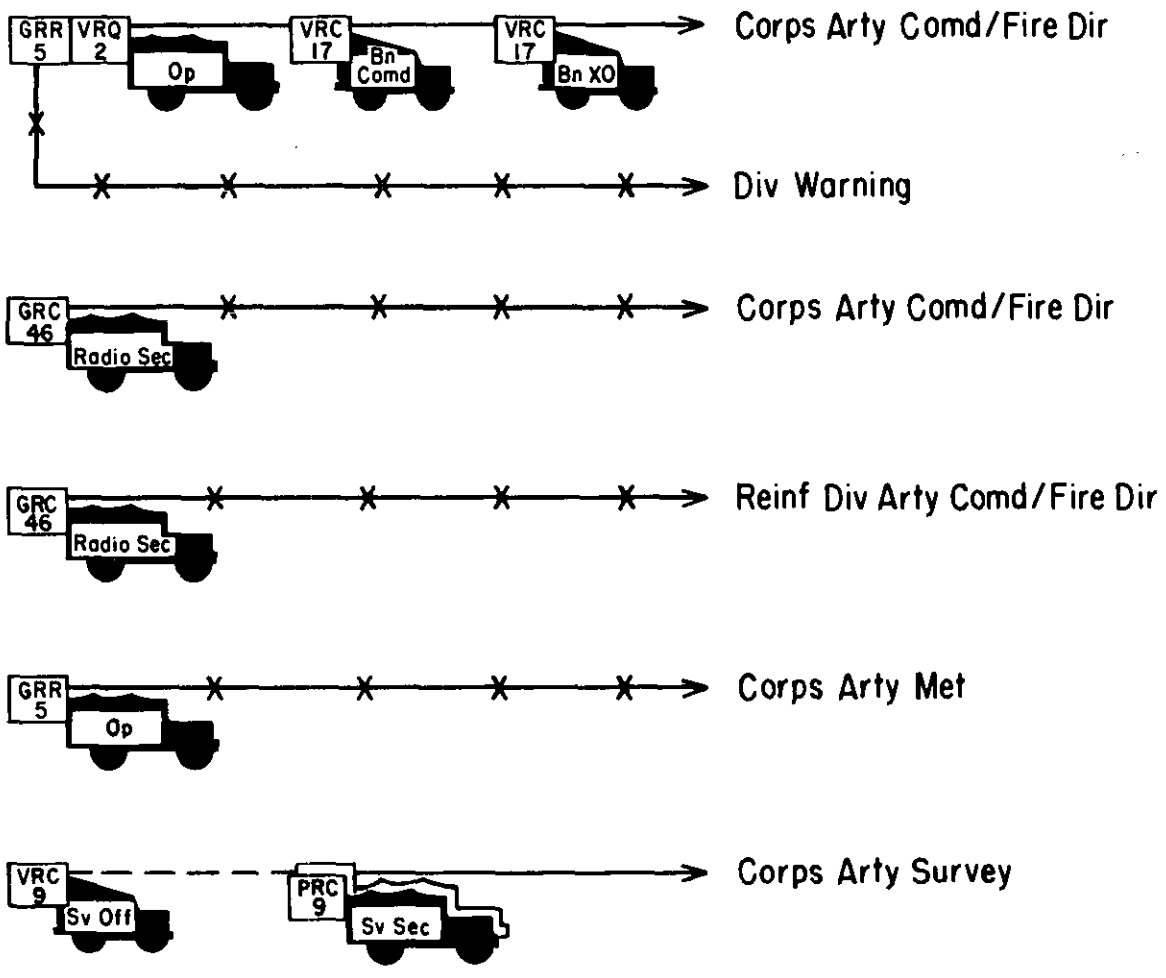


Figure 85. External radio nets, artillery missile battalion, Honest John rocket, self-propelled, reinforcing mission.

mand command/fire direction net nuclear missions, meteorological data and operates in this net as required.

b. Warning Net, AM. The battalion will monitor an appropriate warning net, possibly a special net established by the missile command. This net should provide warnings of air, ground, armor, nuclear, biological, and chemical attacks and other information of an urgent operational nature.

c. Missile Command Survey Channel, FM (S). Survey personnel within the battalion will use the missile command survey channel for communications with other survey elements.

d. Missile Command Meteorological Net, AM (M). The battalion monitors the missile command meteorological net to receive meteorological data.

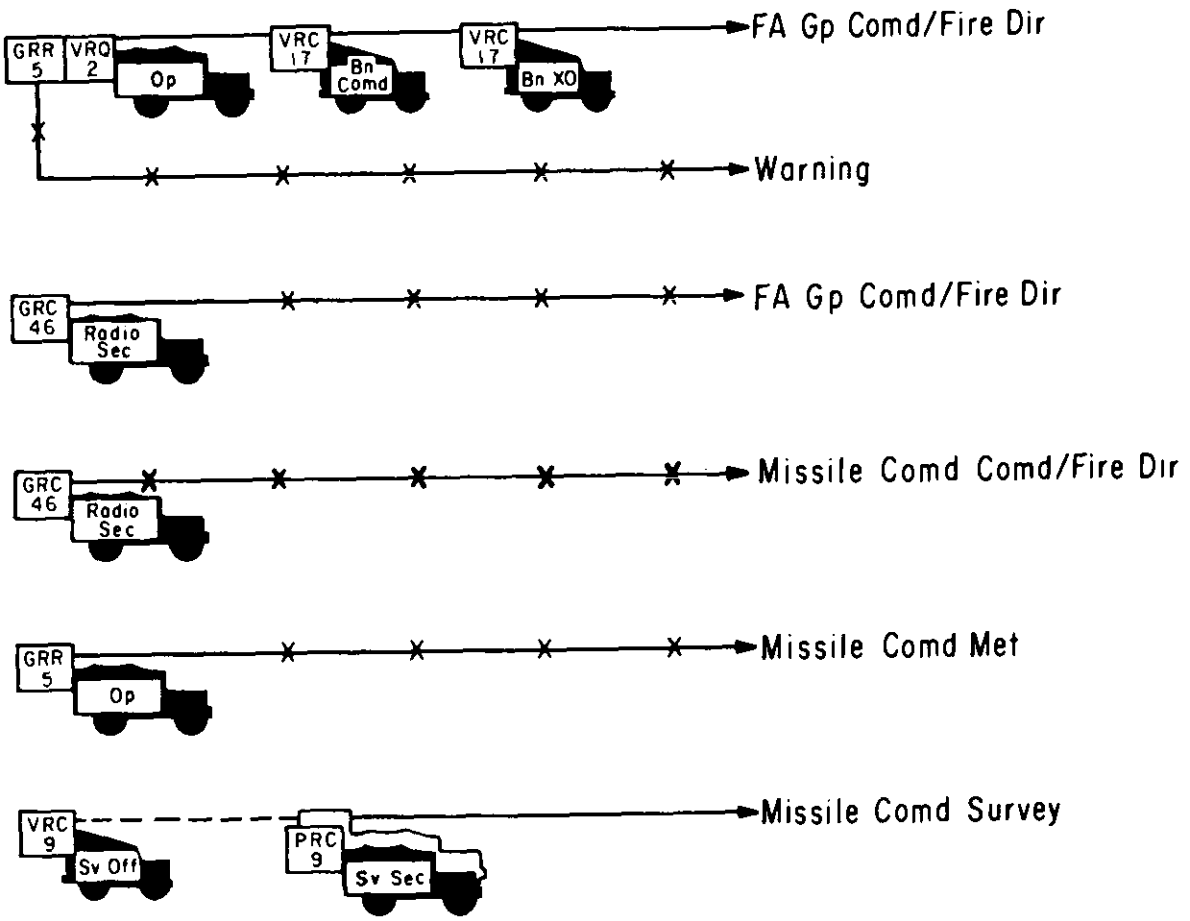


Figure 86. External radio nets, artillery missile battalion, Honest John rocket, self-propelled missile command (medium).

Section XI. COMMUNICATION SYSTEM, ARTILLERY MISSILE BATTALION, LITTLE JOHN ROCKET, MISSILE COMMAND (AIR-TRANSPORTABLE)

225. General

The internal communication system for the Little John battalion is very similar to that of the Honest John battalion. However, since the Little John battalion will normally be under the control of a missile command (air-transportable), the external nets of the battalions will differ.

226. Internal Communication Requirements

The internal communication requirements of the Little John battalion are as shown in paragraph 170 except that this battalion has no internal requirement for collection of information.

227. External Communication Requirements

The external communication requirements of the battalion are those necessary for communication with higher headquarters to include facilities for—

a. Receipt of tactical and administrative orders from the missile command,.

b. Receipt of fire missions from the missile command.

c. Receipt of intelligence from the missile command.

d. Receipt of warnings.

e. Dissemination of meteorological data to the missile command.

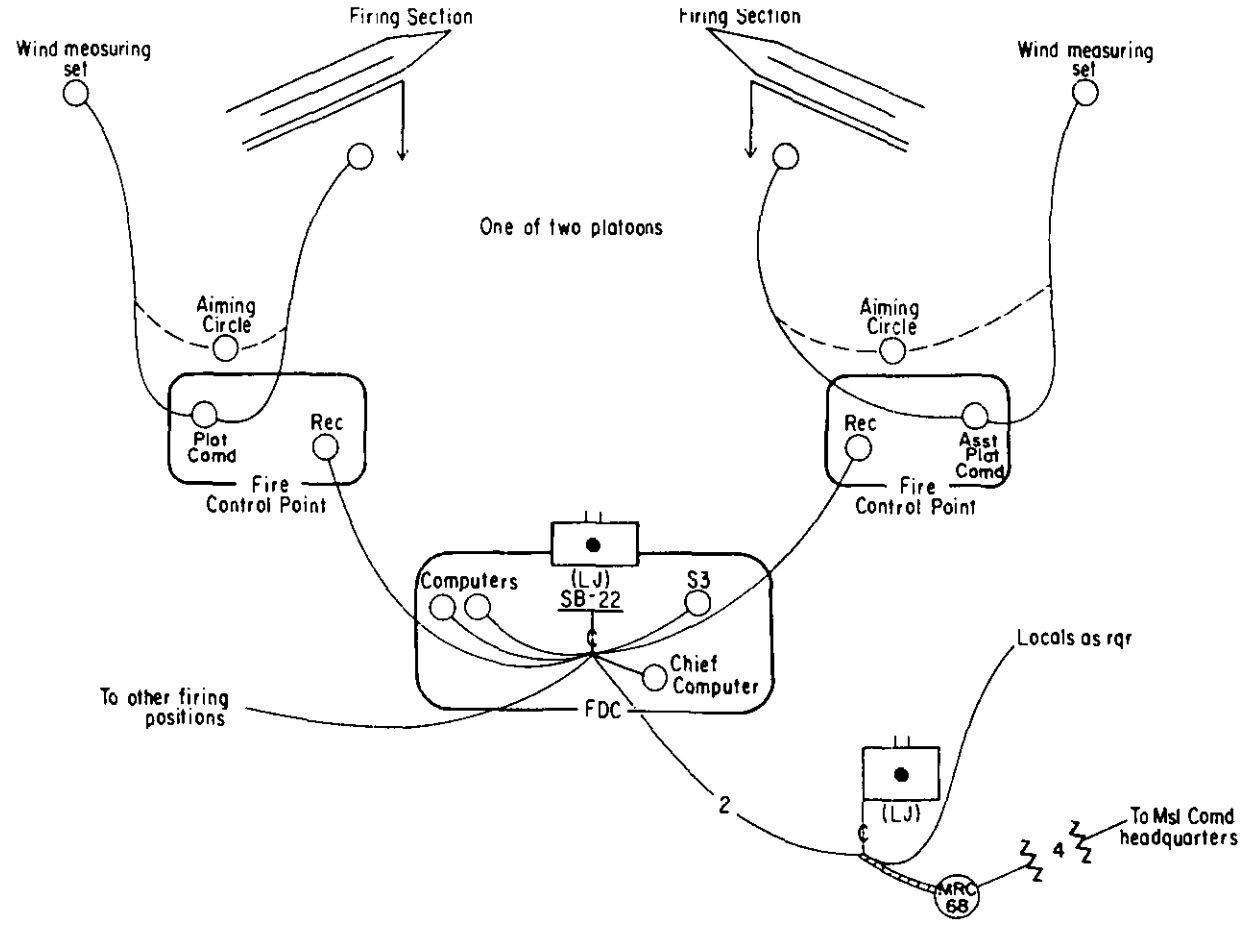


Figure 87. Type wire system, artillery missile battalion, Little John rocket, missile command (air-transportable).

228. Wire System

The extent of the battalion wire system depends on the deployment of the battalion and the situation. This unit normally occupies a tactical assembly area and, from this area, prepares several firing positions, to include a complete installation of wire. The unit may leave the fire direction center in the assembly area and install wire from this area to firing positions, or it may establish a fire direction center in the firing positions. To add flexibility to the system, separate command and fire direction center switchboards are installed. A type wire system for the battalion is shown in figure 87.

229. Internal Radio Net

a. General. To fulfill internal communication requirements, the Little John battalion will operate one internal radio net. Sufficient radio equipment is provided to issue a radio to each firing section. Retransmission facilities are also provided to extend the range capability of the FM equipment.

b. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net is used by the battalion commander and the battery commander to exercise command and control of their respective units. It also provides facilities for transmission of fire missions from the battalion fire direction center to the firing positions. A type command/fire direction net for this battalion is shown in figure 88.

230. External Radio Net

To meet its external requirements, the Little John battalion operates in the external nets discussed in *a* through *d*, below and shown in figure 89.

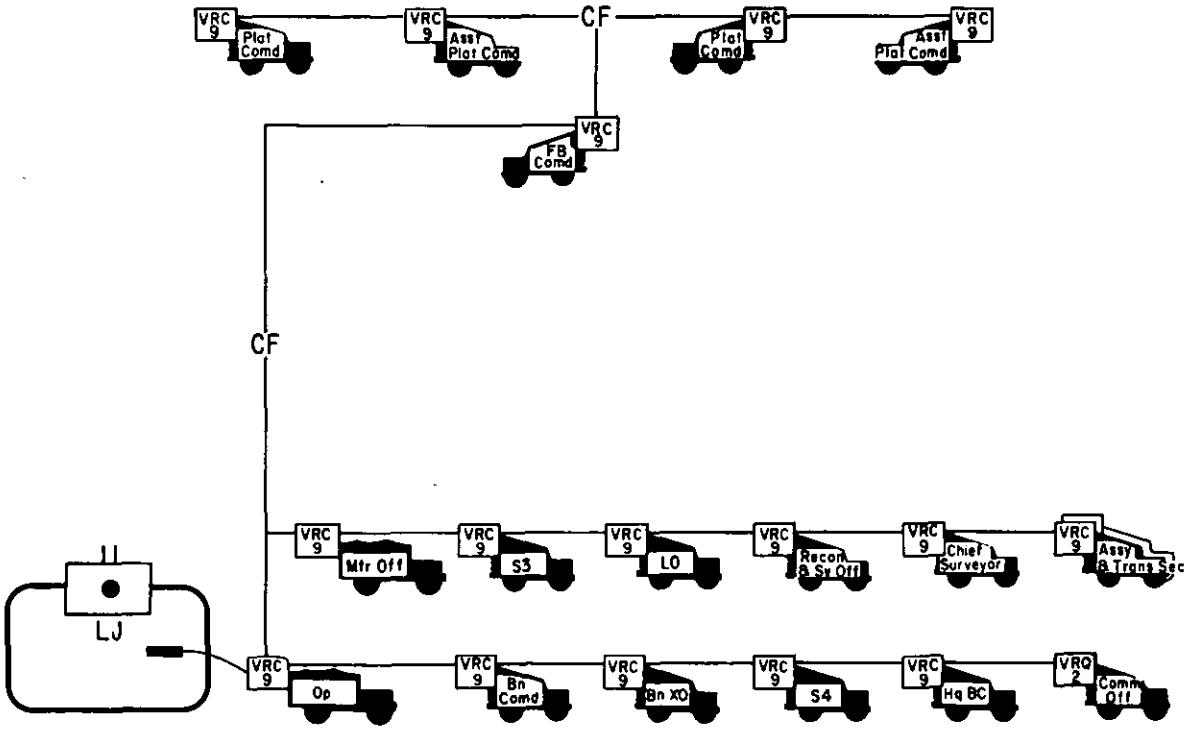


Figure 88. Type command/fire direction net, FM, artillery missile battalion, Little John rockct.

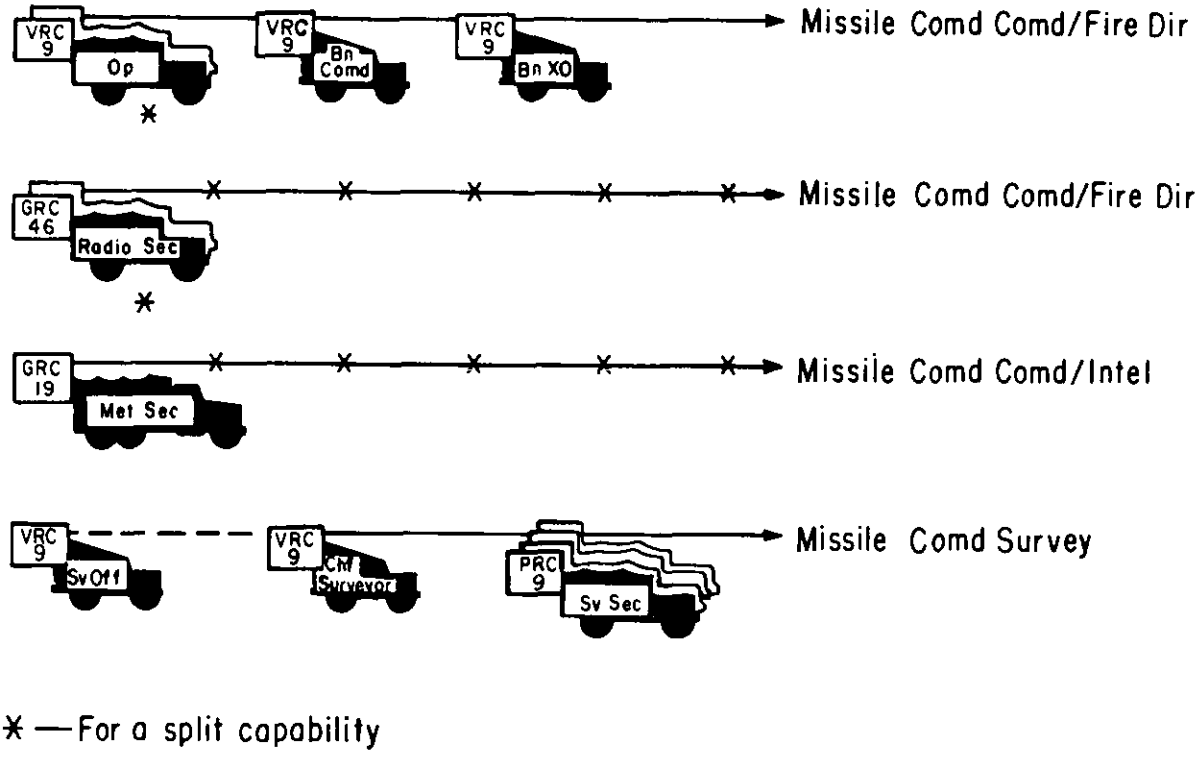


Figure 89. Type external radio nets, artillery missile battalion, Little John rocket, missile command (air-transportable).

a. Missile Command Command/Fire Direction Net, FM (CF). The missile command command/fire direction net, FM, provides a direct radio channel between the battalion commander and the missile command commander. In addition, the battalion fire direction center operates a full-time station in this net for operational and fire direction traffic.

b. Missile Command Command/Fire Direction Net, AM, RATT (CF). The battalion operates in the missile command command/fire direction net, AM, for operational and fire direction traffic with the missile command. This net is also used to receive intelligence and meteorological data.

c. Missile Command Command/Intelligence Net, AM, RATT (CI). The battalion meteorological section operates in this net for transmission of meteorological data to the missile command headquarters.

d. Missile Command Survey Channel, FM (S). Survey personnel within the battalion will use the missile command survey channel for communication with other survey elements.

Section XII. COMMUNICATION SYSTEM ARTILLERY HOWITZER BATTALION, 8-INCH, TOWED OR SELF-PROPELLED

231. General

The overall communication system of the battalion varies with the tactical mission assigned and the headquarters controlling it. The battalion normally is attached to an artillery group, and will operate in the group nets. When the battalion is reinforcing a division artillery, it operates in the corps artillery nets and in a net of the reinforced unit.

232. Communication Requirements

The communication requirements for the 8-inch howitzer battalion are as shown in paragraph 170.

233. Wire System

The wire system of this battalion is very similar to the system described in paragraph 239 for light and medium field artillery battalions. The principal differences are the number of organic weapons and the lack of forward observers in the 8-inch howitzer battalion.

234. Internal Radio Nets

a. General. To meet internal communication requirements, the 8-inch howitzer battalion operates three internal nets, two FM nets and one AM net. The howitzer batteries use the battalion FM nets for internal control. Type internal nets for the battalion are shown in figure 90.

b. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net, FM, provides communication with elements of the staff, airborne aircraft, and subordinate units for tactical and administrative control and for exchange of information and intelligence. This net may also be used for transmission of fire missions.

c. Battalion Command/Fire Direction Net, AM, RATT (CF). The battalion command/fire direction net, AM, is used to transmit fire missions to the batteries. It may also be used for tactical and administrative control of the batteries and for exchange of information and intelligence.

d. Battalion Fire Direction Net, FM (F). The battalion fire direction net is used to receive and transmit fire missions and to exchange information and intelligence.

235. External Radio Nets, 8-Inch Howitzer Battalion Attached To An Artillery Group

To meet its external requirements when it is attached to an artillery group, the 8-inch howitzer battalion operates in the external nets discussed in *a* through *e* below and shown in figure 91.

a. Artillery Group Command/Fire Direction Net, FM (CF). The group command/fire direction net, FM, provides a direct radio channel between the battalion commander and the higher headquarters commander. In addition the battalion fire direction center operates a full-time station in this net to handle operational traffic between the battalion and higher headquarters.

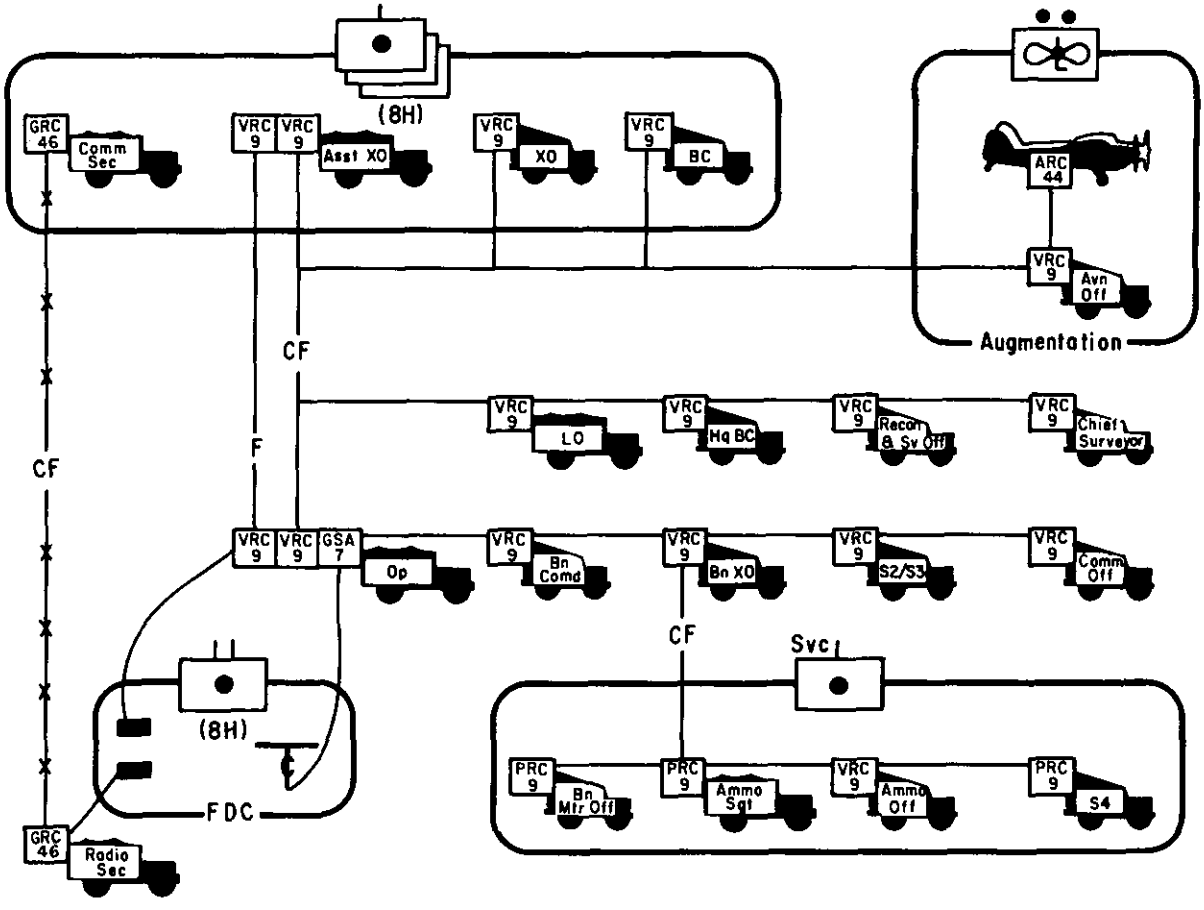


Figure 90. Type internal radio nets, artillery howitzer battalion, 8-inch, towed or self-propelled.

b. Artillery Group Command/Fire Direction Net, AM, RATT (CF). Battalions attached to a group operate in the group command/fire direction net, AM, to receive tactical orders, administrative supervision, fire missions, and meteorological data. This net may also be used for exchange of information and intelligence.

c. Division Warning Net, AM. The 8-inch howitzer battalion monitors a division warning net to receive warnings of various types. Warnings that are pertinent to the battalion should be retransmitted over internal communication systems.

d. Corps Artillery Survey Channel, FM (S). Survey personnel within the battalions utilize corps artillery survey channel for communication with other survey elements.

e. Corps Artillery Meteorological Net, AM (M). Battalions monitor the corps artillery meteorological net to receive meteorological data. Division artilleries and the artillery target acquisition battalion transmit meteorological data on an established schedule over this net.

236. External Radio Nets, 8-Inch Howitzer, Reinforcing Mission

When the 8-inch howitzer battalion has a reinforcing mission it normally is placed under direct control of corps artillery; however, its nuclear fires may be controlled by the reinforced unit. The battalion operates in the external nets discussed in *a* through *d* below and shown in figure 92.

a. Corps Artillery Command/Fire Direction Net, FM (CF). The corps artillery command/fire direction net, FM, provides a direct communication link between the battalion commander and the commanding general of corps artillery. In addition the battalion FDC operates a full-time station in this net for operational traffic.

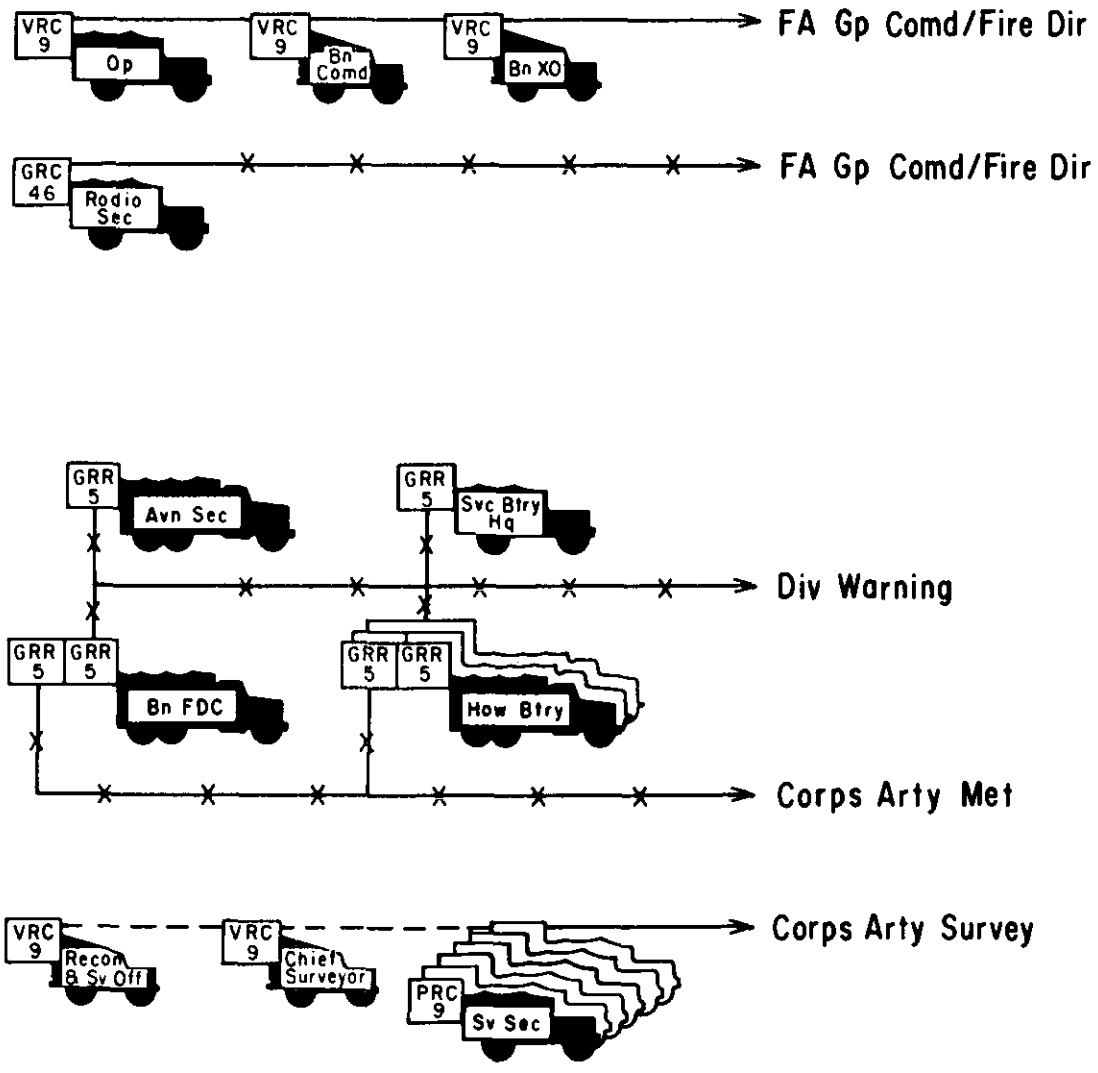


Figure 91. Type external radio nets, artillery howitzer battalion, 8-inch, towed or self-propelled, attached to an artillery group.

b. Corps Artillery Command/Fire Direction Net, AM, RATT (CF). The battalion operates in this net to receive tactical orders and administrative supervision from corps artillery, to exchange information and intelligence, and to receive fire missions and meteorological data.

c. Division Artillery Command/Fire Direction Net, AM, RATT (CF). If a battalion has a mission of reinforcing a division artillery, it will operate in the command/fire direction net of the reinforced division artillery to receive requests for fire.

d. Other Nets. Other nets in which the battalion operates are as shown in paragraph 235*c*, *d*, and *e*.

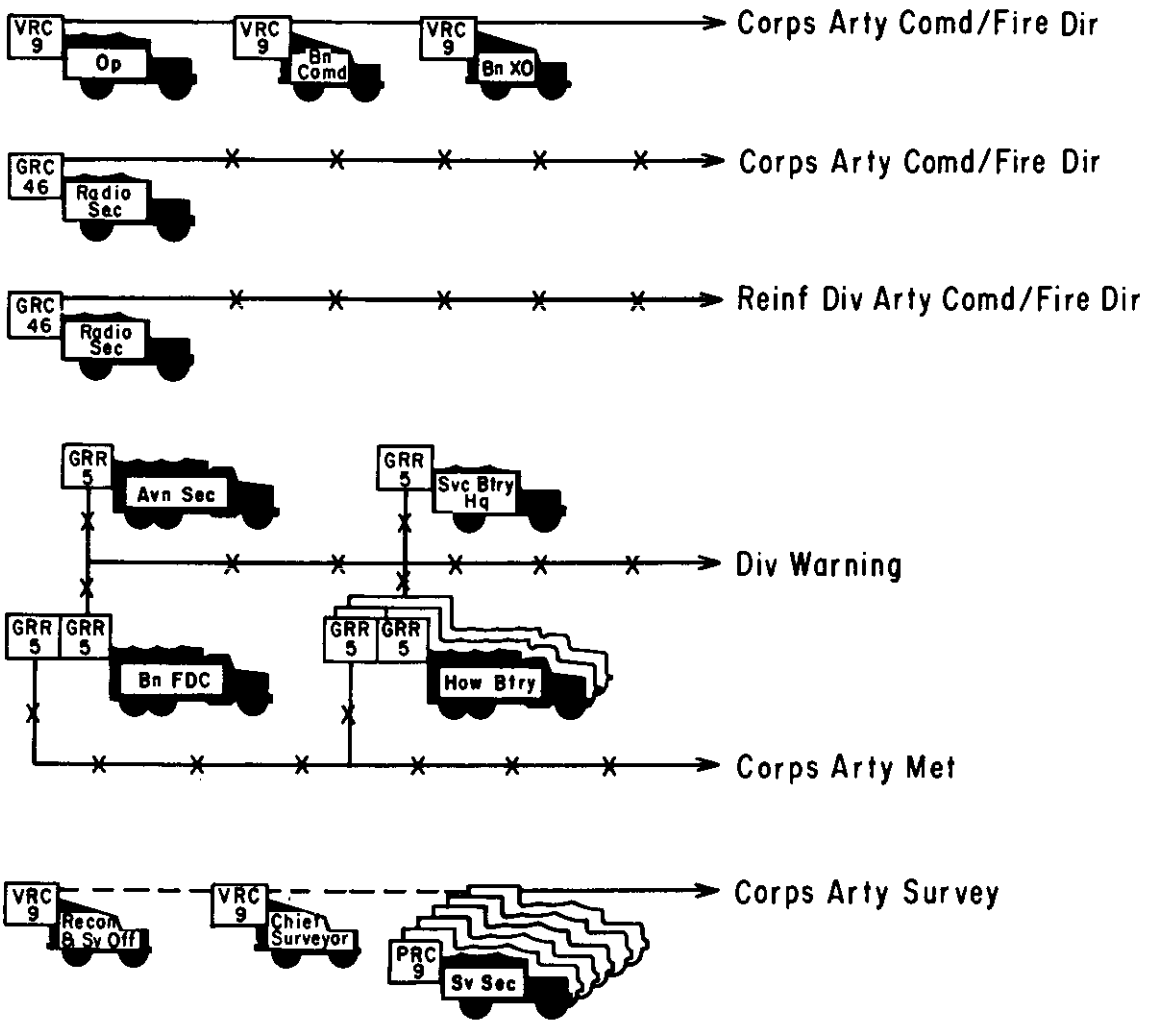


Figure 92. External radio nets, artillery howitzer battalion, 8-inch, towed or self-propelled, reinforcing mission.

Section XIII. COMMUNICATION SYSTEM, ARTILLERY HOWITZER BATTALION, 105-MM, TOWED, AND ARTILLERY HOWITZER BATTALION,155-MM, TOWED AND SELF-PROPELLED

237. General

The communication systems of the 105-mm howitzer battalions, towed and the 155-mm howitzer battalions, towed and self-propelled, are basically the same and will be discussed together in this section. The communications systems for these units vary depending on the tactical mission assigned to the unit.

238. Communication Requirements

The communication requirements for the 105-mm and 155-mm battalions are as shown in paragraph 170.

239. Wire System

a. General. The extent of the battalion wire system depends on the length of time a position is occupied, the tactical situation, and the mission assigned to the unit. To add flexibility to the wire system, separate command and fire direction center switchboards are installed. A type battalion wire system is shown in figure 93.

b. Installation of Wire Circuits. Each light and medium field artillery battalion is authorized four wire teams in the headquarters battery and one wire team in each howitzer battery.

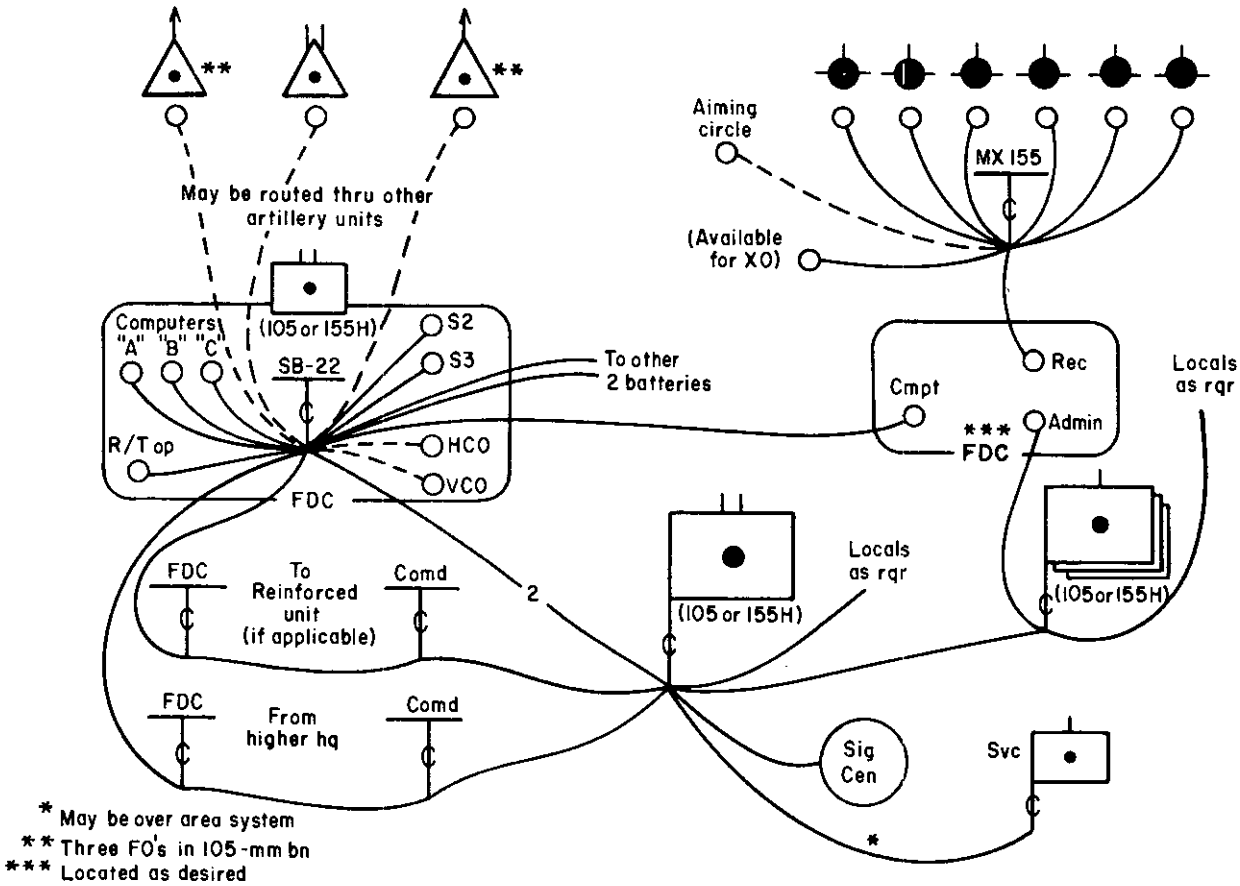


Figure 93. Type wire system, artillery howitzer battalion, 105-mm, towed, and artillery howitzer battalions, 155-mm, towed, or self-propelled.

Although the responsibility for the circuits, the battalion to batteries, rests with the battalion, the batteries are normally designated to install these lines. For example the wire teams in the headquarters battery install the local circuits an the lines to battalion observation posts, area signal center, and service battery. However, higher headquarters may direct that the battalions install the lines to higher headquarters. If the battalion has a reinforcing mission, they will install circuits to the reinforced unit.

240. Internal Radio Nets

a. General. To meet their internal communication requirements, the howitzer battalions utilize two FM channels, establishing a command/fire direction net and a fire direction net. Type internal nets for these battalions are shown in figure 94.

b. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net, FM, is used for tactical and administrative control, for exchange of information and intelligence, and for receipt and transmission of fire missions when necessary.

c. Battalion Fire Direction Net, FM (F). The battalion fire direction net is used for receipt and transmission of fire mission and for the exchange of information and intelligence.

