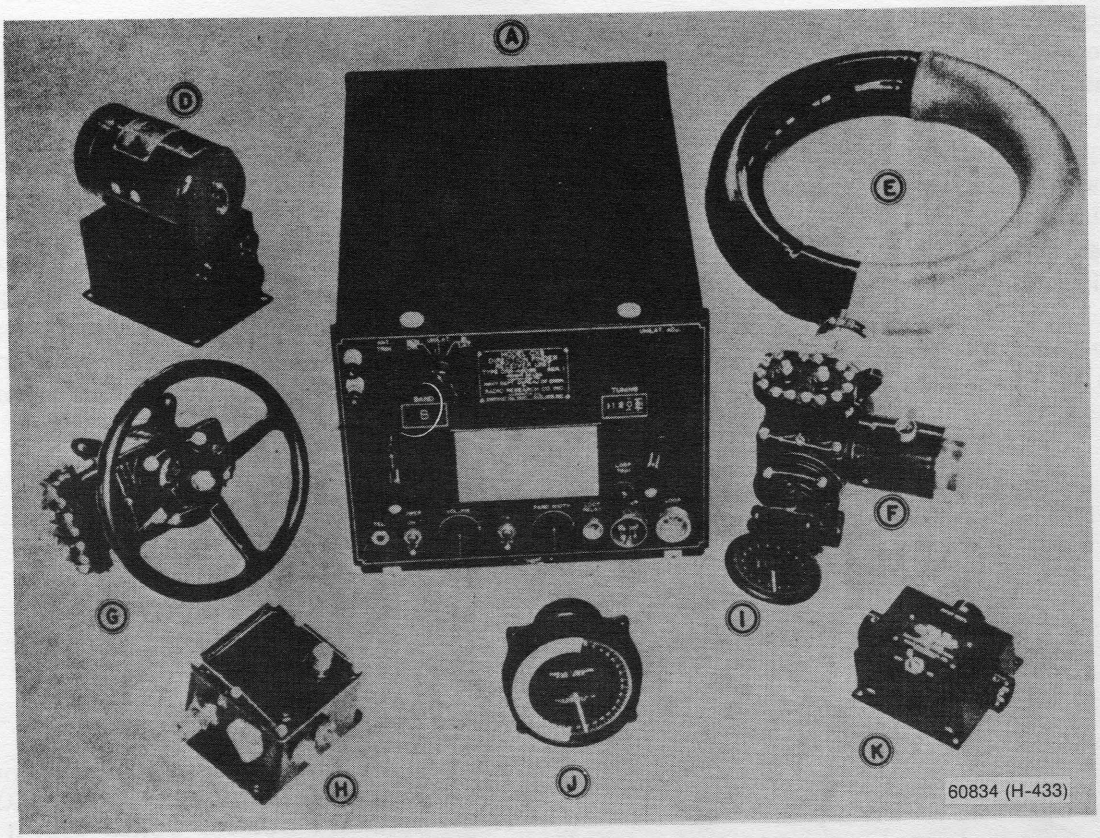


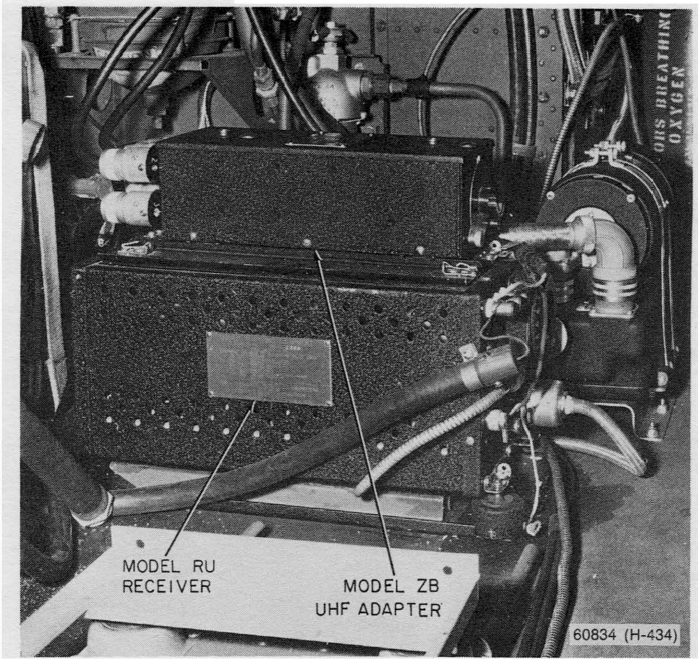
FIRST AIRBORNE RADIO DIRECTION FINDER FOR LONG-RANGE BEARINGS ON VLF—THE MODEL DZ (1939)

