CHAPTER 4

MATERIAL RESPONSIBILITIES

Material responsibilities of the electronics material officer aboard ship include maintenance of the electronics equipment installation on board. The size and complexity of this installation, together with the ship type, largely determine the size and complexity of the maintenance job.

Whether the material to be maintained is aboard your own or another ship, proper accomplishment of maintenance requires knowledge of such factors as past equipment performance, modifications or alterations affecting specific equipment, and sources providing the detailed technical information necessary for proper maintenance. Certain of these factors are discussed in this chapter.

The electronics material officer's material responsibilities further include knowledge of the types and quantity of equipment the ship should carry, the kinds and quantity of parts necessary to support the equipment, and the degree of the EMO's responsibility for seeing that repair items are on board. These matters are discussed in other chapters.

The number and ratings of the personnel on board, and their capabilities, affect the degree of difficulty of your job as electronics material officer. With adequate numbers of well-trained personnel, your job becomes primarily one of assigning and scheduling the work to be done. Because of turn-over of personnel and changing manning levels, there may be times when you will not have enough trained personnel to make the job that simple. You must, therefore, through proper administration, make the best use of the talents at hand while maintaining a continuing training program designed to improve the capabilities of the division.

Cleanliness of electronic equipment and spaces is also a responsibility of the EMO. Most electronic spaces are air conditioned and/or forced-air ventilated. The circulation of air causes deposits of foreign material in and around the electronic equipment. This, coupled with the normal buildup of dirt from personnel entering and leaving the space, causes a serious safety hazard to personnel and equipment. A common personnel safety hazard occurs when the insulating ability of insulating matting and switch handles is diminished because of an accumulation of dirt and grease. Hazards to proper equipment operation are created by accumulated dust and heavy dirt particles in the filters of air cooled equipment and on the contact points of switches and potentiometers.

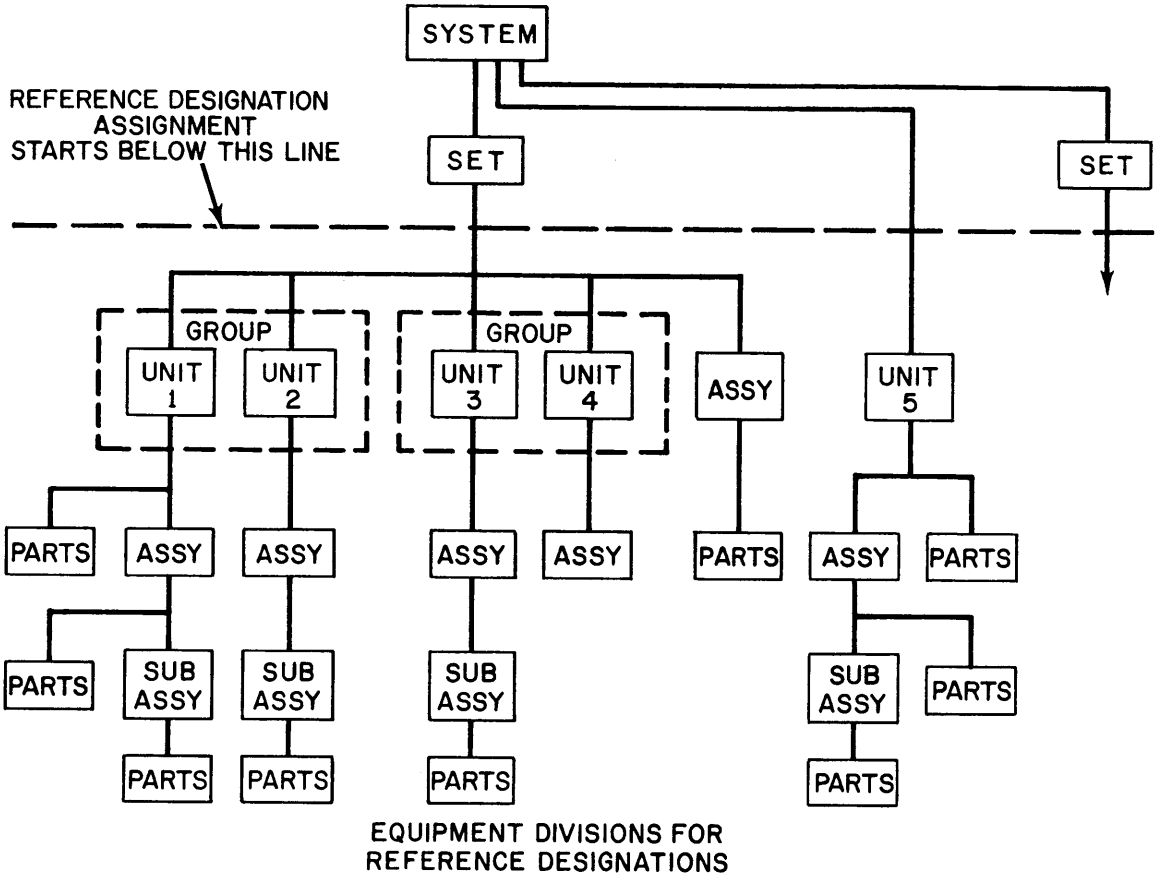
An inspection should be made at least weekly, (daily if possible) to check for cleanliness of spaces, equipment, and air filters, unauthorized stowage of personal gear, and any other safety hazards that may exist.

EQUIPMENT DESIGNATIONS

As naval electronic systems have grown in complexity, an orderly means of subdividing the complete system has become necessary. For example, a ship's radar system includes every item of electronics equipment used for or with a radar set on board that ship. A system is subdivided into sets, groups, units, assemblies, subassemblies, and parts, as shown in figure 4-1.

SYSTEM

A system is a combination of sets, groups, units, assemblies, subassemblies, and parts



162.122

Figure 4-1.—System subdivision.

joined together to perform a specific operational function or functions; for example, a communications system, a radar system, or a navigation system. Figure 4-2 is a block diagram for a typical communications system containing the necessary components for transmission and reception of voice, cw, and teletype signals. The arrows show the direction of signal flow.

SET

A set consists of a unit or units and the necessary assemblies, subassemblies and parts connected or associated together to perform an operational function; for example, a radio receiving set, or a radio transmitting set.

Figure 4-3 is a block diagram of a radio transmitting set, which consists of a radio frequency amplifier unit (1), a radio transmitter unit (2), a power supply unit (3), and an antenna coupler group.

GROUP

A group is a collection of units, assemblies, or subassemblies, which is a division of a set or system, but which is not capable of performing a complete operational function. The antenna coupler group in figure 4-3 requires power and signal from the radio frequency amplifier unit for operation.

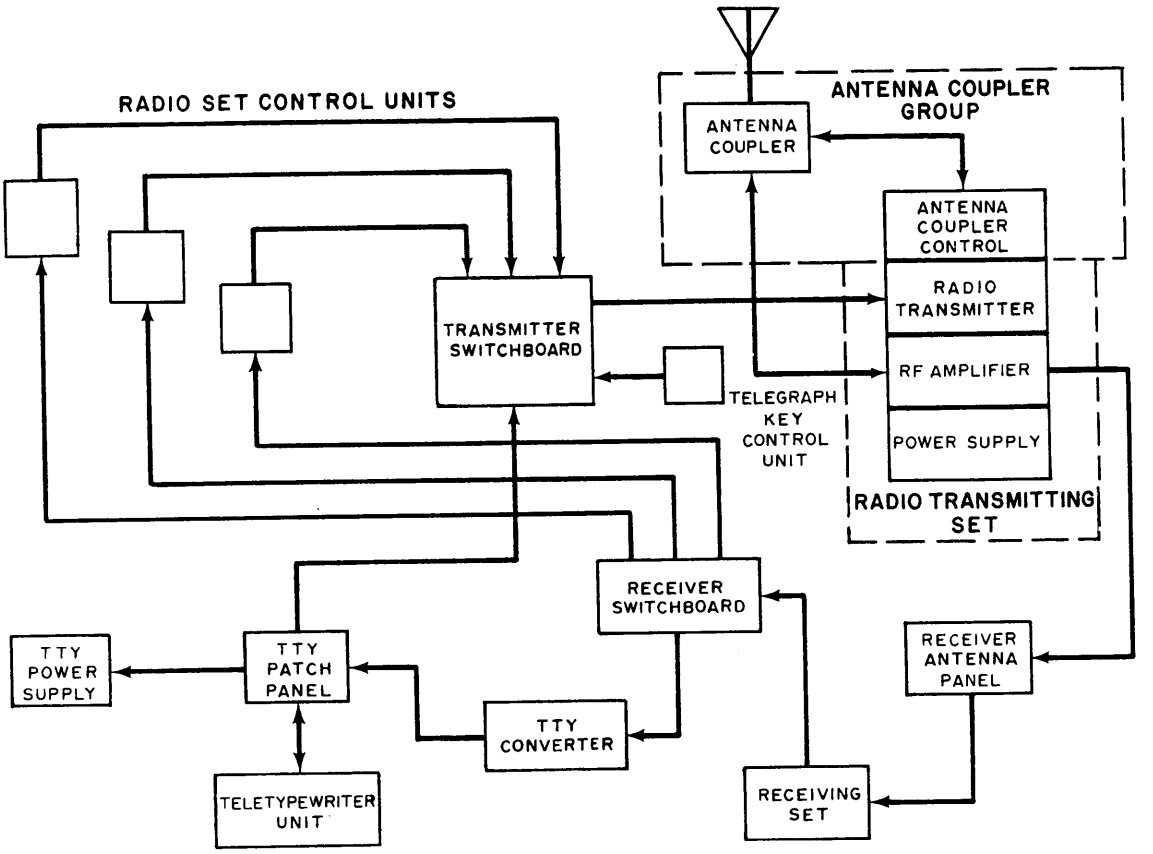


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Figure 4-2.—Communications system block diagram.

UNIT

A unit is an assembly or any combination of parts, subassemblies and assemblies mounted together, normally capable of independent operation in a variety of situations.

ASSEMBLY

An assembly is a number of parts or subassemblies, or any combination thereof, joined together to perform a specific function. Figure 4-4 shows a unit (2) consisting of six assemblies, and an assembly (A6) which is composed of six subassemblies. For purposes of identification, circuit symbol numbers are assigned in accordance with the foregoing equipage divisions. Subassembly (A4) in figure 4-4 is identified as:

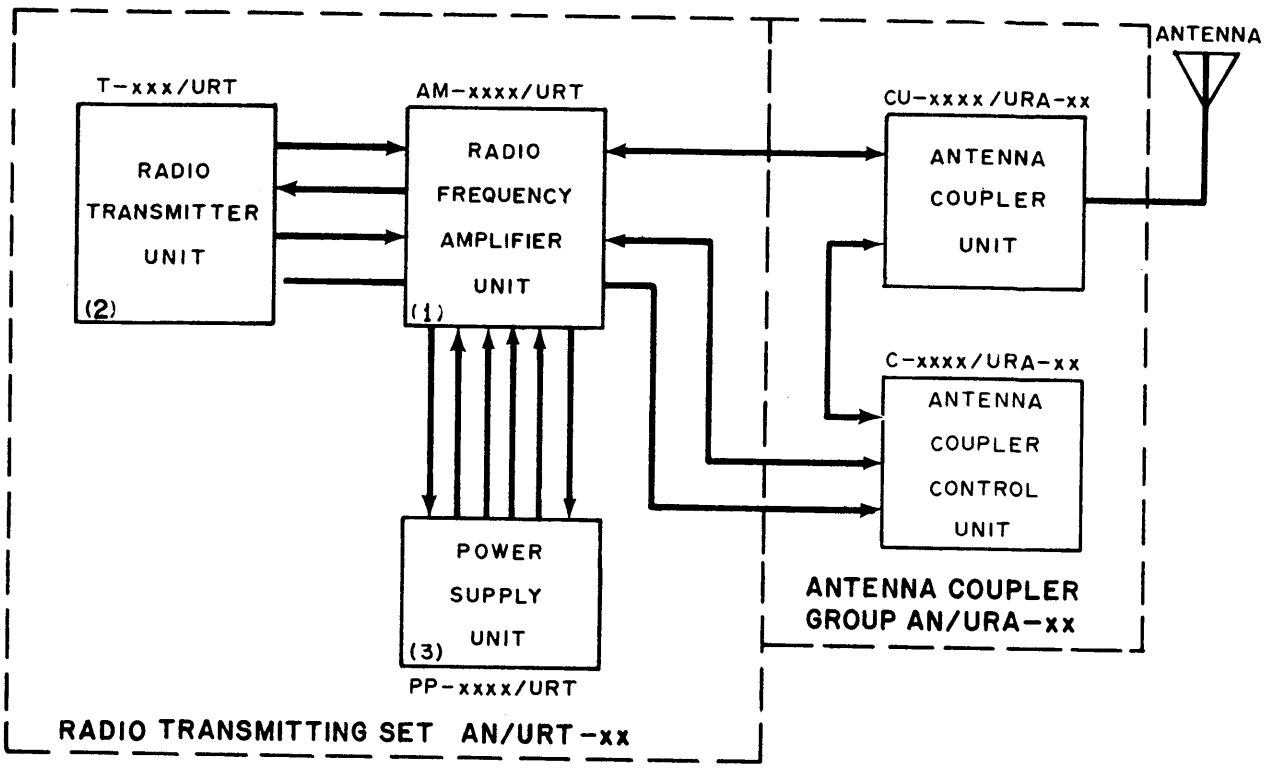
2(unit)A6(assembly)A4(subassembly) or simply as 2A6A4.