241. External Radio Nets

To meet their external communication requirements the howitzer battalions operate in the nets shown in figure 95 and discussed in *a* through *e* below.

a. Higher Headquarters Command/Fire Direction Net, FM (CF). Higher headquarters command/fire direction net, FM, provides a direct radio channel between the battalion commander and the higher headquarters. In addi-

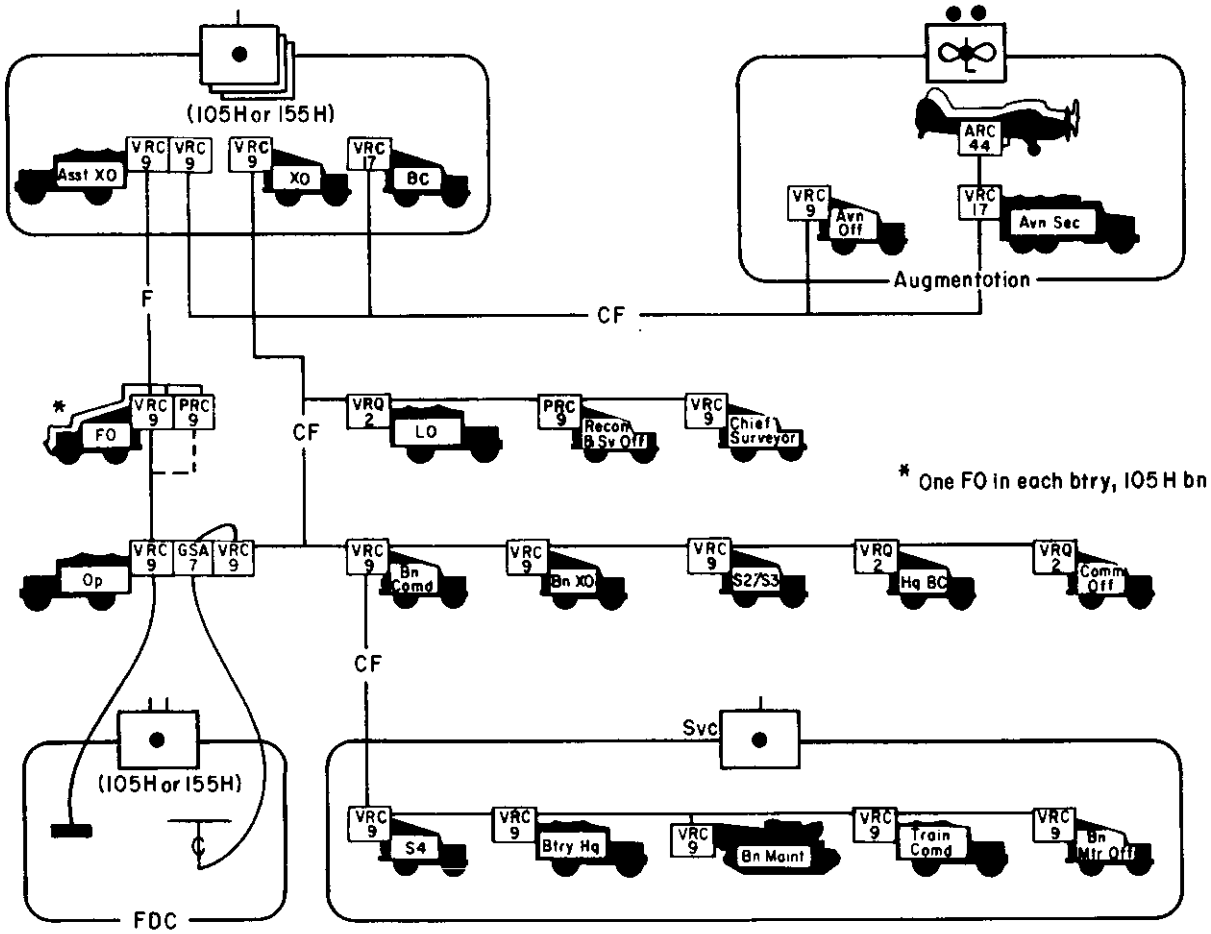


Figure 94. Type internal Radio nets, artillery howitzer battalion, 105-mm, towed, and artillery howitzer battalions, 155-mm towed and self-propelled.

tion the battalion fire direction center operates a full-time station in this net to handle operational traffic between the battalion and the higher headquarters.

b. Higher Headquarters Command/Fire Direction Net, AM, RATT (CF). Battalions operate in the higher headquarters command/fire direction net, AM, to receive tactical orders, administrative supervision, fire missions, and meteorological data. This net may also be used for exchange of information and intelligence.

c. Division Warning Net, AM. The battalions monitor a division warning net to receive warnings of various types. Warnings that are pertinent to the battalion should be retransmitted over internal communication systems.

d. Corps Artillery Survey Channel, FM (S). Survey personnel within the battalions will utilize the corps artillery survey channel for communication with other survey elements.

e. Corps Artillery Meteorological Net, AM (M). Battalions monitor this net to receive meteorological data. Division artilleries and the artillery target acquisition battalion transmit meterological data on an established schedule over this net.

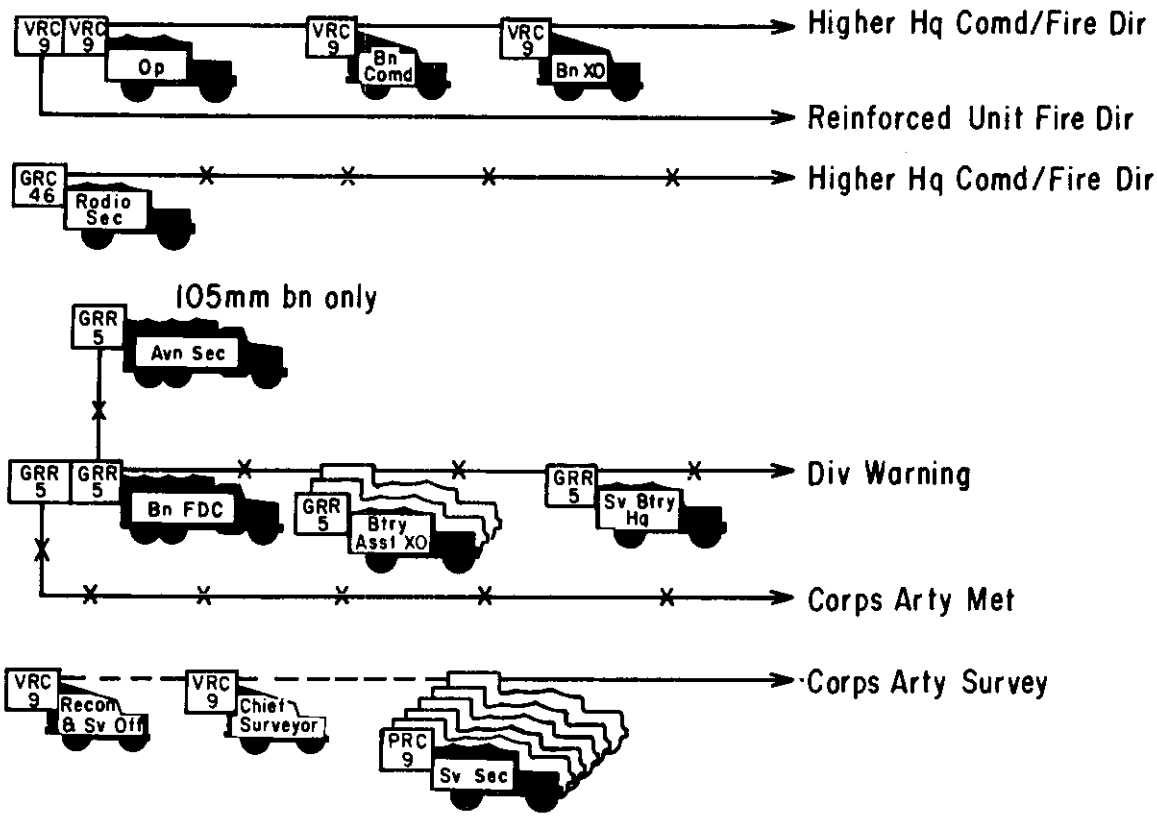


Figure 95. Type external nets, artillery howitzer battalion 105-mm, towed, and artillery howitzer battalions, 155-mm, towed, and self-propelled.

Section XIV. COMMUNICATION SYSTEM, ARTILLERY HOWITZER BATTALION, 105-MM, SELF-PROPELLED

242. General

The communication system of the 105-mm howitzer battalion self-propelled varies with the assignment and tactical mission. The system discussed in this section is based on a mission of supporting an armored cavalry regiment.

243. Communication Requirements

The communication requirements for the 105-mm howitzer battalion, self-propelled are as shown in paragraph 170 with the additional external requirement of communicating with a supported unit.

244. Wire System

a. General. The extent of the battalion wire system depends on the length of time a position is occupied and the tactical situation. In general the wire net parallels the internal radio nets of the battalion. To add flexibility to the system, separate command and fire direction switchboards are installed. A type battalion wire system is shown in figure 96.

b. Installation of Battalion Wire System. The wire section in the headquarters battery installs the local circuits within the command post area and the circuits to the supported unit, area signal center, and higher headquarters when so directed. If forward observers are being utilized, the wire circuits to the observation posts should be installed jointly by the forward observer section and the wire section. These circuits may be routed through other artillery units. If time and wire can be saved, a forward switch may be installed.

c. Installation of the Battery Wire Systems. The wire team of each battery may be directed to install the circuits to the battalion fire direction center and to the command switchboards.

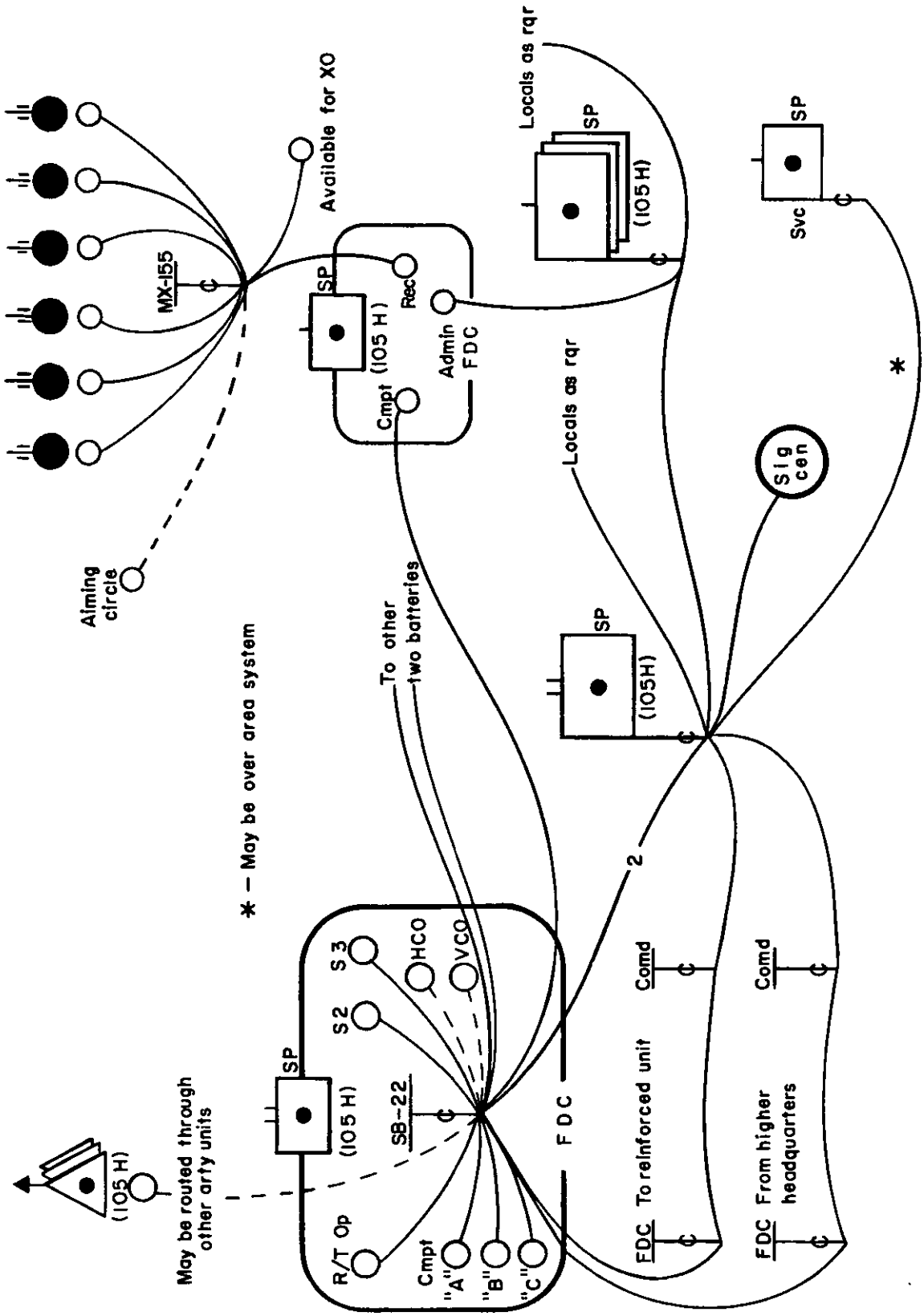


Figure 96. Type wire system, artillery howitzer battalion, 105-mm, self-propelled.

The battery wire team will also install certain local circuits in the battery area. On the other hand, the wire system within the firing battery is installed by firing battery personnel. The howitzer sections install a circuit to the telephone connecting and switching group MX-155/GT; the recorder installs a circuit from his telephone to the MX-155/GT. A fixed location for the executive officer is not specified. He stations himself to facilitate control of the battery, and separate telephone may be established to provide wire communication between him and the howitzer sections. This telephone also should be connected to the telephone connecting and switching group MX-155/GT.

245. Internal Radio Nets

a. General. The 105-mm Howitzer battalion, self-propelled operates in two FM channels to meet its internal communication requirements. On channel is used as a command/fire direction net and the other as a fire direction net. Type internal radio nets for the battalion are shown in figure 97.

b. Battalion Command/Fire Direction Net. FM (CF). The battalion command/fire direction net, FM, is used for tactical and administrative control, for exchange of information and intelligence, and for receipt and transmission of fire missions when necessary.

c. Battalion Fire Direction Net, FM (F). The battalion fire direction net is used for receipt and transmission of fire missions and for the exchange of information and intelligence.

246. External Radio Nets

To meet its external communication requirements, the 105-mm howitzer battalion self-

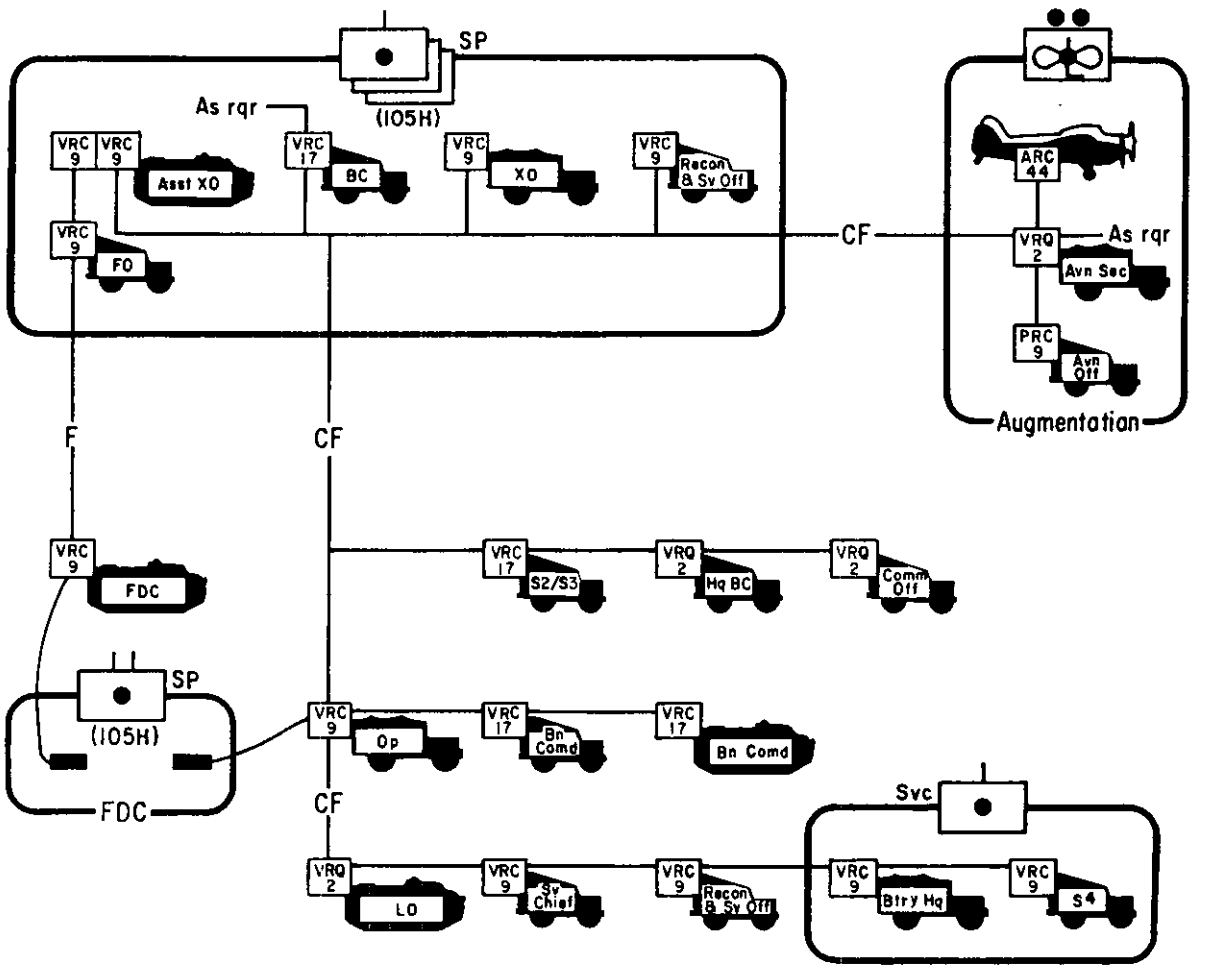


Figure 97. Type internal radio nets, artillery howitzer battalion, 105-mm, self-propelled.

propelled operates in the nets discussed in *a* through *f* below and shown in figure 98.

a. Higher Headquarters Command/Fire Direction Net, FM (CF). The higher headquarters command/fire direction net, FM, provides a direct radio channel between the battalion commander and the higher headquarters commander. In addition, the battalion fire direction center operates a full-time station in this net to handle operational traffic between the battalion and higher headquarters.

b. Higher Headquarters Command/Fire Direction Net, AM, RATT (CF). The battalion operates in the higher headquarters command/fire direction net, AM, for operational, command, meteorological, and fire direction communication with higher headquarters.

c. Armored Cavalry Regimental Command Net, FM. The battalion with a mission of supporting an armored cavalry regiment operates in the command net of the supported unit for coordination of operations and for fire support coordination.

d. Division Warning Net, AM. The battalion monitors a division warning net to receive warnings of various types. Warnings that are pertinent to the battalion should be retransmitted over internal communication systems.

e. Corps Artillery Survey Channel, FM (S). Survey personnel within the battalion utilize

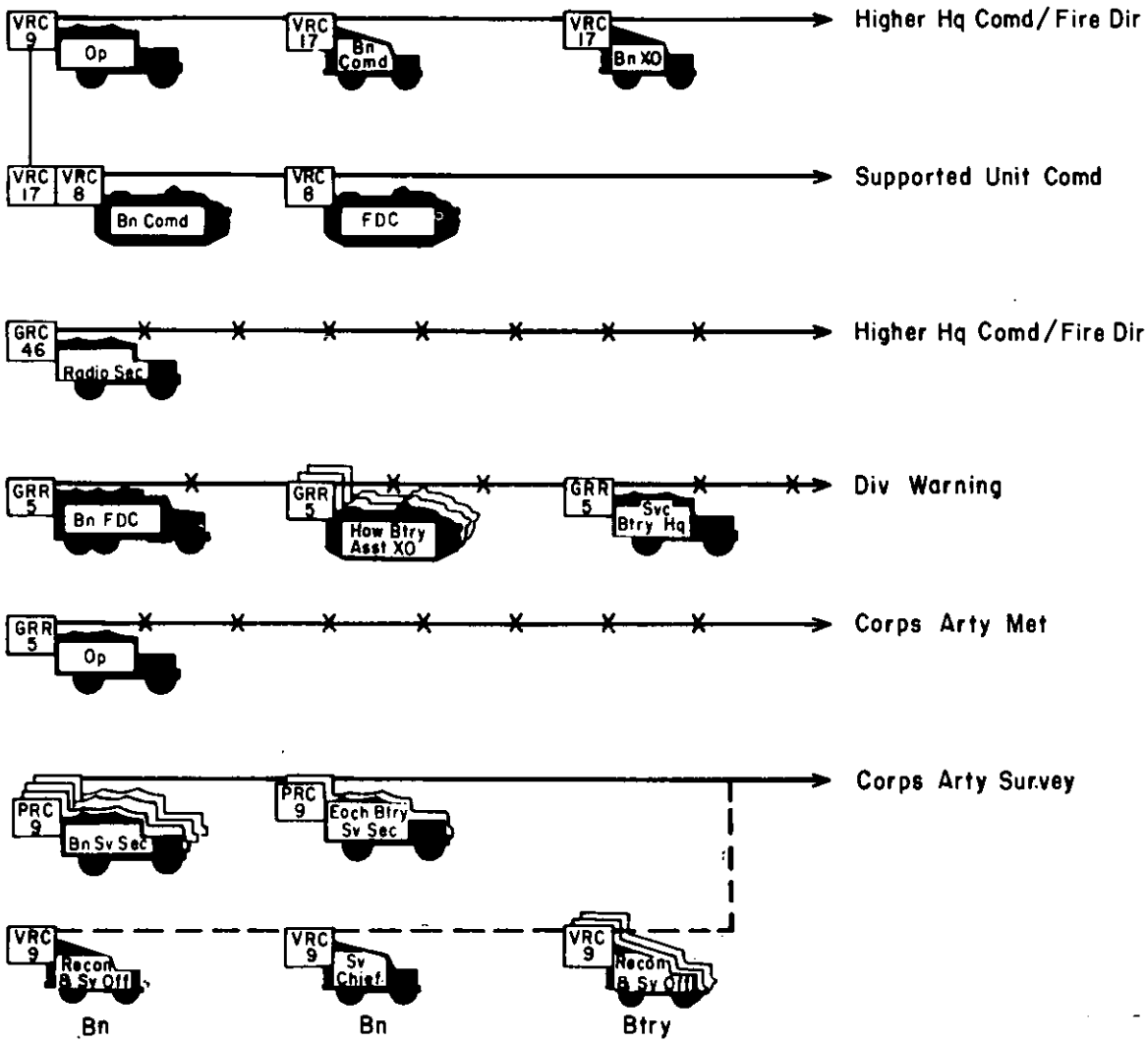


Figure 98: Type external radio nets, artillery howitzer battalion, 105-mm, self-propelled.

the corps artillery survey channel for communication with other survey elements.

f. Corps Artillery Meteorological Net, AM (M). Battalions monitor this net to receive meteorological data. In addition division artilleries and the artillery target acquisition battalion transmit meteorological data on an established schedule area in this net.

Section XV. COMMUNICATION SYSTEM, ARTILLERY HOWITZER BATTERY, 105-MM, SELF-PROPELLED, ARMORED CAVALRY SQUADRON

247. General

The 105-mm howitzer battery, self-propelled is equipped primarily to communicate with its parent unit and other units organic to the armored cavalry squadron. Therefore, when communication with other artillery units is desired, it will be necessary to exchange radio equipment between the units concerned (this battery is equipped with radios of the armor series). The tactical employment of the battery is discussed in FM 17–95.

248. Internal Communication Requirements

The internal communication requirements for the howitzer battery are the same as those for a battalion shown in paragraph 170.

249. External Communication Requirements

The external communication requirements of the battery are those necessary for communication with higher headquarters, adjacent units, and supported units to include facilities for—

a. Receipt of tactical and administrative orders from the cavalry squadron.

b. Coordination of fire support with other supporting artillery.

c. Receipt of warnings.

d. Communication with supported cavalry troops.

e. Coordination of survey.

f. Receipt of meteorological data.

250. Wire System

The extent of the wire system will depend on the length of time a position is occupied and the tactical situation, although the normal mission of the armored cavalry regiment generally dictates extensive use of radio by all organic elements. When the situation and time permit, the wire system installed will parallel the radio system of the battery. However, the number of wiremen authorized the battery does not permit installation of wire to all forward observers simultaneously. The forward observer sections should be trained to assist the wire teams in the installation of wire lines. In addition to a wire line to the battery, each forward observer should install a line to the supported cavalry troop. Wire lines within the fire direction center and the firing battery should be installed by using personnel. A type wire system for the battery is shown in figure 99.

251. Radio Nets

a. Internal Radio Net.

(1) *General.* To meet its internal requirements, the 105-mm howitzer battery, self-propelled, is normally allotted one frequency in the artillery band. If sufficient frequencies are available, a second frequency in the armored band may be authorized for use within the survey section. Type radio nets for the battery are shown in figure 100; the internal radio net is discussed in (2) below.

(2) *Battery command fire direction net, FM (CF).* The battery command/fire direction net, FM will be used by elements of the battery for command and fire direction traffic. It will also be used for transmission of information, intelligence, and warnings.

b. External Radio Nets. The battery operates in the external radio nets necessary to accomplish its mission (fig. 100).

(1) *Squadron command net, FM.* The battery commander operates in the squadron command net, FM, for direct communication with the squadron commander. In addition, the battery fire direction center operates a full-time

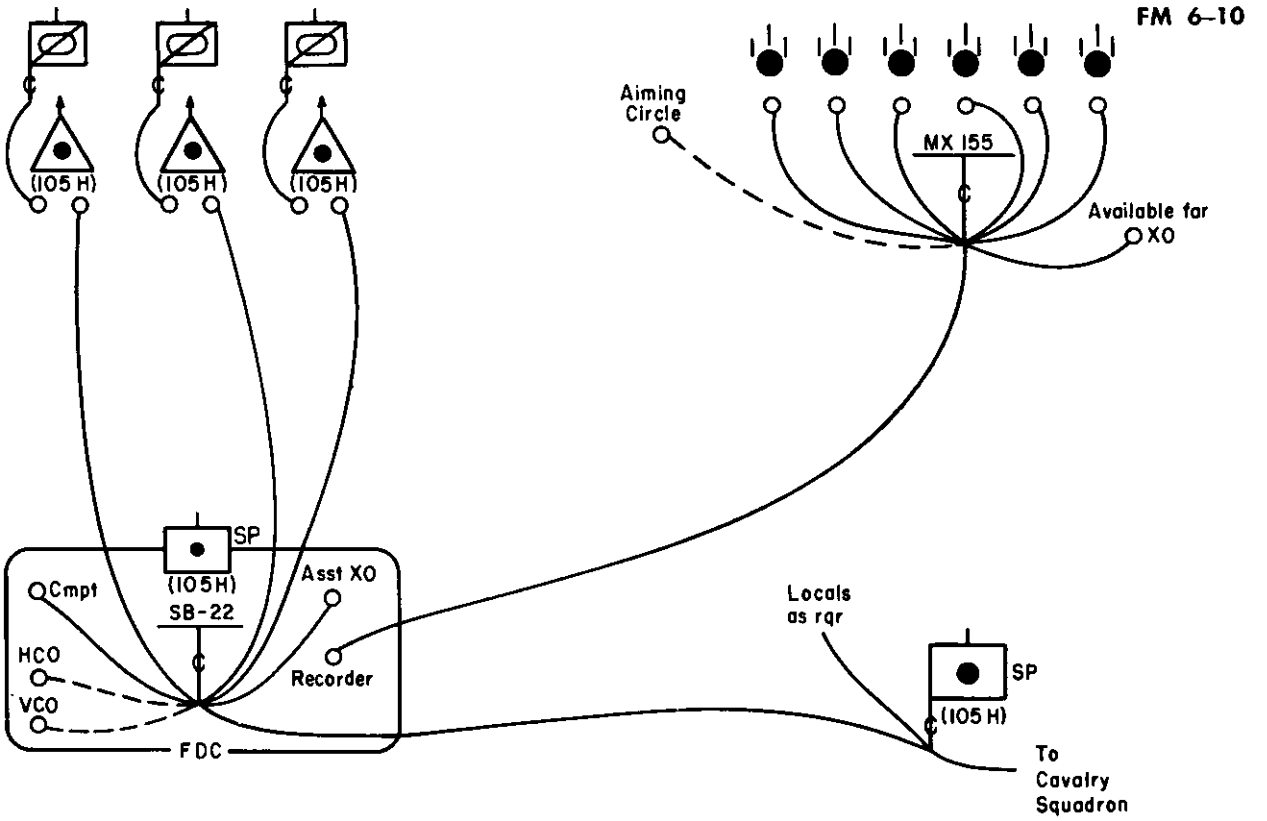


Figure 99. Type wire system, artillery howitzer battery, 105-mm, self-propelled, armored cavalry squadron.

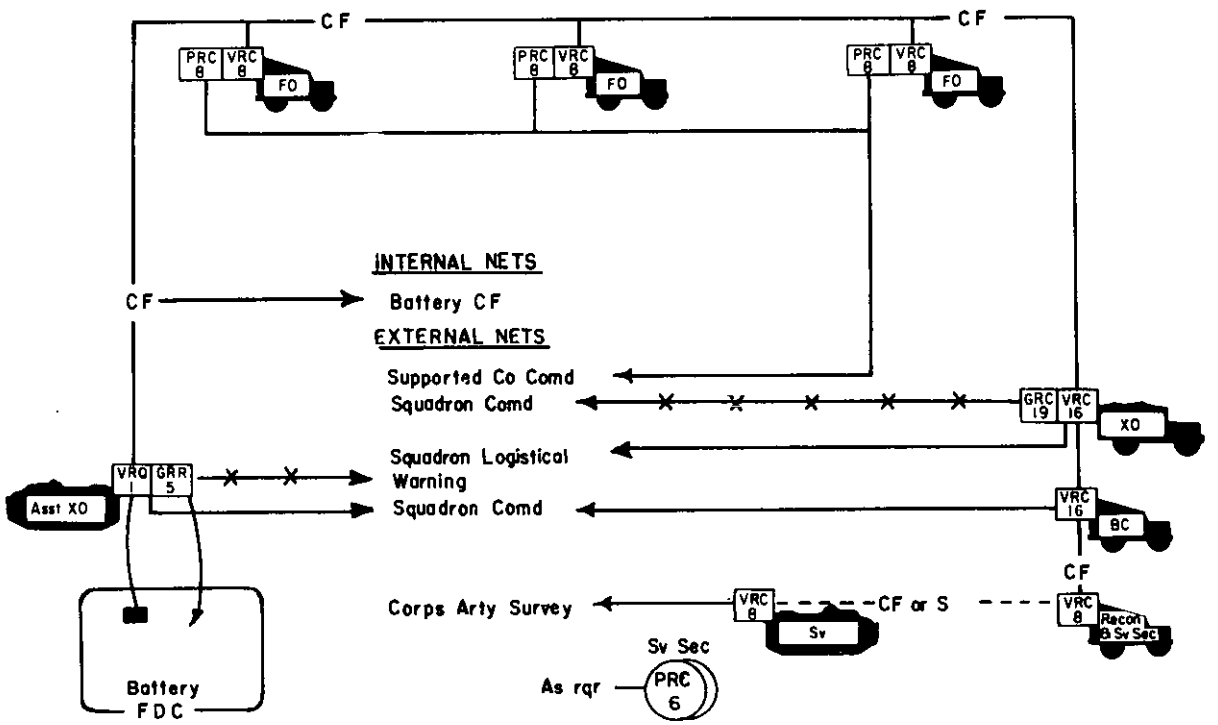


Figure 100. Type radio nets, artillery howitzer battery, 105-mm, self-propelled, armored cavalry squadron.

station in this net for operational traffic between the supported unit and the howitzer battery.

(2) *Squadron command net, AM.* The squadron command net, AM, provides communication between the supported unit and the howitzer battery over extended ranges for command, administrative, and intelligence traffic.

(3) *Squadron Logistical net, FM.* The battery executive officer operates in the squadron logistical net for the exchange of logistical traffic between the battery and the squadron headquarters.

(4) *Supported troop command nets, FM.* The forward observers working with the cavalry troops will operate a radio in the supported troop command net for coordination of operations and fire support.

(5) *Warning net, AM.* The battery will monitor a division or other appropriate warning net to receive warnings of various types. Pertinent information should be retransmitted over the battery internal communication system.

(6) *Corps artillery survey channel, FM (S).* The corps artillery survey channel is used by the battery survey section for coordination of survey with other artillery units. If the corps artillery survey channel is not in the overlap band this unit will be unable to coordinate survey with other units. However, coordination among the three batteries of the regiment may be accomplished if a frequency can be made available in the armored band.

Section XVI. COMMUNICATION SYSTEM ARTILLERY SEARCHLIGHT BATTERY

252. General

Since the searchlight battery is generally deployed over a corps front, the great distances between battery elements present serious communication difficulties. The installation and maintenance of wire lines is particularly difficult; in fact, the great distances involved make assistance from the supported unit necessary for successful operation. Radio sets require careful siting to overcome the difficulties in communicating over great distances. Relay stations may be required for adequate radio communication. It may be necessary for elements of the battery to utilize the radio/wire integration facilities available in the area system.

253. Internal Communication Requirements

The internal requirements for the searchlight battery are, as shown in paragraph 170 with the exception of the battery's requirement for light direction in lieu of fire direction.

254. External Communication Requirements

The external requirements of the searchlight battery include facilities for—

a. Receipt of tactical orders and administrative supervision from corps artillery.

b. Communication with supported units.

c. Exchange of information and intelligence.

d. Coordination of survey.

e. Receipt of warnings.

255. Wire System

The searchlight battery wire system is characterized by maximum utilization of existing lines. The extent of the wire system depends on the length of time a position is occupied and the tactical situation. Each searchlight platoon will generally operate as a separate unit with the platoon command post in the vicinity of a division artillery. Wire communication from the battery to the platoons will normally be routed through corps artillery to division artillery to the platoon. Wire communication from the platoons to their sections is normally routed through division artillery to the artillery howitzer battalion with a direct support mission to

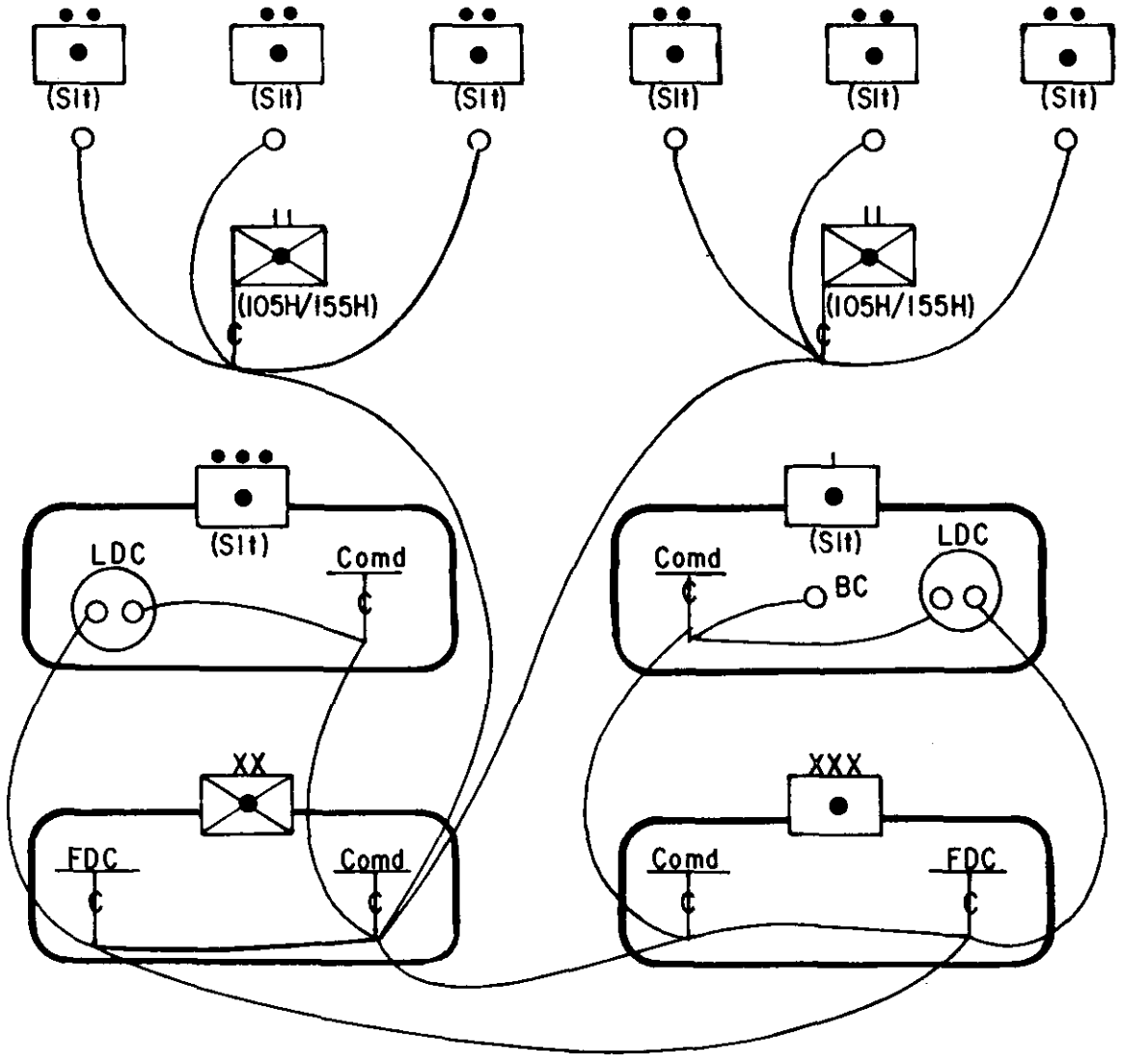


Figure 101. Type wire system, artillery searchlight battery.

the sections. A type wire system for the searchlight battery is shown in figure 101.

256. Radio Nets

a. Internal Radio Net.

(1) *General.* The number of frequencies assigned to a searchlight battery depends on the requirements of the situation and the number of frequencies available. Normally, the battery will require only one channel to establish a command/light direction net. Type radio nets for a searchlight battery are shown in figure 102; the internal radio net for the searchlight battery is in (2) below.

(2) *Battery command/light direction net FM (CL).* This net will be used by elements of the battery for tactical and administrative control and to receive and transmit light direction missions. In normal situations, the battery commander may not be within range of all elements of his battery over this net; however with proper siting of radios and the use of proper antennas he should be able to communicate with the platoon commanders and in turn,

the platoon commanders should be able to communicate with their sections.

b. External Radio Nets. The battery operates in the external radio nets necessary to accomplish its mission (fig. 102).

(1) *Corps artillery command/fire direction net, FM (CF).* The battery operates in the corps artillery command/fire direction net, FM, for communication with corps artillery for tactical control and administrative supervision. The battery light direction center will also receive warnings over this net.

(2) *Division artillery command/fire direction net, FM (CF).* When the platoons are in support of, or attached to a division artillery, they operate in this net for communication with, division artillery.

(3) *Division warning net, AM.* Each platoon light direction center (LDC) monitors this net to receive air defense warnings and warnings of nuclear, chemical, biological, ground, and airborne attacks. Pertinent information should be retransmitted over the battery internal net to the sections.

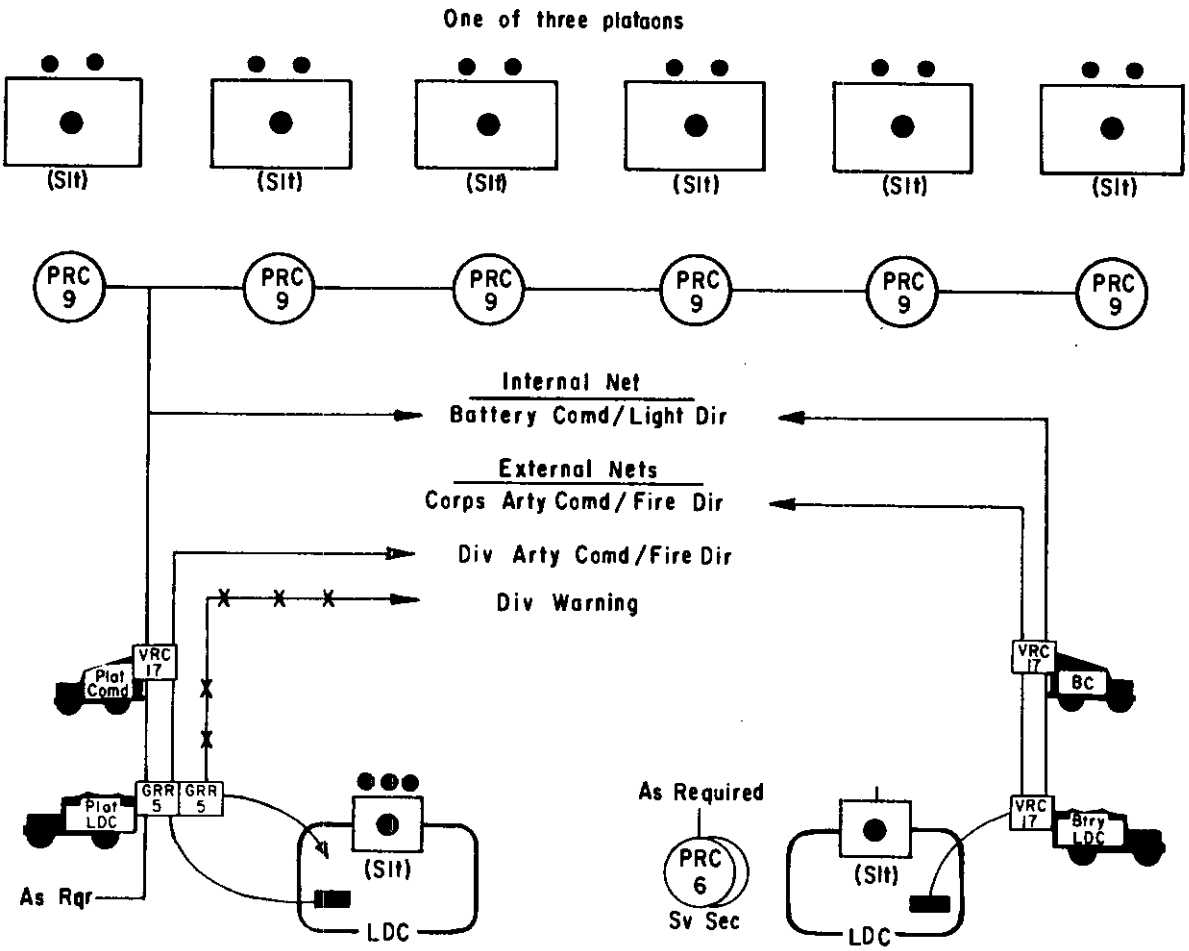


Figure 102. Type radio nets, artillery searchlight battery.

