

Radio Set AN/WRC-1

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The Radio Set AN/WRC-1 is a new 2- to 30-mc. ship and shore radio communication equipment developed for the Bureau of Ships by the General Dynamics/Electronics Company. This equipment, including the integral R-1051/URR receiver, has been service-approved and designated as standard by the Chief of Naval Operations. Deliveries to the Fleet are expected to begin this year.

The AN/WRC-1 transmits and receives single sideband (selectable upper and lower sideband), AM (compatible, carrier and upper sideband), CW, independent sideband (simultaneous transmission of upper and lower sidebands with different intelligence in each sideband), and FSK with an internal keyer. It has input provisions for use with external audio multiplex and facsimile keying equipment. The equipment is rated at 100 watts PEP for SSB and ISB, 25 watts carrier power in AM, and 50 watts in CW and FSK modes.

Unskilled personnel can operate the AN/WRC-1 with only minor training. The equipment consists of receiver R-1051/URR, transmitter (exciter) T-827/URT, RF amplifier AM-3007/URT, Interconnection box J-1265/U, cables, shock and vibration mount for ship and mobile applications, publications, and antenna coupler CU-937/UR. The equipment may be mounted in a standard 19-inch rack mounting if desired.

The AN/WRC-1 receives and transmits on 58,000 channels spaced 0.5 kc. apart. The 0.5 kc. increments are derived from a highly stable frequency synthesizer with a stability of at least one part in 10^8 per day. Additionally, the receiver unit includes a vernier control for tuning between the 0.5 kc. increments. This mode is selectable and has a stability of ± 125 cps. The receiver unit thereby provides continuous frequency tuning coverage of the 2- to 30-mc. spectrum.

The equipment is 17-3/8 inches wide, 24 inches high, and 18-1/2 inches deep. Power input may be 115 volts ± 10 percent, 48 to 450 cps., single phase, approximately 400 watts maximum. The receiver and transmitter units can be used independently; for example, the R-1051/URR as a separate

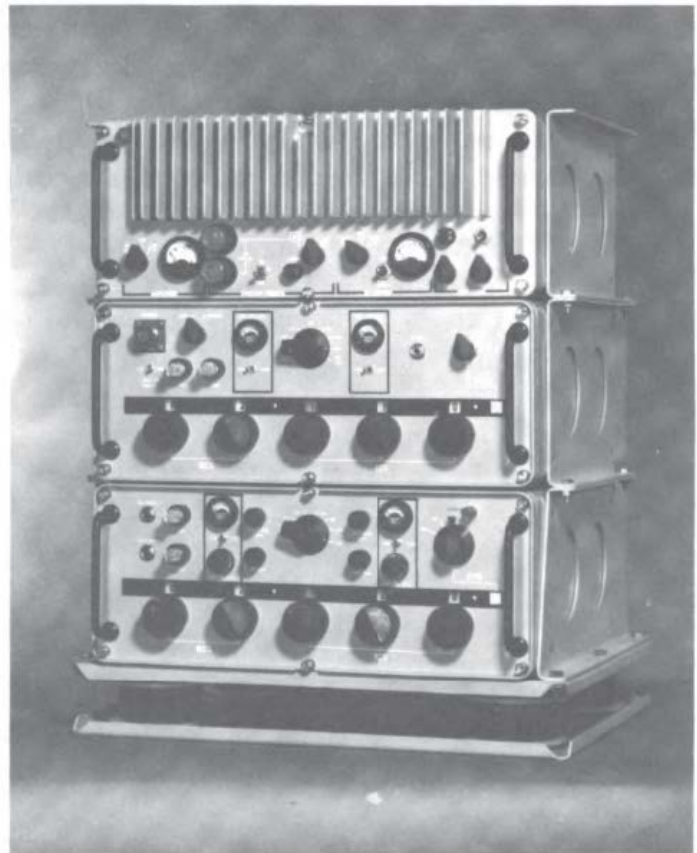
receiver and the T-827/URT for driving higher level power amplifiers. The Bureau is now developing a 1000-watt PEP/average power RF amplifier and automatically tuned antenna coupler for use with this unit.