SUBASSEMBLY

A subassembly consists of two or more parts which form a portion of an assembly or a unit, replaceable as a whole, but having a part or parts which are individually replaceable.

The distinction between an assembly and a subassembly is not always exact; an assembly in one instance may be a subassembly in another instance when it forms a portion of an assembly.

Figure 4-5 shows a printed circuit board subassembly and some of the parts which may be mounted on it.



162.124

Figure 4-3.—Radio transmitting set.

PART

A part is one piece, or two or more pieces joined together which are not normally subject to disassembly without destruction of the designed use; for example, resistors, capacitors and transistors. Circuit symbol numbers are expanded to identify individual parts in an equipment. Thus R1 in Figure 4-5 is identified as:

2(unit)A7(assembly)A15(subassembly)R1(part) or 2A7A15R1.

JOINT ELECTRONIC TYPE DESIGNATION SYSTEM (JETDS)

A key to identifying electronic equipment and units for which the EMO is responsible is the nomenclature assigned to them. The Electronics Type Designation System (AN system) was designed so that a common designation could be used for Army, Navy and Air Force equipment. The system indicator does not mean that the Army, Navy and Air Force use the equipment but simply that the type number is assigned to the AN system.

The AN system for electronic equipment is formulated to:

1. Be logical in principle so that the nomenclature type numbers will be understood readily, and the operation of the armed services supply services will be facilitated.

2. Be flexible and sufficiently broad in scope to cover present types of equipment, as well as new types and uses of equipment that will be developed in the future.

3. Avoid conflict with nomenclature presently assigned to the equipment used by the armed services.

4. Furnish adequate identification on the name plate with or without the name part of the nomenclature.

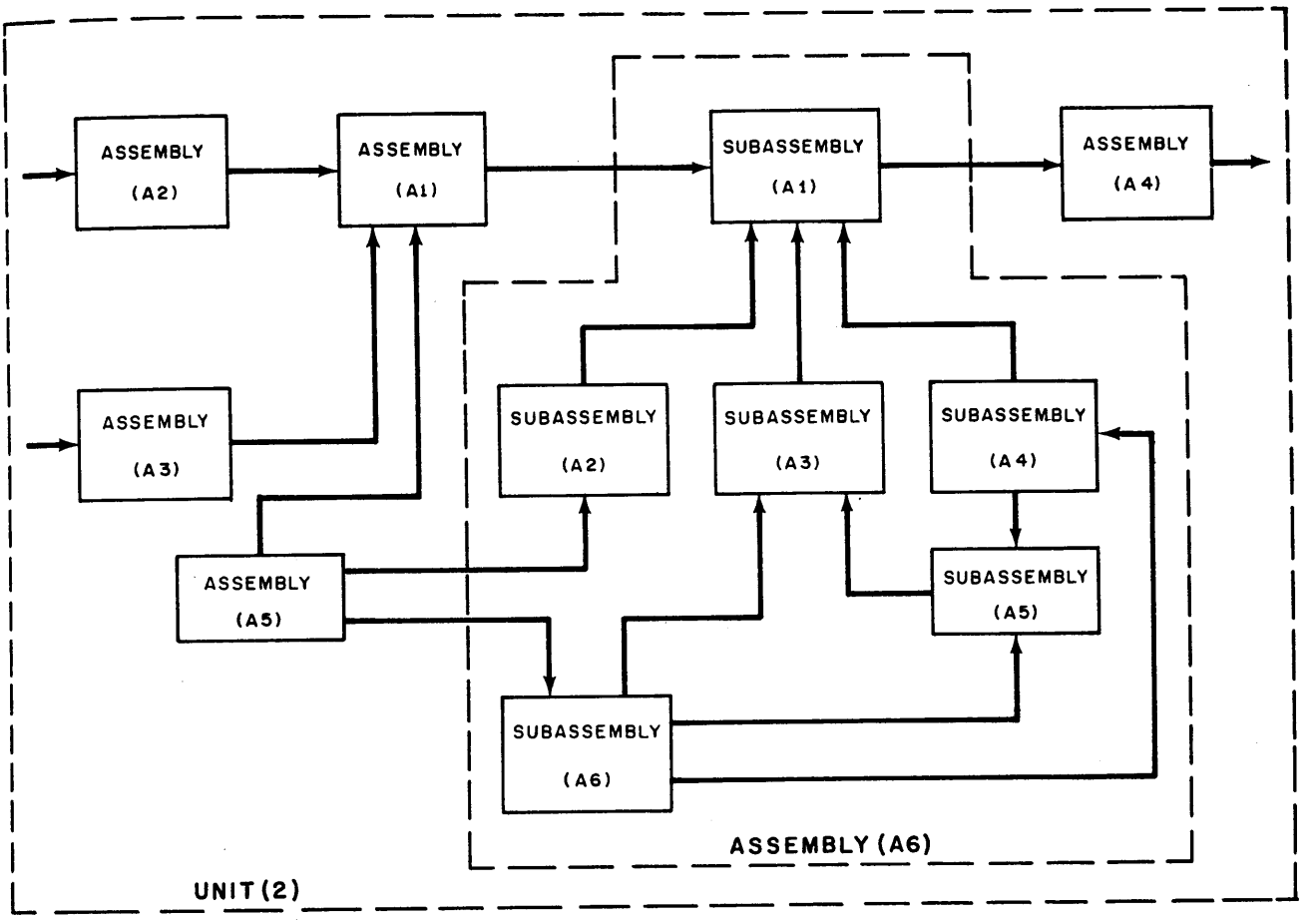


Figure 4-4.—Unit and assemblies. 162.125

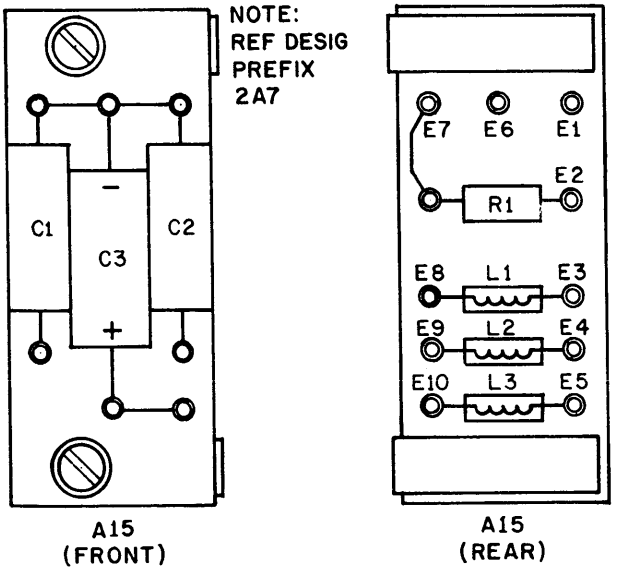


Figure 4-5.—Typical subassembly. 162.126

5. Provide a ready means of identifying equipment in correspondence and other types of communications.

The system is so designed that its indicators reveal at a glance many details that pertain to the item. For example, it tells whether the item is a SET or a UNIT, and such other information as where it is used, what type equipment it is, and what it is used for.

AN nomenclature consists of an approved name followed by the type number. For a complete set, the type number will consist of three identifying letters and an assigned number.

Equipment Indicator Letters

Using this system of identification, the installation type, the type of equipment, and the

purpose of each equipment and unit can be readily determined. The derivation and meaning of the nomenclature for a representative equipment (Communications Central AN/SRC-16) is delineated in figure 4-6.

In the three letter group (fig. 4-6A and B) the first letter "S," designates the type of installation, e.g. "Water." (See table 4-1.) The second letter "R" designates the type of equipment, in this case "Radio." The third letter "C" defines the purpose of the equipment as "Communications (receiving and transmitting)."

The number (type number) immediately following the three letter group identifies a particular equipment and includes all of its modifications as discussed below. The meaning of any three letter group can be similarly interpreted by referring to table 4-1.

A modification letter is used to identify a set that has been modified, but which still retains the basic design and is functionally and electrically (power source is the same) interchangeable with the unmodified set (fig. 4-6A). When the AN/SRC-16 is modified, it becomes the AN/SRC-16A; the "A" indicates the first modification. The next modification would be the AN/SRC-16B, and so on.

The parenthesis ( ) as shown in figure 4-6A is used with the type number assignment to provide a broader identification than that provided by a type number alone. A series of sets or units may be identified by the use of one or more letters and/or numbers in the parenthesis after the identifying number. For example, the AN/SRC-16 (XN-1) designates an experimental or special model. (See table 4-2.) Table 4-1 (Miscellaneous Identification) is used if the same basic design of an equipment is kept, but the input power is changed from 110 volts to 220 volts. However, an "X" is added to the nomenclature so that it becomes the AN/SRC-16X. The second power input change would be identified by the letter "Y." The letter (V) within the parenthesis is used to identify systems with varying parts lists. It indicates that a set utilizes or can utilize a variable grouping or selection of units, thereby making possible optional installations. The letter "T" is used for training sets. It is used in conjunction with the other indicators to show that it is a training set for a specific equipment. Likewise, it may be used to indicate a trainer for

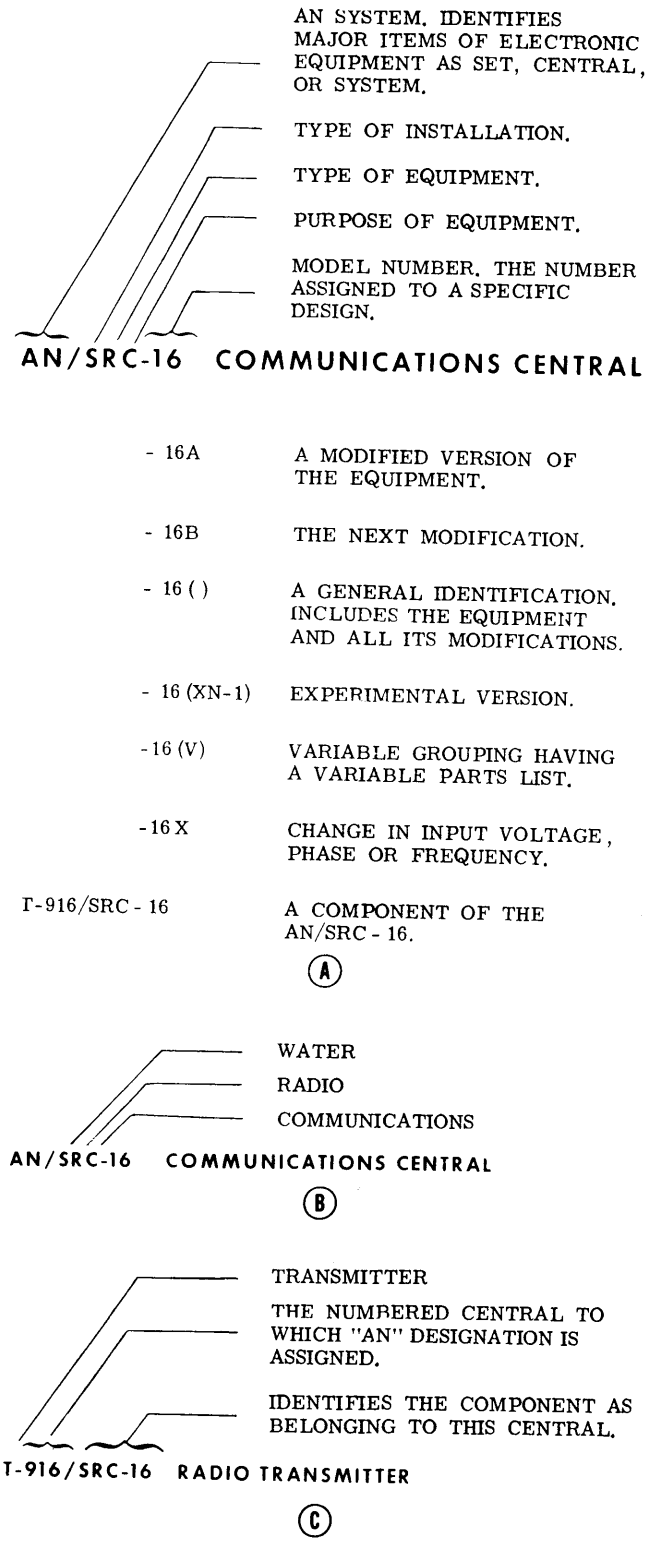


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Figure 4-6.—Joint Electronic Type Designation System for nomenclature AN/SRC-16 Radio Set.

