

RAL

DESIGN & DISCOVERY

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RUTHERFORD APPLETON LABORATORY
SCIENCE AND ENGINEERING RESEARCH COUNCIL

Radio Communications Research Unit

Radio communication systems form an integral part of the worldwide Telecommunications network. Their common feature is the use of freely propagating radio waves, which are transmitted over the entire electromagnetic spectrum from very low frequencies to near optical wavelengths. The Radio Communications Research Unit at the Rutherford Appleton Laboratory has concentrated most of its research activity on studying radio wave propagation effects which are critical in determining the performance of both current and future communications and radar systems. In addition, the study of concepts for future land-mobile services using satellites and the development of novel coding and demodulation techniques also feature in the current programme.

The main objective of these propagation studies is the development of models which are necessary to improve the design of radio systems. In most cases this involves an experimental programme followed by data analysis and model development phases. Much of the experimental work is conducted at Chilbolton near Andover, Hampshire where the main installations include a 25 m diameter steerable antenna and a 500 m experimental range.

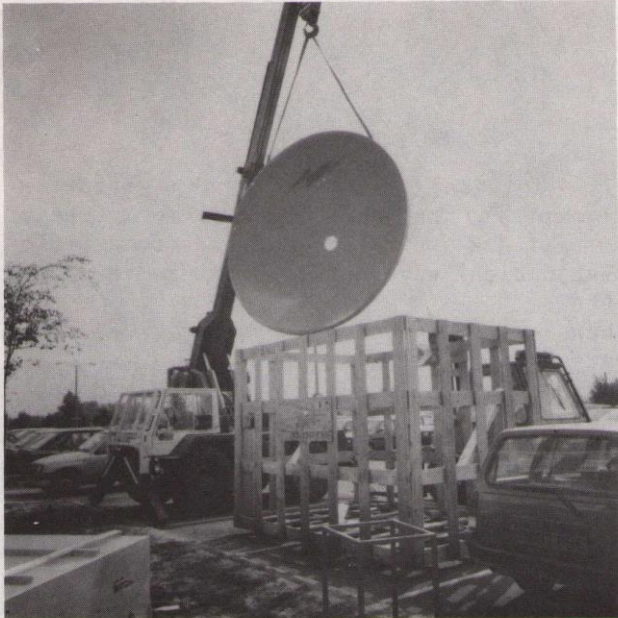


CHILBOLTON ANTENNA

The current programme includes

- Development of high frequency (3-30 MHz) prediction methods.
- Forecasting propagation conditions from ionospheric soundings.
- Measurement of HF fading on medium length paths.
- Development of propagation models for mobile radio systems.
- Studies of satellite based mobile systems.
- Experimental European studies of transhorizon interference.
- Anomalous propagation and diffraction modelling using the parabolic equation method.
- Development of a novel dual polarization radar with cross polar and doppler capabilities.
- Evaluation of the performance of satellite and terrestrial systems using information collected by this radar.
- Development of propagation models for satellite systems.

- Participation in the European Space Agency Olympus project.
- Experimental studies of millimetric propagation.
- Development of millimetric prediction techniques.

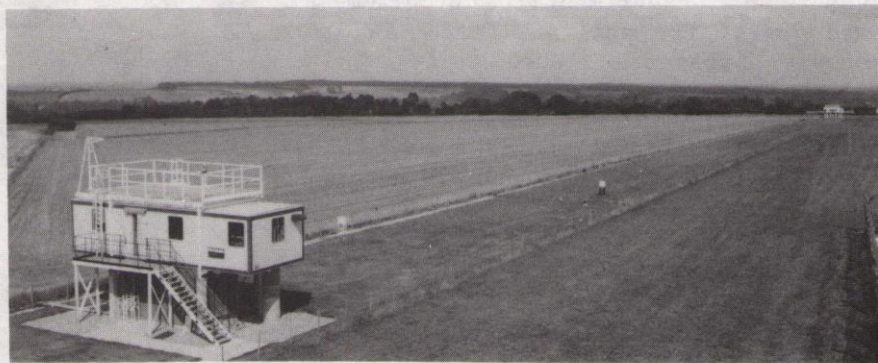


INSTALLATION OF OLYMPUS 12GHz ANTENNA

A number of contract studies, which cover such topics as air-to-ground propagation, over-sea propagation at microwave frequencies, transhorizon HF propagation and meteorological studies using the radar are also included in the present programme.

The communication studies have included the co-ordination of a novel mobile satellite concept which would incorporate full on-board processing and make use of the more favourable propagation properties of highly-inclined elliptical orbits. The study involved the Universities of Bradford, Manchester, Loughborough, Surrey, King's College and QMC London and Portsmouth Polytechnic together with Rutherford Appleton Laboratory. A Loughborough/ RAL collaboration is studying the development of sophisticated demodulation methods which combine the powers of digital

signal processing chips and transputers. Investigation of novel access protocols and demodulation methods for very low bit rate hand-held satellite terminals is also being studied with Bradford University.



MILLIMETRE EXPERIMENTAL RANGE

Funding for this interdisciplinary research programme, which requires an understanding of basic electromagnetic theory, communications systems, meteorology and geophysics, is obtained from several sources. The National Radio Propagation Programme sponsored by Radiocommunications Agency of DTI provides the majority of the funding for the medium term propagation research. A number of individual shorter term studies are supported through contract funds from MOD, Met Office, NERC, ESA and USEOARD. The more speculative communication studies are funded directly by SERC.