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ABSTRACT

This report summarizes the findings and implications of a study that examined the potential for expanded use of satellite-related telecommunications in vocational education, focusing on the short-term potential of satellites in the areas of instruction, training, administration, and governance. The investigation found that a variety of education-oriented experiments with satellite telecommunications have been conducted since the 1960s. These have shown that satellite systems require strong commitment among sponsors and participants and clear incentives for use, including a careful match of technology to educational needs. Today, state educational telecommunications networks are found to be at varying developmental stages, with Alaska's system using satellites pervasively. With vocational education's need to keep current and reach widely dispersed audiences and new clientele, satellite applications are envisioned as beneficial in a number of ways, with great potential for instruction, training, and professional development. Increasingly, video teleconferencing and other programs such as telecourses afford interactivity so that training and instructional purposes can be met more readily. A number of specialized satellite-based projects currently underway should be monitored by vocational educators for their adaptation in program improvement work. Before any satellite-based solutions to vocational educational needs can be implemented, however, issues related to software, "peopleware," and hardware must be confronted, and more intense study must be made of the needs of potential users. The appendix includes several substantive reports by technical experts, telecommunications providers, and educational "adopters." A glossary and extensive references complete the document. (KC)

SATELLITE TELECOMMUNICATIONS AND THEIR POTENTIAL FOR VOCATIONAL EDUCATION

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FOREWORD

This report to the Office of Vocational and Adult Education, U.S. Department of Education, presents the findings of an investigatory study of satellite-assisted electronic telecommunications and other electronic telecommunications that are closely related in real or potential applications. This designated study was conducted by the National Center for Research in Vocational Education and was prompted by recognition of the need to examine further the opportunities and potential problems in the short-term and long-term use of such telecommunications for the improvement of vocational education at large.

The report was developed for the purpose of providing a range of information to assist further decision making and strategy development by U.S. Department of Education staff and other interested regional and State education agencies. Its purpose, nevertheless, is not to design or recommend the establishment of any particular satellite-assisted telecommunications network for vocational education. As an information base for further research, planning, and development, it provides data and perspectives on the background and current status of satellite-related telecommunications, their educational applications, and their capabilities and requisites for furthering the potential of vocational education instruction and training, personnel development, administration and governance, and research.

The profession is indebted to Shelley Grieve and Dr. Norman M. Singer, Project Director, for their scholarship in developing this report. Both are staff members at the National Center, where Ms. Grieve is a Publications Specialist and Dr. Singer a Senior Research and Development Specialist.

The National Center would also like to acknowledge the wide range of individuals and organizations that provided information necessary to this report. We are especially indebted to the following consultants for their contributions: Linda Lee Bower, International Telecommunications Consultant, Chevy Chase, MD; Andrew Calabrese, Research Assistant, OCLC, Inc.; Mary Diebler, Research and Development Manager, and the staff of the Public Service Satellite Consortium/SatServ; Bruce Klopfenstein, Graduate Research Associate, The Ohio State University; Carol Koffarnus, Vice-President, Postsecondary Telecommunications, Central Educational Network; and Steve Levitt, Graduate Research Associate, The Ohio State University.

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Fred Manley, North Carolina State Board of Community Colleges; Bruce Mathews, WOSU Stations, The Ohio State University; Marie Oberle, National University Teleconferencing Network; Arthur Vadnais, Minnesota State Department of Education; and James Zigerell, American Association of Community and Junior Colleges; as well as National Center Staff.

Recognition is also due Randall G. Bretz, Director of Media, Indian Hills Community Church, Lincoln, Nebraska; Martha A. Stroud, Assistant to the Vice President for Academic Affairs, University of Calgary, Calgary, Alberta; and to Yvonne Bergland and Ida M. Halasz, the National Center for Research in Vocational Education, for their critical review of the manuscript. Janet Ray and Brenda Hemming served as word processor operators. Editorial assistance was provided by Janet Kiplinger of the Field Services and Personnel Development staff.

Robert E. Taylor
Executive Director
The National Center for Research
in Vocational Education

EXECUTIVE SUMMARY

Satellite-assisted telecommunications are a communications and information-processing tool that should be more widely utilized to help vocational education keep pace with the changing needs of society. This study provides an information base for further research and planning by vocational education decision makers in the near-term future as well as for contemplation of later possibilities.

As one form among a variety of electronic telecommunications, satellites must be considered in terms of how they work convergently with other media. The interaction of information and telecommunications will figure as an important trend commanding the attention of vocational educators.

A telecommunications satellite functions as a microwave antenna in space to receive and process signals from earth and retransmit the signal to a reception area, or "footprint," which may cover up to one third of the earth's surface. Increased distances between originating and receiving sites do not increase costs as they do with typical earthbound telecommunications. Satellites are now used commonly for TV and radio, telephony, telegraphy, videoconferencing, and data transmission. While available telecommunications options for all applications are increasing, satellites are a preferred medium for particular situations and purposes.

A variety of education-oriented experiments with satellite telecommunications have been conducted since the 1960s. These have shown that satellite systems require strong commitment among sponsors and participants and clear incentives for use, including a careful match of technology to educational needs.

Many organizations today are involved in educational telecommunications and distance learning, especially at the postsecondary level. As vocational educators intensify their involvement, they will increasingly collaborate with and draw upon the resources of these organizations, which include program developers, producers, and service providers. Educational networks also distribute programming they develop or acquire. State educational telecommunications networks are found to be at varying developmental stages, with Alaska's system utilizing satellite pervasively.

With vocational education's need to keep current and reach widely dispersed audiences and new clientele, satellite applications are envisioned as beneficial in a number of ways, with great potential for instruction, training and professional development. To make concerted use of the potential of this advanced technology in vocational education, leadership and increased momentum are needed. Increasingly, videoconferencing and other programs such as telecourses afford interactivity so that training and instructional purposes can be met more readily. A number of specialized satellite-based projects currently underway should be monitored by vocational educators for their adaptation in program improvement work.

Currently, the use of satellite video capacities is constrained most severely by the lack of available programming and the lack of funding for its development. Some programs or series do serve as examples of different types of programming that might be considered for future satellite networking. In general, however, the traditional expectation of hands-on vocational education and the trends toward individualized learning and competency-based instruction have mitigated against distance learning and, hence, against televised instructional programs. But satellite transmissions for instructional purposes and other forms of vocational education can work together, as further study probably will indicate, especially as they may be combined with other technologies and used in new contexts.

The educational uses of communications satellites to date have centered largely on continuing education for professionals, mostly taking the form of teleconferences with one-way video and two-way interactive audio. In addition, satellite-transmitted communication can also be applied to administrative and governance functions, although implementation may be complex.

Satellite communications are also playing an expanding role in electronic publishing, a trend that will profoundly affect the research, development, dissemination and use of vocational curricula, databases, and similar types of information.

Before any satellite-based solutions to vocational educational needs can be implemented, however, issues related to software, "peopleware," and hardware must be confronted. Legal questions and organizational structures must be considered, as well.

With an intensified mission, scarcer resources, and a rapidly-changing society to serve, vocational education must pursue delivery systems that meet highest priority needs and are workable and affordable. Satellite technology can fulfill those criteria, especially in combination with other technologies, in a variety of models for distance learning and other purposes where (for example) the aggregation of small, specialized groups into an interacting nationwide audience or regional audiences is desirable.

Vocational education's use of satellites will require resolution of various issues and attention to the incentives for a well-coordinated professional development and change process at all levels. Earlier experiments with educational use of satellites leave behind important lessons about effective planning and use. And use of satellites requires that staff at all levels have a general visual and media literacy and a flexibility regarding role redefinition. But perhaps the foremost requisite is the development and availability of pedagogically sound programming with good production values and interactive components.

The most important next step toward effective use of satellites in vocational education is further study of users, their agendae and programmatic needs, their intergroup communications needs, and how their respective missions might be changing. Alternative paradigms for providing adequate financial support need to be studied, too.

Diversification will characterize the growth of satellite telecommunications and other media in the 1980s. Changes are occuring in vocational education, as well. The task of vocational educators becomes one of making administrative and programmatic investments to be primed and informed to take systematic advantage of the changes in both areas. Most immediately, cooperation and participation with existing systems and networks in educational telecommunications should be further explored and encouraged.

PART ONE

THE COMMUNICATIONS SATELLITE

CHAPTER ONE

INTRODUCTION: HELPING EDUCATION KEEP PACE

The Problem

Today, the private sector is not alone in looking to telecommunications as a means of keeping technologically current, reaching an ever more specialized and dispersed clientele, and reducing operating costs. In the public sector, educational agencies and institutions have similar expectations as they seek to keep teachers up-to-date, to serve students effectively, to achieve administrative cost-efficiency, and to reach nontraditional populations. As stated by the developers of Canada's Knowledge Network, "Technological innovation, by its very existence, is creating expectations that the same efficiencies applied to other fields can be applied to education as well" (Development, n.d.). In an era in search of educational excellence, forward-looking vocational educators need to consider car fully the short- and long-term potential of telecommunications. Specifically, the question "How can satellite-transmitted telecommunications be used most beneficially and cost-effectively in the near future to improve vocational education?" must be addressed.

The lag between technological potential and social change--particularly in education--can be great, however. Hence establishing the conditions under which these technologies can be incorporated most effectively into the vocational education school or training site, office, or research situation is especially crucial.

About This Study

This report summarizes the findings and implications of a study that examined the potential for expanded use of satellite-related telecommunications in vocational education, focusing on the short-term potential of satellites in the areas of instruction, training, administration, and governance. While not a formal design study, this report seeks to present a wide range of information to facilitate further research and planning by decision makers in vocational education.

The specific objectives of this investigatory study were as follows:

- To describe and interpret information about the possibilities for providing vocational instruction and training through satellite-related telecommunications (See chapter 6.)

- To explore those possibilities in vocational education personnel development, administration and governance, and research and development (See chapters 7 through 9.)

- To investigate the technical aspects of transmitting vocational programming via satellite (See chapters 2 and 10.)

- To describe and interpret the financial, staffing, or in-kind resources known to be associated with effective satellite transmission and local reception and use (See chapters 3 and 10.)

- To review and describe a limited sample of existing, available vocationally related television programs and courses that would be candidates for possible nationwide satellite transmission. Initial methodological plans for this study anticipated the widespread, ready availability of vocational training television program series that could be sampled to identify candidate programs for which satellite distribution would be a well-suited medium. However, searches for such programming and reports from key field contacts indicated a scarcity of vocational training television programs, especially programs incorporating interactivity or affording opportunities for active or hands-on learning. Nevertheless, a variety of models for programming and examples of satellite program types with potential for vocational education use were identified or reviewed in the course of this study and are described in chapter 4.

Assumptions

Briefly, the postulates or assumptions in the course of meeting these objectives were as follows:

o Assumption 1:

> Satellites are simply one means of transmitting information among a number of media, in an era where the boundaries between not only the media themselves, but also between communications and information, are increasingly hard to delineate.

Despite their allure for the news media, satellites are basically only one of five transmission media that commonly carry information from sender to receiver (Emard 1981, p. 70). Those media are--

- o wire carriers, commonly in open-wire or twisted-wire pairs, that can carry a limited amount of transmission traffic from one point to another;
- o coaxial cables that enable high-frequency signals to be sent through insulated wires and can accommodate a larger number of voice channels than can the wire carriers;
- o microwave propagation through the air that allows voice, video, and data signals to be transmitted on a continuous-wave oscillation of a single tunable frequency;
- o optical fibers composed of thread-like glass wires that are capable of carrying nearly 1,500 voice conversations or two television channels of information for distances up to four miles before reamplification is necessary; and
- o satellites that have combined space and telecommunications technologies [microwave transmission] to provide geosynchronous communications relay terminals in order to establish telecommunication services across vast expanses of land and water.

A telecommunications network may be comprised of any combination of the above media, since audio, visual, data, and other electronic signals can be transmitted via any of them. In addition, computer technology has led to the increasing convergence of telecommunications and information processing. (See figure 1 for one interpretation of this confluence and the issues it entails.)