Table 4-1.—Table of equipment indicators

TABLE OF EQUIPMENT INDICATORS			Miscellaneous Identification
Installation (1st letter)	Type of Equipment (2d letter)	Purpose (3rd letter)	
A—Piloted aircraft B—Underwater mobile, submarine D—Pilotless carrier F—Fixed ground G—General ground use K—Amphibious M—Ground, mobile P—Portable S—Water T—Ground, transportable U—General utility V—Ground, vehicular W—Water surface and under water combination Z—Piloted and pilotless airborne vehicle combination	A—Invisible light, heat radiation C—Carrier D—Radiac G—Telegraph or Teletype I—Interphone and public address J—Electromechanical or Inertial wire covered K—Telemetering L—Countermeasures M—Meteorological N—Sound in air P—Radar Q—Sonar and underwater sound R—Radio S—Special types, magnetic, etc., or combinations of types T—Telephone (wire) V—Visual and visible light W—Armament (peculiar to armament, not otherwise covered) X—Facsimile or television Y—Data processing	B—Bombing C—Communications (receiving and transmitting D—Direction finder reconnaissance and/or surveillance E—Ejection and/or release G—Fire control, or searchlight directing H—Recording and/or reproducing (graphic meteorological and sound) K—Computing M—Maintenance and/or test assemblies including tools) N—Navigational aids (including altimeters, beacons, compasses, racons, depth sounding, approach and landing) Q—Special, or combination of purposes R—Receiving, passive detecting S—Detecting and/or range and bearing, search T—Transmitting W—Automatic flight or remote control X—Identification and recognition Y—Surveillance (search detect, and multiple target tracking) and control (both fire control and air control)	X,Y,Z—Changes in voltage, phase, or frequency T—Training (V)—Variable grouping

Table 4-2.—Development indicators

DEVELOPMENT INDICATORS

XA	Aeronautical Systems Division, Wright-Patterson Air Force Base, Oh. 45433
XB	Naval Research Laboratory, Washington, DC
XC	U.S. Army Signal Engineering Laboratories, Hexagon, Fort Monmouth, N.J. (inactivated, use XE)
XD	Electronic Systems Division, Laurence C. Hanscom Field, Bedford, Mass.
XE	U.S. Army Electronics Laboratories, Fort Monmouth, N.J.
XF	Frankford Arsenal, Phila., Pa.
XG	U.S.N. Electronics Laboratory, San Diego, Calif.
XH	Aerial Reconnaissance Laboratory, Wright-Patterson Air Force Base, Oh.
XI	Air Force Armament Laboratory, Eglin Air Force Base, Fla. 32542
XJ	Naval Air Development Center, Johnsville, Pa.
XK	Flight Control Laboratory, Wright-Patterson Air Force Base, Oh.
XL	U.S. Army Signal Electronics Research Unit, Mountain View, Calif.
XM	U.S. Army Signal Engineering Laboratories, Hexagon, Fort Monmouth, N.J. (inactivated, use XE)
XN	Department of the Navy, Washington, DC
XO	U.S. Army Missile Command, Redstone Arsenal, Ala.
XP	Canadian Department of National Defence, Ottawa, Canada
XQ	Aeronautical Accessories Laboratory, Wright-Patterson Air Force Base, Oh.
XR	National Security Agency, Fort George G. Meade, Md.
XS	Electronic Components Laboratory, Wright-Patterson Air Force Base, Oh.
XT	U.S. Army Security Agency, Arlington Hall Station, Arlington, Va.
XU	U.S.N. Underwater Sound Laboratory, Fort Trumbell, New London, Conn.
XV	Air Force Weapons Laboratory, Kirtland Air Force Base, N.M.
XW	Rome Air Development Center, Rome, N.Y.
XY	Weapons Guidance Laboratory, Wright-Patterson Air Force Base, Oh.
XZ	U.S.N. Bureau of Naval Weapons Activities
XAA	Space and Missile Systems Organization, Norton Air Force Base, Calif. 92409
XAE	U.S. Army Electronics Research and Development Activity, Fort Huachuca, Ariz.
XAN	Naval Avionics Facility, Indianapolis, Ind.
XBB	U.S. Army Electronics Command, Proc and Prod Dir., Fort Monmouth, N.J.

a special family of equipment. For example, the first training set for the AN/SRC-16 would be the AN/SRC-16T1.

Unit Indicator Letters

Definitive Units having just one end use are identified by an indicator with a dash, a number, a slant bar, and the equipment it is part of, or used with. (See table 4-3.) For example, the receiver which is part of, or used with, the AN/VRC-12 would be identified as R-40/VRC-12.

Group Indicator Letters

All groups of equipment are identified by a two-letter indicator selected from table 4-4. Equipment indicators with a specific model number (e.g., OK-450/TRC-26, OD-311/GPS-4) will be applied following the slant bar only when the group is known to be particular to a specific equipment (e.g., AN/TRC-26, AN/GPS-4, etc.) with no known potential for other equipment, installation or purpose. Further information on the JETDS may be found in MIL-STD-196 (Series) and MILHDBK 140 (Series).

Table 4-3.—Table of unit indicators

Unit Ind.	Family Name	Example of Use (not to be construed as limiting the application of the unit indicator)
AB	Supports, antenna	Antenna mounts, mast bases, mast sections, towers, etc.
AM	Amplifiers	Power, audio, interphone, radio frequency, video, electronic control, etc.
AS	Antennae, simple and complex	Arrays, parabolic type, masthead, whip or telescopic loop, dipole, reflector, etc.
BA	Battery, primary type	B batteries, battery packs, etc.
BB	Battery, secondary type	Storage batteries, battery packs, etc.
BZ	Alarm units	All types.
C	Controls	Control box, remote tuning control, etc.
*CG	Cable assemblies, RF	RF cables, waveguides, transmission lines, etc., with terminals.
CM	Comparators	Compares two or more input signals.
CN	Compensators	Electrical and/or mechanical compensating, regulating, or attenuating apparatus.
CP	Computers	A mechanical and/or electronic mathematical calculating device.
CU	Couplers	Impedance coupling devices, directional couplers, etc.
CV	Converters (electronic)	Electronic apparatus for changing the phase, frequency, or from "one" medium to "another".
CW	Radomes	Radomes.
*CX	Cable assemblies, non RF	Non RF cables with terminals, test leads, also composite cables of RF and non RF conductors.
CY	Cases and cabinets	Rigid and semirigid structure for enclosing or carrying equipment.
D	Dispensers	Chaff.
DA	Load, dummy	RF and non RF test loads.
DT	Detecting heads	Magnetic pickup device, search coil, hydrophone, etc.
F	Filter units	Electronic types; band pass, low pass, band suppression, noise telephone, filter networks; excludes non-repairable types.
FR	Frequency measuring device	Frequency meters, tuned cavity, etc.
G	Generators, power	Electrical power generators without prime movers (See PU).
H	Head, hand, and chest sets	Includes earphone.
HD	Environmental apparatus	Heating, cooling, dehumidifying, pressure, vacuum devices, etc.
ID	Indicator units, non-cathode-ray tube	Calibrated dials and meters, indicating lights, etc. (See IP)
IM	Intensity measuring devices	Includes SWR gear, field intensity and noise meters, slotted lines, etc.
IP	Indicator units, cathode-ray tube	Azimuth, elevation, panoramic, etc.
J	Interface units	Interconnecting and junction units, etc. Do not use if a more specific indicator applies.
KY	Keying devices	Mechanical, electrical and electronic keyer coders, interrupters, etc.

*Not for use by contractors.

Table 4-3.—Table of unit indicators—Continued

Unit Ind.	Family Name	Example of Use (not to be construed as limiting the application of the unit indicator)
LS	Loudspeakers	Separately housed loudspeakers, intercommunication stations.
M	Microphones	Radio, telephone, throat, hand, etc.
MD	Modulators, demodulators, discriminators	Device for varying amplitude, frequency or phase.
ME	Meters	Multimeters, volt-ohm-millimeters, vacuum tube voltmeters, power meters, etc.
MK	Miscellaneous kits	Maintenance, modification, etc.
ML	Meteorological devices	Miscellaneous meteorological equipment, etc.
MT	Mountings	Mountings, racks, frames, stands, etc.
MX	Miscellaneous	Equipment not otherwise classified. Do not use if better indicator is available.
MU	Memory units	Memory units.
O	Oscillators	Master frequency, blocking, multivibrators, etc. (for test oscillators, see SG).
OS	Oscilloscope, test	Test oscilloscope for general test purposes (See IP).
PL	Plug-in units	Plug-in units not otherwise classified.
PP	Power supplies	Nonrotating machine type such as vibrator pack rectifier, thermoelectric, etc.
PT	Mapping and plotting units	Electronic types only.
PU	Power equipments	Rotating power equipment, motor-generator, dynamotors, etc.
R	Receivers	Receivers, all types except telephone.
RD	Recorder-reproducers	Sound, graphic, tape, wire, film, disc, facsimile, magnetic, mechanical, etc.
RE	Relay assembly units	Electrical, electronic, etc.
RL	Reeling machines	Mechanism for dispensing and rewinding antenna or field wire, cable, etc.
RO	Recorders	Sound, graphic, tape, wire, film, disc, facsimile, magnetic, mechanical, tape and card punch, etc.
RP	Reproducers	Sound, graphic, tape, wire, film, disc, facsimile, magentic, mechanical, punched tape and card readers, etc.
RR	Reflectors	Target, confusion, etc. Except antenna reflectors (See AS).
RT	Receiver and Transmitter	Radio and radar transceiver, composite transmitter and receiver, etc.
S	Shelter	Protective shelter, etc.
SA	Switching units	Manual, impact, motor driven, pressure operated, electronic, etc.
SB	Switchboards	Telephone, fire control, power, power distribution, etc.
SG	Generator, signal	Test oscillators, noise generators, etc. (See 0).
SM	Simulators	Flight, aircraft, target, signal, etc.
SN	Synchronizers	Equipment to coordinate two or more functions.

Table 4-3.—Table of unit indicators—Continued

Unit Ind.	Family Name	Example of Use (not to be construed as limiting the application of the unit indicator)
SU	Optical units	Electro-optical units, such as, night vision, auto-collimator, scope, sights, viewers, trackers, alignment equipment.
T	Transmitters	Transmitters, all types, except telephone.
TA	Telephone apparatus	Miscellaneous telephone equipment.
TB	Towed body	Hydrodynamic enclosures used to house transducers, hydrophones, and other electronic equipment.
TD	Timing devices	Mechanical and electronic timing devices, range devices, multiplexers, electronic gates, etc.
TF	Transformers	When used as separate units.
TG	Positioning devices	Tilt and/or train assemblies.
TH	Telegraph apparatus	Miscellaneous telegraph apparatus.
TN	Tuning units	Receiver, transmitter, antenna, tuning units, etc.
TR	Transducers	Sonar transducers, vibration pickups, etc. (See H, LS, and M).
TS	Test units	Test and measuring equipment not otherwise classified. Do not use if more specific indicators apply.
TT	Teletypewriter and facsimile apparatus	Miscellaneous tape, teletype, facsimile equipment, etc.
TW	Tape units	Preprogrammed with operational test and check out data.
V	Vehicles	Carts, dollies, vans peculiar to electronic equipment.
ZM	Impedance measuring devices	Used for measuring Q, C, L, R, or PF, etc.

COMPONENT IDENTIFICATION

So far, consideration has been given only to the notation used in set nomenclature. Now, let us examine the coding for major components of a set.

Components are identified by means of letters, which tell the type of component; a number, which identifies the particular component; and, finally, the designation of the equipment of which it is a part or with which it is used.

The transmitter for the AN/SRC-16 is identified as shown in figure 4-6C. A modification letter identifies a component that has been modified (e.g., field change or alteration), but still retains the basic design and is interchangeable with the original item. Thus, the T-916(A)/SRC-16 would be a modified version of the T-916/SRC-16.

A complete list of component identifiers is too extensive to be included in this manual. It appears in EIMB 0967-LP-000-0140, Reference Data.

REPORTING ABOARD AS EMO

Soon after you report aboard, the officer you relieved may depart or be assigned another billet. The former EMO will pass to you information which has been accumulated over a period of two or more years. Since you cannot remember all of the information, you should take careful notes. A pocket notebook will serve this purpose and will also be handy for jotting notes as you tour the electronic spaces.

The following outline will aid you in the relieving process. It will not solve all the problems that may be encountered, but if the listed

Table 4-4.—Table of group indicators

Group Ind.	Family Name	Example of Use (not to be construed as limiting the application of the group indicator)
OA	Miscellaneous groups	Groups not otherwise classified. Do not use if a more specific indicator, such as OD, OE, OG, etc., applies.
OB	Multiplexer and/or demultiplexer groups	Multiplexer groups, demultiplexer groups, composites thereof.
OD	Indicator groups	All types.
OE	Antenna groups	All types.
OF	Adapter Groups	All types.
OG	Amplifier groups	All types.
OH	Simulator groups	All types.
OJ	Consoles and console groups	All types.
OK	Control groups	All types.
OL	Data analysis and data processing groups	All types.
OM	Modulator and/or demodulator groups	Modulator groups, demodulator groups, composites thereof.
ON	Interconnecting groups	All types.
OP	Power Supply groups	All types.
OQ	Test Set groups	All types.
OR	Receiver groups	All types.
OT	Transmitter groups	All types.
OU	Converter groups	All types.
OV	Generator groups	All types excluding power generating equipment.
OW	Terminal groups	Telegraph, telephone, radio, etc.
OX	Coder, decoder, interrogator, transponder groups	All types.
OY	Radar Set Groups	Do not use if a more specific indicator, such as, OE, OR, OT, etc., applies.
OZ	Radio Set Groups	Do not use if a more specific indicator, such as OE, OR, OT, etc., applies.

items are accomplished, the electronics division will be well organized.

