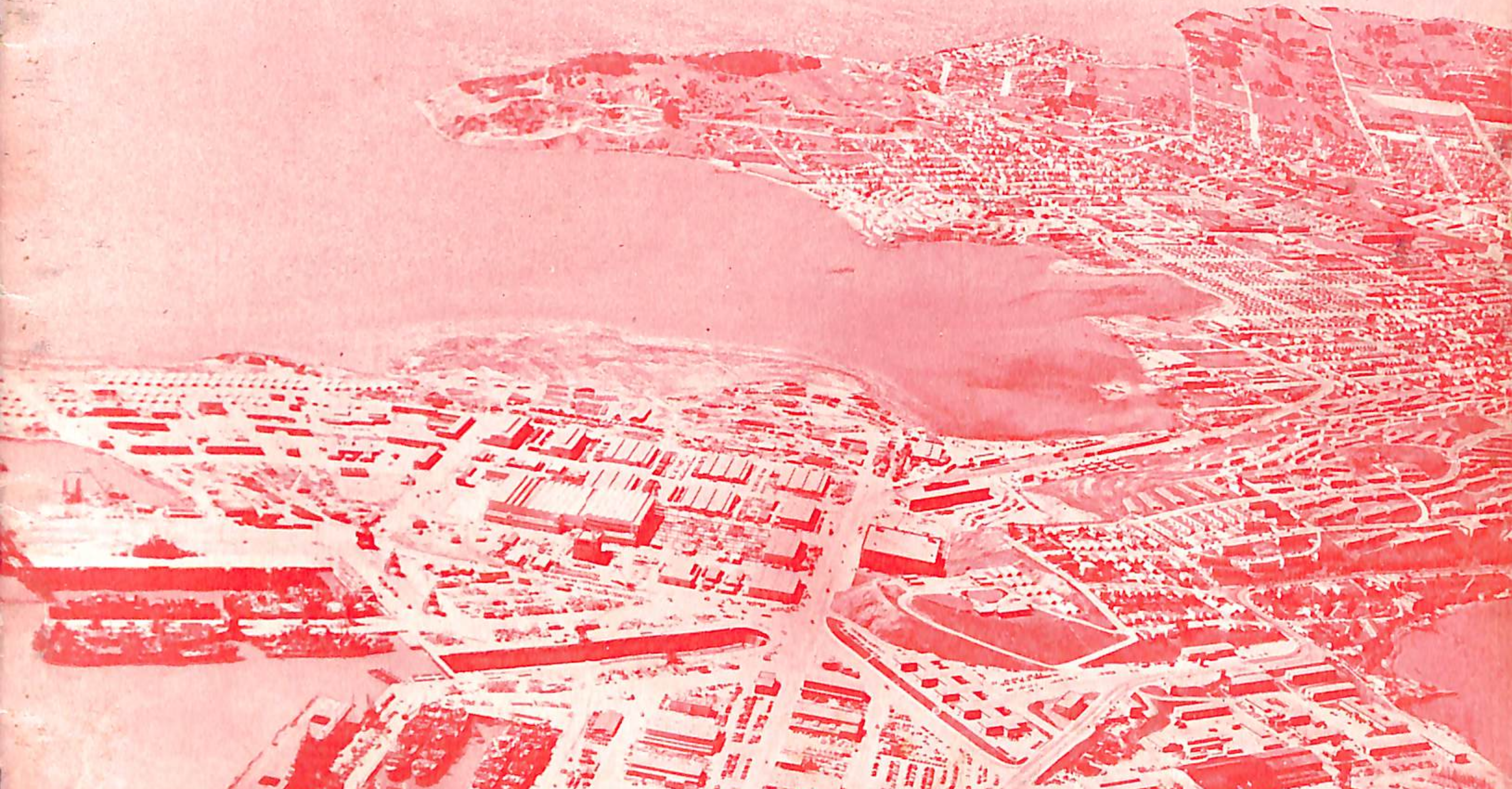
RESTRICTED

SEPTEMBER 1948

BUSHIPS Electron



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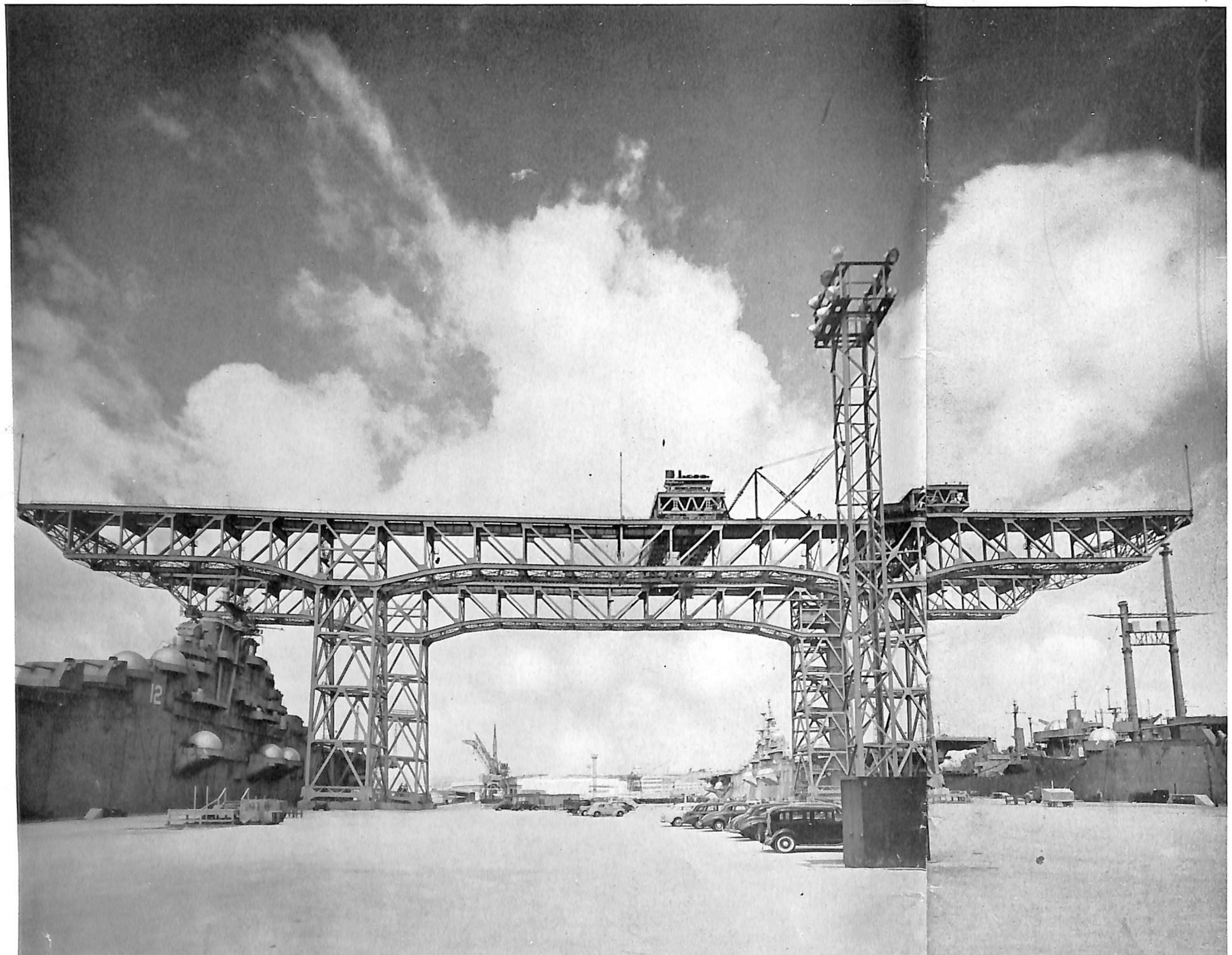
FEATURING . . . . THE SAN FRANCISCO NAVAL SHIPYARD



450-ton revolving crane—considered to be the world's largest crane. The two mobile cabs are controlled by walkie-talkie radio from the ground. Inter-communication between cabs and ground can be maintained at all times. The crane is 740 feet long, 184 feet high; its lifting capability is 450 long tons. The power consumed is enough to supply a city of 5000 people.

BUSHIPS

Electron

A MONTHLY MAGAZINE FOR ELECTRONICS TECHNICIANS

SEPTEMBER • VOLUME 4 • NUMBER 3

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The Editor BuShips Electron
Navy Department
Washington 25, D. C.

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

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BUREAU OF SHIPS — NAVY DEPARTMENT

Captain Hugh E. Haven, Sr.
Commander San Francisco Naval Shipyard

Hugh E. Haven, Sr.
Captain U.S.N.

Captain Hugh E. Haven became Commander of San Francisco Naval Shipyard on 20 July 1948, coming to the San Francisco Naval Shipyard from duty as Deputy to the Assistant Chief of the Bureau for Ships.

Born in Mannsville, New York, 10 May 1898, he was educated in the New York public schools and Werntz Naval Academy Prep School before entering Annapolis in 1916. He was graduated from the Naval Academy in 1919 and had sea duty aboard the battleships SOUTH DAKOTA *and* UTAH *for nearly five years before taking postgraduate courses at Annapolis, Columbia University, and at industrial schools at General Electric Company and Philadelphia Navy Yard. Additional duty aboard the battleship* ARKANSAS *and as Executive Officer of the destroyer* YARNALL *followed.*

Captain Haven's principal duties during his service have been in engineering work. He served more than two years as Test Officer and Executive Officer of the Engineering Experiment Station at Annapolis, in the Boiler Laboratory at Philadelphia, as Ship Superintendent and Design Superintendent at the Philadelphia Naval Shipyard, and as Supervisor of Shipbuilding, Wilmington, Delaware. Prior to joining the Maintenance Section of the Bureau of Ships as a Deputy to the Assistant Chief of the Bureau in August 1947, he served as Planning Officer at the Puget Sound Naval Shipyard.

Captain Haven holds the degree of Master of Science in Mechanical Engineering from Columbia University. He received a citation from the Secretary of the Navy for duty in the Dakar Military Mission. For work in re-designing destroyers for the Brazilian Navy, he was awarded the Order of the Southern Cross, comparable to the U. S. Legion of Merit. For his part as Material Officer on the Atlantic Fleet Training Command Staff in World War II, Captain Haven was awarded the Bronze Star. This duty called for organization, training and equipping over a third of the Navy personnel, shaking down 1500 new ships, and giving refresher training to over 2500 ships in World War II.

A member of the American Society of Naval Engineers and the Society of Naval Architects and Marine Engineers, Captain Haven is author of several widely published papers on the subject of fatigue of metals.

OUR SOLE MISSION IS TO SERVE THE FLEET

"OUR SOLE MISSION IS TO SERVE THE FLEET"

By ALBERT J. HODGES

The San Francisco Naval Shipyard has adopted as its motto the caption of this article. Our Shore Electronics work is of minor importance, to date, and we do little manufacturing of supplies for stock. Truly, then, *our sole mission is to serve the fleet.*

Although a very young shipyard, our facilities, personnel and organization are such as to make it the largest shipyard in the country devoting its energies exclusively to the repair and modernization of ships.

For the benefit of those of you who might be our customers tomorrow, let us look at the San Francisco Naval Shipyard with a word picture to supplement the cover photograph. The San Francisco yard has undergone much the same phenomenal wartime growth as the field of electronics itself.

Established in 1865 on the deep waters of San Francisco Bay as a commercial-ship repair drydock, it was used by the Navy upon the arrival of the Great White Fleet in 1908, and ultimately, in 1940, was purchased by the Navy from the Bethlehem Steel Corporation. At that time the yard included two drydocks and forty-seven acres of land valued at $3,000,000. The Navy did not take over active management of the yard until eleven days after Pearl Harbor when the *U.S. Naval Drydocks, Hunter's Point* was established. In November 1945 this facility was given its present name of *San Francisco Naval Shipyard* and now boasts of six hundred acres of closely knit facilities valued at $100,000,000.

A lively, but extremely friendly, competition exists between us and Mare Island Naval Shipyard on the same inland waterway. It is sort of a father and son relationship which is emphasized by employment at San Francisco of the sons of many Mare Island career employees.

The Electronics organization at San Francisco follows the standard organization set up and authorized for all shipyards by the Chief of the Bureau of Ships.

San Francisco is well equipped to handle any electronics problem arising on a Naval vessel and has had actual experience on the latest and the most intricate of the electronic equipments: SR–6 and SX radar; WFA–1, QHB, QLA–1 sonar; TDZ, RDZ radio with teletype; A.E.W. for carriers; and radar switchboards and communication consoles are but a few.

Electronics work in a typical shipyard overhaul has become such a large fraction of the total authorized work that a high degree of teamwork must be employed to accomplish the assigned tasks correctly and on time. The individual team functions and assignments are described by the team members in articles to follow. Some of the material is technical, some describes shipyard procedures, some deals with our facilities here at San Francisco, some deals with personnel, and some talks about finance.

Electronics personnel in a shipyard are, of necessity, distributed throughout the establishment. Planning has in its department a Technical Desk that provides the contact with the ship, a Central Planning Group to describe the necessary details on the job orders, and a Design Section to provide necessary design plans. Production has its Production Control Section, its new Shop 67, and its Progress Department. Supply has its electronics personnel too—a group of specialists striving to keep tab on the thousands of electronic equipments and parts. The Electronic Officer's own staff deals with the waterfront, the shops, and the Planning Department, coordinating, inspecting, and providing necessary engineering details.

Extra-curricular work of importance to the Fleet is the engineering service provided to Naval vessels making San Francisco its port of call. A technical availability is easily arranged through the Type Commander which will bring an engineer to the ship to service a radar, loran, or other equipment in need of voyage repairs. Unless mechanical work or parts are required, this service is provided without transfer of funds. It is part of the mission of the shipyard to provide this consulting service.

The Electronics team of the San Francisco Naval Shipyard appreciates the opportunity to tell its story in BUSHIPS ELECTRON. All contributors have enjoyed their parts in writing these articles, the preparation of which was personally coordinated by the Electronics Officer, Commander L. M. Peterson.

Comdr. L. M. Peterson, U.S.N.R.

The Electronics Officer

After four years in Electrical Engineering, University of Minnesota, Commander Peterson entered the electric light and power business as an industrial power engineer. After six years in this field, handling large power, commercial lighting and municipal street lighting accounts, he entered the Navy on active duty. This was in April, 1942. After basic and advanced Naval electronics training at Harvard and M.I.T., he was assigned to the office of the Electronics Officer, Mare Island Naval Shipyard. Here he spent two years as Electronics Production Officer on waterfront work and two years as Electronics Planning Officer. Collateral duties during this period were as Technical Advisor to the Electronics Officers at the office of the Assistant Industrial Manager, Ferry Building, San Francisco, and to the San Francisco Naval Shipyard. In July 1945 he was transferred to the San Francisco Naval Shipyard as Electronics Planning Officer, and became Electronics Officer in October, 1945.

Commander Peterson sincerely believes in the shipyard's slogan, "Our Service For Ships Means Ships For Service," and the shipyard motto, "Our Sole Mission Is To Serve The Fleet."

Chief Civilian Assistant

Albert J. Hodges

Albert J. Hodges was born in Vallejo, California, served his apprenticeship as Electrical Machinist at the Mare Island Navy Yard, and attended the University of California. He returned to the Navy Yard just prior to World War I. During the war he was kept on the move helping to install radio stations in Alaska and on the Pacific Coast, and late in 1918 was in charge of the installation of Naval Radio Station, Vladivostok, Siberia.

After doing extensive field work, including work at the San Diego high-power and Point Loma radio stations, he left Mare Island and worked with Admiral Bullard on the planning of a 2000-kw, very-low-frequency station for Shanghai, China. In this project, under development by the Federal Telegraph Company of Delaware, it was planned to cover China with point-to-point radio stations and to provide with direct communication to Bolinas, California. The advent of practicable means of high-frequency radio communication led to the abandonment of the project after the planning had been completed.

A short period of radio sales work then led to a position as Chief Engineer and Operating Manager of radio station KPO, San Francisco. Mr. Hodges then entered the field of talking motion pictures as Installation Superintendent for Western Electric in Hollywood, equipping the studios for recording on wax and film. Moving to New York City, he was then made General Service Superintendent of the Electrical Research Products Division of the company.