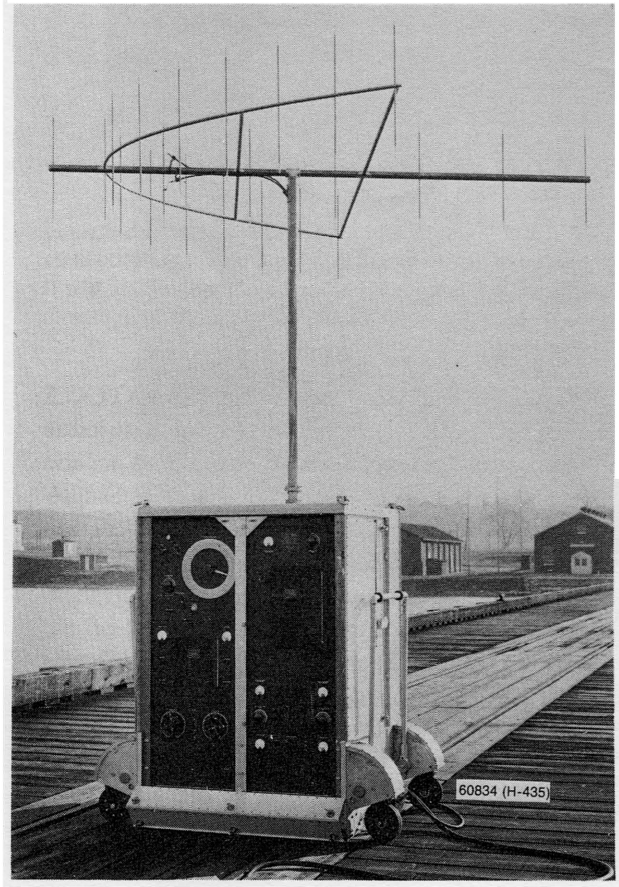
NRL discovered that the large bearing errors due to the "night effect" at VLF could be avoided by selecting the transmissions from stations at proper distances. This discovery resulted in the development of the Model DZ direction finder (15 to 1500 kHz). This direction finder was installed in type PBY and PDM patrol seaplanes, and it was used extensively during World War II in long-range patrols. The loop antenna is shown at E, and the receiver is at A.

The development of direction finders operating at the higher frequencies is treated in Chapter 8, titled "Electronic Countermeasures." When direction finders at these frequencies became effective, the pulse techniques resulting from radar were applied to navigational systems such as Loran, with better navigational accuracy. Thus, the high-frequency direction finder became principally an instrument for determining the position of the source of enemy radio emissions.

AIRCRAFT HOMING SYSTEM

When aircraft carriers first became available, the USS LANGLEY (CV-1) in 1922, the USS LEXINGTON (CV-2) and USS SARATOGA (CV-3) in 1928, there was need for a suitable means of navigating carrier-based planes to and from carriers and air facilities ashore.[21] Single-seat fighter aircraft were equipped with direction finders with fixed loops mounted in pilot headrests or wound around fuselages. This arrangement required objectionable swinging of the planes to obtain bearings. Larger carrier-based planes were equipped with externally mounted rotatable loops, remotely operable by specialists accompanying the pilot. As the performance of aircraft increased, these loops, in the air stream, adversely affected speed and maneuverability. Other means had to be devised. In dealing with