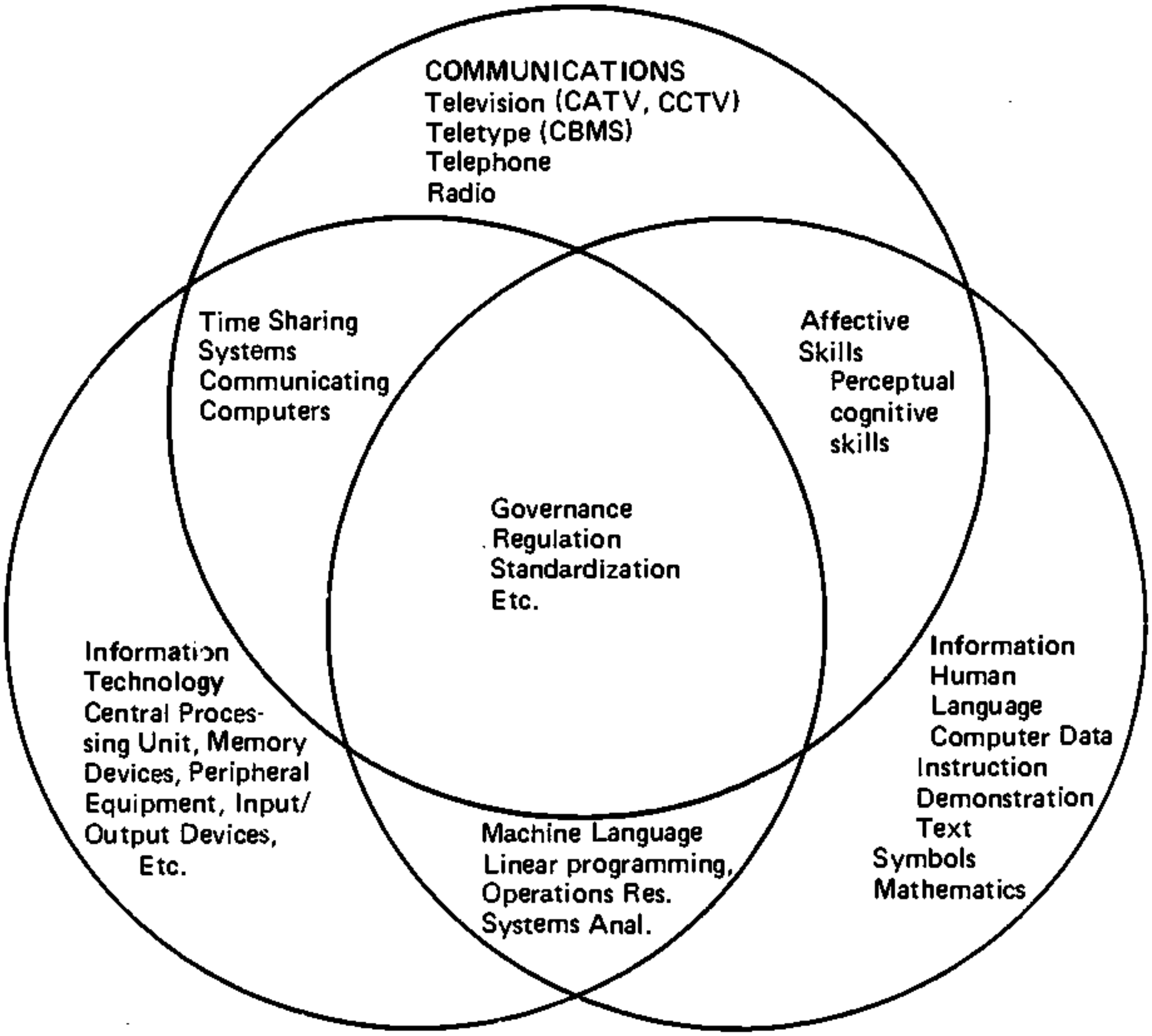

Figure 1. Interaction of Information and Telecommunications Technologies

SOURCE: Emard 1984, p. 104.

This synthesis--which one author has labeled "compunications" (Kochen 1981)--will continue to be a key factor in the next decades of the information age. Gustafson (1983) concludes:

> In the near future . . . the greatest impact on education and training will occur as a result of these interfaces [between technologies] rather than as a result of spectacular hardware breakthroughs. (p. 27)

o Assumption 2:

> The short-term future cannot be discussed without some consideration of long-term trends.

Gustafson (1983) notes that "there is some evidence to suggest that near-term (3-7 years) technological futures can best be predicted by examining current trends" (p. 27). He specifically cites satellites as one component of educational technology that "we must wrestle with immediately" (p. 29). Kochen (1981) nonetheless suggests an alternative approach: one that anticipates powerful new ideas on the assumption that such expression will spur their development. Developmental leaps in the telecommunications field have typically turned "powerful new ideas" into "current trends" in a relatively short time frame. Hence this report continually keeps sight of what is expected in the longer term.

o Assumption 3:

> While an effective transmission medium should be transparent to the user, this does not preclude the need for vocational educators to develop an increased awareness of, and facility with, telecommunications technologies.

This type of awareness and involvement is important for several reasons. The first relates directly back to the expanded capability of the technologies themselves. Brown (in Emard 1981) states that the view of technology as a mere delivery system for education must give way to an awareness of "a means of creating a wide range of environments in which the learner can explore new concepts, exchange ideas, and initiate intelligent interaction through multiple pathways. . . ." (p. 26).

The second reason relates to proper utilization of that expanded capacity: "educational administrators and evaluators must become informed of the specific uses for satellite communications so that they can make knowledgeable decisions concerning the appropriate match of educational needs and technology in their own educational system" (pp. 24-25).

Third--just as they have realized with the microcomputer--educators need to become involved with the technology in order to influence hardware and software development. For organizational and capital investment reasons, the not-for-profit sector will continue to look primarily to the business and industry community (as well as the military) to "pave the way" in developing and utilizing satellite technologies. In this era of deregulation, however, educators must give the strongest input possible into those decisions now being made in the marketplace. Otherwise, the optimal development of satellite telecommunications as an educational technology cannot be guaranteed.

Methodology

Methods employed to articulate and address the feasibility issues inherent in this study included--

- an extensive literature review, centering primarily on North American satellite activity and applications;
- interviews, consultation with, and specialized reporting* by technical experts, telecommunications providers, and "adopters" in vocational, postsecondary, and adult education;

*These short reports are included in this study as appendices B, C, E, and F.

- participation in the user's conferences of the Public Service Satellite Consortium/SatServ and the National University Teleconferencing Network (NUTN) (October and December, 1983);

- an extensive site visit to the facilities of the Learn/Alaska Network and the Alaska State Department of Education (February-March, 1984); and

- a 2-day "convening" of vocational educators and telecommunicstions resource persons at the National Center on March 19-20, 1984 (see chapter 5).

CHAPTER TWO

THE SATELLITE: WHAT IT DOES, WHAT TO EXPECT

The satellite's potential for use in vocational education is directly derived from its unique technological features. Hence, some understanding should be gained of how a satellite operates and the trends that can be expected in the technology. Technical terms not defined in the text are listed in the glossary.

Satellite Technology

Very briefly, communications satellites are "microwave towers in the sky" that receive and modify a radio signal before retransmitting it to receiving stations on earth. A satellite network consists of four basic components (Levitt 1984):

- The local loop refers to the mode of transmission that is used to transmit a signal to an uplink (an earth station equipped to beam the signal to the satellite). Phone circuit, coaxial cable, microwave, or optical fiber can be utilized in the local loop.
- The satellite functions as the relay mechanism. The important communication feature of the satellite is the transponder, which receives the signal, amplifies it, and converts it to a different frequency for retransmission (thus eliminating interference between the uplink and downlink signals). Traditionally, each of a satellite's 12-24 transponders has been equated with a capacity of 1 television signal or 1,000 phone calls, although new techniques in video compression and time- and frequency-sharing are continuously eroding this equivalency.
- The downlink receives the converted signal. The downlink may range from a simple backyard dish to an earth station equipped to distribute the signal further.

A satellite in geosynchronous orbit (22,300 miles above the equator) appears to move at the same speed as the earth. It therefore remains "fixed" above a longitudinal point (i.e., in the same position with respect to its downlinks). Currently, satellites operate predominantly in the C-band (6 GHz uplink, 4 GHz downlink, or 6/4) and Ku-band (14/12 GHz) frequencies. Transmission at 30/18 GHz and even higher--the "extremely high frequencies" (EHF) of 44 GHz up and 20 GHz down--are currently under discussion or development (Fawcette 1983).

A single satellite's coverage area, or footprint, can encompass up to one-third of the earth's surface (with fallout at the fringes). While satellite use cannot be substituted indiscriminately for land lines (Dix 1982), these vast coverage areas and the distance insensitivity of transmission costs account for their popularity.

Satellite Applications

Because satellites "can link any two points on a continent in one quarter of a second" (Traub 1983, p. 8), the advantage of satellite technology is generally characterized as the capacity for simultaneous communication with a large number of widely separated locations (Bransford and Diebler, n.d.; Lewis, n.d.; Smith and Stroud 1982). A few of the common applications for communications satellites are broadcast use, long-distance telephone relay, videoconferencing, and data/text transmission.

- Satellites are a common means of program distribution for television and radio networks. Programs originating at one or more locations are beamed to station affiliates nationwide.
- Several satellites are used primarily for telephony and/or telegraphy. Fewer than one-third of international phone calls travel today via undersea cable. Developing nations can create instant "long lines" networks by satellite, bypassing the need to install extensive terrestrial networks.
- Due to the wide bandwidth required to transmit a video signal, videoconferencing could not be the million dollar market it is today without satellite.

- Time-sensitive text and data can be distributed instantaneously to dispersed locations, altering conventional distribution systems. USA Today and The Wall Street Journal, for example, are printed and distributed regionally from satellite-relayed input. The major news services also utilize satellite.

Technological Trends and Marketplace Developments

Although Gustafson (1983) says that the greatest impacts on education and training will be due to "interfaces" between technologies rather than to "spectacular hardware breakthroughs" (p. 27), developments in the satellite arena over the next decade will be impossible to ignore. Polcyn (1981) summarizes satellite-specific trends of the 1980s that will affect their use by the educational community: a continued increase in (1) satellite life expectancy, (2) channels, and (3) transmitting power; (4) direct broadcast satellite (DBS); (5) intersatellite communication; (6) on-board data processing; (7) digital modulation of signals; and (8) the use of higher frequency bands.

- Increased satellite life expectancy (10 years or more) and channel capacity (40,000 to 50,000 circuits projected)* should increase investors' capacity to recoup initial investments and lower user cost. Due to complexity inversion, increases in transmitting power through improved solar (or possibly nuclear) cells have allowed a decrease in the size (and cost) of earth receiving equipment--a trend that is expected to continue.

- Direct broadcast satellites (DBS) are high-powered, narrowly focused satellites capable of transmitting video, audio, or data directly to the mass market, utilizing 2.5-4 foot (and smaller) dishes (Leibowitz and Wolff 1982; Katz 1983). When the "addressability" anticipated by Sullivan (1981) evolves into the interactive "high-performance, low-cost DBS antenna that will not only receive a video signal, but also be able to transmit a return data channel" anticipated by Pelton (1983), the network of widely dispersed, satellite-accessed learners described by Polcyn will become a reality. (Whether this will be accomplished first via cable or alternate means--if at all--remains to be seen.) (See appendix C for a further discussion of DBS.)

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*In contrast, INTELSAT 1, "Early Bird," had a capacity of 240 phone circuits or one video channel and a design life of 1 1/2 years (Burdine 1981).

- o Intersatellite communications have cost and performance implications domestically, especially in eliminating the time lags that hamper computer interfaces.

- o On-board data processing encompasses packet switching (analogous to "traffic control" for an electronic signal) as well as "demand assignment" (currently available in weather satellites), where data are stored on board until requested by the user.