1. Obtain a copy of the Type Commander's Administrative Check-Off list and commence relief of the Electronics Material Officer.
2. Procure a pocket-size notebook, or use prepared personnel forms.
   a. Use one section for equipment
      (1) List operating characteristics and operating deficiencies
      (2) List capabilities and limitations
   b. Use another section for personnel
      (1) Show ship's allowances for ETs
      (2) Show on-board strength
         (a) Present manning level
         (b) Expected losses
         (c) Expected gains
         (d) Personnel under special circumstances (hospital, school, court martial, and so on)
3. Take inventory (with officer being relieved).
   a. Check SECAS for correctness
   b. Make entries in notebook
   c. Check accuracy of information on custody cards. Don't sign a custody card if the following discrepancies exist:
      (1) Contains inaccurate information
      (2) Equipment does not exist
4. Check operating condition of all equipment:
   a. Note the currency of the calibration date on electronic equipment. Calibration should be in accordance with the Metrology Automated System for Reporting (MEASURE) in OPNAV 43P6. Check the Meter Cards and MEASURE printouts for current data. Make comments in notebook.
5. Write relieving letter to commanding officer.
   a. Include a paragraph containing discrepancies noted
   b. Furnish copy to head of department
6. Observe during the first few weeks aboard.
   a. Keep constant check on electronics section
      (1) Observe routine
      (2) Become acquainted with ETs' abilities
      (3) Note good and bad practices
      (4) Make no unnecessary or precipitous changes in existing policies
   b. Keep eyes and ears open.
      (1) Ask and answer questions
      (2) Ask department officers having use or custody of equipment for suggestions regarding improvements.
   c. Observe how the division officer's notebook lists personnel by:
      (1) Name and rate
      (2) Time in Navy, NECs, obligated service
      (3) Educational background, civilian and Navy
      (4) Home address
      (5) Qualifications for advancement
      (6) Bunk location
      (7) Watch, quarter and station assignments
      (8) Equipment assignment
      (9) Other responsibilities

7. Obtain and read:
   a. Type Commander's Administration Manual
   b. All references given
   c. Fleet, Force, Type Commander Directives
   d. Ship's Organization Manual
   e. Ship's Standing Orders
8. When the overall picture is clear, establish your own policies.
9. Check Coordinated Shipboard Allowances List (COSAL).
   a. Order missing test equipment (Refer to Electronic Test Equipment Calibration Program Indoctrination Handbook NAVMAT 9491.)
   b. Order missing tools (according to current directives)
10. Inaugurate use of Electronic Repair Service Reports.
    a. Submitted by equipment operator or technician
    b. Completed by technician
    c. Reports and forms checked for completion by Leading ET
11. Determine what records are to be used and establish record keeping system.
12. Establish a tickler file for periodic reports and pending action items.
13. Check on maintenance repair parts.
    a. Verify correctness of current inventory
    b. Check inventory against allowance lists (COSAL)
    c. Review division supply log for legibility and completeness. Ensure that parts are on order for each ESL entry requiring parts. Requisition numbers for these parts should be included in both the division supply log and ESL.
    d. Review procedures to follow for turn-in items
14. Inventory publications.
    a. Order missing publications through regular supply channels in accordance with current directives
    b. Check stowage, filing, availability
15. Ensure division files contain:
    a. CSMP
    b. Casualty Control Folders to include:
       (1) Block diagram of systems
       (2) Sketches and drawings of circuits made by the ETs
    c. Deferred 2Ks
    d. Copies of field reports made by field engineers and information retained from MOTU visits
    e. Pertinent information/directives on equipment
    f. SECAS records
    g. TEMPEST records
16. Check blueprint file.
    a. Are blueprints on board for all installations?
    b. Ascertain method of obtaining missing blueprints
17. Check on field changes.
    a. Check authorized field changes against field changes made
    b. Order those that can be accomplished by ship's force
    c. Maintain current SECAS reports
    d. Verify current field change number on APLs and AELs in the COSALs.

18. Review the Planned Maintenance System (PMS) program.
    a. Review the planned maintenance program for completeness and availability of up-to-date references
    b. Remain cognizant of status of program accomplishment. Check work center status boards
    c. Arrange with cognizant officers to familiarize yourself with daily and weekly operational maintenance checks in their work centers
19. Establish all necessary bills
    a. Establish Watch, Quarter and Station Bills
    b. Establish Safety Bill with Safety Precautions
    c. Establish other bills
        (1) Check Ship's Organization Manual
        (2) Check Type Commander's Administration Manual
    d. Have all hands read and initial all bills
20. Establish training program or check existing program for inclusion of following features:
    a. "Buddy system" for equipment training
    b. Lecture or discussion methods for theory; showing and doing for skills
    c. Group training for use of test equipment
    d. Training courses (self-study and correspondence)
    e. Personnel Qualifications Standards (PQS) in accordance with the PQS manager's guide, NAVEDTRA 43100-1 (Series)
    f. Training bill published and followed
    g. Use of ETs as instructors for OSs, RMs, and other operators
21. Inspect spaces frequently. Check for:
    a. Cleanliness and upkeep including the neat, secure stowage of tools, test equipment, repair parts, equipment assemblies, and the like
    b. Necessary safety precaution signs and devices (rubber gloves, shorting probes, and so forth)
    c. Necessary fire-fighting equipment and damage-control fittings (compartment checkoff lists, hull reports)
    d. Necessary destruction tools
    e. Operating instructions to be posted near each equipment
    f. Condition of equipment, mounting, and cables
    g. Violations of safety precautions
    h. Use of correct operating techniques
22. Check reports on last official inspection of electronics section.
    a. Administrative and material
    b. Deficiency correction
23. Maintain a Relief Notebook containing sections on:
    a. Bills affecting the electronics section
    b. EMO standing orders and memoranda
    c. Personnel charts
    d. Captain's and executive officer's standing orders and memos affecting electronics
    e. Copies of interdepartment memos of concern to the electronics section

THE RELIEVING PROCESS

In order to ensure a complete transfer of information from the officer being relieved to the relieving officer, a suggested list of pertinent questions is included on information most needed by a new division officer.

1. What departmental officers are you normally most associated with, and how may they be reached most expeditiously?
2. What divisions and activities are in the department to which you will be attached on this vessel?
3. What are your divisional duties? Collateral duties?
4. What is the watch standing routine of the electronics division?
5. What watch do you stand?
6. For the electronics equipment installed aboard, is there a complete set of blueprints and plans (working copies) indexed and properly filed?
7. Is there a complete set of up-to-date instruction books (working copies) for all equipment on board?
8. How many electronics maintenance school graduates are on board?
9. What is the actual number of ETs on board?
10. Are the Watch, Quarter and Station bills up-to-date?
11. What new equipment is expected, and have necessary wire, cable, and so forth, for installation been requisitioned or otherwise provided?
12. Is the CSMP available, showing work to be accomplished during the next overhaul or upkeep availability?
13. Have work requests been submitted for the next overhaul?
14. What outstanding alterations are incomplete?
15. What equipment or material is awaiting survey?
16. What shipboard procedure is commonly used for surveying material?
17. Is there a complete master file (library copies) of equipment technical manuals?
18. Is there a complete file of Electronics Information Bulletins (EIBs), Electronics Installation and Maintenance Books (EIMBs), and advance messages available? Are the latest changes entered?
19. What routine material reports are you required to initiate?
20. Is there a division budget?
21. In the past, how much has it cost (quarterly) to run the OE division?
22. How much of the quarterly budget, if any, has already been obligated to date?
23. What is the correct procedure for requisitioning material?
24. Who is authorized to sign stub-requisitions for the head of the department?
25. What equipment are you signed for?
26. Do you have sub-custodians for all material for which you are signed?
27. Who is responsible for the custody and stowage of electronics maintenance parts?
28. Are electronics maintenance parts accessible during battle conditions?
29. Is all installed equipment under the Preventive Maintenance System (PMS)?
30. What is the source of power to the equipment?
31. How is emergency power obtained and how long can the plant be operated on emergency power?
32. When were power circuits and cables last tested?
33. Are all fuse holders marked for proper size?
34. Are spare fuses available on the spot?
35. Is the electronics equipment print file (library documents) complete?
36. Have power distribution block diagrams been made of all available sources of power to the equipment?
37. Are all power and control panels, switches, outlets, and so on, suitably marked with nameplates?
38. Are appropriate high-voltage warning signs installed?
39. Are safety rules and artificial respiration instructions posted in all compartments containing lethal apparatus?
40. Are stack gas warnings posted in applicable locations?

41. Are first aid kits installed in or near all OE division spaces?

42. What special precautions must be taken in the OE division prior to firing of ship's armament?

43. Has the equipment suffered any casualties as a result of firing practice or during engineering casualty control evolutions?

44. Are meters marked to show normal reading on all transmitters and associated equipment?

45. Are emergency transmitters tested in accordance with PMS?

46. Are provisions made for coupling the frequency standard to all transmitters and receivers?

47. What preventive maintenance program is being used on rotating equipment?

48. Are there any regularly authorized shutdown periods of equipment, for the purpose of technical checks and adjustments during operational periods?

49. When were sensitivity tests last made on receivers?

50. What type and how many air pressure systems for waveguides and transmission lines are aboard? What is their operating condition?

51. Are you troubled with interference by key clicks when keying several transmitters? If so, what transmitters and receivers are affected and what is being done toward eliminating the trouble?

52. What is the general status of portable test equipment? Is the allowance complete? Is necessary calibration up to date?

53. What is the general condition of the ship's antennas, and are up-to-date antenna photographs available and identified?

54. Is there an emergency antenna made up? Have personnel been exercised in its installation?

55. Is there a spirit of cooperation between the deck force and the maintenance force regarding painting of insulators, care of antenna when rigging, and so on?

56. Are all publications, directives, instructions and notices containing pertinent electronic information, being promptly routed to the ETs?

57. Have personnel been briefed as to the proper handling and stowage of tubes containing radioactive material?

58. What is the procedure for disposing of broken radioactive tubes?

59. What is the battle interior communication system arrangement for Electronics Repair?

60. What is the damage control system as it pertains to the OE division?

61. Are proper going aloft procedures adhered to?

62. Is PMS performed on safety harnesses?

63. What are the special local procedures for calibrating test equipment?

64. Available phone numbers:

(a) MOTU

(b) SURFLANT/SURFPAC/SUBLANT/SUBPAC, etc.

(c) NMPC

(d) local contacts

MAINTENANCE

The mission of the electronics division is to support the mission of the ship by maintaining all assigned electronic equipment at the specified standards of performance. This is done by performing all preventive maintenance actions on schedule and by taking immediate steps to eliminate deficiencies that arise (corrective maintenance). You, as EMO, should keep the operations officer and commanding officer informed of the current status of all assigned electronic equipment, and, at least 36 hours before getting underway, advise them of any equipment that is not operating at the required levels of performance.

CATEGORIES OF MAINTENANCE

Maintenance actions are subdivided into groups of categories in several different ways: for example, operational/technical, preventive/corrective, and overhaul/repair. The operational/technical and overhaul/repair categories can be grouped together according to the technical knowledge and skill required to accomplish the action.

Operational Maintenance

Operational Maintenance consists of inspection, adjustment and minor parts replacement not requiring a high degree of technical skill or internal alignment.

Technical Maintenance

Technical Maintenance will normally encompass replacement of unserviceable parts, subassemblies; and the alignment, testing, and adjustment (internal) of equipment. It requires a high degree of skill and detailed technical knowledge of the equipment.

Tender/Yard Maintenance

Tender/Yard Maintenance includes major overhaul or complete rebuilding of parts, subassemblies, or the end item, as required.

LEVELS OF EQUIPMENT MAINTENANCE

There are three levels (or echelons) of equipment maintenance that will be performed within the Navy. The definitions of these three levels of equipment maintenance are included in the following paragraphs.

Organizational Maintenance

Organizational maintenance is that maintenance which is the responsibility of, and performed by, a using organization on its assigned equipment. The phases of such maintenance normally consist of inspecting, servicing, lubricating, adjusting, and the replacing of parts, minor assemblies and subassemblies. This normally includes shipboard maintenance of its own equipment (mobile or portable (van)), and unit or aircraft squadron maintenance, including scheduled preventive maintenance. In the case of Civil Engineering Support Equipment (CESE), it is service station or field servicing.

Intermediate Maintenance

Intermediate maintenance is that maintenance which is the responsibility of, and performed by, designated maintenance activities for direct support of using organizations. Its phases normally consist of calibration, repair or replacement of damaged or unserviceable parts, components, or assemblies; the emergency manufacture of nonavailable parts; and providing technical assistance to using organizations. This normally includes maintenance performed by aircraft carriers, by tenders in support of other ships, airwing/group maintenance departments, aircraft maintenance departments, public works transportation centers, and shore activities officially designated as such.

Depot Maintenance

Depot maintenance is that maintenance performed on material requiring major overhaul or a complete rebuilding of parts, assemblies, subassemblies, and end items, including the manufacture of parts, modifications, testing and reclamation as required. Depot maintenance serves to support lower categories of maintenance by providing technical assistance and performing that maintenance beyond their responsibility. Depot maintenance provides stocks of serviceable equipment by using more extensive facilities for repair than are available in lower level maintenance activities. This is normally that maintenance performed by the Naval Air Rework Facilities, Depot Field Teams, Naval Ammunition Depots, Naval Ordnance Stations, Naval Weapons Stations, Naval Torpedo Stations, Naval Construction Battalion Centers, TRIDENT/POLARIS Missile Facilities, contractor depot level rework activities and at commercial facilities or Navy shipyards (including ship repair facilities) during availabilities designated "voyage repairs," restricted, technical, regular overhauls and the like.

Preventive Maintenance

Preventive maintenance is the systematic accomplishment of actions deemed necessary to reduce or eliminate the occurrence of failures,

and prolong the useful life of the equipment. All preventive maintenance actions are grouped into three basic categories: routine maintenance, testing, and adjusting. These categories are discussed briefly in the following paragraphs. However, a more useful knowledge of preventive maintenance can be acquired by understanding the Planned Maintenance System (PMS) described later in this chapter.

