CHAPTER 4

COMMUNICATIONS ASHORE

The activities of the Naval Communication System (NCS) are located strategically ashore throughout the world to provide complete radio coverage of the major portions of the earth. These activities are linked to each other by point-to-point radio and landline circuits. They are linked to the operating forces by broadcasts, ship-shore circuits, and special circuits as required.

The NCS consists of the following components:

1. Naval Communication Station (NAVCOMMSTA), which provides all the communication facilities and ancillary equipment required for essential fleet support and fixed communication services for a specific area.
2. Naval Radio Station (NAVRADSTA), usually a remote subcomponent of a NAVCOMMSTA that performs radio transmitting or radio receiving functions. To indicate the function performed, a type designation letter (T or R) is added in parentheses.
3. Naval Communication Unit (NAVCOMMU), assigned a limited or specialized functional mission.

Each component of the NCS is organized into one or more of the following operational integrated elements:

1. Message center;
2. Cryptocenter;
3. Relay station;
4. Wire room;
5. Radio transmitter and radio receiver stations;
6. Control center;
7. Visual signal station as required;
8. Classified relay station; and
9. Facsimile and radiophoto center.

These elements are integrated and controlled at any geographical location by a communication center. Depending on function, a communication center may be classified as primary, major, minor, or tributary (user) message center.

The NAVCOMMSTA is discussed in the following section. Major, minor, and tributary centers maintain facilities and perform limited functions, similar to the primary centers, within their geographic areas. Major centers, linked by radio and landline circuits to the primary centers, maintain the circuits necessary for interconnection with areas where the traffic volume does not justify a larger (primary or major) center. They handle local communications, and relay messages between tributary stations and the major or primary center with which they are associated. A tributary is a small station serving a local command.

NAVAL COMMUNICATION STATION

The NAVCOMMSTA is the largest component of the NCS. Currently there are 19, of which 5 are classed as primary communication centers: NAVCOMMSTAs Washington, D. C., San Francisco (Stockton), Calif.; Honolulu; Guam; and Port Lyautey, Morocco. These 5 form the nucleus of the Naval Communication System.

Primary communication centers are linked by multichannel single sideband (SSB) or RATT, voice, and FAX trunk circuits. (SSB is discussed in chapter 7.) Each center operates and maintains—

1. A fleet broadcast for the delivery of traffic to all U. S. naval ships in each ocean area. These broadcasts consist of a high-power VLF or LF transmitter keyed simultaneously with several high-power HF transmitters.

2. A fleet radioteletypewriter broadcast, similar to the fleet broadcast except that a VLF transmitter is not utilized.

3. A general broadcast, also similar to the fleet broadcast except that a VLF transmitter is not used. These broadcasts provide time signals, weather (RATT and CW), hydrographic warnings and notices, press (RATT and CW), and merchant ship broadcast schedules.

4. A fleet facsimile broadcast.

5. A high-power, high-frequency ship-to-shore circuit, manually keyed.

6. A high-power, high-frequency radioteletypewriter ship-to-shore circuit available for use with fleet commanders.

7. Local MF, UHF manual, radioteletypewriter, and voice ship-to-shore circuits as required.

8. Multichannel radio and landwire teletypewriter, voice, and facsimile trunk circuits to major or minor communication centers throughout the world.

9. Radio or landwire teletypewriter circuits to tributary activities.

10. Other radio or landwire circuits as may be required to meet specific requirements.

11. Radio and landwire link control.

12. Visual signaling facilities as required to meet specific requirements.

The NAVCOMMSTAs also provide communications for naval district and river command commandants; commanders or naval bases, stations, and shipyards; and Marine Corps support establishment commanders. Other tasks assigned to certain NAVCOMMSTAs are the operation and maintenance of one or more of the following: security group facilities; communication facilities for the headquarters of a specific major command; primary and secondary air operational communication facilities; and communication facilities and services for the Army, Air Force, Coast Guard, Federal Aviation Agency, or other Government agency as economically feasible.

ORGANIZATION

Figure 4-1 shows the standard organizational structure of a primary NAVCOMMSTA. Minor deviations from the basic organization are permitted to meet the local situation. Departments or functions for which support is received from other activities may be omitted. An example might be where the NAVCOMMSTA is close enough to a naval station so that it may utilize the public works and supply departments of the naval station without difficulty, or where the public works functions are performed by a public works center. Otherwise it will need public works and supply departments of its own. Two or more departments are combined where one or all are of insufficient size to warrant separate departments.

The buildings and spaces of NAVCOMMSTAs vary so widely in location and arrangement that generalization is difficult. Usually, the components discussed in this chapter are present, but at some stations they are scattered over a large area. Often, the transmitting and receiving radio stations, in particular, are several miles from the remainder of the activity.

The commanding officer of a NAVCOMMSTA usually is of the grade of captain or commander. He is responsible for the station's successful fulfillment of its mission. To this end, he establishes policies and procedures for its operations, and initiates and enforces local directives for its upkeep and security.

The responsibility of the commanding officer includes functions of a management nature. Budget requirements must be determined, fiscal control exercised, and measures of performance developed and applied to ensure the most effective use of available manpower and funds. The efficient and economical operation of the station is a major responsibility of the commanding officer.

In addition to his station command, the commanding officer may be the staff communication officer for the naval district commandant or force or sea frontier commander of the area within which the NAVCOMMSTA is located. As such, he is responsible for coordinating naval communications within the district or area.

As aboard ship, the commanding officer is assisted in the discharge of his responsibilities by an executive officer who coordinates the activities of the department heads in accordance with the general policies promulgated by the commanding officer. The executive officer organizes the activities of the station, plans the details and procedures of the training and discipline of personnel, and prepares and issues operating orders, notices, and directives as required. When the commanding officer of the station also is the district or area communication officer, the executive officer may be the assistant communication officer of the district or area.

Special assistants to the commanding officer and the executive officer are the plans officer, operations officer, and the public information officer. These billets are not directly in the chain of command and may be assigned as collateral duties.

Depending upon its functions and the scope of its operations, a naval communication station may have a complement ranging from a hundred to several hundred officers, men, and civilians. In addition to personnel for communications and electronics, the complement