- o Digital communications--the current trend to convert existing analog-based telecommunications to the binary language of the computer--will eventually result in "the world's largest, most intricate, and expensive machine" (Pelton 1983, p. 10). The Integrated Services Digital Network (ISDN) model, being furthered under the auspices of the International Telecommunications Union, conceives of telecommunications as "information transport," one of a multitude of information services to be provided via the network (Rutkowski 1983). While the ISDN was originally conceptualized as evolving from existing telephone systems (later a point of some controversy,) satellites have the clear capacity for involvement in both a transit role and (assuming on-board processing) in interfacing with other systems.

  Regardless of developments with the ISDN, however, digital processing per se has allowed major time-sharing and cost-cutting developments: frequency division multiple access (FDMA), time division multiple access (TDMA) (techniques that allow disparate signals to be combined for processing and transmission), and advances in video signal compression (which have reduced satellite transmission costs by up to 40 percent to date and will eventually lead to full video on narrow bandwidths).

- o The trend toward higher frequency use will continue (see summary characteristics of common bands in figure 2).

  The transmission characteristics of the 30/18 band have not been demonstrated in use. NASA currently plans to have demonstrated those characteristics via flight demonstration or computer simulations in the Advanced Communications Technology Satellite (ACTS) program by the late 1980s. In the future, frequency characteristics could conceivably be just another satellite characteristic weighed by users exploring cost, availability, security, and reliability trade-offs for various applications.

A number of these trends are discussed further in appendix B. That section summarizes the short-term developments in broadcast, narrowcast, and satellite telecommunications that the Public Service Satellite Consortium expects

Frequency (GHz)	Advantages	Disadvantages
6/4	o Frequency reuse by orthogonal polarization o Rain effects are small	o Large antennas o Sites very limited (terrestrial interference) o Faraday rotation correction needed for frequency reuse (polarization)
14/12	o Rooftop antennas o Short or no back-haul needed o Spot beams o No Faraday rotation correction required o On-board signal processing and beam switching (future) o Less interference in areas with extensive microwave use	o Rain effects are significant o Diversity stations may be required in certain regions o Frequency reuse by orthogonal polarization may be difficult or limited
30/18	o 2.5 GHz bandwidth available o Spot beams, beam switching o Small antennas o No Faraday rotation correction required o No back-haul needed	o Satellite may require high power o Rain effects are very significant o Diversity stations required in most regions o Frequency reuse by orthogonal polarization may be impossible o Bandwidth limitation unknown

Figure 2. Characteristics of Communications Satellite Frequency Bands

Source: Adapted from Burdine (1981, p. 48).

to have the greatest impact on the public sector. Consortium staff would add the following technical and applications developments to Polcyn's list:

- <u>Orbital spacing</u>--Anticipated crowding of satellites in geostationary orbit led the Federal Communications Commission to sanction the 2° spacing of communications satellites. (They are currently 4° apart). This adjustment in physical proximity, when phased in, will affect buyers' choices of earth stations and may affect some dishes in place.

- <u>Encryption</u>--will become more widely available to secure the exchange of proprietary and other private data. Added cost will be a major consideration.

One final trend must also be mentioned: the development of the teleport. As described by Klopfenstein (1984; included as appendix D), the ability to "get on" the satellite system is currently constrained by the relatively limited number of uplinks available nationwide. Hence the genesis of the teleport, described as a fixed satellite uplink/downlink facility that provides both access to telecommunication networks and support services (e.g., management, marketing, and maintenance facilities). More than an "antenna farm," the teleport organization "services users and its physical facility may be part of a research park or other real estate development project" (p. 2). The eight teleports currently operating in the United States may be joined in the future by the approximately 50 now in some stage of development. When completed, they have potential not only as uplinks, but as possible teleconferencing or telelearning production facilities. Klopfenstein concludes: "The good news for those interested in the delivery of educational services by satellite is that teleports will offer new competition in the field of satellite telecommunications. This promises to bring more services and lower costs to satellite system users" (p. 4). According to some in the industry, a city without an uplink might some day be as inconceivable as a city without an airport.

When Is Satellite the Best Alternative?

The basic characteristics of satellite transmission, especially in combination with technological developments expected in the near future, should cause vocational educators to look to satellites to meet a number of communications needs. As stated previously, there will be numerous situations in which satellite technology will be utilized as a "transparent" and unnoticed component of a telecommunications network. Furthermore, satellites will rarely be the only telecommunications option available. A spring 1983 study (France 1983) on the feasibility of videodiscs as a distribution medium shows how discs can both substitute for and complement satellite transmission of programming.

The study, conducted by the International University Consortium (IUC) in cooperation with Pioneer Video, concentrated on disc as a possible replacement for IUC's current distribution method (satellite feed to member institutions and dubbing) for the television component of its distance learning courses. It was hoped that the use of videodisc would--

1. decrease the cost of taping and maintaining the course inventory by members (tape stock, engineering time, equipment, and storage space); and

2. permit placement of multiple copies at campus locations, increasing accessibility and student flexibility (at less expense than the $250-$300 tape duplication fee indicated for an eight-program course by member institutions).

Distribution of one course by disc to six member organizations generally showed the technology to be convenient, easy to use, durable, and flexible. Cost effectiveness of disc as opposed to satellite-to-videotape was approached in the vicinity of 200 copies of 1 course. Cable distribution and local broadcast were both originated by disc and resulted in a high-quality signal, which points to the potential of videodisc as a source for satellite-relayed distribution.

Further study of distribution via videodisc by the International University Consortium will illuminate the kinds of interactive applications for which this medium as most appropriate, as well as the parameters for cost-effective distribution by both disc and satellite/videotape.

In summary, satellites will be a preferred transmission medium in the following situations:

- Point-to-multipoint distribution of preproduced programming when the number of locations is too large to be served cost-effectively by "bicycled" (i.e., physically transported) videotape*
- Situations demanding real-time video (one- or two-way) as the "lowest," or least complex, effective level of technology
- Aggregation of small groups of geographically dispersed individuals with specialized needs or goals into larger audiences
- Communication across mountainous terrain, great distances, or with Alaska, Hawaii, and the territories
- Other situations where satellite interconnections between terrestrial systems will result in cost savings
- Communication consisting of digital audio, video, and data

A number of such satellite-amenable situations, as they occur in vocational education, will be illustrated in the course of this report.

*The IUC example shows how the development of videodisc may affect this satellite application in the near future.

PART TWO

SATELLITES IN EDUCATION

CHAPTER THREE

A RECAP OF EXPERIMENTAL SATELLITE USE IN EDUCATION

Bransford and Diebler (1982) referred to the involvement of education with satellite technology at that point as "over a decade of courtship with no marriage." It is true that many of the experiments of the 1960s and 1970s, conducted by educational organizations in tandem with NASA, failed to continue as permanent operational systems. The exceptions, however, are notable: The Learn/Alaska network, ACSN--The Learning Channel, and others evolved from demonstrations during this era. The education demonstrations on four experimental satellites will be discussed here, not merely to recount their history, but to illustrate the educational applications of communications satellites and to summarize what was learned about the factors that aid or hinder successful utilization.

ATS-1 and the PEACESAT System

Twelve Pacific basin nations, including the United States, have been involved with the PEACESAT (Pan Pacific Education and Communication Experiments by Satellite) system since its inception in the ATS-1 satellite in 1971. The system has utilized satellite, low-cost two-way ground terminal, electronic blackboard, teletype, computer, and still-frame video to augment health, education, and community development services (Schneller 1983). Notable educational utilizations of the system included the following:

- Interlibrary loan services that utilized facsimile or airmailed microfiche to facilitate low-cost collection development.

- PEACESAT carried the world's first regularly scheduled instruction by satellite ("PEACESAT" 1983).
- Professional home economists are an ongoing user group ("The PEACESAT Project" n.d.).
- Several stations with Apple microcomputers used the network to coauthor a grant proposal for software development for CAI ("The PEACESAT Project" n.d.).
- The Western Curriculum Coordination Center (WCCC) in Honolulu, the WCCC Council in American Samoa, and regional office of the U.S. Office of Education first utilized PEACESAT for linkage and communication in 1978 ("Curriculum Center Update" 1978).

The Major ATS-6 Projects

The Health/Education Telecommunications (HET) experiments were conducted jointly by NASA and HEW during 1974 and 1975 to demonstrate satellite applications for the social services. These experiments used small, inexpensive earth stations and easy-to-operate equipment to demonstrate the feasibility of delivering such services via satellite to rural areas (Fitzpatrick 1979).

Alaska Education and Health Demonstration

This state-supported experimental system provided Alaska with a technical experience base for planning a satellite-based State telecommunications system. Included in the educational component were a general interest program on Alaska (adult/general audience) and a commercially produced program on learning motivation used for teacher inservice. Programs consisted of taped portions interspersed with interactive periods, during which the audience could ask questions of a studio panel.

To best serve Alaska's varied linguistic and cultural groups, consumer committees assisted in program development and production. According to Fitzpatrick, "this model for a consumer role in programming via satellite has been cited as one of the major contributions of the Alaskan Educational Experiment"

(1979, p. 5). Low attendance in the adult and teacher inservice programs, and minimal use of the interactive capacity (which did not significantly increase as familiarity with format and equipment increased) were major problems.

Appalachian Educational Satellite Project

The Appalachian Educational Satellite Project (AESP) was sponsored by NIE through the Appalachian Regional Commission as "a means of improving the quality of inservice education by distributing high quality courses from a central source" (Bramble, Ausness, and Marion 1975, p. 1) in a region of rural population and mountainous terrain. For the demonstration, 15 classroom sites from New York to Alabama were equipped to receive and to transmit via two-way radio.

A course in secondary-level career education (fall 1974) was included among the four graduate-level teacher education courses offered. The course formats typically included both satellite-based and nonsatellite-based components:

- A series of 30-minute color television programs (pretaped), with extensive on-site film segments.
- Satellite-delivered audio reviews of the programs, which presented hypothetical teaching situations and four alternate responses. (The student selected a response on a keypad and then heard an explanation of that response via the four-channel audio capacity of ATS-6.)
- Live forums, or videoconferences, allowed students to question content experts.
- Nonsatellite-based components at each site included extensive print materials, as well as resource libraries and computerized and manual information retrieval searches.

The AESP demonstration primarily demonstrated technical feasibility of delivering graduate education courses via satellite to a geographically dispersed student body. The interstate cooperation--particularly between local/regional organizations and AESP--in assessing needs and developing programs for satellite delivery was also worthy of note (Fitzgerald 1979). Other conclusions included the following:

- Site facilitators who were not themselves content experts could administer the courses, given sufficient direction and easy access to central coordinators.

- Even in the mid-seventies, the per-student cost for a 3-hour, master's-level course was found to be competitive with on site delivery ($2,070 per student in the demonstration versus an estimated $1,700 on-site).

- Course participants typically gained in content knowledge, later applied what they had learned, and generally preferred the satellite delivery format to the on-campus graduate education courses with which they were familiar.

- A weakness was noted in the use of interactivity capability, with the scope and frequency of interaction by satellite limited (Morgan et al., April 1975).

Rocky Mountain Education Project Satellite Technology Demonstration

The Satellite Technology Demonstration (STD) program, sponsored by the six-state Federation of Rocky Mountain States, tested a wider variety of the technological capabilities of the ATS-6 satellite. While sites with interactive capability received higher ratings from users, this may have been due to the greater degree of attention paid to those sites (Fitzpatrick 1979). Especially noteworthy was the materials distribution service (MDS), which transmitted videotapes to receiving cites for recording and later replay.

WAMI

A final ATS-6 experiment of interest is the Washington-Alaska-Montana-Idaho (WAMI) experiment in regionalized medical education, which delivered portions of a decentralized medical program (already in operation) via two-way satellite audio and video. Objectives included reducing faculty travel, improving supervision of clinical programs, and increasing interaction with physicians in rural clinical programs (Dohner, Cullen, and Zinser 1975, as cited in Fitzpatrick 1979). Although the project was relatively small, it was more successful in promoting interaction. This may have been due either to the fact that only two sites were interacting, or to the utilization of two-way audio and video. In the clinical phase, user acceptance was stronger on the part of faculty and medical staff than on the part of students.