Section XVII. COMMUNICATION SYSTEM, INFANTRY DIVISION ARTILLERY HEADQUARTERS

257. General

a. The division signal battalion installs and operates radio terminal equipment in the vicinity of the division artillery headquarters. This equipment consists of either 12- or 24-channels linking the division artillery with other elements of the division through the division area communication system. The signal battalion installs the multichannel cable, connecting the radio terminal equipment with the division artillery switchboard.

b. The area communication system is used by division artillery to supplement its organic means of communication. The organic and attached units of the division artillery will be connected into the signal center nearest their position.

c. The division area communication system is comprised mainly of common-user circuits; however, to meet special requirements, a specified number of sole-user circuits will be allocated. Sole-user circuits are those circuits which are allocated to an organization, for full-time use, to provide point-to-point communication. Normally, the division artillery requires only one sole-user circuit from the division artillery fire direction center to the division fire support coordination center (FSCC) and one circuit from the division FSCC to the artillery representative at the battle groups.

d. The corps signal battalion sends radio terminal equipment to division artillery to connect this headquarters to corps artillery with 12 radio carrier channels. For a detailed discussion on the functions of the infantry division signal battalion see FM 11–10.

258. Communication Requirements

The communication requirements for the infantry division artillery are as shown in paragraph 167.

259. Wire System

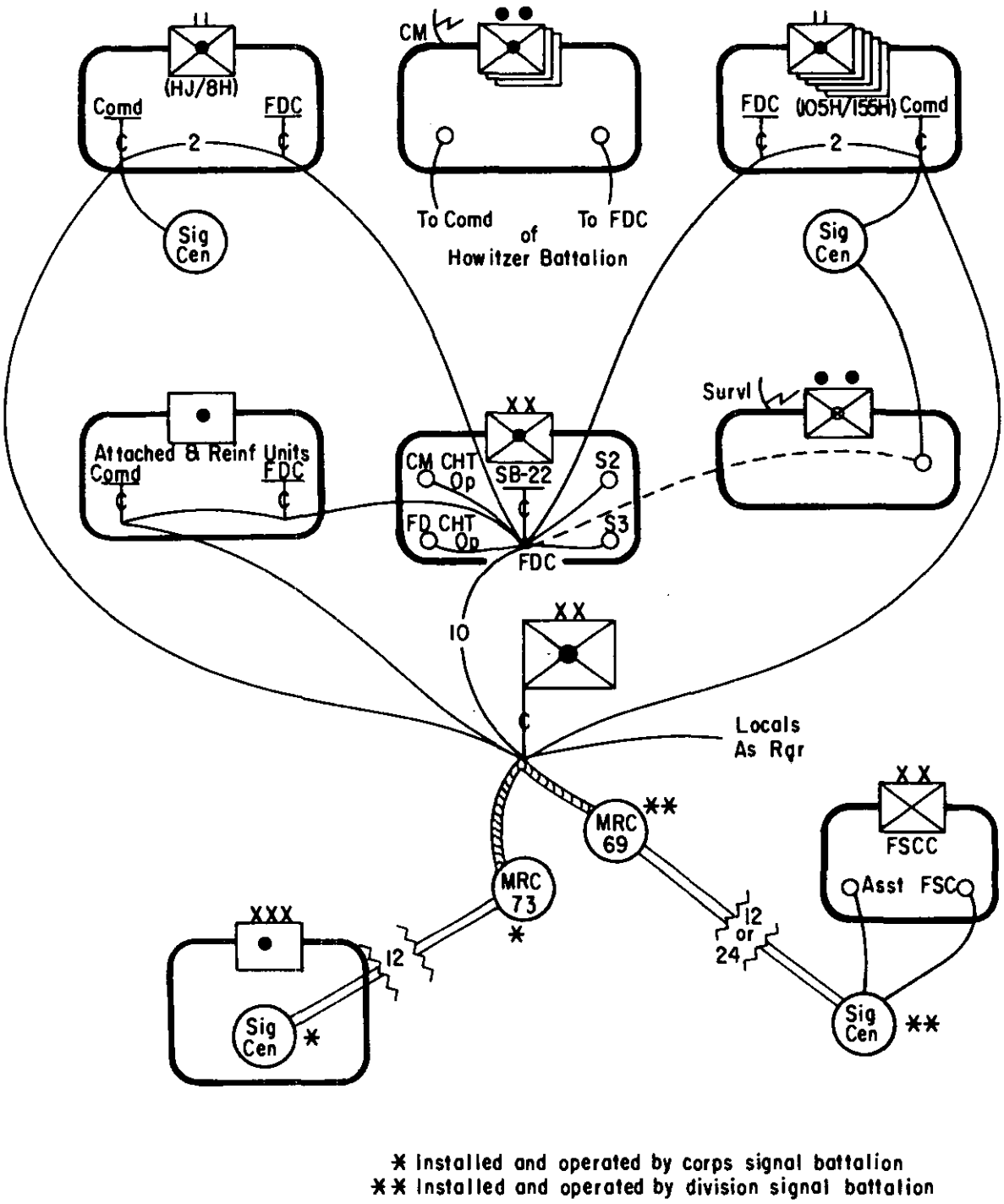
The extent of the division artillery wire system will depend on the tactical situation and the length of time the unit remains in position. To add flexibility to the wire system, the division artillery headquarters establishes separate command and fire direction center switchboards. The division artillery headquarters is responsible for installation of wire to all subordinate elements. However, the shortage of wire teams makes it impractical for this headquarters to install the lines to all subordinate units. The battalions that are assigned a general support or reinforcing mission may be directed to install wire to division artillery, and the countermortar radar sections will normally install wire to the nearest field artillery howitzer battalion, 105-mm or 155-mm, to provide a means of communicating with division artillery. As time permits a circuit should be installed to the surveillance radar section, either direct or through the area communication system. A type wire system for the division artillery is shown in figure 103.

260. Internal Radio Nets

a. General. The division artillery internal radio system must provide the commander with facilities for tactical control, administrative supervision, and fire control. The division artillery headquarters operates two internal radio nets, one FM net and one AM net.

b. Division Artillery Command/Fire Direction Net, FM (CF). The division artillery command/fire direction net, FM, provides communication with elements of the staff, airborne aircraft, and subordinate units for tactical control, collection of information, and dissemination of intelligence. It is also used for transmission of firing data. All Army aircraft in support of the division artillery operate in this net until the aircraft calls in a fire mission, then the aircraft will be directed to change to the appropriate battalion fire direction net to conduct the fire mission. After completion of the mission, an intelligence report will be made on this net. A type command/fire direction net, FM, for the division artillery is shown in figure 104.

c. Division Artillery Command/Fire Direction Net, AM, RATT (CF). The division artillery command/fire direction net, AM, is used



* Installed and operated by corps signal battalion
** Installed and operated by division signal battalion

Figure 103. Type wire system, infantry division artillery.

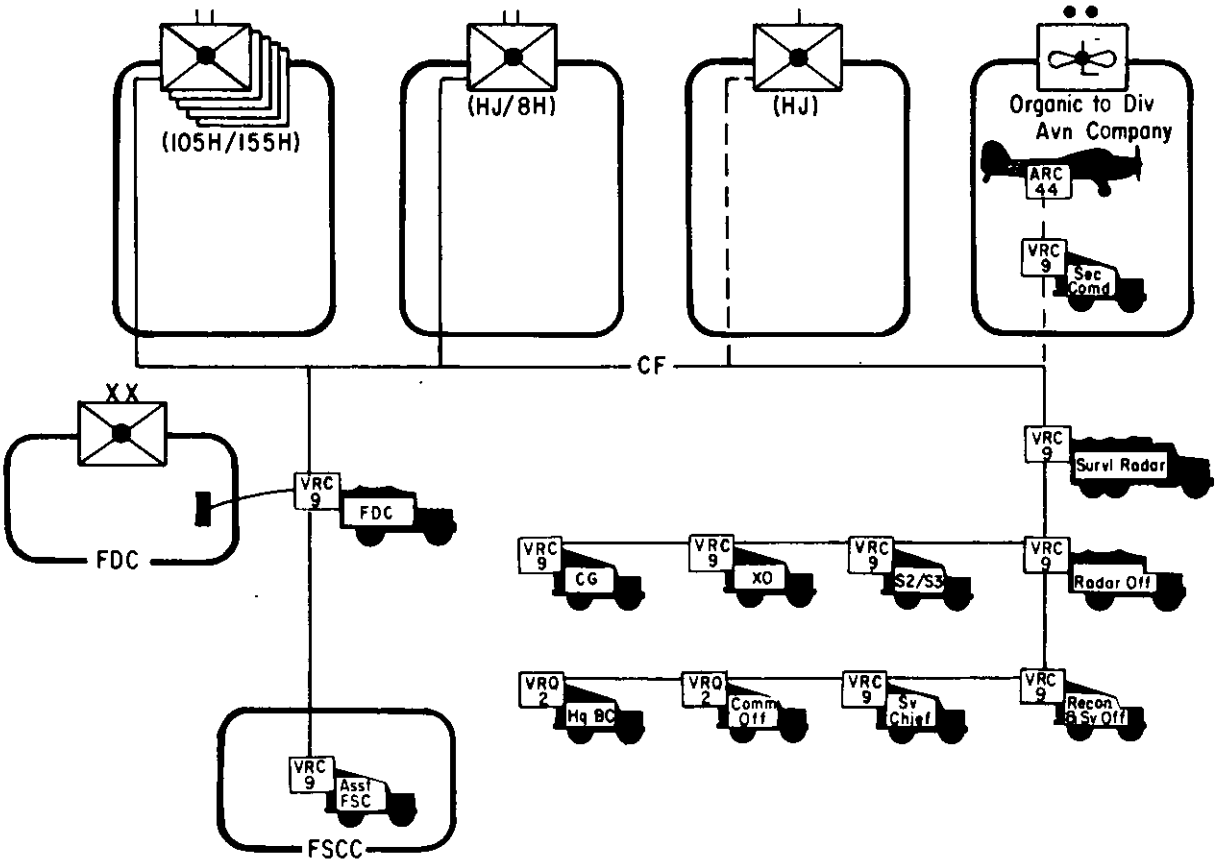


Figure 104. Type command/fire direction net, FM, infantry division artillery.

by direct support battalions to request additional fire support from division artillery; by division artillery to send fire missions to battalions and batteries that have a nuclear capability; and by the division fire support coordination center to send fire missions to division artillery fire direction center and nuclear units. The surveillance radar section uses this net to transmit target information to division artillery. It is also used for tactical control and administrative supervision of subordinate units and for exchange of information and intelligence and for the dissimination of meterological data. A type command/fire direction net, AM, is shown in figure 105.

261. External Radio Nets

To meet its internal requirement of transmitting meteorological data and to meet its external requirements the division artillery headquarters operates in, or listens to, 3 FM and 10 AM external radio nets. Stations or individuals in the headquarters that may operate in these nets are shown in figure 106.

a. Division CG/Command Net, FM. The division CG/command net provides a direct radio channel between the division artillery commanding general and the commanding general of the division. In addition the division artillery fire direction center operates a full-time station in this net to handle operational traffic.

b. Division Intelligence Net, AM, RATT. The division artillery as an intelligence gaining agency, uses this net to transmit information and intelligence to division. It is also used for the exchange of information and intelligence with other intelligence-gaining agencies in the division.

c. Division Command/Operations Net, AM, RATT. Division artillery operates in this net for operational communication with division headquarters.

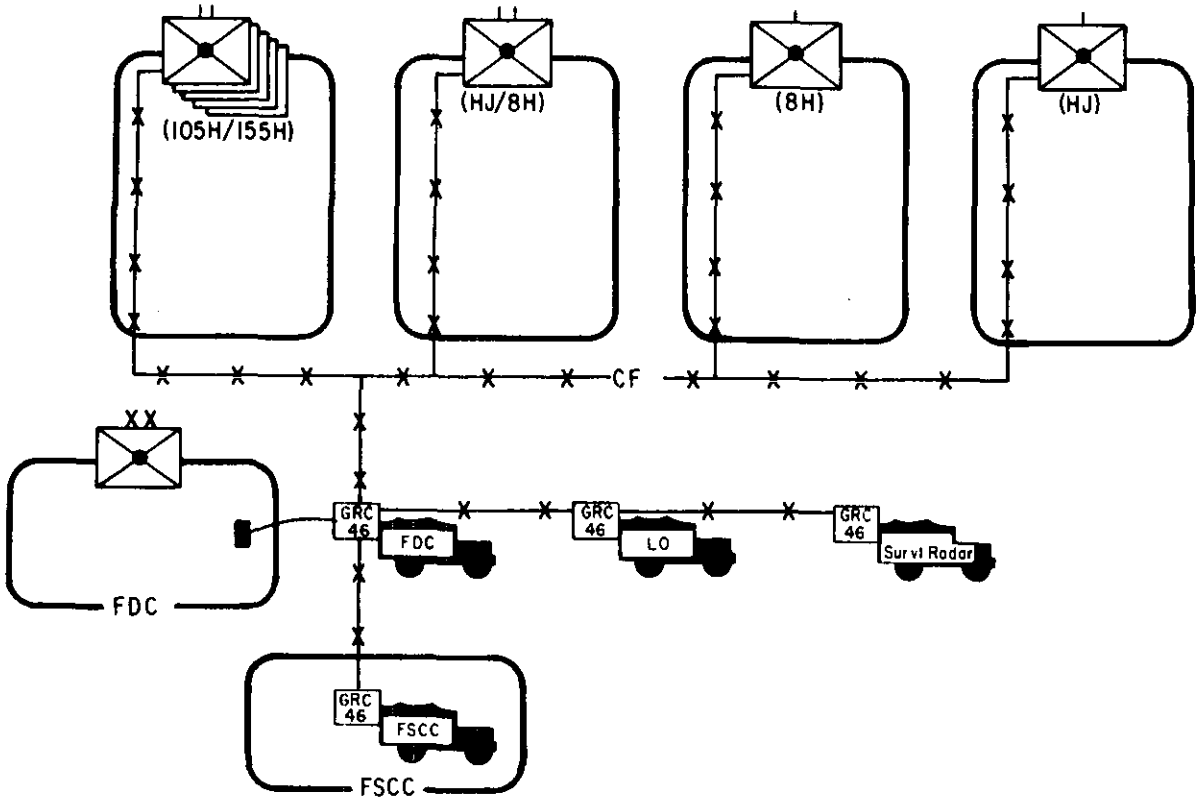


Figure 105. Type command/fire direction net, AM, infantry division artillery.

d. Division Warning Net, AM. The division artillery operates a station in the division warning net to receive warnings from elements of the division and to transmit air defense warnings received over the air defense intelligence net.

e. Division Administrative/Logistic Net, AM; RATT. The division administrative/logistic net, AM, is used for administrative and logistical traffic between division headquarters and the service support elements. The division artillery enters this net as required by changing a radio set from another divisional net.

f. Corps Artillery Survey Channel, FM (S). The corps artillery survey channel is used by artillery survey sections to facilitate survey and to coordinate with other artillery survey elements. Because of the limited range of the radio sets employed on this channel, it is neither intended nor feasible for this to be a coordinated net; however, the survey channel does provide communication within and between all survey sections in the division artillery.

g. Corps Artillery Fire Direction Net, AM, RATT (F). The corps artillery fire direction net, AM, is used by division artillery to request additional artillery support from corps artillery and for coordination of artillery fires.

h. Corps Artillery Meteorological Net, AM (M). The corps artillery meteorological net, AM, will be used by the field artillery target acquisition battalion and the division artilleries to transmit meteorological data. Meteorological data will be transmitted on a schedule to be established by the net control station (field artillery target acquisition battalion).

i. Time Signal Net, AM. A radio set in the division artillery survey information center is used to receive time signals. Normally, one station in each area of operations will be designated to broadcast the time signals to the entire area of operations using the time signal net. The survey sections require accurate time for astronomical observations.

j. Tactical Air Force Control and Coordination Net, FM-AM. The control and coordination

(CAC) net is used by the air liaison officer (ALO) at the division fire support coordination center to control and coordinate the activities of the forward air controllers (FAC) working with the subordinate units. This net may also be used for exchange of information between the ALO and the forward air controllers. The division artillery air control (ACT) furnishes the ALO a vehicle, necessary FM and AM equipment and personnel to operate and maintain this equipment. If the FACs with the battle groups are within range of FM equipment, the ALO will communicate with them using his FM set. If the FACs are not within FM range the ALO will communicate with them, using his AM set as shown in figure 107. The radio section provides the FM/AM retransmission station.

k. Tactical Air Force Air Direction Net, AM, UHF. The air liaison officer at the division fire support coordination center operates in the tactical air direction net utilizing the AM radio set furnished to him by the air control team of division artillery. This net gives the air liaison officer a radio link with high performance aircraft that may be conducting air strikes in the division area. Although the air liaison officer may not be directly involved in the conduct of the air strike, he may be able to obtain valuable information regarding targets in the division area and he will have knowledge of all aircraft that are operating in the division area.

l. Tactical Air Force Tactical Air Observation Net, AM. The tactical air observation (TAO) net is used for communication between tactical air force reconnaissance aircraft and division artillery for artillery adjustments and for surveillance of nuclear fires. High performance reconnaissance aircraft may be called on to adjust long-range artillery when it is not feasible for Army aviation to accomplish the mission.

m. Air Defense Intelligence Net, AM. The division artillery headquarters monitors the air defense intelligence net to receive air defense warnings for the division. Information that is pertinent to the division area will be converted to the universal transverse meractor (UTM) system and rebroadcast over the division warning net.

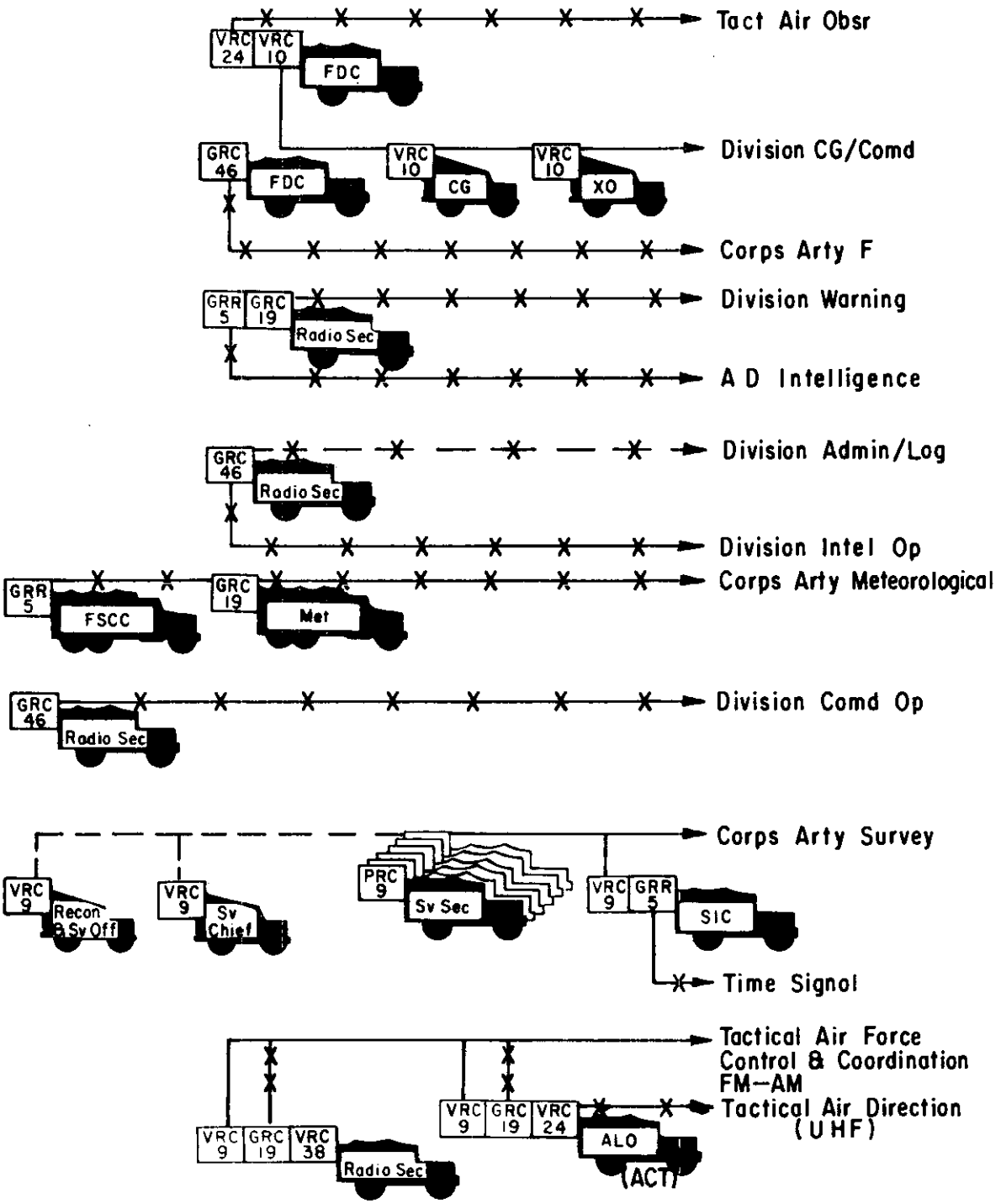


Figure 106. External radio nets, FM and AM, infantry division artillery.

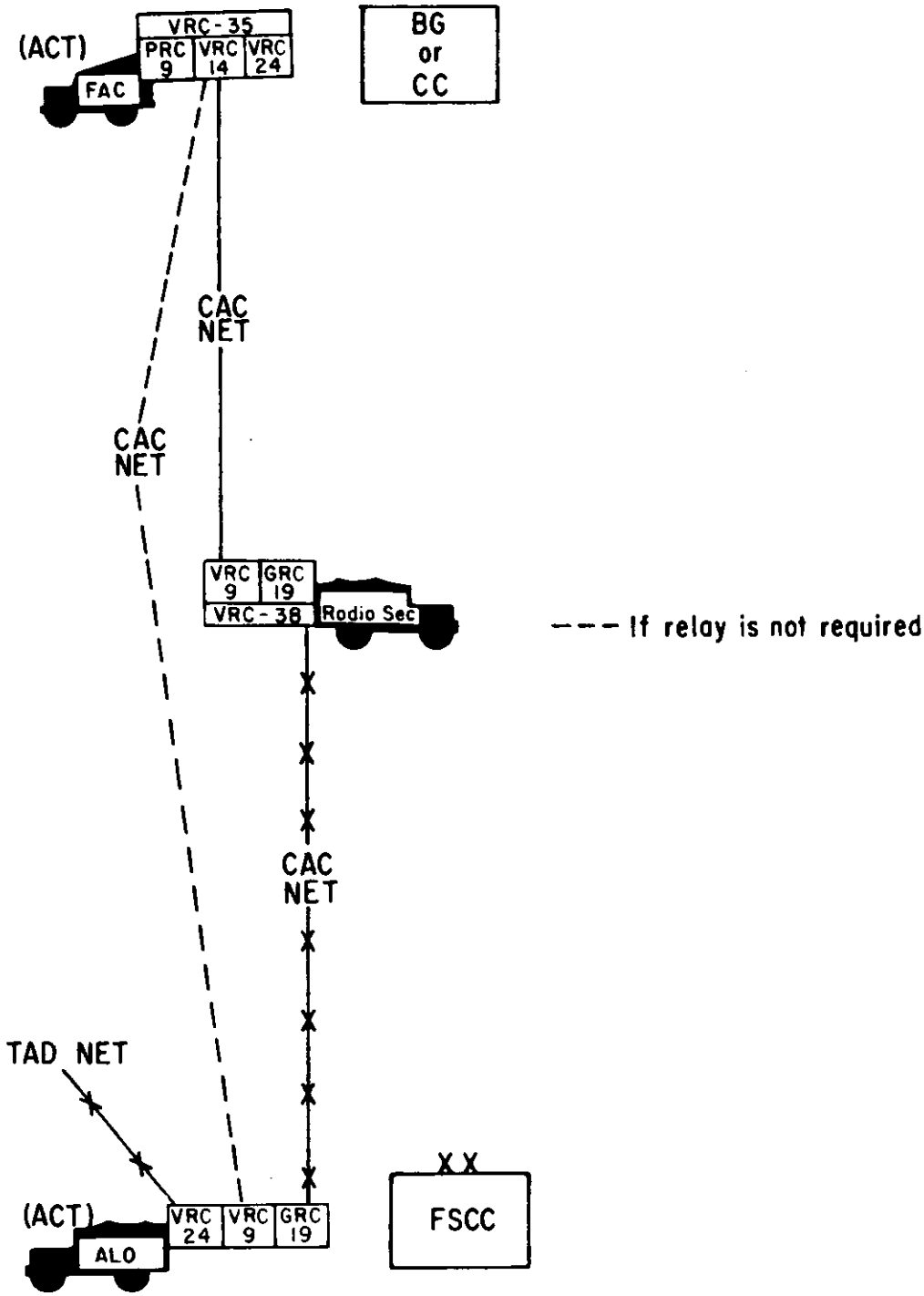


Figure 107. A method of employing the air liaison officer's radio equipment.

Section XVIII. COMMUNICATION SYSTEM, INFANTRY DIVISION ARTILLERY HOWITZER BATTALION, 105-MM AND 155-MM, TOWED AND SELF-PROPELLED

262. General

The communication systems of the towed and self-propelled battalions are generally the same. The communication system of these battalions vary with the tactical mission assigned to the unit.

263. Communication Requirements

a. Internal Requirements. The internal communication requirements for the howitzer battalions are as shown in paragraph 170.

b. External Requirements. The external communication requirements for these battalions are as shown in paragraph 170 with the following additional requirements:

(1) Communication with supported units.
(2) Communication with close support aircraft.
(3) Facilities for requesting additional fire support from division artillery.

264. Wire System

a. Battalion System. The howitzer battalion wire system must provide facilities for fire direction and command control. The extent of the wire system will depend on the length of time a position is occupied and the tactical situation. (A type battalion wire system is shown in fig. 108.) The shortage of wiremen in these battalions makes it mandatory that the installation of the wire system be well planned. A forward switch installed as far forward as local security will permit will conserve time and wire. In addition to the lines to the forward switch, the battalion wire teams will install lines to the supported battle group and area signal center. The forward observer sections should install a line to the supported company and should assist with the installation of a line to the forward switch. The circuit to the mortar platoon fire direction center will be installed in accordance with the division standing operating procedures (SOP) or in accordance with agreement between the commanders concerned. The switchboard operators under the supervision of the communication chief may be required to install local circuits in the command post area.

b. Howitzer Battery System. The shortage of wire teams in headquarters battery dictates that the howitzer battery wire teams install circuits to battalion. Each howitzer section installs a line to the telephone connecting and switching group MX–155/GT. The recorder also installs a circuit from his telephone to the MX–155/GT. A fixed location for the executive officer cannot be specified, since he will station himself to facilitate control of the battery. A separate telephone may be established to provide wire communication between the executive officer and the howitzer sections. This telephone also should be connected to the MX–155/GT.

265. Internal Radio Nets

The artillery howitzer battalions, 105-mm and 155–mm, of the infantry division utilize three frequency modulated (FM) radio channels to fulfill their internal communication requirements. One channel is used for a command/fire direction net, and two channels are used for fire direction nets.

a. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net, FM, is used for the command and administration of the battalion. This net provides a channel of radio communication for the battalion commander, his staff, sections of battalion headquarters, the battery commanders, and radios at the howitzer batteries. This net may also be used for fire direction when necessary. The stations or individuals that may be operating in this net are shown in figure 109.

b. Battalion Fire Direction Net 1, FM (F1). The battalion fire direction net 1, FM (fig. 110), is used for transmission of fire requests from the forward observers to the battalion fire direction center. It is also used for sending firing data from the battalion fire direction center to the howitzer batteries and to communicate with army aircraft that are adjusting artillery fire for the battalion.

c. Battalion Fire Direction Net 2, FM (2). The battalion fire direction net 2, FM (fig. 110), is used primarily for transmitting firing data to the nonadjusting battery but may be used

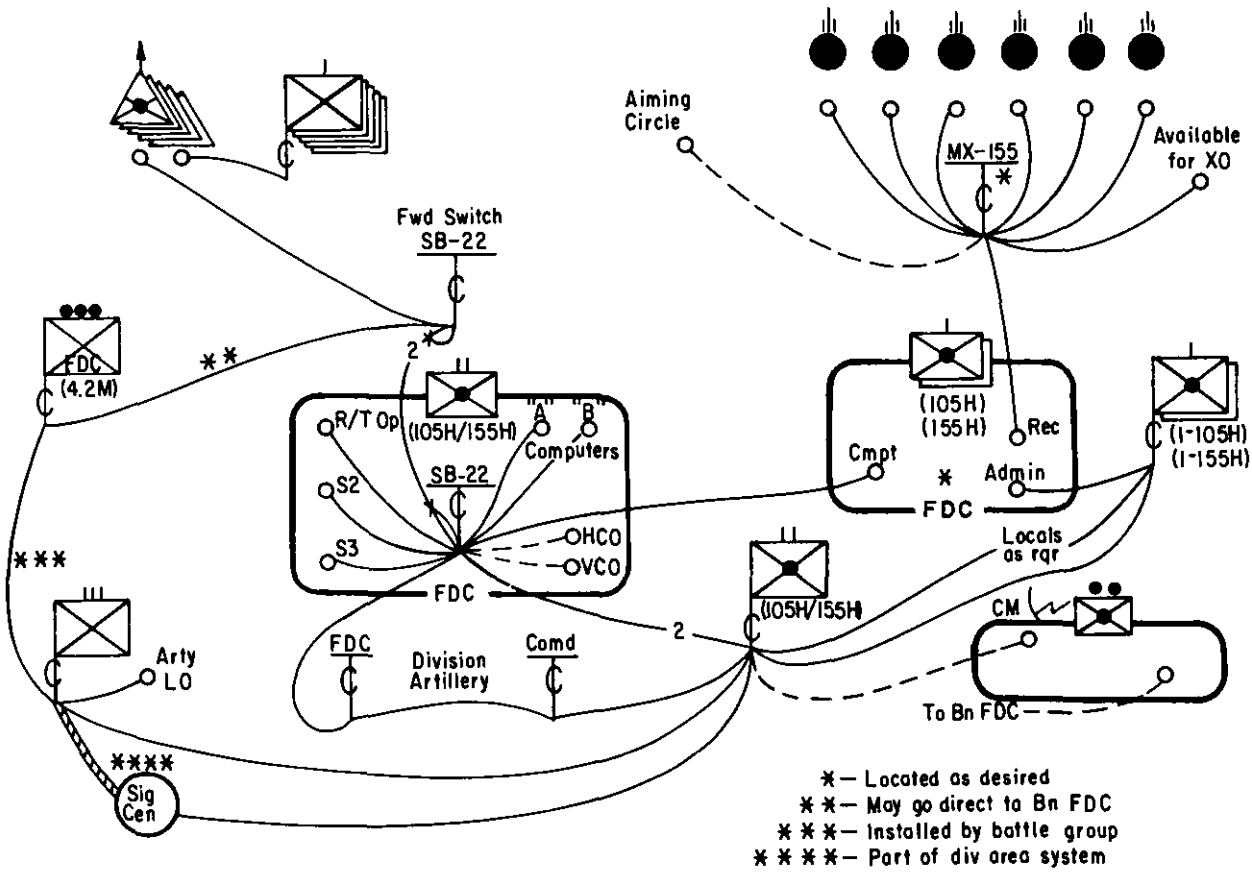


Figure 108. Type wire system, infantry division, artillery howitzer battalion, 105-mm and 155-mm, towed and self-propelled.

by the forward observers as directed when the battalion is firing multiple missions.

266. External Radio Nets

To fulfill external communication requirements, the artillery howitzer battalions 105-mm and 155-mm of the infantry division will operate in or monitor radio nets as shown in figure 111 and discussed in *a* through *i* below.

a. Division Artillery Command/Fire Direction Net, FM (CF). The battalion commander operates in the division artillery command/fire direction net, FM, for direct communication with the division artillery commander. The battalion fire direction center operates a full-time station in this net for operational and fire direction traffic.

b. Division Artillery Command/Fire Direction Net, AM, RATT (CF). The battalion operates in the division artillery command/fire direction net, AM, to receive command and fire direction control and meteorological data from division artillery headquarters and to request additional fire support from division artillery.

c. Division Warning Net, AM. The battalion monitors this net to receive warnings of various types. Information received over this net should be retransmitted over the battalion internal communication system.

d. Supported Battle Group Command Net, FM. The battalion operates in the supported battle group command net for coordination of fire support and exchange of information and intelligence.

e. Supported Infantry Company Command Net, FM. The forward observers operate in the command net of the infantry company with which they are working. This net provides a link between the forward observer and the company commander for coordination of fire support.

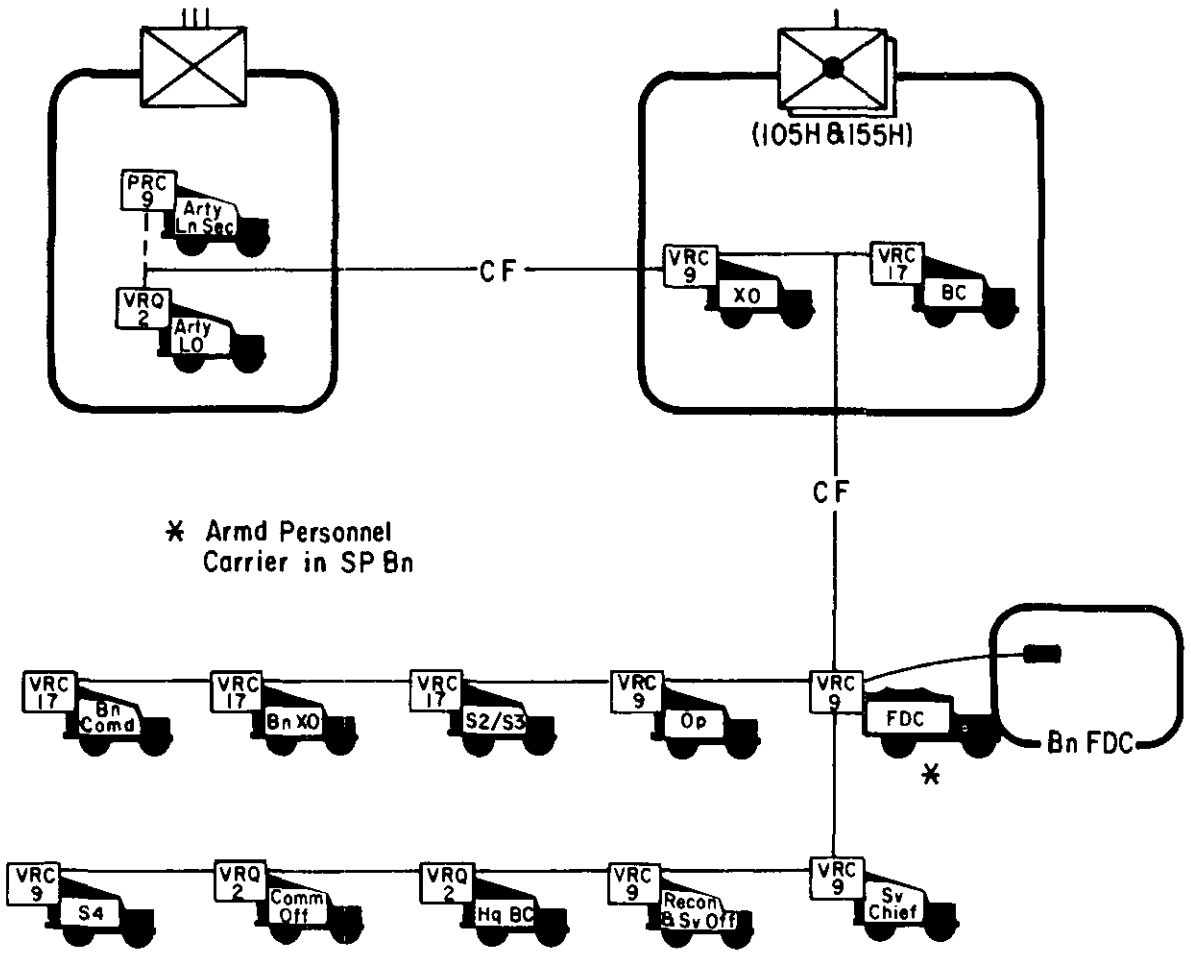


Figure 109. Type command/fire direction net, infantry division artillery howitzer battalion, 105-mm and 155-mm, towed and self-propelled.

f. Corps Artillery Meteorological Net, AM (M). The battalion monitors the corps artillery meteorological net, AM, to receive meteorological data. Division artillery and the field artillery target acquisition battalion will have transmitting stations in this net.

g. Corps Artillery Survey Channel, FM (S). The battalion survey parties use the corps artillery survey channel for coordination of survey with other units and for internal communication.

h. Tactical Air Force Control and Coordination Net, FM. The air control team (ACT) in headquarters battery provides a composit radio set for the forward air controller (FAC). The FAC operates one of the FM components of this set in the control and coordination net for communication with the air liaison officer at division fire support coordination center. When the FAC is actually directing aircraft, it will be necessary for him to leave this net and utilize his radio as shown in figure 112.

i. Tactical Air Force Tactical Air Direction Net, AM, UHF. The forward air controller uses the AM component of his radio in this net for communication from ground to air while he is directing air strikes. If he is unable to observe the target from the vicinity of his vehicle, it will be necessary for him to utilize his portable radio set and, by retransmission, to communicate with the aircraft as shown in figure 112.

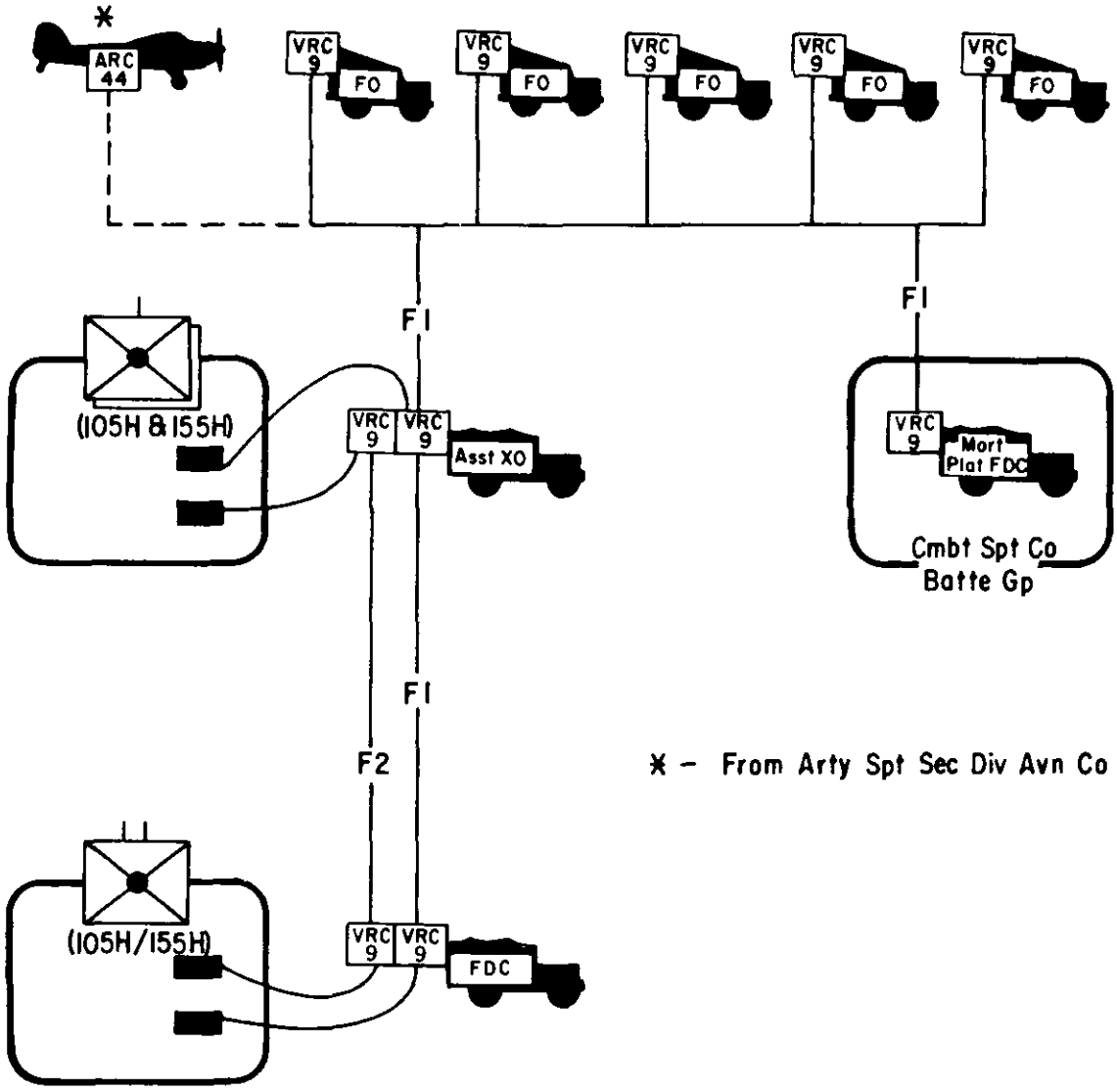


Figure 110. Type fire direction nets, infantry division, artillery howitzer battalion, 105-mm and 155-mm, towed and self-propelled.

