# CHAPTER 2

# NAVAL COMMUNICATIONS

## EARLY HISTORY

In the old days, because of poor communications, naval warfare was largely a matter of guesswork. The commander of a fleet often had trouble trying to figure out not only what the enemy was up to, but also where his own ships were and what they were doing.

For instance, consider what happened when a French fleet slipped through a British blockading squadron off Toulon in 1798. Although the French were discovered and followed by two British observation frigates, Admiral Nelson did not receive news of the French escape until 8 weeks later. He then spent 30 days trying to find the enemy who, meanwhile, had put back into Toulon.

In the American Navy one of the earliest records of a signal system was a set of simple maneuver and recognition signs issued in 1778. An improved system was worked out by Captain Thomas Truxtun in 1797. This was based on 10 numeral flags from 0 to 9. Orders were relayed by numbers and combinations of numbers having meanings that could be looked up in a decode book.

During the Civil War, when many Federal officers went over to the Confederacy, Union signals had to be revised completely. The Bureau of Navigation, which took charge of naval communications in 1862, decided that the Navy should adopt the Army signal system. As a result, Army-style communications dominated Navy signaling until as late as 1892.

Semaphore came into the Navy in 1861, with a system of hand semaphoric signals somewhat similar to the present ones, but with a limited number of characters.

In 1864 two forerunners of the present day flashing light system made their appearance. Under one system a lantern, ball, or similar object was exposed, or a flag was lowered and raised, in dit-dah patterns. In fog or mist, the same code could be used for a trumpet blown in long or short blasts. Under the other system a canvas cylinder, with a lantern inside, was secured to the rigging in a manner permitting the light to be exposed or screened by pulling or releasing a line attached to the cylinder.

Electricity came into naval communications in 1875, when experiments with electric lights were conducted. In 3 years the range of these lights increased from 6 miles to a distance of nearly 17 miles.

It was not until the "wireless" came along about 1895, however, that naval communications could begin to approach the rapidity and long range it has today. By 1903 radio was op rational equipment throughout the United States Fleet. Since then there have been so many improvements in radio that it now is just as easy to send a message to fleets all over the world as it once was to pass the word to a single ship only a shout's range away.

The modern fleet or naval striking force travels faster, is distributed over much greater areas of ocean, and hits harder than any in the past. This increased speed of operation by submarines, surface warships, and aircraft, requires better and faster means of communications. The Navy's communication equipment and methods are changing rapidly and radically to meet this requirement.

No matter how deep into hostile waters a force may penetrate, it never is out of touch with its base of operations. In support is a complex global organization of communication stations with hundreds of radio and landline circuits. Within the force itself are all types of visual and electronic communication facilities. Orders and information that affect the successful outcome of the force's mission are exchanged swiftly and accurately throughout every level of command. The effect is a tightly directed

fighting unit — the direct result of reliable communications.

## MISSION OF NAVAL COMMUNICATIONS

Naval communications is the "voice of command" because it is the means by which naval command makes known its will. In performing your duties, you do your part to fulfill the mission of naval communications. This mission, as stated in the effective edition of DNC 5, is "to provide and maintain reliable, secure, and rapid communications, based on war requirements adequate to meet the needs of naval command, to facilitate administration, and to satisfy as directed, JCS-approved Joint requirements."

Communications serves command when it carries battle orders from a fleet commander to his subordinates, forwards docking information from harbor control to an entering vessel, or delivers a storm warning from the senior officer present afloat (SOPA) to all ships in the area. It aids administration when its circuits are used to furnish ship alteration data to an overseas repair facility, or to arrange transportation for a draft of men.

Naval communications is further pledged to assist in such disasters as floods, hurricanes, and earthquakes when normal communication facilities in the disaster area are out.

## POLICY OF NAVAL COMMUNICATIONS

The policy of naval communications is to —

1. Cooperate with the military services and other departments and agencies of the U. S. Government and Allied Nations.
2. Encourage development of the amateur and commercial communication activities of the U. S. for the enhancement of their military value and for safeguarding the interests of the Nation.
3. Promote the safety of life at sea and in the air, maintain facilities for adequate communication with the U. S. merchant marine, aircraft over the sea, and appropriate U. S. and foreign communication stations.

## FUNDAMENTAL COMMUNICATION PRINCIPLES

Naval communications must always be ready to meet wartime requirements. Its peacetime organization, methods, procedures, facilities, and training must be adequate and capable of shifting to an emergency or war status with a minimum of changes.

Through the years naval communications has been guided by certain basic principles that have been proven under war conditions. Foremost among these are RELIABILITY, SECURITY, and SPEED.

Reliability of communications is always the first requirement. A message must say exactly what the originator means it to say; it must be sent by the best method of communications available; and it must be complete and accurate in every way when finally placed in the hands of the addressee. Reliability cannot be sacrificed to meet the conflicting demands of security and speed, or for more convenience. However, there is a variable relationship between security and speed. Modern operating procedures permit security with speed, but sometimes one must be stressed more than the other. In the planning stages of an operation, secrecy must be preserved at all costs, hence security is more important than speed. During a critical moment in combat, however, very urgent messages may be sent in plain language instead of being delayed for encryption and decryption. Here, security is sacrificed for speed, although security may never be disregarded entirely.

## TELECOMMUNICATIONS

The word telecommunications refers to communications over a distance. Several methods of telecommunications are used by the Navy. Of these, at least four — radiotelegraph, teletypewriter, radioteletypewriter, and radiotelephone — concern the Radioman as operator. In your message-handling duties afloat and ashore, however, you also will work with traffic sent by other methods. Make sure that you know what they are, as listed here.

1. Electrical communications:
   a. Radiotelegraph;
   b. Teletypewriter (wire or radio);
   c. Radiotelephone;
   d. Facsimile (wire or radio).
2. Visual communications:
   a. Flaghoist;
   b. Flashing light;
   c. Semaphore.
3. Sound communications:
   a. Whistles, sirens, and bells;
   b. Sonar.

## ELECTRICAL COMMUNICATIONS

Of the various means of communicating, electrical communications is by far the most

important to the Radioman. A brief description of the listed methods of electrical communications follows.

### Radiotelegraph

Radiotelegraph (often called CW for "continuous wave" telegraphy) is a system for transmitting messages by a radiowave. In this system an operator separates the radio wave into the dits and dahs of the Morse code by opening and closing a hand key. Radiotelegraph was in use by the Navy as early as 1903, and even today, despite the development of faster and more convenient methods of electronic communications, is one of the most reliable and trustworthy systems used by the Navy.

According to a NATO staff communicator:

> "No technical advances have eliminated the need for the manual radio operator. To date, we have no automatic method that can in size, weight, frequency economy, and simplicity compare with CW telegraphy; we have no system which will discriminate against accidental or intentional interference to the extent possible with a trained operator. There is no electronic substitute for an operator's brain. . . Under marginal conditions the additional flexibility, simplicity, and reliability of a CW circuit may mean the difference between having and not having communications."

### Teletypewriter

The mental and manual actions performed by an operator in converting letters to Morse code (and vice versa) are replaced in teletypewriter by electrical and mechanical actions. To transmit a message, the operator types on a keyboard similar to that on a typewriter. As each key is pressed, a sequence of signals is transmitted. At receiving stations the signals are fed into receiving machines that type the message automatically.

Teletypewriter signals may be sent either by landline (wire) or by radio. Landline teletypewriter communication is used both by the military services and by commercial communication companies such as Western Union. Radioteletypewriter (RATT) is intended mainly to furnish high-speed automatic communication over ocean areas.

Today the chief shipboard use of RATT is for receiving fleet broadcast schedules, for which it is well suited. Radioteletypewriter can clear traffic at a rate in excess of 100 words per minute, as compared to the 17- to 29-wpm speed of the CW fleet broadcasts. Because the shipboard operator is freed from manual copying, and hundreds of ships may be receiving a single broadcast, the total saving in trained manpower is considerable.

Other shipboard uses of RATT are for communications between ships and, if the traffic load warrants, between ships and shore communication stations.