The Hermes (CTS) Experiments

A number of educational experiments were conducted, primarily in Canada, on the Hermes or Communications Technology Satellite (CTS) during 1976 and 1977. Its 200 watts of power and operating frequency range of 14/12 GHz were the experimental features that are now the basis of direct broadcast satellite. Educational experiments (among the 25 projects implemented) included the following:

- The aim of the University of Quebec's Reseau Omnibus was to "simulate a versatile communications network which would be integrated, multidirectional, symmetrical and transparent" (Richmond and Daniel 1979, p. 21). The lead time necessary for personnel training and equipment installation precluded spontaneity of use of a fully operational network, however. Experiments involved transmission of images of specimens under electron microscopy, teledocumentation, a lecture on vocational education, and transmission of oceanographic data.

- The Memorial University of Newfoundland's telemedicine project delivered continuing medical education to nurses' assistants as well as doctors and nurses.

- A Carleton University and Stanford University exchange tested an all-digital system (which included video compression) to determine cost-effective methods of curriculum sharing via satellite and to resolve attendant administrative problems such as accreditation and scheduling. Lecturers at the Canadian location were also able to present graphics on command via videodisc.

  The experiment was termed a qualified success: the feasibility of expanding the scope of institutions through curriculum exchange was established, but problems occurred with funding, which affected morale and truncated the project design; with transfer of hard copy via mail; and in underuse of interactive capability.

- The American Indian Telecommunications Satellite Demonstration in April 1978 explored satellite telecommunications between four sites using CTS and portable earth terminals as a mechanism for communication between tribes, educational institutions, and the Federal government in the areas of health, agriculture, education, and other tribal concerns. While a distance education demonstration was included, educational programming for the Indian community was not configured as a dedicated or independent communications system. Rather, it was assumed to be part of a larger communications system; one of many services for tribes (American Indian 1979).

The University of Victoria Anik B Project (September 1979-June 1980)

Students from a feeder of up to 100 kilometers away convened at 5 colleges in British Columbia to participate in the reading and educational administration experimental courses offered via the high-powered Anik B satellite during 1970-80. Although the objective of the one-way video, two-way audio project was to "successfully exploit the interactive nature of the system" (Martin 1981), students felt the audio interaction with their instructors was clearly less desirable than in a traditional course context (Zuckernick 1980). In two classes, one-third and one-fifth of the students stated that they did not speak to their instructor at all during the transmission, despite explicit instructor prompting and continuing verbal attempts to create the illusion of a single class. Over three-fourths of the students participated frequently in the postsession discussions, however. Students at the individual centers also were unable to maintain conversations with their peers in other locations whom they could not see. All other components of the courses were well received.

Recommendations from that experimental series included--

- that courses considered for satellite transmission involve the teaching of a high level of cognitive skills;
- increased lead time for development and advance publicity;

- at least 50 percent of the pretaped materials should be "in the can" prior to the first transmission;
- all instructors should participate in orientation sessions which include in-depth discussions with the instructional design staff;
- well-defined articulation between satellite-based courses and other distance education offerings and consideration and transferability between institutions;
- adequate research materials and facilities to provide data for student assignments;
- the recommended final format of class sessions included a 10-15 minute presession for administrative business, a 70-minute TV seminar with structured interaction; and a 50-minute postsession led by the field associates with explicit instructor guidance; and
- liaison and coordination of responsibilities between program originators and the production centers.

Suggestions for improved student/instructor interaction included the following (Zuckernick 1980):

- Off-air exercises with feedback from each center (10-15 minutes)
- Instructor-initiated questions directed to a specific center and/or student
- More student-initiated questions and comments
- Greater student-to-student interaction

Further consideration of satellite applications in vocational education should take place with an eye on what occurred in past educational uses. In a presentation to the American Education Research Association, Fitzpatrick (1979) summarized what educational administrators and researchers could learn from the early years of experimentation with education via satellites in order to make more informed decisions about the appropriateness of the technology in meeting goals and objectives. Fitzpatrick stressed that decision makers must be informed not only about the technology of the delivery system, but about its educational merits as well. Only after determining educational goals and objectives and cost-related issues should they seek to match a delivery system to those needs. Specifically, Fitzpatrick urged--

- o sufficient planning time to assess needs, establish linkages, and develop quality courseware for satellite efforts;
- o strong commitment from sponsoring groups to satellite communications as a means of solving high-priority problems;
- o incentives (continuing education units, other credit) for participants;
- o high-quality programs with an appropriate media mix that meet a need and good reception quality to attract and maintain target audiences; and
- o careful matching of technology and needs in regard to interaction. Fitzpatrick notes that "some of the higher technology aspects of satellite communications may have been overrated" (p. 20) in this regard and called for further testing of audio-only formats.

CHAPTER FOUR

EDUCATIONAL TELECOMMUNICATIONS TODAY

After the experimental era, technology transfer to both private business and public sector organizations--coupled with the evolution of educational TV--has resulted in a universe of diverse organizations and institutions involved in educational telecommunications. As vocational educators enhance their involvement with distance learning, they will find themselves increasingly collaborating with, and drawing upon the resources of, telecommunications organizations such as those described here. This chapter also includes a sampling of the vocationally pertinent programming currently available, and other program formats with the potential to meet vocational education needs.

Distance Learning

Distance learning may indicate any situation where the student (with or without access to a teacher or tutor) learns primarily from course materials developed elsewhere. Hudson and Boyd (1984) designate today's applications as "more what we could call mediated learning" (p. 13), with instruction mediated by either physical distance or by technology. Such distance learning may be either formal or nonformal.

In the secondary context, Goldstein (1984) defines distance learning as "recognized learning that takes place at a site remote from the point of origination" (p. 4), with "recognized learning" again being instruction that is delivered to the learner through a passive or interactive electronic medium or combination of media. The media involved may include open broadcast radio and television; Instructional Television Fixed Service (ITFS); "bicycled" distribution of tapes or discs; cable, microwave, and satellite systems; telephone networks; or computer-assisted instruction.

The types of distance learning most pertinent to satellite, of course, will be mediated over physical distance. In order to focus this report more concisely on those applications where satellite affords the greatest near-term advantages for vocational education, distance learning programs and organizations with a video component will be stressed.

Organizations and Programming

Despite their myriad organizational forms, the "actors" most central to the educational telecommunications arena basically perform the following roles (singly or in combination):

- Programming developers, producers, or providers
- Educational networks
- Telecommunications networks and service providers
- Receiving sites
- Other resources and support services

A number of these organizations and networks, as well as several state systems, will be described to illustrate the diversity of the telecommunications already in place as a potential resource for vocational education. Additional information from the ROME database is also included in appendix D, Organizations Related to Telecommunications and Distance Learning.

Program Developers, Producers, and Providers

In this category are a wide range of organizations, both public and for-profit, both free-standing and institutionally affiliated. Three such groups, with examples of their vocationally related video programming, are described here.

Coast Telecourses. Coast Telecourses (originating in the Coast Community College system of Orange County, California) is the largest distributor of video-based learning systems for college credit in the country. Coast describes the goal of those courses as "an integrated learning system that employs broadcast television with carefully selected and prepared print materials in a manner that capitalizes on the strength of each medium" (A Decade of Telecourses, n.d., p. 7). A typical course consists of the following components:

- o The video televison components (typically 30 minutes)
- o A textbook chosen from established works or specially developed (utilization of the text of a given course may vary greatly from school to school)
- o A study guide developed by the publications staff in conjunction with content experts and the instructional design team
- o A faculty manual
- o Test instruments
- o Supplemental reading materials
- o A preview package for administrators

In addition to marketing those courses that Coast has produced (or acquired distribution rights for), Coast also develops "wrap around" materials that adapt series previously broadcast by the Public Broadcasting Service (PBS) for use as college courses.

It should be noted that these courses are designed primarily for distance learners who "cannot or do not want to come on a campus to take a particular class" (A Decade, n.d., p. 13). In practice, however, on-campus activities (such as supplementary lectures or testing) are a component of many telecourses in order to provide needed student-and-teacher or peer-to-peer interaction.

Postsecondary Coast telecourses with potential for vocationally related applications include--

- The Growing Years, a course on child development from infancy through adolescence (postsecondary level); and
- Designing Home Interiors, which stresses consumer education in the selection of home furnishings.

Educational Resources Foundation (ERF). The Educational Resources Foundation, a not-for-profit organization affiliated with South Carolina Educational Television, produces audiovisual materials geared toward increased employee productivity through training. The majority of their industry-oriented productions focus on safety training.

While ERF rental agreements are usually 5-day or life-of-print and do not include permission to broadcast or retransmit via any medium, such rights were arranged for distribution of Making It Work by the Agency for Instructional Television in conjunction with the series adaption for classroom use (see Figure 3).

Other titles available from ERF are geared toward workers or supervisors:

- Control Factor--Teaches the use and inspection of overhead pendant-operated cranes in a variety of industrial settings (8 minutes). Also available in Spanish; 12-page Leader's Guide included with rental.
- The Path of Least Resistance--Helps nonelectricians avoid electrical accidents through basic safety techniques (15 minutes).

NEW SERIES

Making It Work

Twelve 10- to 15-minute color programs
Career Development, Vocational Education
High school, adult
24-page teacher's guide (includes 8 pages of student handouts)

Produced by the Educational Resources Foundation, Columbia, South Carolina, and adapted for classroom use by AIT (1983).

Television broadcast fees: see page 140

Audiovisual purchase price:
Videocassette—$125 per program
Film—unavailable

Guide price:
1-9—$1.20; 10-499—$1.05; 500-999—$.95; 1000 plus—$.90

Available: Worldwide

Landing a job takes skill. So does surviving on the job. Designed to help high school students and adults make themselves more employable, *Making It Work* focuses on the characteristics employers consider most important in hiring and keeping employees. The series deals with topics such as dependability, getting along with co-workers, cooperation with supervisors, accepting responsibility, and effective communication. It also covers job searches, interviews, and employment tests.

The programs present realistic characters in typical job-related situations. The series host, Howard Ballou, provides continuity and comments on the job skills—or lack of them—displayed in each situation.

PROGRAMS

1. **How Do I Find a Job?**—The host presents advantages and disadvantages of several ways to find job openings. Joe telephones to follow up on an opening for a mechanic. On his first try he is nervous and ill-prepared. He does much better when he has planned what he will say. (12:56)
2. **Opening Doors**—The host explains that job seeking is easier if the seeker is prepared with a job history, a letter of application, and references or recommendations. Pete learns from a personnel director how to gather these materials and send them. (12:40)
3. **The Application**—The host explains that the application represents the applicant to the employer. Susan and Alan illustrate how poorly prepared applicants can make a bad impression. Lucy arrives on time with a pen and full information, fills out the form completely and truthfully, and carefully reviews it before turning it in. (11:12)
4. **Tests & Stress**—Susan, Alan, and Lucy are all nervous about the typing test. Susan doesn't listen to or ask for directions. Alan arrives late and is tired, hungry, and hostile. Lucy has practiced at home, listens carefully, asks questions, and does well. (11:01)
5. **The Interview**—Mrs. Hinson interviews Lucy for a clerical job and Tim for a maintenance one. Both candidates demonstrate proper interview behavior. (10:50)
6. **Learning by Experience**—The host points out that finding the right job takes time and persistance. Steve and his wife Ann review his efforts and find some things he could do better to improve his chances next time. (10:13)
7. **You Have a Job Offer—Now What?**—Marcie and Diane consider the pros and cons of a sales job each has been offered. The host explains gross and net pay and common deductions. Joe and his wife Gail review their deductions to understand his paycheck. (12:38)
8. **I'm Here to Work—Now What?**—This program deals with *policies* (rules and regulations or guiding principles) and with *procedures* (set ways of doing things). Susan and Lee violate some policies and procedures common to most companies, and viewers see the results. (12:10)
9. **Say That One More Time**—In two versions of Jane's first day, Connie shows her how to use the copy machine. When Jane asks and answers questions, pays attention, takes notes, and works the machine while Connie is there, she learns. Paula demonstrates poor and good telephone communication skills. (14:07)
10. **Practical Planning**—Mary learns to plan ahead to prevent babysitting emergencies from making her late. Connie helps Lucy understand why others resent her behavior on the job and helps her plan how to do better. (1[illegible]:02)
11. **Making the Most of Yourself**—Bill is willing to take additional training, adjust his schedule as needed, and fulfill his commitment when tired. Bobby isn't. The host asks which of them is more likely to get ahead. Lee and Mr. Shuford dramatize how body language, choice of words, and tone of voice are important to effective communication. (14:29)
12. **How Am I Doing?**—Mary's job evaluation turns out to be much less frightening than the nightmare she has about it. Later, Ms. Pearson and another supervisor talk about how hard it is for them to fire someone or give a negative evaluation. (1[illegible]:36)

RELATED MATERIALS

Also available is "First Impressions," a seven-minute program in which viewers see five persons being interviewed for jobs. The host discusses the strong and weak point of each applicant's dress, knowledge of the company, eye contact, answers, and general behavior. Videocassette only—$90.

