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39R06-38 Wide Open D.F.

11-6-51

Purpose

This project is necessary to provide airborne d-f equipment capable of intercepting and obtaining bearings on (a) short duration signals and (b) a multiplicity of pulsed type signals. Present airborne direction finding systems have too low a probability of intercept and/or fail to clearly indicate bearings on the aforementioned types of signals. Direction finders are necessary in order to obtain countermeasures intercept information to facilitate combat air operations.

History

At the start of this project the greatest operational need for an airborne wide-open direction finder was in the VHF band. Therefore, in January of 1950 work was started on the development of the AN/ARD-6 (XB-1). This direction finder which is wide open in azimuth (360° coverage) and in frequency (65 to 85 MC) was completed early in 1951. The component receivers (four matched channels) employ a modified superheterodyne principle allowing full 65 to 85 MC frequency coverage or any portion thereof. The system has an instantaneous frequency analysis mode of operation from 65 to 85 MC. The overall sensitivity is such that field strengths of 500 microvolts per meter provide useful bearings on signals of approximately 10 microseconds pulse width. The AN/ARD-6 has been installed in a P4M-1Q aircraft at Patuxent and about twelve test flights were made by NRL personnel to obtain bearing accuracy (calibration curves) as a function of frequency and maximum range data. The bearing accuracy data obtained during these flights has been compiled jointly by engineers of NRL and the Naval Air Test Center, Patuxent, and has been issued in report form as a set of correction tables for use with the AN/ARD-6. A report in the form of an instruction manual has been prepared describing the operation and circuitry of the direction finder and will be issued shortly as NRL report serial C-3940-181/51 clw.

At the same time as the above effort was being carried out work was also in progress on the development of ~~an~~ interim dipole type d-f antennas for installation and use on aircraft. These antennas were for operation in the 50 to 100 MC and 140 to 280 MC bands with the APR-4 type receiver. The following dipole antennas were developed:

Designation	Nominal Frequency Coverage (MC)	Number Made At NRL
AN/APA-24 x (XB-1)	50 - 100	2
AN/APA-24 x (XB-2)	50 - 100	3
AN/APA-24 xx (XB-1)	140 - 280	1

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The early antenna performance study was made using scale models of the antenna installed at various points on scale models of the PB4Y2 and P4M-1Q aircraft. These models as well as scale models of the P2V and AD aircraft were constructed at NRL. Later tests were made with a 50 - 100 MC dipole installed on a P4M-1Q and numerous calibration curves were measured by personnel of NRL and Patuxent. This data was compiled jointly by engineers of NRL and Patuxent and issued as a set of correction tables for use with the AN/APA-24X.

In October 1950 work was begun on the development of wide open direction finding systems for operation in the microwave region. A high-gain crystal-video type receiver has been developed for use with the rotating antenna type of direction finder such as the AN/APA-69. The purpose of this crystal-video receiver is to provide a wide-open receiver which can replace the AN/APR-9 presently used with the AN/APA-69. The receiver is capable of receiving any signal of sufficient strength within a broad band of frequencies (e.g. 1000 to 10,000 MC). The crystal-video receiver has been designed for the greatest possible usefulness and sensitivity for pulsed-signal operation. A project has been established at Patuxent in order to determine the operational performance of the receiver when used with an AN/APA-69. The experimental receiver was made available to Patuxent on February 21, 1951. Although this flight test data is needed in order to answer certain vital questions which affect future planning and design only two flights have been possible in the 8 months since the project was established at Patuxent. At least two more flights are needed to obtain the essential information.

Work is well under way in the development of a 4-channel wide-open airborne direction finder to cover the frequency range from 2300 to 11,000 Mc. The cathode-ray tube indicator for this system is nearing completion and much of the remaining circuitry has been worked out. Design of the antenna system to cover the complete frequency range has been started and the development of the 4-channel wide-open direction finder is continuing.

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