PROPOSAL

TECHNOLOGICAL INNOVATIONS IN VIDEO AND THEIR POTENTIAL IMPACTS ON INDUSTRY, CONSUMERS AND GOVERNMENT

DENVER RESEARCH INSTITUTE
UNIVERSITY OF DENVER

Denver Research Institute Proposal No. IE-7241/G28

TECHNOLOGICAL INNOVATIONS IN VIDEO AND THEIR POTENTIAL IMPACTS ON INDUSTRY, CONSUMERS AND GOVERNMENT

- Submitted to -
Policy Support Division
Office of Telecommunications
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Boulder, Colorado

- Submitted by -
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STATEMENT OF PROPOSAL

It is proposed that the United States Department of Commerce, Office of Telecommunications, enter into a cost reimbursement contract with the University of Denver (Colorado Seminary)*, Denver, Colorado, 80210, for a period of eight months and in the estimated amount of $54,081 to perform the research proposed herein. The research proposed will be performed by the Denver Research Institute, a department of the University of Denver.

*The correct corporate name to be used on contracts is: Colorado Seminary. This entity is a corporation created by territorial charter on 5 March 1864 which owns and operates the educational institution known as the University of Denver. The University of Denver, as such owns no property and is the degree granting corporation of the Colorado Seminary.

RESEARCH OBJECTIVES

The objectives of this study are: (1) to develop a comprehensive inventory of potential technological innovations in the video industry; (2) to identify those innovations which, in terms of market potential and technological feasibility, may be commercially introduced within approximately the next decade; and (3) to estimate the impact of selected innovations on industry, the consumer and spectrum allocation and regulatory policy.

BACKGROUND OF THE STUDY

Telecommunications policy makers are faced with an uncertain picture of the video industry's course over the next decade and beyond. The uncertainty results from interplay of a large number of potential technological innovations with complex market and regulatory forces.

Video distribution by cable, satellite and ground-based microwave are alternative distribution modes technically available and in some cases already in use. Wide band carrier or digital transmission over two-wire circuits is also being considered. Multiple distribution modes will have a significant effect on future policy, particularly because these alternative modes allow expansion of video distribution from almost solely commercial and educational broadcasting to uses such as video shopping, remote conferencing and still presentation of textual material.

Approaching saturation of the color TV market will spur technological and product innovation by manufacturers to sustain market strength. Large flat wall screens, stereo TV and highly selective advanced technology receivers are examples of potential innovations. The policy maker needs to know the stage of technical development of these innovations, their market feasibility, their potential economic and social impacts on the consuming public, their spectrum requirements and therefore their implications for spectrum allocation and regulation. In addition, the policy maker should be aware of how policy can encourage or impede each potential innovation.

Much recent study has been focused on cable television (CATV) such as the recent Sloan Commission report, On The Cable - The Television of Abundance.

the National Academy of Engineering study, Communications Technology for Urban Improvement and the Urban Institute study, Cable Television in the Cities: Community Control, Public Access and Minority Ownership. In addition to policy-oriented studies, commercial market analyses such as Frost and Sullivan's evaluation of the closed circuit television market and studies of the CATV and video cassete markets are available to all concerned parties. Proprietary market analyses of potential innovations also have been conducted by video manufacturers and broadcast distributors. These studies tend to focus on one or a few innovations; what is required now is a comprehensive, policy-oriented study to provide policy-makers with an overview of all major potential video innovations and their possible consequences for the consumer, for industry and for government.

STUDY PROCEDURE

To ensure a comprehensive review, a service function point of view will be adopted. The system service function will be defined as delivering video information to home or business. This includes not only the present entertainment/advertising/education function, but also new services such as still presentation of textual material, conferencing and video shopping. It is not the intent of this study to duplicate the extensive work already done on the implications of CATV; rather, the results of such research will be incorporated into the review contained in this study.

Task 1 -- Comprehensive Review of Video Technology.

A policy analysis approach will be used based on likely future applications and their potential consequences. The first tasks in this policy analysis approach will be to identify probable technological innovations, evaluate market and technical feasibility, and estimate a time scale for introduction for each innovation. This portion of the study will be accomplished initially by review of the literature, including professional technical and policy-oriented literature, and generally available market studies. Advances in related technologies such as microwave communications, solid state circuitry and lasers will be reviewed with respect to potential video applications. With the literature providing background, a series of personal and telephone interviews will be conducted with selected experts in the electronics and the broadcasting industry, in government regulatory and related policy making agencies (e.g., FCC, OTP), and with individuals involved in research and development of related technologies. Particular emphasis in these interviews will be on determining an estimated time of introduction of the innovations, (e.g., within one decade, two decades or more), evaluation of the potential market (e.g., what segment, what size) for the innovation, and estimated probability of market success. Many innovations to be introduced in the next ten years already exist in the prototype or advanced development stage. Special effort will be directed to identifying those that exist only in conceptual form. A tentative interview guide is presented in Exhibit 1.

From the literature review and interviews, the possible innovations will be listed in a matrix form with columns for present stage of development, estimated date when a laboratory prototype will be tested and approved, estimated date when the device or system can be introduced on the market, and major barriers to introduction (e.g., regulatory, market demand, incompatibility with existing system). This will allow evaluation of each innovation and selection of several (approximately four to six) for impact analysis. Each innovation will be described in enough detail for a non-expert to understand its application. A rating system for probable impact will be developed to aid in evaluation of the list. The selection of the innovations for further study will be made jointly with the contractor monitor. A working paper will be issued summarizing the results of the comprehensive review.

Task 2 -- Cost and Marketability of Selected Innovations.

It should be noted that the evaluation process is iterative. The matrix columns for evaluation referred to under Task 1 will be based on literature review and interviews. No detailed primary source market and economic evaluation can be made for the full array of innovations within the scope of this study. Detailed analysis will be conducted for the four to six innovations selected

Exhibit 1

Tentative Interview Guide

1. What significant innovations do you see being introduced in video devices and distribution? When might these innovations initially be marketed?

- For each innovation -

2. In what stage of development is the innovation - concept, lab prototype, advanced development, manufacturing prototype, test marketing?
3. Describe the innovation - function, features, improvement over present system, probable selling price range, spectrum requirements, patentability.
4. What existing or future systems or devices might compete with this innovation? What characteristics of this innovation indicate market success in light of these competing systems or devices?
5. What barriers to successful introduction do you see (e.g., cost, spectrum needs, system compatibility, producibility, distribution).
6. At what market segments would this innovation be directed (e.g., mass market, the affluent, urban, rural etc.)?
7. What other specific marketing information can you give us, such as potential manufacturers, marketing channels, dependence on development of other systems?
8. Where can we find further information on this innovation?

for further study. The procedure for this is explained in the following paragraphs.

The cost of innovation to the supplier and the consumer will be determined and related to the cost of present service wherever possible. Costs will be categorized. For example, for some innovations major costs might be in development; for others development costs might be low but manufacturing or marketing costs might dominate. This will be accomplished through in-depth interviews with experts -- probably individuals at a somewhat more specialized level of organization than in the first set of interviews. Compatibility problems will be identified, so that transition costs on an industry-wide basis can be estimated and approximate total cost of introduction (costs of the innovation itself plus transition costs) determined. As much accuracy as possible in estimates is desired, but in many cases it is expected that cost estimates necessarily will be order of magnitude.

Technological developments in materials and methods have made possible smaller scales of production for some products, thus reducing the need of a mass market for such products to achieve profitability. Concurrently, increasingly higher levels of discretionary income provide sizeable market segments for high cost, specialized products. Some attention will be focused, therefore, on certain innovations with limited market appeal.

Market forecasts will estimate potential market size and segment (e.g., by income level, age group, etc.) and market growth potential. Review of historical market growth characteristics for similar products (e.g., color

TV) will be reviewed to obtain estimates of growth/time relationships. Without historical review, the time span needed for market acceptance is typically underestimated by "advocates" of an innovation. Major potential producers of the products or systems will be identified. Relevant price structures will be reviewed and compared with the price structure for the innovation, and an estimate of sensitivity of the price factor in the buying decision for each innovation will be made. Characteristics of the innovation such as compatibility with existing products or systems and patentability also will have a major effect on market characteristics of the innovation.

A working paper will be prepared discussing the costs, compatibility and marketability of the selected innovations.

Task 3 -- Impacts of Selected Innovations.

Having identified costs and marketability of the selected innovations, a matrix will be prepared to illustrate the impacts of each innovation. The matrix form will call for assessments of consumer, regulatory, spectrum allocation, manufacturing and broadcast industry impact, and whatever specific external problems may be associated with each innovation. Qualitative descriptions of impact which will address issues such as competing products, administrative complexity of regulation and consumer usage patterns will be prepared. These will be accompanied wherever possible by quantitative figures for support such as sales volumes, percent of market penetration, bandwidth requirements and nominal frequency of the required band. This information will be obtained through further interviews and literature review, and staff analysis of technical market literature. Within each of the impact categories, threats and opportunities for industry, the consumer and regulation will be identified.

Impacts will be combined with the cost and market evaluation in matrix display for use by policy makers. The display would be similar to that used in our environmental policy analysis for the National Science Foundation.[1] Accompanying the display will be support writeups of approximately five pages for each innovation assessing the innovations' potential impacts in detail. This format will provide users of the results of this study with an easily scanned overview and backup material to be reviewed on innovations of interest.

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[1] Gilmore, John S., Paul I. Bortz, et al. "Environmental Policy Analysis: Public Policy Intervention in Inter-Industry Flows of Goods and Services to Reduce Pollution," Denver, Colorado: University of Denver Research Institute, August 1971.

Reporting

The written outputs of the study will include three working papers issued at completion of each major task and a summary or executive report together with an overall project report issued at the conclusion of the study. The three working papers will be:

(1) A comprehensive identification of innovations in video devices and distribution, identification of stage of development, probable date of introduction and barriers to introduction.

(2) Costs and marketability of selected innovations with high probability of market introduction within the next decade.

(3) Consumer, regulatory, spectrum allocation, and industrial impacts of selected innovations with high probability of market introduction within the next decade.

At the conclusion of the project, results will be reported in two volumes:

- A summary or executive report of thirty to fifty pages containing the comprehensive matrix of innovations; an impact matrix of the innovations selected for detailed study, approximately five page summaries of each selected innovation including market analysis, possible consequences of its introduction; and a one to two page set of study conclusions.

- A final report including the summary or executive report and a description of the methodologies, sources and analyses leading to the study conclusions.

Figure 1 shows the planned time phasing of the project with written outputs as major milestones. Overall length of the project will be eight months.

Project Schedule

Months After Project Start

Task	1	2	3	4	5	6	7	8
Comprehensive identification of innovations			△ working paper #1					
Costs, and marketability of selected innovations					△ working paper #2			
Impacts of selected innovations						△ working paper #3		
Final report and executive summary								△ Final report

PERSONNEL AND ORGANIZATIONAL QUALIFICATIONS

Personnel

The project will be supervised by Paul I. Bortz of the Industrial Economics Division. Assistance in technical review and evaluation of innovations will be provided by Fred P. Venditti and Ronald E. Sturm of the Electronics Division. John P. Byrden will perform the marketing analysis and John S. Gilmore will participate in the impact analysis. Harold Mendelsohn, Chairman of the University's Department of Mass Communications, will consult in the impact analysis. Resumes of the principals involved in the project follow.

PAUL I. BORTZ, Research Economist

B.S., Aeronautical Engineering, Purdue University
M.A., Applied Mathematics, Harvard University
Additional studies in Business Management, University of California - Irvine; and History of Science, Harvard University

Mr. Bortz's major activities at DRI have involved systems analysis, long-range planning, technology assessment and the management of industrial and governmental agencies. He is acting head of the Industrial Economics Division.

He has analyzed the major scientific and technological advances in the field of electrochemical energy conversion and storage (batteries and fuel cells). The study included identification of advances through literature review and interviews with experts in the field and, using a modified Delphi technique, the assessment of the technical, scientific, social and economic impact of these advances.

Other recent efforts include development of the organizational, staffing and management plan for the 1976 Olympic Winter Games for the Denver Olympic Organizing Committee, and formulation of physical distribution models for a large regional business firm. He has also been engaged in long-range planning, cost analysis and management evaluation for a large regional telecommunications corporation.

Mr. Bortz has supervised a number of studies concerned with the management and operations of criminal justice agencies. These studies have included planning for the consolidation of police telecommunications and records systems in counties within the Denver metropolitan area.

Other research activities have included a study of public policy alternatives in the reduction of pollution for the National Science Foundation, planning and program evaluation in education and health services, and several technology transfer studies.

Prior to joining the Institute, he was employed by Philco-Ford in Newport Beach, California. He was responsible for the management and technical direction of all engineering and test work for an advanced reentry system, and for systems engineering and integration efforts in the development of a second advanced system. During this period, he also performed analytical and experimental studies of plasmas and coauthored several published papers on magneto-hydrodynamics.

Bortz is a consultant for the Colorado Division of Criminal Justice on matters concerning state-wide criminal justice planning and Division management procedures. He has served as chairman of area and county-wide political and community groups, and was a full-time paid campaign director for a county-wide area in a major electoral campaign. While at Harvard, he taught a course in history and philosophy of science for Harvard and Radcliffe undergraduates.

JOHN P. BYRDEN, Research Economist

B.S.B.A., Marketing, University of Denver
M.B.A., University of Denver

Mr. Byrden's principal research activities with DRI have been in the areas of marketing, management and financial analysis, economic feasibility analyses, economic base analyses and financial institution planning.

He has recently been involved in directing several major marketing and economic feasibility studies, including an analysis of the effectiveness of commercial promotional activities and the business potential for several new high-technology products and processes. He recently completed major studies of distribution costs for a large U.S. Corporation, and of parental attitudes toward educational innovation in a suburban primary school. Mr. Byrden has also been involved in a two-year research study in Central America concerned with the feasibility of introducing new technology; and in analyzing the impact of selected technological developments on the U.S. economy.

Mr. Byrden has assisted industrial organizations in identifying potential markets with respect to size, competition and expected share of market, and he has performed market evaluations for organizations considering diversifying through acquisition.

Byrden's previous experience includes three years with the Equitable Life Assurance Society and two years with Radio Corporation of America in New York City. At Equitable he was responsible for controlling the assembly of basic information underlying the calculation of funds, expense charges, and dividends for all group annuity contracts. His responsibilities at RCA included the analysis and reporting of foreign license income, foreign income taxes, and investment incentive tax credits for RCA and its divisions.

In addition to his research activities, Byrden has taught college courses in statistics and has served as an expert witness in anti-trust litigation. Born in Ireland, he has been in the United States since 1960. He is a member of the American Marketing Association, the National Association of Business Economists and Beta Gamma Sigma (Business Honorary).

JOHN S. GILMORE, Senior Research Economist

B.A., Political Science, Colorado College
M.A., Economics, University of Denver
Graduate Work in Mass Communications REsearch at Stanford University

Most of Gilmore's research experience at the Institute (since 1960) has been with policy studies of environmental problems, technology transfer and assessment, regional and urban development, and defense industry diversification.

He has recently supervised projects in corporate policy analysis and planning, and in the development of methodology for environmental policy analysis. He directed the Institute's research into the diversification experience of defense firms and into the applicability of systems approaches to solving non-defense public problems; and he supervised a project to identify the means used by commercial manufacturing firms to acquire new technology from outside their own organizations.

In urban analysis he has directed research on economic and social forecasting in urban areas, on air pollution control policy analysis, on the management of health maintenance organizations, and on educational planning and program evaluation.

Previously, Gilmore founded and for six years published a weekly newspaper in western Colorado. He received professional awards for editorial writing, journalistic achievement and community service. He had six years experience in operations auditing and economic analysis with the Mountain States Telephone and Telegraph Company, and two years in personnel and economic analysis at the Mountain States Employers Council, Inc.

In addition to his Institute research, Gilmore's recent consulting clients have included the Menninger Foundation (study design for a community-wide mental health system analysis); the Office of Educational Research, University of Notre Dame (social and economic forecasts for redesign of a parochial school system); and the U.S. Arms Control and Disarmament Agency. He is a member of the Board of Directors of Monmouth College; is Chairman of the Economic Advisory Committee of the Denver Regional Council of Governments; is on the Board of the Denver Youth Services Bureau and on the Transportation Advisory Committee to the Colorado Air Pollution Control Commission; and he recently completed a term on the Board of Denver Opportunity, Inc. He belongs to the American Economic Association, the Colorado Press Association, Sigma Delta Chi, and the American Society for Public Administration. He teaches a graduate course on Technology and Public Policy in the College of Engineering, University of Denver.

HAROLD MENDELSOHN, Professor and Chairman, Department of Mass Communications, School of Communication Arts, University of Denver

B.S., Sociology, City College of New York
M.A., Sociology and Mass Communications, Columbia University
Ph.D., Sociology, Psychology, New School for Social Research

Dr. Mendelsohn's extensive research experience has been mainly in the fields of communications, social relations, attitudes and public opinion, and the sociology of politics. Mendelsohn is a frequent contributor to scientific social research journals and books. He is either the author or co-author of three books: Mass Entertainment (College and University Press, 1966); Minorities and the Police (Free Press-Macmillan, 1968. Co-author with David H. Bayley); and Polls, Television and the New Politics (Chandler-In text, 1970. Senior author with Irving Crespi). Additionally, he is the author of numerous monographs, policy papers, and book reviews.

Dr. Mendelsohn has worked in a variety of consultive capacities in government, education, business, broadcasting, advertising and social welfare. Most recently, he has acted as a consultant to the Ford Foundation; the Corporation for Public Broadcasting; the Urban Observatory; the Columbia Broadcasting System, Inc.; the National Instructional Television Center; Public Broadcasting Channel KCET-TV, Los Angeles; Academy for Educational Development; Monmouth College; Colorado Department of Education; Frye-Sills, Inc., Advertising; Colorado Department of Health; Bureau of Social Science Research, Washington, D.C.; U.S. Department of Transportation; and the Alfred P. Sloan Foundation.

Dr. Mendelsohn has earned international recognition for his innovative work in mass communications. He was instrumental in developing the award-winning Columbia Broadcasting System's televised National Driver's Test in 1965; and his experimental work in reaching disadvantaged sub-populations via televised dramatizations -- "Operation Gap-Stop" -- was accorded a regional "Emmy" for community service programming in 1967. In 1968 the National Academy of Television Arts and Sciences presented Dr. Mendelsohn a special award for his contributions in developing and evaluating the Cancion de la Raza series, the first major television series directed to the mass education and social amelioration of disadvantaged Mexican-American sub-populations. In 1962 the Television Bureau of Advertising presented him an award for research in television.

He has been a member of the Radio-Television Research Council; the Continuing Conference on Mass Communication and the Public Interest; the Media Research Committee of the American Marketing Association; and the Academic-Business Communications Liaison Committee of the Advertising Research Foundation.

Dr. Mendelsohn is a Fellow of the American Sociological Association and is a member of the American Psychological Association. In addition, he is a member of the American Association for Public Opinion Research, serving on that organization's Executive Council, 1968-1971; the Chicago Press Club;

the Colorado Psychological Association; the National Association of Educational Broadcasters; the Society for the Psychological Study of Social Issues; the World Association for Public Opinion Research; and the Association for Professional Broadcasting Education.

Prior to joining the mass communications faculty, he was an Associate Director of the Psychological Corporation (1958-62). Previous to this he was Associate Manager of Marketing Communications Research for the advertising firm of McCann-Erickson, Inc. (1956-58), and a Research Associate at the Bureau of Social Science Research, the American University, Washington, D.C. (1952-56). Before affiliating with the American University, Dr. Mendelsohn served as a Senior Survey Analyst with the International Broadcasting Service of the U.S. Department of State (1951-52); as a Study Director with the Department of Scientific Research of the American Jewish Committee where, among other research projects, he worked on the Authoritarian Personality study (1947-52); and as a Research Fellow, Department of Sociology, City College of New York (1945-47).

RONALD E. STURM, Research Engineer

B.S., Electrical Engineering, University of Denver
Graduate study at the University of Denver and University of Colorado

Sturm currently is leader of the Electronic Division's Circuit Development Group. He has done considerable work in circuit development and systems resolution studies of delta modulation techniques applied to television transmission and reception and has maintained a continued interest in TV circuits and systems.

Present activities include supervising the design of equipment to study spherics including a real time transient spectrum analyzer and associated discrimination apparatus. He has supervised the development of a portable, transistorized unit to gather data concerning the frequency of occurence, magnitude and direction of noise in the VLF band. Major activities have included real time transient spectrum analysis in the frequency range from 1Hz to 400 MHz.

Prior to joining DRI, Mr. Sturm was a research associate with Colorado Research Corporation where he was associate project manager for a digital television study and project manager of a transistorized power frequency converter. His initial position after graduation was staff engineer with Sandia Corporation in test equipment design and calibration.

Mr. Sturm has written numerous classified and unclassified technical reports and has a patent application for the transient spectrum analyzer.

FRED P. VENDITTI, Senior Research Engineer

B.S., Electrical Engineering, University of Colorado
Graduate study, Advanced Electronics, Harvard (MIT)
M.A., Mathematics, University of Denver

As Head, Systems Engineering and Circuit Laboratory, Mr. Venditti is in charge of instrumentation, system design and circuit development of special electronic test equipment, systems analysis and systems synthesis. Systems analysis and synthesis includes the generation of complete data acquisition, transmission, recording and reduction systems, the analysis of existing systems such as communications networks, and the development of instrumentation to aid in this analysis. Systems specified and developed have included direction finding, real-time spectral analysis and time-domain measurements of transient signals, high PRF transient recorders, special purpose digital computers and computer interface circuits.

With Hathaway Instruments, Venditti was in charge of instrumentation systems and design and development of electronic test equipment. As Senior Electronics Engineer with Motorola he was involved in the design and development of electronic consumer products including stereophonic audio systems, portable broadcast receivers and television receivers, with emphasis on color television.

Mr. Venditti has published in technical journals as well as authoring numerous classified and unclassified reports on systems analysis, circuit analysis reliability and systems design. He has supervised specification and development of medical and psychological instrumentation and is presently developing an automatic vehicle locator system based on the utilization of existing TV signals.

Organizational Qualifications

The University of Denver Research Institute (DRI) conducts research in engineering, socio-economic analysis and the physical, life and mathematical sciences. Established in 1947, the Institute has conducted over 1300 research investigations for government, non-profit institutions and industry with a total value of more than $75 million. Present operations are at an annual level of $6 million performed by approximately 450 scientists, engineers, industrial economists and supporting personnel.

DRI is uniquely qualified to perform the proposed study because of its long-standing continuing studies of technological changes and their economic, social and policy impacts, coupled with its more recent work on telecommunications policy.

In late 1961 the University of Denver Research Institute (DRI) began investigating the transfer of aerospace-generated technology to the non-aerospace community. Research studies have gathered information about the channels of technology acquisition, the technology transfer process, mechanisms for disseminating technology, and technology impacts. Some selected publications are:

Welles, John G., Lloyd G. Marts, Robert H. Waterman, Jr., John S. Gilmore, and Robert Venuti. The Commerical Application of Missile/Space Technology. Denver, Colorado: University of Denver Research Institute, September 1963. [N64-24335; CFSTI**]

Welles, John G. "A Survey of Commerical Uses of Missile/Space Technology." Paper presented at the Briefing Conference on National Patent Policies and Practices, sponsored by the Federal Bar Association and the Government Patent Lawyers' Association in cooperation with the Georgetown University School of Law, Gramercy Inn, Washington, D.C., May 21, 1963. [DRI]

Gilmore, John S., et al., "What Missile/Space Means for Instrumentation," ISA Journal, January 1964, p. 31 ff.

Welles, John G., and Robert H. Waterman, Jr., "Space Technology: Pay-off from Spinoff," Harvard Business Review, July-August 1964, pp. 106-118.

A 1965 study for the Arms Control and Disarmament Agency probed in depth the diversification experience of twelve major defense firms. Most of these diversification efforts involved attempts to apply defense/space technology in the commercial sector. The study sought information useful to sponsoring government agencies and to defense contractors concerned with conversion into non-defense activities.

U.S. Arms Control and Disarmament Agency. Defense Industry Diversification: An Analysis with 12 Case Studies. Report prepared by John S. Gilmore and Dean C. Coddington, University of Denver Research Institute. Washington: Government Printing Office, 1966. [ACDA Publication 30; GPO, $2.25]

Gilmore, John S. "Who Else Applies Technology?" Paper presented at the AIChE Meeting, Dallas, Texas, February 8, 1966. [DRI]

Gilmore, John S., and Dean C. Coddington. "Diversification Guides for Defense Firms," Harvard Business Review, May-June 1966, pp. 144-159.

A 1966 study for NASA looked at the channels by which commercial industry users acquire technological information. Examining two distinct modes of technology acquisition, current awareness and problem-solving, researchers found that textbooks and handbooks were important for problem-solving, and that trade publications and journals were most important for awareness. Research-oriented personnel relied on journals for new information, whereas product-oriented and management personnel utilized vendor catalogs and sales people to learn about new technology.

Gilmore, John S., William S. Gould, Theodore D. Browne, Carl von E. Bickert, Dean C. Coddington, J. Gordon Milliken, and John G. Welles. The Channels of Technology Acquisition in Commercial Industry, and the NASA Dissemination Program. Washington: National Aeronautics and Space Administration, 1967. [NASA CR-790; CFSTI]

Gilmore, John S. "Review of Current DRI Research on Technology Transfer and Application," in Technology Transfer and Innovation, Proceedings. Washington: National Science Foundation, May 15-17, 1966, pp. 112-114. [NSF 67-5; GPO, $0.65]

Browne, Theodore D., and John S. Gilmore. "Technology Transfer and the Universities," Journal of Engineering Education, 59 (October 1968), pp. 121-122.

Gilmore, John S. "The User of Technological Information: Target or Participant?" Paper presented to OST Seminar on Progress in Scientific Publication, Washington, D.C., November 4, 1969. [DRI]

A study for the Arms Control and Disarmament Agency in 1967 examined prior experience and analyzed the future potential for applying the system resources of the aerospace/defense industry to socio-economic problems in the civil sector. The study concluded that the problem-solving capabilities may have more impact on the civilian economy than other types of transfer. The market for defense firms' systems skills was considered uncertain, and the firms' need for "threshold resources" was emphasized.

U.S. Arms Control and Disarmament Agency. Defense Systems Resources in the Civil Sector. Report submitted by John S. Gilmore, John J. Ryan, and William S. Gould, University of Denver Research Institute. Washington: Government Printing Office, July 1967. [GPO, $1.00]

The Project for the Analysis of Technology Transfer, sponsored by NASA since November 1967, is a continuing DRI project. Its primary purpose is to provide data on the uses made of NASA and AEC developed technology, and to provide a better understanding of the technology transfer process. As a part of this project, a Technology Transfer Library and Data Bank have been established. Some selected publications are:

Gilmore, John S., and Theodore D. Browne. "Cost/Benefit Analysis of Technology Transfer." Statement before Federal Council for Science and Technology, Committee on Scientific and Technical Information (COSATI). Task Group on Technology Utilization, Washington, D.C., April 17, 1968. [not available]

Heller, Terry Sovel, John S. Gilmore, et al. Technology Transfer - A Selected Bibliography. Denver, Colorado: University of Denver Research Institute, February 1971. [NASA CR-1724]

Browne, Theodore, D., et al. Project for the Analysis of Technology Transfer; The Initial Year. Denver, Colorado: University of Denver Research Institute, December 1968. [N69-16644; CFSTI]

Coddington, Dean C., Paul I. Portz, and James E. Freeman. Project for the Analysis of Technology Transfer; Annual Report 1969. Denver, Colorado: University of Denver Research Institute, March 1970. [DRI]

Gilmore, John S., and Charleton R. Price. The Environment and the Action in Technology Transfer, 1970-1980: Report of a Conference. Denver, Colorado: University of Denver Research Institute, 1970. [DRI]

Another project sponsored by NASA was a study of the transferability of aerospace management techniques to the management of other large-scale enterprises. The study developed a source book for managers, describing several innovative management techniques augmented in the aerospace sector and illustrating potential applications of the techniques to problems of commercial industry managers and public administrators.

Milliken, J. Gordon, and Edward J. Morrison. Aerospace Management Techniques: Commercial and Governmental Applications. Denver, Colorado: University of Denver Research Institute, November 1971. [DRI]

Milliken, J. Gordon, and John S. Gilmore. "The Transferability of Aerospace Management Technology," American Astronautical Society Paper 68-271, in Space Projections, AAS Microfiche Series, Vol. 8, 1968. [DRI]

Milliken, J. Gordon. "Management Contributions of Space Technology; An Analytical Report," in Proceedings, Sixth Space Congress, Cocoa Beach, Florida, March 17, 18, 19, 1969, Volume I, Lloyd E. Jones, III, editor. Cocoa Beach, Florida: Canaveral Council of Technical Societies, 1969, pp. 6-9/16.

A recently completed project for NASA identified and described the nature of NASA-generated contributions to various fields of technology and determined the economic, social, scientific and technological impact of these contributions. Fields in which impact and market analyses were conducted included nickel-cadmium batteries, high power microwave transistors and high stability MOS transistors and integrated circuits.

Robbins, Martin D., et al. Mission Oriented R&D and the Advancement of Technology: The Impact of NASA Contributions. Denver, Colorado: University of Denver Research Institute, January 1972. [DRI]

A policy analysis/technology assessment study for the National Science Foundation was recently completed by DRI. The project developed methodology for comparing the effectiveness and costs (including administrative burdens) of various public policy mechanisms for controlling or reducing pollution. The project developed and demonstrated a format for systematically comparing alternative policies or programs. Economic, social, political, administrative and technological impacts are considered.

