10 lb/hph using a more generous allowance for gears and accessories than has been used on other ships, leaving a payload fraction of 38 percent. The payload fraction would increase if the ship size were to increase; however, the speed would be reduced because of the limited engine power available.

Future Potential

Machinery can be expected in the next 10 years or so which can markedly increase the speed of ships. The prime movers would consist of various combinations of presently available aircraft-type, gas turbine engines and existing and newly developed power turbines. The aircraft engine industry, spurred on by military and commercial aircraft requirements is expected to provide the basic gas generators operating at higher temperatures and improved efficiency. The marine industry will have to support the development of special power turbines, and accessory equipment to adapt the aircraft engines to the marine environment. Reduction gears of lighter weight in large powers will require the development of techniques and machinery to harden and grind large diameter gears. The state of the art will be pushed hard to provide the parallel axis, bevel and planetary gears needed to absorb the power of the prime movers which can be built.

To simplify the propulsion of surface effect ships, water jet pumps will require engineering development and test. For large high speed ships, the large size supercavitating propeller will become a necessity. These propellers will be required in sizes now being used for subcavitating propellers; however, their strength requirements and hence material demands will be more stringent.

A great deal of effort must go into developing knowledge in the field of high speed hydrodynamic flow. Major design problems will have to be overcome in the placing of struts, adapting propellers to varying wake patterns, insuring against stall at inlets to water jet systems, preventing unwanted cavitation, and developing cavitation resisting materials. The coming years will challenge marine engineers to provide the machinery for higher speed ships.

The limited number of ship types discussed does not fully explore the potential of future propulsion machinery; however, with the use of resistance curves in the form of Figures 1 and 2, the fuel curves in Figure 3, and the information on machinery components, a quick evaluation of the potential of other designs is possible.

Adapted from a paper presented before the Society of Naval Architects and Marine Engineers, May 11–13, Philadelphia.

References

1. "A Comparative Evaluation of Novel Ship Types," by Philip Mandel, figure 2, *SNAME Transactions*, Vol. 70, 1962, p. 128.

2. "The Surface Effect Ship in the Merchant Marine," Booz Allen Applied Research, Inc., March 1965, figures 3–17, Clearinghouse for Federal Scientific and Technical Information No. PB167990.

3. "Power Plants for GEM's and Hydrofoils," by Reeves Morrisson, Pratt and Whitney Aircraft Company, presented to SAE National Aeronautics and Space Engineering Meeting, Los Angeles, 1963.

4. "Potential Performance of Gas Turbine Power Plants," by R. M. Marwood and W. H. Prueser, October 1965, SAE paper 650715.

5. *Diesel and Gas Engine Power*, December 1965, p. 7.

6. "Size of Gear Sets," by Darle W. Dudley, *Product Engineering*, November 9, 1964.

7. *Practical Gear Design*, by Darle W. Dudley, McGraw Hill, p. 57.

AN/URC-35 Radio Set

By E. L. Warden

Naval Electronics Systems Command

The AN/URC–35 is a new general purpose hf radio transceiver for transmitting or receiving ssb, am or cw signals in the 2 to 30 mHz spectrum. This radio set has a transmit power capability of 100 watts PEP and is digitally tuned in precise 100 Hz increments as well as having the capability of vernier tuning between 100 Hz steps.

The AN/URC–35 radio transceiver normally comprises an RT–618/URC receiver/exciter, an AM–3007/URT linear amplifier, and a CU–937/UR antenna coupler. Auxiliary items include a C–3697/URC remote control unit, an H–169/U handset, shock and vibration mounts, cable assemblies, and an internal rechargeable battery as an option in place of the 115 vac power supply module.

An accessory converter is also under development to extend the capability of the AN/URC–35 to uhf (225 to 400 mHz). When the AN/URC–35 is used

with the uhf converter, a radio set will be available which provides hf *or* uhf capability in smaller size and weight than typical equipment which has only uhf capability.

Because the AN/URC–35 is compact and rugged, it is well suited for a wide variety of mobile and fixed station requirements. Features which contribute to the application flexibility of the AN/URC–35 include:

- Versatility in primary power source requirements (28 vdc or 115 vac, 48 to 450 Hz)
- Modular construction
- Automatic tuning without servos
- Heat-sink cooling to permit complete sealing of cases against environments and eliminating the need for blowers

Operation

Operator confusion is prevented by a straightforward frequency selection of one knob per digit. Operating frequencies are derived by synthesizer techniques from a highly stable internal standard.

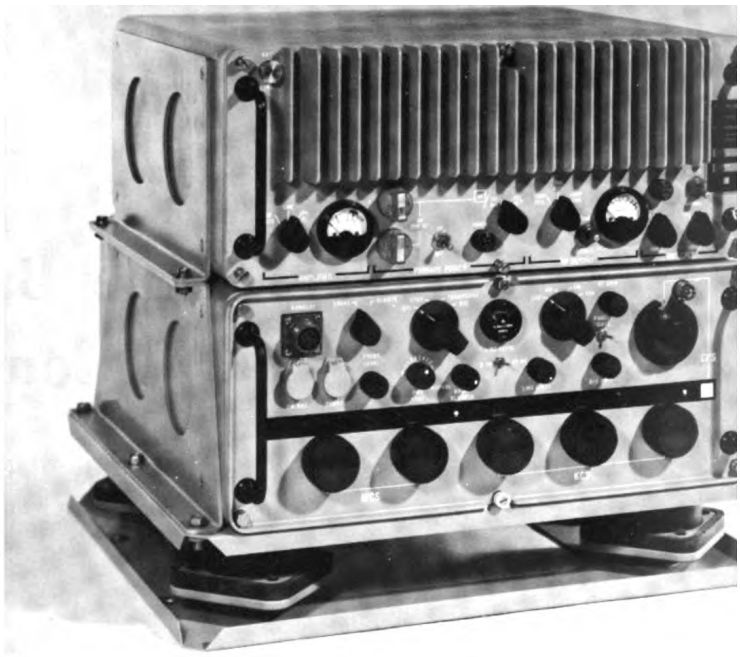
Many of the AN/URC–35 plug-in modules are directly interchangeable with modules from the R–1051A/URR receiver and T–827A/URT exciter

