Summary of Policy Support Division Activities

Volume I

April 7, 1972

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NOTICE

This material has been assembled solely for the purpose of evaluating PSD progress. The sensitive nature of some of the information requires that this document be used for this purpose only.

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This brief summary is limited primarily to the activities of the Boulder Section of the Policy Support Division, and emphasizes the interaction with the Office of Telecommunication Policy (OTP). It was prepared in response to informal requests for an indication of productivity and responsiveness in the first seven and a half months of its existence, i.e., since establishment on August 15, 1971 (P1)*.

The Office of Telecommunication Policy and the Department of Commerce, through its Office of Telecommunications, have held discussions concerning coordination and assistance since OT's establishment on September 20, 1970. Papers of May 10 (P2) and June 7, 1971 (P3), responsive in part to the Hinchman paper "Commerce Support Program FY 72" of December 28, 1970, presented preliminary thoughts concerning the use of Boulder, Colorado based capabilities in policy analysis support, and were discussed informally with OTP personnel shortly after those dates. The papers of September 28, 1971 (P4) and November 1, 1971 (P5) present summaries of the policy support activities as they became further molded into a mutually acceptable program. The paper "Policy Support Division Activities" of January 3, 1972 (P6) presents the latest consolidation of both Boulder and Washington program activities. The Boulder activities were reviewed by Tom Whitehead, Walt Hinchman, and Mike McCrudden on February 17, 18, 1972 (P7, P8).

Some of the significant contributions to OTP during this short existence of PSD include:

- Redrafted material for Domestic Council Study on technological initiatives

- Analysis of the DOMSAT proposals

- Technical monitoring of the Ross Telecommunication Engineering Corp. contract on earth station constraints

- Assistance in evaluation of the SRI DOMSAT report

- Contribution and assistance in preparing OTP DOMSAT statement

*Codes in parentheses indicate appendix documentation.

- Substantial contribution to OTP DOMSAT report
- Satellite interference time-share program
- Access to Comanor/Mitchell and Rand computer models for CATV analysis
- Contract completed on performance/cost of warning system receiver
- Preliminary cost/benefit study of National Home Warning System
- Access to Motorola developed computer model for simulating mobile communication systems
- Analysis of communication satellite cost models-Part 1-Launch Costs
- Assistance in evaluation of RMC CATV cost study
- Assistance in evaluation of Telephone Warning System.
- Orbit utilization time-share program designed for sensitivity analysis
- Initiation of Telecommunication Services Center automated information access

The majority of tasks, as expected, will not culminate with significant outputs for several months, although in most cases background papers have been produced. The following chronology of activity in the current seven areas of BPSD initiative provides a detail of the past and current progress in these areas. Supporting documentation is contained in the appendices.

The interaction between the OTP and PSD staffs in identifying issues and developing plans of action have set the pace for progress.

Satellite Communications

August 27, 1971	Meeting with Hinchman, Lasher, Hatfield, Ewing on DOMSAT analysis requirements.
September 9	Hatfield submitted preliminary report on domestic satellite orbit utilization. (SC1)
October 6	Hatfield submitted preliminary calculations of satellite interference. (SC2)
October 15	Draft report of detailed interference calculations submitted to Lasher. (SC3)
October 26	Supplementary calculations concerning interference, and copy of interference computer program submitted. (SC4)
October 28	Brief statement of conclusions of interference report and supplementary material submitted. (SC5)
	Whitehead Statement on DOMSAT issued reflecting in part Hatfield analysis. (SC6)
November 11	Participated in review of SRI study effort.
December 3	Further conclusions concerning DOMSAT opportunities submitted. (SC7)
December 15-17	Participated in review of Ross TEC and SRI DOMSAT study effort.
	Submitted draft of final report on "Domestic Satellite Orbit/Spectrum Utilization." (SC8)
	Attended meeting with NASA (Sam Fordyce) and contractors regarding orbit/spectrum utilization.
December 29	Work to provide satellite communication cost information initiated with ITS. (SC9)
January 17, 1972	Development started on launch cost computer program. (SC10)
January 19	Comments on Ross TEC Report Submitted to Lasher. (SC11)
January 26	Meeting with Lasher, Nelson, and Hatfield to discuss Ross TEC report. (SC12)
February 1	Report on computer subroutine to calculate interference in FDM/FM systems. (SC13)

February 10	Submitted report "a General Analysis of Domestic Satellite Orbit/Spectrum Utilization" to Hinchman. (SC14)
March 20	Statement from OTP releasing above report to NTIS, and subsequent Press Release. (SC15)
April 3	Request from Lasher for additional work on DOMSAT issue. (SC16)

Mobile Communications

November 24, 1971	Meeting with Thornell, Cooke, Hatfield, Lowe, Polishuk.
	Stated desire for in-depth analysis of proposals and comments due in Spring in response to FCC Docket 18262.
	Would like demand study for mobile service as a function of cost, technology, and social factors, and data concerning Government use of mobile.
	Deferred formal requests until December 13 meeting with Mr. Whitehead. (M1)
December 19	Hatfield notified Mr. Whitehead in agreement on action in the mobile area.
	Hatfield assisted in OTP interviews for potential contractor to study Docket filings. (M2)
December 22	Hatfield and Millie obtaining background information in anticipation of OTP activities. (M3)
December 28	Background paper on "Economic Benefits of Mobile Radio Systems" was prepared. (M4)
January 3, 1972	Meeting with Thornell and Polishuk to proceed on mobile program development. (M5)
January 25	Meeting with Thornell, Cooke, Polishuk, Black, and Salaman to discuss OTP's expectations in mobile area. (M6)
January 27	Attended Motorola briefing on mobile communications at OTP. (M7)

February 9	Meeting with Cooke and Hatfield concerning SRI mobile data, and revised project descriptions. (M8)
February 10	Revised program summary for mobile communications submitted to Cooke. (M9)
February 23	Work on mobile area with ITS initiated. (M10)
February 24	Work statement on mobile area received from Thornell.
	Obtained mobile simulation program from Motorola. (M11)
February 28	Statement of assistance in determining mobile system coverage submitted to ITS. (M12)
February 29	Meeting with ITS personnel to further define mobile tasks. (M13)
March 1-3	Attended IEEE Microwave Mobile Radio Symposium. (M14)
March 7	Meeting with Mandanis, Lane, and Hatfield on SAI Mobile Contract. (M15)
March 14, 15	Participated in AT&T briefing at OTP on their Docket 18262 filing. (M16)
March 23	Request submitted to Wil Dean to release frequency data regarding mobile study. (M17)
March 24	Interim Report on mobile program progress in Tasks I, II, and III submitted to Cooke. (M18)
March 31	Mobile cost data requested form Motorola. (M19)

Spectrum Policy

October 21, 1971	Berry and Ewing submitted preliminary thoughts concerning program for this area to Hinchman. (SP1)
November 2	Meeting with Hinchman, Thompson, Lynch, Lasher, Berry, and Ewing.

Of interest are: a measure of how much a user uses this resource, definition of user rights--considering the TEMPO report results, what portion of the electrospace is occupied, analysis of the communications resource using the geostationary orbit, and a study of the earth station network. (SP2a,b)

December 3	Ewing submitted suggestions concerning orbital communications capacity in response to Nov. 2 meeting. (SP3)
December 9	Meeting with Berry, Ewing and CSC personnel to discuss CSC computer program on Communicaton Satellite Costs. (SP4)
December 10	Meeting with Hinchman, Ewing, Berry. CSC program not of high priority. Presented the need to determine the electrospace unused, e.g., in a metropolitan area. (SP5)
December 27	Letter from Ewing to Lynch discussing progress in furthering ideas of Dec. 3 paper in light of Dec. 10 meeting. (SP6)
January 14, 1972	Berry submitted paper, "Metropolitan Spectrum Availability Study" to Hinchman. (SP7)
	Contacted ECAC concerning availability of frequency and equipment data. (SP8)
February 3	Schedule of tasks for assignment policy for the geostationary orbit submitted to Lynch. (SP9)
February 22	Request to Cohn to obtain frequency data. (SP10)
March 3	Justification for frequency data needed from Dean submitted to Hinchman. (SP11)
March 13	Summary of work in defining Orbit Rights and Value submitted to Hinchman. (SP12)
March 16	Further definition of orbit rights submitted to Hinchman. (SP13)
March 22	Review of orbit value project by Hinchman. (SP14)
March 29	Further review of orbit rights project submitted to Hinchman. (SP15)
March 31	Comments concerning orbit rights and orbit value projects submitted to Hinchman. (SP16)

Broadband Services

October 5, 1971	Meeting with Besen and Partch.
	Not enough time to contribute to CATV policy statement.
	Would like more general investigation of industry with emphasis now on modeling.
	Want Comanor/Mitchell program: running and tested and accessible from Washinton, variable output format, and validation of data such as system costs, also add other models. (B1)
October 14	Initiated assistance from ITS to obtain cost information. (B2)
October 29	Besen notified that Comanor/Mitchell program now available for access. (B3)
November 4	Demonstrated use of Comanor/Mitchell program at OTP.
November 18, 19	Received briefings on current status of CATV by attendance at PLI institute on CATV.
December 2	Seminar on history of CATV regulation.
December 6	Memo from Espeland outlining cost study. (B4)
December 8	Interim report submitted discussing Rand CATV model. (B5)
January 12, 1972	Comments concerning CATV computer model received from Besen. (B6)
January 19	Meeting with Besen and Partch to discuss computer CATV model. (B7)
February 18	Comments submitted to Besen on RMC Interim Report "Investments Costs for Major CATV Components". (B8)
	Report on work on defining CATV equipment cost received from ITS. (B9)
February 19	Request from Hinchman for Partch to attend Theta-Com seminar on microwave systems for local CATV distribution. (B10)
February 28	Request from Hinchman to review CATV Demand Study Work Statement. (B11)

February 29	Final report on CATV costs received from RMC. (B12)
March 3	Comments on OTP CATV Demand Study submitted to Polishuk. (B13)
March 8	Approach to survey of home terminals for CATV systems received from ITS. (B14)
March 10	Attended RMC briefing at OTP.
March 13	Comments on RMC report submitted to Weinberg. (B15)
March 14	Outline of cost survey of local origination equipment for CATV systems received from ITS. (B16)
March 20	Comments concerning follow-up work on RMC results received form Besen. (B17).
April 5	Letter to Besen transmitting Stanford and Rand CATV model programs as revised by PSD for OTP. (B18)
April 5	Sample runs of Stanford and Rand programs: Rand CATV Financial Model, and Comanor/Mitchell CATV Financial Model submitted to Hinchman. (B19)

Warning System

September 30, 1971	Meeting with Joyce, Partch, Polishuk, Salaman. Joyce would like PSD to undertake a thorough study of disaster warning systems to "clarify the menu of Options". Program to be completed by April 1, 1972.
	Would also like an evaluation of IEC proposal to be completed in 2 to 3 months. (W1)
October 6	Joyce confirmed earlier discussions and requested 6 months study. Request study plan by Nov. 1. (W2)
October 29	Partch submitted Study Plan. (W3)
November 3	Meeting Joyce, Partch, Berry, Martin, Babcock with OCD and NOAA on warning system. (W4)
	Meeting Joyce, Partch, Berry, Babcock to discuss narrower study plan.

November 15	Partch submitted revised study plan. (W5)
November 16	Preliminary contract discussions with potential contractor. (W6)
November 17	Meeting with Joyce, Babcock, Partch, Polishuk, Messerschmitt to discuss study plan.
December 6	Meeting with A.R.F. contractor re warning contract. (W7)
December 8	Partch submitted proposed plan for warning receiver contract study to Joyce. (W8)
December 13	Berry presented working paper on costs (benefits of home warning system). (W9)
December 17	Joyce requested Partch to proceed with contract. (W10)
January 4, 1972	Meeting Partch, Russell (IEC), Salaman to discuss IEC proposal per request of Joyce.
January 10	Received warning receiver cost/performance study proposal from contractor. (W11)
January 11	Let purchase request for study contract to purchasing.
January 14	A.R.F. notified to initate work on contract. (W12)
January 20	Meeting with Beery, berry, and Partch concerning progress on warning system project.
	Akima to proceed to examine DEI calculations on probability of falsing and error. (W13)
January 25	Comments on DEI calculations submitted by Akima. (W14)
January 27	Preliminary specifications on receiver obtained from A.R.F. (W15)
February 1	Purchase Order for A.R.F. contract issued. (W16)
February 23	Meeting with Davis (A.R.F.) and Partch concering contract progress. (W17)
	Meeting with Joyce, Beery, Polk, Engle, Berry, Partch, and Polishuk to discuss Warning System program. (W18)

February 24	Meeting with Martin (OCD), Beery and Partch to discuss A.R.F. receiver contract. (W18)
March 7	Preliminary receiver cost data submitted to Joyce. (W19)
March13	Comments concerning receiver contract submitted to Joyce. (W20)
March 24	A.R.F. contract extended to April 10. (W21)
March 25	Meeting with Mainard and Beckham (AT&T), Babcock, Beery, and Partch to discuss use of telephone for home warning. (W22)

Technology/Systems Assessment

December 6, 1971	Lockett Wood prepared preliminary paper showing opportunities and problems in area of short-haul communications.
January 7, 1972	Revision of Wood paper. (TA1)
January 20	Project summary submitted to Hinchman. (TA2)
February 18	TV Technology review Contract outlined by Hinchman to Berry.
March 1	Draft description of TV Technology review contract submitted to Hinchman by Berry. (TA3)
March 6	Memo from Berry to Crumlish, OT, about TV Technology Review contractors. (TA4)
March 8	Initial meeting with Denver Research Institute Industrial Economics Division re TV Technology. (TA5)
March 14	Discussion of Technology/Systems assessment area with Hinchman, Mustin, Lynch of OTP, Hatfield, Berry, Wood of OT.
March 23	Second meeting with DRI. Proposed Project Team and discussed plans.
March 24	Revised description of TV Technology Review contract sent to Hinchman, Mustin, by facsimile. (TA6)

April 5	Received proposal from DRI: Technological innovations in Video and their potential impacts on industry, the consumer, and government. (TA7)

International Communications

December 17, 1971	Background paper "Submarine Cables and Communications Satellites: Some Recent Developments" sent to Lasher. (IC1)
January 3, 1972	Black discussed Pacific communications with Lasher.
January 11	A brief survey of the problem and current Pacific communications situation prepared. (IC2)
January 20	Meeting with Lasher, Black, Cole, Salaman, to define problem areas in international communications. (IC3)
March 15	Request from Tom Mustin for curriculum vitaes of International Relations people. (IC4)
March 28	Possible tasks concerning Pacific Trust Territory communications received from Lasher. (IC5)
March 31	Response sent to Mustin with biographies. (IC6)

Common and Specialized Carriers

February 23, 1972	Meeting with Lasher and Black to define tasks in specialized carrier area. (CC1)
March 9	Re-verificatin of cost characteristics of networks submitted to Lasher. (CC2)
March 10	Phone call from Carruthers turning project attention to station wiring costs. (CC3)
March 16	Tables to support March 9 memo submitted to Lasher. (CC4)
March 31	Company profile data on Continental Telephone Corporation, Submitted to Lasher. (CC5)

March 23	Letter of comment on network cost characteristics from Lasher to Black. (CC6)
April 7	Copies of maps indicating geographical coverage by various phone companies, submitted to Lasher. (CC7)

Information Service

January 11, 1972	Meeting with Joyce, McCrudden, Polishuk, and Salaman, to discuss management information system.
January 13	Meeting with Lyons and Salaman to discuss OTP library automation.
February 17	Reports on MUSE information system received from Meta-Language Products.
February 29	Meeting with Joyce, Lowe, Polishuk, and Salaman to discuss information base activity.
March 3	OTP library (4500 titles) processed on machine readable cards.
March 20	14 files available for computer access within Telecommunication Services Center.
March 28	Draft report on "Guide to Telecommunication Services" provided to Joyce and Hinchman (IS1)
	Meeting with Joyce, Polishuk, Roberts, concerning information base requirements.
April 6	Meeting with Potts, Rosich, and Salaman to discuss MUSE system.
	Preliminary population data accessible.

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FRAMEWORK FOR COMMERCE POLICY SUPPORT

1. Commerce's policy support function will be performed by a separate unit within the Office of Telecommunications, to be known as the Policy Support Division. This unit shall be located in the greater Washington metropolitan area. During FY 1972 certain members of the Policy Support Division shall be located at OT/Boulder, and this arrangement will be continued as long as OT and OTP find it to be useful to the overall program.

2. Proposed programs for the Policy Support Division will be developed by its manager and OTP staff for approval by the Assistant Secretary for Science and Technology and the Director of OTP. It is understood that such programs must remain sufficiently flexible to enable redirection of emphasis as immediate, and to some extent unpredictable, needs of OTP may require.

3. Budget requests for the Policy Support Division will be agreed upon between the Assistant Secretary for Science and Technology and the Director of OTP. OTP will actively support such requests before the Office of Management and Budget, and will provide such assistance as Commerce may require in supporting such requests before Congress.

4. Selection of the Manager of the Policy Support Division and its professional personnel shall be made with the concurrence of OTP. In order to facilitate exchange of information, and thereby to enable the Policy Support Division to provide the close support required, the lines of communication between OTP and the Policy Support Division shall be direct.

Approved

8/27/71

UNDERSTANDINGS CONCERNING

MINIMUM BUDGET AND STAFFING ARRANGEMENTS

FOR

COMMERCE SUPPORT TO OTP

A. BUDGET

1. The Policy Support Division will have a budget of $1.9 million for that portion of FY 1972 from and after August 15. Of this amount, up to $800,000 will be contract funds, leaving a minimum of $1.1 million for salary and expense items. It is assumed that this minimum will be expended in staffing the Division as outlined below (see "Staffing" section). If it becomes apparent, however, that staffing is not proceeding at a rate which will consume the full minimum, funds sufficient to bring the total personnel expenditure up to the minimum will be spent for the temporary detail of OT/Boulder employees to the Policy Support Division, or, if jointly agreed by OT and OTP, for the performance of Policy Support Division work by OT/Boulder.

2. It is understood that OT does not propose to devote any portion of the ITS budget allocation to continued support of all those activities listed under the column "OTP Policy Support" and the activity listed as item 3 (d) under the column "General Technical Support" on the OT Initial FY 1972 Project Plan, dated 7-29-71 and attached as Appendix A. To the extent, however, that OTP wishes such activities to continue, they will be supported from the Policy Support Division's budget allocation.

3. In order to assist OT/Boulder during the transitional year, it is agreed that at least $250,000 of the Policy Support Division's $800,000 FY 1972 contract funds will be expended at Boulder, either to pay for the temporary detail of OT/Boulder employees to the Policy Support Division or, if jointly agreed by OT and OTP, for the performance of Policy Support Division work by OT/Boulder. Funds expended at OT/Boulder pursuant to the last sentence of item (1) above will be credited against this $250,000 commitment.

B. STAFFING

1. The following individuals will be permanently transferred to the Policy Support Division as of August 15 and will be located in Washington: Richard Gabel, Robert Powers and Jack Cole. In addition, Robert Lowe will be appointed Acting Manager of the Division until a permanent Manager is selected.

2. The following individuals will (subject to their approval) be transferred to the Policy Support Division staff as of August 15 and will be located in Boulder, Colorado: Roger Salaman, Dale Hatfield, Donald Ewing, Lester Berry, Jean Adams, Jerome Partch and a secretary to be subsequently identified.

3. In addition to the foregoing ten permanent personnel, twenty vacant slots shall be made available to the Division on August 15, to be filled as soon as possible. By March 31, 1972, twenty more vacant slots shall have been provided, and by June 30, 1972, an additional ten. The build-up to these required 1972 levels shall be made in as gradual and regular a fashion as possible, but it is recognized that in order to avoid an unacceptable level of RIF's the rate of build-up must depend to a large extent upon the rate of normal attrition (through retirements and voluntary resignations) at OT. In any event, however, the required staffing levels of 50 and 60 shall be reached by March 31, 1972, and June 30, 1972, respectively. Both OT and OTP will support a personnel funding level for the Policy Support Division in FY 1973 which will at least enable retention of the 60-man staff. If, however, such funding is not approved then the June 30, 1972, staffing level of 60 will be adjusted downward.

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EXEC[illegible]IVE OFFICE OF THE PRESIDENT
OFFICE OF TELECOMMUNICATIONS POLICY
WASHINGTON, D.C. 20504

FAX sent 3-21-72

September 18, 1971

DIRECTOR

Received ITS Office 27 SEP '71

Honorable Maurice H. Stans
Secretary of Commerce
Washington, D. C. 20230

Dear Mr. Secretary:

As you are aware, the efforts of our staffs have borne fruit, and the Policy Support Division of the Office of Telecommunications is now functioning within your Department.

I want to express to you my pleasure at this achievement and my appreciation for the cooperation which you personally and your people have demonstrated. I am confident that the arrangements we have worked out will go far to bring about the objectives the President set forth in Executive Order 11556 and Reorganization Plan No. 1 of 1970. I thank you for your help.

Sincerely,

Tom

Clay T. Whitehead

CC: JMR
Lowe
→ Salaman
Buckerman
Watson
Powell
Kirkeval

A PROGRAM OF TELECOMMUNICATIONS ANALYSIS

A. INTRODUCTION

The Office of Telecommunications has for many years provided substantial contributions to the basic understanding of telecommunication science -- particularly as applicable to radio technology. With the opportunity now to examine telecommunications from a broader standpoint, the Office has been concerned about establishing programs that not only consider technological feasibility, but the socio-economic consequences. A program to satisfy this concern is discussed here, with the proposal that it be implemented through the establishment of a new Policy and Goal Analysis Division or Directorate.

The current activities of the Office are mainly concentrated in frequency management and radio technology advancement and its application to government systems. It is anticipated that a policy support staff will be established in Washington responsive to analysis requests by the Office of Telecommunications Policy. The program discussed here will also be in support of the broader telecommunication objectives, utilizing the capabilities that exist in Boulder.

The core of the program is analysis of several specific issues requiring urgent policy consideration. In addition, it contains two other tasks that will allow more meaningful analysis in the future. One is the development of information required to clearly define the role of telecommunications in attaining national goals. The second is the development of information required to perform rapid, complex, multidisciplinary analysis.

B. OBJECTIVES

The purpose of this program is to analyze the opportunity for telecommunications to assist in attaining national objectives. This requires an understanding of the national and international demands for information stemming from both economic and sociological opportunities and problems facing the nation. It requires an analysis of policy alternatives to fulfill these requirements. In addition, it requires a knowledge and assessment of the history and growth of telecommunications and its impact on society, and the assessment of current research and innovation to meet the requirements and opportunities for services in the future.