### Radiotelephone

Radiotelephone (sometimes called voice radio) is one of the most useful military communication methods. Because of its directness, convenience, and ease of operation, radiotelephone is used by ships and aircraft for short-range tactical communication. Its direct transmission of voice makes it possible for a conning officer to have in his hands a means of personal communication with the officer in tactical command (OTC) and with other ships. There is little delay while a message is prepared for transmission, and acknowledgments can be returned instantly. Radiotelephone equipment usually is operated on frequencies that are high enough to have line-of-sight characteristics; that is, the waves do not follow the curvature of the earth. This limits the usual range of radiotelephone from 20 to 25 miles. Radiotelephone procedure can be learned easily by persons with no other training in communications.

With these advantages of radiotelephone go some disadvantages. Transmission may be unreadable because of static, enemy interference, or high local noise level caused by shouts, gunfire, and bomb or shell bursts. Wave propagation characteristics of radiotelephone frequencies sometimes are freakish, and transmissions may be heard from great distances. Most radiotelephone messages are in plain language, and if information is to be kept from the enemy, users must keep their messages short, stick to proper procedures, and be careful what they say.

### Facsimile

Facsimile (FAX) resembles television in that it is a process for transmission of pictures, charts, and other graphic information. It is unlike TV in that (1) facsimile gives the receiving station a permanent record of the

transmission, whereas television does not; and (2) facsimile requires several minutes to transmit a picture approximately the size of this page, but television sends a continuous stream of 30 pictures per second.

Facsimile is very useful for transmitting such matter as photographs and weather charts. The image to be sent is scanned by a photoelectric cell, and electrical variations in the cell output, corresponding to the light and dark areas being scanned, are transmitted to the receiver. At the receiver the signal operates a recorder that reproduces the picture. Facsimile signals may be transmitted either by landline or by radio.

## VISUAL COMMUNICATIONS

Visual communication systems have been in use since the beginning of the Navy, and still are the preferred means for communicating at short range during daylight. In reliability and convenience, they are the equal of radio and are more secure.

The types of visual systems are flaghoist, flashing light, and semaphore.

### Flaghoist

Flaghoist is a method whereby various combinations of brightly colored flags and pennants are hoisted to send messages. It is the principal means for transmitting brief tactical and informational signals to surface units. Signals are repeated by addressees, thus providing a sure check on the accuracy of reception. Texts of messages that may be sent usually are limited to those contained in signal books.

### Flashing Light

Flashing light is a visual telegraphic system that utilizes either visible or infrared light beams, and it may be directional or nondirectional.

Directional flashing light may be pointed and trained so as to be visible only from the viewpoint of the recipient. It makes use of signal searchlights on which the operator opens and closes the shutter to form the dots and dashes of the Morse code. Smaller portable lights, in which the source of light is switched on and off to form the code characters, are used also.

Nondirectional flashing light is sent out from lamps located on a yardarm. The operator forms the dots and dashes with a telegraph key that switches the lamps on and off. Because the light is visible in every direction away from the ship, this method is well suited for messages destined for several addressees.

In wartime, flashing light communication that must be carried on after dark is usually conducted by means of infrared beams, which are not visible unless viewed through a special receiver. Infrared is the most secure means of visual communications, and transmission may be either directional or nondirectional. Directional infrared utilizes the standard signal searchlights fitted with special filters. Infrared yardarm blinker lamps are used for nondirectional signaling.

### Semaphore

Semaphore is a communication medium by which an operator signals with two hand flags, moving his arms through various positions to represent letters, numerals, and other special signs. Because of its speed, it is the preferred means of short-range message transmission during daylight. It is not readable much farther than 2 miles, even on a clear day.

## SOUND COMMUNICATIONS

Sound systems include whistles, sirens, bells, and sonar. The first three are used by ships for transmitting emergency warning signals such as air raid alerts, for navigational signals prescribed by the Rules of the Road, and, in wartime, for communication between ships in convoy.

Ships equipped with sonar (underwater sound) apparatus may communicate with other ships by this method, although passing messages is not the chief purpose of the equipment. In peacetime it often is used for coordinating exercises between surface vessels and submarines. Sonar communications may be either by voice or by Morse code.

Sound systems generally have the same range limitation as visual methods but are considered less secure.

## ELEMENTS OF NAVAL COMMUNICATIONS

Naval communications is comprised of five major elements:

1. Office of Naval Communications;
2. Naval Security Group;

3. Naval Communication System;
4. Communication departments of activities of the shore establishment;
5. Communication organizations of the operating forces.

## OFFICE OF NAVAL COMMUNICATIONS

The Office of Naval Communications (a part of the organization of the Chief of Naval Operations) is the headquarters of naval communications and provides the communication coordination and planning for the entire Naval Establishment. The staff of the Director of Naval Communications (DNC) assists him in the execution of his responsibilities. The staff includes two Assistant Directors (one for communications and the other for Naval Security Group matters), six special assistants, and five communication divisions: plans and policy, programs, operations and readiness, administrative and personnel, and radiofrequency spectrum. The work embraces radio and visual communications, landline systems, registered publications, and liaison with the other services and other Government agencies.

## NAVAL SECURITY GROUP

The Naval Security Group, under the direction of CNO (DNC), performs special functions in connection with communication security and communication and electronic intelligence. These operations usually are handled by security group departments of the Naval Communication System, although some may be performed by special teams assigned to fleet units.

The Naval Security Group administers the Registered Publication System, which includes Registered Publication Issuing Offices (RPIOs) and a central shipping and accounting office at the Naval Security Station, Washington, D. C. Most RPIOs are located at a communication activity, but occasionally these activities are not readily accessible to ships. Accordingly, independent RPIOs may be established at places where there are large concentrations of naval ships but no communication activity.

Another function of the Security Group is the operation of certain courier transfer stations. These stations, combined with Army and Air Force courier stations, make up the Armed Forces Courier System (ARFCOS). The ARFCOS transports mail and material requiring officer handling to meet security requirements.

## NAVAL COMMUNICATION SYSTEM

The Naval Communication System may be described as the backbone of naval communications. It includes all shore-based communication activities and the landlines and radio circuits that bind them into a worldwide network. It provides the means for transmission of CNO directives and instructions; broadcast of weather, general messages, orders, and similar message traffic to the fleet; and for the reception of essential intelligence from fleet commanders.

The Naval Communication System is comprised of three major types of activities. These activities are the NAVCOMMSTA, the NAVRADSTA, and the NAVCOMMU.

### U. S. Naval Communication Station (NAVCOMMSTA)

The NAVCOMMSTA includes all communication facilities and equipment required to provide essential fleet support and fixed communication services for a specific area. The various components of the NAVCOMMSTA are discussed in detail later in this chapter.

### U. S. Naval Radio Station (NAVRADSTA)

A naval radio station ordinarily is a component of a NAVCOMMSTA but may be located physically some distance from the NAVCOMMSTA. It is classified either a transmitting station or a receiving station, depending upon the function performed, and is so designated by the letter T or R added in parentheses. For example, NAVRADSTA (T) Lualualei, Oahu, is a component of NAVCOMMSTA Honolulu, Hawaii, but is located approximately 15 miles from the NAVCOMMSTA.

### U. S. Naval Communication Unit (NAVCOMMU)

Naval communication units are assigned limited or specialized missions, which may include some but not all of these assigned a NAVCOMMSTA. For this reason, the NAVCOMMU is much smaller in terms of personnel and facilities than the NAVCOMMSTA. NAVCOMMUs are identified by geographical location, as NAVCOMMU Seattle.

## COMMUNICATION DEPARTMENTS OF ACTIVITIES OF THE SHORE ESTABLISHMENT

Communication departments of shore establishment activities are components of the station or activity they serve. Their mission differs from that of NAVCOMMSTAs and other activities of the Naval Communication System in that, primarily, they furnish local support to the shore station mission. They disseminate information and convey reports and similar data to their own local command, although they may (and often do) work into or connect with the worldwide network of the Naval Communication System.