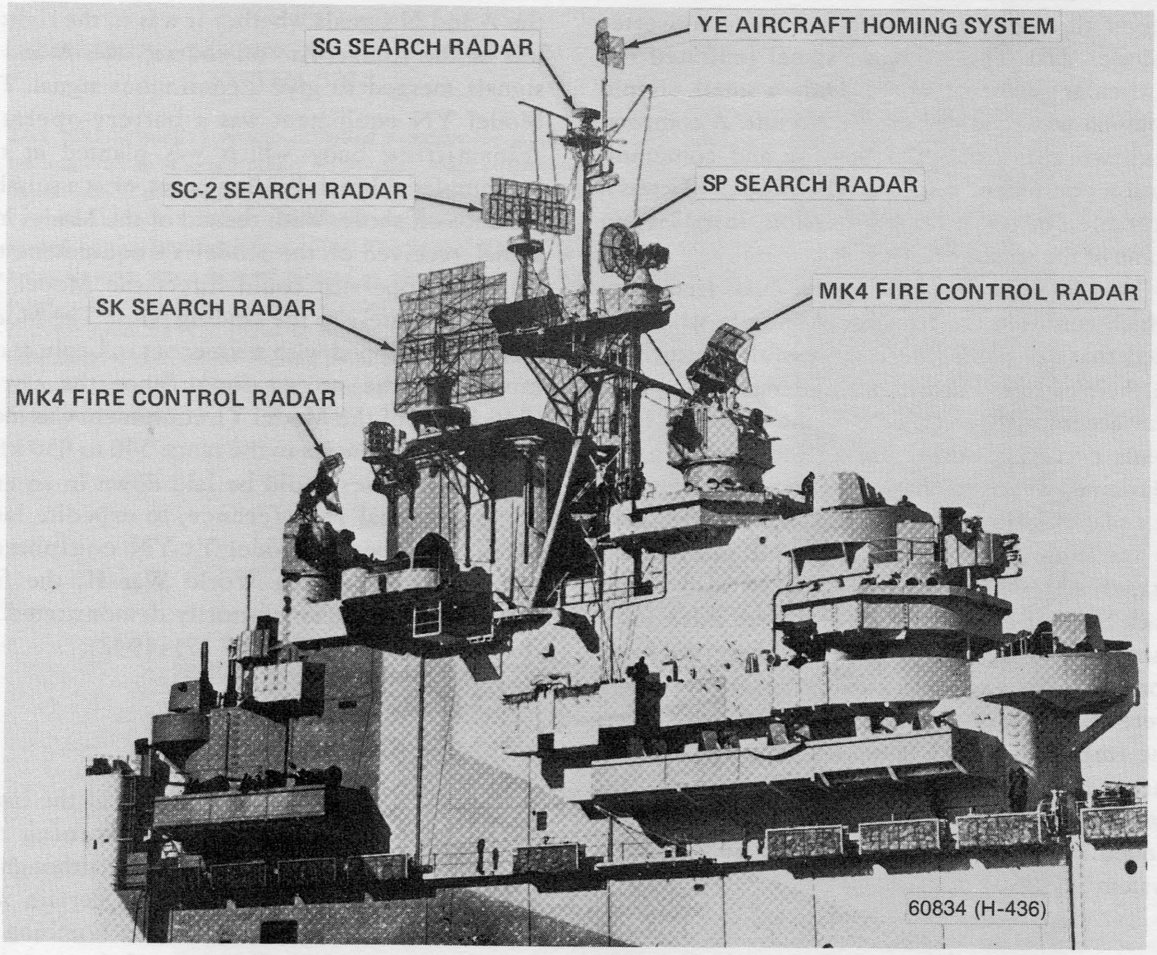


THE PRIMARY AIRCRAFT-TO-CARRIER RADIO HOMING SYSTEM USED BY ALL CARRIERS AND THEIR AIRCRAFT DURING WORLD WAR II
THE MODELS YE-ZB

The experimental model shown here, developed by NRL (1937), comprised the shipboard equipment, the Model YE (lower) and the airborne equipment (upper). For installation aboard ship, the antenna was mounted as high in the superstructure as possible, and the transmitter was placed below decks. The airborne equipment, shown mounted in a type TBF-1 aircraft, comprised the Model ZB UHF adapter and the Model RU high-frequency receiver, which was also used for communication.

this problem, NRL developed an aircraft radio homing system which was installed on all the Navy's aircraft carriers and their aircraft, and which provided the primary means for aircraft to navigate back to their carriers during World War II (Models YE-YG/ZB) (1937).[15c,22] NRL's experimental model was installed on the carrier USS SARATOGA, flagship of the Commander Aircraft Battle Force, then ADM E.J. King (May 1938). After witnessing its performance, ADM King, in a letter to the Navy Department dated 29 Aug. 1938, stated "The acceptability of the principle of a rotating superfrequency beacon for homing to aircraft carriers at sea or landing fields ashore has been fully demonstrated." He made the recommendation, "Adopt the (Model YE) system for primary means of homing carrier aircraft."[23] As a result the system was installed on all aircraft carriers and extensively used during the war in the Pacific.[24]

The system had an operational range out to 275 miles, dependent upon the altitude of the



CARRIER INSTALLATION OF MODEL YE AIRCRAFT HOMING EQUIPMENT

Among the many electronic equipments installed aboard carriers, the Model YE aircraft homing equipment was given top priority, in view of its importance to the safety of carrier aircraft and crews. The installation shown was aboard the USS MAKASSA STRAIT, CVE-91.

aircraft. It was selected after consideration of alternates. However, its development was delayed, since transmitting vacuum tubes producing adequate power at a frequency high enough to provide equipment of a size acceptable for aircraft and shipboard installations did not become available until 1936.

The system included a rotating beam antenna, mounted on the carrier, which transmitted coded signals indentifying twelve equal sectors as the antenna rotated through 360 degrees (Models YE-YG). The signals (246 MHz, modulated by 540 to 830 kHz) were received on the aircraft on its standard Model RU communication receiver through the use of a frequency converter (Model ZB). The strongest signal indicated the particular sector occupied. Only a small, simple antenna was required on the aircraft. A compact, lightweight, combined homing and communication equipment resulted. The Model YG was a portable, lower powered version installed on some of the smaller carriers.[25]

The homing system had a dual frequency which confused the Japanese Admirals, who realized that our planes were successful in returning to their carriers but did not understand how this was accomplished. In one of the reported incidents occurring during one of the battles in the Marianas, where in the waning hours of daylight our planes followed up the stricken enemy nearly to the limit their fuel would permit, most of the planes and their pilots were saved by homing back to their carriers in the dark with this equipment.[15d] The many glowing reports received from combat units and individual pilots whose lives were saved under trying circumstances attested to the importance and value of this NRL development. The British also eventually adopted this system for their carrier aircraft. The system continued in use until it was replaced by the Tacan system in 1960.