The program will not consist of specific system design, or basic technology research, but will utilize the research of others, and at times stimulate alternative research and design directions. Nor will it become involved in the mechanics of frequency management or the detailed research of frequency sharing and compatibility analysis. The program will, however, develop a source of technical and socio-economic information required for telecommunication analysis and policy making, and promote the accessibility of this information.

C. ACTIVITIES

The program can be subdivided into the project areas of Goals Analysis, Policy Analysis, and Information Service.

These correspond to:

1. Analysis of the opportunities for telecommunications to assist in solving national problems, exploiting social and economic opportunities, and identifying the requirements for policy decisions;
2. Analysis required to develop policies that will guide decisions toward accomplishing national objectives, and
3. Collating and stimulating access to information required for comprehensive analysis, and knowledgeable decision making.

All three areas are fundamental inputs to stimulating this nation's social and economic development through the efficient use of telecommunications. The first, goal analysis, will be pursued as a small but comprehensive area. It is not being addressed elsewhere from a telecommunication standpoint, and in the past has been analyzed generally on an ad hoc basis. Here it is established as an accountable area that can take full advantage of both an information base containing the history of progress and the future of opportunities, and being associated with the development of feasible and acceptable policies to stimulate the nation's growth.

The policy analysis area is one of several devoted to assisting the Office of Telecommunications Policy through specific studies and analysis of policy alternatives. The emphasis here is on evaluating telecommunication research and development, and analysis of policies to meet the information requirements of society.

Most information is obtained within the vicinity of the worker's desk. The lack of central source for telecommunication information has caused policy decisions to be made with limited analysis and delays. Although it is difficult to place a quantitative value on either of these factors, it is not difficult to foresee the advantage to rapid access to the required information.

D. BASELINE PROGRAM

Goals Analysis

It is well established that telecommunications (the conveying of intelligence) can have a profound impact on society, both short and long term. The invasion of New York City - as portrayed in Orson Welles' 1938 broadcast had a spectacular effect on some of the listening public; an effect that is sometimes sought in today's news stories. "Sesame Street" demonstrates entertaining educational opportunities for children. Remote access computer technology and the potential of device attachment to the public message switching system open vast opportunities for enhanced communication. Cable systems to the home, mobile systems to the individual, the coupling of medical data to the physician, the enhancement of mental capacities through the use of the computer stimulate an unequalled opportunity in development of man and society to learn and be taught, to hear and be heard, to think and relax. The rate at which technological innovation is progressing leaves anything possible by the time we decide what to do with it.

But what are the telecommunication objectives. How can telecommunications assist in attaining the goals of the country - what are the opportunities and problems, and what role can telecommunications play in exploiting the opportunities and reducing the problems. Many of the problems of this time differ little from those summarized in the early documents of this country. They have only changed in form, along with the natural evolution of human society. The problems take the face of the new technologies, and therefore must be dealt with using current technology. But even more exciting are the opportunities to utilize this technology in combination with the soft sciences - sociology and economics - to minimize the problems facing our children, and to maximize their opportunities.

Let's look at random at what is attracting the attention of the people. Invasion of privacy, women's liberation, inflation, pollution of lakes and air, baseball, national security, airline hijacking, teacher's strikes, travel and vacations, health, violence, freedom of the press, foreign affairs, regulation of railways, historical monuments, cost of city government, etc. Is it possible to form a grouping into areas, e.g. thirst for knowledge, chance to be recognized, personal and national safety and security, the desire for entertainment.

They can, in fact, be summarized by the statement that "We hold these truths to be self-evident, that all men are created equal, that they are endowed by their creator with certain inalienable rights, that among these are life, liberty, and the pursuit of happiness." The question being how do we maintain these opportunities, and in particular, what role can telecommunications play?

This project will develop information necessary to answer this question. Specific goals and policies will be identified in fiscal year 1972, from a survey of presidential, administrative, Congressional, and legislative documents. The issues attracting public attention will be identified from a review of selected newspapers, magazines, and journals. The issues will be summarized, as will the role of telecommunications.

Assistance in pursuing this analysis will be obtained through several consulting contracts in the socio-economics area. In about September, after the initial results from the identification surveys have been collated, an advisory committee will be formed to provide guidance in the analysis of this information.

Policy Analysis

This project area has the objective of providing direct support of the programs within the Office of Telecommunications Policy, and therefore requires close association with OTP in developing and expediting the work.

The functions of the Office of Telecommunications Policy as specified in Executive Order 11556, and largely summarized in section 2 (b) - "Develop and set forth plans, policies, and programs with respect to telecommunications that will promote the public interest, support national security, sustain and contribute to the full development of the economy and world trade, strengthen the position and serve the best interests of the United States in negotiations with foreign nations, promote effective and innovative use of telecommunications technology, resources, and services."

During fiscal year 1972, the support will emphasize analysis of opportunities for new information distribution and acquisition services, and a review of telecommunication related research and development.

In the broadcasting area, a base of information concerning broadcast and cable distribution will be developed including both systems and economic factors. Current and proposed service alternatives for radio broadcasting and cable systems will be summarized. The origination, transmission, and terminal device technology will be reviewed as necessary to evaluate technological opportunities to fulfill the service requirements. A study will be conducted of economic alternatives to the services. Included will be demand projections, evaluation of scalar and specialized economies, and consideration of regulatory constraints. Support will also be provided for a pilot program to evaluate broadband services.

In the area of message services, the evaluation of alternatives and opportunities for interconnection and attachment started in 1971 will continue, emphasizing minimum standards requirements, and maximum innovation leading to extended service opportunities.

To assist in an evaluation of the adequacy of new technology to meet the projected telecommunication demands, and the potential of new opportunities based on technological development, a survey will be conducted of research and development activities in the government, industry, and universities. International activities will also be summarized.

Information Services

The capability to analyze an opportunity, and to solve a problem largely depends on the individual's education and experience as stored and retrievable by the mind. In addition, he uses information that is accessible from individuals with other experience and by use of instruments that are within the vicinity of his desk. The analysis process could be much improved if the analyst had ready access to multidisciplinary information and complex analysis techniques that are not within his repertoire. Such an information base cannot substitute for the analysis by the active human mind. It does not generate ideas, or weigh alternative solutions based on subjective or moral grounds. It can, however, extend the basic storage and analysis capability of the individual, thereby allowing him to more profitably exploit his unique analysis capabilities.

Multidisciplinary analysis requires access to information and data that is diverse in both subject and service. The objectives of this activity are: 1. reduce search time by identification of information and data sources, 2. make the information timely by allowing ready access, 3. facilitate use of the information and data by developing multidisciplinary analysis techniques, and 4. evaluate information requirements through both socio-economic and technical assessment.

The initial steps in 1971 to meet these objectives were the identification of data services within the Washington area government complex (with help of NTIS), a demonstration of access to selected information (including limited 1970 Census and telecommunication system information), and assessment of activity in the radio propagation area.

In fiscal year 1972, the accessible information base will be increased to include telecommunication business statistics and evaluation routines. Access to this information will be made available within OT and OTP to facilitate more rapid and detailed analysis. Telecommunication assessment will be expanded by using the experts in industry, government, and universities to assist in summarizing the status and opportunities for advancement.

Policy Analysis Program

It has been proposed to establish a program within DOC/OT to support the policy analysis requirements of the OTP. This activity would be located primarily within the Washington based Policy Support Division.

It has also been proposed to provide assistance in policy analysis using the capabilities that exist in Boulder. This possibility was discussed in a paper, "A Program of Telecommunications Analysis" of May 10, 1971. More specific details are contained below. Modifications have been made in the program based on discussions with OT management and others. Most noteworthy, it is proposed that although supervision of the Information Base activity be within this proposed program, a significant contribution to this area be made by the Washington staff. It is proposed that the Information Base activity continue with this modification, and the policy analysis be initiated as soon as appropriate arrangements can be made between OTP and DOC.

The purpose of this program, which will be managed through what will be called here PAD (Policy Analysis Division) in Boulder, is to provide interactive support to the OTP. This means a cooperative program and a continual interchange of ideas and progress. This can be contrasted with the conventional contract philosophy where a work statement is prepared in the detail to facilitate a minimum of exchange until the results are presented.

The interaction shall be facilitated through cooperative development of a program (a purpose of this paper) that will allow modification as priorities shift and additional information requirements identified. The interchange shall be encouraged through frequent discussions and conferences in Washington between PAD and OTP project personnel and the liberal use of conference communications. Open and free two-way communications must exist to allow maximum assistance.

A baseline program for FY '72 is shown in the Figure accompanying this paper. The word baseline means that it is the starting point from which departures can be made based on OTP needs and PAD demonstrated responsiveness. To facilitate this responsiveness, it has been suggested that PAD administratively report direct to the Policy Support Division (or the OT Headquarters before PSD is adequately staffed). This will assure the necessary control of resources (funds and personnel).

Four projects have been identified in the Figure. The first three, Information Distribution (mainly broadband services such as in broadcasting and cable), Satellite and Mobile Communications, and Telecommunication Assessment, utilize funds designated for direct OTP assistance. The fourth, Information Base Development, will be supervised within PAD, but the majority of work will be undertaken within ITS and with the assistance of the Washington OT staff.

A summary of project objectives is provided in the appendix to this paper. The Figure shows where the specific project emphasis will interface with the OTP program areas.

Relation Between OTP Program and PAD Projects

PAD Projects	Emphasis	OTP Program
Information Distribution (Berry)	Policy Alternatives, Info. Base Pilot Program	Broadcast (Hinchman)
Satellite & Mobile (Hatfield)	Tech Review & Socio-Eco. Anal.	Mobile (Thornell)
	Domestic Satellite	Bulk & Specialized (Hinchman)
	Cable-Satellite Anal.	International (Joyce)
Telecom. Assessment (Hubbard)	Int'l. Participation Summary	International Conf. (Dean)
	R & D Review	New Technology (Thornell)
		Spectrum Plans (Hinchman)
	Govt. Activity Summary, FY '73 Program	Federal (Joyce)
		Emergency (Joyce)
		Spectrum (Dean)
Information Base (Roberts,Rosich)	Information Center	Special Projects

APPENDIX

PAD Project Summaries

Project: Information Distribution

Project Leader: Les Berry

Objective: The social demand for information, and the economic feasibility of exploiting technology opens new opportunities for services to enhance educational opportunities, improve entertainment and news coverage, provide informational assistance, and promote societal communications. The objective of this project is to assist the OTP evaluate the opportunities and alternatives for distribution of information and entertainment using both radio and cable systems.

Specifics: Assistance will be provided in (1)analysis of broadcast policy alternatives, (2) development of an information base, and (3) development and implementation of a pilot program. Current and proposed service alternatives for radio broadcasting and cable systems will be summarized. The origination, transmission, and terminal device technology will be reviewed as necessary to evaluate technological opportunities to fulfill the service requirements. The economic alternatives to the services will be evaluated including demand projections, evaluation of scalar and specialized economics, and consideration of regulatory constraints. Support will be provided for a pilot program to evaluate broadband services.

<u>Project:</u> Satellite and Mobile Opportunities

<u>Project Leader:</u> Dale Hatfield

<u>Objective:</u> The objective of this project is to assist OTP evaluate satellite and mobile communication opportunities and alternatives, and their resultant policy implications.

<u>Specifics:</u> Assistance will be provided through (1) analysis of domestic satellite alternatives, (2) analysis of international satellite options and their interface with cables, and (3) identification of improved mobile communication opportunities including socio-economic benefits and technology feasibility. The domestic satellite applications will be evaluated in terms of technology and market opportunities. Included will be an evaluation of orbit and spectrum utilization, and the potential of new services. Current and proposed international satellite and cable system characteristics will be collated and summarized. Economic alternatives will be evaluated. Social and economic opportunities for new and expanded application of mobile communications will be studied, including demand estimates, equipment costs, and regulatory constraints. Alternative technology and operational criteria will be evaluated to determine feasibility.

Project: Telecommunication Assessment

Project Leader: Bob Hubbard

Objective: The objective of this project is to help the OTP determine current progress in exploiting telecommunications to attain national objectives, and to provide guidance in Government activities in FY '73.

Specifics: Assistance will be provided through (1) review of telecommunication-related R&D within the Government, (2) review of Government agency interest and participation in telecommunication activities both national and international, and (3) an evaluation of the relation between Government activities and national objectives including cooperation, duplication, and gaps. A survey will be made of telecommunication activities within the Government, making use of the FY '72 budget, annual reports, SIE project information, and interviews. In addition, the national objectives will be summarized from legislative and executive documents, and social demands. The summarization of Government activities and national objectives will assist in evaluating FY '73 and FY '74 budget requirements.

Project: Information Base Development

Project Leader: Bill Roberts

Objective: The objective of this project is to develop a readily available base of information required for telecommunication analysis.

Specifics: Emphasis this year will be on extending the telecommunication data base in both technical and socio-economic areas, and developing the routines necessary to meaningfully access this information. Washington-based personnel shall assist in locating socio-economic data. ITS personnel shall develop the software required for information retrieval, and locate the technical data. the project supervision shall be provided by the PAD.

POLICY SUPPORT DIVISION

FY '72 Program

The objective of the Policy Support Division is to stimulate the opportunity for communications to advance the social and economic objectives of this country. To this end, the PSD will work with the Office of Telecommunications Policy in examining specific issues likely to require policy decisions. It shall maintain an awareness of current and impending technological advances, social and economic problems facing the nation, and current policies and objectives. Finally, it shall apply this awareness to stimulate opportunities for communications to promote social and economic development.

It is expected that the Division's program will be dynamic; that is, continually developing and improving based on opportunities uncovered and OTP requirements. The following tasks are currently being pursued with the indicated direction of effort.

Communication Opportunities

The objective of this program is to stimulate new opportunities for communications to promote this nation's economic development, and social advancement. The requirement for this program is supported by a recent Domestic Council request. To meet this objective, it is necessary to define national and business, individual social goals, objectives, and needs, and to relate them to the available and planned communication services. The output of this program will be a summary of needs and their fulfillment using communications, but more important, an identification of where these needs are not adequately being met, and a priority listing of the steps that could be taken to more effectively exploit the opportunities for communications to assist in this country's advancement.

The goals, objectives, and needs will be defined from a systematic analysis of five primary sources; executive documents and programs, legislative documents, public news and opinion data, business and industry reports and reviews, and international conference and organization activities. This information will be summarized and presented in a form to allow review and analysis. Similarly, current and planned communication services will be summarized, along with preliminary thoughts on potential communication advances. Both sets of information, needs and services, will be correlated to determine the effectiveness of current communication services, and expose the opportunities afforded by full exploitation of the communication potential. This analysis will be guided by assistance obtained from OTP, representatives from segments of society and from the many related disciplines. A summary will be prepared of communication opportunities, estimated economic and social cost, and policy alternatives.

At the present time, the FY '72 budget documents and current annual reports are being reviewed to identify pertinent programs within the Executive Branch; i.e., programs that either promote the use of telecommunications, or have such a potential. Legislative documents are being reviewed to summarize specific national policies. There is an attempt being made to categorize news items in terms of national objectives and telecommunications opportunities. A summary of business in international communication needs and activities will start shortly. By the middle of January, it is expected that sufficient information concerning national objectives and current activities will be collated to start obtaining assistance from a wide range of interests in determining new communication opportunities. It is expected that a report summarizing these opportunities will be available near the end of this fiscal year.

Satellite Communications

The goal of this program is to provide OTP with data base and analytical support in the area of satellite communications. Emphasis will be placed on improving and maintaining expertise and documentation that could be drawn upon by OTP and others on an "as required" basis. The current status and trends in satellite technology, costs, service demands, price elasticity, and the corresponding technology and costs of alternative terrestrial systems will be evaluated and updated on a continuing basis. Close liaison with OTP staff members and their contractors will be maintained. The depth of technical and economic detail would be consistent with the intended purpose of supporting policy decisions; e.g., the details of device operation, costs, and propagation mechanisms would be considered only to the extent that they have a significant impact on system cost and performance.

Specifically, existing satellite communication system costs and performance models will be acquired, evaluated, and modified, and new models would be developed as appropriate. A current bibliography of technical articles, as well as copies of regulatory proceedings, news clippings, and other sources, will be maintained. Close liaison with OTP will be established so that the program would encompass their requirements. The primary output will be data and reports in response to OTP requests such as (1) the technical feasibility of a proposed satellite system, (2) sharing possibilities to minimize the cost of several compatible systems, (3) estimate of demand for a new service, and (4) the impact of a proposed new system on existing systems.

An examination of the satellite proposals, upon OTP request, has provided information concerning the feasibility of accommodating the proposed services. A study of the impact of these services is continuing.

Mobile Communications

Such basic forces as economic growth, increased mobility, and greater demands in the areaof law enforcement and public safety, have combined to produce unprecedented pressure for mobile communication services (land, sea, and air). Existing services are often hampered by severe radio spectrum congestion and new or expanded services are frequently limited by the same factor even though they are economically attractive and technically feasible. The spectrum constraint is particularly binding in the mobile services because alternate means of communication (i.e., wires or cables) are usually impossible, as in the case of aeronautical mobile.

The overall objective of this program element is to provide the Office of Telecommunications Policy with data and analyses to aid in formulating policy for mobile communication services. Three broad activities that have been established for FY-73 are:

(1) identify and evaluate alternative technologies and operational approaches for providing mobile communication services

(2) identify and analyze opportunities for new and expanded applications of mobile communications systems in the 1975-80 time frame

(3) examine the unique requirements and opportunities for improved mobile communications to support law enforcement and public safety

Tasks for FY-72 are aimed primarily at data gathering and methodology development for the above activities. Specific tasks are:

1. Conduct a review of technical articles, manufacturers' literature, FCC documentation, reports of study groups, national and international frequency allocations, etc. and prepare a synopsis of the current status of mobile communications services. This will include a summary of those technical and operational alternatives that have recently been proposed.

2. Develop a methodology for estimating the costs and economic benefits of mobile communications systems. The techniques will be applied to several specific, representative systems. This study will supply the background for estimating the relative benefits of mobile services.

CATV Analysis

The proposed FCC rules on CATV, as detailed in a letter to Congress on August 5, 1971, raise a great many questions concerning the future of this industry. In consideration of the short time frame for any response (the rules are to be promulgated by the end of 1971), the following approach has been taken. The proposed rules are being studied to determine what types of CATV systems and/or broadcasters will be most severely affected (i.e., proposed new systems, expansions of existing systems, small broadcasters, etc.). Actual systems which typify these identified types will be selected for in-depth studies. The affect of the rules on their present operations and any planned expansion will be determined through a market/demand survey of their present and potential future customers, examination of their pricing structure, the plant investment required to meet the new requirements, and an overall study of the possibilities and problems facing the specific systems.

Some of the questions to be addressed are:

Will present systems stagnate rather than expand and fall under the new rules?

Is grandfathering necessary across-the-board, or could it be done on a case basis?

What is the status of systems that previously obtained waivers?

Should some of the requirements be applied according to system size, rather than market size?

Will the two-way channel be useful? What types of two-way systems are actually being considered for installation?

Are new rate structures being considered? Are subscribers willing to pay for the added services?

Will small broadcasters be injured by interconnection of CATV systems?

The proposed rules also raise some broader questions that must be investigated. For instance:

Does the presence of an uncensored public channel in the home constitute an invasion of privacy? Does the public have the right to demand censorship as they have done in the Postal System? Will they retaliate by removing the cable?

Can a local system import originations from other systems? If so, would a monopolistic program source tend to grow and negate the concept behind the local originations? What about the ownership of interconnection facilities and program sources?

Will the two-way channel be considered to be an invasion of privacy?

Should it be optional at the discretion of the subscribers?

Can the leased channels be used for addressed point-to-point communications? What are the limitations placed on the use of the leased channels? Does the local operator or local franchise entity have the authority to regulate the leased channels?

An existing model of the cable industry supplied by OTP will be evaluated and modified as necessary to allow analysis of policy alternates.

Spectrum Allocation, plans and policy

The objective of this program is to develop more flexible and efficient spectrum useage policies with a sound appreciation of the probable technical and economic consequences.

The present method of allocating the radio resource is a license system. It is often difficult to obtain a license because of resource scarcity, but when obtainable, licenses are free. The spectrum is scarce because of competing claimants. The present license system does not allow a claimant to effectively express the degree of his need for the resource. Further, it has been widely claimed that the license method is wasteful of the resource.

Two alternative methods which have been proposed are spectrum leasing and the creation of a spectrum market.

To become conversant with such alternatives requires an evaluation of their relative advantages and disadvantages. Ways that the hypothetical methods could be implemented must be considered and an attempt made to foresee resulting implications relating to policy formation. For example, both the market and leasing systems would probably require that rights to the resource be explicitly formulated which are technically sound as well as legally enforceable.

Ultimately, standards must be delineated whereby the alternatives can be compared. The proper mix of technical, economic, legal, and social factors must be determined to establish standards of measurement.

Initially, the effort will concentrate on isolating the issues, problems, and implications of spectrum allocation alternatives to the extent that the issues can be more clearly enunciated and that some technical, economic, social, and legal problems can be contracted.

Recommendations of assorted task forces, committees, and interested parties are being reviewed and compared.

A system of technical units will be developed to quantify the amount of the spectrum resource which is needed or is being used. Considerations in the development include (a) important dimensions of the resource such as frequency, space, time, direction, polarization, (b) ability to determine units from available data, or data easily obtained, (c) ability to measure nits, and (d) economic usefulness of the units.

New and potential technological developments which could significantly affect the use of the radio spectrum and assess the costs will be identified as will advantages and disadvantages of each.

Progress reports will be communicated to OTP throughout the year.

POLICY SUPPORT DIVISION

Boulder Detachment FY'72 Program

The objective of the Policy Support Division is to assist the Office of Telecommunications Policy in the development and analysis of new communication initiatives and policies which will advance the social and economic objectives of this country. To this end, the PSD will work with the OTP in examining specific issues likely to require policy decisions. It shall maintain an awareness of current and impending technological advances, social and economic problems facing the Nation, and current policies and objectives. Finally, it shall apply this awareness to the analysis of specific opportunities for communications to promote social and economic development.

It is expected that the program will be dynamic; that is, continually developing and improving based on opportunities uncovered and OTP requirements. Likewise, interaction within the group, with OTP and ITS personnel will be dynamic. The Boulder Detachment of PSD (BPSD) will continue to maintain close interactive communications with OTP through frequent conversations with program personnel, exchange of draft documentation, and frequent visits to Washington. A similar arrangement exists between ITS and BPSD personnel. In neither case is the association that of a contractor and contractee, but rather a joint formulation of objectives, methodology, and sharing of results.