Figure 3. Series Description, Making It Work.
Source: Agency for Instructional Television. 1984 AIT Catalog of Educational Materials. Bloomington: AIT, 1984. p. 72. Reprinted by permission.

- Handling Chemicals Safely--A general information source for all industrial workers who handle or work around chemicals. Designed to incorporate additional information from a group leader concerning chemicals specific to the particular audience (12 minutes).

- Desk Set II--A three-part series on effective communications skills for clerical workers.

The Agency for Instructional Television (AIT). AIT was founded in 1973 to expand cooperative production activities between States and Canadian provinces. Its predecessor, National Instructional Television (NIT), was originally funded by the U.S. Department of Education as a clearinghouse for instructional television programs. AIT's current approach to development centers on the consortium, in which a number of agencies pool resources to produce major classroom series.

A modular vocational education curriculum, Principles of Technology, is AIT's current major effort. The series prospectus notes: "Vocational education must respond to the challenge and opportunity in emerging technologies by preparing students with a broad base of technical concepts and principles as well as with current employable skills" (Principles 1983, p. 1). To help in this effort, the series provides up to 300 hours of laboratory exercises that provide practical, hands-on learning, and printed materials. The project, to be completed by September 1986, is being funded at $2.2-2.5 million by a group of 30-35 State and provincial agencies.

AIT also is involved in smaller joint projects and in distributing video materials acquired from other agencies (such as ERF's Making It Work).

Educational Networks

Educational networks distribute programming they and others have developed. The PBS Adult Learning Service (satellite/broadcast) and ACSN--The

Learning Channel (satellite/cable) are well-known examples in the U.S., as is the Knowledge Network in Canada.

PBS Adult Learning Service. The Adult Learning Service of the Public Broadcast Service (PBS) distributes educational programming of three types via satellite: college credit courses, informal learning programs, and professional development/career training series. Classes are administered through local partnerships between public TV stations and colleges or universities. During the 1981-82 school year, 56 percent of the Adult Learning Services' 555 participating institutions were 2-year colleges ("The Partnership," n.d). Recent Adult Learning Service offerings of interest include the following:

- The New Literacy: An Introduction to Computers (produced by Southern CA Consortium for Community College Television, 1984) is "an up-to-date survey of electronic data processing, computer hardware and software systems, and developments that will provide the basis for further advancements" ("Television Course" 1983, p. 11) (twenty-six 30-minute segments)

- Teaching Students with Special Needs (secondary level), produced for teacher preservice or inservice by Maryland Instructional Television/ Maryland State Department of Education (1978). Programs on "Career and Vocational Education," "Survival Skills" and "Employability and the World of Work" are among the 15 video segments.

PBS uses teleconferences to announce new schedules and to assist stations and colleges in effective implementation and promotion.

ACSN--The Learning Channel. ACSN, which originated in the "experimental" years, now owns and operates The Learning Channel as an independent, not-for-profit corporation. Distributed via SATCOM IIIR to cable systems, The Learning Channel reaches 4.5 million subscribers (as of March 1984) with programs "designed to improve their professional and personal lives through lifelong learning" (The Learning Channel, n.d.). Other major program categories include the following of interest to vocational education.

- Get Ahead/Stay Ahead--career-oriented programs such as "Resume Writing," "Interviewing," "Where the Jobs Are," and "Advertising a Small Business."

- Teacher Inservice--Program series that provide information and techniques to teachers, administrators, students, and parents. "Inside Your Schools" covers issues and feature stories in a series of 10 programs with a news magazine format.

- College telecourses--Approximately 60 courses to date, accredited through participating institutions. The 23 half-hour segments of "Making it Count," for example, contain a comprehensive overview of computers and their applications.

The Knowledge Network. The Knowledge Network is funded by the government of British Columbia to operate a telecommunications network for educational institutions in that province. While the network has effectively created the first provincewide educational channel in British Columbia (Development, n.d.), its mandate extends further to active collaboration with institutions in delivering educational opportunities and the development of high-quality learning systems (Knowledge Network 1983). The elements that comprise the network demonstrate the variety of telecommunications configurations that may be employed to meet the needs of geographically dispersed learners:

- Direct satellite distribution (which recently moved from the experimental Anik B to the Anik C-3 satellite) with primary redistribution to home viewers via cable learners

- A broadband cable system capable of carrying up to 20 channels of fully interactive audio, video, and data for closed circuit, interinstitutional use

- A three-channel microwave link to Victoria on Vancouver Island with further signal distribution by cable and ITFS

A sample of vocationally relevant programming currently available from or distributed by the Knowledge Network follows. Most are credit courses, with credit arranged through participating institutions.

- Bits and Bytes--twelve half-hour segments that explore the theory and operation of microcomputers.

Publishing (see bibliography) list numerous firms that can provide telecommunications services in support of video- or audioteleconferencing.

The National University Teleconferencing Network (NUTN). NUTN is a teleconferencing network of over 100 colleges and universities. The network uses audio, satellite video, and computer conferencing to provide continuing education and professional development opportunities, distribute member-originated programming, and collaborate with industry and associations on topics of interest (see figure 4.) Programs are selected based on member interest from proposals submitted by originating institutions. Members are currently required to receive two programs a year.

CONFER, NUTN's computer conferencing/electronic mail link, was established to facilitate rapid coordination between members. Using that system, members can be polled regarding interest in a potential program within hours.

The following teleconferences (reprinted from the NUTN Program Schedule) are among the 1984 network activities which are most germane, in content or format, to vocational education:

- March 23 - Visual Documentation in Medicine. Video by the International Society for Photoscopy. To uplink from Washington, DC and Fort Lauderdale, Florida.

  This first-of-its-kind conference was designed to bring together physicians and medical technicians interested and active in medical video documentation (e.g., radiological documentation, digital storage, etc.) in order to introduce and update documentation technologies and to provide specific instructions in the use of documentation modalities for diagnosis and treatment.

- May 24 - Learning Networks: Technology Serves the Adult Learner. Video by Ohio University and CAEL (The Council for the Advancement of Experiential Learning).

  Second national teleconference in support of LEARN, a national project funded by the W.K. Kellogg Foundation. Provides an overview of current practices in the application of telecommunications technology for postsecondary schools.

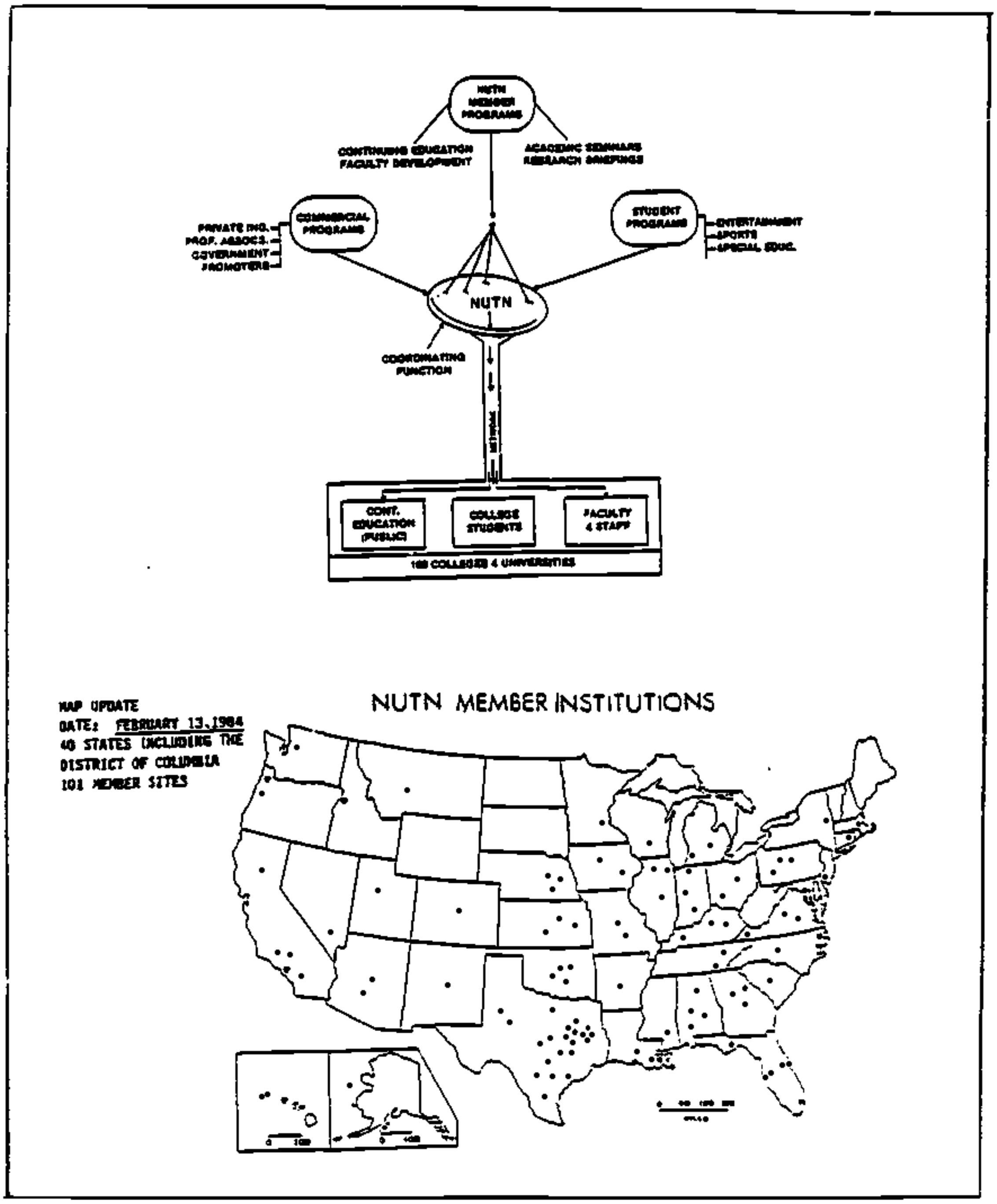


Figure 4. National University Teleconferencing Network Model
Reprinted by Permission

- June 7 - Commercialization of Space. Video by the National Chamber Foundation and BIZNET.

  Final phase of a major study of the subject being conducted by the National Chamber Foundation. In addition to providing the most substantive and current information on space enterprises, the program will actually involve the registrant in the final phase of the study.

- September 21 - The Future of Work. Audio by the University o Wisconsin.

  Designed for leaders and planners in education, industry and government. Discusses long term trends in technological change, employment, snd natural resources. Examines, with prominent futurists, ways to generate creative solutions to long run and short run employment shortages.

- November 15 - How to Obtain Venture Capital. Video by the University of Massachusetts/Boston.

  Focuses on providing participants with information on:

  --when his/her company should apply for venture capital
  --what an application for venture capital should contain
  --how to prepare each part of the package
  --how the venture capitalist makes investment decisions
  --how to negotiate with a venture capitalist
  --how this process played a critical role in the success of a high technology company

The Public Service Satellite Consortium/SatServ. The mission of the Public Service Satellite Consortium (PSSC) and its for-profit subsidiary, SatServ, is "to encourage and facilitate appropriate and timely applications of satellite snd other telecommunications technologies for public service" (Public Service Satellite Consortium, n.d.). The organization, an outgrowth of the experimental satellite programs of the 1970s, provides teleconferencing services; consulting on technical planning, market studies, and other topics; and training and membership services. Headquartered in Washington, D.C., the organization also operates a satellite access facility (consisting of s teleconferencing studio and network control center with microwave link to a 36' C-band earth station) in Denver.