## COMMUNICATION ORGANIZATIONS OF THE OPERATING FORCES

At the level of the operating forces, it is easily seen that communications is the "voice of command." The communication organization aboard ship is under the direct and positive control of the commanding officer. It provides communication services needed to control and employ fleet units. These services include sending and receiving orders, instructions, reports, and various other forms of intelligence. Facilities are provided for rapid ship-shore and air-surface communications as well as for communications between ships.

## NAVAL COMMUNICATION STATION

The component activities of the Naval Communication System are located strategically ashore throughout the world to provide complete radio coverage of the major portions of the earth's area. 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 other special circuits.

The largest component in the System is the NAVCOMMSTA, of which the Navy has about 19 in strategic locations over the world.

The principal communication functions and facilities usually provided by NAVCOMMSTAs are —

1. Facilities for fleet support, consisting of —
   a. Fleet and general broadcasts.
   b. Ship-shore radiotelegraph, radiotelephone, and radioteletypewriter circuits.
   c. Point-to-point wire and radio circuits.
   d. Monitoring of distress frequencies.
   e. Interconnection with Army, Air Force, Federal Government agencies, and commercial communication systems.
2. Facilities for air operational support, including —
   a. Air-ground radiotelephone and radiotelegraph circuits.
   b. Monitoring circuits for navigational aids.
   c. Weather intercept or reception.
   d. Radio or wire circuits to air traffic control agencies.
3. Operation and maintenance of teletypewriter tape relay facilities.
4. Radio transmitting and receiving facilities.
5. Facsimile facilities.
6. Visual communication facilities.

In addition, NAVCOMMSTAs provide communication support facilities for the headquarters of naval district commandants, fleet or sea frontier commanders, and the commanders of naval bases, stations, or shipyards. Most NAVCOMMSTAs have facilities for issuing Registered Publication System publications. The specific missions assigned depend upon the role for the particular station in the Naval Communication System.

## COMMUNICATION CENTER

The various operational components of a NAVCOMMSTA are controlled by the communication center. Communication centers are designated as primary, major, minor, and tributary or user message centers.

Five NAVCOMMSTAS are designated as PRIMARY communication centers. They are —

NAVCOMMSTA Washington, D. C.
NAVCOMMSTA San Francisco, Stockton, Calif.
NAVCOMMSTA Honolulu, Hawaii
NAVCOMMSTA Guam, Mariana Islands.
NAVCOMMSTA Port Lyautey, Morocco.

Each primary center maintains fleet broadcasts, which usually have CW, RATT, and FAX components, for sending traffic to ships in their particular ocean areas (fig. 2-1). Ships in the Mediteranean, for example, receive traffic from NAVCOMMSTA Port Lyautey, Morocco. NAVCOMMSTA Washington transmits to ships in the

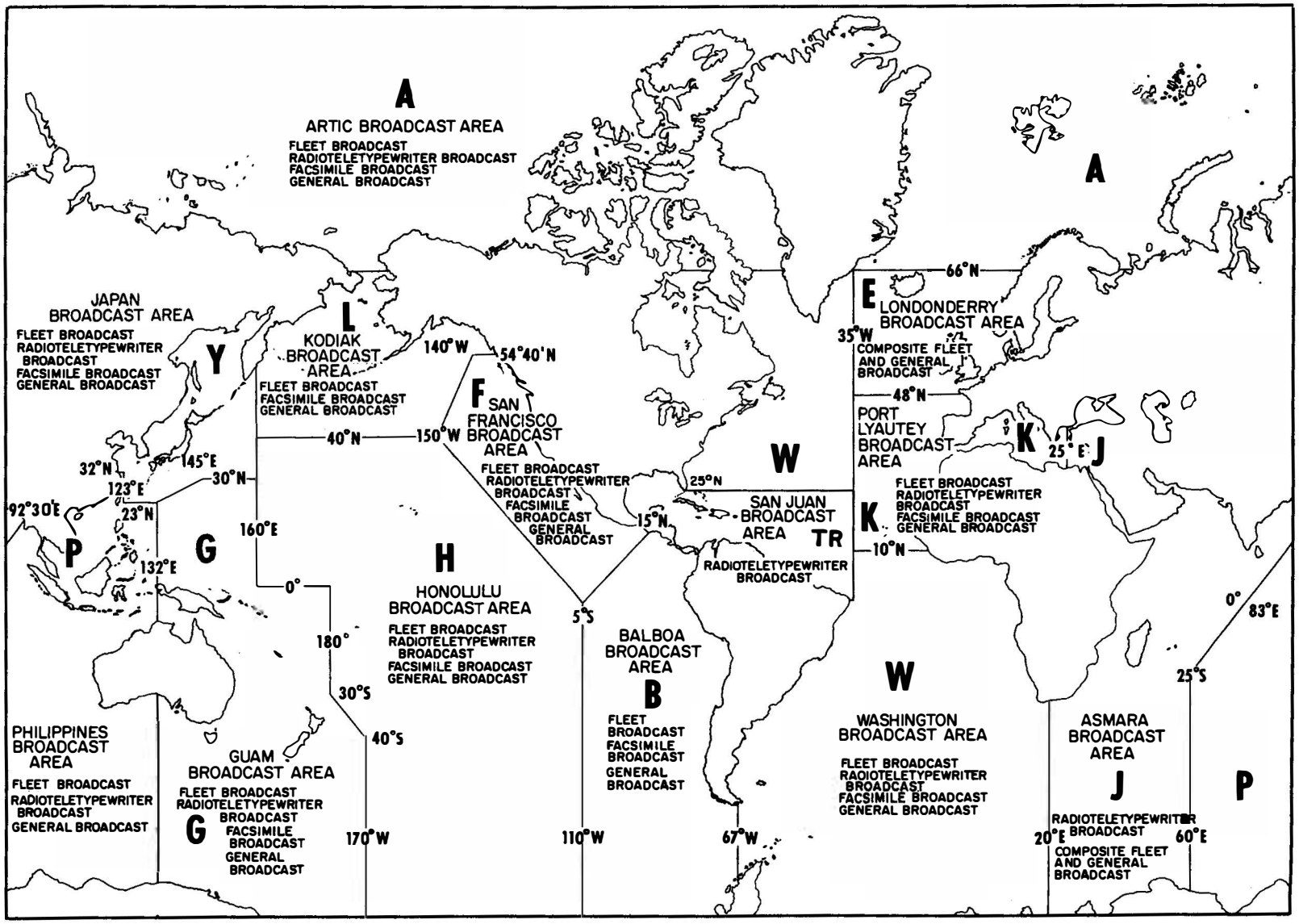


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Figure 2-1.—Fleet broadcast areas.

Atlantic and Caribbean. All the major oceans of the world are covered in a similar manner. Some of the broadcasts may be inactivated at times, because of reduced operations in a certain ocean area, resulting in one broadcast area being extended temporarily to include another. For instance, the Honolulu broadcast area often is extended to include the Balboa area, and the San Francisco area is extended to include the Kodiak area.

Provisions are available so that a primary or major center in a specific ocean may key the transmitters of one or more of the communication stations in the same area simultaneously with its own. This is called coronetting, and results in identical information being broadcast to these areas at the same time.

The RATT component of the broadcast may be utilized to disseminate classified as well as unclassified information to the fleet, in plain language copy, by using cryptographic devices at the sending and receiving ends. This is called a covered broadcast.

Each primary center also sends out a general broadcast of hydrographic information, weather forecasts, time signals, press news, and messages for Navy-controlled merchant ships.

In addition, facilities are provided for ship-shore communication.

The primary communication centers are linked by radio and landline circuits to each other and to the MAJOR communication centers throughout the world. These are also NAVCOMMSTAs or NAVCOMMUs, and each maintains the circuits necessary for interconnection with tributaries and minor communication centers. Many of them operate ship-shore radio circuits and transmit fleet and general broadcasts covering more limited areas than those of the primary centers.