Routine Maintenance

Routine maintenance is the application of special procedures of inspection, cleaning, and lubrication of equipment. The term "special procedures" is used because approved and standard methods are employed whenever such maintenance actions are performed. For example, certain approved methods have been developed for the cleaning and lubrication of ball bearings. Whenever a ball bearing requires lubrication, it must first be cleaned using approved methods and solvents, and then it must be lubricated with the proper lubricant. Included with the lubricating instructions are lubrication charts which specify approved lubricants and their general usage. Such approved methods are routine because they apply whenever ball bearings are lubricated and must be accomplished periodically.

Routine inspections include such actions as checking equipment ground straps for loose connections and broken or frayed straps, checking tightness of screws, bolts, and nuts, checking oil reservoirs for the proper quantity of oil, checking front panel indicators and illumination for burned-out bulbs, and the like. Such inspections require direct analysis and judgment by the person performing the check.

A source of routine inspection, cleaning, and lubrication procedures is contained in Section Three of the General Maintenance EIMB, NAVSHIPS 0967-LP-000-0160.

Testing

Testing of electronic equipment involves the use of calibrated instruments to monitor or record the electrical, mechanical, and chemical properties of functions of the equipment's circuits and other devices, for comparison with established standards. By observing the responses and indications of the test instruments, and by comparing the information presented with established standards, it can be determined if the circuit or device is functioning as it should.

The difference between a test, as explained here, and an inspection is that a test involves the use of an instrument to present information representing a form or function of energy not perceivable by the human senses or which could be hazardous to health. With the information presented by the instrument, a person can then make an examination and analysis. Inspections require direct examination by human senses, normally sight and touch.

Adjusting

Adjusting of electronic equipment is a broad term which encompasses all phases of (1) adjustments to rearrange or change a function or characteristic, (2) circuit alignment which adjusts two or more sections of a circuit or system so their functions are properly synchronized, and (3) circuit calibration by which circuits or instruments of a given accuracy standard are checked against standards of higher accuracy and then aligned or adjusted accordingly. Sometimes other terms (e.g., collimation) are used to indicate special adjusting techniques. Collimation is the precise alignment of the mechanical system of a radar antenna, by comparison with an optical device aligned on known points in azimuth and elevation. It also applies to the process of making light rays or the paths of electrons or other particles in a beam parallel to, or concentric with, each other.

PREVENTIVE MAINTENANCE PROGRAM

An electronics preventive maintenance program consists of a schedule of inspections, tests, adjustments, and routine maintenance procedures, and a system of checkoff lists to ensure that the schedule is carried out. The administration of such a program aboard ship requires that the preventive maintenance needs of every equipment be recognized, planned for, accomplished, and recorded.

The Navy currently uses the Planned Maintenance System which is used with the Maintenance Data System (MDS). These two systems form the Maintenance and Material Systems (3-M). In the years before the advent of 3-M, the Navy used the Performance Operation and Maintenance System for Electronic Equipment (POMSEE). It utilized Reference Standards Books and Performance Standards Books along with Performance Standards Sheets to maintain specified standards of operational readiness for electronic equipment. The EMO will, even today, see and hear reference to the POMSEE program. However, 3-M has become the best tool yet devised to maintain Navy electronic equipment in peak operating condition.

3-M MAINTENANCE AND MATERIAL MANAGEMENT SYSTEMS

The purpose of the 3-M Systems is (1) to provide a tool to the fleet which can be used to manage, schedule, and perform maintenance, and (2) to provide information concerning fleet maintenance and maintenance support experience to organizations responsible for logistic support of the fleet. The Ships' 3-M Systems can survive and will operate in spite of meager resources and human error. These Systems will definitely not work or survive in an atmosphere of indifference, especially an atmosphere created by command indifference. The EMO must create an atmosphere which encourages the best use of the 3-M Systems. A description of the overall 3-M Systems is presented in the following paragraphs.

3-M Systems Objectives

The primary objective of the Ships' 3-M Systems is to provide for managing maintenance and maintenance support in a manner which will ensure maximum equipment operational readiness. To this end, the intermediate objectives of the 3-M Systems are as follows:

1. Achievement of uniform maintenance standards and criteria.
2. Effective use of available manpower and material resources in maintenance and maintenance support efforts.
3. Documentation of information relating to maintenance and maintenance support actions.
4. Improvement of maintainability and reliability of systems and equipment through analysis of documented maintenance information.
5. Provision of the means for reporting ship configuration changes.
6. Identification and reduction of the cost of maintenance and maintenance support in terms of manpower and material resources.
7. Reduction of the cost of accidental material damage by means of accurate identification and analysis of the cost.

3-M Systems Scope

The 3-M Systems, as described in OPNAVINST 4790.4, are fully applicable to all ships, service craft, small boats, nonaviation fleet support equipment and equipment used ashore which is identical to shipboard equipment (in so far as the Planned Maintenance System is concerned). A separate OPNAV Instruction will be issued for all other shore-based equipment.

The Ships' 3-M Systems include all equipment installed in ships except fleet ballistic missile weapon systems, nuclear power plants and associated test equipment. Ships, service craft, and small boats that are operated and maintained by civilian crews (naval stations, shipyards, repair facilities, and so forth) are also excepted from the requirements of the 3-M Systems. Directives promulgated by the Nuclear Power Directorate (NAVSEASYCOM, SEA 08) and the Director Strategic Systems Project Office (DIRSSPO) take precedence over the procedures of the 3-M Systems for the maintenance of equipment under their cognizance. However, this does not exclude the use of various portions of the 3-M Systems as management aids for maintaining these equipments. Type Commanders will issue amplifying instructions specifying application of the 3-M Systems for nuclear power plants and strategic weapons systems in conformance with NAVSEASYSCOM (SEA 08) and Strategic Systems Project Office policy. No information concerning nuclear power plants or strategic weapons systems will be forwarded to

the Navy Maintenance Support Office (NAMSO). This information, if required, shall be maintained at the fleet level (TYCOM, FLTCINC, and the like). This information shall not be made available to foreign governments or agencies or to civilian firms or agencies. The Ships' 3-M Systems consist of those systems designed for maintenance management:

1. PMS (Planned Maintenance System)
   a. Inactive Equipment Maintenance (IEM)
2. MDS (Maintenance Data System)
   a. IMMS (Intermediate Maintenance Activity Maintenance Management System).
   b. SAMIS (Ship Alteration Management Information System)

The scope of these systems is described in the following paragraphs.

3-M Systems Description

The 3-M Systems are the nucleus for managing maintenance aboard all ships and selected shore stations of the Navy. They provide all maintenance and material managers throughout the Navy with the means to plan, acquire, organize, direct, control, and evaluate manpower and material resources expended or planned for expenditure in support of maintenance. Thus, it is essential that all hands recognize the importance of the Systems, and understand the role they play in assisting management to improve the material readiness of equipment in the fleet. (In referring to "management," the term is used in its broadest sense, including the work center on the ship as well as Navy Headquarters in Washington.)

PMS (Planned Maintenance System)

PMS provides each user with a simple and standard means for planning, scheduling, controlling, and performing planned maintenance of all equipment. PMS is the most efficient means developed to date for using available maintenance resources.

PMS maintenance actions are the minimum required to maintain the equipment in a fully operable condition, within specifications. If performed according to schedule, these maintenance actions will provide the means to identify parts requiring replacement prior to failure. PMS procedures are, therefore, preventive in nature in that they are designed to prevent future equipment failures which might otherwise result in repeated corrective maintenance actions.

These PMS procedures and the periodicities in which they are to be accomplished are developed for each piece of equipment based on good engineering practice, practical experience, and technical standards. These procedures are contained on cards designated Maintenance Requirement Cards (MRCs). MRCs provide the detailed procedures for performing the preventive maintenance and state who, what, when, how, and with what resources, a specific requirement is to be accomplished. Some MRCs have Equipment Guide Lists (EGLs) accompanying them to serve as location guides for identical equipment; such as, motors, controllers, valves, life rafts, deck fittings, CO_2 bottles, and the like, which are impractical to schedule individually for routine, periodic preventive maintenance.

PMS procedures are developed by the activities and officers of the Naval Material Command that are responsible for the development and procurement of the systems/equipments for active, new construction, major conversion, and activation ships, boats, and craft. PMS documentation (Maintenance Index Pages [MIPs] and Maintenance Requirement Cards [MRCs]) are developed as part of the Integrated Logistics Support (ILS) effort for all new procurements, reprocurements, alterations, and modifications of systems and equipment. Primary requirements for the PMS development activities are:

- PMS documentation shall be developed in accordance with the current military specification (MIL-P-24534[NAVY]) and critically reviewed in the sponsoring Navy organization

prior to release to ensure that the planned maintenance requirements are current, technically correct, not excessive, and practical for fleet use.

PMS documentation approved by the NAVY organization responsible for the equipment development and procurement shall be delivered concurrently with the installation of the applicable systems/equipments or alterations.

A MIP (Maintenance Index Page) contains a brief description of the requirements on the MRCs for each item of equipment, including the periodicity code, the estimated manhours involved, the recommended rates and, if applicable, the related maintenance requirements. The MIPs for all equipment for which a department is assigned the maintenance responsibility are contained in a departmental master PMS manual. This manual also contains an index of effective MIPs, called a LOEP (List of Effective Pages), Report PMS 5. The Department Master PMS Manual is used by the department head as a scheduling tool when scheduling maintenance on the PMS schedule forms, and also as a cross-reference guide. Additionally, each work center has a Work Center PMS Record which is identical to the Departmental Master PMS Record, except that it contains only those MIPs and LOEPs applicable to the work center. The EMO, work center supervisors, and maintenance personnel use these records for cross-reference purposes.

The planning and scheduling of maintenance requirements are accomplished on the cycle, quarterly, and weekly schedules. Transferring maintenance requirements from the MIPs for each work center contained in the Departmental Master PMS Manual and scheduling them on the Cycle Schedule creates the ship's overhaul-to-overhaul planned maintenance schedule. Quarterly and Weekly Schedules are prepared using the Cycle Schedule as a guide. Maintenance requirements, indicated on the Weekly Schedule, are assigned to specific personnel for accomplishment. Scheduled maintenance actions are crossed over with an "X" when they are completed, and an action not completed is circled and arrowed to a new scheduled date (or left where it is, if it is known that the action cannot be completed, or if it is not known when the action can be completed.)

Changes to PMs are issued by the NAVSEACEN (Naval Sea Support Center, Atlantic and Pacific). More detailed information and procedures concerning PMS can be found in Chapter Five of OPNAVINST 4790.4. Procedures for verification and installation of PMS in new construction/major conversion ships and updating overhauls are outlined in Chapter Seven of OPNAVINST 4790.4. PMS procedures for ship activation, strike, and transfer to a foreign navy are outlined in Chapter Eight of OPNAVINST 4790.4.

PMS FBR (FEEDBACK REPORT) FORM.—The PMS FBR Form (OPNAV Form 4790/7B) provides fleet maintenance personnel with the means to report discrepancies, problems, PSDA (Partial Source Data Automation) requirements, and to request PMS software. All PMS FBRs are sent to NAVSEACENs or TYCOMs (Type Commanders), based on the category of the FBR. Chapter Five of OPNAVINST 4790.4 addresses the categories of the PMS FBR forms and the details of PMS feedback reporting.

IEM (INACTIVE EQUIPMENT MAINTENANCE).—IEM provides PMS procedures modified and reduced for maintenance of systems and equipment during overhaul, availabilities, and other extended periods during which equipment is not operated.

IEM development commenced in 1974. This is an improved concept for modification of PMS during extended periods of equipment inactivation or nonoperation. IEM does not require separate PMS material and assistance from TYCOM teams to implement. Modified procedures to institute during appropriate periods are included on regular PMS documents. IEM is described in Chapter Six of OPNAVINST 4790.4.

MDS (Maintenance Data System)

The following qualifications apply to the scope of MDS:

1. Submarines report all maintenance actions.
2. All ships report all maintenance actions which are deferred for outside assistance.
3. Ships' force report all maintenance actions on designated selected equipment.
4. All other maintenance actions as directed by Fleet CINC/TYCOMs will be reported.

MDS includes the following:

1. Documentation provided by shipboard personnel incident to certain shipboard maintenance actions. This documentation describes what was done, or needs to be done; why it was done, or why it needs to be done; who did it, or who needs to do it; and what resources were used or are needed.
2. The means of producing an automated CSMP (Current Ships Maintenance Project).
3. The means for producing automated ship work requests for intermediate maintenance activity and shipyard use.
4. The means for producing automated PREINSURV (Pre-Inspection and Survey) deficiency listings.
5. The means to produce automated reports tailored to meet the unique needs for all the various types and levels of management thoughout the Navy.
6. The tools necessary to effectively manage and control intermediate maintenance activity workloads.
7. The means for the fleet to report changes to the configuration of equipment installed in ships. Incident to such reporting is the development of the capability to automatically update a ship's PMS coverage.
8. The means for depot level activities to inform the fleet of estimated and actual resource expenditures.
9. The means for managing alterations.

MDS is the means by which maintenance personnel report corrective maintenance actions on specific categories of equipment (except for submarines who report corrective maintenance on all equipment). Information is retrievable from the TYCOM and the NAMSO (Navy Maintenance Support Office) data banks for analyzing maintenance and logistic support problems, for the development of the CSMP, and for generation of automated work requests for maintenance actions deferred for outside assistance.

It is a basic premise of the MDS that maintenance data will be recorded once and only once by fleet personnel and that the MDS data bank (not the maintenance activity) will thereafter provide information to all who have need for it in such form as may be required. In this connection, the NAMSO data bank is designed to be the focal point for receipt and distribution of maintenance and material data. Direct requests to the fleet for data which is available from the NAMSO imposes an unnecessary burden on the operating forces. It is the policy of the CNM (Chief of Naval Material) that the Navy Material Command minimize requests to the fleet for special data. However, if some such requests are deemed essential, special requests for data will include a phrase "The NAMSO data bank has been queried and the data is not available."