Gilmore, John S., Paul I. Bortz, et al. Environmental Policy Analysis: Public Policy Intervention in Inter-Industry Flows of Goods and Services to Reduce Pollution. Denver, Colorado: University of Denver Research Institute, August 1971. [DRI]

Policy analysis of the effects of technological change, regulation, and recent court decisions was performed for Mountain States Telephone and Telegraph Company. The study included a thorough review of anticipated change factors - technical, political, economic and social - and analysis of their implications for Mountain Bell long-range planning.

> Gilmore, John S., Paul I. Bortz, <u>et al</u>. <u>Some Change Factors Affecting Telephone Company Decision-Making</u>, (to be published Spring 1972).

Regional telecommunications policy for public safety agencies has been a major element in several recent studies funded by the Law Enforcement Assistance Administration through the Colorado Division of Criminal Justice. One study involved a review of advances in public safety telecommunications and recommendations for application; other studies have dealt with communications consolidation in Jefferson, Boulder and Adams Counties, Colorado.

> Bortz, Paul I., <u>et al</u>. <u>Police Telecommunications and Information Systems Study, Lakewood, Colorado</u>, Denver, Colorado: University of Denver Research Institute, April 1970. [DRI]

> Bortz, Paul I. <u>Jefferson County Communications and Records Study</u>, similarly for Boulder and Adams County (informal reports available on request).

In addition to market analyses included in the impact studies referenced above, marketing studies for a wide variety of products and services have been performed at DRI since 1957. While most of these are proprietary, two particularly relevant studies can be mentioned which dealt with the market for high technology products. One study analyzed three firms which the sponsor was considering acquiring marketing a total of five high technology-based products (e.g., a credit card reading computer terminal). The other study evaluated the market for pneumatic equipment.

> Gilmore, John S., and Robert H. Waterman. <u>An Analysis of the Factors Important in Marketing Pneumatic Accessories to the Small Metalworking Firm</u>. Denver, Colorado: University of Denver Research Institute, October 1961. [Business Confidential]

> Byrden, John P., Fred P. Venditti, <u>et al</u>. <u>Technical and Market Evaluation of Five Selected Products</u>, Denver, Colorado: University of Denver Research Institute, August 1969. [Business Confidential]

Market analyses have been performed for the State of Colorado analyzing Colorado as a location for several types of industry. Two related studies analyzed the electronics industry and research and development laboratories.

> Lessley, Dean R., and Dean C. Coddington. *Analysis of Colorado as a Location for Research and Development Laboratories*, Denver, Colorado: University of Denver Research Institute, January 1969. [DRI]

> Lessley, Dean R., *et al*. *Analysis of Colorado as a Location for the Electronics Industry*. Denver, Colorado: University of Denver Research Institute, June 1969. [DRI]

The University of Denver's Department of Mass Communications has extensive experience in analyzing the impact of mass media. Dr. Harold Mendelsohn, Chairman of the Department, has published extensively on related topics. Some of Dr. Mendelsohn's publications are:

Publications (selected)

> *Mass Entertainment*. New Haven: College and University Press, 1966.

> (with Melvyn M. Muchnik). "Public Television and Political Broadcasting: A Matter of Responsibility," *Educational Broadcasting Review*, December 1970.

> *Radio in Contemporary American Life*. Vols. I and II. Denver: Communications Arts Center, University of Denver, 1968.

> *Continuing Education and the Electronic Media of Communications*. Prepared for the National Instructional Television Center, Indiana University, September 1969.

> *The Neglected Majority: Mass Communications and the Working Person*. Prepared for the Sloan Commission on Cable Communications, Alfred P. Sloan Foundation, March 1971.

> *Social Research and the Audiences for Public Television*. Prepared for the Ford Foundation, April 1971.

Lectures (selected)

"A Plan for Sub-Community Mass Communications Systems." Annual Meeting. National Association of Educational Broadcasters. November 1969.

"The Potentialities of Public Television for the Social Good." Convocation Lecture, Connecticut College, New London. January 1970.

ESTIMATED BUDGET

Direct Labor (includes 13.2% fringe and 12% vacation and sick leave reserve)

Senior Research Economist	2.2 man-months @ $2610	=	$ 5,742	
Senior Research Engineer	1.0 man-months @ 2610	=	2,610	
Research Economist A	5.0 man-months @ 2005	=	10,025	
Research Engineer A	1.5 man-months @ 2005	=	3,008	
Research Economist B	3.0 man-months @ 1635	=	4,905	
Research Technician A	2.0 man-months @ 1065	=	2,130	
Secretary	1.5 man-months @ 675	=	1,013	
	Subtotal		$29,433	

Overhead @ 66.5%* of direct labor — 19,573

Travel

10 round trips/transportation	$2,100	
35 days per diem @ $25 maximum	875	
Local transportation	150	
	$3,125	3,125

Supplies and Expense

Long distance telephone, books, market reviews, miscellaneous — 750

Report Publication

100 copies of final report and
100 copies of executive report — 1,200

Total — $54,081

* Indirect cost-rate may be verified through DCAA, Denver branch, Phone 837-3077.

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)

SUBMARINE CABLES and COMMUNICATIONS SATELLITES:

Some Recent Developments

Sharon K. Black

December 7, 1971

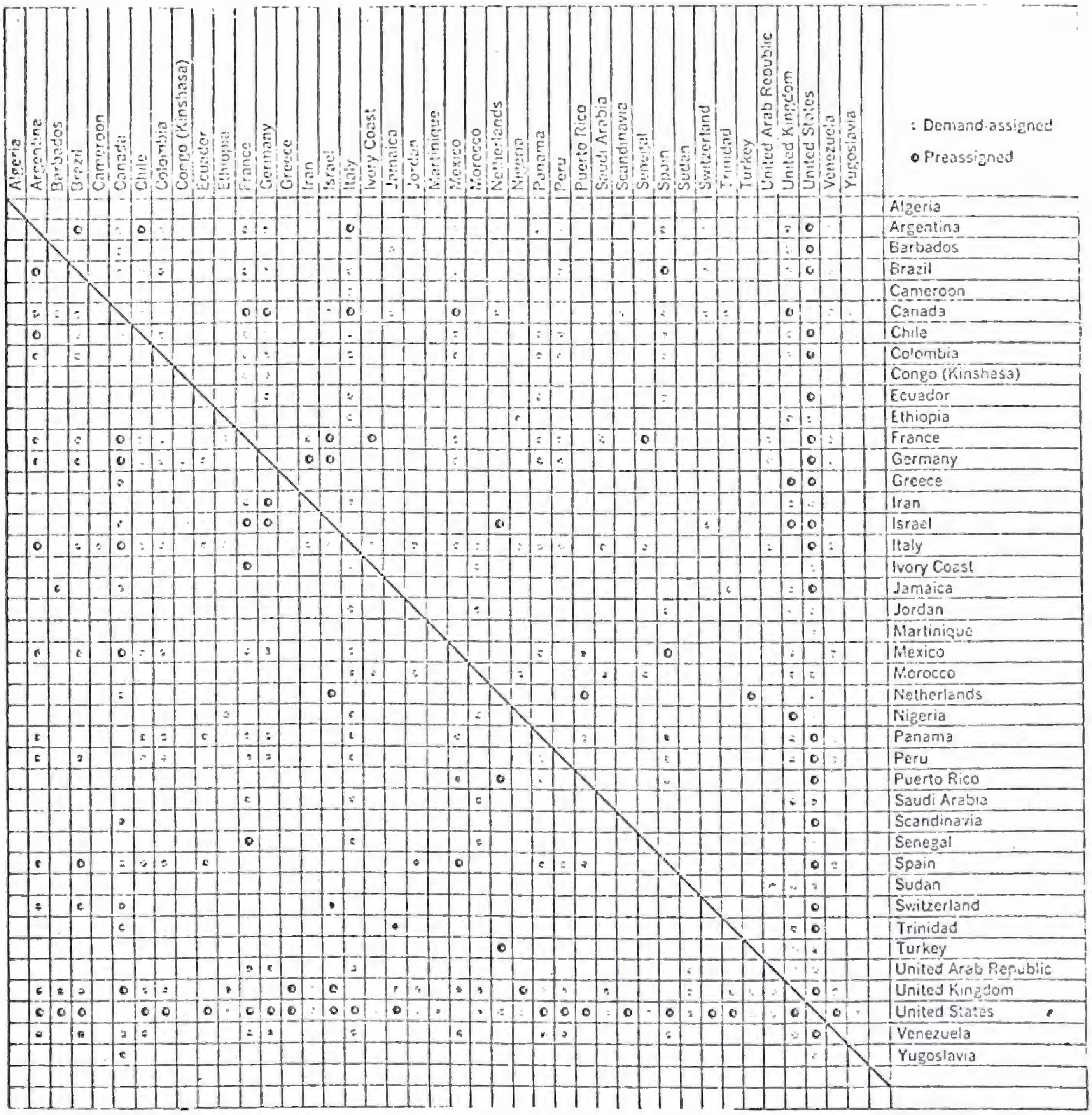
OUTLINE

"In the past ten years, communications to foreign countries has grown almost three times as fast as domestic communication service."[1] According to the 1971 Annual Conference of the International Communications Association (ICA), future demand levels for international communications will continue to rise as the volume of equipment and possibilities for use increase.[2] (See chart on page 2.) AT&T Co., for example, reports that direct dialing service of overseas telephone calls has been expanded to Denmark, Norway, Sweden, Switzerland, and Luxembourg in addition to the existing service reaching the British Isles, France, Germany, and Belgium.[3] The British Post Office (PO) currently offers data services (DATEL) over leased international telephone and telex circuits up to 2400 bits/second over 4-wire private channels and 600/1200 bits/second for public switched networks.[4] In addition, UNESCO[5] and population-expansion scientists[6] cite international telecommunications as the "key to human progress" providing the technology to link the information resources of the world.

To meet this demand, telecommunications advances must provide an expanding level of capacity in the principle modes of international communications: submarine cables and communications satellites. This paper will explore the most current developments in spectrum expansion of these areas: the SF cable and digital communications satellites. While research provides continually newer techniques, these developments currently lack sufficient data to make field tests economically feasible, and they prove too numerous to be included in the scope of this paper.

Figure 1:

Summary of traffic density among Intelsat stations in early 1970's.



Source: Puente, J.G. and Werth, A.M., "Demand-assigned service for the Intelsat global network", IEEE Spectrum, January, 1971, p.61.

II - The SF Submarine Cable

Since 1956, submarine cable has been recognized as an effective method to achieve steady international communication. The SF cable developed by Bell Labs, provides 720 two-way voice channels with capability up to 4,000 miles increasing the number of available submarine voice channels by 50 percent.[7]

Major differences between the SF cable and previous submarine cables include the use of transistors rather than vacuum tubes, and a larger diameter cable design. Transistors marked a turning point in cable technology by reducing the power requirement by a factor of ten, allowing more reliability and closer spacing of repeaters. It is through the variations of these parameters that future cables will be able to reach the capacities desired by the FCC.[8]

For example, the SF cable contains a 0.33 inch diameter welded copper inner conductor, 1.50 inch polyethylene dielectric, a 0.0095 inch overlapped-seam copper outer conductor, and is covered by a 1.75 inch polyethylene jacket.[9] In comparison, the SB cable, an earlier cable design, claimed a diameter equalling 0.620 inches, while the SD system's diameter reached 1.000 inch. (See charts on page 4.) These resulted in channel capacities (3 kHz) of 48, 128, and 720 channels for the SB, SD, and SF systems respectively. The top frequency on each cable fell at 164 kHz for the SB system, 1.1 MHz on the SD cable, and 5.9 MHz on the current SF cable. To provide this, the SB cable consisted of armored cables with flexible vacuum tube repeaters, while the SD and SF operate armorless with rigid repeaters (the SD still a vacuum tube).

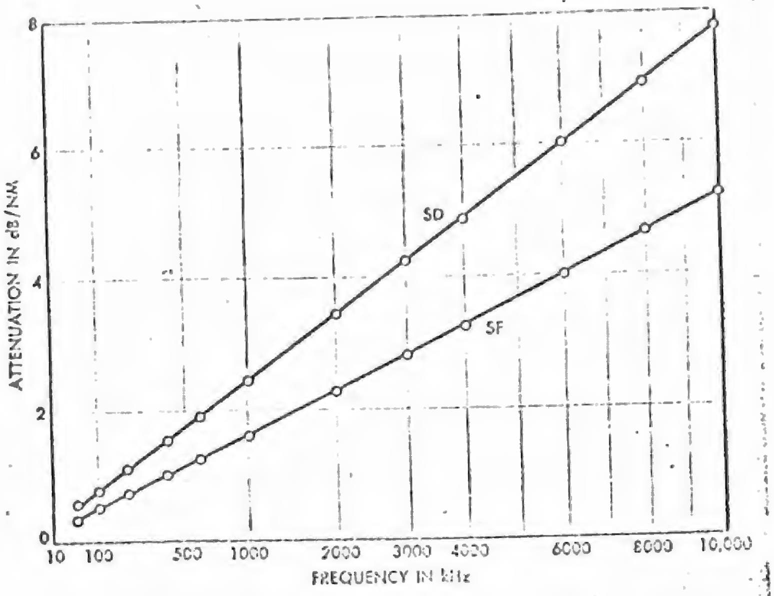


Figure 2a: *Differences between the SD and SF cable designs result from the substantially wider frequency band of the SF system and the consequent need for lower attenuation. The highest frequency in the SD band is 1.1 MHz, while the SF band extends to 5.9 MHz.*

DEEP-SEA CABLES — OLD AND NEW

Cable	Core Dia.	Outside Dia.	Weight in Water (Pounds per Nautical Mile)	Attenuation at 20°C, 0 Pressure (dB per Nautical Mile)	Impedance (Ohms)
Havana to Key West (SA)	0.460	1.12	3000	2.16 (150 kHz)	43
SB	0.620	1.25	3800	1.70 (164 kHz)	54
SD	1.000	1.25	1900	2.4 (1 MHz)	44
SF	1.500	1.75	2100	4.0 (6 MHz)	60

Figure 2b: *Though the SF cable is larger than any predecessor, its weight per nautical mile in water is less than either of the two earlier designs and only slightly greater than that of the SD cable. Though the SF band is six times as wide, cable attenuation at the highest frequency is only 1.6 dB per nautical mile greater. The diameters shown in this table are expressed in inches.*

Source: Lebert, A.W., and Kreutzberg, J., "Ocean Cable for the SF System", Bell Laboratories Record, Vol. 45, No. 10, November, 1967, p. 323.

The number of components per repeater in the three types varies significantly. 67 components supported the SB cable, with repeater spacing at 38.7 nautical miles, while 205 components comprised the SD system with a spacing of 20 nautical miles.[10] Only 161 components support the SF system, including four diffused germanium transistors and five diffused silicon diodes, but they are spaced every 10 miles. This closer spacing of the repeaters reduces the attenuation factor, thus increasing the signal to noise ratio at the receiving end of the system. Since the loss characteristics are proportional to the square root of the frequency (4 db/mile at 5.88 MHz), reliable system design matches the repeaters' gain to this loss. To achieve this, the SB repeater power output must equal 0.1 watt with a noise figure of less than 8 db. Feedback at the top of the frequency band falls around 20 db.[11]

To provide this type of high-performance repeater, manufacturers emphasize uniformity in the components of each repeater. The Western Electric shop at Clark, New Jersey stacks the repeater components in a "cordwood"[12] fashion so that all elements are visible throughout the construction process. The same shop then tests, monitors, and ages these repeaters, striving for reliability levels of no more than two failures per system in twenty years. Despite the care taken, however, repeater gain/loss can occur. To minimize this, equalizers (passive devices) are inserted after every twentieth repeater to gather accumulated mismatches.[13]

Before signals can be transmitted over the SF cables, they must be processed by shore terminals. Transforming the incoming 3 kHz voice channels to nine supergroups of 80 voice channels each (plus administrative and advisory tones), they equalize the transmitted 720 channel signal to match the system noise spectrum. An equivalent 4-wire system, the SF cable provides two-way transmission on the 6 MHz bandwidth, using different frequency bands and high- and low-pass filters to separate the directions of transmission, allowing one amplifier to serve both directions. The system duplicates all terminal equipment to insure continuous operation.[14]

In addition to these coaxial cables, repeaters, equalizers, and terminals for multiplexing signals and adding power, the SF cable consists of fault location test equipment because of its relative inaccessibility once it is laid.[15] Experiments with new composite materials has also led to optimistic results. The principle alternative to copper being considered is aluminium conductors. While preliminary data indicates that it will be very satisfactory, tests are still defining the limitations and trade-offs.[16] Light weight materials are important because the entire unit must be strong enough to support 4-5 miles of its own weight in water, and to withstand handling operations aboard ship and during laying.

With these design characteristics, the SF systems provide strong supplements for the various existing communications systems. First installed between Jacksonville, Florida and St. Thomas, Virgin Islands (1,250 miles) in 1968, it has proved remarkably reliable by existing industry standards.[17] The use of TASI techniques also expands the capacity of the cables allowing them to meet increasing traffic demands on the Transatlantic and Intercaribbean routes.

III - Communications Satellites

From the Early Bird system launched in 1965 with a capacity of 240 channels and five earth stations, the Intelsat global satellite network has grown to a total of six operational and four spare satellites in orbit with a capacity of 6,000 circuits and 55 ground stations. The latest development in this system is the Intelsat IV containing twelve transponders which provide up to the 6,000 voice circuits or twelve TV channels. The first Intelsat was launched in January, 1971, and the second in September, of this year.

Three specific features of Intelsat IV differentiates it from earlier satellites. A despun antenna complex allows both global and spot beams, while single channel access techniques (SPADE) improve utilization of the 500 MHz total bandwidth of the transponder. The use of spot beams increases the effective radiated power by 10 db.[18]

Each of the twelve transponders consists of an RF bandwidth of 36 MHz. Together, they fill the 500 MHz bandwidths allocated for space communications in the 6 GHz (up-link) and 4 GHz (down-link) bands. The Intelsat IV repeater is typical for a modern space segment, serving as a standard with which to compare proposed systems. Its receiving antenna switches between two redundant RF front-ends resulting in a 4 GHz signal transmitted to the appropriate ground station. A separate bicone antenna processes the command and control telemetry.[19]

In the earlier satellites (Intelsat II and III), frequency-division multiple-access (FDMA) systems operated traveling-wave-tube (TWT) power amplifiers in linear regions to provide wide area reception capability (not point-to-point as with Early Bird and U.S.-European links).[20] However, the FDMA systems operated on pre-assigned frequencies, creating situations where high-traffic routes were overloaded while low-density links went unused.

To achieve more efficient use of the available channels, two alternatives have been suggested: the SPADE system (frequency-division) and the MAT-1 system (time-division). Both systems employ demand-assignment, multiple-access (DAMA) theory.

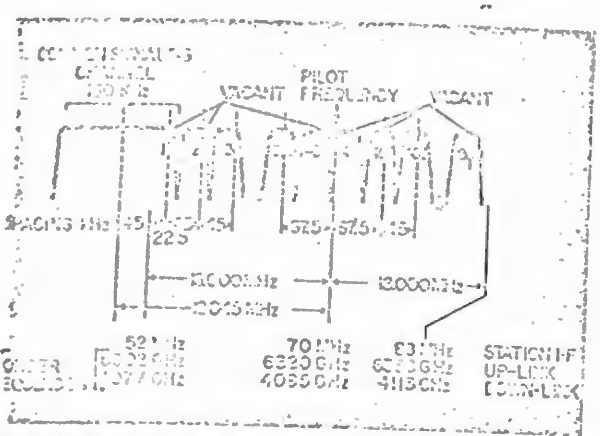
The SPADE approach (single-channel per carrier, pulse-code modulation, multiple-access, demand-assigned equipment) assigns the several channels of a single carrier to a single carrier to a user on demand, shifting overflow traffic to open channels wherever available. Currently it is assigned to only one of the twelve transponders on board Intelsat IV. Each RF carrier in this transponder accomodates a single channel occupying a 45 kHz bandwidth therefore allowing 800 individual carriers to share the 36 MHz bandwidth. (See figure 3a.) Space is provided at the lower end of the band for the common signaling channel, and at the center of the band for a system pilot.[21]

Without the SPADE system, the same 36 MHz bandwidth accomodates: three 24-channel carriers, two 60-channel carriers, one 96-channel carrier, and one 132-channel carrier, resulting in a total capacity of only 418 channels. (See figure 3b.) Therefore, SPADE's capability best serves medium to high-traffic links with minimum channel capacity.[22]

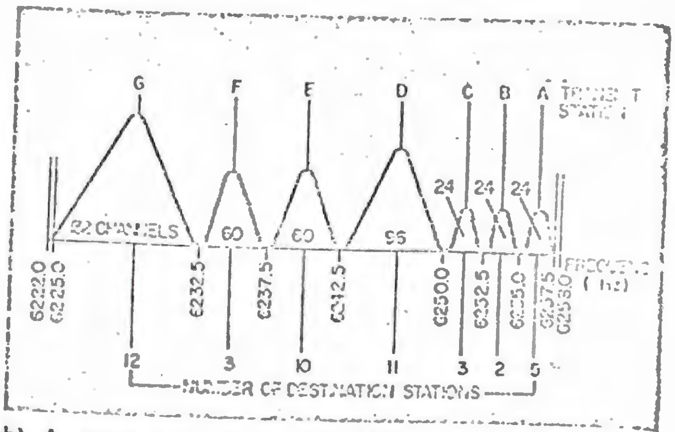
The MAT-1 system, on the other hand, describes a time-division design for higher capacity links (12 to 120 channels).[23] Early Bird, in 1965, carried a MATE three-terminal system (6 Mbits/second) testing burst synchronization to accuracies in the low nanosecond region. MAT-1 represents the next generation of this TDMA approach. Based upon a 50 Mbits/second transmission rate, it yields over 700 8-bit PCM channels in a ten-station network configuration. A DAMA system, all PCM time slots are multidestinational and the channel capacity of each station adapts

Figure 3:

SPADE and conventional channel division



a) The SPADE multiple access technique divides a 36 channel into 800 individually accessible channels.



b) A more conventional 36 MHz channel divides the spectrum into fewer multiple voice-channel carriers.

Source: "Intelsat IV: A network for today", Microwaves, Vol. 10, No. 9, September, 1971, p. 38.

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to the traffic requirements of the network.[24] Bursts are automatically repositioned to accomplish this channel reallocation while the voice traffic continues uninterrupted.

In response to these technological developments, a compatible system is being designed by the Kokusai Kenshin Denwa (KDD) Research Lab. Known as the TTT, this 50 Mbits/second TDMA system includes traffic blocks operating under a PCM-TASI design. Field tests of both the MAT-1 and the TTT terminals were conducted in July, 1970 over Intelsat III (F-4) by stations in Hawaii, Japan, and Australia.[25] With encouraging results, Intelsat has since been studying specification trade-offs for future operational TDMA systems. (See Table 4.)

In these considerations, an important difference between TDMA and FDMA is the terminal cost effectivemess, based on capacity per link.

In a system where several low-traffic areas desire interconnectivity a single-channel per carrier FDMA system is more efficient. Conversely, in a system of few accesses with medium to heavy traffic (12 to 60 circuits) per link, TDMA offers the best solution. In general, as the number of channels per link increases, the effectiveness of demand-assignment channels decreases because earth stations may be forced to process signals through more than one transponder. This increases the costs of the system to include those figures normally associated with multiple

Table 4: TDMA vs. FDMA

	TDMA	FDMA
Intermodulation	Nonexistent	Requires twt output back-off
Up-link carrier control	Can handle wide variation	Requires up-link carrier control
Channels per link	Requires a minimum number of channels per link for efficient power & bandwidth operation	Power efficiency independent of channels per link
Nonstandard earth stations	Requires a minimum G/T for all earth stations	Can handle all-size earth stations
Terminal cost	Low cost for large number of channels per link	Low cost for small number of channels per link
Synchronization	Requires time synchronization	Requires frequency synchronization
Network flexibility	Large number of accesses decreases efficiency; can track variations quickly	Remains at high efficiency for large number of accesses or for any traffic-pattern variation

Source: Pritchard, W.L., and Puente, J.G., "The Advantages of Demand-Assignment for International Satellite Communications Systems," Telecommunications, Vol. 5, No. 3, March, 1971, p. 31.

transmit and receive chains.[26] A switching matrix combining demand-access and pre-assigned channels helps to bridge these intermediate situations. Burst transmissions, channel-organized and grouped by destination, simplify the demultiplexing problem, while the use of TASI techniques increases given channel capacities.

In looking at cost margins, this use of empty channels reduces the cost of the total system because capacity increases, extending the time between necessary additional satellite launchings, and therefore allowing capital investments to cover longer periods of time. By reducing the annual revenue requirements, the user rates fall to lower levels.[27]

IV - Conclusion

A recent example of these lower rates occurred this summer when COMSAT filed with the FCC for a first-step rate reduction of 25 percent for Atlantic area satellite services, effective July 1, 1971. As long as traffic increases as predicted, they also suggested a second-step rate reduction for leased voice grade channels in both the Atlantic and Pacific areas to be effective at the beginning of next year. According to COMSAT, the efforts to expand channel capacity will save the carrier-users more than $1 million each month for the next year and a half.[28] Similar rate reductions have occurred periodically in the cable systems.

Currently, international communications systems employ a "mix" approach using both submarine cable and communications satellites to meet its traffic demands. The trade-offs between these depend on the size and needs of the market served. For example, costs per mile for cable become very expensive, while distance costs have almost no effect on on satellite figures. On the other hand, satellite costs per channel are expensive in low-traffic areas, where cables work well. The life expectency of these cables averages over twenty years, while for satellites it falls around seven years.

Other considerations include the political and economic situation of the market itself. In an area comprised of several underdeveloped countries, the demand trends will reach outward toward trade and communications with the developed countries rather than inward among themselves. In general, these market characteristics describe a need for satellite communication which is still beyond the economic means of these nations.

In any communications link, a back-up system is desirable in case either the satellite or cable system should fail completely. Tremendous capital investment is poured into developing the technology of both of these approaches so that one may back-up the other. Satellites often handle one direction of a conversation while cables carry the response. However, recent use indicates that the time lag and reception levels involved are not equal, leading to a strong signal received on one end, with a weak signal received at the other. As the second party unconsciously speaks louder, thinking the connection is poor, the first party hears shouting. Speaking softer to counter this, the inherent problem in the system is magnified. Obviously, more work in this area is planned for the future.

To optimize the technological advances of international communications, digital, demand-access systems are generally recognized as the best method.

Digital communications offer the capacity, reliability, and flexibility required by future global (20%) and data (80%) demands. According to Intelsat, digital techniques offer more effective utilization of the RF spectrum and satellite power, and signals can be more easily switched and routed in PCM format.[29] This will create a veritable "switchboard in the sky".[30] They feel, that digital systems demonstrate less sensitivity to interference, especially intelligible crosstalk caused by non-linearities in a satellite transponder.

DAMA digital implementation and maintenance cost less than comparable DAMA analog systems,[31] thus offering the large and small user equal access to the satellite system without penalty to either type of user.[32] To provide a model for supporting these statements, COMSAT as manager for Intelsat recently awarded $33,326 to Plessey Telecommunication Research, Ltd. in Berkshire, England to do simulation studies of a digital satellite communication chain.[33]

From this material, it is apparent that the international communications industry will widely adopt digitized methods in the future. With the entire system using one approach, the cost of expensive modulation equipment is saved, and the system will eventually include cable television and data transmission services. This new international common-carrier network, will inevitably require regulation (bit rates, etc.) from a group such as, the CCITT.[34]

Beyond these developments, the distant future will undoubtedly see larger international satellites in synchronous orbit linked with separate DOMSAT systems. The combination will yield more earth stations, faster communication service, and less expensive rates. Most underdeveloped nations will be linked to worldwide satellite communications networks, with digital systems using higher frequencies such as laser channels.[35]

FOOTNOTES:

1/ Welber, I., "The SF Submarine Cable System", Bell Laboratories Record, Vol. 45, No. 5, May, 1967, p. 139.

2/ "Telecom News", Telecommunications, Vol. 5, No. 7, July, 1971, p. 6.

3/ Ibid., Vol. 5, No. 1, January, 1971, p. 8.

4/ Ibid., p. 10.

5/ Busignies, H., "The Future of Telecommunications and their Influence on Mankind, Telecommunications Journal, Vol. 38, No. IV, April, 1971, pp. 203-9.

6/ Austin, Arthur L. and Brewer, John W., "World population growth and related technical problems", IEEE Spectrum, Vol. 7, No. 12, December 1970, pp. 43-54.

7/ Welber, I., op.cit., p. 139.

8/ "News/Washington", Microwaves, Vol. 10, No. 9, September, 1971.

9/ Lebert, A.W. and Kreutzberg, J., "Ocean Cable for the SF System", Bell Laboratories Record, Vol. 45, No. 10, November, 1967, p. 321.

10/ Welber, I., op.cit., p. 143.

11/ Ibid., p. 141.

12/ "Cordwood construction" technique mounts all components between plastic plates with their axes parallel in a manner similar to the pieces of wood in a pile of cordwood. This leaves every soldered connection visible for inspection during construction.

13/ Welber, I., op.cit., p. 141.