MINOR communication centers serve areas where the traffic volume is not heavy enough to justify a primary or major center. Most are located at such activities as naval air stations and supply and ammunition depots. They handle local communications, and relay messages between tributary stations and the major or primary center with which they are associated.

Each primary, major, and minor communication center maintains a tape relay station. Its function is to forward messages in tape form by means of the automatic or semiautomatic teletypewriter tape relay equipment (discussed later in this manual).

A recent addition to the tape relay system is the switching center, with fully automatic equipment for routing messages in tape form. Messages are handled within the switching center at a speed of 200 wpm, thereby speeding up teletypewriter communications while effecting a saving in operational personnel. Presently there are five automatic switching centers serving naval activities in the continental United States. They are at Washington, Norfolk, and Trenton, N. J. for service to east coast and midwestern activities, and San Diego and San Francisco for activities in the western area.

TRIBUTARIES are small stations serving some particular command. They differ from minor communication centers chiefly in that they perform no tape relay functions and generally handle less traffic. Tributaries are the points at which messages enter and leave the shore communication system, and may be compared with the subscriber in a telephone system. They send and receive messages, as necessary, to serve local command.

All the switching centers, tributaries, and the primary, major, and minor centers discussed, and the radio and landline circuits connecting them, form the Naval Teletypewriter and Tape Relay Network (abbreviated NTX). The NTX is the linkage ashore between communication activities. Teletypewriter (carried by wire or radio) is the means of transmission of all the messages handled by NTX. The NTX network is covered fully in chapter 11.

## COMMUNICATION CENTER ORGANIZATION

Let us take the NAVCOMMSTA for an example of the organization of a communication center ashore. Such establishments have many billets for Radiomen, and you might well be assigned to one on your next tour of shore duty. Although the organization described is a typical one for NAVCOMMSTAs, the size and scope of operations vary considerably so that no two are exactly alike. All, however, handle thousands of messages daily, and their personnel must specialize to a far greater extent than aboard ship.

A NAVCOMMSTA may have a personnel allowance ranging from a hundred to several hundred officers, men, and civilians, depending upon its functions and the scope of its operations. In addition to communication and electronics personnel, there also are personnel for

administration, supply, transportation, and other supporting services.

The commanding officer of a NAVCOMMSTA usually is a captain or commander. He establishes policies and procedures for its operations, and initiates and enforces local directives for its upkeep and security. In addition to his station command, the commanding officer of a NAVCOMMSTA normally is the staff communication officer for the naval district commandant or the force or sea frontier commander of the area in which the NAVCOMMSTA is located. He is thereby responsible for coordinating naval communications within his district or area.

## Communication Department

The typical NAVCOMMSTA is organized into eight departments, of which the communication department is by far the largest. It is headed by the communication officer, who has supervision over the personnel and work of the department. He serves as manager of the local communication program and determines its budgetary requirements. Some of his other duties are —

1. Formulating communication plans and directives.
2. Establishing an internal routing and filing system for messages.
3. Providing for physical security of messages and for monitoring facilities.
4. Supervising operation of the publications library by the RPS custodian of the command.
5. Supervising the training of communication personnel and cryptoboard members.
6. Ensuring proper operation and maintenance of electronic and visual communication equipment.

Within the communication department are the radio, traffic, material, and facilities divisions. (See fig. 2-2.)

RADIO DIVISION. — The radio division operates the radio stations of a NAVCOMMSTA. Normally, there are two such stations — a receiving branch and a transmitting branch. Each station is headed by a radio station officer.

TRAFFIC DIVISION. — The traffic division processes incoming and outgoing messages (including facsimile), enforces security, and maintains custody of RPS-distributed matter issued for station use. A traffic and circuit officer is division head. He is assisted by communication watch officers, cryptographers, and a custodian, whose duties are similar to their shipboard counterparts. The following officers may also be attached to this division: a relay station officer, to head the tape relay station; a communication security officer, responsible for monitoring radio circuits and developing communication security measures; and a facsimile officer, to plan and administer operation of facsimile facilities.

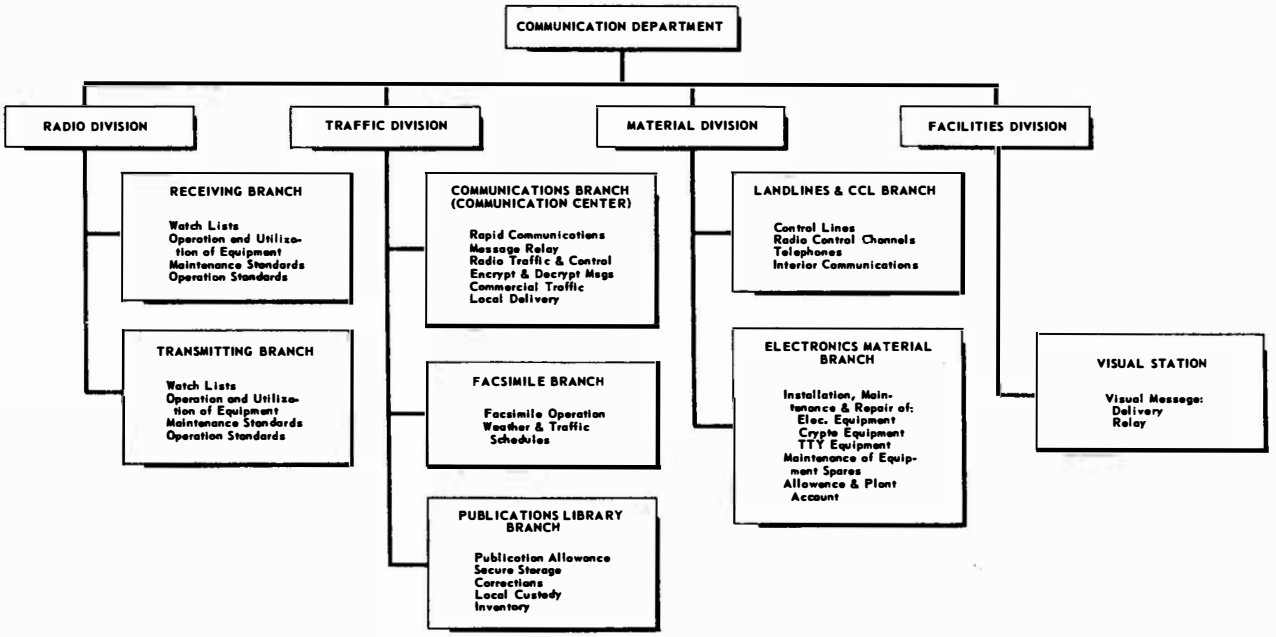


Figure 2-2. —Communication department of a NAVCOMMSTA. 6.3

MATERIAL DIVISION. — The material division is responsible for the physical functioning of wire circuits and for repair of electronic equipment. In charge are a landline officer and an electronics material officer.

FACILITIES DIVISION. — The facilities division operates the visual station. (Inclusion of this division depends upon whether the NAVCOMMSTA is located where these facilities are required.) The visual station is operated by a signal officer. He is in charge of receiving, transmitting, and relaying visual traffic to and from vessels in port or anchorage. His duties parallel those of the shipboard signal officer.

## Communication Center Spaces

The organization of shore communication centers varies considerably from station to station. Although physical arrangements differ, the typical shore communication center includes the following spaces: control center, message center, cryptocenter, relay station, wire room, classified relay, visual signal station, facsimile and radiophoto center, and radio transmitter and receiver stations.

Figure 2-3 shows the physical layout of a typical NAVCOMMSTA. The diagram is schematic, for in practice, buildings and spaces vary so widely in arrangement that generalization is difficult. Usually the elements shown are present, but at some stations they are scattered over many acres. Often transmitting and receiving stations are miles away from the rest of the activity.

