Bendix Radio in World War II

BENDIX RADIO DIVISION OF BENDIX AVIATION CORP., E. Joppa Rd., Towson. 1937. During the war the company also carried on *operations* in *Baltimore City as follows: 920 E. Fort Ave. - the original Maryland plant and later the machine shop; 213-21 E. Fayette St. - spare parts distribution center; 4000 E. Monument St. - the installation of vehicular radios; 2401 N. Charles St. - manufacturing and assembly; North and Mt. Royal Aves. - repair shop; and 4114 Belvedere Ave. - Engineering and Research Departments. Wilbur L. Webb, director of engineering and research, Edward K. Foster, chief factory manager, Walter R. Hedeman, Jr., assistant to the chief engineer, Arnold Rosenberg, manager of contract sales, Adam E. Abel, chief engineer, and Howard E. Sagers, general foreman, received Certificates of Commendation from the Navy Bureau of Ships. War Department Certificates of Appreciation also went to Edward K. Foster, Adam E. Abel and Arnold E. Rosenberg. Walter R. Hedeman, Jr., received a Distinguished Civilian Service letter from the Navy in addition to a letter of Commendation from the British Air Commission for work done* in *England for the Royal Air Force. Robert B. Moon, section chief, receiver and direction finder engineering, received a Letter of Commendation from the Air Force. James W. Colvin, technical advisor* on *Air Force communications and navigation, was awarded a War Department Certificate of Appreciation and an Air Force letter of recommendation. Irley E. Morrison, field engineer, received a War Department Certificate of Appreciation, and Carl* C. *Bath, research project engineer, was awarded a Medal of Freedom by the Army for distinguished service* in *the European Theater. William P. Hilliard, general manager, received a Letter of Commendation from the Navy Bureau of Ships.*

As peacetime manufacturers of radio measuring devices and of aircraft radio equipment for intercommunication, navigation and landing, the Bendix Radio Division contributed significantly to the war effort of both the United States and the Allied Nations, with relatively little conversion but with tremendous expansion. At the outbreak of hostilities in Europe, Bendix was supplying commercial and military aircraft in the United States, Great Britain, France, Poland, China, the Dutch East Indies and South America with such radio equipment as direction finders, manual and automatic compasses and precision frequency measuring units. With the advent of the defense and war periods the company turned over to the government and to other radio manufacturers the knowledge it had gained in long years of research, including designs, specifications and methods of manufacture. By V-J Day the firm had turned out for the United Nations close to half a billion dollars in a wide variety of vitally important electronic equipment. For its contributions to the winning of World War II, in August 1942 Bendix Radio received an Army-Navy "E" to become the first communications plant so honored and, subsequently, added three stars to the original award.

One outstanding Bendix contribution came soon after the German Air Force smashed Coventry and with it the only factory of Britain's major producer of the radio network control equipment which enabled the Royal Air Force to make the most efficient use of its outnumbered fighter planes. To supplement its remaining production, Britain asked the United States for immediate aid and the Army Signal Corps, in turn, requested Bendix to design and turn out the equipment. After a thorough analysis of the one British test model in the United States, Bendix engineers redesigned the equipment to fit American production methods, made all of the changes

necessary to make the systems interchangeable for both British and American equipment and had models ready for testing within seven months.

Among the items in the radio network control equipment were the very-high-frequency ground units, SCS-2 and SCS-3, familiarly known to Bendix employees as the "Queen" and the very-high-frequency airborne unit, SCR-522, known as the "King George." The first two units - fixed and mobile communication systems for liaison, direction finding and approach control - were the ground station networks for communication, while the third unit was a four-channel, crystal controlled airborne transceiver. Very-high-frequency communications and direction-finding equipment were credited with playing as big a part in the air defense of Britain as all radar gear combined.

Bendix produced tens of thousands of King and Queen units for installation at strategic points in the United States, Britain and combat zones and, in addition, supplied civilian technicians who serviced the units and gave instruction in their use and maintenance in the field. The King equipment was used in air-to-ground and plane-to-plane communications, in control tower operation and in point-to-point communication by teletype and radio-telephone on the land and between islands. It also was installed on small craft and in some tanks. All of the 6000 planes which hammered the coast of southern France prior to its invasion were King equipped. The Queen networks assisted lost pilots to fix their positions and to "home" to their airfields and assisted in guiding air-sea rescue boats or planes to aircraft which had crash-landed at sea.

