

INFORMATION PRODUCTS OF THE OFFICE OF TELECOMMUNICATIONS

FOR THE PERIOD FROM SEPTEMBER 1970 THROUGH MARCH 1975



OT

U.S. DEPARTMENT OF COMMERCE/Office of Telecommunications

INFORMATION PRODUCTS OF THE OFFICE OF TELECOMMUNICATIONS

LOIS H. ADAMS



U.S. DEPARTMENT OF COMMERCE
Rogers C. B. Morton, Secretary

Betsy Ancker-Johnson, Ph. D.
Assistant Secretary for Science and Technology

OFFICE OF TELECOMMUNICATIONS
John M. Richardson, Acting Director

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**UNITED STATES DEPARTMENT OF COMMERCE
OFFICE OF TELECOMMUNICATIONS
STATEMENT OF MISSION**

The mission of the Office of Telecommunications in the Department of Commerce is to assist the Department in fostering, serving, and promoting the nation's economic development and technological advancement by improving man's comprehension of telecommunication science and by assuring effective use and growth of the nation's telecommunication resources.

In carrying out this mission, the Office

- Conducts research needed in the evaluation and development of policy as required by the Department of Commerce
- Assists other government agencies in the use of telecommunications
- Conducts research, engineering, and analysis in the general field of telecommunication science to meet government needs
- Acquires, analyzes, synthesizes, and disseminates information for the efficient use of the nation's telecommunication resources.
- Performs analysis, engineering, and related administrative functions responsive to the needs of the Director of the Office of Telecommunications Policy, Executive Office of the President, in the performance of his responsibilities for the management of the radio spectrum
- Conducts research needed in the evaluation and development of telecommunication policy as required by the Office of Telecommunications Policy, pursuant to Executive Order 11556

PREFACE

Information is the most important product of the activities at the Office of Telecommunications. Numerous publications, articles, brochures, and films have been produced and published representing the work undertaken and completed by the staff.

Disseminating this information to the public has been accomplished in the past through the traditional scientific and technical media. OT continues to strive to open new channels of distribution so that the benefit of research and development investment can reach a wider audience. Over the last several years, the office has published the results of its research not only in the scientific and technical journals, but also in the trade press. This practice will continue with increasing emphasis on targeting and packaging the research results in a form useful to the needs of the end user.

It is our privilege to endorse this first edition of OT's information products catalog. This catalog provides, in one source, complete citation on all OT's published output from September 1970 through March 1975.

Special thanks go to Lois Adams and to those who assisted her in the compiling and typing of the manuscript--Beulah Ruffin, Lenora Shelton, and Elaine Cardone.



John M. Richardson
Acting Director
Office of Telecommunications



Paul Polishuk
Acting Deputy Director
Office of Telecommunications

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INTRODUCTION

With the establishment of the Office of Telecommunications in September 1970, a publication program was undertaken to provide a principal and effective means of communicating the results of the office's research and analysis activities to the public, particularly the scientific and technical community. Publications thus constitute a major end product of OT's efforts, totalling about 125 items per year.

This catalog lists about 495 information products representing the results of the various OT programs. In Section I, an alpha/numeric sequence is used to organize OT publications which are alphabetized by title with abstract and key words. The types of publications listed in this section are:

- OT Report -- Important contributions to existing knowledge, such as results of completed projects and major activities, specific major accomplishments, or OT coordinated activities.
- OT Technical Memorandum -- A variety of information about work in progress, incomplete results or complete results of minor projects.
- OT Special Publication -- Information derived from or of value to OT activities but not necessarily reporting results of individual OT programs, i.e., conference proceedings, bibliographies, etc.
- OT Contractor Report -- Information generated under an OT contract or grant and considered an important contribution to existing knowledge.
- Sponsor-Issued Report -- OT frequently authors reports issued by a sponsor under other agency covers.

Annual Report and IRAC Quarterly Progress Report

Sections II and III contain numerical listings of OT reports and technical memoranda, respectively. Section IV contains OT-authored papers which are alphabetized by title using a numerical sequence for cross-indexing with other sections. Features designed to facilitate the catalog's use and to enhance its reference value, include an index by author and an index by key word. A listing of OT brochures and films is provided in Section VII.

Most of OT's publications are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, or the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22151.

Announcements of OT publications can be found in the Monthly Catalog of United States Government Publications issued monthly by the Superintendent of Documents, and the Business Service Check List, a weekly announcement of publications of the Department of Commerce which is also available from the Superintendent of Documents.

For further information regarding these products, direct your inquiry to:

Public and Technical
Information Officer
Office of Telecommunications
U. S. Department of Commerce
1325 G Street, N. W., Room 263
Washington, D. C. 20005

OR

Public and Technical
Information Officer
Office of Telecommunications
Institute for Telecommunication Sciences
U. S. Department of Commerce
Boulder, Colorado 80302

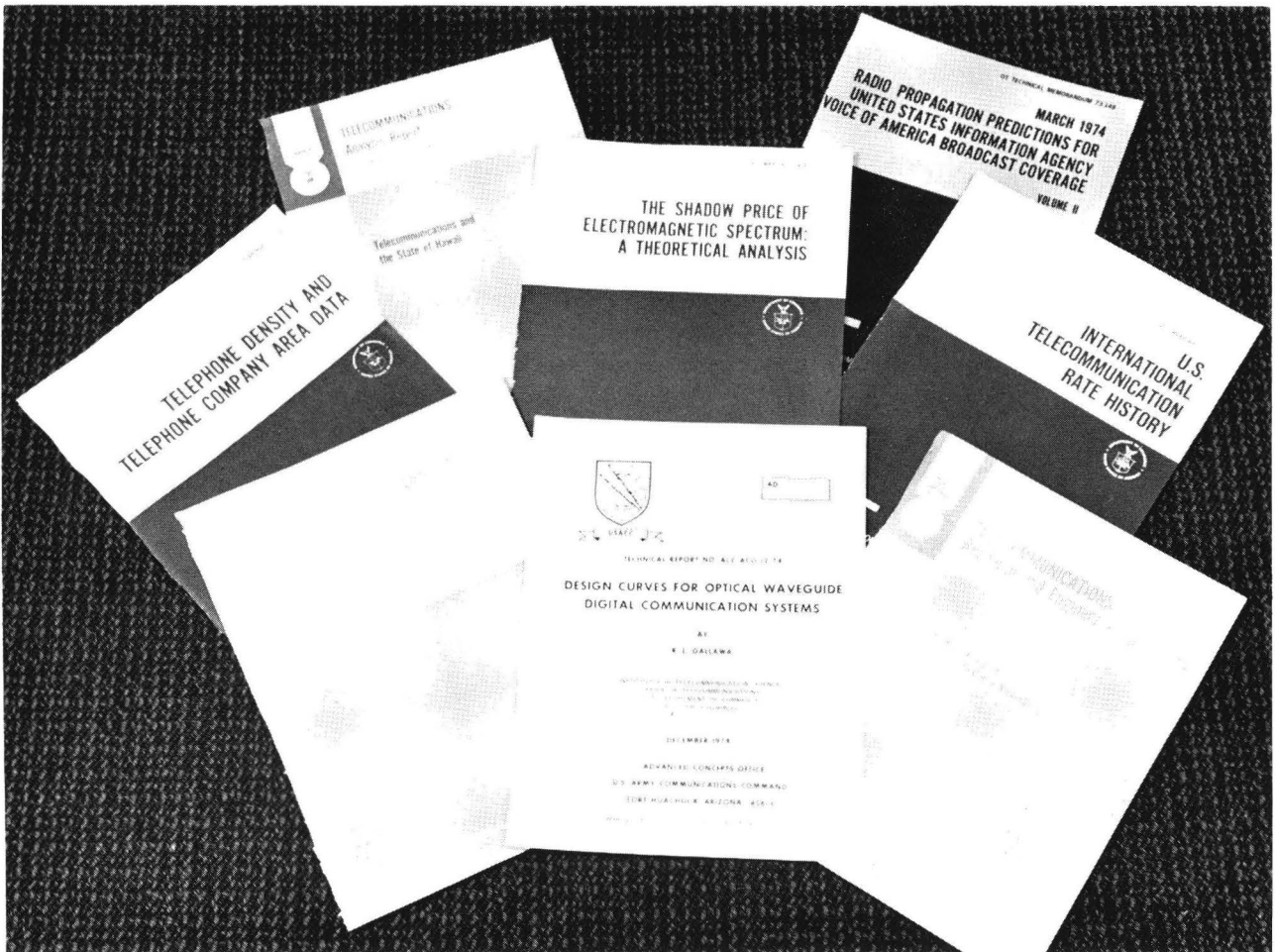
Telephone: (202) 967-5578

Telephone: (303) 499-1000 x 3572

SECTION I

OT PUBLICATIONS

This section contains an alphabetical listing, by title with abstract and key words, of technical reports, technical memoranda, special publications, contractor reports, annual reports, and IRAC quarterly progress reports. An alpha/numerical sequence is also used for cross-indexing.



- A1. ADVANCES IN COMPUTER MODEL AND PREDICTIONS FOR ATS-F-RADIO FREQUENCY INTERFERENCE EXPERIMENT AT 6 GHz; R. R. BERGMAN, P. L. RICE, M. J. MILES; December 1973. 112 pp. OT TM 73-158

The work described in this report was designed to improve the ITS computer prediction model so that better predictions could be generated while the costs for new predictions are significantly reduced. Work is presented showing the verification of assumptions relative to the accuracy of the idealized pencil beam antenna model, when applied to the subject computer prediction process.

ANTENNAS; ATS-F SATELLITE; RADIO INTERFERENCE; SIGNAL NOISE LEVEL.

- A2. ANALYSIS OF AIR-GROUND RADIO WAVE PROPAGATION MEASUREMENTS AT 800 MHz; G. D. GIERHART; A. P. BARSIS, M. E. JOHNSON, E. M. GRAY, F. M. CAPPS; November 1971. 101 pp. OT TRER 21

Analysis is presented of air-ground radio wave propagation measurements, which were performed using an airborne transmission source at approximately 6,400 m above msl. Received signal level data were obtained on 823.75 MHz and 847.75 MHz. Data were analyzed for short-term and long-term statistics of basic transmission loss. Long-term fading range statistics were compared with values calculated using a modified Longley-Rice model and good agreement was obtained.

AIR/GROUND COMMUNICATIONS; TRANSMISSION LOSS; TROPOSPHERIC PROPAGATION.

- A3. AN ANALYSIS OF 8 & 14 GHz PERFORMANCE ON A LONG MICROWAVE RELAY; R. E. SKERJANEC, C. A. SAMSON; May 1971. 37 pp. OT/ITS TM 40

This report presents initial results of a measurement program on a long Radar Microwave Link in Colorado operating in the 7.5-8.0 GHz band. Cumulative distributions of instantaneous signal levels are included, as well as distributions of various combinations of signals at different frequencies and antenna spacings to illustrate diversity effects.

MICROWAVE RELAY; RADAR.

- A4. ANALYSIS OF INDUSTRY RESPONSES TO FCC DOCKET 19311 RELATING TO THE USE OF DIGITAL MODULATION ON MICROWAVE RADIO LINKS; J. E. FARROW; December 1972. 34 pp. OT TM 120

The industry responses to FCC Docket 19311 relating to the use of digital modulation on microwave radio links have been reviewed and the technical information summarized. The information has been reduced to common bases to permit direct comparison where applicable. The use of other sources of information was very limited, but a brief description of modulation techniques is included.

DIGITAL MICROWAVE RADIO; DIGITAL MODULATION; FCC DOCKET 19311; INTERFERENCE.

- A5. ANALYSIS OF INTEGRATING RAWARC AND NWS OVERLAY CIRCUITS; P. M. McMANAMON, J. A. PAYNE; May 1972. 78 pp. OT TM 93

The feasibility of combining two major NWS communication systems has been investigated. A number of alternate system designs based on various combinations of the aforementioned circuits are shown to be theoretically feasible. Performance estimates for the present circuits and the system designs studied are

based on actual message and traffic statistics. An approximate queueing model is used to estimate performance.

NATIONAL WEATHER WIRE SERVICE; RAWARC COMMUNICATIONS; WEATHER COMMUNICATIONS.

- A6. AN ANALYSIS OF THE PREDICTED HF FREQUENCY AND STATION USAGE FOR THE ATLANTIC AMVER COMMUNICATION SYSTEM 1970-1972; J. E. ADAMS, D. N. HATFIELD; June 1971. 15 pp. OT TM 43

A study was conducted to show predicted frequency and station usage for the AMVER Communication Network. The results of this study are based upon a radio propagation analysis of the USGC radio stations at Boston, New York, Portsmouth, Miami, New Orleans, and San Juan, using a computer simulation model (Hatfield and Adams, 1970).

AMVER COMMUNICATION SYSTEM; HF FREQUENCY; RADIO PROPAGATION.

- A7. AN ANALYSIS OF PREDICTED HF PROPAGATION FOR THE PACIFIC AMVER COMMUNICATION SYSTEM FOR 1972-1974; J. W. FINNEY; September 1972. 14 pp. OT TM 111

This report gives the results of a study of AMVER Communication networks in the Pacific which indicates that the best station/frequency pair in the western Pacific is San Francisco/16 MHz in the daytime and Honolulu/8 MHz at night and in the eastern Pacific is Guam/16 MHz in the day and Guam/8 MHz at night.

AMVER COMMUNICATION SYSTEM; HF PROPAGATION; RADIO PROPAGATION.

- A8. AN ANALYSIS OF THE PREDICTED HF STATION/FREQUENCY USAGE FOR THE USCG PACIFIC AMVER COMMUNICATION SYSTEM; J. E. ADAMS, J. E. FALCON; February 1974. 18 pp. OT TM 74-162

The Pacific Basin AMVER communication system was examined over extremes of ionospheric and noise parameters. An analysis was made of the station-frequency pairs available for communicating to 286 simulated ship positions in the area and recommendations made for the most useful station/frequency pair assignments.

AMVER COMMUNICATION SYSTEM: HF FREQUENCY: RADIO PROPAGATION.

- A9. AN ANALYSIS OF THE PREDICTED HF STATION/FREQUENCY USAGE FOR THE USCG SSB SMALL CRAFT COMMUNICATION SYSTEM; W. M. ROBERTS, G. H. STONEHOCKER; August 1974. 63 pp. OT TM 74-180

A study of the HF propagation using SSB voice communications for the USCG AMVER-METEO-SAR network is presented in this paper. Charts of the Atlantic and Pacific geographical areas within 400 statute miles (640 km) of the Atlantic coast, Gulf of Mexico coast, Pacific coast, and around the Hawaiian Islands show where predicted communications reliability can be expected to be 85 percent or greater. Histograms showing the "first choice" use of each receiving station for night and day, winter and summer, and high and low sunspot numbers to allow station utilization planning for the AMVER-METEO-SAR network conclude the report.

AMVER COMMUNICATION SYSTEM; HF FREQUENCY; HF PROPAGATION; VOICE COMMUNICATION.

- A10. ANALYSIS OF PROBLEMS IN THE APPLICATION OF RADAR SENSORS TO AUTOMOTIVE COLLISION PREVENTION; L. E. WOOD, R. A. CHANDLER, B. D. WARNER; December 1973. 371 pp. DOT-HS-801-011
(Prepared for the U. S. Department of Transportation)

The report describes the results of an investigation of the practicality and technical feasibility of applying radar as a sensor for automatic automotive

braking systems. The study obtained characteristic radar echoes from typical vehicular targets and pedestrians at 10, 35, and 60 GHz. It also compared the relative merits of different design philosophies applicable to the automotive problem, estimated possible radiation hazards, and predicted the effects of precipitation on such a radar system. Effects of roadway geometry were considered using factors such as curves, overpasses and ridges, and parked vehicles.

AUTOMOTIVE BRAKING SYSTEMS; RADAR SENSORS; RADIATION HAZARDS.

- A11. ANALYSIS OF VHF AND UHF AVIATION SATELLITE SYSTEMS; G. W. HAYDON; September 1971. 75 pp. OT TM 58

The effects of propagation and other natural phenomena upon the capability of these systems to achieve their operational objectives were analyzed.

AVIATION SATELLITE SYSTEMS; PROPAGATION; UHF; VHF.

- A12. ANALYSIS AND REPRESENTATION OF THE DAILY DEPARTURES OF THE foF2 FROM THE MONTHLY MEDIAN; W. B. JONES, R. M. GALLET, M. LEFTIN, F. G. STEWART; June 1973. 80 pp. OT Report 73-12

The report describes the first phase of a two-part study, the numerical representation of global variation of the daily hourly foF2 deviations from the median. The deviations form large-scale global patterns which evolve systematically with time and represent normal fluctuations of the ionosphere as well as strong perturbations caused by magnetic storms. Various maps and tables are used to show the foF2 deviations.

CRITICAL FREQUENCY; DEVIATIONS; GLOBAL PATTERNS; MAGNETIC STORMS; SOLAR-GEO-PHYSICAL CONDITIONS.

- A13. AN/FRC-80(V)3 RETUNE AND TIME DIVISION MULTIPLEX INTERFACE INVESTIGATION; J. E. FARROW, R. E. SKERJANEC; October 1974. 136 pp. OT TM 74-182

An analog FM microwave radio was tuned and tested to published specifications. Appropriate interface changes were determined and made to permit this radio to handle a 12.6 Mb/s 3-level partial response digital baseband. Bit error rate performance as a function of received signal level, orderwire subcarrier frequency and deviation, and radio pilot level were investigated and reported. The radiated spectra for several variations of the above parameters are included.

DIGITAL TRANSMISSION; FM RADIO; RADIO FREQUENCY SPECTRUM.

- A14. ANNUAL PROGRESS REPORT TO U. S. INFORMATION AGENCY VOICE OF AMERICA, CONTRACT IA-14761-23; A. F. BARGHAUSEN, R. M. DAVIS, J. W. FINNEY, R. K. ROSICH, L. D. SCHULTZ, D. H. ZACHARISEN; October 1971. 24 pp. OT TM 61

The report contains a summary of work performed for the United States Information Agency for the period July 1970 through June 1971.

BROADCAST COVERAGE; RADIO PROPAGATION.

- A15. ANNUAL PROGRESS REPORT TO U. S. INFORMATION AGENCY VOICE OF AMERICA, CONTRACT IA-15566-23; M. LEFTIN, K. D. BOGGS, J. W. FINNEY, G. W. HAYDON; January 1973. 21 pp. OT TM 73-124

The report contains a summary of work performed for the United States Information Agency for the period July 1971 through September 1972.

BROADCAST COVERAGE; RADIO PROPAGATION.

- A16. ASATEC COMMUNICATION NETWORK DETAIL DESIGN REPORT; J. E. FARROW, L. G. HAUSE; March 1974. 182 pp. OT Report 74-31

This report describes the traffic analysis and engineering design of a voice and data communication system to control a military test range.

ASATEC COMMUNICATION NETWORK; DATA COMMUNICATION; VOICE COMMUNICATION.

- A17. ATTENUATION OF HIGH-FREQUENCY GROUNDWAVES OVER AN INHOMOGENEOUS EARTH; R. K. ROSICH; December 1970. 87 pp. OT/ITS RR 6

This report describes the model used and the results obtained in a study of the effect that inhomogeneities in the earth's surface have upon the attenuation of the surface-wave component of the ground-wave electric field at high frequencies. Computations were performed for three paths at frequencies of 10, 15, 20, and 25 MHz. The results are displayed in tabular and graphical form.

ELECTROMAGNETIC WAVES; GROUNDWAVE; PROPAGATION; RADIO WAVE.

- A18. AUTOMATED TECHNICAL CONTROL FOR DCA COMMUNICATION SYSTEMS; P. L. McQUATE, A. P. BARSIS; April 1973. 55 pp. (prepared for the U. S. Army Strategic Communications Command)

This brochure is a description of automated technical control operations and functions for military communications based on the automated system concept now under development. Emphasis is placed on the objectives and potential utilization of automated technical control, and on the functions of stand-alone equipment elements which will probably be implemented first at selected sites.

COMMUNICATION SYSTEMS.

- B1. BACKSCATTER STUDIES AND 3-D RAY TRACING--Quarterly Report--April-June 1970; L. H. TVETEN, J. C. BLAIR; November 1970. 37 pp. OT/ITS TM 11

Work performed during the quarter in sidescatter research and range estimation development is described.

EARTH STATION; FIXED-BEAM; RAIN SCATTER; TERRESTRIAL STATION.

- B2. BACKSCATTER STUDIES AND 3-D RAY TRACING--Quarterly Report--July-September 1970; L. H. TVETEN, J. C. BLAIR; December 1970. 29 pp. OT/ITS TM 12

Work performed during the quarter in sidescatter research and range estimation development is described.

EARTH STATION; FIXED-BEAM; RAIN SCATTER; TERRESTRIAL STATION.

- B3. BACKSCATTER STUDIES AND 3-D RAY TRACING--Quarterly Report--October-December 1970; L. H. TVETEN, J. C. BLAIR; January 1971. 20 pp. OT/ITS TM 30

Work performed during the quarter in sidescatter research and range estimation development is described.

EARTH STATION; FIXED-BEAM; RAIN SCATTER; TERRESTRIAL STATION.

- B4. BACKSCATTER STUDIES AND 3-D RAY TRACING FINAL REPORT, January 1969-January 1970, Part I--Sidescatter Research; J. C. BLAIR; Part II--Range Estimation; L. H.

Part I--Azimuth and spectrum spread was measured from sidescatter and great circle signals over two transmission paths: Washington, D. C. to Boulder, Colorado, and Long Branch, Illinois, to Boulder. Both Doppler and fading spread were measured. The effectiveness of these spread measurements in detecting sidescatter to improve the accuracy of DF measurements was determined.

Part II--A description of the development and details of a range estimation computer program is presented. The program was tested with about 1700 range estimates with known sources. Results of the tests are provided.

EARTH STATION; FIXED-BEAM; RAIN SCATTER; TERRESTRIAL STATION.

- B5. BACKSCATTER STUDIES AND 3-D RAY TRACING FINAL REPORT--March 1970-March 1971; L. H. TVETEN, J. C. BLAIR; August 1971. 112 pp. OT TM 52

Azimuth and fading spectrum spread was measured from sidescatter and great circle signals over 2350-km path. This report describes the second phase of an effort to determine the effectiveness of these measurements in detecting sidescatter to improve the accuracy of radio DF measurements.

EARTH STATION; FIXED-BEAM; RAIN SCATTER; TERRESTRIAL STATION.

- B6. BIBLIOGRAPHY ON PROPAGATION EFFECTS FROM 10 GHz TO 1000 THz; L. F. VOGLER, S. F. VAN HORN; March 1972. 86 pp. OT TRER 30

A bibliography on electromagnetic wave propagation over line-of-sight paths through the troposphere at frequencies about 10 GHz. The references are divided into three main categories covering the area of propagation through non-turbulent clear atmosphere and precipitation.

ELECTROMAGNETIC WAVE PROPAGATION; PROPAGATION; TROPOSPHERIC.

- B7. A BRIEF ANALYSIS OF FSK, MSK, CSK AND PSEUDO-RANDOM SIGNALLING TECHNIQUES; J. R. JURUSHEK; December 1970. 35 pp. OT/ITS TM 17

A brief survey of the available literature was made to determine the performance of four phase-continuous, digital signalling techniques. The first three techniques (FSK, MSK, and CSK) are described using a geometrical approach to the classification of signals, while the fourth technique (pseudo-random modulation) is analyzed in terms of the correlation coefficient between the two binary signals.

SIGNALLING TECHNIQUES.

- B8. BURIED VERTICALLY POLARIZED UHF ANTENNAS; R. G. FITZGERRELL, R. L. GALLAWAY, L. L. HAIDLE, A. Q. HOWARD, JR., J. E. PARTCH; November 1970. 115 pp. OT/ITS RR 8

Four UHF antennas were designed and their gains versus elevation angle up to 45 and horizontal plane patterns for a 5 elevation angle were measured with each antenna buried beneath 1 m of refractory concrete. Techniques were developed and used to measure loss tangent and dielectric constant of plane ground and large samples of refractory concrete versus drying time and temperature.