CONTROL CENTER. — Essentially the control center is the master switchboard and monitoring station. All of the equipment of the communication center is wired through switchboards and patching panels of the control center. From the control center landlines branch out to other communication spaces, and landline or radio links lead to the remotely located transmitting and receiving stations serving the communication center. Control center personnel connect radio and landline circuits to appropriate equipment in the message center, relay station, classified relay, and other spaces. The control center contains control and terminal equipment and built-in monitoring and test equipment. It ties together, electronically, all the spaces of the communication center, and is the electrical

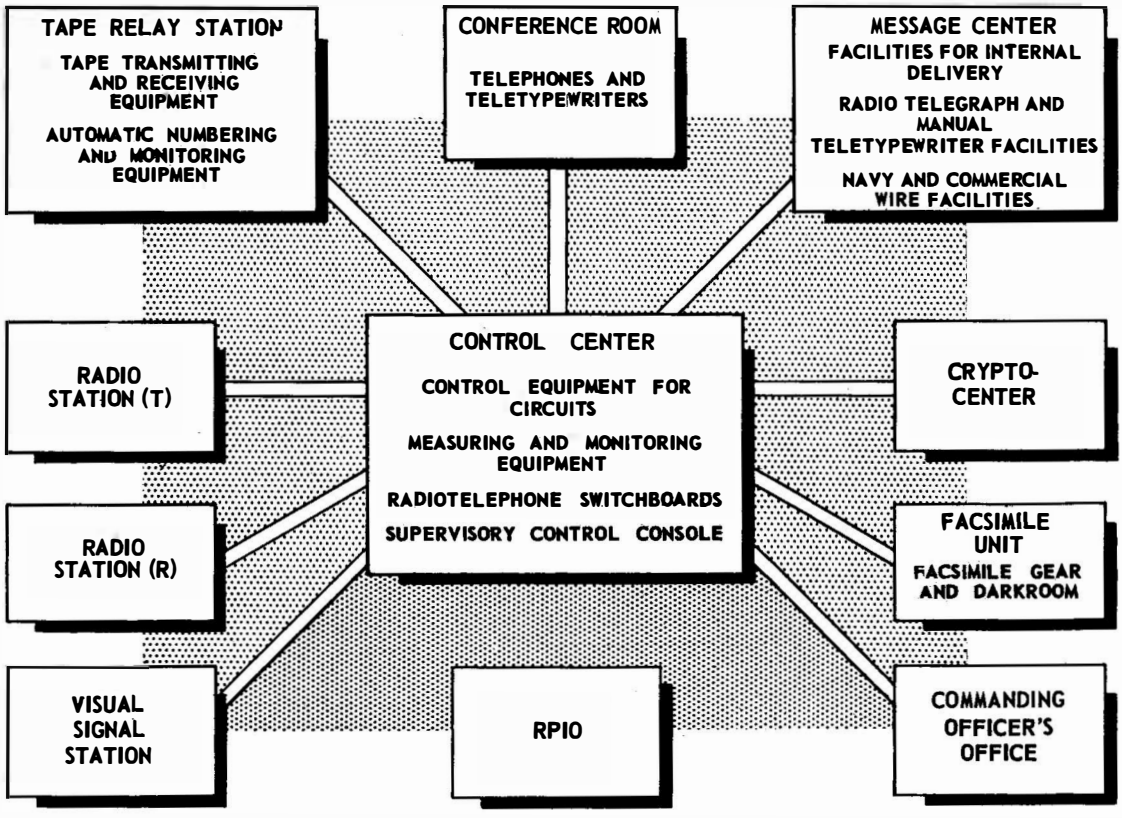


Figure 2-3.—Physical arrangement of a NAVCOMMSTA. 76.2

outlet from the communication center to other communication centers.

MESSAGE CENTER. — The message center is the converging point of all messages sent or received by the command it serves. In the message center, messages are logged, placed in proper form for transmission, checked for accuracy and security violations, serviced as necessary, written up, distributed internally, and filed in appropriate reference files. The message center operates circuits with the relay station for the reception or transmission of these messages.

CRYPTOCENTER. — As its name implies, the function of the cryptocenter is the encryption and decryption of messages. Messages to be encrypted or decrypted are passed from the message center and, after appropriate processing, returned for internal delivery or onward transmission as necessary.

RELAY STATION. — Messages handled by the relay station are in tape form. The relay station is the communication center's linkage with the Naval Teletypewriter and Tape Relay Network (NTX). It contains automatic or semiautomatic teletypewriter tape receiving, tape transmitting, and message numbering and monitoring equipment. This equipment is wired to the control center and, through the control center, to other NTX relay stations.

WIRE ROOM. — The wire room operates those radio or landline circuits that are not a part of the NTX system. These circuits include circuits to commercial companies, circuits to other Government agencies, fleet and general broadcasts, and certain ship-shore circuits.

CLASSIFIED RELAY. — The methods, procedures, practices, and functions of the classified relay are similar to those of the relay station. Using on-line cryptographic equipment, the classified relay provides naval communications with a secure and rapid means of handling classified messages.

As equipment becomes available, all teletypewriter circuits operated by the Navy are being converted to on-line operation.

VISUAL SIGNAL STATION. — A visual signal station is established at a NAVCOMMSTA only when the communication station is within sight of a harbor or anchorage. The visual signal station usually is located in a tower high above surrounding buildings so that there is an unrestricted view of the harbor. Messages to and from ships in the harbor are sent by flashing light, semaphore, or flaghoist.

FACSIMILE AND RADIOPHOTO CENTER. — The facsimile and radiophoto center operates the equipment required for sending and receiving pictures, photographs, weather maps, charts, and other material in graphic form. Facsimile traffic is processed in the message center along with regular messages.

RADIO TRANSMITTER AND RECEIVER STATIONS. — Depending upon the equipment installed, a radio station provides either transmitting or receiving facilities for the communication station of which it is a part. Radio stations usually are located some distance from the communication center to minimize the interference that results when high-power transmitters are located too near receiving units. Additionally, large fields are required for transmitter and receiver antennas, and suitable fields often are difficult to find near the communication center. Transmitters and receivers at the radio station are wired into the control center and, from the control center, are patched to remote operating positions or equipment in other communication spaces.

## DEFENSE COMMUNICATION SYSTEM

The Defense Communication System (DCS) was established in 1960 to provide a single communication system within the Department of Defense. The Defense Communication System is supervised and operationally controlled by the Defense Communication Agency (DCA). The DCA consists of a chief (an officer of general or flag rank), a headquarters staff, and such other units as are specifically assigned the Agency by the Secretary of Defense or the Joint Chiefs of Staff.

The DCS includes all Department of Defense circuits, terminals, control facilities, and tributaries (regardless of military department to which assigned) that are required to provide communications from the President, down the chain of command, to the fixed headquarters of the various subordinate commands. This takes in the point-to-point long-haul, Government-owned or -leased circuits that are a part of the Naval Communication System. Fleet broadcasts, ship-to-shore, ship-to-ship, and tactical circuits within a tactical organization normally are excluded from the DCS.

## JOINT COMMUNICATIONS

The need for coordinated and standardized communications among the United States

military services was clearly apparent during the early stages of World War II. Army and Navy facilities sometimes were duplicated in one location, and differences in procedures made efficient interservice communications difficult. Now communication procedures are standardized through the Department of Defense, hence the handling of interservice messages creates no special problems. Joint procedures are set forth in Joint Army-Navy-Air Force Publications (JANAPs). You will become familiar with these publications as you study naval communications.

## ALLIED COMMUNICATIONS

With worldwide cooperation between friendly nations and the United States, again the need arose for coordinated and standardized communications on an allied basis. To meet this need, Allied Communication Publications (ACPs) were promulgated. The ACP series provides the communication instructions and procedures essential to the conduct of combined military operations and communications in which two or more of the Allied Nations are involved. Your work in communications undoubtedly will require that you be familiar with many of the ACPs.

## NAVY MILITARY AFFILIATE RADIO SYSTEM

The Navy Military Affiliate Radio System (Navy MARS) was established to train amateur radio operators in Navy communication procedures. Through Navy MARS, amateur radio operators maintain an affiliation with the Navy, and provide a source of trained operators for use in a local disaster situation or a general emergency.

The operators, many of them former Navy personnel, generally operate from their own amateur stations with Navy-assigned calls. They handle message traffic of a morale nature that does not qualify for regular transmission over Navy circuits.