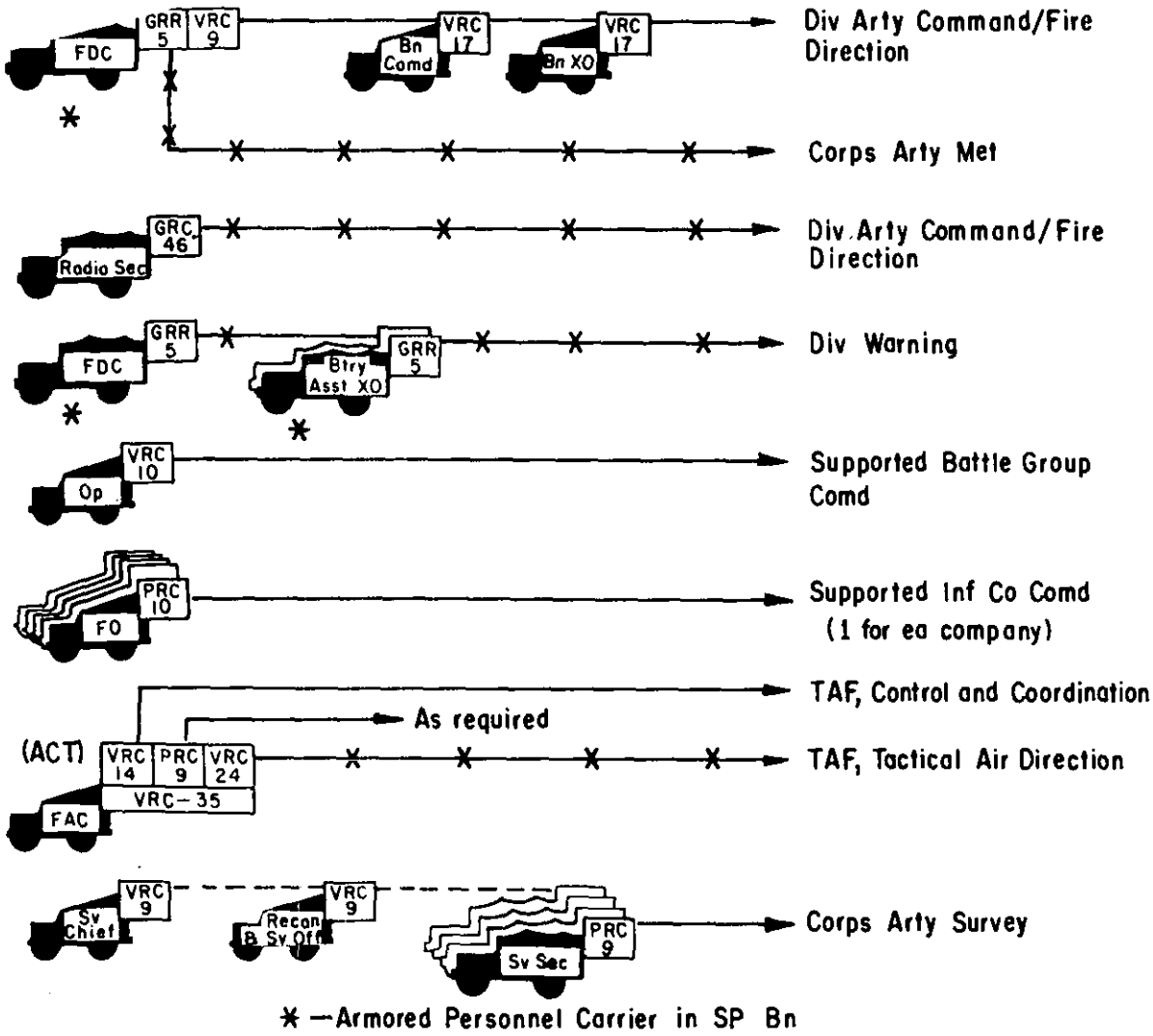


Figure 111. External radio nets, infantry division, artillery howitzer battalion, 105-mm and 155-mm, towed and self-propelled.

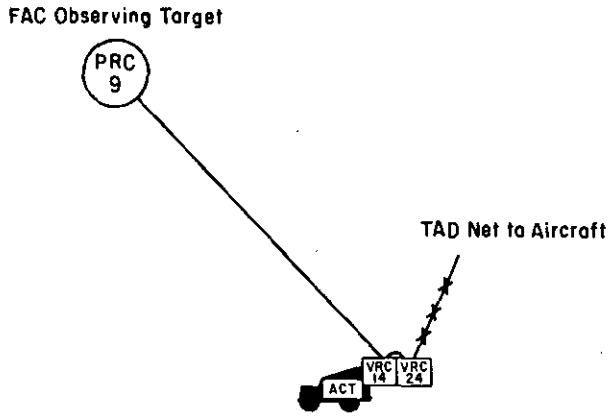


Figure 112. A method of employing the air controller's radio equipment in directing aircraft.

Section XIX. COMMUNICATION SYSTEM, INFANTRY DIVISION ARTILLERY BATTALION, 762-MM ROCKET, SELF-PROPELLED AND 8-INCH HOWITZER, TOWED

267. General

For a detailed discussion concerning the tactical employment of the rocket/howitzer battalion, see FM 6–20–1 and FM 6–20–2.

268. Communication Requirements

The communication requirements for this battalion are as shown in paragraph 170.

269. Battalion Wire System

A complete battalion wire system provides the commander with facilities for fire direction and command control. This system will be established as time permits. The battalion wire teams install local circuits in the command post area, a line to the nearest area signal center, and circuits to the Honest John battery. The battalion may also be directed to install wire to division artillery. A type battalion wire system is shown in figure 113.

270. Wire System, Artillery Howitzer Battery, 8-Inch, Towed

The extent of the battery wire system depends on the length of time the unit remains in a position and the tactical situation. The 8-inch howitzer has a nuclear capability and, therefore, installs a line to the nearest signal center to insure communication with division artillery and the division fire support coordination center. Normally the battery wire team installs lines to battalion, and circuits within the firing battery should be installed by firing battery personnel. If a portion of the battery is attached

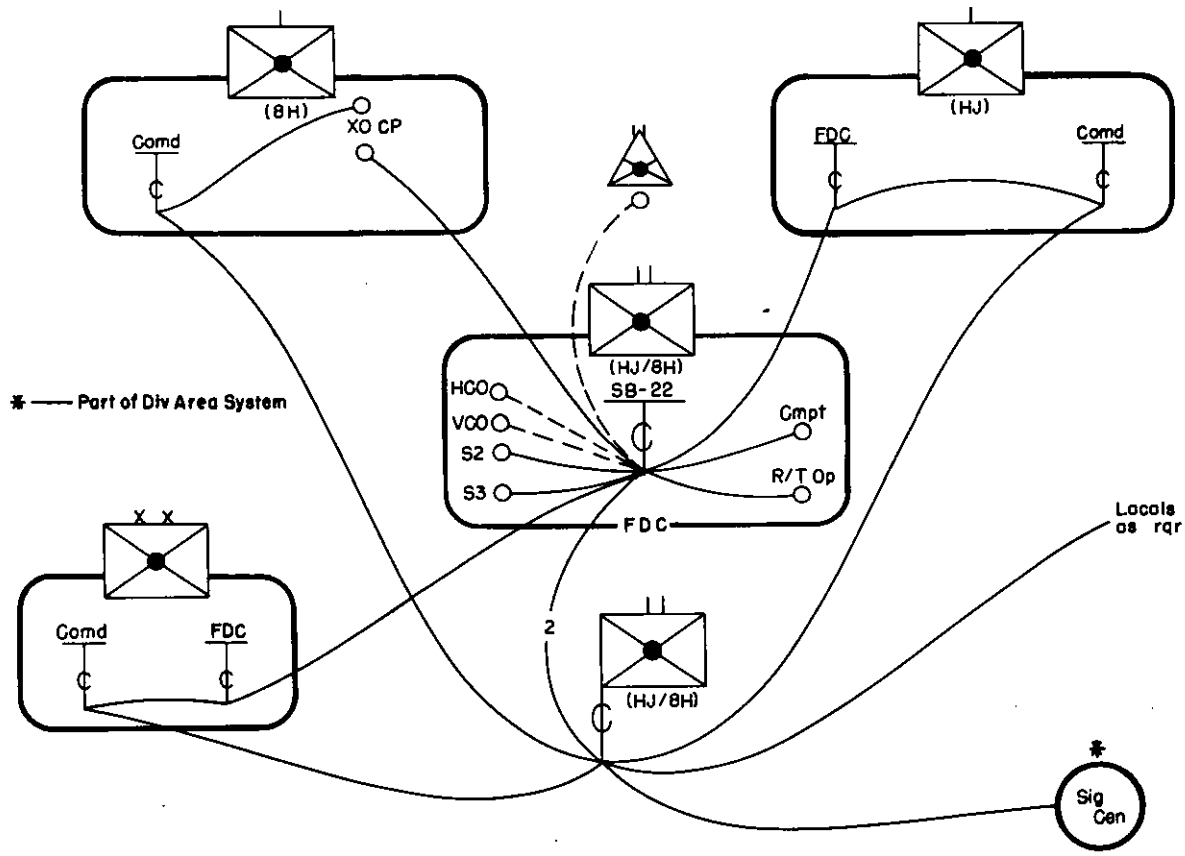


Figure 113. Type wire system, infantry division, artillery battalion, 762-mm rocket, self-propelled and 8-inch howitzer towed.

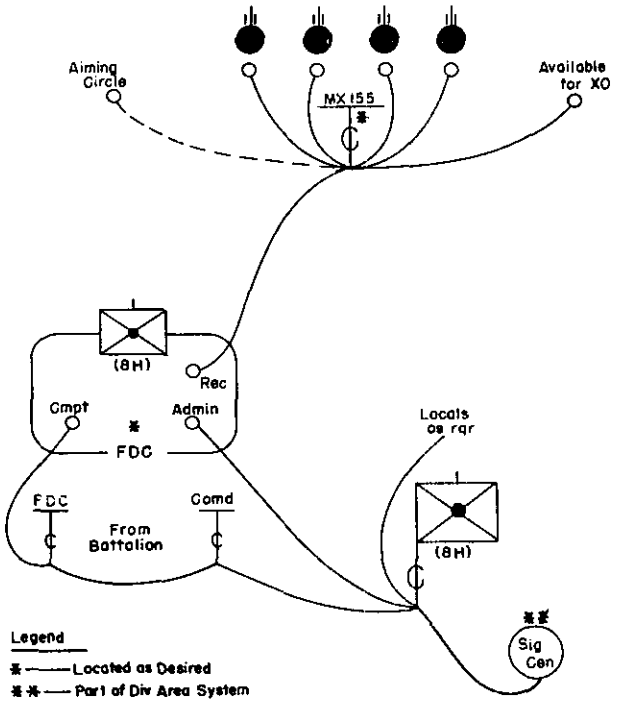


Figure 114. Type wire system, infantry division artillery howitzer battery, 8-inch, towed.

to another unit the controlling headquarters should provide communication to the attached element. A type wire system for the battery is shown in figure 114.

271. Wire System, Artillery Missile Battery 762-MM, Rocket, Self-Propelled

The extent of the battery wire system will depend on the tactical situation and the length of time the battery is in position. The rocket battery will normally occupy a tactical assembly area and prepare several firing positions to include installation of wire. Wires are installed from the firing positions to the fire direction center which remains in the assembly area. To add flexibility to the system, separate command and fire direction center switchboards are installed. Since the battery has a nuclear capability, it will normally install a line to the nearest signal center to insure communication with division artillery and the division fire support coordination center. A type battery wire system is shown in figure 115.

272. Internal Radio Nets

The rocket/howitzer battalion uses two frequency modulated (FM) channels to fulfill its internal communication requirements. One channel is used for a command/fire direction net and the other for a fire direction net.

a. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net is used by the battalion commander to exercise tactical and administrative control over subordinate units and for coordination between staff sections. A type battalion command/fire direction net is shown in figure 116.

b. Battalion Fire Direction Net, FM (F). The battalion fire direction net is used for transmission of fire requests from the forward observer to the battalion fire direction center. It is also used for sending firing data from the battalion fire direction center to the battery fire direction centers and to communicate with army aircraft that are adjusting artillery fire. A type fire direction net is shown in figure 117.

273. External Radio Nets

To fulfill its external communication requirements, the rocket/howitzer battalion will operate in, or listen to, radio nets as shown in figure 118, and discussed in *a* through *e* below.

a. Division Artillery Command/Fire Direction Net, FM (CF). The battalion commander operates in the division artillery command/fire direction net, FM, for direct communication to the division artillery commander. The battalion fire direction center operates a full-time station in this net for operational and fire direction traffic.

b. Division Artillery Command/Fire Direction Net, AM, RATT (CF). The battalion operates in the division artillery command/fire direction net, AM, to receive command and fire direction control and meteorological data from division artillery headquarters. The battalion may also use this net for transmission of nuclear fire missions to the firing batteries.

c. Division Warning Net, AM. The battalion and batteries monitor the division warning net to receive warnings of various types. Information received should be immediately retransmitted over the battalion internal communication system.

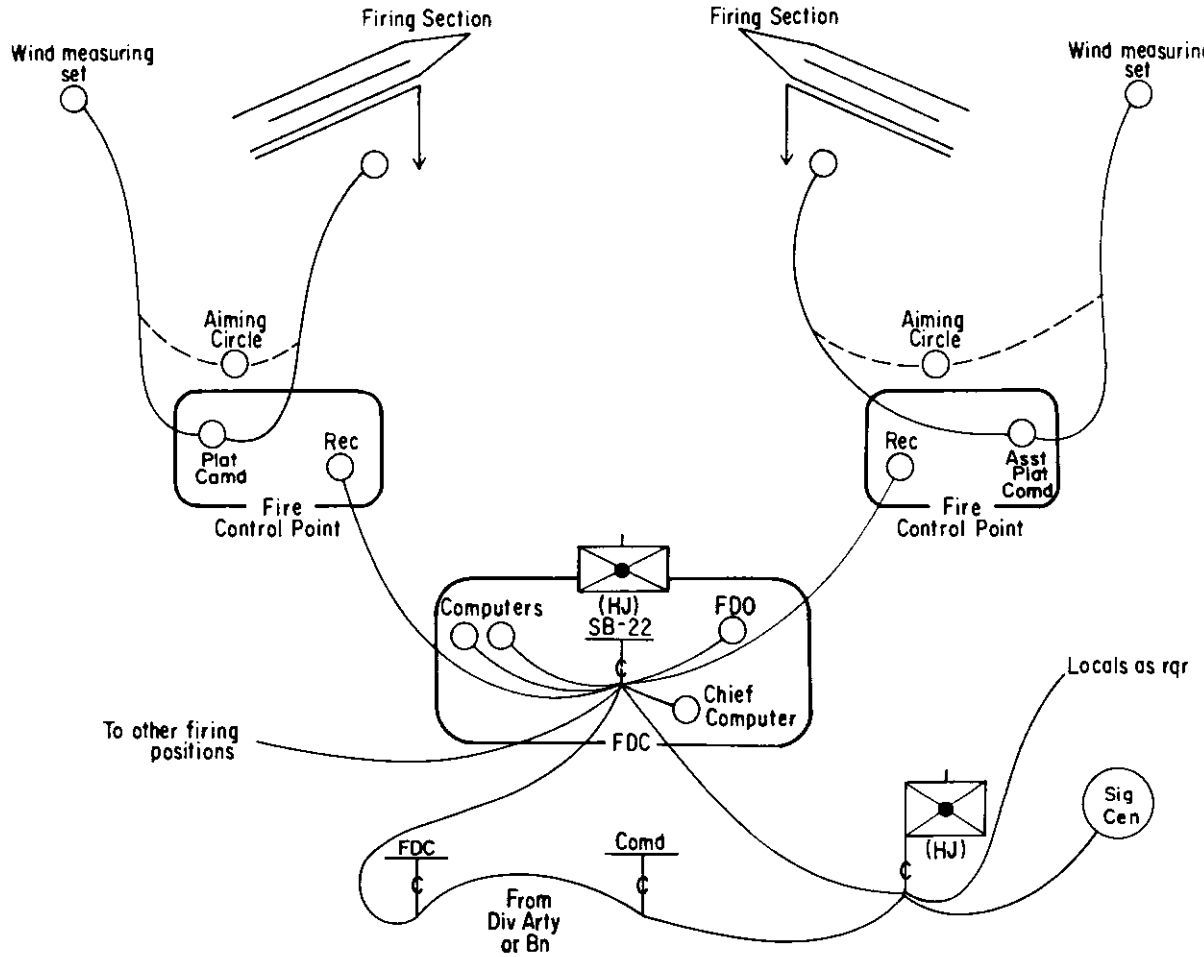


Figure 115. Type wire system, infantry division artillery missile battery, 762-mm rocket, self-propelled.

d. Corps Artillery Survey Channel, FM (S). The battalion survey parties operate in the corps artillery survey channel for coordination of survey with other units and for internal communication.

e. Corps Artillery Meteorological Net, AM (M). The battalion monitors this net to receive meteorological data. The batteries also monitor this net, since both are capable of producing firing data. However, if the missile battery is deployed by platoon transmission of meteorological data from one fire direction center to the other, will be necessary, since the platoons are not equipped to monitor this net in two fire direction centers.

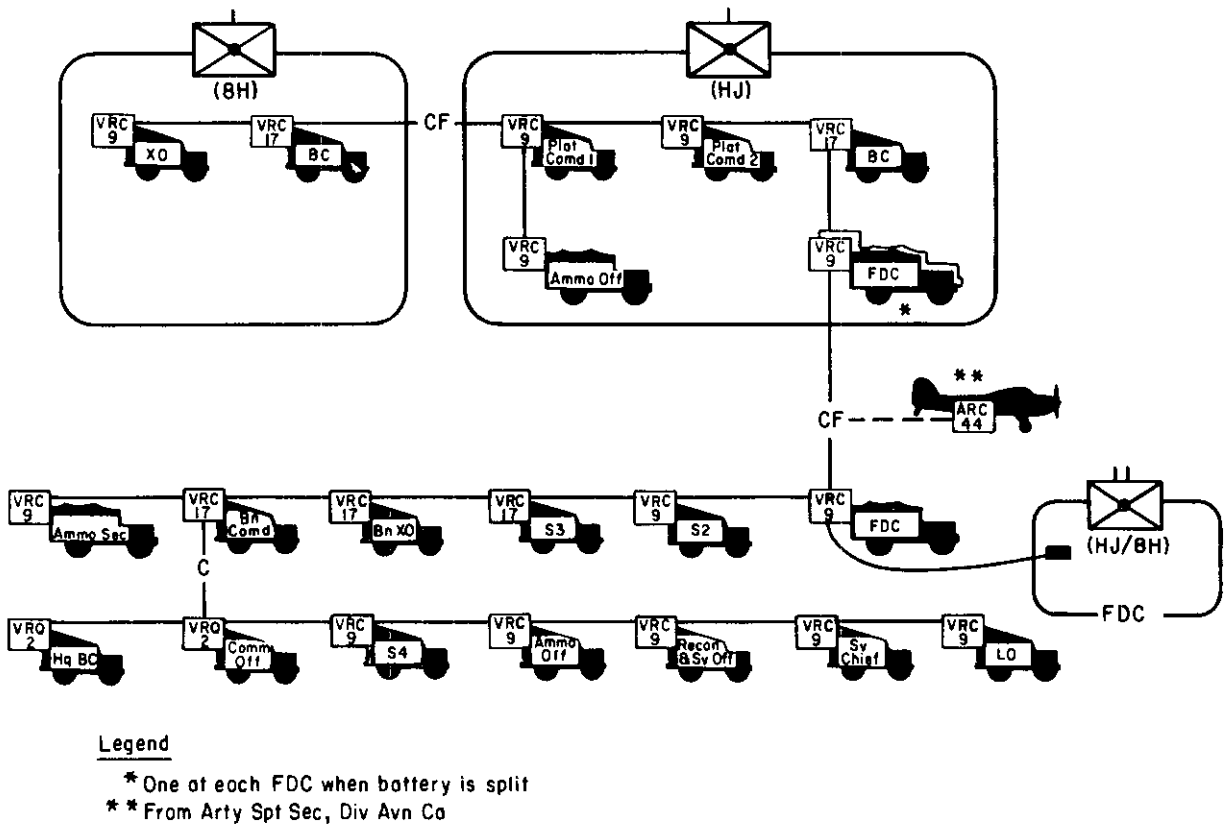


Figure 116. Type command/fire direction net, infantry division field artillery battalion, 762-mm rocket, self-propelled, and 8-inch howitzer, towed.

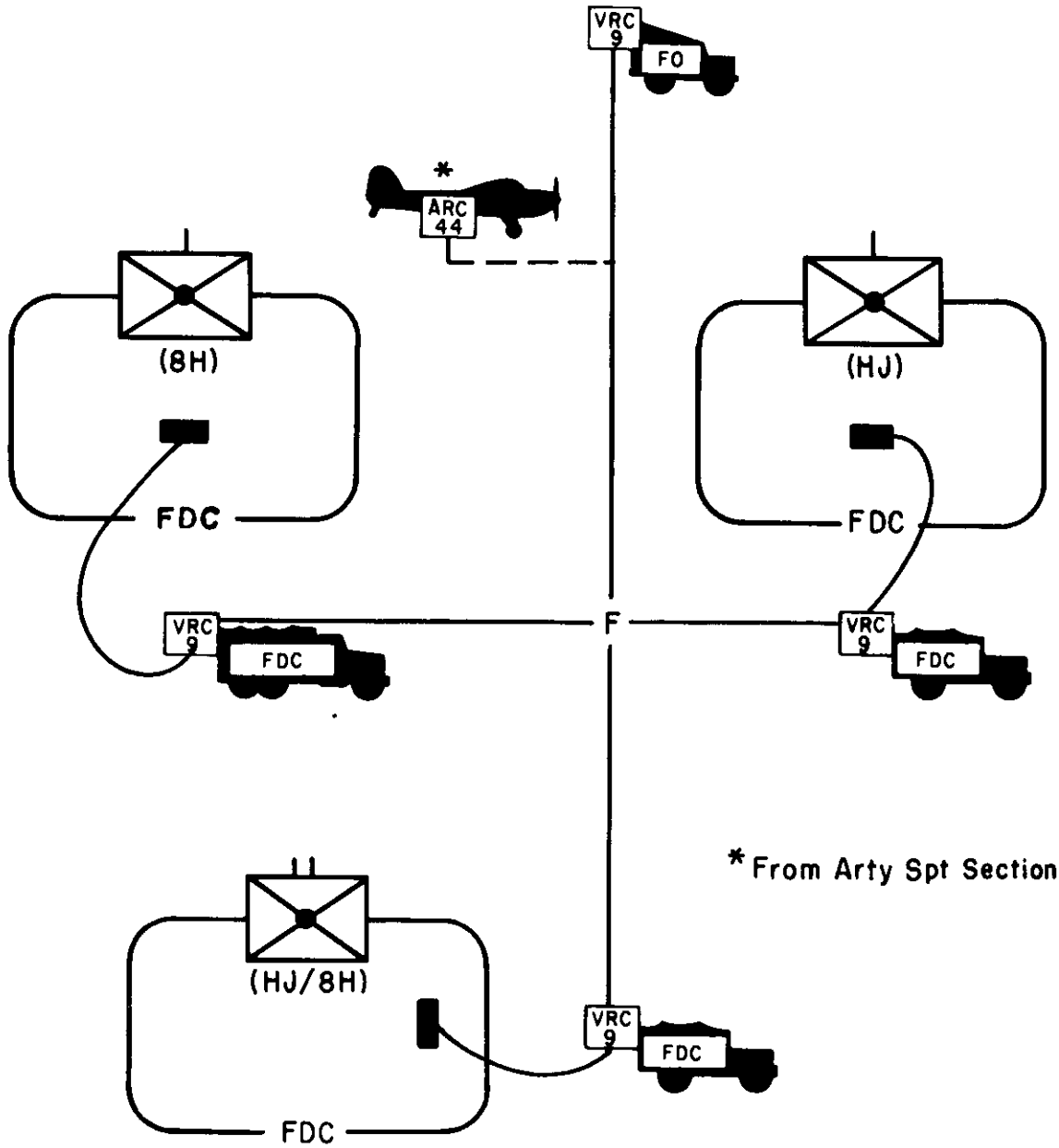
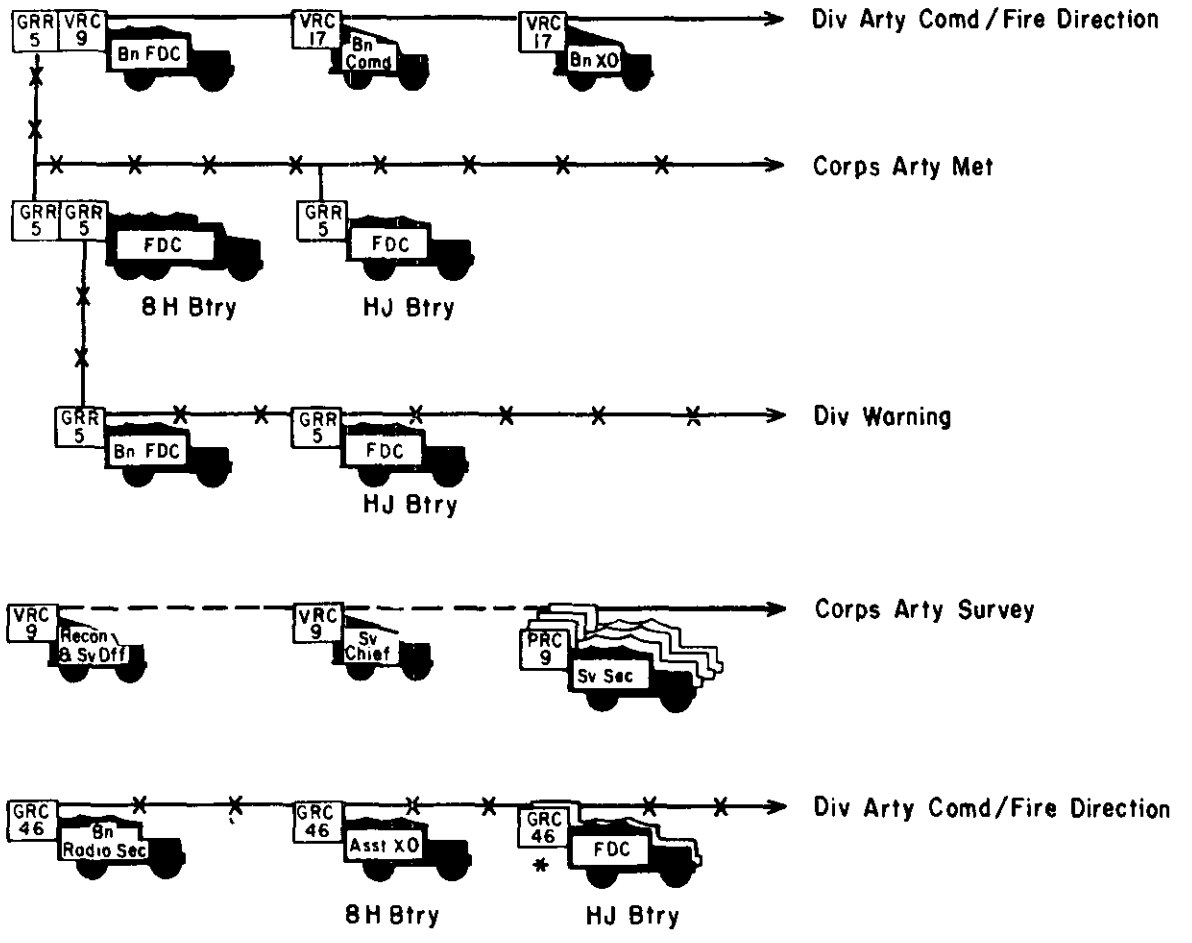


Figure 117. Type fire direction net, infantry division artillery battalion, 762-mm rocket, self-propelled, and 8-inch howitzer, towed.



* One at each FDC when btry is split

Figure 118. Type external radio nets, infantry division artillery battalion, 762-mm rocket, self-propelled and, 8-inch howitzer, towed.

Section XX. COMMUNICATION SYSTEM, ARMORED DIVISION ARTILLERY HEADQUARTERS

274. General

The division signal battalion will install and operate a division area communication system of multichannel radio relay and field cable. The connection between the division artillery switchboards and the radio relay terminal at or near division artillery is established by the division signal battalion. This radio relay system may be augmented by the installation of spiral-four cable or field wire between division headquarters and the division artillery headquarters. The organic battalions will connect into the nearest signal center by field wire in order to enter the division area communciation system. However, this system is not intended to replace the separate organic wire and radio system of the artillery. For complete details on the function of the armored division signal battalion, see FM 11-11.

275. Communication Requirements

The communication requirements of the armored division artillery are as shown in paragraph 167.

276. Wire System

Although radio may be used extensively in armored units, installation of wire should

always be initiated as soon as possible; however, the extent of the wire installation depends on the tactical situation and the time and equipment available. The division artillery wire teams will normally install lines to subordinate battalions with a direct support mission and to the field artillery missile battery if it is directly under division artillery control. Division artillery wire teams also install lines within the command post area and to the surveillance radar section either direct or through the area system. Battalions with a general support or reinforcing mission will normally be directed to install wire to division artillery. A type wire system is shown in figure 119.

277. Internal Radio Nets

The division artillery utilizes one frequency-modulated and two amplitude-modulated nets for internal command, intelligence, administration, and fire control.

a. Division Artillery Command/Fire Direction Net, FM (CF). The division artillery command/fire direction net is operated for internal command and administrative supervision of division artillery units. This net will be used for fire control as required. The division artillery commander operates in this net to control units directly under division artillery control and to communicate with his staff and subordinate battalion commanders. Initially all army

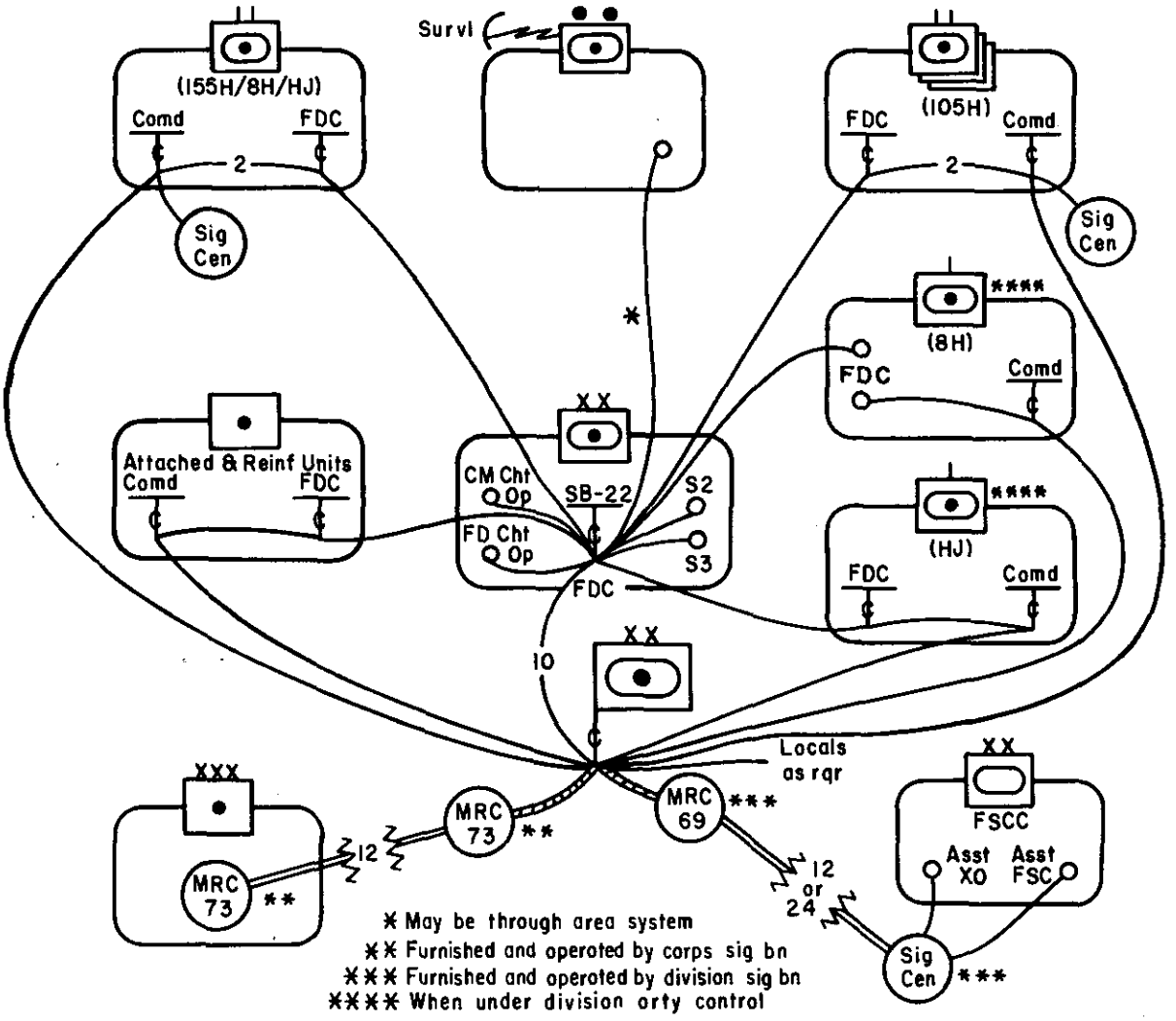


Figure 119. Type wire system, armored division artillery.

aircraft in support of division artillery operate in this net, but, when an aircraft sends in a fire mission, it will be directed to change to the appropriate battalion fire direction net. Individuals, sections, and units who may operate in this net are shown in figure 120.

b. Division Artillery Fire Direction Net, AM, RATT (F). The division artillery fire direction net will be used for transmission of fire requests from battalions to division artillery, firing data from division artillery to battalions, nuclear missions to batteries with a nuclear capability, and time-on-target missions and meteorological data. The surveillance radar section will use this net to transmit target information to division artillery. The units and section operating in this net are shown in figure 121.

c. Division Artillery Command/Intelligence Net, AM, RATT (CI). The division artillery command/intelligence net is used for transmission of command and administrative traffic and for exchange of information and intelligence. The officers, sections, and units in this net are shown in figure 121.

278. External Radio Nets

To meet its internal requirement of transmitting meteorological data and to meet its external requirements, the armored division artillery headquarters operates in external nets shown in figure 122 and discussed in *a* through *k* below.

a. Division Command Net, FM. The division command net, FM, provides a direct radio channel between the division artillery commanding general and the commanding general of the division. In addition, the division artillery fire direction center operates a full-time station in this net to handle operational traffic.

b. Division Command Net, AM, RATT. The division artillery operates in the division command net, AM, for operational communication with division headquarters.

c. Division Warning Net, AM. The division artillery operates in the division warning net to receive warnings of various types from elements of the division and to transmit the air defense warnings received over the air defense intelligence net.

d. Air Defense Intelligence Net, AM. The division artillery listens to the air defense intelligence net to receive air defense warnings for the division. Warnings received that are pertinent to the division will be retransmitted over the division warning net.

e. Corps Artillery Fire Direction Net, AM, RATT (F). The division artillery operates in

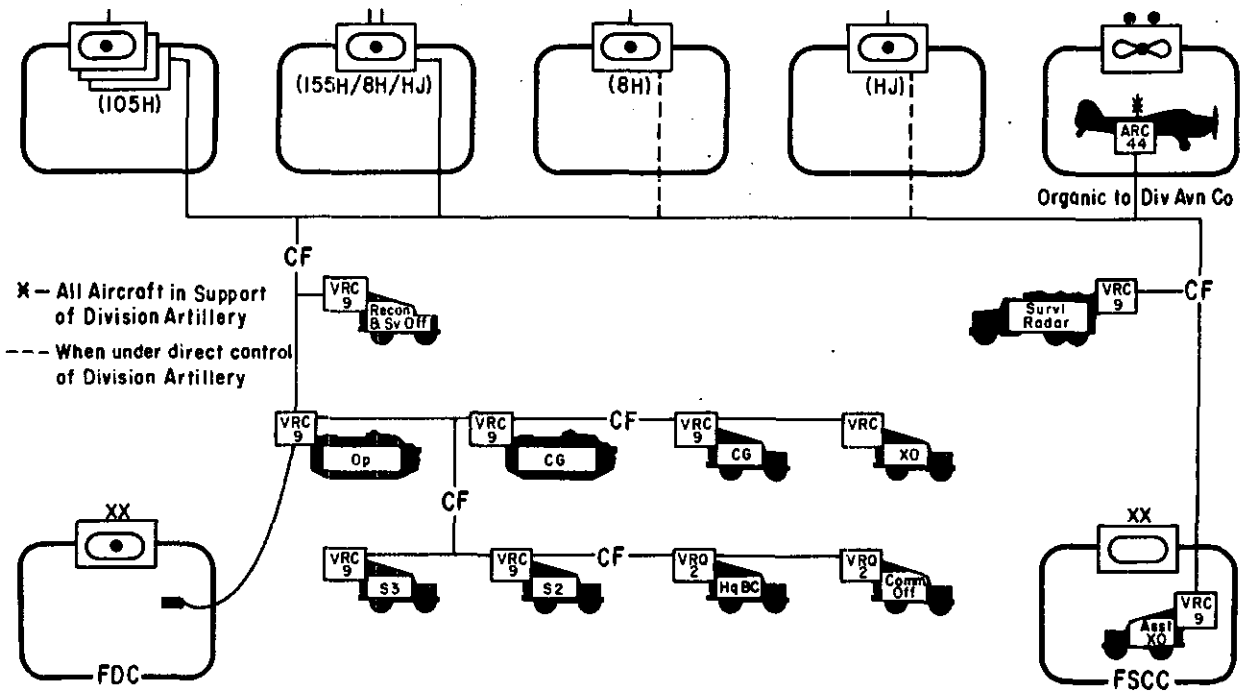


Figure 120. Type command/fire direction net, FM, armored division artillery.

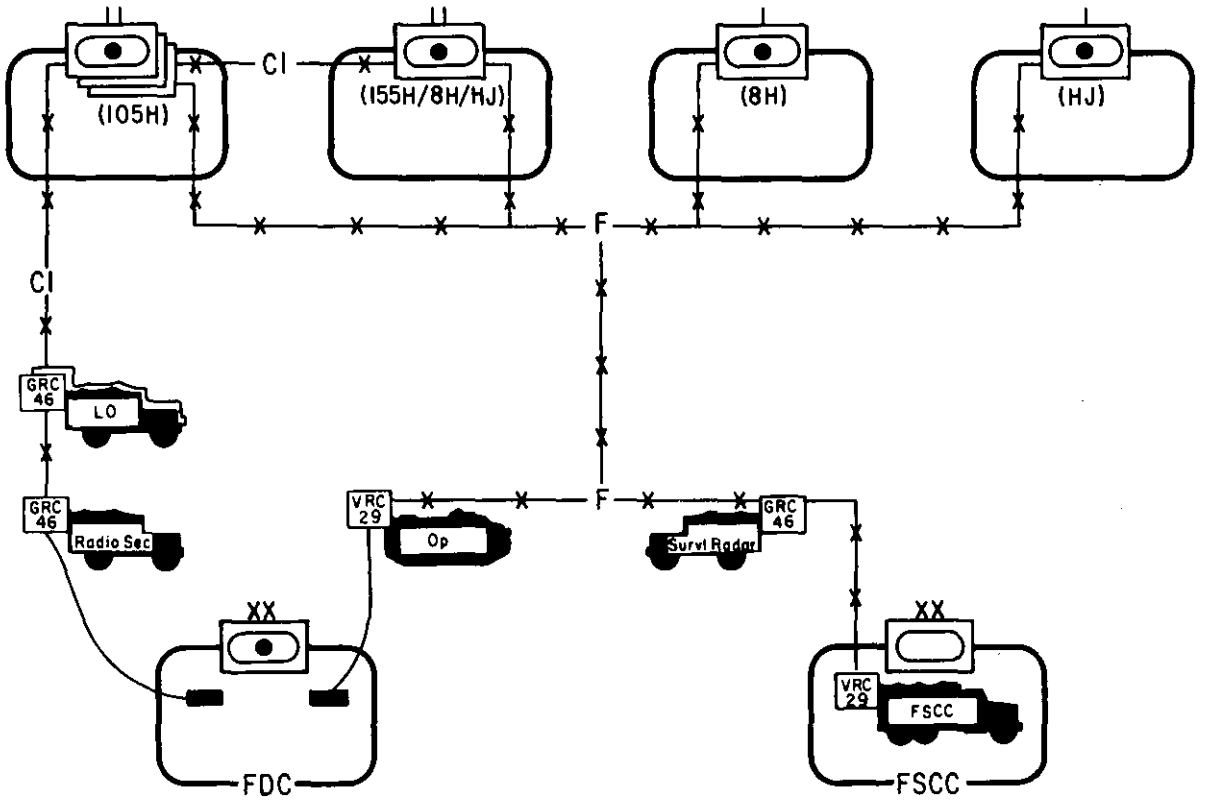


Figure 121. Type AM internal nets, armored division artillery.

the corps artillery fire direction net to request additional artillery support from corps artillery and for coordination of artillery fires.

f. Corps Artillery Meteorological Net, AM. The corps artillery meteorological net will be used by the target acquisition battalion and the division artilleries to transmit meteorological data. This data will be transmitted over this net on an established schedule.

g. Corps Artillery Survey Channel, FM (S). The corps artillery survey channel is used by artillery survey sections to facilitate survey and to effect coordination of survey with other survey elements.

h. Time Signal Net, AM. The survey information center monitors the time signal net to obtain accurate time. This information is then disseminated to all interested survey elements.

i. Tactical Air Force Tactical Air Observation Net, AM. The tactical air observation net provides communication between tactical air force reconnaissance aircraft and division artillery for surveillance of nuclear missions, for reconnaissance missions, and for adjustment of long-range artillery fires when it is not feasible to use Army aviation.

j. Tactical Air Force Control and Coordination Net, FM-AM. The control and coordination (CAC) net is used by the air liaison officer (ALO) at the division fire support coordination center to control and coordinate the activities of the forward air controllers (FAC) working with the subordinate units. This net may also be used for exchange of information between the air liaison officer and the forward air controllers. The division artillery air control team (ACT) furnishes the ALO with a vehicle, necessary FM and AM equipment, and the personnel to operate and maintain this equipment. If the FACs with subordinate units are within range of FM equipment the ALO will communicate with them, using his FM set. If the FACs are not within FM range the ALO will communicate with them, using his AM set as shown in figure 107. The radio section provides the FM-AM retransmission station.

k. Tactical Air Force Tactical Air Direction Net, AM, UHF. The air liaison officer at the

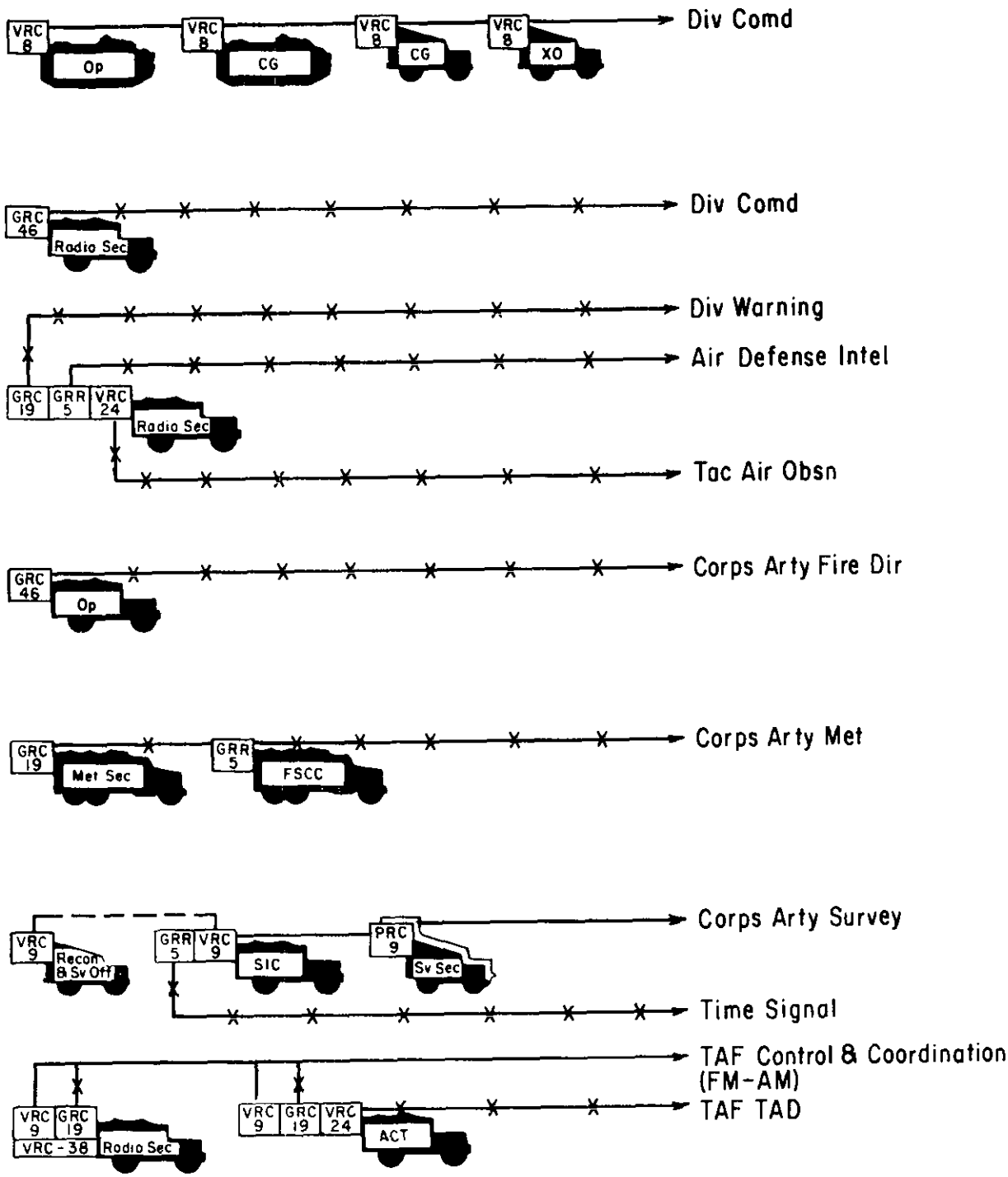


Figure 122. Type external radio nets, armored division artillery.

division fire support coordination center will operate in the tactical air direction net utilizing an AM radio set furnished him by the air control team of division artillery. This net gives the air liaison officer a radio link with high performance aircraft that may be conducting air strikes in the division area. Although the air liaison officer may not be directly involved in the conduct of the air strike, he will be able to obtain valuable information regarding targets in the division area and will have knowledge of all aircraft that are operating in the division area.