In 1938 he returned to the Navy at San Diego where during World War II he was in charge of the engineering and installation work on the Shore Radio Stations in the Eleventh Naval District. In March 1946, after a year at Long Beach Naval Shipyard, he was transferred to San Francisco, as Senior Electronics Engineer.

On 10 December 1924, he was appointed a Lieutenant Commander in the Naval Reserve and discharged in 1940. He was active in the volunteer Naval Reserve and served on the *Nevada* and *Arizona* on extended training cruises.

Organization of Shop 67 . . . .

By Harold Osborne

Firmly established in its new quarters on the third floor of Building 253, the most modern building within the San Francisco Naval Shipyard, the Electronics Shop is now in full operation as a separate shop, able and willing to carry out its assigned mission of repairs to electronic equipment on any vessel of the fleet.

Shop 67 Organization. A clear understanding of the operation of Shop 67 can be obtained by an analysis of the shop organization chart, shown here as figure 1. In the course of the preparation of this chart, several factors were considered, as well as several different types of organization. All were resolved to this final plan. Under this plan, the shop could expand or contract as necessary to meet changing conditions without a complete reorganization for each change. Older methods of shop functionally dividing sections into Radio, Radar and Sonar are now becoming inadequate, due to the development of myriad functions within the electronic organization. In keeping with the shipyard policy set by the Bureau of Ships it was necessary to assume that Shop 67 would be comprised primarily of electronics mechanics, radio mechanics, helper radio mechanics, and workers in a few other specialist trades, such as an electroplater for plating work and a machine operator for engraving work. Workers in other trades are supplied by other shops as required. For example, machinists are supplied by the Machine Shop, pipefitters by the Pipe Shop for use in the Antenna Repair Section, and painters by the Paint Shop.

The functions of Shop 67 are limited, for the time being at least, to the removal, repair, reinstallation and preliminary shipboard test of all repaired equipment, and to the final installation and preliminary test of all new equipments. Final tests and inspection are conducted by the Electronics Officer's representatives.

Quartermen and leadingmen were questioned at some length regarding the establishment of an inside and an outside group in a manner similar to the system employed in the Electric Shop. After making a detailed breakdown of several electronic jobs, and analyzing the steps to be taken in each job, it appeared to the quartermen that they would prefer to have control over the entire installation from the start to the finish, rather than have one of the quartermen find it necessary to rely upon the other for a portion of his particular job to be accomplished. This assures continuous control of repair work through all stages from removal, through overhaul, to reinstallation. From a shop administration standpoint, it is also easier for the foreman to control his shop if it is not necessary to act as a mediator between quartermen in discussions involving the status, progress, and costs of a particular job. Similar thinking led to the selection of leadingmen to head up the specialty groups (such as sonar). By this arrangement, a quarterman has complete control of that specialty through a single leadingman, who likewise has full responsibility for the progress, cost, and final operation of that specialty equipment. This shipyard holds the opinion that no more complete control over the productive efforts of a shop can be obtained by any other system of organization. A natural development in the formation of the organization led to placing one quarterman in charge of all equipment used for audio circuits, and the other quarterman in charge of all equipment used for video circuits. These two divisions now form the basic sections of our Electronics Shop.

SAN FRANCISCO NAVAL SHIPYARD SHOP 67
ORGANIZATION CHART

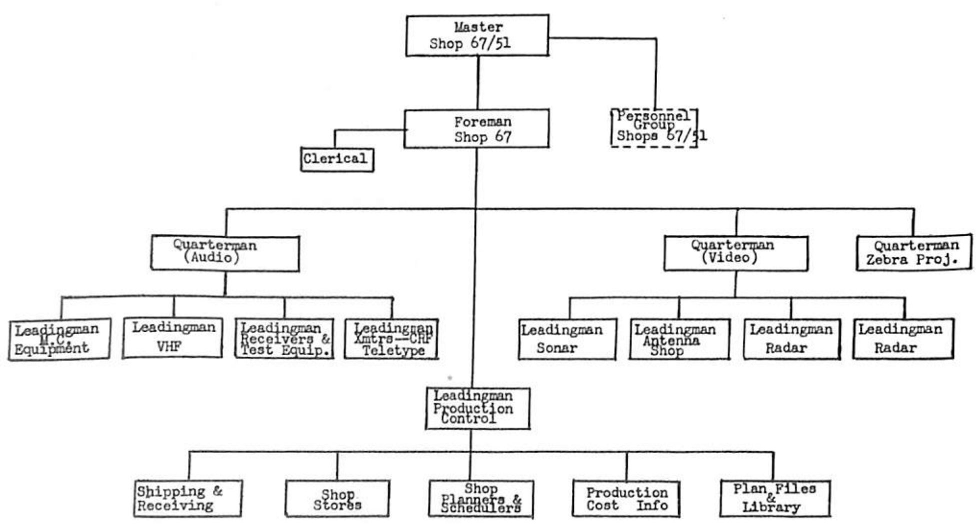
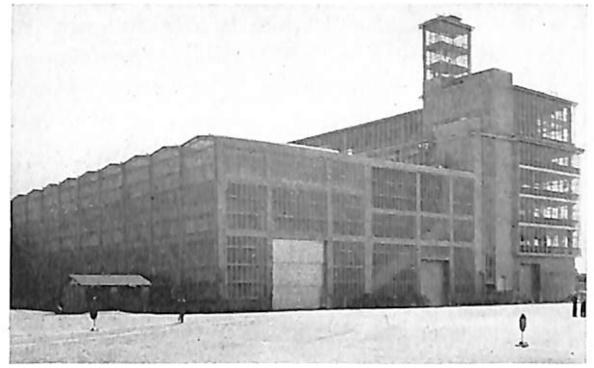
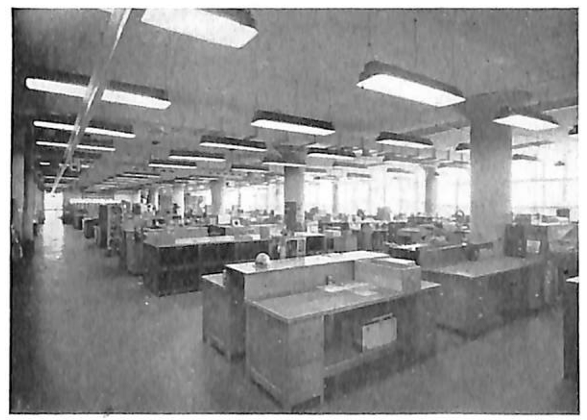


Figure 1.



The home of electronics, Bldg 253, San Francisco Naval Shipyard. A complete set of radio and radar antennas are installed and operating seven and ten stories above the ground. An escalator takes personnel to their working areas and return. An elevator in the front and one at the rear take freight and passengers up and down six floors.

Going back to the organization chart, we find an "audio" quarterman, with four leadingmen, each of whom is respectively responsible for shop and ship work on MC equipment; for v-h-f equipment, receivers and test equipment; and for radio transmitters. The teletype and C.R.F. sections were not large enough to require a leadingman, hence it was necessary to combine them under the one transmitter leadingman supervisor. Likewise the "video" quarterman has four leadingmen, covering the sonar equipment, antenna repairs, and two leadingmen for the radar group.

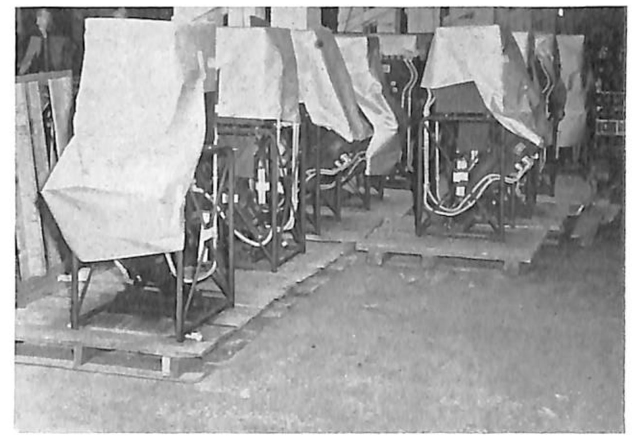


Electronics Shop, San Francisco Naval Shipyard. Interior view looking from front to rear showing receiver and transmitter sections.

The quartermen in charge of the two sections average about half of their time out on the ships and the other half of the time within the shop. The leadingmen are either aboard the ship or in the shop, wherever they have their men assigned. Each leadingman averages about 18 men and the workload supports this arrangement very closely.

Teletype repair facility.

Zebra project—An extra-curricular activity that has been taken on by Shop 67 is a project familiar to West Coast activities and is known as the ZEBRA project. This work consists of the rehabilitation of and repairs to electronics material in storage. Approximately 4000 items, such as AN/ARC–1's, RBO's, DAU's, BL's, attack plotters, etc., have been accepted for repair. This work is done in another building on a production-line basis, utilizing about 100 to 150 men. Supervisors for this project were selected from some of the older men in the shop, and will consist of a quar-



DAU direction finders coming off Project Zebra assembly line after rehabilitation.

terman and about four leadingmen. One inspector from the Electronics Office has been assigned to the project for technical advice and control.

J. H. Osborne

J. H. Osborne served the Mare Island Naval Shipyard for fifteen years prior to the last war, first as Apprentice Electrician, last as Quarterman. A commissioned officer in the Coast Artillery Corps Reserve, he was called to active duty in 1942.

After several Signals Corps courses of instruction in radio and radar, he took a Signal Aircraft Warning Company to the South Pacific. In April of 1945 he was released from the Army to fill a vacancy in the Electric Shop at the San Francisco Naval Shipyard, where he served as Chief Quarterman Electrician before taking charge of the Electric Shop as Acting Master.

He was appointed Master Electrician last year. In addition to these duties he is now the Acting Foreman of Shop 67.

Cables for Type CBM-78258 Transducers

Field activities have reported to the Bureau of Ships that Type CBM-78258 bottomside hull transducers have been received from the contractor with 325BH cable leads of insufficient length to permit satisfactory installation. The contractor has been informed of the deficiency and has agreed to increase the lead lengths. CBM-78258 transducers bearing serial nos. 65 through 70 will be provided with lead lengths of at least 12½ feet, and transducers with serial nos. 71 and above will be supplied with lead lengths of 14 feet. Type 325BH cable for use as repair or replacement cable for CBM-78258 transducers is available at N.S.D. Bayonne and N.S.D. Oakland.

ELECTRONICS SERVICE SECTION

By RAY STYLE

The Electronics Services Section of the Electronics Office was officially "born" on 2 July 1948. Prior to this time, such an organization had existed, but not under its present title. Staffed by five people, the Services Section functions as its name implies. All clerical work and maintenance of electronics facilities records are handled by this group, as well as budget control and administration of electronics funds. Personnel matters such as promotions, reallocations, transfers, position descriptions, and employee relations are also handled by the section.

Technical assistance to the Supply Department on electronics problems is furnished by the specialist in charge. Information on electronics at the San Francisco Naval Shipyard is provided to the Bureau of Ships and to local publications to keep interested persons informed. Public information work for the Electronics Office is also a function of the section. Displays at numerous industrial, electrical and electronics shows are handled, as well as tours of the shipyard by students and conventions.

When word was received that the San Francisco Naval Shipyard would contribute heavily to Electron the Services Section began to devote its energies to collecting material and coordinating the efforts of the photographers, cartoonists, typist and authors who contributed their work to this issue.

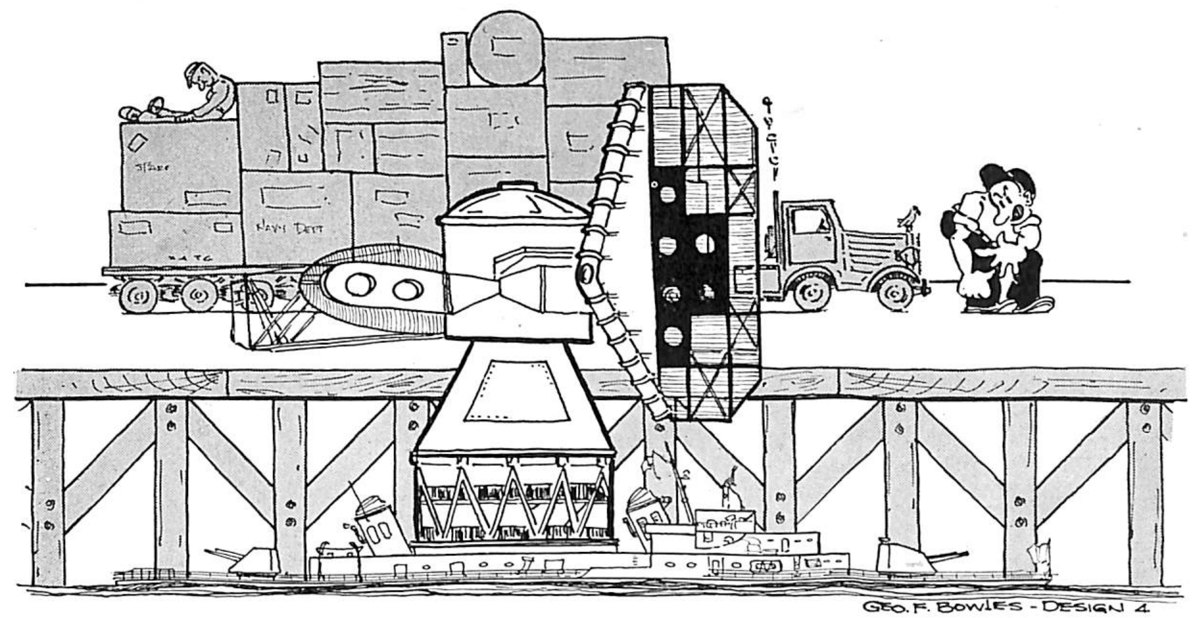
Ray Style as he looked when notified that the September issue of the ELECTRON *would be "his baby."*

Ray Style entered the field of electricity and electronics in 1928 by joining the Western Union Telegraph Co. After attending the University of Minnesota he was employed in the research laboratories of the Texas Company. Subsequent active duty with the Navy took him into both the Atlantic and Pacific conflicts for three years of overseas service. Upon his release from active duty in 1945 he joined the Office of the Assistant Industrial Manager at the San Francisco Naval Shipyard.

SO YOU WOULD LIKE SX ON YOUR DD?

By C. M. MILLER

Rumors circulating through the fleet have credited the SX radar with almost unbelievable powers. Range, bearing, and height-finding simultaneously from the same antenna! Simultaneous continuous-intercept data of several different targets! Better definition of surface targets than the SG-lb at double the SG-lb ranges! Air targets spotted at distances comparable to the SK, but definitely better intercepts of low-flying planes! Accurate height-finding on targets to 40,000 feet! Rumors, such as these, become facts upon closer examination of the SX radar.



"Hey— Where d'ya want dese 80 boxes of spare parts?"

A separate search-system, consisting of receiver, modulator, and transmitter, functions as a complete S-band radar with a peak-power-output of one-million watts in a 1-microsecond pulse at a repetition-rate of 390 pulses per second. This power is fed into a search-antenna array through a triple-throated waveguide horn (see figure 1) to provide an elongated flat-topped beam pattern about 1.5 degrees wide in train by 18 degrees in height. Uniform power distribution has been fanned out in the vertical axis of the beam so that plane targets up to a 40,000-foot ceiling present 'scope signals of practically equal magnitude regardless of distance. Substantial power at the lower angles of radiation increases the probability of intercepts of low-flying targets and gives exceptional surface-target definition and range.