ANTENNA MEASUREMENTS; BURIED ANTENNAS.

- C1. CABLE TELEVISION FOR EUROPE; S. K. BLACK; February 1974. 124 pp.
OT Report 74-28

The report covers the development of cable television in Europe. Due to the organizational structure of the separate national communications systems, the direction that this development will take will be determined by political decisions and is likely to be considerably different than the development of the CATV industry in the United States. These decisions and the technical and economic factors that affect them are explored.

BROADCASTING; CABLE TELEVISION; EUROPE; WIRED TV SYSTEMS.

- C2. CABLE TELEVISION MANPOWER: JOB DESCRIPTIONS AND EDUCATIONAL REQUIREMENTS; E. J. ROTH; March 1973. 118 pp.
OT Report 73-2

Forty-five technical positions in the cable television field are presented in draft job descriptions. These descriptions were used for discussion by all segments of the cable television industry, as a possible step toward development of general accepted job criteria.

CABLE TELEVISION MANPOWER; EDUCATIONAL REQUIREMENTS.

- C3. CALCULATIONS OF INTERFERENCE POTENTIAL BETWEEN GEOSTATIONARY SATELLITE NETWORKS: PROGRAM WARC 71.A29 USER'S MANUAL; T. A. HARR, W. M. ROBERTS; March 1974. 58 pp.
OT TM 74-161

This user's manual contains a program description of what the "WARC 71.A29" does, a sample calculation, explanations, and instructions for use of the program. Guidance is provided as to the various sources of information needed to operate the program and as to the applicability and limitations of the various classes of data. Procedures applicable in the early analysis and coordination of new foreign and domestic space systems are outlined and flow diagrams are furnished as guidance to potential users of the program.

GEOSTATIONARY SATELLITE NETWORKS; INTERFERENCE; SPACE TELECOMMUNICATIONS; WARC SPACE TELECOMMUNICATIONS.

- C4. CAS/ALTIMETER INTERFERENCE; J. E. ADAMS, G. G. AX; September 1971. 26 pp.
OT TM 53

The report examines the effects of different types of possible radiated EM interfering signals on the Collision Avoidance System.

COLLISION AVOIDANCE SYSTEM; RADAR ALTIMETERS.

- C5. CHARACTERIZATION OF A VHF AIR-GROUND CHANNEL; G. A. HUFFORD, A. G. LONGLEY; October 1974. 80 pp.
OT Report 74-47

This report describes an air-ground, narrow bandwidth radio channel near 120 MHz for use by the VHF Digital Data Link System. Among the topics discussed are general signal levels, short-term and long-term variability, noise, multipath spread, and Doppler shifts. A bibliography is included which stresses the available data for this and similar channels.

AIR/GROUND COMMUNICATION; RADIO CHANNELS; RADIO COMMUNICATIONS; RADIO WAVE.

- C6. CITIZENS BAND CLASS D ANTENNA HEIGHT CONSIDERATIONS; L. A. BERRY; June 1974. 10 pp. OT TM 74-169

This memorandum analyzes the effects of changing the present antenna height restrictions on Class D Citizen's Band operations. The groundwave coverage and potential sky wave interference are compared for monopoles and beam antennas at 20, 40, and 60 feet. The calculations show that a monopole at 60 feet provides slightly more groundwave coverage and significantly less potential sky wave interference than a beam antenna at 20 feet.

CLASS D ANTENNA; CITIZENS BAND; GROUNDWAVE; SKY WAVE INTERFERENCE.

- C7. CLASSICAL SCATTERING CALCULATIONS FOR DIATOMIC MOLECULES--A General Procedure and Application to the Microwave Spectrum of O_2 ; U. MINGELGRIN; July 1972. 58 pp. OT TRER 32

This report contains a description of a procedure for the calculation of the classical trajectories of two interacting diatomic molecules. The actual outcome of a representative sample of many trajectories at 298K was computed and the use of these values at any temperature for calculations of various molecular properties are described.

DIATOMIC MOLECULES; MICROWAVE SPECTRUM.

- C8. COLLINS TEST REPORT DCS MICROWAVE RADIO TECHNICAL PROPOSAL VERIFICATION MODEL; R. E. SKERJANEC; February 1972. 217 pp. OT TM 82

This report contains the test and inspection results on the technical proposal verification model of the DCS microwave radio. The tests and inspection were performed by teams composed of engineers and technicians from ITS and Mil-Dep.

MICROWAVE RADIO.

- C9. COMMUNICATIONS AT UHF WITH BURIED ANTENNAS; A. G. LONGLEY; January 1971. 27 pp. OT/ITS TM 22

This report considers communications from aircraft and within a squadron of UHF using buried antennas. Both theoretical and experimental studies indicate that properly designed antennas buried 1 m below the earth's surface provide satisfactory performance at UHF for air-to-ground communications and for limited ground-to-ground communication.

AIR/GROUND COMMUNICATION; BURIED ANTENNAS; UHF.

- C10. COMMUNICATIONS/ELECTRONICS RECEIVER PERFORMANCE DEGRADATION HANDBOOK; IIT RESEARCH INSTITUTE (jointly sponsored by the Department of Defense Electromagnetic Compatibility Analysis Center and the Office of Telecommunications); July 1973. 171 pp. ESD-TR-73-014

This Handbook provides reference curves for determining receiver performance as a function of input signal-to-interference ratio. The performance degradation curves were obtained using both simulation models and measured data. The desired signal modulation types considered are A2, A3, A3J, A9B, F1, Fe, and F9. The interference modulation types are A1, A3, A3j, A9b, F1, F3, F9, Po and noise.

DEGRADATION; ELECTROMAGNETIC COMPATIBILITY; RECEIVER PERFORMANCE; SIGNAL-TO-INTERFERENCE RATIO.

- C11. COMPARISON OF OBSERVED AND PREDICTED PHASE-FRONT DISTORTION IN LINE-OF-SIGHT MICROWAVE SIGNALS; H. B. JANES, M. C. THOMPSON, JR.; September 1971. 18 pp.
OT TM 54

The report covers two experiments designed to demonstrate the theoretical relationship between the phase front distortion of line-of-sight microwave signals and the refractive index structure along the propagation path. Measurements were made using a horizontal array of 4 antennas to observe the phase structure function, and an airborne refractometer to measure the refractive index structure.

MICROWAVE SIGNALS; PROPAGATION.

- C12. COMPARISON OF PREDICTED AND MEASURED RADIO NOISE LEVELS AT THE PENTAGON, WASHINGTON, D. C., AND AT EGLIN AIR FORCE BASE, FLORIDA; R. T. DISNEY; February 1973. 98 pp.
OT TM 73-132

Measurements of radio noise were recorded at the Pentagon, Washington, D. C., and at Eglin Air Force Base, Florida. The results obtained from the analysis of the noise data are given and compared with previously predicted values for the two locations.

RADIO NOISE.

- C13. A COMPATIBILITY ANALYSIS OF THE AF 487M AND NAVY VERDIN MODEMS; J. R. JUROSHEK; September 1971.
OT TM 51C

- C14. COMPATIBILITY MEASUREMENTS OF DIGITAL MSK AND VOICE TRANSMISSIONS; J. R. JUROSHEK; April 1973. 94 pp.
FAA-RD-73-63
(prepared for the Federal Aviation Administration)

The report describes a series of experimental tests to measure interference between digital and voice systems. Measurements were made showing the effects of digital interference on voice transmission, voice interference on digital transmission and digital interference on digital transmission. The report also describes an experiment to frequency multiplex the MSK signal for simultaneous transmission with voice.

DIGITAL MODULATION; MSK SIGNAL; VOICE INTERFERENCE; VOICE TRANSMISSION.

- C15. COMPUTER ACCESS TO GEOGRAPHIC DISTRIBUTION OF THE POPULATION; D. R. EWING, J. A. PAYNE; July 1973. 39 pp.
OT TM 73-146

A computer procedure is described which provides a map of population and/or housing units. Another procedure finds the population within arbitrary circles. The data base is the 1970 Master Enumeration District List, with coordinates, furnished by the U. S. Census Bureau.

ENUMERATION DISTRICT LIST; GEOGRAPHIC DISTRIBUTION; HOUSING UNIT MAPS; POPULATION MAPS.

- C16. COMPUTER METHODS FOR THE OBJECTIVE EVALUATION OF SPEECH COMMUNICATION SYSTEMS; R. W. HUBBARD, J. A. PAYNE; February 1974. 68 pp.
OT Report 74-29

This report considers the Articulation Index (AI) as described by the American National Standards Institute as an objective method for evaluating the performance of voice communication systems. Several methods for automatically computing

the AI from test data are presented. An on-line instrument known as the SCIM system is discussed, and methods to score AI data using general purpose computer programs are presented.

ARTICULATION INDEX; SCIM SYSTEM; SPEECH COMMUNICATION SYSTEM; VOICE COMMUNICATION.

- C17. COMPUTER PROGRAM FOR GROUNDWAVE PROPAGATION IN AN IONIZED ATMOSPHERE WITH ARBITRARY VARIATION OF THE CONDUCTIVITY WITH ALTITUDE; J. R. JOHLER; October 1970. 75 pp. OT/ITS TM 5

A computer program for calculating groundwave propagation in an ionized atmosphere is documented and listed. The conductivity of the atmosphere can vary in an arbitrary way with altitude. The notion of continuous stratification of the profile has been introduced. The input and output of a sample case are listed.

GROUNDWAVE PROPAGATION; IONIZED ATMOSPHERE; PROPAGATION.

- C18. COMPUTER PROGRAMS FOR AIR/GROUND PROPAGATION AND INTERFERENCE ANALYSIS, 0.1 TO 20 GHz; G. D. GIERHART, M. E. JOHNSON; September 1973. 223 pp. FAA-RD-73-103

(Prepared for the Federal Aviation Administration)

This report describes three computer programs for use in predicting the service coverage associated with air/ground radio systems operating in the frequency band from 0.1 to 20 GHz. Power density, station separation and service volume programs are used to obtain computer-generated microfilm plots. A detailed discussion of the propagation model involved and program listings are included in the appendices.

AIR/GROUND PROPAGATION; FREQUENCY SHARING; INTERFERENCE; NAVIGATION AIDS; PROPAGATION MODEL; TRANSMISSION LOSS.

- C19. COMPUTER PROGRAMS FOR THEORETICAL LF, VLF FIELD CALCULATIONS WITH SPHERICAL WAVE FUNCTIONS OF INTEGER ORDER; J. R. JOHLER, C. M. MELLECKER; February 1971. 125 pp. OT/ITS TM 24

The subject computer programs are described and the FORTRAN source decks are listed. The physical problem solved by the computer program is described. It allows an anisotropic ionospheric model, and variations in the model along the propagation path. The input and output of a sample case are listed.

ANISOTROPIC IONOSPHERIC MODEL; FORTRAN PROGRAM; PROPAGATION; VLF.

- C20. CONFIDENCE LIMITS FOR DIGITAL ERROR RATES; E. L. CROW; November 1974. 76 pp. OT Report 74-51

Confidence limits for error rates (probabilities of an error) of digital communication systems are derived and implemented under the assumptions that the error rate is constant and the trials are independent. Four types of binomial samples are considered.

DIGITAL COMMUNICATION SYSTEMS: MONTE CARLO SIMULATION.

- C21. A CONSIDERATION OF POSSIBILITIES AND DIFFICULTIES IN PASSIVE CIRCUITS IN INTEGRATED OPTICS; M. KOYAMA, R. L. GALLAWAY; April 1974. 37 pp. OT Report 74-34

Consideration is given to the possibilities and difficulties of passive opti-

optical circuits implemented in integrated optics. Optical channel dropping filters and band splitting filters are considered in detail to help visualize the possibilities and difficulties of the integrated optical circuits. An importance of the multi-layered dielectric filters in the thin-film configuration is emphasized.

INTEGRATED OPTICS; OPTICAL CIRCUITS; WAVEGUIDE COMPONENTS.

- C22. CONSIDERATIONS FOR DIGITAL ENCODING OF THE NTSC COLOR TELEVISION SIGNAL; E. K. SMITH; December 1974. 39 pp. OT TM 74-189

This report considers the minimum bit-rate required for transmission of NTSC video color standard when used for teleconferencing. The smallest values are found for fixed cameras. Problems of coding the audio portion separately from the video are also considered briefly.

TELECONFERENCING; VIDEO COLOR STANDARD.

- C23. THE CONTENT, STRUCTURE, FORMAT, DEVELOPMENT AND MAINTENANCE OF AN EQUIPMENT CHARACTERISTICS FILE FOR FREQUENCY MANAGEMENT IN THE FEDERAL GOVERNMENT; SACH/FREEMAN ASSOCIATES under OT Contract No. 1-35527; December 1971. 195 pp. OT CR 72-01

This report establishes the technical requirements necessary to develop an automated Equipment Characteristics File (ECF) in support of the Office of Telecommunications Frequency Management and Records System. These requirements include the general procedures that would be employed to create and maintain an ECF, the contents of the file, the file structure and format, data edit requirements, and forms for use in file updating. A method of keying the file to Government frequency assignment records is also identified in detail.

EQUIPMENT CHARACTERISTICS FILE; FREQUENCY MANAGEMENT.

- C24. CORRELATION OF MAN-MADE RADIO NOISE RECEIVED ON TWO ANTENNAS; R. T. DISNEY; January 1972. 52 pp. OT TM 74

The report covers a pilot study of the correlation of the man-made radio noise envelope voltage from two receiving systems measured as a function of the antenna configuration of the systems.

ANTENNAS; MAN-MADE RADIO NOISE.

- C25. A COST MODEL FOR OPTICAL WAVEGUIDE COMMUNICATION SYSTEMS; R. L. GALLAWAY, M. KOYAMA; March 1974. 43 pp. OT Report 74-32

A cost model for an optical waveguide communication system is derived and discussed. Curves are given which allow the design engineer to optimize the repeater spacing or the bit rate for the most economical operation. It is also shown that a price of \$1 per meter for low-loss single mode fiber will, under the conditions assumed here, yield a system cost of about \$1 per channel kilometer (64 kb/s channel) in certain cases. The approach and the results are quite general and are not restricted to optical waveguides.

GLASS FIBERS, OPTICAL COMMUNICATIONS; OPTICAL WAVEGUIDE.

- D1. DATA RESULTS ON NANOSECOND PULSE PROPAGATION MEASUREMENTS OVER LINE-OF-SIGHT PATHS; R. E. SKERJANEC; November 1972. 38 pp. OT TRER 37

This report contains an analysis of the data resulting from an experiment designed to determine the effects of atmospheric multipath propagation and of dispersion on extremely short pulses. The experimental methods and results of the analysis of the data are presented in terms of time variations of pulse parameters variations.

LINE-OF-SIGHT PATH; MICROWAVE; MULTIPATH; PROPAGATION.

- D2. DEPENDENCE OF HIGH LATITUDE SPREAD F OCCURRENCE ON SOLAR AND MAGNETIC ACTIVITY; R. M. DAVIS; November 1973. 44 pp. OT Report 73-23

This report contains the method of analysis and discusses results of a study of the question of the comparative importance of solar activity and magnetic activity as they affect spread-F probability throughout the world. Numerical maps are presented for the northern fall season (August, September, and October) of 1958 and 1964, years of extremely high and low solar activity, respectively, and for the magnetic activity conditions represented by Kp1 and Kp3.

IONOSPHERE; MAGNETOSPHERE; SPREAD F.

- D3. DESIGN CONSIDERATIONS FOR A MODEL TELECOMMUNICATIONS SYSTEM; P. M. McMANAMON; September 1972. 77 pp. OT TM 105

The report covers preliminary design information relating to cost, performance, and the state-of-the-art for the initial aspects of a Data Reports and Conferences Model Telecommunications System between Boulder, Colorado, and Washington, D. C. using common carrier services for transmission. Encoded typewriters, facsimile, audio teleconferencing and audio-with-video teleconferencing are considered in this study.

COMMON CARRIER COSTS; TELECOMMUNICATIONS; TELECONFERENCING.

- ✓ D4. DESIGN CURVES FOR OPTICAL WAVEGUIDE DIGITAL COMMUNICATION SYSTEMS; R. L. GALLAWAY; December 1974; 170 pp. ACC-ACO-12-74
(prepared for the U. S. Army Communications Command)

Contains a series of curves intended to assist the communicator in specifying an optical waveguide digital communication system. The important parameters considered are pulse rate, distance between repeaters, and cost. Discussion and curves are given to show the transition from dispersion-limit to detector-noise-limit operation. A measure of cost is defined to assist the communicator in specifying values of pulse rate if cost is, in fact, a design parameter.

DIGITAL COMMUNICATION SYSTEMS; OPTICAL WAVEGUIDE.

- D5. DETERMINATION OF SERVICE AREA FOR VHF/UHF LAND MOBILE AND BROADCAST OPERATIONS OVER IRREGULAR TERRAIN; A. P. BARSIS; September 1971. 28 pp. OT TM 56

This report defines service area of VHF/UHF land mobile and broadcast stations, and demonstrates graphical and computer methods to determine and present such areas as a function of known equipment parameters and of a propagation model derived largely from an extensive measurement program over irregular terrain.

IRREGULAR TERRAIN, LAND MOBILE COMMUNICATION; TV BROADCASTING; UHF; VHF; VEHICULAR COMMUNICATIONS.

- D6. DETERMINATION OF THE ELECTROMAGNETIC ENVIRONMENT IN COAL MINES; J. H. CRARY; March 1972. 139 pp.
(prepared for the U. S. Department of Interior, Bureau of Mines)

The report contains results of research done on the electromagnetic environment in coal mines. Outstanding problems were identified as to the location of, and communication with, trapped miners. Tentative solutions involving long-wave electromagnetic signals were provided.

COAL MINES; ELECTROMAGNETIC ENVIRONMENT.

- D7. DEVELOPMENT OF THE 61.152-kHz SUBSYSTEM OF THE DECISION INFORMATION DISTRIBUTION SYSTEM; R. M. COON, H. AKIMA, G. G. AX; July 1971. 64 pp. OT TM 44

Details are given of a feasibility model of a low-frequency subsystem for the DIDS which was designed, developed, and successfully demonstrated.

DIDS; SIGNAL ACQUISITION; SIGNAL-TO-NOISE RATIO; TRANSMITTER POWER.

- D8. A DIGITAL LF ATMOSPHERIC RADIO NOISE SIMULATOR; E. C. BOLTON; June 1971. 48 pp.
OT/ITS TM 38

Details are given of the circuitry involved in the construction of a digital atmospheric radio noise simulator developed at the Lab. Since the simulator has known statistics that are stationary it is useful in determining the performance of radio systems which may have to operate under the influence of random impulsive types of noise which is characteristic of atmospheric radio noise.

RADIO NOISE; SIMULATOR.

- D9. DIPOLE RADIATION FROM A CIRCULARLY CYLINDRICAL CAVITY IN A FINITELY CONDUCTING GROUND PLANE; A. Q. HOWARD, JR.; July 1971. 52 pp. OT TM 46

A formal, exact solution is given to an electromagnetic boundary value problem with relevance to buried vertically polarized antennas. Numerical results both for aperture and radiation fields are presented.

ANTENNAS; DIPOLE RADIATION.

- D10. DIRECTORY OF FIELD CONTACTS FOR THE COORDINATION OF THE USE OF RADIO FREQUENCIES; IRAC SECRETARIAT; February 1974. 176 pp.

The directory was compiled to assist, as appropriate, in the local (1) preliminary coordination of contemplated frequency usage, (2) selection and scheduling of the use of assigned frequencies, and (3) resolution of cases of harmful interference. Field contacts are listed for states, U. S. possessions, department and agencies of the Federal government, and Non-Federal Frequency Advisory Committees.

ELECTROMAGNETIC COMPATIBILITY; RADIO SPECTRUM; SPECTRUM MANAGEMENT.

- D11. A DISCUSSION OF PERFORMANCE PREDICTIONS AND STANDARDS FOR TROPOSPHERIC TELECOMMUNICATION SYSTEMS; J. E. FARROW, R. E. SKERJANEC, A. P. BARSIS; November 1971. 31 pp. OT TM 62

A review is made of the guidelines used for recommending revisions to Defense

Communication Systems Standards for wideband point-to-point communication links. Among the topics discussed are prediction errors and their significance in calculating path loss and received signal levels, and short-term signal level distributions for a two-ray fading model.

NOISE ANALYSIS; PERFORMANCE PREDICTIONS; PERFORMANCE STANDARDS; TELECOMMUNICATIONS.

- D12. DSCS AIRBORNE EARTH TERMINAL-TERRESTRIAL MICROWAVE LINK COMPATIBILITY MEASUREMENTS IN THE 7.25-8.40 GHz BAND; A. D. SPAULDING, L. L. PROCTOR, A. F. BARGHAUSEN; June 1973. 112 pp. OT TM 73-143

The majority of the 7.25-8.40 GHz band has been allocated, on a shared basis, to both satellite communications and fixed and mobile terrestrial communications, primarily microwave radio relay systems. This report presents the measurement procedures and results of tests conducted under actual operating conditions to assess the nature of the interaction between a prototype airborne satellite terminal (AN/ASC-18) and microwave radio relay systems (FAA RML-4 links).

AIRBORNE SATELLITE TERMINAL; ELECTROMAGNETIC COMPATIBILITY; MICROWAVE RADIO RELAY SYSTEM.

- E1. AN ECONOMETRIC STUDY OF RETURNS TO SCALE IN THE BELL SYSTEM; L. H. MANTELL; February 1974. 106 pp.

The analyses contained in this study were confined to an econometric (as opposed to an engineering) study of data reported by the Federal Communications Commission, supplemented by data from the Department of Commerce and the American Telephone and Telegraph Company. Production functions were fitted employing stepwise regression methods available in prepared computer routines. In addition to the venerable Cobb-Douglas fitted by curvilinear regression and by linear regression to logarithms of the data, a linear function and two non-homogeneous equations were employed.

ECONOMETRIC STUDY; RETURNS-TO-SCALE.

- E2. EFFECT OF VARIABILITY IN RECEIVED POWER ON PROBABILITIES OF COMMUNICATION AND DELAY IN LAND MOBILE COMMUNICATION SYSTEMS; E. L. CROW; December 1972. 45 pp. OT TRER 40

The performance of a land mobile communications system depends on many environmental factors and design parameters. This study is concerned primarily with the random variations of received power, or, equivalently, basic transmission loss due to variation in the terrain around a mobile receiver and a mobile transmitter. Relationships among the variables of a single channel land mobile communications system are formulated and tabulated or graphed in particular cases.

CHANNEL USAGE; LAND MOBILE COMMUNICATION.

- E3. EFFECTS OF DEBRIS ON BURIED UHF ANTENNA PERFORMANCE; L. L. HAIDLE; June 1974. 34 pp. OT Report 74-40

This publication reports on a series of flight tests conducted at the minute-man launch facility LF09 at Vandenberg Air Force Base to establish the effect of debris on the performance of the buried UHF antenna installed at LF09.

BURIED ANTENNAS; PROPAGATION; UHF ANTENNA.

- E4. EFFICIENCY TRADE-OFFS IN LAND MOBILE RADIO; J. R. JUROSHEK; September 1972. 25 pp. OT TM 106

Considerable attention has been devoted in recent years to conservation of the radio spectrum. This paper examines some of the trade-offs affecting the number of users of the radio spectrum. In particular, the report examines the question of "how many users can be accommodated in a given bandwidth W, and area A, with a given level of performance." Although the report is primarily concerned with existing land mobile modulation techniques (SSB, DSB-AM, FM) some effort is devoted to other modulation types, such as spread spectrum and digital, that may find increasing use in future land mobile systems.

LAND MOBILE COMMUNICATION; RADIO SPECTRUM.

- E5. ELECTROMAGNETIC COMPATIBILITY OF COLLISION AVOIDANCE SYSTEMS WITH PROPOSED MARITIME SATELLITE AND AERONAUTICAL SATELLITE SYSTEMS; R. D. JENNINGS; September 1972. 40 pp. OT TM 110

This report examines the expected EMC between the proposed CAS and postulated MARSAT and AEROSAT systems. Other studies were used along with more recent information now available in the Aerosat Technical Specification, Draft No. 4 (FAA, 1972) and the ATA (CAS) Technical Description, Revision 10 (ATA, 1971).

