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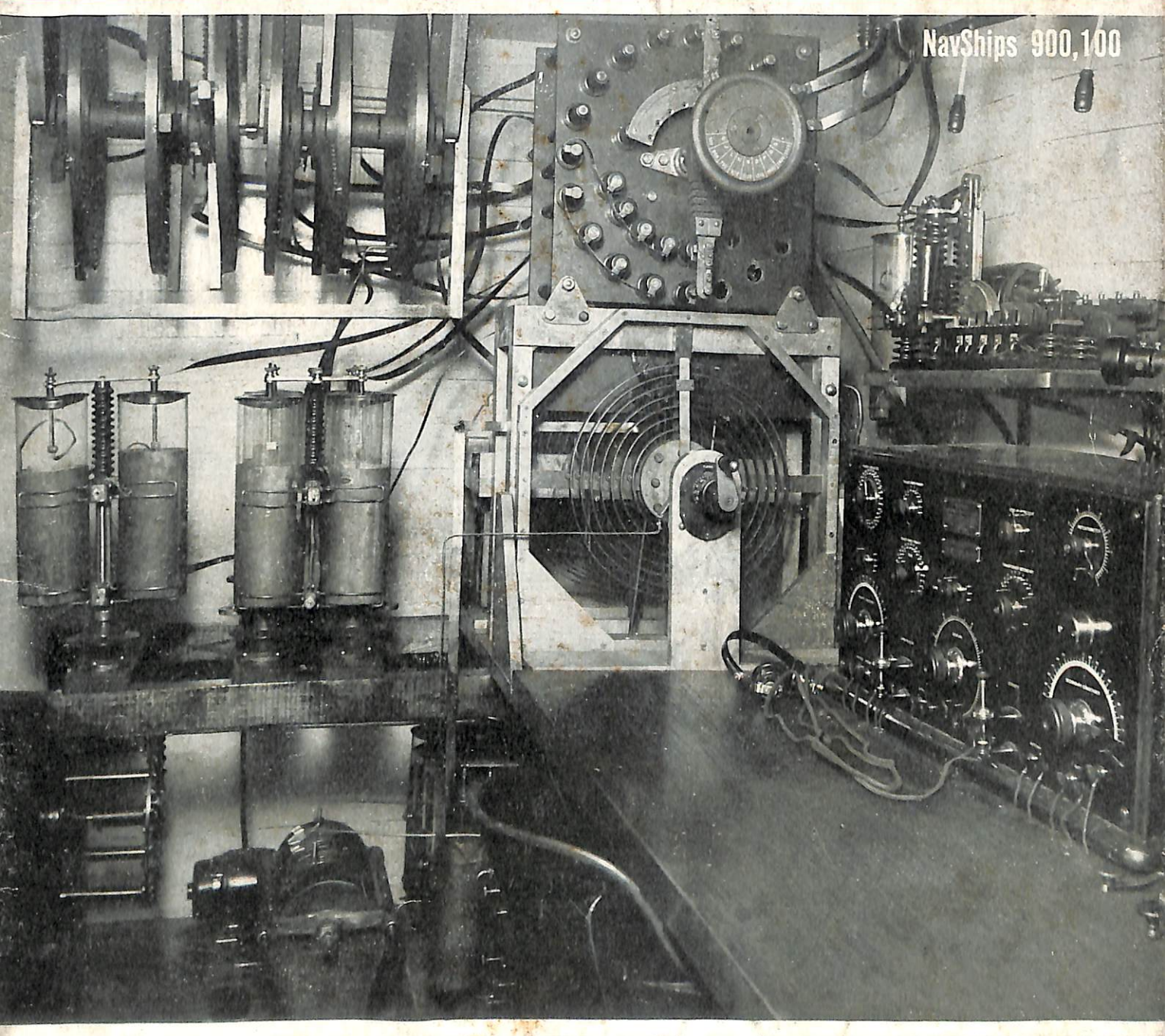
BUSHIPS ELECTRON

JULY 1950



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THE "RADIO SHACK" OF THE *U.S.S. NEW JERSEY* IN 1914. THIS PHOTO PRESENTS AN EXCELLENT OPPORTUNITY TO COMPARE THE OLD AND THE NEW IN NAVAL ELECTRONICS.

BUSHIPS

ELECTRON

VOLUME 6

NUMBER 1

A MONTHLY MAGAZINE FOR ELECTRONICS TECHNICIANS

July 1950

THIS ISSUE

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Navy Department
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and forwarded via the commanding officer. Whenever possible articles should be accompanied by appropriate sketches, diagrams, or photographs.

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RESTRICTED

Captain A. L. Becker

LEAVES THE BUREAU OF SHIPS

On 22 May 1950 Captain A. L. Becker was detached from duty as the Assistant Chief of the Bureau of Ships for Electronics and ordered to duty as the Commander, San Francisco Naval Shipyard. With this change in duty, both the outstanding capabilities of Captain Becker and the importance of Naval Electronics are recognized in that Captain Becker is the first Electronics Officer to assume over-all command of such an organization as a Naval Shipyard.

This signal honor comes as no surprise to those of us who are familiar with the long and highly successful career of Captain Becker. Throughout his Naval career Captain Becker has repeatedly been placed in important roles in the field of electronics. He was chosen for special training in post graduate work in radio engineering and completed courses at Annapolis and Yale University, receiving his Masters Degree in 1927. However, he is not without renown in the pursuit of Naval achievements likewise, for it was he who navigated the *U.S.S. Augusta* with the late President Roosevelt aboard to the famous "Atlantic Charter" rendezvous with Prime Minister Churchill in 1941. In fact, because of his exceptional aptitude with electronic aids coupled with his superiority as a navigator, Captain Becker personally was transferred to the bridge of the British ship to insure the safety of the meeting of the two ships in the thick weather.

Other important billets have included various types of combat ships, commands afloat and ashore and service on the staffs of seventeen Admirals including Fleet Admirals King and Nimitz. As Radio Material Officer at Pearl Harbor during the peak of the Pacific Area campaign, he was responsible for the electronic outfitting and battle damage repair of the countless vessels frequenting Pearl Harbor. He was also responsible for the communication facilities expansion necessary to Admiral Nimitz in the Pacific and personally directed the early reconstruction of radio facilities on Guam midst the rain of snipers bullets. For this service he was awarded the Bronze Star.

However, his contributions to Naval Electronics in his capacity as Assistant Chief of the Bureau of Ships for Electronics far transcends any of his previous accomplishments. His rare judgment, leadership and outstanding ability in the fields of electronics and high-level administration have been the driving force behind the tremendous expansion in Naval Electronics during the past few years. New and improved electronic devices, too numerous for listing, have been designed, developed, produced, procured and installed under the guiding genius of Captain Becker.

He has, by untiring effort, also been directly responsible for immeasurable increases in military and civilian electronics personnel and prestige throughout the Naval Service. He has been responsible for placement of many Electronics Officers in billets of other bureaus and activities, wherein they will function as advisers and technical consultants and be in a position to further enhance the importance of electronics to all branches of the Navy. Civilian personnel allowances and promotions have likewise prospered during Captain Becker's tenure in the Bureau, having increased from 336 to 445, with 94% holding permanent Civil Service status, during the past twenty-six months.

As a direct result of his indomitable will and devotion to the cause of electronics, there has been a material increase in the funds allocated for procurement of electronic hardware, in spite of the fact that the trend of the Navy's and the Bureau's appropriations has been sharply downward. In addition Captain Becker has at all times evidenced a very sincere interest in improving the quality and quantity of Buships electronics publications and has been instrumental in retaining, despite severe budgetary limitations, your Electron magazine

(Continued on page 15)

RADIO RECEIVING SET AN/URR–13

Radio Receiving Set AN/URR–13, companion equipment to the Model TED Radio Transmitting Equipment is now being produced in rather large quantity. This set features miniaturized construction and provides performance superior to any of its forerunners in the VHF/UHF ranges.

The AN/URR–13 is a twenty-three tube superheterodyne, designed primarily for operation as a pre-tuned, single channel, crystal controlled receiver. By employing a Type CH–24/U (harmonic mode) crystal of the proper frequency, any channel within the frequency range of 225 to 400 megacycles may be selected. Provisions are also included for continuously variable manual tuning. A single tuning control is employed for tuning to any frequency for either crystal controlled or manual tuning operation. Either one of these two methods of operation may be selected by a switch located in the port side crystal compartment.

Provisions are made for connecting a panoramic display. The scanning channel has a band width of 600 kilocycles, flat to within 6db.

The receiver has a sensitivity of better than eight microvolts for a 10-db signal-to-noise ratio. A balanced push-pull circuit arrangement is employed for the r-f amplifier and oscillator-multiplier circuits which provides for stable operation and freedom from spurious radiation from the receiver antenna.

All power necessary for operation of the equipment is supplied by a built-in power supply, designed for connection to a 110/115/120-volt 50-60 cycle, single-phase, a-c source. The audio and power source connections to the receiver are filtered to limit possible radio-frequency interference.

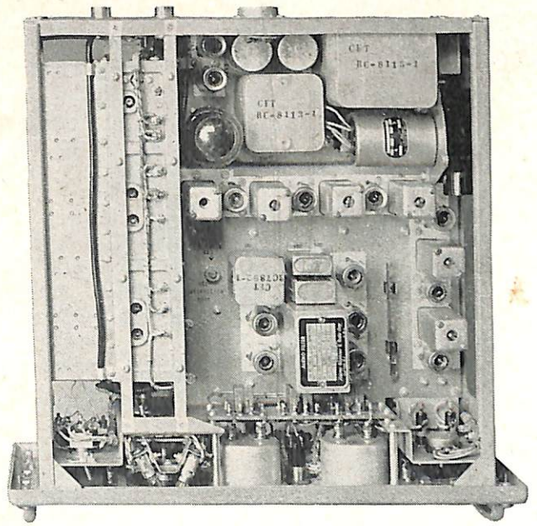
Radio Receiving Set AN/URR–13 consists of a panel, frame and chassis assembly housed in a cabinet equipped with shock-mounts for shipboard installations. The equipment is also supplied with detachable angle brackets to permit its installation on a standard 19-inch relay rack at shore stations.

The circuit parts are grouped on a functional basis into four major sections, namely: the preselector, i-f/a-f, power supply and cable filter sections. The first three sections are assembled on the panel mounted chassis frame. The cable filter section is mounted against the rear of the cabinet. Each section is removable for maintenance and/or replacement purposes.

The preselector section is an assembly of the r-f amplifier-converter unit and the oscillator-multiplier unit, mounted along the left side of the chassis frame. Each unit consists of an aluminum casting with removable covers. The antenna input circuit, two r-f amplifier stages and the mixer are mounted as one unit, and the oscillator, two frequency doubler stages and a frequency tripler stage comprise the second unit. Partitions in the castings provide r-f shielding between stages.

The tuning coils for the r-f amplifier and the multiplier tripler circuits consist of semi-circular strips of brass. The adjustable trimmer inductances consist each of two parallel rods and an adjustable shorting bar. The tuning coils, trimmer inductances and the concentric

COMPLETE EQUIPMENT including mounting brackets and four connectors (P401–P404).



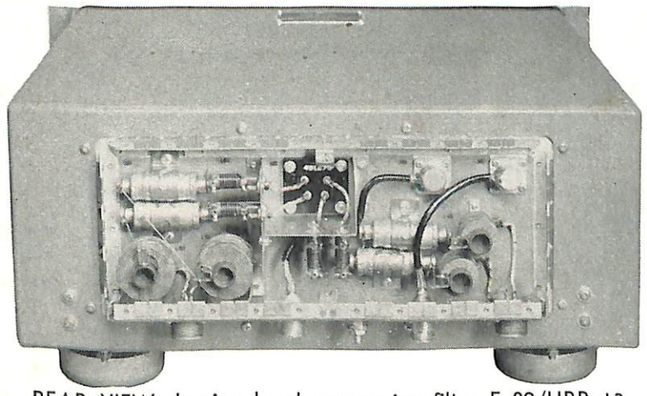
TOP VIEW of complete chassis.

cylinder type trimmer capacitors are integral parts of the gang capacitor sections.

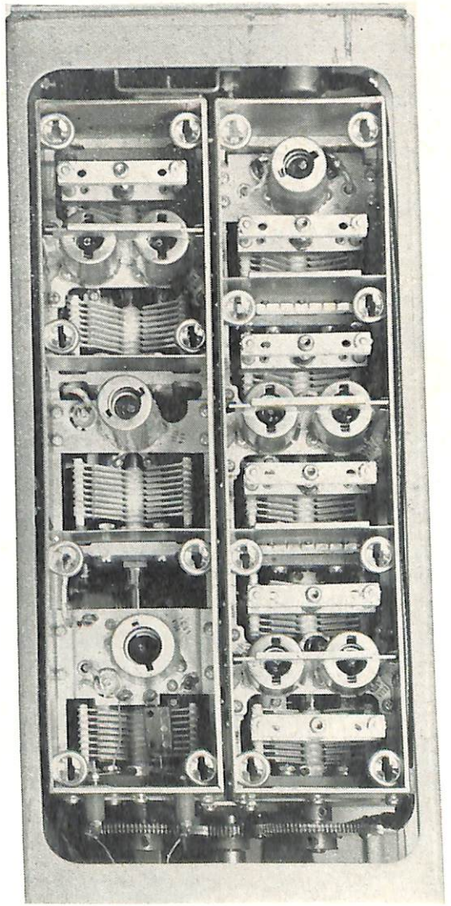
The i-f/a-f section is located on the right side of the chassis frame. It mounts the circuit parts for the five 18.6-megacycle intermediate-frequency stages, the second detector, automatic volume control, silencer and silencer amplifier, noise limiter, and three stages of audio amplification.

The power supply section is mounted at the rear of the i-f/a-f section. It includes all the circuit parts necessary to provide the a-c and d-c voltages and currents for operation of the equipment. The power transformer and the filter parts are designed to provide a power supply of reduced size and weight in comparison with the power requirements. A blower is also mounted in this section to keep the temperature inside the cabinet cool enough for safe operation of all electrical parts. Dust-filtered louvers on each side of the cabinet serve as an entrance for cool air and exit for warm air.

The cable filter contains the a-c power input and the audio output r-f noise filters and the through connections to the antenna input and the scanning channel output circuits. The filters are mounted on a baseplate which is attached by means of slide-snap fasteners to the inside wall of the cabinet. The filter cover attached to the baseplate constitutes an r-f shield and projects through a cut-out in the rear wall of the cabinet. The a-c power input, audio output, scanning channel output and the antenna transmission line input connectors, to which all external connections are made, are mounted on an angle bracket attached to the baseplate. When the receiver chassis assembly slides into the cabinet, connectors at the rear of the filter baseplate plug into the mating connectors on the chassis frame, establishing connections between the external and internal receiver circuits. The filter components are made accessible for servicing by removal of the filter cover.

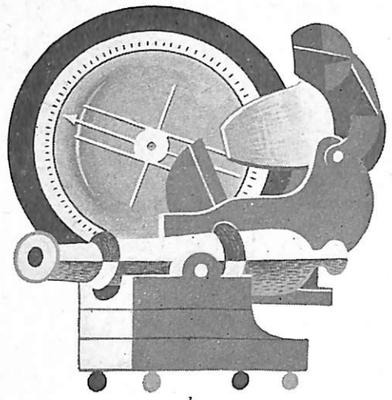


REAR VIEW showing band suppression filter F–89/URR–13 with filter housing removed.



PRESELECTOR UNIT from left side of chassis, shielding covers removed.

FIRE CONTROL RADAR ANTENNA ALIGNMENT



by
RALPH H. SAMUELSON
Supervising Engineer, Fire Control Branch
Electronics Office, Boston Naval Shipyard

Fire control radar antenna alignment on vessels undergoing construction, conversion, overhaul, or repair at this facility has been considered a responsibility of the Boston Naval Shipyard from the time of the first FD (Mark 4) fire control radar installation. This covers a period of approximately nine years, during which time an estimated two thousand fire control radar antennas have been aligned.

It has always been considered impractical to align fire control radar antennas on vessels berthed at the Boston Naval Shipyard, due to its geographic location. The Shipyard is practically surrounded by land with buildings and structures (Figure 1), which makes it extremely difficult to distinguish an isolated target, a very important factor in obtaining accurate antenna alignments. Because of this difficulty, it was determined that the best alignments could be obtained if vessels went out to sea where no nearby echoes would interfere with the target echo. Varying conditions, such as changes in the type of aircraft target, changes in the activity supplying the target aircraft, changes in the type of fire control radar equipments requiring antenna alignment, and changes in personnel have necessitated changes in the procedure and method of aligning antennas.