14/ Ibid., p. 142.

15/ Ibid., p. 142.

16/ Horn, F.W. and Bleinberger, W.E., "Aluminum-Conductor Cable", Bell Laboratories Record, Vol. 45, No. 10, November, 1967, pp. 314-19.

17/ Welber,I., op.cit., p. 143.

18/ "Intelsat IV: A network for today", Microwaves, Vol. 10, No. 9, September, 1971, p. 35.

19/ Ibid., p. 36.

20/ Puente, J.G., and Werth, A.M., "Demand-assigned service for the Intelsat global network", IEEE Spectrum, January, 1971, p. 16.

21/ "Intelsat IV", op. cit., p. 38.

22/ Ibid., p. 38.

23/ Puente, J.G., Schmidt, W.G., and Werth, A.M., "Multiple-access Techniques for Commercial Satellites", Proceedings of the IEEE: Special Issue on Satellite Communications, Vol. 59, No. 2, February, 1971, p. 219.

24/ Ibid., p. 224-6.

25/ Ibid., p. 224.

26/ Ibid., p. 226.

27/ Ibid., p. 225.

28/ "Telecom News", Telecommunications, Vol. 5, No. 8, August, 1971, p. 1.

29/ Pritchard, W.L., and Puente, J.G., "The Advantages of Demand-Assignment for International Satellite Communications Systems", Telecommunications, Vol. 5, No. 3, March, 1971, p. 30.

30/ Puente, Schmidt, and Werth, op. cit., p. 228.

31/ Pritchard and Puente, op. cit., p. 31.

32/ Puente, Schmidt, and Werth, op. cit., p. 228.

33/ "Telecom News", Telecommunications, Vol. 5, No. 1, January, 1971, p. 10.

34/ Martin, James, Future Developments in Telecommunications, New Jersey: Prentice-Hall, Inc., 1971, p. 348.

35/ Ibid., pp. 345-353.

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1/ Austin, Arthur L. and Brewer, John W., "World population growth and related technical problems", IEEE Spectrum, Vol. 7, No. 12, December, 1970, pp. 43-54.

2/ Busignies, H., "The Future of Telecommunications and their Influence on Mankind, Telecommunications Journal, Vol. 38, No. IV, April, 1971, pp. 203-9.

3/ "First Direct Submarine Cable Link Between United States and England Completed", Bell Laboratories Record, Vol. 41, No. 11, December, 1963, pp. 432-3.

4/ Haviland, R.P., "Why Space Broadcasting", IEEE Spectrum, Vol. 7, No. 2, February, 1970, pp. 86-91.

5/ Horn, F.W. and Bleinberger, W.E., "Aluminum-Conductor Cable", Bell Laboratories Record, Vol. 45, No. 10, November, 1967, pp. 314-19.

6/ "Intelsat IV: A network for today", Microwaves, Vol. 10, No. 9, September, 1971, p. 34-8.

7/ Lebert, A.W. and Kreutzberg, J., "Ocean Cable for the SF System", Bell Laboratories Record, Vol. 45, No.10, November, 1967, pp. 320-23.

8/ Leopold, G. Robert, "TASI-B: A System for Restoration and Expansion of Overseas Circuits", Bell Laboratories Record, Vol. 48, No. 10, November, 1970, pp. 299-306.

9/ Martin, James, Future Developments in Telecommunications, New Jersey: Prentice-Hall, Inc., 1971, pp. 345-53.

10/ "News/Washington", Microwaves, Vol. 10, No. 9, September, 1971.

11/ "Telecom News", Telecommunications, Vol. 5, No. 1, January, 1971, pp. 8 and 10.

12/ Ibid., Vol. 5, No. 7, July, 1971, pp. 6 and 10.

13/ Ibid., Vol. 5, No. 8, August, 1971, p. 1.

14/ The Bell System Technical Journal, "SF Submarine Cable System", Vol. 49, No. 5, May-June, 1970.

15/ Pritchard, W.L., and Puente, J.G., "The Advantages of Demand-Assignment for International Satellite Communications Systems", Telecommunications, Vol. 5, No. 3, March, 1971, pp. 27-33.

16/ Puente, J.G., Schmidt, W.G., and Werth, A.M., "Multiple-access Techniques for Commercial Satellites", Proceedings of the IEEE: Special Issue on Satellite Communications, Vol. 59, No. 2, February, 1971, pp. 218-229.

17/ Puente, J.G., and Werth, A.M., "Demand-assigned service for the Intelsat global network", IEEE Spectrum, January, 1971, pp. 51-9.

18/ Welber, I., "The SF Submarine Cable System", Bell Laboratories Record, Vol. 45, No. 5, May, 1967, pp. 138-43.

POLICY RESEARCH ESTIMATE

Prepared for the

Office of Telecommunications Policy

Hawaiian (International) Question:
A brief survey of the problem and the current
Pacific communications situation

January 11, 1972

Prepared by: Sharon K. Black

Policy Support Division papers consist of policy research estimates (PRE) and policy option formulations (POF). These papers result from a continuing effort to maintain total awareness of activities of interest to, or affecting, telecommunications, and to explore all alternatives to present and contemplated systems and issues. They are reproduced to stimulate discussion of new ideas, to provide data, or to supply background information about various topics related to telecommunications and telecommunications policy. They do not necessarily represent completed studies or official positions, either of the authors, the Policy Support Division, the Office of Telecommunications, Department of Commerce, or the Office of Telecommunications Policy. Instead they are working papers representing the current views of the responsible research team leaders preparing them.

U.S. DEPARTMENT OF COMMERCE
Office of Telecommunications
INSTITUTE FOR TELECOMMUNICATION SCIENCES
Boulder, Colorado 80302

Date: January 11, 1972

Reply to Attn of: PSD/SKB

Subject: Hawaiian (International) question: A brief survey of the problem and the current Pacific communications situation

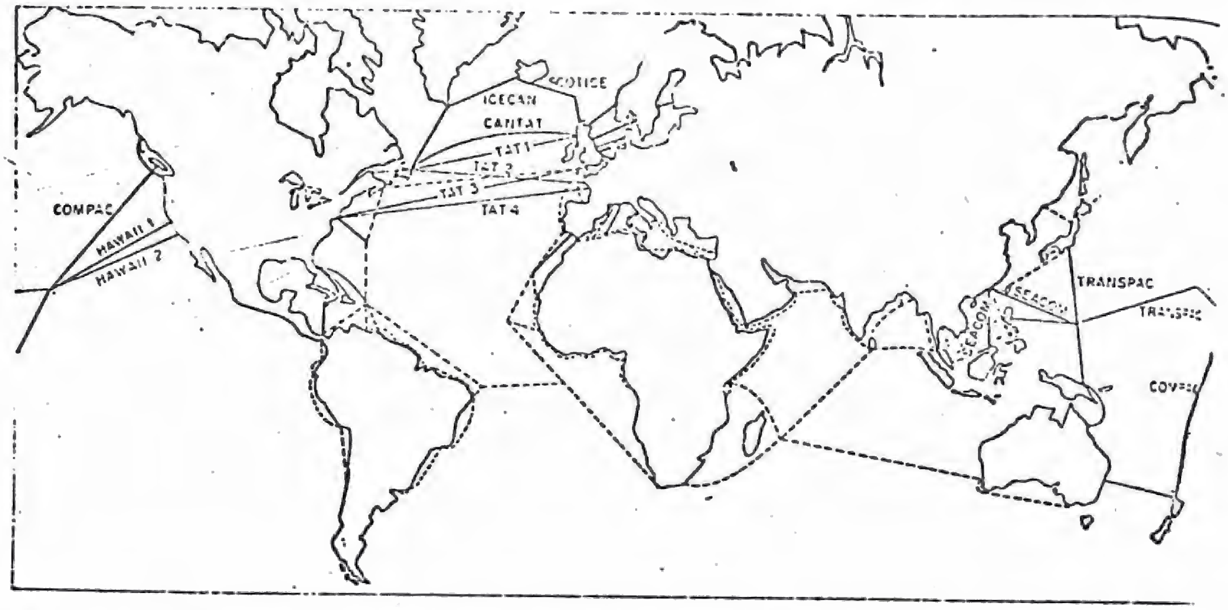
To: R.K. Salaman
D.N. Hatfield

In a recent telephone conversation, Lt. Col. Seb Lasher described to me the principal points of interest concerning the Hawaiian-Pacific communications question. As discussed with Dale, Lt. Col. Lasher feels that an economic-political impact statement of the various alternatives for the U.S.-Hawaiian links would be helpful in future negotiations. At present, the trade-offs using submarine cables, domestic satellites, or international satellites for this market have never been clearly defined. "When we sit down to make a decision, we'd better know how much it's costing us". (2)

In response to this, I began a background survey of the Pacific ocean communications situation. At present, December 1971, two AT&T Co. submarine cables connect the U.S. and Hawaii (1957 and 1964); and one COMPAC (Commonwealth Pacific-1963) cable connects Canada and Hawaii. Of the two AT&T Co. cables, one 50-channel cable links Pt. Arena, California with Hanama Bay on the eastern side of Hawaii; while a 138-channel cable joins San Luis Bisbol, California with Macawa on the western side of Hawaii. (1) The COMPAC cable consists of 80 channels connecting Victoria, Vancouver with Hawaii, Australia, and New Zealand. Links to Japan, Midway, Wake, Quam, the Phillipines, and Australia continue on from Hawaii through various routes. (See charts 1 and 2.) An 845-channel "SF" cable has been proposed by the AT&T Co. and the Hawaiian Telephone Co. to link California with Oahu, Hawaii, but the FCC has not ruled on this as yet.

In addition, communications traffic can be routed through the Intelsat III satellite (1,200 circuits) launched May 21, 1969, and later the Intelsat IV (6,000 voice of 12 TV channels) to be launched January 19, 1972. A spare Intelsat I (Early Bird) exists as a back-up satellite but is not used for normal traffic. (4)

Figure 1 --Predicted submarine-cable network in 1980. The solid lines indicate existing cable, while the dotted lines indicate submarine-cable circuit requirements on new routes.



Source: "Submarine Cable Systems Survey", internal document, Standard Telephones and Cables Limited, London, 1964. (reference 7 - p. 84.)

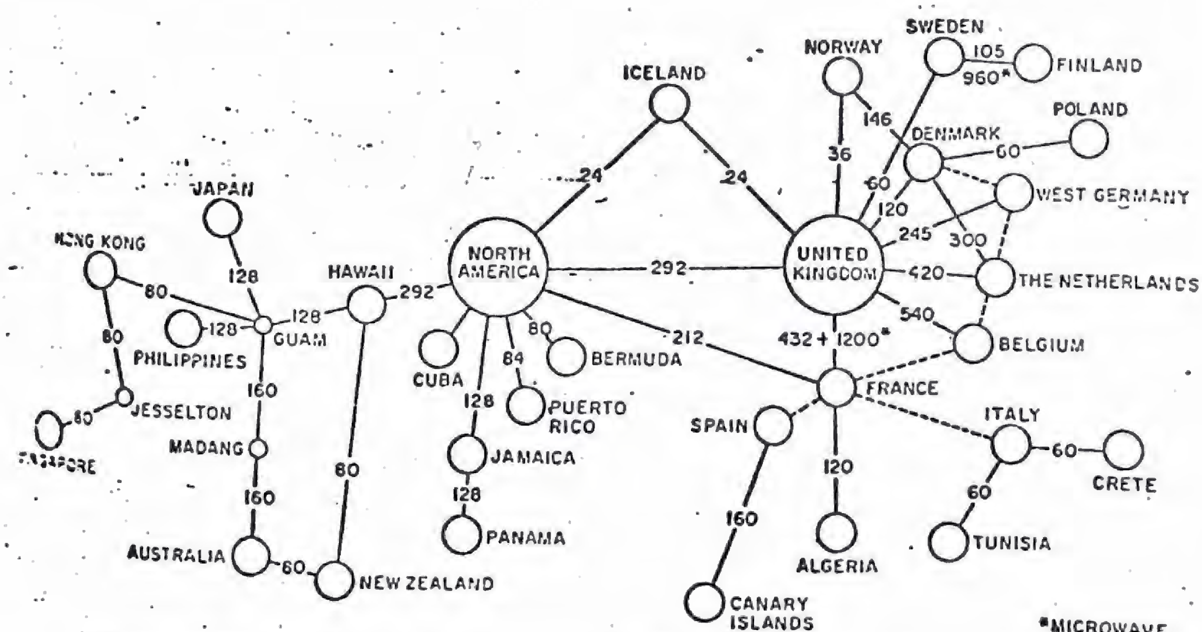


Figure 2—Traffic routing chart for submarine cables. The numbers indicate channel capacities.

Source: a) "General Plan for the Development of the International Network - Rome, 1963", International Telecommunications Union, Geneva, 1964.

b) Standard Telephones and Cables (reference 7 - p. 87.)

Of course, radio, military, marine mobile, etc., links exist in the Pacific, but the question at hand revolves around civilian commercial links. Two main events have prompted study in this area. The recent filings for a DOMSAT system (FCC Docket #16495) include Hawaii and Alaska in the various plans. However, under Intelsat agreement, if a country puts up a satellite, they must have a technically defined arrangement with Intelsat proving that the satellite will not create interference for other existing or planned satellites. Also, if it is to be an international satellite, economic losses to competing international links must be defined. (2) A system is international if it transmits over the high seas (i.e., the Pacific ocean between the U.S. and Hawaii), beyond our legal boundaries, or over territory not under our jurisdiction (i.e., Canada). Under this definition, the DOMSAT plans including Alaska and Hawaii concern international satellites and an economic impact statement must therefore be obtained from Intelsat.

While military, security, social and political reasons make it desirable to include Alaska and Hawaii in a DOMSAT plan, various alternatives exist. Briefly, these include:

1.) the use of submarine cables - these are point-to-point links and therefore are not bound by the international agreements surrounding satellites, and

2.) differentiated prices for various routes - the current rate stands at $1500 per one-half circuit in all three ocean basins while the traffic patterns in thos areas are not equal. Size of satellites, channel capacity, number of subscribers, mode of financing, etc., all represent factors which could be varied to reduce the rates per channel in each area.

The optimum balance of cables and satellites for the Pacific area has not yet been determined, but COMSAT has stated that it does not oppose the presence of the other services. However, since the planned Intelsat IV satellite facilities will be sufficient to meet projected traffic demands in the Pacific ocean area through 1976, COMSAT feels that the construction of other facilities is excessive on a purely economic basis. On the other hand, the proposed cable would provide an appreciable degree of diversity and balance of media, and demand in most areas has historically increased with the availability of new facilities. (See chart 3.) COMSAT does request, however, that the cable should not be used for traffic destined beyond Hawaii unless the SF application can substantially justify its use. The current application does not.

I have already begun to collect information to look further into these alternatives.

The second issue arises from a complaint of unequal treatment for the state of Hawaii by Governor Burns to the FCC. In considering Hawaii's communication requirements, Governor Burns urged that "the needed steps be taken to include facilities servicing Hawaii in domestic rate making and rate averaging". Currently, service rates between the mainland and Hawaii are more than double the highest mainland rates between the contiguous states. Hawaii-mainland or Hawaii-Alaska rates almost equal Hawaii-Japan rates. Also Hawaiians do not enjoy the present mainland lower night rates which are essentially independent of distance, nor do they have WATS or direct distance dialing service. TV transmission, and data, facsimile, and record traffic are too costly for use as in other states.

To correct this situation, Governor Burns points out that rate averaging should come from a single domestic U.S. base. All of the DOMSAT plans have included Hawaii but with delayed implementation of services. Governor Burns feels that Hawaii must be included as a full member of any DOMSAT system and that licensees should be held to offering full service to Hawaii from the beginning date of such a system. "It is not equitable ... that citizens of Hawaii in using interstate communications must carry a heavier burden than other U.S. citizens for making COMSAT or Intelsat workable and for supporting cost-averaged international communications services. These objectives are national and the responsibility for achieving them should be shared equally by all." (6)

A third consideration falls from provisions in the Satellite Act of 1962 that COMSAT should essentially be a carrier's carrier making

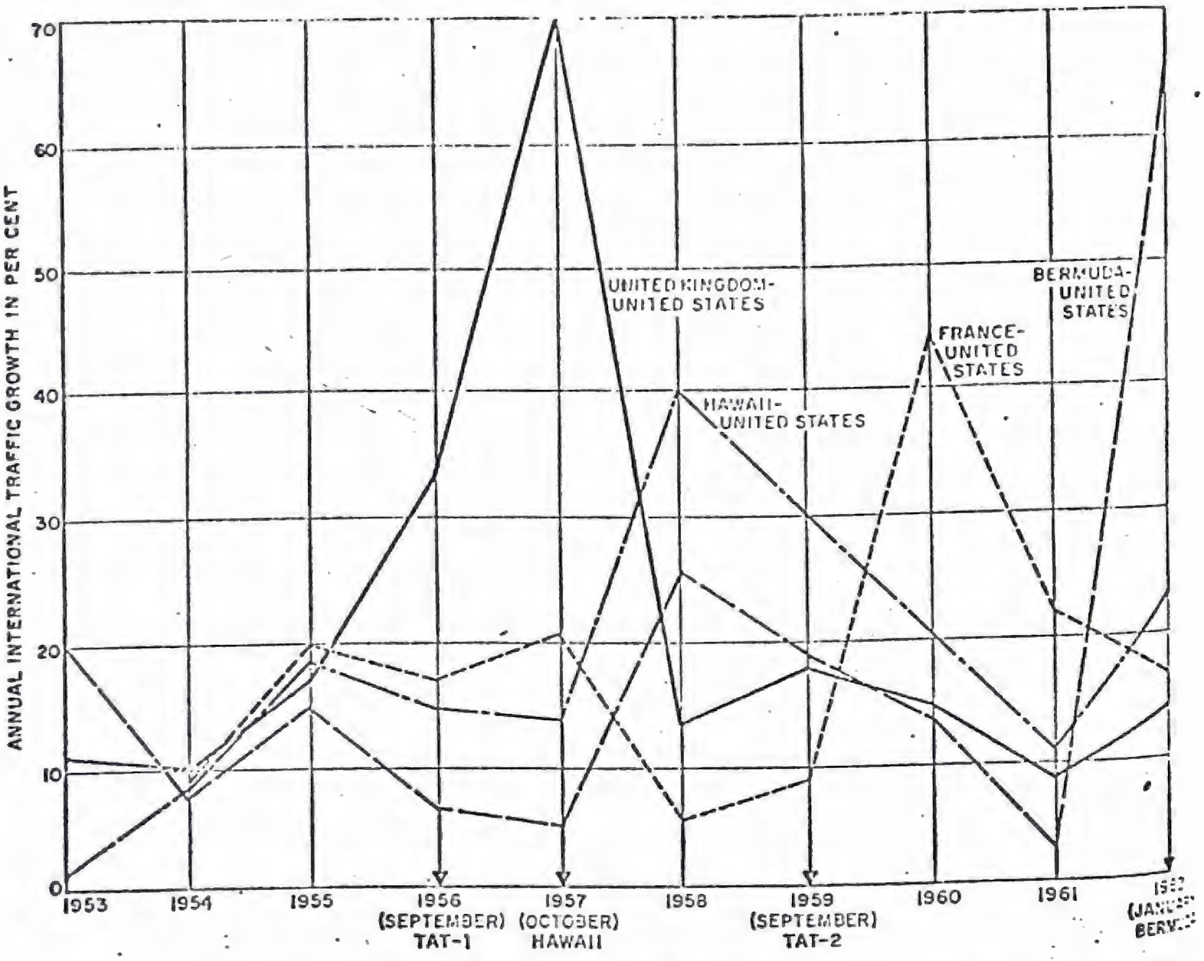


Figure 3—Annual traffic increase in per cent over 4 submarine-cable routes.

Source: a) "General Plan for the Development of the International Network - Rome, 1963", International Telecommunications Union, Geneva, 1964.

b) Standard Telephones and Cables, London. (reference 7 - p. 86.)

the savings from satellite technology available to all modes of public communication (telephone, message telegraph and telex users) by leasing circuits to the owners of the various communications companies. These savings are then to be passed on to the consumers through lower rates. This arrangement, reviewed in the Authorized User Inquiry (Notice of Inquiry, No. 16058 - FCC, June 16, 1965) determined that COMSAT was authorized by law to provide communications service to other entities other than communications common carriers (i. e., government, etc.), but not directly to the ultimate user. This decision led to questions of competing applications for service in the same markets and the ownership of the earth stations involved. (Ownership and Operation of Earth Stations, 5 F.C.C. 2d 812, 1966.) The FCC decided that these should be owned jointly by COMSAT and the terrestrial carriers. COMSAT is to own 50% of these stations and therefore act as station manager, while the other 50% ownership should be divided among the competing carriers. In the case of Hawaii, this division results in: Hawaiian Telephone Co. - 30%, ITT World Communications, Inc. - 6%, RCA Global Communications, Inc. - 11%, and Western Union International, Inc. - 3%. (5) With these earth station ownership rights and the fact that the pending U.S.-Hawaiian cable application is a joint application by AT&T Co. and Hawaiian Telephone Co. it appears that the Hawaiian Telephone Co. will remain economically secure no matter which of the two filings is accepted. The actual tradeoffs and cost/rate balances will be included in the total economic menu now being researched.

Up until now, most of my time has been spent collecting background information in the international area and establishing contacts in COMSAT, AT&T, etc. As a result, we now have a strong file of such information and a good bibliography, but a large gap still remains in FCC information and the work being done at OTP. Even after several phone calls to Washington, I cannot seem to get hold of what OTP is working on or what information lies in the FCC filings. I will need some assistance in collecting this. Once I have this information, an extensive report in the international area could easily be written.

During Dale's absence, I've been reading background information in the land-mobile area in an attempt to familiarize myself enough with the area to offer some research talent to Dale.

In addition, Professor George A. Codding, Jr. (Political Science - University of Colorado) and I re beginning to put together a textbook for the M.S. in Telecommunications program. The book will be entitled, The Regulation of Telecommunications and is scheduled to be completed for class use by Fall semester, 1972 (September). I will make copies of the chapters for the members of the PSD for comment as they become available. The first and second chapters to appear concern themselves with the structure of the communications industry and local problems (for example, franchising CATV systems), respectively.

Just as a general point of interest, my Masters thesis will be concerned with the potential impact of CATV in Europe. At present, the European Broadcasting Union (EBU) forms a strong structure for trading TV programs between the countries but the selection of the programs remains with the governments and not with public demand. With the 20+ channels possible through CATV, a full-time Italian, French, German, etc., channel could be made available to any European country. The ensuing political, economic, and social problems are very similar to those involved in direct broadcast from satellites here in the U.S. (I would like to look into this more closely anyway.) This thesis plan lends itself to incorporating the engineering, political, social and economic aspects of any telecommunications problem area, and hopefully will offer a complete enough model for wide future application in any broad communication link.

S. K. Black

.eferences

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(2) Lt. Col. Seb Lasher, Phone conversation, January 3, 1972.

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(7) Timmerman, Dawidziuk, and Hvidsten, (Standard Telephones and Cables Limited, London), "Expanding Global Submarine-Cable Network", Electrical Communication, Vol. 41, No. 1, pp. 77-90, 1966.

U.S. DEPARTMENT OF COMMERCE
Office of Telecommunications
INSTITUTE FOR TELECOMMUNICATION SCIENCES
Boulder, Colorado 80302

IC

Date: January 20, 1972

Reply to Attn of: BPSD/SKB

Subject: Morning meeting on international telecommunications with Lt. Col. Seb Lasher, Roger Salaman, Sharon Black, and Jack Cole.

To: BPSD

The Thursday morning meeting with Lt. Col. Seb Lasher proved helpful for the BPSD in gaining an understanding of the areas in international communications that the OTP feels merit consideration.

Col. Lasher spent two hours informally outlining the following problem areas:

I. Pacific (Hawaiian) area:
   A. What is the potential economic impact on Intelsat of alternative U.S. Domsat policies (i.e. the removal of Hawaiian traffic from Pacific Intelsat routes)? Could any loss be regained in other places through rates, etc.?

   B. What impact would the inclusion of Hawaii in a Domsat plan have on Hawaiian telephone rates?

   C. How extensive are the Japanese and Canadian plans for increased Pacific submarine cables and domestic satellite systems? How will these plans affect Intelsat?

   D. What impact would different regulatory policies have on the Pacific area? (Especially the suggestions made by OTP, the Department of State, and the Department of Justice.)

   E. What validity does the 1-1 ratio policy between satellites and submarine cables have in the Pacific? Should this be changed?

   F. What are the international political considerations involved?
      1. What international agreements and treaties (trade agreements) affect policy decision-making in the Pacific area?
      2. What will be the probable reaction of our Intelsat partners in the Pacific to policy changes (i.e. new domsat systems) and added circuitry?

   G. Economic considerations:
      1. The leasing of satellite circuits by the common carriers is not a capital investment and therefore cannot be incorporated in the rate base. The suggestion that this lease cost be capitalized on does not appear favorable to OTP because this allows a double counting of the lease for revenue purposes. What are possible alternative solutions?

II. Col. Lasher also mentioned as background information:

A. An SRI computer model (30 K) is being finished which will look at the optimum cost when considering life-exectancies of facilities, cable-satellite mix ratios, costs, etc. It is hoped that this model will be extended to specialized common carriers.

B. Mike Lynch also has a computer program that he has been working with on the international area.

C. The Rostow Report offered several alternatives for restructuring the international communications industry that would be worth looking into further:

1. Should the international industry become a single entity either by assigning one company to handle the traffic, or by allowing a merger of the existing international facilities?

2. Should the customer be allowed to "dial" a carrier preference based on different rates? (Using different prefix numbers to indicate their choice.)

3. Should the TAT-4 decision prohibiting AT&T from transmitting data be reversed? Would this be cartel-management splitting or competition?

4. Do we really want "gateway stations" or should international traffic be distributed from its point of origin? What effect would a change have on the various international common carriers? (For example, 40% of Western Union's domestic business is concerned with transporting international traffic to the gateway stations)

5. Should Comsat be allowed to serve the ultimate users or should it remain a carrier's carrier.

6. Should AT&T be removed from Comsat's Board of Directors? (Gravell Bill).

7. Should Comsat be regulated or allowed to operate on a market mechanism with the entry of other carriers into the satellite area?

8. Should companies other than Comsat be allowed to buy satellites, fill the circuits, and sell communications services?

III. Other bothersome issues:

A. Overcapacity:

1. What drives Comsat to continually larger capacities? Is this in the public interest?

2. What is the "right size" for satellites considering traffic demands and redundancy allowances?

3. Again, what is the proper mix between cables and satellites? The current FCC 1-1 ratio policy creates a monopoly situation for the two groups where the first circuit is expensive and the others free. We need a methodology to help determine the optimum balance.

4. Why are satellites over the Paicfic and Indian oceans the same size with the same rates when the traffic demands are so different?

5. What is the amount of cross-subsidization between heavy and light traffic routes?

6. What would be the effect of satellite-to-satellite relay systems and switching in the sky?

7. What would be the effect of a subsidy on R & D costs? (especially if you could include it in the rate base.)

8. What is the feasibility of most of the alternatives for Intelsat V discussed in a recent ICSC paper? (Bill Lyons)

B. How should we regulate:

1. capital investment

2. the tendency to build large costly earth stations so as to include their cost in the rate base.

C. Look at the OTP letter to Senator Pastore, December, 1971 on the international industry structure and trade negotiations.

D. The electronics equipment producers:

1. We develop the technology for modern communications systems and then export it - only to buy it back again from countries who have capitalized on the technology and produced equipment.

2. How does this practice affect:
   a. international tariff rates, etc.
   b. the domestic electronic equipment industry (for example, equipment production by GT&E represents a much larger share of their business than their common carrier services.)
   c. domestic employment

3. How much money and expense does this actually involve yearly?

4. Are we selling our technology too cheaply?

5. Why don't we sell satellites - i.e. to regional communications systems?

6. What are the problems in the area of equipment producers - if any?

S.K. Black

Memo

To: R. K. Salaman

From: Sharon Black

Date: March 15, 1972

Re: Telephone call from Tom Mustin, OTP (202)395-3783

OTP is interested in contacting a recognized expert in the International Relations field to write a description of the issues involved in the upcoming ITU Conference (1973), and what we can do to better prepare our delegates.

To help in selecting the appropriate person, Tom gave me the following list of names, requesting a brief curriculum vitae of each.

1. Gabriel A. Almond
2. Harlan Cleveland
3. George A. Codding
4. Karl Deustch
5. Robert Dohl
6. Leo Gross
7. Stanley Hoffman
8. Don K. Price
9. Anatol Rapoport
10. Herbert A. Simon
11. Delbert Smith

OT FORM 10
(1-71)

IC 5

OFFICE OF TELECOMMUNICATIONS

April 3, 1972

MEMO

To: R. K. Salaman

From: D. N. Hatfield

Subject: Telephone calls from Seb Lasher and Tom Mustin, OTP, March 28, 1972

I think it might be useful if I briefly summarized the subject telephone conversations.