AERONAUTICAL SATELLITE; COLLISION AVOIDANCE SYSTEM; MARITIME SATELLITE; SATELLITE SYSTEMS.

- E6. ELECTROMAGNETIC COMPATIBILITY OF RADAR ALTIMETERS WITH PROPOSED MARITIME SATELLITE AND AERONAUTICAL SATELLITE SYSTEMS; G. G. AX, R. D. JENNINGS; August 1972. 61 pp. OT TM 101

A description of each system analyzed is given. Analysis was performed on the worst cases for various equipments and systems. Interference levels and distance separation were computed. The MARSAT system was used as the common baseline system in performing analysis of interference effects from radar altimeter emissions. Results and recommendations are provided.

AERONAUTICAL SATELLITE; MARITIME SATELLITE; RADAR ALTIMETERS.

- E7. ELECTROMAGNETIC COMPATIBILITY OF SIMULATED CATV SIGNALS AND AIRCRAFT NAVIGATION RECEIVERS; T. HARR, F. HAAKINSON, S. MURAHATA; June 1974. 75 pp. OT Report 74-39

This report describes the results and gives the conclusions of the laboratory testing of the compatibility of CATV type signals to VHF aircraft navigation receiving systems. The report also describes how these systems operate and gives details of the frequency and time domain signal structures of the equipment tested. The procedures and interconnections used are described in detail. Appendices are included with complete test data.

AIRCRAFT NAVIGATION SYSTEMS; CABLE TELEVISION; CATV SIGNALS.

- E8. ELECTROMAGNETIC FIELDS OF A DIELECTRIC COATED COAXIAL CABLE WITH AN INTERRUPTED SHIELD; J. R. WAIT, D. A. HILL; January 1975. 55 pp. OT TM 75-192

Results of two analytical methods employed to solve the boundary-value problem of a dielectric-filled coaxial structure that consists of a solid center conductor with a concentric metal shield with a circumferential gap are contained in this report. Using either method, it is shown that typically 15%

of the incident power in the cable is converted to external radiation and typically 20% is transferred into surface waves in the dielectric jackets. Such power calculations are exhibited for frequencies of 20, 50, 100, and 300 MHz and for two coaxial cables that are typical of those being used in present day CATV systems.

CATV SYSTEMS; COAXIAL CABLE.

- E9. ELECTROMAGNETIC INTERFERENCE ENVIRONMENT MEASUREMENT AND PREDICTION CONSIDERATIONS; R. T. DISNEY; February 1971. 89 pp. OT/ITS TM 28

The determination of an optimum receiving system for a given class of signals or how satisfactorily a given receiving system will operate requires information on the interference environment in which the system must operate. Considerations for the establishment of programs to obtain this information and a discussion of the measurement of the environment are given.

ELECTROMAGNETIC INTERFERENCE.

- E10. ELECTROSPACE PLANNING AND ENGINEERING FOR THE AIR TRAFFIC ENVIRONMENT; G. D. GIERHART, R. W. HUBBARD, D. V. GLEN; December 1970. 303 pp. FAA-RD-70-71 (prepared for the Federal Aviation Administration)

Service limitations imposed upon VHF/UHF/SHF radio communication links by co-channel and adjacent-channel interference is the primary subject, but limitations imposed by intermodulation and noise are also discussed. Methods for predicting available desired-to-undesired signal ratios (protection ratio) and determining the required protection ratio are summarized. Appendices on frequency sharing with air traffic control satellite, modulation characteristics, and system performance measurements are included.

AIR TRAFFIC CONTROL; FREQUENCY SHARING; RADIO COMMUNICATION; RADIO NOISE; SATELLITE COMMUNICATION.

- E11. AN ENGINEERING FEASIBILITY STUDY OF COMMUNICATIONS VIA A SUBTERRANEAN WAVEGUIDE; R. L. GALLAWA, L. L. HAIDLE; November 1972. 128 pp. OT TRER 39

This report considers the signal strength at a point in subterranean waveguide, and compares it with the noise that might be expected. Noise is that owing to atmospheric and subsurface thermal sources.

SIGNAL-TO-NOISE RATIO; SUBTERRANEAN WAVEGUIDE.

- E12. AN ENGINEERING STUDY OF COMMUNICATIONS IN A SUBTERRANEAN WAVEGUIDE; L. L. HAIDLE, R. L. GALLAWA; April 1972. 33 pp. OT TM 88

This report considers the signal strength at a point in subterranean waveguide, and compares it with the noise that might be expected. Noise is that owing to atmospheric and subsurface thermal sources.

SIGNAL-TO-NOISE RATIO; SUBTERRANEAN WAVEGUIDE.

- E13. EVALUATION OF BEVERAGE ANTENNAS FOR HF, OVER-THE-HORIZON RADAR APPLICATIONS; H. V. COTTONY; July 1973. 45 pp. OT TM 73-145

A novel, five-wire rhomboid-shaped Beverage developed at Rome Air Develop-

ment Center, Griffis AFB, is examined from the standpoint of its applicability to HF, over-the-horizon radar. Both receiving and transmitting applications are considered.

ANTENNAS; BEVERAGE ANTENNAS; OVER-THE-HORIZON RADAR.

- E14. EVALUATION OF A SYSTEM FOR REMOTE OSCILLATOR SYNCHRONIZATION; L. E. WOOD, M. C. THOMPSON, H. B. JANES, D. SMITH; March 1972. 51 pp. OT TRER 29

The report describes results of field tests of a microwave telecommunication system for synchronization of a remote oscillator to a precision master oscillator.

OSCILLATOR SYNCHRONIZATION.

- E15. EVALUATION OF TECHNIQUES FOR IMPROVING THE PERFORMANCE OF RADAR MICROWAVE LINK SYSTEMS; D. SMITH, C. A. SAMSON, R. E. SKERJANEC; October 1973. 93 pp. FAA-RD-73-83

(Prepared for the Federal Aviation Administration)

Techniques for improving the performance of radar microwave links were evaluated. State-of-the art modules such as a tunnel diode amplifier, balanced mixer, Gunn diode local oscillator, and a solid-state IF amplifier were procured and evaluated in the laboratory. Selected components were then tested in an operational system for 3 months, and recordings of received signal level on two adjacent links were correlated with existing weather conditions and system outages.

OSCILLATOR; MICROWAVE LINK ANALYZER; SOLID-STATE AMPLIFIER; RML SYSTEM.

- E16. EXCITATION MECHANISMS FOR TRANSMISSION THROUGH FOREST-COVERED AND VEGETATED MEDIA; R. H. OTT, J. R. WAIT; November 1973. 32 pp. ACC-ACO-8-73

(prepared for the U. S. Army Communication Command)

Simple asymptotic expressions are derived for the lateral wave excited by loop and dipole antennas in or above a foliage layer. It is shown that the horizontal magnetic dipole (loop in vertical plane) has signal strengths comparable with the vertical electric dipole provided the moments for the two antennas are normalized so that they have equal radiation resistances in free-space.

ANTENNAS; LATERAL WAVES.

- E17. AN EXPERIMENT FOR THE STUDY OF EARTH STATION-TERRESTRIAL STATION INTERFERENCE; OT/ITS TM 14

Part 1--Interference Model for Rain Scatter and Fixed Beam Experiment; J. A. HULL, P. L. RICE, R. W. HUBBARD, G. D. THAYER; December 1970. 82 pp

The extrapolation of the measurements made at the present site to other locations will depend on models being developed to relate the time and space statistics of radar reflectivity, Z . The present fixed-beam configuration of the experiment is providing critically needed measurements of interference phenomena which must be assessed in terms of cumulative distributions for the given fixed configurations as a function of season and for total seasonal variations of a "typical" year.

Part II--Statistical Data Summary for the Ripp Fixed Beam Experiment at Langley,
Va.; R. W. HUBBARD, G. D. THAYER, J. A. PAYNE; January 1971. 41 pp.

The data processing and analysis procedures for the RIPP fixed beam experiment have been implemented, tested and applied to the assimilation of data for the period September 15 to December 7, 1970. The primary value of this report is to indicate what the long-term trends in these data are, and to illustrate the manner in which the data are to be assimilated in the overall conduct of this experiment.

EARTH STATION; FIXED-BEAM; RAIN SCATTER; TERRESTRIAL STATION.

- E18. AN EXPERIMENTAL STUDY OF THE ATMOSPHERIC CONDITIONS CONDUCIVE TO HIGH RADIO FIELDS; H. T. DOUGHERTY, R. E. MCGAVIN, R. W. KRINKS; September 1970. 52 pp.
OT/ITS RR 4

Results are presented for an experimental investigation of anomalous propagation on two overland transhorizon paths at 185.75 MHz. The anomalous signals, 15 to 42 dB above the long-term median and persisting 1 to 6 hours, are described and their possible modes of propagation are reviewed. Surface search radar was found to be a most promising method for monitoring the surface refractivity conditions conducive to high fields.

PROPAGATION; TROPOSCATTER PROPAGATION.

- E19. AN EXPERIMENTAL STUDY OF THE TEMPORAL STATISTICS OF RADIO SIGNALS SCATTERED BY RAIN; R. W. HUBBARD, J. A. HULL, G. D. THAYER, P. L. RICE; March 1971. 143 pp.
OT/ITS TM 37

A description is given of a fixed-beam, bistatic CW experiment designed to measure the temporal statistics of the volume reflectivity produced by hydrometeors at several selected altitudes, scattering angles and at two frequencies (3.6 and 7.8 GHz). Surface rain gauge data, local meteorological data, surveillance S-band radar and great-circle path propagation measurements are also made to describe the general weather and propagation conditions and to distinguish precipitation scatter signals from those caused by ducting and other non-hydrometeor scatter mechanisms.

FIXED-BEAM; RADIO SIGNALS; RAIN SCATTER.

- E20. AN EXPERIMENTAL STUDY OF THE TEMPORAL STATISTICS OF RADIO SIGNALS SCATTERED BY RAIN; R. W. HUBBARD, J. A. HULL, P. L. RICE, P. I. WELLS; June 1973. 147 pp.
OT Report 73-15

A fixed-beam bistatic CW experiment designed to measure the temporal statistics of the volume reflectivity produced by hydrometeors at several selected altitudes, scattering angles, and at two frequencies (3.6 and 7.8 GHz) is described. A number of figures and tables are used to depict the precipitation scatter data on frequencies in both the S-band and X-band portions of the electromagnetic spectrum.

FIXED-BEAM; FREQUENCY SHARING; RADIO SIGNALS; RAIN SCATTER; SATELLITE/TERRESTRIAL COMMUNICATIONS.

- F1. FEASIBILITY MODEL DEVELOPMENT OF THE 61-kHz SUBSYSTEM OF THE DECISION INFORMATION DISTRIBUTION SYSTEM; H. AKIMA, R. M. COON, T. DEHAAS; November 1974. 122 pp. OT Report 74-52

Design procedures for the 61-kHz subsystem of the Decision Information Distribution System (DIDS) are discussed, and a feasibility model developed for the subsystem is described.

DIDS.

- F2. FIELD-INTENSITY METER MODIFIED TO MEASURE RMS AND AVERAGE NOISE ENVELOPE VOLTAGE; R. J. MATHESON, K. R. BEASLEY; November 1972. 40 pp. OT TM 119

This paper gives details on a modification of a commercial field-intensity meter which enables it to simultaneously measure the rms and average envelope of the noise, using high dynamic range detectors. Appendices include information on modification procedures, parts lists, and initial alignment.

NOISE RATIO.

- F3. A FIRST APPROACH TO THE PROPAGATION OF LATERAL WAVES IN AN INHOMOGENEOUS JUNGLE; R. H. OTT, J. R. WAIT; November 1973. 17 pp. OT TM 73-154

Estimates for the effects on a lateral wave of a clearing in a foliage layer are considered. A first-order solution to the integral equation for the mixed-path problem is derived and two examples are considered. They show that a mid-path clearing has little effect on the path loss. The path loss decreases if a terminal is in a clearing.

LATERAL WAVES.

- F4. A FIRST LOOK AT CERTAIN WIDEBAND DETECTION PROBLEMS; M. NESENBERGS; June 1974. 64 pp. OT TM 74-175

Consideration is given to a wideband detection problem where the number and structure of the received signal set is arbitrary. A particular spectral weighting approach is taken and the processing results are found to be inadequate. The search for substantially better detectors, in particular for those with optimal features, is initiated. An outline of future work is provided in the conclusion.

WIDEBAND DETECTION; SPECTRAL WEIGHTS.

- F5. FISCAL YEAR 73 PROGRESS REPORT TO UNITED STATES INFORMATION AGENCY VOICE OF AMERICA CONTRACT IA-16129-23; M. LEFTIN, V. AGY, K. BOGGS, G. HAYDON, R. K. ROSICH; September 1973. 123 pp. OT TM 73-151

This report contains a summary of work performed for the United States Information Agency, Voice of America, under contract IA-16129-23 for the period July 1972 through June 1973.

BROADCAST COVERAGE; RADIO PROPAGATION.

- F6. FISCAL YEAR 74 PROGRESS REPORT TO UNITED STATES INFORMATION AGENCY VOICE OF AMERICA CONTRACT IA-16744-23; M. LEFTIN, V. L. AGY, K. D. BOGGS, G. W. HAYDON, J. L. LLOYD, R. K. ROSICH; July 1974. 53 pp. OT TM 74-181

This report contains a summary of work performed for the United States Information Agency, Voice of America, under contract IA-16744-23 for the period

July 1973 through June 1974.

BROADCAST COVERAGE; RADIO PROPAGATION.

- F7. FORTRAN PROGRAM FOR ESTIMATING LF-VLF RADIO SYSTEM; L. A. BERRY, J. E. HERMAN; October 1971. 133 pp. OT TM 63

A computer program for estimating the available signal-to-noise ratio of an LF or VLF transmitter at any time given its location, frequency, and radiated power is described and listed. The data bases, mathematical models, and assumptions built into the program are listed and their limitations and inaccuracies discussed.

PROPAGATION; SIGNAL-TO-NOISE RATIO.

- F8. FORTRAN PROGRAMS AND DESCRIPTIONS FOR USE IN A LORAN C GRID CALIBRATION AND PREDICTION METHOD; R. H. DOHERTY; March 1972. 109 pp. OT TM 79

This note describes and lists the computer programs used in a process to minimize the errors associated with Loran C/D data within the bounds of propagation theory. Also described is a data bank and IBM card formats capable of preserving most information that might be associated with Loran C/D observed data points. The appendix to this note contains a listing of data that was available in the data bank as of July 1971.

FORTTRAN PROGRAM; LORAN C; LORAN D;

- G1. GAIN PATTERNS OF HARDENED ARRAY ANTENNAS USING DIPOLES AS RADIATING ELEMENTS; H. V. COTTONY; October 1971. 51 pp. OT TRER 20

Describes the relationships necessary for computing the radiation intensity in free space radiated by an antenna embedded in a hardened medium and to use these relationships to compute the far-field performance of several typical array antennas embedded in the medium.

ANTENNA GAINS; ANTENNAS; HARDENED ANTENNAS.

- G2. A GENERAL ANALYSIS OF DOMESTIC SATELLITE ORBIT/SPECTRUM UTILIZATION; D. HATFIELD; December 1971. 38 pp.

This report evaluates the geostationary orbit/spectrum utilization of the U. S. domestic communication satellite system applications. It provides information for considering the scarcity of the orbit/spectrum resource and DOMSAT policy recommendations.

DOMESTIC SATELLITE; SATELLITE COMMUNICATION; SPECTRUM; TELECOMMUNICATIONS.

- G3. GEOGRAPHIC AREA COVERAGE OF NAVAL HIGH FREQUENCY COMMUNICATION SYSTEMS (area coverage from H. E. Holt Australia); L. L. PROCTOR, J. W. FINNEY, G. W. HAYDON; September 1971. 100 pp. OT TM 55

The area coverage of the H. E. Holt Station in Australia was examined with emphasis on possible improvement of the coverage by revised frequency scheduling, antenna selection. Predictions of area coverage by high-frequency sky-wave systems through the use of electronic computers were developed.

ANTENNA SELECTION; FREQUENCY SCHEDULING; SKY WAVE SYSTEMS.

- G4. GEOGRAPHICAL AREAS SERVICED BY BELL AND INDEPENDENT TELEPHONE COMPANIES IN THE UNITED STATES; B. A. HART; February 1973. 126 pp. OT Report 73-1

The geographic coverage of all telephone companies in the U. S. is presented in a series of maps. These consist of U. S. maps of operating areas served by the major companies, and individual State maps depicting the operating areas served by Bell and each of the various Independent companies. State by state listings of over 1500 telephone companies and their headquarters are also given.

BELL TELEPHONE COMPANY; INDEPENDENT TELEPHONE COMPANIES; MAPS; TELEPHONE COMPANIES.

- G5. GLOBAL REPRESENTATION OF ANNUAL AND SOLAR CYCLE VARIATION OF foF2 MONTHLY MEDIAN 1954-1958; W. B. JONES, D. L. OBITTS; October 1970. 46 pp. OT/ITS RR 3

Annual and solar cycle variations of foF2 monthly median numerical maps are analyzed for the 60 months of 1954 through 1958. The report includes a description of the procedures used in the analysis, an analysis of residuals between observed data and computed values, and FORTRAN program statements.

SOLAR CYCLE.

- G6. GOES DATA COLLECTION SYSTEM MEASUREMENTS; D. V. GLEN, P. M. McMANAMON; October 1974. 108 pp. OT Report 74-49

This report presents results of measurements for the interrogation and data reply communications between the DCPRS and the CDA station demodulators using recorded and simulated signals with and without +70 degree Manchester encoded PSK modulation transmitted through a GOES transponder prior to launch. BER measurements are used to compare performance for one or three DCPRS and give estimates of degradation due to spacecraft spin modulation and simultaneous operation of other satellite communication subsystems. Post-launch measurements were made and are compared to the pre-launch measurements.

DATA COLLECTION PLATFORM RADIO SETS; GOES COMMUNICATIONS; SATELLITE COMMUNICATION MEASUREMENTS.

- G7. GOES DATA COLLECTION SYSTEM PERFORMANCE ESTIMATES; P. McMANAMON; January 1973. 121 pp. OT TM 73-125

This report presents performance estimates and recommended measurements for the interrogation and data reply transmissions between the remote data collection platform radio sets and the command and data acquisition station through the GOES transponder.

DATA COLLECTION PLATFORM RADIO SETS; GOES COMMUNICATIONS; IONOSPHERIC SCINTILLATIONS.

- G8. GOES TELECOMMUNICATION STUDY-1971; J. J. TARY, R. R. BERGMAN, G. D. GIERHART; November 1971. 77 pp. OT TM 64

A telecommunication study for the GOES/SMS satellite system. The effects of propagation phenomena, radio frequency interference, and noise for the 400 MHz communication system link performance are considered.

GOES COMMUNICATIONS; IONOSPHERIC SCINTILLATIONS; SATELLITE COMMUNICATION.

- H1. AN HF HIGH-POWER VERTICALLY DIRECTED ARRAY FOR IONOSPHERIC MODIFICATION; P. W. ARNOLD; October 1973. 34 pp. OT Report 73-21
A ten-element array of crossed conical dipoles designed for transmission at or near vertical incidence in the 5-10 MHz portion of the HF spectrum is described.
ANTENNAS; CONICAL DIPOLE; HF SPECTRUM; IONOSPHERIC MODIFICATION.
- H2. HIGH CAPABILITY BUOY MODEL ANTENNA PERFORMANCE MEASUREMENTS; R. G. FITZGERRELL; March 1972. 53 pp. OT TM 78
This report describes scale model antenna measurements performed to aid in predicting the performance of full scale, high capability buoy antennas. The basic parameters for the performance measurements were frequency, number of cone, wires on the essentially discone antenna configuration and buoy tilt angle. A 1/36/05 scale model was used for all measurements with wire mesh or aluminum simulating sea surface.
ANTENNAS; VOLTAGE STANDING-WAVE RATIO.
- H3. HIGH FREQUENCY PERFORMANCE PREDICTIONS (MARS) FOR JANUARY 1971; J. W. FINNEY, E. PADILLA; September 1970. 41 pp. OT/ITS TM 4
High frequency system performance prediction were provided for the Military Affiliate Radio System.
IONOSPHERIC PREDICTIONS; RADIO SYSTEMS.
- H4. HIGH FREQUENCY PERFORMANCE PREDICTIONS (MARS) FOR FEBRUARY 1971; J. W. FINNEY, G. R. ENOCH; February 1971. 41 pp. OT/ITS TM 8
High frequency system performance prediction were provided for the Military Affiliate Radio System.
IONOSPHERIC PREDICTIONS; RADIO SYSTEMS.
- H5. HIGH FREQUENCY SYSTEM PERFORMANCE PREDICTIONS (MARS) FOR MARCH 1971; J. W. FINNEY, E. C. PADILLA; February 1971. 41 pp. OT/ITS TM 18
High frequency system performance prediction were provided for the Military Affiliate Radio System.
IONOSPHERIC PREDICTIONS; RADIO SYSTEMS.
- H6. HIGH FREQUENCY SYSTEM PERFORMANCE PREDICTIONS (MARS) FOR APRIL 1971; J. W. FINNEY, E. C. PADILLA; March 1971. 41 pp. OT/ITS TM 26
High frequency system performance prediction were provided for the Military Affiliate Radio System.
IONOSPHERIC PREDICTIONS; RADIO SYSTEMS.
- H7. HIGH FREQUENCY PROPAGATION PREDICTIONS AND ANALYSIS FOR CIRCUITS FROM THE USCG SAN FRANCISCO RADIO STATION TO SHIPS AND AIRCRAFT OPERATING IN THE NORTH PACIFIC AREA; R. D. HUNSUCKER; June 1971. 155 pp. OT TRER 15
This report presents the results of an investigation of the capability of the

U. S. Coast Guard San Francisco HF Radio Station to communicate with ships and aircraft in the northern Pacific Ocean area. The general high-latitude HF propagation problem is discussed, and the ITS propagation prediction computer program has been modified to include some high-latitude ionospheric effects.

HF PROPAGATION.

- H8. HOME WARNING RECEIVER PRICE AND DISTRIBUTION CONSIDERATIONS; G. G. AX, S. O. ROSEN; June 1974. 49 pp. OT TM 74-168

This study considers two factors that have a bearing upon the effectiveness of any national home warning system that requires the public to purchase a warning device. These factors were estimates of the warning receiver costs as a function of production volume and considerations in the distribution of them from manufacturer to the consumer.

HOME WARNING SYSTEM.

- H9. HOURLY PROBABILITY OF WORLD-WIDE THUNDERSTORM OCCURRENCE; W. Q. CRICHLAW, R. C. DAVIS, R. T. DISNEY, M. W. CLARK; April 1971. 106 pp. OT/ITS RR 12

An evaluation of the probability that a thunderstorm will occur during any specified hour and season for any location throughout the world. The data are presented by means of a series of synoptic world charts, each representing a particular universal time.

MAPS; RADIO INTERFERENCE; THUNDERSTORMS.

- I1. IMPEDANCE MAPS TO PREDICT THE EFFECTS OF IRREGULAR, INHOMOGENEOUS GROUND OF LORAN C/D RADIO NAVIGATION SYSTEMS; J. R. JOHLER, D. C. HYOVALTI, W. B. JONES; February 1973. 93 pp. OT Report 73-6

Previously developed ideas on the prediction of loran over irregular inhomogeneous ground are implemented in this paper using concepts of numerical analysis that have been successfully applied to the mapping of the ionosphere. The region of Eglin Air Force Base, Florida, mapped in some detail to demonstrate the principles involved. Computer techniques are introduced to solve the problem.

LOLAN C; LORAN D; RADIO NAVIGATION SYSTEMS.