The following specific tasks are now cooperatively being pursued by OTP, BPSD, and ITS personnel. Identification of primary contributing BPSD and ITS personnel, and estimated level of effort is included.

Satellite Communications

The goal of this program is to provide OTP with data base and analytical support in the area of satellite communications. Emphasis will be placed on improving and maintaining expertise and documentation that could be drawn upon by OTP and others on an "as required" basis. The current status and trends in satellite technology, costs, service demands, price elasticity, and the corresponding technology and costs of alternative terrestrial systems will be evaluated and updated on a continuing basis. Close liaison with OTP staff members and their contractors will be maintained. The depth of technical and economic detail would be consistent with the intended purpose of supporting policy decisions; e.g., the details of device operation, costs, and propagation mechanisms would be considered only to the extent that they have a significant impact on system cost and performance.

Specifically, existing satellite communication system costs and performance models will be acquired, evaluated, and modified, and new models would be developed as appropriate. A current bibliography of technical articles, as well as copies of regulatory proceedings, news clippings, and other sources, will be maintained. Close liaison with OTP will be established so that the program would encompass their requirements. The primary output will be data and reports in response to OTP requests such as (1) the technic feasibility of a proposed satellite system, (2) sharing possibilitic to minimize the cost of several compatible systems, (3) estimate of demand for a new service, and (4) the impact of a proposed new system on existing systems.

An examination of the satellite proposals, upon OTP request, has provided information concerning the feasibility of accommodating the proposed services. A study of the impact of these services is continuing.

Mobile Communications

Such basic forces as economic growth, increased mobility, and greater demands in the area of law enforcement and public safety, have combined to produce unprecedented pressure for mobile communications services (land, sea, and air). Existing services are often hampered by severe radio spectrum congestion and new or expanded services are frequently limited by the same factor even though they are economically attractive and technically feasible. The spectrum constraint is particularly binding in the mobile services because alternate means of communications (i.e., wires or cables) are usually impossible, as in the case of aeronautical mobile.

The overall objective of this program element is to provide the Office of Telecommunications Policy with data and analyses to aid in formulating policy for mobild communication services. Three broad activities that have been established for FY-73 are:

(1) Identify and evaluate alternative technologies and operational approaches for providing mobile communication services;

(2) Identify and analyze opportunities for new and expanded applications of mobile communications systems in the 1975-90 timeframe;

(3) Examine the unique requirements and opportunities for improved mobile communications to support law enforcement and public safety.

Tasks for FY-72 are aimed primarily at data gathering and methodology development for the above activities. Specific tasks are:

1. Conduct a review of technical articles, manufacturers' literature, FCC documentation, reports of study groups, national and international frequency allocations, etc. and prepare a synopsis of the current status of mobile communications services. This will include a summary of those technical and operational alternatives that have recently been proposed.
2. Develop a methodology for estimating the costs and economic benefits of mobile communications systems. The techniques will be applied to several specific, representative systems. This study will supply the background for estimating the relative benefits of mobile services.

Spectrum Allocation, Plans and Policy

The objective of this program is to develop more flexible and efficient spectrum usage policies with a sound appreciation of the probable technical and economic consequences.

The Electrospace Commodity

Any method of allocating the radio resource presupposes a basic understanding of the "thing" being allocated. The benefits and costs of an allocation system can be analyzed well only when the "commodity" has been adequately defined.

Economists have envisioned allocation of the radio resource (the electrospace) by a market mechanism. The mechanism could have a variety of forms including rental, auction, and selling. Those advocating such mechanisms contend that incentives which do not now exist could be provided for judicious use of the electrospace.

Whatever the allocation method, there is a need to define the commodity involved. Further, the desired incentives can become operational in many cases only if the commodity is defined in terms allowing trading.

Because of the close relationship between the definition of the commodity and rights to the commodity, definitions should be made with cognizant legal considerations.

Activities

1. Define the commodity under the present allocation system
2. If the commodity depends on the allocation method, give alternative definitions of the commodity relative to

various market methods. Discuss relative advantages and disadvantages.

3. Define what constitutes usage or consumption of the commodity.

4. Describe the units of the commodity.

Spectrum User Rights

An integral part of a spectrum allocation method is the definition of the rights of the user of the resource. In the process of investigating the merits of alternative allocation procedures, user rights must be defined. In particular, in any type of market method, the rights must be "marketable," that is, they must be exclusive and transferable.

While the final formulation of the rights is the work of a lawyer, his formulation must have technical basis. Since the electrospace has unique properties as a resource, it is to be expected that user rights shall also be unique in some respects.

The purpose of this task is to investigate the relation between user rights and spectrum characteristics. The extent that particular allocation methods enter the relation should be studied.

Activities

1. Delineate desirable properties of a "rights package" for spectrum users.

2. Give a brief exposition of a licensee's rights under the present allocation method.

3. Delineate one or more rights packages, and consider the probable methods of enforcement for an auction system

of allocating the spectrum.

Anomalous Regions of the Spectrum

One need in analyzing alternative ways of allocating the radio resource is to have knowledge of "areas" of the electrospace where the present allocation is clearly inadequate. The results of this task can be used to decide on an area where alternative allocation methods could be simulated or an experiment could be conducted.

This project is to be informative or exposatory in nature. The purpose is to clarify our thinking regarding the desired qualities of an allocation method and to describe several areas where the radio resource is now now adequately allocated. Thus the regions to be analyzed are anomolous in that their allocation under present methods is definitely suboptimal.

Activities

1. Delineate the qualities of a good allocation method.
2. Give a brief exposition of the present allocation method. (Who allocates? What is allocated? What are the rights of a licensee? What are some political, technical, and economic constraints of the method?)
3. Enumerate several regions where present allocation methods are clearly suboptimal relative to part 1 above.

Broadband Services

The main objective of our present program in the area of broadband services is to gain the understanding necessary to model the broadband services industry. A computer model will be maintained by PSD for use as an analytical tool by OTP. The model will be modified and updated as new supporting data become available. We will also assist as required in the evaluation of data supplied to OTP by contractors and consultants, with a view toward incorporation into the model.

One of the areas of greatest impact on the model is the cost and capability of equipment for CATV and other broadband services. To aid in this area, ITS will conduct studies of both presently available and envisaged equipment. The study will typically be aimed at providing the range of costs for:

...upgrading present systems to 20 or more channels.

...providing new 20 or more channel systems.

...special 20 or more channel receivers.

...local origination (mobile and fixed).

...two way communication capability..

The question of special television receivers has taken on new importance with the recent announcement of a CATV receiver leasing arrangement in a trial system. The study should not be merely a price list from equipment manufacturers, but should include the past experience and future projections of actual system operators, and the imagination of the investigators to envision future services.

Although the main thrust of the present program is the maintenance of the computer model, the objective of gaining an understanding of the opportunities and problems of the industry will also be emphasized for its later value to OTP.

Warning System

The Federal Government is pursuing a program to establish a rapid, reliable warning capability, to bring the cost of a warning receiver within the reach of every American household. This study is directed toward evaluation of options to meet this objective.

Data Base for Population Coverage

Before any meaningful discussion of penetration rates can be given, the location of the population must be known at various times of the day. The following types of information must be obtained:

Percent of population in homes vs. time of day

Percent of population in work areas vs. time of day

Percent of population in transit vs. time of day

It is also important to be able to break the total population into population density subsets to evaluate systems coverage. Much of this information is available from Census Bureau statistics. This information will be used to form a data base for the determination of penetration rates.

Receiver Costs

The penetration rate of any warning device is highly dependent on its cost. The cost of a variety of receiver types and configurations will be studied in detail. As a part of the study, possible additional services or uses for the warning device will be considered.

The costs associated with inclusion of addressing capabilities will be carefully determined.

Penetration vs. Transducer Type

The penetration rate achieved by a variety of warning transducers (i.e., various receiver configurations, sirens, broadcast services, etc.) will be determined utilizing statistics on the buying habits of the public and the data base as discussed previously.

System Evaluation

The four systems DIDS, the existing NOAA VHF system, a system operating through the private broadcast industry, and a system using a communications satellite will be analyzed with particular emphasis on the following areas:

Penetration rates

Total system cost (capitalized costs)

Public vs. individual costs

Meaning of reliability figures

Frequency spectrum requirements and interference problems.

The stated requirements for the warning system will be carefully considered.

Penetration vs. Cost Curves

In order to present a clear picture of the options available for a warning system, curves of penetration rate vs. total system cost will be prepared utilizing the information obtained during the study. If other parameters, such as time response, prove to greatly affect system cost they will also be parametrically displayed.

The proposal presented to the Office of Telecommunications Policy by International Electric Corporation will also be evaluated.

Communication Service Analysis

This nation is in the process of expanding the opportunity for interactive communication among its people. A few examples illustrate this movement. Not only is the telephone system being expanded to meet the growing demand for telephone service, but with the Carterfone and subsequent decisions, innovative opportunities are being developed to use this vast moderate-capacity information switching system to meet the modern needs of business and society.

Pilot experiments are being planned by the Office of Telecommunication Policy, in conjunction with other agencies, to demonstrate the opportunities presented by broadband services, such as CATV. The Postal Service is planning rapid economical mail service. The objective of this effort is to assist in analyzing the communication services currently being offered, and to illuminate other service potentials based on current technology.

An example of potential new services lies in the demand for short-range, inexpensive telecommunications links that appears to be increasing dramatically. The extent of this demand and the technical and economic feasibility of alternate techniques for implementation, needs to be determined.

Short telecommunication links are being used over distances of a few tens of meters to a few kilometers to carry voice, video, and data. Application on potential applications include intra-airport automation control and remote sensor monitoring, video distribution in closed circuit television systems, and local distribution for CATV, computer-to-computer and computer-to-remote terminal, interconnection across freeways or between buildings when regulations or economics prohibit installation of cable or conventional microwave links. The full extent of this demand and its impact on the telecommunications industry is not yet known. However, some projections show a $50 million dollar market in link alone by 1975.

Nove[illegible]er 1, 1971

Estimated Resource Allocations

			Time
Satellite Communications - Hatfield		100%	August-November
		40%	November-March
	ITS $10K		August-March
Mobile Communications - Hatfield		60%	November-March
		40%	March-June
	ITS $30K		
	Ax	100%	November-June
Spectrum Policy - Berry		60%	October-June
Ewing		100%	August-November
		80%	November-June
	ITS $40K		
	Chilton	80%	November-June
Warning System - Partch		50%	October-April
Berry		40%	November-April
	ITS $40K		
	Gray	40%	November-April
	Watts	40%	November-April
	Washburn	30%	November-April
Broadband Services - Partch		50%	
	ITS $50K		
	Wieder	50%	October-February
		80%	February-June
	Espleland	50%	November-June
Service Analysis - Salaman		60%	November-June
	ITS $40K		
	Gray	30%	November-April
		100%	April-June
	Wood	80%	November-June
Interconnection	ITS $40K		
	Gray	30%	November-April

PSD-72-1

POLICY SUPPORT DIVISION

ACTIVITIES

January 3, 1972

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POLICY SUPPORT DIVISION ACTIVITIES

I. Personnel on Board

a. Washington
b. Boulder

II. Program Status

a. Washington

b. Boulder

III. Contracts

IV. Outside Activities

V. Publications

POLICY SUPPORT DIVISION

FY '72 PROGRAM

The objective of the Policy Support Division is to assist the Office of Telecommunications Policy in the development and analysis of new communication initiatives and policies which will advance the social and economic objectives of this country. To this end, PSD works closely with the OTP in examining specific issues likely to require policy decisions. It shall maintain an awareness of current and impending technological advances, perceived needs for telecommunications services, ongoing Government telecommunications activities, social and economic problems facing the Nation, and current policies and objectives. Finally, it shall apply this awareness to the analysis of specific opportunities for communications to promote social and economic development.

It is expected that the program will be dynamic; that is, continually developing and improving based on opportunities uncovered and OTP requirements. Likewise, interaction within the group, with OTP and OT personnel will be dynamic. The Boulder Detachment of PSD (BPSD) will continue to maintain close inter-active communications with OTP through frequent conversations with program personnel, exchange of draft documentation, and frequent visits to Washington. A similar arrangement exists between ITS and BPSD personnel. In neither case is the association that of a contractor and contractee, but rather as problems are attached, there is a joint formulation of objectives, methodology, plans, and evaluation of results.

The purpose of this document is to maintain a current record of major PSD activities and its output.

I. Personnel On Board

POLICY SUPPORT DIVISION

Personnel on Duty 1/3/72

Washington, D. C.

Name	Title	Comments
Lowe, Robert	Admin.	
Polishuk, Paul	Gen. Phys. Sci.	
Gabel, Richard	Opns. Res. Analyst	
Powers, Robert	Gen. Phys. Sci.	
Cole, Jack	Comm. Spec.	
McCormick, Terance	Opns. Res. Analyst	Will report 1/10/72
Millie, H. R.	Infor. Analyst	Reim. detail, GSA
Crumlish, Joseph	Prog. Asst.	Reim. detail, NBS
Messerschmitt, John	Comm. Analyst	
Andrews, Anne	Admin. Asst.	Part-time, temp.
Asher, Warren	Prog. Analyst	
Hall, Arthur	Consultant	Occasional
Kovanic, Edward	Consultant	Reim. part-time detail
Thomas, Allen	Consultant	Occasional
Von Alven, William	Consultant	Occasional
Holton, Shirley	Research Asst.	
Colbert, Billie	Secretary (Steno)	
Duda, Loren	Secretary (Typing)	
Sink, Hillary	Secretary (Steno)	

POLICY SUPPORT DIVISION

Personnel on Duty 1/3/72

BOULDER

Name	Title	Comments
Salaman, Roger	Elec. Eng.	
Berry, Les	Mathematician	
Hatfield, Dale	Elec. Eng.	
Partch, Jerome	Elec. Eng.	
Ewing, D.	Mathematician	
Morenco, Patricia	Secretary (typing)	
Briels, Dorene	Secretary (steno)	
Black, Sharon	Student Asst.	Part-time, temp.
Avila, Nick	Work Study Student	Intermittent, indef.
McArthur, Clovis	Work Study Student	Intermittent, indef.
Ruderman, Eric	Work Study Student	Intermittent, indef.
McLean	Student Asst.	Intermittent, indef.

Personnel

WPSD Personnel - Full Time	Primary Contribution
Robert Lowe	. Management . Organizational Development . Long Range Tele-communications policy analysis
Paul Polishuk	. Survey of Federal Telecommunications Assistance to State and Local Governments . Management Information Systems and Data Base . Long Range Telecommunications Policy Analysis
Richard Gabel	. Interconnection
Robert Powers	. Broadband Cable Systems
Jack Cole	. International Policy
Joseph Crumlish	. Long Range Telecommunications Policy Analysis
John Messerschmitt	. Demand Study for Cable TV . Broadband Telecommunications Demand Study . Marketing Study for Emergency Warning System
Edward Kovanic	. 911 Emergency Number Cost Benefit Analysis

Personnel

BPSD Personnel - Full Time	Primary Contribution
Leslie A. Berry	Spectrum Policy Warning System
Donald R. Ewing	Spectrum Policy
Dale N. Hatfield	Satellite Communications Mobile Communications
Jerome E. Partch	Warning System Broadband Services
Roger K. Salaman	Service Analysis
Dorene Briels and Patricia Moreno	Secretaries

BPSD Personnel - Part Time	Primary Contribution
Nick Avila	Information Center
Sharon Black	International
Dick Fisher	Cable
Linda Kinney	Mobile Communications
Clovis McArthur	Cable
Bob McLean	Information Center
Carlos Rozo	Satellite Communications
Eric Ruderman	Cable

ITS Personnel	Primary Contribution
Hiroshi Akima	Spectrum Policy
Gene Ax	Mobile Communications
Charles Chilton	Spectrum Policy
Marshall Coon	Interconnection
George Enoch	Mobile Communications
Martin Gray	Interconnection
Dwight Irwin	Satellite Communications
Rita Reasoner	Cable
William Roberts	Information Center
Judy Stephenson	Information Center
Moody Thompson	Spectrum Policy

ITS Personnel (continued)	Primary Contribution
James Washburn	Cable
James Watts	Warning System
Bernard Wieder	Cable
Lockett Wood	Communication Services
Lewis Vogler	Communication Services

II.b. Boulder Activities

PROJECT: Satellite Communications

SPONSOR: OTP

PRINCIPAL INVESTIGATOR: D. Hatfield
ITS $10K

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

The goal of this program is to provide OTP with data base and analytical support in the area of satellite communications. Emphasis will be placed on improving and maintaining expertise and documentation that could be drawn upon by OTP and others on an "as required" basis. The current status and trends in satellite technology, costs, service demands, price elasticity, and the corresponding technology and costs of alternative terrestrial systems will be evaluated and updated on a continuing basis. Close liaison with OTP staff members and their contractors will be maintained. The depth of technical and economic detail would be consistent with the intended purpose of supporting policy decisions; e.g., the details of device operation, costs, and propagation mechanisms would be considered only to the extent that they have a significant impact on system cost and performance.

Specifically, existing satellite communication system costs and performance models will be acquired, evaluated, and modified, and new models would be developed as appropriate. A current bibliography of technical articles as well as copies of regulatory proceedings, news clippings, and other sources, will be maintained.

Close liaison with OTP will be established so that the program would encompass their requirements. The primary output will be data and reports in response to OTP requests such as (1) the technical feasibility of a proposed satellite system, (2) sharing possibilities to minimize the cost of several compatible systems, (3) estimate of demand for a new service, and (4) the impact of a proposed new system on existing systems.

An examination of the satellite proposals, upon OTP request, has provided information concerning the feasibility of accommodating the proposed services. A study of the impact of these services is continuing.

PROJECT: Mobile Communications

SPONSOR: OTP

NCIPAL INVESTIGATOR: D. Hatfield
ITS $30K
Ax

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

Such basic forces as economic growth, increased mobility, and greater demands in the area of law enforcement and public safety, have combined to produce unprecedented pressure for mobile communications services (land, sea, and air). Existing services are often hampered by severe radio spectrum congestion and new or expanded services are frequently limited by the same factor even though they are economically attractive and technically feasible. The spectrum constraint is particularly binding in the mobile services because alternate means of communications (i.e., wires or cables) are usually impossible, as in the case of aeronautical mobile.

The overall objective of this program element is to provide the Office of Telecommunications Policy with data and analyses to aid in formulating policy for mobile communication services. Three broad activities that have been established for FY-73 are:

(1) Identify and evaluate alternative technologies and operational approaches for providing mobile communication services;

(2) Identify and analyze opportunities for new and expanded applications of mobile communications systems in the 1975-90 timeframe;

(3) Examine the unique requirements and opportunities for improved mobile communications to support law enforcement and public safety.

Tasks for FY-72 are aimed primarily at data gathering and methodology development for the above activities. Specific tasks are:

1. Conduct a review of technical articles, manufacturers' literature, FCC documentation, reports of study groups, national and international frequency allocations, etc. and prepare a synopsis of the current status of mobile communications services. This will include a summary of those technical and operational alternatives that have recently been proposed.

2. Develop a methodology for estimating the costs and economic benefits of mobile communications systems. The techniques will be applied to several specific, representative systems. This study will supply the background for estimating the relative benefits of mobile services.

PROJECT: Spectrum Policy

SPONSOR: OTP

PRINCIPAL INVESTIGATOR: L. Berry, D. Ewing
ITS $40K
Chilton

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

The objective of this program is to develop more flexible and efficient spectrum usage policies with a sound appreciation of the probable technical and economic consequences.

The Electrospace Commodity

Any method of allocating the radio resource presupposes a basic understanding of the "thing" being allocated. The benefits and costs of an allocation system can be analyzed well only when the "commodity" has been adequately defined.

Economists have envisioned allocation of the radio resource (the electrospace) by a market mechanism. The mechanism could have a variety of forms including rental, auction, and selling. Those advocating such mechanisms contend that incentives which do not now exist could be provided for judicious use of the electrospace.

Whatever the allocation method, there is a need to define the commodity involved. Further, the desired incentives can become operational in many cases only if the commodity is defined in terms allowing trading.

Because of the close relationship between the definition of the commodity and rights to the commodity, definitions should be made with cognizant legal considerations.

Activities

1. Define the commodity under the present allocation system.
2. If the commodity depends on the allocation method, give alternative definitions of the commodity relative to various market methods. Discuss relative advantages and disadvantages.
3. Define what constitutes usage or consumption of the commodity.
4. Describe the units of the commodity.

Spectrum User Rights

An integral part of a spectrum allocation method is the definition of the rights of the user of the resource. In the process of investigating the merits of alternative allocation procedures, user rights must be defined. In particular, in any type of market method, the rights must be "marketable," that is, they must be exclusive and transferable.

While the final formulation of the rights is the work of a lawyer, his formulation must have technical basis. Since the electrospace has unique properties as a resource, it is to be expected that user rights shall also be unique in some respects.

The purpose of this task is to investigate the relation between user rights and spectrum characteristics. The extent that particular allocation methods enter the relation should be studied.

Activities

1. Delineate desirable properties of a "rights package" for spectrum users.
2. Give a brief exposition of a licensee's rights under the present allocation method.
3. Delineate one or more rights packages, and consider the probable methods of enforcement for an auction system of allocating the spectrum.

Anomalous Regions of the Spectrum

One need in analyzing alternative ways of allocating the radio resource is to have knowledge of "areas" of the electro-space where the present allocation is clearly inadequate. The results of this task can be used to decide on an area where alternative allocation methods could be simulated or an experiment could be conducted.

This project is to be informative or expository in nature. The purpose is to clarify our thinking regarding the desired qualities of an allocation method and to describe several areas where the radio resource is now now adequately allocated. Thus the regions to be analyzed are anomolous in that their allocation under present methods is definitely suboptimal.

Activities

1. Delineate the qualities of a good allocation method.
2. Give a brief exposition of the present allocation method. (Who allocates? What is allocated? What are the rights of a licensee? What are some political, technical, and economic constraints of the method?)
3. Enumerate several regions where present allocation methods are clearly suboptimal relative to part 1 above.

PROJECT: Broadband Services

SPONSOR: OTP

PRINCIPAL INVESTIGATOR: J. Partch
ITS $50K
Wieder
Espleland

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

The main objective of our present program in the area of broadband services is to gain the understanding necessary to model the broadband services industry. A computer model will be maintained by PSD for use as an analytical tool by OTP. The model will be modified and updated as new supporting data become available. We will also assist as required in the evaluation of data supplied to OTP by contractors and consultants, with a view toward incorporation into the model.