Advantages

The AN/WRC-1 combines high stability, simplicity of operation, tuning speed, and ease of maintenance. The equipment is provided with digital tuning of frequency selection and is fully tuned upon selection of the desired frequency. This type of tuning contributes to ease and speed of operation while minimizing the possibility of operator error. The operator simply selects the desired frequency, using the front panel knobs, and the equipment is completely tuned in about 5 seconds. No other tuning is required, except for selecting the desired mode of transmission and reception.

The RF amplifier is a linear type with broadband driver and output circuits automatically set by information supplied by the T-827/URT transmitter unit. It is tuned without additional manual

Figure 1. Radio set AN/WRC-1. Top unit: AM-3007/URT RF amplifier; center unit: T-827/URT transmitter (exciter); bottom unit: R-1051/URR receiver.



controls. Reliability is greatly improved by the elimination of servo motors, discriminators, slug racks and variable element circuits that depend on electrical sensing for tuning or manual tuning by an operator.

The output impedance of the RF amplifier is 50 ohms. The output can be connected directly to a 50-ohm antenna or antenna multicoupler system if the VSWR is not greater than 3 to 1.

The associated antenna tuning device, antenna coupler CU-937/UR, is semi-automatic and is installed at the base of the antenna. Controls for tuning this device are on the front panel of the AN/WRC-1 RF amplifier unit. When the operator has selected the desired frequency, information is sent to the CU-937/UR antenna tuner unit for rough pre-programming of the tunable elements. The controls on the front panel of the RF amplifier then provide for fine tuning of the antenna. For highest efficiency, the CU-937/UR unit is used with a standard Navy 35-foot whip antenna, but it may also be used with such shorter antennas as 28-, 25- or 15-foot whips with a corresponding reduction in efficiency. The CU-937/UR and the AN/WRC-1 RF amplifier units are also designed for use with a radio transceiver nomenclatured AN/URC-35.

Internal Frequency Standard

The AN/WRC-1 transmitter and receiver units contain an internal 5 mc. equipment reference frequency standard unit of high accuracy and stability. The equipment can be operated using this internal frequency standard, or, by optional selection, the equipment can be used from an external frequency standard, such as the AN/URQ-9, 10 type if a higher order of frequency stability and accuracy is desired. The AN/WRC-1 also contains internal comparator provisions for use with an external frequency standard for calibration of the equipment's internal standard. If either the transmitter or receiver frequency standard fails, the frequency standard of the opposite unit can be patched over and both units can operate from the one operating frequency standard. The self-contained frequency standard provides an equipment frequency stability exceeding one part in 10^8 per day.

The equipment is mostly transistorized and has only two tubes in each of the receiver, transmitter, and RF amplifier units. As a result, power input requirements are low and the equipment is more reliable. The AN/WRC-1 does not contain any blowers.

The RF amplifier unit, which has the most heat, is provided with radiating fins for convection cooling. The high heat generating tubes are located in a heat sink on the inside of the front panel.

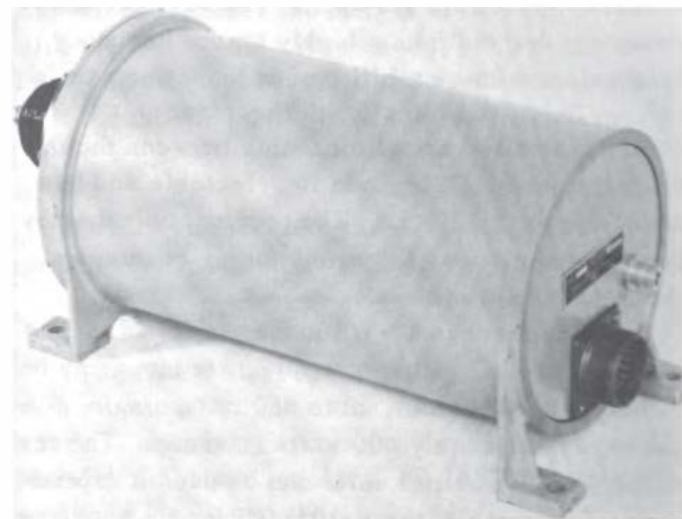
The equipment is of modular construction with plug-in replaceable module assemblies. The modules have test points for localizing a failed unit. Servicing cables are provided which permit removal of the module and attachment of the extension cable so that the module circuitry may be accessible for maintenance purposes with the equipment operating as in Navy radio set AN/URC-32. The Bureau is initiating a module repair and replacement program similar to that provided for the AN/URC-32 equipment.