- I2. THE INTERDEPARTMENT RADIO ADVISORY COMMITTEE-50 YEARS OF SERVICE; C. R. KIRKEVOLD; June 1972. 31 pp. TEL-IRAC-72-30

Report contains the history of the Committee.

ELECTROMAGNETIC COMPATIBILITY; RADIO SPECTRUM; SPECTRUM MANAGEMENT.

- I3. INTERFERENCE AND COMPATIBILITY MONITORING AND MEASUREMENTS FOR UHF SATELLITE EARTH TERMINALS; D. H. ZACHARISEN, R. T. DISNEY, L. D. SCHULTZ, A. F. BARGHAUSEN, R. J. MATHESON; December 1971. 43 pp. OT TM 69

This report summarizes the work performed for the National Environmental Satellite Services from June through September 1971. Emissions in two UHF bands, centered on 468.825 and 1690 MHz were monitored and analyzed at four GOES system Data Utilization Stations (DUS) to determine the RFI/EMC environment. The data collection technique and the measurement/monitoring system instrumentation are

discussed. Distributions and tables showing diurnal and geographic variations of spectrum usage in the lower band are presented along with photographs of emissions observed in the higher band.

GOES COMMUNICATIONS; SPECTRUM USAGE; UHF SATELLITE.

- I4. INTERFERENCE PREDICTIONS FOR VHF/UHF AIR NAVIGATION AIDS (Supplement to IER 26-ITSA 26 and ERL 138-ITS 95); G. D. GIERHART, M. E. JOHNSON; January 1971. 58 pp.
OT/ITS TM 19

This report supplements information previously developed by the authors on interference predictions for VHF/UHF air navigation aids. Included are (a) radiation patterns needed to adapt curves previously developed for the ILS localizer and TACAN to new equipment types, (b) comparisons of the propagation models used for predictions made from 1962 to the present, (c) propagation information in a different form, i.e., attenuation greater than free space for DME, TACAN, and VOR, (d) DME, TACAN and VOR service volume without interference curves for equipment configurations not previously considered, and (e) an errata list for earlier ESSA Technical Reports.

PROPAGATION MODEL; VHF/UHF AIR NAVIGATION.

- I5. INTERMODULATION EFFECTS IN SPACE-QUALIFIED-TYPE TRAVELING-WAVE TUBES; W. M. WELCH; January 1975. 35 pp.
OT Report 75-55

Characteristics of space-qualified traveling-wave tubes are summarized. The nonlinear behavior of these tubes is outlined, and the experimental and theoretical investigations of several authors are given. Recent advances which will influence satellite communication systems are discussed.

SATELLITE COMMUNICATION; TRAVELING-WAVE TUBES.

- I6. THE INTERNATIONAL RADIO CONSULTATIVE COMMITTEE (CCIR); Part 1, History and Structure; Part 2, Current Technical Program; R. C. KIRBY, E. K. SMITH; June 1974. 76 pp.
OT TM 74-173

This report is designed to make the significance and usefulness of the CCIR more understandable to the engineer involved in systems planning and in operations. Part 1--attempts to look at CCIR rather broadly, e.g., from the standpoint of the history of its parent organization, the International Telecommunication Union; from the standpoint of its effectiveness and future prospects when the organization is considered as a whole. Part 2--a more detailed examination is made of the CCIR by Study Group, and attention is primarily directed towards work during the last four years.

INTERNATIONAL TELECOMMUNICATIONS; RADIO COMMUNICATIONS; SYSTEM ENGINEERING.

- ✓ I7. AN INTRODUCTION TO UNDERSEA CABLE SYSTEM; R. L. GALLAWAY, F. H. WILLIS; June 1974. 142 pp.
OT Report 74-41

This report is addressed to the system engineer and is intended to provide a broad tutorial overview of a submarine cable system. It assumes a background in telecommunications and concentrates on the peculiarities of the typical undersea system. The concepts discussed in the text are illustrated through the description of two modern systems as shown in the Appendix.

SUBMARINE CABLE SYSTEM; TELECOMMUNICATIONS; UNDERSEA CABLE.

18. INVESTIGATION OF EFFECT OF ANTENNA SITE AND ANTENNA TYPE ON LF NON-DIRECTIONAL BEACON PERFORMANCE; L. A. BERRY, R. G. FITZGERRELL, L. E. VOGLER; December 1973. 81 pp. FAA-RD-73-174
(prepared for the Federal Aviation Administration)

The reasons that out-of-tolerance needle swings are indicated by low-frequency direction-finding receivers tuned to FAA non-directional beacon transmitters are investigated theoretically and experimentally.

ANTENNA SITING; LOW FREQUENCY BEACON; RADIO PROPAGATION.

19. IONOSPHERIC MODIFICATION EFFECTS AT PLATTEVILLE WITH REDUCED POWER; W. F. UTLAUT, E. J. VIOLETTE, L. L. MELANSON; August 1973. 19 pp. OT TM 73-149C

110. IONOSPHERIC PREDICTIONS; Volumes 1-4; September 1971 OT TRER 13

Vol. 1--contains the estimation of maximum usable frequencies from world maps of MUF (ZERO)F2, MUF (4000)F2, and MUF (2000)E. 22 pp.

Vol. 2--contains maximum usable frequencies MUF(ZERO)F2, MUF (4000)F2, MUF (2000)E for a period of minimum solar activity, $R_{12} = 10$. 437 pp.

Vol. 3--contains maximum usable frequencies MUF(ZERO)F2, MUF (4000)F2, MUF (2000)E for a maximum solar activity period of an average solar cycle, $R_{12} = 110$. 437 pp.

Vol. 4--contains maximum usable frequencies MUF(ZERO)F2, MUF (4000)F2, MUF (2000)E for a maximum solar activity period of an above average solar cycle, $R_{12} = 160$. 437 pp.

IONOSPHERIC PREDICTIONS.

111. IONOSPHERIC SCINTILLATION AS IT AFFECTS SATELLITE COMMUNICATION; Part 1--Geophysical Aspects; E. K. SMITH; November 1974. 118 pp. OT TM 74-186

This study concerns ionospheric scintillation as it affects satellite communications between about 100 MHz and 30 GHz. It is divided into three parts. This part reviews the pertinent physics and suggests some boundaries and values for some of the critical geophysical parameters needed to make communications estimates.

IONOSPHERIC SCINTILLATIONS; RADIO WAVE; SATELLITE COMMUNICATION.

112. IONOSPHERIC SCINTILLATION AS IT AFFECTS SATELLITE COMMUNICATION; Part 2--A Transfer Function for Ionospheric Scintillations; R. H. OTT; December 1974. 20 pp. OT TM 74-187

The Born approximation is used to derive a general expression for a radio wave passing through the random medium. The medium is characterized by a random index of refraction. An explicit transfer function is derived using the Fremouw and Rino model for the index of refraction. The bandwidth of the channel is derived in terms of the variance or the index of refraction.

FREQUENCY CORRELATION; IONOSPHERIC SCINTILLATIONS; RADIO WAVE; SATELLITE COMMUNICATION.

113. IONOSPHERIC SCINTILLATION AS IT AFFECTS SATELLITE COMMUNICATION; Part 3--Scintillation Channel Characterization and MPSK Performance Estimation; M. NESENBERGS; December 1974. 56 pp. OT TM 74-190

This memorandum is concerned with scintillation effects on digital MPSK

channels in presence of additive Gaussian noise. The basic channel statistics, such as the correlation bandwidth and related spreads are introduced. Later the function of the demodulator is reviewed and the most popular digital performance index, the bit error probability, is pursued.

CHANNEL STATISTICS; IONOSPHERIC SCINTILLATIONS; SATELLITE COMMUNICATION.

- I14. IONOSPHERIC SIMULATION TECHNIQUES FOR TESTING OPERATIONAL COMMUNICATIONS EQUIPMENT; J. C. BLAIR; APPENDIX A--ITS IONOSPHERIC CHANNEL SIMULATOR; C. C. WATERSON; November 1972. 61 pp. OT TM 118

A description of a technique of testing operating communications equipment with magnetic tape recordings of simulated ionospherically propagated signals. Data are given on a set of these simulation tapes made on two FSK systems.

HF SIMULATION; MAGNETIC TAPE FIDELITY.

- I15. IRREGULAR TERRAIN PROPAGATION MODEL-MODIFICATIONS FOR ZERO HEIGHT ANTENNAS AND VEGETATION EFFECTS; A. G. LONGLEY; March 1972. 26 pp. OT TM 87

This report describes some effects of the electrical ground constants and possible modifications of the irregular terrain propagation model (Longley and Rice, 1968) for special applications with low and zero-height antennas. Effects of vegetation or other objects near a ground-based emitter are considered.

ANTENNAS; IRREGULAR TERRAIN; PROPAGATION MODEL; VEGETATION.

- ✓ I16. ITS ANNUAL TECHNICAL PROGRESS REPORT 1974--For the Period July 1, 1973 through June 30, 1974; INSTITUTE FOR TELECOMMUNICATION SCIENCES; September 1974. 96 pp.

This is a report on progress in the technical program of the Institute for Telecommunication Sciences of the Office of Telecommunications.

DATA COMMUNICATION; OPTICAL SYSTEMS; RADIO WAVE; SATELLITE SYSTEMS; SPECTRUM ENGINEERING

- L1. LOCAL AND DIURNAL VARIATIONS IN GROUND-BASED RADIO REFRACTIVITY GRADIENTS AT TROPICAL LOCATION; B. A. HART, G. D. THAYER, H. T. DOUGHERTY; November 1971. 65 pp. OT TRER 23

Discusses the delineation of characteristics that make tropical radio climates unique, and presents (1) recent data to illustrate the refractivity gradient variability that is normal in the tropics but would be extreme in other regions, (2) telecommunication problems which have resulted from usage of present radiometeorological forecasting procedures in tropical countries, and (3) guides which might be used to alleviate climatic problems that now prevent accurate predictions of propagation behavior.

REFRACTIVE INDEX; TROPICAL PROPAGATION.

- L2. LORAN A GROUNDWAVE PULSE PROPAGATION; J. R. JOHLER; March 1971. 71 pp. OT/ITS RR 10

The Loran A groundwave radio navigation pulse is analyzed with a computer simulation of the general pulse propagation theory for linear amplitude systems.

The natural perturbations of the propagation medium are introduced into the computer simulation and the limitations imposed by nature on the navigation system are estimated quantitatively. The propagation corrections for the radio navigator's equation are formulated so that the ultimate accuracy of the system (using arithmetical propagation corrections) can be estimated.

GROUNDWAVE PROPAGATION; LORAN A; LORAN C; LORAN D; PULSE PROPAGATION; RADIO NAVIGATION SYSTEMS.

- L3. A LORAN-C GRID CALIBRATION AND PREDICTION METHOD; R. H. DOHERTY; February 1972. 47 pp. OT TRER 25

Small area calibration, Loran-C coordinate conversion to UTM, and Loran-C prediction outside the calibrated area are treated in detail. The elimination of bad data points and other uses of the method are discussed. The errors associated with coordinate conversion techniques are treated separately from errors associated with propagation anomalies. When measured data are fitted directly to a coordinate conversion model, the type of errors are inseparable.

LORAN C; PROPAGATION.

- L4. LORAN RADIO NAVIGATION OVER IRREGULAR, INHOMOGENEOUS GROUND WITH EFFECTIVE GROUND IMPEDANCE MAPS; J. R. JOHLER; November 1971. 175 pp. OT TRER 22

Some deterioration of accuracy was predicted theoretically in 1967 in the presence of irregular, inhomogeneous ground. This paper presents further evidence concerning this phenomenon and offers a simplified approach to keep the degradation in navigation accuracy to a minimum by introducing the notion of impedance mapping. As a guide to theoretical and experimental work in Loran navigation, five principles are introduced. Some experimental and theoretical examples in support of these principles are presented in specific cases pertinent to the 100 kHz Loran C/D System.

LORAN C; LORAN D; LORAN RADIO NAVIGATION.

- M1. MAN-MADE RADIO NOISE, Part I--Estimates for Business, Residential, and Rural Areas; A. D. SPAULDING, R. T. DISNEY; June 1974. 133 pp. OT Report 74-38

This report discusses a data base of man-made radio noise measurements in the frequency range from 250 kHz through 250 MHz taken in a number of geographical areas. This data base has been analyzed to provide estimates of the expected characteristics of man-made radio noise in business, residential, and rural areas. Examples of amplitude and time statistics of the received man-made radio noise process also are shown and discussed.

MAN-MADE RADIO NOISE; NOISE CHARACTERISTICS; NOISE LEVELS.

- M2. MAN-MADE RADIO NOISE CHARACTERISTICS ON AND IN THE VICINITY OF MILITARY AND OTHER GOVERNMENT INSTALLATIONS; A. D. SPAULDING, L. R. ESPELAND; September 1971. 86 pp. OT TM 48C

- M3. MATHEMATICAL COMPUTER MODEL AND PREDICTIONS FOR ATS-F RADIO INTERFERENCE EXPERIMENT AT 6 GHz; R. R. BERGMAN, P. L. RICE, M. J. MILES; August 1972. 142 pp. OT TM 107

A description is given of a mathematical model for calculating radio frequency interference (RFI) levels at synchronous orbit from common carrier microwave

systems in the 5925-to-6425 MHz common carrier band is described. The input data for the resulting computer program are derived from various government frequency sources. Results are based on assigned terrestrial transmitter locations, power levels, average antenna patterns, assigned and random azimuths and assumed signal polarizations.

ANTENNAS; ATS-F SATELLITE; COMMON CARRIER; TERRESTRIAL COMMUNICATIONS.

- M4. MEASURED PERFORMANCE OF UHF ANTENNAS IN CONCRETE; R. G. FITZGERRELL, L. L. HAIDLE; September 1971. 152 pp. OT TRER 17

Two types of hardened antennas for long-range ground-to-air communication links at UHF were investigated--the buried annular slot and the conical monopole cast in a concrete hemisphere. Extensive antenna performance data, results of measured power gain and input VSWR, are presented in contour plot form as functions of frequency from 225 MHz to 400 MHz. The detrimental effects of debris on antenna performance were measured, and the resulting data are plotted as contours of power gain and VSWR as functions of debris depth for two debris moisture contents. Some additional antenna performance measurements were made between 10 MHz and 200 MHz.

ANTENNA MEASUREMENTS; UHF ANTENNA.

- M5. MEASURED AND PREDICTED LONG-TERM DISTRIBUTIONS OF TROPOSPHERIC TRANSMISSION LOSS; A. G. LONGLEY, R. K. REASONER, V. L. FULLER; July 1971. 374 pp. OT TRER 16

This report summarizes measurements of tropospheric transmission loss and its long-term variability for nearly 800 paths in various parts of the world. The measurements were made at frequencies from 40 MHz to 10 GHz over distances which range from 10 to 1000 km. Terrain profiles and cumulative distributions of both observed and predicted losses are plotted for more than 500 of these paths.

LOCATION VARIABILITY; MEASUREMENTS; TROSPHERIC PROPAGATION.

- M6. MEASUREMENT OF FEDERAL LAND MOBILE RADIO USAGE AT NORFOLK, VIRGINIA, DURING JUNE 1974; G. D. GIERHART; October 1974. 56 pp. OT TM 74-184C

- M7. MEASUREMENT OF FEDERAL LAND MOBILE RADIO USAGE IN THE VICINITY OF WASHINGTON, D. C., DURING THE NOVEMBER 1973 TO MARCH 1974; G. D. GIERHART, A. F. BARGHAUSEN; August 1974. 110 pp. OT TM 74-178C

- M8. MEASUREMENT OF INTERFERENCE EFFECTS BETWEEN TDM-FM AND FDM-FM MICROWAVE SYSTEMS; D. SMITH, F. G. KIMMETT; March 1975. 39 pp. OT TM 75-194

Effects of various types of interference on system performance between TDM-FM and FDM-FM Microwave Systems were investigated. Bit-error-rate and orderwire signal-to-noise ratio were used as indices of TDM-FM system performance, and noise power ratio was used as the index for the FDM-FM system evaluation. These measurements indicate that the TDM-FM system can operate at higher interference levels than the FDM-FM system when subjected to TDM-FM interference.

BIT-ERROR-RATE; MICROWAVE SYSTEMS; NOISE POWER RATIO; SIGNAL-TO-NOISE RATIO.

- M9. MEASUREMENT REPORT ON RADAR OPERATIONS IN NORFOLK, VIRGINIA, AND VICINITY, MAY-JUNE 1974; A. F. BARGHAUSEN, R. J. MATHESON; December 1974. 114 pp. OT TM 74-188C

- M10. MEASUREMENTS REPORT ON RADAR OPERATIONS IN WASHINGTON, D. C., AND VICINITY, MARCH-MAY 1974; A. F. BARGHAUSEN, R. J. MATHESON; July 1974. 58 pp.
OT TM 74-176C
- M11. A METEOROLOGICAL MODEL FOR USE IN THE STUDY OF RAINFALL EFFECTS ON ATMOSPHERIC RADIO TELECOMMUNICATIONS; E. J. DUTTON; December 1971. 20 pp.
OT TRER 24

The first part of this report is devoted to finding drop-size distribution parameters at the earth's surface. The second and third parts are devoted to methods of ascertaining the drop-size distribution in the cloud itself using an approach for analysis of data (radiosonde) taken during a known rainstorm and then using an approach that involves only surface data. It should be emphasized that the modelling is primarily oriented toward solution of the telecommunication problems of scatter and attenuation rather than toward solution of a problem in cloud and precipitation physics.

METEOROLOGICAL MODEL; TELECOMMUNICATIONS.

- M12. A METHOD FOR FINDING D-REGION ELECTRON DENSITY DISTRIBUTIONS FROM LF BROAD-BAND PULSE MEASUREMENTS; B. WIEDER, R. H. ESPELAND; November 1972. 68 pp.
OT TRER 38

A Loran-C transmitter is used as the signal source for the experiment. In the experiment, both the normal and abnormal components of the pulses reflected from the ionosphere are measured, and the reflection coefficients are determined as a function of frequency through Fourier analysis of both the groundwave and the skywave signals. The resultant data are then compared with reflection coefficients calculated from a series of test D-region electron density profiles.

ELECTRON DENSITIES; LF BAND; LORAN C; PULSE MEASUREMENTS; RF PULSES.

- M13. A METHOD OF BIVARIATE INTERPOLATION AND SMOOTH SURFACE FITTING BASED ON LOCAL PROCEDURES; H. AKIMA; March 1973. 42 pp.
OT REPORT 73-7

A method is designed for interpolating values given at points of a rectangular grid in an x-y plane by a smooth bivariate function $z=z(x,y)$. The interpolating function is a bicubic polynomial in each cell of the rectangular grid. Emphasis is on avoiding excessive undulation between given grid points.

BIVARIATE INTERPOLATION.

- M14. MEASUREMENTS OF LORAN C SKYWAVE STABILITY; B. WIEDER, R. H. ESPELAND, L. R. TETERS; April 1973. 22 pp.
OT Report 73-9

Describes a technique designed to determine the characteristics of the ionospheric wave, such that the effects of these waves on the navigation process can be evaluated with the objective of improving and/or extending the range of Loran-C navigation. Suggested tasks for further investigation are given.

GROUNDWAVE MEASUREMENTS; LORAN C.

- M15. A METHOD OF NUMERICAL REPRESENTATION FOR THE AMPLITUDE-PROBABILITY DISTRIBUTION OF ATMOSPHERIC RADIO NOISE; H. AKIMA; March 1972. 24 pp.
OT TRER 27

This report presents a method for numerically representing the ADP function

of atmospheric radio noise for a specified V_d value. It also presents two computer subprograms that implement the method.

ATMOSPHERIC RADIO NOISE.

- M16. METRICS FOR SPECTRUM-SPACE USAGE; D. R. EWING, L. A. BERRY; November 1973. 51 pp. OT Report 73-24

The position is taken that use of the spectrum-space means denial of frequency bandwidth, geographic area, and time to other prospective users. Further, both transmitters and receivers use the spectrum space in this sense. Three alternative spectrum space metrics are defined: (1) situation-specific metric; (2) uniform metric; and (3) autonomous metric.

RADIO FREQUENCY; SPECTRUM USAGE.

- M17. MICROWAVE COMMUNICATION LINKS AT 15 GHz; A. P. BARSIS, C. A. SAMSON, H. T. DOUGHERTY; June 1973. 60 pp. SCC-ACO-2-73
(prepared for U. S. Army Strategic Communications Command)

Examination is made of the feasibility of using frequencies around 15 GHz for point-to-point wideband communication links. System parameters are summarized and initial estimates of long-term median performance are presented. The effects of rainfall and of the statistics of rain rate distributions are applied to system performance estimates, and potential system reliability and outage time are determined. An alternative method for determining rainfall probabilities is given in the appendix.

LINE-OF-SIGHT LINKS; MICROWAVE SYSTEMS; RAIN ATTENUATION.

- M18. MICROWAVE COMMUNICATION LINKS AT 15 GHz; A. P. BARSIS, C. A. SAMSON, H. T. DOUGHERTY; June 1973. 60 pp. OT TM 73-142

Examination is made of the feasibility of using frequencies around 15 GHz for point-to-point wideband communication links. System parameters are summarized and initial estimates of long-term median performance are presented. The effects of rainfall and of the statistics of rain rate distributions are applied to system performance estimates, and potential system reliability and outage time are determined. An alternative method for determining rainfall probabilities is given in the appendix.

LINE-OF-SIGHT LINKS; MICROWAVE SYSTEMS; RAIN ATTENUATION.

- M19. MODELING THE EFFECTS OF CLOUDS AND RAIN UPON SATELLITE-TO-GROUND SYSTEM PERFORMANCE; E. J. DUTTON, H. T. DOUGHERTY; March 1973. 49 pp. OT Report 73-5

A state-of-the-art engineering model is described for estimating the expected performance degradation of satellite-to-ground microwave systems because of atmospheric gases, clouds, and rain. The model incorporates an allowance for a vertical structure of atmospheric gases, clouds, and rain as well as local and regional rainfall statistics. A composite prediction is given for 15 GHz, as representative of microwave signals, for 1.0, 0.1, and 0.01 percent of an average year.

ATMOSPHERIC GASES; MICROWAVE SIGNALS; SATELLITE-TO-GROUND SYSTEM.

- M20. MOLECULAR ATTENUATION AND PHASE DISPERSION BETWEEN 40 AND 140 GHz FOR PATH MODELS FROM DIFFERENT ALTITUDES; H. J. LIEBE, W. M. WELCH; May 1973. 112 pp.
OT Report 73-10

The report addresses the use of the frequency spectrum 40 to 140 GHz for radio propagation through the clear atmosphere and discusses in detail ultimate limitations due to air molecules of which oxygen is a major species. Attenuation and dispersion rates for path models are evaluated by computer routines. Examples of computer plots are given as a function of altitude for homogeneous zenith and tangential path geometries. Baseline data on unique atmospheric transfer properties for a largely unused portion of the spectrum is provided.

ATMOSPHERIC TRANSMISSIVITY; MICROWAVE SPECTRUM; RADIO PROPAGATION.

- M21. MOTOROLA TEST REPORT DCS MICROWAVE RADIO TECHNICAL PROPOSAL VERIFICATION MODEL; R. E. SKERJANEC; February 1972. 225 pp.
OT TM 83

This report contains the test and inspection results on the technical proposal verification model of the DCS microwave radio.

MICROWAVE RADIO.

- M22. MULTIPATH IN AIR TRAFFIC CONTROL FREQUENCY BANDS; Volume I--Classification of Multipath, Effects of Multipath on Systems, and Causes of Multipath; 300 pp. Volume II--CIII through GIV, General Bibliography; 470 pp; EDITED BY W. J. HARTMAN; July 1974. FAA-74-75 I & II
(prepared for the Federal Aviation Administration)

Volume I--This handbook presents a collection of theories and techniques which have one or more of the following qualities: It has been in frequent use by engineers; it has been shown to be accurate; it can be applied to a wide variety of problems; it offers an easily obtainable upper or lower bound. Since the handbook is directed toward air traffic control (ATC) frequencies, most of the material presented is oriented toward frequencies above VHF, and toward line-of-sight paths. Two special sections, one on Omega and one on Loran are included. No information on HF propagation or ionospheric scatter is included. Volume II--This volume is a continuation of the Handbook sections CII through GIV and a general bibliography.