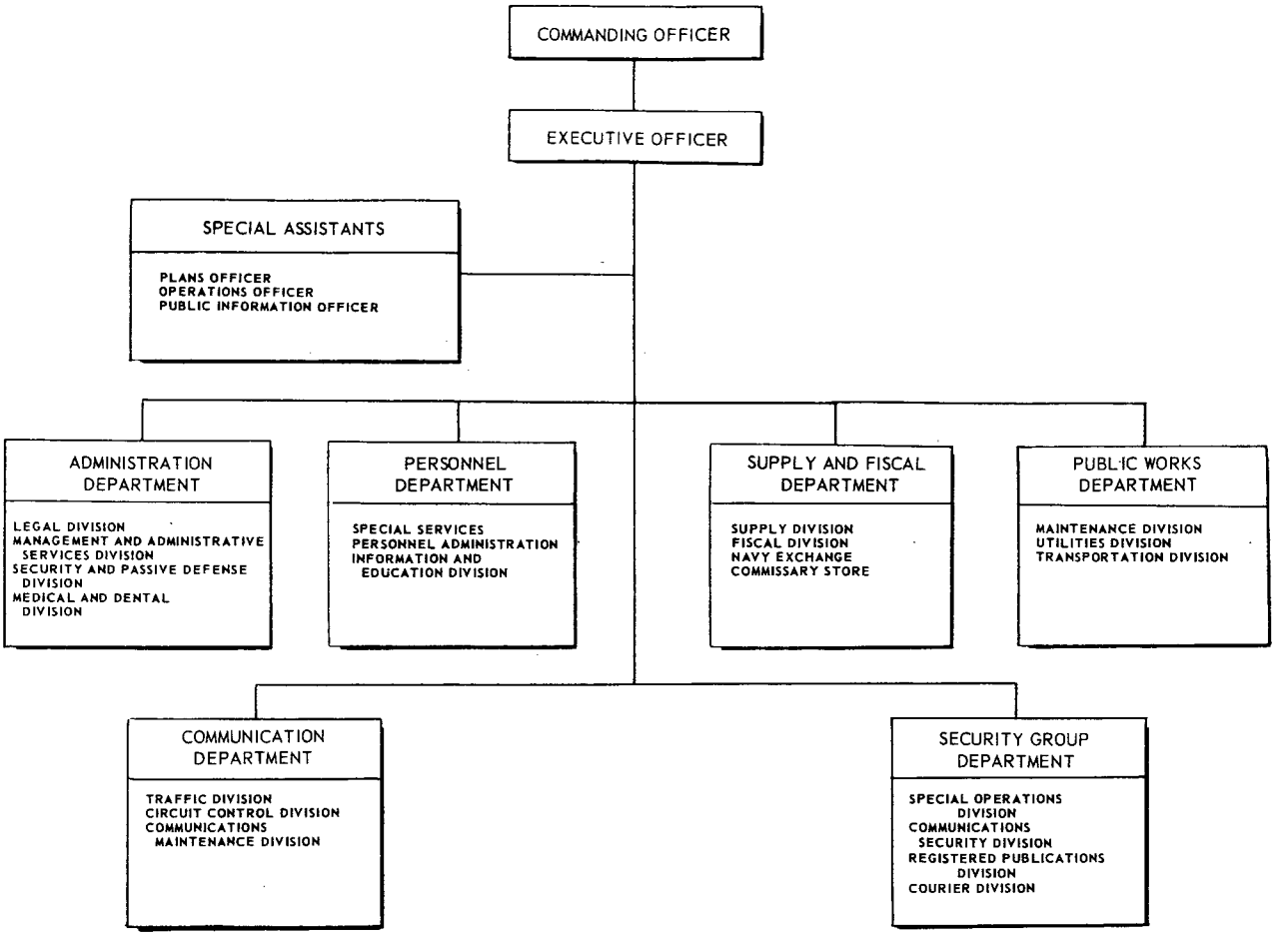

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Figure 4-1. —Standard organizational structure of a primary NAVCOMMSTA.

includes those needed for supply, administration, transportation, and other supporting services.

Communication Department

Of the various departments constituting the NAVCOMMSTA, the communication department (fig. 4-2) is by far the largest. Again, deviations usually are made from the basic organization plan to meet the local situation. In addition, the terminology for identifying the components of the communication department may vary from station to station. Basically, the divisions of the communication department are the traffic, circuit control, and communications maintenance divisions. When a receiver station is at the same location, the department may include a receiver division.

The communication officer of a NAVCOMMSTA usually is of the grade of lieutenant commander. He has direct supervision over the responsibility for most of the personnel and functions of the communication department of the station. He serves as manager of the local communication program and determines its budgetary requirements. In addition, he is responsible to the commanding officer for—

1. Formulating communication plans and directives.
2. Establishing an internal routing and filing system.
3. Providing for the physical security of messages and maintaining monitoring facilities.
4. Supervising the operation of the NAVCOMMSTA registered publications library through the command's appointed RPS custodian.

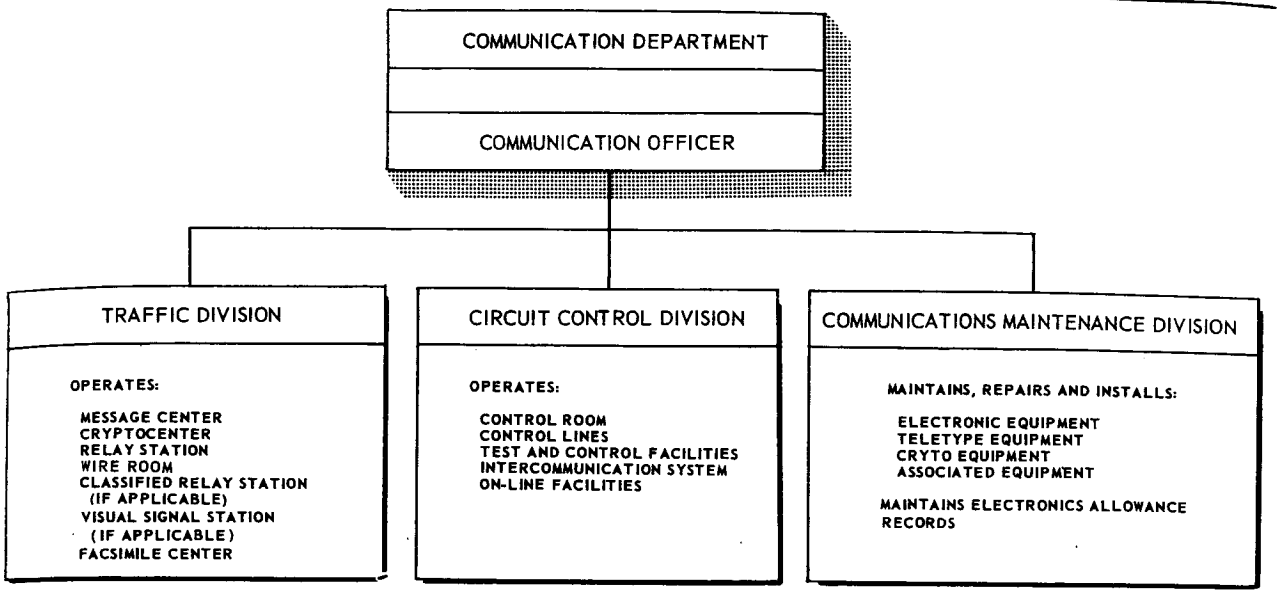

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Figure 4-2.—Basic organization plan for a NAVCOMMSTA communication department.

5. Supervising the training of communication personnel and cryptoboard members.

6. Operating and maintaining electronic and visual communication equipment.

7. Conducting inspection and inventories.

8. Maintaining records and forwarding abstracts and statements of the usage of naval communication funds.

TRAFFIC DIVISION.—Within the communication department, the traffic division is that section in which all incoming and outgoing messages (including FAX) are processed. The components of the traffic division include a message center, wire room, cryptocenter, relay station, classified relay station, visual signal station (when applicable), and a facsimile center.

Message Center—When an outgoing message from a local activity is received for transmission, the message is time-stamped and the releasing signature is checked against the master file of the authorized releasing officers to ensure that transmission of the message is properly authorized. A date-time group is assigned to the message and a check is made to determine if all security requirements have been met. Routing indicators, call signs, and address groups are assigned to the message and the heading is prepared. If the message is classified, it is sent to the cryptocenter for processing before transmission.

Messages received by electrical means for local delivery are also handled in the message center. The time of receipt is stamped on the incoming message. Next, it is scanned for garbles. It is prepared for further relay over local radio and/or wire circuits when required. The call signs and address groups are decoded and duplicate copies are made for internal distribution. Messages then are routed to the delivery desk where they are logged for delivery by messenger pickup, pneumatic tube, and telephone to the local activities served by the NAVCOMMSTA.

It is the responsibility of the message center to maintain current message routing and information facilities to expedite routing messages to proper circuits or transmission. Close liaison is maintained with the movement report center for ship locations. In addition, the message center should maintain the message files and a service section for obtaining and making prompt corrections to messages.

Wire Room.—The wire room operates those radio or landwire circuits that are off-net or not a part of the integrated tape relay network, such as—

1. Circuits to commercial companies.
2. Circuits to other Government agencies.

3. Fleet and general broadcast.
4. Certain ship-to-shore circuits.
5. Cables.

The wire room usually is located close to the message center; at some NAVCOMMSTAs it is considered part of the message center.

Cryptocenter.—At small stations, the proximity of all components of the traffic division enables message traffic to and from the cryptocenter to be passed by hand. Large stations require a more complex arrangement, both because of the greater volume of traffic and because of the physical separation of the various components. The cryptocenter at large stations is a tributary station of the relay station.

The routing of decrypted traffic from the cryptocenter is facilitated by the maintenance of a card file arranged according to subject matter. Each card lists those activities interested in a particular subject, and the action activity can be determined readily from this listing. The other activities are put on the routing sheet as activities interested for information only. A message is routed only to those activities that require it for their proper functioning. The number of copies made of a message of any classification is limited to the number required by the activities to which it is routed.

