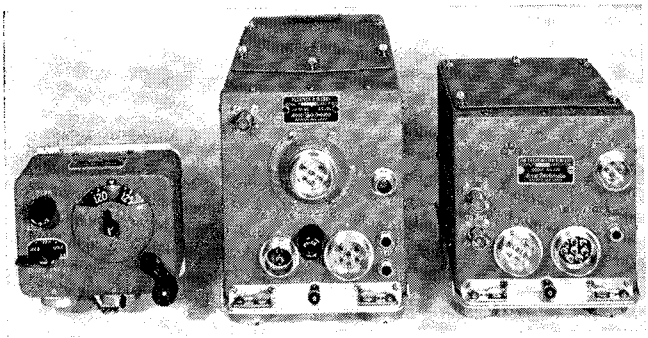


Model XRAV receiving equipment designed for installation aboard a Navy Patrol plane.

the Army Air Corps was the Aircraft Radio Corporation SCR-183. The Navy was using an almost identical A.R.C. set, the GF/RU. Neither was designed for long range communication or navigation. Both were TRF types.

With the advice of a few Navy friends, and a circle of Air Corps cronies that included Carl Spaatz and Hap Arnold (but no federal money) A.R.C. worked out the complete "channel" receiver design in 1935 and 1936. In 1937, Dr. Atherton Noyes was brought from General Radio to design the transmitters.

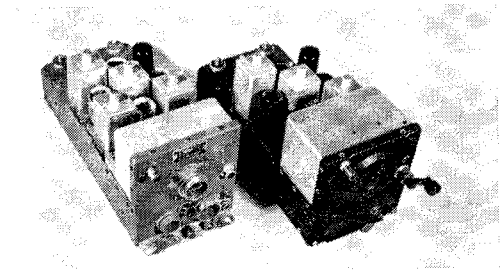
The design established a number of firsts: It was the first superheterodyne receiver to be standardized and widely used in U.S. combat aircraft.

It was the first truly miniaturized military electronic equipment, much smaller than the Model D (SCR-183/GF-RU), and one of the first to use modular, plug-in components. Dr. Drake, Paul O. Farnham, John Johanson, A. W. Parkes Jr., and A.R.C. President Dr. Lewis Hull all worked on the set.

Testing

After 1937, the next five years were spent in testing, improving, and selling the set to the military.

The Navy tested a prototype in 1939, and immediately bought production models starting with RAT (13.5-20 and 20-27 mc receivers) followed by RAV (eight receivers from 190 kc to 27 mc) RAT-1 (24-volt version of the RAT) and ordered the GT/RBD set of receivers and transmitters in June, 1940.



On the left is a post-war v.h.f. Command receiver. Note the smaller tuning capacitor shield and the four 15 mc i.f. transformers. On the right, for comparison, is the familiar R26/ARC-5 (3-6 mc) receiver with three 1415 kc i.f. transformers.

The Army, after suffering a failure in its new crystal-controlled SCR-240 design, tested the type T, but put it aside in 1940 for competitive bidding on command set specifications. Under the urgency of F.D.R.'s 50,000 plane air force, announced in May, 1940, the Air Corps turned to A.R.C. in June, buying the design under the Navy specification, as the SCR-274-N. (The N stood for Navy.)

The British had proved the utility of very high frequencies (known then as ultra high frequency) above 100 mc, in the Battle of Britain, in 1940. The U.S. military then took new notice of the v.h.f. bands, which had been used, until then, only experimentally, although the C.A.A. had been trying v.h.f. for airport control tower use.

Contracts were let early in March, 1941 for v.h.f. experimentation to Western Electric, which had taken over the Army's production of the A.R.C. SCR-274-N, for a v.h.f. component for the command set. The specifications stipulated that the receivers and transmitters fit the SCR-274-N racks, and be compatible with the existing command system, and to use no crystals. Frequencies were to cover the 100-156 mc band.

Western brought in a sub-contractor, Colonial Radio (later Sylvania) for SCR-274-N production, and both companies worked on the v.h.f. design along different, but parallel, lines.