AIR TRAFFIC CONTROL; MULTIPATH; OMEGA; PATH LOSS CALCULATIONS; RADAR REFRACTIVITY.

- N1. NARROW-BAND DIRECT-PRINTING RADIOTELEGRAPHY: A State-Of-The-Art Survey; P. I. WELLS; October 1974. 41 pp.
OT Report 74-48

This report is a survey of the state-of-the-art of direct printing radiotelegraphy techniques which are applicable to the maritime mobile radiotelegraphy service. First, the current status of the maritime mobile radiotelegraphy service is assessed. Then the available direct printing radiotelegraphy technology is assessed. The technology surveyed included radio equipment, telegraphy, terminal equipment and error control techniques.

MARITIME MOBILE; RADIOTELEGRAPHY.

- N2. NEAR-ZONE FIELDS AND POWER DENSITIES OF MONOPOLE AND DIPOLE ANTENNAS; D. A. HILL, D. S. IRWIN; July 1972. 70 pp.
OT TM 95

Near-zone field and power density expressions are derived for vertical monopole

and horizontal dipole antennas over imperfect ground using the sinusoidal current and reflection coefficient approximations. Computer program results are given for representative cases. The extent of the near-field region is also examined.

ANTENNAS.

- N3. NECESSARY BANDWIDTHS FOR FREQUENCY-MODULATED MICROWAVE RADIO RELAY SYSTEMS; H. AKIMA; February 1972. 13 pp. OT TRER 26

A method for determining the necessary bandwidth for a frequency-modulated (FM) microwave radio relay systems that is equipped with a continuity pilot is described. A set of values necessary for determining the peak frequency deviation in an FM system that transmits a frequency-division-multiplexed (FDM) telephony signal and those for the level of a uniform-spectrum signal that approximates an FDM telephony signal are given.

FREQUENCY MODULATION; MICROWAVE RADIO RELAY SYSTEM; TELEPHONY SIGNAL.

- N4. A NEW METHOD FOR PREDICTING HF GROUND WAVE ATTENUATION OVER INHOMOGENEOUS IRREGULAR TERRAIN; R. H. OTT; January 1971. 57 pp. OT/ITS RR 7

Several examples of the numerical evaluation of an integral equation for the calculation of the attenuation of a radio wave are given. The applicability of the program to permit computations of propagation over terrain with smooth height variation is demonstrated.

HF GROUNDWAVE ATTENUATION; PROPAGATION; RADIO WAVE.

- N5. NUMERICAL MAPPING OF THE CONTINENTS FOR USE IN HIGH-FREQUENCY SKYWAVE RADIO PREDICTIONS; D. H. ZACHARISEN; May 1972. 16 pp. OT TRER 31

Worldwide surface electrical properties represented by sea water, poor ground/sea ice, and polar cap ice have been rescaled in one degree increments in latitude and longitude. These are used in computing the ground reflection losses of ionospherically propagated HF radio waves. The 65,160 scaled points are represented by a numerical map of 405 coefficients that are continuous in latitude and longitude. This numerical map and a computer program for evaluating it are included in this report along with a new interpolation scheme for eliminating the step function at the continental boundaries.

HF RADIO PREDICTIONS.

- N6. A NUMERICAL METHOD FOR PREDICTING LF BEACON BEARING ERRORS CAUSED BY RIDGES; R. H. OTT, J. A. FULLER; February 1972. 36 pp. OT TM 73-129

A numerical method for predicting the performance of a monopole beacon antenna in the vicinity of a ridge-like terrain feature is given. The airborne receiving antenna is assumed to be equivalent to two crossed loops. The numerical method compares favorably with the exact eigenfunction solution for the special case where the terrain cross-section is an elliptic cylinder. The bearing error is shown to be proportional to the cross-sectional area of the ridge. The maximum bearing error occurs approximately along the ridge.

ANTENNAS; LF BEACON.

- N7. THE NUMERICAL REPRESENTATION OF THE CRITICAL FREQUENCY OF THE F1 REGION OF THE IONOSPHERE; R. K. ROSICH, W. B. JONES; October 1973. 102 pp.
OT Report 73-22

A numerical representation of the monthly median F1-layer critical frequency foF1 is given for the worldwide geographic and diurnal variation, as well as for the periodic seasonal variation and the secular trend due to solar activity. Numerical maps based upon analysis of about 40,000 data values from a worldwide network of ionospheric stations from January 1954 to December 1966 are presented.

CRITICAL FREQUENCY; IONOSPHERE; NUMERICAL MAP; RADIO PROPAGATION.

01. AN OBJECTIVE SPEECH QUALITY MEASUREMENT OF A COMMUNICATION CHANNEL; J. A. PAYNE, P. M. McMANAMON; June 1973. 58 pp.
OT Report 73-14

A signal generator has been constructed for the purpose of objectively testing a communication channel for speech quality. The processed value is an Articulation Index. The primary virtue of this testing method is the low cost in comparison to subjective methods. From the technical literature of the Bell System Technical Journal and the American National Standard S3.5 (1969), theoretical articulation index values are calculated. Finally, a statistical characterization of transmission loss and message circuit noise for the telephone system is related to theoretical AI value.

ARTICULATION INDEX; COMMUNICATION CHANNEL; NOISE LEVELS; SIGNAL NOISE LEVEL; SPEECH QUALITY.

02. THE OCCURRENCE OF SPREAD F AND ITS EFFECT ON HF PROPAGATION; R. M. DAVIS, JR.; March 1972. 136 pp.
OT TRER 28

The widely different patterns of spread-F probability found at low, middle, and high latitudes are discussed in detail.

HF PROPAGATION.

03. ON OPTICAL ALTERNATIVES TO MICROWAVE LOS COMMUNICATIONS; H. T. DOUGHERTY; July 1973. 18 pp.
SCC-ACO-3-73

Results of a study on the utilization of electromagnetic radiation in the region of 15 GHz and above for wideband military communications are presented.

ELECTROMAGNETIC RADIATION; WIDEBAND COMMUNICATIONS.

04. ON THE CALCULATION OF AN AVERAGE SURFACE IMPEDANCE FOR A PERIODIC SURFACE; R. K. ROSICH, J. R. WAIT; October 1970. 69 pp.
OT/ITS RR 1

A point-matching technique is employed to obtain the electromagnetic fields scattered from a surface whose height profile is periodic. The surface impedance or Leontovich boundary condition is assumed to apply in a local sense. Thus, the results are restricted to situations where the lower medium is well conducting (e.g., sea water).

ELECTROMAGNETIC FIELDS.

05. ON THE PREDICTION OF LORAN-D; R. H. DOHERTY, J. R. JOHLER; September 1972. 20 pp. OT TRER 35

Observations concerning the deployment of Loran-D system in Germany are recorded and interpreted using the theory of propagation. The experiences gained from this mission are discussed and recommendations for future deployments are made.

LORAN D; PROPAGATION.

06. A 100-kHz ATMOSPHERIC RADIO NOISE SIMULATOR; E. C. BOLTON; September 1971. 47 pp. OT TM 57

Details are given of the circuitry involved in the construction of a digital atmospheric radio noise simulator developed at the Lab. Since the simulator has known statistics that are stationary it is useful in determining the performance of radio systems which may have to operate under the influence of random impulsive types of noise which is characteristic of atmospheric radio noise.

RADIO NOISE; SIMULATOR.

- ✓ 07. OPTICAL COMMUNICATION SYSTEMS FOR SHORT-HAUL APPLICATIONS; L. E. WOOD, S. MURAHATA; March 1973. 79 pp. OT Report 73-3

Describes the installation and operation of a commercial 40.8-kilobit optical communications link on a 3000-ft. path near Boulder, Colorado. Objectives were to obtain equipment reliability, and to determine problems associated with fog, rain, snow, and atmospheric turbulence. The system was operated for 6 months between December 1971 and June 1972.

OPTICAL COMMUNICATIONS.

- ✓ 08. OPTICAL FIBER LINKS FOR TELECOMMUNICATIONS, Part Two; R. L. GALLAWAY, A. G. HANSON, R. B. CHADWICK, M. KOYAMA; July 1973. 138 pp. (prepared for U. S. Army Strategic Communications Command) SCC-ACO-1-73

The report contains a review of military requirements, a review of the state of the technology, and a list of recommendations for further work. The latter is divided into two time frames, indicating certain tasks which have a bearing on the mid-1980's time frame. The report contains the justification for the recommendations which suggest work that could provide the interface between the state of the technology and workable communication system.

OPTICAL FIBER LINKS; TELECOMMUNICATIONS.

09. OPTIMUM DISTANCES AND FREQUENCY COMPLEMENTS FOR HF DATA TRANSMISSIONS FROM OCEAN BUOYS IN THE GULF OF MEXICO; D. N. HATFIELD; December 1970. 23 pp. OT/ITS TM 13

This paper gives the optimum distances and HF frequency complements for the buoys as indicated by predicted propagation conditions for the time period. Graphs of communication reliability versus distance for each allocated frequency are given along with communication coverage maps of the Gulf of Mexico.

AUTOMATIC BUOYS; HF FREQUENCY; PROPAGATION.

- 010.. OPTIMUM FREQUENCY COMPLEMENTS FOR HF DATA TRANSMISSIONS FROM OCEAN BUOYS IN THE GULF OF MEXICO, GULF OF ALASKA AND EAST-WEST COASTS; G. H. STONEHOCKER, November 1974. 103 pp. OT TM 74-185

This paper considers predicted propagation conditions to determine optimum HF frequency complements for buoys at various distances from the receiving stations. Graphs of communication reliability versus distance for each allocated frequency are given for the four seasons for 1974-75 during the sunspot minimum period.

AUTOMATIC BUOYS; HF FREQUENCY; PROPAGATION.

011. OPTIMUM HF FREQUENCIES FOR U. S. COAST GUARD ICE BROADCASTS ON CW AND FAX FOR 1971; J. E. ADAMS; January 1971. 39 pp. OT/TTS TM 15

The report describes a study which made it possible to obtain almost equivalent reliability and coverage from a radio system using two HF frequencies rather than three. The study utilizes a computer base simulation model which was applied to transmitting equipment used by U. S. Coast Guard at Otis Air Force Base, Cape Cod, Massachusetts. The frequency combination 8502 and 12750 kHz provides best system operation. Elimination of the third frequency reduces the predicted system reliability by 2 or 3 percent.

HF FREQUENCY; ICE BROADCASTS.

012. OT ANNUAL REPORTS--

FY 1974, For the Period from July 1, 1973 through June 30, 1974; PUBLIC INFORMATION OFFICER; December 1974. 54 pp.

FY 1973, For the Period from July 1, 1972 through June 30, 1973; PUBLIC INFORMATION OFFICER; December 1973. 52 pp.

FY 1972, For the Period from July 1, 1971 through June 30, 1972; PUBLIC INFORMATION OFFICER; March 1973. 52 pp.

FY 1971, For the Period from July 1, 1970 through June 30, 1971; PUBLIC INFORMATION OFFICER; April 1972. 29 pp.

These reports contain major accomplishments of the various program undertaken by the office during the fiscal years.

POLICY SUPPORT; SPECTRUM MANAGEMENT; TELECOMMUNICATION APPLICATION; TELECOMMUNICATION TECHNOLOGY.

013. OUTSIDE FUNDING AT UNIVERSITIES AND AT ITS; E. K. SMITH; December 1971. 30 pp. OT TM 71

A study conducted on outside funding at universities and at the Institute of Telecommunication Sciences.

FUNDING; UNIVERSITIES.

- ✓ 014. AN OVERVIEW OF TELECOMMUNICATIONS VIA OPTICAL FIBER WAVEGUIDES; A. G. HANSON, R. L. GALLAWAY; June 1974. 107 pp. OT TM 74-170

This report presents an overview of guided optical communications via optical

fiber waveguides, describing the techniques, a sampling of currently available devices, components and systems, and some typical applications. Fabrication of a rudimentary optical video teleconferencing link is discussed, and systems design trade-offs are weighted. The scope of the report is deliberately broad as opposed to in-depth examination of any signal problem area of this emerging technology. Recommendations are made as to which specific technological areas require attention in order to expedite the growth of a viable communications medium.

FIBER WAVEGUIDES; OPTICAL COMMUNICATIONS; VIDEO TELECONFERENCING.

- P1. PERFORMANCE ANALYSIS OF THE ET-A WESTWARD EXTENSION LINKS--1972; C. A. SAMSON, J. E. FARROW, L. J. MALONEY; July 1972. 53 pp. OT TM 96

Performance measurements were made on three toposcatter links of the ET-A Westward Extension system during January, February, and March 1972. Recordings were made of signal levels and noise, operational and maintenance procedures were investigated, alignment of antennas and other system components was checked, and meteorological conditions analyzed. The results of this study indicate that the primary need in the system is improved maintenance.

NOISE-POWER RATIO; RADIO REFRACTIVITY; TROPOSPHERIC SCATTER.

- P2. PERFORMANCE CRITERIA FOR DIGITAL DATA NETWORKS; P. M. McMANAMON, R. K. ROSICH, J. A. PAYNE, M. J. MILES; January 1975. 145 pp. OT Report 75-54

This report presents a "user-oriented" approach to the development of telecommunication network performance criteria. Using a survey of presently accepted engineering-oriented performance criteria, a set of user-oriented performance criteria is developed and related to digital data transmission networks in general. The set of criteria is compared to the ANSI and another recently proposed set of performance measures. As an illustrative example, the results of a simulation of these criteria are presented for a simple network.

DATA COMMUNICATION; DIGITAL DATA NETWORKS; PERFORMANCE CRITERIA; TELECOMMUNICATIONS.

- P3. PERFORMANCE OF A COHERENT COMMUNICATION SYSTEM WITH CONSTANT AMPLITUDE INTERFERENCE; H. AKIMA, M. NESENBERGS; January 1973. 18 pp. OT TM 73-123

The output signal-to-noise ratio is derived and numerically evaluated for phase-shift-keying (PSK) modems in presence of noise and continuous wave (CW) interference. The corresponding error probability performance is expressed in a form suitable for future computation. The CW carrier is angle modulated with band-limited Gaussian noise. The results are applicable to satellite, aero mobile, instrument landing system, and other interference that affect the proposed Collision Avoidance System (CAS) operation in the 1600 MHz band.

COLLISION AVOIDANCE SYSTEM; PHASE-SHIFT-KEYING; SATELLITE COMMUNICATION; SIGNAL-TO-NOISE RATIO.

- P4. PERFORMANCE OF A COHERENT COMMUNICATION SYSTEM WITH PULSED INTERFERENCE; M. NESENBERGS, R. H. OTT, L. C. WALTERS; May 1972. 20 pp. OT TM 89

The error probability and output signal-to-noise ratio performance of

binary PSK and Manchester PSK systems are derived and numerically evaluated in presence of pulsed interference. The results are directly applicable to a coherent Collision Avoidance System (CAS).

COLLISION AVOIDANCE SYSTEM; PHASE-SHIFT-KEYING; SATELLITE COMMUNICATION.

- P5. PERFORMANCE OF COHERENT QPSK MODEMS OVER TIME-VARYING CHANNELS WITH RANDOM INTERSYMBOL INTERFERENCE DUE TO SCATTER; M. T. MA, M. NESENBERGS, R. H. OTT; April 1972. 28 pp. OT TM 90

The performance of a QPSK modem is derived and numerically evaluated for an ideal dispersive channel. The channel model postulates a received signal that consists of three parts: the undistorted (direct path) signal, additive white Gaussian noise, and time-varying (scatter path) intersymbol interference. Performance curves are given showing the effects of the parameters associated with the scattering function.

SIGNAL-TO-NOISE RATIO.

- P6. PERFORMANCE ESTIMATES FOR SCOPE COMMUNICATIONS SYSTEM, SUBSYSTEM 1; D. V. GLEN, L. J. MALONEY; January 1972. 89 pp. OT TM 72

Hop and subsystem performance estimates for a portion of the Scope Communications line-of-sight system are presented here. These estimates are based on applicable meteorological information, calculations of long-term power fading and received signal levels, and of thermal, intermodulation and feeder echo noise. Recommendations are made for antenna heights and sizes, and for transmission line types and equipment loan isolation.

ANTENNAS; MICROWAVE LINE-OF-SIGHT; SCOPE COMMUNICATIONS SYSTEM.

- P7. PERFORMANCE ESTIMATES FOR SCOPE COMMUNICATIONS SYSTEM, SUBSYSTEM 2; G. D. GIERHART, D. V. GLEN, C. A. SAMSON, G. A. HUFFORD; June 1972. 88 pp. OT TM 94

Hop and subsystem performance estimates for a portion of the Scope Communications line-of-sight system are presented here. These estimates are based on applicable meteorological information, calculations of long-term power fading and received signal levels, and of thermal, intermodulation and feeder echo noise. Recommendations are made for antenna heights and sizes, and for transmission line types and equipment loan isolation.

ANTENNAS, MICROWAVE LINE-OF-SIGHT; SCOPE COMMUNICATIONS SYSTEM.

- P8. PERFORMANCE ESTIMATES FOR SCOPE COMMUNICATIONS SYSTEM, SUBSYSTEM 3; D. V. GLEN, G. D. GIERHART; October 1972. 67 pp. OT TM 116

Hop and subsystem performance estimates for a portion of the Scope Communications line-of-sight system are presented here. These estimates are based on applicable meteorological information, calculations of long-term power fading and received signal levels, and of thermal, intermodulation and feeder echo noise. Recommendations are made for antenna heights and sizes, and for transmission line types and equipment loan isolation.

ANTENNAS, MICROWAVE LINE-OF-SIGHT; SCOPE COMMUNICATIONS SYSTEM.

- P9. PHILCO TEST REPORT DCS MICROWAVE RADIO TECHNICAL PROPOSAL VERIFICATION MODEL; R. E. SKERJANEC; February 1972. 263 pp. OT TM 84

This report contains the test and inspection results on the technical proposal verification model of the DCS microwave radio.

MICROWAVE RADIO.

- P10. PLAN FOR MEASUREMENTS AND ANALYSIS OF 616A AND VERDIN MODEMS; C. C. WATTERSON; October 1972. 63 pp. OT TM 113C

- P11. PLANNING FOR TELECOMMUNICATION SYSTEM DEVELOPMENT IN ALASKA, Vol. 1 (Text), Vol. 2 (Appendices); E. C. HAYDEN; April 1971. Vol 1--71 pp. Vol. 2--200 pp. OT AR 1

A study of telecommunications in Alaska.

ALASKA; TELECOMMUNICATIONS.

- P12. POLE-MOUNTED LOW-POWER MILLIMETER WAVE REPEATERS FOR WIDEBAND COMMUNICATIONS; L. G. HAUSE, C. A. SAMSON; October 1973. 31 pp. ACC-ACO-6-73
(prepared for U. S. Army Communications Command)

The "pole-mounted repeater" is here defined as an unmanned, low-power microwave repeater in a small equipment shelter mounted on the antenna supporting structure. Examples are provided which illustrate primary considerations for application of such repeaters to FDM/FM or digital systems using frequencies between 10 and 100 GHz. The self-interference problem is discussed and millimeter wave equipment which might be suitable for pole-mounted repeaters is briefly described.

DIGITAL SYSTEMS; MILLIMETER WAVE REPEATERS; POLE-MOUNTED REPEATERS; RAIN ATTENUATION.

- P13. POPULATION DATA WITHIN GRADE A AND GRADE B SERVICE CONTOURS OF 294 PUBLIC BROADCASTING SERVICE TV STATIONS; J. A. PAYNE; February 1975. 110 pp. OT TM 75-193

A computer procedure called program AREAPOP is used to count the number of persons and housing units within Grade A and Grade B service contours of 294 Public Broadcasting Service television stations in the United States. These population statistics are derived from the 1970 Census Bureau Master Enumeration District List of the United States (listed on magnetic tapes).

POPULATION MAPS; PUBLIC BROADCASTING SERVICE; TELEVISION STATIONS.

- P14. THE POPULATION WITHIN VARIOUS DISTANCES OF SELECTED RADIO AND TELEVISION STATIONS; D. R. EWING; April 1971. 52 pp. OT/ITS TM 31

This report tabulates population data for the area surrounding 322 selected radio and television stations in the continental United States. Specifically, the population within 10, 20, 30, 40, 50, 60, and 70 miles is estimated. Associated rankings and population density estimates are also listed. The data base is the 1960 census by standard location areas.

RADIO STATIONS; TELEVISION STATIONS.

- P15. POTENTIAL MARKET DEMAND FOR TWO-WAY INFORMATION SERVICE TO THE HOME: 1970-1990; P. BARAN; December 1971. 131 pp.
(prepared by the Institute for the Future under OT Contract I-35549)

This report describes potential market demand and service parameter estimates for thirty potential new information services to the home for the period 1970 to 1990.

BROADBAND COMMUNICATIONS; CABLE TELEVISION; DATA COMMUNICATION; INFORMATION SERVICES.

- P16. POWER SPECTRA OF COMPUTER SIMULATED FREQUENCY MODULATION WITH DIGITAL MSK AND VOICE INPUT; E. J. DUTTON, J. R. JUROSHEK; March 1973. 76 pp.
(prepared for the Federal Aviation Administration) FAA-RD-73-56

The report presents a FORTRAN computer program, FMSPECT, which obtains the power spectrum of an FM signal, modulated by a voice signal, a digital signal, and combinations of both. The theory behind the simulation of the voice signal (265-5575 Hz) is described as well as the theory of simulating an MSK digital signal (2400 bits-per-second). Sample spectra are shown for various modulation conditions and the results are presented in the form of graphs and tables. A listing of the program is given in the appendix.

FREQUENCY MODULATION; POWER SPECTRUM; VOICE SIMULATION.

- P17. PRECIPITATION CLIMATOLOGY FOR MICROWAVE LINK PERFORMANCE IN SOUTHERN GERMANY; S. A. SAMSON; April 1974. 28 pp. ACC-ACO-4-74
(prepared for U. S. Army Communications Command)

Estimates of link and system reliability for microwave communications at 15 GHz depend principally on knowledge of rainfall intensity and storm size in the system area. The general characteristics of precipitation in southern Germany, particularly in those areas near Frankfurt, Stuttgart, Augsburg, and the upper Rhine Valley, are discussed in this report. Data from rainfall-rate measurements at several locations are summarized and the possibility of squall line formation is analyzed.

GERMANY; PRECIPITATION; RAINFALL RATE; THUNDERSTORMS.

- P18. PREDICTIONS OF THE MAIN F-LAYER TROUGH FROM HIGH-LATITUDE SPREAD-F PROBABILITIES; R. M. DAVIS, JR.; October 1972. 42 pp. OT TM 112

Location of the main F-layer trough is predicted as a function of invariant latitude, local time, season, solar activity, and magnetic activity. The prediction is based on an assumed association of the trough with the equatorward boundary of high-latitude spread F. Current knowledge of the association of the trough with the magnetospheric plasma pause and with various manifestations of auroral electron precipitation is discussed in some detail.

AURORAL ELECTRON; MAGNETOSPHERE.

- P19. PREDICTION OF RADIO NOISE TO BE EXPECTED AT THE PENTAGON, WASHINGTON, D. C., AND EGLIN AIR FORCE BASE, FLORIDA; R. T. DISNEY; September 1972. 27 pp. OT TM 103

Predictions of the radio noise power at two specific locations, one at the Pentagon and one at Eglin Air Force Base, are presented based on information

obtained from OT/ITS data base of radio noise measurements. The predictions utilize data concerning type of area, periods of different kinds of activity, and traffic densities to provide an estimate of the noise power at the two locations.

RADIO NOISE.

- P20. A PRELIMINARY SURVEY OF DATA COMMUNICATIONS IN THE UNITED STATES; J. M. RICHARDSON, R. GARY; October 1970. 95 pp.