One of the areas of greatest impact on the model is the cost and capability of equipment for CATV and other broadband services. To aid in this area, ITS will conduct studies of both presently available and envisaged equipment. The study will typically be aimed at providing the range of costs for:

...upgrading present systems to 20 or more channels.

...providing new 20 or more channel systems.

...special 20 or more channel receivers.

...local origination (mobile and fixed).

...two way communication capability.

The question of special television receivers has taken on new importance with the recent announcement of a CATV receiver leasing arrangement in a trial system. The study should not be merely a price list from equipment manufacturers, but should include the past experience and future projections of actual system operators, and the imagination of the investigators to envision future services.

Although the main thrust of the present program is the maintenance of the computer model, the objective of gaining an understanding of the opportunities and problems of the industry will also be emphasized for its later value to OTP.

PROJECT: Warning System

SPONSOR: OTP

PRINCIPAL INVESTIGATOR: J. Partch, L. Berry,
J. Messerschmidtt
ITS$40K
Gray
Watts
Washburn

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

The Federal Government is pursuing a program to establish a rapid, reliable warning capability, to bring the cost of a warning receiver within the reach of every American household. This study is directed toward evaluation of options to meet this objective.

<u>Data Base for Population Coverage</u>

Before any meaningful discussion of penetration rates can be given, the location of the population must be known at various times of the day. The following types of information must be obtained:

Percent of population in homes vs. time of day

Percent of population in work areas vs. time of day

Percent of population in transit vs. time of day

It is also important to be able to break the total population into population density subsets to evaluate systems coverage. Much of this information is available from Census Bureau statistics. This information will be used to form a data base for the determination of penetration rates.

Receiver Costs

The penetration rate of any warning device is highly dependen on its cost. The cost of a variety of receiver types and configurations will be studied in detail. As a part of the study, possible additional services or uses for the warning device will be considered.

The costs associated with inclusion of addressing capabilitie will be carefully determined.

Penetration vs. Transducer Type

The penetration rate achieved by a variety of warning transducers (i.e., various receiver configurations, sirens, broadcast services, etc.) will be determined utilizing statistics on the buying habits of the public and the data base as discussed previously.

System Evaluation

The four systems DIDS, the existing NOAA VHF system, a system operating through the private broadcast industry, and a system using a communications satellite will be analyzed with particular emphasis on the following areas:

Penetration rates

Total system cost (capitalized costs)

Public vs. individual costs

Meaning of reliability figures

Frequency spectrum requirements and interference problems.

The stated requirements for the warning system will be carefully considered.

Penetration vs. Cost Curves

In order to present a clear picture of the options available for a warning system, curves of penetration rate vs. total system cost will be prepared utilizing the information obtained during the study. If other parameters, such as time response, prove to greatly affect system cost they will also be parametrically displayed.

The proposal presented to the Office of Telecommunications Policy by International Electric Corporation will also be evaluated.

PROJECT: Services Analysis

SPONSOR: OTP

PRINCIPAL INVESTIGATOR: R. Salzman
ITS $40K
Gray
Wood

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

This nation is in the process of expanding the opportunity for interactive communication among its people. A few examples illustrate this movement. Not only is the telephone system being expanded to meet the growing demand for telephone service, but with the Carterfone and subsequent decisions, innovative opportunities are being developed to use this vast moderate-capacity information switching system to meet the modern needs of business and society.

Pilot experiments are being planned by the Office of Telecommunication Policy, in conjunction with other agencies, to demonstrate the opportunities presented by broadband services, such as CATV. The Postal Service is planning rapid economical mail service. The objective of this effort is to assist in analyzing the communication services currently being offered, and to illuminate other service potentials based on current technology.

An example of potential new services lies in the demand for short-range, inexpensive telecommunications links that appears to be increasing dramatically. The extent of this demand and the technical and economic feasibility of alternate techniques for implementation, needs to be determined.

Short telecommunication links are being used over distances of a few tens of meters to a few kilometers to carry voice, video, and data. Application on potential applications include intra-airport automation control and remote sensor monitoring, video distribution in closed circuit television systems, and local distribution for CATV, computer-to-computer and computer-to-remote terminal, interconnection across freeways or between buildings when regulations or economics prohibit installation of cable or conventional microwave links. The full extent of this demand and its impact on the telecommunications industry is not yet known. However, some projections show a $50 million dollar market in link alone by 1975.

November 1, 1971

Estimated Resource Allocations

Project	Staff		Time
Satellite Communications	Hatfield	100%	August-November
		40%	November-March
	ITS $10K		August-March
Mobile Communications	Hatfield	60%	November-March
		40%	March-June
	ITS $30K		
	Ax	100%	November-June
Spectrum Policy	Berry	60%	October-June
	Ewing	100%	August-November
		80%	November-June
	ITS $40K		
	Chilton	80%	November-June
Warning System	Partch	50%	October-April
	Berry	40%	November-April
	Messerschmitt		
	ITS $40K		
	Gray	40%	November-April
	Watts	40%	November-April
	Washburn	30%	November-April
Broadband Services	Partch	50%	
	ITS $50K		
	Wieder	50%	October-February
		80%	February-June
	Espleland	50%	November-June
Service Analysis	Salaman	60%	November-June
	ITS $40K		
	Gray	30%	November-April
		100%	April-June
	Wood	80%	November-June
Interconnection	ITS $40K		
	Gray	30%	November-April

1K TS 11/1/71

II.a. Washington Activities

PROJECT: International Policy Development

SPONSOR: OTP, W. Hinchman

PRINCIPAL INVESTIGATOR: Jack Cole

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

This task is being directed toward developing an information base and performing analyses to provide an in-depth understanding of the international telecommunications field. Future analyses can be performed more competently and in a more timely manner if the factors contributing to the evolution of present day international telecommunications are fully understood, current information on past and present market factors is readily available and appreciated, and the data and techniques for projecting future demand are established.

Specifically, this task will include the following activities:

1. Survey the services, market factors, contributions and inter-relationships of the five major international carriers.

2. Derive estimated ranges of trunking requirements for the period 1972-1980 in the Atlantic and Pacific Ocean regions.

   a. Obtain the tariff history (since 1950) for message and private line telephone, message record, alternate voice data, data, and video services between the U. S. and selected foreign countries. This data will be summarized by international carrier.

   b. Obtain the traffic history (since 1950) for the above services by international carrier, ocean region, and major transmission facility.

PROJECT: Management Information System and Data Base

SPONSOR: ~~Policy Support~~ Division

PRINCIPAL INVESTIGATOR: Paul Polishuk

ESTIMATED COMPLETION DATE: Continuing

DESCRIPTION OF ACTIVITY:

This task involves the design and implementation of an internal management information system and data base required for management of Policy Support Division and OTP activities as well as providing required data base for analyses. Some of the data being contemplated includes files of persons having unique or useful skills in telecommunications, studies and analyses that have been done or are in process, models that have been developed and their status, and sources of basic data.

PROJECT: 911 Emergency Number Cost Benefit Analysis

SPONSOR: C. Joyce

PRINCIPAL INVESTIGATOR: E. Kovanic
U. S. Army
Ft. Monmouth
(On detail to Policy Support Division, approximately 0.4 man effort for 6 months)

ESTIMATED COMPLETION DATE: February 1972

DESCRIPTION OF ACTIVITY:

This project is a cost-benefit analysis of the incremental worth of an "enhanced" 911 system as opposed to a "basic" 911 system.

In very simple terms, the basic 911 system would consist of a national 911 emergency number which might be answered in designated emergency communication centers by an operator who would then connect the caller to the appropriate emergency dispatching service. Inherent in this system is the necessity for the caller to identify the emergency, and its location and his location to the answering operator (probably a public emergency employee of some kind) who will then transfer the call to the appropriate emergency dispatching service. The location of the emergency communications center will vary depending upon various local political jurisdictional situations.

The enhanced system is really not very clearly defined. There are a number of features which could be added to the basic system (all at a price, of course). Among them are: automatic location identification, selective routing to the proper political jurisdiction and/or emergency dispatching center, forced disconnect, joint control of the line connection, etc. Each of the added features makes the 911 system more effective. The question is: How much more effective and at what cost?

PROJECT: Long Range Telecommunications Policy Analysis

SPONSOR: Policy Support Division

PRINCIPAL INVESTIGATOR: Joe Crumlish, Paul Polishuk

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

This task involves the collection of data on postulated telecommunications policy issues of interest to OTP that have been expounded by government and industry in speeches, reports, studies, analyses, etc., with the aim of defining critical skills required for Policy Support Division operation and is an aid in long range planning.

Specific areas where data will be collected, computed, and analyzed include:

a. National Goals in Telecommunications
b. Major Issues in Telecommunications
c. Description of the Telecommunications Universe
d. Morphological Analysis in the following areas of Telecommunications:

    State and local
    International
    Domestic
    Government
    Mobile
    Technology

Contacts are being made with industry, OTP, and others in this data collection process.

PROJECT: Demand Study for Cable TV

SPONSOR: Policy Support Division

PRINCIPAL INVESTIGATOR: John Messerschmitt

ESTIMATED COMPLETION DATE: Continuing

DESCRIPTION OF ACTIVITY:

Since this study concerns itself with an aspect of telecommunications which already exists, and seeks to forecast the form of its next generation, this study will concern itself with a service not yet in even an experimental stage.

One of the many proposed uses of a two-way capability, is that of shopping at home by cable. In that it seems to have received a great deal of play in many articles as a technological possibility this study will seek to determine if it is a marketable one. Additionally, it will attempt to determine what affect can be expected on the current market structure, and the trade-offs between that structure as we know it today and as it may become if the cable shopping system is introduced.

PROJECT: Broadband Telecommunications Demand Study

SPONSOR: Policy Support Division

PRINCIPAL INVESTIGATOR: John Messerschmitt

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

According to Sherrif, each individual consumer has three ranges in which he views a product:

Acceptance Non-Commitment Rejection

Studies have shown that the degree to which each of these plays a part in his selection depends in great part on the variety of choices available to him. The relationship works this way:

When choices are limited, the consumer has a very narrow range of rejection, while his ranges of acceptance and non-commitment are comparatively wide. For example, when electric refrigerators were first introduced, once a consumer decided to make his purchase he did so with little thought as to the item's size, shape or color. These considerations played a minor if any part at all the buying decision in that the product was new to him and possibilities other than those available were not part of his perception.

As more and different kinds of refrigerators were produced, his willingness to accept any refrigerator as long as it was a refrigerator deminished, and he began to reject all but those that fit his needs.

This works well when applied to the history of radio programming since the advent of television. Pre-TV radio programmed in much the same way as television is today, directing the total program package toward the widest section of audience. In order to survive, however, radio had to change. Today, radio selects a format directing it to a specific sub-market, and remains with them twenty-four hours per day.

As station after station sub-divided the listeners, it became apparent that there were enough such groups to sustain a large number of different formats and today some forty formats exist..

These radio consumers have now assumed a very narrow range of acceptance, and will listen to a station only if it has directed itself to the consumer's specific interests.

PROJECT: Broadband Cable Systems

SPONSOR: Department of Commerce

PRINCIPAL INVESTIGATOR: R. S. Powers

ESTIMATED COMPLETION DATE:

DESCRIPTION OF ACTIVITY:

"Working Group" representative and staff support for the Secretary of Commerce in his duties for the President's Committee on Cable Television.

Monitoring a contract with the Institute for the Future which will produce a preliminary framework for formulation of telecommunications policy, with particular reference to broadband cable systems.

Chairman, Frequency Allocation Subcommittee, IEEE (See IEEE "Spectrum", November 1971, article on cable television systems).

PROJECT: Marketing Study for Emergency Warning System

SPONSOR: OTP C. Joyce

PRINCIPAL INVESTIGATOR: J. Partch, Boulder

Market Study : John Messerschmitt

DESCRIPTION OF ACTIVITY:

On Page 3, Summary and Conclusions of the 1965 Rand Study of Methods of Distributing Radio Alert and Warning Receivers is the statement that: "Over 90% of all households would have one or more alert and warning receivers within 10 years if all AC-operated home radios, television sets and radio-phonographs included such receiver capability." Rand believed, however, that Congressional action would be necessary for this to be accomplished.

A marketing approach to this would attempt to discover methods of transforming the alert system into a marketable product which the public would purchase freely and without the need for Congressional action.

The approaches will be:

1) Determine applications of the system which are other than warning; (i.e., time, weather). In this way, the warning aspect would be marketed as a secondary function;

2) Determine add-on cost of such a system to existing consumer electronic products;

3) Market test the new product to determine consumer acceptance; and

4) Present the findings to industry to determine their willingness to incorporate the "warning-plus" module into their products.

This approach has been selected mainly for the reason that all evidence points to the impossibility of selling the warning functions solely.

PROJECT: Interconnection

SPONSOR: Policy Support Division

PRINCIPAL INVESTIGATOR: Richard Gabel ITS $40K
Gray

ESTIMATED COMPLETION DATE: July 1, 1972

DESCRIPTION OF ACTIVITY:

This project is an outgrowth of the 1968 decision of the FCC in the Carterfone case. How can the government most effectively implement the objective of the Commission so as to enable entry of terminal equipment and system suppliers to the general message exchange network consistent with the integrity of the network. Questions of equipment standards, the installation and maintenance of communication devices enter into the scope of the issue. Many alternative possibilities for securing the foregoing results are available. The crux of the study is development of a series of cost/benefit analyses to permit determination of the most advantageous manner in which Carterfone objectives can be implemented.

PROJECT: Survey of Federal Telecommunications Assistance to State and Local Governments

SPONSOR: OTP, A. R. Cooke

PRINCIPAL INVESTIGATOR: C. Lathey, Office of Telecommunications
P. Polishuk, Policy Support Division

ESTIMATED COMPLETION DATE: June 1972

DESCRIPTION OF ACTIVITY:

Develop and provide to the Director, OTP, information so that the Director can determine the extent to which he should coordinate Federal telecommunications assistance to State and local governments. At the present time approximately 29 major Federal agencies are administering or 996 programs of assistance. This program will attempt to identify and analyze those parts of the programs involving telecommunications.

III. Contracts

CONTRACTS

SUBJECT	PROJECT LEADER	AMOUNT	WITH WHOM
Survey of "Federal Telecommunications Assistance to State and Local Governments"	C. Lathey	$51,000	Office of Telecommunications, Department of Commerce
Design and Estimate Receiver Costs for National Emergency Warning System	J. Partch	15,000	ARF Products, Inc., Boulder, Colorado

IV. Outside Activities

OUTSIDE ACTIVITIES

Paul Polishuk

Member, Administrative Committee (ADCOM), Nuclear Science Group, IEEE

Member, Editorial Advisory Board, IEEE Spectrum

Joseph Crumlish

Member of the Ad Hoc Interagency Committee on Futures Work, which meets monthly at the National Science Foundation.

Robert Powers

Chairman, Frequency Allocation Subcommittee, IEEE (See IEEE "Spectrum", November 1971, article on cable television systems).

Richard Gabel

Member, FCC Advisory Committee on PBX Standards.

V. Publications

PUBLICATIONS

BERRY, L. "Preliminary Cost Benefit Analysis of Home Warning Systems for National Disasters" internal note, December 1971.

HATFIELD, D. "Domestic Satellite Orbit/Spectrum Utilization" internal working paper, December 13, 1971.

POLISHUK, P. "Notes on Models and Their Use in R&D Management and Planning" internal note December 1971.

GABEL, R. "Telecommunications Interconnection--Wherefrom and Whitherto" paper prepared for International Symposium on Communication, Annenberg School of Communications, University of Pennsylvania, Philadelphia, Pa., March 23-25, 1971.

COLE, J. and Lathey, C. "Telecommunications in the State of Hawaii" internal Department of Commerce study for Senator Inouye of the State of Hawaii, December 1971.

CRUMLISH, J., MESSERSCHMITT, J. "Selected Data on the Movie Industry" internal PSD note, November 1971.

CRUMLISH, J. "Background Data on Communications Policy Research Centers", internal PSD note, January 1972.

AFFELDER, D. "Local Orginations on Cable Television" internal PSD note, January 1972.

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

March 1, 1972

To: The File

From: Michael McCrudden

Subject: Meeting with PSD Management Personnel, February 29, 1972

The following agenda items were discussed:

1. Allocation of funds remaining to be expended with ITS personnel. (NOTE: The original agreements establishing the PSD division indicated that $250,000 of the $800,000 of PSD R&D funds would be expended with ITS personnel.) Through mid-February 1972, approximately $44,000 of the $250,000 had been expended. Therefore, the following breakdown indicates how the remaining $206,000 is to be expended for ITS personnel in support of the work being supervised by PSD Boulder personnel for PSD Washington.

Project 1: Satellite -- $7,000.
Project 2: Mobile -- $50,000.
Project 3: Spectrum -- $58,000.
Project 5: Broadband -- $15,000
Project 6: Services -- $20,000.
Project 7: Interconnection -- 0.
Project 8: Information Base -- $56,000.
Project 9: International -- 0.
Project 10: Carriers -- 0.

2. Allocation of surplus funds available from PSD. (NOTE: The agreements which established PSD indicated that to the extent surplus funds were available from the $1.1 million budgeted for salaries and expenses, those surplus funds would be available to be used for the reimbursable detail of ITS personnel to PSD, or alternatively, could be used for additional contract studies to be conducted by ITS personnel under the supervision of PSD Boulder personnel.) As of March 2, 1972, and based on a compilation entitled, "Third Monthly Projection of FY-72 PSD Obligations. FZ: 2/22/72," (Attachment 1) $181,000 is expected to exist as a surplus from PSD funds through the end of FY-72. The following decisions have been made concerning the reallocation of that $181,000, and are as follows:

a. $75,000 will be available to Mr. Dean to support his "Survey of Government Spectrum Management Project" which was originally to be supported [illegible] of the $206,000 which remains available (see paragraph 1 above).

b. $40,000 will be used to increase the level of program funds support for the Mobil Communication Study Program.

c. The remaining $66,000 has not yet been allocated to a particular project and further consideration will be given by the respective OTP and PSD senior management personnel as to how best to allocate those funds.

3. During our visit to Boulder (the week of February 14) it was discovered that a $15,000 contract in the warning area had already been let, with the approval of Mr. Joyce. Since our previous deliberations as to the allocation of PSD contract funds did not reflect the awarding of this contract, the contingency fund of $55,000, which previously existed has been reduced to reflect the awarding and the obligation of the $15,000 (a revised schedule of OTP/PSD proposed contracts is attached as Attachment 2). 40K

4. General discussions were held concerning the utilization of contingency funds remaining from the PSD R&D funds for use in the data base and information systems project area. It was agreed that prior to these funds being expended, Mr. Joyce and Mr. Polishuk will discuss in detail the exact manner in which they were to be used and would decide the extent to which they would be utilized at ITS.

5. A discussion was held as to the need to maintain an updated awareness of the status of personnel hiring against the skills matrix which has been agreed upon. Paul Polishuk will undertake to keep OTP staff informed of the positions against which newly hired personnel are being charged.

6. Agreement was reached in principle to transfer Bob Powers from PSD to the Telecommunications Analysis project staff. Appropriate transfer of funds will be conducted to support Mr. Powers with that activity for the remainder of this fiscal year. Further discussions between Bob Lowe and Walter Hinchman will be held to determine the exact nature of the work which Mr. Powers will perform during this time.

7. General dicussion was held about the graduate school recruiting which PSD will be conducting during the next several months. It was agreed, by Mr. Joyce and Mr. Hinchman, that the internal staffing requirements do not assume any recruiting of graduate school personnel this spring. Therefore, the OTP and programs in this area will be minimal. It was confirmed that OTP personnel will not be involved in the interviewing of PSD candidates for positions at levels GS-11 and below.

Attachments

[illegible] Monthly Projection of FY 72 PSD Obligations

	Policy Spt. Div. ($000)	Allocated by PSD to ITS ($000)	Total ($000)
Available for FY 72			
Initial availability	$1,650	$250	$1,900
LESS: Amt. transferred to reserve	-24	...	-24
LESS: Amt. transferred to PBS (GSA)	-33	...	-33
	1,593	250	1,843
1. Actual obligations thru 2/5/72	359	55	414
2. Firm anticipated additional FY 72 obligations:			
a. PSD (157 pd. days in FY 72 thru 2/5/72 less 32 days prior to 8/15/71 = 125; $2,072 per day x 105 remaining)	+218	...	+218
b. ITS (60 days in FY 72, 11/15/71 thru 2/5/72 = 920 per pd. day x 105 rmng)	...	+97	+97
c. Pending personnel actions (not reflected in obligations thru 2/5/72)			
Arnaud, GS-9 (10,000)			
Kahn, GS-14 (17,000)			
McElhorne, GS-13 (15,000)			
Snyder, GS-11 (12,000)			
Anderson, GS-12 (13,000)			
Others listed as at 1/8/72 (125,000)	+143	...	+143
d. ARF Products contract (cost/performance tradeoff, home warning receivers)	+15*	...	+15
e. Contract (contractor incl.) on land mobile economic benefits	+50*	...	+50
f. Reimbursable details	+30	...	+30
g. Adjustment in average daily rate as safety factor (5%)	+11	...	+11
h. State and local government project	+51	...	+51
Subtotal, firm projects	877	152	1,029
3. Soft projections:			
i. ITS additional obligations	...	+98	+98
j. Projected contracts	+450*	...	+450
k. Additional hires possible	+85	...	+85
Subtotal, incl. soft projections	1,412	250	1,662
4. Anticipated overage	181	...	181

* Latest material informally received from OTP thru PSD sets contract level at $515,0[illegible]

OTP/PSD PROPOSED CONTRACTS
FY-72
(Revision as of 3-1-72)

Contract	Tentatively Selected For OTP	Amount Requested	Tentatively Selected For Funding By PSD	Amount Requested
1. Communications for the EXOP	X	$100,000		
2. Navigation Program Review	Delete	(50,000)		
3. Improved Planning Process			X	$ 75,000
4. System Evaluation & Testing			X	100,000
5. Emergency Broadcast System	X	40,000		
6. Computers & Communications	X	100,000		
7. Land Mobile Radio	X	85,000		
8. Applications Check Program	X	50,000	(HRB Singer extension of contract)	
9. Program for Equipment Characteristice File	(To be transferred to OT for extension of Freeman SACHS contract I-35527)		X	70,000
10. Survey of Government Spectrum Management	(To be performed by redirecting $50-$75,000 of the $250,000 ear-marked for PSD work at ITS. Dean to direct.			
11. Survey of Spectrum Government Data Bases			Delete	(100,000)
12. Policy Issues & Spectrum Engineering			Delete	(60,000)
13. Spectrum Technology Assessment			Delete	(120,000)

Contract	Tentatively Selected For OTP	Amount Requested	Tentatively Selected For Funding By PSD	Amount Requested
14. CATV Demand Study			X	$ 75,000
15. Interconnection	X	$75,000		
16. Common Carrier Communications }				
17. Common Carrier Depreciation Practices }	X	200,000		
18. Common Carrier Accounting Procedures }				
19. CATV Policy Information Handbook	Delete	(50,000)		
20. T.V. Standards Review			X	50,000
21. Costs of Regulation	Delete	(50,000)		
22. Spectrum Bank (IRAC)			X	75,000
23. Broadband Pilot Program Planning	X	200,000		
24. [illegible] Area			X	15,000
Subtotal		$850,000		$460,000
Total obligations OPT,PSD			$1,310,000	
Balance unobligated		150,000		30,000
Total R&D funds available 1-15-72, OTP, PSD			$1,500,000	

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

March 6, 1972

To: John Richardson
Robert Lowe

From: Walter R. Hinchman WRH

Subject: PSD/Boulder Program and Related ITS Support

Pursuant to the discussion at the February 29 OTP/PSD coordination meeting, the following guidance is provided with respect to the PSD/Boulder program and related ITS support for the balance of FY 72.