Until March of 1949, the following was the general procedure for antenna alignment:

1—During a vessel's Readiness for Sea Period, a day was scheduled by the Commanding Officer for fire control radar antenna alignment. The Shipyard would arrange for an aircraft to be made available for the antenna alignment, and when the scheduled day arrived, weather permitting, Electronics Office engineers would board the vessel and align the antennas while the vessel was out at sea, using the aircraft as a target. During the "Sea Trial" alignment, if time permitted and a suitable target were available, the fire control radars were calibrated in range, using the "double echo" method.

The "Sea Trial" method for aligning fire control radar antennas did not prove entirely satisfactory for the following reasons:

1—The frequently encountered rough seas in this area during the winter months impaired the alignment and made it extremely difficult to obtain an accurate alignment.

2—On the day scheduled for alignment, weather conditions in the Harbor frequently would be favorable, but a sea fog would be encountered out to sea. The fog precluded the possibility of optically seeing the target plane, thereby making it impossible to align the antennas.

3—Machinery trials, drills, compass calibrations, etc., conflicted with the time scheduled to conduct antenna alignments, hindered the alignment procedure, and sometimes made it practically impossible to accomplish alignment.

About March of 1949, the elimination of a sea trial for the alignment of antennas was considered. In the past it had been practically impossible to align the MK 12/22 radar combination while a vessel was berthed in the harbor. This was because the MK 12/22 radar has a relatively wide antenna beam pattern and relatively poor range discrimination, due to a long range "gate" time which made it next to impossible to distinguish the target aircraft from the numerous land and aircraft echoes present.

With the advent of the MK 25 Mod 2 radar, which has a narrow antenna beam pattern and very good range discrimination because of a short range "gate" time, it was decided to attempt the alignment of the radar antennas while the vessels were in the Harbor. It was decided to have the vessels go to either the North or East jetty at the South Boston Annex, which is not so completely surrounded by buildings and structures, and have a target aircraft fly a predetermined course. An examination of Figure 1 will show how poorly situated the Shipyard is for radar antenna alignment as compared with the location of the South Boston Annex. The "dockside" method of antenna alignment was tried and proved very satisfactory.

Figure 1 also shows that the target aircraft is required to operate in the landing pattern of the Logan Airport, which made it necessary to obtain permission from the Civil Aeronautics Administration to operate an aircraft in that area. Permission was granted, with the stipulation that the target aircraft would maintain constant contact with the Logan Airport Control Tower, and keep the Tower informed constantly of any changes in altitude or operating area. The operating areas were determined and designated as ABLE, BAKER, CHARLIE, and DOG. The area to be utilized is determined by the berthing location of the vessel on which the antenna alignment is to be accomplished.

Arrangements for the services of a target aircraft are made by dispatch request to the Fleet Training Command, Operations Center, Narragansett Bay Area, Newport News, R. I. This Command controls the operation of Utility Squadron 4, which is stationed at the U. S. Naval Air Station, Quonset Point, R. I. The services of a slow aircraft are desired, and in most instances a PBY type aircraft has been used. Recently, a TBM type aircraft has been used, and has proven reasonably satisfactory.

The communications controlling the aircraft are between the aircraft and the Shipyard. It was deemed advisable to use the Shipyard for a communication center rather than the vessel being aligned, for the following reasons:

1—To eliminate any possible confusion in the communication procedure.

2—The same personnel are involved in each antenna alignment, and familiarity tends for an efficient procedure.

3—First-hand information on the progress of the antenna alignment is always available to the Electronics Officer of the Shipyard.

The communications employed during an antenna alignment are as follows:

1—One hour prior to the rendezvous of the plane and vessel, the Shipyard contacts the U. S. Naval Air Station at Quonset Point on 5080 kilocycles, CW, and maintains contact until the aircraft reports on station to the Shipyard.

2—Upon arrival on station, the aircraft contacts the Control Tower at the Logan Airport, and maintains contact during the entire operation.

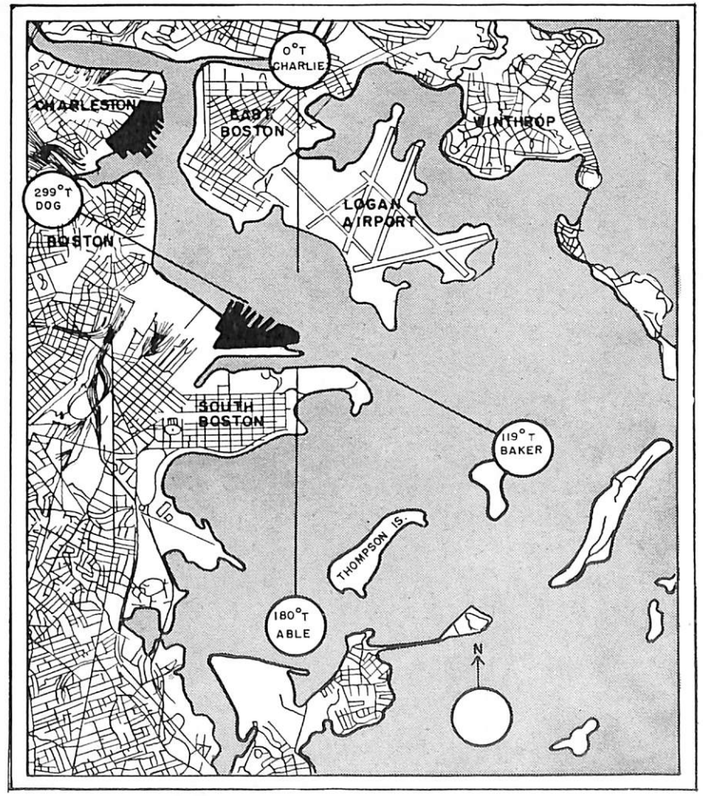
3—The Shipyard directs movements and maintains contact with the aircraft by transmissions in the h-f band, voice primary, and in the v-h-f band, voice secondary.

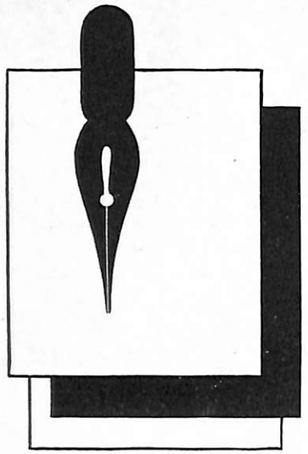
4—The Electronics Office engineer in charge of antenna alignment on the vessel directs the operations of the plane by contacting the Shipyard by radio, using the v-h-f band on voice, or by land line telephone. The Shipyard, in turn, contacts the aircraft.

5—When the antenna alignments have been completed and the aircraft has been released, the Shipyard notifies the U. S. Naval Air Station at Quonset Point, and maintains contact until the aircraft lands at the Station.

In conclusion, it may be stated that the "dockside" method of antenna alignment has proven far more efficient than the "sea trial" method, and is being used for all antenna alignments at this activity, with the exception of the MK 12/22 equipment, for which antenna alignment, dockside method, is impractical.

FIGURE 1. (Shipyard shown in solid black.)





Administrative Guide for Electronics Officers

by
LT. CDR. CARL F. CARLSON, USN.
Electrical and Electronics Officer
Staff, Commander Underway Training Unit, San Diego,
U. S. Pacific Fleet

In an endorsement to this article, Commander Fleet Training Group and Underway Training Element, San Diego, says: "In his present tour of duty as an inspector of electronic equipment with the Underway Training Element, San Diego, LCDR. CARLSON has had the opportunity of observing the organization and administration of electronics maintenance in practically every ship of the Pacific Fleet It is felt that this unique position qualifies him as an authority on practical aspects of electronic maintenance, and that the enclosed guide will be of material assistance in improvement of electronic performance."

As an aid to officers, particularly those having limited or no electronic background and training, who have been assigned electronic duties, the following information is set forth. It is essentially administrative in nature and written for the purpose of assisting electronics officers in effectively organizing the electronics repair division, and in addition, fulfilling the requirements with respect to records and reports laid down by the various Bureau of Ships directives.

It is fully appreciated that the apparent lack of higher electronics technical petty officer ratings introduces endless complications with respect to establishing an effective administrative organization and overcoming the existing problems associated with electronic equipment maintenance. On the other hand there is evidence uncovered as a result of Training Readiness Inspections indicating that full and effective use is not being made of available men and facilities. Consequently it is believed there exists a need for information contributing towards a more thorough understanding of requirements and the nature of subsequent steps necessary in realizing a more effective administrative organization in the interest of effective utilization of available technical manpower.

Responsibilities

Chapter 7, Para. 9 of Standard Ship Organization, U. S. Navy (OPNav 03–P103, 1947) states the duties of the electronics repair officer and includes:

1—The repair of all electronic equipment of the ship.
2—Operation, maintenance and repair of equipment connected with electronic repair.
3—The training and supervision of assigned personnel.
4—The preparation of reports and records required in connection with the assigned functions.
5—Cleanliness and upkeep of assigned spaces.

It must be realized that this responsibility of repair entails the technical maintenance necessitated in connection with maintaining operation (material readiness) of the ship's electronic equipment at the designed standards of performance since any piece of equipment not normally capable of meeting such performance standards is in need of repair.

This obligation of maintenance is not to be considered as including the adjustment, operation, and operational maintenance of electronic equipment. Such responsibilities with respect to equipments assigned to various ship departments is covered in Articles 0921, 0926, 0931, and 0935, U.S.N.R. Details with respect to operation and operational maintenance can be found in Sections 4 and 5 of the equipment instruction books. There is a prevailing tendency of becoming involved in this phase of maintenance. Not that it should be disregarded, but rather, intelligently handled by instructing operators and compiling daily check-off lists for their use.

Organization

Facilities

Is the present evolution of job preparation a major undertaking? Time is the essence these days. If electronics repair personnel must spend the greater part of available time in searching for information, repair equipment, spare parts, etc., their maintenance effectiveness is practically non-existent. In placing the division on a production basis, provisions must be made for three fundamental requirements in connection with establishing repair facilities; (1) stowage for the full allowance of test equipment and tools that affords suitable accessibility, (2) bin stowage in or near the repair space for frequently used spare parts, and (3) stowage facilities for centralized systematic filing of maintenance records and documents preferably in the repair space.

Electronic equipments, particularly radar, are instruments of considerable precision. The test equipment used for checking its performance in the ship must have still greater accuracy. To insure reliable operation of the latter it must be the recipient of deserving care and maintenance. Haphazard stowage on decks or in crowded lockers will ultimately result in maloperation. Consequently suitable racks and/or shelving must be provided, and in the interest of accessibility and overall centralization must be in the repair space. The use of suitable tools, many of special design, for effecting replacement and repairs is a necessity in consideration of the numerous circuit components comprising the present day electronic equipment units. Such tools as slim shank long blade screw-drivers, Phillips screw-drivers, Allen and Bristo set screw wrenches, long nose pliers, etc., must be readily available. It is impossible to assume maintenance and repair responsibilities without adequate tools and test equipment. And having acquired the full allowance the important factor of security must be considered. The best insurance against such loss is provision for adequate and centralized stowage facilities.

A tabulation of the ship's full allowance of tools and test equipment is available in the applicable pages of NavShips 900,115, Electronic Equipment Type Allowance Book, which constitutes the ship's allowance of S67 material. In the near future the Bureau of Ships will combine electrical and electronic test equipment into one allowance group. This will be the S69 portion of the allowance. The changeover will be gradual, taking place as revisions are made in the allowance of each ship, either in the S67 or S69 portions. The S69 portion will be divided into two parts, the S69–1 allowance constituting the electronic test equipment (with minor exceptions) now shown in the S67 allowance.

The spare parts stowage program, long overdue, but being undertaken by BuShips will ultimately result in bin stowage for all spares other than large units not adaptable to drawer stowage. However the space generally assigned for electronic repair parts bin stowage, or presently used for spare parts box stowage is remote from equipment and repair spaces. Therefore in the interest of ready accessibility, frequently used spare parts such as vacuum tubes, fuses, indicator lights, crystal rectifiers and detectors, etc., should have bin stowage provided in or near the latter space. Although not specifically required, Stock Tally Card, NavSandA Form 211 is recommended in connection with maintaining stock level requirements of frequently used spares.

A common deficiency uncovered as a result of Training Readiness Inspections is the lack of a centralized and systematic stowage of records and publications affording suitable security. Provisions for such a stowage contributes measurably to overall efficiency. Immediate reference to pertinent technical data is of primary concern in the interest of developing a well informed technical crew. Systematic filing of publications and records insures meeting existing requirements.

The publications to be made readily available for technical and general information reference include the following:

1—One copy of the final issue instruction book for each type of ship's electronic equipment. (Includes portable and test equipment.)
2—One copy of equipment maintenance handbooks. (If available.)
3—Radar Maintenance Bulletin, NavShips 900,096.
4—Communication Equipment Maintenance Bulletin, NavShips 900,020(A).
5—Sonar Bulletin, NavShips 900,025(A) (ASW vessels only).
6—Complete file of ELECTRON, NavShips 900,100.
7—Chapter 67, BuShips Manual (Radio Equipment), 1944 edition.
8—Chapter 68, BuShips Manual (Underwater Sound Equipment), 1943 edition.
9—Complete file of electronic equipment installation blueprints (printed and issued by installing yard).
10—BuShips Electronic Components List, NavShips 900,113.
11—Applicable pages from the Type Allowance Book, NavShips 900,115.

To insure that all electronics installation, maintenance and repair personnel will be well informed relative to the Electronics Divisions, BuShips publications listed above, a description covering material content, distribution, physical construction, and other features was published in ELECTRON, Feb. 1949. Pertinent extracts from this article and additional information is given under *Publications* in this guide.

Administration

Doctrine

Matters pertaining to fulfilling administrative requirements in connection with shipboard electronics are found in the following:

1—Bureau of Ships Manual, Chapter 6, 31, 67, and 68.
2—Fleet, Force, and Type Commander Directives.
3—Shipboard Radar Maintenance Bulletin, NavShips 900,096.

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4—Communication Equipment Maintenance Bulletin, NavShips 900,020(A).
5—Sonar Bulletin, NavShips 900,025(A).
6—ELECTRON, NavShips 900,100.

Policies

In connection with the management exercised and procedures established and followed in the interest of realizing effective utilization of available man-power in meeting requirements and instructions, the value of specific policies becomes apparent. The policies formulated constitutes the division administrative plan and are best promulgated in the form of an Electronic Repair Division Organization.

Such formulated policies should cover the following subjects:

1—*Written Instructions for General Quarters Covering the Following:*
- a—Assignments of General Quarters stations manned with respect to billet number.
- b—Duties and responsibilities associated with manning designated stations.
- c—Tabulation of 'on station' repair facilities such as instruction books, repair kits, maintenance test equipment, safety equipment.
- d—Channels of communications available in connection with disseminating electronic casualty information.
- e—Reporting procedures to be followed in connection with being in all respects manned and ready.

2—*Watches.*
- a—Instructions relative to watches underway and at anchor. A watch list should be published to insure availability of technicians on call.

3—*Maintenance Assignments.*
- a—The assignment of specific equipment maintenance responsibilities with respect to billet number. These responsibilities involve preventive as well as corrective maintenance routines and are set up principally for the purpose of insuring equipment operation at designed levels of operating efficiency by carrying out prescribed preventive maintenance procedures. Believed mandatory with respect to extensive electronic equipment installations, specific maintenance responsibilities are beneficial where two or more technicians are available. Such a practice tends to eliminate misunderstandings, creates the sense of responsibility, and establishes qualifications with respect to demonstrated ability. Assignments with respect to test equipment are not to be overlooked.

4—*Records and Reports, and the Maintenance Thereof.*
- a—A tabulation of records maintained and reports submitted.

A tickler system established in connection with submitting reports will insure prompt submission.

The use of maintenance service reports will provide compilation of information desired with respect to record maintenance.

Only by effectively delegating this responsibility will records be maintained and reports submitted.