1. Seb requested that we do some additional work on the DOMSAT issue. As you are aware, the FCC staff recommendations are for a modified open entry policy. OTP apparently feels that this would have many of the disadvantages of both open entry and monopoly but the advantages of neigher. The staff recommendations would allow COMSAT to provide satellites to AT&T or have satellites of their own to compete in the remainder of the market--but not both. Seb reasons that COMSAT will choose the latter for numerous reasons. This will leave AT&T with three choices: (a) go to another supplier, (b) own and operate their own, or (c) enter into a joint ownership agreement with COMSAT. Seb notes that (a) would not be attractive and (b) would force them to be a second round entrant with considerably more requirements to show "public necessity." This leaves (c) which Seb feels is the loophole in FCC recommendations. He and Walt would like an economic analysis of this latter arrangement, particularly with regard to the very large earth stations that would be required. Seb's tentative position is that this is hardly different than the current (proposed) situation with separate AT&T and COMSAT systems. If it makes little economic difference then why require it? It has many disadvantages (redesign, revised proposals, delay, etc.). Any economic difference would be in terms of earth station economies of scale. This is the question we are to address.

2. Tom's call was in regard to the Pacific communications study. The agenda for the first meeting with the representatives from Alaska, Hawaii, and the Dept. of Interior (Pacific Trust Territories) isn't firm yet, but to allow us to get as much lead on the problem as possible,

SURNAME	DATE	SURNAME	DATE

FILE COPY

OT FORM 10
(1-71)

OFFICE OF TELECOMMUNICATIONS

4-3-72

Memo to RKS

Milt and Tom have identified several possible tasks for us. These include:

A. Identifying communication service requirements and highlighting areas of communication concern.

B. Identifying gaps and excessive supply (or plans) in current or planned facilities/services.

C. Surveying technical options (and relevant costs) which might serve the markets previously identified.

D. Providing a time phased schedule (PERT?) of communications support for the Pacific area over the next decade.

Nick is doing a background study on the Trust Territories for us and Sharon's work should also be useful. We also have the OT Hawaiian and Alaskan studies as background.

FILE COPY

SURNAME	DATE	SURNAME	DATE

March 31, 1972

Biographics

Tom Mustin, LCDR, USN, Office of Telecommunications Policy

Enclosed are brief biographics of: Gabriel A. Almond, Harlan Cleveland, Karl Deutsch, Leo Gross, Stanley F. Hoffman, Stanley Hoffmann, Don K. Price, Jr., Anatol Rapoport, Herbert A. Simon, and G. A. Codding.

No information could be found for Robert Dohl and Delbert Smith.

Sharon K. Black
Policy Support Division

Enclosure

SB:CR:ded

BRIEF BIOGRAPHIES

Gabriel A. Almond -- Educator, born Rock Island, Ill., Jan 12, 1911
Ph.D. - Univ. of Chicago, 1938
Fellow Social Sci. Research Council, 1935-36
War Dept., 1945; Yale (Assoc. Prof. Pol. Sci., 1947-49
Princeton (Assoc. Prof.) Int. Affairs, 1951-54
" (Prof.)(?), 1954-63
Stanford Prof. Pol. Sci. 1963- --; Dept. Head, 1964-68
U. of Tokyo visiting prof., 1962
Cons. Air U., 1948; State Dept., 1950; Naval Research, 1951
Rand Corp., 1954-55.
Travel & Study Award, Ford Found., 1962-63
Am Pol. Sci. Assn. (Pres. 1965-66)
Am. Philosophical Soc.

Author of
The American People & Foreign Policy 1950
The Appeals of Communism 1954

Editor, Author: The Struggle for Democracy Germany 1949
Co-Author: Politics of the Developing Areas 1960
" The Civic Culture 1963
Comparative Politics: A developmental approach 1966

HOME: 4135 Old Trace Rd., Palo Alto, Cal.

Harlan Cleveland -- Government official
U.S. Representative to NATO, 1965-69
President of U. of Hawaii, 1969-, --

Author: The Obligations of Power, 1966
Co-Author: The Overseas Americans, 1960
Editor: Promise of World Tensions, 1961
The Ethic of Power, 1962
Ethics and Bigness, 1962

Member, Board of Trustees, "The Experiment in International Living"
Member, Am. Pol. Sci. Assn
Member, Am. Soc. for Pub. Adm.

HOME: 36 Av. du Vert Chasseur, Brussels 18

Karl Deustch -- Political Scientist, Prague, July 21, 1912
Naturalized 1948

M.I.T., Prof. History - Pol. Sci., 1952-58
U. of Yale, Prof., Pol. Sci.
U. of Harvard, Govt., Prof., 1967- --

Dept. of State
Chief of various research Sect.

Author: Nationalism & Soc. Comm., 1953
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World Handbook of Political & Social Indicators
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The Analysis of International Relations
Nationalism and its Alternatives

Mem., Am. Pol. Sci. Assn. (Pres. 1968-69)
" Am. Acad. Pol. & Soc. Sci.
" Am. History Assn.

HOME: 25 Lakeview Av., Cambridge, Mass. 02138

Leo Gross (Leonard) -- Mfg. Co. Executive, born Phila., Jun 9, 1921
Temple U., 1938-40
U.S. Navy/DC, 1944-45

Pres. Shelen Corp., 1961- --
" Golf Ball Inc., Chicago, 1963- --

HOME: 3200 Lake Shore Dr., Chicago

Stanley F. Hoffman -- Govt. Off., born NYC, 1924
BA - Cal., U. of LA, 1947; MA-Econ., Berkeley 1958
Rand Co., 1951-65
Strategic Prog. Def. Dept. 1965-67
Asst. Dir. Budget, US Bu. of Budget, 1967- --
US delegate NATO 1963-64, Paris
Mem: Am. Econ. Assoc.; Am. Statistical Assoc.;
Inst. of Strategic Studies; Operations Research Society.

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Stanley Hoffmann -- Educator, Pol. Sci.

Born Vienna, Austria, Nov. 27, 1928
Grad. Inst. d'Etudes Politiques, Paris, Fr. 1948
Doctorate, Paris Law Sch., 1953
M. A. Govt., Harvard, 1952

Came to U.S. 1955; Naturalized 1960.

Harvard Faculty 1955- --
Prof. Govt. 1963- --
Fellow Center for Adv. Study in the Beh. Sci.
Stanford, Cal., 1965-66

Mem. Council of Foreign Relations
Am. Acad. of Arts & Sci.
Am. Pol. Sci. Assn.
Am. Soc. Intl. Law

Author: Organizations Internationales et Pouvoirs Politiques des Etas, 1954
Le Movement Poujade, 1956
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Co-auth: In Search of France, 1963
The Relevance of Intl. Law, 1968

Editor: Contemporary Theory of Intl. Relations, 1960
Conditions of World Order, 1968

HOME: 91 Washington Av., Cambridge 40, Mass.

Don K. Price, JR -- Univ. Dean

A.B. - Vanderbilt U., 1931; B.A. - Oxford U., 1934
L.H.D. Case Inst. Tech., 1967
US Defense Dept., 1952-53
Pol. Sci. Lecturer, U. of Chicago, 1946-53
Trustee Rand Corp., 1961- --
Asst. to Herbert Hoover --
Advisor to King of Nepal, 1959-61
Assoc. Dir. Ford Foundation, 1953-54; Vice Pres. 1954-59
Prof. Govt.
Dean Kennedy Sch. of Govt, Harvard 1958- --

Author: City Manager Gov in the U.S.
US Foreign Policy; its Organization & Control
The Political Econ. of Amer. Foreign Policy, 1955
Government & Science, 1954
The Scientific State, 1965
Co-auth: The Secretary of State, 1960

Mem. Board of Trustees, 20th Cent. Fund.
Cons. Exec. Off. of President, 1961- --
Dir. Social Research Counc. 1949-1952, 1964- --
Trustee, the Rhodes Trust, 1968- --
Fellow, Am. Academy Arts & Sci.
AM. Phil. Assn.

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Anatol Rapoport -- Math; Biologist - Born in Lazovaya, Russia (1911); U.S. Naturalized 1928.

Assoc. Prof., Stanford, Behavioral Sciences, 1954-55
Assoc. Prof., U. of Mich., Math & Biology
Prof., U. of Mich., Math & Biology -- to present

Author: Science & the Goals of Man, 1950
Operational Philosophy, 1953
Fights, Games & Debates, 1960
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Prisoner's Dilemma, 1965
Two-Person Game Theory, 1966

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Am. Math Soc.
Intl. Soc. Gen. Semantics

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Herbert A. Simon -- Social Scientist; Born Milwaukee, 1916
U. of Chicago, Ph. D.; L. L. D.; Yale 1963; Lund U., Sweden 1968.
Bu. of Pub. Ad., U. of Cal. 1939-1942
Asst. Prof., Pol. Sci., Ill. Inst. Tech. 1942-45
Asso. Prof., 1945-49
Consultant, Intl. City Mgrs Assn., 1942-49
US Bu. of Budget, 1946-49
US Census, 1947
Cowles Found. For Res. in Econ. 1948-60
Consultant & Acting Dir., Management Engineering
Carnegie Inst. Tech.
Prof. of Adm. & Psych. 1949- --
Prof. Comp. Sc. & Psych. 1965- --
Head, Dept. of Industrial Management
Asso. Dean, Grad. Sch.
Lecturer, Princeton, Harvard, Northwestern U., M. I. T.
Member-President's Sc. Advisory Comm. 1968- --
Gov. Milk Inquire Com. 1964-65

Auth: The Sc. of the Artificial, 1968
The Shape of Automation, 1965
New Sc. of Management Dictionary, 1960
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G. A. Codding -- Political Sc.
Prof. Pol. Sc., U. of Colorado 1961- --
U. of Washington, B.A. 1943
U. Geneva, Ph. D. 1952
Am Pol. Sc. Assoc.
Am Soc. of Intl. Law
Intl. Pol. Sc. Assoc.
Western Pol. Sc. Assoc.
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Rocky M. Social Sc. Assoc.
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Author: The Universal Postal Union
--Fed. Government of Switzerland
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Intl. Telecommunications Union
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CC

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)

February 28, 1972

PSD/SKBlack

Work Activities in order of approach

Seb Lasher, OTP

Following our meetings of February 23rd and 24th, I will be working on the following three projects as preliminary research in the specialized common carrier area:

1. Re-verifying the cost characteristics of networks as stated in your memo to the record dated February 17, 1972.

2. Drawing up company profiles of the common carriers. In this, I will research such areas as: where their money is (i.e., percentages of investments, profits, equipment, and labor); how these companies operate; and what conditions, investment, and changes they are sensitive to. Indications of cross-subsidization, etc. should suggest areas where the specialized common carriers might successfully compete with the standard common carriers.

3. Examining station connection wiring costs, beginning with a review of Bruce Carruther's paper dated January 21, 1972. With this information, I will begin a comparative cost analysis of phone jack installations vs. current station wiring practices in order to determine what consumer savings are possible.

Sharon K. Black
Policy Support Division

cc: RKSalaman

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

February 17, 1972

To: The Record

From: Seb Lasher

Subject: Cost Characteristics of Networks

Certain similarities in cost breakouts between the U.S. Postal Service and the nationwide telephone network* suggest that more importance should be associated with local service and switching than heretofore.

% operating costs (including depreciation)

	AT&T	USITA
long distance transmission	17%	8%
switching	45%**	36%
local loops	15%	56%
stations	23%	

USPS

Collection - retailing, stamps	9%
Processing - originating	10%
Transportation-long haul	11%
Processing - terminating	22%
Delivery - local transportation	42%
Administration	6%

* These two networks account for virtually 100% of inter-personal communications within the United States other than face to face.

** 28% equipment, 17% salaries.

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

January 21, 1972

To: Seb Lasher

From: Bruce Carruthers BC – 395-3606

Subject: AT&T Interest in Expensing Station Connections

In an attempt to answer your question why AT&T is interested in expensing station connections, the attached table projects the effects of expensing if it were initiated in 1972. The figures are based on the November 1971 value of Acct. 31.232 (station connections) for the Bell System and a conservative 4% annual growth rate in stations.

Some Observations:

1. Substantial additions to internal cash flow in first four years (bottom line of table). Any reduction in rate base accompanying this cash flow would, of course, be offset by investment of cash flow in other asset accounts.

2. The proportionately smaller rate base which results from expensing will have a long term effect of reducing revenue requirements for station connections (starting year 4(1975)). This would allow Bell to compete more effectively with suppliers who might supply both an interconnected terminal and station connection wiring, etc.

3. In order for AT&T to revise its price structure to be more in line with potential competition from interconnection, it must, according to accounting convention, match revenues with expenses. To structure a lease arrangement (Bell leases services to earn on a rate base; it doesn't sell equipment) to be comparable with outright sale of terminal equipment by competition, a major proportion of the lease cost must be loaded in the first billing period (that is, the station connection cost). Another consideration might be that expensing will allow AT&T more readily to tailor its charges to actual costs of station connection in particular cases, since there's no longer concern with the impact on overall amortization rate, etc. of any asset account. Or in the case where Bell is competing only for the terminal (not the connection), expensing could provide flexibility to load the connection charge to subsidize the terminal cost (price).

BELL SYSTEM STATION CONNECTIONS ACCT. 31.232

Estimate based on November 1971 values (4.7 Billion), 4% growth in stations, and 20% S.L. depreciation rate (including provision for salvage per FCC prescription)

	1972	1973	1974	1975	1976	1977	
	(000,000)						
Write-off old station	940	750	560	380	190	0	
Replacement (cash expenditure)	940	940	940	940	940	940	
Additions (cash expenditure)	198	195	203	211	216	225	
Additions (amortized)		38	38 39	38 39 41	38 39 41 45	38 39 41 45 49	5 yrs. @20%
Expense under capitalization method	940	978	1,017	1,058	1,113	1,162	
Expense with full expensing	2,068	1,885	1,703	1,531	1,346	1,165	
Difference in expense	1,128	907	686	473	213	003	
Minus earnings effect of small rate base @.08	90	162	217	255	273	273	
Minus revenue requirements effect of smaller rate base (tax @ 50%)	180	324	434	510	546	546	(d.r. = discount rate)
Difference in revenue requirements with expensing	948	583	252	(37)	(333)	(543)	PV=0 in 9yrs @4%d. PV=0 in 8yrs @3%d. PV=0 in 10yrs @9%d.
Additions to cash flow with expensing	1,038	748	469	218	(60)	(270)	PV=-641 @9% to ∞ assuming 2% growth in station from 1977 hence

U.S. DEPARTMENT OF COMMERCE
Office of Telecommunications
Washington, D.C. 20230

CC 2

Date: March 9, 1972

To: Seb Lasher

From: Sharon Black

Subject: Re-verification of cost characteristics of networks (Memo-2/17/72)

In looking at the cost breakouts of the nationwide telephone network*, I have come up with the following differences:

(% operating costs - including depreciation)

	2/17/72 Memo	(Ind.)	Bell	USITA
long distance transmission	17%	(8%)	16%	16%
switching	45%	(36%)	24%	20%
local loops	15%	(56%)	25%	33%
stations	23%	"	20%	21%

*This percentages were derived from the FCC and USITA data appearing in the A.D. Little report (pp. 92-3), in the following ratios:

long distance transmission= (toll costs) .16 outside plant costs
(circuit equ).32 of central office eq.
switching = (local dial, & other) .68 of central office eq.
local loops = (exchange) .84 of outside plant cost
stations = (apparatus, connections, & PBX).

Memo

To: R. K. Salaman

From: Sharon Black

Date: March 10, 1972

Re: Telephone call from Bruce Carruther (OTP)

Bruce is turning his attention to station wiring costs and asked us to also start working on this area before we complete the company profiles.

March 16, 1972

PSD/SKB

CC 4

Percentages reported for cost characteristics of networks (Comparison to your 2/17/72 memo)

Seb Lasker, OTP

The attached tables indicate how the percentages reported for network costs were derived (March 9--Washington Memo).

Sharon K. Black
Policy Support Division

Enclosure: 2 tables

Copy to: Ben Gray, ITS (w/encl)

SKB:dd

FORM CD-14 (3-9-59) Prescr. by A.O. 214-2 — U.S. DEPT. OF COMM. — TRANSMITTAL SLIP	DATE 3-16/72
TO: Ben Gray, ITS	REF. NO. OR ROOM, BLDG.
FROM: D Dean, PSD	REF. NO. OR ROOM, BLDG.

ACTION

☐ NOTE AND FILE	☐ PER OUR CONVERSATION
☐ NOTE AND RETURN TO ME	☐ PER YOUR REQUEST
☐ RETURN WITH MORE DETAILS	☐ FOR YOUR APPROVAL
☐ NOTE AND SEE ME ABOUT THIS	☐ FOR YOUR INFORMATION
☐ PLEASE ANSWER	☐ FOR YOUR COMMENTS
☐ PREPARE REPLY FOR MY SIGNATURE	☐ SIGNATURE
☐ TAKE APPROPRIATE ACTION	☐ INVESTIGATE AND REPORT

COMMENTS:

This memo and tables are transmitted without verification by the author.

GPO 643-16-81009-1 411-231 USCOMM-DC

BELL*

(in thousands of dollars)

1965	1966	1967	1968	1969	
1,679,300,000 (.0523) 3,399,100,000 (.1060) (.1583)	1,912,844,375.2 (.0486) 4,371,873,352.32 (.1111) (.1597)	2,039,620,829.76 (.0479) 4,761,865,888.64 (.1120) (.1599)	2,163,887,769.12 (.0469) 5,197,427,877.76 (.1127) (.1596)	2,341,946.4 (.0463) 5,697,940.8 (.1128) (.1591)	(decreasing) (increasing)
7,196,900,000 (.2244)	9,290,230,873.68 (.2362)	10,118,965,013.36 (.2380)	11,044,534,240.25 (.2396)	12,108,124.2 (.2398)	(increasing)
8,837,500,000 (.2756)	10,042,432,969.8 (.2554)	10,708,009,356.24 (.2519)	11,360,410,787.88 (.2464)	12,295,218.6 (.2435)	(decreasing)
7,053,300,000 (.2199)	7,851,161,069 (.1996)	8,535,673,471.0 (.2007)	9,385,967,632 (.2036)	10,418,439.0 (.2063)	(constant)
32,064,800,000 (.8782)	39,316,832,450 (.8509)	42,508,396,757	46,091,401,856	50,479,993 (.8487)	(increasing)

BELL*

(in ~~thousands of~~ dollars)

	1965	1966	1967	1968	
1. Long distance (16%)					
a) Toll (.16 of total outside plant)	1,679,300,000 (.0523)	1,912,844,375.2 (.0486)	2,039,620,829.76 (.0479)	2,163,887,769.12 (.0469)	2,
b) Circuit equipment (.32 of total central office equipment)	3,399,100,000 (.1060)	4,371,873,352.32 (.1111)	4,761,865,888.64 (.1120)	5,197,427,877.76 (.1127)	5,
	(.1583)	(.1597)	(.1599)	(.1596)	
2. Switching (24%) a) Local dial and other (.68 of total central office equipment)	7,196,900,000 (.2244)	9,290,230,873.68 (.2362)	10,118,965,013.36 (.2380)	11,044,534,240.25 (.2396)	12,1
3. Local loops (25%) a) Exchange (.84 of total outside plant)	8,837,500,000 (.2756)	10,042,432,969.8 (.2554)	10,708,009,356.24 (.2519)	11,360,410,787.88 (.2464)	12,2
4. Station equipment (20%) (apparatus connections, PBX)	7,053,300,000 (.2199)	7,851,161,069 (.1996)	8,535,673,471.0 (.2007)	9,385,967,632 (.2036)	10,4
5. Gross plant investment	32,064,800,000 (.8782)	39,316,832,450 (.8509)	42,508,396,757	46,091,401,856	50,4

*A. D. Little, Vol. 3, p. 92.

1966	1967	1968	1969	1970	
429,977.28 (.0625) 641,717.12 (.0933) (.1558)	474,026.24 (.0622) 719,651.2 (.0944) (.1566)	530,642.08 (.0608) 847,560 (.0972) (.1580)			(decreasing) (increasing)
1,363,648.88 (.1982)	1,529,258.8 (.2006)	1,801,065 (.2066)			(increasing)
2,257,380.72 (.3282)	2,488,637.76 (.3265)	2,785,870.92 (.3196)			(decreasing)
1,454,251 (.2114)	1,604,276 (.2105)	1,816,327.0 (.2084)			(decreasing)
6,877,526	7,620,505	8,714,127			(increasing)

[redacted] U[redacted]A * [redacted]

	1966	1967	1968	1969	1970
1. Long distance (16%)					
a) Toll	429,977.28	474,026.24	530,642.08		
(.16 of total outside plant)	(.0625)	(.0622)	(.0608)		
b) Circuit equipment	641,717.12	719,651.2	847,560		
(.32 of total central	(.0933)	(.0944)	(.0972)		
office equipment)	(.1558)	(.1566)	(.1580)		
2. Switching (20%)					
a) Local dial and other	1,363,648.88	1,529,258.8	1,801,065		
(.68 of total central office equipment)	(.1982)	(.2006)	(.2066)		
3. Local loops (33%)					
a) Exchange	2,257,380.72	2,488,637.76	2,785,870.92		
(.84 of total outside plant)	(.3282)	(.3265)	(.3196)		
4. Station equipment (21%)					
(apparatus connections, PBX)	1,454,251	1,604,276	1,816,327.0		
	(.2114)	(.2105)	(.2084)		
5. Gross plant investment	6,877,526	7,620,505	8,714,127		

*A. D. Little, Vol. 3, p. 93.

OT FORM 10
(1-71)

OFFICE OF TELECOMMUNICATIONS

CC 5

March 31, 1972

ITS/MB Gray

Continental Telephone Corporation Data

Lt. Col. S. A. Lasher, OTP

The enclosed data relating to the operations of the Continental Telephone Corporation have been extracted from the sources referenced on page 8. The text (pp. 1-7) is from source three.

State maps indicating the geographic areas served by the various communications common carriers are currently being prepared as part of another study. If these are of interest to you, I will forward them as they are completed.

I plan to add somewhat to the information on GTE and United, which Sharon Black has prepared for you. I am also attempting to obtain more detailed information on station connection costs (including, if available from the state commissions, information relating to the Bell System Phone Center experiments).

Please let me know if my efforts appear to be inconsistent with your requirements. My current FTS number is (303) 499-3826 (I am told that this will be changed to (303) 499-4135 within the next few weeks).

M. B. Gray
Institute for Telecommunication Sciences

See Green Copy

Enclosure: "Continental Telephone Corporation"
(8 pages)

cc: R. Salaman
S. Black

MBG:dd

FILE COPY

SURNAME	DATE	SURNAME	DATE

Y Tra

CONTINENTAL TELEPHONE CORPORATION

Continental Telephone Corporation (CTC) is the third largest independent telephone holding company in the United States. It was organized in 1960 primarily to acquire telephone operating properties. As of December 31, 1970, CTC's subsidiaries served approximately 1,638,000 telephones in 42 states, Canada and five Caribbean countries. Certain subsidiaries manufacture wire and cable and communications equipment for sale primarily to the independent telephone industry. Other subsidiaries operate community antenna television systems, primarily in areas served by certain of CTC's telephone subsidiaries, publish telephone directories for the independent telephone industry and for affiliates and render data services to subsidiaries and others.

TELEPHONE OPERATIONS

CTC's telephone subsidiaries primarily serve small towns and agricultural areas, which contain various manufacturing, mining, lumbering and recreational facilities. Of the telephones served at December 31, 1970, over 99% were dial. Of the total, 48.5% were single-party lines, 10.4% two-party, 16.9% four-party and 24.2% more than four-party. In 1970, 51% of CTC's total telephone revenues consisted of toll revenue.

At December 31, 1970, CTC owned several telephone properties in Canada serving approximately 30,700 telephones and The Grand Bahama Telephone Company Limited serving approximately 14,500 telephones. CTC also owned interests of approximately 84.9% in The Barbados Telephone Company, Limited (29,100 telephones), and 60.2% in The Jamaica Telephone Company, Limited (71,800 telephones). In addition, CTC owned a 50% interest in both The Trinidad and Tobago Telephone Company, Limited (56,200 telephones) and The Grenada Telephone Company, Limited (3,100 telephones), the balance being owned by the Trinidad and Tobago and Grenada governments, respectively.

CTC, through Continental Telephone Service Corporation (Service Corporation), provides managerial and financial supervision and assistance to its operating subsidiaries and the services of specialists in toll, traffic, rate case, marketing and data services. The Service Corporation also provides general accounting, customer billing, purchasing, payroll and general clerical services and certain specialized engineering functions to subsidiaries.

Business relationships exist between telephone company subsidiaries and certain affiliated telecommunication manufacturing, directory and service companies within the Continental System. Descriptions of the affiliated companies involved and information pertaining to their operations follow.

MANUFACTURING SUBSIDIARIES

CTC's manufacturing subsidiaries are organized under Superior Continental Corporation and VIDAR Corporation.

Superior Continental Corporation

Superior Continental Corporation (Superior), a wholly-owned subsidiary of CTC, was formed on September 1, 1967 by the merger of Superior Cable Corporation, acquired on March 28, 1967, Communication Apparatus Corporation (CAC), acquired on February 28, 1967, and Central Western Supply Division of CTC. Superior, headquartered in

Hickory, North Carolina, manufactures and sells a wide variety of telephone and other communications wire and cable, electronic distribution systems and other communications equipment. Manufacturing facilities are located in North Carolina, Texas, Iowa and Ontario, Canada.

Superior is also responsible for the management of Universal Lancaster, Inc., Republic Wire and Cable Corporation and Link Communications, Inc., small, wholly-owned CTC subsidiaries, as well as majority-owned Metelpel Products, Inc.

The largest manufacturing unit of Superior is the Superior Cable and Equipment Division, which produces communications wire and cable and telephone accessory products. Superior Cable and Equipment Division was originally Superior Cable Corporation, organized in 1952 to manufacture plastic insulated telephone cable in the Southeast. At that time, most telephone wire and cable manufacturing plants were in the Northeast. The company was dedicated to the premise that plastic insulated cable would gradually replace the paper and lead type then dominant.

In 1960 Superior acquired Supa Insulations Incorporated of Rocky Mount, North Carolina. This acquisition broadened the product line and provided a second manufacturing plant which has since been substantially expanded.

The Systems Equipment Division was formed in 1963 to develop and manufacture telephone accessory products. In 1966 Superior acquired the S & G Manufacturing Company and added its pressurization equipment and mobile power unit products to form what is now the Systems Equipment plant of the Superior Cable and Equipment Division.

In 1964 Superior constructed a new cable plant at Brownwood, Texas. The Brownwood plant was designed to serve the Southwest, Midwest and West Coast markets. A fourth telephone cable plant was opened at Mt. Pleasant, Iowa in 1967.

In addition to its Cable and Equipment Manufacturing Division, Superior also operates Continental System Supply and Continental Telephone Laboratories as divisions of Superior.

Continental System Supply (CSS) provides quick, dependable delivery of finished products to CTC subsidiaries while exercising close control over funds employed in maintaining finished goods inventories and accounts receivable, as well as over sales, transportation and warehousing expenses. It accumulates information regarding System customers' future needs and satisfaction with past services and products. With this information as a guide, CSS advises its suppliers of future requirements in terms of quantity, quality and needed new product developments to obtain for its customers the benefits of bulk purchasing, assure its customers of receiving products of suitable quality, and be prepared to supply to its customers products of recent design as needed to permit them to render service to their customers in accordance with their service objectives.

CSS has the responsibility of billing, collecting, remitting, warehousing and accounting for products ordered from Superior and other manufacturers for use by the companies in the Continental System. It also handles credits, adjustments and assists with claims for transportation damage, as well as handling complaints on defective materials, shortages of materials or other supplier deficiencies. CSS has the further responsibility of analyzing product usage and performance for the preparation of reports to the Continental System Equipment and Materials Standards

Committee for its use in determining suitable material standards for the Continental System.

At the end of 1970 CSS was in the process of stocking its new warehouses at O'Fallon, Missouri and Reno, Nevada to supplement its Hickory, North Carolina warehouse in providing rapid nationwide delivery of products required by the Continental telephone companies.

CSS also maintains a systemwide material and supply catalog so that all Continental operating companies will be aware of System standards with respect to materials and supplies.

Continental Telephone Laboratories, located in Hickory, North Carolina, was set up as a Superior division in 1967. It performs research and development for Superior's manufacturing operations and for Continental's telephone operating companies.

Communications Apparatus Corporation (CAC)

CAC has a manufacturing plant at Keller, Texas supplying load coils, station apparatus and related products to the telephone industry. It is a subsidiary of Superior.

Communication Apparatus Company (Canada) Ltd. - CAC (Canada)

Through the CAC acquisition, Superior acquired a 50% interest in its first foreign facility, CAC (Canada), which produces communication products at Stratford, Ontario. Superior purchased the other 50% interest in 1968, and now operates CAC (Canada) as a wholly-owned subsidiary.

Comm/Scope Corporation (Comm/Scope)

Growth of demand for coaxial cable products primarily for community antenna television (CATV) led to construction in 1967 of a new coaxial cable plant at Sherrills Ford, North Carolina. Comm/Scope, a subsidiary of Superior, assumed the management of the Sherrills Ford cable plant in 1969.

Continental Telephone Electronics Corporation

In 1964 Superior started a research and development program leading to the Electronic Distribution System (EDS) family of products. The EDS subscriber carrier systems are designed to reduce time and cost in upgrading multi-party telephone service and serving additional customers. They are produced by Superior's subsidiary, Continental Telephone Electronics Corporation, at Euless, Texas.

Continental Trading Corporation

In 1967 Superior established Continental Trading Corporation as a western hemisphere trading corporation. Continental Trading sells communications equipment in western hemisphere countries other than the United States. Continental Trading operates an office and warehouse at Miami Lakes, Florida.