Search presentation on the SX console has, in addition to the main P.P.I. 'scope, an Off-Center Plan Position Indicator (O.C.P.P.I.) 'scope which displays a small sector of the main P.P.I. presentation. A mechanical cursor assembly placed on the main P.P.I. electronically transmits to the O.C.P.P.I. a sector, bisected by the cursor, which may be 10 or 30 degrees in train and 20 or 40 miles in depth, with a starting point delayed from zero to 100 miles in distance. This expanded sector displays very accurate intercept data on all targets or raids within its boundaries. Similar Off-Center P.P.I. presentations on the five consoles furnished with the SX will enable five different target

FIGURE 1—*SX Antenna—Search Array, Left, Height Array, Right.*

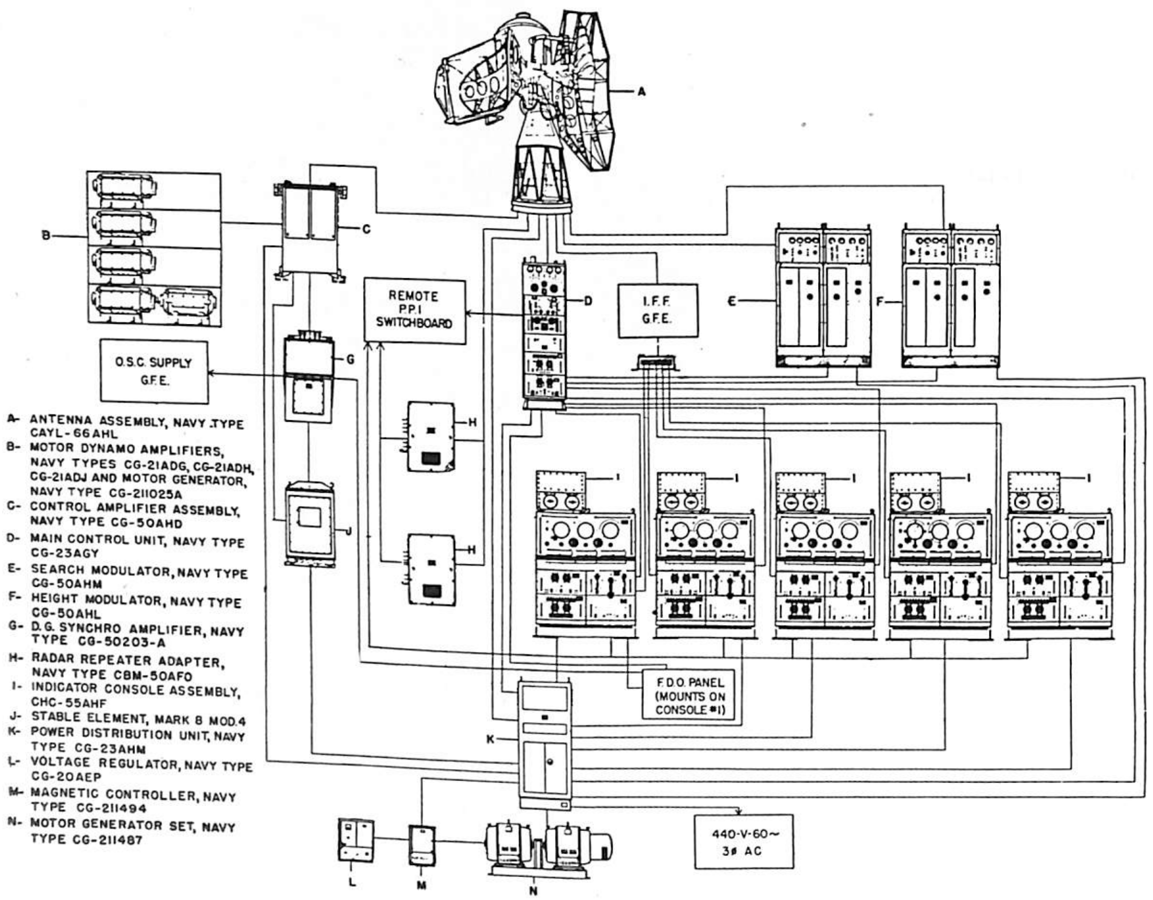


FIGURE 2—*SX radar system, essential units.*

areas or raids to be tracked individually or simultaneously.

The height-finding system, which is also a separate complete S-band radar unit, receiver, modulator and transmitter, is capable of a peak-power output of 600,000 watts in a 1 micro-second pulse at either 390 or 1170 pulses per second. A separate antenna array for height, mounted on the same pedestal but displaced 90 degrees in bearing from the search array, has a beam pattern 3.5 degrees in train by 1.1 degrees in height. By using a folded-waveguide horn with an internal rotating waveguide throat which directs radio-frequency energy into the height reflector it is possible to vary the height of the radiated beam from $\frac{1}{4}$ degree above the horizon to 11 degrees. Motor-driven controls permit continuous-height-beam scanning at a rate of 10 scans per second. An electronic and servo circuit, connected to the mechanically scanned height-finding beam, gives a third 'scope presentation on each console. This third 'scope, the Range Height Indicator (R.H.I.) 'scope, displays targets with height plotted vertically above the earth's surface and range plotted horizontally. Target height (to 40,000 feet) is found by adjusting a height line, which is "written in" electronically and superimposed on the R.H.I. display, until it coincides with the desired signal. The height is found by reading a dial calibrated directly in thousands of feet. The R.H.I. presentation covers either the same 10- or 30-degree sector being watched on the O.C.P.P.I. or a full 360-degree train sector for air search in conjunction with the main P.P.I.

In case of search-system failure, the height system may be used for search, and the information be presented on the P.P.I.

Each console, then, provides complete height, range, and bearing information on one or more targets without interfering with the tracking on adjacent consoles or without affecting the search function of the equipment. Operators can individually interrogate, for i-f-f evaluation, targets in their O.C.P.P.I. sector without affecting the targets displayed on other consoles.

To insure accurate height readings as well as steady target response the antenna is fully stabilized for roll or pitch up to $15\frac{1}{2}$ degrees.

These two separate systems, search and height finding, with the powers available in the highly concentrated beams and the complex interpretations at the operating consoles explain some of the exceptional results reported throughout the Fleet.

Essentially the SX is simple, consisting of two radar systems, a dual-array stabilized antenna, and five consoles. *Almost simple enough to install on that DD? Not quite.* To make the SX a complete workable installation requires many more items of equipment. Figure 2 shows a motor-generator with starter and voltage regulator, an antenna servo system which includes four amplidynes, a main control unit, i-f-f equipment, a stable element, remote P.P.I. adapters, and the associated radar distribution switchboard. It does not show the various junction boxes, line switches, adapters, etc., which to complete the whole SX picture would require a total of over 50 separate units. These 50 units may not seem so impressive until a further analysis indicates the antenna is over 20 feet in height (see figure 3). It rotates on a swing diameter of 22 feet and weighs about three tons. It is sufficiently large to enable the two transmitters and receivers to be mounted in a large hut or igloo between the two antenna arrays. This transmitter igloo may be entered by the technicians for normal service operations. Each of the consoles requires a deck mounting space of about 12 square feet and weighs over 1200 pounds, a size further emphasized in figure 4, which shows a typical C.I.C. installation on the *U.S.S. Antietam* (CV36). The two modulators occupy a total space of 120 cubic feet and weigh $2\frac{1}{2}$ tons apiece. Remaining units of various sizes, exclusive of the antenna, bring the total mounting space required to over 200 square feet. A volume of about 750 cubic feet is occupied. The overall weight of the equipment is 18 tons.

FIGURE 3—*SX antenna on the U.S.S.* ANTIETAM *(CV-36).*

From a maintenance standpoint the SX is the technician's "steady job." Each console uses 117 tubes and in addition to the P.P.I., O.C.P.P.I., and R.H.I. 'scopes has a self-contained portable-service 'scope for trouble-shooting and calibrations. An overall total of 20 synchros, 30 motors, 150 relays, 183 fuses, 280 variable adjustments, 300 test points, and 852 tubes contribute somewhat to the SX service problems. Even the instruction book comes in the "giant economy size," filling about 1 cubic foot of space in the files and weighing 15 pounds.

DO YOU STILL WANT AN SX INSTALLED ON YOUR DD?

As the SX radar dims all other radar equipments in its complexities and outstanding performance, so also does a shipyard SX installation job overshadow all other radar work in the yard. A typical SX installation such as was completed by the San Francisco Naval Shipyard on the *Antietam* (CV36) requires a prodigious amount of concentrated work effort from every department, shop, and worker in the yard. Supply Department must handle over 122 crates—two freight car loads—of equipment for the SX alone. Design Section must provide over 60 blueprints covering the SX portion of the completed job. The Planning Section will issue at least 60 detailed job orders pertaining to the SX. Shop 51 must secure from Supply and install over ten tons of cables, consisting of 160 multi-conductor and co-axial cables, and must place 2200 separate soldering lugs and end-fittings on the 1100 individual leads. Each lead must be carefully "talked out" and tagged to match the working blueprints. Various

FIGURE 4—*SX consoles in CIC, U.S.S.* ANTIETAM.

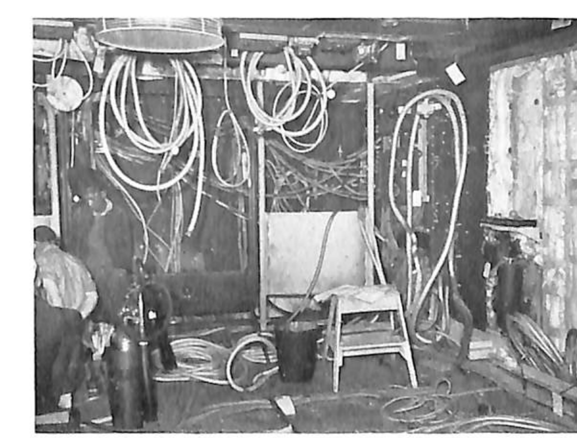


FIGURE 5—*Cable runs in CIC, U.S.S.* ANTIETAM.

shops throughout the yard will do special jobs, furnish special fittings, and provide hundreds of man-days of labor assistance to the lead shops. Shop 67 (Electronics) will make a complete mechanical and electronic inspection of the individual units before installation on

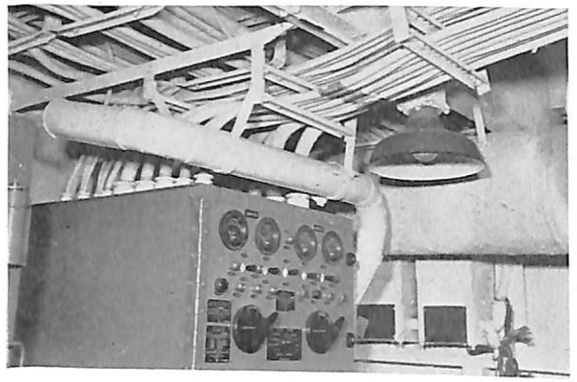


FIGURE 6—*Cable runs to SX Main Control Unit in* ANTIETAM.

shipboard, will check the equipment hook-up on the ship for wiring errors, and perform a preliminary operating warm-up before calling in the Electronic Engineers for the final tests. The Electronic Engineering group board the ship on arrival, conduct an operational test of ship's electronic equipments, check compartments and superstructure for new installations and make detailed work recommendations to Planning and Design Sections. They assist in equipment procurement, advise about special transportation and rigging needed, and check and approve all electronic equipment prior to shipboard installation. They give engineering assistance and instruction to yard workmen in new installation techniques, and make final operational tests and equipment calibrations after completion of the job. They will instruct shipboard Navy personnel in operating and maintenance problems peculiar to the SX. Being conversant with all phases of a major installation, the electronic engineers are constantly on the alert for any deviations from established shipyard and Navy practices.

The electronic "know how" of a shipyard is quickly evidenced throughout the Fleet by an electronic installation such as the SX radar. Through the smooth merging of thousands of man-days of work effort, with perfect co-ordination between all departments and shops, the San Francisco Naval Shipyard, in the finished perfection of its work, has demonstrated its ability to undertake all new electronic developments.

SO IN SPITE OF ITS SIZE AND INSTALLATION PROBLEMS YOU STILL WANT AN SX ON YOUR DD?

OK! By a very judicious placement of equipment in the available spaces, such as consoles in C.I.C., wheelhouse, wardroom, captain's cabin and chief's mess; modulators in the old radar transmitter space; stable element and motor generator in the crew's quarters; main control unit, antenna servo systems, and remaining units scattered up and down the passageways, it might just be possible to get all of the SX on board. Of course to make weight compensation for that total of 28 tons, you had to cut down the mast and mount the antenna on the wheelhouse, toss overboard the fore and aft five-inch guns, the midships torpedo tubes, the evaporators, gyro compass, three radio transmitters, the RBO, all the canned spinach, the powdered eggs, two bos'n mates, and the paint locker.

But you finally have the job done and all ready for sea when two huge semi-trailers pull up alongside on the dock and a driver yells over, "Where do you want these 82 boxes of spare parts?"

That's all, mister, that's all.

C. M. Miller

C. M. Miller entered the field of radio in 1921. Leaving a radio service business in early 1942 to enlist in the Navy, he attended Radio Materiel Schools at Logan, Utah, and Treasure Island, California, and remained at Treasure Island until 1945 as an instructor in electronics. He came to the San Francisco Naval Shipyard in 1946 after having served the 12th Naval District as Assistant Industrial Manager (San Francisco).

LOSS OF MODEL JT HYDROPHONES

Several guppy submarines are reported to have lost the hydrophones of their Model JT Sound Receiving Equipments while proceeding at moderate speeds. These losses have occurred because the hydrophones were trained so as to be subjected to maximum water drag.

In order that unnecessary loss of these hydrophones may be prevented, the hydrophones should be retracted at speeds in excess of nine knots. If this is impracticable, they should be trained to a bearing of 90 or 270 degrees to reduce the strain due to water drag.

ELECTRONIC SHIELDED ROOM

By HARRY B. DUNLAP

Late in 1947, the Electronics Laboratory, while still a division of the Electrical Shop 51, moved into its new quarters on the third floor of Building 253. The Electronics Shop 67 Administrative Offices, Electronic Laboratory, and the Electronic Engineering Office now occupy the entire modern third floor—this location providing 200,000 square feet of area.

An electronics laboratory requires, among other facilities, modern electronics shielded rooms wherein sensitive interference-free measurements can be conducted. Floor space has been allocated in the Electronics Laboratory for three shielded rooms, but the construction was delayed because there were no specifications available for their design. The Electronic Engineers were given the assignment of correlating guide specifications for the design and construction of the shielded rooms.

Extensive reference research into scientific, engineering and trade indexes was conducted with but little success. Available textbooks contained no specific information on the subject; however, some fundamental concepts were brought forth. Fortunately, leads were established on several recent Navy publications containing articles on screened rooms, and from these articles considerable information was secured.

Where a maximum attenuation to all interference signals is required, a well-designed and well-planned shielded room of quality construction is necessary. Today, an interference signal of considerably less than one microvolt per meter field strength is the permissible maximum within the shielded room. The advanced Electronics Laboratory operates and tests pulsed, megawatt, microwave transmitting equipment. It is not too difficult to believe that electronic detecting, receiving, measuring, etc., units will continue to be improved upon and to be extended in upper frequency limits and sensitivity. Therefore, it is conceivable that a modern shielded room must approach perfection in its attenuation characteristics. The assignment was undertaken with that principle in mind.

Guide specifications. 1—Double-wall shielded enclosures can be constructed to obtain the maximum attenuation to interfering signals. Single-wall shielded enclosures are not as effective as the double-wall type.

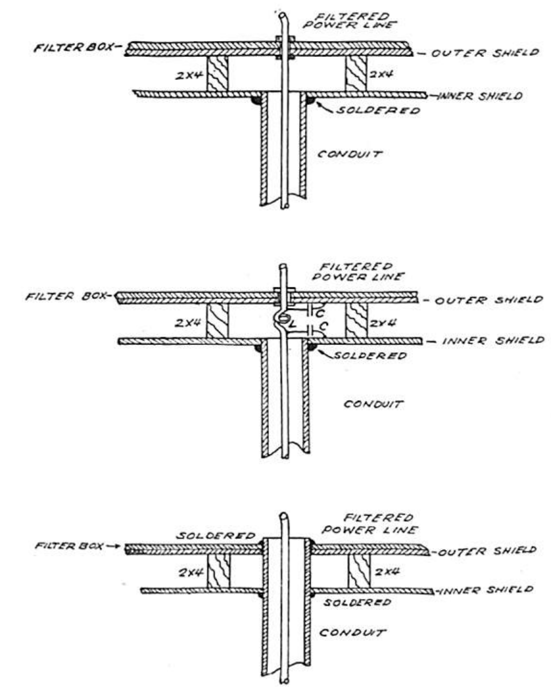
a—Double-wall shielded enclosures with each shield wall separated and supported by standard 2- x 4-inch lumber, well seasoned and moisture-proofed, are currently in use. Where available, dressed white pine or aircraft spruce (well seasoned, dry- and moisture-proofed) is most suitable for frame construction. The wood can be moisture-proofed by first drying, then immediately applying shellac, varnish or lacquer.

b—The mounting centers or spacing of the frame members will be determined by standard construction practice.

c—The metallic connection between the inner and outer shield wall is critical; the details will be covered in a later paragraph.