Navy MARS is a projection of Navy Department policy to encourage and support amateur radio activity among Regular, Reserve, and Retired personnel of the Navy, Marine Corps, and Coast Guard for morale, recreation, training, international good will, and public service.

## STANDARD SHIPBOARD ORGANIZATION

Each person in the communication division, from the Radioman striker to the watch supervisor, must know the departments aboard his ship and the nature of the work performed by each. Figure 2-4 is representative of a standard shipboard organization, and serves as a guide for type commanders in preparing the organizations of ships under their command. Shipboard organization varies slightly among types. In addition to figure 2-4, study the organization book for your individual ship. If necessary, make exploratory visits to other spaces.

The operations department is one of the five command departments of the ship. Its functions embrace all external communications, the combat information center, control of aircraft in the air, and repair of electronic equipment.

The effectiveness of the many changes taking place in ships, in equipment, and in weapons rests more and more heavily upon the capability and output of the operations department. Men who constitute, maintain, and give effect to the components of the operations department exert a marked influence upon the quality and extent of the ship's total capability.

## SHIPBOARD COMMUNICATION ORGANIZATION

The shipboard communication organization, shown in figure 2-5, is a branch of the operations department. As such, it comes under the cognizance of the operations officer.

## OFFICER BILLETS

The communication organization is headed by the communication officer, who is responsible for all communications sent and received by radiotelegraph, radiotelephone, radioteletypewriter, facsimile, and visual means. He is not responsible for the ship's interior communications.

The communication officer is responsible also for (1) the care and maintenance of communication equipment (including landlines and teletypewriter switchboards on ships equipped with these facilities); (2) preparation of communication reports; (3) procurement, custody, correction, distribution of, and reports on publications issued to the ship through the Registered Publication System; (4) supervision and training

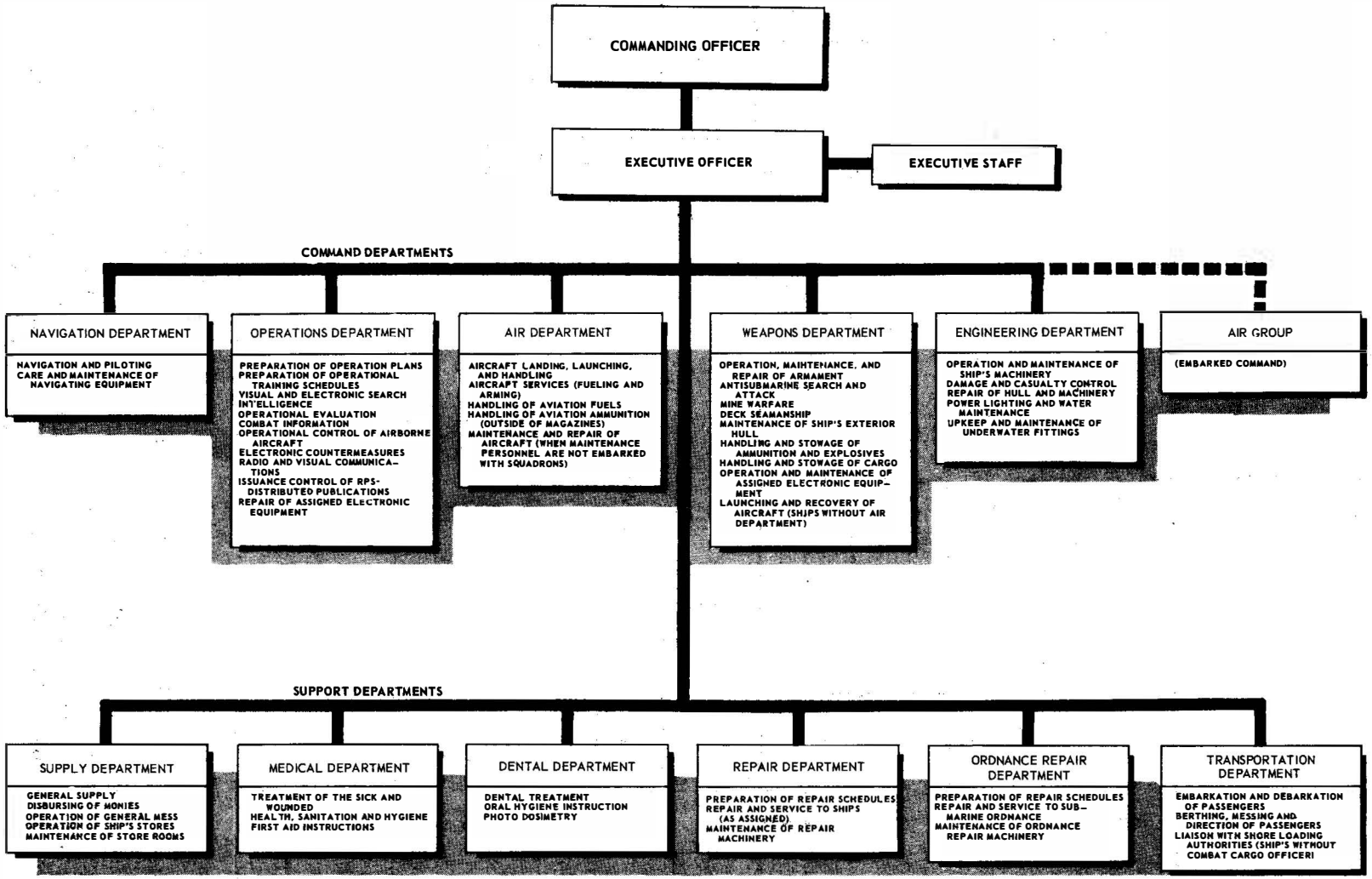


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Figure 2-4.—Standard shipboard organization.