BASIC SPECIFIED CHARACTERISTICS

FREQUENCY RANGE:	2 to 30 mHz
TUNING:	Digitally in 100 Hz increments locked to frequency standard. With vernier control which can be switched in for transmitting or receiving frequencies between discrete digital steps.
MODES OF OPERATION AND RF OUTPUT:	AM Compatible—25 watt carrier SSB—100 watts PEP CW—(800 Hz Bandwidth) 50 watts
FREQUENCY RESPONSE:	±1½ db from 300 to 3500 Hz
TRANSMIT AUDIO INPUT:	30 ohm front panel, 600 ohm remote line; nominal 250 mv at 600 ohms with automatic compression adjusting for levels up to 20 db over nominal.
STABILITY:	1 part in 10^8 per day.
OUTPUT IMPEDANCE:	50 ohms nominal.
INTERMODULATION DISTORTION:	−35 db
HARMONIC SUPPRESSION:	40 db
TUNING METHOD:	Direct digital selection (1 knob per digit) on the Receiver/Transmitter and automatic broadband in the Linear Amplifier.
TUNING TIME:	5 seconds maximum
PA INPUT:	50 ohms nominal 100 mw maximum required for 100 w PEP output.
EXCITER OUTPUT:	250 mw PEP minimum
RECEIVER SENSITIVITY:	Substantially better than 1 microvolt for 10 db $\frac{S+N}{N}$
PRIMARY POWER:	115 ±10% volts AC single phase 48 to 450 Hz or 24 to 32 volts DC external or 24 to 32 volts DC internal battery* *(Optional in place of Internal 115 VAC power supply module.)
SIZE:	Height 35.6 cm (14 inches) Width 44.2 cm (17⅜ inches) Depth 48.0 cm (19 inches)
WEIGHT:	82 KG (180 pounds)* *With AC supply and antenna coupler.

used in the AN/WRC–1A system and other radio systems. Because of the commonality of modules, a substantial reduction in cost of logistic support is expected. A substantial reduction in technical training requirements for maintenance personnel is also expected.

Production model AN/URC–35 radio sets are scheduled to begin deliveries to the Fleet during March 1967. Completion of development and testing of the accessory uhf converter is expected in less than one year.



New AN/URC–35 radio set is compact and rugged for flexibility of application. First production models are scheduled to reach the Fleet in March 1967. An accessory converter for uhf, under development, will extend the frequency range to 400 mHz.

• U.S. Naval Ship Repair Facility, Guam, commended in a Resolution by the Legislature of the Territory of Guam for their part in salvage of the *Guam Bear* after a collision in Apra Harbor. "Despite enormous damage done to the *Guam Bear,* the United States Navy and the United States Coast Guard, acting with utmost celerity, managed to prevent the vessel from sinking in the deep water of the harbor. This astonishing rescue consisted of pushing the vessel onto a sand bar by means of Navy tugs and there cabling it in place, with the result that although the cargo and vessel were badly damaged, the ship did not sink, much of the cargo can be saved, and the vessel may be ultimately repaired and returned to use . . . the people of Guam are again reassured in the knowledge that the Navy and Coast Guard facilities and work force at Apra Harbor, Guam's lifeline to the world, are among the finest in the world, and that nothing will prevent the two services from keeping Apra Harbor open and its facilities in use."

• San Francisco Bay Naval Shipyard, Hunters Point Division, for being commended by the Consul General of Italy in relation to the transfer of two ships, the *F. Morosini* and the *Alfredo Cappellini* to the Republic of Italy. "The transfer project was carried out in an efficient and expeditious manner, thanks to the close and friendly cooperation between the shipyard authorities and the members of the two Italian Navy units."

• Boston Naval Shipyard for receiving a "well done" from Commander, Amphibious Force, Atlantic, for the recent 100 percent on time completion of the *USS Rockbridge* (APA–228) overhaul.

• U.S. Naval Ship Repair Facility, Guam, commended by the Overseas Telecommunications Mission (Australia) for repair work on the *H.M.T.S Monarch.* "*H.M.T.S. Monarch* was in Guam prior to commencing the final cable lay between Guam and Madang (New Guinea) of the SEACOM high capacity coaxial cable communication system which connects Singapore, Jesselton, Hong Kong, Guam, Madang, Cairns (N.E. Australia), and Sydney. The entire system is scheduled for service in March 1967 and you can be assured the assistance rendered by Ship Repair Facilities played a major part in enabling *H.M.T.S. Monarch* to maintain its schedule."

• Philadelphia Naval Shipyard cited by Commander, Submarine Force, U.S. Atlantic Fleet, for the early completion of a recent battery renewal on *USS Jallao* (SS–368). "Request all concerned be apprised of my personal appreciation for their efforts on behalf of the Submarine Force, U.S. Atlantic Fleet."

• U.S. Naval Ship Repair Facility, Subic Bay, commended by COMSERVGRU THREE for work done on *USS Canberra.* "The recent regunning of *USS Canberra* by NAVSHIPREPFAC SUBIC, believed to be the first 8-inch regunning in WestPac, was accomplished in far less time than was estimated by other repair activities. The preplanning and ingenuity which made this possible are a credit to all concerned. Well done."