5—*Technical Training.*
- a—Training supervision with respect to advancement in rating is generally carried on at the departmental level. However a technical training curriculum is mandatory in the interest of establishing familiarity with the installation characteristics and maintenance requirements of the ship's electronic equipment.

  Maintenance qualifications will only become a reality if systematic indoctrination is employed.

  Installation blueprints, instruction books, CEMB, RMB, and ELECTRON (NavShips 900,-100) are analyzed and pertinent technical data studied.

6—*Safety Precautions.*
- a—Together with the average technician's increasing ability as a trouble shooter there often appears the growing indifference to high voltage hazards. Apparently in attaining the classification of "Hot Shot" technician the standard demanding work in and around the hot stuff creeps in. Taking chances may arouse envy and praise, however it is unfortunate that a swelled ego contributes little to increasing body resistance against the disastrous effects of contact with high voltage.
- b—It is recommended that a memorandum be tabulated for signature by all hands relating to the following phases to be observed in connection with servicing electronic equipment.
  - (1)—Digest of the following:
    - (a) Part 15, Chapter 67, BuShips Manual.
    - (b) "Effects of Electrical Shock," ELECTRON, March 1948.
    - (c) "You Too Can Be A Dead Technician," ELECTRON, Dec. 1948.
    - (d) "Safety Notices" appearing in all instruction books.
  - (2)—*Demonstrated* ability to render artificial respiration.
  - (3)—*Mandatory use of:*
    - (a) Safety belt when going aloft.
    - (b) Protective gloves and goggles when handling cathode-ray tubes.
    - (c) Discharge probes and grounding leads while servicing to eliminate residual charges.
    - (d) Rubber or similar matting on bare metal decks while servicing.
  - (4)—*THE NAVY NEEDS YOU ALIVE.*

Preventive Maintenance

The criterion by which the usefulness of the electronic repair facility is judged is based fundamentally on the material readiness of the ship's electronic equipment at designed standards of performance. Any piece of electronic equipment not normally capable of meeting this standard can be considered as being in need of repair. Success in meeting this criterion is almost wholly dependent on carrying out a preventive maintenance program. Consequently, an electronic repair force properly organized and effectively administered will have established as the principal objective prescribed preventive maintenance procedures, the common tendency to disregard the benefits realized from such a program notwithstanding.

In analyzing the factors contributing to achieving such a standard of equipment maintenance, the following considerations will not only establish the benefits derived therefrom, but will demonstrate the inevitableness of preventive maintenance.

1—The ingenuity of modern shipboard electronic equipment is reflected in complexity of circuits. Evidence of this fact is found in the number of vacuum tubes, which for a single radar may be as high as 800. Notwithstanding the most careful Naval design specifications, it is more or less routine for radar performance to become impaired under operating conditions.

Not only are Naval radar sets complex, but their performance criteria are less tangible than those of conventional communication systems. For instance, ordinary radio sets are to some extent self testing in that reception of intelligible speech or signals constitutes sufficient check of performance. On the other hand, the working range of a ship's radar may fall into a fraction of the possible maximum or some other malfunctioning may occur with nothing in the operation of the radar to indicate what has happened. Since the lack of maximum performance may have serious military results, measurement of performance assumes the utmost importance. This important maintenance requirement is only effectively processed as a preventive maintenace procedure.

One of the common deficiencies uncovered as a result of Underway Training Element Exercises is the lack of maximum performance on the air search radar. This condition exists primarily because of the accepted practice of checking air search radar performance solely by the demonstrated ability of picking up distant land masses rather than the measurement of performance by use of test equipment as a part of preventive maintenance.

2—The outstanding requirement in connection with expeditious corrective maintenance work is thorough familiarity with the electronic equipment. The training curriculum contributes measurably to this realization. However by virtue of carrying out prescribed preventive maintenance routine, familiarity is developed to a point where the technician's confidence becomes a reality.

3—The benefits derived from preventive maintenance is a factor which should not be overlooked in connection with eliminating the vicious circle of electronic maintenance now widely prevailing, that of keeping just ahead of the corrective maintenance work load. The old adage, an ounce of prevention is worth a pound of cure, applies to this problem. For instance, the relatively simple procedure of rotating vacuum tubes will contribute effectively to curtailing maloperation of electronic equipments.

The necessity of preventive maintenance is definitely established by a digest of service reports received by the Bureau of Ships on many types of shipboard electronic equipments. In realizing the importance of this fact the Bureau has published numerous equipment maintenance handbooks. Prescribed maintenance procedures are available in equipment instruction books (Section 6), maintenance handbooks, CEMB, RMB, and ELECTRON. They are readily progressed by means of master check-off lists. Files can be made up by permanently mounting procedures on one side of a folder while check-off sheets are mounted on the opposite side.

Reports

Submission of the following reports is required:

1—*NavShips 383 (Rev. 4-49) U. S. Navy Electronics Failure Report.*

Long known as failure report card this form has recently been revised and is no longer printed on stiff paper, being furnished in pad form with detailed instructions interleaved. All failures of any component part of an electronic equipment, whether of electronic, electrical, or mechanical nature will be reported to the Electronics Divisions, Code 980, Bureau of Ships, Washington 25, D. C. Information relative to its use can be found elsewhere in this magazine. Excellent articles emphasizing the necessity of correctly submitting such reports appear in ELECTRON, March 1949 and Sept. 1946.

2—*NavShips 4110 Ship's Electronic Inventory Form.*

Instructions for maintaining Ship's Electronic Inventory System is found in NavShips 900,135. It is a closely integrated and expeditious system for reporting and recording current status of the electronic equipments comprising shipboard installations. Upon receipt of the original copy of this inventory form from BuShips the ship will thoroughly and conscientiously check the listing for errors and omissions. Corrections, if any, will be made in red ink or colored pencil and the corrected copy returned immediately to the Navy Department, Bureau of Ships, Code 980. When the inventory is entirely cor-

rect and in complete agreement with the equipment installed, it shall be retained on file for such reference purposes as may be desirable. Thereafter submission will be made under the following circumstances:

a—When corrections are necessitated incident to a change in the electronic installation made by the ship's force, tender, or shore-based activity other than Naval shipyard.

b—Annual inventory report on the first of January each year.

Background data relative to this form will be found in ELECTRON, Dec. 1948, and facts pertaining to increased distribution in ELECTRON, June 1949.

3—*NavShips 3642 (3–49) Communications and Counter Measures Equipment Monthly Performance and Operation Report.*

In conformance with a recent Bureau of Ships request, vessels are required to submit by letter a monthly performance and operational report on certain communication, radar, sonar, and test equipment. In order to facilitate the preparation of such reports for communication and countermeasures equipment the Bureau of Ships has furnished to active vessels a pad of the subject forms. The June 1949 ELECTRON carries a revised list of equipments for which such reports are required along with an analysis of requirements with respect to the present form. An article in the March 1949 ELECTRON analyzes the basic requirements.

Section I, Sub-section 3 (Reports and Forms) of the RMB gives details relative to submitting such reports in connection with observed performance of radar equipments.

Execution of performance reports is not normally the responsibility of the ship's electronics officer since the information required is largely gained from operation and adjustment of the equipment concerned. However there are comments required under the categories of 'Operational Difficulties,' 'Field Changes,' 'General Remarks,' etc., for which information is readily gained from the Electronics Officer's files and records.

Comments pertaining to the operation of electronic test equipment will be originated and submitted by the Electronics Officer.

4—*NavShips 2369 (Rev. 2–47) Electronics Field Change Report.*

This report card form is packed with each field change kit. It is to be filled out and mailed as soon as the change has been accomplished. Normally it is the responsibility of the activity making the modification to submit the report. In cases where an outside activity such as a shipyard accomplishes the field change the electronics officer of the ship concerned will check with the activity concerned relative to the prompt submission of the report. He is also responsible for proper entries in NavShips 537 (Record of Field Changes).

In connection with reporting completion of such field changes not involving use of parts constituting a furnished 'kit,' hence no NavShips 2369 being provided, the procedure recommended by BuShips as outlined in Section I, Part 3 (Reports and Forms) Page 3–6 of RMB will be used.

General information with respect to field changes affecting a specific equipment model will be found in CEMB, RMB and the Sonar Bulletin. An electronics field change index is being printed in parts in ELECTRON, starting with the November 1949 issue.

5—*NavShips 99 (Rev. 4–47) Electronic Ship Alteration Completion Report.*

In connection with the completion of authorized outstanding electronic equipment alterations the pink copy of this set of Bureau furnished forms is executed by the Electronics Repair Officer for the Commanding Officer's signature and submitted via the Type Commander. Appropriate entries will be made in the CSMP, and NavShips 536 originated if new equipment is installed.

Records

Chapter Six, Section III, BuShips Manual (Material History Records and Current Ship's Maintenance Projects) specifies the following history cards will be kept as the ship's material history with respect to the repair and maintenance of the ship's electronic equipment.

Equipment History

NavShips 536, Equipment History Card. This card is used for recording information concerning electronic equipment troubles and the corrective maintenance work necessitated in connection with the operation of the ship's electronic equipments, including the installation of field changes. A card will be filled out for each component of all electronic equipment in the ship. This includes portable and test equipment.

A description and detailed analysis of factors pertaining to their use can be found in ELECTRON, Feb. 1948.

NavShips 537, Record of Field Changes. This card form is used in maintaining a record of field changes applicable to the ship's electronic equipment. As the name suggests, field changes are modifications specified for electronic equipments subsequent to the date of manufacture in the interest of improving overall operation. The recorded information is necessary in the interest of remaining up to date with respect to operating features, maintenance requirements, and ordering applicable spare parts.

A series for each equipment, rather than for equipment components as required for the use of NavShips 536, will be maintained tabulating pertinent field change data with respect to assigned number, applicability, and date of completion.

Additional information is available in the February, 1948 issue of ELECTRON.

Current Ship's Maintenance Record

NavShips 529, Repair Record Card. Provides a convenient record of major repair work considered beyond the capacity of ship's force, to be accomplished during the first repair availability afloat or ashore.

NavShips 520, Alteration Record Card. Provides a convenient record of outstanding and completed alterations. This card form is filled out on receipt of authorized alterations. Pertinent information is then entered when applicable in connection with execution of NavShips 99 (Rev. 4–47).

Spare Parts Allowance

NavShips 3550 (4–48), Electronics Equipment Spare Parts Allowance. These IBM tabulated forms are forwarded to the ship concerned in connection with setting up the binning of the spare parts allowance.

Binning of spare parts other than vacuum tubes is generally placed in effect during a yard availability following the installation of drawer bin units. However the vacuum tube allowances have been widely established to date and stock levels are to be maintained in accordance with the NavShips 3550 (A–48) form, which constitutes a convenient reference as well as authority.

NavShips 3662 (5–49) Table of Replacement Parts. An IBM form which tabulates the spare parts allowance with reference to equipment component parts symbol number. It provides the key to expeditious stowage location of the desired part as originally identified from the instruction book spare parts tabulation list.

Miscellaneous

Spare Parts Inventory Records:

S&A Form 484, Spare Parts Stock Card. BuSandA Manual, Vol. 3, Chapter 7, Part D (Electronic Equipment and Spare Parts), Para. 37400 (General Instructions), states that stock records and inventory of electronic spare parts, except fire control radar spare parts, will be handled in the same manner as stock records and inventories of machinery spare parts outlined in Part G (Ship's Machinery and Spare Parts).

Fire Control Radar equipment spare parts will be handled as outlined in Part F (Ordnance Equipment and Spare Parts). Part F, Para 37600 (Ordnance Equipment), states that the stock records, stock control, and inventories of ordnance spares will be handled in the same manner as outlined in Part G for machinery spares.

Accordingly, the governing policy with respect to radar equipment spare parts is Part G, Para. 37700 (Stock Records to be Maintained) which states: 'The Supply Officer will maintain a Spare Parts Stock Card, S&A Form 484, for each set of spare parts or independent spares on board.

While it is recognized that the responsibility rests with the ship's supply officer, or the head of the department concerned when no supply officer is aboard, the electronics officer by virtue of having in his custody the electronics equipment spare parts boxes assumes a responsibility in connection with the maintenance of records associated with custody. Furthermore the use of this form represents the simplest procedure available in the matter of insuring accurate record of stowage, expenditures, and replacements.

Detailed instructions relative to the manner of maintaining this record can be found in Part G, Vol. 3, BuSandA Manual.

S&A Form 211, Stock Tally Cards. In connection with the bin stowage of frequently used spare parts such as vacuum tubes, fuses, indicator lights, crystal rectifiers and detectors, etc., some form of stock tally record must be maintained in the interest of insuring suitable levels. The S&A Form 211 is very well suited and therefore highly recommended for this purpose.

Maintenance Information

Equipment Maintenance Service Report:

One of the most effective means of expediting electronic equipment repair work is the utilization of service reports. Such reports aside from providing an effective means of assigning personnel can be elaborated upon to the extent that the information needed for electronic equipment record entries can be readily gained. Furthermore a highly useful record of corrective maintenance work is established for highly useful reference purposes.

Many variations of such service reports are now in existence. Some fulfill the requirements believed desirable. For the benefit of electronics officers not presently utilizing such a report, the following advantages are tabulated:

1—A convenient reference for analyzing the status of current maintenance work is established.

2—Systematic assignment of repair personnel is realized.

3—The processing of required electronic maintenance work is provided for reference purposes, containing informative details not normally entered in NavShips 536.

Past Training Readiness Inspections have revealed the desire on the part of repair personnel to keep a record of equipment troubles and the work necessitated in clearing matters up. A daily work book is widely used in the interest of recording this information. However, it has the disadvantage of burying pertinent information by virtue of chronological filing. The advantage realized with this type of record is that filing can readily be accomplished under equipment categories. A copy of an appropriate service report form is attached.

Publications

In order that all electronics installation, maintenance, and repair personnel will be better informed relative to the Electronics Divisions, BuShips publications, a description covering material content, distribution, physical construction, and other features has been covered in an

ELECTRONICS REPAIR SERVICE REPORT

Date .....

Equipment Model .....Serial No. .....

Equipment Unit .....Location .....

Personnel Assignment .....

Nature of trouble.

Corrective Maintenance Work.

Work completed .....Man Hours ..... Per .....
Date *Time* *Senior ET*

Replacement Parts Used

Circuit symbol	Description	Navy Type No.	Source
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

Record of entries:

Equipment History Card, NavShips 536.....

Record of Field Changes, NavShips 537.....

Field Change Completion, NavShips 2369.....

Inventory Change, S&A Form 484.....

Stock Level—S&A Form 211.....

Stock Level—S & A Form 211.....

.....
Name *Rate*

Requisition:

Form S&A 307 and/or 302.....

Form S&A 43 completed by S.O.....

Requisitioned parts received.....and placed in .....

.....
Name *Rate*

article appearing in ELECTRON, Feb. 1948. Pertinent extracts from this article and additional pertinent information follows:

Equipment Instruction Books

In connection with the installation or receipt of Naval electronic equipments, two sets of instructions known as the manufacturer's instruction books are furnished setting forth information pertaining to installation, maintenance and operation specifications. Such instructions in final form are divided into eight sections covering information pertaining to the following: (1) General Description, (2) Theory of Operation, (3) Installation, (4) Operation, (5) Operator's Maintenance, (6) Preventive Maintenance, (7) Corrective Maintenance, and (8) Parts List.

In the case of major equipments, sections covering the above eight categories are generally bound into three separate volumes. Volume I, holding all of the eight sections and associated drawing prints comprises the equipment instruction book. Sections 4 & 5 comprising Volume II is known as the Operator's Handbook. Volume III comprising Sections 6 & 7 constitutes the Maintenance Handbook.

The 'Operator's Handbook' and 'Maintenance Handbook' as such represent a compilation of technical data bound into relatively light weight volumes, conveniently referenced and adequately illustrated for use by operators and maintenance personnel respectively. The former volume contributes measurably in establishing responsibilities to be assumed by operating personnel in connection with operation and operational maintenance. For the convenience of maintenance personnel the latter volume tabulates preventive maintenance procedures and outlines trouble shooting procedures.

A set of instructions released with BuOrd fire control radar equipment covers the above eight categories bound into three volumes but with a slight modification. Volume I comprises sections covering the first five categories, Volume II comprises sections covering categories 6 & 7, and Volume III comprises a section covering category 8.

No Operator's Handbook is therefore available as such. However this compilation of data is generally furnished in an Ordnance publication covering the specific fire control system.