2—A continuous, electrically uniform, high-conductivity, corrosion-resistant metal must be used for the shield walls to obtain maximum attenuation to interfering signals. Soft copper or aluminum are both suitable for the purpose; however, copper is preferable because of its workability.

a—Continuous-shield walls can be constructed of



Filtered power line entrance to shielded room.

continuous-metal sheeting formed from soldered or welded standard commercial sheets. Shield-walls constructed of relatively thin sheet-copper material are best suited to the purpose. The required mechanical stability primarily determines the thickness of the sheet material. Shielded enclosures constructed of sheet copper (with soldered joints), with ventilation and light ports covered by copper screen wire, have satisfactorily attenuated interference signals in excess of 10,000 megacycles.

b—Fabric-backed, metallic-foil, climatic, insulating-sheet material has been successfully adapted to the construction of shielded walls. This material can be lapped and soldered. The attenuation characteristics of this more fragile material are the same as for the copper sheet. This material is recommended where the cost or weight are major considerations.

c—Soft-copper screen wire of 16 to 22 mesh can be used for shield walls; however, sheet copper is more effective as a shielding material. Copper-screen rooms will satisfactorily attenuate interference signals up to approximately 1,000 megacycles.

d—Galvanized hardware cloth can be used to construct shielded enclosures where inexpensive shielding is required for frequencies below 100 megacycles. Hardware cloth with a 4 x 4 mesh has been used in some temporary installations.

3—Where construction permits, all lighting, electric heating, ventilating fans, etc., should be mounted external to the shielded room. The power and number of power lines entering the shielded room should be kept to a minimum.

a—Where the shield room is constructed of sheet material, the ventilation and light ports can be covered with copper screen, wire-soldered at the joint between the screen and the sheet.

b—Non-metallic service, such as air hoses, etc., can be brought into the shield room through waveguide sections. Cylindrical waveguide having a length equal to three times its inside diameter will act as a high pass filter with a sharp cut-off characteristic to any signal having a wave length greater than twice the inside diameter of the waveguide. Rectangular waveguide is also adaptable to this purpose. The waveguide filter section must be soldered to either the inner or outer shield wall. In one installation the generator of a motor-generator set was installed inside the shielded room with the motor adjacent to the generator and external to the shielded room. The motor and generator were coupled by a non-metallic shaft extending through a waveguide filter section.

4—All of the power fed into the shielded room must be effectively shielded and filtered to attenuate interference signals carried by the power lines.

a—A special, static-shielded, isolating transformer is used to "interference-isolate" the shielded room from the general power system. The transformers are of a special design and are commercially available.

b—The complete line-filter is usually designed and assembled for the particular installation, and is mounted in a specially designed and constructed shield box. Commercially available line-filter units are sometimes used alone, or better, assembled in cascade with additional microwave filters. In any case, each and every line entering the room must be adequately filtered beyond the expected interference frequency range.

c—The transformer and filter unit must each be separately mounted in copper or brass shield boxes, preferably of double wall and lid construction—a box within a box. The bottom is common to the inner and outer box. Serrated, phosphor-bronze sealing-strips between the lid and the wall, soldered to either the lid or the wall, assure a bonded fit.

5—Figure 1 illustrates the three general methods for feeding the power lines from the filter output into the shielded room. In Method C, the conduit forms the ground connection between the inner and outer shield wall.

6—All of the entrance conduit and shield boxes, etc., are to be bonded to the outer shield-wall at the entrance point to the shielded room. This bond, usually soldered, must be continuous and flexible at all mating surfaces.

7—The power-distributing circuit inside the shielded room must be in conduit and outlet boxes. The conduit and outlet box system is preferably constructed of copper or brass, continuously bonded to the inner shield wall of the room.

8—All of the friction joints, such as doors, etc., must be sealed with strips of serrated, phosphor-bronze material. Some engineers have used non-serrated, commercial, door, weather-stripping material, with excellent results. These wiping contact strips are either mounted and soldered around the door frame or around the door. Care must be exercised so that no metallic contact exists between the inner and outer shield wall at the door.

9—For maximum attenuation at all frequencies, there must be only one ground contact or contact between the inner and outer shield walls. The grounding strap must be short, heavy, and bonded to adjacent points on the inner and outer shield walls. One portable screen room was constructed where a number of metallic contacts existed between the inner and outer shield wall. Satisfactory results were claimed up to 1,000 megacycles; however, no measurements were made above that frequency.

10—A copper sheet of not less than 0.025 inches in thickness should completely cover the bench top surface in the shielded room. There must be only one ground contact between the copper sheet and the inner-shield wall.

11—Use a solder with a minimum tin content of 50 percent for all soldering. Do not use an acid-based flux; if a flux is necessary use resin-core solder or resin in alcohol.

12—Where existing pipes are in the way of shielded room construction, those pipes may be covered with shielding material and the pipe shield soldered to the inner wall.

13—Miscellaneous:

a—The nails used to fasten the shield wall material to the wood frame must be of the same metal as the shield wall. The nail heads must be soldered to the shield wall. The nails from the inner wall must not come into contact with the outer wall or the nails from the outer wall.

b—Any number of iron nails can be used to secure the wood frame members. The frame nails must not come into contact with the metal shield.

c—The door hinges are preferably of brass or copper, soldered to the shield wall and the corresponding door shield.

d—The door catches are preferably of brass or copper constructed on the "dog" principle.

e—While assembling or constructing a shielded room, either continuous or frequent megger readings between the inner and outer shield walls are necessary to quickly locate and eliminate stray contacts between the shield walls. The condition of the wood will largely determine the final megger reading, prior to establishing the ground bond between the two walls. This reading will be in the vicinity of 50 to 100 megohms.

f—Required, concentrated, high-level illumination can be secured by installing small light fixtures at the bench.

A very comprehensive engineering report by Mr. H. B. Dunlap detailing screen-room construction practice at the San Francisco Naval Shipyard is available to activities which request it. Address inquiries to Commander, San Francisco Naval Shipyard, Attenion: Electronics Officer.

H. B. Dunlap

Harry B. Dunlap received a degree in electrical engineering from the University of Cincinnati in 1940. He was employed by the Cincinnati Gas and Electric Company from 1940 to 1942. In April, 1942 he accepted a commission in the U.S. Naval Reserve, immediately being called to active duty. After receiving electronics training at Harvard University and M.I.T., he served as Electronics Officer on a CVE. On separation from active duty as Lieutenant E(T) in 1946, he joined the Electronic Engineering Section here at the San Francisco Naval Shipyard.

WFA-1 INDICATOR LAMP TROUBLE

On certain Model WFA-1 Echo Ranging-Listening-Sounding Equipments, the 1/4-watt neon indicator lamps I-901, I-902, I-903 and I-904 on the local and remote range recorders remain lighted even when the supply circuit to them is open. There appears to be sufficient capacity coupling between conductors in the cables running from the forward torpedo room to the conning tower to keep these lamps burning. The lamps can be made to operate properly by shunting them with 51,000-ohm resistors. These resistors will have no adverse effect upon the equipment.

ERRORS IN MODEL SX INSTRUCTION BOOK

Ships 379, the instruction book for the Model SX Radar Equipment, contains an error in figure 2-29. Resistor R-3409 should be shown wired from the grid of V-3401 to ground ahead of C-3405.

This book was prepared for the four pre-production Model SX Radar Equipments furnished under Contract NXsr-76195. It is also used as the preliminary instruction book for the production Model SX equipments furnished under Contract NXsr-[illegible]53.

Due to the fact that late changes were made in the equipment design, there are undoubtedly a number of other errors in this instruction book. These errors will be picked up, and correct information will appear in the final book for which the manuscript is now being prepared.

The unit schematic diagrams which are furnished in blueprint form and come packed in the equipment spare parts boxes should be consulted where more information is required.

MODEL JT HYDROPHONE MOUNTING BOLTS

A report has been received by the Bureau of Ships that while a submarine was operating at periscope depth at an estimated speed of 14 knots, the hydrophone of the Model JT Sound Receiving Equipment sheared at the upper half of the sound absorbing coupling. Inspection disclosed that the two brass bolts connecting the hydrophone to the sound absorbing coupling had sheared. Close examination of the bolts disclosed that 75% of their cross-sectional areas had previously cracked and oxidized at the break.

Accordingly, all Naval installation and repair activities are cautioned not to substitute brass bolts for the stainless steel bolts originally supplied by the manufacturer. The proper bolts are identified by Symbol H-1201 and RCA Drawing and Part no. 131401-8 in the JT Instruction Book NavShips 900,424(A).

RADAR ANTENNA OVERHAUL

By H. B. DUNLAP

"Say, what do you people do to our radar antennas in the shop, just give them a coat of paint?"

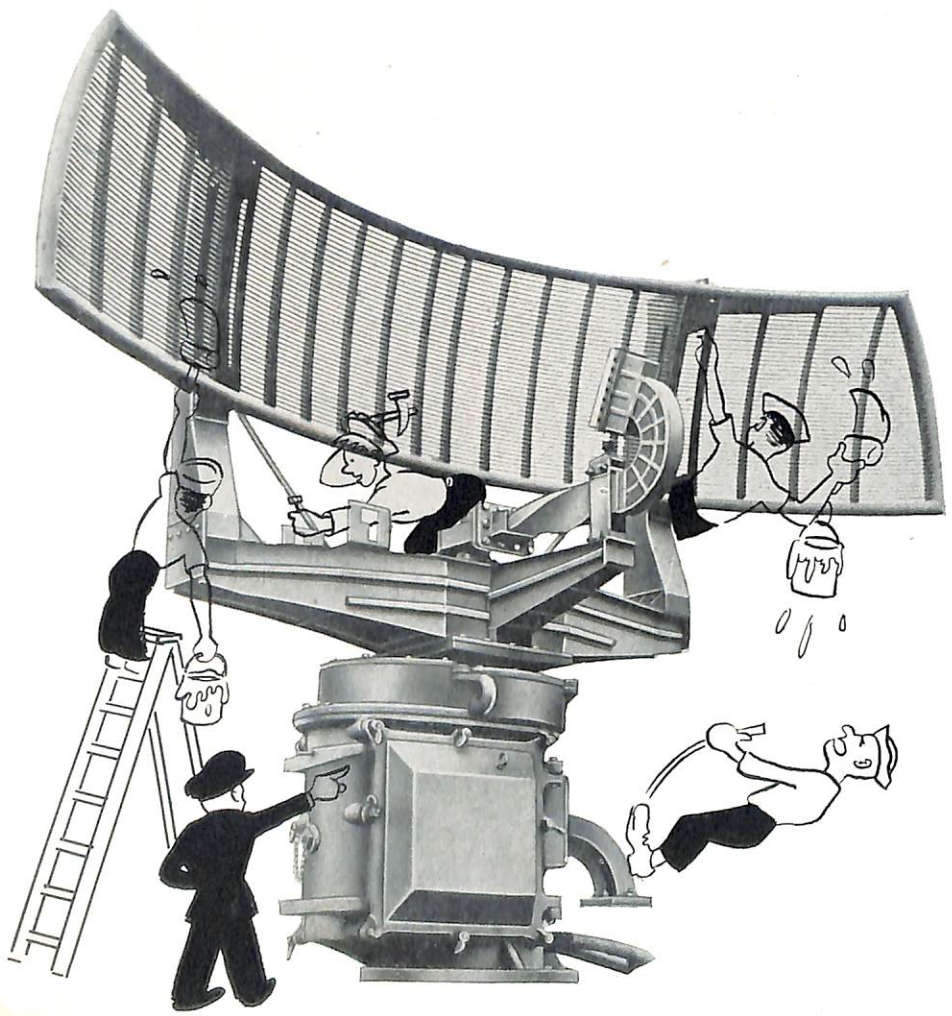
To shipboard personnel who observe a freshly painted antenna being reinstalled on their ship, such may appear to be the case. The shipboard pre-overhaul test and inspection, shop inspection, overhaul and alteration, and final shop test, however, along with the application of accumulated experience by shop personnel and engineers, are among the values hidden under that new paint.

Possibly, too, shipboard personnel are unaware of the extent and number of shops and administrative sections directly concerned with the overhaul of even the smallest of radar antennas. A list of the shops and administrative sections involved is as follows:

X67—Electronics.
X02—Transportation.
X11 & X26—Shipfitters and Welders.
X31—Inside Machinists.
X38—Outside Machinists.
X51—Electrical.
X56—Copper (Coax and Waveguide).
X71—Painters.
X72—Riggers.
Design Section.
Electronic Engineers (Electronics Officer).
Planning Section.
Supply Department.

The formation and institution of the new Electronics Shop 67 (X67) has further provided for improvement in radar antenna overhaul through: 1—the acquisition of permanent, adequate floor space, 2—direct control of personnel, material, and procedures, and 3—improved personnel morale and incentive. In recent months Electronics has moved to the front in the active Beneficial Suggestion Program, a positive indication of increased interest.

The Antenna Repair Division of Electronics Shop 67 recently moved into its newly assigned space in Building 211. This building is directly connected to Building 253 wherein are housed the Electronics Shop Administrative Offices, the Electronics Laboratory, and the Electronics Engineers Office. This new central location of the Antenna Repair Division provides approximately 12,000 square feet of floor space, an increase of nearly 30 times the previously assigned space in Building 251. This progressive move has spurred the development of a modern efficient antenna overhaul shop complete with testing facilities.



Considerable thought, backed up by engineering and shop experience, and practice, has gone into the development of the proposed antenna overhaul shop floor plan. The basic principle underlying this proposal is the efficient overhaul and shop test of all radar type antennas, regardless of size or complexity. Post-shop repairs and alignments are to be reduced to a minimum.

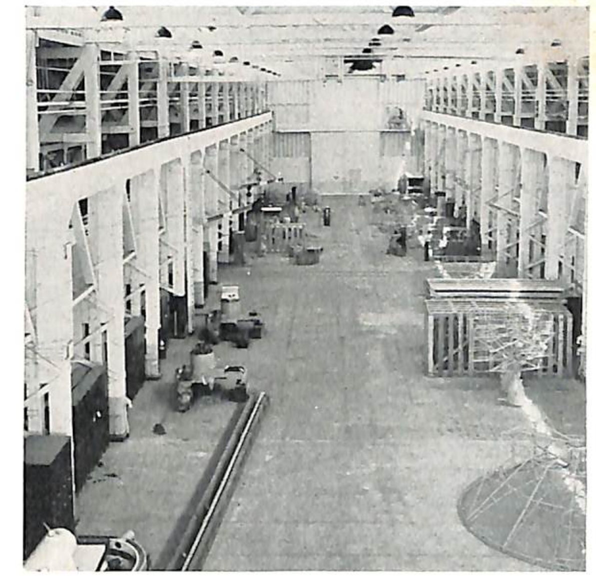
This plan is not rigid, but is rather flexible in nature, always available for the incorporation of new ideas. New techniques will be assimilated as they are brought forth.

With but few exceptions the repair facilities within the assigned floor space will be complete. Electrical motors, synchros, and similar devices will be transported to Shop 51 for test and overhaul. Major machine work will be accomplished by Shops 31 and 38, and, where required, material will be moved to their respective shops. The arrays, coax, and waveguide repairs will be made in the antenna shop by Shop 56, or transported to their shop when necessary. The sandblasting, cleaning, and painting booths are in the same building, adjacent to the antenna shop. The shop and booths are serviced by a traveling overhead crane, adding to the shop efficiency.

A study was conducted of the large number of radar equipments, their antennas and associated units, with the idea of arriving at the best possible test set-up. The servo-synchro control systems, electronic-synchro systems, and direct control systems have been consolidated and combined into a minimum of test controls and associated units. The peculiarities of each equipment's antenna control system will be satisfied by using specific units from that radar equipment: for example, the SU Radar Antenna Motor Generator Set will supply 30 and 115 v, 240-cycle a.c. and 24-v d.c. for testing the SU antenna. The proposed test control panel will be centrally located in the antenna shop. The radar transmitter units and antenna control units will be mounted adjacent to the test control panel. This plan is believed to be more practical and efficient than filling valuable floor space with bulky semi-portable test stands.

In the preparation of the data used in the development of the antenna test set-up, it was necessary to consider all of the available radar equipments, even the so-called obsolete equipments. One can never tell just when another "fleet of SO-1's" will steam into the shipyard. Every type radar antenna from SO's to SX's taken down will be given a complete shop test before it is reinstalled on the ship.