Section XXI. COMMUNICATION SYSTEM, ARMORED DIVISION ARTILLERY HOWITZER BATTALION, 105-MM, SELF-PROPELLED

279. General

The organization for combat and the employment of the supported combat command determine to a certain extent the communication system of the 105-mm battalion, self-propelled. The tactical mission assigned the battalion is also a determining factor. For example, although radio is used extensively during rapidly moving situations and during initial occupation of position, wire will be installed as soon as time and distance permit.

280. Communication Requirements

a. Internal Requirements. The internal communication requirements for the 105-mm howitzer battalion are as shown in paragraph 170*b*.

b. External Requirements. The external communication requirements for these battalions are as shown in paragraph 170*c* with the following additional requirements:

(1) Communication with supported units.
(2) Communication with close support aircraft.
(3) Facilities to request additional fire support from division artillery.

281. Wire System

a. Battalion Wire System. The extent of the battalion wire system installed depends on the tactical situation and the time and equipment available. The installation of wire should be initiated without delay. The wire teams in the battalion headquarters battery will install wire to the liaison officers with the supported task forces, to the supported combat command, and to the nearest area signal center and will install the local circuits within the command post area. The line to service battery may be direct or through the area system. Artillery liaison officers with battalion task forces are responsible for wire circuits to the battalion task force headquarters and to each forward observer with the task force. Each forward observer is responsible for wire circuits to the supported company headquarters. A type wire system for the battalion is shown in figure 123.

b. Howitzer Battery Wire System. The battery wire system must provide for internal control. Each howitzer battery is authorized one wire team; the wire team will install the wire system shown in figure 123. Normally the battery wire teams install the lines to battalion; the recorder installs a circuit from the executive officer's command post to the telephone connecting and switching group MX–155/GT; and each howitzer section installs a circuit to the MX–155/GT. The location of the executive officer cannot be specified. He will station himself to facilitate control of the battery, and a telephone may be installed to connect him to the howitzers through the MX–155/GT.

282. Internal Radio Nets

The battalion normally operates four frequency modulated (FM) radio nets to fulfill the internal communication requirements. The howitzer batteries are not authorized radio frequencies for internal control and will use battalion nets for this purpose.

a. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net is used for command and administration of the battalion. It provides a radio channel between the commander and his subordinates and to the fire direction center, the liaison sections, and the radar sections. A type command/fire direction net is shown in figure 124.

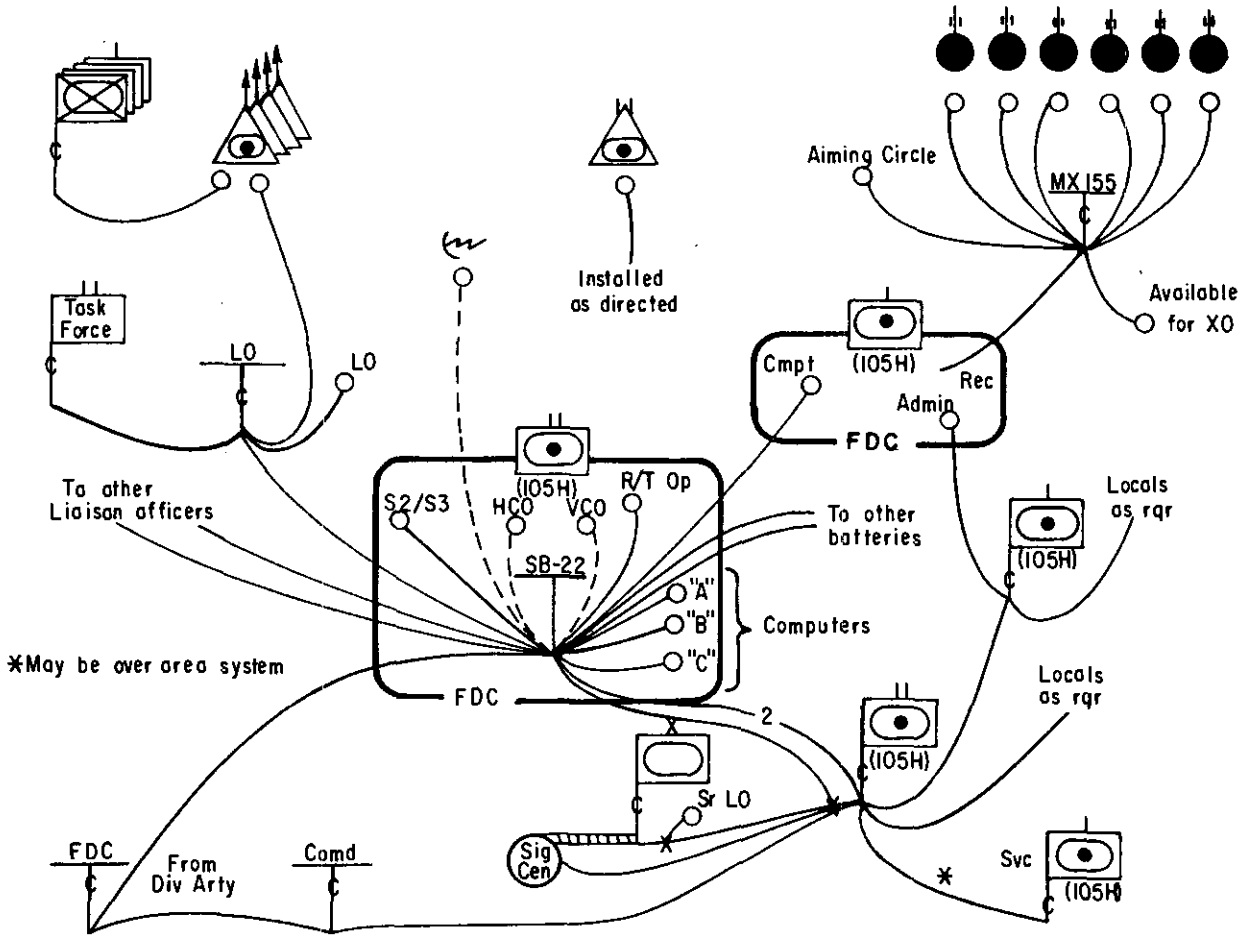


Figure 123. Type wire system, armored division artillery howitzer battalion, 105-mm, self-propelled.

b. Battalion Fire Direction Net 1, FM (F1). Battalion fire direction net 1 provides communication for initial fire requests from forward observers operating under liaison officer number 1 to battalion and from battalion to battery A. It also provides a channel for control of observers by liaison officer number 1. A type fire direction net is shown in figure 125.

c. Battalion Fire Direction Net 2, FM (F2). Battalion fire direction net 2 by liaison officer number 2, battalion fire direction center, battery B, and the forward observers operating under the control of liaison officer number 2 for the same purpose as fire direction net 1.

d. Battalion Fire Direction Net 3, FM (F3). Battalion fire direction net 3 is used by liaison officer number 3, battalion fire direction center, battery C, and the forward observers operating under the control of liaison officer number 3, for the same purpose as fire direction net 1.

283. External Radio Nets

To fulfill its external communication requirements, the battalion will operate in or listen to radio nets as discussed in *a* through *k* below and shown in figure 126.

a. Division Artillery Command/Fire Direction Net, FM (CF). The battalion commander operates in the division artillery command/fire direction net for direct communication with the division artillery commander. The battalion fire direction center operates a full-time station in this net for operational and fire direction traffic.

b. Division Artillery Command/Intelligence Net, AM, RATT (CI). The battalion headquarters operates a radio in the division artil-

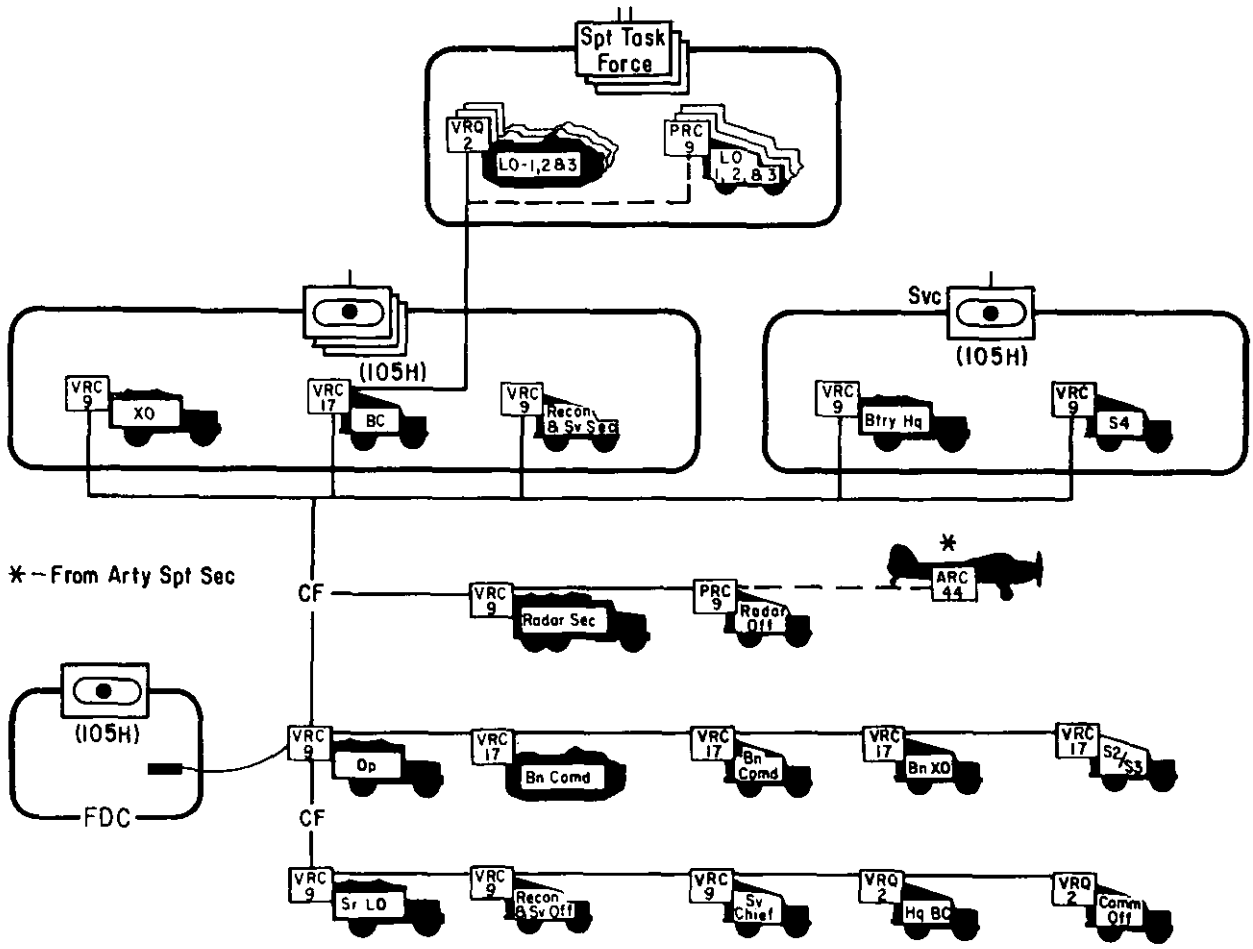


Figure 124. Type command/fire direction net, FM, armored division artillery howitzer battalion, 105-mm, self-propelled.

lery command/intelligence net to receive tactical orders and intelligence and to exchange information.

c. Division Artillery Fire Direction Net, AM, RATT (F). The battalion headquarters operates a radio in the division artillery fire direction net to request additional fire support and to receive fire missions and meteorological data from division artillery.

d. Division Warning Net, AM. The battalion headquarters and each battery monitor the division warning net to receive air defense warnings or nuclear fallout warnings of chemical or biological attack and similar information of an urgent operational nature. Pertinent information received over this net should be retransmitted to all subordinate elements over existing internal communication systems.

e. Supported Combat Command Command Net, FM. The battalion operates in the combat command command net to provide radio communication for coordination of operations and fire support with the combat command headquarters.

f. Supported Battalion Task Force Command Net, FM. The liaison officer with each battalion task force operates a radio in the supported battalion task force command net for coordination of operations and fire support with task force headquarters.

g. Supported Company Command Net, FM. Each forward observer with a rifle company operates a radio in the supported company command net for coordination of fire support. Forward observers with a tank company are provided a tank with a radio that will operate in the tank company command net.

h. Corps Artillery Meteorological Net, AM.

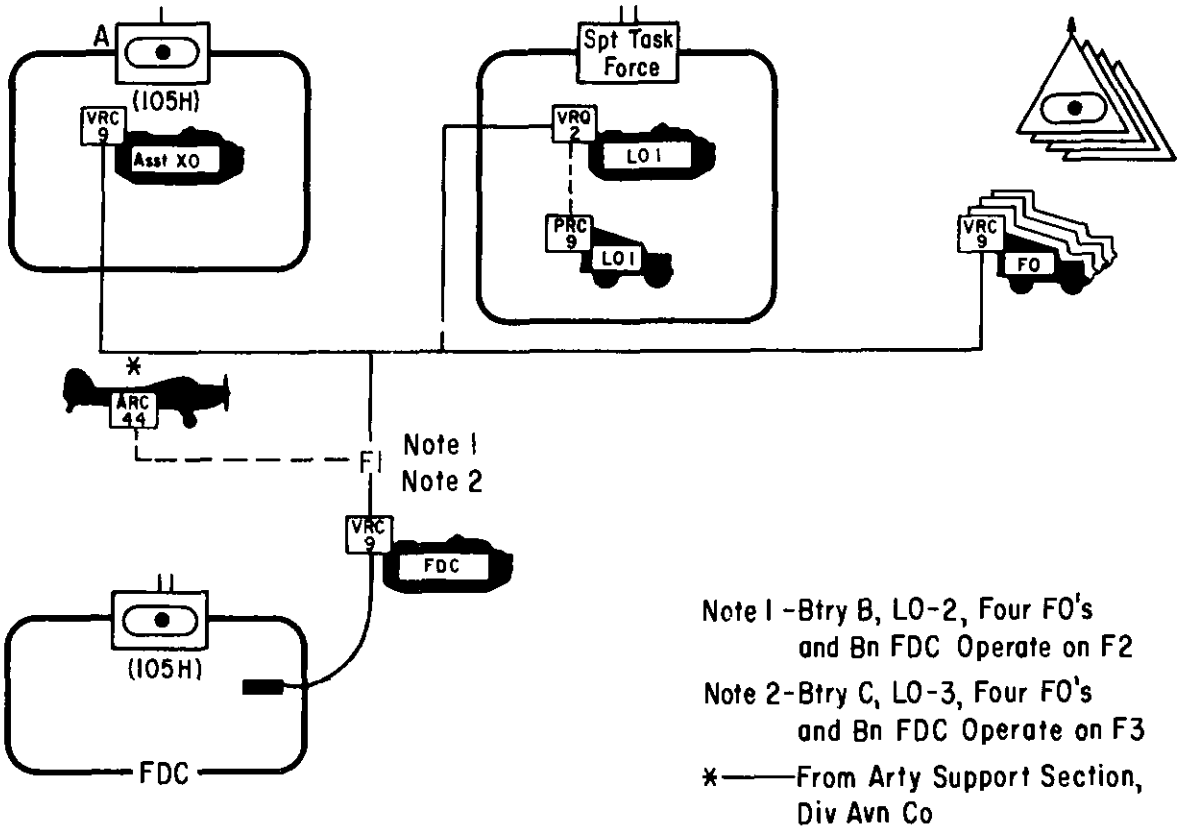


Figure 125. Type fire direction net, FM, armored division artillery howitzer battalion, 105-mm, self-propelled.

The corps artillery meteorological net will be used by the field artillery target acquisition battalion and the division artillery to transmit meteorological data. The data will be transmitted on a time-sharing schedule. The battalion fire direction center will monitor this net.

i. Corps Artillery Survey Channel, FM (S). The battalion and battery survey parties use this net for coordination of survey with other units and for internal communication.

j. Tactical Air Force Control and Coordination Net, FM. The air control team (ACT) in the headquarters battery provides a composite radio set for a forward air controller (FAC). The FAC operates one of the FM components of this set in the control and coordination net for communication with the ALO at division FSCC. When the FAC is actually directing aircraft it will be necessary for him to leave this net and utilize his radio as shown in figure 112.

k. Tactical Air Force Tactical Air Direction Net, AM, UHF. The forward air controller enters this net with the AM component of his radio for communication from ground to air while he is directing air strikes. If he is unable to observe the target from the vicinity of his vehicle, it will be necessary for him to use his portable radio set and, by retransmission, to communicate with the aircraft as shown in figure 112.

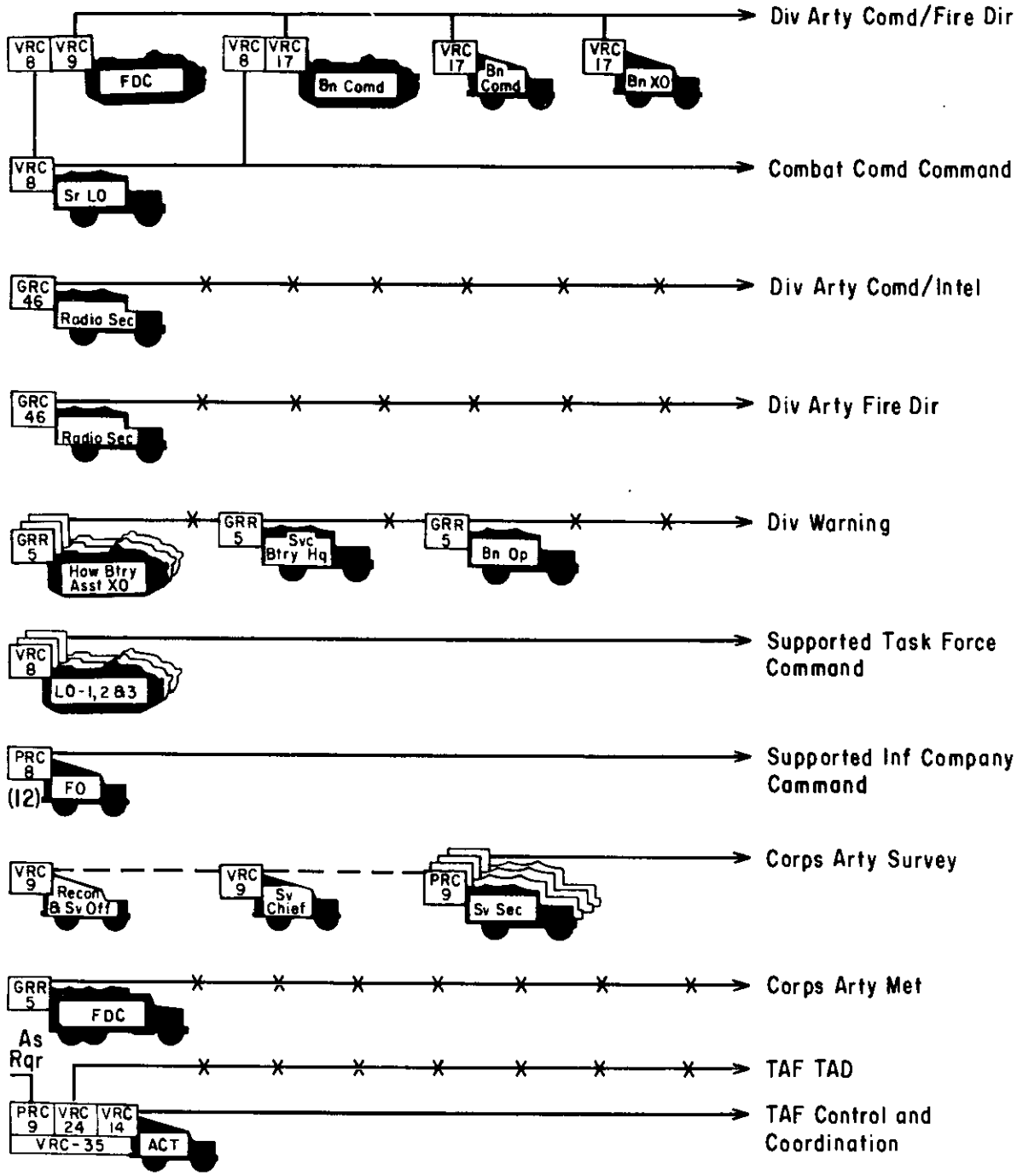


Figure 126. Type external radio nets, armored division artillery howitzer battalion, 105-mm, self-propelled.

Section XXII. COMMUNICATION SYSTEM, ARMORED DIVISION ARTILLERY BATTALION, 155-MM HOWITZER, 8-INCH HOWITZER, 762-MM ROCKET SELF-PROPELLED

284. General

The organization for combat and the tactical situation will dictate the communication system of the rocket/howitzer battalion. The artillery missile battery, 762-mm rocket and the 8-inch howitzer battery may, at times, be attached to other elements of the division artillery. In this event they will utilize the internal nets of the unit to which they are attached for internal battery control.

285. Communication Requirements

The communication requirements of the rocket/howitzer battalion are as shown in paragraph 172.

286. Wire System

The extent of the battalion wire system installed will depend on the tactical situation and the time and equipment available. The installation of wire should be initiated without delay. A type wire system for the battalion is shown in figure 127. For type wire systems for the batteries, see figures 113 and 114. The wire systems for the infantry division batteries discussed in paragraphs 263*b*, 269, and 270 are applicable to the batteries of the armored division, field artillery battalion, 155-mm howitzer, 8-inch howitzer, 762-mm rocket, self-propelled.

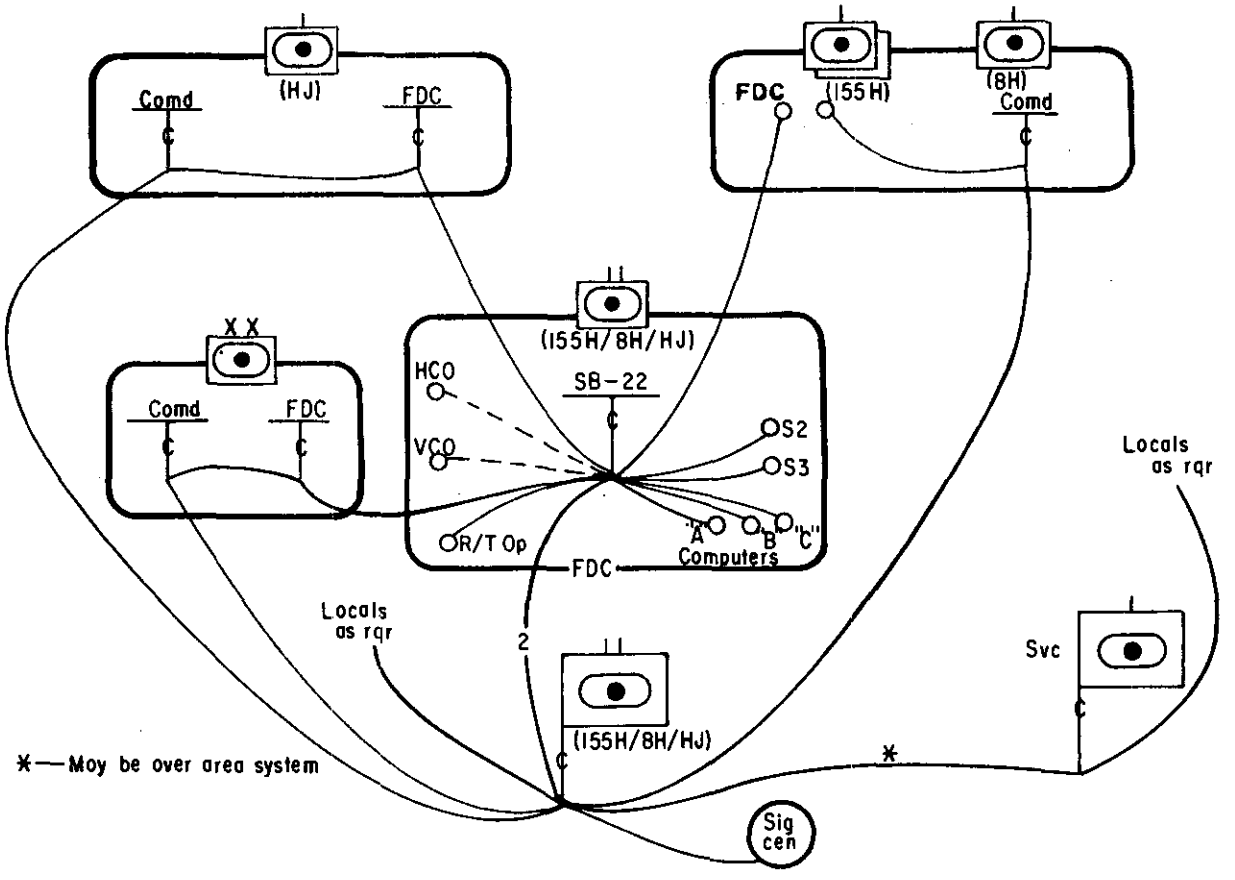


Figure 127. Type wire system, armored division artillery battalion, 155-mm, 8-inch howitzer, 762-mm rocket, self-propelled.

287. Internal Radio Nets

The rocket/howitzer battalion utilizes two frequency-modulated (FM) radio nets to fulfill its internal communication requirements. One net is used for a command/fire direction net and the other for a fire direction net.

a. Battalion Command/Fire Direction Net, FM (CF). The battalion command/fire direction net will be used by the battalion commander to exercise tactical and administrative control over subordinate units and for coordination between staff sections. A type battalion command/fire direction net is shown in figure 128.

b. Battalion Fire Direction Net, FM (F). The battalion fire direction net is used for transmission of fire requests from the forward observers to the battalion fire direction center. It is also used for sending firing data from the battalion fire direction center to the battery executive officer's command post or to the fire direction center, as appropriate, and to communicate with army aircraft that are adjusting artillery fire. A type fire direction net is shown in figure 129.

288. External Radio Nets

To fulfill its external communication requirements, the rocket/howitzer battalion will operate in, or listen to, radio nets as shown in figure 130 and discussed in *a* through *f* below.

a. Division Artillery Command/Fire Direction Net, FM (CF). The battalion commander operates in the division artillery command/fire direction net for direct communication with the division artillery commander. In addition, the battalion fire direction center operates a full-time station in this net for operational and fire direction traffic.

b. Division Artillery Command/Intelligence Net, AM, RATT (CI). The battalion headquarters operates a radio in the division artillery command/intelligence net to receive tactical

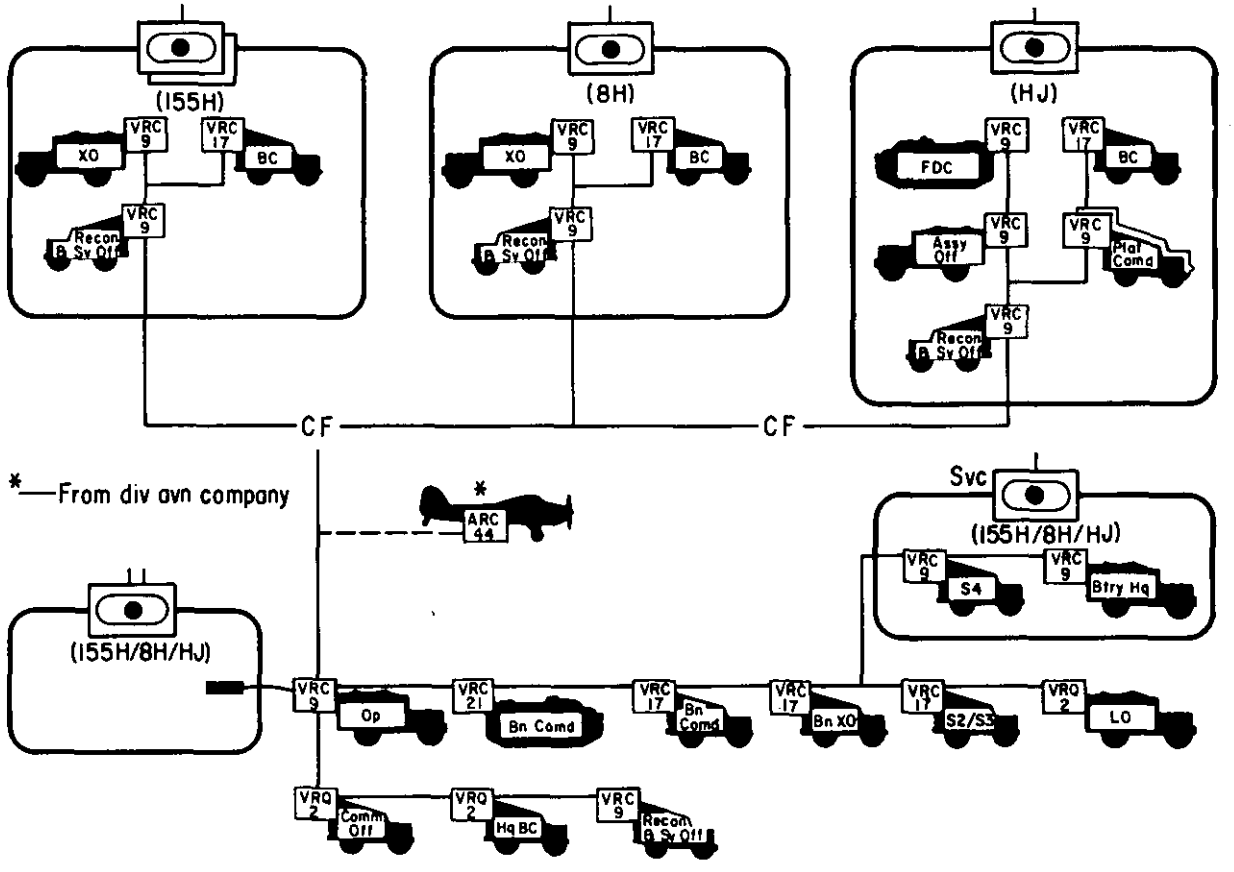


Figure 128. Type command/fire direction net, armored division artillery battalion, 155-mm howitzer, 8-inch howitzer, 762-mm rocket, self-propelled.

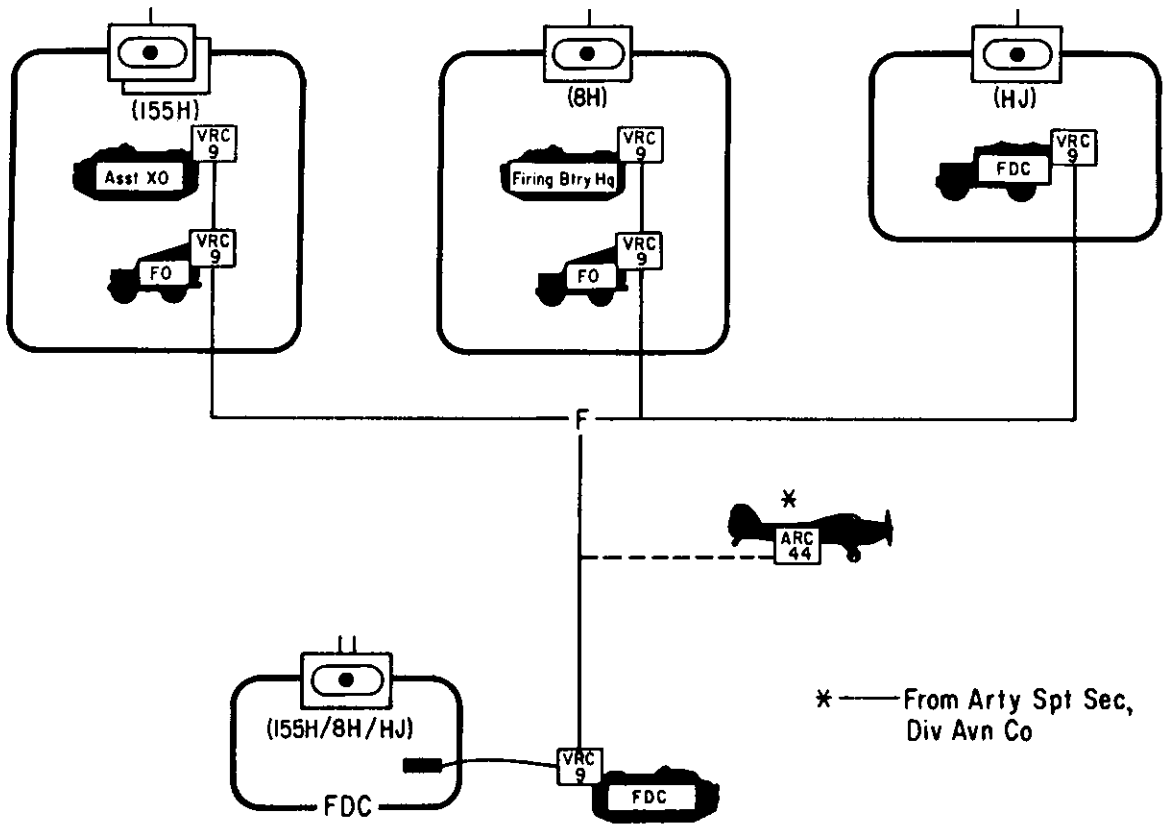


Figure 129. Type fire direction net, armored division artillery battalion, 155-mm howitzer, 8-inch howitzer, 762-mm rocket, self-propelled.

orders, and intelligence and to exchange information.

c. Division Artillery Fire Direction Net, AM, RATT (F). The battalion headquarters and the batteries with a nuclear capability operate a radio in the division artillery fire direction net to receive fire missions and meteorological data from division artillery.

d. Division Warning Net, AM. The battalion headquarters and each battery monitor this net to receive air defense and nuclear fallout warnings, warnings of chemical or biological attack, and similar information of an urgent operational nature. Pertinent information received over this net should be retransmitted to all subordinate elements over existing internal communication systems.

e. Corps Artillery Meteorological Net, AM. The corps artillery meteorological net will be used by the field artillery target acquisition battalion and the division artillery to transmit meteorological data. The data will be transmitted on a time-sharing schedule. The battalion fire direction center and the batteries with a nuclear capability will monitor this net.

f. Corps Artillery Survey Channel, FM (S). The battalion and battery survey parties use this net for coordination of survey with other units and for internal communication.

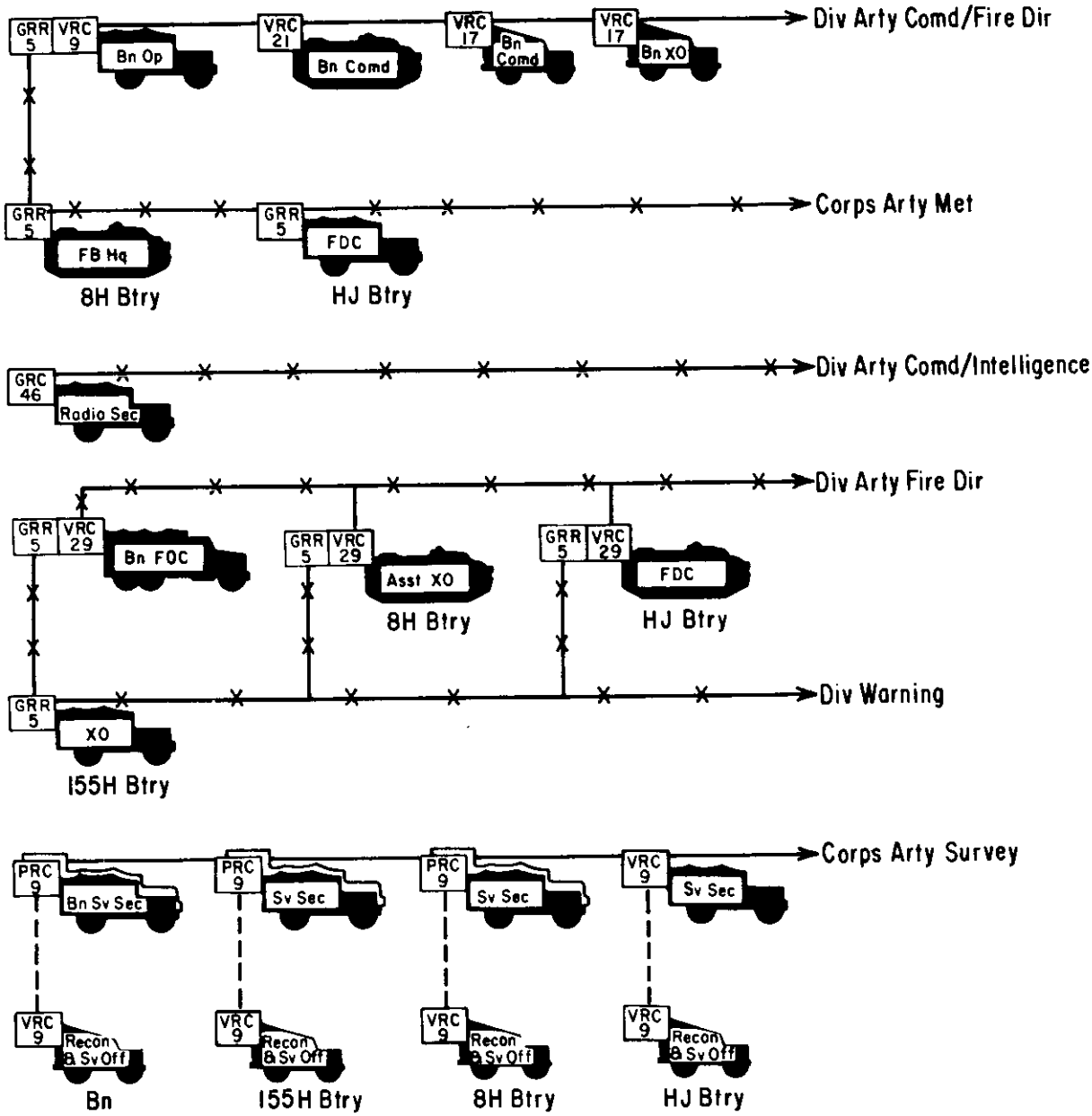


Figure 130. Type external radio net, armored division artillery battalion, 155-mm howitzer, 8-inch howitzer, 762-mm rocket, self-propelled.