SatServ recently established the Campus Conference Network (CCN) to control the operating costs and quality of receive sites. These campus sites (plans call for at least 1 in each of 60 targeted markets) provide and staff a meeting facility and purchase an earth station (or additional receiver for an existing steerable dish) for use by CCN. Programming requests are initiated by clients as PSSC/SatServ is not a program provider. In return, the campus affiliates receive revenue from CCN programming plus free (1 hour monthly) and discounted (3 hours monthly) transponder time to transmit their own events. The earth station is also available for campus use. In addition to revenue, benefits to campuses cited by CCN include access to expanded community outreach, and the educational advantage of having the earth station available.

Receiving Sites

The receiving sites function as the "local node" of the distance learning network. While such sites may be the individual's home, they are more likely to be a local school, college branch campus, community center, or place of employment. As such, they may coordinate the activity, provide enrollment services, provide accreditation, and--more often than not--serve as the focus of interaction in the distance learning experience. In vocational education, for example, regional vocational centers might serve such a function.

Other Resources and Support Services

In this category fall a number of organizations and projects that enable, facilitate, and enrich educational telecommunications activities.

Central Educational Network (CEN). The Central Educational Network (CEN) is a Chicago-based regional network of states that serves public broadcasting, telecommunications, and educational groups. Its Postsecondary Education Council (PSEC) seeks continually to improve telecourse offerings and expand audiences. The recently established associate category has extended membership services including an annual program screening, "group buys," a free loan library, a production consortia for new programming, and a variety of development and marketing services to vocational-technical schools and 2-year colleges.

CEN, the University of Nebraska--Lincoln, and the Nebraska Educational Television Network also co-own and operate a satellite uplink on the Lincoln campus. Programs originating from that uplink utilize the public broadcasting transponders on Westar IV, which are available to educational and public agencies.

The Annenberg/CPB Project. The Annenberg/CPB Project is providing $150 million over a period of 10 years for the development of telecourses and for projects exploring telecommunications delivery systems. In the latter category, the project has funded these activities ("Annenberg/CPB," n.d.):

- Electronic text demonstration--The Electronic Text Consortium (a group of universities and television stations) is exploring instructional, administrative, and library applications of videotext, cable text, computer simulation/games, and microcomputer networks in order to give college-level educators "a body of experience by which to assess the technologies" (p. 1.)

- Telecourse enhancement--This project utilizes electronic mail to increase the interactivity in a television course, document use of the system, and compare student performance to that of a control group taking the course in a "traditional" telecourse format.

- Experimental video production--WGBH in Boston will explore the feasibility of lower-cost but high quality telecourses using master teachers and produced using inexpensive video techniques.

- Audio use--A 1982 demonstration project explored the appeal and effectiveness of incorporating audio/radio components into correspondence courses.

State Networks and Systems

Learn/Alaska. The Learn/Alaska network is a statewide instructional telecommunications system that incorporates distinct technical capabilities to provide maximum opportunities for instruction and teleconferencing throughout the State and with other locations worldwide. The Learn/Alaska network includes the world's first and largest low-power television transmitter system (LPTV), an audioconferencing two-wire bridging system with teletext and audiographics capabilities, and computer conferencing (Hickman 1983).

With a land mass of 555,000 square miles (one fifth the size of the United States), the State of Alaska has more coastline than all of the other 49 states combined. Of its population of approximately 400,000 people, nearly 60 percent live in and around the major urban center of Anchorage. The rest are scattered among almost 250 communities, many of which have as few as 15 or 20 residents living in virtual physical isolation. Only 15 percent of the 250 Alaskan communities are accessible by road or trail. The balance can be reached only by air or water. Because so much of Alaska is inaccessible, the development of terrestrially based telecommunications systems has been limited primarily to the larger population centers. Prior to the development of the Small Earth Station Program in the mid-1970's to provide basic phone service via satellite, VHF radio was the only means of communication for many of the communities.

Given this situation, the Alaska State legislature requested that the Department of Education and University Statewide System examine the use of satellite-delivered television and audioconferencing as a way to deliver teleconferencing instruction in a constant, reliable fashion to all citizens throughout the State. As a result of the legislative request, the Learn/Alaska network now operates--

- o a satellite-based, 24-hour-a-day instructional television network downlinked to 250 low-power transmitters;

- o eight-line, 2-wire dial-up audioconferencing bridging network accessible via voice-grade transmission line with 200 specially equipped audioconferencing sites within the state; and

- o an effective statewide computer network with three distinct applications:

  --electronic mail service and computer data banks

  --teletext system utilizing the television vertical blanking interval to remote printers and monitors and a point-to-multipoint downloading of Apple II microprocessors, and

  --computer conferencing via the audioconferencing bridging network.

The three components of the Learn/Alaska network each have stand-alone functions, and each is used for instructional and/or administrative purposes by educators, Federal and State agencies, and private/public groups. But the network's greatest potential is realized when all three components are combined to provide a high level of service in the form of teleconferencing, point-to-point, and multipoint. Two-way videoconferences and one-way audioconferences receive high priority as network applications.

The audioconferencing bridging system. Two hundred Learn/Alaska audioconferencing sites are now in place in 145 Alaskan communities, with expansion expected to reach 300 audioconferencing sites in 250 communities. Each site was established via a formal agreement between the local educational sponsor, other educational users in participating communities, and Learn/Alaska. The agreements assure multiuser access to the site and identify the individuals who will receive site coordinator training. The trained site coordinator becomes responsible for local access and appropriate utilization of the network.

The audioconferencing network has used dial-up distance phone service via Alascom, Alaska's longline carrier. Audioconference calls are connected or bridged together via 4 interconnected 20-line Darome conferencing bridges.

Scheduling for University of Alaska instructional use is made on a semester basis. The Alaska Department of Education and individual school districts, however, schedule use on shorter time lines. More occasional users schedule network time up to one day prior to a proposed conference.

Local audioconference participation is coordinated by the audio site coordinator, and each established site has access to one or more portable Darome, Icon, or Contech conveners. (A convener includes a small speaker with push-to-talk microphones linked into the speaker.)

The audioconferencing system operates about 120 hours per week and handles up to 180 audioconferences. Conference bridging operators handle from 3 to 80 sites per conference and can conduct up to 8 conferences simultaneously. Conferences are operator assisted to adjust for the great variations in line sensitivity and phone line quality that results from the 29 different phone companies in Alaska. With any given conference, bridging operators may establish connections with ships at sea, foreign longline carriers, U.S. sites, and Alaska locations.

Seventy percent of the audioconferences are instructional in nature, and as such, receive first priority. The balance are administrative or supportive of instruction. Slow-scan technology is supplied on a regional basis and the Telidon teletex system provides the primary audiographics capabilities.

Instructional Television Network. The Learn/Alaska television network is a satellite-bssed system, the first low power television network to be licensed by the Federal Communications Commission and to become operational in the United States. Learn/Alaska gains access to satellite-delivered programming sources via its 9-meter earth station located in Eagle River Valley outside of Anchorage. From Eagle River, programming is microwaved to the Learn/Alaska Operations Center on the campus of Anchorage Community College. The program signal is then fed directly via microwave to the Alascom toll center for uplinking to Satcom F5, transponder 20, or is taped for delayed transmission. The Learn/Alaska system has uplink capability in Juneau, Fairbanks, and Kotzebue, and can arrange occasional uplinks from 30 other Alaskan sites.

Once the Learn/Alaska television signal is uplinked to transponder 20, programs are received in local sites via small 4.5-meter earth stations. Local distribution is via low-power VHF or UHF transmitters. The open, primary access enables viewers to participate in both formal and informal learning situations either in homes, community centers, meeting halls, or schools.

Computer conferencing system. Learn/Alaska staff now use two existing computer networks for electronic mail service to all university locations. The 23 locations are accessed by dedicated lines and worldwide services via modem. The second computer network was established by the State department of education and connects all 52 school districts. The audioconferencing bridges are used for computer conferences in which one site of a multisite conference is designated as the location for the transmission of microcomputer data for transfer. The audioconferencing system is based on the two-wire dial-up technology, so the present equipment configuration only allows for half-duplex computer data transmissions.

Learn/Alaska uses a Telidon-based broadcast teletext system. The Telidon teletext system can be used to provide audiographics for the audioconferencing system. It also provides for a data stream to be delivered via the television vertical blanking interval to hard copy printers.

The Learn/Alaska network's teletext project affords the ability to provide point-to-multipoint downloading of Apple II microprocessors. This enables rapid distribution of microcomputer programs for immediate use with any Apple computer, a television set, and an inexpensive teletext decoder. This particular teletext service will give an instructor or administrator using audioconferencing the capacity to display textual or color graphic information on a standard television receiver. The material can then be called up by individual students at will.

Capacity in other States. Alaska's unique geographical situation makes it one of the few satellite-based educational telecommunications networks in the Nation. Satellite is a component, however, in most "hybrid" telecommunications--two of which are described here as illustrative.

- The Association for Higher Education of North Texas (AHE)--AHE's TAGER Television Network has grown since its inception in 1967 to utilize ITFS, point-to-point microwave, cable, satellite, videocassette, and telephone. Its current role is described as "a telecommunications utility for the business and higher educational communities of north Texas" (Lewis n.d., p. 88). Graduate-level engineering, business, and computer science courses constitute 85 percent of the course offerings, 90 percent are interactive. Telecommunications activities of note in this system include cable interfaces with Dallas/Fort Worth cable suppliers (which will eventually give access to an estimated one million subscribers), a planned "narrowcast" subscription educational service, and uction of an earth station. One problem encountered has been underutilization (70 percent of full capacity) of the television capacity, "in part because faculty do not want to teach at irregular hours" (p. 88).

o Pennsylvania State University, Open Learning Program (OLP)--The 200 or more correspondence courses of the Open Learning Program are largely print oriented, with less than 15 percent incorporating video components. However, the delivery system for those courses, whose video segments may range from 5 to 40 percent of the course, combines the university's public broadcast station; satellite earth stations that record programming from the National University Consortium, PBS's Adult Learning Service, and other sources; a system for hospital systems; and the PENNARAMA system, which extends the network by linking individual cable systems via microwave. PENNARAMA was expected to reach 1.5 million households by the end of this year (1984). Penn State has found its existing correspondence course structure and services invaluable in facilitating and gaining administrative and faculty support for its video-based distance learning efforts. The university has also centralized responsibility for all media-based activities, on and off campus, in le organizational unit--the Division of Learning and Telecommunications Services. A recent activity of note was a four-university agreement to distribute video components of courses through a private company to students with home VCRs (Lewis, n.d.).

When the organizational capacity available nationwide is taken into account, it appears that vocational education has rich resources to draw from and to collaborate with in developing its own distance learning efforts.

In order to take full advantage of the network, organizational and production capacity that presently exists, decision makers in vocational education should forge alliances with existing groups--as well as collaborate with their colleagues nationwide--rather than duplicate other's efforts. Doing so will achieve an optimal economy of effort and resources.

In some States, vocational education is developing its own capacity as well. In the satellite area, for example, a number of States (such as Minnesota, Wisconsin, and Oklahoma) are experiencing rapid growth in the number of satellite receive-only earth stations being installed at area vocational-technical schools.