Instruction books are essential in connection with the proper maintenance and operation of electronic equipments. It is therefore imperative that the two copies of each complete set of instruction books and handbooks accompanying each equipment are accounted for on receipt of the latter. A basic requirement in the manufacturer's contract holds the contractor responsible for furnishing and packing the required books with each equipment. In connection with the receipt of the equipment the initial instruction books may be what is termed the preliminary copies. This issue will in time be replaced by the 'Final Copy' when the latter becomes available. In order to keep the Naval service informed of the distribution of final issues, the Bureau of Ships from time to time has published a list of available copies as received from contractors. Accordingly a list was published of all instruction books, final or otherwise, issued since October 1945, in the ELECTRON of December 1947. A supplementary list has been printed in subsequent issues of ELECTRON (Sept. 1949 and April 1950). Such a reference list tabulating instruction books available for radar equipment is available in the RMB.

Shipboard Radar Maintenance Bulletin

This bulletin, NavShips 900,096, is a *confidential* looseleaf publication released in two editions, containing pertinent information necessary for the efficient maintenanc of shipboard radar equipment. It is divided into ten sections of information covering the following: (1) General, (2) Radar Fire Control, (3) Search, Large, (4) Search, Small, (5) Submarine Equipment, (6) IFF, (7) Beacons, (8) Repeaters, (9) Test Equipment, and (10) Miscellaneous. The General Section is reserved for information which is of general interest but which does not apply to any one specific gear. The other sections are divided into specific equipment types, listed alphabetically or numerically, and containing four parts each: (1) General, (2) Maintenance and Service, (3) Field Changes, and (4) Trouble Shooting Notes.

The two editions of the RMB are the "C" and "S" Editions. The former intended for major ships and activities, is a complete copy containing all ten sections. The "S" Edition contains only those sections which apply to equipments on the allowance of smaller ships.

As in the case of the other maintenance bulletins, this bulletin is kept up to date by loose-leaf supplements issued quarterly. The result is a file of useful radar maintenance information.

Communication Equipment Maintenance Bulletin

The CEMB, NavShips 900,020(A) is a loose-leaf publication containing information on the maintenance and repair of all electronic communications equipment used by the Navy. Supplements are issued quarterly to keep the bulletin up to date.

It is published as a result of close co-operation between manufacturers, BuShips, and forces afloat. Most of the material is originated by the engineering staff of the Bureau, which investigates difficulties reported by the fleet and makes recommendations which appear as field changes, alterations, and authorized procedures. Also included are handy maintenance tricks which have been evolved by technicians in the field, endorsed by the Bureau, and passed on for the benefit of all maintenance personnel.

The CEMB is divided into 15 sections: (1) General, (2) Antennas and Transmission Lines, (3) Interference, (4) Direction Finders, (5) Calibrating Equipment, (6)

Combination Transmitting and Receiving Equipment, (7) Measuring Equipment, (8) Receiving Equipment, (9) Transmitting, (10) Aircraft Navigation Equipment, (11) AN and Army Equipment, (12) Miscellaneous Equipment and Components, (13) Navy Type Numbered Components, (14) Schematic Wiring Diagrams and (15) Sonar Sounding Equipment.

Since the distribution of the Sonar Bulletin is limited to those Naval vessels and installations having sonar ranging equipment, vessels having only sonar echo sounding equipment installed do not receive the Sonar Bulletin and the pertinent sounding information it contains. In order to furnish all Naval vessels and activities with relevant echo-sounding equipment information, the Echo-Sounding Section of the Sonar Bulletin is also being published as a regular section in the CEMB.

Sonar Bulletin

The Sonar Bulletin, NavShips 900,025(A), is a loose-leaf publication which groups together in one volume all the existing non-obsolete maintenance information for all types of sonar equipments, sonar components, sonar attachments, sonar training equipments, bathythermographs, echo sounding, and harbor detection equipments. In addition it carries a list of all existing field changes for those equipments, complete instructions for accomplishing all field changes that do not require kits, and a chapter on sonar publications and corrections.

The present bulletin is in its sixth edition and contains about four hundred pages divided into 28 chapters.

Information in the Sonar Bulletin is kept up to date by loose-leaf supplements of about 50 pages each, issued quarterly. These pages either replace or follow existing pages in the Bulletin, and each article on each page is dated to show the time in which it was written.

A vessel which has only echo sounding equipment on board is not entitled to the Sonar Bulletin. Information on these equipments is published now in the CEMB.

Electron Magazine

This publication, BUSHIPS ELECTRON, NavShips 900,100, gets the widest distribution of any electronics publication. All ships and stations with electronics personnel receive copies. The purpose of ELECTRON is to keep personnel up to date in the Navy's broad field of electronics and to help them gain an overall understanding of the subject. Frequently a technician, with an individual job to do, loses sight of the work that others are doing and the equipments others are using. In keeping all personnel informed of the many types of equipments, and of the problems and answers to problems of others, it is believed that they are enabled to do their own work more efficiently.

In addition, information on field changes is promulgated; available instruction books are listed; Bureau policies concerning certain equipments are outlined; and interesting developments are published for news value.

It is the policy of the magazine seldom to publish any information of a technical nature not endorsed by the cognizant section in the Electronics Divisions (unless the article carries an individual's by-line). Readers are thus assured that if an article suggests certain procedures, such procedures are not a violation of regulations or policies.

For some time it has been the consensus of opinion among personnel attached to fleet activities that the content of ELECTRON could be of more practical value and interest. Certain recommendations for improvement along such lines were offered at the last BuShips Electronic Conference.

Electronic Component List

The List of Electronic Components arranged by Navy Type Number, NavShips 900,113, promulgated by the Bureau of Ships, was originated with the view of listing all common electronic items used in Naval Electronic Sets against a 'Navy Type Number.' The Navy type number, assigned by the Electronics Divisions (Code 963) of BuShips, electrically and physically identifies the item assigned. The Navy type number in many instances is stamped or marked on the individual items and is also found in the parts list of instruction books.

A cross index contains all known identifying part numbers that have been used in any manner for any electronic item described in the catalog section. This includes manufacturer's parts numbers, contractor's part numbers, supply dept. stock numbers, etc.

A pictorial section shows illustrations of the various items described in the catalog section. The master table lists descriptions of all the electronic items in sequence, either electrically or physically. Each description has listed with it the appropriate Navy type number for the item.

Electronic Equipment Type Allowance Book

Otherwise known as the TAB, the Electronics Equipment Type Allowance Book, NavShips 900,115, is a loose-leaf book kept up to date by the periodic issue of revisions, additions, or corrections. It contains the official BuShips allowance of electronic equipment for all types and classes of vessels. The allowances listed are based on military requirements prescribed by CNO to be met by the ship's electronic installations.

Distribution of the complete TAB is limited to certain major commands and to planning, installation, and supply activities directly concerned with the installation and supply of electronic equipment. Individual ships are not supplied with the complete book but receive only those pages applicable. As stated earlier under *Facilities,* the Bureau will in the near future combine electrical and electronic test equipment into one allowance group.

At present the tabulation of ship's full allowance of hand tools and test equipment is available in applicable pages of NavShips 900,115.

MODEL SX LOCAL OSCILLATOR TUNING RODS

Two types of tuning rods were distributed with the Model SX radar for adjustment of the Type 35ACB local oscillator assembly. The rods supplied with the earlier SX equipments are made of dark fibre and have been reported to be subject to breakage. Later SX equipments were furnished with a superior type plastic rod which is "milky" in color and easily distinguishable from the old type due to its lighter color.

Vessels having only the old type rods should request one new type rod for each oscillator assembly on hand. The request should be sent to the Chief of the Bureau of Ships, Attention: Code 983. Any increase over normal ships spares allowance of oscillator assemblies (created as a result of previous requisitions for tuning rod replacements and receipt of the oscillator assembly) should be returned to stock.

FAULTY MODEL TBM FUSES

The Bureau of Ships has received information that several of the one-ampere 5,000-volt, non-renewable fuses (F–221) used in Model TBM Radio Transmitting Equipments did not have center links although their ends had been soldered. These fuses had been in spares and had not been used prior to test.

It is to be noted that over a period of time, the links in these fuses will deteriorate. It is therefore recommended that maintenance personnel check the spare fuses of this type periodically so that good ones will be on hand at all times.

CAPT. BECKER (Cont'd from page 1)

while other magazines of a similar nature were either discontinued or drastically curtailed.

The departure of Captain Becker from the Bureau of Ships was a great loss to all of us, not only as a very close and understanding friend, but as an energetic leader, administrator and above all an officer and gentleman. The Bureau's loss is only compensated by the realization that once again the abilities of this highly capable officer have been recognized and also by the fact that the chief interest of all of us,*Electronics,* has at long last been recognized for its true worth to the Naval service.

Captain Becker has been relieved of his duties as Assistant Chief of the Bureau of Ships for Electronics by Captain W. H. Beltz, USN.

CAUTION IS CHEAP— LIFE IS NOT

Recently an ET3 lost his life on a Service Force Atlantic ship. This man, from all indications, was carrying out his routine duties and observing all safety precautions. However, he is dead and cannot tell us just what happened. All equipments are provided with safety devices, interlocks, screens, etc. It is just as important to check the safety devices as to check the equipment. Warning signs and safety precautions mean nothing if you do not heed them. Bear in mind that any piece of electronic equipment, large or small, high or low voltage, can and does kill. You may get away with disabling an interlock or safety device or ignoring a warning sign this time—BUT HOW ABOUT THE NEXT TIME . . .

Electronic Equipment is Potentially Deadly
DEATH IS PERMANENT

——SerLant Monthly Bulletin

SAFETY PRECAUTIONS FOR TIMES FACSIMILE CORPORATION TRANSCEIVERS

Because of the presence of high voltages, as noted in the "Safety Notice" of the instruction books, during normal operation of the Model TT–41/TXC–1B and other transceivers manufactured by the Times Facsimile Corporation, maintenance personnel are urged to exercise caution in performing maintenance work. The following measures are required to ensure adequate safety to personnel. These instructions apply to all Navy-owned facsimile transceivers installed, or whenever installed in the future: Model TT–41/TXC–1B, TT–1/TXC–1, TT–1A/TXC–1, AN/TXC–1A, AN–TXC–1B, FX, FX–1A, FX–1B, TT–66/TXC, Times Facsimile Corporation equipments RC—120, RC–120–A, and RC–120–B.

1—All maintenance personnel are cautioned to read the "Safety Notice" in instruction book TM11–2258 prior to performance of maintenance on equipment.

2—Stencil on the external motor cover "CAUTION —HIGH-VOLTAGE, TURN POWER SWITCH OFF BEFORE REMOVING COVER".

3—Permanently install an insulated flexible ground lead in the cable form from the ground connection on the terminal strip adjacent to the motor to the bottom end bell of the motor. This ground lead shall remain connected during maintenance testing of the motor.

4—Earth ground all equipments.

CONTROL TOWER MODERNIZATION
at NAS, PATUXENT RIVER, MD.

by
CHARLES H. HOLM *and* AMOS B. COLLINS
Electronics Branch
U. S. Naval Gun Factory, Washington, D. C.

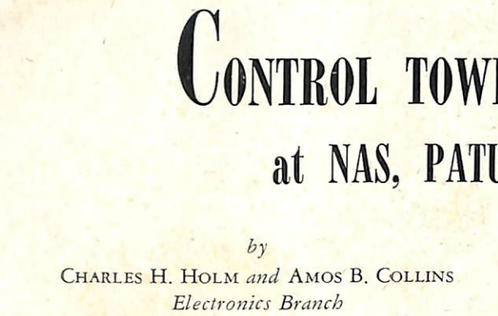
Early in the spring of 1949 it was mutually agreed by representatives of the cognizant activities that strong action would be taken to correct the poor material condition of the electronic facilities at the Control Tower of the Naval Air Station, Patuxent River, Maryland. Deficiencies due to inadequate planning, scarcity of materials, insufficient manpower, hurried wartime installation, lack of routine maintenance and lack of proper inspection had gradually accumulated over a period of years to such an extent that the efficiency of operations was seriously impaired.

The Naval Air Station, Patuxent River, Maryland, is a supporting activity for the Naval Air Test Center, where many important research and developmental tests are made. The large and extremely varied operational load includes catapult shots, simulated carrier landings, JATO tests, all kinds of flying associated with NATC test projects, routine supporting flights, and MATS and Fleet Squadron activities. The Naval Air Station is also an important part of the emergency link of "The Washington Control Area."

In order to support the numerous electronic navigational aids and to provide an adequate control center at the Patuxent River Base, it was decided that a complete moderniaztion of the Control Tower would be effected. As a result of various conferences between personnel of the Bureau of Ships, Bureau of Aeronautics, Naval Air Station, Potomac River Naval Command and Naval Gun Factory and the inspection of air facilities within and without the Potomac River Naval Command, the following steps were taken to place the subject installation in first class materiel and operating condition.

1—Plans were formulated with long-range point of view and according to the following precepts:

a—Consideration was given to present equipment, that available in the immediate future, and that which (as far as was known) the Bureau of Ships might contract for at a future undetermined date.



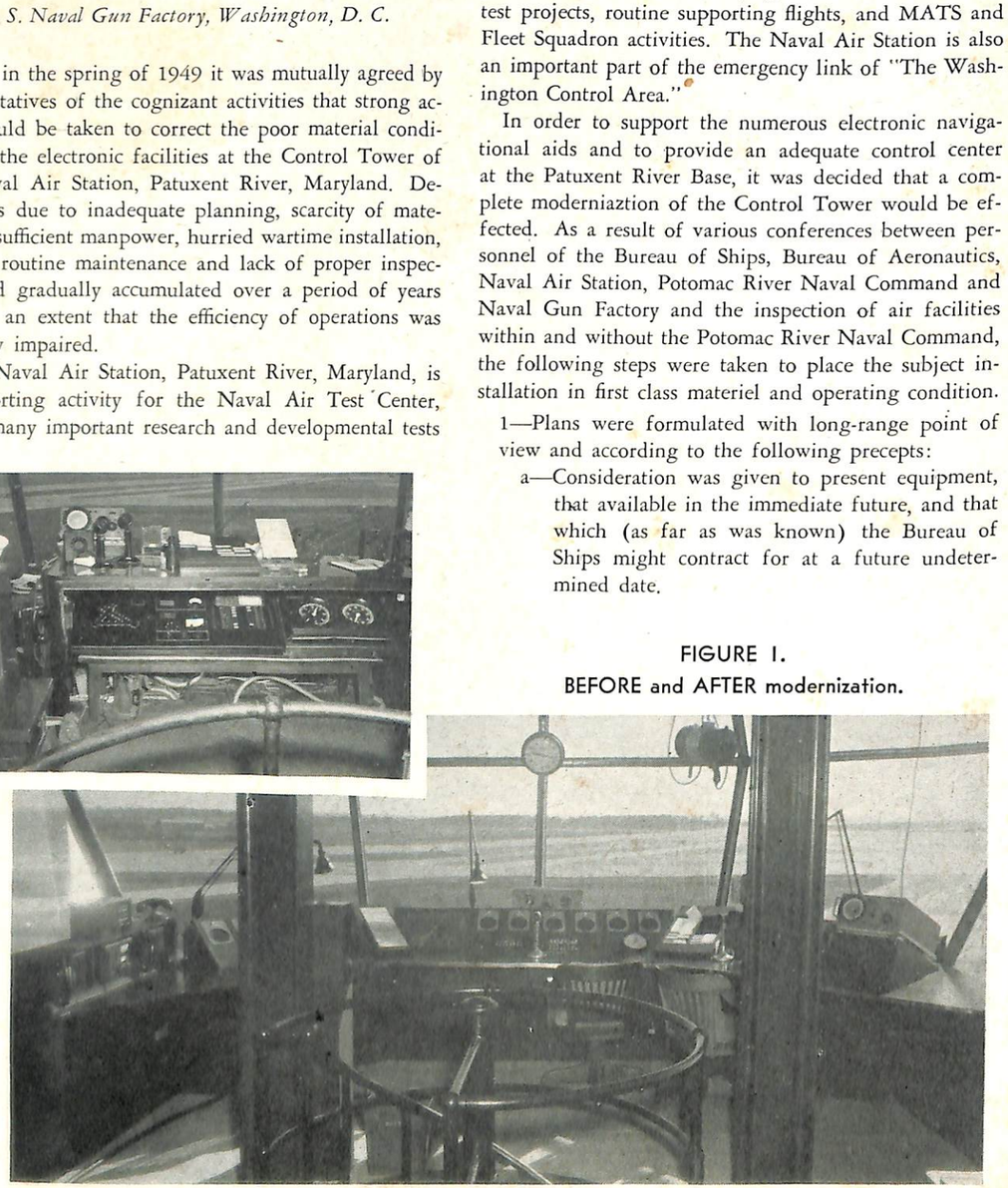


FIGURE 1.
BEFORE and AFTER modernization.