One of the few available market forecasts of data transmission demand in the decade of the 1970's is summarized as to traffic volume, numbers of termination points, distribution of users by industry and hardware requirements. Some data transmission systems of the U. S. Government dealing with records, space information, defense data communications, and scientific computation are described. Proposed and planned additions

DATA COMMUNICATIONS; DIGITIZED NETWORK; PRIVATE LINE; SPACE INFORMATION.

- P21. PRELIMINARY TELEMETRY LINK PERFORMANCE ESTIMATES FOR DEPARTMENT OF TRANSPORTATION HIGH-SPEED TEST TRACK; R. T. DISNEY, A. G. LONGLEY; February 1973. 84 pp. OT TM 73-130

This report investigates possible interference to high speed test track communications from man-made radio noise generated or carried by power lines. Measurements were made of similar line in the Boulder, Colorado, area. This information along with propagation loss estimates from two "worst case" paths, determined by terrain profiles, was used to estimate the required separation between the power line and the receiving antenna at the test center.

MAN-MADE RADIO NOISE; TELEMETRY LINK.

- P22. PRELIMINARY VIEWS OF THE UNITED STATES OF AMERICA FOR THE WORLD ADMINISTRATIVE RADIO CONFERENCE FOR MARITIME MOBILE TELECOMMUNICATIONS; IRAC SECRETARIAT; October 1972. 160 pp.

The report contains USA preliminary views on Maritime Telecommunications Objectives for the conference and proposed amendments to radio regulations.

RADIO REGULATIONS; MARITIME TELECOMMUNICATIONS.

- P23. A PRESSURE SCANNING REFRACTION SPECTROMETER FOR ATMOSPHERIC GAS STUDIES AT MILLIMETER WAVELENGTHS; H. J. LIEBE; April 1972. 132 pp. OT Report 74-35

This report describes an instrument which simulates the affect of atmospheric condition on propagation at millimeter wave lengths. Dispersion and attenuation pressure profiles are measured between 10^{-3} and 10^3 torr. Experimental difficulties and their elimination are discussed. Examples of data taken for the 9^+ line (61.15 GHz) and the $5^+/5$ doublet (60.4 GHz) are given.

EHF PROPAGATION; OXYGEN MICROWAVE SPECTRUM; QUANTITATIVE SPECTROSCOPY.

- P24. PROBABILISTIC INTERFERENCE PREDICTION MODEL AIR/GROUND VOICE COMMUNICATIONS; J. R. JUROSHEK, G. G. AX; January 1972. 49 pp. OT TM 70

A probabilistic interference prediction model for voice communications was developed. The model can be adapted to include additional statistical uncertainties such as transmitter power and propagation variabilities.

PROPAGATION; VOICE COMMUNICATION.

- P25. A PROCEDURE TO EVALUATE NON-DIRECTIONAL BEACON SIGNALS USING GROUND BASED MEASUREMENTS; R. H. ESPELAND, B. WIEDER; March 1973. 16 pp. OT TM 73-136

This report is on the design and calibration of an experimental technique to evaluate existing non-directional beacon sites using ground based measurements. A station located in a relatively flat area and reporting no faulty operations was chosen to evaluate the technique.

ANTENNAS; BEACON SIGNALS; IRREGULAR TERRAIN.

- P26. PROCEEDINGS OF THE 1972 CONFERENCE OF STATE TELECOMMUNICATIONS DIRECTORS; C. E. LATHEY; August 1972. 237 pp. OT SP 72-1

A compilation of papers presented at the 1972 Conference of State Telecommunications Directors.

INFORMATION TECHNOLOGY; 911; TELECOMMUNICATIONS; TELEPROCESSING.

- P27. PRODUCTION BURIED ANNUAL SLOT ANTENNA MEASUREMENTS; R. G. FITZGERRELL, L. L. HAIDLE, D. J. BURCH; April 1974. 88 pp. OT Report 74-33

This document is a compilation of antenna performance data measured during 1973. Appendixes discuss dielectric characteristics of the refractory concrete using resonant cavity and TDR data, and the use of monopoles as control antennas.

ANTENNA MEASUREMENTS.

- P28. PROPAGATION ASSESSMENT FOR FACSAC LINKS SAN CLEMENTE ISLAND/PT. LOMA AND NORTH ISLAND/IMPERIAL BEACH; H. T. DOUGHERTY, J. J. TARY; May 1974 42 pp. OT TM 74-164

This report covers a review of the available documentation for two links of the FACSAC microwave system as well as the findings of on-site inspections.

MICROWAVE FINDING; PROPAGATION.

- P29. PROPAGATION CHARACTERISTICS AT 15 GHz ON AN 18-km OVERWATER RELAY; C. A. SAMSON, R. E. SKERJANEC; October 1971. 24 pp. FAA-RD-71-74
(Prepared for the Federal Aviation Administration)

A 14.87 GHz prototype relay system was operated between the Federal Aviation Administration control towers at Tampa and St. Petersburg-Clearwater Inter-

national Airports to evaluate its use in relaying surveillance radar information between adjacent airports. This report describes the results of the weather and fading analysis for the test period, with emphasis on the intervals that resulted in a marginal or unusable operational status.

MICROWAVE RELAY; MULTIPATH; RADAR; RAIN ATTENUATION.

- P30. PROPAGATION OF LORAN C GROUND AND IONOSPHERIC WAVE PULSES; J. R. JOHLER, S. HOROWITZ; January 1973. 152 pp. OT Report 73-20

Loran-C ionospheric wave and ground wave pulses have been simulated on the computer using the full wave theory of propagation. Three propagation models--normal day, normal night, and a disturbed day model ionosphere electron and ion density profiles--have been employed to demonstrate the technique.

IONOSPHERIC WAVES; LORAN C; LORAN D; PULSE PROPAGATION.

- P31. PROPOSALS OF THE UNITED STATES OF AMERICA FOR THE WORLD ADMINISTRATIVE RADIO CONFERENCE FOR MARITIME MOBILE TELECOMMUNICATIONS; IRAC SECRETARIAT; September 1973. 191 pp.

The report contains USA objectives for the conference and proposed amendments of the radio regulations.

MARITIME TELECOMMUNICATIONS; RADIO REGULATIONS.

- P32. PROPOSED CODE FOR THE DECISION INFORMATION DISTRIBUTION SYSTEM; H. AKIMA; April 1971. 13 pp. OT/ITS TM 34

A binary code that satisfies requirements for the Decision Information Distribution System is generated. Requirements for the code, procedure for generating such a code, and resulting code are described. Comparison with the theoretical bounds indicate that the code obtained in this study is nearly optimum.

DIDS.

- P33. PROTOTYPE ANNULAR SLOT ANTENNA MEASUREMENTS; R. G. FITZGERRELL; October 1972. 44 pp. OT TRER 36

The final prototype annular slot antenna has been fabricated and its performance measured, thus ending a 2.5 year design and measurement study of vertically polarized, buried, UHF antennas. Pre-prototype antenna performance was also measured and is presented here.

ANTENNA MEASUREMENTS.

- P34. PUBLICATIONS ABSTRACTS, Fiscal Year 1974; INSTITUTE FOR TELECOMMUNICATION SCIENCES; 1974. 56 pp.

The document contains a listing of publications that have been authored by members of the staff of OT's Institute for Telecommunication Sciences during fiscal year 1974.

TELECOMMUNICATIONS.

- R1. RADAR SCATTER FROM THE SEA; G. A. HUFFORD, R. H. OTT, A. Q. HOWARD, JR.;
February 1973. OT TM 73-131

- R2. THE RADIATION FIELDS FROM HF COASTAL ANTENNAS; R. H. OTT; June 1974. 28 pp.
OT TM 74-174

The radiation fields (i.e., elevation patterns) of HF coastal antennas are computed for several possible terrain profiles near land-sea boundaries. The numerical technique for evaluating the radiation fields is compared with analytical formulas if the latter exist for the specific profile in question. The results appear to indicate that adequate low-angle coverage can be obtained from an antenna on a sloping beach using vertical polarization without the use of a ground screen or sea water in front of the antenna.

ANTENNAS; HF ANTENNAS.

- R3. RADIO CHANNEL CHARACTERIZATION; R. K. SALAMAN, G. G. AX, A. C. STEWART;
January 1971. 126 pp. OT/ITS TM 27

The critically increasing demand for radio frequency allocations has simulated development of information needed to reexamine efficient use of the radio spectrum. The characteristics and limitations, of the radio channel, with emphasis on the transmission channel (propagation and noise), are discussed along with typical communication systems currently using the radio spectrum.

PROPAGATION; RADIO FREQUENCY ALLOCATIONS; RADIO NOISE; RADIO SPECTRUM.

- R4. RADIO NOISE LEVELS AT POW MAIN, ALASKA; R. T. DISNEY; June 1971. 27 pp.
OT TM 47

Radio noise levels at 13 and 51 kHz measured in a 200 Hz bandwidth at Pow Main (Point Barrow), Alaska, are given.

MAN-MADE RADIO NOISE; RADIO NOISE.

- R5. RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE

The following reports cover the HF radio propagation predictions calculated for Voice of America circuits using the OT/ITS prediction program. Some of the parameters given are maximum usable frequency (MUF), the optimum traffic frequency (FOT), the lowest useful frequency (LUF), available signal-to-noise ratio (S/N) and circuit reliability. The program selects the optimum antenna at the facility for each circuit and the antenna identification and gain are listed in the predictions.

BROADCAST COVERAGE; RADIO PROPAGATION; SIGNAL-TO-NOISE RATIO.

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--May 1971; J. W. FINNEY, G. R. ENOCH; October 1970.
Volume I--409 pp. OT/ITS TM 1
Volume II--151 pp. OT/ITS TM 2

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--July 1971; J. W. FINNEY, G. R. ENOCH; December 1970.
Volume I--409 pp. OT/ITS TM 9
Volume II--151 pp. OT/ITS TM 10

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF
AMERICA BROADCAST COVERAGE--September 1971; J. W. FINNEY, E. C. PADILLA;
February 1971.
Volume I--409 pp. OT/ITS TM 20
Volume II--151 pp. OT/ITS TM 21

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF
AMERICA BROADCAST COVERAGE--November 1971; J. W. FINNEY, E. C. PADILLA;
April 1971.
Volume I--409 pp. OT/ITS TM 32
Volume II--151 pp. OT/ITS TM 33

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF
AMERICA BROADCAST COVERAGE--January 1972; J. W. FINNEY, E. C. PADILLA;
June 1971.
Volume I--409 pp. OT/ITS TM 41
Volume II--151 pp. OT/ITS TM 42

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF
AMERICA BROADCAST COVERAGE--March 1972; J. W. FINNEY, E. C. PADILLA;
August 1971.
Volume I--409 pp. OT TM 49
Volume II--156 pp. OT TM 50

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF
AMERICA BROADCAST COVERAGE--May 1972; J. W. FINNEY, E. C. PADILLA; November 1971.
Volume I--406 pp. OT TM 59
Volume II--151 pp. OT TM 60

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF
AMERICA BROADCAST COVERAGE--July 1972; J. W. FINNEY, E. C. PADILLA;
December 1971.
Volume I--406 pp. OT TM 65
Volume II--253 pp. OT TM 66

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF
AMERICA BROADCAST COVERAGE--September 1972; J. W. FINNEY, E. C. PADILLA;
February 1972.
Volume I--406 pp. OT TM 75
Volume II--253 pp. OT TM 76

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF
AMERICA BROADCAST COVERAGE--November 1972; J. W. FINNEY, E. C. PADILLA;
April 1972.
Volume I--406 pp. OT TM 80
Volume II--252 pp. OT TM 81

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF
AMERICA BROADCAST COVERAGE--January 1973; J. W. FINNEY, E. C. PADILLA;
June 1972.
Volume I--406 pp. OT TM 91
Volume II--253 pp. OT TM 92

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE
OF AMERICA BROADCAST COVERAGE--March 1973; J. W. FINNEY, E. C. PADILLA;
September 1972.
Volume I--406 pp. OT TM 98
Volume II--253 pp. OT TM 99

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--May 1973; J. W. FINNEY, E. C. PADILLA; October 1972.
 Volume I--406 pp. OT TM 114
 Volume II--253 pp. OT TM 115

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--July 1973; J. W. FINNEY, E. C. PADILLA; January 1973.
 Volume I--406 pp. OT TM 121
 Volume II--253 pp. OT TM 122

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--September 1973; J. W. FINNEY, E. C. PADILLA; February 1973.
 Volume I--406 pp. OT TM 73-127
 Volume II--253 pp. OT TM 73-128

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--November 1973; J. W. FINNEY, E. C. PADILLA; April 1973.
 Volume I--406 pp. OT TM 73-134
 Volume II--253 pp. OT TM 73-135

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--January 1974; J. W. FINNEY, E. C. PADILLA; June 1973.
 Volume I--406 pp. OT TM 73-140
 Volume II--273 pp. OT TM 73-141

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--March 1974; M. LEFTIN; August 1973.
 Volume I--474 pp. OT TM 73-147
 Volume II--273 pp. OT TM 73-148

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--May 1974; M. LEFTIN; October 1973.
 Volume I--469 pp. OT TM 73-152
 Volume II--273 pp. OT TM 73-153

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--July 1974; M. LEFTIN; December 1973.
 Volume I--469 pp. OT TM 73-156
 Volume II--273 pp. OT TM 73-157

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--September 1974; M. LEFTIN; January 1974.
 Volume I--473 pp. OT TM 74-159
 Volume II--273 pp. OT TM 74-160

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--November 1974; M. LEFTIN; April 1974.
 Volume I--471 pp. OT TM 74-166
 Volume II--253 pp. OT TM 74-167

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--January 1975; M. LEFTIN; June 1974.
 Volume I--471 pp. OT TM 74-171
 Volume II--273 pp. OT TM 74-172

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--March 1975; M. LEFTIN; August 1974.
 Volume I--393 pp. OT TM 74-179

RADIO PROPAGATION PREDICTIONS FOR UNITED STATES INFORMATION AGENCY, VOICE OF AMERICA BROADCAST COVERAGE--May 1975; M. LEFTIN; October 1974. Volumes I & II--407 pp. OT TM 74-183

- R6. THE REAL COST OF BASIC TELEPHONE SERVICE TO THE AVERAGE WORKER IN FIFTEEN DEVELOPED COUNTRIES; M. KARYDES; August 1973. 38 pp. OT Report 73-17

The paper addresses the question: "What does it actually cost the average worker to buy his basic telephone service?" Fifteen developed countries are surveyed. The most recent information available on the extent of telephone development in each, and the number of telephones per 1,000 population, is presented in Table 1. Table 2 shows the cost in the number of working hours required to purchase basic service, 1960-1971, and four separate tables depict the different categories of telephone charges for each year and each country during the same time period. Each table is followed by a brief discussion.

FOREIGN TELEPHONE RATES; INTERNATIONAL TELECOMMUNICATIONS; TELEPHONE SERVICE; TELEPHONE USAGE CHARGES.

- R7. RECONFIGURATION OF SPECIFIC LINE-OF-SIGHT LINKS TO 15 GHz; C. A. SAMSON, L. G. HAUSE; October 1973. 28 pp. SCC-ACO-7-73

Results of a study on the utilization of electromagnetic radiation in the region of 15 GHz and above for wideband military communications are presented.

ELECTROMAGNETIC RADIATION; WIDEBAND COMMUNICATIONS.

- R8. REFLECTION COEFFICIENTS FOR THE COMPUTER SIMULATION OF LORAN C/D PULSE PROPAGATION TRANSFORMS; J. R. JOHLER, S. HOROWITZ; May 1973. 62 pp. OT Report 73-11

The variation of the ionosphere reflection coefficients with frequency for various ionosphere electron density profiles is studied from the viewpoint of a transform that can be constructed to simulate propagation of the Loran C/D pulse. An array of reflection coefficients is developed for each profile to simulate propagation on the computer at frequencies between 50 and 150 kHz and angles of incidence on the ionosphere between 40° and 90°.

IONOSPHERIC WAVES; LF SKYWAVES; LORAN C; LORAN D; PULSE PROPAGATION.

- R9. REPORT OF THE INTERDEPARTMENT RADIO ADVISORY COMMITTEE; Executive Secretary; For the Period: January 1-June 30, 1974; A. M. CORRADO; October 1974. 61 pp.
July 1-December 1974; C. R. KIRKEVOLD; February 1974. 52 pp.
January 1-June 30, 1973; C. R. KIRKEVOLD; July 1973. 52 pp.
July 1-December 1972; C. R. KIRKEVOLD; January 1972; 52 pp.
January 1-June 30, 1972; C. R. KIRKEVOLD; March 1972; 52 pp.
July 1-December 1971; C. R. KIRKEVOLD; July 1971; 52 pp.
January 1-June 30, 1971; C. R. KIRKEVOLD; July 1971; 52 pp.
July-December 1970; C. R. KIRKEVOLD; January 1971; 52 pp.

Progress report on the IRAC's accomplishments; OTP Data processing system; future work programs; and statistics.

ELECTROMAGNETIC COMPATIBILITY; RADIO SPECTRUM; SPECTRUM MANAGEMENT.

- R10. REQUIRED SIGNAL-TO-NOISE RATIOS FOR THE 61-kHz SUBSYSTEM OF THE DECISION INFORMATION DISTRIBUTION SYSTEM; H. AKIMA; January 1973. 19 pp.
OT TM 73-126

Required signal-to-noise ratios for the 61-kHz subsystem of the Decision Information Distribution System developed at ITS/OT have been determined. The results indicate that the ratio of total signal energy to noise power density of 24 to 27 dB is required for the receiver of the subsystem. The exact value depends on the system specification and the complexity of computation in the receiver.

CODED BINARY SIGNAL; DIDS; SIGNAL-TO-NOISE RATIO.

- R11. REQUIREMENTS FOR AN AIR-GROUND VHF DATA LINK FOR AIR TRAFFIC CONTROL APPLICATIONS; J. P. MURRAY, J. R. JURUSHEK; September 1974. 142 pp. OT Report 74-44

Requirements based on the needs of the Air Traffic Control system through 1982 are defined for a digital data-link to operate in the VHF aeronautical mobile band (108-136 MHz). The system described is based on the Universal Data Link specified by the Radio Technical Commission on Aeronautics and on the standard prepared by ARINC. Requirements are based on air traffic forecasts, ATC plans, coverage needs, and capacity estimates based on allowable errors and waiting times.

AIR/GROUND COMMUNICATION; AIR TRAFFIC CONTROL; VHF DATA LINK.

- R12. A REVIEW OF THE ACTIVE DOCUMENTS OF THE INTERNATIONAL RADIO CONSULTATIVE COMMITTEE (CCIR); E. K. SMITH; April 1973. 28 pp. OT TM 73-138

This study attempts to serve as a bridge between the active documentation of the CCIR (documents of the XII Plenary Assembly, 1970, supplemented by the conclusions of the 1972 "Interim Meetings" of the Study Groups) and the following six areas of current interest: propagation (P), spectrum standards (S), considerations of electromagnetic compatibility (E), radio noise (N), systems aspects (F), and broadband communications (C).

BROADBAND COMMUNICATIONS; PROPAGATION; RADIO NOISE; SPECTRUM STANDARDS.

- R13. REVIEW OF A DATA-LINK STUDY; A. G. LONGLEY; April 1971. 27 pp.
OT/ITS TM 35

A review was made of Raytheon Company data-link study for a communication system deployment in West Germany. Original predictions of tropospheric transmission loss prepared by the company were based on an early version of a computer model described by the Longley and Rice. Using path parameters obtained from the profiles provided by Raytheon, calculations were made of basic transmission loss for 146 paths on a point-to-point basis for comparison with their values.

COMMUNICATION SYSTEMS; TROPOSPHERIC PROPAGATION.

- R14. A REVIEW OF PROPAGATION FACTORS IN TELECOMMUNICATIONS APPLICATIONS OF THE 10 to 100 GHz RADIO SPECTRUM; M. C. THOMPSON, JR.; L. E. VOGLER; H. B. JANES; L. E. WOOD; August 1972. 76 pp. OT TRER 34

This paper discusses systems applications in the 10- to 100-GHz frequency band, propagation factors pertinent to the design of these systems, and

recommendations for future action. Consideration is given to the complementary roles of experiment and analysis in providing the information necessary for optimal utilization of EHF frequencies.

PROPAGATION; RADIO SPECTRUM; TELECOMMUNICATIONS.

- R15. A REVIEW OF PROPAGATION INFORMATION NEEDED FOR THE EFFECTIVE USE OF THE 1- TO 40-GHz BAND; M. C. THOMPSON, Jr.; April 1973. 35 pp. OT Report 74-30

An inquiry was sent out to 60 persons engaged in research, engineering, or system applications in the 1- to 40-GHz band. This report summarizes the propagation-related problems identified by these people and also indicates where work is being done to provide additional information for system design.

MILLIMETER WAVE; PROPAGATION.

- R16. REVIEW OF RADIATION CHARACTERISTICS OF THE 487L TRAILING WIRE ANTENNA; L. A. BERRY; October 1970. 14 pp. OT/ITS TM 6C

- S1. SCALED MODEL MEASUREMENTS ON RF SENSOR ANTENNAS FOR OUTER PLANET GRAND TOUR (TOPS) PROJECT; H. V. COTTONY; March 1972. 118 pp. OT TM 86

Launchings of four Thermoelectric Outer Planet Spacecraft (TOPS) for outer space exploration are projected by NASA for 1976, 1977, and 1979. Two 1/10 full-scale models of spacecraft were constructed for use in measuring over the 30 to 300 MHz band corresponding to 3 to 30 MHz full-scale the impedances and the radiation patterns on scaled model antennas. The sensor antennas on one model were found to have a degree of electrical imbalance and some lobing at the higher end of the frequency band while the input impedance of the quadrant antennas of the other model was found to have a high-voltage standing wave ratio.

ANTENNAS; THERMOELECTRIC OUTER PLANET SPACECRAFT.

- S2. SCATTERING BY WATER WAVES GENERATED BY A MOVING PRESSURE POINT; R. H. OTT, G. A. HUFFORD, A. Q. HOWARD, JR.; August 1972. 18 pp. OT TM 102

An analysis for scattering of scalar waves in air by a wake on the surface of water is developed. The wake on the water surface is generated as a concentrated pressure point travels over the free water surface. The wake has characteristics resembling a diffraction grating. The grating produces maximum constructive interference (resonance) in the backscattered wave under certain conditions. At resonance the acoustic wavelengths, water wavelength and angle of incident satisfy a simple geometrical condition.

ACOUSTIC WAVELENGTH; WATER WAVELENGTH.

- S3. SEMIANNUAL PROGRESS REPORT TO U. S. INFORMATION AGENCY, VOICE OF AMERICA, Contract IA-14761-23--July-December 1970; A. F. BARGHAUSEN, R. M. DAVIS, JR., L. D. SCHULTZ, D. H. ZACHARISEN; December 1970; 17 pp. OT/ITS TM 29

This report contains a summary of work performed on various technical tasks related to ionospheric morphology and HF system performance predictions.

IONOSPHERIC PREDICTIONS.