PART THREE

FURTHERING THE POTENTIAL OF SATELLITE IN VOCATIONAL EDUCATION

CHAPTER FIVE

COMMUNICATION NEEDS IN VOCATIONAL EDUCATION

Nowhere, perhaps, is today's pressure to "keep current" and reach widely dispersed and highly specialized student populations felt more keenly than it is in vocational education. This can be attributed to a number of factors:

- The need to keep complex, highly technical curricula current with rapidly developing technologies
- The need to update teachers' and administrators' skills with a minimum of travel expense and release time
- The need for a quick response to business and industry, based on a desire to cooperate more closely, to collaborate in State economic development efforts, and to get a piece of the industrial training "pie"
- The need to accommodate new clientele: workers who now require retraining every 5 years, older students with job and family commitments, and others
- The need for expanded access to rural, workplace, and other nontraditional settings
- Networking needs among highly specialized, geographically separated individuals
- The need to aggregate and coordinate resources

A number of these concerns were discussed by the participants at the March 1984 convening on satellite applications in vocational education. The participants (see appendix A) included a variety of vocational education professionals. They envisioned the extension of satellite applications to vocational education as beneficial in a number of ways.

The "Voc Ed 120 Minutes" scenario developed by one group of convening participants (see figure 6) visualizes an interactive news magazine format for professional development. This approach was based on the following perceptions:

- o Satellite-distributed programming (both interactive and one-way) can help deliver the most current information available for staff updating.
- o Inservice needs of a large State or large geographical area might be accomodated.
- o Videoconferencing might be a viable alternative to travel in such instances.
- o Satellite distributed information can help guarantee equal access to and better utilization of funding information and the RFP process.
- o Satellite telecommunications might facilitate more effective program promotion and the diffusion of program practices.

Quality control in "training of trainers" situations was also expressed as a concern. A scenario which uses interactive teleconferencing to follow up onsite training events is described in figure 6. While the telecommunications costs involved in this scenario would not make it cost-effective in the near future, it does illustrate the potential of telecommunications in allowing one "master trainer" to follow up with trainers at four sites in the course of a single afternoon.

Telecommunications was cited as a promising aid in addressing these needs in the Job Training Partnership Act (JTPA) and job skills arenas:

- o Retraining of an existing work force on limited resources
- o Improved coordination between JTPA service delivery areas (SDAs) and labor market areas as well as between SDAs themselves
- o Delivery of vocational training to previously underserved clienteles
- o Strengthened business-industry linkages to coordinate use of training materials and provide "in demand" skills
- o Better staff awareness of technological changes, emerging job areas, and similar developments
- o Expedient delivery of high-demand vo-tech courses

SCENARIO BUILDING WORKSHEET

Attach extra sheets as necessary.

GIVEN: ______________________________

SCENARIO "TITLE" OR PROJECT NICKNAME: VOC ED 120 minutes

● WHAT ? WHAT WOULD BE THE PURPOSES AND OBJECTIVES? MAJOR ONES? SECONDARY ONES?

An interactive "newsmagazine" featuring topics of current interest in the areas of

- legislation
- research
- exemplary product news and exchange
- innovative practices
- issues
- technical update

A combination of taped segments and live teleconference-style format (panels, etc.)

● WHY ? WHAT PROBLEMS OR NEEDS WOULD BE ADDRESSED IN THIS VOC ED "TELECOMMUNICATIONS ORIENTED" SCENARIO? WHAT'S THE RATIONALE? WHY DO IT???

To disseminate information to, and facilitate information exchange among, state department of vocational education staffs.

To Provide interactive opportunities for state audiences and panel experts, etc.

● WHO? COMPREHENSIVELY, WHO WOULD BE DIRECTLY INVOLVED? WHO ARE THE VARIOUS ACTORS/PARTICIPANTS/BENEFICIARIES? (INCLUDE INDIVIDUALS AS WELL AS ORGANIZATIONS.)

- State-level vocational staff: state directors, supervisors and invited local voc-ed administrators/staff. (Note: state directors as governance/advisory councils with audience based on needs and assessed via survey).
- states--sources of videotapes and other programming sources
- special interest groups--funding
- community colleges--Programming source for videotapes
- further dissemination within state via cable link or other means (state discretion)

● WHEN ? WHEN WOULD ACTIVITIES OCCUR? HOW OFTEN? HOW REGULARLY? WHAT KINDS OF SCHEDULING FACTORS WOULD BE INVOLVED?

GET COSTS BASED ON:

Option # 1: Four quarterly telecasts of 2 hours each

Option # 2: Four quarterly telecasts of 3 hours each--get marginal cost for 3d hour.

Option #3: Twelve monthly telecasts of 2 hours each

Figure 5. VOC ED 120 MINUTES scenario

● WHERE ? WHERE WOULD THE VARIOUS PARTICIPANTS BE LOCATED? AT WHAT DIFFERENT SITES? IN WHAT EDUCATIONAL/ADMINISTRATIVE CONTEXTS?

Uplink: Washington, DC -- transmission and facilities costs, including facsimile or text transmission capacity.

Downlink: capital cities of 50 states and territories. Give samples of 8-10 geographically scattered downlink costs (return audio capacity assumed at each site). PLUS give estimate for some sort of text or facsimile equipment and capacity at those sites (rental/purchase prices on equipment as well as telecommunications time).

● HOW ? HOW WILL ALL THIS HAPPEN? WHAT'S THE DELIVERY SYSTEM TO BE ENVISIONED? HOW DOES IT FOLLOW FROM THE SCENARIO INFORMATION PROVIDED ABOVE? WHAT WOULD THE "PEOPLE NETWORK" AND/OR THE "TELECOMMUNICATIONS NETWORK" LOOK LIKE? TELL WHAT YOU ENVISION AND/OR POSE YOUR UNANSWERED QUESTIONS.

See above.

● NOTES ON PROBLEMS AND BARRIERS TO RESOLVE:

ADDITIONAL COST: Ballpark video production costs for three ten-minute segments of prepared footage (plausible range of costs).

Figure 5--Continued

SCENARIO BUILDING WORKSHEET

Attach extra sheets as necessary.

GIVEN: ______________________________

SCENARIO "TITLE" OR PROJECT NICKNAME: "SAT TRAIN" ("We'll keep you on the right track")

- **WHAT ? WHAT WOULD BE THE PURPOSES AND OBJECTIVES? MAJOR ONES? SECONDARY ONES?**

To Provide follow-up, critique, evaluation and possible certification of trainers by "master trainers" using point-to-point, one-way video via satellite.

Would also allow master trainer to self-check his own techniques.

Master trainer might edit tapes for use in future training.

- **WHY ? WHAT PROBLEMS OR NEEDS WOULD BE ADDRESSED IN THIS VOC ED "TELECOMMUNICATIONS ORIENTED" SCENARIO? WHAT'S THE RATIONALE? WHY DO IT???**

1. Need for follow-up after initial training
2. Ability of trainer to see results
3. Opportunity to take corrective action if necessary
4. Chance for trainee to demonstrate proficiency following period of practice
5. Advantage of immediate feedback (not possible with videotaped feedback)
6. Chance for immediate correction of errors

Pilot effort: DACUM institute follow up after "training the trainers"

- **WHO? COMPREHENSIVELY, WHO WOULD BE DIRECTLY INVOLVED? WHO ARE THE VARIOUS ACTORS/PARTICIPANTS/BENEFICIARIES? (INCLUDE INDIVIDUALS AS WELL AS ORGANIZATIONS.)**

1. Master trainers: the "trainers of trainers"
2. Trainers: those who will be providing training to learners/apprentices
3. Possibly trainees, i.e. those who will be acquiring the information

- **WHEN ? WHEN WOULD ACTIVITIES OCCUR? HOW OFTEN? HOW REGULARLY? WHAT KINDS OF SCHEDULING FACTORS WOULD BE INVOLVED?**

Annually or at other intervals depending on the type of training

Transmissions could occur as:
1. Certification (could be included as one portion of training)
2. Periodic follow-ups
3. One time events scheduled at convenience of master trainer or trainees

Need costs for: initial event
marginal cost for second event, three months later (if any change/decrease)
marginal cost for third event, six months later (if any change/decrease)

Figure 6. SAT TRAIN scenario

● WHERE ? WHERE WOULD THE VARIOUS PARTICIPANTS BE LOCATED? AT WHAT DIFFERENT SITES? IN WHAT EDUCATIONAL/ADMINISTRATIVE CONTEXTS?

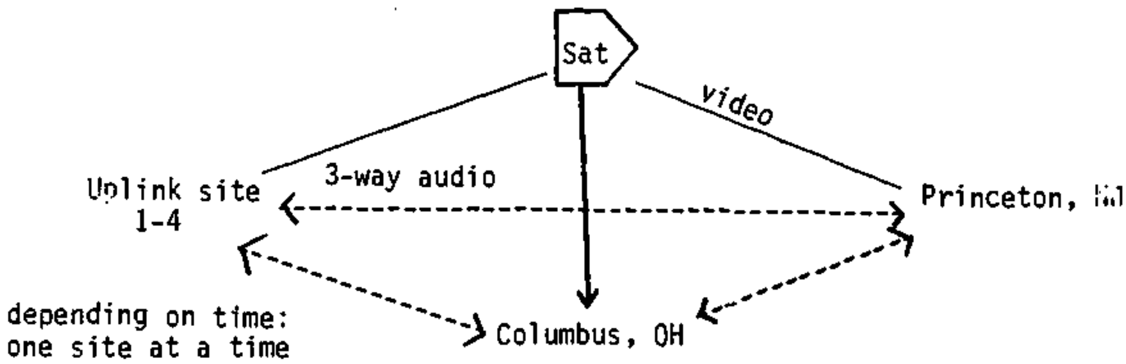
Four uplink/origination sites: (four consecutive transmissions, one hour each; also give marginal cost of adding a second hour at San Francisco site)	Kansas City, MO (9am EST) Davenport, IA (10am EST) River Grove, IL (11am EST) (Chicago vicinity) San Francisco, CA (12-2pm EST)
Downlink Site: (entire five-hour transmission)	Columbus, OH option #1: view at WOSU option #2: portable downlink (rental) at National Center
Marginal cost of adding second downlink site (entire transmission) including three-way audio	Princeton, NJ

● HOW ? HOW WILL ALL THIS HAPPEN? WHAT'S THE DELIVERY SYSTEM TO BE ENVISIONED? HOW DOES IT FOLLOW FROM THE SCENARIO INFORMATION PROVIDED ABOVE? WHAT WOULD THE "PEOPLE NETWORK" AND/OR THE "TELECOMMUNICATIONS NETWORK" LOOK LIKE? TELL WHAT YOU ENVISION AND/OR POSE YOUR UNANSWERED QUESTIONS.

Satellite transmission plus transmission of signal from originating city to nearest uplink, if not local.

Need cost of two-way audio between Columbus, OH downlink and each uplink site for the time it is transmitting (one hour per site except San Francisco, two hours)

Need marginal cost if audio is <u>three way</u> between Columbus, transmitting uplinks (during their hour) and Princeton downlink sites



● NOTES ON PROBLEMS AND BARRIERS TO RESOLVE:

Policy question:
--private between two individuals?
--onlookers/recording?

General cost question: to what degree is the cost of uplinking expected to decrease in the next five years (enough to make this type of application much more plausible than it would be today?)

Figure 6--Continued

- o Expanded training capacity that accommodates more sites and more people
- o Improved relocation of the work force when applicable

See figure 7 for the scenario that was developed in recognition of these needs.

Further, telecommunications was cited as a possible component of improved administrative reporting and coordination systems. Needs cited in this area were as follows:

- o Need to standardize information that all States and agencies receive from the U.S. Department of Education, such as legislation and request for proposal announcements, as well as the need to address questions
- o Need for improved communication and reporting among State, regional, and Federal offices
- o Need for better student follow-up for evaluation and research
- o Need to link State networks and improve interstate collaboration
- o Need for heightened coordination in the regional dissemination of USED projects

Attention was also given to the potential of telecommunications in meeting the vocational education needs of specific target populations, including special needs groups. Satellite delivery was envisioned as one component of a systematic approach to these situations:

- o Delivery of quality vocational rehabilitation
- o Transfer of high quality bilingual programs to locales where needed
- o Ability to reach corrections populations (a group not addressed under JTPA) on-site
- o Assistance for low income and small-family farmers in need of management techniques

Finally, participants voiced their concerns about vocational education organizations and their participation in the information age:

- o Need to establish momentum in the voc ed/telecommunications area

- Need for one group or agency to "take the initiative"
- Need to "head off" proprietary schools in the area of distance learning
- Need to heighten motivation for administrative use of telecommunications systems

In addition to the scenarios, a number of the needs discussed at the convening will be addressed in the chapters that directly follow on the applications of satellite telecommunications in the instruction and training, personnel development, administration and governance,and research areas.