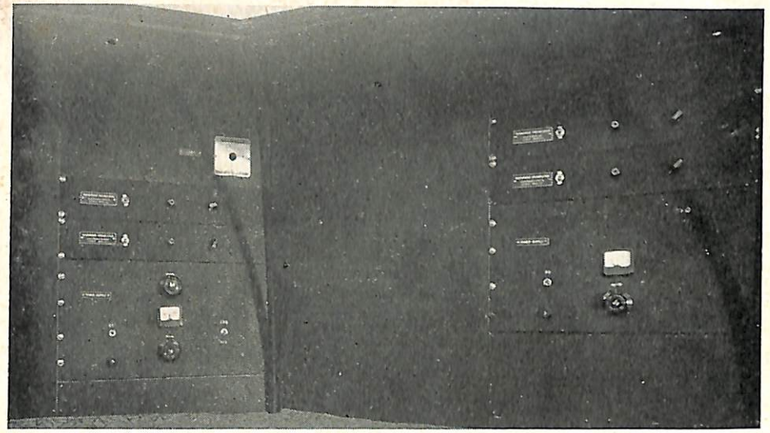


FIGURE 2.
Power supplies
and pre-amplifiers.

b—Provisions for sufficient flexibility, circuits, and space were incorporated in order that unforeseen future requirements can be met with a minimum of inconvenience, cost and lost time.

c—A firm installation schedule was established in as far as possible to permit continued operation of the field, to minimize costs of labor, and to facilitate coordination of this work with that of other departments.

Planning Divisions

The modernization program was divided into two phases, the immediate and the long-range. The layout of supporting towers and huts for the radar equipments, the ducts for cables, and equipment were planned for the long-range program in order that subsequent major changes may be avoided. Planning for the tower and hut arrangement has progressed, but is yet flexible enough to allow for future changes or additions. It was recognized early that the planning for the Control Tower proper would necessarily include a very broad program to allow for Instrument Control, and the project has been planned from an Air Traffic Control Standpoint, attempting to include all phases of this work. Under the immediate program a temporary control tower was constructed by the station for planned activation during a two-month period in which time an entirely new control tower console designed and manufactured by the Naval Gun Factory was installed in the permanent visual control room.

Visual Control Room

The initial planning called for the renovation of the visual control room on the sixth deck of the operations building, the establishment of an equipment room on the fifth deck, and the establishment of an instrument control room on the fourth deck. Originally, the visual control room had contained the control console, the receivers, the recorders, patch panels, a radar plan position indicator, and a v-h-f direction finder. The crowding of such a variety of equipments into a small space had resulted in the constriction of the operation personnel's movements and the impossibility of providing proper maintenance by service personnel.

The controls for all the communication circuits of the visual control room are grouped in a console fabricated in Shop 67, U. S. Naval Gun Factory. All of these circuits may be either switched or patched from the visual control room or equipment room respectively to the instrument control room. Sufficient spare circuits are provided to take care of all foreseeable needs. The console framework is constructed of brass tubing with silver-soldered joints, 30-degree inclined panels are used to

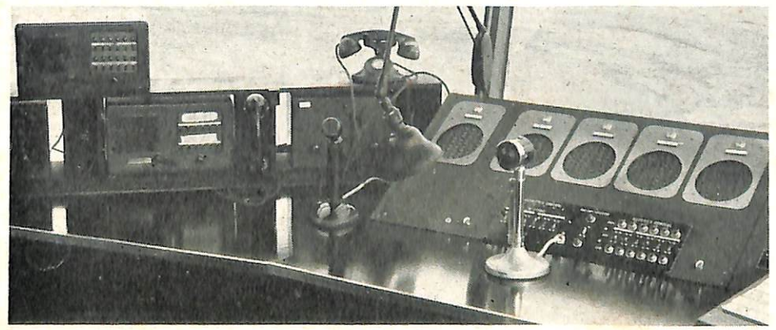


FIGURE 3.
B-stand—IFR and
radio range control.

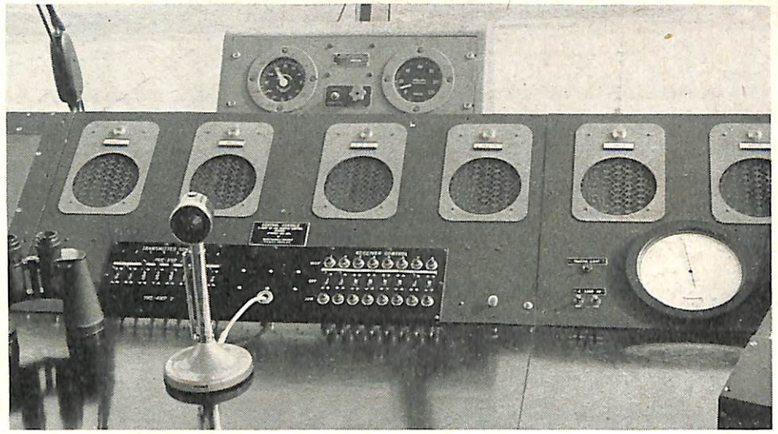


FIGURE 4.
A-stand—VFR control position.

house the loudspeakers and control switches, and 15-inch writing panel surfaces of black phenolic are provided as depicted by Figures 1 and 2. The console was manufactured in independent sections for ease of fabrication, transportation, and installation. All sections are bolted together during installation. The grouping of communication channels was accomplished by providing three main control positions: namely, A-stand, B-stand, and C-stand.

IFR Position

B-stand, shown in Figure 3, includes six each transmitting and receiving channels in one unit with arrangements for the parallel or simultaneous operation of all or less of the six transmitters by means of anti-capacity toggle switches. B-stand is also provided with a flight progress board using standard CAA-type slides, and is designated as the Instrument Flight Rule or IFR position. All of the six transmitters may be fed from one microphone, through either of two independent preamplifiers selectable from the control panel, this feature being incorporated in order to minimize outage time due to failure of electronic components. The receivers have individual controls for audio volume, OFF, LOW, and HIGH levels for each channel. LOW is the normal operating position, with the HIGH position providing an increase in audio power of 7 db for use with a weak signal or high noise level which occasionally occurs. Each receiving channel is provided with automatic muting, a reduction in signal level of approximately 6 db below the level prevailing in the LOW position to prevent acoustical feedback when the transmitting and receiving frequencies are identical. However, there is sufficient volume to actuate the loudspeaker and the operator can monitor his own transmission. When the airfield is under instrument flight rules the control of the equipment of B-stand may be switched directly to the instrument control room console (now under construction) on the fourth deck of the operations building. The Radio Range microphone located at B-stand is separated from the "cornet" and is controlled independently. All telephones and wire-line communication boxes are located at this position.

VFR and Taxiway Control

The A-stand, Figure 4, designated as the Visual Flight Rule or VFR position, is arranged similarly to the B-stand except that the circuits in this position are not switched directly to the instrument control room. Nevertheless, these circuits may be patched through the distribution board of the equipment room to the instrument control room. Six receivers and eight transmitters may be controlled from the A-stand operating position. The transmitters may be used simultaneously from one microphone as in B-stand, and two independent selectable preamplifiers are also available. A larger Fight Control Board utilizing small paper clearance forms is furnished. With the A-stand are associated the Field Condition Indicator, an Altimeter, and Aerology information provided by a Navy Type UMQ–5 equipment which is mounted in a central location and discernable from all parts of the tower. Built directly into the console at the A-stand position is the field facsimile including taxiway lighting control. Eventually, all runway lights will be likewise controlled from this position. The lighting control facsimile was developed and manufactured under a separate Bureau of Aeronautic Project by the Airport Lighting Section, U. S. Naval Air Test Center.

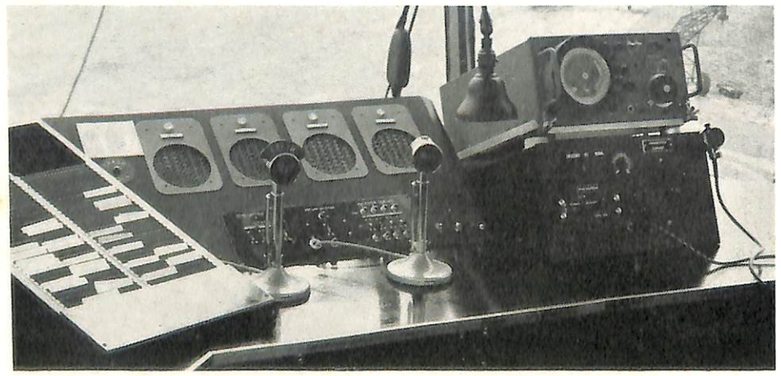


FIGURE 5.
C-stand—Emergency radio and d/f.

Emergency Position

C-stand, Figure 5, which is designated as the emergency position, includes four transmitting and four receiving channels. The transmitters may be paralleled, as in the other stands, or fed from either of two separate preamplifiers by the flick of a switch. All of the transmitting and the receiving circuits may be instantaneously transferred to the instrument control room as in B-stand.

Controlled from the C-stand are a DBF–1 v-h-f direction finder and a ten-channel v-h-f transceiver for emergency use. The crash equipment is also operated from this position by means of standard Model TCS transmitter-receivers; the output level from the console is reduced by means of a transformer in order that no modification be required to the TCS audio input circuit, Figure 6.

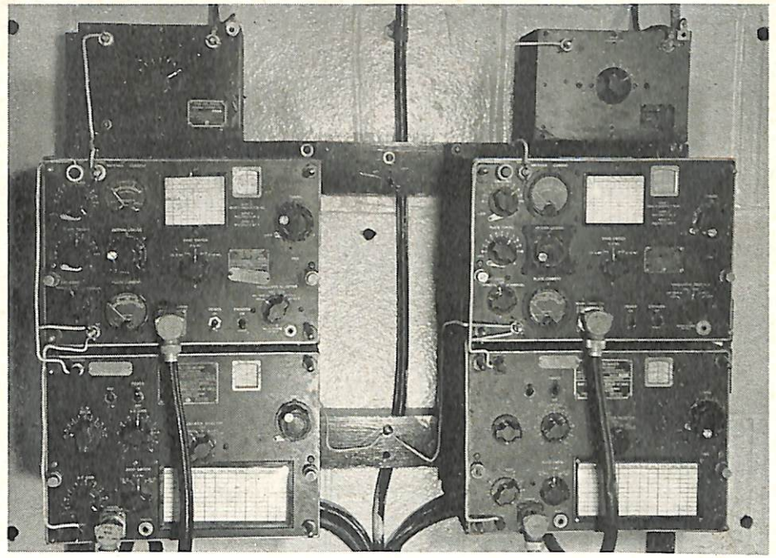


FIGURE 6.
"Crash" equipment.

Construction Details

The paralleling or corneting of transmitter controls was accomplished by the use of multi-secondary transformers. The selected output preamplifier is fed into the primary of a multi-secondary line transformer, the transmitting tie lines being wired directly through the console switches to the secondary windings. Other methods of providing individual or simultaneous transmission were considered: e.g., the use of cathode follower line matching mixers was contemplated; however, a major design problem was to simplify the circuits as much as possible in order to minimize equipment failures. For the same reason, two switchable preamplifiers were used at each stand or position with an automatic muting monitor for each. In the case of failure of one preamplifier, the operator becomes aware of the fact immediately and merely flips the switch to the other preamplifier. Likewise, two direct-current switchable power supplies are used as a source for the indicator lamps and relays. Four volts d.c. is fed to the lamps, the reduced voltage providing longer life and sufficient illumination.

The choice of microphones was a considerable problem. For low loss, maximum intelligibility, and noise-cancelling properties, it was decided that the carbon type would be the most suitable. As a commercial type with the desired light weight desk stand was not to be found, the microphones were constructed by the Naval Gun Factory from JAN type microphone buttons and commercial grip-to-talk desk stands. This composite type has proved to be very satisfactory for the purpose for which it is intended. Seven-foot microphone cords with standard telephone switchboard counterweights were employed for a "pull-out" mechanism.

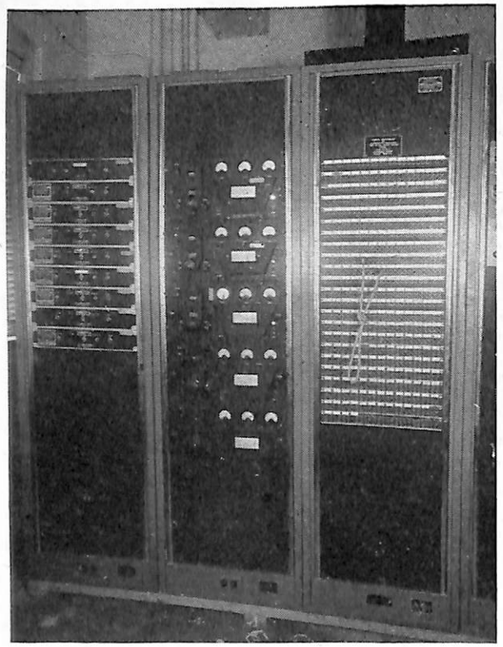


FIGURE 8. Receiver racks, left side.

The preamplifiers are of straight-forward design with a gain of approximately 30 decibels, the principal design features emphasizing simplicity and reliability rather than superfluous frills and critical adjustments. They occupy 3½ inches of vertical space in a standard relay rack.

It should be mentioned that a cheaper and just as satisfactory framework for the console may be constructed from angle iron rather than from tubing, using welded joints. By the use of standard relay rack panel sizes, the cost may be further reduced.

Equipment Room

Figures 7 and 8 show the equipment layout on the 5th deck. Five standard Navy racks were used along with a frame structure fabricated for the u-h-f equipment. The left cabinet houses the m-h-f receivers and associated equipment. Cabinet 2 contains v-h-f receivers, with spares. The center cabinet is the main distribution center, with all suitable circuits brought to the patch panel. Navy Type TTRS–16 cable was used as much as possible, for uniformity of color codes, size and wire type. All other wiring was made with Type TTRS–4 or TTRS–6. Shielding and bonding were carefully done, and the noise and interference was reduced to a nearly negligible level.

Cabinet 4 contains test and servicing equipment and the range control unit, and Cabinet 5 houses recorders and associated gear. The recorders are fed entirely from receivers, so that there is no question of recording a signal which is not actually transmitted.

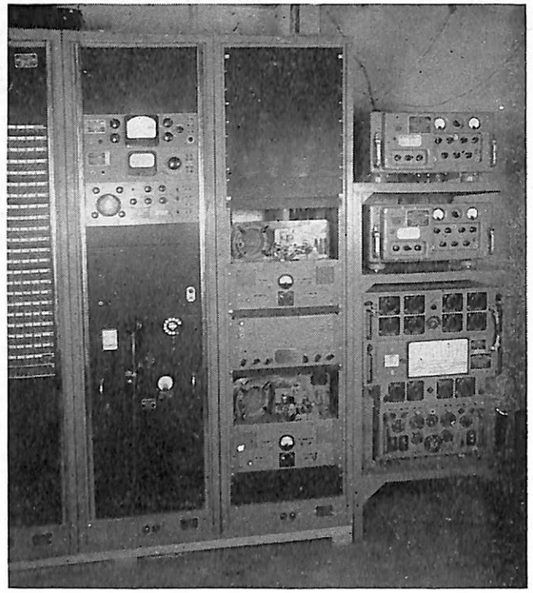


FIGURE 9. Receiver racks, right side.

To satisfy the present operational requirements and to provide for the future instrument control of aircraft, the establishment of an Instrument Control Room was included in the initial planning. Although the equipment on hand such as air surveillance radar, v-h-f and m-h-f direction finders, and an instrument control console, have not as yet been installed in the instrument control room, the plans and drawings are complete and it is hoped that the instrument control room will be in operation in the very near future. It is expected that a detailed description of the Instrument Control Room facilities will be available in a later issue of this publication.