- S4. 72-HOUR SHAKEDOWN TEST REPORT DCS MICROWAVE RADIO TECHNICAL PROPOSAL VERIFICATION MODEL; R. E. SKERJANEC; February 1972. 20 pp. OT TM 85
- Results are presented on a 72-hour shakedown test on a DCS microwave radio.
- MICROWAVE RADIO.
- S5. THE SHADOW PRICE OF ELECTROMAGNETIC SPECTRUM: A Theoretical Analysis; J. ALLEMAN; July 1974. 20 pp. OT Report 74-42
- Shadow prices have been recommended as a method by which the electromagnetic spectrum can be allocated. This paper explores two distinct definitions of shadow prices and concludes that, in general, allocating spectrum on the basis of its shadow prices is not feasible.
- ELECTROMAGNETIC SPECTRUM; SHADOW PRICE; SPECTRUM.
- S6. SIGNAL ACQUISITION IN THE DECISION INFORMATION DISTRIBUTION SYSTEM; H. AKIMA; September 1971. 30 pp. OT TRER 18
- Decision procedures for signal acquisition in the Decision Information Distribution System are suggested, and a method of determining the required signal-to-noise ratio for specified probabilities of false alarm, error, and miss is described. A decision procedure that has been implemented in a prototype receiver for the system is described.
- DIDS; SIGNAL-TO-NOISE RATIO.
- S7. SIGNAL ACQUISITION IN THE DECISION INFORMATION DISTRIBUTION SYSTEM; H. AKIMA; November 1971; 26 pp. OT/ITS TM 39
- Decision procedures for signal acquisition in the Decision Information Distribution System are suggested, and a method of determining the required signal-to-noise ratio for specified probabilities of false alarm, error, and miss is described. A decision procedure that has been implemented in a prototype receiver for the system is described.
- DIDS; SIGNAL-TO-NOISE RATIO.
- S8. SIGNAL RECEPTION IN A MULTI-LINK INTERFERENCE ENVIRONMENT; D. MIDDLETON; July 1972. 52 pp. OT TM 100
- A problem is formulated to determine the optimum receiver structure and performance of a single-link operating in an electromagnetic environment of man-made interference consisting of $J - 1$ other communication links, at and near the same frequency regions of the desired link. The results serve as departure points for the development of more specialized, detailed and particularized system and channel models, including explicit computations of performance.
- COMMUNICATION LINKS; ELECTROMAGNETIC COMPATIBILITY; FREQUENCY CORRELATION.
- S9. A SIMPLIFIED FORMULATION AND COMPUTATION FOR CONICAL MONOPOLE ANTENNAS; M. T. MA, K. P. SPIES; December 1974. 39 pp. OT Report 74-53
- Power gains for a conical monopole above a homogeneous and lossy earth with an additional ground screen are formulated by a simplified approach, based on

the array concept and a realistic assumption for the current distribution on antenna wires. Numerical results on gains can be easily obtained as a function of frequency, antenna and screen sizes, and ground constants.

CONICAL MONOPOLE.

- S10. SIMULATING ATMOSPHERIC RADIO NOISE AT 60 kHz, 200 kHz, and 5 MHz; E. C. BOLTON; August 1974. 85 pp. OT TM 74-177

Magnetic tape recordings were made of atmospheric radio noise from low frequency through high frequency. The recordings were computer analyzed and were used as a model for the design of an atmospheric noise simulator.

RADIO COMMUNICATION; RADIO NOISE.

- S11. SIMULATING LF ATMOSPHERIC RADIO NOISE AND COMPARATIVE CHARACTERISTICS OF MAN-MADE AND ATMOSPHERIC RADIO NOISE AT 60, 76, and 200 kHz; E. C. BOLTON; August 1972. 73 pp. OT TM 97

Recordings of two types of impulsive noise have been made at 60, 76 and 200 kHz, then statistically analyzed by computer and graphically plotted for comparative characteristics. Thunderstorms are non-stationary and each storm presents a different set of statistics while man-made noise is generally more periodic and its amplitude generally exhibits a smaller dynamic range. A digital simulator has been developed that will simulate atmospheric radio noise at 60 kHz and 200 kHz.

ATMOSPHERIC RADIO NOISE; MAN-MADE RADIO NOISE; RADIO COMMUNICATIONS; RADIO FREQUENCY SPECTRUM.

- S12. SIMULATION OF IONOSPHERIC DISPERSION; C. C. WATTERSON; November 1970. 47 pp. OT/ITS TM 7

An ideal dispersion filter for simulating ionospheric dispersion is defined as one with constant dispersion in a channel frequency band and zero dispersion outside the band. The pole-zero values required by optimum narrowband dispersion filters are presented with the corresponding nominal dispersions for 70 combinations of filter orders. A limited set of wideband solutions shows that while larger fractional bandwidths are possible with wideband designs, there is a limiting bandwidth beyond which the wideband filters are not physically realizable. A description is given of an active all-pass network that avoids several undesirable features of lattice networks, and an easy method of using the tabulated solutions to synthesize filters of this type is described.

BANDWIDTHS; FREQUENCY CORRELATION; IONOSPHERIC DISPERSION.

- S13. A SITE SELECTION STUDY FOR A U. S. COAST GUARD EAST COAST, LONG RANGE RADIO STATION; Part 2 of 2; J. E. ADAMS, D. M. HATFIELD; January 1971. 73 pp. OT/ITS TM 23

The three sites selected by USCG have been simulated in combination with the seven existing radio stations. The HF (4-22 MHz) predicted performance for all such combinations has been computed for the worst case propagation conditions. Based on this propagation analysis it is concluded that new sites are ranked (1) Northwest-Pungo, (2) La Plata-Washington, (3) Sugar Grove-La Plata. With the addition of the new site, HF communication functions at Radio Washington and New York can be deactivated with little impact on HF coverage.

COMMUNICATION SYSTEM; PROPAGATION; RADIO STATIONS.

- S14. SPACE/TERRESTRIAL RADIO SERVICE COORDINATION AREAS: Program WARC 71.A28 User's MANUAL; T. A. HARR, JR., K. E. BECHARD; J. J. STEPHENSON; May 1973. 88 pp.
OT TM 73-139

Describes a computer program that implements the procedure for determining the co-ordination area around an earth station in frequency bands between 1 and 40 GHz shared by Space and Terrestrial Radio Communication Services. The manual explains how to access the computer program, how to run the computer program, how to change the input values for subsequent runs of the computer program, and how to interpret the results.

EARTH STATION; FREQUENCY CORRELATION; GEOSTATIONARY SATELLITE NETWORKS; SATELLITE SYSTEMS; SPACE TELECOMMUNICATION; TERRESTRIAL STATION.

- S15. SPECTRUM RESOURCE ASSESSMENT IN THE 7.25-8.40 GHz BANDS; R. MAYHER, R. PARLOW; December 1973. 307 pp.
OT TM 73-155

The potential interference between systems in the 7.25 to 8.4 GHz band was investigated. This investigation shows that all intersystem interactions could be placed in serious, manageable, or no problem categories.

SATELLITE COMMUNICATION; SPECTRUM; TERRESTRIAL COMMUNICATIONS.

- S16. SPECTRUM RESOURCE ASSESSMENT FOR THE 1535-1660 MHz BAND, Phase II--Analysis; E. J. HAAKINSON, H. G. KIMBALL; March 1974. 175 pp.
OT TM 74-165

The potential interference between systems in the 1535-1660 MHz bands was investigated. This investigation shows that all intersystem interactions could be placed in serious, manageable, or no problem categories. The single serious problem results from the interaction between the L-band aircraft radar altimeters and the aircraft collision avoidance systems. The problem is serious because no tractable solutions are easily implemented. All other intersystem interactions in the band are considered manageable or fall into the no problem category.

COLLISION AVOIDANCE SYSTEM; FREQUENCY CORRELATION; SPECTRUM.

- S17. SPECTRUM RESOURCE ASSESSMENT FOR THE 1535-1660 MHz BANDS-ADDENDUM; E. J. HAAKINSON; October 1974. 104 pp.
OT TM 74-165-2

This report lists the available technical information on the satellite systems, compares their characteristics and parameters, analyzes the compatibility between the two Maritime Satellite Systems and computes the interference potential between the maritime systems and the other systems sharing the 1535-1660 MHz band. The currently available system characteristics of the Global Positioning System (GPS) have also been obtained. The report compares them with the earlier characteristics of the AFNAVSAT and Timation systems and discusses the compatibility of the GPS receivers with the other band-sharing systems.

FREQUENCY CORRELATION; SPECTRUM; MARITIME SATELLITE.

- S18. SPECTRUM RESOURCE ASSESSMENT FOR THE 4990-5250 MHz BANDS PHASE II--ANALYSIS; W. E. FRAZIER, E. L. MCHUGH; January 1975. 172 pp.
OT TM 75-191

Results are given of a compatibility analysis among the major telecommunications systems that are operational or planned in the 4990-5250 MHz Bands. It was concluded that a number of electromagnetic compatibility problems could occur among

the systems. Recommendations are made that would lead to solutions of these problems. Government agencies concerned with these systems were briefed on the potential problems and remedial actions taken by these agencies to resolve the problems are reflected in the report.

AERONAUTICAL SATELLITE; ELECTROMAGNETIC COMPATIBILITY; RADIO ASTRONOMY; SPECTRUM.

- S19. ST. LOUIS RADAR RFI STUDY; H. E. PETRIE; February 1972. 21 pp. OT TM 77

The study assessed the radio frequency interference environment for existing radio communication services and the proposed operation of a weather radar system in St. Charles County, Missouri.

FREQUENCY SHARING; RADIO COMMUNICATIONS; WEATHER RADAR SYSTEM.

- S20. STATE TELECOMMUNICATIONS DATA BASE STRUCTURE; T. ZOIS; May 1974. 102 pp.
OT Report 74-37

This report defines a state-oriented telecommunications data base structure developed to support the internal needs of the Office. The structure contains three major sections: (1) State/Regional/Local/Federal Descriptive Information; (2) Telecommunications Information; and (3) Information References. The report should be useful to anyone contemplating an automated information system, especially concerning telecommunications.

TELECOMMUNICATIONS; TELECOMMUNICATIONS DATA BASE STRUCTURE; TELECOMMUNICATIONS INFORMATION; TELECOMMUNICATIONS TAXONOMY.

- S21. STATISTICAL-PHYSICAL MODELS OF MAN-MADE RADIO NOISE: Part 1, FIRST-ORDER PROBABILITY MODELS OF THE INSTANTANEOUS AMPLITUDE; D. MIDDLETON; April 1974. 68 pp.
OT Report 74-36

A general statistical-physical model of man-made radio noise processes appearing in the input stages of a typical receiver is described analytically. The first-order statistics of these random processes are developed in detail for narrow-band reception. Specifically treated here are the important classes of interference with bandwidth comparable to (or less than) the effective aperture-RF-IF bandwidth of the receiver, the common situation in the case of communication interference.

MAN-MADE RADIO NOISE; RADIO NOISE MODELS; STATISTICAL COMMUNICATIONS THEORY.

- S22. A STATISTICAL PROPAGATION MODEL FOR THE IMPROVED INTERFERENCE PREDICTION MODEL; A. LONGLEY, G. HUFFORD, R. REASONER, J. MONTGOMERY; December 1971. 55 pp.
OT TM 67

An examination was made of the transmission loss computation methods currently used in the Interference Prediction Model (IPM) which was developed by the Electromagnetic Environmental Test Facility.

ELECTROMAGNETIC COMPATIBILITY; INTERFERENCE; TRANSMISSION LOSS.

- S23. A STUDY AND FORECAST OF THE ELECTROMAGNETIC SPECTRUM TECHNOLOGY, Part III; W. J. HARTMAN; January 1971. 29 pp.
OT/ITS TM 25

Some factors which could or should affect frequency allocations and assignments in the future are considered. These include propagation predictions,

modulation, coding and information processing. In addition a forecast of the use of cables as replacements for Broadcast TV and microwave relay is presented.

CABLE; TV BROADCASTING; FREQUENCY ALLOCATIONS; MICROWAVE RELAY; PROPAGATION.

- S24. STUDY OF SATELLITE FREQUENCY REQUIREMENTS FOR THE U. S. POSTAL SERVICE ELECTRONIC MAIL SYSTEM; February 1974. OT Report 74-27

Volume I--Summary; P. M. McMANAMON; February 1974. 64 pp.

Optimum frequency allocations are recommended for electronic mail distribution by geostationary satellite digital data transmission to serve 125 locations in the continental United States, Alaska, Hawaii, and Puerto Rico. The relationships between a definition of an electronic mail service, system performance and requirements and selection of an optimum frequency allocation have been outlined.

Volume II--Frequency Allocations and Network Designs; P. M. McMANAMON, J. R. JUROSHEK, M. NESENBERGS; February 1974. 218 pp.

This volume summarizes the available frequency allocation restrictions and limitations. Candidate satellite telecommunication system networks are described with different time division, frequency division, and space division multiple access techniques with both preassignment and demand-assignment operating protocols. Network transmission rates including overhead bits and network performance estimates are developed. Error control techniques are included in performance estimates for satellite power and ground station antenna diameter.

Volume III--Technology Studies; J. R. JUROSHEK, P. M. McMANAMON, M. NESENBERGS, D. A. HILL; February 1974. 268 pp.

This volume includes reviews of satellite frequency allocations, restrictions, and requirements. The performance of a number of candidate network designs, the state-of-the-art of existing and proposed satellite telecommunications systems, multiple access techniques, power tubes, modems, and antenna systems are described. Propagation effects, including rain attenuation, are summarized and are included in determination of requirements for satellite EIRP and ground station antenna diameter.

ELECTRONIC MAIL SYSTEM; FREQUENCY ALLOCATIONS; SATELLITE COMMUNICATION; SATELLITE DATA TRANSMISSION NETWORKS.

- S25. A SUMMARY REPORT ON THE DIGITAL SELECTIVE CALLING PROGRAM AT ITS; P. I. WELLS; April 1974. 134 pp. OT TM 74-163

This report summarizes the technical assistance to the Maritime Administration in the development of a digital selective calling system for use by the maritime mobile service. Draft documents to working groups of CCIR and to RTCM as well as other important memorandum reports, are included as appendices to this report.

DIGITAL SELECTIVE CALLING SYSTEMS; MARITIME MOBILE.

- S26. A SURVEY OF DISPLAY SYSTEMS AND THEIR VIDEO RECEPTION CAPABILITIES; A. G. HANSON, November 1974. 64 pp. OT Report 74-46

This report provides an overview of the current developmental status of devices which demonstrate applicability to display of video information, with emphasis

upon compatibility with broadband digital transmission. Primary discussions is concerned with newly-emerging types of devices which indicate promise of overcoming inherent limitations of the conventional analog cathode ray tube. Of particular interest are several technological approaches to creation of a "flat panel" display.

BROADBAND DIGITAL TRANSMISSION; VIDEO DISPLAY SYSTEMS.

- S27. A SURVEY OF EARTH-TO-SATELLITE PROPAGATION FACTORS BETWEEN 2.5 AND 275 GHz; D. A. HILL; July 1974. 42 pp. OT Report 74-43

Propagation factors for earth-to-satellite paths are reviewed for frequencies between 2.5 and 275 GHz. The effects of precipitation are discussed with emphasis on rainfall.

ATTENUATION; EARTH-TO-SATELLITES; PROPAGATION; SATELLITE COMMUNICATION.

- S28. A SURVEY OF GRADUATE EDUCATION IN THE UNITED STATES APPROPRIATE TO TELECOMMUNICATIONS POLICY DETERMINATION; E. K. SMITH; July 1972. 21 pp. OT TM 117

This report contains a summary of graduate education available for training of individuals in the field of telecommunications policy.

TELECOMMUNICATIONS POLICY.

- S29. A SURVEY OF TECHNICAL REQUIREMENTS FOR BROADBAND CABLE TELESERVICES; July 1973. OT Report 73-13

Volume 1--A Summary of Technical Problems Associated with Broadband Cable Teleservices Development; P. M. McMANAMON, W. F. UTLAUT; 64 pp.

Volume 2--Subscriber Terminals and Network Interface; B. WIEDER, R. H. ESPELAND, C. J. CHILTON; 88 pp.

✓ Volume 3--Signal Transmission and Delivery Between Head-End and Subscriber Terminals; R. B. CHADWICK, R. A. CHANDLER, R. L. GALLAWAY, L. E. WOOD; 224 pp.

Volume 4--System Control Facilities: Head-ends and Central Processors; E. K. SMITH, R. K. ROSICH, E. C. HAYDEN, L. L. MELANSON; 154 pp.

Volume 5--System Interconnections; P. M. McMANAMON; 136 pp.

Volume 6--The Use of Computers in CATV Two-Way Communications Systems; L. J. CAMPBELL; 38 pp.

Volume 7--A Selected Bibliography; W. HOLMBERG, E. GRAY, P. McMANAMON; 142 pp.

The seven volumes comprise a series of reports resulting from a survey of the CATV industry and related technological industries. The survey identifies some of the important technical factors which need to be considered in order to successfully bring about the transition from the technical state of today's cable television and services to those new teleservices which seem to be possible in the future.

BIBLIOGRAPHY; BROADBAND CABLE TELESERVICES; CABLE TELEVISION; COMMON CARRIER; PRIVACY; SECURITY; TELECOMMUNICATIONS.

- S30. A SURVEY OF TROPOSPHERIC PROGRAM IN ITS; F. EKLUND; December 1971. 17 pp.
OT TM 68

Trends in telecommunications systems, in the needs, and the development of technical resources were identified.

TELECOMMUNICATIONS RESOURCES; TELECOMMUNICATIONS SYSTEMS.

- S31. SYNTHESIS OF VHF/UHF RADIO SIGNALS PROPAGATED OVER LINE-OF-SIGHT PATHS; R. W. HUBBARD; September 1972. 52 pp.
OT TM 108

This paper describes the atmospheric and multipath characteristics of radio signals propagated thru the atmosphere in the VHF/UHF bands, and presents a method for synthesizing these signals for Line-of-Sight communication links. The methodology and discussion reflect the results of a pilot-study undertaken to support and expand the simulation aspects of the Standard Measurement Techniques Program conducted by the Naval Electronics Command, Southwest Division (NAVELEX-SW).

LINE-OF-SIGHT LINKS; PROPAGATION; RADIO SIGNALS; VHF/UHF BANDS.

- T1. TABLES OF PERCENTAGE POINTS F (NU SUB1, NU SUB2,P) OF THE FISHER-SNEDECOR VARIANCE RATIO; L. E. VOGLER, K. A. NORTON; March 1971.95 pp.OT TRER 9

Tables are presented of percentage points of the Fisher-Snedecor variance ratio for certain values and at specific probability levels. A discussion is included which describes the relationship of the F distribution to various other statistical distributions.

FISHER-SNEDECOR VARIANCE RATIO.

- T2. TABULATIONS OF PROPAGATION DATA OVER IRREGULAR TERRAIN IN THE 230 TO 9200 MHz FREQUENCY RANGE, Part IV: Receiver Site in Grove of Trees; P. L. McQUATE, J. M. HARMAN, M. E. McCLANAHAN; October 1971. 296 pp.
OT TRER 19

This is the fourth part of a four-part report containing tabulations and graphs of transmission loss data resulting from propagation experiments in the 230- to 9200-MHz frequency range conducted over irregular terrain in Colorado. This part presents data obtained at a common receiver site, located in a small grove of cottonwood trees, over propagation of paths varying in length from 0.5 to 50 km.

IRREGULAR TERRAIN; PROPAGATION; UHF.

- T3. TECHNICAL CONSIDERATIONS IN THE EFFICIENT USE OF THE SPECTRUM: Part 1--Terrestrial Surface Power Flux Density Limits for Services Using Satellites; G. W. HAYDON, R. K. ROSICH; April 1973. 116 pp.
OT Report 73-19

The role of power flux density limitations at the earth's surface in the efficient use of the spectrum is examined. Computer routines have been developed to examine the probable impact of various levels of power flux density at the earth's surface upon terrestrial systems as a function of percentage of terrestrial systems affected. The use of these routines is illustrated by an examination of terrestrial systems between 6 GHz and 10 GHz in the State of Colorado.

ANTENNAS; SATELLITE COMMUNICATION; SPECTRUM USAGE; TERRESTRIAL COMMUNICATIONS.

- T4. TECHNICAL AND ECONOMIC TRADE-OFFS FOR THE GEOSTATIONARY ORBIT COMMUNICATIONS RESOURCE; R. B. CHADWICK, D. S. IRWIN; April 1973. 43 pp. OT Report 73-8

The effects of certain trade-offs in utilizing the geostationary orbit communications resource are discussed. The trade-offs are identified and a concise list of specific results is presented in the summary.

SATELLITE COMMUNICATION; SPECTRUM.

- ✓T5. TECHNOLOGICAL INNOVATIONS IN VIDEO AND THEIR POTENTIAL MARKET INSTITUTIONAL AND CONSUMER IMPACT; DENVER RESEARCH INSTITUTE; February 1973. Executive Summary, 18 pp. Final Report, 142 pp.

Potential technological innovations in video that might be introduced within the next ten to twenty years are discussed in the report. Approximately one hundred technical items, grouped into thirty-six categories of innovation, are reviewed briefly in terms of stage of development, estimated time of introduction and potential market impact. Technical feasibility, market size and description, and institutional and consumer impacts are treated in more detail for five selected areas of innovation.

CABLE TELEVISION; ELECTRONICS TECHNOLOGY; OPTICAL FIBER TRANSMISSION; VIDEO RECORDING; VIDEO TECHNOLOGY.

- T6. TELECOMMUNICATIONS AND THE STATE OF HAWAII; C. E. LATHEY; December 1971. 127 pp. OT AR 2

The report presents an overall discussion of Hawaii's telecommunications resources and requirements. The information in the report is not intended to provide economic, social, or political value judgments.

DOMESTIC SATELLITE; HAWAII; TELECOMMUNICATIONS.

- T7. TELECOMMUNICATIONS SUBSTITUTES FOR TRAVEL; R. HARKNESS; December 1973. 700 pp. OT SP 73-2

A review of telecommunications technology and an assessment of possibilities for its use as a substitute for travel is given. The basic objective is to provide knowledge that will explore the various uses of telecommunications as it affects transportation urban growth, and central city development. Social benefits and cost consideration are explored. Future development of telecommunications is considered with urban and rural area growth patterns.

ENERGY CONSERVATION; TECHNOLOGY ASSESSMENT; TELECOMMUNICATIONS; TRANSPORTATION; URBAN GROWTH.

- T8. TELECOMMUNICATIONS VIA CERTAIN GUIDE WAVE STRUCTURES; R. L. GALLAWAY; March 1973 99 pp. OT Report 73-4

A survey of telecommunication possibilities utilizing various forms of guided waves was made. A brief historical background is given, along with recent developments and limiting factors in each of several guided wave structure. A listing of the important unresolved problems in the use of glass fibers at optical frequencies is presented in the final section.

TELECOMMUNICATIONS.

- T9. TELECONFERENCE SERVICE REQUIREMENTS FOR CATV NETWORKS; P. M. McMANAMON;
November 1974. 41 pp. OT Report 74-45

CATV networks have the potential capacity for a large number of television channels (more than 80 channels). The telecommunications requirements for analog and digital transmission of audio and video teleconference signals are investigated. Separated-groups teleconference service is defined and the audio, graphics, and video modes are outlined. The teleconference facility requirements are explored in relation to the interactive, interpersonal communications process which takes place during a group meeting.

CABLE TELEVISION; DIGITAL TRANSMISSION; TELECONFERENCING.

- T10. TELEPHONE DENSITY AND TELEPHONE COMPANY AREA DATA; B. A. HART, R. F. MARTIN;
August 1973. 20 pp. OT Report 73-18

The density of telephones per square mile and the percentage coverage of geographical areas serviced in each state by the three major telephone companies, and by the other independent companies as a whole, are presented for the contiguous United States. These data should be very useful to individuals or groups who require state-by-state statistics on the telephone industry.

TELEPHONE COMPANIES; TELEPHONE DENSITY; STATE TELEPHONE STATISTICS.

- T11. TEST INSTRUMENTATION FOR A 15 GHz DIGITAL RADIO LINK; C. A. SAMSON, L. G. HAUSE,
J. E. FARROW, R. E. SKERJANEC; July 1974. 26 pp. ACC-ACO-6-74
(prepared for the U. S. Army Communications Command)

In this report we discuss requirements for test instrumentation to determine directly the relationship between the performance of 15 GHz digital radio links and the atmospheric environment. The methods of obtaining the required radio and meteorological information are outlined, electronic test instruments and recording configurations are described, and the advantages of a particular radio link for initial testing of 15 GHz systems in Germany are considered.

DIGITAL COMMUNICATION SYSTEM; MICROWAVE; LINE-OF-SIGHT LINKS.

- T12. TESTS RESULTS FOR DIGITAL TESTING OF THE CANDIDATE RADIOS FOR THE DCS MICROWAVE
RADIO; R. E. SKERJANEC; April 1973. 78 pp. OT TM 73-137C

The report contains the plan, procedures, and results for digital testing of the candidate radios for the DCS microwave radio. The tests were conducted from January 24 through February 1, 1972.