From the 3-M Systems central data bank maintained at NAMSO, numerous reports are already programmed and available upon request by any command. These reports yield data concerning equipment maintainability and reliability, manhour usage, equipment alteration status, material usage and costs, and fleet material condition. Many reports are produced periodically for users in both the Navy Shore Establishment and Operating Forces. General information concerning NAMSO products is contained in Chapter Four of OPNAVINST 4790.4. Detailed information is contained in NAMSOINST 4790.2, *An Outline and Guide for use in the Selection of Ships 3-M Information Reports.*

From the deferred maintenance that is reported, a CSMP file is developed by the ADP (Automated Data Processing) facility designated by the TYCOM. From the CSMP file a series of computer reports is provided to the ship and/or unit commander. These reports are also used by the TYCOM. The reports provide either a

detailed or summary listing of deferred maintenance information in various format options. Chapter Nine of OPNAVINST 4790.4 discusses the CSMP in detail. By-products of the CSMP include automated work packages, PRE-INSURV packages, and the like. A package of AWRs (Automated Work Requests) is generated by the ADP facility for each ship prior to overhaul and availability periods. These packages contain work requests for CSMP items appropriate to the designated repair activity as well as standard work requests for routine jobs performed during Intermediate Maintenance Activity (IMA) and ship-yard availabilities. Chapter 12 of OPNAVINST 4790.4 addresses AWRs in detail.

Prior to an inspection by the Board of Inspection and Survey, a package of automated INSURV items is generated by the TYCOM from all deferrals listed in a CSMP file. These items are in a format similar to AWRs. After the INSURV board has screened these items and assigned priority numbers, if appropriate, the package is used to update the CSMP. Chapter Nine of OPNAVINST 4790.4 discusses automated INSURV procedures.

The usefulness of MDS is dependent upon the accuracy, adequacy and timeliness of the information reported into the system. It is a system in which potential benefits are directly proportional to the efforts applied. Present programs for improving reliability, maintainability, and logistic support of fleet equipment depend upon conscientious adherence to reporting procedures. Much of the fleet support effort resulting from use of 3-M Systems data is not visible immediately to the fleet because of the time span required to test, evaluate, and implement engineering and design changes. Corrections of malfunctioning equipment through improvement in design often occur subsequent to reassignment of the personnel who provided the information which precipitated the corrective action.

IMMS (INTERMEDIATE MAINTENANCE ACTIVITY MAINTENANCE MANAGEMENT SYSTEM).—IMMS is comprised of computerized procedures used aboard tenders, repair ships, and repair bases/activities. These mechanized procedures are used to manage the planning, scheduling, production, and monitoring of the maintenance workloads of tended ships.

SAMIS (SHIP ALTERATION MANAGEMENT INFORMATION SYSTEM).—The SAMIS is an automated accounting procedure designed to assist the type commander in fulfilling responsibilities toward monitoring and controlling the configuration of attached units and in satisfying the requirements of the Fleet Modernization Program (FMP). The SAMIS computer programs produce reports of each alteration in convenient formats so that the type commander may properly advise the Chief of Naval Operations concerning the structure of the FMP.

This completes the discussion of the 3-M Systems. The EMO must become thoroughly familiar with the basic instruction, OPNAV 4790.4, in order to conduct an adequate maintenance program aboard ship.

CORRECTIVE MAINTENANCE

Corrective maintenance of electronic equipment consists of the actions and operations needed to restore an inoperative equipment, or an equipment operating at reduced capability, to a fully operative condition. Corrective maintenance actions may be those needed to repair an equipment after a fire, to locate and then replace a defective component, or to locate a faulty function and then adjust its circuit for an output which is within specification. Common to each of these examples of corrective maintenance actions, and to all other corrective maintenance actions, is a sequence of three basic operations which are always performed. A brief discussion is given of the steps involved in corrective maintenance so that you, as EMO, may be a more knowledgeable figure in the repair of malfunctioning equipment. Familiarity with the actions the technicians undertake to place the equipment on-the-line is important. These actions, listed below, are discussed in the subsections which follow.

1. Symptom recognition
2. Malfunction location (troubleshooting)
3. Repair (organizational, intermediate, and depot levels)

Symptom Recognition

Symptom recognition is, perhaps, the weakest link of the three basic operations. Numerous incidents have occurred where malfunctioning equipment was operated for hours, days, and even months without any symptom of malfunction being recognized by anyone. Of course, repair was not performed and the equipment continued to operate, but in a status of reduced capability. This is an example of poor material management and can place your ship in jeopardy if it is allowed to exist, particularly in a combat situation. The symptoms of many malfunctions are quite subtle and may not be easily recognized, even by highly skilled and experienced operators and technicians. Consequently, operators and technicians trained in the methods of symptom recognition are very important. A good training aid is the equipment for which the operators and technicians are responsible. They must know proper equipment operation, what function each operating control performs, and the function of each operating mode (even of those rarely used).

Symptom recognition may be difficult under electronic countermeasures (ECM) attack, but consider the probable consequences if corrective action were not taken because the symptom was not reported to a technician. In many cases, a mode change or the adjustment of an operator's control is all that is needed.

Very often, a competent equipment operator can see or sense an equipment malfunction which can be corrected without the aid of a technician. The operator is qualified to make some adjustments and changes to an equipment, provided they do not require a high degree of technical skill. Operators who are not technically qualified technicians on the equipment they operate are still responsible for reporting a malfunction or a symptom of probable malfunction to the electronic technician.

Not all pieces of equipment produce symptoms that are easily recognized, and problems may be discovered during performance of preventive maintenance. It is important that the not so apparent as well as the apparent troubles be recognized.

Malfunction Location

The process of malfunction location (troubleshooting) begins after a symptom of malfunction has been recognized, and ends when the cause of the malfunction has been located and verified.

Modern electronic equipment is extremely complex because there is so much interfacing and interacting circuitry, and to troubleshoot such equipment can be exasperating. It should be apparent that troubleshooting efficiency depends on knowledge of the equipment's operation as well as its technical characteristics. This is very important. You must know what the equipment should do before you can determine what it is not doing or is doing incorrectly. To troubleshoot efficiently, five logical operations must be performed. These operations are listed below and are discussed subsequently:

1. Identifying the symptom
2. Identifying the malfunction
3. Localizing the malfunction
4. Locating the cause of malfunction
5. Analyzing the failure

IDENTIFYING THE SYMPTOM.—After an equipment trouble has been recognized, all the available aids designed into the equipment should be used to further elaborate on the symptom. Use of front panel controls and other built-in indicating and testing aids should provide better identification of the symptom. The equipment operation sections of technical manuals may serve as guides.

IDENTIFYING THE MALFUNCTION.—The next step in troubleshooting is to formulate a number of logical choices as to the basic cause of the symptom, or what function is at fault. The logical choices should be mental decisions based on knowledge of equipment operation, a full identification of the symptom, and information contained in technical manuals. (The overall functional descriptions with associated block diagrams are especially helpful.)

LOCALIZING THE MALFUNCTION.—Once the malfunction is identified, its basic source must be localized to a circuit, group of circuits, unit, or equipment. Localizing the malfunction is normally accomplished by using the servicing block diagrams in technical manuals. The logical choices should be tested by following the signal flow of a function believed to be at fault through the diagrams in an order that will require the least time. If one test does not prove that a particular function is at fault, the next choice should be tested, and so on, until the faulty function or basic cause of the symptom is localized.

LOCATING THE CAUSE OF MALFUNCTION.—Once the malfunction is localized, it may be necessary to make additional choices as to which circuit, or group of circuits is at fault. Again, the servicing block diagrams supported with these parameters are used, along with schematics and other test location information that may be helpful in bracketing the faulty circuit. If the trouble is not immediately apparent, test methods are then necessary to further isolate the fault. Some of the most common test methods are waveform analysis, voltage checks, resistance checks, tube testing, semiconductor testing, and module testing. This process continues until the specific cause is located. Examples of specific causes are defective components, improper wiring and soldering of components and terminations, loose connectors and shielding, covers left off circuits and equipment cabinets, circuits not in proper electrical alignment, and dirty air filters.

FAILURE ANALYSIS.—After the faulty component, misalignment, or other problem, has been located, but prior to making the repair, the procedures followed up to this point should be reviewed to determine exactly why the fault affected the equipment in the manner it did. This review is usually necessary to make certain that the fault discovered is actually the cause of the malfunction, and not just the result of the malfunction. For example, a defective transistor may have caused the loss of a certain function. Upon analysis, it may be determined that insufficient cooling of the transistor caused it to fail. The real culprit could be a dirty air filter or an improperly installed heat sink. While the faulty transistor must be replaced, the cause of the overheating must also be corrected.

REPAIR AT THE ORGANIZATIONAL LEVEL (SHIPS FORCE REPAIR)

Regardless of how effective the preventive maintenance program is, electronic equipment will continue to malfunction and be deranged by battle, foul weather, accidents, and so on. Most equipment malfunctions and minor damages can be repaired by the ship's force, but the more severe casualties may require repair at the intermediate or depot level.

Each ship should, insofar as practicable, be self-sustaining with regard to normal repairs. Each ship should be adequately supplied with materials, repair parts, tools, and test equipment so that much of its own repair work can be accomplished by ship's force. Repairs should be undertaken under the supervision of the most competent and experienced personnel. (For information on work beyond the capability of ship's force, see Chapter 13.)

REPAIR ACTIVITIES

Repair activities afloat include repair ships and tenders. Repair activities ashore include naval shipyards, private shipyards under contract with the Navy, Shore Intermediate Maintenance Activities (SIMAs), and naval ship repair facilities (usually located outside the continental limits of the United States). The repairs and alterations that are within the capacity of a ship's force are accomplished by the ship's force. Repairs and alterations that are beyond the capacity of a ship's force may be accomplished by repair activities afloat or ashore as directed by the cognizant type commander or other authority assigning the availability.

Repair ships, SIMAs, and tenders are normally available to fleet and type commanders for the accomplishment of regular Intermediate Maintenance Availabilities (IMAV), emergency availabilities, parent tender/automatic availabilities, and concurrent availabilities. Work that is beyond the capacity of the repair ships, SIMAs, and tenders may be accomplished by depot level repair activities ashore. In

addition to the type of work requested, the availability of funds and the workload of available repair activities govern the assignment of repair work that is beyond the capacity of the ship's force.

The placement and administration of contracts for the repair or overhaul of naval ships at private shipyards are functions of an Office of the Supervisor of Shipbuilding (SUPSHIP) of the area in which the shipyard is located. (See Chapter 13 for further information.)

CLASSES OF OVERHAUL WORK

Five classes of equipment overhaul (A, B, C, D, and E) define the type of overhaul work to be performed, and should not be confused with the term "regular overhaul." A regular overhaul is a scheduled availability for a ship, during which time needed maintenance is performed and equipment improvements are made. The classes of overhaul describe the type and scope of work which is required of each equipment.

Class "A" Overhaul

A Class "A" overhaul includes that work which requires such overhaul, repairs, or modifications (e.g., field changes, ORDALTS, SPALTS, or SHIPALTS) as will sustain or improve the operating and performance characteristics of the system, subsystem or component to meet its most recent design and technical specifications. The end product should be in a "like-new" condition in appearance, operation, and performance. All manufacturers' and technical manual performance standards and specifications, unless superseded by proper authority, will be met, as will all technical documentation. The repair activity will demonstrate that the end product successfully meets all performance criteria specified by the governing specifications. Defining an overhaul as Class "A" means that all actions required to meet the definition are authorized. The definition is applicable to all components, subsystems and systems whether machinery/electrical/hull, electronics, or weapons, without regard to equipment cost, size or complexity. Thus, a Class "A" overhaul of a 10-horsepower motor is just as much Class "A" as that of a radar set or a boiler; although the demands on resources differ greatly.

Class "B" Overhaul

A Class "B" overhaul includes that work which requires such overhaul or repairs as will restore the operating and performance characteristics of a system, subsystem or component to its "original" design and technical specifications. If it is required to restore the operating and performance characteristics of an item to meet its service application, it must be so specified and the performance criteria defined. SHIPALTS, ORDALTS, SPALTS, field changes, and other modifications, even if applicable, are not to be accomplished unless specified by the customer. Maintenance adjustment and calibration routines specified by the applicable instruction manual, unless superseded by authority, are required. The repair activity will demonstrate that the end product successfully meets all performance criteria specified by the governing specifications.

Class "C" Overhaul

A Class "C" overhaul includes repair work on a system, subsystem or component specified by the work request, or that work required to correct the particular deficient conditions or malfunctions specified by the customer. The repair activity must demonstrate that the work requested has been accomplished or that the conditions/malfunctions described have been corrected, but the repairing activity has no responsibility for the repair or proper operation of the associated components of the equipment or for the operation of the system/subsystem equipment as a whole.

Class "D" Overhaul

A Class "D" overhaul includes that work associated with the "open, inspect and report" type of work request where the customer cannot be specific about what is or may be wrong with the item. This class of work is intended to be diagnostic in nature and thus, depending on the type of equipment, may require various tests, followed by inspection to assist in a complete

diagnosis. The repair activity will report findings, recommendations and cost estimates to the customer for authorization prior to any repair work being accomplished. When requested by the customer, minor repairs and adjustments may be accomplished without prior authorization, to the extent specified.