Amcor, Incorporated

Superior acquired majority ownership of Amcor, Incorporated in 1970. Amcor manufactures electronic and communications products at Raleigh, North Carolina.

Universal Lancaster, Inc.

Universal Lancaster produces meters and regulators for the gas utility industry at three manufacturing facilities in Texas and Ohio.

Republic Wire and Cable Corporation

Republic Wire and Cable Corporation, acquired in 1969, distributes elevator control cable from a warehouse in New York City.

Link Communications, Inc.

Link Communications, acquired in 1970, modifies and supplies terminal equipment for data communications systems, and also manufactures electronic components. It operates two plants, in New York City and Copaigue, New York.

Metelpel Products, Inc.

CTC acquired majority ownership of Metelpel Products in 1970. Metelpel processes ferrous, non-ferrous and paper scrap at its plant at Bettendorf, Iowa.

VIDAR Corporation

In June 1970, CTC acquired VIDAR Corporation of Mountain View, California. VIDAR produces VICOM digital transmission systems, VIDAR data acquisition and integration equipment, and Autolab gas chromatography equipment at plants at Mountain View and San Luis Obispo, California.

SERVICE OPERATIONS

Continental Telephone Service Corporation

Continental Telephone Service Corporation (Service Corporation) has the responsibility for performing certain services for all the companies within the Continental System.

The Service Corporation has eleven operating divisions - the corporate office in St. Louis, Missouri, the telephone division in Bakersfield, California, six operating divisions and three data centers. The corporate office performs services for all the Continental subsidiaries, the telephone division performs services for all domestic and foreign telephone operations, and the six operating divisions and data centers limit their services primarily to the domestic telephone operating subsidiaries within the division boundaries. A management service contract has been executed between the Service Corporation and each of the telephone operating subsidiaries. A copy of the contract is included herein which outlines the services performed by the Service Corporation. The distribution methods of billing subsidiaries for Service Corporation services from the corporate office and operating divisions is set forth in an enclosed accounting memorandum entitled, "Explanation of Operations of Service Corporation and Basis for Distributing Costs".

Leland Mast Directory Company

The Leland Mast Directory Company sells the "Yellow Pages" advertising and produces directories for some 220 telephone companies. Of the number, 167 are for companies outside the Continental System.

The 331 directories published in 1970 had a combined total of 1,125,575 telephones.

The compilation of the alphabetical listings and the "Yellow Pages" advertising material is processed in the Company's general offices in Overland Park, Kansas. The actual printing of the directories is done by two commercial printing establishments under specific contractual arrangements. Both firms also print directories for two Bell Companies.

The Directory Company has 83 full-time employees including 41 "Yellow Pages" salesmen who are located in their assigned geographical sales areas.

Medusa Leasing Corporation

Medusa Leasing Corporation (Medusa), a Delaware Corporation, is a wholly-owned subsidiary of CTC. The principal and only office of Medusa is located in Bakersfield, California. Medusa's finance lease agreement is specifically designed and administered to satisfy the automotive requirements of the operating telephone companies at a reasonable cost.

Medusa is in the business of leasing vehicles and a nominal amount of work equipment to the operating subsidiaries of CTC. Vehicles are purchased for lease from dealers within the respective service areas at fleet prices. Original lease terms are 24 months for passenger cars, 36 months for installer service trucks and 60 months for construction trucks. Leases may be renewed at reduced rates subject to mileage, condition and adjusted salvage value. Generally, Medusa's lease rates have been designed to recover vehicle cost net of salvage, interest and carrying charges, administrative expenses and a reasonable return on investment. Final lease settlement with the operating company leasee is based on a comparison of salvage sale price with predetermined salvage value. An excess of sale price is refunded, a deficiency is charged.

West Indies Telephone Service Corporation

The principal function of West Indies Telephone Service Corporation is to furnish directory services to Grand Bahama, Jamaica, Barbados and Trinidad and Tobago Telephone Companies.

CATV OPERATIONS

Continental's CATV activities, through its wholly-owned subsidiary, Continental Transmission Corporation, and new acquisitions expanded considerably in 1970, its fourth year of operation. At year end Continental was operating a total of 70 systems serving 94,000 connections in 18 states. Of these, some 36,000 connections are outside areas served by Continental Telephone Companies.

HOLDING AND FINANCE OPERATIONS

Continental Telephone Company of North America

Effective January 15, 1970, CTC, through a newly formed subsidiary, Continental Telephone Company of North America, acquired the operating subsidiaries of North American Communications Corporation. On March 15, 1971, Continental Telephone Company of North America was merged into CTC.

Continental Telephone Holding Company, Ltd.

Continental Telephone Holding Company, Ltd., a wholly-owned subsidiary of Continental Telephone International Finance Corporation, is a Canadian telephone holding company with holdings in Canada and the Caribbean. It was formed on September 26, 1966 by CTC for the purpose of acting as a holding company for foreign properties.

Continental Telephone International Finance Corporation

On February 19, 1968, Continental Telephone International Finance Corporation, a wholly-owned subsidiary formed by CTC for the purpose of financing foreign subsidiaries, received from CTC 100% of the outstanding common shares of Continental Telephone Holding Company, Ltd. in exchange for common shares of Continental Telephone International Finance Corporation.

OTHER OPERATIONS

Consumers Money Order Corporation of America

Consumers Money Order Corporation of America is a commercial money order business selling orders through appointed agencies consisting mainly of retail grocery, drug and variety stores. Consumers also is the majority stockholder (approximately 75%) of the Commonwealth Bank, located in Wentzville, Missouri.

At the time Consumers was acquired by CTC in November, 1967, sales of money orders were at an annual rate of 2,100,000 items in six states. Present sales of money orders are at an annual rate of 5,300,000 items, through 2,900 agencies in sixteen states.

Continental Data Services Corporation

In 1969 Continental Data Services Corporation was formed to enter into commercial data service activities. The functions of this operation are completely separate from the data services performed for the Continental System. Continental Data is composed of two divisions; a management consulting group and a data center operation. The consultants advise clients and design, test and implement computer and non-computer oriented management information systems. The data center is engaged in running and maintaining systems designed by the consultants for clients outside the Continental System.

Financial Data Service, Inc.

Financial Data Service, Inc. was acquired on July 24, 1969 by CTC. It sells installment loan services to more than 1,000 banks located throughout the country. The service includes a computer printed, magnetic ink encoded coupon book, a pre-calculated and computer printed loan ledger card and a monthly computer printed analysis of installment loans. A similar service for mortgage loans was announced in May, 1971.

National Computing Industries

National Computing Industries (NCI) markets software products developed by others and by its development staff. Its major products are Work Ten and RSVP. Work Ten is a high level computer language and file management system which produces well documented COBOL, and substantially reduces computer system development and programming machine and personnel time. RSVP is a file interrogation and report generation system which enables an executive to access a data tape without requiring the services of computer programmers or system analysts. The products are marketed through the United States, Canada, Mexico and Europe.

Financial Data Systems, Inc.

Financial Data Systems developes and markets "on-line" computer software systems for banks and savings and loans. Its principal systems are a modular savings passbook posting and accounting software package, a certificate of deposit package, and a mortage loan package. In addition, the Company has developed and is marketing an "on-line" stockholder records system. In St. Louis the Company operates an "on-line" data center for several banks.

CONTINENTAL TELEPHONE CORPORATION

(Years ended December 31; entries in thousands of dollars)

	1966	1967	1968	1969	1970
Telephone					
Total Telephone Plant+	---	666,494	829,428	998,292	1,170,489
Total Operating Revenues*	125,092	151,130	174,910	202,545	237,333
Total Operating Expenses*	95,896	115,775	131,574	150,023	175,765
Net Operating Income*	29,196	35,355	43,336	52,522	61,568
Adjusted Net Income**	18,007	21,826	27,419	32,806	37,841
Manufacturing & Supply					
Manufacturing Plant+	---	11,311	13,835	15,812	22,726
Net Sales	53,992	62,633	70,496	96,885	119,948
Net Income	5,490	5,943	3,841	6,278	8,012
CATV, Directory, etc.					
Property, Plant & Equipment+	---	13,812	22,434	29,207	38,296
Net Income	(111)	595	1,252	1,376	818
Consolidated Net Income	21,415	24,757	27,661	33,475	40,435

NOTES: +Substantially at original cost.
*Reflects retroactively the effect of subsequent poolings of interests.
**Includes misc. income and interest expense.

SOURCES: (1) CTC Annual Report for Fiscal Year ended Dec. 31, 1970.
2) Amendment No. 1 to CTC 1970 Annual Report (above)
3) CTC Data on Mfg., Supply, Directory and Service Affiliates. Prepared at request of Joint NARVC-FCC Subcommittee for the year 1970.

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

March 23, 1972

Miss Sharon Black
OTP Support Division
Boulder Section
325 S. Broadway Room 1-3001
Boulder, Colorado 80302

Dear Sharon:

Thanks for calling my attention to the A.D. Little breakout of investment costs of USITA and Bell.

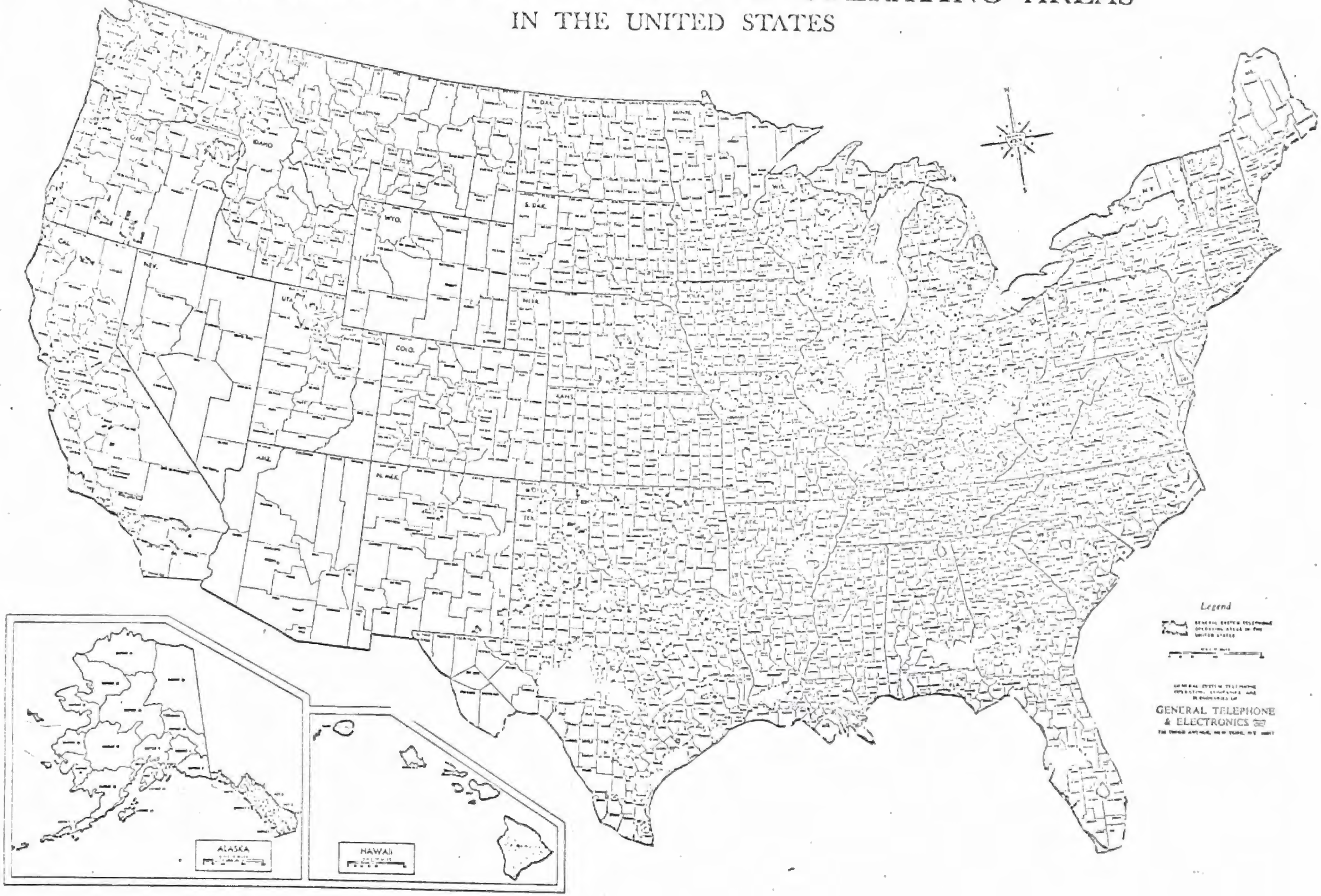
One fact which might account for the differences between the figures is that my dollars were attempting to estimate percentages of annual expenses (both depreciation on investment and operating expenses e.g. salaries etc.), while A.D. Little is looking at net (undepreciated) investment only. I don't know how one proceeds to reconcile the two figures -- but it should prove to be an interesting task for you. It also will certainly highlight those areas of the telephone business which are most capital intensive (small differences) and those which are more labor intensive (larger differences). This distinction would be very helpful in our future studies of this industry.

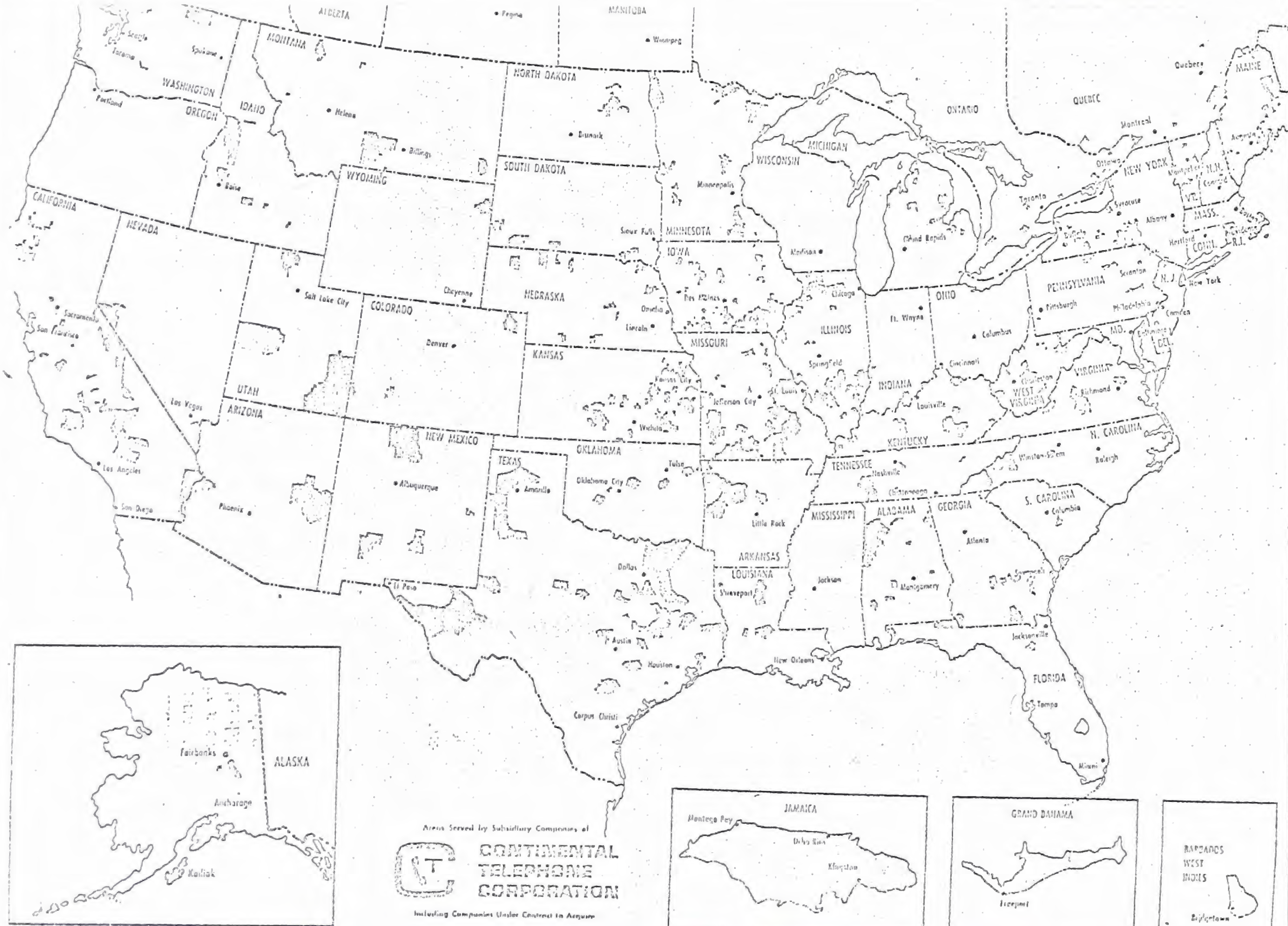
Sincerely,

Sebastian A. Lasher
Lt. Col., U.S.A.

CC 7

GENERAL SYSTEM TELEPHONE OPERATING AREAS
IN THE UNITED STATES



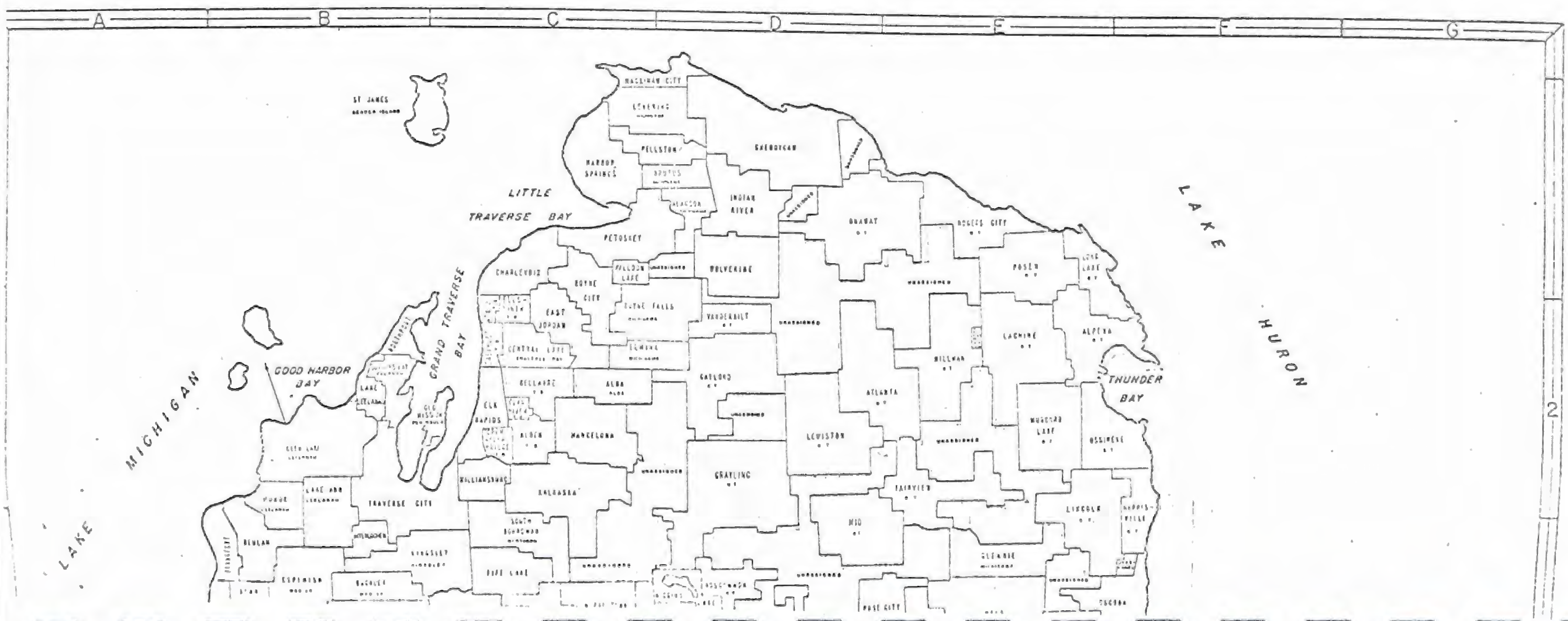


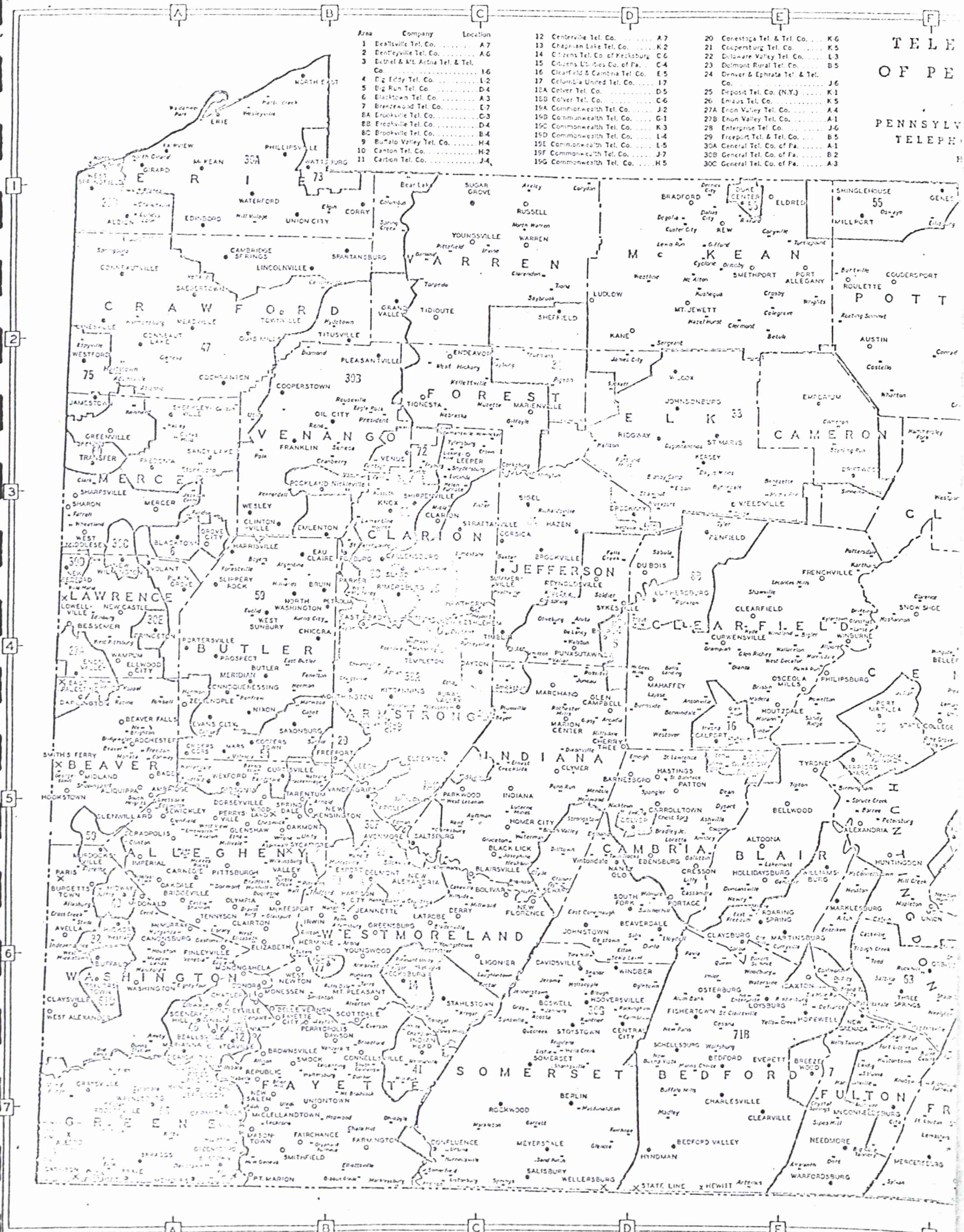
February 1, 1968

PRINTING SERVICE E-2167


LAKE MICHIGAN
GOOD HARBOR BAY
GRAND TRAVERSE BAY
HURON
THUNDER BAY
SAGINAW BAY
LAKE MICHIGAN
LAKE ST. CLAIR
ST. CLAIR RIVER

MICHIGAN BELL TELEPHONE COMPANY
MICHIGAN BELL AND INDEPENDENT COMPANY EXCHANGE AREAS
AS APPROVED BY MICHIGAN PUBLIC SERVICE COMMISSION
LOWER PENINSULA