Other Bendix Radio communications units were standard equipment on many military aircraft, including the Martin PBM *Mariner*. The British manned PBY *Catalina*, which sighted the German battleship *Bismarck*, used a Bendix TA-2 high-powered transmitter to report the information which resulted in the sinking of the *Bismarck*. The unit saw wide service in many of the Pacific naval and air engagements and regularly flew the Himalayas between India and China. Pan-American Clippers on the Atlantic route and Royal Dutch Airway planes flying between Ceylon and Australia also used the TA-2.

The Bendix RA-10 receiver, designed early in 1939, became standard equipment on all Army and Navy planes built by Martin, Vought-Sikorsky, Douglas and Consolidated Vultee, as well as on many British, Russian and Union of South Africa planes and on Dutch torpedo boats. The RA-10 receiver was the first Bendix aircraft equipment to be ordered in quantity.

In 1940 Bendix, in cooperation with commercial airline engineers, completed the engineering model of the RTA two-way communications unit which permitted conversation between ground and plane. Not primarily a military product, nevertheless, the RTA was installed in all planes of the Naval Air Transport Service and the Army Air Transport Command as well as on practically all commercial transports in the United States. Still another Bendix equipment used on most airlines and in the majority of the allied nations' bombers was the automatic radio compass. Consisting of two loop aerials in streamlined housings, two radio compasses, a dual azimuth indicator and remote control devices, the automatic radio compass allowed pilots to plot their positions and courses with little more than a glance at a dial. All of these items and many others of equal importance the Bendix Radio Division turned out from its Baltimore area assembly lines.

Much of Bendix Radio's research and production was highly secret. Even before the war Bendix engineers were exploring the ultrahigh frequency field and, by 1941, had concluded that planes could land safely under conditions of poor visibility with the assistance of microwave ground radar and instructions by radio from ground to pilot. Also a leader in this research was the Radiation Laboratory at the Massachusetts Institute of Technology which set the stage for the first trials in Washington, D. C. Following the test the Navy adopted the Ground Controlled Approach system, and Bendix undertook production of the equipment. The company made all of the Navy's GCA radar during the war and at the end of hostilities installed the first tower-operated GCA at the Quonset, R. I. Naval Air Base. Post-war developments have resulted in an improvement known as the Airport Surveillance System or AN/GPN-2 which gives complete coverage of the sky up to 10,000 feet within a range of 30 nautical miles and, finally, directs the aircraft to a landing.

In cooperation with the Radiation Laboratory of the Massachusetts Institute of Technology, by 1943 Bendix had perfected the AN/MPG-1, a coastal fire-control radar which it produced in quantity. Housed in a trailer van and capable of being placed in operation in a few hours after the selection of a site, the radar could transmit present position data on a given target to a battery command post, where the information was either fed directly into a computer which, in turn, supplied firing data to guns, or was used to furnish data from which a future position of the target could be predicted, all in an amazingly short time. Bendix made numerous such units during the war and, in a complete reorganization of its engineering department in 1945, pointed up a trend, which had begun years earlier, toward turning out mobile systems complete as to antenna, tower, mobile equipment and power unit.

The constant attention of Bendix Radio to research was indicated by a report of the chief engineer that in the fiscal year 1944 consideration was being given to 46 design and development projects while 20 were in progress.

Throughout the war a persistent problem in the entire electronics industry was the development of processes by which delicate equipment would withstand humidity, extremes of heat and cold and the shock of vibration. Bendix Radio laboratories put all equipment through intensive tests which scientifically simulated conditions of actual use. In specially built chambers at the plant, engineers could produce temperatures from minus 50 degrees to plus 70 degrees Centigrade and atmospheric conditions ranging from sea level to the stratosphere. To insure consistent performance under conditions similar to those encountered in flight, engineers also "tortured" equipment in prolonged vibration tests.

By mid-war about 75% of the company's military output consisted of communication, navigation and detection equipment for the Army and the balance for the Navy, all on fixed price contracts, with Bendix frequently reducing costs as production techniques increased in efficiency. During 1944, due to the tactical requirements of the services, some contracts were cut back and others expired. In September of that year production of the Queen equipment ended; in October came a 50% slash in the RTA-1 combination receiver-transmitter contract, a 66% cut in the King George output and a sharp decrease in automatic radio compass production. However, other contracts for old, new or improved items took up most of the slack. In May l944 the company announced the recent receipt of contracts to the value of $20,000,000 and of miscellaneous orders which would average $3,000,000 monthly for some time.