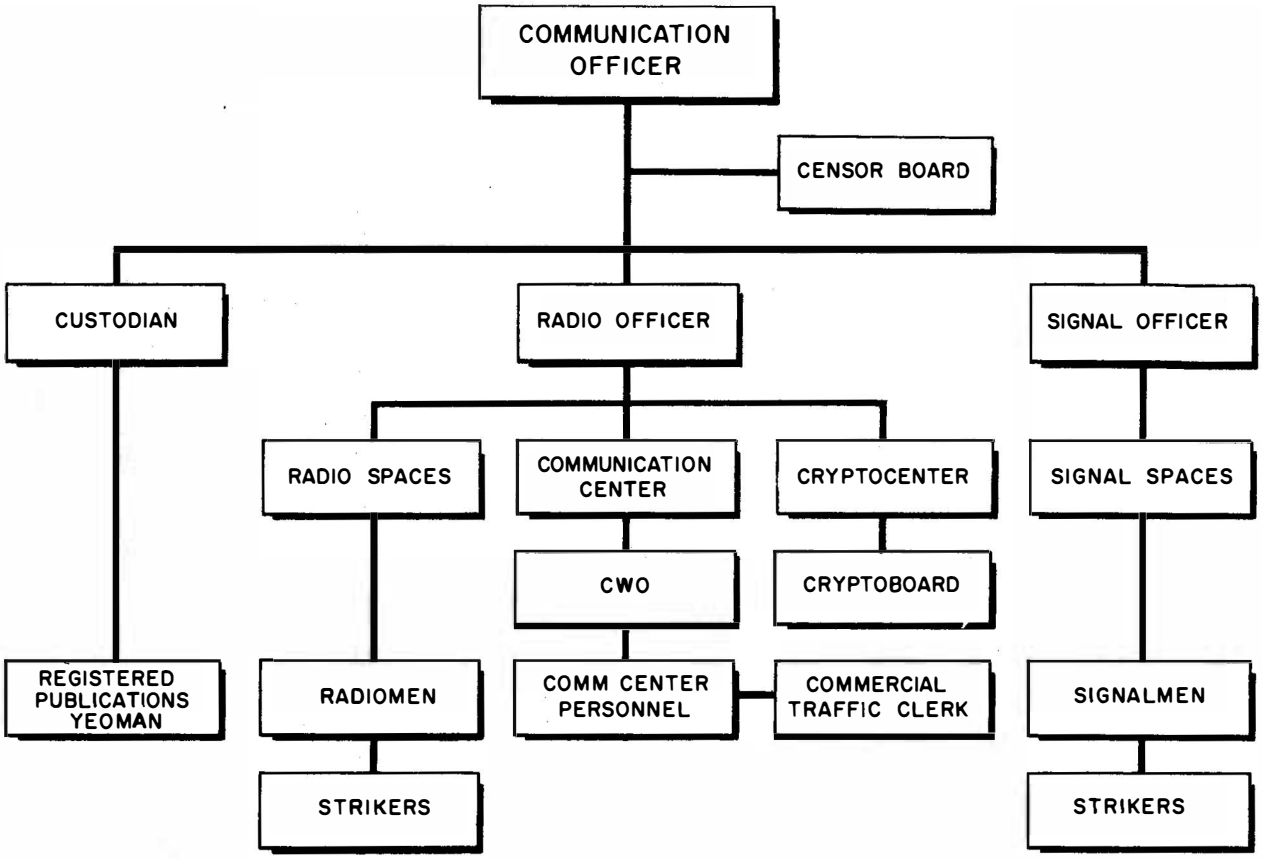



Figure 2-5.—The shipboard communication organization. 76.4

of the cryptoboard; and (5) cleanliness and upkeep of assigned spaces.

In large ships the communication organization is divided into two divisions--the OR (radio) division, headed by the radio officer, and the OS (visual) division, headed by the signal officer. In addition, the communication organization is assigned a custodian of registered publications, communication watch officers, cryptographers, and a cryptosecurity officer.

The radio officer is liable for the work of the OR division and for operation and maintenance of assigned equipment. It is his duty to assure reliable, secure, and rapid handling of radio communications. His responsibilities for the internal handling, routing, and filing of messages are usually delegated to communication watch officers. The radio officer is the communication officer's principal assistant.

The signal officer, heading the OS division, is charged with operation of the ship's visual signaling facilities. His duties in handling visual messages parallel those of the radio officer for radio messages.

The custodian, sometimes called the registered publications officer or RPS officer, is accountable to the commanding officer for keeping a complete, up-to-date, and corrected allowance of registered publications issued to the ship. He handles the drawing, stowage, correction, destruction, reports, and issuance of these publications aboard his ship.

Communication watch officers (CWOs) include the junior officers of the OR division. The CWO on watch is in active and immediate charge of the ship's communications, and during his watch is the personal representative of the communication officer. He sees that incoming and outgoing messages are placed in correct form, delivered promptly and properly to action and information addressees, and that all rules governing the conduct and security of all forms of communication are observed carefully. Radiomen assist the CWO by routing messages, preparing file and routing copies, or serving as traffic checkers, messengers, or file clerks. On small ships an experienced Radioman may himself act as CWO.

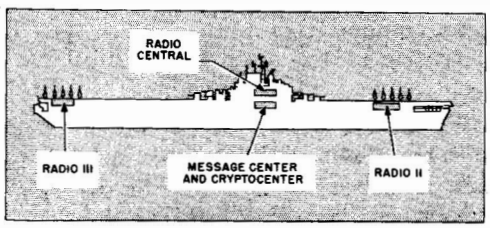
Cryptographers — collectively called the cryptoboard — assist the CWO with encryption and decryption of messages when the traffic load is so heavy he cannot handle it by himself. Members of the cryptoboard are designated in writing by the commanding officer. All cryptoboards have commissioned officers as members but may, in addition, include warrant officers and competent and reliable enlisted personnel.

The cryptosecurity officer is assigned full time only on the largest ships. He is charged with the training, assignment, and detailed performance of the cryptoboard and serves as advisor to the communication officer and the commanding officer in all matters relating to cryptosecurity and the physical security of cryptomaterials. In most ships the custodian, a CWO, or some other communicator is given this responsibility as collateral duty. In small commands the communication officer usually serves as cryptosecurity officer. Other collateral communication duties to which an officer may be assigned include that of Top Secret control officer, and membership on the censoring board.

## SHIPBOARD COMMUNICATION SPACES

The number, size, and arrangement of the communication spaces of a ship depend upon her size, type, and mission. Most large warships have communication spaces located fore, aft, and amidships (fig. 2-6). Besides scattering the ship's antennas, thereby helping to reduce interference, this arrangement minimizes the danger of loss of communications by heavy damage to a portion of the ship. Equipment is so distributed that any one space can carry on at least partial communications.

The most important communication spaces aboard are amidships, where, under normal operating conditions, most radio traffic is handled. Here are located radio central (also called main radio or radio I), the message center, and the cryptocenter. Communication functions also are carried out in other radio spaces, in other battle control locations, and in visual signal stations.




76.5

Figure 2-6.—Location of communication spaces, CVA.

### Radio Central

Radio central is the largest and most completely equipped radio space on board ship. It contains local operating positions for radiotelegraph, radiotelephone, radioteletypewriter, and facsimile. Usually, it is where transmitters, receivers, and remote speakers and keying positions are selected and tied together to provide communication channels for the remote operating stations elsewhere in the ship. Radio central is located close to the message center and cryptocenter, and is the duty station of the watch supervisor and of most of the ship's Radiomen.

### Message Center

Convenient to radio central is the message center, where outgoing traffic is prepared for transmission and incoming traffic is readied for local delivery. It is the duty station of the CWO and other personnel of the watch.

An outgoing message is delivered "in rough" to the message center, where it is checked for possible drafting errors. It is then written up "in smooth" and sent to the releasing officer for his approval and signature. If the message is classified, it is passed to the cryptocenter, encrypted, then given to radio central or the signal bridge for transmission. After incoming messages are received from radio central or the signal bridge, they are logged, decrypted if necessary, written up, routed, and delivered by messenger. All messages must clear the message center before internal routing or external transmission. There are certain exceptions, such as operational messages received and sent direct from the OOD or CIC.

In ships without space allotted for a message center, the functions of the message center are carried out in radio central.

### Cryptocenter

Adjoining the message center is the cryptocenter, where outgoing messages are encrypted and incoming messages are decrypted. Here are located cipher equipment and cryptographic publications (called cryptoaids), safes for the stowage of classified messages, and desks and typewriters as necessary. Files kept in the

cryptocenter include a file for classified general messages and one for edited plain language copies of encrypted messages. Access to the cryptocenter is strictly controlled. Admittance is limited to designated cryptographers, and an authorized entry list is posted on the door. There is only one entrance, and it connects with the message center. The door ordinarily is locked, and traffic is passed in and out through a window or slot in the bulkhead.

### Other Radio Spaces

According to the size of the ship, there may be one or more additional spaces containing special equipment, additional equipment, or duplicate facilities. Depending upon their arrangement and intended use, they may be designated as transmitter room, emergency radio room, auxiliary radio, or other appropriate titles.

Most of the ship's transmitters are located in the forward radio space, called the transmitter room or radio II. It usually is manned by a Radioman in charge, assisted by watch standers. The duties of the watch are to keep transmitters tuned to prescribed frequencies and connected or "patched" to keys, microphones, teletypewriters in radio central, and to remote operating positions in CIC, on the bridge, and in other parts of the ship. Receiving equipment includes one or two emergency receivers and ship's entertainment receivers.

Originally the larger Navy ships kept their emergency radio room (radio III) in readiness for emergency use only, but in many vessels the increasing demand for radio circuits has turned this into an active transmitter room. In ships where radio III still is an emergency radio room, watches are stood only when the ship is at general quarters.

Other radio spaces are scattered throughout large combatant ships. Many of these are small spaces supplementing the three main stations.

### Remote Control Facilities

Remote control stations, consisting of receiving outlets and transmitter keying positions, are located on the bridge, in CIC, and other battle control spaces where the need exists for direct radio communications. Receivers in radio central and transmitters in radio II and radio III can be connected to remote control positions as required. Positions on the bridge and in CIC are often paralleled. For instance, a tactical maneuvering net can be controlled from either the bridge or CIC by means of remote control units in these two spaces, which are connected through radio central to the same transmitter and receiver.