Antennas and test units will be directly controlled at the test panel. Flexible cables will be adapted for transmitting control information, power, and radio frequency from the test control panel and transmitters to the test antennas at the test slab or Scorsby unit. Power, train-control information, metering, etc., will be patched to the multi-conductor test cable at the test control panel. Radio-frequency coaxial-cable-to-waveguide couplers and fittings will be constructed and assembled where required.



Antenna Shop, San Francisco Naval Shipyard. This spacious area is devoted entirely to the renovation of all types of radar antennas. A paint spray booth has been installed to handle the largest radar antennas. Two large cranes on tracks run the full length of the shop.

The alignment of limit switches, checking of circuit continuity and slip ring contacts, etc., requiring the use of portable ohmmeter test equipment, will be conducted as in the past. Much of that testing is preliminary to the final shop operational test, anyway. The electronics engineers assisted by shop personnel will conduct the testing.

For assistance in the shop-zeroing of antenna synchros, it is planned to inscribe a "bearing reference mark" between the reflector and pedestal prior to the removal of the antenna from the ship for overhaul. This calibration can be accurately accomplished for narrow beam surface search antennas by establishing the relative radar bearing of the shipyard surface calibration target. The relative bearing of the surface target from the ship can be obtained visually through the use of a telescopic bearing circle and pelorus. The wide angle beam air search antennas will be aligned on the bow before inscribing the "bearing reference mark." This procedure will help to reduce to a minimum the "stick climbing" required during the ship operational test and calibration time after the overhauled antenna has been reinstalled on the ship.

The final shop test, conducted under nearly actual operating conditions, will be thorough and complete. The shop personnel will assist the engineers in this testing. The following list brings forth the extensiveness of the test; it is necessary to:

1—Test the radio frequency transmission system, especially the rotating joint or coupling.

2—Compare the electrical operating characteristics of the motors against the manufacturer's data.

3—Check the electrical operation and characteristics of the synchro units.

4—Check the alignment and control exercised by the synchro units.

5—Check for quietness and smoothness of mechanical rotation.

6—Test operation of heater units.

7—Test for air leakage in the pressurized, coaxial transmission-lines.

8—Check the operation of the personnel-safety devices.

9—Note "touch-up" painting required.

These operations are already being independently follower in the testing of repaired antennas. Later, they will be consolidated as the new test set-up is installed.

The overhauled antenna reinstalled on the ship is better than new in all respects. The completeness of the repair, correction of chronic defects, alterations, and field changes assure that newness.

BULLETIN FOR F.C. NO. 25—QGA & NO. 8—QGA-1

The field change bulletins for Field Change No. 25—QGA and No. 8—QGA-1 entitled "Replacement of Transformer T-409 with Reactance Tube Modulator" contain several errors and should be changed as follows:

1—Page 9, Line 8 and Page 11, Line 28—Change "smaller reactance" to "larger reactance."

2—Page 18, Figure 4—The note should refer to R-442 instead of R-422.

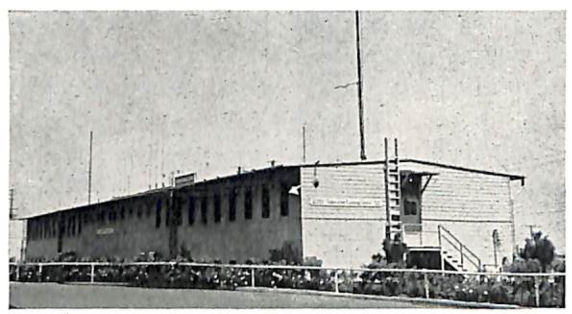
3—Pages 23 and 24—Change R-422 to R-442. Change R-422 (Alt.) to R-442 (Alt.). Change Contractor's Part No. from 1000S-204 to 1000S-376.

NAVAL RESERVE ARMORY AT SAN FRANCISCO NAVAL SHIPYARD

By T. A. Carr

In line with the shipyard's slogan, "Our Sole Purpose Is to Serve the Fleet," the San Francisco Naval Shipyard went "all out" to provide adequate facilities for Naval Reserve training and was among the first to complete work on an armory. A former barracks building immediately adjacent to the main entrance to the shipyard was designated the Naval Reserve Armory. Extensive remodeling of the building resulted in well-arranged administrative, recreational, work, and drill spaces. Four organized divisions of the Submarine Reserve occupy and use the armory.

The electronics installation occupies one complete wing of the upper or second floor. Coordination of procurement and installation of equipments were accomplished by the Procurement Officer from the Director of Naval Reserve Training Office, Treasure Island, and an Electronic Specialist from the Shipyard Electronics Office. All shops and activities normally concerned with shipboard electronics installations



USNR Armory Bldg. 104, San Francisco Naval Shipyard. One of the first of its kind in the United States.

contributed in their normal manner to the successful completion of the installation. Utilizing Navy equipments and components currently in use, the installation simulates, in all respects, a shipboard installation with its Radio Central, Transmitter Room, Workshop, Motor-Generator Room, and Storeroom. Using standard Navy transfer panels, selector switches, radiophone units, key controls, shipboard cables and cable markings, and receivers and transmitters for all frequencies except the ultra-highs, the installation is flexible and adequate for large-group training.

Sufficient communications equipment is installed to adequately handle normal naval communications channels and amateur communications as well. For disaster or emergency use a TBW-5 equipment is kept in semi-portable readiness.

Inspection of major equipments, procured through normal channels available to the Reserve, indicated that the majority of the equipments were either mechanically damaged or weather-exposed. In order to minimize future repair or maintenance by shipyard personnel, and to assure maximum availability for use, all equipments were completely overhauled by shipyard facilities.

Plans for the immediate future include installation of radar equipments, sonar training devices, and intercommunication systems. Adequate room is available for this and further expansion or alterations in step with the ever-changing electronics picture.

It is felt that the material phase of the program of maintaining the Reserve in a state of readiness is being successfully accomplished at the San Francisco Naval Shipyard.

The Cartoonist

—George F. Bowles

George F. Bowles' talents are a combination of those of an artist, a musician, a singer, and a designer. He was graduated from M.I.T. in the class of 1927. Drumming for the Duke Ellington orchestra added to his musical talents. After five years at Portsmouth Naval Shipyard, he arrived at the San Francisco Naval Shipyard in 1943, where he has been active in the Design Section. It was George who coined the shipyard slogan, "Our Service for Ships Means Ships for Service."

CONDITIONING OF FIELD CHANGE NO. 61—SP

During the initial operation of the 8-foot antenna of a Model SP Radar Equipment recently installed on a U.S. Naval vessel, it was observed that the nutating drive mechanism was noisy. The measured nutating drive motor current was 25 amperes. Disassembly of "Field Change No. 61—Nutator for SP 8-foot Antenna" revealed that the bearings in the waveguide were defective and the grease in the bearings was hard and dry.

A spare nutating assembly was disassembled and the grease in its bearings also was found to be hard and dry. The bearings were cleaned, properly lubricated and assembled in the housing. Field Change No. 61 then performed satisfactorily and the drive motor current measured normal.

Reports of similar difficulties have been received from various activities. The Boston Naval Shipyard Beneficial Suggestion No. 6534 deals with this problem. They found that the nutator drive was very noisy and had imposed an excessive load on the driving motor, effectively preventing the system from attaining its full speed. All attempts to reduce the load by mechanical adjustment

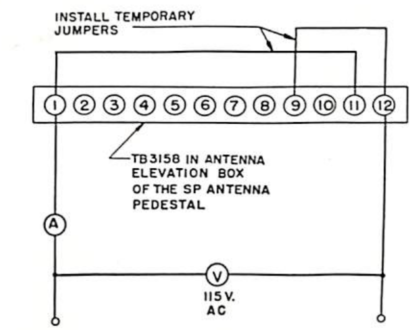


FIGURE 1—*Test connections to nutator motor of Model SP Radar Equipment, as used by Boston Naval Shipyard. Correct mechanical alignment of nutator drive assembly is indicated by minimum motor current at rated voltage.*

failed. After the eccentric assembly was completely disassembled, all bearings were found to be normal. It was noted, however, that the bearings were packed with a heavy sticky grade of grease, which could cause excessive drag on the motor. The bearings were washed out, dried and repacked with the proper grease. This resulted in improved operating characteristics, and the drive system attained its full speed. The final mechanical adjustment was facilitated by the use of a voltmeter and ammeter as shown in figure 1. When the system was adjusted for minimum power input, it operated quietly and smoothly. This adjustment was made while the system was in operation.

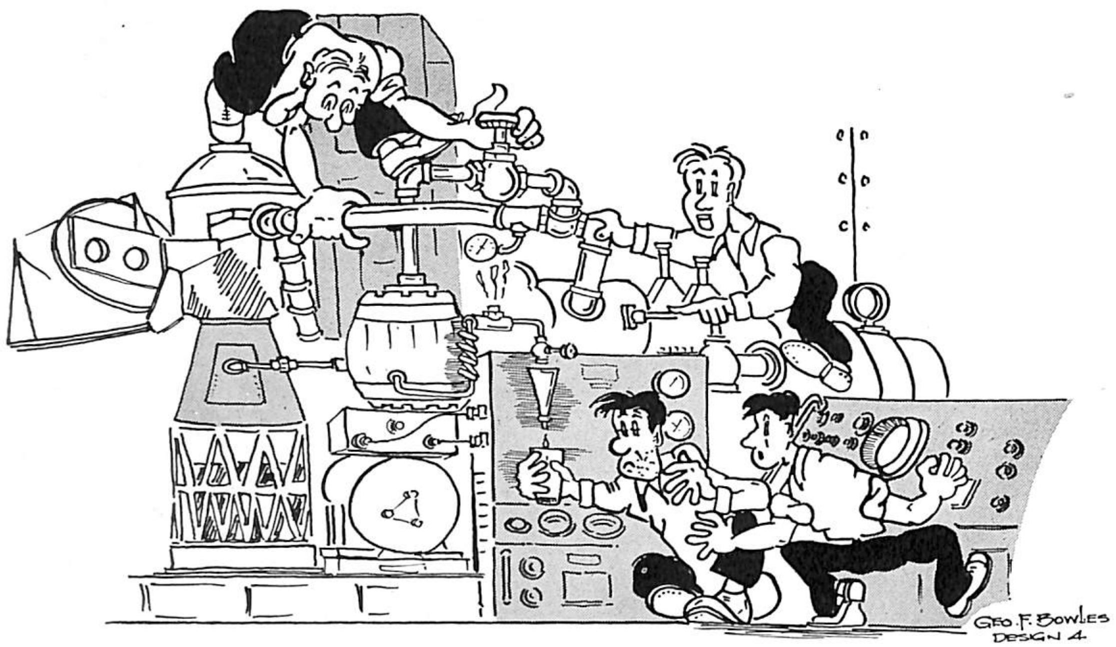
Accordingly, the Bureau of Ships requests that all Naval shipyards stocking Field Change No. 61 check to determine how long the change has been in stock. If it is determined that the change has been in stock for one year or more, it should be removed from stock and conditioned. Included with the field change bulletin is G.E. Dwg. No. W-9076755 (figure 25). The bearings and gears should be cleaned and lubricated in accordance with the instructions of Note 8 on this drawing. The field change should then be reassembled and placed back in stock. Naval shipyards that received this field change from the Naval Supply Depots at Mechanicsburg or Clearfield should inquire from these activities as to the length of time it was held in their stock prior to releasing.

Shop 56—Copper Shop . . . .

By Frank C. Winslow

Just as necessary as abstract mathematics to the proper and efficient functioning of a complicated antenna—and sometimes much more practical—is the skilled craftsmanship of the experienced pipefitters of Shop 56.

The normal staff of Shop 56 assigned to Electronics shipboard work consists of eleven men, a leadingman pipefitter, eight mechanics and two helpers. Past experience has proven the success of this specialty group, which works very closely with the electronics group in Shop 67 and the engineers under the Electronics Officer.



Modification of the SX Antenna

In addition to shipborne work, Shop 56 has journeymen assigned to Shop 67 on a loan basis. These men overhaul, repair and modify dipole antennas, antenna mattresses, waveguide nozzles and anything that "looks like a pipe" on the "mattresses" and "dishpans." Many metal parts are manufactured when replacements are not available.

These specialists do not lose any opportunity to improve their technique. The men of Shop 56 have turned in twelve beneficial suggestions on waveguide and coaxial work and received a reward on every one.

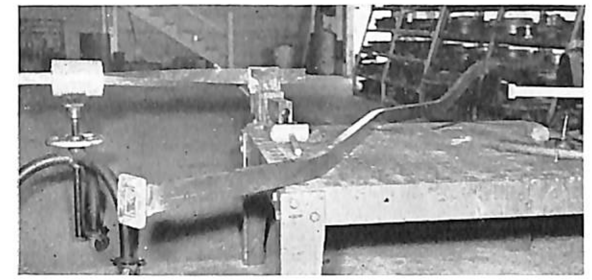
Shop 56 personnel fabricate, bend, twist and install waveguide sections for the following radar equipments: SR-6, SR-3, SG-6, SG-1b, SO series, SU, AN/CPN-6, SV, SS, and also fire control equipment.

Experience has demonstrated that in the fabrication of waveguide a procedure is desirable which will require a minimum of operations and methods and be adaptable for almost all types of bends and twists.

The system used calls for the use of rosin-filled, annealed waveguide. Upon completion of the bending operation prior to removal of the rosin, many sections require a twist or change in the axis of the waveguide to facilitate the completed installation. This is accomplished by securing a clamp to a firm foundation, clamping the pipe with a considerable area of the waveguide in contact with the clamp, and then twisting the waveguide with some type of wrench or lever to the desired angle. Figures Lt. Bailey will illustrate procedures used. The advantage in bending a waveguide with rosin fill, rather than the hollow method of bending, is that the operation can be accomplished with a minimum of operation. "Bend alloy," a patented filler used for this procedure, would serve as successfully as rosin but would not, from our viewpoint, be as economical.

In addition to the shipborne waveguide work, the shop installs, maintains, repairs, and tests all types of gaseous coaxial line.

Antenna repair, modification, and testing in the Antenna Repair Shop of Shop 67 which require Shop 56 services are performed by Pipe Shop personnel assigned on a loan basis to that activity. This arrangement eliminates the possibility of damage, costly handling, and transfer of antenna mattresses beween shops, and permits Shop 56 personnel to begin work immediately after the antenna is received from a vessel without waiting for dis-assembly of the mattress from the pedestal.



Waveguide twists and bends.

A few of the types of antennas worked on are: the SA, SC, SK, SR and SR-a series, including waveguide work on various surface and fighter director radar antennas.

Bend being made by Shop 56 pipefitter.

Many Naval vessels which have entered the San Francisco Naval Shipyard for repairs to their radar antennas and transmission lines can thank Shop 56 personnel, too, for the excellence of the work accomplished.

Shop 56 personnel twisting waveguide.

Frank C. Winslow

Frank C. Winslow has been in the coppersmith game for nineteen years. During this time he has become an expert in the trade through the knowledge he has gained by working in the Pearl Harbor Naval Shipyard, the Mare Island Naval Shipyard, and several leading commercial concerns throughout the country.

He came to the San Francisco Naval Shipyard in 1942, having been selected as Leadingman Coppersmith to take charge of Shop 56. Through a series of promotions he became Master of the Pipe and Copper Shop of this activity in 1944.

In 1945, during the reorganization of Shop 51 (Electrical), Mr. Winslow was appointed Acting Master of that shop in addition to his regular duties. Shop 51 employed about 2500 persons at that time who were engaged in installation and repair of electronic and electrical equipment, fire control equipment, and electronic and electrical instruments. For his outstanding achievement in this position he was given the Distinguished Civilian Service Award by the Secretary of the Navy.

UNSATISFACTORY CAPACITOR IN THE MODEL JT

In the case of high-submerged-speed submarines having a Model JP amplifier of the Model JT Sound Receiving Equipment aboard, 12-μf 450-volt d-c working voltage capacitor C-101 is unsatisfactory because of its low working voltage. Capacitor C-101 should be replaced by a new capacitor bearing the Stock Number N16-C-11692-7 and Type No. 481735-10, and having a d-c working voltage of 1000 volts. These capacitors can be obtained from the Electronics Supply Officer at the Boston Naval Shipyard.