Authorized messengers from the activities served by the cryptocenter pick up copies of messages routed to their activities at the classified delivery desk. Carrier authorization cards for these messengers are retained at this desk. After presenting suitable identification, a messenger signs for and receives the messages for his activity. The messenger's receipt for a Secret message must indicate the copies (or copy numbers) of the messages received. A separate receipt is required for each copy of a Top Secret message. Top Secret messages are delivered to the Top Secret control officer of the activity. A continuous chain of receipts must be maintained for all individual items of Top Secret information. Responsibility for accounting for Top Secret information originated or received by the activity rests with the Top Secret control officer.

For outgoing messages requiring encryption, the original, signed by the releasing officer, is time-stamped at the time of receipt, and is retained in the cryptocenter as evidence of authorization to transmit the message. After the message is processed and the encrypted version is transmitted, a smooth copy containing the DTG, time of delivery, and special markings required is returned to the originating office for proof of delivery; other copies are routed as necessary to any local addees. Other than normal local distribution, if required, is indicated by the originator at the bottom of the last page of his message.

Relay Station.—The function of a relay station is to forward messages in tape form by means of automatic or semiautomatic teletypewriter relay equipment. The relay station is the communication center's link with the Defense Communications System.

At the present time five automatic switching stations link the naval activities in the United States. For services to east coast and midwestern activities they are at Cheltenham, Maryland; Norfolk, Virginia; and Trenton, New Jersey; and at San Diego and Stockton, California for activities in the western area. The system handles almost 100 percent of the Navy's command and administrative messages in the continental United States.

In the semiautomatic (torn tape) system, the incoming circuits of the NTX terminate in typing reperforators that automatically perforate and print messages on tapes. Message tapes are removed by hand (torn) from the receiving consoles by an operator who checks the tape for legibility of the routing indicators and station serial numbers. He also scans the remainder of the tape for garbles and multilation.

If the tape is found to be correct, the operator crosses off its channel number on his received numbers sheet for that circuit and enters his personal sign in the S-T (sign-time) column. Each operator and supervisor at a teletypewriter station is assigned a two-letter sign, usually his initials. No two persons at a single station are given the same sign, nor can the sign conflict with channel designators or prosigns.

When the tape is mutilated, garbled, without a channel number, missent or misrouted, or is in any other way unfit for relay, it is passed to the service desk.

Opening and closing notices (messages sent to commence or cease transmissions on a given channel), stop and go ahead (GA) notices (signals sent to suspend or recommence transmissions on a given channel), and other service and procedure messages are called to the supervisor's attention after checkoff.

After the receiving operator removes the tape from the console, checks it, and makes the proper entries on his numbers sheet, he delivers it to the routing line segregator.

The automatic relay system utilizes a method of routing multiple-call tapes (messages having 2 or more routing indicators in the routing line) known as routing line segregation. This means that routing indicators in the routing line are segregated or distributed in accordance with the desired transmission channel in the switching process. Under this system, only the routing indicators applicable to a particular circuit appear in the routing line. Messages received at a station which has further relay responsibility contain the routing indicators for which that station has relay responsibility.

Routing line segregation does not affect the tape preparation at the originating station; it is accomplished at the relay stations. At the automatic relay stations, the relay equipment (multiple address processing unit (MAPU)) automatically segregates the routing indicators according to the required transmission path.

In order to make the semiautomatic relay system compatible with the fully automatic system, relay stations which are not directly connected to the automatic system also must use routing line segregation procedure on all relayed messages. Semiautomatic relay stations require an operator using special equipment to perform the routing line segregation.

Figure 4-3 shows the page copy of a multiple-address message received by the message center at Guam (RUMGC) for processing in the NTX format and introduction into the relay station RUMG for onward relay.

The first line that appears in the message is line 2, line 1 being reserved for channel numbers between relay centers. Line 2, the basic routing line, consists of the precedence prosign RR (repeated) and the routing indicators identifying stations that are to affect refile or delivery of the message.

Before proceeding, you recall from chapter 2 the explanation of three- and four-letter call signs beginning with N. In addition to these type calls there are address groups composed of four random letters identifying various commands (e.g., EZLE—Commander Fleet Activities, Sasebo, Japan). In teletypewriter procedure, each shore communication center is identified by a group of four or more letters starting with the letter R; this is know as a routing indicator group, and is explained later in the chapter.

(line 2)	RR RUWSC RUHPC RUATAF RUECPA
(line 3)	DE RUMGC 098 10/1430Z
(line 4)	ZNR
(line 5)	R 1Ø14ØØZ
(line 6)	FM NFDR
(line 7)	TO RUWSC NALK/USS CARPEN
	RUHPC/NARL/USS LYONEL
(line 8)	INFO RUATAF/COMNAVFORJAPAN
	RUECPA/NAS PAX RIVER
(line 10)	GR 75
(line 11)	BT
(line 12)	Text
(line 13)	BT

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Figure 4-3.—Multiple-address message.

In line 3, the prosign DE means "This transmission is from the station whose routing indicator follows." RUMGC 098 is the routing indicator and the station serial number of the station processing the message tape. The time shown is the local filing time.

The letters ZNR in line 4 constitute a security warning indicating, in this case, that the message may be forwarded without change.

Line 5 shows the precedence and DTG of the message.

Line 6 contains the call sign of the originator.

In line 7, TO indicates the message is for action to addees following TO. RUWSC and RUHPC are the routing indicators that are to protect delivery to the ships having call signs NALK and NARL. The call signs are followed by the plain language version for the two mobile units.

Line 8 contains the information addressees. Again, the routing indicators shown are to protect delivery to the commands indicated.

Line 9, reserved for exempted addees when a collective call sign appears in either line 7 or line 8, is not applicable in this message.

Lines 10 through 13 are self-explanatory.

Line 14, when utilized, is reserved for corrections to the message.

If the relay station, RUMG, has direct circuits with the four routing indicators in line 2, four tapes are reproduced for onward transmission. In relay stations equipped with an MAPU, the tapes are cut automatically. In stations not so equipped, the routing line segregation operator determines the need for, and makes, the required tapes.

Next, the tapes are put into the tape holder at the transmitting position. The transmitting operator selects them in order of precedence. Tapes of the same precedence are selected in order of time of arrival or receipt. High-precedence traffic is transmitted at once, lower-precedence messages being removed from the transmitter if necessary. After selecting the tape, the operator inspects the routing indicator to decide the proper transmitter in which to insert the message.

Supervisory duties may be performed by one man, as is done at many smaller tape relay stations, or by several. Regardless of the number of supervisors, the basic responsibilities are the same.

The relay station supervisor must work in close coordination with watch officers at the radio stations. He is charged with the operation of all circuits and equipment, and with the movement of traffic through the relay station. He assigns personnel to the various sending and receiving positions. The relay supervisor keeps informed of all current operating instructions and changes to them. When an unusual event occurs, he notifies, in turn, the officer in charge, the CWO, and the section chief, making reports as necessary.

The relay station supervisor also maintains the relay station log, which records the opening and closing of circuits and any pertinent information regarding the watch, such as defective circuits, equipment casualties, and abnormal delays to traffic.

Supervision of the transmitting operations of the relay station is the responsibility of the sending supervisor. He instructs operators in the proper methods of inserting tapes and operating transmitters. He ensures that number comparisons are sent at designated times, and that stop and GA messages are complied with. He watches for the faulty operation of sending, automatic numbering, and monitoring equipment. If such a casualty occurs, he immediately notifies the relay supervisor and sends for the maintenance man.

Service operations of the relay room are under the direction of the service and monitor supervisor. These operations include—

1. Locating missent, misrouted, or lost messages and transmitting them correctly.
2. Retransmitting messages that were not delivered to an addressee because of equipment failures.
3. Preparing new message tapes when existing tapes result in faulty transmission.
4. Clearing up garbled or overlined (obliterated) message tapes.
5. Investigating claims of delay or nondelivery of messages handled by the station.
6. Investigating and correcting failures of automatic numbering equipment.

The receiving supervisor is responsible to the watch supervisor for the operation of the receiving positions. He checks the received message records for completeness of the required data (such as circuit designation and date), and inspects and endorses the records every half hour, reporting any open numbers to the service desk. He instructs personnel in the correct handling of tapes, the checking of channel numbers, the special handling of messages of high precedence, and in the general routing of messages.

Classified Relay Station. — The classified relay station operates a high-command (on-line crypto) teletypewriter relay network consisting of classified relay stations linked by channels and circuits of the DCS, utilizing on-line crypto equipment for handling high-precedence classified and unclassified traffic between the commands served by the network. The methods, procedures, practices, techniques, and functions of the classified relay stations are similar to those of the relay stations.