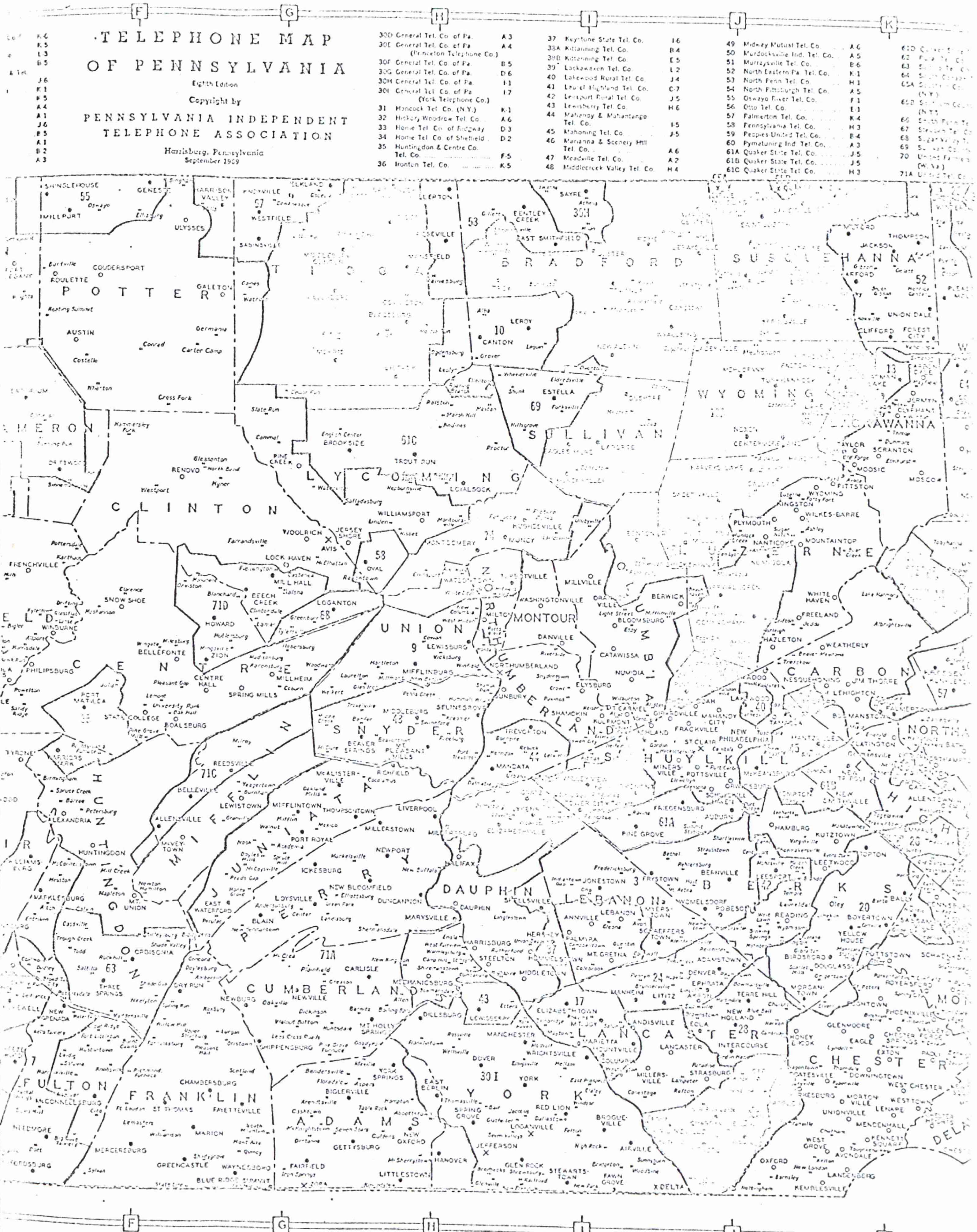
TELE

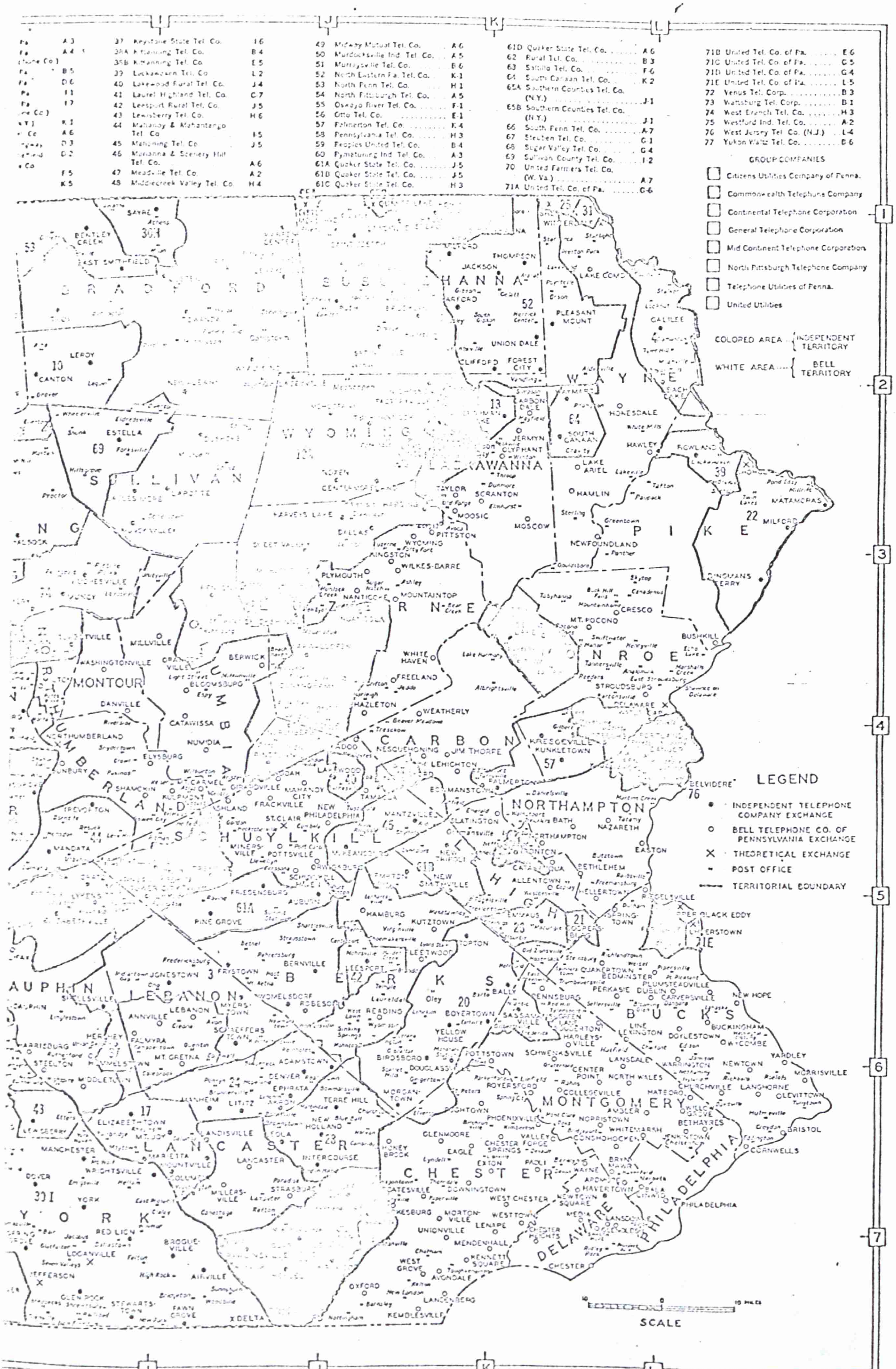
OF PE

PENNSYLV

TELEPH

Area	Company	Location
1	Deallsville Tel. Co.	A-7
2	Dentleyville Tel. Co.	A-6
3	Bethel & Mt. Aetna Tel. & Tel. Co.	I-6
4	Big Eddy Tel. Co.	L-2
5	Big Run Tel. Co.	D-4
6	Blacktown Tel. Co.	A-3
7	Breezewood Tel. Co.	E-7
8A	Brookville Tel. Co.	C-3
8B	Brookville Tel. Co.	D-4
8C	Brookville Tel. Co.	B-4
9	Buffalo Valley Tel. Co.	H-4
10	Canton Tel. Co.	H-2
11	Carbon Tel. Co.	J-4
12	Centerville Tel. Co.	A-7
13	Chapman Lake Tel. Co.	K-2
14	Citizens Tel. Co. of Kecksburg	C-6
15	Citizens Utilities Co. of Pa.	C-4
16	Clearfield & Cambria Tel. Co.	E-5
17	Columbia United Tel. Co.	I-7
18A	Colver Tel. Co.	D-5
18B	Colver Tel. Co.	C-6
19A	Commonwealth Tel. Co.	J-2
19B	Commonwealth Tel. Co.	G-1
19C	Commonwealth Tel. Co.	K-3
19D	Commonwealth Tel. Co.	L-4
19E	Commonwealth Tel. Co.	L-5
19F	Commonwealth Tel. Co.	J-7
19G	Commonwealth Tel. Co.	H-5
20	Conestoga Tel. & Tel. Co.	K-6
21	Coopersburg Tel. Co.	K-5
22	Delaware Valley Tel. Co.	L-3
23	Delmont Rural Tel. Co.	B-5
24	Denver & Ephrata Tel. & Tel. Co.	J-6
25	Deposit Tel. Co. (N.Y.)	K-1
26	Emaus Tel. Co.	K-5
27A	Enon Valley Tel. Co.	A-4
27B	Enon Valley Tel. Co.	A-1
28	Enterprise Tel. Co.	J-6
29	Freeport Tel. & Tel. Co.	B-5
30A	General Tel. Co. of Pa.	A-1
30B	General Tel. Co. of Pa.	B-2
30C	General Tel. Co. of Pa.	A-3


TELEPHONE MAP
OF PENNSYLVANIA
Eighth Edition
Copyright by
PENNSYLVANIA INDEPENDENT TELEPHONE ASSOCIATION
Harrisburg, Pennsylvania
September 1969
30D General Tel. Co. of Pa. A 3
30E General Tel. Co. of Pa (Princeton Telephone Co.) A 4
30F General Tel. Co. of Pa. B 5
30G General Tel. Co. of Pa. D 6
30H General Tel. Co. of Pa. I-1
30I General Tel. Co. of Pa (York Telephone Co.) I-7
31 Hancock Tel. Co. (N.Y.) K-1
32 Hickory Woodrow Tel. Co. A 6
33 Home Tel. Co. of Ridgway D 3
34 Home Tel. Co. of Sheffield D 2
35 Huntingdon & Centre Co. Tel. Co. F-5
36 Ironton Tel. Co. K-5
37 Keystone State Tel. Co. I-6
38A Kittanning Tel. Co. B 4
38B Kittanning Tel. Co. E 5
39 Lackawaxen Tel. Co. L 2
40 Lakewood Rural Tel. Co. J 4
41 Laurel Highland Tel. Co. C-7
42 Leesport Rural Tel. Co. J 5
43 Lewisberry Tel. Co. H 6
44 Mahanoy & Mahantango Tel. Co. I-5
45 Mahoning Tel. Co. J-5
46 Marianna & Scenery Hill Tel. Co. A 6
47 Meadville Tel. Co. A 2
48 Middlecreek Valley Tel. Co. H 4
49 Midway Mutual Tel. Co. A 6
50 Murdocksville Ind. Tel. Co. A 5
51 Murraysville Tel. Co. B 6
52 North Eastern Pa. Tel. Co. K-1
53 North Penn Tel. Co. H 1
54 North Pittsburgh Tel. Co. A 5
55 Oswayo River Tel. Co. F 1
56 Otto Tel. Co. E-1
57 Palmerton Tel. Co. K-4
58 Pennsylvania Tel. Co. H 3
59 Peoples United Tel. Co. B-4
60 Pymatuning Ind. Tel. Co. A 3
61A Quaker State Tel. Co. J-5
61B Quaker State Tel. Co. J-5
61C Quaker State Tel. Co. H 3
F
G
H
I
J
K
POTTER
TIOGA
BRADFORD
SUSQUEHANNA
WYOMING
SULLIVAN
LYCOMING
CLINTON
UNION
MONTOUR
SNYDER
MIFFLIN
JUNIATA
PERRY
DAUPHIN
LEBANON
SCHUYLKILL
CARBON
BERKS
CUMBERLAND
LANCASTER
CHESTER
YORK
ADAMS
FRANKLIN
FULTON



37 Keystone State Tel. Co. I 6
38A Kittanning Tel. Co. B 4
38B Kittanning Tel. Co. E 5
39 Lackawaxen Tel. Co. L 2
40 Lakewood Rural Tel. Co. J 4
41 Laurel Highland Tel. Co. C 7
42 Leesport Rural Tel. Co. J 5
43 Lewisberry Tel. Co. H 6
44 Mahanoy & Mahantango Tel. Co. I 5
45 Mahoning Tel. Co. J 5
46 Marianna & Scenery Hill Tel. Co. A 6
47 Meadville Tel. Co. A 2
48 Middlecreek Valley Tel. Co. H 4
49 Midway Mutual Tel. Co. A 6
50 Murdocksville Ind. Tel. Co. A 5
51 Murrysville Tel. Co. B 6
52 North Eastern Pa. Tel. Co. K 1
53 North Penn Tel. Co. H 1
54 North Pittsburgh Tel. Co. A 5
55 Oswayo River Tel. Co. F 1
56 Otto Tel. Co. E 1
57 Palmerton Tel. Co. K 4
58 Pennsylvania Tel. Co. H 3
59 Peoples United Tel. Co. B 4
60 Pymatuning Ind. Tel. Co. A 3
61A Quaker State Tel. Co. J 5
61B Quaker State Tel. Co. J 5
61C Quaker State Tel. Co. H 3
61D Quaker State Tel. Co. A 6
62 Rural Tel. Co. B 3
63 Saltillo Tel. Co. F 6
64 South Canaan Tel. Co. K 2
65A Southern Counties Tel. Co. (N.Y.) J 1
65B Southern Counties Tel. Co. (N.Y.) J 1
66 South Penn Tel. Co. A 7
67 Steuben Tel. Co. G 1
68 Sugar Valley Tel. Co. G 4
69 Sullivan County Tel. Co. I 2
70 United Farmers Tel. Co. (W. Va.) A 7
71A United Tel. Co. of Pa. C 6
71B United Tel. Co. of Pa. E 6
71C United Tel. Co. of Pa. C 5
71D United Tel. Co. of Pa. G 4
71E United Tel. Co. of Pa. L 5
72 Venus Tel. Corp. B 3
73 Wattsburg Tel. Corp. B 1
74 West Branch Tel. Co. H 3
75 Westford Ind. Tel. Co. A 2
76 West Jersey Tel. Co. (N.J.) L 4
77 Yukon Waltz Tel. Co. B 6
GROUP COMPANIES
Citizens Utilities Company of Penna.
Commonwealth Telephone Company
Continental Telephone Corporation
General Telephone Corporation
Mid Continent Telephone Corporation
North Pittsburgh Telephone Company
Telephone Utilities of Penna.
United Utilities
COLORED AREA — INDEPENDENT TERRITORY
WHITE AREA — BELL TERRITORY
LEGEND
INDEPENDENT TELEPHONE COMPANY EXCHANGE
BELL TELEPHONE CO. OF PENNSYLVANIA EXCHANGE
THEORETICAL EXCHANGE
POST OFFICE
TERRITORIAL BOUNDARY
SCALE
BRADFORD
SUSQUEHANNA
WAYNE
WYOMING
SULLIVAN
LACKAWANNA
PIKE
LUZERNE
MONROE
MONTOUR
COLUMBIA
CARBON
NORTHUMBERLAND
SCHUYLKILL
NORTHAMPTON
LEHIGH
LEBANON
BERKS
BUCKS
MONTGOMERY
LANCASTER
CHESTER
DELAWARE
PHILADELPHIA
YORK
I J K L
1 2 3 4 5 6 7

IS

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.

Copy No. ______

TELECOMMUNICATIONS

SERVICES REPORT

U.S. Department of Commerce
OFFICE OF TELECOMMUNICATIONS

GUIDE TO TELECOMMUNICATION SERVICES

WASHINGTON, D.C.
BOULDER,
COLORADO

March 1972

U.S. DEPARTMENT OF COMMERCE
Maurice H. Stans, Secretary

OFFICE OF TELECOMMUNICATIONS
Armig G. Kandoian, Director

OT SERVICES REPORT - DRAFT

GUIDE TO TELECOMMUNICATION SERVICES

OFFICE OF TELECOMM[illegible]CATIONS
WASHINGTON, D.C. 20[illegible]
BOULDER, COLORAD[illegible]
March 1972

Table of Contents

Preface

The Department of Commerce has provided telecommunication services to the public, industry, and government since 1942. At that time, the North Atlantic Radio Warning Service was established to issue forecasts of radio propagation conditions for high and middle latitudes of the northern hemisphere. Based on advances in telecommunications since then, the higher demands in operational system performance, and the new tools and techniques available for information processing and dissemination, this service was revised on July 1, 1968. The Telecommunication Services Center was established, forecasts were issued in terms more applicable to system operation, the service area was expanded to worldwide coverage, and computerized information processing was used to the greatest practical extent. These forecasts continue to be available based on current solar-terrestrial activity.

The demands for telecommunication information, for example for policy analysis, frequency management, and government and business decision making have prodded further expansion of this service. The available information and services are discussed in this guide.

Introduction

A number of services are provided within the Office of Telecommunications to assist in both the needs of its own program management and execution, and to provide telecommunication information and assistance to others, particularly the Office of Telecommunications Policy. Examples of these services include telecommunication data bases, information files, and analysis models and routines, maintained in the Telecommunication Services Center, record keeping and analysis assistance for the government's frequency management activity of the IRAC Secretariat, and general consulting and advisory services to federal, state, and local government organizations.

This Guide of Telecommunication Services provides a description of these services, and information necessary for access. It is formated to allow updating as the services improve. For example, a page number that includes a decimal point indicates an addition, and should be inserted in appropriate numerical order. Bulletins announcing changes to the services will be issued periodically, and should be filed at the end of the next section, Telecommunication Services Center.

Telecommunication Services Center

The function of the Telecommunication Services Center is to provide the primary core of information, data, and analysis tools required to examine, evaluate, and analyze telecommunication problems and opportunities. The nucleus of the Center is an automated access to files containing this information, data, and analysis tools. As the capability of this Center expands, bulletins reflecting changes are issued and should be filed at the end of this section.

Initiation of Service

Access to this service is available through conventional remote access computer terminals, using the commercial or FTS telephone systems. The number to be called depends upon the speed of your terminal according to the following table.

		Commercial Number	Boulder Laboratories
speed	10	303-494-7100 thru 494-7104	3011 thru 3018
(characters	15	494-7108 thru 494-7109	3001 thru 3004
per second)	30	494-7110	3731 thru 3732

FTS number is 303-499 + Boulder Laboratories number.

Terminals may be damaged if used at higher than the design speed (most inexpensive printing terminals work at 10 cps).

Current system status can be obtained from a recorded message on 303-499-100 ext. 3915 or for FTS, 303-499-3915. Information concerning the status of services can be obtained by accessing "news" as discussed below.

After dialing the number, a tone indicates the system is ready for interaction with your terminal, and it will respond with*:

TSS - 4.M

ACCOUNT [illegible] ASE: K5XXX;T[illegible]C;XXXXX[illegible]

* [illegible] ers are those [illegible] input [illegible]

or

ACCOUNT PLEASE: K4(CR)*

PASSWORD: XXX (CR)

USER NAME: TIC (CR)

PROJECT NUMBER: XXXXXXX (CR)

The "X" inputs above are used for system accounting purposes, and will be assigned by the Office of Telecommunications. The system will, in general, accept either upper ot lower case input.

If the user detects an error anytime during use of the system, he may abort and restart by typing the escape (ESC) key, the alter mode (ALT - MODE) key, or CONTROL-SHIFT-K.

The system will then respond with the date and time, and:

** TELECOMMUNICATION SERVICES CENTER**

TYPE (IN CAPITAL LETTERS) YOUR INITIALS AND LAST NAME, EXAMPLE: R J SMITH

URNAME (CR)

If at any time the system returns with: -, type [illegible] to reinitiate service or type LOG if finished. For example,

- TIC (CR)

or

- LOG (CR)

If a mistake is detected on inputing information, typing CONTROL A** will delete previous character, typing CONTROL [illegible] will delete entire line.

* (CR) means [illegible] type Carriage [illegible] which is [illegible] at the end of any line [illegible] information [illegible]

** hold [illegible] key and typ[illegible]

Discussion of Files

The following TSC files are available for access. In addition, a number of public files are available to system users. Public Files are discussed in the next section.

Sample runs are included following the indices.

TSC FILES

INDEX OF TSC FILES

March 20, 1972

Descriptions

Service Information

IND

IND is the index to all available files, as presented on the previous page.

NEW

NEW is news on current improvements, changes, and problems concerning the telecommunication services that have not yet been reported in the bulletin.

PUB

PUB is a list of all files that are generally available on the computer system, but not maintained by personnel of the Office of Telecommunications. Information on accessing these files is contained in file PUI. PUC initializes the system to access public files. Information on these files begins on page 30.

SER

SER is a brief discussion of the services available from the Office of Telecommunications, and the points of contact.

CMS

```
SPECIFY 3 LETTER PROGRAM NAME (FOR INDEX TYPE IND)CMS


DO YOU NEED AN EXPLANATION OF THE INPUT?

YES
THIS PROGRAM WILL ASK FOR THE FOLLOWING PARAMETERS.

 ITITLE= TITLE OF RUN.
 TOP100=1. IF FIRM IS IN ONE OF THE TOP 100 MARKETS: 0. IF NOT.
 CHAN20=1. IF FIRM HAS 20 CHANNEL  CAPABILITY: 0. IF NOT.
 ICHANMI= THE NUMBER OF MICROWAVE CHANNELS.
 RATE1= THE MONTHLY RATE FOR THE FIRST OUTLET.
 RATE2= THE MONTHLY RATE FOR THE SECOND OUTLET.
 RATEH= THE ONE TIME CONNECTION RATE.
 COSTU= THE UNDERGROUND CABLE COST PER MILE.
 MILESU= THE PERCENT OF MILES OF UNDERGROUND CABLE.
 DERAT= THE DEBT EQUITY RATIO.

 ASYMP= THE ASYMPTOTIC PENETRATION.
 SIZE= THE TOTAL NUMBER OF HOMES SERVED IN YEAR 10.
 HOUSE= THE HOMES PER MILE (DENSITY).
 NEWS=1. IF A NEWS CHANNEL IS PROVIDED: 0. IF NOT.
 TIME=1. IF A TIME, WEATHER CHANNEL IS PROVIDED: 0. IF NOT.
 SW= THE NUMBER OF CHANNEL SWITCHERS.
 HOPS= THE NUMBER OF HOPS PER MICROWAVE CHANNEL.
 CASMIN= THE MINIMUM CASH BALANCE REQUIRED.
 AINTRAT= THE INTEREST RATE PAID ON BORROWED FUNDS.
 INETOLD= THE NUMBER OF NETWORK STATIONS AVAILABLE WITHOUT CABLE.

 INDOLD= THE NUMBER OF INDEPENDENT STATIONS AVAILABLE WITHOUT CABLE.
 IEDOLD= THE NUMBER OF EDUCATIONAL STATIONS AVAILABLE WITHOUT CABLE.
 INETNEW= THE NUMBER OF NETWORK STATIONS AVAILABLE WITH CABLE.
 INDNEW= THE NUMBER OF INDEPENDENT STATIONS AVAILABLE WITH CABLE.
 IEDNEW= THE NUMBER OF EDUCATIONAL STATIONS AVAILABLE WITH CABLE.
 IOWNMI=1 IF MICROWAVE EQUIPMENT IS OWNED: 0 IF RENTED.
 INEWREG=1 FOR PROPOSED REGULATIONS: 0 FOR CURRENT.
 ITOP50=1 IF FIRM IS IN ONE OF THE TOP 50 MARKETS: 0 IF NOT
 IDUAL=1 FOR DUAL CABLE 20 CHANNEL CAPABILITY: 0 FOR CONVERTER.
 IMINORG=1 FOR MINIMUM COST ORIGINATION SYSTEM: 0 FOR STANDARD.

ADIN= ANNUAL ADVERTISING REVENUES IN DOLLARS/SUBSCRIBER.


ALL VARIABLES THAT BEGIN WITH AN "I".SHOULD BE INTEGERS (NO DECIMALS)
AND BE [illegible]OWED BY A COMMA ON INPUT.

AL[illegible] VARIABLES SHOULD BE INPUT WITH A DEC[illegible]L.

[illegible]ES HA[illegible] BEEN GIVEN A 2 DIGIT RE[illegible] NUMBER TO [illegible]
[illegible]GING [illegible] AFTER TYPING THE [illegible] NUMBER.
[illegible]LUE OF [illegible] CHANGED PARAMETER. [illegible]VE [illegible]
[illegible]UMBER [illegible] YOU ARE FINISHED CHA[illegible] A [illegible]
[illegible]0 WILL [illegible]INATE CHANGES.
```

CURRENT FCC REGULATIONS
MARKET TYPE: OUTSIDE TOP 100
SYSTEM SIZE IN 10TH YEAR = 3500. SUBSCRIBERS
TOTAL HOMES PASSED = 4811., TOTAL MILES CABLE = 68.7, 70. HOMES/MILE
6.9 (10%) MILES OF UNDERGROUND CABLE AT $ 10000. PER MILE
1.00 APPROXIMATE DEBT/EQUITY RATIO .100 INTEREST RATE ON NOTES

SIGNALS OFF AIR	CABLE SIGNALS
1 NETWORKS	7 NETWORKS
0 INDEPENDENTS	1 INDEPENDENTS
0 EDUCATIONAL	0 EDUCATIONAL
1 TOTAL	8 TOTAL
	5 TOTAL MICROWAVE

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

2

SUBSCRIBER GROWTH

YEAR	INCREASE	AVERAGE	ENDING	PENETRATION
1	902.	451.	902.	.19
2	722.	1263.	1624.	.34
3	902.	2075.	2526.	.52
4	433.	2742.	2959.	.61
5	216.	3067.	3175.	.66
6	108.	3229.	3284.	.68
7	108.	3338.	3392.	.70
8	36.	3410.	3428.	.71
9	36.	3446.	3464.	.72
10	36.	3482.	3500.	.73

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

7

RATE OF RETURN

INCLUDING POLE RENT		EXCLUDING POLE RENT
8.69%	- ASSUMING 10 YEAR LIFE -	10.25%
9.53%	- ASSUMING 12 YEAR LIFE -	11.11%
10.31%	- ASSUMING 15 YEAR LIFE -	11.88%

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

6

DO YOU WANT ALL NEW IN

YOU WANT ALL NEW IN

```
ALL QUESTION ANSWERS OR VARIABLE VALUES MUST TERMINATE
WITH A CARRIAGE RETURN.
ONE (OR MORE) "CONTROL A('S)" MAY BE USED TO CHANGE A
CHARACTER(S) AT THE TIME OF INPUT BEFORE THE CARRIAGE RETURN.

10 ITITLE=(NAME)HAYS CABLE TV CO.
[redacted] TOP100=(X.)0.
[redacted] CHAN20=(X.)0.
29 ICHANMI=(N,)5,
[redacted] RATE1=(X.)6.95
[redacted] RATE2=(X.)1.
15 RATEH=(X.)12.50
[redacted] COSTU=(X.)10000.
[redacted] MILESU=(X.)10.
18 DERAT=(X.)1.
19 ASYMP=(X.)75.
[redacted] SIZE=(X.)3500.
21 HOUSE=(X.)70.
22 NEWS=(X.)1.
[redacted] TIME=(X.)1.
[redacted] SW=(X.)0.
25 HOPS=(X.)2.
[redacted] CASMIN=(X.)25000.
[redacted] AINTRAT=(X.)10.
30 INETOLD=(N,)1,
[redacted] INDOLD=(N,)0,
[redacted] IEDOLD=(N,)0,
33 INETNEW=(N,)7,
34 INDNEW=(N,)1,
[redacted] IEDNEW=(N,)0,
[redacted] IOWNMI=(N,)0,
37 INEWREG=(N,)0,
[redacted] ITOP50=(N,)0,
[redacted] IDUAL=(N,)0,
40 IMINORG=(N,)1,
[redacted] ADIN=(X.)0.
[redacted] YOU WANT TO CHANGE ANY OF THE PARAMETERS?

NO
[redacted]PUT FINISHED. WAIT FOR PROGRAM TO ASK ABOUT OUTPUT.


[redacted] YOU WANT TO KNOW WHICH TABLES ARE AVAILABLE?
YES
[redacted]BLE 1 GIVES INPUT PARAMETERS.
[redacted]BLE 2 GIVES SUBSCRIBER GROWTH.
TABLE 3 GIVES REVENUES.
TABLE 4 GIVES INCOME AND CASH FLOW.
[redacted]BLE 5 GIVES SOURCES OF FUNDS.
TABLE 6 GIVES USES OF FUN[illegible]
TABLE 7 GIVES RATE OF [illegible]
[redacted]BLE 8 GIVES CAPITAL [illegible]ES.
TABLE 0 TERMINATES TH[illegible] ASKS FOR NEW INPUT.
TABLE 9 TERMINATES TH[illegible] THE PROGRAM.

[redacted]YS CABLE TV CO.

[redacted]AT IS THE NUMBER OF [illegible] YOU WANT?
```

WHAT IS THE REFERENCE NUMBER OF THE FIRST CHANGE?

2600.

INPUT FINISHED. WAIT FOR PROGRAM TO ASK ABOUT OUTPUT.

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

CURRENT FCC REGULATIONS
MARKET TYPE: OUTSIDE TOP 100
SYSTEM SIZE IN 10TH YEAR = 2600. SUBSCRIBERS
TOTAL HOMES PASSED = 3574., TOTAL MILES CABLE = 51.1, 70. HOMES/MILE
5.1 (10%) MILES OF UNDERGROUND CABLE AT $ 10000. PER MILE
1.00 APPROXIMATE DEBT/EQUITY RATIO .100 INTEREST RATE ON NOTES

SIGNALS OFF AIR	CABLE SIGNALS
1 NETWORKS	7 NETWORKS
0 INDEPENDENTS	1 INDEPENDENTS
0 EDUCATIONAL	0 EDUCATIONAL
1 TOTAL	8 TOTAL
	5 TOTAL MICROWAVE

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

2

SUBSCRIBER GROWTH

YEAR	INCREASE	AVERAGE	ENDING	PENETRATION
1	670.	335.	670.	.19
2	536.	938.	1206.	.34
3	670.	1541.	1876.	.52
4	322.	2037.	2198.	.61
5	161.	2278.	2359.	.66
6	80.	2399.	2439.	.68
7	80.	2479.	2520.	.70
8	27.	2533.	2546.	.71
9	27.	2560.	2573.	.72
10	27.	2587.	2600.	.73

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

?

REVENUES

YEAR	1ST OUTLET	2ND OUTLET	ADVERTISING	TOTAL
1	27943.	603.	0.	28546.
2	78241.	1689.	0.	79930.
3	128539.	2774.	0.	131313.
4	169895.	3667.	0.	173562.
5	190014.	4101.	0.	194115.
6	200074.	4318.	0.	204392.
7	206780.	4463.	0.	211243.
8	211251.	4559.	0.	215811.
9	213487.	4608.	0.	218094.
10	215722.	4656.	0.	220378.
TOTAL	1641948.	35438.	0.	1677386.

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

4

INCOME AND CASH FLOW

YEAR	REVENUE	-OPERATING EXPENSES	OPERATING INC(LOSS)	INTEREST	-DEPRECIATION	PRETAX INC(LOSS)
1	28546.	138751.	-110205.	0.	32431.	-142636.
2	79930.	140355.	-60425.	13785.	34026.	-108237.
3	131313.	149667.	-18354.	22802.	36090.	-77246.
4	173562.	162446.	11116.	28981.	37435.	-55300.
5	194115.	166125.	27991.	32112.	38395.	-42517.
6	204392.	169443.	34949.	33485.	39133.	-37668.
7	211243.	171099.	40144.	34076.	39823.	-33755.
8	215811.	171463.	44348.	34159.	40355.	-30167.
9	218094.	171675.	46420.	33673.	40893.	-28146.
10	220378.	171887.	48491.	32936.	41436.	-25880.
TOTAL	1677386.	1612911.	64475.	266009.	380017.	-581551.

YEAR	INCOME TAX	NET INCOME
1	0.	-142636.
2	0.	-108237.
3	0.	-77246.
4	0.	-55300.
5	0.	-42517.
6	0.	-37668.
7	0.	-33755.
8	0.	-30167.
9	0.	-28146.
10	0.	-[illegible]380.
TOTAL	0.	[illegible]551.

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

7

RATE OF RETURN

INCLUDING POLE RENT		EXCLUDING POLE RENT
2.84%	- ASSUMING 10 YEAR LIFE -	4.10%
3.67%	- ASSUMING 12 YEAR LIFE -	4.94%
4.44%	- ASSUMING 15 YEAR LIFE -	5.73%

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

8

CAPITAL EXPENDITURES

ONE TIME EXPENDITURES	
HEADEND	28200.
MICROWAVE	0.
DIST. ABOVE GROUND	183800.
DIST. BELOW GROUND	51055.
POLE ARRANGEMENT	13785.
TOWER	10000.
BUILDING	3000.
INVENTORY	6516.
TOOLS AND TEST EQ.	4648.
FURN AND LSHOLD IMP.	8900.
PUB. SERV. CHANNELS	0.
TWO WAY CAPABILITY	0.
SUBTOTAL	309904.

YEARLY EXPENDITURES

YEAR	DROPS	SIGNAL UPGRAD	20 CHAN CAP	ORIG EQUIP	TOTAL
1	14407.	0.	0.	0.	324311.
2	15953.	0.	0.	0.	15953.
3	20636.	0.	0.	0.	20636.
4	13447.	0.	0.	0.	13447.
5	9607.	0.	0.	0.	9607.
6	7371.	0.	0.	0.	7371.
7	6903.	0.	0.	0.	6903.
8	5326.	0.	0.	0.	5326.
9	5376.	0.	0.	0.	5376.
10	5426.	0.	0.	0.	5426.
TOTAL	104451.	0.	0.	0.	414355.