THE ELECTRONICS SHIPS SECTION TRAINS MEN TO SERVE THE FLEET

By J. L. TAYLOR

The Ships Section of the Electronics Officer's organization is ever-cognizant of the rapid growth of electronics in the Navy. The Electronics Officer knows he must make every effort to keep the members of his group well informed in the latest advancements.

This is normally accomplished in two ways: 1—By sending selected members of his group to special schools, some of which are established by the Bureau of Ships and some conducted by manufacturers of electronic equipment under contract with the Navy. These schools are established for the purposes of training professional people in the technical advancements made in the electronics field by the Navy, of acquainting them

The champ in for Fixin'.

with the proper procedures of installation, maintenance, and operation of equipment, and of informing them of the limitations and expected performance of these equipments. 2—By working in close cooperation with field engineers and manufacturing representatives sent to this activity to assist with pilot installations of new equipments.

Upon completion of a school or special training course, the individual is required to hold classes at the shipyard and give lectures to the personnel of the various trade shops, sections and other activities who require or would benefit from the information.

The benefit of this training is passed on to the Fleet in a number of ways. At the request of the Commanding Officer of a vessel, training classes are held for technicians and operators of the ship's company, when ships availability permits, in an effort to familiarize and acquaint them with the unique problems of operation and maintenance of the new equipments installed.

This training program insures that the Electronics Officer's representatives (who help plan and co-ordinate the work during installation or modification, and whose responsibility it is for the final test and calibration of electronic equipment) are well qualified to offer technical advice and assistance to the personnel of any group or trade shop which may find a need for such service. It offers an added assurance that electronics work at this activity will be accomplished in conformance with the highest standards of the Navy.

Joseph Taylor got his start in radio during his high school days. Later, through service with the Bell Telephone, Standard Oil, and Phillips Petroleum companies, he became firmly interested in the subject of electronics and gained a considerable amount of proficiency in it. He entered the Mare Island Naval Shipyard in 1941, quit to go into active duty with the Navy in 1942. Returning to inactive duty with the rank of Lieutenant, he was transferred to the San Francisco Naval Shipyard in 1945. He is now in the Radio Engineering Section where he frequently serves as acting Senior Supervisor.

The champ back in fighting trim.

In addition, a large number of this group are members of engineering societies, such as the Institute of Radio Engineers. Some are members of industrial organizations whose primary function is the advancement of the field of electronics and the dissemination to interested parties of information on technical advancements in this field. Many are taking advanced engineering courses from colleges, while others are radio amateurs. It is with pride in our group, therefore, that we say each man is, through his own chosen means and on his own time, making an effort to improve his knowledge in this ever-expanding field of electronics, that he may better serve. It is a well-known and well-established fact that persons engaged in working in the wide field of electronics are required, in order to keep abreast of developments, to do more study and experimental work on his own time off the job than in any other field of applied science today. This service is for *you*.

When at the San Francisco Naval Shipyard, contact the engineers of Ships Section, Electronics Office, and feel free to use its facilities.

ELECTRIC SUPPLY SERVES THE FLEET

By R. H. CORNELL

In order to carry out the vast construction, repair, and maintenance programs at our Naval Shipyards, attention must be given to three fundamental factors involved in this work. These are personnel, facilities, and material. Without an exacting and proper relationship between all three of these factors, a shipyard cannot function successfully. At the San Francisco Naval Shipyard there have been provided excellent shop facilities for the processing of electronic equipment, and the plant is situated in the midst of an adequate labor market. It is the mission of the Shipyard Supply Department to provide the material for this operation in necessary quantities and at the required time.

Many thousands of specialized parts are needed for the repair and maintenance of Navy electronic equipment. These must be of finest quality, in order to assure continued operation of electronic equipment such as radar, sonar, radio communication, and allied equipment. Such smooth operation is vital to the operation and safety of a ship, and it is obligatory if the ship is to accomplish its assignment successfully.

The distribution of these parts to the Naval establishment in the right quantities and at the required time is a large operation. It has necessitated the setting up of the Electronic Supply Office, Great Lakes, Illinois, charged with the control and distribution of this class of material. This material is known in the supply system as Class 16 material.

Electronics Supply Bldg. 813, San Francisco Naval Shipyard. Home of 40,000 electronic items.

Before a widespread distribution of parts can be made which are as complicated as those which go to make up electronic equipment, it is necessary to develop a language to describe them, a language which will be understood by both technical people and laymen. This language has been provided in the form of a stock numbering system. The Electronic Supply Office has endeavored to describe every electronic item within the system in a catalog, using a prescribed system, or format, showing in an orderly sequence all pertinent information, and listing cross-reference numbers. This catalog, furnished to all field activities, is the medium used to translate material requirements into terms of stock numbers.

At the San Francisco Naval Shipyard Supply Department stocks of repair parts have been set up. These stocks have been arranged according to stock number. They are available to the shop for repairing equipment, and to vessels as spare parts to replace those previously expended for maintenance and repairs. These stocks are automatically replenished by the Electronic Supply Office according to the number of issues made during the previous three-months period.

Interior view of Bldg. 813, Electronics Supply. Packaged parts are on the right; unpackaged spares in bins on the left. Wide aisles facilitate the movement of material on fork lifts and trucks.

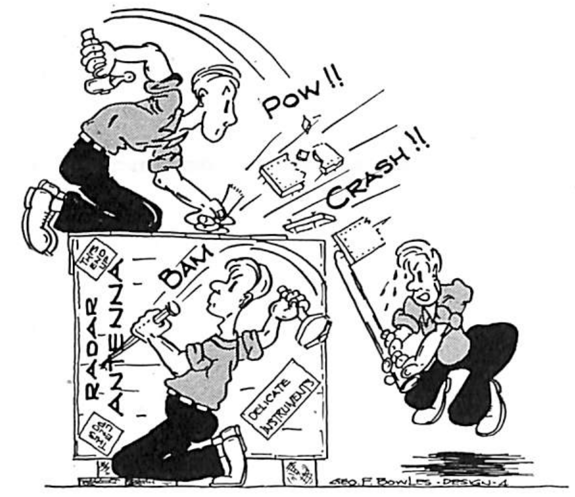
A stock of fast-moving items sufficient to cover a three-months period is maintained in the Electronic Shop and is known as Shop Stores. Here the mechanic will find the ordinary small parts which he must use frequently in his daily work, and may draw these parts from the Storekeeper by signing an appropriate chit. Routine replenishment of these stocks is accomplished by means of a Shop Store Requisition Nav S & A Form 132, whenever low limits have been reached.

Major equipments and components required to accomplish planned overhaul or replacement, as well as items that are used infrequently or those which are not practical to maintain in shop stores, are drawn out of the Supply Department by means of a Stub Requisition, Nav S & A Form M129.

Material required aboard ship is drawn out by means of a Ship's Requisition Nav S & A Form 43. This is the requisition form which all ships should prepare incidental to replacing depleted stocks of authorized spare parts.

Ships cannot requisition Title B equipment, which includes major equipment or test equipment. These materials are supplied by the shipyard Electronics Officer. All of the necessary papers must be drawn up in accordance with instructions contained in the Bureau of Supplies and Accounts Manual, and must show the necessary accounting information, as well as correct descriptions and stock numbers. The completed requests are then presented to the Supply Department, Document Control Section, where they are logged in, and, in the case of ships' requisitions, a folder prepared. The requests are then delivered to the Stock Control Section where they are screened by a technician and preposted to the stock control cards, either for direct issue, or as an obligation against incoming stock. Stocks on hand are issued by the Storekeeper immediately upon receipt of the preposted stub from the Stock Control Section. Steps are taken to procure items not in stock or those for which there has been no previous demand by local purchase or by interim replenishment. Deadline dates are assigned to these procurement requests, taking into account the need for the material and the priority of the work to be accomplished, in order to assure that the material will be on hand at the right time. These items are then considered for routine replenishment at the next regular reporting period in order that they will be on hand in sufficient quantity to meet future demands.

Oftentimes the material is required to meet an emergency condition. Ordinarily, if the part requested is in stock on the shelves at the shipyard, it is possible for a stub requisition to be "walked" through in a matter of minutes. If the part is not in stock, however, then it becomes necessary to procure it by the best means possible to meet the deadline date. First, the local area, which includes S.S.D., N.S.C., Oakland and the Mare Island Naval Shipyard, is canvassed to determine if the part is available. Material in stock at either of these activities can be procured and brought into the shipyard within a few hours after receipt of the stub requisition. If the material is not stocked at any local government activity, a canvass is made of nearby electronic jobbers. Any material on the dealers' shelves and suitable for the job at hand can also be procured under emergency conditions within a few hours. If the material cannot be found anywhere in the local area, requests are forwarded to the Electronic Supply Office, Great Lakes, Ill., for their action. It is not always possible to purchase materials within the required time; at the present time the Electronic Supply Office finds it necessary to forward many of these requests to the Naval Purchasing Office for procurement action. Upon receipt of notification that E.S.O. cannot meet the deadline, a search is made of remaining sources of material. Spare-parts boxes are searched, and every possibility for substitution investigated. If the emergency warrants, it may be necessary to cannibalize new equipments in stock. All of these actions are initiated within the Supply Department, and no further action is required from an activity after it has prepared and presented a requisition. Material received into the Supply Department in answer to these requests is promptly delivered to the person designated on the original request. If, after exhausting all possible sources of procurement, it is not possible to obtain the material or a suitable substitute in time to meet the deadline date, the requesting activity is notified in sufficient time to permit plans to be changed.



The electronics system within the Navy has grown at a rapid rate since the beginning of World War II. The number of repair parts required to support the system has grown from a few hundred to an estimated hundred thousand or more. Many of these are still available only in spare-parts boxes. Many of them have not been identified properly. There are now 40,000 items carried on our shelves at S.F.N.S., however, and it is expected that this quantity will be doubled or tripled as the system expands. Much of the ground work is being carried out at a rapid pace at the Electronic Supply Office with the help of its field activities, in order that all of this material can be made available to fill our requests. In the near future E.S.O. will be able to analyze our requirements and control the stocks in such a way that emergency procurement will seldom be needed. In the meantime, there exists close cooperation between all hands of the far-flung supply activities, in order that our obligation to provide electronic material where and when needed may be efficiently accomplished to better serve you—the Fleet.

R. H. Cornell

Amateur and commercial radio operator since 1916, R. H. Cornell received the degree of Bachelor of Science from the University of California in 1931. He worked as a research chemist in the petroleum industry for ten years before joining the Mare Island Naval Shipyard as a radar inspector in 1942. In June 1944 he was transferred to the San Francisco Naval Shipyard. He was in charge of the Material Section of the Electronic Office when the Electronic Supply Section functioned under the E.O. He entered the Supply Department when it set up the Electronic Branch in 1946. Mr. Cornell has been in charge of the Electronic Technical Unit since 1947, when the Electronic Branch was integrated into the General Supply System.

WFA LIFTING-TUBE PACKING

A submarine, while operating at a depth of 300 feet, suffered a serious leakage of water when the flax packing of the forward lifting tube of the hoist-lower mechanism of its Model WFA Echo Ranging-Listening-Sounding Equipment was blown inboard.

Subsequent investigation disclosed that seven rings of packing had been installed instead of the prescribed six. This additional packing caused the packing gland nut to be held on by only three or four fine screw threads which were stripped by the pressure at 300 feet.

Damage to the packing can also result from the overzealous use of a grease gun. It is recommended that the packing gland nut be unscrewed several turns prior to lubricating the packing through the pressure fitting provided on each of the packing gland assemblies. The packing nuts should then be tightened so that water leakage does not occur when the retracting mechanism is in either the lowered or housed position. Hand tight is usually sufficient.

Planning Tips to the Fleet

By Lt. W. F. Wadewitz

The Electronic Technical Desk, consisting of the Assistant Planning and Estimating Superintendent for Electronics, and two Civilian Technical Assistants, has as its primary function the preparation and pre-planning of the ships' repair and alteration work lists for use by all shipyard departments and shops. The information used in this pre-planning phase is dependent to a great extent upon the accuracy and amount of information furnished by those ships scheduled for an availability. Pre-planning work is begun by the Technical Desk between thirty and ninety days prior to the ship's arrival. This work may include such things as repairs, alterations, conversions, modernization, and re-activation of all classes of naval vessels. It is essential, therefore, in order to accomplish a timely and efficient overhaul, that the ship's personnel submit extensive and accurate information on inventories and condition of equipment.

Upon arrival of the ship at the Yard, the Electronic Technical Desk jointly meets with the ship's personnel to discuss scheduled work as well as recently encountered troubles. At this time additional work is screened, authorizations are made, and a complete investigation is conducted of local design problems or Bureau-handled decisions.

The civilian technical assistants are present and available at all times during the availability to assist the ship's personnel with any problems which may arise. With the completion of the preliminary planning work, their services become available to furnish information or specifications on any phase of electronics. Co-operation between the ship and the Technical Desk is of great importance, to assure the vessel that the maximum amount of work will be accomplished. Remember that this co-operation should not start when the ship first reaches the yard, but several months or more prior to that time.

Keeping this in mind, we know that your ship, with your help, will receive the very best job possible.

★ Submit detailed work requests early.

★ Assign a high priority to all work which definitely must be accomplished.

★ Let it be known if an approved alteration already has been made.

★ Tell the Yard all you know about the origin of the troubles with your equipment, and all displayed symptoms.

★ For additional work during availability, submit supplementary requests as early as possible.

★ Submit S & A Form 43 early enough to allow for procurement of the spare parts which you need.

★ Co-operate with the Yard personnel at all times, before and during the availability. This leads to greater efficiency.

Production Tips to the Fleet

By LIEUT. ELLIS H. AVERILL

The production problems we are confronted with in making electronic repairs or installations do not differ greatly from other types of shipboard work.

The timely, efficient accomplishment of any shipboard work requires a flow of accurate information to permit first, planning and second, scheduling and procurement of material.

To facilitate this flow of information and to further simplify and implement the necessary work on your ship, the following suggestions are submitted:

★ Carefully recheck your IBM inventory against both your allowance list and the equipment actually on board.

★ Prepare a complete list of each component of every unit of equipment on board, giving serial number, exact location and location of main power switch; in this manner you can eliminate delays caused by personnel transfers.

★ Determine and record the status of field changes in each unit of equipment.

★ Complete BuSandA Form 127 on all units of equipment which are scheduled to be removed from the ship.

★ Operate each unit of equipment as much as practicable, particularly underway, and observe the performance of the equipment. Knowledge of the following details is most helpful to the repair activity in determining the extent of work required:

1—Excessive heating.

2—Vibration or noisy operation.

3—Arcing at the brushes.

4—Recurrent bearing failures.

5—Variation of current and voltage readings from normal.

6—Recurrent vacuum tube or other electronic component failures.

7—Specific comments on the condition of all radar and radio antennas.

8—Definite statements on mechanical condition of sonar hoist-train, and all rotating equipments are most desirable, particularly observations made while underway.

It cannot be over-emphasized that early submission of complete details on difficulties encountered in the operation of any unit of electronics equipment are time saving, make authorization more likely, and insure correction within vessel's availability.

★ Upon arrival stow or lock up all loose gear such as extra hand sets, head phones, tools and instruments.

★ Contact your Assistant Repair Superintendent or Ship Superintendent (Electronics) as soon as possible after arrival regarding the progress of the work or any questions concerning shipyard procedure, organization, or other matters requiring attention.

★ Last but not least, make the acquaintance of key yard personnel assigned to your ship, particularly the Ship Superintendent, Electronic Engineers, Quartermen and Leadingmen Electronic Mechanics, Electricians and Machinists.

Tips for the Techs

By C. M. MILLER

Many VJ range helipots are damaged beyond repair because improper installation permits the moving arm to run past the end stops. In replacing this range helipot, R635, use an ohmmeter and follow the instructions given on page 7–15 and 7–16 in the VJ instruction book (Navships 900,829-A). The internal helipot stop and the external mechanical stop must be synchronized to avoid breakage of the internal stop and jamming of the moving arm. Similar precautions should be observed on range helipot replacement in VF repeaters.

If VF phasing-bridge-balance controls need calibration, and an AJ scope is not available, use a 256B A/B range scope for emergency calibration.

Thirty-six-speed servo-system troubles in VF repeaters can be isolated by cutting out the 36-speed systems, permitting single speed operation only. O.S.C. 36-speed can be cut out by grounding terminal No. 52 on E-1309; a ground on terminal No. 19 on E–1306 will cut out the Azimuth 36-speed.