Visual Signal Station. —The visual station, when required, is responsible for the visual branch of communications at the NAVCOMMSTA. The station handles receipt, transmission, and relay of traffic to or from ships entering or leaving port or at anchorage. It parallels the shipboard signal division.

Facsimile Center. —Facsimile is the established system of telecommunication for the transmission of fixed images with a view to their reception in a permanent form. Facsimile transmission consists of sending pictorial-graphic intelligence by wire or radio, and is made via broadcasts to the fleet, from ships to

shore, and by point-to-point circuits. Facsimile transmissions have no inherent security as such, requiring ancillary security equipment to effect secure transmissions. Aside from purely naval FAX facilities, there is also a joint facility maintained by the U. S. Weather Bureau, Navy, and Air Force, called the National Facsimile Network.

The facsimile center of a NAVCOMMSTA has the functions of operating area facsimile broadcasts, working point-to-point facsimile circuits, and receiving ship-to-shore facsimile traffic. It may maintain a drop on the National Facsimile Network.

The equipment used by a facsimile center includes receiver-converters and facsimile transmitter-receivers (transceivers). In addition, the facsimile center has complete darkroom facilities.

The major facsimile operations are the fleet broadcasts, such as the broadcast from Washington (designator WP). Broadcasts are composed mainly of weather and radio propagation charts, but infrequently also may include photos, blueprints, drawings, charts, and other graphic material. At the present time, written messages are not transmitted on facsimile circuits, nor do they carry classified material.

Weather maps originate in a fleet weather central. Transmissions from weather central are carried by wire or radio carrier control link (CCL) to the radio transmitting station, where they are broadcast.

Each item of facsimile traffic carries an identification block, usually in the lower left corner. The identification block contains the standard message heading format, modified as indicated in table 4-1.

Table 4-1.—FAX Traffic Standard Format

Element	Line No.	Explanation
WP NR 115 R 101515Z	3 & 5	Station or broadcast identifying letters; station serial number; precedence prosign; DTG.
FM YASM	6	Prosign FM; originator's designation.
TO NERK	7	Prosign TO; action addressee designation (any or all U. S. N. ships).

Stations in the Naval Weather Service add headings to the weather maps they originate. All other headings are prepared in the message center.

Incoming point-to-point and ship-to-shore facsimile is received at the NAVRADSTA(R), and is carried by landline or radio CCL to the traffic division. Weather traffic goes directly to weather central, and a line monitor in the facsimile unit makes a copy. Material intended for activities served by the traffic division is sent by the facsimile unit to the incoming routing desk of the message center. Facsimile traffic is handled at that position in the same manner as other incoming traffic.

CIRCUIT CONTROL DIVISION.—Personnel in the circuit control division are responsible for operating the equipment in the control center of the NAVCOMMSTA. The control center (fig. 4-4) is a space that, in outward appearance and function, is comparable to a large telephone exchange. It is the entry point for the landlines and the central control point for the intercommunication facilities of the NAVCOMMSTA. Within the control center, all components of the communication center can be interconnected.

The radio and landwire link facilities for remote control of the equipment at the naval radio stations by the other components of the communication center are terminated in the control center. Personnel in the center operate equipment for testing all circuits or channels. Malfunctions are analyzed and remedial action is taken before returning the circuit or channel to its appropriate terminal or user.

Control center personnel operate the equipment for patching circuits or channels to alternate terminals or users, the telephone switchboard, and the associated facilities of the point-to-point telephone channels. They operate the intercommunication system between the control center and the naval radio stations and other components of the communication center and terminal users. Close surveillance is maintained over conditions existing on all circuits and channels, and emergency changes or adjustments to all circuits are directed by personnel in the center.

Control center operators maintain and operate the terminal equipment of the multichannel radio circuits. They operate the frequency measuring equipment in coordination with distant stations and direct frequency shifts. In addition, the facilities required for on-line

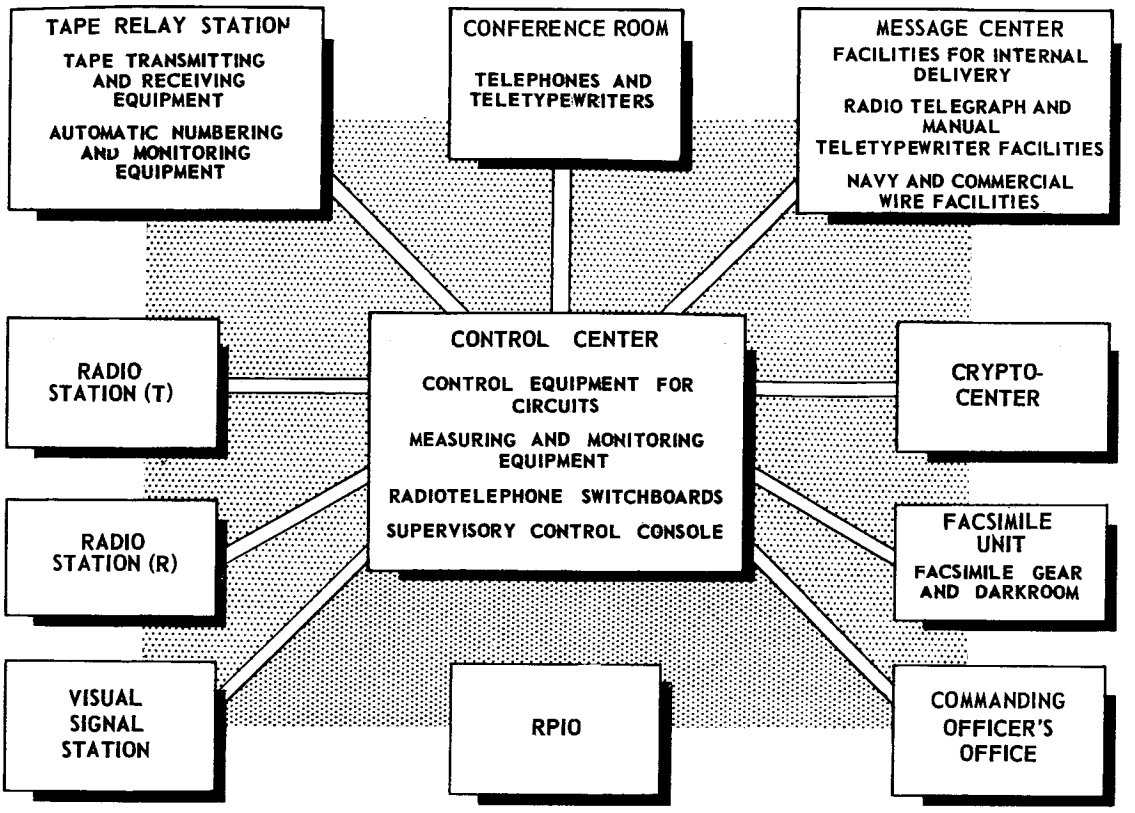

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Figure 4-4. —All components of a communication center are interconnected in the control center.

operation are maintained and operated in the control center.

COMMUNICATIONS MAINTENANCE DIVISION. —Personnel in the communications maintenance division are responsible for maintaining, repairing, and installing the electronic, teletype, and crypto equipment for the entire NAVCOMMSTA and for keeping the electronic allowance records up to date.

NAVAL RADIO STATION(R). —Radio receiving sites normally are located at some distance from both the communication station and the transmitting station. The location of the site is limited by the requirement for a quiet electrical environment permitting best receiving conditions.

Incoming signals usually are received and relayed to the communication station by landline or microwave facilities.

Certain receivers, particularly on ship-shore circuits, frequently are remotely tuned and controlled by the communication station operators. Receivers on long-haul point-to-point links are tuned and monitored by receiving station personnel.

All major communication stations maintain continuous watches on the primary ship-shore CW circuits. When a ship desires to pass traffic, contact is first established by this means. The shore station then directs the ship to a specific RATT frequency for passing teletype traffic.

At the shore station, ship-shore RATT is received on a teletypewriter and reperforator. The page copy made by the teletypewriter is kept for the station file, and the reperforator's tape is used to relay the message by direct wire to the traffic division. A typing reperforator is used to make a tape of CW ship-shore traffic from the receiving operator's copy, and this tape is relayed to the traffic division in the same manner as the RATT traffic.