Section XXIII. COMMUNICATION SYSTEM, AIRBORNE DIVISION ARTILLERY HEADQUARTERS

289. General

During the assault phase of an airborne operation, the howitzer batteries may be attached to battle groups. As soon as communication is established, units will normally be brought under control of division artillery. Although radio may be used initially, wire circuits should be installed as soon as possible. For complete details concerning the tactical employment of the airborne division artillery, see FM 57-30.

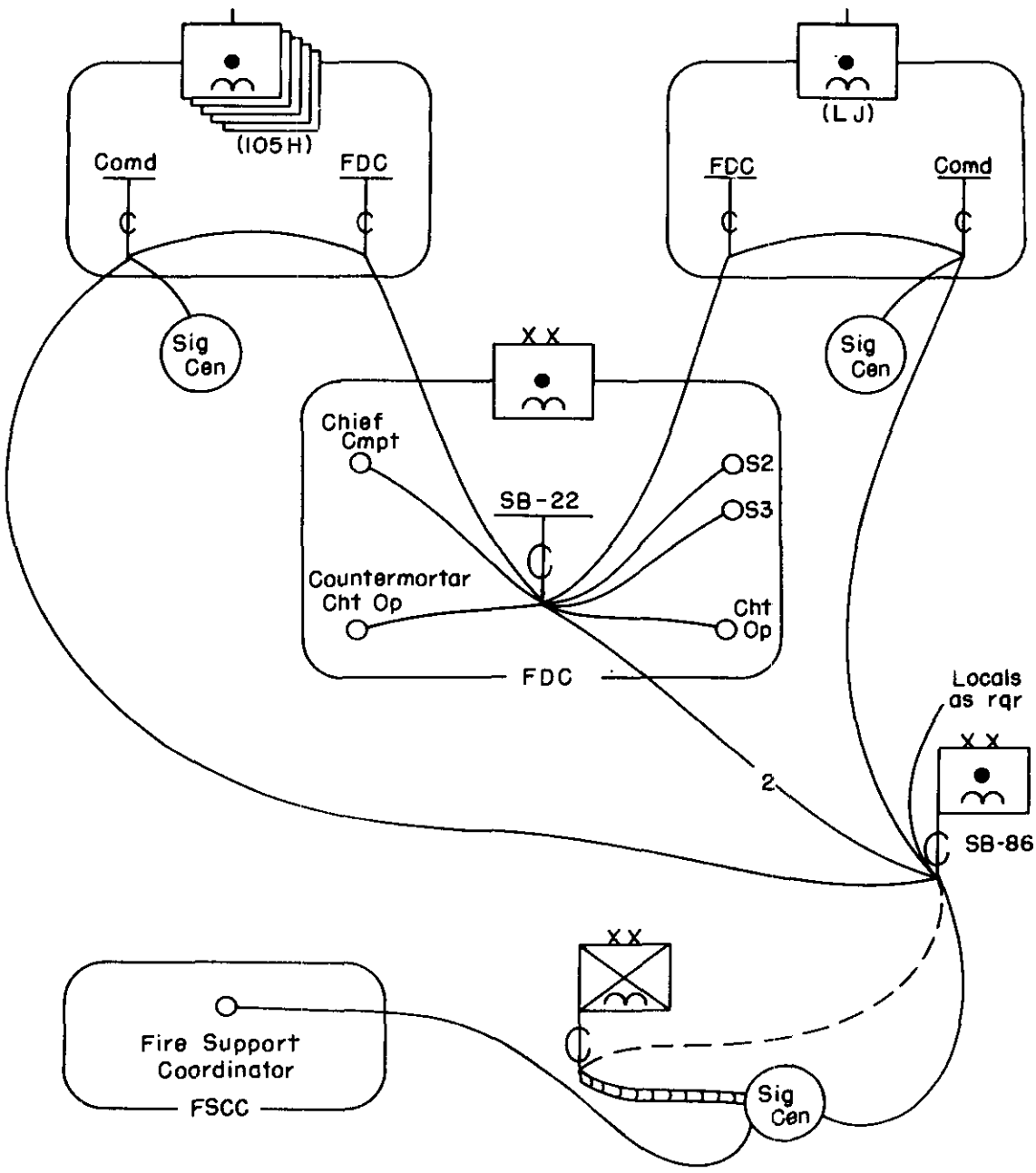


Figure 131. Type wire system, airborne division artillery.

290. Comunication Requirements

a. Internal Requirements. The internal communication requirements of the airborne division artillery are as shown in paragraph 167.

b. External Requirements. The external requirements are as shown in paragraph 167 with the deletion of the requirement for coordinating fires with corps artillery and requesting additional fires from corps artillery. This requirement is replaced with the requirement for communicating with the artillery of the linkup force.

291. Wire System

a. General. If the howitzer batteries are attached to the battle groups during the assault phase, division artillery will install wire to these units and to the missile battery as soon as possible in order to facilitate centralized control of all artillery support. A type wire system for division artillery is shown in figure 131.

b. Installation of Wire. The wire section in the headquarters battery is authorized three wire teams. However, since this authorization is insufficient to provide the installation of lines to all subordinate units simultaneously, priorities must be established. First priority is given to fire direction circuits to the howitzer batteries with a direct support mission and to the missile battery. Howitzer batteries with a general support or reinforcing mission may be directed to install lines to division artillery. The switchboard operators under the supervision of the communication chief, may install local lines in the command post area. The division signal battalion will normally install the circuits necessary to connect division artillery headquarters into the area system and to division headquarters. For a detailed discussion of the division signal battalion, see FM 11–57.

292. Internal Radio Nets

To meet its internal requirements, the airborne division artillery requires three internal nets.

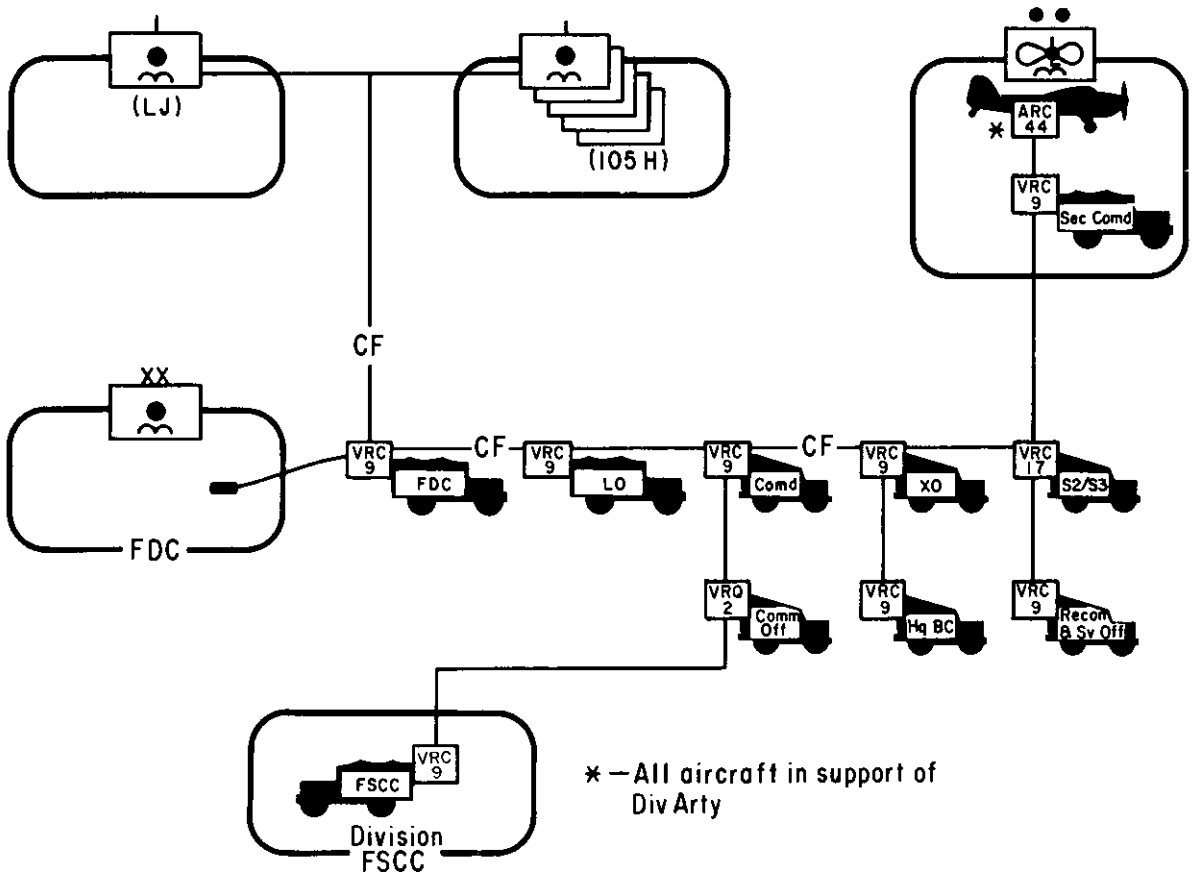


Figure 132. Type command/fire direction net, FM, airborne division artillery.

a. Command/Fire Direction Net, FM (CF). The command/fire direction net, FM, is used for the internal control of division artillery. It can be used for fire direction, to issue tactical and administrative orders to subordinate units of the division artillery, to collect battlefield information from the howitzer batteries, and to disseminate intelligence to the batteries. A type command/fire direction net is shown in figure 132.

b. Division Artillery Fire Direction Net 1, FM (F1). The fire direction net 1, FM, is used by division artillery headquarters and the batteries of division artillery for the receipt and adjustment of fire missions. In addition, it may be used by division artillery for the dissemination of target data and fire missions. Figure 133 shows the units, stations and individuals that may operate in this net.

c. Division Artillery Fire Direction Net 2, FM (F2). The fire direction net 2, FM, is used for receipt and adjustment of fire missions and the coordination of artillery support. It is also used for the dissemination of meteorological data. This net is available to the mortar batteries of the battle groups for requesting additional fire support. Figure 133 shows the units and stations that may operate in this net.

293. External Radio Nets

The division artillery headquarters operates in, or listens to, three FM and light AM external radio nets to fulfill the external communication requirements. In addition, the division artillery provides a considerable number of radios at the division FSCC. Stations or individuals that may operate in these nets are shown in figure 134.

a. Division CG/Command Net, FM. The division artillery commander operates in the division CG/command net for direct communication with the division commander. Also, the division artillery fire direction center operates a full-time station in this net, and the FSCC section provides a full-time station at the division FSCC.

b. Division Intelligence Net, AM. The division artillery monitors this net and transmits pertinent information and intelligence over the

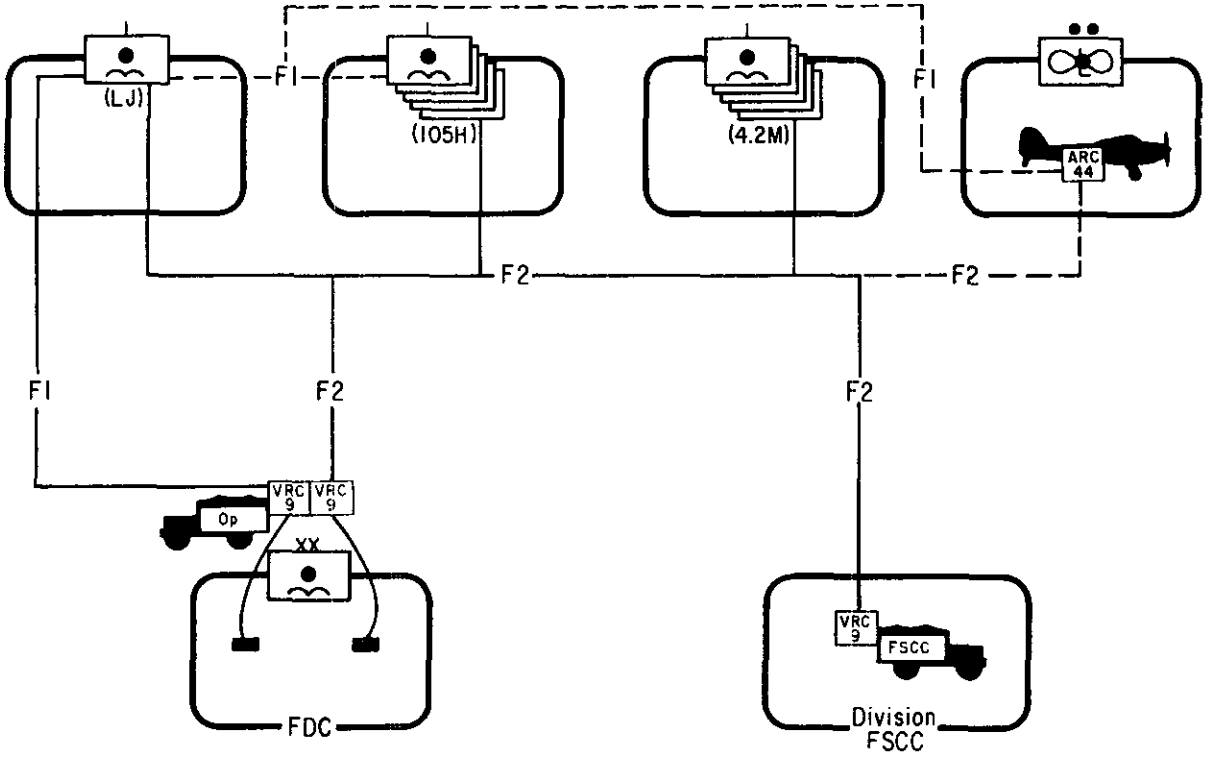


Figure 133. Type fire direction nets, FM, airborne division artillery.

internal communication system of division artillery.

c. Division Command Net Number 1, AM. The division artillery headquarters provides a radio teletypewriter set at the division FSCC to operate in this net.

d. Division Assault Net, FM. This net is used during the assault phase of an airborne operation. The division artillery operates a radio in this net at the FSCC to receive information necessary for fire planning.

e. Division Air Request Net, FM. The division artillery provides a radio at the division FSCC to operate in this net.

f. Artillery Linkup Net, AM, RATT. The artillery linkup net, AM, provides a radio teletypewriter link with the liaison officer at the artillery headquarters of the linkup force. It is used to coordinate artillery support between the airhead and linkup force artillery. It is also used for the adjustment of fire coordination lines between the two closing forces.

g. Corps Artillery Survey Channel, FM (S). The corps artillery survey channel is used by the division artillery headquarters and by the artillery battery survey sections to facilitate survey and coordination with other artillery survey elements. Because of the limited range of the radio sets employed on this channel, it is neither intended nor feasible for this to be a coordinated net; however, this net does provide communication within and between all survey sections in the division artillery.

h. Time Signal Net, AM. Normally one broadcasting station in each theater will be designated to broadcast time signals to the entire theater of operations using the time signal net. The time signal is used in conjunction with astronomic observations by survey personnel.

i. Spot Report Receiver System, AM, UHF. The division artillery provides a radio set at the FSCC to operate the spot report receiver system.

j. Tactical Air Force Control and Coordination Net, FM. The control and coordination (CAC) net, FM, is used by the air liaison officer at the division fire support coordination center to control and coordinate the activities of the forward air controllers working with subordinate units. This net may also be used for an exchange of information between the air liaison officer and the forward air controllers. The division artillery headquarters battery has three air control teams. Two of these teams provide personnel and equipment for forward air controllers (FAC) to be used as required. The third ACT provides personnel and equipment for the air liaison officer at division FSCC. In addition two vehicles equipped with FM-AM repeater sets are assigned to the radio section. These two repeater sets are used by the ALO as necessary to extend the range of this equipment. Figure 135 shows a method of employing the ALO radio and the repeater sets.

k. Tactical Air Force Tactical Air Direction Net, AM. The air liaison officer at the division fire support coordination center (FSCC) will operate in the tactical air direction net, AM, utilizing the amplitude-modulated component of a radio set provided him by division artillery. This net gives the air liaison officer radio communication with high performance aircraft that may be conducting air strikes in the division area. Although the air liaison officer may not be directly involved in the conduct of the air strike, he may be able to obtain valuable information regarding targets in the division area.

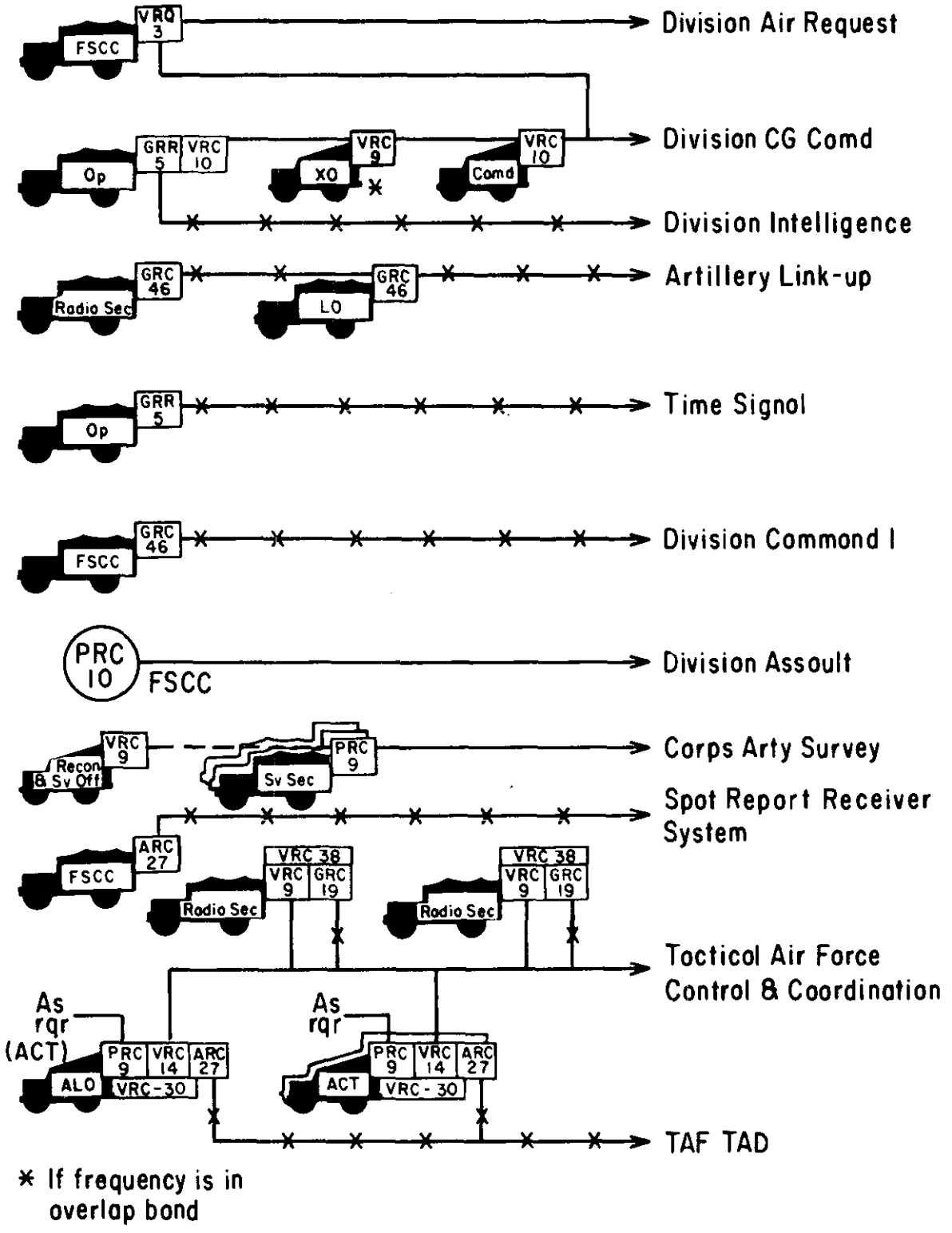


Figure 134. Type external radio nets, airborne division artillery.

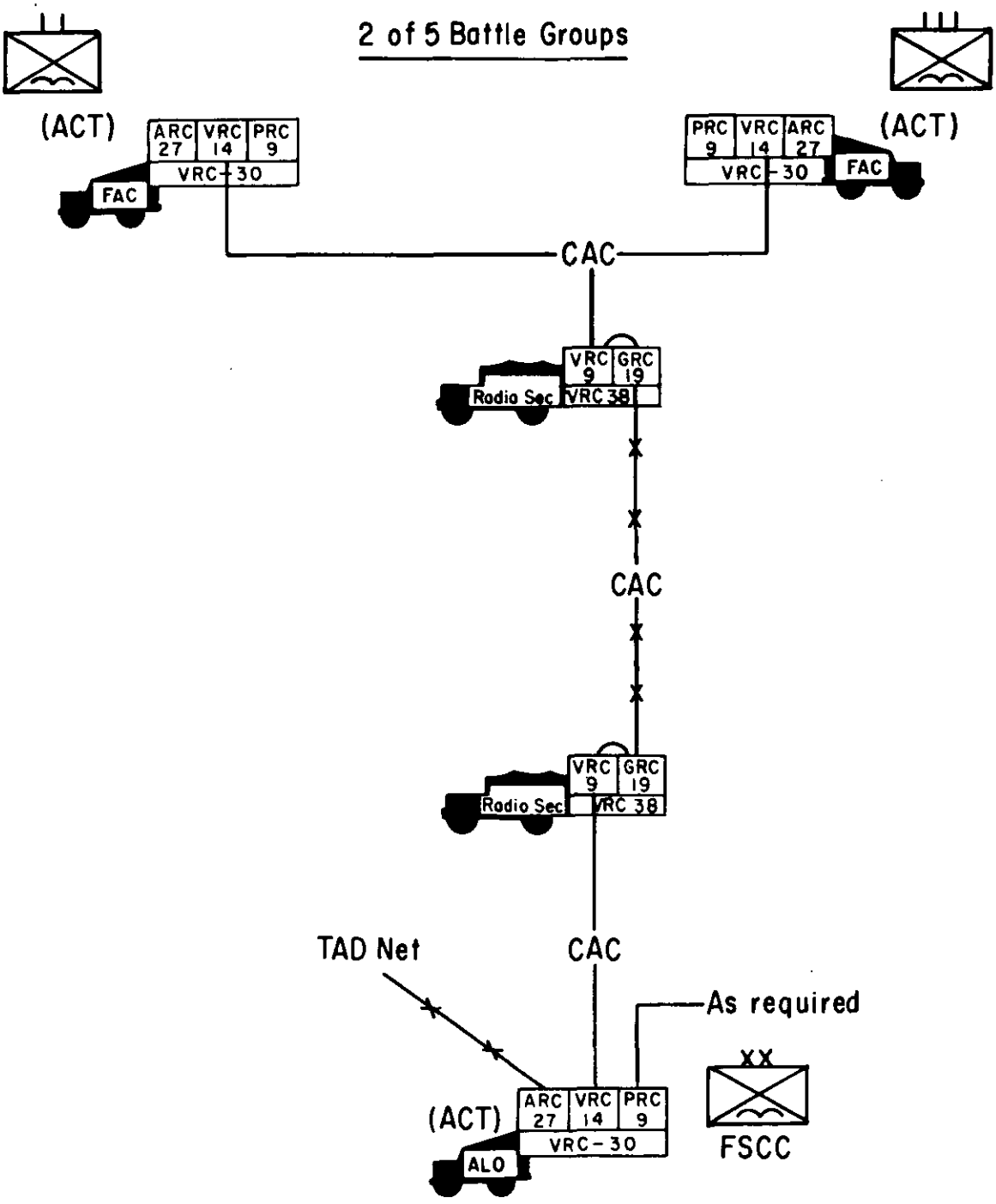


Figure 135. A method of employing radio equipment by air liaison officer, airborne division.

Section XXIV. COMMUNICATION SYSTEM, AIRBORNE DIVISION ARTILLERY HOWITZER BATTERY, 105-MM

294. Communication Requirements

The communication requirements for the batteries are as shown in paragraph 170.

295. Wire System

a. General. The extent of the battery wire system will depend on the tactical situation and the length of time the unit remains in position. To add flexibility to the system the battery normally installs separate command and fire direction. A type battery wire system is shown in figure 136.

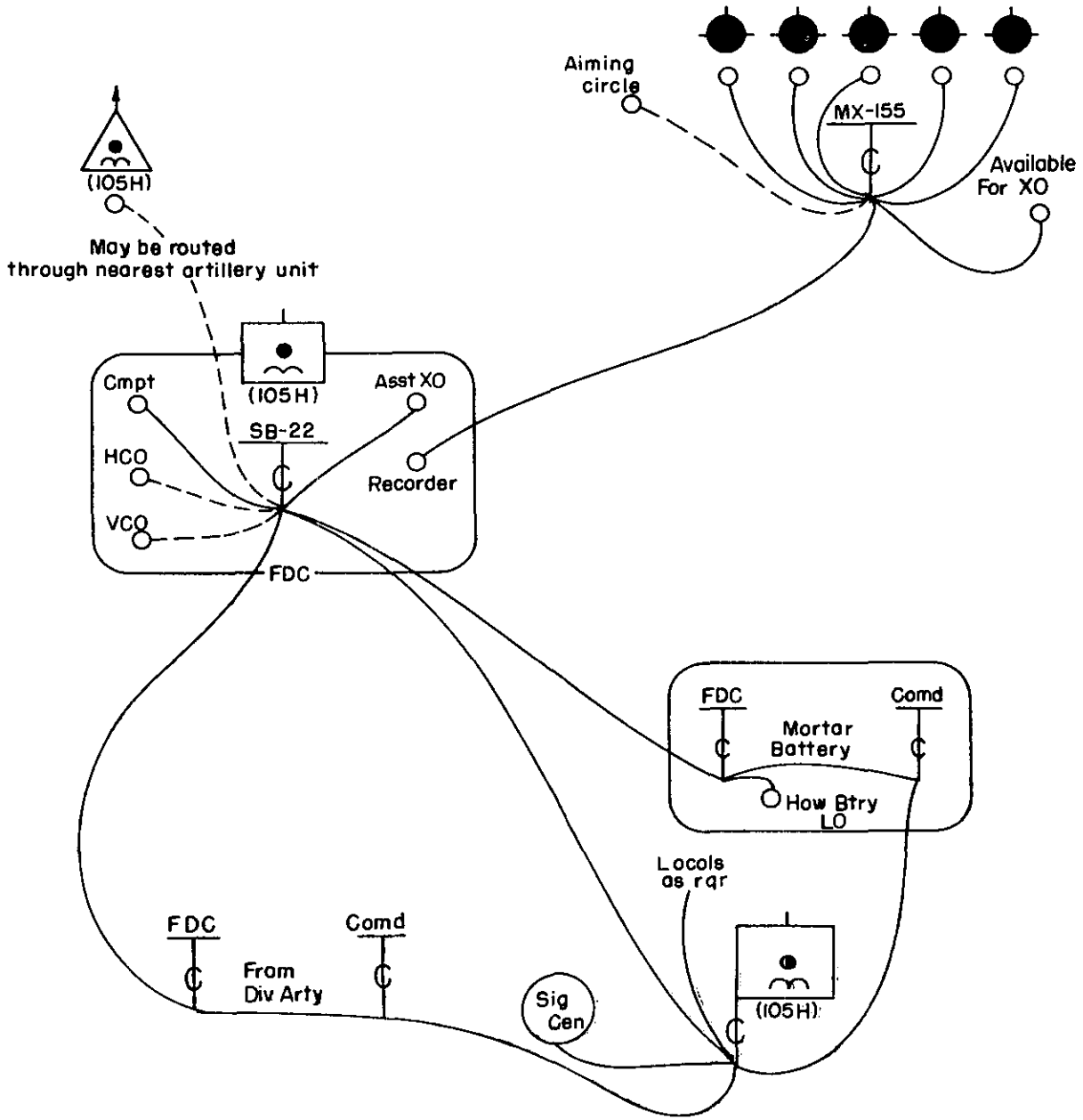


Figure 136. Type wire system, airborne division artillery howitzer battery, 105-mm (reinforcing mortar battery).

b. Installation of Wire Circuits. The 105-mm howitzer battery is authorized two wire teams. Batteries with a reinforcing mission will establish a fire direction line to the reinforced mortar battery as soon as possible after arriving in the drop zone. As time permits, a command line is installed as a back up for the other line. Units with a general support mission will normally be directed to install wire to division artillery headquarters, since this headquarters has insufficient organic wire teams to provide wire circuits to all subordinate units. The battery will also install a circuit to the nearest signal center as time and distance permit.

296. Radio Nets

Each howitzer battery operates one internal net and operates in or monitors the external nets necessary to accomplish its mission. Type radio nets for the battery are shown in figure 137.

a. Internal Radio Net—Battery Command/Fire Direction Net, FM (CF). The battery command/fire direction net is used by the battery commander for tactical and administrative control, for collection of information and dissemination of intelligence, and for transmission of firing data.

b. External Radio Nets. The battery operates in the following external nets:

(1) *Division artillery command/fire direction net, FM (CF).* The battery commander operates in this net for direct communication with the division artillery commander. In addition, the battery fire direction center operates a full-time station in this net for exchange of information and intelligence with division artillery and the other batteries.

(2) *Division artillery fire direction net 1, FM (F1).* If the battery has a general support mission it will operate a radio set in the division artillery fire direction net 1 to receive fire missions from division artillery. When the battery has a reinforcing mission, it does not operate in this net.

(3) *Division artillery fire direction net 2, FM (F2).* The battery operates in the division artillery fire direction net 2 to receive fire missions and meteorological data to transmit fire requests to division artillery.

(4) *Mortar battery fire direction net, FM (F).* When a howitzer battery is rein-

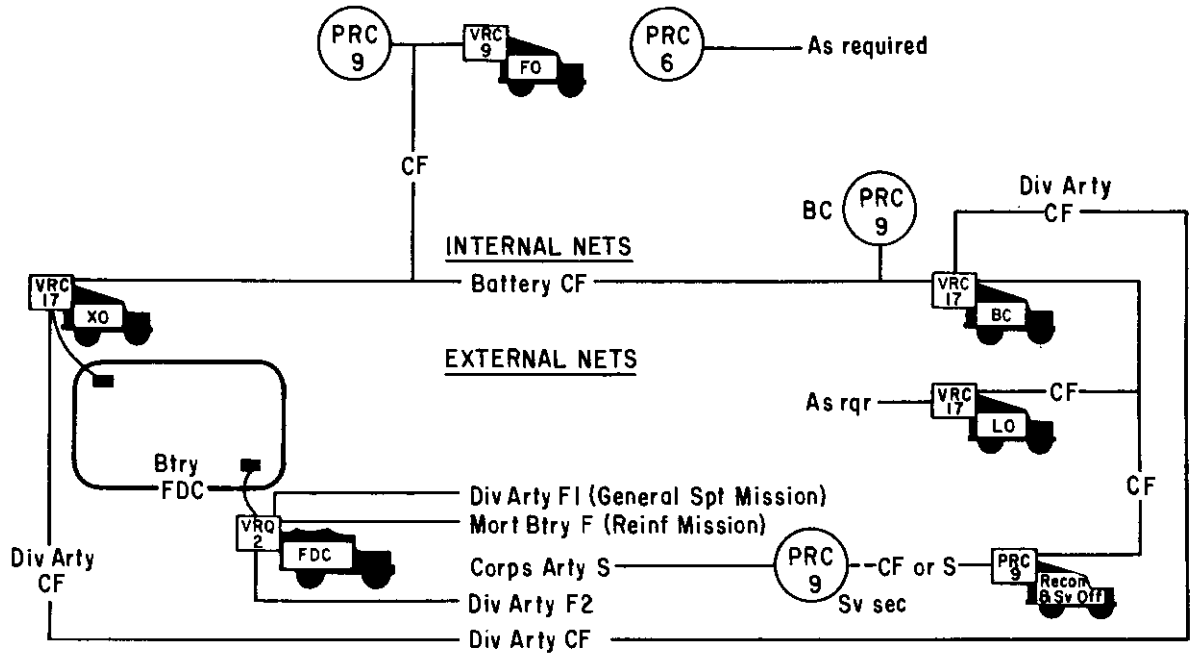


Figure 137. Type radio nets, airborne division artillery howitzer battery, 105-mm.

forcing a mortar battery, the howitzer battery will operate a radio set in the mortar battery fire directon net coordination of fire support. This net will also provide the mortar forward observers with a direct channel to the howitzer battery. The forward observers (FO) will normally send their initial fire request to the mortar battery fire direction center (FDC); however, if the howitzer battery is to fire the mission, the FO will be directed to send his mission directly to the howitzer battery fire direction center.

(5) *Corps artillery survey channel, FM (S).* The battery survey section will operate in this net for coordination of survey with other units and for internal communication.

Section XXV. COMMUNICATION SYSTEM, AIRBORNE DIVISION ARTILLERY MISSILE BATTERY, LITTLE JOHN ROCKET

297. General

a. The battery communication system employed by the Little John rocket battery of the airborne division is similar to the communication system of a small battalion.

b. The unit will rely on radio communication during the assault phase of an airborne operation, but wire should be installed to all firing positions as soon as possible.

298. Communication Requirements

The communication requirements for the Little John battery of the airborne division are as shown in paragraph 170 except that this unit has no requirement for collection of information.

299. Wire System

The extent of the battery wire system will depend on the deployment of the battery and the situation. Since the Little John battery has only two wire teams, priority is established for the fire direction lines to the firing positions. If the battery is required to install wire to several firing positions, it should not be directed to install lines to division artillery. To add flexibility to the system the battery installs separate command and fire direction switchboards. In addition to the circuits to the firing positions the battery installs a circuit to the nearest signal center when time and distance permit. A type battery wire system is shown in figure 138.

300. Radio Nets

The battery operates one internal net and operates in or monitors the external nets necessary to accomplish its mission. Type radio nets for the battery are shown in figure 139.

a. Internal Net—Battery Command/Fire Direction Net, FM (CF). The battery command/fire direction net is used by the battery commander for tactical and administrative control, dissemination of intelligence and transmission of firing data. In addition, the firing platoons have sufficient radio sets to establish a radio at each firing position as a backup for the wire system.

b. External Radio Nets. The battery operates in the following external nets:

(1) *Division artillery command/fire direction net, FM (CF).* The battery commander and executive officer operate in this net for direct communication with the division artillery commander. The battery fire direction center operates a full-time station in this net for operational and fire direction traffic.

(2) *Division artillery fire direction nets 1 and 2, FM (F).* The battery operates in the division artillery fire direction nets to receive fire missions from division artillery and to receive meteorological data.

(3) *Division warning net, AM.* The battery monitors the division net to receive air defense warnings and warnings of nuclear, chemical, biological, ground and airborne attacks. Information received over this net should be retransmitted over the internal communication system of the battery.

(4) *Corps artillery survey channel, FM (S).* The battery survey section will use this net for communication with survey elements of other units.

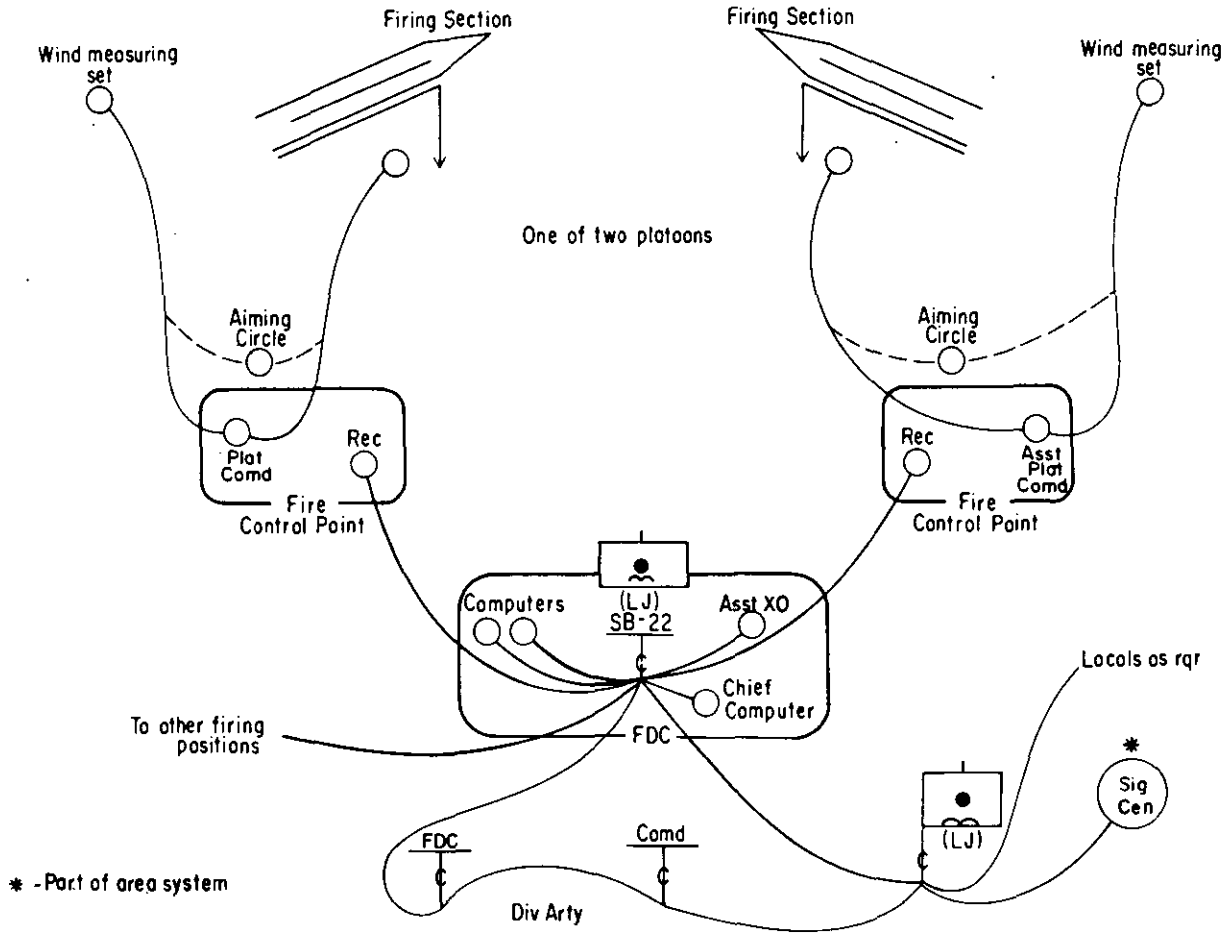


Figure 138. Type wire system, airborne division artillery missile battery, Little John rocket.

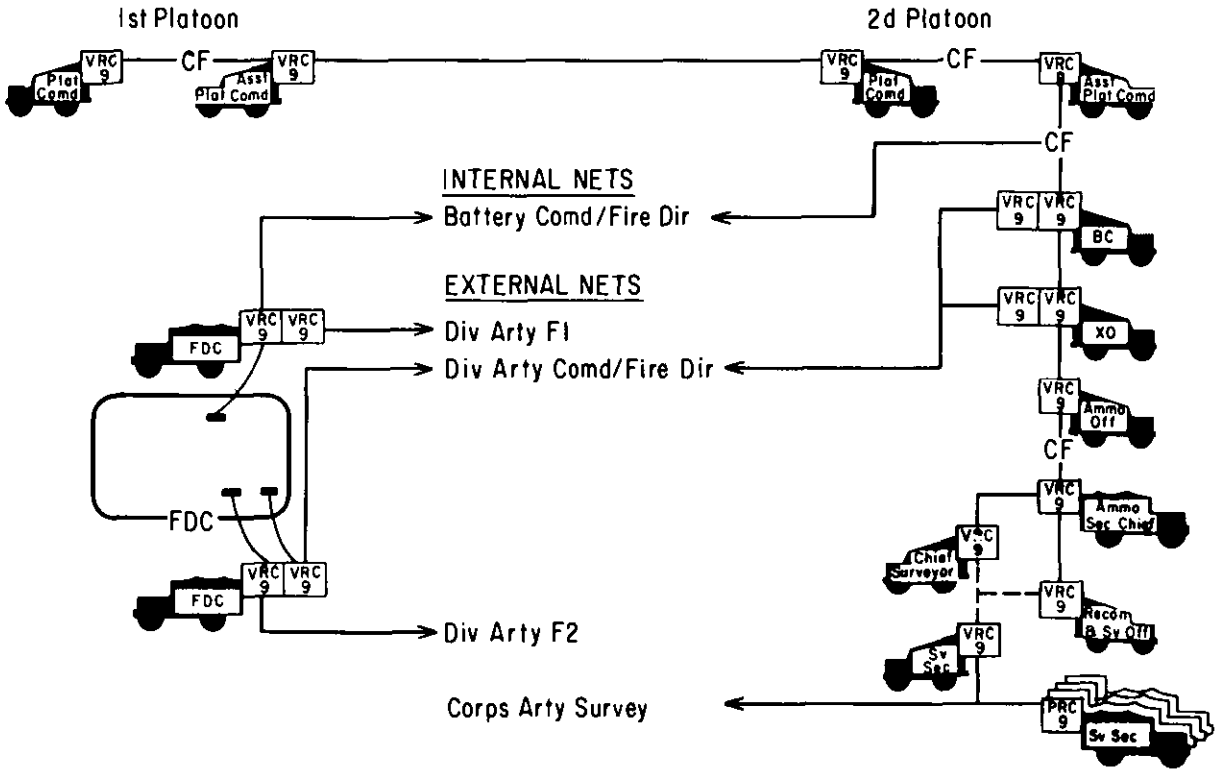


Figure 139. Type radio nets, airborne division artillery missile battery, Little John rocket.