DIGITAL TRANSMISSION; MICROWAVE RADIO.

- T13. THEORETICAL COMPUTER SIMULATIONS FOR LORAN C/D RADIO NAVIGATION SYSTEM PRE-
DICTIONS; Part 1; J. R. JOHLER, D. C. HYOVALTI; March 1973. 90 pp. OT TM 73-133

This report describes the overall plan for Loran C/D predictions and gives a detailed description of basic Loran C/D groundwave prediction programs for irregular, inhomogeneous ground.

LORAN C; LORAN D; RADIO NAVIGATION SYSTEM.

- T14. A THEORETICAL INVESTIGATION OF THE VULNERABILITY OF A COMMUNICATION SYSTEM--
AN INFORMATION THEORETIC APPROACH; A. MILTON; May 1971. 22 pp.
OT/ITS TM 36C

- T15. THEORY AND APPLICATION OF ANTENNA ARRAYS, M. T. MA; John Wiley & Sons, Inc.,
1974. 413 pp.

Chapter 1 introduces the reader to the fundamentals of linear arrays of discrete elements. Chapter 2 offers many recently developed techniques for synthesizing various linear arrays. Chapter 3 provides both analysis and synthesis of two-dimensional arrays as an extension of the material presented in the first two chapters. In chapter 4, currents, impedances, fields, and power gains for simple antennas such as dipoles, monopoles, and sleeve antennas above lossy ground are presented in detail. Chapter 5 gives the basic principle and analytical formulation for a class of broadband antennas. Chapter 6, a few commonly used traveling-wave antennas above lossy ground are analyzed.

ANTENNA ARRAY.

- T16. 35 GHz STRATOSPHERIC PROPAGATION; L. E. VOGLER, L. E. WOOD; April 1974. 37 pp.
ACC-ACO-3-74
(prepared for U. S. Army Communications Command)

A recent translation of a Russian paper purports to have established a new long-range communication link at 30-45 GHz using reflections from a stratospheric layer. Because of certain questionable aspects of the translation, a study has been undertaken to explore what mechanisms might exist for propagation via the stratosphere at giga-hertz frequencies. It is concluded that some mechanisms are possible but none are very probable. The most likely means might be one making use of the whispering gallery effect.

MILLIMETER WAVE; PROPAGATION.

- T17. A TIME-VARYING ELECTRON DENSITY MODEL FOR LF/VLF PROPAGATION CALCULATIONS;
L. A. BERRY, R. M. JONES; October 1970. 50 pp.
OT/ITS TM 3

Published measured profiles of the lower ionosphere are used as the basis of an analytic model of the D-region electron density which varies with the sun's zenith angle. The model is the sum of an exponential layer and a daytime Chapman-like C-layer. The parameters of the model are adjusted by comparing its calculated full wave reflection coefficients with various published experimental propagation data. The model reproduces the measured diurnal variation of amplitude and phase height of VLF and LF signals for summer, mid-latitude conditions, including the sunrise dip in amplitude.

IONOSPHERE; LF/VLF PROPAGATION; PROPAGATION.

- T18. TOWARD A FRAMEWORK FOR COMMUNICATIONS POLICY PLANNING; A. J. LIPINSKI;
(Prepared under contract I-35549 by the Institute for the Future);
December 1971. 33 pp.
OT-CR-72-03

This paper suggests a modeling approach to the future interaction of the CATV and TV Broadcast industries. It addresses the consequences of FCC, Supreme Court, and Congressional actions and considers the desirability of these consequences to the FCC (representing the public interest) and to each of the two industries.

BROADBAND COMMUNICATIONS; CABLE TELEVISION; REGULATORY POLICY; TV
BROADCASTING.

- T19. TOWARD A STUDY OF FUTURE URBAN HIGH-CAPACITY TELECOMMUNICATION SYSTEMS; P. BARAN; (prepared under contract I-35549 by the Institute for the Future); December 1971. 21 pp. OT-CR-72-04

This report describes an outline and structure for a proposed handbook containing reference information useful to the designer of broadband information services to the home.

BROADBAND COMMUNICATIONS; CABLE TELEVISION; DATA COMMUNICATION; INFORMATION SERVICES.

- U1. UHF TRANSMISSION LOSS ESTIMATES FOR GOES; G. D. GIERHART, M. E. JOHNSON; September 1972. 40 pp. OT TM 109

This report describes a computer method for predicting transmission loss over nominal line-of-sight earth/satellite telecommunication links, and provides predictions for the GOES satellite system. The method is applicable to radio frequencies from about 0.1 to 6 FHz and includes allowances for average tropospheric ray bending, horizon effects, antenna gains, long-term power fading, surface reflection multipath, tropospheric multipath, and ionospheric scintillations. Comparisons of predictions with experimental data are included.

GOES COMMUNICATIONS; IONOSPHERIC SCINTILLATIONS; RADIO FREQUENCY; SATELLITE COMMUNICATION.

- U2. U. S. INTERNATIONAL TELECOMMUNICATION RATE HISTORY; J. E. COLE, G. W. ARNAUD, L. H. ADAMS; December 1973. 204 pp. OT Report 73-25

This report provides a historical compendium of U. S. international telecommunication rates. It is intended to provide a comprehensive source of rates, the rate component for analysis of potential price elasticity of demand, and a basis for not only examining the causes for past rate changes but also estimating potential rate changes. Brief sections outline the major milestone in international telecommunications, explain how international rates are established, and show the rate trends over the past years for various services for some of the major paths.

INTERNATIONAL TELECOMMUNICATIONS; TELECOMMUNICATION RATES; TELEPHONE CARRIERS.

- U3. UNITED STATES TREATIES AND OTHER INTERNATIONAL AGREEMENT PERTAINING TO TELECOMMUNICATIONS; S. A. BOBROFF; January 1974. 176 pp. OT Report 74-26

This document constitutes the compilation, classification, summarization and synthesis of all the international bilateral and multilateral treaties and agreements as of January 1, 1973, to which the U. S. was a party and which pertain to telecommunications. It encompasses a total of 342 treaties and agreements, 317 of which are bilateral and 25 of which are multilateral.

INTERNATIONAL TELECOMMUNICATIONS; INTERNATIONAL TREATIES AND AGREEMENTS; SATELLITE COMMUNICATION; TRACKING STATIONS.

- U4. URBAN RESIDENTIAL MAN-MADE RADIO NOISE ANALYSIS AND PREDICTIONS; A. D. SPAULDING, W. A. AHLBECK, L. R. ESPELAND; June 1971. 76 pp. OT TRER 14

A survey of man-made radio noise in certain areas within the city of San Antonio, Texas was made during May and June of 1968. The results of part of this survey of residential urban man-made radio noise is given, along with the correlations of the measured value of noise power density with population

density and vehicular count (traffic density). Also given are various detailed amplitude and time statistics of man-made noise recorded in the vicinity of Grand Coulee Dam, Washington, and in an urban area of Boulder, Colorado.

RADIO NOISE.

- U5. USE OF MAGNETICALLY ENCODED CARDS AND DIGITAL TRANSMISSION IN THE LAND MOBILE SERVICES; P. M. McMANAMON, D. V. GLEN; August 1973. 57 pp. OT Report 73-16

A telecommunications two-way connection between the card reader and a time-share computer system is described. Specific applications in public safety (police), business, and surface transportation radio services are presented.

DIGITAL TRANSMISSION; LAND MOBILE COMMUNICATION; MAGNETIC CARD READER; MOBILE RADIO.

- U6. A USER'S GUIDE TO PATH LOSS COMPUTATIONS; G. A. HUFFORD; September 1972. 93 pp. OT TM 104

The User's Guide defines, describes, and explains input parameters and and output values of the path loss between 20 MHz and 20 GHz.

PATH LOSS CALCULATIONS.

- V1. VLF-LF IONOSPHERIC CHANNEL CHARACTERISTICS; J. H. CRARY, F. K. STEELE; January 1972. 96 pp. OT TM 73

Calculated phase and amplitude of the significant components of the total fields from 10 to 60 kHz for models of the normal day and night D-region are presented. Estimates of VLF-LF time delays and dispersions of the dominant components (modes and hops) are made. Available results on the effect of rough sea on phase and amplitude of VLF signals received below the sea surface is presented.

IONOSPHERIC CHANNEL; VLF.

- W1. THE WAVE-HOP FIELDS FOR AN INCLINED DIPOLE OVER SPHERICAL EARTH WITH AN ANISOTROPIC IONOSPHERE; R. L. LEWIS; October 1970. 43 pp. OT/ITS RR 5

A review is made of the derivation of expressions for the fields due to a horizontal antenna over a spherical earth with an isotropic ionosphere. Diagram shows how upgoing and downgoing waves add to form individual wave hops and the solution is cast in the form of a wave hop series. Matrix formulation of the expressions for the radial electric and magnetic wave-hop fields of an inclined dipole is presented.

ANTENNAS; IONOSPHERE; WAVE HOP SERIES.

- W2. A WAVE HOP PROPAGATION PROGRAM FOR AN ANISOTROPIC IONOSPHERE; L. A. BERRY, J. E. HERMAN; April 1971. 93 pp. OT/ITS RR 11

Report documents a digital computer program for computing the propagation of LF and VLF radio waves using the wave hop theory. The documentation includes a description of the physical model, detailed mathematical formulas, a main flow chart, listing of the FORTRAN source deck, and the input and output of a sample case. This report supersedes NBS Report 8889.

IONOSPHERE; PROPAGATION; WAVE HOP SERIES.

- W3. WEST COAST COMMUNICATIONS COVERAGE AT 500 MHz; L. A. BERRY; July 1973. 16 pp.
OT TM 73-144

Coast Guard stations on the west coast of the United States provide adequate 500 kHz coverage of the ocean within 300 miles of the shore, except possibly for some regions around northwest Alaska.

MEDIUM FREQUENCY COVERAGE.

- W4. WIDEBAND DIGITAL COMMUNICATION SATELLITE SYSTEM; E. J. VIOLETTE; November 1974.
45 pp. OT Report 74-50

This report investigates the use of a wideband digital communications satellite system. State-of-the-art bit-rate capacity is estimated for digital data transmission in the entire frequency bands of each assumed frequency allocation in one geostationary orbital slot.

DIGITAL COMMUNICATION SYSTEMS; FREQUENCY ALLOCATIONS; SATELLITE COMMUNICATION.

- W5. WIDE DYNAMIC RANGE CORRELATOR; R. J. MATHESON; June 1971. 20 pp.
OT TM 45

Equipment used to measure correlation between two radio noise envelopes, using analog techniques with very wide dynamic range is described. Inputs to the system are as 455 kHz in a 3.5 kHz bandwidth.

RADIO NOISE.

- W6. WORK SHOP ON RADIO SYSTEMS IN FORESTED AND/OR VEGETATED ENVIRONMENTS; J. R. WAIT, R. H. OTT, T. TELFER; February 1974. 322 pp. ACC-ACO-1-74
(prepared for U. S. Army Communications Command)

The report contains summaries of twenty technical papers and four working group reports presented at subject workshop. The papers are principally devoted to radio and radar propagation in jungles and forests, path loss predictions, electrical characteristics of the forest and earth media, and lateral wave applications. Appendices provide names and addresses of all attendees, and a bibliographic summary of reports and articles from Project SEACORE, and which was sponsored by the Advanced Research Projects Agency and the U. S. Army Electronics Command.

PROJECT SEACORE; RADAR PROPAGATION; RADIO PROPAGATION.

- W7. WORLD MAPS OF ATMOSPHERIC RADIO NOISE IN UNIVERSAL TIME BY NUMERICAL MAPPING; D. H. ZACHARISEN, W. B. JONES; October 1970. 32 pp. OT/ITS RR 2

Worldwide atmospheric noise at 1 MHz, as presented in CCIR Report 322 (1963) has been numerically mapped in universal time. Fourier analyses were performed separately on the periodic functions that represent the longitudinal and diurnal variations of the data.

ATMOSPHERIC RADIO NOISE; IONOSPHERIC PREDICTIONS; RADIO PROPAGATION.

SECTION II

TECHNICAL REPORTS

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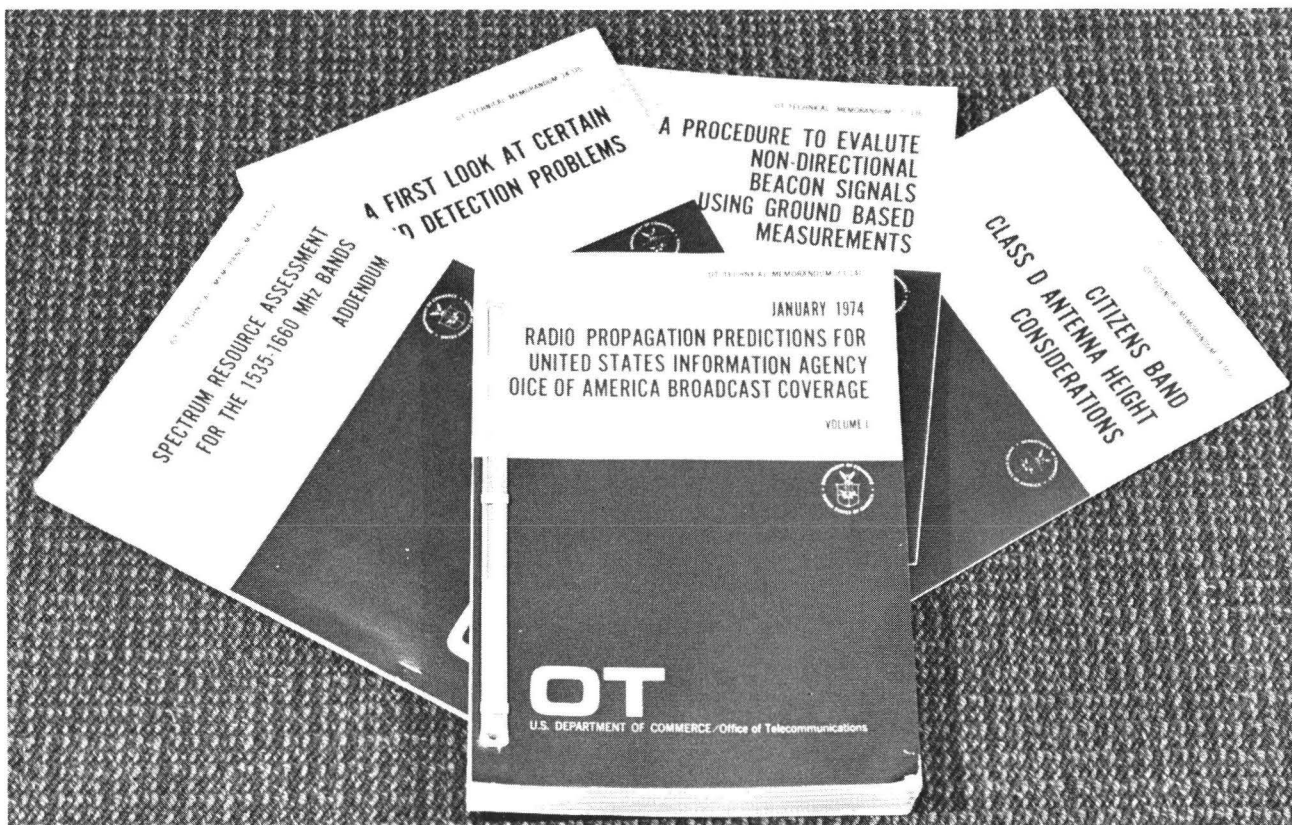
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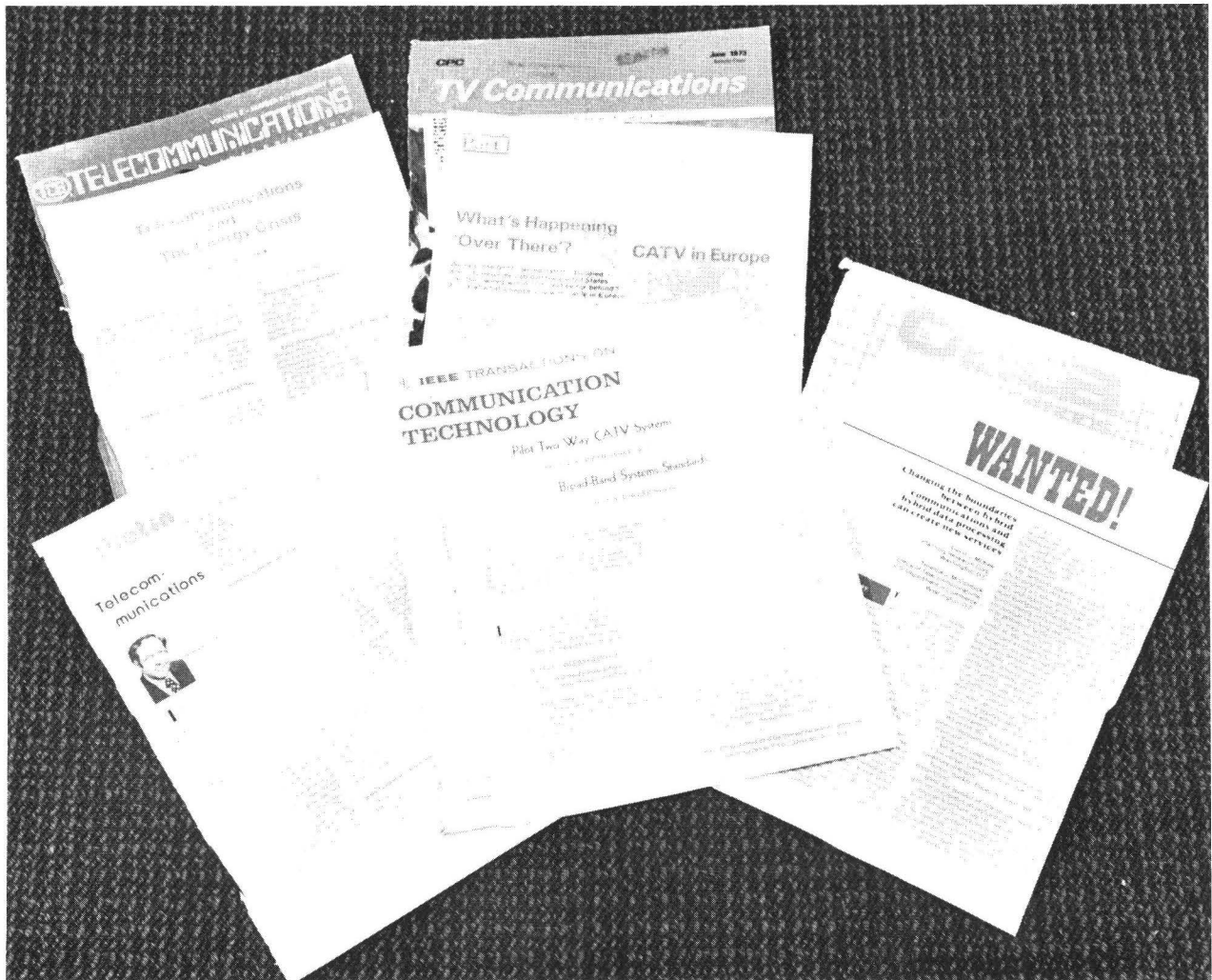
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OT TM 73-126.....	R10	OT TM 74-173.....	I6
OT TM 73-127.....	R5	OT TM 74-174.....	R2
OT TM 73-128.....	R5		
OT TM 73-129.....	N6	OT TM 74-175.....	F4
OT TM 73-130.....	P21	OT TM 74-176C.....	M10
		OT TM 74-177.....	S10
OT TM 73-131.....	R1	OT TM 74-178C.....	M7
OT TM 73-132.....	C12	OT TM 74-179.....	R5
OT TM 73-133.....	T13		
OT TM 73-134.....	R5	OT TM 74-180.....	A9
OT TM 73-135.....	R5	OT TM 74-181.....	F6
		OT TM 74-182.....	A13
OT TM 73-136.....	P25	OT TM 74-183.....	R5
OT TM 73-137C.....	T12	OT TM 74-184C.....	M6
OT TM 73-138.....	R12		
OT TM 73-139.....	S14	OT TM 74-185.....	O10
OT TM 73-140.....	R5	OT TM 74-186.....	I11
		OT TM 74-187.....	I12
OT TM 73-141.....	R5	OT TM 74-188C.....	M9
OT TM 73-142.....	M18	OT TM 74-189.....	C22
OT TM 73-143.....	D12		
OT TM 73-144.....	W3	OT TM 74-190.....	I13
OT TM 73-145.....	E13	OT TM 75-191.....	S18
		OT TM 75-192.....	E8
OT TM 73-146.....	C15	OT TM 75-193.....	P13
OT TM 73-147.....	R5	OT TM 75-194.....	M8
OT TM 73-148.....	R5		

SECTION IV

ARTICLES

This section contains an alphabetical listing, by title, of articles authored by OT staff members. A numerical sequence is also used for cross-indexing.



1. ACQUISITION OF A CODED-BINARY FREQUENCY SHIFT-KEYED SIGNAL IN ONE-SHOT TRANSMISSION; H. AKIMA; 1972. IEEE Int'l Sym. on Info. Theory, Pacific Grove, Ca., Jan-Feb. 1972.
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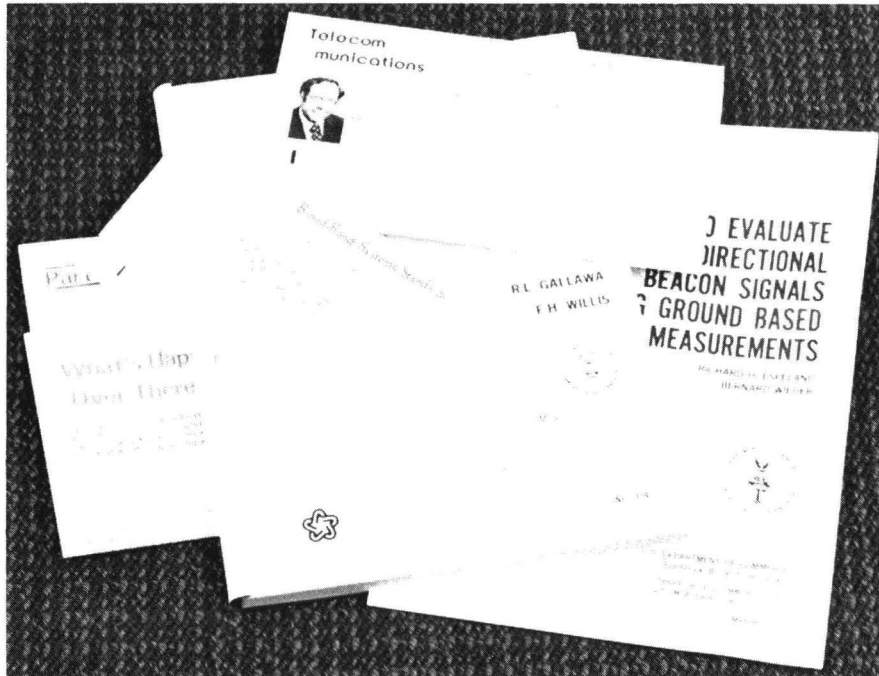
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SECTION V

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SECTION VII

MISCELLANEOUS

INFORMATION

PRODUCTS

This section contains a listing of OT brochures and films. Copies of the brochures can be obtained upon request and the films are available on-a-loan basis from:

Public and Technical Information
Officer
Office of Telecommunications
U. S. Department of Commerce
1325 G Street N. W. Room 263
Washington, D. C. 20005



BROCHURES --

Conserving Energy through the use of Mobile Radio (1974)
Conserving Energy through Telecommunications (1974)
Radio Spectrum Measurement System (1973)
Office of Telecommunications (1972)
U. S. Telecommunications Industry: Growth Implications and
Capital Requirements (1974)

FILMS --

Conserving Energy Through Telecommunications (7 minutes) (1974)
Call First, Drive Later (1 minute) (1974)
Talk is Cheaper (1 minute) (1974)
Radar Braking (15 minutes) (1974)
Telecommunications Research (20 minutes) (1973)

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