Messages forwarded to the traffic division are relayed exactly as received, except that they are preceded by a station serial number assigned by the receiving station. As each message is received in the traffic division, the number is checked off on a "received numbers sheet."

The radio receiving station receives point-to-point radio signals and forwards them directly to the traffic division by either landline or a carrier control system. This procedure is used also for both point-to-point and ship-to-shore FAX traffic.

Because the receiving station has facilities for accomplishing special tasks, such as those performed by the communications security division, the security division usually is located at or near the radio receiving station.

NAVAL RADIO STATION (T). — The radio transmitting station usually is separated from the radio receiving station of the communication station. Personnel of the NAVRADSTA(T) operate and maintain 60 or more transmitters for the NAVCOMMSTA. The transmitters vary in capability from less than 1 kw up to a 2-million-watt output.

The circuits requiring transmission from the traffic division to the radio transmitting station go either by landline or by microwave radio link. Instructions concerning transmitting frequencies are passed from the control center to the transmitting personnel via a direct teletypewriter line (order wire). A log is maintained at the transmitting station listing the circuits, frequencies, transmitters in use, changes in any of these, outages, and any other pertinent data. The traffic division usually is notified by telephone of an outage, its expected duration, the reason for it, and other necessary information. (Outage denotes a circuit that is unusable for any reason—atmospheric conditions, equipment failure, and the like.)

A number of equipments are designed for shore radio stations to handle high-power, low-frequency broadcasts, other high-power broadcasts, and point-to-point transmissions. Some of these are link receivers, single-sideband transmitters, frequency shift keyers, and high-power, high-frequency transmitters for shore radioteletype communication. There also is a high-power transmitter of special design for low-frequency broadcasts.

The communication control link (CCL) receiver and its associated transmitter have a frequency range in the VHF or UHF band. It is used to receive signals originating in the traffic division of the radio receiving station, and is transmitted either there or at a special radio link station between the traffic division and the transmitting station. The signals employed may be multichannel telegraph signals using voice frequency tones, voice signals, or a combination of voice and telegraph signals. The audiofrequency range of the link channel is 300 to 12,000 cycles.

Single-sideband transmitters in the high-frequency band are used for long-distance, point-to-point, multichannel, tone, and voice communications.

A frequency shift keyer unit shifts a constant amplitude carrier between two extreme fixed frequencies representing the marking and spacing conditions of the radioteletypewriter signal, or, as with FAX, through a chosen variation of frequencies between two fixed frequency points. There also is a frequency shift keyer designed solely for use on facsimile circuits.

Also in use are special high-frequency, high-power transmitters for radioteletype transmission for shore-to-ship and point-to-point communications. These transmitters have a power output on the order of 40 kw. They have an internal water-cooling unit, as well as motors and blowers, and weigh almost 40,000 pounds. Frequency shift keyers or single-sideband transmitters may be used in conjunction with them.

DUTIES OF OFFICERS. —Because of the many and varied facets of the activities of the NAVCOMMSTA, it may be helpful to acquaint you with some of the particular duties and responsibilities of officers attached to the communication department of the station. Many of the functions discussed are performed to a lesser degree in most communication activities, including shipboard stations.

Traffic and Circuit Control Officer. —The traffic and circuit control officer operates and controls the radio and landline facilities at a major communication activity. He performs the following functions:

1. Supervises communication personnel, such as routing clerks, radio and teletypewriter operators, relay station operators, maintenance technicians, and messengers.

2. Determines workloads and effects personnel distribution to meet prevailing conditions.

3. Provides adequate facilities and circuits to meet communication requirements.

4. Interprets and applies communication procedures and regulations.

5. Conducts traffic studies and analyses to ensure efficient use of facilities and circuits.

6. Maintains current communication guard lists of forces afloat.

7. Investigates causes of delayed or lost messages, and takes appropriate corrective action.

8. Supervises preparation and submission of reports.

9. Controls security of assigned spaces and classified material contained therein.

Communication Watch Officer.—While on watch, the CWO is responsible for all incoming and outgoing traffic. It is his duty to ensure that all messages transmitted or received are handled rapidly and accurately in accordance with existing regulations and orders. The CWO controls communications as the direct representative of the communication officer for the period of his watch. In addition to the knowledge required of all officers performing communication duties, the CWO must have a particularly thorough knowledge of communication methods and procedures, including the internal handling of messages. Primarily, the CWO is responsible for—

1. Ensuring that messages are routed correctly and delivered promptly.

2. Ensuring that messages are prepared and transmitted in accordance with the procedures set forth in the current edition of DNC 5.

3. Maintaining the necessary records of incoming and outgoing traffic.

4. Proper filing of incoming and outgoing messages.

5. Proper operation of the cryptocenter during his watch period.

The CWO maintains a CWO notebook, and ensures that it is not removed from the message center. Immediately upon receipt of special orders, instructions, and information, the CWO notes in the book all data that should be passed on to his relief. The oncoming CWO reads and initials all new entries before relieving the watch.

Cryptosecurity Officer.—The cryptosecurity officer is responsible, under the commanding officer, for the accurate, secure, and efficient operation of the cryptocenter. To this end, he is charged with the following duties:

1. Provides for and supervises the training of all crypto personnel, ensuring that each member of the cryptoboard is thoroughly familiar with the provisions of ACP 122, with such other local service directives as may be issued by competent authority, and with the operating instructions for each cryptosystem he will use.

2. Ensures that all suspected violations of instructions or compromises of cryptosystems are reported promptly. This applies both to those suspected within his own cryptocenter, and those noted in incoming traffic.

3. Ensures that there is present in the cryptocenter at all times during its operation at least one person competent to select the proper cryptosystem for outgoing messages.

4. Requests drafters to make changes in messages, or their classification or precedence, when he believes that errors have been made.

5. Is responsible for the detailed performance of duty by crypto personnel, the assignment of tasks to them, and the supervision thereof.

6. Ensures that there is present in the cryptocenter at all times during his absence a person qualified and specifically designated to have responsibility for the performance of the foregoing duties.

7. When higher authority declares a particular system compromised and directs a review of messages encrypted in that system, the cryptosecurity officer brings to the attention of the commanding officer all such messages encrypted in his command. After reviewing these messages, the commanding officer takes such action as he deems necessary and feasible so far as his own operations may be concerned, and reports to the next higher headquarters any compromise of information involving major operations, strategic intelligence, or significant military planning.

Cryptoboard Members.—Cryptoboards always include commissioned officers as members, but in addition may include warrant officers and competent and reliable rated enlisted personnel who possess communication or general administrative training and are of unquestionable loyalty. All members must have an appropriate security clearance

in their records, and must have the commanding officer's permission for access to the cryptocenter.

Warrant officers and enlisted personnel thus employed, however, must be under the supervision of a commissioned officer who is a qualified cryptoboard member. The supervising officer furnishes the direction and guidance necessary to ensure the efficient and secure operation of the cryptocenter and of the cryptoaids and materials used therein. He must be physically present or immediately available at all times when the cryptocenter is in operation.

Station Relay Officer.—The relay station officer is directly responsible to the communication officer for the organization, administration, and supervision of the relay station. The station relay officer, usually a lieutenant, has two principal assistants: the chief in charge of the relay station, and a civilian administrative assistant.

In addition to supervising operation of the relay circuits and station relay terminal facilities, the station relay officer administers a training program for station relay personnel, provides adequate control of message accountability, and works with other components of the NAVCOMMSTA and with communication officers of other activities to ensure satisfactory service and operation of the station.

Facsimile Officer.—The facsimile officer plans and administers the operations of facsimile receiving and transmitting facilities. He performs the following functions:

1. Directs the location, installation, and maintenance of fixed and mobile facsimile equipment.

2. Supervises the training of communication personnel in all phases of maintenance and operation of facsimile and related auxiliary equipment.

Electronics Material Officer.—The electronics material officer is in charge of the maintenance of the electronic equipment. His primary responsibilities are—

1. Installation, maintenance, and repair of electronic equipment crypto equipment, and teletypewriter equipment.

2. Allowance and plant accounting (i. e., maintenance of records and filing of reports for all installed electronic equipment).