Section XXVI. COMMUNICATION SYSTEM U.S. ARMY MISSILE COMMAND (MEDIUM)

301. General

This section will cover the communication system of the missile command headquarters. The communication system for the artillery group is discussed in section V; the artillery missile battalion, Corporal, in section IX, the artillery missile battalion, Honest John rocket, in section XI; and the artillery target acquisition battalion in section XXVIII.

302. Signal Centers

The signal company furnishes the personnel and equipment for four signal centers, that are capable of operating from 50 to 70 miles from command headquarters; one signal center is located at command headquarters; one, at each of the artillery groups; and, one at the service and support group. Radio terminal facilities will be provided from the nearest signal center for the ordnance, engineer, Corporal, and target acquisition battalions. Each signal center provides messenger service, 12-channel radio relay service, secure teletype service over at least one of the 12 channels, AM-FM integration equipment, and message center service. One of the signal centers assigned to the artillery groups is capable of becoming the alternate command center when so designated.

303. Wire System

Wire will be used for internal communication within the command post area. Radio terminal equipment will be used to establish telephone communication to major subordinate units. Each artillery group is responsible for establishing wire communication to its attached missile battalions. However, if wire is impractical due to excessive distances, the signal company (within its capabilities) may provide terminal equipment as shown in figure 140. Wire communication within the service and support group is the responsibility of the signal company. Communication within all other units is the responsibility of the unit concerned. A type

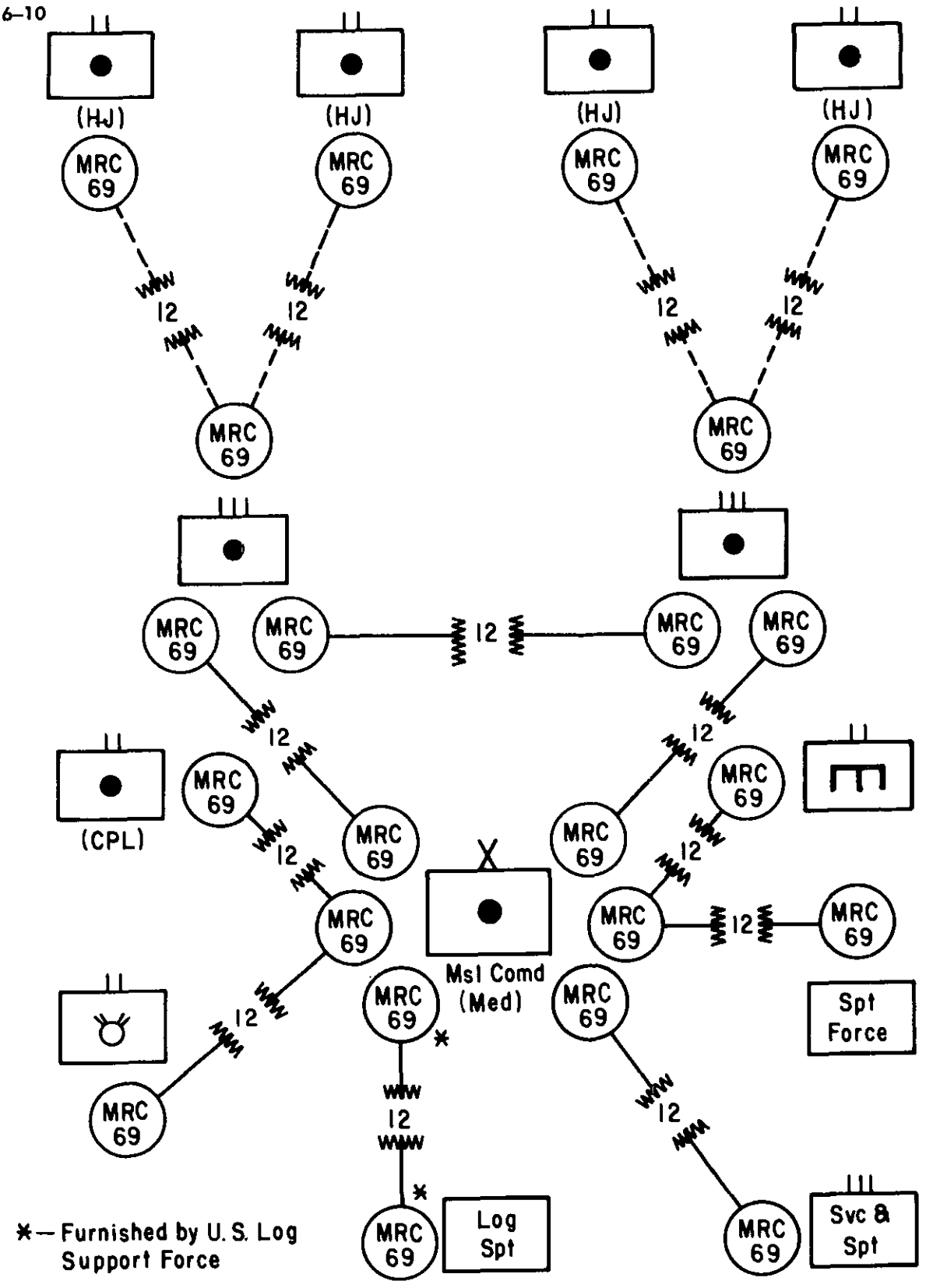


Figure 140. Type radio carrier system, U.S. Army missile command (medium).

radio carrier system for the missile command (medium) is shown in figure 140.

304. Internal Radio Nets

The missile command operates one FM net and two AM nets for internal command control. In addition, the missile command is allocated an FM frequency to be used by the artillery survey sections and an AM frequency to be used by the target acquisition battalion for transmission of meteorological data. Each detachment, company, battery, and battalion commander is authorized FM radio equipment for column control, communication with supporting aircraft, and operation in the next higher headquarters command net.

a. Missile Command Command/Operations Net, FM (CO). The missile command command/operations net provides radio communication within the command headquarters, with aircraft in flight and with subordinate units that are within the range capability of the radio equipment. A type command/operation net is shown in figure 141.

b. Missile Command Command/Intelligence Net, AM, RATT (CI). The missile command command/intelligence net is used for tactical and administrative control of subordinate units and for transmission of intelligence. This net will also be used by the drone platoons of the target acquisition batteries to transmit target information to the missile command. A type command/intelligence net is shown in figure 142.

c. Missile Command Command/Fire Direction Net, AM, RATT (CF). The missile command command/fire direction net is used for transmission of fire missions and meteorological data to subordinate artillery units. Missile battalions attached to artillery groups monitor this net to receive nuclear fire missions and operate in this net as required. A type command/fire direction net is shown in figure 143.

d. Missile Command Meteorological Net, AM (M). The missile command meteorological net is used by the meteorological sections of the artillery target acquisition batteries for transmission of meteorological data to the artillery

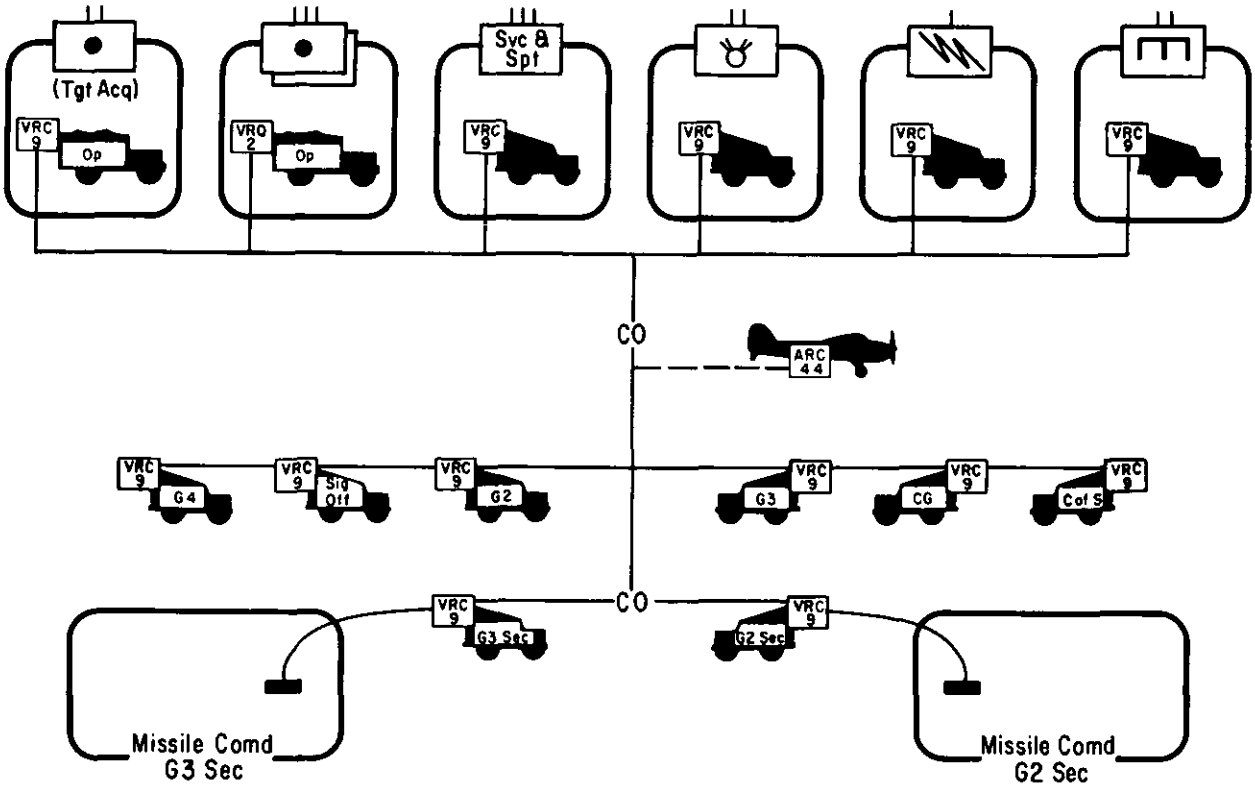


Figure 141. Type command/operations net, U.S. Army missile command (medium).

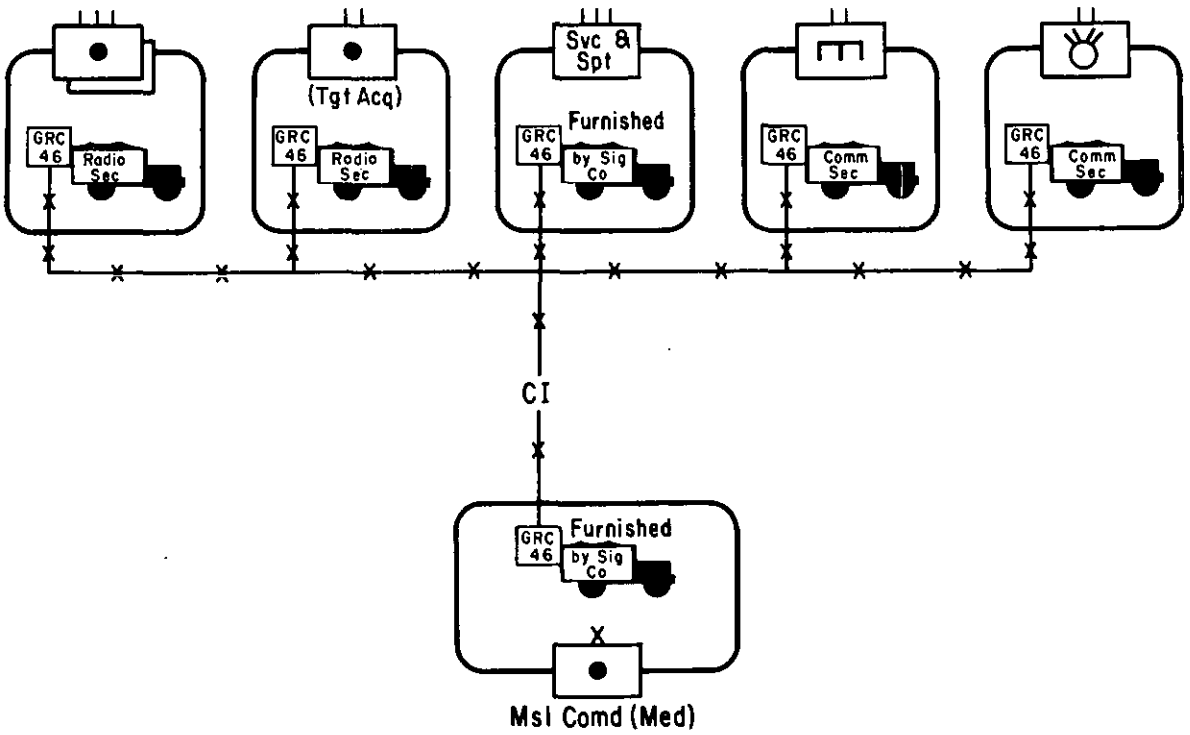


Figure 142. Type command/intelligence net, U.S. Army missile command (medium).

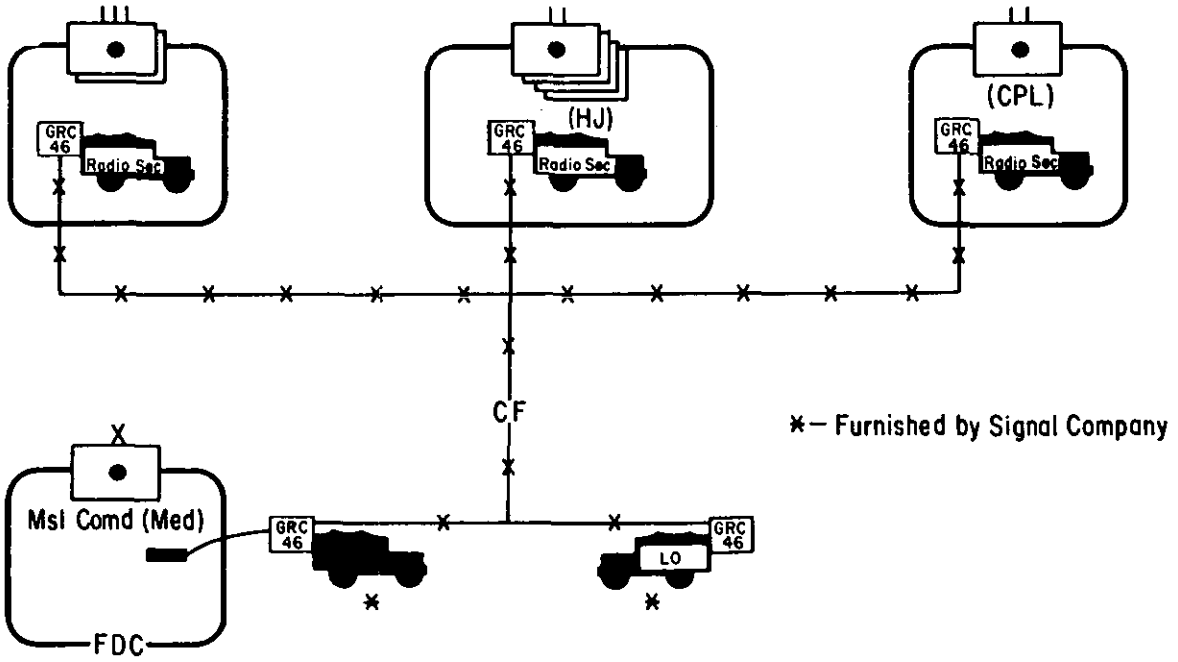


Figure 143. Type command/fire direction net, U.S. Army missile command (medium).

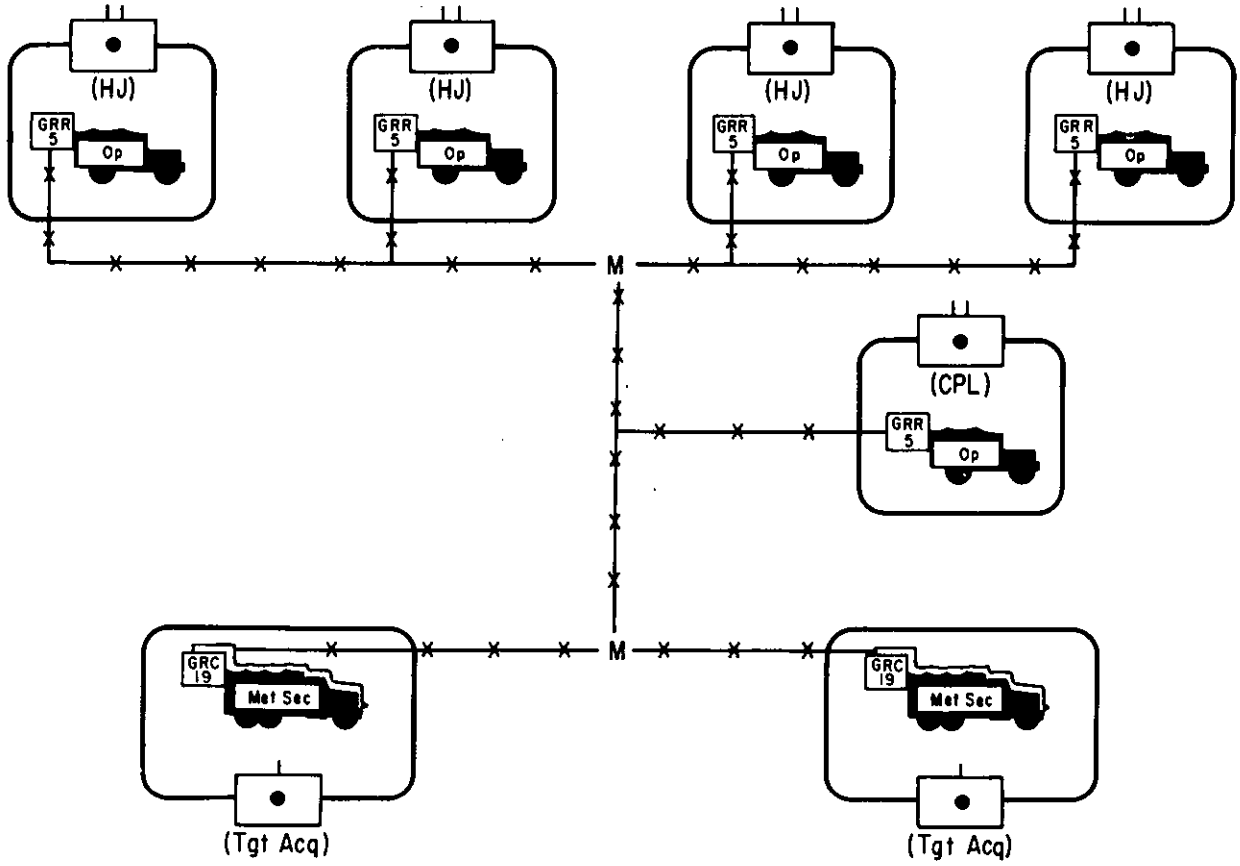


Figure 144. Type meteorological net, U.S. Army missile command (medium).

battalion fire direction centers. The missile command will receive meteorological data over an existing radio net. A type meteorological net is shown in figure 144.

e. Missile Command Survey Channel, FM (S). The missile command may be allocated one frequency modulated (FM) channel to be used as a survey channel, thereby reducing the required number of frequencies. This channel is common to all artillery survey sections within the missile command and provides radio communication within or between these sections. Although this channel is usually referred to as the missile command survey net, operation as a coordinated net is neither intended nor feasible. If interference exists between units, normal radio discipline will prevent confusion. Since the missile command does not have a survey section, the headquarters will not use this channel.

305. External Radio Nets

The missile command operates in two external radio nets. The equipment and personnel for these nets are furnished by the signal company. The signal company also provides equipment and personnel to a designated artillery group for operation in these two nets as an alternate command post for the missile command. Type external nets for the missile command are shown in figure 145.

306. Messenger Service

The signal company is organized and equipped to provide messenger service as shown in figure 146. Messenger service within the artillery groups, missile battalions, and artillery target acquisition battalion will be provided by organic means. The target acquisition battalion may use the system shown in figure 146 when the batteries are attached to artillery groups.

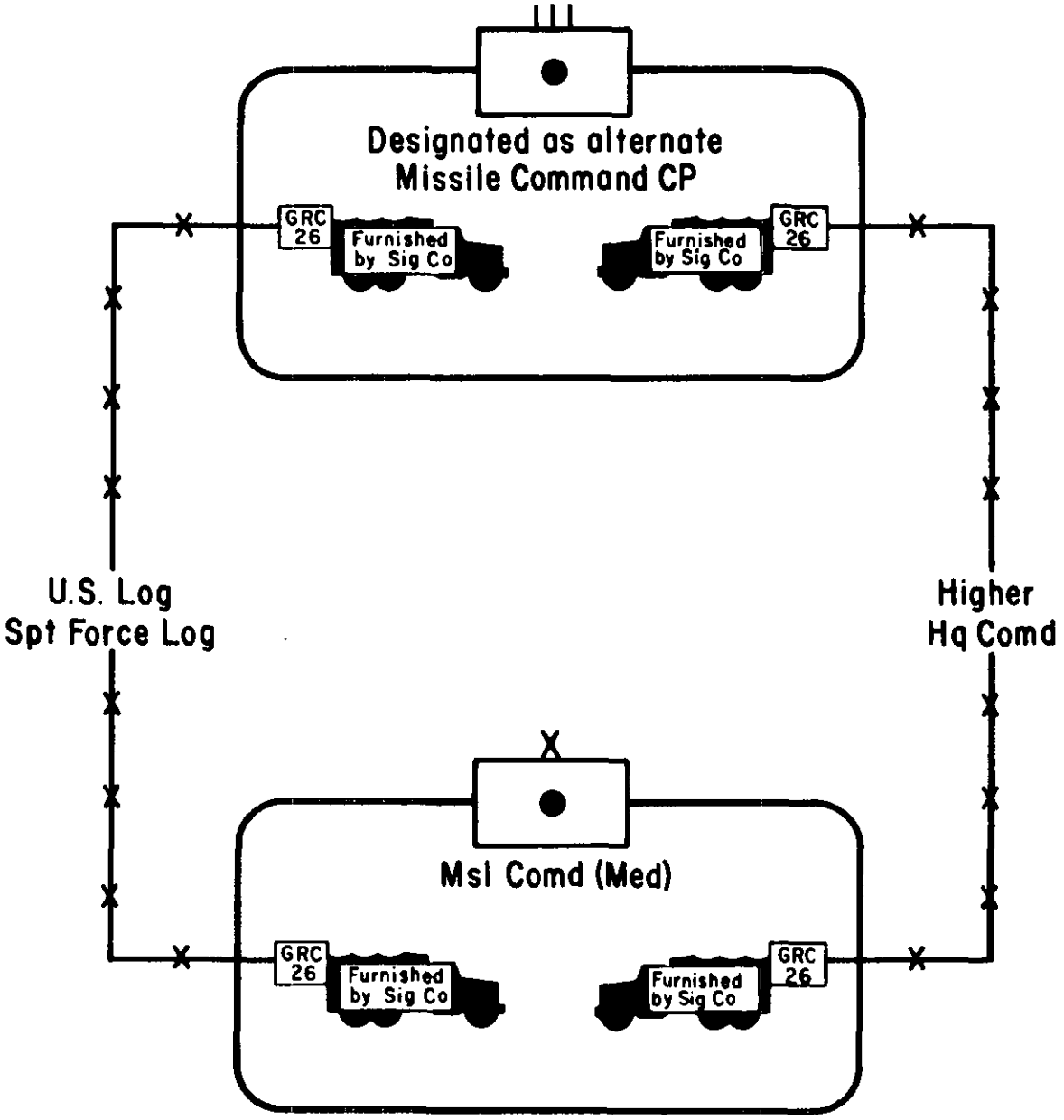


Figure 145. Type external radio nets, U.S. Army missile command (medium).

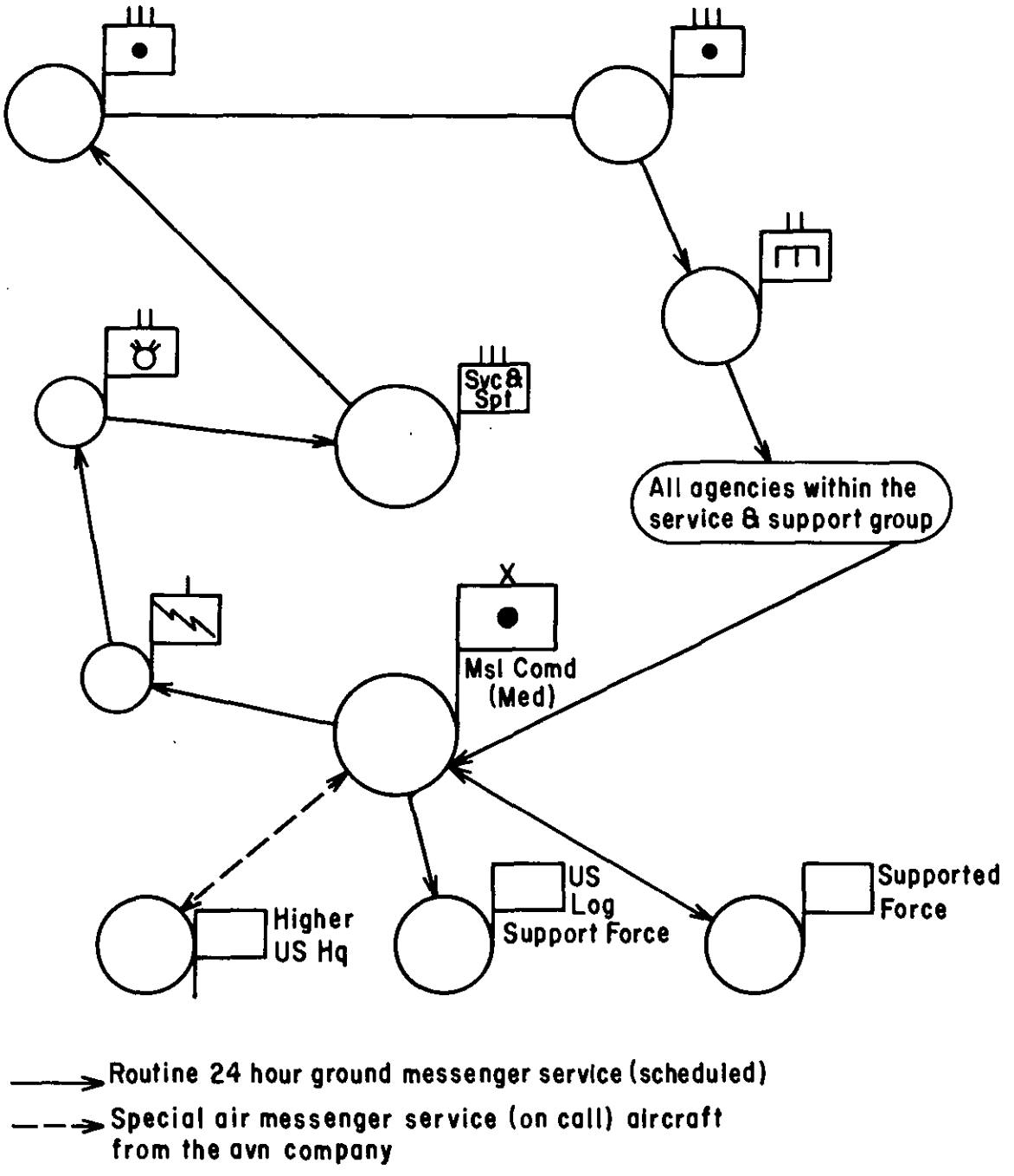


Figure 146. Type messenger service, signal company, U.S. Army missile command (medium).

Section XXVII. COMMUNICATION SYSTEM, ARTILLERY TARGET ACQUISITION BATTALION, U.S. ARMY MISSILE COMMAND (MEDIUM)

307. General

The target acquisition batteries of this battalion may be located a considerable distance from the battalion headquarters and may also be placed under the tactical supervision of an artillery group. When under control of a group, the batteries should install wire to a group signal center as a means of communicating with the target acquisition battalion.

308. Internal Communication Requirements

The internal communication requirements of the target acquisition battalion include facilities for—

a. Tactical and administrative control.

b. Collection of information and dissemination of intelligence.

c. Collection of hostile target information.

309. External Communication Requirements

The external communication requirements of the target acquisition battalion include facilities for—

a. Receipt of tactical orders and administrative supervision from the missile command.

b. Exchange of information and intelligence.

c. Receipt of warnings.

d. Dissemination of survey information.

e. Dissemination of meteorological data.

f. Dissemination of hostile target information.

310. Battalion Wire System

A type wire system for the artillery target acquisition battalion, missile command (medium), is shown in figure 147. The wire section in the headquarters battery will install the

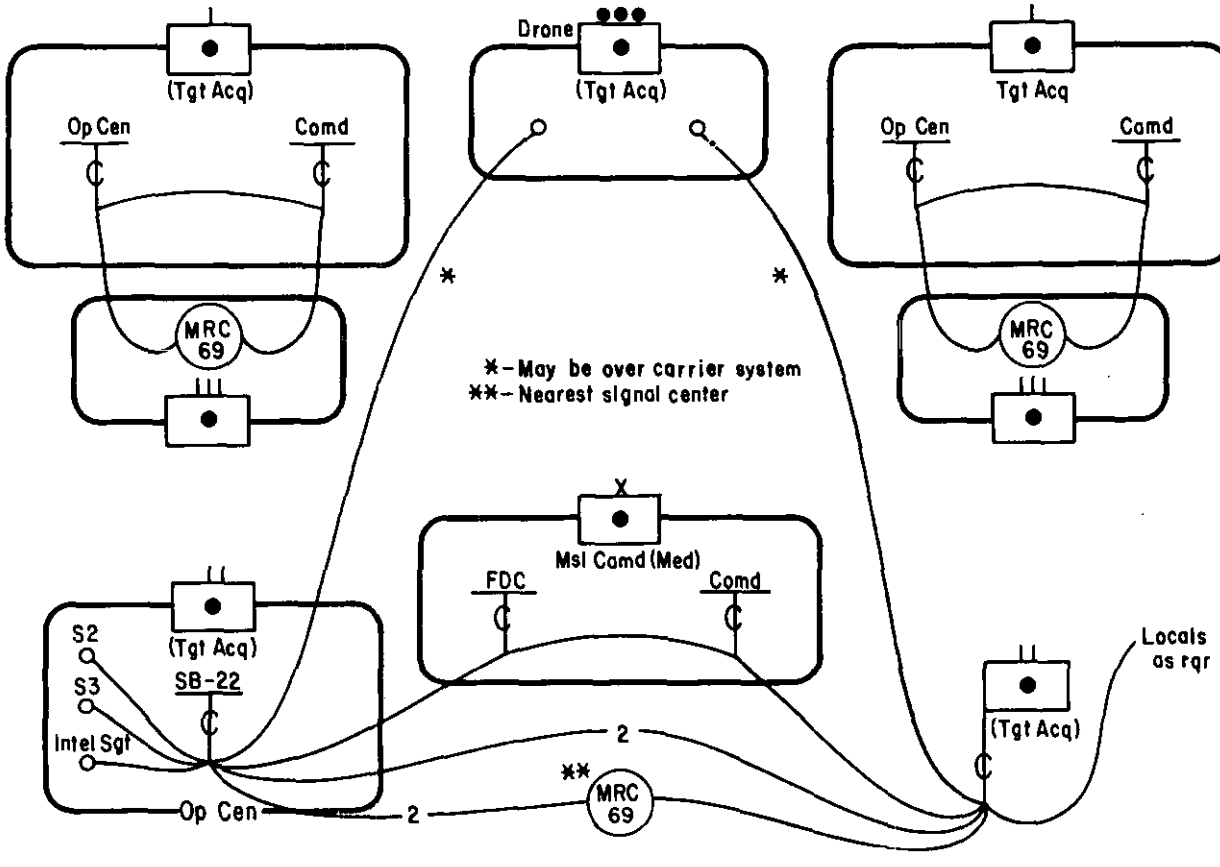


Figure 147. Type wire system, artillery target acquisition battalion, U.S. Army missile command (medium).

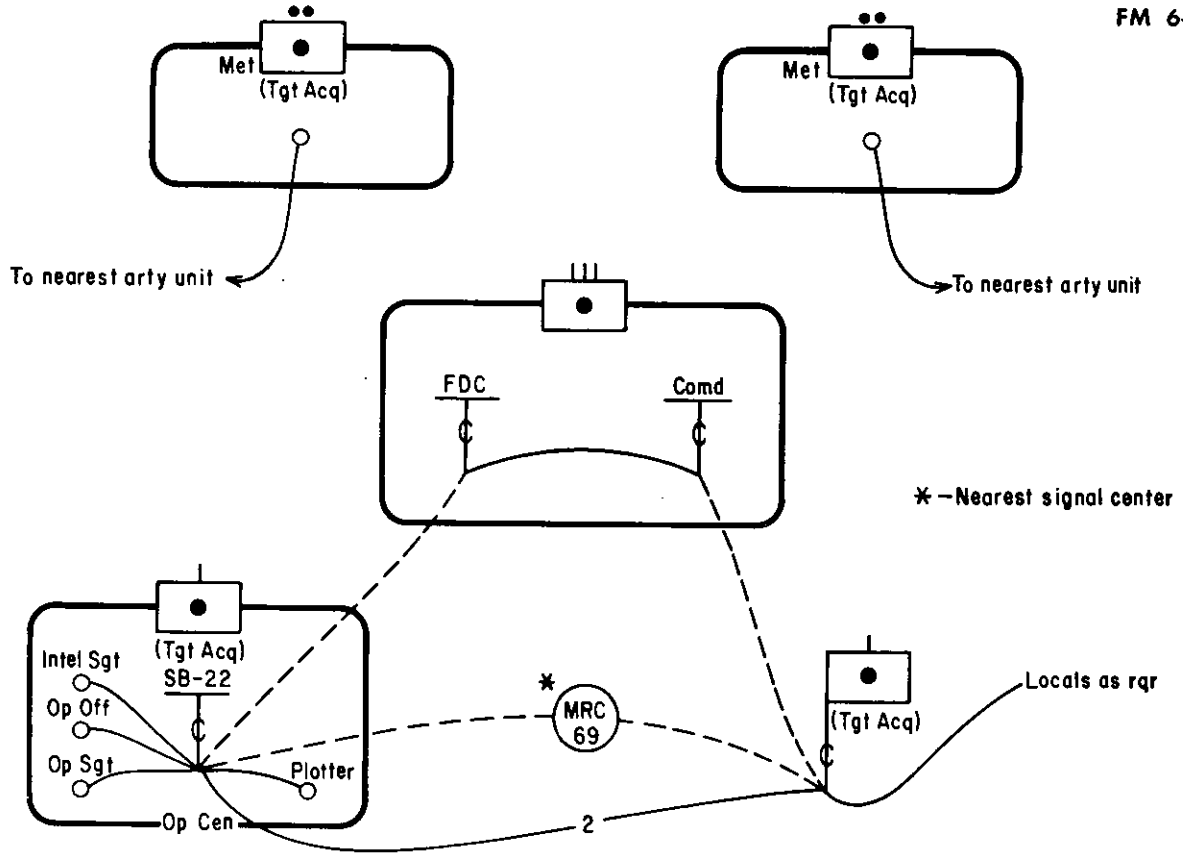


Figure 148. Type wire system, artillery target acquisition battery, U.S. Army missile command (medium).

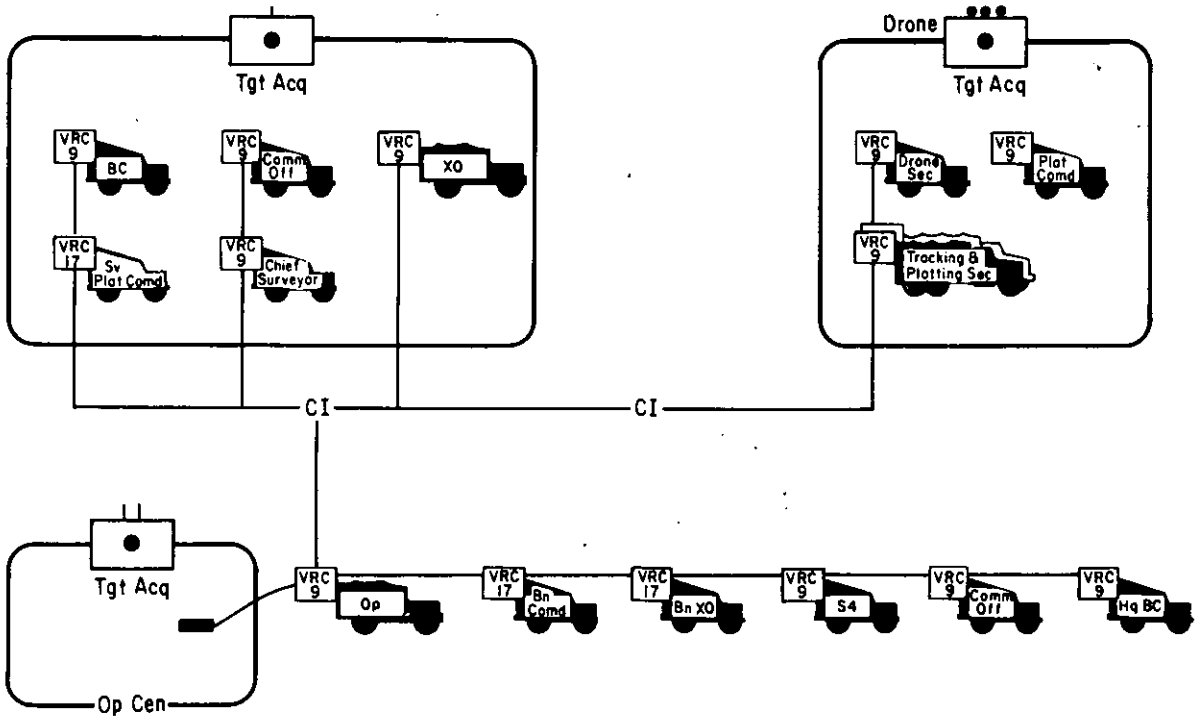


Figure 149. Type command/intelligence net, FM artillery target acquisition battalion, U.S. Army missile comamnd (medium).

local circuits in the command post area and the circuits necessary to connect the battalion headquarters to the nearest signal center. The unit SOP should establish responsibility for providing wire communication to elements of the medium endurance drone platoons. Since these platoons will be operating in the forward area, they may depend on the communication facilities of other artillery units or the carrier system for communication with the parent battalion.

311. Battery Wire System

A type wire system for an artillery target acquisition battery is shown in figure 148. Battery wire teams will install circuits from the battery to the nearest signal center and to an artillery group if distance permits. The positions of the battery meteorological sections may require them to depend on other artillery units or on the carrier system for wire communication.

312. Battalion Internal Radio Nets

a. General. To meet its internal communication requirements the target acquisition battalion operates two internal nets, one AM net and one FM net.

b. Battalion Command/Intelligence Net, FM (CI). The battalion command/intelligence net, FM, will be used by the commander for communication with his staff and with subordinate elements that are within the range capability of the equipment. This net is also used by the batteries for internal communication. A type command/intelligence net is shown in figure 149.

c. Battalion Command/Intelligence Net, AM, RATT (CI). The battalion command/intelligence net, AM, provides a radioteletype link between the battalion and its batteries. This net may be used for tactical control and for exchange of information and intelligence, and

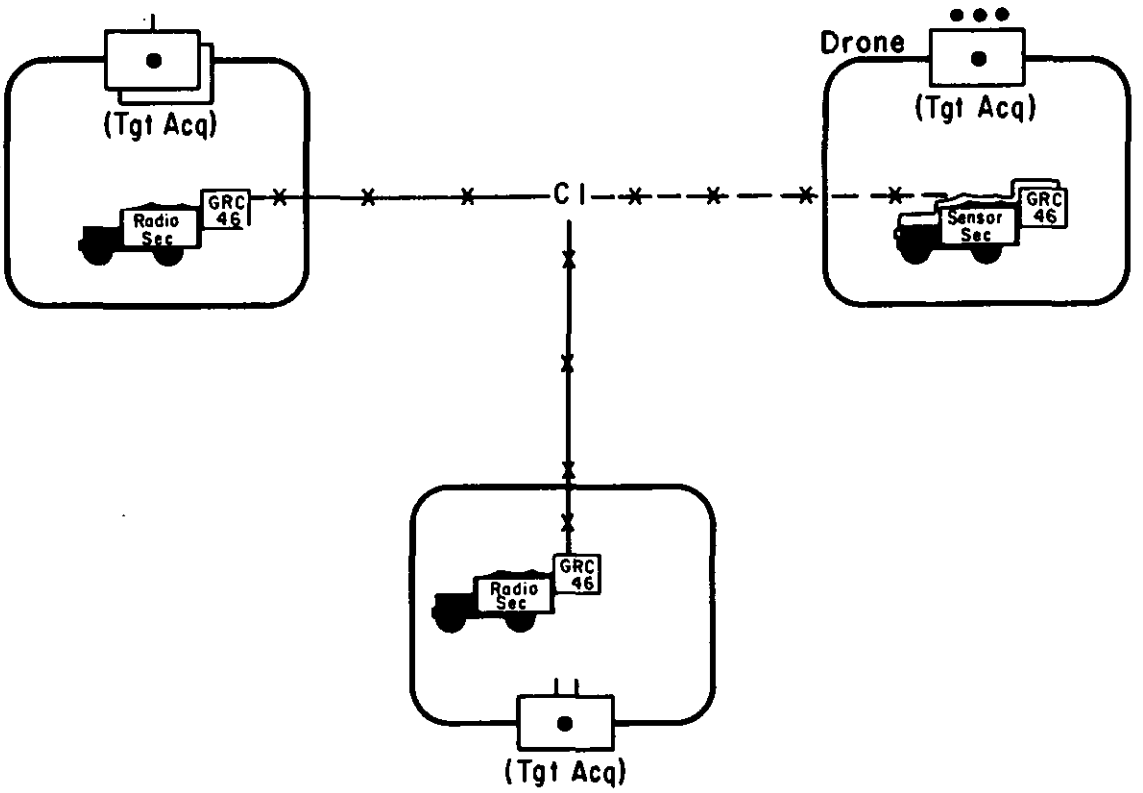


Figure 150. Type command/intelligence net, AM, artillery target acquisition battalion, missile command (medium).

it may also be used for transmission of battlefield information from the drone platoon to the battalion operations center. A type command/intelligence net, AM, is shown in figure 150.