To isolate antenna rotational troubles caused by faulty slewing motors, worn gear trains, defective synchros, etc., or to secure emergency antenna rotation, apply about 1 volt a.c. to the input terminals of the antenna control amplifier for steady antenna rotation.

Low a-c voltages for test or calibration purposes can be obtained from the tube socket filament pins on a tube tester. An adjustable a-c voltage, 0 to 78 volts, can be conveniently obtained from any two stator leads of a test synchro when the rotor leads (R1–R2) are connected to a 115-volt a-c source.

Targets close in to CV's may fade out of the SU radar as the concentrated 3-degree cone beam pattern will be *above* the close targets.

Poor signal response on the SU radar can often be traced to faulty antenna reflector bowl alignment. Excessive looseness between the reflector drive arm and the reflector shaft, caused by wear in the taper pin, can give a droop or boost of several degrees from the stabilized level position. Realign stabilizer and reflector, replace taper pin and tighten lock nut.

Excessive heating of equipments with internal space blowers can often be traced to reverse rotation of the blower.

Burned resistors R109 to R117 in a VJ driver unit may be caused by the grounding of R118's holding clamp to a rivet in the protective cover over high-voltage cable plug, E110. Place insulating material over the rivet or bend the holding clamp of R118 to eliminate contact to rivet and ground.

Beware of false range readings when using a VJ repeater on delay. It is possible to crank in the second transmitter "bang" and second duplicate row of targets if the VJ is operating from a high pulse-repetition-frequency radar, such as the SG or SU. The second "bang" ranges can be calculated from the formula:

$$\frac{10^6}{P.R.F. \times 12.2} = \textit{range, in radar miles;}$$

or, roughly,

$$\frac{82{,}000}{P.R.F.} = \textit{range}$$

As an example, an SG at 1000 P.R.F. will start a second row of targets on a "delayed" VJ at 82 miles.

Loss of power to the SX stable element will cause relay K–3221, the 30-second time-delay relay in the Antenna Control Amplifier Assembly, to be de-energized, stopping the amplidynes and antenna rotation. In an emergency, the relay K–3221, may be energized and antenna rotation restored by connecting a jumper from terminal No. 2 to terminal No. 39 on E–3201 in the Antenna Control Amplifier Assembly. Stow switch S–3706, on the SX Main Control Unit must be placed in the Stable Element OFF position to keep the antenna erect.

Rotational failure of SG antennas can occasionally be traced to an inoperative load-divider (Field Change No. 47) which has been incorrectly connected to a non-vital a-c power source external to the SG supply. One installation, corrected at the San Francisco Naval Shipyard, had the load-divider connected to a galley lighting circuit. Failure of this galley light circuit de-energized the load divider and stopped the amplidyne and rotation of the SG antenna in a dense fog between the Farallones and the Gate, causing the radar technicians much embarrassment.

Several engineering service calls have been made to ships reporting, "no SG antenna rotation." Simple as it sounds, the trouble was found to be loss of gyro O.S.C. excitation and the failure of the operator or technician to change the NORMAL-EMERGENCY switch, lower left corner of the console, over to the EMERGENCY position.

Troubles in the SG driver and "bootstrap amplifier," characterized by loss of magnetron current, can often be isolated as follows: 1—magnetron and modulator high voltage is present if magnetron current meter needle "wiggles" when the variac is rocked quickly; 2—observe the "trigger" pulse on the monitor scope—a vertical trace indicates that the modulation generator is functioning; 3—a brightened spot one third of the way down on the "trigger" trace indicates that the driver unit is O.K. up to the 304th modulator grids; 4—if the brightened spot, usually seen as the knee on a normal trigger pulse and caused by feedback from the 829 bootstrap amplifier, is not visible, the trouble may be between modulation generator and the 829 or in the 829 bootstrap circuit.

As TR tubes age, the tuning plugs will have to be moved progressively farther out in order to reach the cavity-tuning peak. Tubes should be changed at recommended intervals or at least before the tuning plugs have to be backed out completely.

Don't interchange those external cable connections before thoroughly checking lead markers and color code against the "Elementary" and "Isometric" installation prints. In many instances leads and color codes are switched in hidden junction boxes, leading one to believe that mistakes were made in the original installation.

A very useful gadget for radar trouble shooting is a single high-impedance headphone equipped with alligator-clip leads. Sync and video can be easily heard and distinguished. By the use of a 0.01-μ rfd blocking condensor in one lead, sync or video can be followed through coaxial cables, amplifiers, etc., from source to termination. It can also be used for tuning by connecting to the 2nd detector output and peaking for maximum repetition-rate amplitude.

In extreme emergencies, the BM or BO series of i-f-f equipment may be used as a short-range low-power search radar. The calibrated monitor scope will indicate large targets up to 12 miles.

Do not remove the "grease" found in modulator pulse cable plugs, such as that used on the SR, SP, SU, SX radars. This "grease" is a special Dow-Corning No. 4 Compound inserted in the plugs during installation to minimize high-voltage arcing and corona loss.

Some SV radar antenna reflectors are made of aluminum rather than brass. This aluminum reflector should be frequently inspected for small cracks and breaks.

The small micro-switch on the bottom of the SS radar wave guide fitting, located in the periscope well, can cause considerable trouble. This switch will break very easily if the periscope travel is not carefully adjusted.

The R.C.M. equipment can be used to monitor the operation of the ship's radar and i-f-f equipment. The pulse rate, pulse shape, and frequency can be checked. If the R.C.M. equipment is uncalibrated, periodic comparative measurements can be made.

If the i-f-f equipment fails to respond when keying is made from either the SS or SV radar positions, first look for trouble in the Remote Control Relay Box, CN 23AGK. This box contains two relays, one for each of the search radar positions, and there may be insufficient "wipe" to the relay contacts to maintain proper operation.

Stubborn intermittent and fading troubles can often be isolated by applying external heat from a hot soldering iron held close to resistors and capacitors. Any shifts in value or circuit performance will quickly identify the faulty component.

THE ELECTRONICS SHIP SECTION SERVES YOU—THE FLEET

By SAMUEL SLAVIN

The Electronics Ship Section is a group composed of radio, radar, and sonar specialists whose members possess a broad background of radio engineering and a specialized knowledge of specific Navy electronic equipments.

The Electronics Officer is responsible for the accomplishment of all electronics work during a ship's availability in the shipyard or in the immediate San Francisco Bay area and therefore must have qualified electronics personnel in his Ship Section in order to meet assigned work schedules. The time element is usually a very important factor. Due to shortage of shipboard personnel, incomplete work lists, and inventories of electronic equipments on board, it becomes necessary for the Electronics Planning Officer to rely on the Electronics Ship Section to supply all information and necessary details for the planning and preparation of the electronic work schedules, electronic equipment allowance lists, and other allied data. When a ship arrives in the shipyard for overhaul or voyage repairs, the personnel of the Electronics Ship Section are the first to go aboard to test and analyze the condition of all electronic equipments, determine repairs, modifications or alterations necessary, and prepare a complete and concise technical report for the Electronics Planning Officer. This must be accomplished in a minimum of time so that installation plans may be prepared and job orders issued to start work as soon as possible in order to complete the job on schedule. Throughout the overhaul period, the personnel of the Ship Section keep close contact with the progress of the shipboard and shop electronic work, furnishing technical assistance and advice when necessary. They keep in liaison with, and furnish assistance to, the Design Branch in the preparation and subsequent technical review of electronics installation plans. Similarly, they furnish assistance to the Planning and Estimating Branch in the preparation and subsequent technical review of job orders, design requests, electronics workload and overhaul schedules, cost estimates, and advance material planning for ship electronics work. When all shipboard and shop electronics work is completed, the engineers test and calibrate all the electronic equipments and instruct the ship's crew in their proper use if necessary.

Frequently a ship arrives in the shipyard or in the San Francisco Bay Area with an availability of only one or two days but requiring emergency repairs to its radio, radar, or sonar equipment. The engineer from the Electronics Ship Section assigned to the job must quickly diagnose the trouble and personally make minor repairs on board or call in technicians or artisans in order to get the ship on its way.

A review of the qualifications and background of the men in the Electronics Ship Section at the San Francisco Naval Shipyard shows that almost all of the men have been engaged in radio or electronic work prior to World War II. Some were radio engineers in private industry or at Naval establishments. Most of the men have been radio amateurs of long standing; others have been members of the Naval Reserve (Communications Section). About sixty-six percent of the men served in the Navy during the last war and have had the opportunity to receive special electronics training at Naval service schools, such as at Harvard, M.I.T., Bellevue, Treasure Island, and others. Upon completion of the service school courses, they have been actively engaged in the operation and maintenance of electronic equipment on various Naval vessels. Some of the men were members of the Electronics Field Service Group who joined our Ship Section after the close of the war. Others have received specialized training on specific electronic equipment, having previously worked for manufacturers of electronic equipment such as Western Electric Company, R.C.A., Raytheon, and other leading industrial concerns. For more than two years most of these men have been in the Electronics Ship Section of this shipyard, and their special electronic training and experience have proved to be of great value.

When your ship is in the San Francisco Naval Shipyard or in the San Francisco Bay Area, contact the Ship Section for whatever electronics problem you may have. They will assist you in finding a solution to your problem or will refer you to the proper section within the shipyard. These engineers are the Electronic Officer's special representatives in the yard and are here to provide you with a maximum of service and assistance. These men are here to serve you—the Fleet.

Samuel Slavin

Samual Slavin received a B.S. degree in electrical engineering from the University of California in 1927. Engaged in radio research with the General Electric Company, he later was radio engineer with R.C.A. Communications. In 1940 he joined the Radio Laboratory of the Naval Gun Factory, Washington, D.C., as radio engineer in charge of special projects assigned to the Laboratory by BuShips. He was transferred to the San Francisco Naval Shipyard in 1945 and has been in charge of Radar Engineering, Ship Section, since 1946.

ERROR IN MODEL SA ANTENNA BOOK

The "Service Manual for Antennas and Antenna Pedestals Radar Equipments SA, SA-2 and SA-3," NavShips 900,733, contains an error in the spare parts section. Item 39, manufacturer's designation, should be changed from 203-SV (ball bearing) to 203-S-12.

Maintenance and Repair of Navy-Owned Teletype Equipment

In view of the current shortage of qualified teletype maintenance personnel in the field, it devolves upon the operating personnel to make certain preliminary tests to ascertain if the trouble can be remedied locally before calling the teletype repairman.

The routine maintenance and test procedures to be described in this paper are in actual use at some of the larger Naval activities. Although the details may need to be modified to fit a particular installation, the principles themselves are sound. These suggestions may therefore be used as a guide for personnel at any teletype station.

CLEANING

In order to obtain maximum usage from the equipment and to reduce the number of breakdowns in service, a daily routine cleaning should be carried out by the local operating personnel. This routine should include dusting the machine, inspecting and changing the ribbon if necessary, cleaning the type and platen, inspecting the power cord and connections, inspecting the signal lines for any signs of deterioration or damage, inspecting the machine for signs of mechanical wear or damage, and checking tightness of all fuses and plugs. A record of the routine accomplished should be kept in the equipment log. It is important that all the routine maintenance be accomplished without interruption to regular communications. The usual safety precautions for handling all electrical equipment should be observed.

PRELIMINARY TESTS

Before calling a teletype repairman the following preliminary tests should be made by the operating personnel.

Motor or rectifier fails to operate. Check power outlet socket with test lamp or voltmeter to make sure there is power. If power is available, remove the power plug from its socket and check the screw-in type fuse in the back of the machine. To gain access to this fuse, lift the cover off the machine. Be sure to lift the cover straight up until it clears all parts of inner mechanism. The fuse in question will be found in the left-hand-rear corner of the machine. Check the fuse with a continuity tester; if the fuse is bad replace it. If it is good, check the two fuses in the rectifier power unit. To gain access to these fuses, unlatch door of power unit by turning holding screws on cover one-half turn to left with a screwdriver. Check the fuses; if found to be bad replace them with good fuses. If transmitter-distributor motor fails to start, the transmitter-distributor fuse, which is located in the right-hand-rear corner of the Model 19 table, should be checked, and replaced if found to be bad. If power is available at the wall outlet and all fuses check good, call a teletype repairman.

Machine runs open. This means that the machine continues to run when the operator is not typing on the keyboard, but nothing is recorded on the teletype paper. It may be determined whether the local machine is at fault by operating it on "local test." All machines having a rectifier power unit may be operated in this manner.

To operate the Model 15 teletypewriter on "local test," find two patch cords, one with the plug painted red, and one with the plug painted black. These are located under the table. Remove these plugs from the jacks marked LINE and plug them into jacks marked LOCAL TEST. One jack is marked red and one is marked black. Be sure to plug the red plug into the red jack, and the black plug into the black jack. To operate the Model 19 teletypewriter on "local test," put the line switch key in the center position. This switch is located at the left side on front edge of table.

When the machine is set up for "local test," type a few lines on the keyboard. If the local machine runs normal, it may be eliminated as a trouble source. If it still runs open, call a teletype repairman.

If your machine runs normal on "local test," the trouble is probably in the interconnecting cables or in the telephone leases line.

Machine garbles. Proceed the same as for "machine runs open"; if garbling continues, replace the type 215 relay. To gain access to this relay, lift cover straight up until it clears all parts of the inner mechanism. The relay is located in the left-hand-rear corner directly above the power fuse. Pull the relay straight out—*do not rock or twist.* If garbling continues after "local test" call teletype repairman.

If these tests are performed by the operating personnel, a great number of emergency calls for teletype repairmen will be eliminated.

TELETYPE TAPE FACTORY

The "teletype tape factory" is an arrangement of teletype machines whereby one to three identical teletype tapes can be simultaneously made from an original.

The "tape factory" described here is suitable for minor and major teletype relay centers for the purpose of "manufacturing" additional tapes required for multiple tape routing where the "tape recovery" method for rerunning tapes to multiple addressees is not desired. At the Minor Relay Office at Shanghai, where this "factory" was developed, an average of 1900 to 2200 dispatches are passed through the office daily. Approximately 125 require cutting extra tapes at the "tape factory" with an average of 284 tapes cut. Although a maximum of 4 tapes may be produced at any time, including the original, the usual number is one or two additional tapes.

The arrangement consists of two Model 14 typing reperforators (send-receive) and one Model 14 typing reperforator (receiving-only) installed on shelves in a frame, one atop the other, the receiving-only unit at the top. A Model 14 transmitter-distributor is located at the lowest level, just to the right of the framework holding the reperforators. See cuts.

One send-receive typing reperforator adds to the utility of this assembly by allowing tape to be "patched." Two such units are not required and should not be used in this manner where receive-only reperforators are available.

The power supply is located in a cabinet on which the reperforators and transmitter-distributor rest, and consists of an RA-87 Rectifier Unit, plus a BE-77 Line Unit.

A 4-position rotary switch is used to supply 110 v. a.c. to the motors of the reperforators. One side of the supply is common to all motors, the other side goes to the switch. The switch is so arranged that one, two or three reperforators are on at the same time. The motor of the transmitter-distributor is also connected to one position of the switch so that when one reperforator is turned on the transmitter-distributor is also turned on. The 4th position of the switch is the OFF position of all motors.

The selector magnets of all reperforators, the keyboard contacts of the typing reperforators, and the contacts of the transmitter-distributor are connected in series with the BE-77 Line Unit. Therefore, when the transmitter-distributor or keyboard on either of the typing reperforators is used, tapes will be cut by the reperforators whose motors are running.

This "factory" was constructed by station personnel of material at hand in the absence of standard commercial equipment. An old surveyed former British commercial transmitter cabinet was utilized for the supports for the three reperforators. A salvaged metal cabinet was employed to house the RA-87 Rectifier Unit and the BE-77 Line Unit and rotary switch and to support the transmitter-distributor and reperforator mount. Credit is due Chief Radio Electrician W. M. Howell, USN, formerly Electronics Officer at Shanghai and his enlisted teletype maintenance assistant D. P. Ross, SN, USN, for design and construction of this unit.