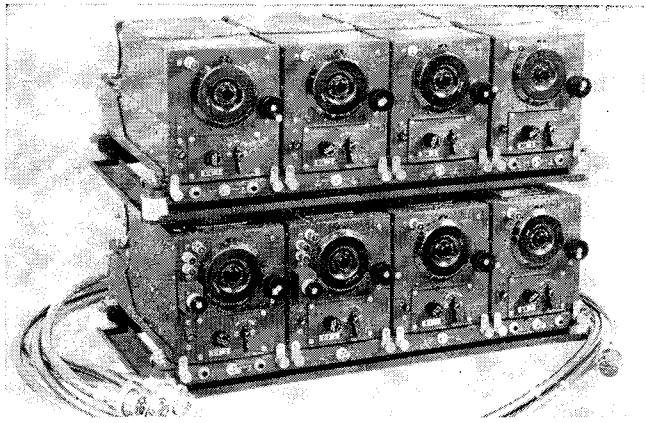
Crystal Control

Bendix Radio was given, at British insistence, a contract to copy the Royal Air Force v.h.f. set. Under extreme secrecy the Bendix Company copied and improved the British design, producing it eventually as a 4 channel crystal-controlled transceiver covering 100-156 mc, under nomenclature SCR-522. The first units went into combat planes in mid-1942.

Bendix also was given a contract to design a v.h.f. set for the SCR-274-N equipment, using frequency synthesis to get multiple crystal-controlled channels with only two or three crystals, since crystals were in extremely short supply.

Fairchild was given a v.h.f. design contract, in July '41, for a non-crystal transceiver.

At Aircraft Radio, production of the early SCR-274-N sets, and conversion to the Navy ATA/ARA, absorbed the energies of the handful of design engineers. Stromberg Carlson, in Rochester, N.Y., was also set up for ATA/ARA



View of the post-war command receiver, transmitter and remote control, type ARC/17, airborne equipment.

production. Engineering in 1942-43 was spent on the improved AN/ARC set, a somewhat better Navy version.

Dr. Drake, who had experimented with v.h.f., and with crystal control, was a non-believer in both. The company pressed on with its own design, and no military interest in an A.R.C. v.h.f. design is recorded.

It was Alanson Parkes, A.R.C. field engineer, who saw a demonstration of v.h.f., at Bellevue. Here, the Navy was testing the Western Electric WE-233-A, an air line set bought for wartime use as AN/ARC-4. Converted to a v.h.f. enthusiast on the spot, Parkes carried the word back to Drake.

Dubious at first, Drake resisted. Design work was already badly hampered by the demands of production. Finally, after demonstrations, Drake was converted. Characteristically, he made the design nearly a one man effort. Without disrupting the work of the Boonton plant he closed himself in his workroom, and six weeks later emerged with a receiver design for a non-crystal v.h.f. receiver.

The circuit was adapted to fit the ARA receiver chassis, by the addition of a v.h.f. preselector. Two stages of r.f. were followed by a 15 mc i.f. output. Use of four miniature tubes in the preselector allowed room for an additional i.f. stage, all in the same receiver unit that had been used for the lower frequency bands.

Dr. Noyes, brought in to work with the transmitter design, helped Drake put a tuneable v.h.f. transmitter into the ATA transmitter shell, late in 1942.

As with any new design, particularly at very high frequencies, initial mechanical and circuit work needed to be followed up by painstaking test and improvement. Under the press of wartime, Paul Farnham, the detail man at A.R.C., was delayed again and again.

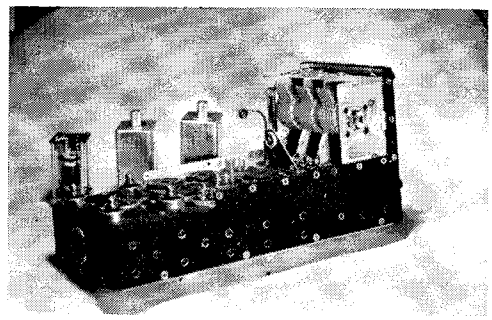
It was late in 1943 before prototypes were far enough along to propose the design to the

Transmitters

0.5-0.8 mc — T15/ARC-5.
0.8-1.3 mc — T16/ARC-5.
1.3-2.1 mc — T17/ARC-5.
2.1-3.0 mc — GTATA 52232, T18/ARC 5.
3.0-4.0 mc — Type K (model), GTATA 52208, BC-696, T19/ARC-5.
4.0-5.3 mc — Type K (model), GTATA 52209, BC-457, T20/ARC-5.
5.3-7.0 mc — Type K (model), GTATA 52210, BC-458, T21/ARC-5.
7.0-9.1 mc — Type K (model), GTATA 52211, BC-459, T22/ARC-5.
100-125 mc — BC-699, BC-950, T23/ARC-5, T-126/ARC-5, T89/ARC-5 Type 15 (civilian) T11, T13, (Military) T-336/ARC, T-363/ARC, T-364/ARC.
125-156 mc — T90/ARC-5.
228-258 mc — TV10-A/ARC-60.