WHAT IS THE NUMBER [illegible] THE TABLE YOU WANT?

0

DO YOU WAN[illegible] OUT?

NO

WHAT IS THE REFERENCE NUMBER OF THE FIRST CHANGE?

?
17
0.
?
21
80.
?
00
INPUT FINISHED. WAIT FOR PROGRAM TO ASK ABOUT OUTPUT.

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

1
CURRENT FCC REGULATIONS
MARKET TYPE: OUTSIDE TOP 100
SYSTEM SIZE IN 10TH YEAR = 2600. SUBSCRIBERS
TOTAL HOMES PASSED = 3574., TOTAL MILES CABLE = 44.7, 80. HOMES/MILE
.0 (0%) MILES OF UNDERGROUND CABLE AT $ 10000. PER MILE
1.00 APPROXIMATE DEBT/EQUITY RATIO .100 INTEREST RATE ON NOTES

SIGNALS OFF AIR
1 NETWORKS
0 INDEPENDENTS
0 EDUCATIONAL
1 TOTAL

CABLE SIGNALS
7 NETWORKS
1 INDEPENDENTS
0 EDUCATIONAL
8 TOTAL
5 TOTAL MICROWAVE

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

4
INCOME AND CASH FLOW

YEAR	REVENUE	-OPERATING EXPENSES	OPERATING INC(LOSS)	INTEREST	-DEPRECIATION	PRETAX INC(LOSS)
1	28546.	137226.	-108680.	0.	26561.	-135241.
2	79930.	138373.	-58943.	11979.	28049.	-98969.
3	131313.	148224.	-16910.	20557.	29975.	-67442.
4	173562.	160925.	12637.	26231.	31242.	-44836.
5	194115.	164659.	29457.	28858.	32159.	-[illegible]1560.
6	204392.	167982.	36410.	29715.	32872.	-26176.
7	211243.	169496.	41747.	29759.	33544.	-1555.
	215811.	169859.	45951.	29232.	34073.	-7353.
	218094.	170070.	48024.	28088.	34606.	4670.
	[illegible]20378.	170282.	50096.	26628.	[illegible]5145.	[illegible]677.
	[illegible]77386.	1597596.	79790.	23104[illegible]	3[illegible]8225.	[illegible]30.

YEAR	INCOME TAX	NET INCOME
1	0.	-135241.
2	0.	-98969.
3	0.	-67442.
4	0.	-44836.
5	0.	-31560.
6	0.	-26176.
7	0.	-21555.
8	0.	-17353.
9	0.	-14670.
10	0.	-11677.
TOTAL	0.	-469480.

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

7

RATE OF RETURN

INCLUDING POLE RENT		EXCLUDING POLE RENT
4.26%	- ASSUMING 10 YEAR LIFE -	5.63%
4.97%	- ASSUMING 12 YEAR LIFE -	6.35%
5.63%	- ASSUMING 15 YEAR LIFE -	7.02%

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

8

CAPITAL EXPENDITURES

ONE TIME EXPENDITURES	
HEADEND	28200.
MICROWAVE	0.
DIST. ABOVE GROUND	178694.
DIST. BELOW GROUND	0.
POLE ARRANGEMENT	13402.
TOWER	10000.
BUILDING	3000.
INVENTORY	5877.
TOOLS AND TEST EQ.	4138.
FURN AND LSHOLD IMP.	8900.
PUB. SERV. CHANNELS	0.
TWO WAY CAPABILITY	0.
SUBTOTAL	252211.

YEARLY EXPENDITURES

YEAR	DROPS	SIGNAL UPGRAD	20 CHAN CAP	ORIG EQUIP	TOTAL
1	13402.	0.	0.	0.	265614.
2	14863.	0.	0.	0.	14863.
3	19273.	0.	0.	0.	19273.
4	12674.	0.	0.	0.	12674.
5	9165.	0.	0.	0.	9165.
6	7128.	0.	0.	0.	7128.
7	6726.	0.	0.	0.	6726.
8	5285.	0.	0.	0.	5285.
9	5336.	0.	0.	0.	5336.
10	5386.	0.	0.	0.	5386.
TOTAL	99237.	0.	0.	0.	351449.

WHAT IS THE NUMBER OF THE TABLE YOU WANT?

9

DO YOU WISH TO RERUN THIS PROGRAM?
(TYPE Y OR N) n
DO YOU WISH TO RUN A DIFFERENT PROGRAM?
(TYPE Y OR N) n

ORA

```
SPECIFY 3 LETTER PROGRAM NAME (FOR INDEX TYPE IND)ora

WHAT IS THE SATELLITE LONGITUDE IN DEGREES?(0.00 TO 180.00)
USE - FOR WEST + FOR EAST

135.50

WHAT IS THE EARTH STATION LONGITUDE IN DEGREES?(0.00 TO 180.00
 USE - FOR WEST + FOR EAST

142.75

WHAT IS THE EARTH STATION LATITUDE IN DEGREES?(0.00 TO 90.00)
USE - FOR SOUTH + FOR NORTH

39.50


ELEVATION ANGLE TO SATELLITE   =    43.68 DEGREES

DO YOU WISH TO RERUN THIS PROGRAM?
(TYPE Y OR N)  n
```

ORB

SPECIFY 3 LETTER PROGRAM NAME (FOR INDEX TYPE IND)orb

THIS PROGRAM CALCULATES ELEVATION ANGLE, TRUE BEARING FROM THE NORTH, SATELLITE ANTENNA POINTING ANGLE, AND SLANT RANGE TO A GEOSTATIONARY OR A NON-SYNC SATELLITE. ANSWERS TO QUESTIONS SHOULD BE FOLLOWED BY A COMMA AND A CARRIAGE RETURN. (E.G. 165.12, CR.)

TYPE 1 FOR A GEOSTATIONARY ORBIT, OR TYPE 2 FOR A NON-SYNC ORBIT.

2,

WHICH EAST/WEST HEMISPHERE IS THE SATELLITE STATIONED IN?
(E FOR EAST, W FOR WEST)

W

WHAT IS THE SATELLITE LONGITUDE IN DEGREES? (0.00 TO 180.00)

135.50

WHAT NORTH/SOUTH HEMISPHERE IS THE SATELLITE STATIONED IN?
(N FOR NORTH, S FOR SOUTH)

N

WHAT IS THE SATELLITE LATITUDE IN DEGREES? (0.00 TO 90.00)

35.25

WHAT IS THE SATELLITE ALTITUDE IN NAUTICAL MILES?

15000.

WHICH EAST/WEST HEMISPHERE IS THE EARTH STATION IN?
(E FOR EAST, W FOR WEST)

W

WHAT IS THE EARTH STA1TION LONGITUDE IN DEGREES? (0.00 TO 180.00)

50.00

WHAT NORTH/SOUTH HEMISPHERE IS THE EARTH STATION IN?
(N FOR NORTH S FOR SOUTH)

N

WHAT IS THE EARTH STATION LATITUDE IN DEGREES? (0.00 TO 90.00)

51.50

AZIMUTH FROM [illegible] 41.76 DEGREES
ELEVATION AN[illegible] [illegible]ATE 66.43 DEGREES
SLANT RANGE [illegible] [illegible]216.53 KM, O[illegible] [illegible]ICAL MILES
SATELLITE [illegible] [illegible]NGLE 4.28 DEGR[illegible]
DO YOU WISH [illegible] [illegible]S PROGRAM?
(TYPE Y OR N)

SAT

SPECIFY 3 LETTER PROGRAM NAME (FOR INDEX TYPE IND)sat

TYPE 1 FOR UPLINK, TYPE 2 FOR DOWNLINK, TYPE 3 TO QUIT 2

DO YOU WANT INPUT QUESTIONS SUPPRESSED? (Y=YES, N=NO) N

DOWNLINK INPUT

1. DOWNLINK CARRIER FREQUENCY, MHZ = 468.825

2. SATELLITE DOWNLINK POWER INTO TRANSMITTING ANTENNA, WATTS = 10.

3. GROUND RECEIVER INTERMEDIATE AMPLIFIER BANDWIDTH, KHZ = 0.001

4. SATELLITE TRANSMITTER ANTENNA POWER GAIN, DB = 8.

5. TYPE 1. TO INPUT ANTENNA POWER GAIN
   TYPE 2. TO INPUT HELICAL ANTENNA DIMENSIONS
   TYPE 3. TO INPUT PARABOLIC REFLECTOR DIMENSIONS 1.

6. GROUND RECEIVER ANTENNA POWER GAIN, DB = 4.

13. TYPE 1. TO INPUT ELEVATION ANGLE AND SLANT RANGE
    TYPE 2. TO INPUT ELEVATION ANGLE AND SATELLITE ALTITUDE
    TYPE 3. TO INPUT LONGITUDES AND LATITUDES 2.

4. ELEVATION ANGLE TOWARDS SATELLITE MEASURED FROM HORIZONTAL, DEGS = 45.

16. SATELLITE ALTITUDE, KM = 36000.

3. TYPE 1. TO INPUT OVERALL EFFECTIVE NOISE-TEMPERATURE
   TYPE 2. TO CALCULATE DETAIL NOISE AND PATH ATTENUATION 2.

5. RAINFALL RATE AT GROUND STATION, MM/HR = 11.

26. TYPE 1. FOR DAY, TYPE 2. FOR NIGHT 0.

27. TYPE 1. TO INPUT RECEIVER NOISE TEMPERATURE
    TYPE 2. TO INPUT RECEIVER NOISE FIGURE 2.

29. RECEIVER NOISE FIGURE, DB = 7.

0. ESTIMATED CONNECTOR AND LINE LOSSES BETWEEN THE
   ANTENNA TERMINALS AND THE RECEIVER FRONT END, DB = 7.8

1. TYPE [illegible] FOR RURAL
   TYPE [illegible] FOR URBAN
   TYPE [illegible] OF URBAN [illegible] ANTENNA DISCRIMINATION 1.

[illegible]2. [illegible] TEMPERATURE [illegible] SATELLITE, [illegible] KELVIN = 290

TO [illegible] CHANGE [illegible] BEFORE RUNNING TYPE THE STATEMENT
N[illegible] DECIMAL), A [illegible], THE NEW VALUE, AND A RETURN.
T[illegible] THE PROGRAM, [illegible] RETURN.

DO YOU WANT TO LIST YOUR INPUT DATA? (Y=YES, N=NO) Y

DOWNLINK INPUT

DOWNLINK CARRIER FREQUENCY	468.825 MHZ
SATELLITE DOWNLINK POWER INTO TRANSMITTING ANTENNA	10.000 WATTS
GROUND RECEIVER INTERMEDIATE AMPLIFIER BANDWIDTH	.001 KHZ
SATELLITE TRANSMITTER ANTENNA POWER GAIN	8.000 DB
GROUND RECEIVER ANTENNA POWER GAIN	4.000 DB
ELEVATION ANGLE TOWARDS SATELLITE	45.000 DEGS
SATELLITE ALTITUDE	36000.000 KM
RAINFALL RATE AT GROUND STATION	11.000 MM/HR
1.=DAY, 2.=NIGHT	.000
RECEIVER NOISE FIGURE	7.000 DB
ESTIMATED CONNECTOR AND LINE LOSSES	7.800 DB
1.=RURAL, 2.=URBAN, 3.=URBAN WITH DISCRIMINATION	1.000
AMBIENT TEMPERATURE OF SATELLITE	290.000 DEGS KELVIN

DOWNLINK CALCULATIONS

CARRIER FREQUENCY	468.82 MHZ
TRANSMITTER ANTENNA POWER GAIN	8.00 DB ABOVE ISOTROPIC
RECEIVER ANTENNA POWER GAIN	4.00 DB ABOVE ISOTROPIC
ELEVATION ANGLE TO SATELLITE	45.00 DEGS
SLANT RANGE TO SATELLITE	37625.63 KM
FREE SPACE PATH LOSS	177.43 DB
TOTAL LOSSES	185.28 DB
RECEIVER FRONT END NOISE	1163.44 DEG KELVIN
CLEAR SKY NOISE-TEMPERATURE	188.45 DEG KELVIN
TOTAL N-T FOR CLEAR SKY	1627.93 DEG KELVIN
CARRIER/NOISE FOR CLEAR SKY	33.21 DB
EFFECTIVE SKY NOISE-TEMPERATURE	188.67 DEG KELVIN
TOTAL EFFECTIVE NOISE-TEMPERATURE	1628.14 DEG KELVIN
CARRIER/NOISE FOR EFFECTIVE N-T	33.20 DB
POWER FLUX DENSITY	-90.48 DBW/SQ.M/4 KHZ
FIGURE OF MERIT (G/T)	-22.67 DB

TYPE 1 FOR UPLINK, TYPE 2 FOR DOWNLINK, TYPE 3 TO QUIT 1

DO YOU WANT INPUT QUESTIONS SUPPRESSED? (Y=YES, N=NO) N

UPLINK INPUT

1. UPLINK CARRIER FREQUENCY, MHZ = 401.85
2. GROUND UPLINK POWER INTO TRANSMITTING ANTENNA, WATTS = 6.
3. SAT[illegible] RECEIVER INTERMEDIATE A[illegible] NDWIDTH, KHZ = 0.001
4. SAT[illegible] RECEIVER ANTEN[illegible] POWER [illegible] .3
5. TY[illegible] ANTENNA POWER [illegible]
   TY[illegible] HELICAL ANTENN[illegible]
   TY[illegible] PARABOL[illegible] REFLE[illegible] NS 1.

```
6. GROUND TRANSMITTER ANTENNA POWER GAIN, DB = 4.

13. TYPE 1. TO INPUT ELEVATION ANGLE AND SLANT RANGE
    TYPE 2. TO INPUT ELEVATION ANGLE AND SATELLITE ALTITUDE
    TYPE 3. TO INPUT LONGITUDES AND LATITUDES    2.

14. ELEVATION ANGLE TOWARDS SATELLITE MEASURED FROM HORIZONTAL, DEGS = 45.

16. SATELLITE ALTITUDE, KM = 36000.

23. TYPE 1. TO INPUT OVERALL EFFECTIVE NOISE-TEMPERATURE
    TYPE 2. TO CALCULATE DETAIL NOISE AND PATH ATTENUATION    1.

24. OVERALL EFFECTIVE NOISE-TEMPERATURE, DEGS KELVIN = 426.570

TO INPUT OR CHANGE A VALUE BEFORE RUNNING, TYPE THE STATEMENT
NUMBER (NO DECIMAL), A COMMA, THE NEW VALUE, AND A RETURN.
TO START THE PROGRAM, TYPE A RETURN.


DO YOU WANT TO LIST YOUR INPUT DATA? (Y=YES, N=NO)    Y

      UPLINK INPUT

UPLINK CARRIER FREQUENCY                                           401.850 MHZ
GROUND UPLINK POWER INTO TRANSMITTING ANTENNA                        6.000 WATTS
SATELLITE RECEIVER INTERMEDIATE AMPLIFIER BANDWIDTH,2                 .001 KHZ
SATELLITE RECEIVER ANTENNA POWER GAIN                                7.300 DB
GROUND TRANSMITTER ANTENNA POWER GAIN                                4.000 DB
ELEVATION ANGLE TOWARDS SATELLITE                                   45.000 DEGS
SATELLITE ALTITUDE                                               36000.000 KM
OVERALL EFFECTIVE NOISE-TEMPERATURE                                426.570 DEGS KELVIN

            UPLINK CALCULATIONS

 CARRIER FREQUENCY                       401.85 MHZ
 TRANSMITTER ANTENNA POWER GAIN            4.00 DB ABOVE ISOTROPIC
 RECEIVER ANTENNA POWER GAIN               7.30 DB ABOVE ISOTROPIC
 ELEVATION ANGLE TO SATELLITE             45.00 DEGS
 SLANT RANGE TO SATELLITE              37625.63 KM
 FREE SPACE PATH LOSS                    176.09 DB
 TOTAL EFFECTIVE NOISE-TEMPERATURE       426.57 DEG KELVIN
 CARRIER/NOISE FOR EFFECTIVE TEMP         45.29 DB .


TYPE 1 FOR UPLINK, TYPE 2 FOR DOWNLINK, TYPE 3 TO QUIT   1

DO YOU WANT INPUT QUESTIONS SUPPRESSED? (Y=YES, N=NO)   N


         UPLINK INPUT

 1. UPLINK CARRIER FREQUENCY, MHZ = 401.85

 2. GROUND UPLINK POWER INTO TRANSMITTING ANTENNA,

 3. SATELLITE RECEIVER INTERMEDIATE AMPLIFIER BANDW

 4. SATELLITE RECEIVER ANTENNA POWER GAIN, DB = 7.3
```

5. TYPE 1. TO INPUT ANTENNA POWER GAIN
TYPE 2. TO INPUT HELICAL ANTENNA DIMENSIONS
TYPE 3. TO INPUT PARABOLIC REFLECTOR DIMENSIONS <u>1.</u>

6. GROUND TRANSMITTER ANTENNA POWER GAIN, DB = <u>4.</u>

13. TYPE 1. TO INPUT ELEVATION ANGLE AND SLANT RANGE
TYPE 2. TO INPUT ELEVATION ANGLE AND SATELLITE ALTITUDE
TYPE 3. TO INPUT LONGITUDES AND LATITUDES <u>2.</u>

14. ELEVATION ANGLE TOWARDS SATELLITE MEASURED FROM HORIZONTAL, DEGS = <u>45.</u>

16. SATELLITE ALTITUDE, KM = <u>36000.</u>

23. TYPE 1. TO INPUT OVERALL EFFECTIVE NOISE-TEMPERATURE
TYPE 2. TO CALCULATE DETAIL NOISE AND PATH ATTENUATION <u>2.</u>

25. RAINFALL RATE AT GROUND STATION, MM/HR = <u>11.</u>

26. TYPE 1. FOR DAY, TYPE 2. FOR NIGHT <u>0.</u>

27. TYPE 1. TO INPUT RECEIVER NOISE TEMPERATURE
TYPE 2. TO INPUT RECEIVER NOISE FIGURE <u>2.</u>

29. RECEIVER NOISE FIGURE, DB = <u>3.9</u>

30. ESTIMATED CONNECTOR AND LINE LOSSES BETWEEN THE
ANTENNA TERMINALS AND THE RECEIVER FRONT END, DB = <u>8.1</u>

31. TYPE 1. FOR RURAL
TYPE 2. FOR URBAN
TYPE 3. FOR URBAN WITH ANTENNA DISCRIMINATION <u>1.</u>

32. AMBIENT TEMPERATURE OF SATELLITE, DEGS KELVIN = <u>290.</u>

TO INPUT OR CHANGE A VALUE BEFORE RUNNING, TYPE THE STATEMENT
NUMBER (NO DECIMAL), A COMMA, THE NEW VALUE, AND A RETURN.
TO START THE PROGRAM, TYPE A RETURN.

DO YOU WANT TO LIST YOUR INPUT DATA? (Y=YES, N=NO) <u>N</u>

UPLINK CALCULATIONS

CARRIER FREQUENCY	401.85 MHZ
TRANSMITTER ANTENNA POWER GAIN	4.00 DB ABOVE ISOTROPIC
RECEIVER ANTENNA POWER GAIN	7.30 DB ABOVE ISOTROPIC
ELEVATION ANGLE TO SATELLITE	45.00 DEGS
SLANT RANGE TO SATELLITE	37625.63 KM
FREE SPACE PATH LOSS	176.09 DB
TOTAL LOSSES	184.24 DB
RECEIVER FRONT END NOISE	421.97 [illegible]
CLEAR SKY NOISE-TEMPERATURE	273.[illegible]
TOTAL N-T [illegible] CLEAR SKY	[illegible]
CARRIER [illegible] FOR CLEAR SKY	[illegible]
EFFECTIVE [illegible] NOISE-TEMPERATURE	[illegible]
TOTAL [illegible]VE NOISE-TEMPERATURE	[illegible]
C[illegible] FOR EFFECTIVE N-T	

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TYPE 1 FOR UPLINK, TYPE 2 FOR DOWNLINK, TYPE 3 TO QUIT   2

DO YOU WANT INPUT QUESTIONS SUPPRESSED? (Y=YES, N=NO)   N

        DOWNLINK INPUT

 1. DOWNLINK CARRIER FREQUENCY, MHZ = 468.825

 2. SATELLITE DOWNLINK POWER INTO TRANSMITTING ANTENNA, WATTS = 10.

 3. GROUND RECEIVER INTERMEDIATE AMPLIFIER BANDWIDTH, KHZ = 0.001

 4. SATELLITE TRANSMITTER ANTENNA POWER GAIN, DB = 8.

 5. TYPE 1. TO INPUT ANTENNA POWER GAIN
    TYPE 2. TO INPUT HELICAL ANTENNA DIMENSIONS
    TYPE 3. TO INPUT PARABOLIC REFLECTOR DIMENSIONS   1.

 6. GROUND RECEIVER ANTENNA POWER GAIN, DB = 6.4

13. TYPE 1. TO INPUT ELEVATION ANGLE AND SLANT RANGE
    TYPE 2. TO INPUT ELEVATION ANGLE AND SATELLITE ALTITUDE
    TYPE 3. TO INPUT LONGITUDES AND LATITUDES   2.

14. ELEVATION ANGLE TOWARDS SATELLITE MEASURED FROM HORIZONTAL, DEGS = 45.

16. SATELLITE ALTITUDE, KM = 36000.

 8. TYPE 1. TO INPUT OVERALL EFFECTIVE NOISE-TEMPERATURE
    TYPE 2. TO CALCULATE DETAIL NOISE AND PATH ATTENUATION   1.

24. OVERALL EFFECTIVE NOISE-TEMPERATURE, DEGS KELVIN = 1148.

TO INPUT OR CHANGE A VALUE BEFORE RUNNING, TYPE THE STATEMENT
NUMBER (NO DECIMAL), A COMMA, THE NEW VALUE, AND A RETURN.
TO START THE PROGRAM, TYPE A RETURN.

DO YOU WANT TO LIST YOUR INPUT DATA? (Y=YES, N=NO)   N

        DOWNLINK CALCULATIONS

CARRIER FREQUENCY                         468.82 MHZ
TRANSMITTER ANTENNA POWER GAIN              8.00 DB ABOVE ISOTROPIC
RECEIVER ANTENNA POWER GAIN                 6.40 DB ABOVE ISOTROPIC
ELEVATION ANGLE TO SATELLITE               45.00 DEGS
SLANT RANGE TO SATELLITE                37625.63 KM
FREE SPACE PATH LOSS                      177.43 DB
TOTAL EFFECTIVE [illegible]ERATURE       1148.00 DEG KELVIN
CARRIER/NOISE FO[illegible]E TEMP          44.97 DB

TY[illegible] FOR UPLI[illegible] [illegible]OR DOWNLINK, TYPE 3 TO QUIT
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STR

SPECIFY 3 LETTER PROGRAM NAME (FOR INDEX TYPE IND)str

THIS IS A PROGRAM TO COMPUTE SATELLITE RELAY SYSTEM
 PERFORMANCE.  IF YOU NEED MORE INFORMATION, TYPE 1,
IF NOT, TYPE 2.1

THE INFORMATION FOR THIS PROGRAM WAS TAKEN FROM
 FIRST IEEE ANNUAL COMMUNICATIONS CONVENTION: CONFERENCE
 RECORD,"AIDS FOR THE GROSS DESIGN OF SATELLITE COMMUNICATION
 SYSTEMS" BY G.M.NORTHRUP, RAND CORP.

IF YOU WANT TO CALCULATE THE UPLINK, TYPE 1.
 IF YOU WANT TO CALCULATE THE DOWNLINK, TYPE 2.  IF YOU
 WANT TO CALCULATE BOTH UPLINK AND DOWNLINK, TYPE 3.3,

WHAT IS THE SATELLITE RECEIVER EFFECTIVE NOISE-TEMP
IN DEGREES KELVIN?1200.,

WHAT IS THE UPLINK POWER TRANSMITTED INTO THE
 ANTENNA IN WATTS?10.,

WHAT IS THE  DIAMETER OF THE PARABOLIC DISH ANTENNA
IN METERS?1.22,

WHAT IS THE SATELLITE RECEIVER I-F BANDWIDTH IN HERTZ?6000.,

WHAT IS THE UPLINK RADIO FREQUENCY IN MHZ?6000.,

WHAT IS THE SATELLITE RECEIVER ANTENNA GAIN IN DB?1.,

IF YOU WANT TO INPUT SATELLITE TO EARTH SEPARATION
DISTANCE, TYPE 1, IF YOU WANT TO INPUT SATELLITE ORBIT
COORDINATES, TYPE 2.2,

WHAT IS THE SATELLITE ALTITUDE IN KILOMETERS?3218.,

WHAT IS THE ELEVATION ANGLE?10.,

WHAT IS THE DOWNLINK POWER TRANSMITTED IN WATTS?2.,

WHAT IS THE DIAMETER OF THE PARABOLIC DISH ANTENNA IN
METERS?1.22

WHAT IS THE DOWNLINK TRANSMITTER FREQUENCY IN MHZ?4000.,

WHAT IS THE GROUND RECEIVER EFFECTIVE NOISE-TEMPERATURE
 IN DEGREES KELVIN?290.,

WHAT IS THE GROUND RECEIVER I-F BANDWIDTH IN HERTZ?6000.,

WHAT IS THE SATELLITE TRAN[illegible] ANTENNA GAIN IN DB?6.,
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UPLINK CALCULATIONS

TRANSMITTER ANTENNA GAIN  1          =       35.0 DB
RECEIVER ANTENNA GAIN  1             =        1.0 DB
TRANSMITTER FREQUENCY  1             =     6000.0 MHZ
FREE SPACE PATH LOSS  1              =      183.2 DB
SLANT RANGE TO SATELLITE             =     6144.8 KM
CARRIER TO NOISE RATIO (ONE-WAY 1)   =       22.2 DB