Class "E" Overhaul

A Class "E" overhaul includes that work required to incorporate all alterations and modifications specified for a designated system, subsystem, or component. The repair activity will demonstrate the successful checkout of the work accomplished to assure compliance with the performance standards established for the modification, only to the extent of the work performed. When required by the customer, the repair activity will conduct system tests to prove system operability through affected interfaces. Repairs, if any, are minor in nature.

ALTERATIONS TO SHIPS AND EQUIPMENT

An alteration to a naval ship is defined as any change in the hull, machinery, equipment, or fittings that involves a change in design, materials, number, location, or relationship of the component parts of an assembly regardless of whether it is undertaken separately from, or in conjunction with, repairs, or is identical to designated repairs.

Alterations to naval ships, whether they be promulgated as Ship Alterations (SHIPALTS) or Ordnance Alterations (ORDALTS) by the Naval Sea Systems Command (NAVSEA), Special Project Alterations (SPALTS) by the Project Offices of the systems commands or as designated by the Chief of Naval Material, or as any other systems command controlled alteration or modification (except electronic equipment field changes) are categorized by one of the following three terms:

1. Military Alteration

A military alteration is one which changes or improves the operational or military characteristics of a ship.

2. Technical Alteration

A technical alteration is one which does not affect the operational or military characteristics of a ship. In general, technical alterations concern matters of safety of personnel and equipment and effectiveness of equipment performance.

3. Alteration-Equivalent-to-Repair

An alteration-equivalent-to-repair (AER) is an alteration which meets one of the following conditions.

- The substitution, without change in design, of different materials which have prior approval of the cognizant systems command for similar use and which are available from standard stock.

- The replacement of worn or damaged parts, assemblies, or equipment requiring those of later and more efficient design previously approved by the cognizant systems command.

- The strengthening of parts which require repair or replacement in order to improve reliability of the parts and of the unit, provided no other change in design is involved.

- Minor modifications involving no significant changes in design or functioning of equipment, but considered essential to eliminate recurrence of unsatisfactory conditions.

AUTHORITY FOR THE APPROVAL AND AUTHORIZATION OF ALTERATIONS.—The word "approve" used in connection with an alteration indicates an action of approval of a proposed change. Promulgation of an approved alteration constitutes authority to expend design resources to plan for the accomplishment, but does not constitute authority to procure material or accomplish the alteration. The word "authorize" is used to signify permission to proceed with the installation and the granting of funds for a particular ship during a particular availability.

Alterations affecting the military characteristics of a ship (i.e., military alterations) may be approved only by the Chief of Naval Operations who shall establish the priority for the accomplishment of such alterations by the systems commands concerned.

Alterations not affecting the military characteristics of a ship (e.g., technical alterations) may be approved and authorized for accomplishment by the systems command concerned without reference to the Chief of Naval Operations.

Alterations-equivalent-to-repairs may be approved and authorized for accomplishment by fleet or type commanders to the extent that such authority has been delegated to them by the systems commands concerned.

UNAUTHORIZED MODIFICATIONS.—Alterations shall not be made unless previously approved and authorized for accomplishment by competent authority or unless accomplished for emergency purposes. Unauthorized alterations to electronic equipment, or to cabling and wiring, which affect existing systems or approved plans, must, upon their determination, be reported to NAVSEA and to any other applicable cognizant systems command. Appropriate action should then be taken to correct them or to obtain approval for them. Annual inspections and other inspections and tests performed must be carried out with a view to revealing unauthorized alterations.

EMERGENCY ALTERATIONS.—Alterations accomplished for emergency purposes, where advance authorization is impossible, must be reported to NAVSEA and to other cognizant hardware systems commands (if applicable) at the earliest practical time, and authorization requested.

When circumstances warrant emergency alterations, adequate consideration should be given to the safety of personnel and equipment and to the basic equipment performance requirements.

REQUESTING THE APPROVAL OF NONAUTHORIZED ALTERATIONS.—Requests for the approval of alterations to the ship or ship's equipment or systems shall be forwarded to NAVSEA via the applicable type commander (with an information copy to the type commander of the opposite fleet). The two type commanders will then forward to NAVSEA their recommendations concerning the proposed (or emergency) alteration and a list of ships affected.

SHIP ALTERATIONS (SHIPALTS).—A ship alteration (SHIPALT) is an alteration which involves material under the technical cognizance of NAVSEA. Alterations which affect shipborne systems and equipment under the technical cognizance of other systems commands (e.g., Air Alterations and SPALTS) are not SHIPALTS, but may require concurrent SHIPALTS where system interface changes are involved.

SHIPALTS are assigned categories (or "Titles") as follows:

1. Title "D" is assigned to alterations-equivalent-to-repairs. Title "D" SHIPALTS are authorized by type commanders.
2. Title "F" is assigned to alterations that are capable of being accomplished by forces afloat and do not require Special Program Material. (Special Program Material is that material which is procured specifically to support accomplishment of approved SHIPALTS and is provided to the installing activity on a nonreimbursable basis.) Title "F" SHIPALTS are authorized by type commanders and no industrial assistance is required.
3. Title "K" is assigned to all other types of SHIPALTS authorized by NAVSEA.

ELECTRONIC EQUIPMENT FIELD CHANGES.—Alterations to electronic equipment are issued as field changes in accordance with the General Specification for Field Changes and Field Change Kits. A field change is any modification or alteration made to an electronic equipment after delivery to the government. Recommendations for field changes may originate from any of several sources including the fleet, naval shipyards, contractors, project managers, and equipment engineers.

Field Changes are developed for the purpose of improving performance, operational characteristics, maintenance, reliability, and safety features of equipment. They may

require minor wiring or mechanical changes to an item of equipment and consist only of instructions for making the change, or they may be more extensive, requiring circuit changes and the removal and/or substitution of parts. The nature of each field change issued is identified by a type and classification designation, operational category and an accomplishment priority.

Field Changes are designated as Type I, Type II, Type III, or Type IV. These type designations afford an abbreviated method of indicating the material (including the publications package) which is contained in the field change kit and/or furnished by the installing activity. The publications package consists of the Electronic Field Change Bulletin, and changes to technical manuals, reference standards books, and other NAVSEA/NAVELEX-supplied equipment manuals. Not included in the package are Planned Maintenance System (PMS) documentation, Allowance Parts List (APL) documentation, or other documentation not controlled by NAVSEA or NAVELEX. Corrections and revisions to these documents, as a result of field changes, will be issued by the activities which have cognizance over them.

Type I.—A Type I field change requires parts, all of which are included in a kit. The kit consists of a publications package, all parts, materials, and special tools required to accomplish the change to one equipment and to revise existing equipment nameplates, publications, and charts.

Type II.—A Type II field change requires parts, none of which are included with the field change. The Type II field change may be either a kit consisting of only the publications package, or instructions which are published in the Electronics Information Bulletin (EIB) or other official instruction or letter. When published in the EIB, complete instructions for accomplishing the field change and for correcting related publications are included. The parts, tools, and test equipment required to accomplish a Type II field change are either standard shipboard items (e.g., wire, terminal lugs, soldering irons) or readily available from stock supplies (e.g., repair parts stocked for the equipment).

Type III.—A Type III field change requires parts, of which some, but not all, are included in a kit. The kit consists of a publications package and some of the parts, materials, and special tools required to accomplish the field change to one equipment and revise existing equipment nameplates, publications, and charts. The parts, tools, and test equipment not included in the kit are either standard shipboard items (e.g., wire, terminal lugs, soldering irons), or readily available from stock supplies (e.g., repair parts stocked for the equipment).

Type IV.—A Type IV field change does not require parts or use of special tools. This type of field change may be either a kit consisting of only the publications package, or instructions which are published in the EIB or other official instruction or letter. When published in the EIB, complete instructions for accomplishing the field change and for correcting related publications are included.

Classes of Field Changes.—There are three class designations (A, B, and C) for field changes, one of which is assigned to each field change. They provide an abbreviated method of indicating the funding and installation responsibility.

- A Class A field change designates that the field change is approved for accomplishment by forces afloat or station personnel, and no installation funding is required.

- A Class B field change requires fleet installation funding. Class B field changes to shipboard equipment are approved for accomplishment by naval shipyards, tenders, or repair facilities under the conditions stated in the field change bulletin, when authorized by type commanders. Class B field changes to equipment at training activities are approved for accomplishment and funded by the appropriate systems command. EXCEPT FOR CLASS B FIELD CHANGES PRESENTLY UNDER PROCUREMENT, IN THE SUPPLY SYSTEM, OR IN THE FLEET INSTALLATION PLANNING STAGE, THIS TYPE OF FIELD CHANGE WILL NO LONGER BE ISSUED.

A Class C field change normally requires industrial assistance for installation and requires the appropriate systems command installation funding.

Operational Categories of Field Changes.—Two operational categories are assigned to field changes which describe the effect of the change on the operating characteristics of the equipment. These categories are: Operational and Nonoperational. An Operational change affects the military characteristics of the equipment (e.g., a range increase of a radar, the addition of electronic countermeasures equipment to a radar). A Nonoperational change does not affect the military characteristics of the equipment. These categories concern matters of equipment maintenance and reliability improvements, safety of personnel and equipment, and effectiveness of equipment performance.

Accomplishment Priorities of Field Changes.—An accomplishment priority (Emergency, Urgent, or Routine) is assigned to each field change to indicate the urgency of the accomplishment.

1. Emergency. This priority is assigned to field changes for either of the following reasons:

- To effect a change in operational characteristics which if not accomplished without delay, may seriously compromise the national security.

- To correct a hazardous condition which may result in fatal or serious injury to personnel, extensive damage, or destruction of equipment.

2. Urgent. This priority is assigned to changes for the following reasons:

- To effect a change in operational characteristics which if not accomplished expeditiously, may seriously compromise the mission effectiveness of deployed equipment.

- To correct a potentially hazardous condition which may result in serious injury to personnel or in damage to equipment. A potentially hazardous condition compromises safety and embodies risk, but within reasonable limits permits continued use of the affected equipment, provided the operator has been informed of the hazard and appropriate precautions have been defined and distributed to the user.

- To meet certain significant contractual requirements.

- To effect an interface change which if delayed, will cause a schedule slippage or increased cost.

- To effect through value engineering or other cost reduction efforts substantial life cycle cost savings to the government.

3. Routine. This priority is assigned to proposed changes where "emergency" or "urgent" is not applicable.

Approval of Field Changes.—Field changes to electronic equipment are developed for the purpose of improving the equipment's performance and operational characteristics and maintenance, reliability, and safety features. Therefore, field changes are approved only after it has been determined that the effort and cost involved is warranted by the improved results achieved. Approval of field changes is given by the systems commands having cognizance over the equipment to be modified. The cognizant systems commands for shipboard electronic equipment are NAVSEA and NAVELEX.

Authority for Accomplishing Field Changes.—An approved field change is the authority for accomplishment, but only on those installations, systems, and equipment as specified by the approving activity (the cognizant systems command). The applicability of field changes to specified installations, systems, and equipment is presented in each Electronic Field Change Bulletin and/or promulgated in advance by publication in the EIB or, in special cases, by letter or message from the cognizant systems command or project office.

Accomplishment of approved and applicable field changes is mandatory when they are available, and the changes shall be performed at

the earliest opportunity in accordance with the accomplishment priorities assigned.

Recording the Accomplishment of Field Changes.—The final procedure in the accomplishment of a field change is an important one, and must be performed even if it was not included in the field change bulletin. This procedure includes the following two steps:

1. Stamp the field change number (e.g., 4) on the SECAS Field Change Accomplishment plate attached to the equipment or unit which the field change bulletin is promulgated against. The plate should belong to the equipment or unit whose type designation matches, exactly, the type designation (e.g., AN/SPS-I0D) of the field change bulletin (e.g., 4-AN/SPS-I0D). If the equipment or unit does not have a plate, put one on.

2. Make a complete report in accordance with the following paragraphs in configuration reporting.

REPORTING CHANGES TO EQUIPMENT CONFIGURATION

One of the major objectives of the Maintenance Data System (MDS) is to provide the capability for reporting configuration changes. The importance of configuration change reporting cannot be overemphasized. When the structure or composition of either the ship or a particular system or equipment on the ship is modified, the modification must be documented. This action will ensure proper accounting of configuration changes, and will facilitate improved supply and maintenance support (i.e., technical manuals, PMS coverage, COSAL, and the like) to the fleet. The Ship Equipment Configuration Accounting System (SECAS) is the designated system responsible for maintaining the configuration status reported by the fleet. The SECAS data is maintained in a central file, the Weapons Systems File (WSF) at SPCC, Mechanicsburg, Pa., and it is this central file on which supply and maintenance support managers depend to provide support to the fleet.

The responsibility of identifying and reporting configuration changes rests at all levels of the command. The work center supervisor will ensure that the proper documentation is completed and processed when a configuration change is accomplished. A configuration change is:

1. Accomplishment of any action prescribed by an alteration directive.
2. The installation, removal or modification of any system/equipment/component/unit. The replacement of repair parts (e.g., nuts, bolts, wires, "O" rings, gaskets, resistors, capacitors) with like parts, does not constitute a configuration change.