1. Program Plans

The program plans presented to Mr. Whitehead and myself by PSD/Boulder staff on February 18, 1972 are accepted as the basis for PSD/Boulder support to this Office for the balance of FY 72, subject to the modifications and interpretations contained in Attachment 1.

2. Allocation and Use of ITS Policy Support Funds

Subject to such minor reprogramming as may be subsequently found necessary by the responsible OTP and PSD/Boulder program managers, the allocation of remaining ITS policy support funds should be approximately as described in Attachment 2. The use of these funds should be in accordance with the February 18 program plan as modified and interpreted in Attachment 1, under the continuing guidance and direction of the responsible PSD/Boulder program manager.

3. Program Management

To ensure the timely and effective conduct of both PSD/Boulder and ITS policy support activities, PSD/Boulder program managers should be assigned as outlined in Attachment 3, which reflects current assignments modified as necessary in light of the February 18 program plan. These program managers should be given sufficient authority over both PSD and ITS staff assigned to their programs to ensure a coordinated and integrated approach.

- 2 -

I trust this information will enable you to make the necessary ITS funding obligations and personnel assignments discussed at the February 29 meeting without delay. If you require further clarification of the program plans or priorities, please let me know.

Walter Hinchman

Walter R. Hinchman

Attachments

Modification and Interpretation of PSD/Boulder Program Plans (FY 72)

The following comments are based on the PSD/Boulder program plans as discussed with Mr. Hinchman on February 17 and presented orally to Mr. Whitehead on February 18, 1972. These generally followed the descriptions contained in report PSD-72-1 on Policy Support Division Activities dated January 3, 1972, with some additions.

Satellite: Present program plan is accepted, but should be expanded somewhat to include supporting analyses and related activities for forthcoming OTP planning conferences on Pacific area domestic communications.

Mobile: PSD/Boulder program plan, as modified by subsequent discussions with Jack Thornell on February 24, 1972.

Spectrum: Basic program plan (i.e., general dimensioning and definition of spectrum rights, metropolitan case study, and satellite spectrum orbit case study) is accepted as described. Subsidiary studies on spectrum/orbit costing and satellite spectrum rights are conditionally accepted subject to development of more definitive work statements and continuing PSD/Boulder direction.

Warning: Program as outlined by C. Joyce is accepted.

Broadband: Basic program plan is accepted, with the understanding that the principal effort will be devoted to further development of a computer-based simulation model of broadband systems and services and the relevant input data for this model, and that technology and cost surveys will be closely coordinated with OTP staff to avoid unnecessary duplication or misorientation.

Services: Recommend that the program be re-titled Technology/Systems Assessment, and the focus shifted accordingly to the local distribution systems survey discussed with Lockett Wood and the television technology review discussed with Berry and Hatfield. The "services" aspect of the study should be limited to identifying and defining functional categories of services (e.g., one-way distribution, interactive distribution, exchange etc.) as a basis for developing and costing alternative systems using combinations of present and projected technologies.

Attachment 1

Interconnection: Program has been terminated.

Information Base: Program as defined by Charles Joyce is accepted.

International: Program to remain at minimal level, i.e., part-time studies by Sharon Black in response to specific OTP requests.

Common/Specialized Carriers: Program yet to be formally defined or assigned, interim development of program/project proposals to be coordinated with Dale Hatfield and Sharon Black.

In all cases, our continuing dialogue with PSD/Boulder staff may lead to some redefinition or redirection of program activities. Wherever ITS personnel are involved, we will rely on the responsible PSD/Boulder staff member to define the appropriate work program and to provide the required monitoring and substantive interaction with ITS staff members actively involved.

Attachment 2

Allocation of ITS Policy Support Funds (FY 72)

Program	Expended to date	FY 72 Additional Allocation	FY 72 Total
Satellite	7 K	7 K	14 K
Mobile	1	50 1/	51
Spectrum	7	58	65
Warning	1	--	1
Broadband	6	15	21
Technology/Systems Assessment (Services)	6	20	26
Interconnection	13	--	13
Information Base	3	56	59
International	-	--	--
Common and Specialized Carriers	-	--	--
	44k	Total FY 72	250

1/ Plus $43K from Washington PSD funds per ~~Mansur~~ Thornell memorandum of February 23, 1972.

Attachment 3

PSD/Boulder Program Management

The timely and effective conduct of PSD/Boulder programs for the balance of FY 72 is highly dependent on the assignment and availability of PSD/Boulder staff during this period. Based on the extensive interaction which has developed between OTP and PSD/Boulder staff, plus a comparison of relative OTP priorities for PSD support, the following assignments and approximate time allocations are recommended:

Salaman	Information Base (PM)	75%
	Mobile (PM?)	25%
Berry	Spectrum (PM)	50%
	Warning	40%
	Technology/Systems Assessment(PM)	10%
Hatfield	Satellite (PM)	40%
	Common/Specialized Carriers (PM)	20%
	Technology/Systems Assessment	20%
	Mobile (PM?)	20%
Partch	Warning (PM)	50%
	Broadband (PM)	50%
Ewing	Spectrum	80%
	Information Base	20%

Note: (PM) indicates Program Manager. Both Hatfield and Salaman are identified as possible managers for the mobile program; however, there is some doubt that either will be able to devote sufficient time to this and still meet other demands on their time. It is recommended that PSD actively recruit for an experienced mobile communications engineer to fill this function.

SC

Satellite Communications

August 27, 1971	Meeting with Hinchman, Lasher, Hatfield, Ewing on DOMSAT analysis requirements.
September 9	Hatfield submitted preliminary report on domestic satellite orbit utilization. (SC1)
October 6	Hatfield submitted preliminary calculations of satellite interference. (SC2)
October 15	Draft report of detailed interference calculations submitted to Lasher. (SC3)
October 26	Supplementary calculations concerning interference, and copy of interference computer program submitted. (SC4)
October 28	Brief statement of conclusions of interference report and supplementary material submitted. (SC5)
	Whitehead Statement on DOMSAT issued reflecting in part Hatfield analysis. (SC6)
November 11	Participated in review of SRI study effort.
December 3	Further conclusions concerning DOMSAT opportunities submitted. (SC7)
December 15-17	Participated in review of Ross TEC and SRI DOMSAT study effort.
	Submitted draft of final report on "Domestic Satellite Orbit/Spectrum Utilization." (SC8)
	Attended meeting with NASA (Sam Fordyce) and contractors regarding orbit/spectrum utilization.
December 29	Work to provide satellite communication cost information initiated with ITS. (SC9)
January 17, 1972	Development started on launch cost computer program. (SC10)
January 19	Comments on Ross TEC Report Submitted to Lasher. (SC11)
January 26	Meeting with Lasher, Nelson, and Hatfield to discuss Ross TEC report. (SC12)
February 1	Report on computer subroutine to calculate interference in FDM/FM systems. (SC13)

February 10	Submitted report "a General Analysis of Domestic Satellite Orbit/Spectrum Utilization" to Hinchman. (SC14)
March 20	Statement from OTP releasing above report to NTIS, and subsequent Press Release. (SC15)
April 3	Request from Lasher for additional work on DOMSAT issue. (SC16)

DRAFT

September 9, 1971

DOMESTIC SATELLITE ORBIT UTILIZATION

Preliminary Conclusion

On a technical basis, it appears that all of the currently proposed domestic satellites can be successfully accommodated in the geostationary orbit.

Assumption

Service to Alaska will be provided by the satellite(s) of a single applicant because of economic considerations.

Basis

This conclusion is based upon the following reasoning:

1. There is approximately 70° of useful orbital arc for coverage of the contiguous U.S. (CONUS) for earth station elevation angles greater than 10°.
2. There are applications for 24 orbital slots, but 4 of these are designated for ground spares. Considering number 1, an orbit spacing slightly greater than 3° is indicated - including Canada's intention to put up 2/3 satellites.
3. In view of: (a) the relative homogenuity of the proposed satellites, (b) earth station antenna characteristics, and (c) rudimentary signal/interference requirements; such a separation appears feasible and is supported in part by the proposals themselves (see paragraph 4).

4. The WTCI and Hughes' applications actually request 3° spacing for their systems. Of these two, the Hughes' analysis is more detailed. It concludes that 3° spacing is adequate for its own satellites, and their satellites could be located "within 3 to 5° of other satellite systems using the same frequency bands (depending upon the other satellite system design). TCI references the North American-Rockwell Coordination Analyses and states that: "Several additional satellites are permitted by 3° spacing and system calculations indicate this to be feasible." The RCA application proposed 4° spacing of its satellites. The COMSAT and ATT/COMSAT applications propose alternating their satellites at 5° spacing (in accordance with the FCC guidelines). COMSAT has a detailed analysis and a summary table which shows required satellite spacing as a function of the type of signal and for typical earth station equipment. The spacings range from 1.3° to 4.3°, but the 4.3° is footnoted with the comment that "it reduces to 3.0° by cross polarization with respect to the interfering satellite ... (and) that $\pm$ 2.5° orbital spacing between satellites would be theoretically possible." The ATT/COMSAT proposal contains a detailed analysis for 4.5° which shows protection margins consistent with the analysis given by COMSAT. The MCI proposal also uses 5° spacing, but their analysis is not detailed. WU uses 7° minimum spacing, but notes that 2.5° spacing would be possible with cross polarization.

5. Any concern that this 3° spacing would not be adequate is partially alleviated by the following:

(a) Economic factors may limit the actual number of satellites placed in orbit.

(b) It will probably prove most economical for successful applicants to share orbiting spares, and/or to enter into agreements calling for other applicants to handle the service of an applicant experiencing a major failure -- thereby decreasing the number of secondary/spare satellites in orbit.

(c) Ground spares could occupy the same slot as the satellite it is replacing.

(d) There are tradeoffs available which would permit a decrease in capacity in exchange for decreased orbital spacing.

(e) There is some flexibility in moving the satellites in orbit to reduce interference on a case-by-case basis.

(f) Only 11 of the satellites are designated as "primary," and these can be given added protection.

(g) More extensive use could be made of spot beams to high traffic density locations or regions of interest to a specific applicant - thereby permitting additional spectrum sharing.

(h) The possibilities of using other bands have not been fully exploited.

(i) The Canadian satellites are intended to cover a different geographic area, and this should diminish the sharing problem with them.

(j) There may be certain operational procedures and detailed engineering design improvements that could be pursued, if there are any residual interference problems.

6. A preliminary plan demonstrating the feasibiliy of accommodating currently proposed satellites is attached.

A PRELIMINARY PLAN FOR DEMONSTRATING THAT ALL CURRENTLY PROPOSED SATELLITES CAN BE ACCOMMODATED IN THE GEOSTATIONARY ORBIT

1. For this exercise, the proposals will be grouped as follows:

   (a) Dual — COMSAT, AT&T-COMSAT, MCI

   (b) Single — RCA, HUGHES, WTCI, WU

   (c) Dual-Mixed — FAIRCHILD

   Dual indicates that these offerors propose both horizontal and vertical polarization as well as offset channels in their 4GHz down-link. Single indicates that that group employs a single polarization and no offset channels in their down-link. Dual-Mixed indicates that the offeror uses a mixture of polarizations depending on channel and the geographic coverage of the spot beams. (See attached summary of frequency plans.)

2. It is assumed that only the 20 in orbit satellite slots will be assigned (i.e., none for ground spares).

3. The companies in group (a) propose 5^{o} spacing, but analysis indicates that 4.5^{o} would still give satisfactory performance. This group involves 8 satellites which would require 31.5^{o} degrees of orbital arc at 4.5^{o} spacing.

4. By alternating the polarizations and offsetting the channels of the satellites in group (b), 2.5^{o} separation appears satisfactory. Since this group involves 10 satellites, 22.5^{o} of orbital arc would be required.

5. The Fairchild proposal is unique and initially a full 5^{o} separation is assumed necessary.

6. These 3 groups, in turn, must be separated. This requires an additional 10^{o}.

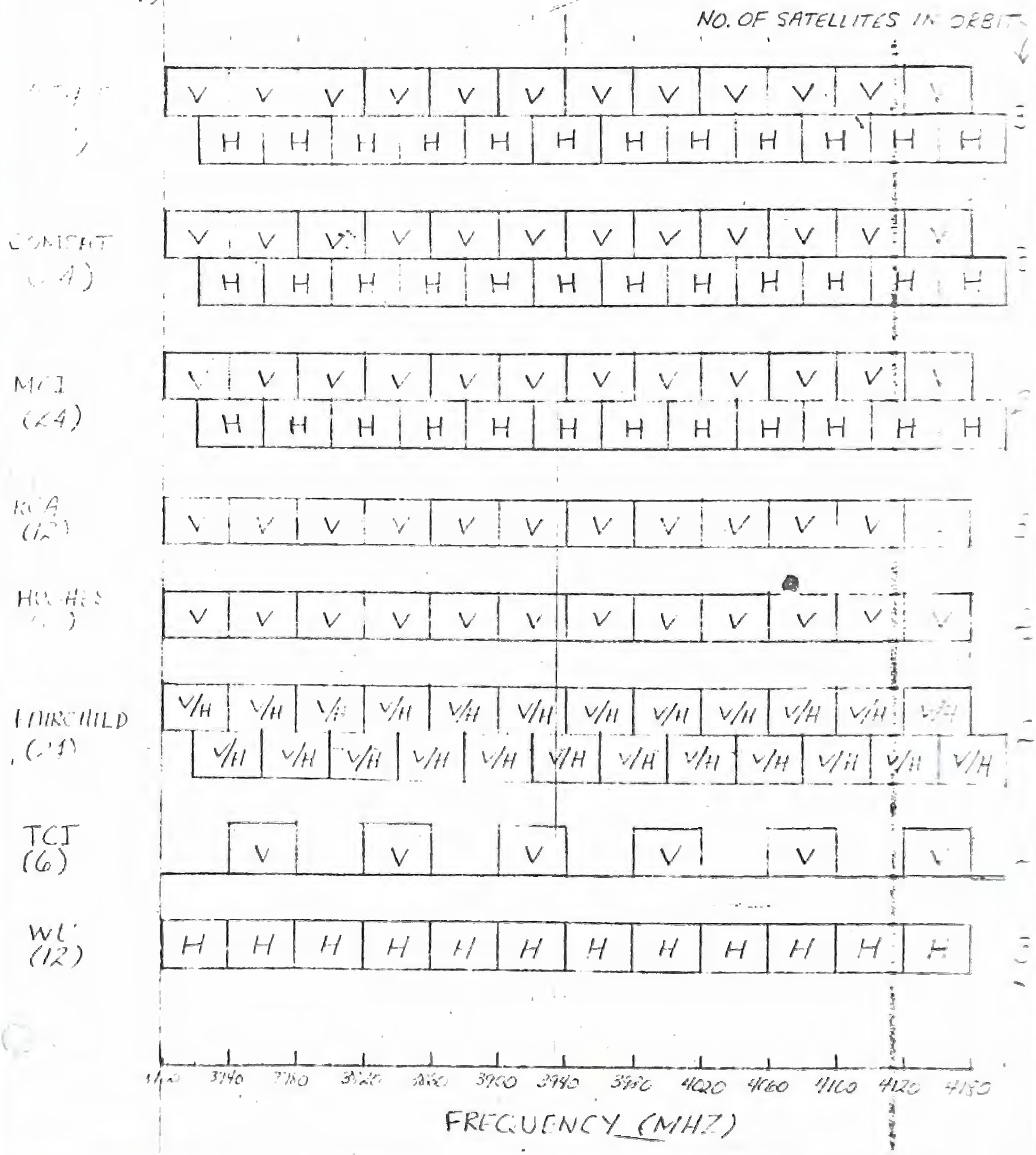
7. Adding the above requirements gives a total of 69^{o} which is consistent with that available.

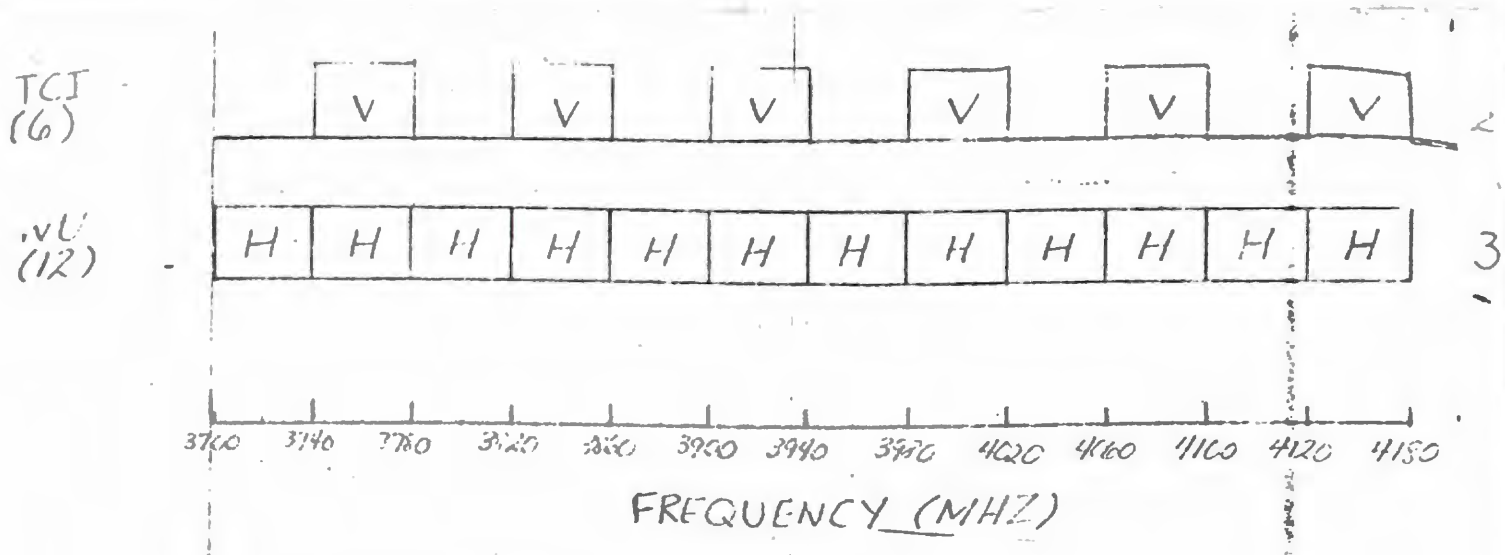
NOTES: The changes to proposals appear minimal, although the spacing requirements for those systems using a single dish (with dual feed) to cover two adjacent satellites must be re-evaluated.

The Canadian satellite requirements are not considered.

Stationkeeping accuracy of $\pm 0.1^{\circ}$ is assumed.

4 GHz (DOWNLINK) FREQUENCY PLANS





V = Polarization Parallel to Spin Axis
H = Polarization Perpendicular to Spin Axis

DNH 9-8-71

SC2

October 6, 1971

D. N. Hatfield/OT

Domestic Satellite Orbit Assignments

Lt. Col. Lasher, OTP

Over the past two weeks I have reviewed the interference calculations of the applicants, and I have completed some preliminary 4/6 GHz calculations for a specific orbital configuration. The configuration is similar to the one I distributed with previous material, and the calculations are for nominal 1200-voice circuit per channel FDM/FM systems. Worst-case assumptions were made, e.g., the smallest T/R antennas were used. I am in the process of completing a detailed report on these calculations but, in the meantime, will present the general results here.

The interference in pWpO for this particular configuration is shown in the following table:

Interference (pWpO)

Satellite	Downlink	Uplink	Total
TCI	170	220	390
RCA	680	1,170	1,850
H	610	490	1,100
WU	1,650	550	2,200
F	510	10,600	11,110
ATT	370	80	450
CS	4,230	2,740	6,970
MCI	4,190	870	5,060

The downlink interference includes the undesired signals from all other satellites and the Canadian satellites as well. The uplink interference includes the undesired signals from all earth stations. Note how these compare with the CCIR recommendation of 1,000 pWpO total. The downlink performance appears adequate in all but the three cases (Western Union, COMSAT, and MCI) where the applicants propose 32/45-ft antennas. Generally speaking, past analyses have assumed that if the downlink performance is acceptable, then the uplink performance will also be acceptable, due to the greater antenna directivity at 6 GHz. This is true, however, only if the Earth Stations have similar characteristics. In this case they are not. For example, AT&T proposes an uplink EIRP of 93 dBW, and Fairchild proposes 73 dBW. This accounts for part of the wide variations in uplink interference power. Another factor is that these calculations are based on the assumption that Canada will be transmitting with antennas as small as 26 ft. This increases the uplink interference to our satellites.