Signal Officer.—The signal officer is in charge of the NAVCOMMSTA visual station. His duties are to—

1. Organize, coordinate, and supervise his personnel to ensure accurate, secure, and rapid handling of communications.

2. Record and report all discrepancies noted.

Security Group Department

The Naval Security Group (NAVSECGRU) protects the area of naval communications by directing the communications security effort. Most of the special functions involved are handled by components of the Naval Security Group located at NAVCOMMSTAs and naval security group activities (NAVSECGRUACTs). Certain operations may be performed, however, by special teams or detachments assigned to the fleet or to other activities of the Navy.

The direction, administration, and coordination of the operations of the NAVSECGRU are the direct responsibility of the Head, NAVSECGRU under the supervision of the Assistant Director, Naval Communications for NAVSECGRU matters. Communication officers should be aware of the following functions performed by NAVSECGRU:

1. Safeguarding U. S. Navy communications against foreign intelligence.

2. Administering the Registered Publications System.

3. Supervising and administering the naval portion of the Armed Forces Courier Service (ARFCOS), including manning and operation of specified ARFCOS courier transfer stations.

4. Supervising the organization and administration of and training within the Naval Reserve NAVSECGRU program.

In addition to the special operations division, which is not covered in this text, the security group department usually is composed of a communications security division, a registered publications division, and a courier division.

COMMUNICATIONS SECURITY DIVISION.—The functions of the communications security division are—

1. Monitoring circuits to find evidence of improper circuit procedures, poor circuit discipline, off-frequency operation, and violation of rules for communication security.

2. Examining and analyzing all message traffic to determine errors.

3. Examining and analyzing all U. S. naval message traffic to ascertain what cumulative intelligence is available to foreign intercept.

4. Issuing communication improvement memorandums (CIMs) to the commands responsible for errors and malpractices in communications.

5. Effecting liaison with communication officers of naval activities on all matters pertaining to communication security.

6. Making training visits to fleet and shore-based activities.

The communication improvement memorandums are designed to invite the attention of communication personnel to procedural errors. They are not official letters to reflect upon the performance of any individual. An exception is made, however, when flagrant violations of communication discipline are uncovered, such as use of obscenity, unauthorized conversations between radio operators, and serious violations involving physical or cryptographic compromises. CIMs should not be used as a basis for determining the winner of a communication competition or for assigning penalties to personnel.

Communication personnel of naval activities should have liaison with communication security personnel and consult on all matters pertaining to communication security. Communication officers of staffs, ships, and stations are urged to utilize the technical knowledge and experience of communication security personnel.

Training visits, designed to improve overall communication procedures, are made by communication security personnel when requested by an activity. The visits are not official investigations or tests. A report of each training visit is made only to the commanding officer of the activity visited. Requests for training visits should be sent directly to the nearest NAVCOMMSTA, NAVCOMMU, or NAVSECGRUACT. All commands should make arrangements for at least one communication security training visit a year, if practicable.

REGISTERED PUBLICATIONS DIVISION.—The registered publications division is responsible for the operation of the registered publications issuing office. The RPIOs, responsible for supplying RPS-distributed publications, are located at points chosen to give maximum support to the Naval Establishment. Although normally components of NAVCOMMSTAs, they may be independent detachments or mobile units. Registered publication mobile issuing offices (RPMIOs) serve under appropriate service force commanders and operate at sea. Sometimes they are temporarily based ashore at a remote location when such location will best serve the fleet.

COURIER DIVISION.—The courier division is charged with the operation of a station of the Armed Forces Courier Service (ARFCOS). The ARFCOS is responsible for the secure and expeditious delivery of authorized classified material to military addressees and certain civilian agencies throughout the world. It is designed to eliminate duplication of effort and expense through the use of strategically located interservice courier transfer stations.

Officer messenger mail (OMM) centers, formerly operated within RPIOs, have been designated as courier transfer (CT) stations. Although OMM facilities still are frequently located within RPIOs and are operated by RPIO personnel, this no longer is an assigned mission of the Naval Communication System. The establishment and maintenance of facilities for handling officer messenger mail is the responsibility of the local commander.

The Naval Communication System is charged with operating the Navy's proportionate share of the approximately 60 courier transfer stations located throughout the world. The operation of local courier systems is the option and responsibility of local commanders.

NAVCOMMUS; TRIBUTARY STATIONS

Although much of the work of the Naval Communication System is done by the NAVCOMMSTAs and independent facilities, important functions are performed by naval communication units. The two departments in a NAVCOMMU are the communication department and the administration department.

A NAVCOMMU is under an officer in charge rather than a commanding officer. The assistant officer in charge has collateral duty as head of the administration department.

The communication department includes the message center, the cryptocenter, relay station, control room, classified relay station, visual signal station (if applicable), receiver station, and transmitter station. The functions of the communication department are the same at a NAVCOMMSTA and a NAVCOMMU.

The communication departments of naval bases, naval stations air stations, and other shore activities primarily provide local communication support for the activity of which they are an organic component. They furnish fleet support facilities air operational support facilities, and such extra-local service as may be required. They disseminate information and convey reports, progress data, current status information, and similar intelligence to the command or activity. In addition to providing local communication support, a communication department usually is a tributary of the Naval Communication System.

A communication department normally consists of a communication center, including wire and radio transmitting and receiving equipment, associated control equipment, cryptocenter, and such other equipment as local circumstances and requirements may dictate.

NETWORKS AND CIRCUITS

For point-to-point communications ashore, the NCS uses both radio and landline circuits. The largest share of traffic between these fixed stations, however, is carried by the teletypewriter (tape) relay network. This network includes certain channels of the radio trunk circuits, particularly overseas circuits, and practically all landline circuits.

The three principal methods used for transmitting messages to the fleet via radio circuits are broadcast, intercept, and receipt. These methods are discussed following the next section on point-to-point relay communications.

RELAY NETWORK

Stations comprising the worldwide relay network are designated as primary relay, major relay, minor relay, and tributary (terminal) stations. These designations are synonymous with the designations of their respective communication centers.

Traffic is handled in the network by tape relay, i.e., messages are both received and routed to their destinations or next relay points in tape form by means of either semiautomatic or automatic equipment.

Routing Indicators

A tape is routed in the network by means of a routing indicator, which is a predesigned group of letters assigned to identify a station (addressee) within the teletypewriter network. The proper assignment of a routing indicator is particularly important because of the possible relay by completely automatic equipment. Figure 4-5 shows the routing indicators for the relay stations and several of the tributary stations of the naval teletypewriter network.

It can be seen in figure 4-5 that the routing indicators are combinations of four or more (usually four to seven) letters. The first letter (R) identifies each group in the illustration as a worldwide relay network routing indicator, and distinguishes the group from a call sign, address group, or theater routing indicator. (The last is a self-contained localized network within a command or theater.)

The second letter of the indicator group identifies the nation or international alliance to which the group is alloted. In each group illustrated, the letter U indicates United States. In general (but not always), the second letter identifies the country by association—U for United States, D for Denmark, I for Italy, and so on.

The third letter identifies the geographical area in which a particular station is located or from which it is served. This is necessary for relay purposes because in a number of instances the second letter indicates a large nation with a number of stations (as the U. S.) or a group of small nations.

As you can see in figure 4-5, stations in the United States are designated by the third letter C, E, or W, based on the geographical position of the station. On the other hand, stations in Guam and the Philippines are blanketed by the letter M because of their proximity and a RATT trunk circuit.

The fourth and subsequent letters of a routing indicator designate relay and tributary stations.

Theater teletypewriter routing indicators are those used within a command or theater of operations, or which support a homogeneous purpose or activity. They are distinguished from the indicators used in the worldwide relay system in that the first letter is U instead of R. The meanings of subsequent letters are the same as those used in the worldwide system indicators. Local routing indicators, however, may not be used in the headings of messages transmitted over the worldwide relay system.