Receivers

0.19-0.55 mc — Type K (200-580 kc) (model), RAV 46102, RBD ARA 46129, R23/ARC-5, R23A/ARC-5, R148/ARC-5, BC-453, Type 15 R-11A.
0.52-1.5 mc — Type K (model), RAV 46103, RBD ARA 46145, ARA-2-46181, R24/ARC-5, BC-946, Type 15 R10A, R22.
1.5-3.0 mc — Type K (model), RAV 46104, RBD ARA 46104, R20/ARC-5, R25/ARC-5.
3.0-6.0 mc — Type K (3.5-7) (model), RAV 46105, RBD ARA 46105, R21/ARC-5, R26/ARC-5, BC-454.
6.0-9.1 mc — Type K (model), RAV 46106, RBD ARA 46106, R22/ARC-5, R27/ARC-5, BC-455.
9.1-13.5 mc — Type K (model), RAV 46107.
13.5-20. mc — Type K (model), RAT 46083, RAV 46108, RAT-1/46108.
20.0-27. mc — RAT 46084, RAV 46108, RAT-1/46109.
100.0-125 mc — R112/ARC-5, R28/ARC-5, BC-942, R13 AN/ARN-30 (108-135 mc) AN/ARC 60 R19 (228-258 mc), Type 15 R15 (108-135 mc), R19 (118-148 mc).
125-156 mc — R/113/ARC-5



Uncovered view of the RAV receiver (circa-1939) which covers 20-27 mc.

Navy, and the tuneable v.h.f. was later pushed into 1944, as crystals became available in larger and larger quantities. By the time the Naval Research Laboratory finished tests, wartime design pressures were easing; the military had decided to use frequencies in the 225-400 mc band, and crystal-controlled sets had become common.

By 1944 the other non-crystal efforts had failed, a reputation that cast a shadow on the A.R.C. work. Fairchild, after three years of work, had abandoned its design. Bendix had dropped its frequency-synthesis plans in 1943. Western Electric had advised the Signal Corps that non-crystal v.h.f. equipment would take three years to build, and had received permission to use crystals in its v.h.f. SCR-274-N. The first prototype of the Western Electric, receivers BC-695 and transmitters BC-699 were rejected.

As finally produced, the Western Electric set (receiver BC-942 and transmitter BC-950) was bought in only token quantities.

Unclassified records show that about 1,000 of the SCR-274-N v.h.f. sets were bought in early 1943, but the contract was taken over by the Navy, which assigned nomenclature R-28 and T-23 ARC-5. Under the Navy type numbers about 22,000 sets were finally bought from Western Electric.

When the Navy tested the Aircraft Radio Corporation tuneable v.h.f. set at Bellevue, in 1944, the lab did not recommend its procurement for Naval aircraft. Under the development contract of 1943, 50 sets were bought, and sent to other military and civilian agencies for test. The Air Force, the C.A.A., and the British supply mission, in Philadelphia, all received samples, along with several of the airlines.

Although it had missed wartime use, the v.h.f. ARC-5 had immediate peacetime applications in the newly-assigned civil v.h.f. frequencies between 108 and 136 mc. The Civil Aeronautics Administration and A.R.C., in 1946, adapted the receiver to the new "Omni" air navigation system and it became the first commercial v.h.f. navigation receiver as part of A.R.C.'s Type 15 system. The Type 15 was also bought by the military as AN/ARN-30.

Although military production of the SCR-274-N and the AN/ARC-5 dropped to a trickle in 1945, and small contracts were signed with the Lewyt Vacuum Cleaner Company and Stromberg Carlson in 1949, 1951 and '52 for a few thousand R-23A low frequency receivers. A.R.C. continued to produce a civilian version of the low frequency receivers in 190-550 kc and 520-1,500 kc bands.

When the Korean war started, these later command sets were widely used in light aircraft and helicopters. The v.h.f. receivers were combined with a light-weight v.h.f. transmitter, and with a u.h.f. "transceiver," or converter system, covering 228-258 mc, under nomenclature AN/ARC-60.

Production of the post WW II command sets continued, at Aircraft Radio Corporation for civilian use, until 1960, when v.h.f. 360 channel crystal controlled equipment became virtually mandatory for U.S. all-weather civilian flying. ■