If all applicants went to 98-ft antennas for this FDM/FM multi-channel telephony service (as many do for their major terminals), then the downlink performance would be satisfactory for all as shown in the table:

Interference (pWpO)

98-ft antennas and adjusted Earth Station EIRP

Satellite	Downlink	Uplink	Total
TCI	70	90	160
RCA	270	130	400
H	610	590	1200
WU	330	170	500
F	510	720	1230
ATT	370	270	640
CS	530	230	760
MCI	520	210	730

The uplink interference is also satisfactory if the Earth Station EIRPS are made uniform (e.g., 83 dBW). The total interference for Hughes and Fairchild exceed the CCIR recommendation slightly (less than 1 dB), but this is not considered serious. The uplink interference to the Hughes satellite is predominantly from the link to its other satellite spaced 5° away. The interference in the case of Fairchild is predominantly from the Canadian satellites. Since Fairchild uses spot beams and since this additional discrimination toward Canada was not included in the calculations, the interference should be less.

The limitations on Earth Station transmitter power implied above seem reasonable, especially since it may aid in reducing the interference to terrestrial systems.

We are currently preparing a computer program to calculate interference. It will enable us to evaluate different orbit configurations, other services (e.g., video), different antenna sizes, etc. in an efficient manner. The preliminary calculations contained herein were done manually. However, I believe they confirm our previous conclusion that there is adequate orbital arc/spectrum available to accommodate the presently proposed Domestic Satellites if certain additional constraints are placed on them. The details of these manual calculations will be presented in tabular form, along with supporting material in the report which is in preparation.

Dale N. Hatfield

bcc:
R. Salaman
D. Hatfield
subject
daily
OT

DNHatfield/cajurgens

SC 3 file Project Satellite Communications

SC3

October 15, 1971

PSD/DNH

DOMSAT Orbit/Spectrum Utilization Working Paper

Lt. Col. Lasher, OTP

Enclosed is a draft copy of the detailed report on the interference calculations that I mentioned in my memorandum of October 6. In the period since this report has been prepared, we have completed the writing and debugging of the computer program to do these calculations. We are currently running the program to verify my manual calculations contained in the report. We are also using the program to evaluate alternative orbit arrangements and the various tradeoffs. We will incorporate the results in a supplement to the current report.

I would appreciate any comments on the report. I have tentative plans to be in Washington the week of October 26-29.

Dale N. Hatfield
Policy Support Division

Enclosure

DOMESTIC SATELLITE ORBIT/SPECTRUM UTILIZATION

-Working Paper-

Draft - Dale N. Hatfield October 12, 1971

1.0 Background and Assumptions

In the previous analysis of the orbit utilization problem, it was concluded that there was adequate arc/spectrum to accomodate the present DOMSAT applications if only a single applicant was required to serve Alaska. This conclusion was based on a very general analysis of the interference situation. In this paper, specific orbit locations for the satellites of each applicant are proposed, and interference levels are computed for nominal 1200-voice circuit per channel FDM/FM systems. The calculations indicate that the applicants can all be accommodated if certain modifications to the proposals are required. The particular orbit arrangement given here assumes that RCA would serve Alaska and that no other applicant would be required to do so. This arrangement should not be construed as an optimal or recommended allocation. It is advanced solely to show the existence of a feasible solution and to indicate the nature of the required modifications.

Objections to any arrangement to accommodate all applicants probably will be of two types. First, those applicants who want the FCC to grant them an exclusive license may argue that there is too much technical risk in making the assignments at the spacings used in this analysis, even though the interference calculations indicate acceptable performance. To counter this argument, conservative assumptions must be made in the interference computations and the factors contained in the original general analysis must be recalled. The second objection may be from individual applicants who argue that their particular orbital allocation is less favorable than anothers', putting them at a competitive disadvantage. This could be a legitimate complaint, and further study will be needed to insure an equitable allocation.

In the analysis which follows, both the uplink and downlink interference will be computed. These two cases and supporting derivations are given in figures 1 and 2. A maximum total of 1000 pWpO of added noise (interference) is generally agreed to as the criterion for acceptable performance. This arbitrary choice is consistent with CCIR recommendations and the applications. Allowing more noise in the satellite link at the expense of noise in other portions of the system would permit closer spacing.

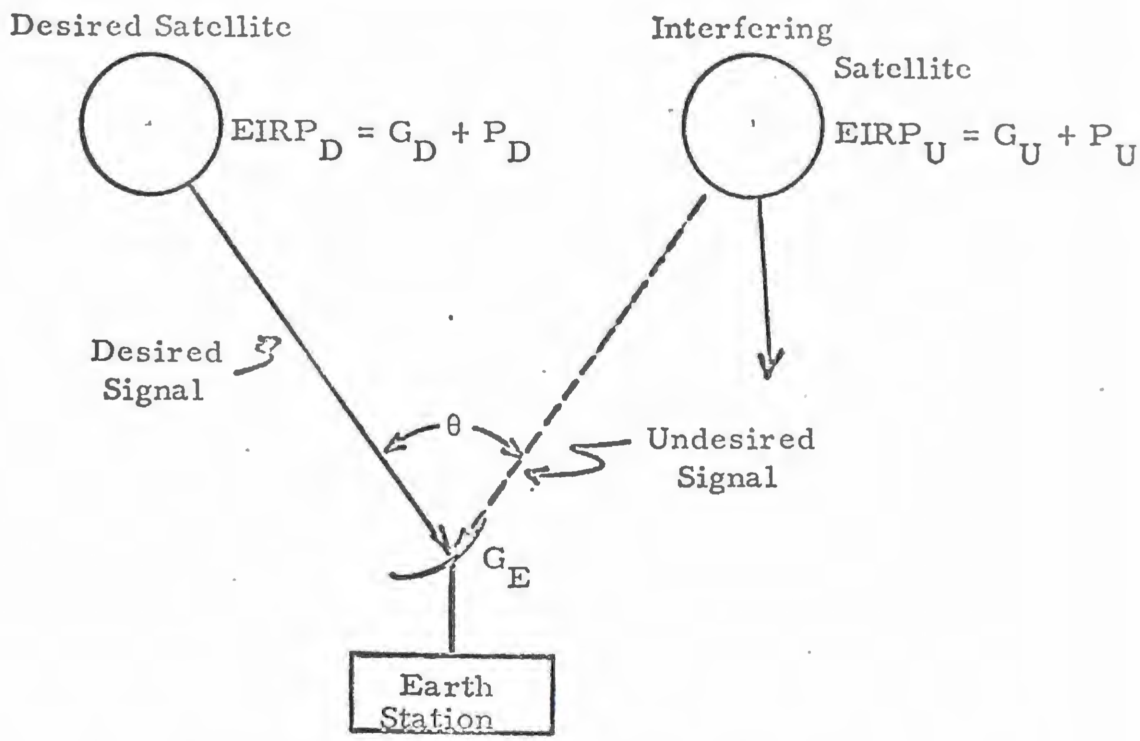
It will be assumed that the angle between two satellites as observed at an earth station is equal to the satellite spacing in degrees of equatorial arc. This is a conservative assumption in that the former angle is always greater than the latter, and hence the computed interference will be slightly higher. For the analysis a nominal 1200-voice circuit per channel (transponder), FDM/FM system with an RMS modulation index of 0.6 and a top baseband frequency of 5.5 MHz is assumed. This nominal system is the same as that given by COMSAT in their Comments dated 12 May 1971, and it is generally representative of voice circuit systems. It is assumed (with some precedent) that acceptable performance in this case would allow acceptable performance of other services. This assumption will be reviewed in a subsequent analysis.

Isolation between adjacent satellite links using the same frequency band is obtained by taking advantage of any or all of the following:

(a) the directional properties of the earth station antennas

(b) cross polarization discrimination

Figure 1. Downlink Interference



$$CNR = G_E + G_D + P_D - (G_U + P_U) - [32 - 25 \log_{10}(\theta)] + P \quad \text{dB}$$

$$= G_E - [32 - 25 \log_{10}(\theta)] + (G_D + P_D) - (G_U + P_U) + P \quad \text{dB}$$

$$= G_E - [32 - 25 \log_{10}(\theta)] + [EIRP_D - EIRP_U] + P \quad \text{dB}$$

Antenna Suppression (Figure 3) — Relative EIRP Adjustment — Polarization Isolation

where

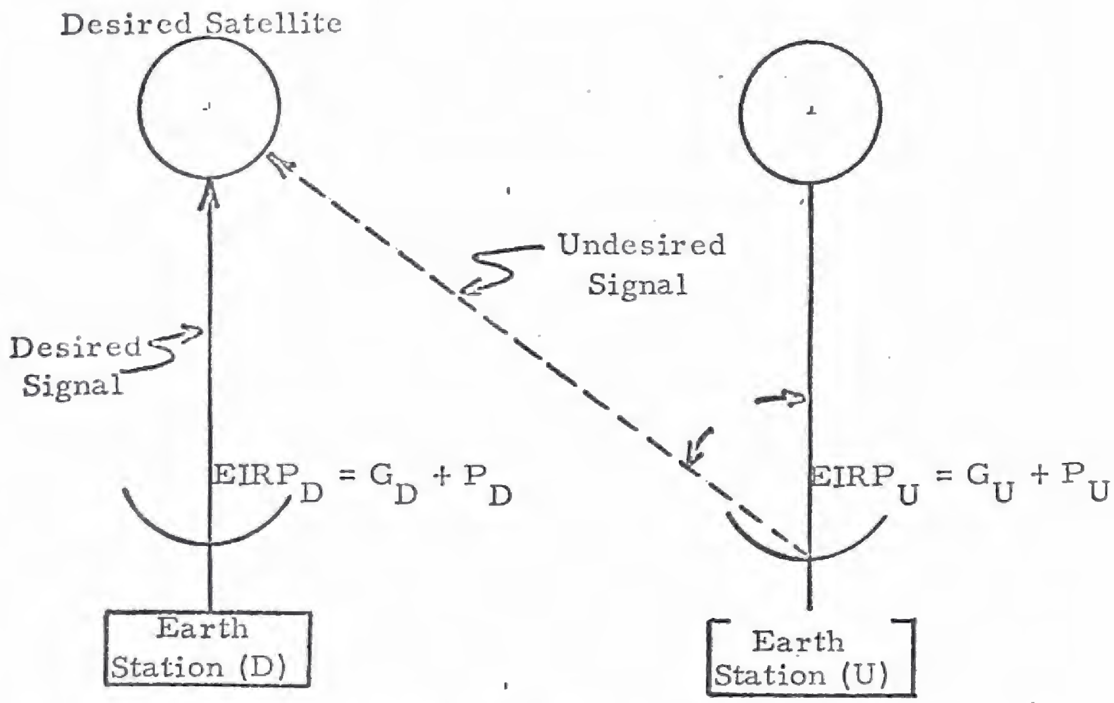
- CNR = Carrier-to-noise ratio
- G_E = Earth station antenna gain (on-axis) - dBi
- G_D = Antenna gain of desired satellite - dBi
- P_D = Desired satellite transmitter power output - dBW
- G_U = Antenna gain of undesired (interfering) satellite - dBi
- P_U = Undesired satellite transmitter power output - dBW
- θ = Orbit spacing angle (degrees)

$[32 - 25 \log_{10}(\theta)]$ = Earth station antenna gain at off-axis angle θ

Assume no satellite antenna directivity, i.e., undesired signal =

$$EIRP_U = G_U + P_U$$

Figure 2. Uplink Interference



$$CNR = G_D + P_D - [P_U + 32 - 25 \log_{10}(\theta)] + P \quad \text{but} \quad P_U = EIRP_U - G_U$$

$$= EIRP_D - [EIRP_U - G_U + 32 - 25 \log_{10}(\theta)] + P \quad \text{dB}$$

$$= (EIRP_D - EIRP_U) + G_U - [32 - 25 \log_{10}(\theta)] + P \quad \text{dB}$$

Relative EIRP Adjustment	Antenna Suppression (Interfering Station)	Polarization Isolation

where

CNR = Carrier-to-noise ratio - dB

G_D = Desired earth station antenna gain - dBi

P_D = Desired earth station transmitter power output - dBW

P_U = Undesired (interfering) earth station transmitter power output - dB

θ = Orbit spacing angle (degrees)

$[32 - 25 \log_{10}(\theta)]$ = Earth station antenna gain at off-axis angle θ

Assume no satellite antenna directivity to discriminate between Desired and Interfering earth stations

(c) the interference reduction factor associated with FM

(d) interleaving (offsetting) carrier frequencies.

Antennas proposed for earth stations are dishes ranging in size from 32 to 98 ft in diameter. The isolation available from the spatial directivity of these antennas is assumed to be in accordance with figure 3 which is from a recent COMSAT report. The gain and sidelobe suppression [32-25 log (ϕ)] indicated are also consistent with CCIR recommendations and specifications in the applications.

Polarization discrimination outside the main beam of the antenna is assumed to be an additional 10 dB. This is the figure recommended by CCIR and generally supported by the applicants.

The signal-to-interference (SIR) ratio in the worst case (highest) telephone channel is related to the carrier-to-unwanted noise (CNR) at the input of the receiver by an expression

$$SIR = CNR + B$$

where B is the interference reduction factor. The factor B depends upon the modulation characteristics of the wanted and unwanted signals and the separation of their carrier frequencies (offset). For the parameters of the FDM/FM system assumed in this analysis, B is computed to be approximately 25 dB when the carrier frequencies are the same. If the interfering signal is offset 20 MHz (half the channel width), then B is approximately 17 dB greater or 42 dB. In such a situation the desired channel may receive noise from both the 20 MHz higher and the 20 MHz lower interfering channel, and hence this must be reduced 3 dB to 39 dB. These figures were computed independently in accordance with a COMSAT report. With no offset the 25 dB figure is consistent with those given by the applicants, i.e., AT&T, 24.7; RCA, 26.8; and GT&E, 24. The slight differences in systems account for the variation. The additional isolation produced by offsetting (inter-

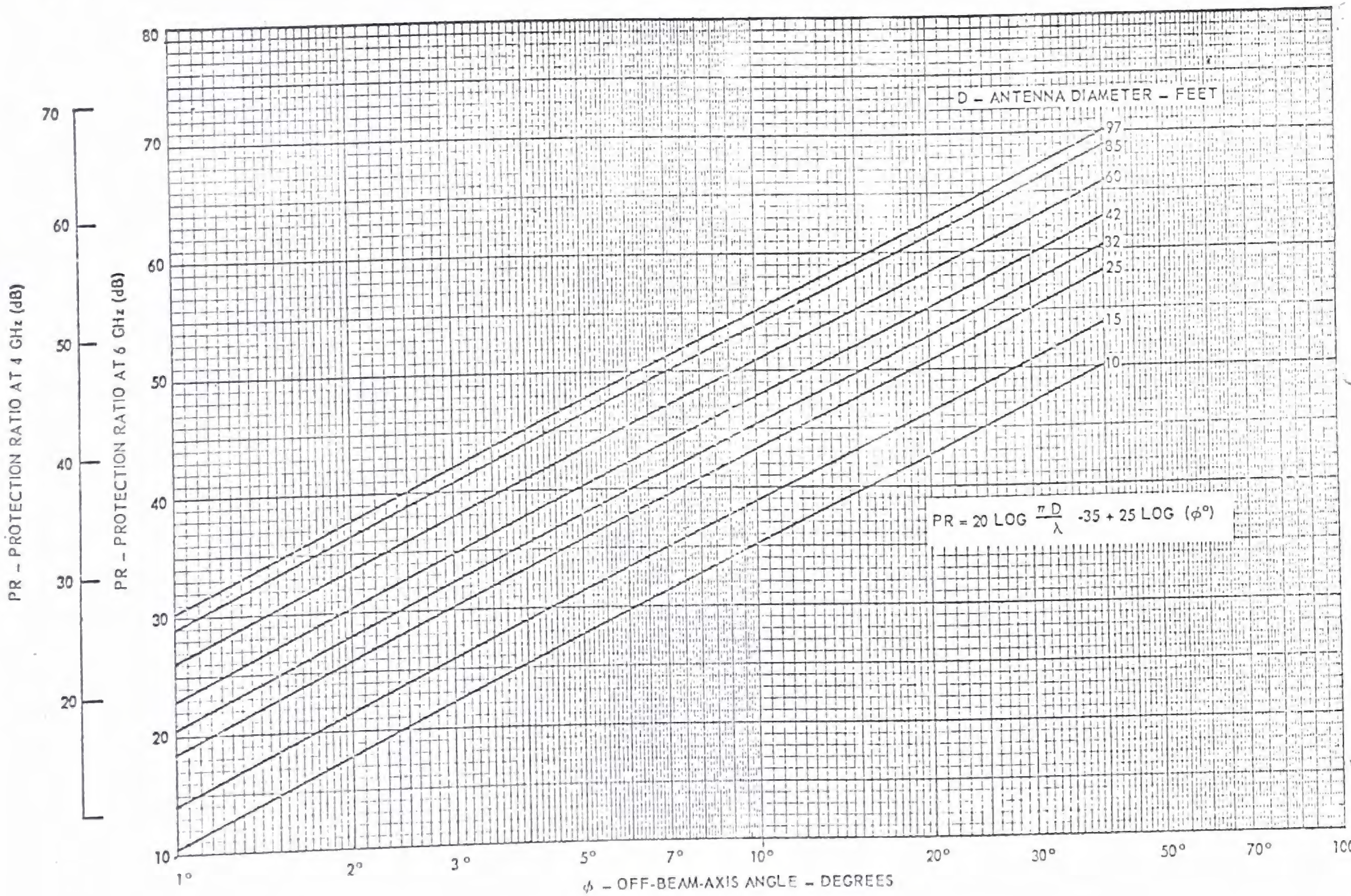
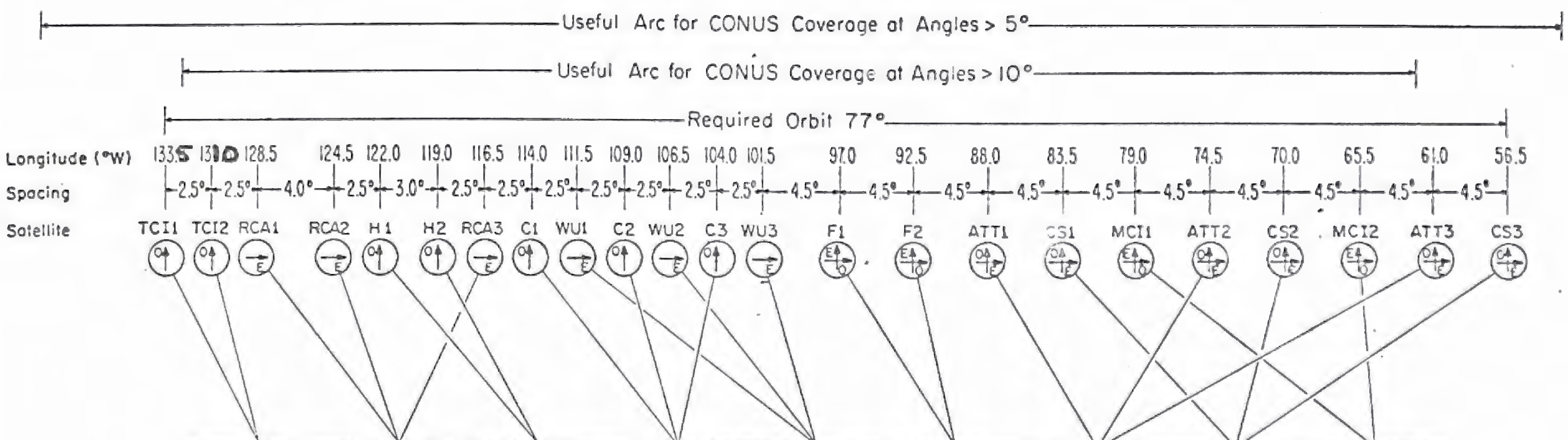


Figure 3. Protection ratio vs. off-beam-axis angle assuming 50% antenna efficiency and [32 - 25 log (θ)] sidelobes (from COMSAT Report DS-1-68).

Fig 4 ORBIT ARRANGEMENT AND EARTH STATION PARAMETERS



Western Tele-Communications (TCI)	RCA	Hughes (H)	Canada (C) -Reference Only-	Western Union (WU)	Fairchild (F)	AT + T (ATT)	COMSAT (CS)	MCI
R/T Ant EIRP	R/T Ant EIRP	R/T Ant EIRP	R/T Ant EIRP	R/T Ant EIRP	R/T Ant EIRP	R/T Ant EIRP	R/T Ant EIRP	R/T Ant EIRP
60' 88 dBw 45' 87 dBw	98' 83 dBw 60' 84 dBw 35' 88 dBw	98' 83 dBw 100' 92 dBw	98' 83 dBw 32' 83 dBw 26' 81 dBw	45' 83 dBw	100' 73 dBw	100' 93 dBw	98' 90 dBw 32' 81 dBw	32' 85 dBw
RO Ant G/T	RO Ant G/T	RO Ant G/T	RO Ant G/T	RO Ant G/T	RO Ant G/T	RO Ant G/T	RO Ant G/T	RO Ant G/T
-- --	-- --	35' --	-- --	32' --	-- --	-- --	42' --	-- --

Earth Station Characteristics

leaving) the channels is open to more question. Many applicants do not address this issue since they do not propose interleaving. The 42 dB figure is, however, consistent with that given in the COMSAT Comments and is 2.2 dB less than the figure used by AT&T.

2.0 Proposed Orbit Locations

The specific orbit locations proposed for this analysis are illustrated in figure 4. The assignments were made in a largely arbitrary fashion with the following exceptions:

(a) the 12-channel and 24-channel systems were separated

(b) RCA was given locations consistent with the assumption that they would be awarded the Alaskan service

(c) the Canadian Telesat orbit locations were determined from their published descriptions.

The orbit spacings shown are the nominal values. The applicants propose stationkeeping accuracies of $\pm 0.1°$ which means under worst-case conditions the satellites could be .2° closer. These conditions were not included in this analysis because (1) the probability of both satellites being at their extremes at the same time is small, (2) at the closest spacings used (2.5°) the increase in interference would be 1 dB or less, and (3) an increase in interference by movement to one side is often offset by a decrease in interference from the other side.

Also shown in the figure are the earth station EIRPs and the antenna sizes for Receive/Transmit (R/T) and Receive Only (RO) sites as proposed. All applicants propose satellite EIRPs very close to 33 dBW and no differences in satellite EIRPs are assumed. The arrows inside the satellite representations show the assumed polarization of the satellite antenna and the "O" and "E" refer to the "odd" and "even" channels, respectively, where the even channels are offset 20 MHz from the odd channels. In some instances these will be different than that proposed by the particular applicant, but such modifications are of a minor nature.

3.0 Interference Calculations

In the subsections which follow, the total 4/ 6 GHz interference power will be computed for the systems of each applicant using the assumptions given in section 1.0 and the orbital assignments and system parameters shown in figure 4.