SUFFIX LETTERS.—Suffix letters may be added to routing indicators to aid the routing of

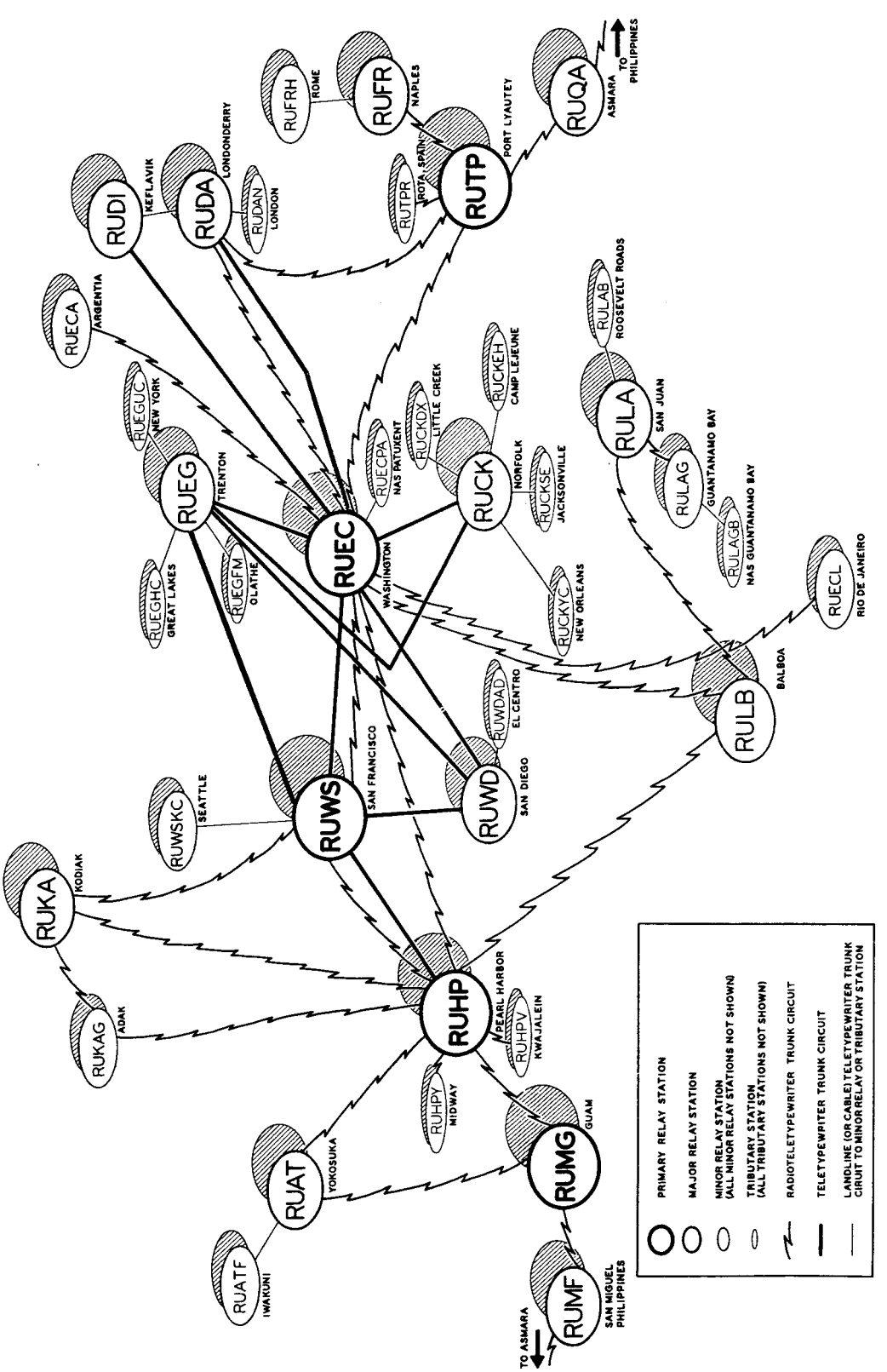

Figure 4-5.—Routing indicators used in the Naval Teletypewriter and Tape Relay Network.

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tapes for processing purposes or for other localized action by the relay station, including its supplementary sections or facilities. The authorized suffix letters are the letter C alone and certain two-letter combinations from CA through CZ. The use of these suffixes for intraservice messages is optional, but they are not used in joint or combined messages unless they appear in the routing columns of the encode sections of the combined worldwide routing indicator book. The meanings of authorized suffixes follow:

C—Local delivery of refile in page form is required.
CF—Section that accomplishes delivery by broadcast methods.
CI—Section that coordinates routing information.
CM—Section that prepares tape copies for retransmission.
CN—Electrical conference facility or section.
CP—Circuit/facility control point.
CR—Cryptocenter.
CS—Section dealing with service messages.
CT—Section that accomplishes delivery or traffic by telephone.
CU—Section that accomplishes delivery of traffic to commercial carriers.
CW—Section that relays traffic by radiotelegraph (CW).
CX—Section that uses tape relay methods for delivery of traffic to activities served by a military or commercial teletypewriter exchange system.

LEASED TELETYPEWRITER EXCHANGE SERVICE

Commercial teletypewriter exchange service (TWX) is employed by the Naval Communication System for communication with activities for which there is insufficient traffic to justify a full-time teletypewriter line.

The TWX service is supplied by a telephone company. The equipment is owned, installed, and maintained by the company. Teletypewriter communications are available to any TWX subscriber; subscribers and their TWX numbers are listed in a TWX directory. Connections for TWX communication are made by the telephone company TWX operator in a manner similar to a long-distance telephone call. The company is paid for the time used in actual communication with another station.

Normally, traffic for naval activities served by TWX is routed to a designated relay station rather than transmitted directly to the addressee by TWX, unless the TWX addressee is within a certain distance of the originator. This method of routing results in a considerable saving because the long-haul portion of the traffic travels over Navy-leased lines. The only cost is for the short-distance transmission between the nearest relay station and the addressee.

Relay of TWX messages to naval activities is facilitated by the assignment of routing indicators to facilities served by TWX. Activities equipped only with TWX facilities are designated by a routing indicator ending with the letters CX. The letters preceding CX in the indicator identify the relay station that transfers traffic routed via the relay network to and from the TWX-served activity. Because a particular routing indicator ending in CX may apply to several TWX-served activities, messages (including service messages) to the TWX-served activities must bear a complete address. The CX at the end of the message routes the message to the TWX section of a communication center, where the operator must read the address portion of the tape to determine the destination.

CIRCUIT TYPES

In discussing circuits, it should be noted that the word has a different meaning as a communication term than as an engineering term. When employed in the latter sense, it refers to a number of components connected electrically for the purpose of performing some desired function. As a communication term, a circuit is an electronic path between two or more points capable of providing one or more channels for the transmission of intelligence.

The four types of teletypewriter circuits are as follows.

A HALF-DUPLEX (or simplex) circuit is a landline circuit used for one-way communication between stations. It permits transmission in both directions, but not simultaneously.

A DUPLEX (or full duplex) circuit is a radio or landline circuit over which transmissions between stations may take place in both directions simultaneously.

MULTIPLEX (MUX) is a circuit capable of transmitting and receiving multiple teletypewriter messages simultaneously. Each

message is placed on a separate channel, and the channels are combined by using time division on a single carrier frequency.

A SINGLE-SIDEBAND (SSB) circuit is capable of transmitting and receiving simultaneously the information contained in up to 16 teletypewriter or RATT channels and one or more voice channels on both the upper and lower sideband frequency. (See chapter 7.)

RADIO TRANSMISSIONS TO THE FLEET

Three principal methods are used for transmitting messages to the fleet: broadcast, intercept, and receipt. When either of the first two methods is used, fleet units copy all transmissions but do not answer, thus avoiding the disclosure of their positions as happens when the receipt method is used. The broadcast and intercept methods have one common disadvantage in that there is no positive assurance that the message, as transmitted, has been received by the station called. This disadvantage is minimized by using transmitters of adequate power, careful choice of frequencies, good operating technique, monitoring transmissions for accuracy, and sequential serial numbers.

Broadcast Method

The broadcast method of transmission, as already stated, is the primary method of delivering traffic to the fleet. With this method, information transmitted is contained in sequentially numbered messages addressed to ships concerned. Communication personnel on each ship ensure that they have a complete message file (this is mandatory for all units and commands) by checking the sequential serial numbers.

