RESEARCH PROJECT REPORT

ENGINEERING EXPERIMENT STATION · UNIVERSITY OF ILLINOIS

5336

Department of: Electrical Engineering Date: June 12, 1959

Title of Investigation: Research and Investigation on Antennas for High Speed Aircraft

Departmental Contract No.: 46-22-25-314 Sponsor's Contract No.: AF 33(616)-6079

Name, Division, Code No. of Sponsor's Technical Contract Monitor:
Wright Air Development Center
Air Research and Development Command
Attn: WCRCE

Investigator in Charge: Georges Deschamps Annual Budget (Approx.): $100,000

Other Investigators:

P.E. Mayes, W. L. Weeks, J.D. Dyson
P.E. Mast, R. Mittra, Y.T. Lo
D.E. Isbell, C.R. Allen, R.H. MacPhie, C.H. Tang, K. G. Balmain

Est. Full Time Equiv. Persons Employed (including shop, student help, etc.): 11

Number graduate thesis investigations supported by this project: Ph.D. 3 M.S. 3

Summary of (a) objectives, (b) methods used, (c) achievements during year, and (d) present status.
Statement should be brief and suitable for publication.

The general objective of this research is to advance the knowledge of electromagnetic phenomena associated with controlled radiation which is used in a wide variety of communication systems. The products of this effort provide engineers with information useful in the design of antennas for many applications.

Achievements of immense practical import have been realized in obtaining antennas which operate satisfactorily over a much wider range of frequencies than heretofore possible. In the past year investigations in this area have produced two significant new designs: the conical equiangular spiral, which has a broad circularly polarized beam, and the logarithmically periodic dipole array which has a broad linearly polarized beam. These antennas were developed in experimental research and efforts toward their analysis are continuing.

Two projects completed during the past year have provided evaluations of the effect upon the radiation pattern of dielectric in the near field of an antenna. In one instance the dielectric was a coating on a spheroid; in the other case, a thin sheet of finite extent.

Other areas of investigation include the following: coupled waveguide radiators, zoned microwave reflectors, waveguide junctions, antennas with low noise output, antennas with integral distributed detecting action.

Publications published and theses completed during year (give full information — date, volume, page, etc.).
Use back of sheet if necessary. List separately technical and progress reports to sponsors.

P.E. Mayes, D.E. Isbell, R.L. Carrel "Antennas with Periodic and Pseudo Frequency Independent Performance," 1958 National Telemetering Conference, p. 279; June 2-4, 1958. Published by the Institute of Aeronautical Sciences. (This work was partially supported by Boeing Aircraft Co. under another contract.

P.E. Mayes, "The Equivalence of Electric and Magnetic Sources," Mass. IRE, PGAD-6, No. 3, p. 295; July 1958.

R. Mittra, "On the Solution of an Eigen Values Equation of the Wiener-Hopf Type Defined in Finite and Infinite Ranges," 1959 IRE National Convention Record, Part 1, March 1959.

W. L. Weeks, "Phase Velocities in Rectangular Waveguides Partially Filled with Dielectric," Trans. IRE, PGMTT-7, No. 2, April 1959.

(over)

500—3-59—68113

Signed

J.D. Dyson, "Measuring the Capacitance Per Unit Length of Two Infinite Cones of Arbitrary Cross Section," Trans. IRE, PGAP-7, No. 1, PP. 102, January 1959.

J.W. Duncan, "The Efficiency of Excitation of a Surface Wave on a Dielectric Cylinder," Trans. IRE. PGMTT-7,No. 2, April 1959.

Technical reports issued, May 1, 1958 - April 30, 1959

J.W. Duncan, "The Efficiency of Excitation of a Surface Wave on a Dielectric Cylinder," TR No. 32, May 25, 1958. Also thesis of same title.

J.D. Dyson, "A Unidirectional Equiangular Spiral Antenna," TR No. 33, July 10, 1958.

W.L. Weeks, "Dielectric Coated Spheroidal R diators," TR No. 34, September 12, 1958. Also thesis.

P.E. Mast, "A Theoretical Study of the Equiangular Spiral Antenna," TR No. 35, September 12, 1958. Also Thesis.

R.H. MacPhie, "Use of Coupled Waveguides in a Traveling Wave Scanning Antenna," TR No. 36, April 30, 1959. Also thesis.

Progress Reports

"Research Studies on Problems Related to ECM Antennas," Quarterly Engineering Reports No. 10, May 1958; No. 11, August 1958, Contract No. AF 33(616)-3220.

"Research Studies on Problems Related to Antennas," Quarterly Engineering Reports No. 1, January 1959; No. 2, April 1959, Contract No. AF33(616)-6079.