3.1 Western Telecommunications (WTCI)

The two satellites of this applicant are located adjacent to one another at the western edge of the useful arc. WTCI proposes the use of dual beam dish antennas so that both satellites can be simultaneously covered by a single antenna. This necessitates that their two satellites lie within a few degrees of each other.

It is clear that the links from the more easterly satellite ($WTCI_2$) will experience more interference than the one at the extreme west edge ($WTCI_1$). Therefore the computations in Table 1A and Table 1B are for the former. The 4/ 6 GHz, 60 ft in diameter antenna with an EIRP of 84 dBW was used in the calculations.

These tables show that the interference is 173 pWpO on the downlink and 208 pWpO on the uplink with spacings as shown in figure 4. The total of less than 400 pWpO is well within the 1000 pWpO limit. It is interesting to note that the uplink interference power is greater than that of the downlink. This is the opposite result of what would be obtained if the systems were homogeneous since the earth station antennas are

TABLE 1A

4GHz DOWNLINK INTERFERENCE TO THE TCI_2 EARTH STATION FROM:

SATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
ANGLE (DEGREES)	2.5		2.5	6.5	9.0	12.0	14.5	17.0	19.5	22.0	24.5	27.0	29.5	34.0	38.5	43.0
ANT. SUPPRESSION (60')	32	X	32	42	46	49	51	53	55	56	57	58	59	60	61	63
POLARIZATION ISO.	0	X	10	10	0	0	10	0	10	0	10	0	10	0	0	0
REL. EIRP ADJ	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INT. REDUCTION FACTOR	>99*	X	39	39	25	25	39	25	39	25	39	25	39	25	25	25
TOT SUPPRESSION	>99	X	81	91	71	74	799	78	>99	81	799	83	799	85	86	88
INTERFERENCE dBmOp	<-99	X	-81	-91	-71	-74	<-99	78	<-99	81	<-99	-83	<-99	-85	-86	-88
INTERFERENCE pWOp	---	X	8	1	80	40	---	16	---	8	---	5	---	3	3	2

TOTAL 173 pWOp

*The TCI proposal is unique in that each satellite will use only every other channel. Thus the inte offset a full 40MHz. The Interference Reduction Factor is estimated to be greater than 99dB in thi AT&T application)

TABLE 1A

4GHz DOWNLINK INTERFERENCE TO THE TCI_2 EARTH STATION FROM:

[illegible]	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
5	6.5	9.0	12.0	14.5	17.0	19.5	22.0	24.5	27.0	29.5	34.0	38.5	43.0	47.5	52.0	56.5	61.0	65.5	70.0	[illegible]
	42	46	49	51	53	55	56	57	58	59	60	61	63	64	64	64	64	64	64	64
	10	0	0	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]
	39	25	25	39	25	39	25	39	25	39	25	25	25	25	25	25	25	25	25	[illegible]
	91	71	74	>99	78	>99	81	>99	83	>99	85	86	88	89	89	89	89	89	89	89
	-91	-71	-74	<-99	78	<-99	81	<-99	-83	<-99	-85	-86	-88	-89	-89	-89	-89	-89	-89	-89
	1	80	40	---	16	---	8	---	5	---	3	3	2	1	1	1	1	1	1	1

.s unique in that each satellite will use only every other channel. Thus the interfering carriers are
Iz. The Interference Reduction Factor is estimated to be greater than 99dB in this case. (Reference:

TABLE 1B

6GHz UPLINK INTERFERENCE TO THE TCI_2 SATELLITE FROM THE EARTH STATION OF:

RCA_2 6.5	H_1 9.0	H_2 12.0	RCA_3 14.5	C_1 17.0	WU_1 19.5	C_2 22.0	WU_2 24.5	C_3 27.0	WU_3 29.5	F_1 34.0	F_2 38.5	ATT_1 43.0	CS_1 47.5	MCI_1 52.0	ATT_2 56.5	CS_2 61.0	MCI_2 65.5	ATT_3 70.0	CS_3 [illegible]
32	98	98	32	26	45	26	45	26	45	98	98	98	32	32	98	32	32	98	32
41	44	57	49	49	55	52	53	54	60	68	70	71	62	62	72	62	62	72	[illegible]
10	0	0	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0	0	0
-4	1	1	-4	-3	1	-3	1	-3	1	11	11	-9	3	1	-9	3	1	-9	3
39	25	25	39	25	39	25	39	25	39	25	25	25	25	25	25	25	25	25	25
86	80	83	94	71	>99	74	>99	76	99	>99	>99	87	90	88	88	90	88	88	90
-86	-80	-83	-94	-71	<-99	-74	<-99	-76	<99	<-99	<-99	-87	-90	-88	-88	-90	-88	-88	-90
3	10	5	---	80	---	40	---	25	---	---	---	2	1	2	2	1	2	2	1

TABLE 1B

6GHz UPLINK INTERFERENCE TO THE TCI_2 SATELLITE FROM THE EARTH STATIO[illegible]

SATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	[illegible]
ANGLE (DEGREES)	2.5		2.5	6.5	9.0	12.0	14.5	17.0	19.5	22.0	24.5	27.0	29.5	34.0	38.5	[illegible]
ANT. SIZE	60	60	32	32	98	98	32	26	45	26	45	26	45	98	98	[illegible]
ANT. SUPPRESSION	36		30	41	54	57	49	49	55	52	58	54	60	68	70	[illegible]
POLAR. SUPPRESSION	0		10	10	0	0	10	0	10	0	10	0	10	0	0	0
REL. EIRP ADJ	0		-4	-4	1	1	-4	-3	1	-3	1	-3	1	11	11	-9
INT. REDUCTION FACTOR	>99*		39	39	25	25	39	25	39	25	39	25	39	25	25	25
NET SUPPRESSION	<99		75	86	80	83	94	71	>99	74	>99	76	99	>99	>99	[illegible]
INTERFERENCE dBmOp	<-99		-75	-86	-80	-83	-94	-71	<-99	-74	<-99	-76	<-99	<-99	<-99	[illegible]
INTERFERENCE pWOp	---		32	3	10	5	---	80	---	40	---	25	---	---	---	2

TOTAL 208 pWOp

more directive at 6 GHz than at 4 GHz. In this case, however, other applicants are proposing smaller antennas than WTCI in some instances (notably RCA as well as Canada), and different EIRPs.

WTCI also proposes Receive Only (RO) stations with antennas as small as 20 ft. This would decrease the antenna suppression by as much as 14 dB with a corresponding increase in noise power. It is assumed that the service requirements of these terminals is consistent with the degradation in performance.

3.2 RCA

Two of the satellites of this applicant are located adjacent to each other and east of the two WTCI satellites as shown in figure 4. The third satellite is located to the east of the two Hughes satellites. These locations are consistent with the assumption that RCA will serve Alaska. The spacing between the two adjacent RCA satellites (RCA_1 and RCA_2) is 4° as they requested. RCA used a tradeoff analysis involving minimizing sun outage time and reducing interference on one hand (requiring a wide spacing) and staying within the spacing requirements for serving both satellites from a single antenna with dual beam. Even at 4° their analysis indicates total interference power greater than 1000 pWpO for 32 ft antennas, and they make little comment about this fact. For the purpose of this analysis, 60 ft antennas (which are also proposed by RCA) are assumed. In other sections evaluating interference caused by RCA earth stations, 32 ft antennas are substituted. The resulting interference calculations are shown in tables 2A and 2B. The interference to the RCA_1 links should be less than that of RCA_2 and are not considered.

The uplink interference is 1173 pWpO and the downlink interference is 683 pWpO, resulting in a total of approximately 1860 pWpO.

TABLE 2A

4GHz DOWNLINK INTERFERENCE TO THE RCA_2 EARTH STATION FROM:

[illegible]	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS [illegible]
[illegible]		2.5	5.5	8.0	10.5	13.0	15.5	18.0	20.5	23.0	27.5	32.0	36.5	41.0	45.5	50.0	54.5	59.0	63.5	[illegible]
		32	41	45	48	50	52	54	55	56	58	60	61	62	63	64	64	64	64	64
		10	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		39	39	25	39	25	39	25	39	25	25	25	25	25	25	25	25	25	25	25
		81	90	70	97	75	>99	79	>99	81	83	85	86	87	88	89	89	89	89	[illegible]
[illegible]		-81	-90	-70	-97	-75	<-99	-79	<-99	-81	-83	-85	-86	-87	-88	-89	-89	-89	-89	[illegible]
[illegible]		8	1	100	---	32	---	13	---	8	5	3	3	2	2	1	1	1	1	1

TABLE 2A

4GHz DOWNLINK INTERFERENCE TO THE RCA$_2$ EARTH STATION FROM:

SATELLITE	TCI$_1$	TCI$_2$	RCA$_1$	RCA$_2$	H$_1$	H$_2$	RCA$_3$	C$_1$	WU$_1$	C$_2$	WU$_2$	C$_3$	WU$_3$	F$_1$	F$_2$	[illegible]
ANGLE (DEGREES)	9.0	6.5	4.0		2.5	5.5	8.0	10.5	13.0	15.5	18.0	20.5	23.0	27.5	32.0	[illegible]
ANT. SUPPRESSION (60)	46	42	38		32	41	45	48	50	52	54	55	56	58	60	61
POLARIZATION ISO.	10	10	0		10	10	0	10	0	10	0	10	0	0	0	0
TEL. TEMP ADJ	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0
INT. REDUCTION FACTOR	39	39	25		39	39	25	39	25	39	25	39	25	25	25	25
NET SUPPRESSION	95	91	63		81	90	70	97	75	>99	79	> 99	81	83	85	86
INTERFERENCE dBmOp	-95	-91	-63		-81	-90	-70	-97	-75	<-99	-79	<-99	-81	-83	-85	-86
INTERFERENCE pWOp	---	1	500		8	1	100	---	32	---	13	---	8	5	3	3

TOTAL 683 pWOp

TABLE 2B

6GHz UPLINK INTERFERENCE TO THE RCA_2 SATELLITE FROM THE EARTH STATION OF:

RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
	2.5	5.5	8.0	10.5	13.0	15.5	18.0	20.5	23.0	27.5	32.0	36.5	41.0	45.5	50.0	54.5	59.0	63.5	68.0
32	98	98	32	26	45	26	45	26	45	98	98	98	32	32	98	32	32	98	32
	40	49	43	44	51	48	54	51	57	66	67	68	60	61	72	62	62	72	[illegible]
	10	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0	0	0	0
	-5	-5	0	-3	-5	-3	-5	-3	-5	5	5	-15	-3	-7	-15	-3	-7	-15	-3
	39	39	25	39	25	39	25	39	25	25	25	25	25	25	25	25	25	25	25
	84	93	68	90	71	94	74	97	77	96	97	78	82	79	82	84	80	82	84
	-84	-93	-68	-90	-71	-94	-74	-97	-77	-96	-97	-78	-82	-79	-82	-84	-80	-82	-84
	4	1	160	1	80	---	40	---	20	---	---	16	6	13	6	4	10	6	4

TABLE 2B

6GHz UPLINK INTERFERENCE TO THE RCA_2 SATELLITE FROM THE EARTH STATION OF:

SATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
[illegible] (DEGREES)	9.0	6.5	4.0		2.5	5.5	8.0	10.5	13.0	15.5	18.0	20.5	23.0	27.5	32.0	36.5
ANT. SIZE	60	60	32	32	98	98	32	26	45	26	45	26	45	98	98	98
ANT. SUPPRESSION	50	46	36		40	49	43	44	51	48	54	51	57	66	67	63
POLAR SUPPRESSION	10	10	0		10	10	0	10	0	10	0	10	0	0	0	0
REL. EIRP ADJ	-6	-6	0		-5	-5	0	-3	-5	-3	-5	-3	-5	5	5	-15
INT. REDUCTION FACTOR	39	39	25		39	39	25	39	25	39	25	39	25	25	25	25
NET SUPPRESSION	93	89	61		84	93	68	90	71	94	74	97	77	96	97	73
INTERFERENCE dBm0p	-93	-89	-61		-84	-93	-68	-90	-71	-94	-74	-97	-77	-96	-97	-73
INTERFERENCE pW0p	1	1	800		4	1	160	1	80	---	40	---	20	---	---	16

[illegible] 1173 pW0p

This is approximately 2.5 dB greater than the 1000 pWpO limit referenced earlier. Note that the interference is almost entirely due to signals from RCA's own satellites. For example, the 4 GHz downlink interference for RCA_1 consists of 500 pWpO of interference from RCA_2 and only 183 pWpO from other systems. In RCA's own analysis they assume slightly greater antenna suppression and a 26.8 dB Interference Reduction Factor which gives almost 50% lower interference. Since the allocation (spacing) is in accordance with RCA's application, since the interference is predominantly from RCA's own system, and because their calculations were based on a more detailed analysis of their own system, this level of interference is not considered objectionable.

3.3 Hughes

Between RCA_2 and RCA_3 are the two satellites of Hughes. They are spaced at 3° in accordance with their application and they are cross-polarized and frequency interleaved with the RCA satellites. Hughes refers to a similar tradeoff study of the spacing and specifies that a "soft optimum" between 2.5° and 3.0° be used. The Hughes interference analysis is in terms of signal-to-noise ratios for video transmission. The calculations for FDM/FM are contained in the GT&E applications for Earth Stations which will use the Hughes satellites. Those calculations and the calculations in this section (tables 3A and 3B) are based on the 98 ft Earth Station antennas proposed for FDM/FM transmission. Hughes also proposes the use of smaller antennas for use at video RO sites. These will be considered in a subsequent analysis.

The total interference predicted for H_1 is about 1100 pWpO. This is slightly in excess of the arbitrary limit. The downlink interference is primarily from the companion Hughes satellite (500 pWpO out of the

TABLE 3A

GHz DOWNLINK INTERFERENCE TO THE H_1 EARTH STATION FROM:

1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
	2.5		3.0	5.5	8.0	10.5	13.0	15.5	18.0	20.5	25.0	29.5	34.0	38.5	43.0	47.5	52.0	56.5	61.0	65.5
	36		38	45	50	52	54	56	58	59	61	63	65	66	67	68	68	68	68	68
	10		0	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0	0	0
	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	39		25	39	25	39	25	39	25	39	25	25	25	25	25	25	25	25	25	25
	85		63	94	75	>99	79	>99	83	>99	86	88	90	91	92	93	93	93	93	93
	-85		-63	-94	-75	<-99	-79	<-99	-83	<-99	-86	-88	-90	-91	-92	-93	-93	-93	-93	-93
	3		500	---	32	---	13	---	5	---	3	2	1	1	1	1	1	1	1	1

TABLE 3A

4GHz DOWNLINK INTERFERENCE TO THE H_1 EARTH STATION FROM:

SATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT.
ANGLE (DEGREES)	11.5	9.0	6.5	2.5		3.0	5.5	8.0	10.5	13.0	15.5	18.0	20.5	25.0	29.5	34.0
ANT. SUPPRESSION (98)	53	50	47	36		38	45	50	52	54	56	58	59	61	63	65
POLARIZATION ISO.	0	0	10	10		0	10	0	10	0	10	0	10	0	0	0
REL. EIRP ADJ	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
INT. REDUCTION FACTOR	25	25	39	39		25	39	25	39	25	39	25	39	25	25	25
NET SUPPRESSION	78	75	96	85		63	94	75	>99	79	>99	83	>99	36	88	90
INTERFERENCE dBm0p	-78	-75	-96	-85		-63	-94	-75	<-99	-79	<-99	-83	<-99	-86	-88	-90
INTERFERENCE pW0p	16	32	---	3		500	---	32	---	13	---	5	---	3	2	1

TOTAL 614 pW0p

TABLE 3B

6GHz UPLINK INTERFERENCE TO THE H_1 SATELLITE FROM THE EARTH STATION OF:

RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
2.5		3.0	5.5	8.0	10.5	13.0	15.5	18.0	20.5	25.0	29.5	34.0	38.5	43.0	47.5	52.0	56.5	61.0	65.5
32	98	98	32	26	45	26	45	26	45	98	98	98	32	32	98	32	32	98	32
31		42	37	41	49	46	53	50	56	64	67	68	60	61	72	62	62	72	62
10		0	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0	0	0
5		0	5	2	0	2	0	2	0	10	10	-10	2	-2	-10	2	-2	-10	[illegible]
39		25	39	25	39	25	39	25	39	25	25	25	25	25	25	25	25	25	25
85		67	91	68	98	73	>99	77	>99	99	>99	83	87	84	87	89	85	87	89
-85		-67	-91	-68	-98	-73	<-99	-77	<-99	-99	< -99	-83	-87	-84	-87	-89	-85	-87	-89
3		200	1	160	---	50	---	20	---	---	---	5	2	4	2	1	3	2	1

TABLE 3B

6GHz UPLINK INTERFERENCE TO THE H_1 SATELLITE FROM THE EARTH STATION OF:

[illegible]ATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
[illegible] (DEGREES)	11.5	9.0	6.5	2.5		3.0	5.5	8.0	10.5	13.0	15.5	18.0	20.5	25.0	29.5	34.0
[illegible]T. SIZE	60	60	32	32	98	98	32	26	45	26	45	26	45	98	98	98
[illegible]T. SUPPRESSION	52	50	38	31		42	37	41	49	46	53	50	56	64	67	68
POLAR. SUPPRESSION	0	0	10	10		0	10	0	10	0	10	0	10	0	0	0
REL. EIRP ADJ	-1	-1	5	5		0	5	2	0	2	0	2	0	10	10	-10
INT. REDUCTION FACTOR	25	25	39	39		25	39	25	39	25	39	25	39	25	25	25
NET SUPPRESSION	76	74	92	85		67	91	68	98	73	>99	77	>99	99	>99	83
INTERFERENCE dBm0p	-76	-74	-92	-85		-67	-91	-68	-98	-73	<-99	-77	<-99	-99	<-99	-83
INTERFERENCE pW0p	25	40	1	3		200	1	160	---	50	---	20	---	---	---	5

[illegible] -39 pW0p

total of 614 pWpO). The uplink interference is about evenly divided between the radiation intended for the other Hughes satellite and the interference from the Canadian links. Since the spacing between the two satellites is in accordance with their application, since the downlink interference is predominantly from their own satellite, and since the differences in geographic coverage of the Canadian and Hughes satellite will tend to diminish the interference from that source, this level of interference appears reasonable.

3.4 Western Union

The three satellites of this applicant have been alternated with the three Canadian satellites and are cross-polarized and frequency interleaved with them. WU proposes the use of 45 ft antennas for T/R Earth Stations and 32 ft antennas at RO terminals. The calculations in this section (tables 4A and 4B) are based on the 45 ft antennas.

The indicated interference is 1651 pWpO in the downlink and 549 pWpO in the uplink. WU_2 and RCA_3 both contribute 640 pWpO of interference to the downlink. The 5° spacing to these two interference sources is clearly inadequate for the 45 ft antennas proposed. If 60 ft antennas were required of this applicant, the total downlink interference would be reduced by about one-half to a more acceptable level. Furthermore, it would reduce the interference produced in other systems. A further evaluation of this situation is contained in section 4.

3.5 Fairchild

In this proposed arrangement, the two satellites of this applicant are spaced 4.5° apart between the 12 transponder and 24 transponder groups. Earth Stations with 98 ft antennas are proposed and used in the

TABLE 4A

4GFz DOWNLINK INTERFERENCE TO THE WU_1 EARTH STATION FROM:

	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
	13.0	10.5	7.5	5.0	2.5		2.5	5.0	7.5	10.0	14.5	19.0	23.5	28.0	32.5	37.0	41.5	46.0	50.5	55.0
	47	45	41	37	30		30	37	41	44	48	51	53	55	57	58	60	61	62	[illegible]
	0	10	10	0	10		10	0	10	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	39	39	25	39		39	25	39	25	25	25	25	25	25	25	25	25	25	25
	72	94	90	62	79		79	62	90	69	73	76	78	80	82	83	85	86	87	87
	-72	-94	-90	-62	-79		-79	-62	-90	-69	-73	-76	-78	-80	-82	-83	-85	-86	-87	[illegible]
	64	---	1	640	13		13	640	1	125	50	25	16	10	6	5	3	3	2	2

TABLE 4A

4GHz DOWNLINK INTERFERENCE TO THE WU_1 EARTH STATION FROM:

SATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
ANGLE (DEGREES)	22.0	19.5	17.0	13.0	10.5	7.5	5.0	2.5		2.5	5.0	7.5	10.0	14.5	19.0	23.5
ANT. SUPPRESSION (45')	53	51	50	47	45	41	37	30		30	37	41	44	48	51	53
POLARIZATION ISO.	10	10	0	0	10	10	0	10		10	0	10	0	0	0	0
REL. EIRP ADJ	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
INT. REDUCTION FACTOR	39	39	25	25	39	39	25	39		39	25	39	25	25	25	25
NET SUPPRESSION	>99	>99	75	72	94	90	62	79		79	62	90	69	73	76	78
INTERFERENCE dBm0p	<-99	<-99	-75	-72	-94	-90	-62	-79		-79	-62	-90	-69	-73	-76	-78
INTERFERENCE pW0p	---	---	32	64	---	1	640	13		13	640	1	125	50	25	16

1651 pW0p

TABLE 4B

z UPLINK INTERFERENCE TO THE WU_1 SATELLITE FROM THE EARTH STATION OF:

RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
13.0	10.5	7.5	5.0	2.5		2.5	5.0	7.5	10.0	14.5	19.0	23.5	28.0	32.5	37.0	41.5	46.0	50.5	55.0
32	98	98	32	26	45	26	45	26	45	98	98	98	32	32	98	32	32	98	32
48	55	52	38	28		28	41	40	48	59	62	64	56	58	69	61	62	72	62
0	10	10	0	10		10	0	10	0	0	0	0	0	0	0	0	0	0	0
5	0	0	5	2		2	0	2	0	10	10	-10	2	-2	-10	2	-2	-10	2
25	39	39	25	39		39	25	39	25	25	25	25	25	25	25	25	25	25	25
73	>99	>99	68	79		79	66	91	73	94	97	79	83	81	84	88	85	87	89
-78	<-99	<-99	-68	-79		-79	-66	-91	-73	-94	-97	-79	-83	-81	-84	-88	-85	-87	-89
16	---	---	160	13		13	250	1	50	---	---	13	5	8	4	2	3	2	1

TABLE 4B

6GHz UPLINK INTERFERENCE TO THE WU_1 SATELLITE FROM THE EARTH STATION OF:

SATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
[illegible] (DEGREES)	22.0	19.5	17.0	13.0	10.5	7.5	5.0	2.5		2.5	5.0	7.5	10.0	14.5	19.0	23.5
ANT. SIZE	60	60	32	32	98	98	32	26	45	26	45	26	45	98	98	98
ANT. SUPPRESSION	62	58	51	48	55	52	38	28		28	41	40	48	59	62	64
POLAR. SUPPRESSION	10	10	0	0	10	10	0	10		10	0	10	0	0	0	0
REL. EIRP ADJ	-1	-1	5	5	0	0	5	2		2	0	2	0	10	10	-10
INT. REDUCTION FACTOR	39	39	25	25	39	39	25	39		39	25	39	25	25	25	25
TOT SUPPRESSION	>99	>99	81	78	>99	>99	68	79		79	66	91	73	94	97	7[illegible]
INTERFERENCE dBm0p	<-99	<-99	-81	-78	<-99	<-99	-68	-79		-79	-66	-91	-73	-94	-97	-79
INTERFERENCE pW0p	---	---	8	16	---	---	160	13		13	250	1	50	---	---	13

5-9 pW0p

interference analysis (tables 5A and 5B). Note that no polarization isolation or interleaving advantage is assumed.