A broadcast message serial number consists of the letter designating the broadcast area (as shown in fig. 4-6). Transmissions other than CW consist of a letter indicating the type of broadcast (RATT—R, facsimile—P (photo)), the abbreviation NR (number), and the sequential number of the message issued by the appropriate broadcasting station. For example, WR NR 105 is the one hundred fifth message broadcast during the month by RATT (R) from NAVCOMMSTA Washington (W); G NR 7 is the seventh CW fleet broadcast transmitted during the month by NAVCOMMSTA Guam. (The transmission is understood to be by CW unless otherwise indicated.) The serial number appears as the first item of the procedure component of the message. The first message of the month is number 1. Succeeding messages are numbered sequentially until the end of the last day of the month, at which time a new series is begun.

Fleet units and commands are required to guard a designated broadcast frequency that usually, but not always, is the frequency of the broadcast area within which they are operating.

On CW circuits, broadcasts follow regular schedules; no deviation is made without previous notification to the fleet. Messages are placed on these schedules in order of precedence. If a message with a precedence of immediate or higher is given to the transmitting station while a message of lower precedence is being broadcast, the lower precedence message is interrupted (unless only a short portion remains to be transmitted), and the high-precedence message is sent out. On RATT circuits, which have continuous broadcasts, a device may be keyed to ring bells on all receiving teletypewriters to call the attention of personnel to an incoming high-precedence message. It is possible that a long, low-precedence message that was interrupted may not be completed until the next schedule. Messages usually are not repeated on subsequent schedules. All ships copy schedules and maintain a complete file of all broadcast messages, but only the addressee takes action on any message.

To ensure reception by all units, the broadcast station employs several transmitters simultaneously—normally one very-low-frequency or low-frequency transmitter, and as many as five high-frequency transmitters. Most ships copying a broadcast tune to a low frequency and a high frequency, or to two high frequencies.

Broadcasts employ automatically keyed radiotelegraphy, radioteletypewriter, and radio facsimile. In the first method, messages are perforated on tape, and fed into a machine that keys them at a speed no greater than 29 words per minute. Ships with RATT equipment copy the RATT broadcasts, and do not copy the CW schedules. Facsimile broadcasts usually are limited to weather maps and similar material.

In addition to the fleet broadcasts, broadcast stations also transmit general broadcasts. General broadcasts include hydrographic warnings, notices to mariners, merchant ship traffic (MERCAST), and weather reports. In some

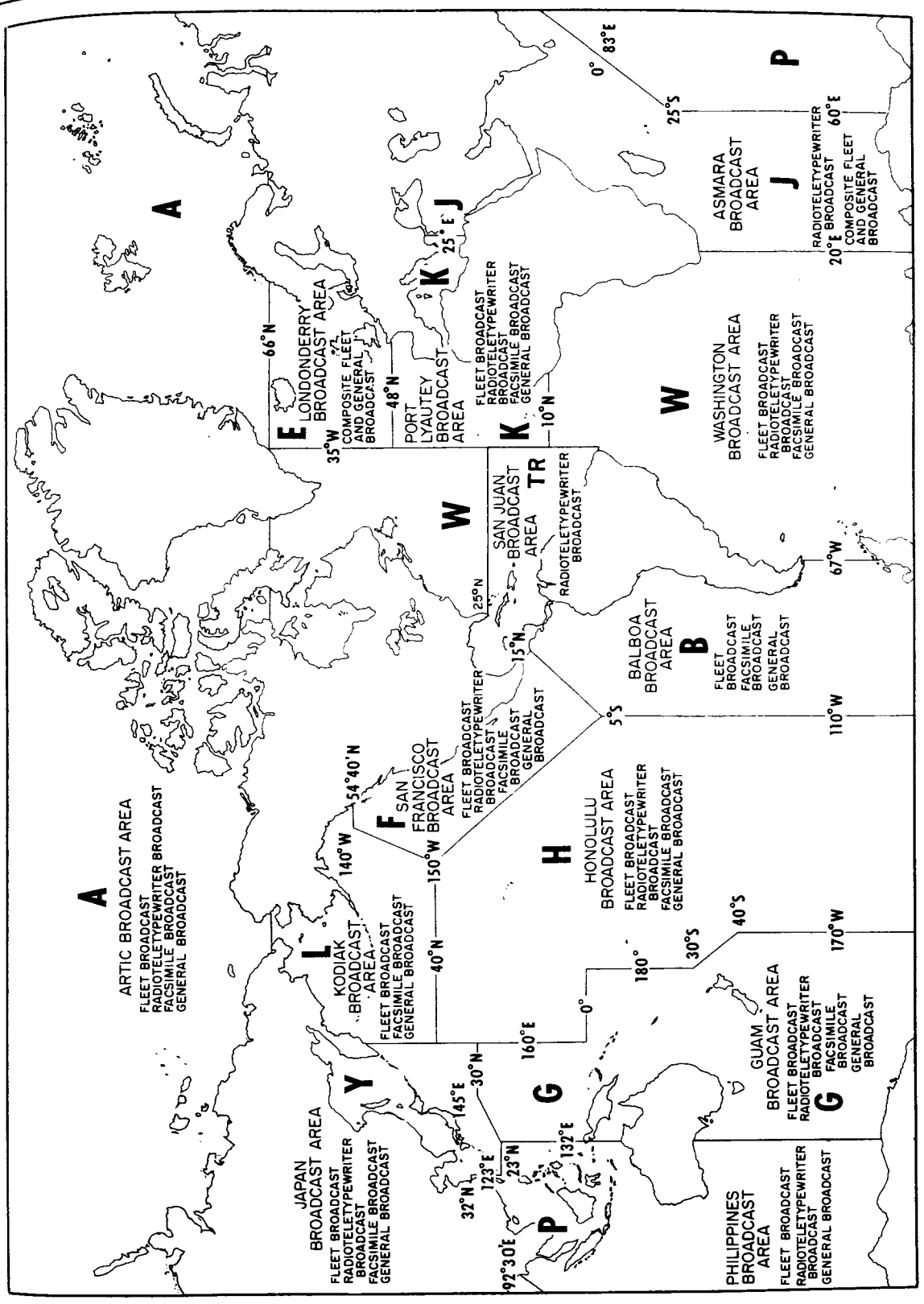

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Figure 4-6.—Broadcast areas.

areas, general broadcasts also include press and time signals.

Intercept Method

Using the intercept method, the transmitting shore station sends to a second shore station. The latter obtains necessary repetitions to ensure correct reception, and repeats back. Messages thus transmitted are actually intended for third stations or ships, which are required to copy the transmissions but do not receipt for them or use their transmitters for any other purpose directly in connection with these transmissions.

The intercept method has an advantage over the broadcast method in that the necessary verifications can be pointed out and corrections obtained. In addition, the third party has two opportunities to copy the same transmission. Despite these advantages, the broadcast method is superior in that it affords a higher degree of security and greater amounts of traffic can be handled in a given period. For this reason, the intercept method is not currently employed within the U. S. Navy.

Receipt Method

The receipt method of transmitting messages is a system of delivery in which the receiving station indicates that it has received each transmission. This may be done by the receiving station transmitting a receipt after each message or sequence of messages, or by making a periodic station serial or channel number comparison with the transmitting station.

The receipt method is the normal method of handling radiotelegraph point-to-point, ship-to-ship, ship-to-shore, and aircraft traffic. It also may be authorized by responsible commanders for shore-to-ship communication in peacetime and, under exceptional circumstances, in wartime.

The receipt method is the most reliable way of handling traffic because no doubt exists concerning the addressee's receipt of the message. Repetitions and corrections may be obtained as desired at the time of transmission.

A decided disadvantage in using the receipt method in wartime is that the location of both stations may be disclosed to the enemy through direction-finding equipment. In addition, the identity of the station using this method may be disclosed because of the use of individual call signs.

SHIP-SHORE RADIO CIRCUITS

Besides their responsibilities for operating fleet and general broadcasts, NAVCOMMSTAs are the principal agents in receiving radio traffic from the fleet. The primary means for delivering this traffic from individual ships to shore stations is via the ship-shore radio circuits. Certain NAVCOMMSTAs maintain a continuous guard on the fleet ship-shore circuit. Stations that do not guard the primary ship-shore circuits may guard special area ship-shore circuits instead. At many communication stations, a guard also is maintained on secondary ship-shore and harbor common circuits. These ship-shore frequencies are not used for point-to-point transmission, but rather as contact frequencies, the station then shifting to the working frequency.