The OPNAV Form 4790/CK, SHIP'S CONFIGURATION CHANGE FORM, (fig. 4-7) is used to report configuration changes at the individual equipment level, whereas the 4790/2K Form is used to report maintenance actions at the job level. The 4790/2K Form will still be used to document all deferred maintenance actions (including deferred configuration changes), and to report the completion of those maintenance actions (closing deferrals and completed maintenance actions) that do not result in a configuration change. When the 4790/CK Form is used to report a configuration change, it is not necessary to document the accomplishment of the maintenance action on a 4790/2K Form. The 4790/CK Form will be used both as a closing deferral for reporting the accomplishment of a previously deferred maintenance action which results in a configuration change, and as a completed maintenance action (no prior deferral) reporting a configuration change. The 4790/2K will never be used to report accomplishment of any maintenance action that results in a configuration change.

In the same manner that material history information is retained in the 3-M central data bank, so is configuration status information maintained in a central data bank. The difference between the information in these two data banks is that the information in the 3-M data bank is maintained by Job Control Number (at the job level), and the information in the configuration data bank is maintained for each ship at the equipment level. The information in the configuration data base is used to produce the

SHIP'S CONFIGURATION CHANGE FORM
OPNAV 4790/CK (5-80) S/N 0107-LF-047-9000

COMP. M/A NO DEFL | COMP DEFL

SECTION I JOB IDENTIFICATION

JOB CONTROL NUMBER			ALTERATION IDENTIFICATION
1 SHIP'S UIC	2 WORK CENTER	3 JOB SEQ NR	4 ALTERATIONS (SHIPALT, ORDALT, FLD CHG, ETC)

A SHIP'S NAME	B HULL NUMBER	5 EIC	6 ACT TKN
7 EQUIPMENT NOUN NAME	8 S/F MHRS EXP	9 ACT MAINT TIME	10 COMP DATE / 11 M/R

SECTION II JOB DESCRIPTION/REMARKS

12 JOB DESCRIPTION/REMARKS

SECTION III COMPONENT CONFIGURATION CHANGE IDENTIFICATION

13 COMPONENT NOUN NAME		14 QUANTITY	15 C/A
16 COMPONENT IDENTIFICATION	17 COMPONENT SERIAL NUMBER		
18 COMPONENT APL/AEL	19 LOCATION (DECK/FRAME/SIDE)	20 EIC	
21 NEXT HIGHER ASSEMBLY	22 S A C	23 WORK CENTER	
24 NAMEPLATE DATA			

SECTION IV SPECIAL PURPOSE

25 RIN	26 AILSIN	27 SECAS OFFICE USE

—INSTRUCTIONS—

ITEM NUMBER	SECTION I & II DESCRIPTION	SECTION I & II PAGE 1	SECTION I & II ADDL PAGE
1-3	JOB CONTROL NUMBER	M	M
4	ALTERATION/IDENTIFICATION	IP	NR
5	EQUIPMENT IDENTIFICATION CODE	M	NR
6	ACTION TAKEN	M	NR
7	EQUIPMENT NOUN NAME	M	NR
8	SHIP'S FORCE MANHOURS EXPENDED	M	NR
9	ACTIVE MAINTENANCE TIME	M	NR
10	COMPLETION DATE	M	NR
11	METER READING	IP	NR
12	JOB DESCRIPTION (REMARKS)	O	NR

ITEM NUMBER	SECTION III DESCRIPTION	REMOVE (R/D)	INSTALL (I/A)	MODIFY (M)
13	COMPONENT NOUN NAME	M	M	M
14	QUANTITY	M	M	M
15	COMPONENT ACTION	M	M	M
16	COMPONENT IDENTIFICATION	IP	IP	IP
17	COMPONENT SERIAL NUMBER	IA	IA	IA
18	COMPONENT APL/AEL	M	NR	IA
19	LOCATION	M	M	M
20	EQUIPMENT IDENTIFICATION CODE	M	IA	M
21	NEXT HIGHER ASSEMBLY	IP	IP	IP
22	SERVICE APPLICATION CODE	IA	IA	IA
23	WORK CENTER	M	M	M
24	NAMEPLATE DATA	NR	M	NR

LEGEND

IA – IF AVAILABLE
IP – IF APPLICABLE
M – MANDATORY
O – OPTIONAL
NR NOT REQUIRED

SECTION I ACTION BLOCK 6 TAKEN

5A – PARTIALLY COMPLETED ALTERATION
5B – FULLY COMPLETED ALTERATION
5C – FULLY COMPLETED EQUIVALENT TO ALTERATION
5D – ALTERATION DIRECTIVE NOT APPLICABLE
1 – MAINTENANCE ACTION COMPLETED; PARTS DRAWN FROM SUPPLY
2 MAINTENANCE ACTION COMPLETED REQUIRED PARTS NOT DRAWN FROM SUPPLY (LOCAL MANUFACTURE, PRE EXPENDED BINS)
3 – MAINTENANCE ACTION COMPLETED, NO PARTS REQUIRED

SECTION III COMPONENT BLOCK 15 ACTION

R – REMOVED EQUIPMENT
I – INSTALLED EQUIPMENT
M – MODIFIED EQUIPMENT
A – ADDITION, NO MAINTENANCE ACTION
D DELETION, NO MAINTENANCE ACTION

WORK CENTER SUPERVISOR	DIVISION OFF	SUPPLY DEPT	3 M COORDINATOR

PAGE _____ of _____

Figure 4-7.—Ship's Configuration Change Form, OPNAV 4790/CK.

COSAL for each ship and to provide PMS, existing PSDA, and technical manuals. The quality of information recorded in the configuration data base directly determines the quality of support to the fleet. The 4790/CK Form is the only means available to operating ships to update or correct the configuration status of the ship.

It is very important to recognize that reporting of configuration changes by the ship is absolutely essential to ensure that spare parts are available to support maintenance actions. If configuration changes are not reported as described in Section Nine of the Ship's 3-M Manual, in all likelihood parts will not be available when the maintainer has need for them. Ensure that the ship's supply officer is included in the distribution/routing of all 4790/CK forms.

Use of the 4790/CK Form

The 4790/CK Form must be used whenever the accomplishment of a maintenance action results in a configuration change. A configuration change occurs whenever the accomplishment of a maintenance action results in the:

1. Addition or installation of any new equipment.
2. Deletion or removal of any installed equipment.
3. Replacement or exchange of any equipment. A replacement or exchange is reported as the removal of an installed equipment and installation of a new equipment.
4. Modification of any installed equipment. A modification results from a maintenance action which alters the design or operating characteristics of the equipment, or a maintenance action in which nonstandard replacement parts (not identified on the APL or in the technical manual) are used.
5. Relocation of any equipment.
6. Accomplishment of any alteration directive.

For the purposes of reporting configuration changes, all removals, modifications, additions, and/or replacements of equipment are included in the term "maintenance action," whether or not corrective maintenance of an actual equipment failure takes place.

Correction of any erroneous data in the support establishment's configuration records shall also be accomplished through use of the Ship's Configuration Change Form, OPNAV 4790/CK (fig 4-7).

Section I (JOB IDENTIFICATION) and Section II (JOB DESCRIPTION/REMARKS) are filled in on the first page to identify the maintenance action at the job level. Section III (COMPONENT CONFIGURATION CHANGE IDENTIFICATION) is filled in, using the first page and as many additional pages as necessary to identify each equipment for which a configuration change was accomplished as part of the maintenance action described in Sections I and II. Most of Section IV (SPECIAL PURPOSE) is not filled in aboard ship. Instructions are included on the form to assist in proper completion of the form. At the bottom of the page are blocks for recording the initials of shipboard personnel when reviewing the completed 4790/CK forms. Space is also provided for identifying the number of pages of information provided for each maintenance action documented. For example, if a configuration change occurs to four different pieces of equipment as a result of the accomplishment of a single maintenance action, Sections I, II and III will be completed on the first form (page 1) to describe the maintenance action and identify the configuration change to one of the equipments. Three additional forms (Pages 2, 3 and 4) will be completed to describe the configuration change to the other three equipments. Pages 2, 3 and 4 need only the JCN recorded in Blocks 1-3, the completion of Section III, and the appropriate page numbers entered at the bottom of the page.

UNCOMPLETED WORK.—Except in unusual circumstances, job orders for uncompleted repair work are closed or canceled upon the ship's departure from the repair activity. Job orders for authorized alterations, however, are held open until the work is later completed or canceled by the systems command concerned.

In case of the departure of the ship when unfinished work is to be completed at another activity, all outstanding job orders are transferred

to the latter activity together with all pertinent information and such material as has been assembled for the work.

Should work be desired later on job orders which have been closed or canceled, new requests must be made by the commanding officer of the ship.

PREPARATION FOR SEA.—Readying a ship for sea, including its initial voyage after an overhaul, involves meticulous planning, persistent work, and determined follow-up to make certain that necessary actions or material are not omitted. As electronics material officer, you must see that the division is in order and that allowances of equipment, tools, and repair parts are on board and properly stowed. The reason for this is obvious, as negligence can make your ship a liability during crucial action. You must impress the technicians and operators with the importance of reporting to proper authority all defects, regardless of their apparent insignificance. When you report the division ready for sea, or for getting underway, the commanding officer assumes that each equipment is in condition to give the performance required of it. If advised of the exact condition of the equipment on board, the commanding officer knows to what extent the ship can or cannot meet commitments and can act accordingly.

INSPECTIONS OF SHIPS AND EQUIPMENT

Type commanders must ensure that the ships under their command are informed of and kept up to prescribed standards of maintenance and readiness. These standards are found in various directives stemming from fleet commanders, technical commands, and the Chief of Naval Operations (CNO). These directives may be in the form of regulations, letters, directives, or manuals. Most of these sources get fleetwide dissemination, but the material is so voluminous that it is not readily effective except for detailed reference. Consequently, type commanders issue type instructions and type letters in which pertinent material is quoted or summarized, thus reducing the general instructions to specific instructions peculiar to the type.

Not only must type commanders issue data as to the standards required for their ships, they must also enforce those standards by means of inspections. The number and kinds of inspections are specified in Navy Regulations and CNO directives. Three types of inspections are mandatory: Administrative, Operational Readiness, and Material. The scheduling of inspections is based upon the operating cycles of the ships; that is, the periods between regularly scheduled shipyard overhauls.

Inspections of ships and aircraft squadrons are under the control of the fleet commanders who delegate this responsibility to the type commanders. The commanders of task forces or groups conduct, or direct the conduct of, such inspections as are recommended by the type commanders and submit to the latter the appropriate reports. When requested, fleet training commands assist the type commanders in the conduct of administrative and operational readiness inspections.

The grade a ship receives on an inspection is based upon the readiness of its personnel and material to carry out its missions.

Administrative Inspection

An administrative inspection is an inspection of all the administrative methods and procedures normally employed by a ship to determine whether or not the ship is being administered in an intelligent and efficient manner, and whether the organization, methods, and procedures are directed toward keeping the ship prepared to perform its wartime mission. At least one administrative inspection is conducted in each training cycle and is divided into two categories, the ship as a whole and each department.

Operational Readiness Inspection

An operational readiness inspection (ORI) consists of a demonstration on the part of a ship of its readiness and ability to perform the operations which might be required of it during war. Normally two such inspections are conducted during a training cycle.

As with administrative inspections, the conduct of an operational readiness inspection is the

responsibility of the type commander who normally requests the assistance of the fleet training command. The inspection includes a battle problem prepared, conducted, and observed as specified by CNO in the publication, "Preparation, Conduct and Analysis of a Battle Problem, FXP3-2(B)." In addition, other operational exercises are prescribed by the type commander, including gunnery, damage control, engineering, CIC, communications, seamanship, and aviation.

The inspection is conducted under way except for those portions which are tasks normally conducted at anchor, or in getting under way and coming to anchor. The inspection lasts for a period of 24 hours during which the ship is rigged for battle to the maximum extent possible. The criteria for performance are (1) whether the ship as a whole can carry out its operational functions and (2) whether the ship's company is well trained and competent in all phases of the evolutions.

Material Inspection

The purpose of a material inspection is to determine the actual material condition of a ship and its equipment in respect to ability to perform all functions for which the items were separately and interrelatedly designed, and to recommend repairs, alterations, changes, or developments that will ensure the material readiness of the ship to carry out the mission for which it was designed. Material readiness implies that the ship has established routines for own force inspections, tests, and preventive maintenance; that there is effective utilization of facilities for repair and preservation; and that outstanding items of work have been correctly determined as within the capacity of the ship's force, repair ships/tenders, or naval shipyards, respectively.

The scope of material inspections is similar to that of inspections made by the Board of Inspection and Survey (INSURV). Since an INSURV inspection is required every three years, and since in most cases the period between overhauls is 18 months, the scheduling of a material and an INSURV inspection is alternated. One of the above inspections should be conducted a minimum of three months prior to a shipyard overhaul.

INSURV Inspection

Every three years, a material inspection is conducted by the Board of Inspection and Survey (INSURV) to determine the material readiness of electronic equipment and systems and to establish work requests covering deficiencies. (See Article 2016-Navy Regulations.) Whenever practical the INSURV inspection is held in advance of the regular overhaul and in lieu of the material inspection.

Arrival Inspection

Arrival inspections for electronic equipment and systems are conducted upon or before the arrival of a ship for overhaul. This inspection is authorized by the type commander and includes the determination of the condition of the equipment and system, and the preparation of a list of the repairs required to ensure effective electrical and mechanical operation.

Post-Overhaul Inspection

Post-overhaul inspections are for the purpose of furnishing the commanding officer of a ship a report on the condition, capabilities, and limitations of the electronic equipment and systems. This inspection is normally made at a test and calibration facility and shall include new installations of equipment and systems, and those equipment and systems which were included in overhaul job orders. (Refer to the Naval Ships' Technical Manual, Chapter 094.)