Meanwhile company engineers were developing new and modifying old applications with a view toward postwar production. Bendix applied modifications of King and Queen equipment to the development of railroad radio for train operations and pioneered in this field in conjunction with such railroads as the Chicago, Burlington and Quincy, the Seaboard Air Line, the Sante Fe, the Milwaukee and the Baltimore and Ohio. The company made some permanent installations of such equipment. From equipment perfected in wartime, the company developed two-way very-high-frequency automobile and marine radios which found use in taxicab and tugboat operations. Still another item of research and production was lightweight radio equipment for use in private planes. Toward the end of the war the company set up an assembly line for the mass production of AM and FM home radios, and the research department announced satisfactory progress toward the perfection of color television. Volume for the war years was: 1940 - $4,645,000; 1941 - $29,337,000; 1942 - $119,764,000; 1943 - $116,663,000; 1944 - $64,000,000; and 1945 - $36,000,000 including subcontract figures for all years except 1944 and 1945.

To accommodate the great increase in production, the company tremendously expanded its facilities. Before Pearl Harbor the original Fort Ave. plant took in other buildings across the street plus a warehouse on Orleans St. and the firm acquired an 18-acre tract, later increased to 28-l/2 acres, on the Joppa Road, where, by April 1941, the Defense Plant Corp. completed .a modern plant. Sizeable additions to the structure were made during hostilities, and toward the war's end an entire wing was built along with railroad connections to the Maryland and Pennsylvania line. Floor space in the Maryland plants grew from 143,724 square feet in 1939 to 336,300 in 1941. In 1945 Bendix closed operations in all locations except at the main plant, which, in 1946, it purchased from the Defense Plant Corp. Meanwhile, in order to serve better the concentration of aircraft manufacturers on the West Coast, in 1943 Bendix Radio had opened a West Coast Sales and Service Branch with facilities for installation, servicing, test equipment and a machine shop for the fabrication of standard items in limited quantities.

Employees in 1940 numbered about 700, but at the war's peak approximately 8600, with the proportion of women workers increasing from 30% to 73%. The firm accepted part-time employees who worked four hours to fill in on the three regular shifts and also small groups of professional people who worked on alternate nights. Over 1550 employees entered the armed forces. Bendix employees were active in sending books, magazines and Christmas boxes to servicemen, and employee choruses and amateur shows frequently entertained at nearby military installations. In 1944 the employees presented a complete soda fountain to the crew of the *U.S.S. Chourre*, a tender and repair ship for aircraft carriers, which was commissioned in Baltimore. About 2000 workers, of whom eight were Gallon Club members, donated blood to the Red Cross, the company paying for the time. By payroll deductions employees purchased about $150,000 in war bonds monthly, with about 88% participation, and in June 1945 paid for a Martin PBM *Mariner* with bonds. The Bendix Aviation Corp. also purchased several millions in war bonds through local banks.

Bendix formed a War Production Drive Committee in March 1941 and a Labor-Management Committee later. The firm maintained an employee suggestions program, with a minimum prize of $5.00, and one worker, Mary Vaughn, received a $1000 war bond, together with a War Production Board award of Individual Production Merit. In August 1944 the company received a National Security Award from the Office of Civilian Defense for its plant production program and in November 1945 a citation for its organized transportation plan from

the Office of Price Administration. For reducing its accident frequency rate, the company also received a Certificate of Safety Achievement in May 1945. In 1944 Bendix leased nearby land and sponsored many acres of Victory Gardens.

Early in the war an acute shortage of radio technicians not only affected the production of precision instruments, but also hindered the operation and servicing of equipment in use. Bendix established an education system to help meet this shortage, holding some classes at its plants, laboratories or shops and others at Baltimore Polytechnic Institute, offering courses in radio physics, radio and shop mathematics and engineering courses in radio fundamentals and navigation. Enrollment in the typical month of April 1944 was 361 students, including a group of officers and men assigned by the Air Force for general training in dead reckoning, the use of the automatic compass and other Bendix radio equipment on the B-17 *Flying Fortress.* Between December 1941 and August 1945 employees to the number of 9651 received some formal training. Training other manufacturers for the production of Bendix equipment was another major job, and the company utilized an expanding production line on new equipment to teach the management and workers of its subcontractors. For use at Signal Corps, Air Force and Navy schools and in the various theaters of operation, Bendix technical writers also prepared and constantly revised many training manuals and instruction books relative to the company's equipment.

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