The modernized Visual Control Room and associated equipment has been in operation for several months and has proved to be satisfactory and reliable. The arrangement is such that operation personnel have much more freedom of movement, the operating positions are more comfortable and produce less fatigue, both man-made static and that originating from poor and intermittent connections are considerably less than that previously encountered, the problems of maintenance are simplified, and last but not least the physical appearance has improved tremendously.

The writers wish to take this opportunity to express their deep appreciation for the splendid cooperation and help given by officers and engineers of the Bureau of Ships, officers and enlisted personnel of the Naval Air Station, Patuxent, personnel of the Bureau of Aeronautics, and all others who offered suggestions and encouragement for the accomplishment of this modernization program.

REVISION OF BROADCAST SERVICES OF STATIONS WWV AND WWVH

The technical broadcast services of stations WWV, near Washington, D. C., and WWVH, near Puunene, T. H., were revised slightly on January 1, 1950. These services which are made available by the National Bureau of Standards include the following:

1—Station WWV broadcasts continuously, night and day, on standard radio frequencies of 2.5, 5, 10, 15, 20, 25, 30, and 35 Mc. Station WWVH (recently established in Hawaii) broadcasts on standard radio frequencies of 5, 10, and 15 Mc. The entire broadcast is interrupted for 4 minutes following each hour and half hour, and for periods of 40 minutes beginning at 0700 and 1900 UT.

2—Two standard audio frequencies, 440 cycles per second and 600 cycles per second, are broadcast on the above radio frequencies except 30 and 35 Mc. The audio frequencies are broadcast alternately, starting with 600 cycles on the hour for four minutes, interrupted one minute, followed by 440 cycles for four minutes, and interrupted one minute. Each ten-minute period is the same. The 440 cycles per second is the standard musical pitch, A above middle C.

3—The audio frequencies are interrupted for intervals of precisely one minute before the hour and are resumed precisely on the hour and each five minutes thereafter. They are in agreement with the basic time service of the U. S. Naval Observatory so that they mark accurately the hour and the successive 5-minute periods.

Universal Time (Greenwich Civil Time or Greenwich Mean Time) is announced in telegraphic code each five minutes starting with 0000 at midnight. Time announcements are with reference to return of the audio frequencies.

A voice announcement of *Eastern* Standard Time follows each telegraphic code announcement from Station WWV.

There is a pulse on each carrier frequency of 0.000-5 second duration which occurs at intervals of precisely one second. The pulse consists of five cycles, each of 0.001-second duration, and is heard as a faint tick when listening to the broadcast.

4—Frequencies as transmitted from WWV and WWVH are accurate to within 2 parts in 10^8; this is with reference to the mean solar second, 100-day interval, as determined by the U. S. Naval Observatory with a precision of better than 3 parts in 10^9. Time intervals, as transmitted, are accurite within $\pm$ 12 parts in 10^8 + 1 micro-second.

Frequencies received are as accurate as those transmitted for several hours per day during total light or total darkness over the transmission path at locations in the service range. During the course of the day errors in the received frequencies vary approximately —3 to +3 parts in 10^7. During ionospheric storms transient conditions in the propagating medium may cause momentary changes as large as 1 part in 10^6.

Time intervals as received are normally accurate within $\pm$12 parts in 10^8 + 1 millisecond. Transient conditions in the ionosphere at times cause received pulses to scatter by several milliseconds.

5—An announcement of radio propagation conditions is broadcast in code on each of the standard radio frequencies at nineteen and forty-nine minutes past the hour. If a warning is in effect, the letter "W" (in International Morse Code) is repeated 6 times following the time announcement; if unstable conditions are expected, the letter "U" is repeated 6 times; if there is no warning, the letter "N" is repeated 8 times.

MARINE CORPS NOTES

Marine Ground Control Intercept Squadron 17 at U. S. Naval Air Station, Willow Grove, Pennsylvania reports the following difficulty encountered with the VK remote indicator located in an SP–1M operating van. The VK repeater was found to be erratic when the input voltage dropped even a few volts below 115 volts. The trouble was overcome by installing a 7.5-ampere variac in the input circuit of the VK. The input voltage was then set at 118 volts and the resulting operation was satisfactory.

Marine Ground Intercept Squadron 5 at the Marine Corps Air Station, Cherry Point, N. C. reports an unusual failure in the AN/CPS–5 radar equipment. The selsyn driving pinion shaft, which connects with the selsyn gear box, broke off for no apparent reason, causing the antenna to rotate violently out of control. A new shaft was made locally since no spare was available.

This squadron also reports a simple but very useful solution to troubles in this radar equipment as a result of accumulated moisture. A number of 200-watt light bulbs were installed in the antenna pedestal and are kept burning constantly. The resultant heat has materially reduced troubles in the modulator, transmitter, receiver, junction box and echo box. Acting as a drying agent, the light bulbs prevent excessive moisture from accumulating.

MODEL SU

MAINTENANCE and OPERATION

It has been said that it is the little things in life that count.

This statement might well be applied to the upkeep of electronic equipment and especially radar, because it is the preventive and the corrective maintenance that a radar receives that keeps it in excellent, mediocre, or poor condition. It is with the above thought in mind that the following is written.

Receiver Tuning

It is stated in the instruction book, "The LO TUNING CONTROL must be set reasonably close to the correct operating point in order that the AFC (automatic frequency control) channel may function properly and maintain the proper LO frequency, which should be 30 megacycles higher than the magnetron frequency."

May we add, that it is absolutely necessary that the above condition exists. Here is why: Let us say the transmitter is operating on 9000 megacycles, then the LO should be operating on 9030 megacycles giving us an i-f (or difference) frequency of 30 megacycles. Now if the LO frequency dropped to 9029 megacycles giving a difference frequency of 29 megacycles input to the i-f strip and the AFC channel, the AFC channel will try to increase the frequency of the LO until a difference frequency of 30 megacycles is obtained. If the difference frequency is over 30 megacycles the AFC channel has a tendency to lower the LO frequency, consequently if the LO is operating on the lower side of the magnetron frequency the AFC channel will have exactly the opposite effect. Instead of correcting the error in the LO frequency it will only throw it farther off frequency, or in other words the AFC channel will pull the LO in the wrong direction and all the signals will disappear. So if your radar loses all the signals when the LO control is thrown from MANUAL to AFC, there is a pretty good chance that the LO frequency is on the wrong side of the magnetron frequency.

Important items which affect the maximum range of your SU radar are the TR and ATR tubes and cavities. The purpose of the TR tube and cavity is to protect the crystal mixer from the high r-f power present for the duration of the transmitted pulse and to match the crystal to the waveguide during the receive time, thus obtaining as much voltage as is possible from the received signal. Therefore, the tuning of the TR tube and cavity is of the utmost importance.

The purpose of the ATR tube and cavity is to keep the magnetron from absorbing any of the received signal and to aid in matching the TR cavity and the crystal to the waveguide. Thus we have maximum received signal transferred from the waveguide to the crystal mixer only when the TR and ATR are properly tuned.

The presence of Keep-Alive should be checked if the equipment blows crystals excessively, as crystals should last 300 or 400 hours minimum. If the TR tube does not have a definite peak in the response as indicated by an increase in echo amplitude, it should be changed.

Duplexers should never be allowed to become dirty and new ones should be cleaned before installation. This should be done with brightwork polish, however, *all,* repeat *all* of the polish must be removed, this is especially true of the ATR tube fins. Never use carbon tetrachloride to clean these tubes or cavities.

It is good to tune the cavities on the echo box for maximum ring time but it is much better to make the final adjustment on a distant steady echo such as a land target.

Preventive Maintenance

Cleaning radar equipment is something that is often neglected. Periodic cleaning is necessary and the routine should be carried out. It is well to check all terminal boards and tighten all loose terminals about every 90 days. Lubricate in accordance with Table IX Page 6–2 of the SU instruction book.

Small tubes should be tested on a monthly basis if the proper testing equipment is available; large tubes should be cleaned and inspected.

All insulators, including the porcelain stand-off type should be perfectly clean at all times.

Corrective Maintenance

Some recent casualties and remedies are listed here to aid the service technician should these casualties occur in his equipment:

Case #1—The Range Step MIN SET controls would not bring the range step far enough to the left to calibrate properly:

First check the 300 volts at the hot side of R–614. This is the supply side of the range resistor network and should read 300 volts d.c. plus or minus 10 volts. If the voltage is right and the range potentiometer is good then R–614 is probably at fault, having changed value, and should be replaced.

Case #2—Faulty antenna stabilization:

In this case the antenna operates properly in the STOW position but not in the STABILIZE position, which eliminates the fact that the elevation motor might be at fault.

First, all the supply voltages to the stabilization unit should be checked at the antenna where possible. The supply voltages to the servo-generator should be checked. Next the input to the gyroscope motor and the 24 volts d.c. at terminal 25 should be checked.

If all the above voltages are present and are of the correct value and the antenna operates properly in the STOW position but not in the STABILIZE position, then the gyro unit should be changed.

Case #3—Modulator or magnetron trouble:

Check for the proper primary supply voltages first. Is the AC POWER ON light burning? If not check fuse F–203. Be sure the OPERATE—STANDBY switch S–510 is in the OPERATE position, HIGH VOLTAGE ON switch S–207 in the ON position, after 3 minutes have elapsed. The HIGH VOLTAGE ON light I–203 should light. If it does not, check the lamp and the fuse F–205.

If none of the above remedies cure the trouble, change the magnetron and the tubes in the modulator one at a time checking for proper operation after changing each one. Since a large percentage of the trouble is caused by tube casualty, this will more than likely correct the trouble.—*SerLant Monthly Bulletin*

D/F EXTENDS THE EFFECTIVE RANGE OF GCA

Direction Finder Set AN/URD–2 is the Navy's newest v-h-f direction finder (See BUSHIPS ELECTRON for February, 1950). It is similar to the DBF–1 equipment which is in use on ships and shore stations.

As an example of the usefulness of D/F to GCA (Ground Control Approach) and to all who have occasion to use the GCA landing system, an extract from the November Operations Report from GCA Unit #32, Naval Air Station, St. Louis, Missouri is quoted below:

At 1725 November 27, 1949, the GCA crew was alerted for possible assistance to USAF T–6 No. 0952—overdue from nearby Scott Airforce Base and reporting low on fuel and position unknown. At 1730 radio contact was established on 126.18 Mc. At that time the pilot was preparing to bail out. Bearings were taken with the AN/URD–2 equipment and the plane was given a "steer" for Lambert (St. Louis) Airport. At 1745 first radar contact was established at a range of 27 miles bearing 090. A straight-in PPI approach to runway 24 was made and the landing completed at 1800. Estimated position at time of initial contact was 60 miles bearing 060 from Lambert Airport. Although the plane was at an altiude of only 3500 feet, a good bearing was obtained at that range. Weather at Lambert Airport for 1730: 25,000 feet overcast, lower broken at 12,000 feet —visibility 3 miles with smoke."

FALSE ECHOS ON MODEL AN/SPS–6 SERIES RADARS

The Charleston Naval Shipyard has reported the presence of a false echo on an AN/SPS–6B radar set. The false echo appeared at a range of 4500 yards with a width of 1000 yards and remained fixed at all bearings. The trouble proved to be a defective pulse transformer, T109.

These defective pulse transformers were all supplied in one small lot to the manufacturer from the vender and were discovered almost immediately to be defective. Apparently, a few defective transformers have been shipped in radar sets and in spares.

The explanation for the false echo is that a voltage surge from the pulse transformer, caused by core material of the wrong characteristic, appears after the main pulse and causes the magnetron to oscillate.

In cases where the false echo is observed, the spare transformer should be installed.

Replacements will be obtained from the manufacturer on a straight exchange basis. Since the manufacturer has no transformers in stock to effect immediate replacement, the stocking activities will be required to issue this item, T109, in exchange for the defective unit. Any vessel or activity with a defective transformer should mark or label it, "AN/SPS–6 Defective Pulse Transformer removed from (Radar Set or Spares) Serial # ", and turn it in at the nearest electronics supply activity, together with a requisition for another T109. The requisition should be marked "Direct Exchange" and reference this article.

Upon the receipt of any defective units, the supply activity should notify the Bureau of Ships, Code 882, and shipment instructions for its replacement will be issued.

In cases where the transformers in both the equipment and the repair parts are defective and a replacement is not available, the Bureau of Ships authorizes the following temporary modification to eliminate the false echo until a good transformer is available:

1—Install an 1850-ohm resistor with a 50-watt rating between the pulse transformer Terminal C and ground.

2—Report to the Bureau of Ships, Code 983, when the temporary modification is added and when it is removed.

Revised ELECTRONIC FAILURE REPORT
NAVSHIPS 383

One of the most important links in the chain of events in the electronics maintenance program is the Electronic Failure Report, NavShips 383. This report, submitted for each and every mechanical and electronic failure of electronic equipment, furnishes valuable data for the following vital functions:

1—Procurement of maintenance repair parts.
2—Location of design and manufacturing defects.
3—Development of field changes.
4—Contractual adjustments.
5—Preparation of maintenance data.
6—Assistance in future design.

Use of this revised form provides several features. First, copies are not required and the necessary information can be entered with pen, pencil, or typewriter. The procedure has been simplified further in that the type of failure can be entered by a check mark (or X). Also, in order to facilitate stocking, pads of reports are issued instead of single copies. Detailed instructions are interleaved in each pad. Another advantage of the revised report is that one set of data blanks fulfills the requirement for reporting tubes and parts instead of having one side for tubes and the other for parts as previously used.

The report is self explanatory, and care should be exercised in entering the data as indicated, in order that the best possible use can be made of the information. It cannot be overemphasized that the report should be complete and that only one failure should be reported on each sheet.

Figure 1 is a failure report correctly prepared. It is recommended that all maintenance personnel familiarize themselves with this sample. It is suggested that the items be completed in the following order:

(1) This space is provided for numbering the reports as found necessary.

(2) List the date on which the failure occurred.

(3) Include both the ship's number and name or the station.

(4) Specify the ship's number and name or the station which effected the repair.

(5) Specify the name and rate of the person who effected the repair.

(6) Indicate the service using the equipment.

(7) Indicate the type activity using the equipment.

CAUTION: The information entered in items (3) through (7) *must be compatible. Example #1:* If an electronic equipment, which is installed in a plane aboard a carrier is serviced by a technician from a tender, the plane's number should appear in item (3), the name and number of the tender in item (4), the name and rate of the person effecting the repair in item (3), "NAVY" should be checked in block No. 1 of item (6), and block No. 4 "AIR-BORNE" should be checked in item (7).

Example #2: If an electronic equipment which is installed in a jeep carried aboard a ship is serviced by personnel at a Naval shipyard, the jeep's designation should appear in item (3), the name of the yard in item (4), the name and rate of the person effecting the repair in item (3), block No. 1 "NAVY" of item (6) should be checked, and block No. 3 "AMPHIBIOUS" in item (7) should be checked.

Example #3: If an elctronic equipment such as the ground control approach equipment, AN/MPN–1A located at an air station adjacent to a Naval shore station is serviced by technical personnel from the shore station, the name of the air station should be entered in item (3), the name of the shore station should be entered in item (4), the name and rate of the person effecting the repair should be entered in item (5), and block No. 1 "NAVY" of item (6), and block No. 2 "SHORE" of item (7) should be checked.

(8) Indicate the proper category of the equipment in which the failure occurred (as shown in NAVSHIPS 900,135 for shipboard use).

Entries (9) through (12) are obtained from the main nameplate of the equipment:

(9) Include the model designation (letter and numeral) of the complete equipment, for example TBL, –49545, AN/FMQ–2, AM–215/U.

(10) Include the serial number of the complete equipment. This number usually follows the model designation.

(11) Include the name of the contractor of the complete equipment.

(12) Include the contract number (very essential).

(13) Indicate the date the complete equipment was installed. This information should be available on the Electronic Equipment History Card NAVSHIPS 536 as used aboard ship. If the exact date is not available, the approximate date should be listed.

Entries (14) and (15) are obtained from the nameplate of the component (unit) in which the failure occurred.

(14) Include the type number and name, such as CNA–46080 receiver, or AS–369/FMQ–2 antenna.

(15) Include the serial number which usually follows the component (unit) type number.

(16) Indicate whether a tube or part failed.