The downlink interference is calculated to be 491 pWpO. As noted before, it is often assumed that if the downlink interference is acceptable then the uplink interference will also be acceptable because of the additional antenna directivity at 6 GHz. This is not the case in this situation because of the inhomogenity in uplink parameters. The downlink parameters are homogeneous because of the maximum flux density limitation and uniformity of desired coverage area. The uplink power outputs vary from 12 W (Fairchild) to 3 kW (RCA and others) per carrier and EIRPs vary from 73 dBW (Fairchild) to 93 dBW (AT&T). In the present case, the uplink interference is totally unacceptable for Fairchild since it is over 10 dB above the criterion.

3.6 AT&T

The applications of AT&T, COMSAT, and MCI-Lockheed are for similar 24 transponder systems and they have been grouped together in the eastern part of the orbit. AT&T also proposes 98 ft antennas. The interference calculations are shown in tables 6A and 6B.

The downlink interference power is 373 pWpO and the uplink interference power is 76 pWpO for a total of 449 pWpO. The uplink interference is low because of the relative EIRP being proposed for the earth stations (93 dBW) especially in relation to the Fairchild stations (73 dBW).

3.7 COMSAT

The interference computations for COMSAT are shown in tables 7A and 7B assuming their use of 32 ft antennas as proposed. For the western-most satellite, the downlink interference is computed to be

TABLE 5A

4GHz DOWNLINK INTERFERENCE TO THE F_1 EARTH STATION FROM:

TELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS
GLE (DEGREES)	36.5	34.0	31.5	27.5	25.0	22.0	19.5	17.0	14.5	12.0	9.5	7.0	4.5		4.5	9.0	13
T. SUPPRESSION (98')	65	64	63	62	61	60	58	57	55	53	51	47	43		43*	50	5
LARIZATION ISO.	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
L. EIRP ADJ	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
T. REDUCTION FACTOR	25	25	25	25	25	25	25	25	25	25	25	25	25		25	25	2
T SUPPRESSION	90	89	88	87	86	85	83	82	80	78	76	72	68		68	75	8
TERFERENCE dBmOp	-90	-89	-88	-87	-86	-85	-83	-82	-80	-78	-76	-72	-68		-68	-75	-8
TERFERENCE pWCp	1	1	2	2	3	3	5	6	10	16	25	60	160		160	32	1

TAL 510 pWOp

TABLE 5A

-GHz DOWNLINK INTERFERENCE TO THE F_1 EARTH STATION FROM:

RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
27.5	25.0	22.0	19.5	17.0	14.5	12.0	9.5	7.0	4.5		4.5	9.0	13.5	18.0	22.5	27.0	31.5	36.0	40.5
62	61	60	58	57	55	53	51	47	43		43*	50	55	58	60	61	64	65	66
0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	[illegible]
25	25	25	25	25	25	25	25	25	25		25	25	25	25	25	25	25	25	[illegible]
87	86	85	83	82	80	78	76	72	68		68	75	80	83	85	86	89	90	91
-87	-86	-85	-83	-82	-80	-78	-76	-72	-68		-68	-75	-80	-83	-85	-86	-89	-90	-91
2	3	3	5	6	10	16	25	60	160		160	32	10	5	3	3	1	1	1

TABLE 5B

6GHz UPLINK INTERFERENCE TO THE F_1 SATELLITE FROM THE EARTH STATION OF:

SATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
ANGLE (DEGREES)	36.5	34.0	31.5	27.5	25.0	22.0	19.5	17.0	14.5	12.0	9.5	7.0	4.5		4.5	9.0
ANT. SIZE	60	60	32	32	98	98	32	26	45	26	45	26	45	98	98	98
ANT. SUPPRESSION	64	63	58	56	65	63	53	49	52	45	47	39	39		47	54
POLAR. SUPPRESSION	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
REL. EIRP ADJ	-11	-11	-5	-5	-10	-10	-5	-8	-10	-8	-10	-8	-10		0	-20
INT. REDUCTION FACTOR	25	25	25	25	25	25	25	25	25	25	25	25	25		25	25
TOT SUPPRESSION	78	77	78	76	80	78	73	66	67	62	62	56	54		72	59
INTERFERENCE dBm0p	-78	-77	-78	-76	-80	-78	-73	-66	-67	-62	-62	-56	-54		-72	-59
INTERFERENCE pW0p	16	20	16	25	10	16	50	250	200	640	640	2500	4000		64	1250

TOTAL 10,606 pW0p

TABLE 5B

6GHz UPLINK INTERFERENCE TO THE F_1 SATELLITE FROM THE EARTH STATION OF:

RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
27.5	25.0	22.0	19.5	17.0	14.5	12.0	9.5	7.0	4.5		4.5	9.0	13.5	18.0	22.5	27.0	31.5	36.0	[illegible]
32	98	98	32	26	45	26	45	26	45	98	98	98	32	32	98	32	32	98	32
56	65	63	53	49	52	45	47	39	39		47	54	48	52	64	56	58	60	[illegible]
0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	[illegible]
-5	-10	-10	-5	-8	-10	-8	-10	-8	-10		0	-20	-8	-12	-20	-8	-12	-20	-8
25	25	25	25	25	25	25	25	25	25		25	25	25	25	25	25	25	25	25
76	80	78	73	66	67	62	62	56	54		72	59	65	65	69	73	7	7-	77
-76	-80	-78	-73	-66	-67	-62	-62	-56	-54		-72	-59	-65	-65	-69	-73	-71	-7-	-77
25	10	16	50	250	200	640	640	2500	4000		64	1250	320	320	125	50	80	40	20

TABLE 6A

4GHz DOWNLINK INTERFERENCE TO THE ATT_1 EARTH STATION FROM:

[illegible]TELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
A[illegible]LE (DEGREES)	45.5	43.0	40.5	36.5	34.0	31.0	28.5	26.0	23.5	21.0	18.5	16.0	13.5	9.0	4.5	
[illegible]. SUPPRESSION (98')	68	67	66	65	64	64	63	62	60	59	58	57	55	50	44	
[illegible]LARIZATION ISO.																
[illegible]. EIRP ADJ																
[illegible]. REDUCTION FACTOR	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
[illegible] SUPPRESSION	93	92	91	90	89	89	88	87	85	84	83	82	80	75	69	
[illegible]TERFERENCE dBmOp	-93	-92	-91	-90	-89	-89	-88	-87	-85	-84	-83	-82	-80	-75	-69	
[illegible]TERFERENCE pWOp	1	1	1	1	1	1	2	2	3	4	5	6	10	32	125	

[illegible]TAL 373 pWOp

TABLE 6A

[illegible]Hz DOWNLINK INTERFERENCE TO THE ATT_1 EARTH STATION FROM:

RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
36.5	34.0	31.0	28.5	26.0	23.5	21.0	18.5	16.0	13.5	9.0	4.5		4.5	9.0	13.5	18.0	22.5	27.0	31.5
65	64	64	63	62	60	59	58	57	55	50	44		44	50	55	58	60	62	64
25	25	25	25	25	25	25	25	25	25	25	25		25	25	25	25	25	[illegible]	[illegible]
90	89	89	88	87	85	84	83	82	80	75	69		69	75	80	83	85	[illegible]	[illegible]
-90	-89	-89	-88	-87	-85	-84	-83	-82	-80	-75	-69		-69	-75	-80	-83	-85	[illegible]	[illegible]
1	1	1	2	2	3	4	5	6	10	32	125		125	32	10	5	3	2	[illegible]

TABLE 6B

6GHz UPLINK INTERFERENCE TO THE ATT_1 SATELLITE FROM THE EARTH STATION OF:

[illegible]	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
[illegible] (DEGREES)	45.5	43.0	40.5	36.5	34.0	31.0	28.5	26.0	23.5	21.0	18.5	16.0	13.5	9.0	4.5	
[illegible]. SIZE	60	60	32	32	98	98	32	26	45	26	45	26	45	98	98	98
[illegible]. SUPPRESSION	68	66	60	59	68	67	56	53	57	51	55	48	51	54	46	
[illegible]. SUPPRESSION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
[illegible]. DIFF ADJ	9	9	15	15	10	10	15	12	10	12	10	12	10	20	20	
[illegible]. REDUCTION FACTOR	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
[illegible] SUPPRESSION	>99	>99	>99	99	>99	>99	96	90	92	88	90	85	86	99	91	
[illegible]FERENCE dBmOp	<-99	<-99	<-99	99	<-99	<-99	-96	-90	-92	-88	-90	-85	-86	-99	-91	
[illegible]FERENCE pWOp	---	---	---	---	---	---	---	1	1	2	1	3	3	---	1	

[illegible] 76 pWOp

TABLE 6B

LINK INTERFERENCE TO THE ATT$_1$ SATELLITE FROM THE EARTH STATION OF:

[illegible]A$_2$	H$_1$	H$_2$	RCA$_3$	C$_1$	WU$_1$	C$_2$	WU$_2$	C$_3$	WU$_3$	F$_1$	F$_2$	ATT$_1$	CS$_1$	MCI$_1$	ATT$_2$	CS$_2$	MCI$_2$	ATT$_3$	CS$_3$
36.5	34.0	31.0	28.5	26.0	23.5	21.0	18.5	16.0	13.5	9.0	4.5		4.5	9.0	13.5	18.0	22.5	27.0	31.5
32	98	98	32	26	45	26	45	26	45	98	98	98	32	32	98	32	32	98	32
[illegible]	68	.67	56	53	57	51	55	48	51	54	46		37	47	58	52	56	66	55
0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	[illegible]
25	10	10	15	12	10	12	10	12	10	20	20		12	6	0	12	6	0	12
25	25	25	25	25	25	25	25	25	25	25	25		25	25	25	25	25	25	25
[illegible]	>99	>99	96	90	92	88	90	85	86	99	91		74	78	83	89	87	-91	-95
[illegible]	<-99	<-99	-96	-90	-92	-88	-90	-85	-86	-99	-91		-74	-78	-83	-89	-87	-91	-95
---	---	---	---	1	1	2	1	3	3	---	1		40	15	5	1	2	1	[illegible]

TABLE 7A

4GHz DOWNLINK INTERFERENCE TO THE CS_1 EARTH STATION FROM:

SATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
ANGLE (DEGREES)	50.0	47.5	45.0	41.0	38.5	35.5	33.0	30.5	28.0	25.5	23.0	20.5	18.0	13.5	9.0	4.5
INT. SUPPRESSION (32')	59	58	58	57	56	55	55	54	53	52	50	49	48	45	41	33
POLARIZATION ISO.																
DL. EIRP ADJ																
INT. REDUCTION FACTOR	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
NET SUPPRESSION	84	83	83	82	81	80	80	79	78	77	75	74	73	70	66	58
INTERFERENCE dBm0p	-84	-83	-83	-82	-81	-80	-80	-79	-78	-77	-75	-74	-73	-70	-66	-58
INTERFERENCE pW0p	4	5	5	6	8	10	10	13	16	20	32	40	50	100	250	1600

TOTAL 4,231 pW0p

TABLE 7A

[illegible]LINK INTERFERENC[illegible] TO THE CS_1 EARTH STATION FROM:

$[illegible]_2$	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
[illegible].0	38.5	35.5	33.0	30.5	28.0	25.5	23.0	20.5	18.0	13.5	9.0	4.5		4.5	9.0	13.5	18.0	22.5	27.0
57	56	55	55	54	53	52	50	49	48	45	41	33		33	41	45	48	50	52
25	25	25	25	25	25	25	25	25	25	25	25	25		25	25	25	25	25	[illegible]
82	81	80	80	79	78	77	75	74	73	70	66	58		58	66	70	73	75	77
-82	-81	-80	-80	-79	-78	-77	-75	-74	-73	-70	-66	-58		-58	-66	-70	-73	-75	-77
6	8	10	10	13	16	20	32	40	50	100	250	1600		1600	250	100	50	32	20

TABLE 7B

6GHz UPLINK INTERFERENCE TO THE CS_1 SATELLITE FROM THE EARTH STATION OF:

SATELLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1
ANGLE (DEGREES)	50.0	47.5	45.0	41.0	38.5	35.5	33.0	30.5	28.0	25.5	23.0	20.5	18.0	13.5	9.0	4.5
ANT. SIZE	60	60	32	32	98	98	32	26	45	26	45	26	45	98	98	98
ANT. SUPPRESSION	68	67	61	60	70	69	58	55	59	53	57	51	54	58	54	46
POLAR. SUPPRESSION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REL. EIRP ADJ	-3	-3	13	13	-2	-2	13	0	-2	0	-2	0	-2	8	8	-10
INT. REDUCTION FACTOR	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
NET SUPPRESSION	-90	89	99	98	93	92	96	80	82	78	80	76	77	91	87	61
INTERFERENCE dBm0p	-90	-89	-99	-98	-93	-92	-96	-80	-82	-78	-80	-76	-77	-9[illegible]	-87	-61
INTERFERENCE pW0p	1	1	---	---	1	1	---	10	6	16	10	25	20	1	2	800

TOTAL 2,739 pW0p

TABLE 7B

[illegible] TO THE CS_1 SATELLITE FROM THE EARTH STATION OF:

[illegible]	[illegible]	[illegible]	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
[illegible]	[illegible]	35.5	33.0	30.5	28.0	25.5	23.0	20.5	18.0	13.5	9.0	4.5		4.5	9.0	13.5	18.0	22.5	27.0
[illegible]	98	98	32	26	45	26	45	26	45	98	98	98	32	32	98	32	32	98	32
[illegible]	70	69	58	55	59	53	57	51	54	58	54	46		37	54	48	52	64	56
0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	[illegible]
13	-2	-2	13	0	-2	0	-2	0	-2	8	8	-10		-4	-10	0	-4	-10	[illegible]
25	25	25	25	25	25	25	25	25	25	25	25	25		25	25	25	25	25	[illegible]
98	93	92	96	80	82	78	80	76	77	91	87	61		58	69	73	73	79	81
-98	-93	-92	-96	-80	-82	-78	-80	-76	-77	-91	-87	-61		-58	-69	-73	-73	-79	[illegible]
---	1	1	---	10	6	16	10	25	20	1	2	800		1600	125	50	50	12	[illegible]

4, 231 pWpO and the uplink interference is computed to be 2, 739 pWpO for a total of 6, 970 pWpO. This is almost 8 dB above the 1000 pWpO criterion. However, closer examination of the COMSAT applications reveal that they are proposing the use of 32 ft antennas in Alaska only. If RCA is given the exclusive right to serve Alaska, then COMSAT would be using only 98 ft antennas in CONUS. With a 98 ft antenna the downlink interference would be reduced to only 530 pWpO Further changes to reduce the uplink interference are discussed in section 4.

3.8 MCI

The interference calculations for the western-most MCI satellite (MCI_1) are given in tables 8A and 8B. The downlink and uplink interference for a 32 ft antenna and an EIRP of 85 dBW are computed to be 4, 185 and 869 pWpO, respectively. Since MCI proposes to use the 32 ft antennas at all locations, this is the best performance that can be expected. The great majority of the downlink interference comes from the four closest satellites. If 60 ft antennas were employed, the downlink interference would be reduced to approximately 1300 pWpO and it would be reduced to approximately 400 pWpO if 98 ft antennas were used. The interference calculations given by MCI in their application are not sufficiently detailed to permit an evaluation of how they intended to meet performance objectives in terms of interference. It would appear that with the 32 ft antennas, the interference would exceed the CCIR Recommendations at the 5° spacing they propose between their own satellites.

TABLE 8A

4GHz DOWNLINK INTERFERENCE TO THE MCI EARTH STATION FROM:

SATELLITE	TCI$_1$	TCI$_2$	RCA$_1$	RCA$_2$	H$_1$	H$_2$	RCA$_3$	C$_1$	WU$_1$	C$_2$	WU$_2$	C$_3$	WU$_3$	F$_1$	F$_2$	ATT$_1$
ANGLE (DEGREES)	54.5	52.0	49.5	45.5	43.0	40.0	37.5	35.0	32.5	30.0	27.5	25.0	22.5	18.0	13.5	9.0
ANT. SUPPRESSION (32')	59	59	59	58	57	57	56	55	54	53	52	51	50	48	45	41
POLARIZATION ISO.																
SAT. EIRP ADJ																
INT. REDUCTION FACTOR	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
NET SUPPRESSION																
INTERFERENCE dBmOp	-84	-84	-84	-83	-82	-82	-81	-80	-79	-78	-77	-76	-75	-73	-70	-66
INTERFERENCE pWOp	4	4	4	5	6	6	8	10	13	16	20	25	32	50	100	250

TOTAL 4,185 pWOp

[illegible] 6A

[illegible] TO THE MCI_1 EARTH STATION FROM:

[illegible]	[illegible]	$[illegible]_2$	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
.5	+3.0	40.0	37.5	35.0	32.5	30.0	27.5	25.0	22.5	18.0	13.5	9.0	4.5		4.5	9.0	13.5	[illegible]	[illegible]
[illegible]	57	57	56	55	54	53	52	51	50	48	45	41	33		33	41	45	[illegible]	[illegible]
25	25	25	25	25	25	25	25	25	25	25	25	25	25		25	25	25	25	[illegible]
-83	-82	-82	-81	-80	-79	-78	-77	-76	-75	-73	-70	-66	-58		-58	-66	-70	-73	[illegible]
5	6	6	8	10	13	16	20	25	32	50	100	250	1600		1600	250	100	50	[illegible]

TABLE 8B

6GHz UPLINK INTERFERENCE TO THE MCI_1 SATELLITE FROM THE EARTH STATION OF:

...LLITE	TCI_1	TCI_2	RCA_1	RCA_2	H_1	H_2	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	[illegible]
...LE (DEGREES)	54.5	52.0	49.5	45.5	43.0	40.0	37.5	35.0	32.5	30.0	27.5	25.0	22.5	18.0	13.5	9.0	[illegible]
...T. SITE	60	60	32	32	98	98	32	26	45	26	45	26	45	98	98	98	
...T. SUPPRESSION	68	68	62	62	71	70	60	57	61	55	60	53	57	61	58	54	
...LAR. SUPPRESSION																	
...I. EIRP ADJ	1	1	7	7	2	2	7	4	2	4	2	4	2	12	12	-[illegible]	
...T. REDUCTION FACTOR	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
...I SUPPRESSION																	
...TERFERENCE dBm0p	-94	-94	-94	-94	-98	-97	-92	-86	-88	-84	-87	-82	-84	-98	-95	-71	-
...TERFERENCE pW0p	---	---	---	---	---	---	1	3	2	4	8	6	4	---	---	80	[illegible]

...TAL 869 pW0p

[illegible] 83

[illegible] MCI_1 SATELLITE FROM THE EARTH STATION OF:

	[illegible]	[illegible]	RCA_3	C_1	WU_1	C_2	WU_2	C_3	WU_3	F_1	F_2	ATT_1	CS_1	MCI_1	ATT_2	CS_2	MCI_2	ATT_3	CS_3
	[illegible]	[illegible]	37.5	35.0	32.5	30.0	27.5	25.0	22.5	18.0	13.5	9.0	4.5		4.5	9.0	13.5	[illegible]	22.5
	98	98	32	26	45	26	45	26	45	98	98	98	32	32	98	32	32	98	32
[illegible]	71	70	60	57	61	55	60	53	57	61	58	54	37	X	47	44	49	61	[illegible]
														X					
	2	2	7	4	2	4	2	4	2	12	12	-8	4	X	-8	4	0	-[illegible]	-
25	25	25	25	25	25	25	25	25	25	25	25	25	25	X	25	25	25	25	25
														X					
-[illegible]	-98	-97	-92	-86	-88	-84	-87	-82	-84	-98	-95	-71	-66	X	-64	-73	-7[illegible]	-7[illegible]	-[illegible]
---	---	---	1	3	2	4	8	6	4	---	---	80	250	X	400	50	40	[illegible]	[illegible]

4.0 Discussion

Table 9 summarizes the interference levels calculated in section 3.0. The downlink performance appears to be adequate in all but three cases - Western Union, COMSAT, and MCI. As noted in section 3.7, however, COMSAT only proposes 32 ft antennas in Alaska and if RCA was exclusively authorized to give this service all of COMSAT's remaining CONUS stations would use 98 ft antennas. With 98 ft antennas, the downlink interference would be just 530 pWpO. The two remaining cases - Western Union and MCI - are more difficult to resolve. Both propose relatively small antennas - 45 ft and 32 ft, respectively. The total Western Union interference is not categorically unacceptable. An increase in antenna size to 60 ft would reduce the downlink interference from 1650 to 528 pWpO, an acceptable level. The crucial factor in the case of MCI is whether or not the performance would be acceptable if their two satellites were spaced at 5° (as they propose) and the 32 ft antennas were used. The 5° spacing would reduce the interference by only 1 dB. It is pretty clear that the 1000 pWpO performance objective would not be met, but MCI's definition of acceptable performance for the services they expect to offer is not evident. Since the spacing used in this sample orbit allocation is comparable to the spacing they actually propose, it could be argued that the allocation would be acceptable. As noted in section 3.8, increases in antenna size to 60 ft and 98 ft would reduce the downlink interference to approximately 1300 and 400 pWpO, respectively.

Because of the limitations on maximum flux densities incident on the earth, the satellites are all relatively homogeneous. They all propose satellite EIRPs of about 33 dBW. This tends to simplify the downlink interference situation. This is not the situation in the uplink case. AT&T, for example, proposes an earth station transmitter power