313. Battalion External Radio Nets

To meet its external communication requirements, the battalion operates in the external radio nets discussed in *a* through *b* below and shown in figure 151.

a. Missile Command Command/Operation Net, FM (CO). The missile command command/operation net, FM, provides a direct radio channel between the battalion and its higher headquarters.

b. Missile Command Comand/Fire Direction Net, AM, RATT (CF). The missile command command/fire direction net, AM, provides a radioteletype link between the battalion and the missile command. Target information obtained by the drone platoon will normally be transmitted to the missile command over this net.

c. Missile Command Meteorological Net, AM (M). The target acquisition battalion will operate the net control station in the missile command meteorological net. All units having a requirement for meteorological data will monitor this net and utilize pertinent data from the nearest transmitting station.

d. Missile Command Survey Channel, FM (S). Survey sections within the target acquisition battalion will use the missile command survey net for internal communication and for communication with other unit survey elements. This net will also be used by the survey information center to receive and transmit survey information.

e. Warning Net, AM. The target acquisition battalion and batteries will monitor an appropriate warning net to receive air defense warnings and warnings of airborne, nuclear, chemical and biological attacks. Information received over this net, which is pertinent to the battalion, should be retransmitted over the battalion internal communication system.

f. Time Signal Net, AM. Each theater of operations will normally broadcast accurate time on a prescribed schedule using the time signal net. The survey information center monitors this net and disseminates correct time to interested survey parties.

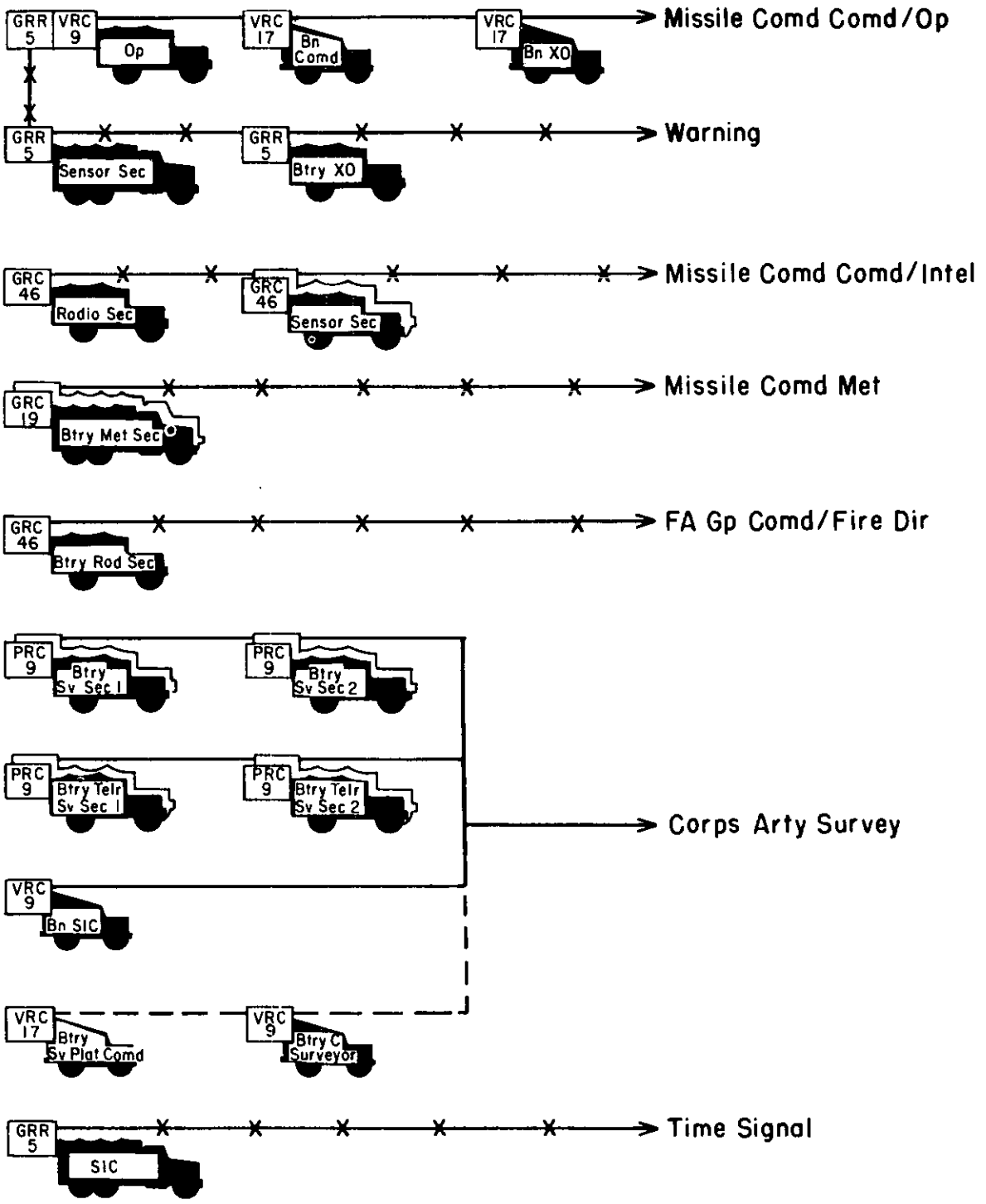


Figure 151. Type external radio nets, artillery target acquisition battalion, missile command (medium).

Section XXVIII. COMMUNICATION SYSTEMS EMPLOYED IN AIR-GROUND OPERATIONS AND FIRE SUPPORT COORDINATION IN THE FIELD ARMY

314. General

The need for complete coordination of all means of fire support, to include close air support, available to a force commander is increasing in importance. Moreover, the powerful long-range weapons being developed for future combat forces compel combat commanders to think in terms of greater destruction and devastation. Therefore, to enable the ground force commander to effectively employ the vast potential available, reliable and flexible communication facilities are imperative.

315. Communication Requirements

The communication requirements for fire support coordination include facilities for requesting and controlling—

a. Conventional artillery fires.

b. Nuclear fires.

c. Tactical air support.

316. Communication At Fire Support Element Fire Support Coordination Center

a. General. Reliable communication must be established within the fire support element (FSE) and the fire support coordination center (FSCC). Communication must also be established between—

(1) The FSE at higher headquarters and FSEs or FSCCs at the next lower echelon.

(2) The FSE/FSCC and the force or supported unit.

(3) The FSE/FSCC and the artillery fire direction center (FDC).

(4) The FSE and other elements of the tactical operations center (TOC).

b. Division Fire Support Coordination Center. A type communications system at an infantry division FSCC is shown in figure 152. The division signal battalion is responsible for providing the radio equipment for all nets except the artillery and Air Force nets. The signal battalion also provides a switchboard for the FSCC.

(1) *Wire communications.* Local lines within the FSCC are installed as required. In addition, a minimum of one sole-user circuit is required from the FSCC to the division artillery fire direction center (FDC). This circuit is normally a part of the division area communication system. A requirement also exists for circuits from the FSCC to the artillery representative at each battle group and to each artillery unit with a nuclear capability. These circuits also will normally be routed through the area communication system.

(2) *Radio communication.* The number and types of radio sets employed in the FSCC will vary according to the mission and the types of fire support represented. Net control stations for division nets that are not used for fire support coordination should not be at the FSCC, however, telephone communication should be provided to them in the event they are required. On the other hand, all radios used for fire support coordination should be remoted into the FSCC whenever possible; radio receivers AN/GRR–5 can also be placed in the FSCC.

c. Corps Fire Support Element. Type communications at a corps fire support element is shown in figure 153. At this echelon the corps signal battalion provides the radio equipment for all nets except the artillery and Air Force nets.

(1) *Wire communication.* The corps signal battalion establishes a radio carrier system between the corps and corps artillery which is used to provide communication between the FSE and FDC. The corps signal battalion also establishes radio carrier equipment at each field artillery group and artillery missile battalion, Corporal. In this manner, direct circuits can be estab-

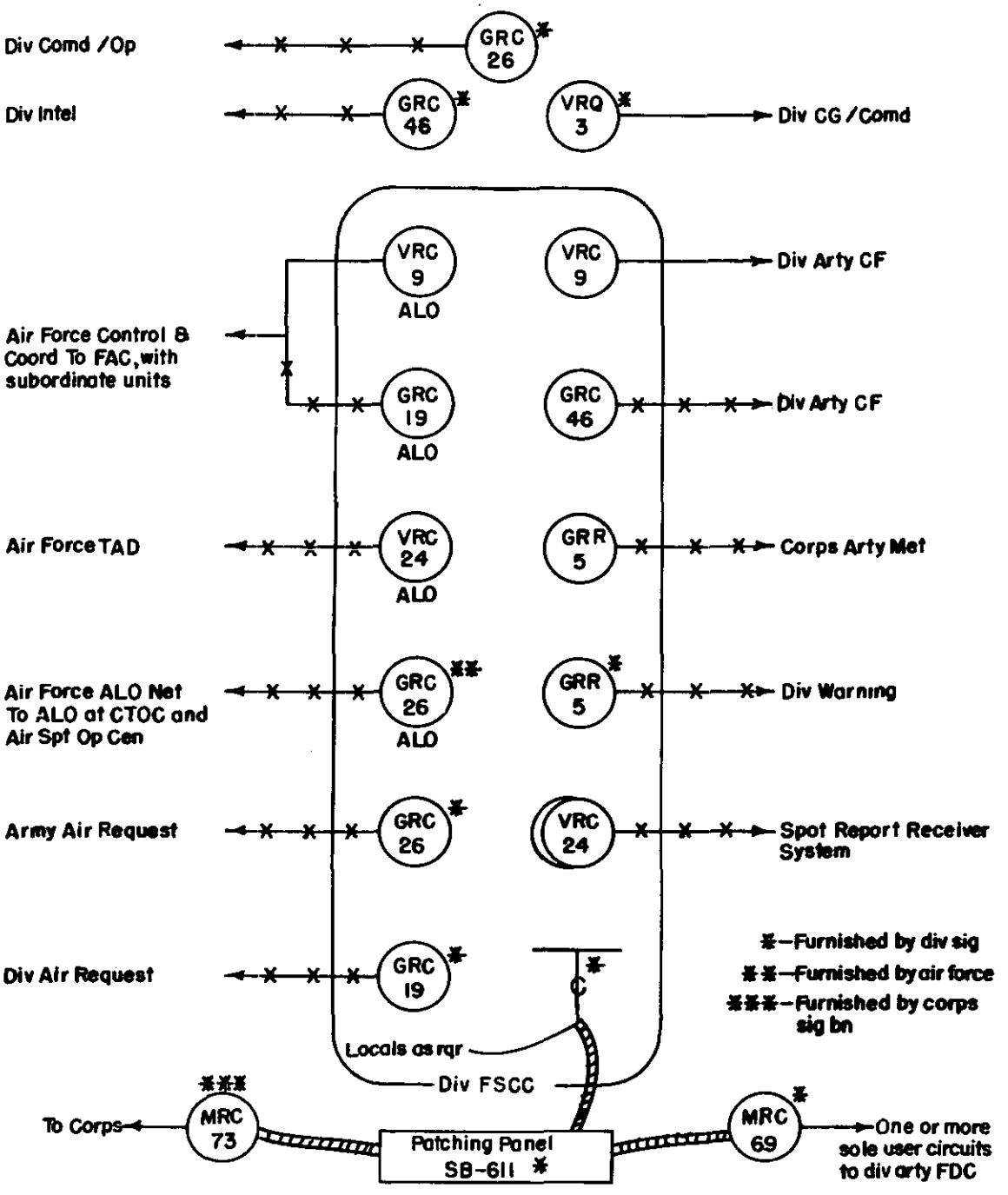


Figure 152. Type communication for a division fire support coordination center.

lished between the FSE and the artillery battalions with a nuclear capability.

(2) *Radio communication.* Radio communication discussed in *b*(2) above is also applicable to the corps FSE.

317. Communication Systems for Nonnuclear Artillery Fires

To provide the communication facilities necessary for requesting and controlling nonnuclear artillery, separate radio and wire nets are established. Fire missions for nonnuclear artillery are transmitted over normal fire direction channels. For details concerning these systems, see sections III through XXVII.

318. Communication Systems for Nuclear Missions

Nuclear fire missions will be encoded unless transmission is over a secure means. They will be processed through command channels over any available means of communication.

319. Communications Systems for Tactical Air Support, General

Communication facilities, over which tactical air support may be requested and directed,

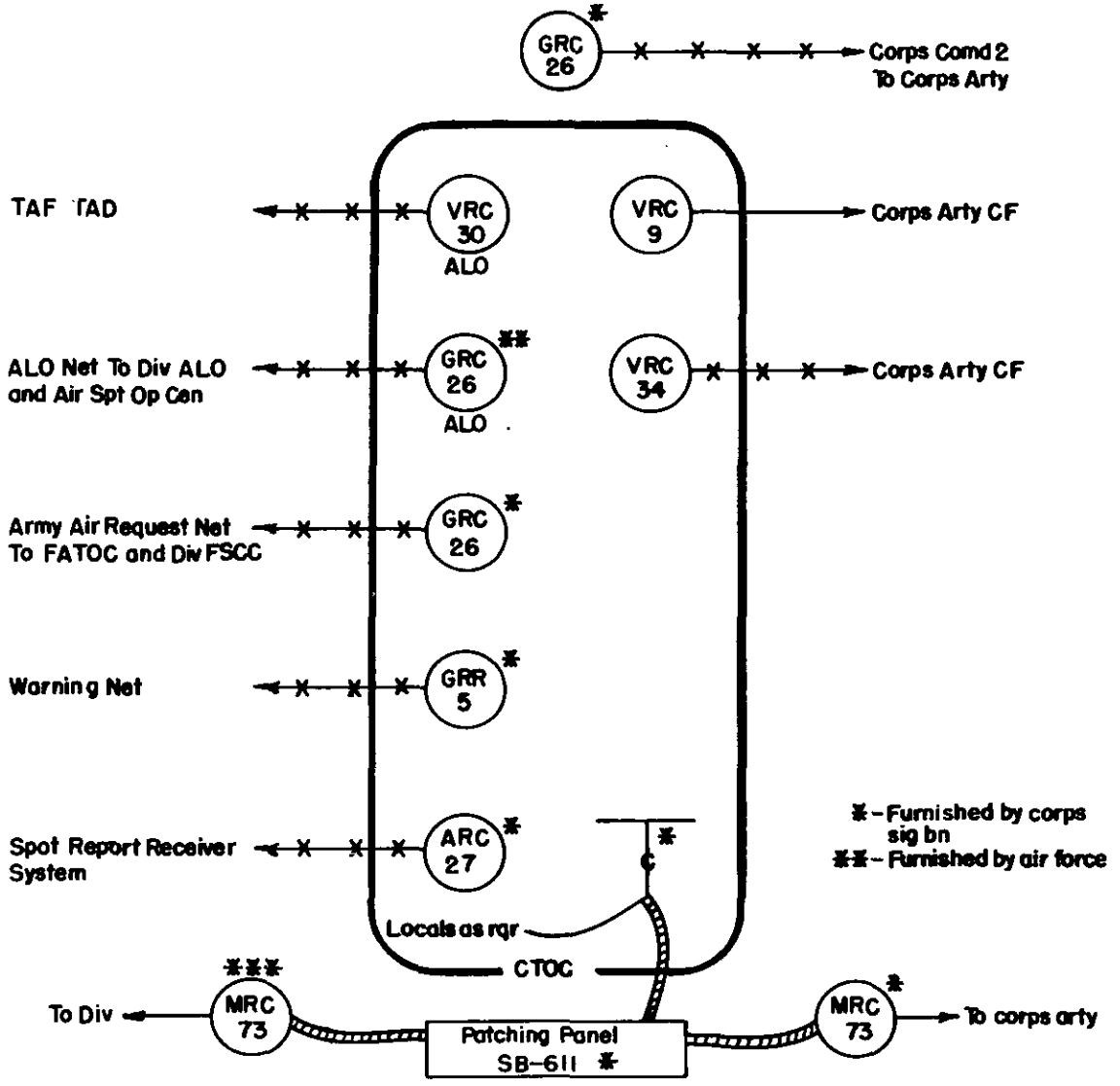


Figure 153. Type communication for a fire support element, corps tactical operations center.

are required from the frontline rifle company through the various echelons of command to the army operations center at field army. A requirement also exists for communication for liaison between the army operations center and the fighter bases and between the air reconnaissance support battalion and the reconnaissance air bases. (Although only radio nets are discussed for air support, all other available means will be integrated.)

320. Division Air Request Net, AM

a. The requests of infantry and tank companies for immediate tactical air support are transmitted to higher headquarters over the higher headquarters command net, FM, or by wire. Approved requests are transmitted from the higher headquarters to the division G3 air in the fire support coordination center over the division air request net, AM.

b. The infantry division air request net, AM, connects the battle groups, armored battalion, and reconnaissance squadron with the division fire support coordination center. In the armored division this net connects the combat commands, armored battalions, armored infantry battalions, and armored cavalry squadron with the division FSCC. Requests for preplanned and immediate tactical air support are transmitted to the division G3 air in the fire support coordination center. (The equipment and the operating personnel are furnished by the division signal battalion.)

321. Army Air Request Net, AM

The army air request net (one for each corps) connects the division fire support coordination center and corps tactical operations center with the field army tactical operations center by radioteletype. The division signal battalion furnishes the equipment and operating personnel for the station located at the division fire support coordination center. Requests for tactical air support are handled as follows:

a. Immediate Requests. Requests for immediate tactical air support are transmitted from the division fire support coordination centers direct to the field army tactical operations center over the army air request net. The corps tactical operations center listens to immediate requests; silence on the part of corps indicates approval of the request. On the other hand, if corps disapproves a request, the disapproval is sent to the requesting division over the army air request net.

b. Preplanned Requests. Requests for preplanned tactical air support are transmitted from the division fire support coordination center to corps tactical operations center over the army air request net. Approved requests are transmitted from the corps tactical operations center to the field army tactical operations center over the army air request net.

322. Ground Liaison Officers' Net, AM

The ground liaison officers' net connects the field army tactical operations center with the ground liaison officers at the fighter airfields. Instructions to ground liaison officers for briefing pilots are received from the field army tactical operations center over the ground liaison officers' net. On completion of a mission, the ground liaison officers debrief the pilots, and the debriefing information is transmitted over this net to the field army tactical operations center.

323. Air Reconnaissance Ground Liaison Officer Net, AM

The air reconnaissance liaison officers ARLO net connects the air reconnaissance support battalion with the ARLO's located at the reconnaissance airfields. Instructions to the ARLO's for briefing pilots are received from the air reconnaissance support battalion (ARSB) over this net. On completion of a mission, the air reconnaissance liaison officers debrief the pilots, and the debriefing information is transmitted to the ARSB over this net.

324. Information Net, AM

a. The information net connects the field army tactical operations center with the ARSB. The information net is used to forward the information and intelligence that has been obtained or developed from tactical air force reconnaissance units to the field army tactical operations center.

b. Corps headquarters also operates in the information net to obtain intelligence information.

325. Tactical Air Direction Net, UHF

a. The tactical air direction net is an Air Force net which is used to control tactical aircraft when they are engaged in close air support. Each field artillery howitzer battalion organic to a division, division artillery headquarters, and corps artillery headquarters is authorized the radio equipment and enlisted personnel for an air control team (ACT). During combat operations, the tactical air force provides qualified fighter pilots as forward air controllers (FAC) and air liaison officers (ALO) who work with the air control teams to control the tactical aircraft when they are engaged in close air support. The air control team of the howitzer battalion normally remains at the battle group (combat command or brigade) headquarters when it is not engaged in controlling tactical aircraft. The air control teams of division artillery and corps artillery headquarters normally remain at their respective fire support coordination centers (tactical operations centers).

b. The tactical air force provides one air liaison officer for each corps headquarters and each division headquarters. The air liaison officer monitors the tactical air direction net to obtain information pertaining to air strikes. Aircraft operating in a division or corps area will normally contact the air liaison officer over this net.

326. Control and Coordination Net, FM –AM

The Air Force operates a control and coordination net which is used for the exchange of air control information between the air liaison officers and the forward air controllers within the divisions. The air liaison officer at division also uses this net for control of forward air controllers with subordinate units.

327. Spot Report Receiver System, UHF

a. On completion of a mission flown for the ground forces, the pilot, while in flight, makes a spot report of the results to the air support operations center. Any information or sightings by a pilot may be reported over this system.

b. This spot report provides the ground forces with immediate results of the missions flown in their respective sectors. The infantry division, armor battalions, reconnaissance squadrons, battle groups, armored division, combat commands, armor battalions, armored infantry battalions, armored cavalry squadron, division, and corps have radio equipment for monitoring the spot report receiver system. The airborne division artillery also monitors this net at the division FSCC.

328. Tactical Air Observation Net, UHF

a. The tactical air observation net is an Air Force net used for communication between tactical aircraft engaged in observation or reconnaissance missions and the army unit requesting the mission. Speed is one of the greater advantages of visual reconnaissance. Information is secured quickly and relayed immediately. Units requesting observation or reconnaissance missions operate in the tactical air observation net to obtain information directly from the pilot. Artillery requests for reconnaissance missions are submitted through S2–G2 channels to the FSCC/FSE.

b. The tactical air observation net is also used for artillery fire adjustment and for surveillance of missile fires by high performance reconnaissance aircraft. Corps artillery and division artillery are authorized radio equipment to operate in the tactical air observation net.

CHAPTER 15

SIGNAL MAINTENANCE

329. General

Maintenance of artillery communication equipment is a continuous operation. Preventive maintenance of radio and wire equipment is performed daily by the operator of the equipment. Organizational maintenance (first- and second-echelon maintenance) is prescribed by AR 750–5 and, specifically for signal equipment, by AR 750–625. Organizational maintenance is performed by personnel of artillery organizations and supervised by commanders and communication supervisors of all artillery commands. The general efficiency of artillery organizational maintenance of signal equipment is supervised by the Signal Corps through command maintenance inspections, spot check inspections, and control of work performed by higher echelon maintenance shops. Specific instructions for the maintenance of any type of communication equipment is contained in the technical manual pertaining to the equipment and the maintenance checklists for the equipment. A list of ten maintenance checklists covering all types of communication equipment is published as appendix I to AR 750–625. Maintenance of communication equipment must be scheduled to insure its performance. The use of DA Form 460 (Preventive Maintenance Roster), modified for use with signal equipment will facilitate the scheduling of second-echelon maintenance and prevent the overloading of this echelon of maintenance.

330. Operator Maintenance (First-Echelon)

First-echelon maintenance is performed by the man or crew using the equipment. Such maintenance consists of inspecting, cleaning, servicing, preserving, and adjusting items of communication equipment used by an operator or crew. These operations are *preventive maintenance* and are the "keystone" of the entire maintenance system. First-echelon maintenance is performed daily on all equipment in use and weekly, on equipment not in daily use. At the first sign of any defect in the equipment, the operator must alert his section chief or the organizational radio mechanic so that further deterioration may be checked.

331. Organizational Maintenance (Second-Echelon)

Second-echelon maintenance is work performed by trained organization mechanics. It consists of inspecting, adjusting, lubricating, testing, and replacing such parts as subassemblies, fuzes, and tubes. Definite limits to the extent of repairs to be performed by the organizational radio mechanic are prescribed in Department of the Army Supply Manuals SIG 7 and 8 pertaining to each item of equipment and in the maintenance allocation appendixes to technical manuals. Another limitation is imposed on the mechanic through the amount and type of test equipment and repair parts issued to the organization. Any piece of equipment with a maintenance problem beyond the scope of the organizational radio mechanic must be promptly evacuated to a higher echelon of maintenance. Such evacuation is accomplished through normal organization supply channels to the signal field or depot maintenance shop serving the organization.

332. Repair Parts Supply

The supply of repair parts and the resupply of spare part items for signal equipment is the most critical phase of second-echelon maintenance. A prescribed load of such parts must be maintained within the organization at all times. Communication equipment deadlined for lack of parts is a violation of all the principles of good maintenance. All artillery commanders and communication supervisors must constantly check this aspect of maintenance to insure an adequate supply of parts and to prevent hoarding and overstocking of vital maintenance parts within their organization.

APPENDIX I

REFERENCES

1. Allied Communication Publications

ACP 122 (B)	Communication Instructions—Security
ACP 125 (B)	Communication Instructions—Part V Radiotelephone Procedure
ACP 134 (A)	Telephone Switchboard Operating Procedure

2. Army Regulations

AR 105–15	Army Field Commands
AR 320–50	Authorized Abbreviations and Brevity Codes
AR 380–5	Safeguarding Defense Information
AR 380–6	Automatic, Time-Phased Downgrading and Declassification
AR 380–41	Control of Crypto Material
AR 380–46	Radiation of Intelligence Hearing Information by Communications, Communications Security, and Duplicating Equipment (U)

3. Field Manuals

FM 6–20–1	Field Artillery Tactics
FM 6–20–2	Field Artillery Techniques
FM 11–10	Infantry Division, Signal Battalion
FM 11–11	The Signal Battalion, Armored Division
FM 11–92	Corps Signal Battalion
FM 17–95	The Armored Cavalry Regiment
FM 21–60	Visual Signals
FM 24–18	Field Radio Techniques
FM 24–20	Field Wire and Cable Techniques
FM 32–5	Communications Security (U)
FM 101–5	Staff Officer's Field Manual, Staff Organization and Procedure

4. Joint Army Navy Air Procedures

5. Technical Manuals

TM 11–286	Radio Sets AN/VRC–8, 9 and 10
TM 11–287	Radio Sets AN/VRQ–1, 2 and 3
TM 11–295	Radio Receiving Set AN/GRR–5
TM 11–381	Cable Assembly CX–1065/G, Telephone Cable Assemblies CS–1606/G and CS–1512/U, Telephone Loading Coil Assembly CU–260/G, and Electrical Connector Plug U–176/G
TM 11–611	Radio Sets AN/VRC–16, 17 and 18
TM 11–612	Radio Sets AN/PRC–8, 9 and 10
TM 11–678	Fundamentals of Telephony
TM 11–2059	Telephone TP–9 and Telephone Set TA–264/PT

TM 11–2134	Manual Telephone Switchboard SB–26/P
TM 11–2155	Telephone Set TA–312/PT
TM 11–2240	Wire Dispenser MX–306A/G
TM 11–5805–243–12	Operation and Organizational Maintenance: Telephone Set TA–1/PT
TM 11–5815–204–10	Radioteletypewriter Set AN/GRC–46
TM 11–5815–206–12	Operation and Organizational Maintenance: Teletypewriter Set AN/PGC–1 and Teletypewriters TT–4A/TG and TT–4B/TG
TM 11–5820–295–10	Operator's Manual: Radio Set AN/GRC–19
TM 11–5805–262–12	Operator's and Organizational Maintenance Manual: Switchboards, Telephone, Manual SB–22/PT and SB–22A/PT

APPENDIX II

GLOSSARY OF TERMS AND DEFINITIONS

Ampere	The basic unit for measurement of electric current flow.
Amplitude	In connection with alternating current or any other periodic phenomena, the maximum value of the displacement from the zero position.
Antenna	An electrical conductor or system of conductors for radiating or receiving radio waves.
Area communication system	An integrated communication system, installed, operated, and maintained by signal corps personnel, utilizing radio, radio relay, radio/wire integration, wire and multichannel cables. This system does not replace, but supplements, separate organic communication systems.
Assign	To place a unit under the control of a specified command, by orders which change the parent headquarters of the affected unit.
Attach	To bind a unit temporarily to a command other than its parent organization for a specified purpose.
Authentication	A security measure designed to protect a communication system against fraudulent messages.
Automatic retransmission	The receiving and automatic relaying of signals by an intermediate station.
Coaxial cable	A transmission cable consisting of two conductors concentric with and insulated from each other.
Common-battery operation	A telephone system in which current for both talking and signaling the switchboard or other telephones is supplied from a central source.
Common battery signaling (CBS)	A telephone system in which the current to signal each telephone is supplied from a central source. Current for talking is furnished locally.
Directional antenna	Any antenna which sends out or receives radio waves more effectively in some directions than in others.
Duplex operation	The operation of a communication system in which two operating stations can transmit and receive simultaneously.
Fire Control	All operations connected with planning, preparing, and placing fire on a target.
Fire direction	The tactical employment of firepower, the exercise of tactical command of one or more units in the selection of targets, the concentration and distribution of fire, and the allocation of ammunition for each mission. It includes the method and techniques used in FDCs to convert fire missions into fire commands.
Fire support coordination	The process of integrating and coordinating all fire support elements available to the force. It includes all artillery fire, naval gunfire, nuclear strikes, and aircraft strafing and bombardment.
Frequency	The number of electrical cycles occurring in a stated time interval, usually cycles per second.

Frequency modulation	The process of varying the frequency of an radio frequency carrier wave in accordance with the amplitude and frequency of an audio signal.
Ground	1. The term applied to the earth as a conductor of electricity or to a fixed reference in a particular circuit if the reference is not at a zero voltage potential with respect to the earth. 2. A metallic connection with the earth to establish ground potential.
Jamming	The intentional transmission of interfering radio signals in order to disturb the reception of other signals.
Lead in	The conductor which connects the antenna to the radio set.
Line-of-sight communication	That type of communication which depends on a point-to-point, unobstructed transmission path.
Local-battery operation	A telephone system in which the current for talking is supplied locally by each telephone. The signaling current may be supplied from a local hand generator or from a centralized power source.
Local circuit	A wire circuit connecting a telephone to a switchboard or other distribution point.
Maintenance	All action taken to retain materiel (including communication equipment) in a serviceable condition or to restore items to serviceability.
Microphone	A device used to change mechanical sound energy into electrical energy.
Modulation	The process of modifying a radio-frequency carrier wave by superimposing audio frequencies on it is called modulation. The two types of modulation used principally in military radio sets are amplitude modulation and frequency modulation.
Monitor	The process of checking the operation and performance of a system by examining a part of the system or by sampling the output.
Net	Two or more stations able to communicate with each other.
Organic	Assigned to and forming an essential part of, a military organization. The organic elements of a unit are those listed in its TOE.
Phantom circuit	A telephone or telegraph circuit obtained by superimposing an additional circuit on two existing circuits.
Polarity	A condition in an electrical circuit by which the direction in which current tends to flow can be determined. Polarity is usually applied to batteries and other direct voltage sources.
Polarization	A property of an antenna system which determines some of its radiation characteristics. A vertical antenna emits a vertically polarized radio wave.
Power source	A generator, battery, or other source of electrical power for a radio set.
Power supply	A unit for producing an AC or DC power at suitable voltage and current ratings for circuits in electronic equipment.
Radio frequency	Any frequency above the audio range that is used for transmitting intelligence.
Radio relay system	A point-to-point radio transmission system in which the signals are received and retransmitted by one or more intermediate radio stations.

Radio/wire integration	A communication system, combining radio and wire facilities into a coordinated system by means of remote control equipment, radio relay equipment, radio terminal equipment, wire, cables and switching equipment. A system of integration stations at signal centers is used to establish communication between mobile FM radios and elements of the command connected into the system by telephone. The system can also be used in lieu of radio relay stations, since it can maintain radio communication between FM radio stations that are beyond direct FM range.
Remote control	A system or method of radio-transmitter control whereby the control functions are performed electrically from a distance, over intervening wire or radio circuits.
Signal center	Signal centers are established, operated and maintained by signal corps personnel at major commands. A signal center usually includes a message center, messengers, cryptographic facilities, teletypewriter facilities, telephone central office equipment, circuit patching and switching equipment, radio/wire integration equipment and testing facilities.
Signal subcenter	A signal installation which provides radio carrier facilities and necessary terminal equipment as part of the area communication system.
Signal operating instructions (SOI)	A series of orders (subject to frequent change) issued for technical control and coordination of the signal communication activities of a command.
Simplex operation	A method of operation in which communication between two stations takes place in one direction at a time.
Standing signal instructions (SSI)	A set of instructions (not subject to frequent change) necessary for the operation of signal communication equipment, agencies and means. Instructions for the use of data in the SOI are contained in the SSI.
Sole user circuit	A circuit in an area communication system allocated to a unit for full-time use to provide point-to-point communication in this system.
Terminal equipment	Carrier equipment used at end stations of a communication system.
Trunk circuit	A circuit connecting two switchboards or other distribution points.

APPENDIX III

ABBREVIATIONS AND SYMBOLS

1. Abbreviations

To save space and to avoid confusion, abbreviations have been used extensively on illustrations throughout this manual. The following abbreviations, which are used in this manual are in accordance with AR 320–50 as nearly as possible:

ACT ——— air control team
AD ——— air defense
admin ——— administrative or administration
ALO ——— Air Force liaison officer
ammo ——— ammunition
ant ——— antenna
armd ——— armored
arty ——— artillery
asst ——— assistant
assy ——— assembly
avn ——— aviation
BC ——— battery commander
bde ——— brigade
BG ——— battle group
bn ——— battalion
btry ——— battery
CAC ——— control and coordination
cbtry ——— counterbattery
CC ——— combat command
cht ——— chart
cm ——— countermortar
cmpt ——— computer
CO ——— commanding officer
co ——— company
comd ——— command or commander
comm ——— communication
CommCen ——— communications center
CP ——— command post
Cpl ——— Corporal (missile)
CTOC ——— corps tactical operations center
det ——— detachment
div ——— division
EB ——— enemy battery
FATOC ——— field army tactical operations center
FA ——— field artillery
FAC ——— forward air controller
FB ——— firing battery
FDC ——— fire direction center
FDO ——— fire direction officer
FLRNG ——— flash ranging
FO ——— forward observer
FSC ——— fire support coordinator
FSE ——— fire support element
FSCC ——— fire support coordination center
fwd ——— forward
GC ——— guidance central
gp ——— group
HCO ——— horizontal control operator
HJ ——— Honest John
how ——— howitzer
HQ ——— headquarters
inf ——— infantry
intel ——— intelligence
LDC ——— light direction center (searchlight)
LJ ——— Little John (missile)
ln ——— liaison
LO ——— Liaison Officer
log ——— logistics or logistical
LOX ——— liquid oxygen
LX ——— Lacrosse (missile)
maint ——— maintenance
met ——— meteorological
mort ——— mortar
msg cen ——— message center
msl ——— missile
obsn ——— observation
obsr ——— observer
off ——— officer
OP ——— observation post
op ——— operation of operator
plat ——— platoon
radar ——— radio detection and ranging
RATT ——— radio and teletypewriter
rec ——— recorder
RED ——— redstone (missile)
reinf ——— reinforce, reinforced or reinforcing
rkt ——— rocket
rqr ——— required
Rad Tel Op ——— radiotelephone operator
sec ——— section
scty ——— security
Sgt ——— Sergeant (missile)
SIC ——— survey information center
SigCen ——— signal center
slt ——— searchlight
SORNG ——— sound ranging
SP ——— self propelled
spt ——— support or supported
sr ——— senior
survl ——— surveillance
sv ——— survey
svc ——— service
TAD ——— tactical air direction
TAF ——— tactical air force
tgt acq ——— target acquisition
TAO ——— tactical air observation (or observer)
TOC ——— tactical operations center
TRS ——— target ranging set
VCO ——— vertical control operator

wng ----------warning
XO ----------executive officer

2. Short Titles For Radio Nets

The short titles shown in figure 154 are used in conjunction with artillery radio net diagrams and the discussions of radio nets. Frequency modulated (FM) nets are shown by a solid line, Amplitude modulated (AM) nets are shown by a solid line on which a series of X's are superimposed at convenient intervals. Suffix numbers are added to short titles if more than one net is used for the same purposes; i.e., F1, F2, F3 if a unit has three fire direction nets.

3. Basic Communication Symbols

The basic communication symbols are shown in figure 155.

FM Nets	Purpose	AM Nets
CF	Command Fire Direction	X CF X
F	Fire Direction	X F X
CI	Command Intelligence	X CI X
CL	Command Light Direction	X CL X
R	Sound Ranging	X R X
T	Flash Ranging	X T X
S	Survey	X S X
M	Meteorological	X M X
LN	Liaison	X LN X
CO	Command Operations	X CO X
- - - - - - - - - -	Alternate Net (or net of secondary interest)	- - X - - - - X - -

Figure 154. Short titles for radio nets.

Repeating coil (Simplex coil) on a line circuit	Not always provided
Wire circuit with telephone set TA-312/PT	Telephone switching central at a command post or headquarters
Remote control unit for radio	Radar station
Wire circuit, indicating number of pairs available (2)	Telephone switching central at a command post or hq
Telephone	Teletype facilities
Multi-channel cable	Signal center, operated by signal unit (Sig Cen)

Figure 155. Communication symbols.

4. Silhouettes of Vehicles

The silhouettes of vehicles shown in figure 156 are used in illustrations throughout this manual to depict the type of vehicles as shown on tables of organization and equipment.

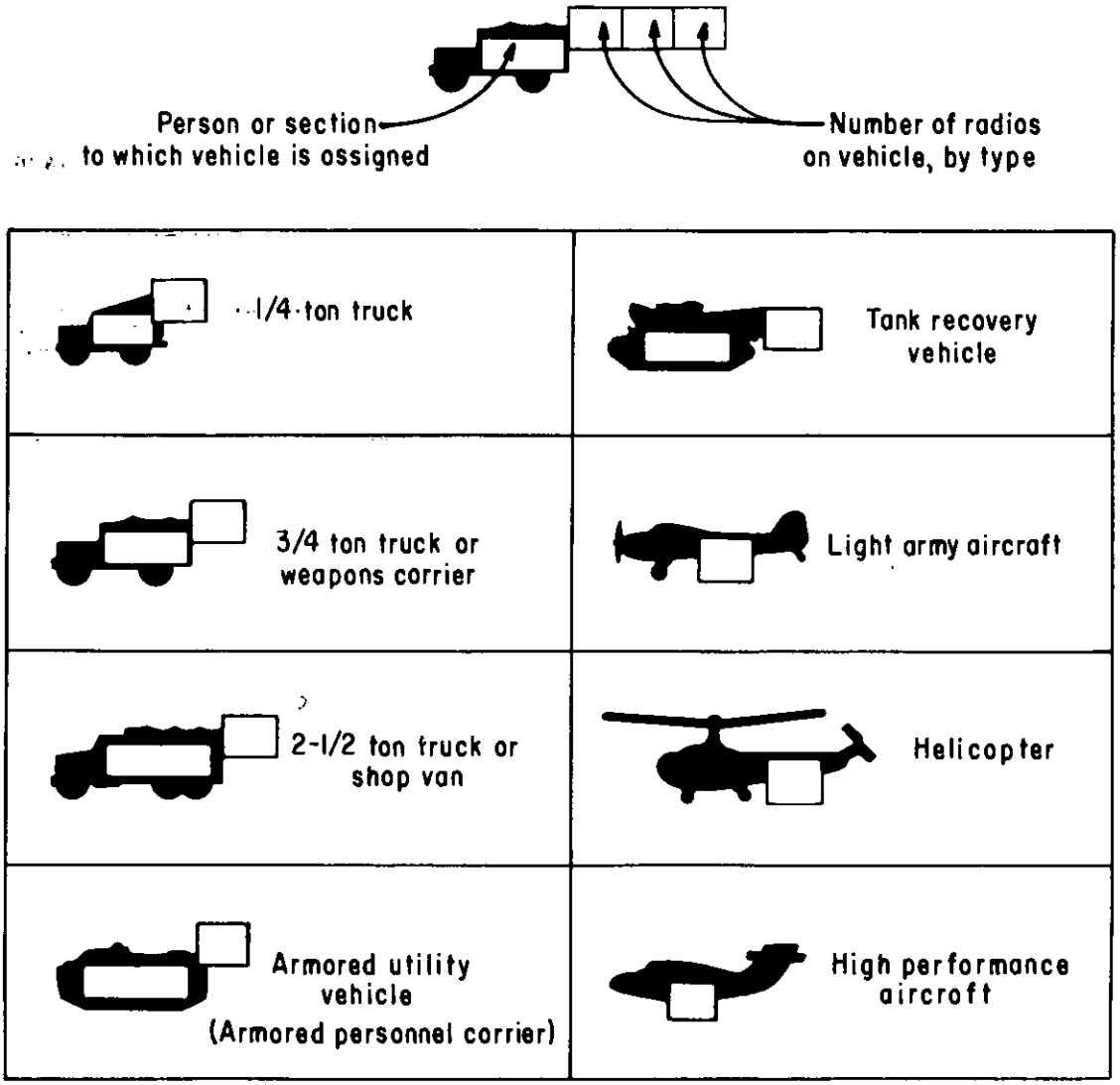


Figure 156. Vehicle silhouettes.

INDEX

BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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DCSPER (2)
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DCSLOG (2)
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CRD (1)
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CINFO (1)
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TJAG (1)
TPMG (1)
TSG (1)
Tech Stf, DA (1)
ARADCOM (1)
ARADCOM Rgn (1)
LOGCOMD (1)
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Div Arty (10)
AD Bde (1)
Arty Bde (1)
Inf Bde (1)
Regt/BG (5)
FA Gp (5)
FA Bn (5)
FA Btry (5)
USMA (5)
USAWC (5)
USACGSC (30)
MAAG (5)
Mil Msn (5)
Br Svc Sch (5) except
USAARMS (30)
USAAMS (2300)
USAIS (33)
USASCS (25)
Units org under fol TOE:
17–22 (5)

NG: State AG (3); TOE Units: 1–7 (1), 1–17 (1), 6–100 (3), 6–115 (3), 6–125 (3), 6–300 (3), 6–401 (3), 6–415 (3), 6–425 (3), 6–501 (3), 6–575 (3), 7 (1), 17 (1). All Other Arty Units (2).

USAR: Same as Active Army except allowance is one copy to each unit.

For explanation of abbreviations used see AR 320–50.

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