(17) If a tube failed, give the complete tube type such as 6SN7GT, 807 W, etc. If a part failed, indicate the name and Navy type number such as resistor –63758, switch –24003, or the name and JAN number such as capacitor CV11A070.

(18) Enter the "Standard Navy Stock Number." If the SNSN is not known, omit this entry.

(19) Include the correct symbol designation of the part or tube that failed as marked on the unit or chassis and shown in the instruction book (V–303, T–101, etc.).

(20) Indicate properly whether failure occurred in operation or handling or was due to faulty packaging. NOTE: If failure was noted when the maintenance part or tube had just been taken from the shelf or from stock, specify the exact condition by inserting the word "stock" in No. 4 of item (20). Indicate the approximate shelf life in item (21) (example: 6 months—SHELF) and check the type of failure properly, item (26). Elaborate as necessary under remarks, item (27).

(21) State the life of the part or tube in hours. If the exact life is not known, list the approximate number of hours of life.

(22) The name of the manufacturer of the part or tube that failed should be entered in this space. For the majority of parts, this name can be obtained from the instruction book or handbook. For tubes, this name can usually be obtained from the body or base of the tube or from the carton.

(23) Include the serial number of the tube which can be obtained from the body or base of the tube. Several individual parts also have serial numbers identifying year of manufacture, series, etc. This should always be stated.

(24) Enter the Army Stock Number. This space applies particularly to the U. S. Marine Corps.

(23) Include the manufacturer's identification data such as drawing number, part number, etc., if the equipment model, symbol designation, SNSN, etc., are not known.

(26) Indicate the type of failure. Where more than one type is involved, explain under "Remarks."

(27) Include the contract number and guaranteed life hours of guaranteed electron tubes. State the cause of the failure of parts and tubes, and enter any suggested changes, comments, or recommendations to improve equipment operation.

It is recommended that Failure Reports be submitted immediately following repair or replacement of the defective part. Simultaneously, the Electronic Equipment History Card, NAVSHIPS 536, or Tube Performance Record, NAVSHIPS 538, whichever is applicable for shipboard, should be maintained. Records which are kept up to date provide a valuable reference and aid in maintenance and repair of electronic equipment.

Additional pads of the Electronic Failure Report are available from the nearest district Publications and Printing Office.

Don't Delay—Submit your reports. The link must not be broken.

U. S. NAVY ELECTRONIC FAILURE REPORT
NAVSHIPS 383 (REV. 4-43)

NOTICE: 1. Read instructions interleaved in this pad prior to preparing report. 2. Report all failures (Electronic, electrical, and mechanical). 3. Use separate sheet to report each part failure.

(1) REPORT—SHIPS-84 REPORT NO. .....
(2) DATE OF FAILURE 25 JAN. 1950

(3) EQUIPMENT INSTALLED IN (Number and name of ship or station)	(4) REPAIRS MADE BY (Number and name of ship, yard, tender, etc.)	LEAVE BLANK	(5) REPAIRED BY (Name and rate of person)
DD-999 USS EVERSAIL	DD-999 USS EVERSAIL		P. DOE ETI

(6) SERVICE USING EQUIPMENT (Check one): 1 ☒ NAVY 2 ☐ USCG 3 ☐ USMC 4 ☐ ARMY 5 ☐ AIR FORCE

(7) TYPE ACTIVITY USING EQUIPMENT (Check one): 1 ☒ SHIP 2 ☐ SHORE 3 ☐ AMPHIBIOUS 4 ☐ AIR-BORNE 5 ☐ OTHER (Specify)

(8) EQUIPMENT CATEGORY (Check one): 1 ☒ RADIO 2 ☐ RADAR 3 ☐ SONAR 4 ☐ TEST 5 ☐ ORDNANCE 6 ☐ NANCY AND RADIAC 8 ☐ POWER 9 OTHER (Specify)

NAME PLATE DATA — EQUIPMENT

(9) MODEL DESIGNATION	(10) SERIAL NO.	(11) NAME OF CONTRACTOR	MAJOR UNIT INVOLVED: (14) TYPE NO. AND NAME
XXX-5	1745	RADIO CO.	-46080 RECEIVER
LEAVE BLANK	(12) CONTRACT NO. NXs-99999	(13) DATE INSTALLED 25 JAN. 1949	(15) SERIAL NO. 1762

PART FAILURE DATA (Check one): (16) ☐ TUBE ☒ OTHER

(17) COMPLETE TUBE TYPE, OR NAME AND NAVY TYPE NO. OF PART	STANDARD NAVY STOCK NO (See note 10)	SYMBOL DESIGNATION (V-101, R-201, etc.)	FAILED IN (Check one): (20)
POTENTIOMETER -63757	(18)	(19) R-136	1 ☒ OPERATION 2 ☐ FAULTY PACKAGING 3 ☐ HANDLING 4 ☐ OTHER (Specify)

(21) APPROXIMATE LIFE (Hours)	LEAVE BLANK	(22) MANUFACTURER'S NAME	(23) SERIAL NO. OF TUBE OR PART	(24) ARMY STOCK NO. (USMC only)	(25) MFRS' DATA (See note 13)
420		RESISTER CORP			

CHECK TYPE OF FAILURE (26)

002 ☐ AIRLEAK	130 ☐ CHANGE OF VALUE	300 ☐ GROUNDED	360 ☐ INTERMITTENT OPERATION	225 ☐ MFR'S DEFECT	003 ☐ OPEN FILAMENT	510 ☐ PUNCTURED	620 ☐ SHORTED TO PRIMARY
007 ☐ ARCING	170 ☐ CORRODED	310 ☐ HANDLING IMPROPER	380 ☐ LEAKAGE	009 ☐ MICROPHONIC	450 ☐ OPEN PRIMARY	011 ☐ SCREEN DEFECTS	630 ☐ SHORTED TO SECONDARY
070 ☐ BROKEN	190 ☐ CRACKED	320 ☐ HIGH VOLTAGE BREAKDOWN	013 ☐ LOOSE BASE	008 ☐ NOISY	470 ☐ OPEN SECONDARY	005 ☐ SHORTED INTERMITTENT	020 ☐ UNSTABLE OPERATION
014 ☐ BROKEN BASE	330 ☐ EXCESSIVE HUM	340 ☐ INSTALLED IMPROPERLY	012 ☐ LOOSE ELEMENTS	022 ☐ NO OSCILLATION	480 ☐ OVERHEATED	006 ☐ SHORTED PERMANENT	OTHER (Specify in remarks)
015 ☐ BROKEN GLASS	001 ☐ GASSY	350 ☐ INSULATION BREAKDOWN	004 ☐ LOW EMISSION	440 ☐ OLD AGE (Specify in remarks)	021 ☐ OVERLOADED	600 ☐ SHORTED TO CASE	
080 ☐ BURNED OUT	016 ☐ GLASS STRAIN		040 ☐ MECHANICAL BINDING	450 ☒ OPEN	010 ☐ POOR FOCUS	610 ☐ SHORTED TO FRAME	

REMARKS: INCLUDE CAUSE OF FAILURE AND SUGGESTED CHANGES (Continue remarks on reverse side) LEAVE BLANK

(27) OPEN ON HIGH SIDE, BELIEVED DUE TO HEAT, 2nd SUCH FAILURE IN YEAR

OPO 16—48703-1

FIGURE 1.

LEAK DETECTOR FOR MODEL QHB/QHBa TRANSDUCERS

An interesting report on the operation of new type leak detectors for QHB/QHBa transducers (Sangamo Part No. 870629) has been submitted by the Boston Naval Shipyard. This report reveals that leak detector readings are apparently not accurate criteria for judgment of the watertight integrity of QHB transducers.

An article entitled "Notes on Model QHB Series Trouble Shooting" BuShips Electron, Page 21, November 1949, discusses certain difficulties in the leak detectors furnished with QHBa transducers. Boston Naval Shipyard reports similar difficulties to those described in this article. Readings taken at the same time, under the same conditions, on three of the new type leak detectors showed the following wide variations: 20,000 ohms, 380,000 ohms and 750,000 ohms. Table I shown below is a list of leak detector readings taken before and after the installation of the transducers on several ships.

Reports from the *USS Keppler* (DD–765) state that the leak detector readings on one transducer varied from an initial reading of 5 megohms to 190,000 ohms within a period of six months. When the *USS Keppler* was drydocked and serviced at Boston Naval Shipyard, the detector reading, upon removal on 13 December 1949, was 150,000 ohms. The operation of the transducer had been satisfactory, and the insulation resistance readings of the staves taken with a Navy Type CV–60089 vacuum tube megohmmeter were in excess of 1,000 megohms.

The Instruction Book for Model QHB and QHB–1 Scanning Sonar Equipment, NavShips 900,976A and the QHBa Scanning Sonar Equipment Instruction Book, NavShips 91125 state that a continuous gradual dropping of leak detector resistance below one half of the initial recorded reference value indicates that the silica gel in the transducer is saturated, and should be replaced at the first opportunity. Replacement of the silica gel in the transducer while the vessel is in drydock is a costly operation.

It is the opinion of the Boston Naval Shipyard personnel that the leak detector is not a satisfactory means by which to check the watertight sealing of the QHB transducer; therefore, a record of its readings should not be the cause for removal or repair of a transducer. Before repairs are undertaken, operational and insulation tests are recommended to indicate the condition of the transducer. Insulation tests should show values in excess of 2 megohms, as indicated in Section 7, Paragraph 2a(120)(b) of the QHBa Scanning Sonar Equipment Instruction Book.

The report from Boston Naval Shipyard also notes the following with reference to the two QHB series instruction books discussed above. Two types of transducer leak detectors have been received and installed with the QHB and QHBa equipments; the old type, Sangamo Part No. 874216, is shown in Figure 3–1 of NavShips 900,976A (for QHB and QHB–1 equipments) and the new type, Sangmo Part No. 870269, is shown in Figure 3–1 of NavShips 91125, (for QHBa equipments). However, although the new type detector is illustrated in NavShips 91125, Paragraph 2, Page 1–7 of that publication describes the old type leak detector.

TABLE I

RECORD OF LEAK DETECTOR READINGS TAKEN ON NAVY TYPE CAN–51114 SONAR TRANSDUCER USED ON MODEL QHB/QHBA SCANNING SONAR EQUIPMENT ON 30 DECEMBER 1949

Transducer Serial Number	*Installed on (U.S.S.)*	*Resistance Test Before Installation on Vessel* 1st	2nd	*Time Lapse*	*Date*	*Resistance Test After Installation on Vessel*
2	Sarsfield (EDD837)	0.8 meg.	1.2 meg.	10 hrs.	7/22/49	3 meg.
41	O'Hare (DD889)	9 k	38 k	18 hrs.	11/21/48	300 k
43	Noa (DD842)	0.5 meg.	1.8 meg.	8 hrs.	1/ 4/49	2 meg.
72	Meredith (DD890)	10 k	00	60 hrs.	12/ 1/48	10 meg.
82	Cone (DD866)	250 k	320 k	4.5 hrs.	11/16/48	300 k
101	Corry (DD817)	68 k	3 meg.	24 hrs.	1/24/49	1.5 meg.
103	Warrington (DD843)	42 k	68 k	60 hrs.	1/30/49	1 meg.
118	Owens (DDK827)	25 k	5 meg.	176 hrs.	6/10/49	450 k
137	McCard (DD822)	12 k	20 k	65 hrs.	10/26/49	150 k
156	Roan (DD853)	27 k	30 k	24 hrs.	12/ 8/49	70 k
157	Brownson (DD868)	20 k	1.1 meg.	72 hrs.	12/ 8/49	1.4 meg.
158	Keppler (DD765)	45 k	2 meg.	72 hrs.	12/12/49	2 meg.
159	Roberts (DD823)	20 k	10 meg.	72 hrs.	11/14/49	30 meg.

Notes:

1—The first resistance test before installation on the vessel was taken just after the cables were attached and the terminal chamber was sealed.

2—The second resistance test was taken after the complete transducer was submerged in a tank of water fifteen feet deep for periods of time ranging from 4.5 hours to 176 hours, as shown in the above table.

3—The third resistance test after the transducer had been installed on the vessel was taken after a time lapse varying from one day to approximately sixty days.

2C39 ELECTRON TUBE FAILURES

A destroyer recently reported "Failure of 2C39 electron tubes was reduced to a minimum by not driving the Model TDZ above 25 watts output. 2C39 tubes previously believed to be burned out were reused, with a resultant TDZ output averaging about 20 watts. These tubes also have a much longer life if the TDZ is left in the OPERATE position for about 10 minutes prior to keying the transmitter".

Have you tried the new TDZ tuning procedure on Page TDZ:6 of the Communication Equipment Maintenance Bulletin?

ADDENDUM TO F.C. NO. 1— AN/ARC–1 RADIO EQUIPMENT

Previous instructions for Field Change No. 1 for the Model AN/ARC–1 radio equipment indicated that a 10,000–mmf ± 20%, 1000-volt d-c capacitor, JAN type number CM34A103M should be used in replacement of C-801. This should be corrected throughout the article to read 10,000-mmf ± 20%, 600-volt d-c capacitor, JAN numberCM45A103M, Standard Navy Stock Number 16–C–33628–1231. Maintenance handbooks should also be corrected accordingly.

FILM ON SILVER BRAZING STAINLESS STEEL WAVEGUIDE FLANGES

A fifteen minute motion picture film illustrating the correct procedure for silver brazing coupling flanges to "L" Band stainless steel waveguide is now available to installation activities. The film clearly demonstrates the correct tools and technique necessary to insure proper assembly and brazing. This film is titled "Silver Brazing Coupling Flanges on L-Band Stainless Steel Waveguide" and is indexed as Bureau of Ships Film Number 148-387.

Five copies of this film are available and will be issued in the order of receipt of requests from installation activities. Address all requests and desired showing dates for this film to the Chief of the Bureau of Ships, Code 258. The issue and return of the films will be scheduled by Code 258 so that as many activities as possible will have the film for the showing dates they desire.

DUPLICATION OF SYMBOLS IN F.C. NO. 10 AND NO. 18–B FOR THE QGB

The Electronic Supply Office, Great Lakes, Illinois in a recent letter to the Bureau of Ships pointed out that duplication of symbols exists in Field Changes No. 10 and No. 18–B for the Model QGB. Part of their letter is quoted below:

"Feld Change No. 10, optional equipment auxiliary junction box CG–62141 for equipment QGB found in NavShips 900341 (A) Section 9 (supplementary data) and also listed separately under NavShips 900,394 Contract NXss–25283 assigns symbols R–510–1 and R-511-1 for certain resistors.

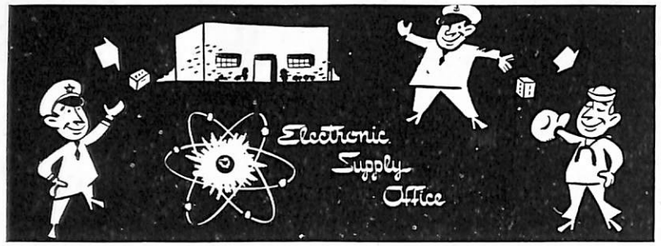
"These same symbols are duplicated for different value resistors in QGB Field Change No. 18-B as shown in Field Change Bulletin NavShips 98081 Contract NObsr–30151."

This is a notice to all activities that the error does exist.

The Bureau of Ships has contacted the contractor and as soon as the corrected symbols are available the information will be distributed for inclusion in the NavShips publications affected.

MODEL QDA SLEWING SWITCHES

A recent report from ComDesLant indicates that considerable damage can be caused to the Model QDA transducer, micro-switches, and operating mechanism by improper use of test switches S1901 and S1902 in the tilt control amplifier unit, especially when the slewing signal is applied near the forward limit of travel. These switches are shown in Figures 2-26 of Section 2 NavShips 900,700 (Instruction Book for Model QDA Equipment). It will be noted that the upper switch, S1902, has no neutral position and that throwing the lower switch, S1901, to the TEST position will apply full slewing power to the system in one direction or the other. This is not serious if S1902 is in the UP position, for in this case the sword is driven aft, and the weight of the sword when at around ninety degrees to the vertical reduces considerably the force with which it is driven into the stop. However, with switch S1902 in the DOWN position, if switch S1901 is left more than momentarily in the TEST position, the sword swings forward and coasts through the limit switch into the stop with such force that this could be the primary cause of a shear pin failure.