The AN/WRC-1 is designed for use in the Navy shipboard standard radio remote control system with remote control unit C-1138/UR or similar units. The interconnection box J-1265/U supplied with AN/WRC-1 is intended for bulkhead mounting near the basic equipment. The box permits pre-installation of all external cabling, including main power input, remote control and cables to the antenna tuner. After the basic units are installed, furnished 5-foot interconnection cables can be easily connected from the equipment to the junction box for completed system installation. The front panel cover of the interconnection box can be opened for access to the system interconnection wiring terminal boards. The interconnection box should be installed in a location easily accessible for future trouble-shooting.

Equipment Installation

Installation of the equipment is considered within the capability of the ships' force. Installation costs

Figure 2. CU-937/UR antenna coupler.



are therefore less than for equipment requiring shipyard work.

The equipment has a shock and vibration mounting for use in shipboard or mobile applications. It is designed to improve reliability by eliminating vibration and shock damage to the equipment. For shore installations, the shock mount is not needed and should be returned to the supply system for stock.

The receiver unit is designed with front end protection from damaging high RF power levels from adjacent transmitting antennas. The receiver can use the same antenna as the transmitter by means of an antenna change-over relay in the RF amplifier unit. If the receiver is to be operated on the same frequency as the associated transmitter, the antenna coupler CU-937/UR tuning elements in the circuit can be used for higher selectivity. If the receiver is to be operated on a frequency other than that of the transmitter, the "bypass-normal" switch on the RF amplifier is set in the bypass position. With this setting, the antenna tuning elements are used in transmitting, and the receiver is automatically connected directly to the antenna for reception, without having the circuitry of the antenna tuner in the receiver antenna line.

The AN/WRC-1 was designed to military specifications for the environmental extremes encountered in Naval use. The equipment has protective measures for suppression of radio interference.

FBM System Module Repairs

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"Modular" construction is rapidly being incorporated in a large portion of the electrical and electronics equipment procured for use aboard FBM submarines. Some advantages of this construction technique are: reduced equipment "down time;" reduced maintenance requirements (training, test equipment, and documentation) for the equipment operators; and reduced piece parts stowage and accountability requirements.

To achieve these advantages of modular construction, the logistics "pipe line" must be responsive to replacement modules. Failure of the logistics support system to provide replacement modules when,

where, and as required, compels the ship's personnel to conduct "emergent" repairs. Since "emergent" repairs require test equipment, documentation, skill acquisition and piece parts, the advantage of the construction technique is lost.

Whereas the earlier concepts of modular construction leaned toward the use of mass produced, low-cost, nonrepairable modules, current design trends are toward a concept of utilizing repairable functional modules. Malfunctioning units can be quickly identified and replaced; then repairs to the malfunctioning units can be made in an orderly systematic manner with resultant savings in the cost of purchasing new modules.

In the "pipe line" of the Fleet Ballistic Missile Weapon System are four levels of maintenance: submarine, first level; tender, second level; naval shore installation, third level; and contractors' plants, fourth level. Repairs generally at the first two levels were to be limited to module replacements. Third and fourth level activities were to receive malfunctioning modules from the operating ships through the supply department and make repairs including piece parts replacements. The fourth level was also to provide support for the modules for which it was not economical to acquire and maintain the necessary skills and facilities in a naval shore installation.

Charleston Designated

Early in 1960, Charleston Naval Shipyard was designated as the primary logistics support point

Figure 1. New facility provides special environmental conditions, including temperature, humidity, dust and vibration control required for precision electronics and optical equipment repairs.