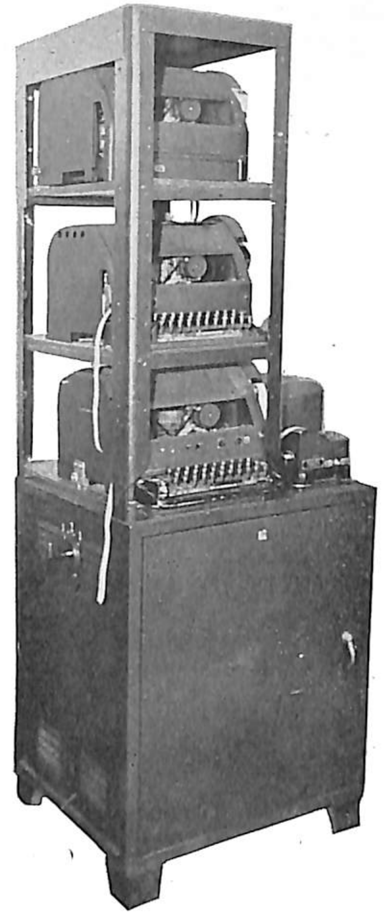


FIGURE 1—*Rack Mounting of "Teletype Tape Factory."*

For offices which might have a sufficient volume of multiple-address traffic a local modification might be made to include a second transmitter-distributor mounted above the present one utilizing two rotary switches, one to transmitter-distributor "A" and reperforator "A" and "B," and the other wired to transmitter-distributor "B" and reperforator "C." This would produce two sets of tapes simultaneously, a master tape and two extras for the lower unit, and a master tape and one extra for the upper.

The commercial tape factory is more flexible and employs up to three transmitter-distributors and three reperforators. It is not readily available to all offices, however, and occupies much greater floor space.

This unit has been in continuous use for about eight months with no difficulties experienced other than the usual normal maintenance of the component parts.

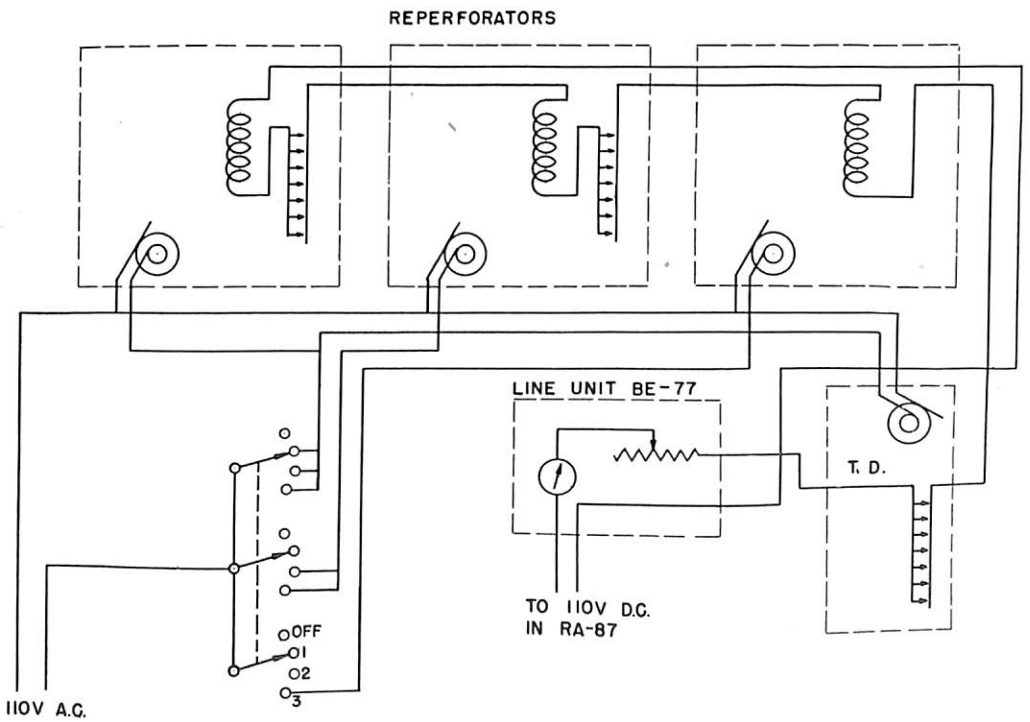


FIGURE 2—*Schematic Diagram of "Teletype Tape Factory."*

Model WFA T.D.M. Training Difficulty

Submarine Signal Company engineers working on the USS *Halfbeak* at the Electric Boat Company report that they found the wrong oil in the reduction gear box of the bottomside training unit CBM-10558 of the Model WFA Echo Ranging-Listening-Sounding Equipment. The oil cans were properly marked "SAE 80 EP" but contained a much heavier oil which had been poured into them by mistake. These Submarine Signal Company engineers estimate that this difference in viscosity of the oil amounts to a ¼-horsepower drag.

It has been estimated that half of all the equipments in the field have the wrong oil in their training gear box, and that all equipments shipped recently have the wrong oil. In all these equipments the gear boxes should be drained, flushed out and refilled with the proper oil. The proper oil is SAE 80 EP (extra pressure), Army Spec. 2-105.

As a matter of interest, it may be noted that the Submarine Signal Company is continuing to work on a change in the design of the motor to overcome the training difficulty encountered with the torpedo detection modification (TDM).

Model SC/SK Replacement Antennas

During the last 18 months of World War II there were an increasing number of failures due to deterioration of the antennas of Model SC/SK Radar Equipments. In an effort to remedy this condition, the electronics divisions of the Bureau of Ships have developed and procured a quantity of stainless steel antennas to be used as a replacement for all SC-series and SK-series antennas.

This new antenna is being furnished in two frequency bands, blue (NT-66ALA) and yellow (NT-66ALB). The blue-band antenna has a Mk 3 IFF orange-band antenna incorporated, while the yellow-band antenna has a Mk 3 IFF purple-band antenna incorporated. A total of 42 blue-band and 41 yellow-band antennas have been distributed to major Naval activities, and are available for immediate use as replacements. Since only 23 sets of grid coils and tuning stubs (11 yellow and 12 blue) were procured originally, it is requested that the present antenna color be retained where practicable.

The antenna pedestal is a new design which improves the accessibility and serviceability of the synchros and gears. A fixed sub-base and pedestal column support the stationary section of the pedestal transmission line, the drive motor, three synchros and a two-compartment gear box. The pedestal shell, which revolves about the pedestal column on an upper and a lower bearing, supports the reflector. The 66ALA and 66ALB reflectors are similar to those in the SK-3 array. They scan in azimuth at approximately 5 rpm with a beam measuring about 22° in the horizontal plane and 40° in the vertical, as compared to an SK-3 beam of 22° in the horizontal and 16.5° in the vertical.

The antenna servo-synchro system is a duplicate of the standard SC/SK antenna with the exception of the antenna drive motor which has a separately excited field. A rectifier power unit (CRP 20AEK) is shipped with each new antenna to supply d-c energy to the separately excited field of the drive motor. All presently installed SC/SK series antenna drive motors, with the exception of the SC-5, have permanent-magnet type fields. The rectifier power unit (CRP-20AEK) is not required when an SC-5 antenna is replaced by a new 66ALA or 66ALB antenna since a similar power unit has been incorporated in the SC-5 control unit. When an SC-1 antenna is being replaced, the 21AAE amplidyne must be replaced with a 21ABU amplidyne.

The following drawings have been distributed to major Naval activities to assist in the installation of the 66ALA and 66ALB antennas:

RE 66J	576A	Outline and mounting
	596A	SC-1 interconnection wiring
	597A	SC-2
	598A	SC-3
	599A	SC-4
	600A	SC-5
	601A	SK
	602A	SK-2
	603A	SK-3

Attention is invited to BuShips confidential letter Serial C-982-790 (982) over C-EN28/A2-11 dated 7 August 1945 in regard to the maintenance of shipboard radar antennas. A quantity of SC-2 and SK dipoles and feedlines have been distributed to major Naval stocking activities for the repair of these antennas. Antennas removed from shipboard requiring minor repairs should be reconditioned as soon as possible and placed in stock for reissue. Miscellaneous parts should be salvaged from antennas that are beyond economical repair. Replacement of antennas beyond economical repair must be specifically authorized by the Bureau of Ships because in some cases weight and moment compensation will be required.

A standard shop procedure is being prepared by the Bureau of Ships for the electrical testing of reconditioned antennas. It is requested that all procedures now being followed by any yard or repair activity be forwarded to the Bureau of Ships (attention Code 982) for evaluation and possible inclusion in the standard shop procedure being prepared.

Synchro Synchronizing Transformer

By Harry B. Dunlap

The synchro unit is extensively applied in electronic equipment, especially in radar systems; therefore the Navy Electronics Technician must be thoroughly trained in synchro theory and practice. Since the subject in general has been very well covered by "United States Navy Synchros, Ordnance Pamphlet No. 1303," dated 15 December 1944, such material will not be repeated here.

It is here assumed that the reader has absorbed the material in OP 1303 and is familiar with the general rules for the zeroing of a synchro-control transformer.

Little has been said, however, about one important but elusive component used in conjunction with 1X synchro-control transformers—the "synchronizing transformer" or "bucking transformer." This transformer is elusive primarily because of its small physical size, coupled with the change in psychological perception one acquires when gazing upon a "nest" of synchro units, servo-motors, gears, etc.

Today, too many ships are requiring engineering service to correct erratic operation of synchro control systems and bearing errors because their technicians are overlooking this important component of the 1X system. A partial listing of typical radar units in which this transformer is used follows:

SP Radar Train Control.
SP Radar Mk 8 Mod 2 Stable Element Train Control.
SX Radar Mk 8 Mod 4 Stable Element Train Control.
SX Radar DG Synchro Amplifier.
Bendix Synchro Amplifier, CM–211103–A.

Figure 1 illustrates a sample connection diagram for a synchro amplifier with the typical connection of the 1X synchronizing transformer in the 1X synchro control transformer rotor. There are slight variations to the location and connection of the synchronizing transformer; however, the end results are the same. The Mk 8 Mod 4 Stable Elements probably have the most difficult circuit to analyze, since those equipments use the 6.3-volt filament winding of the Train Control Amplifier for synchronizing the 1X synchro system.

The primary of the synchronizing transformer is supplied by the synchro phase-voltage (R_1—R_2) of the incoming "S" synchro voltages which go to the stators of the synchro control-transformers. The voltage from the secondary of the synchronizing transformer, usually of the order of magnitude of 1.5 to 7.0 volts, is introduced in series with the 1X synchro control transformer rotor voltage. This voltage is inserted into the rotor circuit to prevent the servo-synchro system from locking-in 180 degrees out of synchronism, or to have the output 180 degrees out with respect to the bearing input. This voltage from the secondary of the synchronizing transformer is sometimes given the name "anti-180-degree zeroing voltage" or "bucking voltage."

Synchro-control systems are frequently aligned by technicians who ignore this "anti-180 degree zeroing voltage," with the result that erratic operation of the controlled radar equipments follows. It is imperative that the electronics technician analyze and fully understand synchro theory and practice and radar synchro control systems before he loosens those three clamps that rigidly maintain a synchro unit in place. Several times on CV's the incorrect alignment of the 1X synchro control transformers in the Bendix Synchro Amplifier and the SX radar DG synchro amplifier have resulted in erratic training of the SX radar antenna and hunting of the SU and SK radar antennas.

The following list comprises some of the more common symptoms encountered where the 1X synchro control transformer has been improperly aligned and the "synchronizing voltage" neglected:

1—Non-equal c-w and c-c-w torque.

2—Non-uniform c-w and c-c-w training.

3—Hunting as ship changes course; frequent loss of complete control.

4—Bearing error. The greatest observed error, five degrees, was found where a Mk 8 Mod 2 Stable Element had been zeroed with neglect of 6.3 volt synchronizing voltage in the train amplifier.

When a synchro control transformer is zeroed, the following rule must be observed:

Where a synchronizing or bucking voltage is inserted in series with the rotor voltage of a synchro control transformer, always measure the algebraic sum of the two voltages, rotating the body of the synchro unit for a minimum meter reading.

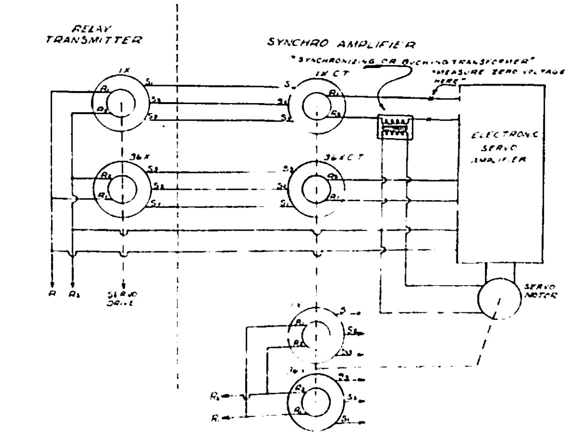
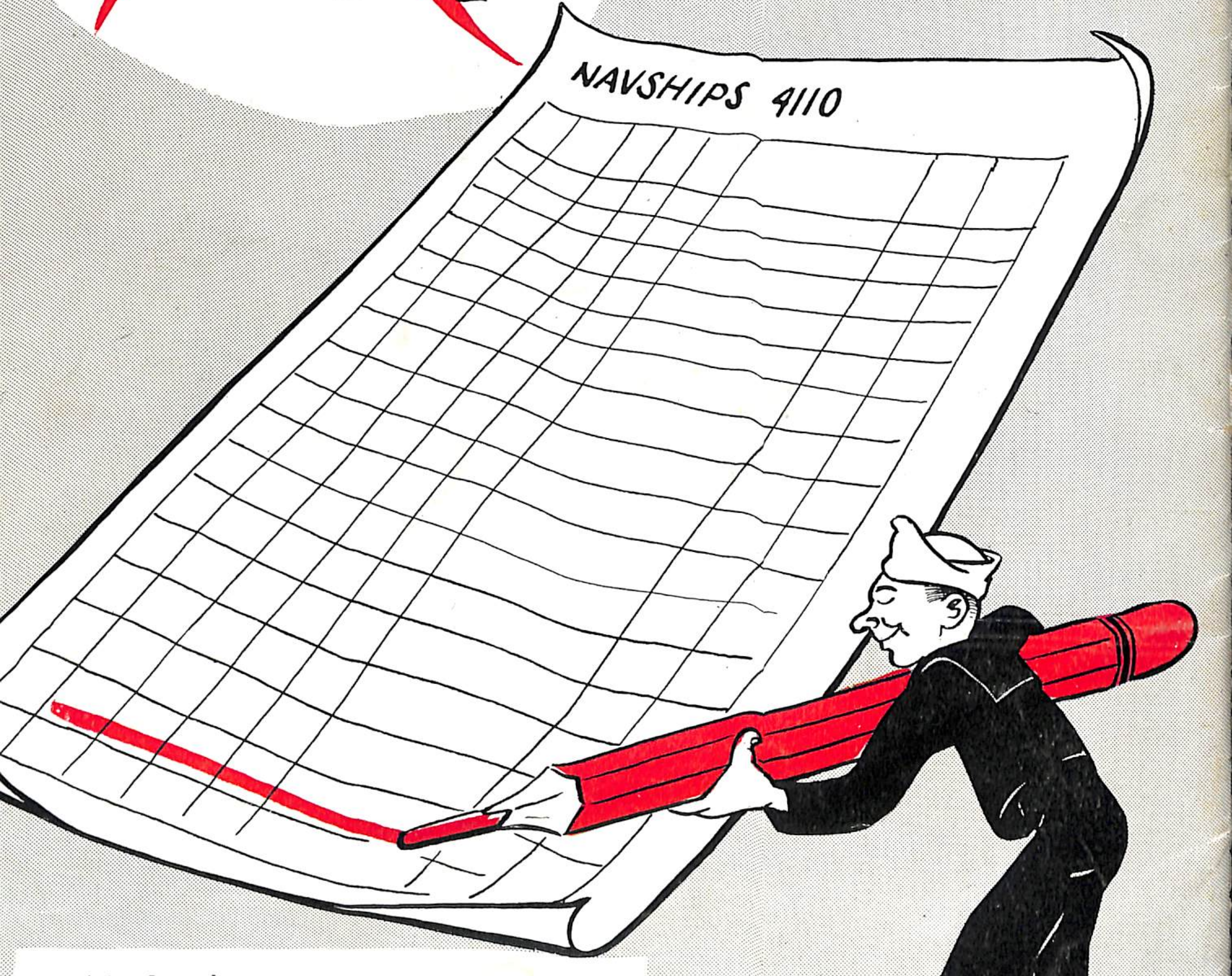


Figure 1—*Typical synchro amplifier connection.*



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