DOWNLINK CALCULATIONS

TRANSMITTER ANTENNA GAIN  2          =       -6.0 DB
RECEIVER ANTENNA GAIN  2             =       31.5 DB
TRANSMITTER FREQUENCY  2             =     4000.0 MHZ
FREE SPACE PATH LOSS  2              =      180.3 DB
SLANT RANGE TO SATELLITE             =     6144.8 KM
CARRIER TO NOISE RATIO (ONE-WAY 2)   =       14.4 DBDO YOU WISH TO RERUN THIS PR
(TYPE Y OR N)  n
```

U[redacted]L

DO YOU WANT DATA FROM A FILE? (Y OR N):NO

D[redacted] YOU WANT INPUT INSTRUCTIONS? (Y OR N):YES

UTL

ANY TIME YOU ARE ASKED TO TYPE A NUMBER FOLLOW IT WITH A COMMA AND A CARRAGE RETURN.

A REAL NUMBER IS ONE WITH A DECIMAL POINT AS A PLACE HOLDER.

AN INTEGER NUMBER IS A COUNTING NUMBER AND MUST NOT HAVE A DECIMAL POINT.

THERE ARE FOUR PARAMETERS :

- A = SATELLITE SEPARATION IN DEGREES
- B = INTERFERENCE NOISE IN PWOP
- C = RATIO OF EARTH STATION ANT. DIAMETER TO WAVE LENGTH
- D = RMS MODULATION INDEX OF THE MULTICHANNEL BASEBAND

ONE OF WHICH MAY BE VARIED AND ONE CALCULATED WHILE HOLDING THE OTHER TWO FIXED.

"THERE ARE SEVEN QUESTIONS"

1. WHAT PARAMETER IS TO BE VARIED ? : TYPE ONE OF THE ABOVE LETTERS.

2. WHAT IS THE STARTING VALUE FOR YOUR LETTER ? : TYPE A REAL NUMBER, TEN DIGITS OR LESS IN THE RANGE OF YOUR LETTER.

   0.5 < A < 10.0
   100. < B < 7000.
   50. < C < 600.
   0.2 < D < 2.0

3. INCREMENT YOUR LETTER BY : TYPE A REAL NUMBER TEN DIGITS OR LESS.

4. WHAT IS THE NUMBER OF TERMS IN YOUR SEQUENCE ? : TYPE AN INTEGER TEN DIGITS OR LESS.

5. WHICH PARAMETER IS TO BE CALCULATED ? : TYPE ONE OF THE REMAINING LETTERS.

6. WHAT IS THE VALUE FOR FIXED PARAMETER : TYPE A REAL NUMBER TEN DIGITS OR LESS.

7. WHAT IS THE VALUE FOR FIXED PARAMETER : TYPE A REAL NUMBER TEN DIGITS OR LESS.

[redacted]. WHAT PARAMETER IS TO BE [illegible] B
2. WHAT IS THE STARTING [illegible] ? 500.
3. WHAT IS B INCREMENT [illegible] 25.
[redacted]. HOW MANY ITERATIONS [illegible] 8.
5. WHICH PARAMETER IS TO [illegible] ? A
6. WHAT IS THE VALUE [illegible] 600.
[redacted]. WHAT IS THE VALUE FOR [illegible] 1.0

CONTINUE ? (Y OR N) :YES

	THETA	NOISE	DIAM/LAM	MOD INDX	C/MHZ/S	C/MHZ/D	CHNLS
1	4.32	500.	100.	1.0	28.59	6.62	22505.
2	4.24	525.	100.	1.0	28.59	6.75	22948.
3	4.16	550.	100.	1.0	28.59	6.88	23379.
4	4.08	575.	100.	1.0	28.59	7.00	23799.
5	4.02	600.	100.	1.0	28.59	7.12	24207.
6	3.95	625.	100.	1.0	28.59	7.24	24606.
7	3.89	650.	100.	1.0	28.59	7.35	24995.
8	3.83	675.	100.	1.0	28.59	7.46	25375.

DO YOU WISH TO EXIT? (Y OR N):YES
DO YOU WISH TO RUN A DIFFERENT PROGRAM?
(TYPE Y OR N) Y

ADM

U.S. DEPT. OF COMMERCE
OFFICE OF TELECOMMUNICATIONS/ITS
BOULDER, COLORADO

031623032

"ADMIN" SUMMARY AND FORECAST

PRESENT(+ OR - 12 HRS) MONTH-DAY-(Z)TIME GROUP(DDDDDDDD): 03160001

SUMMARY - MAR 150001Z TO MAR 160001Z

UNCONFIRMED EXCESS ATTENUATION ON DAYLIGHT PATHS(REF.=TSC REFERENCE NUMBER, INT.=RELATIVE INTENSITY, %=PERCENT CHANCE):

REF.	TIME	INT.	%
1767	MAR 150527Z-MAR 150546Z	MODERATE	5
1768	MAR 150450Z-MAR 150507Z	LOW	2
1769	MAR 152231Z-MAR 152248Z	LOW	2

FORECAST - MAR 160001Z TO MAR 170001Z

PREDICTED EXCESS ATTENUATION ON DAYLIGHT PATHS:
30% CHANCE OF PEAK UP TO 20 DB, RETURNING TO NORMAL WITHIN 30 MIN.
34% CHANCE OF PEAK UP TO 40 DB, RETURNING TO NORMAL WITHIN 60 MIN.
7% CHANCE OF PEAK UP TO 80 DB, RETURNING TO NORMAL WITHIN 2 HRS.

PREDICTED PERIODS(PLUS OR MINUS 10 HRS) OF UNSTABLE MUF'S AT MIDDLE AND HIGH LATITUDES WITH ERRATIC ATTENUATION ON AURORAL ZONE CIRCUITS(REF = TSC REFERENCE NUMBER, INT.=RELATIVE INTENSITY, %=PERCENT CHANCE):

REF.	TIME	INT.	%
1762X	MAR 151900Z-MAR 171900Z	SMALL	36

(X HAVE NOT BEEN REPORTED BUT STILL COULD OCCUR.)

STOP

CUR

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OFFICE OF TELECOMMUNICATIONS/ITS
BOULDER, COLORADO

031623027

"CURRENT" SUMMARY AND FORECAST

SUMMARY - MAR 150000Z TO MAR 162302Z

EXCESS ATTENUATION ON DAYLIGHT CIRCUITS COULD HAVE OCCURRED DURING AT LEAST ONE PERIOD BUT UNCONFIRMED.

MAXIMUM USEABLE FREQUENCY VARIATIONS DURING THE INTERVAL SHOULD HAVE BEEN WITHIN NORMAL(UNDISTURBED) LIMITS.

FORECAST - MAR 162302Z TO MAR 170000Z

THERE IS A VERY GOOD CHANCE OF RELATIVELY SHORT PERIODS (5 MIN TO 2 HRS) OF EXCESS ATTENUATION ON DAYLIGHT CIRCUITS.

FOR MORE DETAILED SUMMARY AND FORECAST, RUN "ADMIN".

STOP

GSM

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OFFICE OF TELECOMMUNICATIONS/ITS
BOULDER, COLORADO

04852308Z

"GENERAL SUMMARY"

AREA CODE LISTING?(0 FOR NO, 1 FOR YES): 1

0-WORLDWIDE
1-E.ATLANTIC
2-W.ATLANTIC,S.AMERICA
3-N.AMERICA,E.PACIFIC
4-MID-PACIFIC
5-W.PACIFIC
6-ASIA
7-NEAR EAST,INDIAN OCEAN
8-EUROPE,AFRICA

AREA CODE(S): 3
SPECIFY SUMMARY INTERVAL. USE MONTH-DAY-(Z)TIME GROUPS(DDDDDDDD).
START: 03130000
END: 03150000

AREA 3 - MAR 130000Z TO MAR 150000Z

UNCONFIRMED SHORT INTERVALS OF EXCESS ATTENUATION ON CIRCUITS IN LATITUDES FROM 75S TO 75N(REF.=TSC REFERENCE NUMBER, U=UNCONFIRMED, C=CONFIRMED, IMP.=IMPORTANCE, LONG.EXT.=LONGITUDINAL EXTENT):

REF.	INTERVAL	IMP.	LONG.EXT.
1766U	MAR 141536Z-MAR 141553Z	LOW	135E , 0W
1763U	MAR 142128Z-MAR 142147Z	MODERATE	150W , 0E
1764U	MAR 142133Z-MAR 142152Z	MODERATE	135W , 0E

MAXIMUM USABLE FREQUENCY VARIATIONS SHOULD HAVE BEEN WITHIN NORMAL (UNDISTURBED) LIMITS.

SUMMARY FOR ANOTHER AREA OR TIME PERIOD? (0 FOR NO, 1 FOR YES): 0

STOP

WRN

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OFFICE OF TELECOMMUNICATIONS/ITS
BOULDER, COLORADO
031623062

(FOLLOWING IS THE MOST RECENT MESSAGE AUTOMATICALLY DISTRIBUTED)

"PROPWARNING" ISSUED 03162107Z

150527Z TO ABOUT 150550Z - SMALL SIGNAL ATTENUATION EXPECTED ON DAYLIGHT PATHS.

180100Z TO ABOUT 200100Z - SMALL MUF CHANGES WITH SIGNAL ATTENUATION AND FADING EXPECTED ON AURORAL ZONE PATHS.

FOR A SPECIFIC CIRCUIT, REQUEST "DETAIL" REF. NO. 1767

STOP

PUBLIC FILES

THE FOLLOWING FILES ARE GENERAL ACCESS PROGRAMS AND INFORMATION AVAILABLE THROUGH THE BOULDER LABORATORIES XDS-940 SYSTEM. INSTRUCTION FOR ACCESS IS CONTAINED IN THE FILE PUI. GENERAL XDS-940 ACCESS IS AVAILABLE THROUGH THE FILE CODE PUC

INDEX OF PUBLIC FILES

MARCH 20, 1972

FILE	TYPE	LANG	DESCRIPTION
PROGRAMS			
BUSINESS			
AMORT	GO	FOS	COMPUTES AMORTIZATION SCHEDULES
SALARI	SYM	---	INSTRUCTIONS FOR SALARY
SALARS	SYM	FTC	SYMBOLICS FOR "SALARY"
SALARY	GO	EXEC	CALCULATES BIWEEKLY PAYCHECK FROM ANNUAL SALARY
ELECTRICAL ENGINEERING			
CIRCUITS			
AC-UC	BIN	FOS	AC CIRCUITS USER CONTROL
ACPT2	BIN	FOS	FOR SPECIAL AC CIRCUITS
ANALYZE	SYM	BAS	CHAIN FROM "FILTER"
CIRC-AC	BIN	FOS	FIRST LINK FOR AC-CIRC
CIRC-DC	BIN	FOS	FIRST LINK FOR DC-CIRC
CIRCAC	GO	EXEC	START UP CIRC-AC PROGRAM
CIRCTR	GO	EXEC	START UP CIRC-TRANSIENT PROGRAM
DC-UC	BIN	FOS	DC CIRCUITS USER CONTROL
DCPT2	BIN	FOS	DC CIRCUITS SPECIAL LIBRARY
DRAW	SYM	BAS	CHAIN FROM "FILTER"
FILTER	SYM	BAS	DESIGNS PARALLEL TEE FILTERS
LPFILT	SYM	BAS	DESIGNS M-DERIVED LOW PASS FILTERS
PINET	SYM	BAS	PI-NETWORK CALCULATIONS
VALUES	SYM	BAS	CHAIN FROM "FILTER"
COMPONENTS			
MICB	BIN	FOS	BINARY OF MICRO
MICRO	SYM	FTC	MATCHES COMPONENTS AT MICROWAVE FREQUENCIES
MATHEMATICS			
GEOMETRY			
CIRCLE	SYM	BAS	DIVIDES CIRCLES INTO N EQUAL PARTS
COGO	GO	FOS	COORDINATE GEOMETRY SYSTEM
[illegible]	SYM	[illegible]	[illegible] ES SPHERICAL TRIANGLES
[illegible] NGLE	SYM	[illegible]	[illegible] S TRIANGLES AND GIVES AREA
[illegible]	SYM	[illegible]	[illegible] ES TRIANGLES

FUNCTION ANALYSIS

FFTB	BIN	FOS	FAST FOURIER TRANSFORM (BINARY)
FFTS	SYM	FTC	FAST FOURIER TRANSFORM
LINPRI	SYM	---	INSTRUCTIONS FOR LINPRO
LINPRO	SYM	BAS	LINEAR PROGRAMMING
MATINV	SYM	BAS	INVERTS MATRICES
MINMAX	SYM	BAS	MINIMUM AND MAXIMUM OF FUNCTIONS
NUMINT	SYM	BAS	NUMERICAL INTEGRATION
POLZER	SYM	BAS	ZEROES & POLES OF A TRANSFER FUNCTION
ROOTER	SYM	BAS	FINDS ROOTS OF A POLYNOMIAL
SIMUL	SYM	BAS	SOLVES SIMULTANEOUS EQUATIONS
TMFCEV	SYM	BAS	EVALUATION OF TIME FUNCTIONS
ZEROFS	SYM	BAS	MIN, MAX, AND ZEROES OF A FUNCTION

STATISTICS

A1	SYM	BAS	TEST FILE FOR MULREG
BICONF	SYM	BAS	BINOMIAL DIST. CONFIDENCE LIMITS
BINDIS	SYM	BAS	BINOMIAL PROBABILITY DISTRIBUTION
BITEST	SYM	BAS	STATISTICAL TEST OF BINOMIAL PROPORTION
CHISQ	SYM	BAS	COMPUTES CHI-SQUARES
COLINE	SYM	---	LINEAR REGRESSION CONFIDENCE LIMITS
CONBIN	SYM	BAS	CONFIDENCE LIMITS FOR NORMAL APPROXIMATION
CONLIM	SYM	BAS	CONFIDENCE LIMITS
CURFIT	SYM	BAS	LEAST SQUARES CURVE FIT
LINREG	SYM	BAS	LINEAR REGRESSION FOR TWO VARIABLES
MANDSD	SYM	BAS	CALC. MEAN, VARIANCE, AND STANDARD DEVIATION
MULDAT	SYM	BAS	DATA FOR MULREG
MULREG	SYM	BAS	MULTIPLE REGRESSION ANALYSIS
MULREI	SYM	---	INSTRUCTIONS FOR MULREG
PFIT	SYM	BAS	FITS P'S
POLFIT	SYM	BAS	LEASTSQUARES POLYNOMIAL FIT
PROVAR	SYM	BAS	NORMAL CURVE INTERPOLATION
PROVEX	SYM	---	INSTRUCTIONS FOR PROVAR
SIGNIF	SYM	BAS	CONFID. LIM. FOR DIFF BETWEEN 2 MEANS
STATANAL	SYM	BAS	STATISTICAL ANALYSIS

SYSTEM INFORMATION

OPERATIONS

CLASSES	SYM	---	COMPUTER SERVICES' CURRENT TRAINING SCHEDULE
COST	SYM	BAS	FIGURES COST OF 940 USE.
FILINF	SYM	---	INFORMATION ABOUT 940 FILES
HELP	SYM	---	FIRST POINTER TO INFO FILES
LANGUAGE	SYM	---	INFORMATION ON OUR LANGUAGES
LETINF	SYM	---	INSTRUCTIONS FOR 'LETTER' PROG.
LETTER	GO	EXEC	SENDS LETTERS TO A USER.
MANUALS	SYM	---	LISTS MANUALS AVAILABLE
MERIT	GO	EXEC	GIVES FIGURE OF MERIT FOR CURRENT SYSTEM LOADING
NEWS	SYM	---	GENERAL SYSTEM NEWS
PHNEWS	SYM	---	NEWS ABOUT YDS 940 TELEPHONE NUMBERS
RATES	SYM	---	PRESENT 940 CHARGES
SERVICE	SYM	---	940 USER SERVICES
TROUBLE	[illegible]	-	POSSIBLE SYSTEM TROUBLES
UPCK	[illegible]	[illegible]C	CK TO SEE IF COMPUTER IS [illegible]
UPTIME	[illegible]	--	HOURS OF 940 OPERATION

DIRECTORY INFORMATION

BUSINESS	SYM	---	DIRECTORY OF PUBLIC BUSINESS FILES
ENGINEER	SYM	---	DIRECTORY OF PUBLIC ENGINEERING FILES
INFORM	SYM	---	DIRECTORY OF PUBLIC INFORMATION FILES
MATH	SYM	---	DIRECTORY OF PUBLIC MATHEMATICAL FILES
NEWPUB	SYM	---	NEWLY CREATED PUBLIC FILES
PUBLIC	SYM	---	THIS LISTING
SCIENT	SYM	---	DIRECTORY OF PUBLIC SCIENTIFIC FILES
SPECIAL	SYM	---	DIRECTORY OF SPECIAL PUBLIC FILES

EDITING

TEXT

COMP1	DUM	SNO	FIRST PASS OF COMPOSITOR
COMP2	DUM	SNO	SECOND PASS OF COMPOSITOR
COMPC	DUM	SNO	SPECIAL 2ND PASS OF COMPOSITOR FOR TWO COLUMN OUTPU[illegible]
COMPT	SYM	---	TEST PROGRAM FILE FOR 'COMP1' AND 'COMP2'
LOWCASE	DUM	SNO	TRANSLITERATES UPPER-CASE TO UPPER/LOWER-CASE FIL[illegible]
SUBS	SYM	---	SUBSTITUTES A CHARACTER FOR ANY OTHER IN YOUR FIL[illegible]
UC	GO	EXEC	TRANSLITERATE UPPER- TO LOWERCASE SELECTIVELY

FILES

APPEND	GO	EXEC	APPENDS ANY SYMBOLIC FILE TO ANY OTHER
BIGF	GO	EXEC	SEPARATES BIG FILE INTO SMALLER FILES
CKSUM	GO	EXEC	CHECKS USER'S FILES FOR DISC ERRORS
COMB	GO	EXEC	COMBINES FILES INTO ONE LARGE FILE
COMPARE	GO	EXEC	COMPARES TWO FILES FOR EQUALITY
FREAD	GO	EXEC	READS ANY FILE (USE DDT)
ISORT	SYM	---	INSTRUCTIONS TO "SORT" AND "MERGE"
MERGE	DUM	SNO	COMBINES TWO FILES
SCRAMBLE	GO	EXEC	SCRAMBLES OR UNSCRAMBLES ANY INPUT FILE
SCRAMI	SYM	---	INSTRUCTIONS FOR SCRAMBLE
SORT	DUM	SNO	SORTS FILES ALPHABETICALLY
VERIFY	GO	FOS	SIMULATES KEY PUNCH VERIFICATION OF 940 DATA FILES
VERINF	SYM	---	INSTRUCTIONS FOR 'VERIFY'

INPUT/OUTPUT

TELETYPE

35TEST	GO	EXEC	TEST 33 OR 35 TTY SEND/RECEIVE.
37TEST	GO	EXEC	TESTS 37 TTY SEND/RECEIVE
BANNER	GO	EXEC	PRINTS BIG CHARS. OUT OF INDIVIDUAL SMALL CHARS.
BOX	SYM	---	OUTPUTS TTY CHARACTERS
FIVO	GO	EXEC	CONVERTS ASC II FILE TO FIVE LEVEL TTY TAPE
FOX	GO	EXEC	PRINTS QUICK BROWN FOX
FTSC	GO	EXEC	CONVERTS 5-LEVEL TTY TAPE TO 8-LEVEL
LABEL	GO	EXEC	PUNCHES LABELS ON PAPER TAPE
READP	GO	EXEC	READ PAPER TAPE EFFICIENTLY.
T37	SYM	---	TEST FILE FOR MODEL 37 TELETYPES
TCHAR	GO	EXEC	TYPES ALL CHARACTERS FOR EVER
TTYNEWS	SYM	---	NEWS ABOUT TELETYPE PACKAGE FOR TSS-4.15
TTYTEST	SYM	BAS	GENERAL TELETYPE TEST PROGRAM

CRT

CRT	BIN	FOS	[illegible] LIBRARY FOR [illegible] CRT ROUTINES

```
  FLOW       GO    EXEC DRAWS FLOW CHARTS ON COMPUTEK CRT
  PAGER      GO    EXEC PROVIDES PAGE TO OUTPUT (FOR CRT)
  PAGIT      GO    EXEC PAGES TEXT FOR LISTING ON COMPUTEK CRT

 FLEXOWRITER
  FLEXI      SYM   ---  INSTRUCTIONS FOR FLEXO
  FLEXO      GO    EXEC PUNCHES FLEXOWRITER TAPE FROM ASCII FILE
  FLEXP      GO    EXEC FLEXO FOR PB-250 COMPUTER
  INFLEX     GO    EXEC READS FLEXOWRITER TAPE INTO FILE
  OUTFLEX    GO    EXEC PUNCHES FLEXOWRITER TAPE FROM FILE

 TYPAGRAPH
  EZINF      SYM   ---  INFO ON TYPAGRAPH SOFTWARE
  EZLIB      BIN   FOS  TYPAGRAPH SUBROUTINES
  EZPLOT     GO    EXEC PLOT ROUTINE FOR TYPAGRAPH
  XEZPLOT    GO    FOS  ADVANCED VERSION OF "EZPLOT"

 PLOTTING

   TELETYPE
  MASSPLOT GO      EXEC PLOTS X-Y COORDINATE POINT DENSITIES ON THE TELETY-
   MPLOT      SYM  CAL  MULTIPLE FUNCTION PLOT
  PLOTNEWS SYM     ---  INFORMATION ON THE LINE PLOTTER
  PLOTTO     SYM   BAS  PLOTS ONE TO 6 FUNCTIONS
  PZPLOT     SYM   BAS  PLOTS ZEROES AND POLES OF A TRANSFER FUNCTION
  TWOPLO     SYM   BAS  PLOTS TWO CURVES
  XYPLOT     SYM   BAS  X-Y-PLOT ROUTINE

   CALCOMP
  CLIB       BIN   FOS  CALCOMP PLOTTER LIBRARY

   HOUSTON INSTRUMENTS
  HINF       SYM   ---  INFO ON HOUSTON INSTRUMENTS PLOTTING SUBROUTINES
   HLIB       BIN   FOS  LIBRARY FOR HOUSTON INSTRUMENT PLOTTER
  PLOTOUT    GO    EXEC PLOT ROUTINE FOR HOUSTON INSTRUMENT PLOTTER

   ZETA
  OPLOT      GO    FOS  ZETA 230 PLOTTER PROGRAM
  ZLIB       BIN   FOS  ZETA PLOTTER LIBRARY
  ZS         BIN   FOS  ZETA PLOTTER ROUTINES

LANGUAGE INFORMATION

 BASIC
  BASCON     SYM   ---  BASIC CONVERSION FROM GE TO [illegible]RS
  BASINF     SYM   ---  BASIC INFORMATION
  BASNEWS    SYM   ---  BASIC NEWS
  RESEI      SYM   ---  INSTRUCTIONS FOR RESEQ
  RESEQ      GO    EXEC RESEQUENCES BASIC PROGRAMS

 CAL
  CALINF     SYM   ---  INFORMATION ABOUT CAL
  CALNEWS    SYM   ---  NEWS AND CH[illegible] TO CAL

 DESK CALC.
  DESC       GO    EXEC SIMULAT[illegible] CALCULATOR, [illegible] 'DESK
  DESINF     SYM   ---  INSTRUC[illegible] 'DESC'
```

DDT

DDTINF	SYM	---	INFORMATION ABOUT DDT
DDTNEWS	SYM	---	NEWS ABOUT AND CHANGES TO DDT

EXEC

EXCINF	SYM	---	INFORMATION ABOUT THE EXECUTIVE
EXCNEWS	SYM	---	NEWS ABOUT THE EXECUTIVE

FORTRAN II

FOSINF	SYM	---	INFORMATION ABOUT FORTRAN II OPERATING SYSTEM
FOSNEWS	SYM	---	NEWS ABOUT AND CHANGES TO FOS
FTCDEM	SYM	---	FORTRAN II DEMONSTRATION INSTRUCTIONS
FTCDMP	SYM	FTC	FORTRAN II DEMONSTRATION PROGRAM
FTCINF	SYM	---	INFORMATION ABOUT FORTRAN II COMPILER
FTCNEWS	SYM	---	NEWS ABOUT AND CHANGES TO FTC
FTCRWB	BIN	FOS	FAST READ/WRITE BINARY FILE SUBROUTINE
FTCRWS	SYM	TAP	SYMBOLIC FILE FOR FTCRWB
GECON	SYM	SNO	CONVERTS GE 400 FORTRAN TO 940 FTN II
LBRINF	SYM	---	INFORMATION ABOUT FORTRAN 2 LIBRARY :
LBRNEWS	SYM	---	NEWS ABOUT THE FORTRAN II LIBRARY
LBRSYM	SYM	TAP	FORTRAN II LIBRARY SYMBOLICS
LIB	BIN	FOS	FORTRAN II LIBRARY BINARIES
MLIB	GO	EXEC	FORTRAN LIBRARY MAINTENANCE ROUTINE
RANINF	SYM	---	INFO ABOUT FORTRAN II RANDOM-ACCESS-FILES SUBROUTI
SPEEDTST	SYM	FTC	FORTRAN TESTER
XFTC	GO	EXEC	EXPERIMENTAL FORTRAN II COMPILER (TEMPORARY)
XLIB	BIN	FOS	EXTENDED LIBRARY, SEE "XLINF"
XLINF	SYM	---	INFORMATION ON XLIB
XXLIB	BIN	FOS	EXTENDED EXPERIMENTAL LIBRARY, SEE FII MANUAL

SCIENTIFIC SUBROUTINE PACKAGE

ADSAM	GO	FOS	MATRIX ADDITION SSP SAMPLE, SEE 'SSPINF'
ANOVA	GO	FOS	ANALYSIS OF VARIANCE, SEE 'SSPINF'
DASCR	BIN	FOS	HISTOGRAM AND STATISTICS FOR SCREENED DATA, SEE 'SS
EXPON	GO	FOS	TRIPLE EXPONENTIAL SMOOTHING, SEE 'SSPINF'
FACTO	GO	FOS	FACTOR ANALYSIS, SEE 'SSPINF'
GETSSP	GO	FOS	RETRIEVES 1130 SSP SUBROUTINE SOURCE CODE
INSSSP	GO	FOS	SELECTIVELY LISTS INSTRUCTIONS FOR SSP SAMPLE PROG
MDISC	GO	FOS	DISCRIMINANT ANALYSIS, SEE 'SSPINF'
POLRG	GO	FOS	POLYNOMIAL REGRESSION, SEE 'SSPINF'
QDINT	GO	FOS	NUMERICAL QUADRATURE INTEGRATION, SEE 'SSPINF'
REGRE	GO	FOS	MULTIPLE LINEAR REGRESSION, SEE 'SSPINF'
RKINT	BIN	FOS	RUNGE-KUTTA INTEGRATION, SEE 'SSPINF'
SMPRT	GO	FOS	REAL AND COMPLEX ROOTS OF POLYNOMIAL, SEE 'SSPINF'
SOLN	GO	FOS	SOLUTION OF SIMULTANEOUS EQUATIONS, SEE 'SSPINF'
SSPINF	SYM	---	INFO ABOUT IBM 1130 SCIENTIFIC SUBR PACKAGE
SSPMATH	BIN	FOS	SSP MATHEMATICAL SUBROUTINE BINARIES
SSPMTX	BIN	FOS	SSP MATRIX SUBROUTINE BINARIES
SSPSPC	BIN	FOS	SSP SPECIAL SUBROUTINE BINARIES
SSPSTAT	BIN	FOS	SSP STATISTICAL SUBROUTINE BINARIES

FORTRAN IV

[illegible]RINF	SYM	---	CONVERSATIONAL FORTRAN INFORMATION
[illegible]NEWS	SYM	---	NEWS ON CONVERSATIONAL FORTRAN IV
[illegible]TSG	GO	EXEC	GENERAL FORTRAN TEST PROGRAM (FTN [illegible])
[illegible]ST	SYM	FTC	FORTRAN TEST PROGRAM

```
LIST
 LISINF    SYM  ----  INFO ABOUT LIST SUBSYSTEM
 LISNEWS   SYM  ----  NEWS ABOUT LIST

MIRTH
 MIRTH     GO   FOS   MANAGEMENT INFORMATION RETRIEVAL PROGRAM
 QMIRTH    GO   FOS   QUICK MIRTH

QED
 QEDINF    SYM  ---   INFORMATION ABOUT QED
 QEDNEWS   SYM  ---   NEWS ABOUT AND CHANGES TO QED
 QUICKQED  SYM  ----  SUMMARY OF QED COMMANDS

SNOBOL
 SNOBUGS   SYM  ----  PROBLEMS WITH SNOBOL
 SNOINF    SYM  ---   INFORMATION ABOUT SNOBOL
 SNONEWS   SYM  ---   NEWS ABOUT AND CHANGES TO SNOBOL

TAP
 SBRINF    SYM  ---   INFORMATION ON TAP SUBROUTINES IN FTN II
 TAPINF    SYM  ---   INFORMATION ABOUT TAP
 TAPNEWS   SYM  ---   NEWS ABOUT AND CHANGES IN TAP

INTERFACE WITH OTHER SYSTEMS

CDC 3800
 CDC38     GO   EXEC CONVERTS CDC 3800 FLT-PT BIN. NOS. TO DEC. FLT-PT.
  INTAPE    GO   EXEC READS ANY PAPER TAPE INTO FILE FOR CDC 3800
 INTAPI    SYM  ---  INFORMATION AND INSTRUCTIONS FOR INTAPE
 STRIP     GO   EXEC STRIPS ID FROM CARD IMAGES
 SUBINF    SYM  ---  TELLS HOW TO SUBMIT 3800 JOBS FROM 940 FILES

PDP 8
 PDPRW     GO   EXEC READS AND WRITES DIRECTLY TO PDP-8 CORE
 XPDP      GO   EXEC EXPERIMENTAL PDP-8 ASSEMBLER

999
```

Descriptions

Descriptions of public files to be included at a later date.

Telecommunication Services Center

Bulletins

U.S. DEPARTMENT OF COMMERCE
OFFICE OF TELECOMMUNICATIONS
Washington, D. C. 20005
Boulder, Colorado 80302

Telecommunication Services Center

Bulletin

March 20, 1972

The Telecommunication Services Center has begun a concentrated expansion of the service initiated in July 1968. Since that time, forecasts of the effects of solar-geophysical disturbances on radio system operations have been available. The objective of this expansion is to make information, data, and analysis models and routines available as necessary to examine, evaluate, and analyze telecommunication problems and opportunities.

A Guide to Telecommunication Services is available from the Office of Telecommunications in looseleaf form to allow updating as the service expands.

The collation of these services is within the Telecommunication Services Center. Automated, remote access to much of the information is maintained by the Center. Information concerning access to these services is contained in the Guide. Currently, the remotely accessible information includes routines to perform technical and economic analysis of systems, summaries and forecasts of current radio conditions and current information about the services. Within the next months, population, bibliographic, and source information as used in telecommunication anaylsis will also be available.

At present, access to these services is available upon [illegible] arrangement with the Office of Telecommunications.

Frequency Management Services

The Office of Telecommunications provides support to the Office of Telecommunications Policy by managing the Interdepartment Radio Advisory Committee (IRAC) Secretariat. This service consists of maintaining the Government Master File of Frequency Assignmnets, and modifying this file in accordance with applications for use of radio frequencies, and the needs and actions of the IRAC members.

In addition, the Office of Telecommunications provides an anlaysis of electromagnetic compatibility for government agencies as required to assure effective use of the radio spectrum.

Further information is available by contacting the Frequency Management Program Manager, Office of Telecommunications.

System Prediction Services

The Office of Telecommunications has, through its predecessor organizations (ITSA and CRPL), provided system prediction services to government and non_government organizations for many years. These predictions of parameters such as signal_to_noise ratio, transmitted power, and error rate are available primarly for radio systems, covering the current used radio spectrum.

For further information, contact the Program Manager, Telecommunications Technology, Office of Telecommunications.

Radio Forecast Services

The Department of Commerce has issued forecasts of ionospheric disturbances since 1942. In July 1968, these forecasts were modified to estimate the attenuation and maximum usable frequency variations for high frequency system operations. Solar radiation and terrestrial disturbance information are communicated from observatories around the world in near real-time to computerized data files that are accessed and analyzed to produce automated warnings, forecasts, and summaries of radio conditions on request of the user. In addition, disturbance information is transmitted to the public over NBS radio standard station WWV on 5 frequencies. A Weekly Forecast is mailed to about 500 recipients, worldwide, indicating near past, current, and future radio conditions, and including revision factors necessary for accurate system performance calculations. A forecaster is on duty at the Office of Telecommunications Boulder, Colorado facilities during normal 8 AM to 5 PM working hours.

Further information is available by contacting the Duty Forecaster, Telecommunication Services Center, Boulder, Colorado.

Consulting and Advisory Services

The Office of Telecommunications maintains an active consulting and advisory service with many government agencies. This service includes for example, participation in review and recommendation of telecommunication programs and international conferences and activities. For further information, contact the Director, Office of Telecommunications.