### Visual Signal Spaces

Equipment and spaces for visual communications are provided in the superstructure of the ship. Signal halyards run from the yardarm to flag bags at the foot of the mast for flaghoist signaling. Signal searchlights and semaphore platforms are positioned where each has the largest arc of vision, and so that their total coverage is 360°. Remote control keys for operating yardarm blinkers are placed in convenient and protected positions.

## ENLISTED OPERATING PERSONNEL

Specific duties of enlisted personnel assigned to communication duties vary according to the size, type, and mission of the ship. The principal duties of the Radioman are to operate radiotelegraph, radiotelephone, teletypewriter, and facsimile equipment in accordance with prescribed procedures.

The senior Radioman, as the leading petty officer, is in direct charge of all enlisted men in the radio division. He prepares the watch lists for Radiomen and makes daily checks of the message files and logs. Another of his most important duties is the training program, which he must organize and conduct so that his operators will be able to perform efficiently any communication function they may be assigned. Additionally, the leading petty officer has responsibilities for the cleanliness and preventive maintenance of all radio and teletypewriter equipment and for the compartments and deck spaces occupied by equipment under his cognizance.

The watch supervisor in radio central must be an experienced Radioman. The proper handling of traffic is his main responsibility. The equipment in use and the personnel on watch are under his direct supervision. He assists the CWO and, in organizations without a communication watch officer, may be designated to act as the CWO insofar as the internal routing and delivery of messages are concerned. His other duties include monitoring circuits, enforcing proper circuit discipline, accounting for

classified matter in radio central, taking prompt action to prevent disruption of communications in event of equipment failure, and maintaining a communication status board listing information relative to the nets and circuits in use.

The operators in radio central are under the authority of the supervisor while on watch. They must know and use correct operating procedures for radiotelegraph, radiotelephone, radioteletypewriter, and facsimile circuits; must keep accurate logs; must know how to tune transmitters and receivers and associated equipment; and must be able to patch receivers and transmitters to remote operating positions. Other duties include message writeup, internal and external routing, delivery, and filing.

Radiomen are placed in charge of each additional radio space, such as the transmitter room and emergency radio room. They must be able to tune and calibrate each transmitter to every frequency within the equipment's range, and know the power panels and switches for both normal and emergency power distribution systems. Other duties include patching transmitters and receivers to remote positions, and keeping records relating to equipment tests and inspections.

The Signalmen are concerned primarily with visual communications, although they have the secondary duties of standing quartermaster watches and operating the radiotelephone.

## SMALL SHIP COMMUNICATION ORGANIZATION

Preceding sections outlined the communication organization aboard a large ship, where the specific duties of each officer are more clearly defined and standardized. Communication organizations of smaller ships (DD or DE types, for example) carry on much the same work, but their personnel allowances are smaller, and each individual must accept more varied duties and a heavier workload.

Communications on a DD or DE still is one of the functions of the operations department, but radio and visual signaling personnel are combined into one division, the OC division. The communication officer may not have any commissioned assistant, or perhaps only one, and must himself do work that on a larger ship would fall to the radio officer, signal officer, custodian, or CWOs. On a destroyer the communication officer is an active assistant to the operations officer. He has deck as well as communication duties, and spends many hours daily on the bridge. If this duty is heavy, he may have little time to devote to the routine of communications, and must depend on his Chief Radioman or leading Radioman to carry the load.

## WATCH, QUARTER, AND STATION BILL

When a Radioman — or any other man — reports aboard, he is assigned by his division officer to a watch section, duty station, to battle and other emergency stations, and to a cleaning station. This information is posted in his work spaces on the watch, quarter, and station bill (fig. 2-7).

Normally, watches stood by communication personnel are based on the master bill of the ship or station. However, the watches of communication personnel cannot always be made to conform to the hours or watches of other personnel of the command. Often the peak load of message traffic occurs when other activities of the command are at a comparative lull. Hence, communication personnel often do not stand the usual 4-on--8-off watches.

Aboard many ships the midwatch is from midnight to breakfast. The morning watch runs from breakfast to dinner, and the afternoon watch from dinner to supper. The first dogwatch runs from supper to 1800, or until movie call, and the second dogwatch until 2000. The evening watch is from 2000 until midnight.

A variation of this system is to have no dogwatches or perhaps only one. If there are no dogwatches, the evening watch may last from supper until midnight. If there is one dogwatch, it usually is from supper to 2000 and is followed by the evening watch that runs to midnight.

At most shore communication stations the day, evening, and midwatches are approximately 8 hours each. Radiomen usually rotate on a 4-section watch list, and stand a series of three watches in a row before rotating from days to evenings, evenings to mids, and mids to day watches. Certain peak load operators customarily are assigned to work during the busiest hours, and rotate watches differently from the rest of the station.

During general quarters Radiomen are assigned to each radio communication space. Every circuit or net is manned by a battle-efficient operator, and standby men maintain duplicate facilities in other radio spaces, keeping duplicate logs of traffic coming into radio central.

# WATCH, QUARTER & STATION BILL

SECTION 1 DIVISION OR

| BILLET | NAME | BUNK NO. | LKR. NO. | RATE | | | CLEAN STATION | BATTLE STATIONS | | | LANDING PARTY | EMERG. GETTING UND'WAY | WATCH DETAIL | | SPECIAL SEA DETAIL | FIRE | | RESCUE & ASSIST. | | COLLISION | ABANDON SHIP | | MAN OVERBD. | SPECIAL DETAIL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | COMP. | ALL. | ACT'L. | | CONDITION I (GENL. CTRL.) | CONDITION II | CONDITION III | | | AT SEA | IN PORT | | STATION | PROVIDE | PARTY | PROVIDE | | STATION | PROVIDE | | |
| C-101 | H.J. SAYER | 4 | 4 | RMC | RMC | RMC | ← | IN CHARGE | | → | | RAD I | | | | ↑ | | ↑ | | ↑ | 6 | | ↑ | |
| C-102 | R.E.L. CLARK | 7 | 7 | RM1 | RM1 | RM2 | RAD I | SUPVR | SUPVR | SUPVR | | RAD I | | | | | | | | | 4 | | | |
| C-103 | J.D. BUCKNER | 8 | 8 | RM1 | RM2 | RM2 | RAD II | RAD II | RAD II | RAD II | | RAD II | | | | | | | | | 2 | | | |
| C-104 | B.A. JOHNSON | 12 | 12 | RM2 | RM2 | RM3 | RAD III | RAD III | RAD I | RAD I | | RAD II | | | | | | | | | 3 | | | |
| C-105 | M.E. POPE | 14 | 14 | RM3 | RM3 | RM3 | RAD II | RAD I | RAD I | RAD I | PORTABLE RAD/OPR | RAD I | | | | | | | | | 4 | PORTABLE RADIO | | |
| C-106 | W.A. SCRUGGS | 17 | 17 | RM3 | RM3 | RMSN | RAD I | RAD I | RAD I | RAD I | | RAD I | | | | | | | | | 6 | | | |
| C-107 | R.J. GILLETTE | 20 | 20 | RM3 | RM3 | RM3N | RAD I | JX TALKER | RAD I | RAD I | | JX TALKER | | | | | | | | | 5 | | | |
| C-108 | M.L. HAMILTON | 15 | 15 | RM3 | RM3 | RMSA | PSGY. | MSGR. | MSGR. | MSGR. | MSGR. | MSGR. | | | | | | | | | 3 | | | |

STANDBY

STANDBY

STANDBY

QUARTERS

76. 6

Figure 2-7.—Watch, quarter, and station bill.

A Radioman is placed in charge of the cleaning detail in each communication space, and the available personnel are assigned specific areas for cleaning and upkeep.

Detailed information concerning special stations (such as fire, fire and rescue, collision, and abandon ship) is contained in your ship's organization book.