E.S.O. MONTHLY COLUMN

ARE YOU BRAND MINDED?

Do you prefer the product of a certain manufacturer to that of his competitors, or in other words, do you prefer to buy by brand name? You may indulge in being partial to a brand name when you purchase soap, toothpaste or shaving cream for your own needs. However, when you order electronic maintenance repair parts through the supply system, it's a different story and here's the reason why.

In most instances, a brand name, which, for the purpose of this article is considered synonymous to the term part number, doesn't mean a thing since the Navy is aware that several manufacturers can make the same item equally well, and that, over a period of time, the item may be purchased from different manufacturers, bearing different part numbers. Then again, manufacturers on occasion supply material to the Navy under their own part number even though another firm actually may have fabricated the item. As a result, individual part numbers tend to lose their significance once the material, of which they are representative at the time of procurement, enters the supply system and is stowed together with equivalent materials having different part numbers. In other words, in a given bin of material there may be items which, although mechanically and electrically interchangeable, bear or are identifiable by several different part numbers.

Perhaps it is appropriate to explain, at this point, several of the factors that bring about this condition. First, government regulations require competitive bidding be entered into at the time of procurement. Hence, when several manufacturers produce a particular item within the tolerances of the procurement specification, the one tendering the lowest bid is awarded the contract. This office cannot elect to make awards on the basis of brand names. Second, technical personnel are constantly striving to establish equivalency among the different materials offered by manufacturers under their part numbers, in order that the Navy is not confined to a single source of procurement to satisfy its requirements.

Bearing in mind the various conditions that influence the nature of the material available in the supply system, it should be apparent that your chance of obtaining a brand name is relatively small. Let's assume, for example, that you desire a resistor made by X company. The stocking activity has 10,000 resistors of the ohmic value and tolerance you desire, and, while some of these may well be those of the brand you prefer, there will also be varous amounts of material purchased from A. B, C, D, and E companies. Not only would it be extremely difficult, if not impossible, for a storekeeper to "hand pick" the particular brand you desire, but there would be no assurance that the quantity you ordered would be available. Further, there is no real need to do so since this office has determined in advance that any one of the 10,000 items will equally satisfy your needs.

Now that we have exposed the reasons why you should not order material by brand name, we will also tell you what number to use. *Use the Standard Navy Stock Number when ordering your material.* When you order by this stock number, you are assured of getting an item that will do the job. On occasion you may receive an item that is not identical, in its non-essential characteristics, to others you may have received using the same stock number, but you may accept it with confidence. If it meets the requirements established by the description associated with the stock number, it will satisfy your needs.

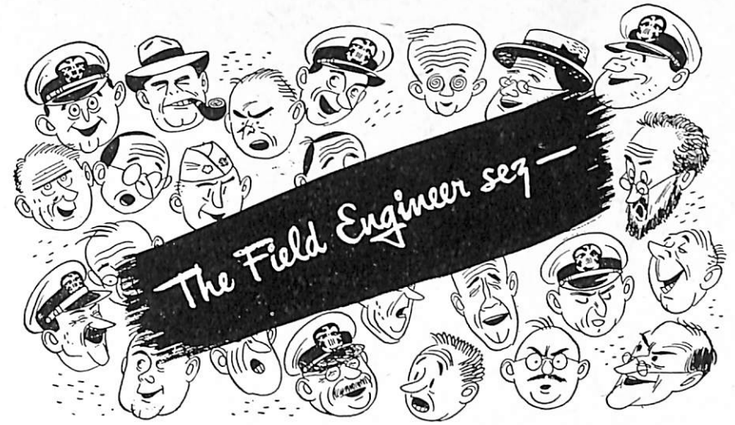
Bear in mind that ordering by part number delays delivery and many times results in needless correspondence.

Research and development activities, by reason of their peculiar requirements, will at times require material which if ordered by Standard Navy Stock Number, would not be satisfactory. To satisfy these requirements, such activities must, of necessity, order by specific manufacturer's part number, and such requests will be processed accordingly.

ANNUAL PROCUREMENT

By tabulating system-wide requirements for electronic maintenance repair parts over a nine-month period, this office has arrived at a basis for determining quantities needed for annual procurement of items on which replenishable demand is experienced. Statistics on equipment population, the number of circuit applications and failure data also are used, along with the demand history tabulation, to determine accurately the annual requirements for the Electronic Supply System.

Because procurement in larger quantities ordinarily results in lower production costs per item, considerable savings in the purchase of parts common are anticipated.



MARK 34 MOD 2

Field Engineer E. E. Mahoney of the 12th Naval District reports troubles located and remedies applied as follows:

U.S.S. Taussig (DD–746)

CW–20ABG Regulated Rectifier

Close observation of the Range Indicator revealed two steps, one barely discernible. This condition was present in any position of the sweep selector switch, causing all signals to appear lacy. The steps were judged to be 1 to 2 microseconds apart. When the manual gain was operated a slight shift in the horizontal time base was observed. Trouble was found to be a defective 300-volt regulated supply. The proper voltage was observed but was not regulated. Upon replacing a 6L6 (V-1403) and a 6AG7 (V-1414) normal operation was obtained.

U.S.S. Moore (DD–747)

General

J. N. T. Heineman of the 12th Naval District reports troubles located and remedies applied as follows:

Upon first reporting aboard, was informed by the ship's personnel that the antenna would not nutate or nod. Detailed check and analysis revealed that the 440-volt switch on the 40-MM power board was turned off and also that the pump motor on the gun mount was not turned on. Gave detailed instructions to ship's personnel on the importance of these components and also their exact location in case of future repetitions of this failure.

MARK 22 MOD 0

Field Engineers C. H. Jones and T. R. Lange of the Boston Naval Shipyard report the following troubles and remedies:

U.S.S. Rush (DD–714)

Indicator Circuit Unit CW–5 D–151707

The AFC unit was found to be inoperative. Examination revealed that someone had placed metal envelope tubes Type 6H6 and 6SQ7 in sockets where only glass envelope types should be used. These tubes were found in sockets X–501–3 and X–501–4. Glass tubes are necessary in these sockets because pins are used for tie points of resistors and when metal tubes are installed the shield shorts the resistors.

MARK 34 MOD 6

Field Engineers V. G. Popof and T. R. Lange from the Boston Naval Shipyard report the following deficiencies and remedies:

U.S.S. Salem (CA–139)

Coaxial Cables

The range notch and the AGC cables were found to be reversed at the Train and Elevation Indicator Unit. Reversal of cables corrected the trouble. Video cable #159 to the Control Indicator was found shorted, due to poor termination. Remaking of the cable termination corrected the video trouble and operation returned to normal.

Transmitter-Receiver Unit

Excessive crystal failures were reported due to defective TR tubes. Suggested a method to check TR tubes for determining if they were operating satisfactorily. Using a 20,000 ohms-per-volt Simpson meter or a Navy Type OE, measure the voltage across the TR tube by connecting the voltmeter (1000-volt scale) to ground and to the TR tube side of resistor R-14A of the r-f line and oscillator unit. If the voltage, as read on the meter, is between 350 and 435 volts the tube is considered good. If the voltage is not within these limits the TR tube should be replaced. It was suggested that the ship's electronics personnel include this check on the weekly preventive maintenance schedule thereby eliminating most of the crystal failures.

ELECTRONICS FIELD CHANGE INDEX

Field Change Number	Field Change Title	Date of Field Change	Serial Numbers of Equipment Affected	Modifying Activity	Man-Hours Req'd	Source of Material	Stock Number of Kit	Instruction Bulletin	Number Contract
Radar Set AN/SPS-6/6A/6B									
1	Magnetron Gear Box Replacement	12/22/48	1-5 incl.	YD or SF	½	Kit	ESO F16-K-3011-501	NAVSHIPS 98107	NObsr-39420
2	Replacement of Filter By-pass (C-170)	10/20/48	1-11	YD or SF	½	Kit	ESO F16-K-3011-502	NAVSHIPS 98109	NObsr-39420
3	Replacement of Motor Brush Holder Caps and Addition of Funnel for Oil Fill Purposes	3/ 3/49	1-25 and 71-117	YD or SF	1	Kit	ESO F16-K-3011-503	NAVSHIPS 98113	NObsr-39420
4	Spacers for TR Tube Clamping	7/19/49	1-49 and 71-151	YD or SF	½	Kit	ESO F16-K-3011-504	NAVSHIPS 98146	NObsr-39420
5	De-Spiking of Thyratron Waveform	7/14/49	26-47, 71, 76, 77, 80, 82, 83, 84, 89-95, 97, 98, 102, 104, 143-150	YD or SF	16	Kit	ESO F16-K-3011-505	NAVSHIPS 98141	NObsr-39420
6	Replacing the Antennas	8/ 2/49	1-160	YD	—	Kit	ESO F16-K-3011-506	NAVSHIPS 98147	NObsr-39420
7	Addition of A. F. C.		AN/SPS-6 1-25 AN/SPS-6A 26-70 AN/SPS-6B 7-136 and 138-180 E.S. 1-180 EES 1-17 TS 1-18 SS 1-24	YD	160	Kit			NObsr-39420
8	Replacement of Silver Mica Capacitors	11/ 9/49	Ser. #1-25 & #71-104, Equip. Spares E1-E25 & E71-E104, Extra Equip. Spares EE1-EE8, Tender Spares T-1—T-6, Stock Spares S1-S9	YD or SF	25	Kit	——	NAVSHIPS 98158	NObsr-39420
9	IFF Nameplate and Motor Drain Plug Breather Hole	3/ 1/49	1-20 incl.	YD or SF	1	Kit	ESO F16-K-3011-509	NAVSHIPS 98114	NObsr-39420
10	Maintenance Prints Replacement	3/ 1/49	1-25 incl. and 71-96 incl.	YD or SF	½	Kit	ESO F16-K-3011-510	NAVSHIPS 98112	NObsr-39420
11	Addition of Snap Rings to Antenna Gear Motor	3/ 1/49	Spares only	YD or SF	2	Kit	ESO F16-K-3011-511	NAVSHIPS 98116	NObsr-39420
12	Change of Spare Field Coil Leads	3/ 1/49	Spares only	YD or SF	2	Kit	ESO F16-K-3011-512	NAVSHIPS 98117	NObsr-39420
13	Change of Antenna Mounting Gear Motor	3/ 1/49	1-25 and 71-117	YD	12	Kit	ESO F16-K-3011-513	NAVSHIPS 91818	NObsr-39420
14	(FUTURE)	——	——	——	—	——	——	——	——
15	Change of Ship's Head Marker Switch	8/ 4/49	Ser. #1-164 incl., unit stock spares #1-50 incl., equip. spares 1-164 incl., extra equip spares #1-#14, tender spares #-#14, stock spares #1-#22	YD or SF	4	Kit	——	NAVSHIPS 98161	NObsr-39420
Model SR-3 Radar Equipment									
1	Antenna And Pedestal Revisions	4/14/47	Antenna Pedestal (CAPZ-21ADK) Equip. #1-#19, Stock Spares Ser. #1 & #2. Radar Antennas (CAY-66ALN) Equip. #1-#20, Stock Spares #1 & #2	SF	6	Lubrication Charts 47833A Navships 250-970-4A	——	No. 1 SR-3	NXsr-86343
2	Antenna Hunt At 2½ RPM	8/ 8/47	Ser. #1-#5 incl.	SF	20	Kit	——	No. 2 SR-3	NXsr-86343
3	Antenna Pedestal Synchro Bearing	6/23/47	Antenna Pedestal CAPZ-21ADK of model equip. X1 & X2, model equip. spares XE1 & XE2, equip. ser. #1-#25 incl., equip. spares E1 to E27, tender spares T1-10, stock spares S1 to S5 and unit stock spare pedestals S1 to S10	SF	3	Kit	——	No. 3 SR-3	NXsr-86343

Field Change Number	Field Change Title	Date of Field Change	Serial Numbers of Equipment Affected	Modifying Activity	Man-Hours Req'd	Source of Material	Stock Number of Kit	Instruction Bulletin	Number Contract
4	Zeroing of Synchros in Antenna Pedestal	1/ /47	SR–3 Ser. #1–#25 & spare pedestals Ser. #1–#10	SF	3	No Kit	——	See RMB Supplement No. 17,, Section 3–34	
5	Addition of Input Stage to I-F Pre-Amplifier CAY–50 AHR	4/20/49	SR–3 equip. ser. X1, X2, & 1–25, extra equip. spares EE1 & EE2	SF	5	Kit	——	Navships 98133	NObsr–43141
6	Antenna Assembly, Train and Control Replacement	6/10/49	XSR–3 Radar Equip. X1 and X2, Equip. Spares XE1 & XE2. SR–3 Equip. Ser. 1–25, equip. spares E1–E25, Unit Stock Spares S1–S10. In addition 5 sets equip. spares for AN/SPS–6 antennas & antenna mountings, 5 sets equip. spares for AN/SPS–6A antennas & antenna mountings, 1 set bulk stock spares for all items shipped by this change	YD	200	Kit	——	Navships 98139	NObsr–43074
7	Adapter for Tunable Magnetron	8/ 4/49	X1 and X2, and #1–#25	SF	50	Kit	——	Navships 98154	NObsr–43412
8	Addition of Fuse to Train Control Amplifier and Correction of Antenna Motor Wiring	3/25/49	X–SR–3 Ser. X1 & X2, SR–3 #1–25, and stock spare pedestals ser. S1 thru S10	SF	3	Fuse mounting board furnished with Inst. Bulletin	——	Navships 98123	NXsr–86343
9	Spacers for TR Tube Clamping	4/19/49	XSR–3 Ser. X1 & X2, SR–3 Ser. #1–25, Tender Spares T–1 thru T–10 & Stock Spares S–1 thru S–5	SF	½	Spacers furnished with Instruction Bulletin	——	Navships 98127	NXsr–86343

Model SR–6 Radar Equipment

1	Addition of Braces To Mk 3 IFF Antenna Reflector	1/ 8/48	Serial #1–#33 incl. & 5 unmod. Mk–3 IFF Antennas (CAY–66 AMW) which were shipped as stock spares	SF	10	Kit	——	Navships 98070	N5sr–8674
2	Reducing Possibility of Faulty Operation of Relays K–1102 & K–1106 in Train Control Amplifier	8/ 3/48	Equip. Ser. #1 thru #60 incl.	SF	4	Kit	——	Navships 98088	N5sr–8674
3	Additional Interlocks For Radar Transmitter-Receiver CAY–43 ADV	9/ 1/48	Equip. Ser. #1 thru #60 incl. Tender Spares Ser. #1–#12 incl., Stock Spares Ser. #1–#6 incl.	SF	4	Kit	——	Navships 98098	N5sr–8674
4	Battle Short Warning Light For Radar Transmitter-Receiver CAY–43 ADV–1	9/ 8/48	Equip. Ser. #1–#60, Tender Spares Ser. #1–#12, Stock Spares Ser. #1–#6	SF	12	Kit	——	Navships 98099	N5sr–8674
5	Antenna Replacement and Train Improvement	6/27/49	Equip. Ser. #–#60 incl.	YD	200	Kit	——	Navships 98143	NObsr–43150
6	New Wave Guide Gaskets	9/ 1/48	Equip. Spares Ser. #1–#66, Tender Spares Ser. #1–#12, Stock Spares Ser. #1–#6	SF	12	Kit	——	Navships 98103	N5sr–8674
7	Tunable Magnetron Modification	8/25/49	SR–3 Ser. #1–#25	SF	50	Kit	——	Navships 98160	NObsr–43412
8	Replacement of Filter By-Pass C-710	12/22/48	Equip. Ser. #1–#60, Tender Spares Ser. #1–#12, Stock Spares #1–#6	SF	½	Capacitor (C710) included with Inst Bulletin	——	Navships 98106	N5sr–8674
10	Addition of Input Stage to I-F Pre-Amplifier CAY–50 AHR	4/20/49	Equip. Ser. #1–#60, Equip. Spares Ser. #E1–#E60, Extra Equip. Spares #EE1–#EE6	SF	5	Kit	——	Navships 98132	NObsr–43141
11	Spacers for TR Tube Clamping	4/19/49	Equip. Ser. #1–#60, Tender Spares Ser. #T1–#T12, Stock Spares Ser. #S1–#S6	SF	½	Kit	——	Navships 98128	N5sr8674

ELECTRONICS