SCENARIO BUILDING WORKSHEET

Attach extra sheets as necessary.

GIVEN: Existing and Emerging Satellite-based Delivery Systems, A Voc Ed Telecommunications Network is Possible

SCENARIO "TITLE" OR PROJECT NICKNAME: Job Skills Network (JTPA tie-in)

● WHAT ? WHAT WOULD BE THE PURPOSES AND OBJECTIVES? MAJOR ONES? SECONDARY ONES?

Establish a network whereby clusters of high-demand vocational/technical courses & instructional modules can be delivered to working adults & others at their place of employment, at area vo-tech centers, at community colleges, at community centers, or at home, (non-JTPA application).

A library of instructional and career assessment & counseling materials and modules would be developed/adapted.

● WHY ? WHAT PROBLEMS OR NEEDS WOULD BE ADDRESSED IN THIS VOC ED "TELECOMMUNICATIONS ORIENTED" SCENARIO? WHAT'S THE RATIONALE? WHY DO IT???

- Retraining of existing work force on limited resources.
- Improve relocation of work force (non-JTPA application).
- JTPA--improve coordination: between service delivery areas and labor market areas, and between SDAs themselves.
- Bring vocational training to previously underserved clienteles.
- Strengthen business/industry linkages (coordinate joint utilization of training materials/personnel; provide "in demand" skills.
- Keep staff aware of technological changes, emerging job areas, etc.

● WHO? COMPREHENSIVELY, WHO WOULD BE DIRECTLY INVOLVED? WHO ARE THE VARIOUS ACTORS/PARTICIPANTS/BENEFICIARIES? (INCLUDE INDIVIDUALS AS WELL AS ORGANIZATIONS.)

- Trainees--those needing new job skills due to skill obsolecence, unemployed and under-employed, in general anyone in need of marketable skills
- JTPA personnel--state supervisors, service delivery arsa, staff, etc.
- Curriculum & other developers
- delivery site coordinators/contacts
- business/industry personnel, National Alliance of Business, etc.

● WHEN ? WHEN WOULD ACTIVITIES OCCUR? HOW OFTEN? HOW REGULARLY? WHAT KINDS OF SCHEDULING FACTORS WOULD BE INVOLVED?

- Courseware delivery/downloading on request (by JTPA coordinator, etc.)
- Electronic bulletin board/message switching to facilitate
  - --daily exchange of job opportunities
  - --weekly/monthly exhange of other labor market data
  - --monthly personnel development transmissions and technological updates
  - --exchange of administrative data and reporting as needed.

Figure 7. JOB SKILLS NETWORK/JTPA scenario

● WHERE ? WHERE WOULD THE VARIOUS PARTICIPANTS BE LOCATED? AT WHAT DIFFERENT SITES? IN WHAT EDUCATIONAL/ADMINISTRATIVE CONTEXTS?

Administrative centers (e.g., JTPA service delivery area centers) plus concentration of activity in high unemployment areas.

● HOW ? HOW WILL ALL THIS HAPPEN? WHAT'S THE DELIVERY SYSTEM TO BE ENVISIONED? HOW DOES IT FOLLOW FROM THE SCENARIO INFORMATION PROVIDED ABOVE? WHAT WOULD THE "PEOPLE NETWORK" AND/OR THE "TELECOMMUNICATIONS NETWORK" LOOK LIKE? TELL WHAT YOU ENVISION AND/OR POSE YOUR UNANSWERED QUESTIONS.

Would make use of a dedicated voc ed channel (regional uplinks) plus computer network.

Some possible extension via narrowcast or cable, arranged locally.

● NOTES ON PROBLEMS AND BARRIERS TO RESOLVE:

Would require extensive development of video and videotex materials.

Get general cost factors only for this scenario:

1. Annual cost of leasing channel or transponder for dedicated network <u>plus</u> what lead time needed to "reserve"?

2. General cost comparison for video courseware distribution via satellite for taping vs. bicycled videotapes (i.e., what scale needed to make it worthwhile?)

3. General comparisons (range of % savings) of telecommunications costs for satellite vs. phonelines/longlines/microwave.

   a. one-way data

   b. one-way video

   (In other words, compare cost of satellite to going through the phone company.)

Figure 7--<u>Continued</u>

CHAPTER SIX

APPLICATIONS IN INSTRUCTION AND TRAINING

Polcyn (1981) believes that, while education and training have not been the primary focus of satellite teleconferencing to date, they are the areas of greatest overall potential. Although less than 1 percent of the circuit capacity available in 1980 was used for those purposes, Polcyn states: "If satellite teleconferencing does mushroom, it is highly probable that it will be used a great percentage of the time for education and training" (p. 240). Lipson (1984) also lists satellite among the trends in educational technology that will have a profound effect on education and training.

The previous discussion of organizations involved in educational telecommunications summarized examples of vocationally relevant programming currently being offered. Tom Gripp (Dean, Telecourse Development, Coast Telecourses), notes that most early televised classes resembled correspondence courses, with little or no teacher/student contact or interchange (A Decade, n.d.). Today, however, the interactive components of most telecourses have been developed to the extent that the difference in degree of interactivity between a "telecourse" and a "videoconference" is becoming less consequential. Nonetheless, Rice (1983) cautions that true "instructional" videoconferences should be distinguished from glorified product introductions and other "one-way" messages.

Although Lewis (n.d.) did not locate any instances of two-way full-motion video in his survey of educational programs (presumably due to cost), such videoconferencing courses do occur. For example, such a course took place shortly thereafter between two Ohio universities. Classes in Athens and Columbus, Ohio were linked via microwave, and in the course of a 10-week quarter negotiated on communications issues. Although the usual model in this situation would have been a faculty member addressing a remote audience, interaction in this case was concentrated on discussion between people separated in space.

Such efforts can be expensive, however. The value of the facility use, production, transmission services contributed to the project by the Columbus public television station (WOSU) was estimated by one source at up to $2,500 per weekly 3-hour session. Costs for the Athens group, who used a specially equipped "teleclassroom," were substantially less.

Promising Current Developments

Several satellite-based projects currently underway in the instructional arena should be monitored by vocational educators, either with an eye toward participation or toward using a similar model.

PLATO by Satellite

Upcoming plans for delivery of computer-based education and training on the PLATO system are indicative of the effect that the interface of microcomputer and satellite technology can have on data transmission costs. The U.S. Army, for example, has utilized satellite transmission and PLATO software to transmit education and training databases to Europe. From the original eight logistics-related topics, programming expanded substantially to meet the Army's vast training needs (Polcyn 1981).

In an upcoming civilian pilot test planned for fall 1984, microcomputer PLATO software will be transmitted (via Westar IV, transponder 5 or 7) for reception and real-time use at school and administrative sites. The return link to the mainframe computer will be by simplex telephone line. Anticipated costs are as follows:

- o cost of terminal--$600-1000 (one-time cost)
- o access fee--$25 per month (includes access to courseware, computation services, etc.)
- o communications costs--$10 per month (includes satellite transmission plus return phone link)

After the field test is complete, a greater aggregation of users could lower these costs even further. Currently, communications costs for PLATO (using a 2-way phone line) can run as high as $250 per month between the individual terminal and one of PLATO's 35 mainframe systems around the world.

Currently, up to 4,000 microcomputer terminals (linked in groups of 250-300) are being identified for participation in a field test of the system. Targeted areas for participation include cities such as Houston, Cincinnati, Philadelphia, Chicago, Sacramento, and New York State.* Dr. Robert H. Decker, field-test site coordinator, notes that other information service providers will be watching this field test closely and that an increasing amount of activity in the area can be expected.

National Technological University (NTU)

The National Technological University (NTU) is evolving as a preeminent model for reaching a highly specialized nationwide audience via satellite with formal instruction and state-of-the-art education. Its specific purpose is to extend the instructional television systems in engineering that currently

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*For information on participation, contact Decker, Director of Satellite Education at KLM Electronics, (217) 773-2477.

operate on a regional level. Cooperating institutions will use a dedicated network to offer courses to on- and off-campus sites as well as share responsibility for course development and organization. The first activity occured this spring with a six-part series over the Hewlett-Packard network to H-P plants and offices, with one of the six broadcasts interactive. A pilot program (credit courses) will take place via videotape delivery during fall 1984, with delivery via the dedicated satellite network (currently under development) available by summer/fall 1985.

NTU's preliminary projections call for approximately 180 credit courses annually within the decade. The number of uplinks available at member universities is projected to rise from 6 to 18 during that time. According to those projections, a typical site would enroll as few as 67 students in either credit or short courses in a given semester.

NTU's parent association, the Association for Media-based Continuing Education for Engineers (AMCEE), plans to utilize the satellite delivery system during "off hours" to offer its current continuing education professional development courses, as well as seminars, conferences, interactive workshops, and special events ("Non-credit Program" 1983). The live programming is expected to allow AMCEE to respond rapidly to technological developments and relay them to its professional constituency.

AMCEE expects its current continuing education programs to benefit from satellite distribution. Small classes (aggregated from a number of sites) are expected to find it more cost-effective than the rental of videotape sets for on-site use. The convenience of the television system may also be preferred for even larger classes.

The combined AMCEE/NTU program is visualized as "an aggregate of many sites drawing selectively from a wide range of instructional topics and levels" ("Preliminary Program Projections," p. 2). The NTU planning effort has received wide financial and organizational support from universities, numerous corporations, and the Department of Defense.

The National Narrowcast Service (NNS)

In the past, limitations on available broadcast time have restricted the educational efforts of the Public Broadcasting Service (PBS) to meeting only "the most broad-based and easily identified educational needs" (Public Broadcasting 1983). In the National Narrowcast Service (NNS), PBS seeks to combine satellite interconnection with ITFS and related technologies to address the critical education and training demands that cannot currently be accommodated. The NNS demonstration project, initially geared to two target strands (business and educators), will use the existing PBS satellite system to distribute programming to ITFS systems. PBS notes the following advantages in utilizing ITFS (1983, p. 15) as the "final mile" distribution technology:

- Though it is a mass distribution medium, ITFS is relatively inexpensive to operate.
- ITFS channels are generally awarded in groups of four to single licensees, permitting distribution of multiple strands of programming simultaneously.
- The ITFS technology makes on-site, workplace delivery of educational services both efficient and cost-effective.
- ITFS channels include the capability for two-way communication, including audio feedback and computer inactivity.

The two major thrusts for which PBS/NNS currently requires developmental resources are the construction of ITFS systems in as many communities as possible and the aggregation, commissioning, or acquisition of programming.

While the National Narrowcast Service will presumably not produce courseware, they expect to provide an impetus for programming development. In addition to providing a delivery system, NNS might, for example, help developers tailor a project to best serve the needs of a national clientele.

When implemented, NNS programming will allow for interactivity in a variety of modes. From the national base, of course, telephone calls during live seminars and workshops can be utilized. However, the greatest and perhaps most viable interactivity via NNS is projected for the local community where, depending on the program, it can include local activities which are not necessarily a part of the national network.

As one scenario, a 30-minute telecast incorporating a vocational skill might be distributed to 10 or 15 work sites. One college would facilitate those sites. After the program, the instructor could be made available on television to do a follow-up/wrap-around local question period. In this way, there would be any number of possibilities for interactivity. The college, for example, might very well be able to afford to send a faculty person to 15 sites in the course of a semester, while providing a faculty person to 15 sites for every session would be infeasible. For students, five sessions at the postsecondary institution in a lab or shop situation might be sufficient if adequate television, print, and other programming were in use the rest of the time.

Finally, note that methods of utilizing the ITFS capacity for response will be explored in the demonstration, as well as new video services.

As projected, NNS stands as one of the most promising alternatives for satellite distribution of vocational programming, especially instruction and training. Assuming that it develops as projected, the vocational education community should initiate active involvement.

Satellite telecommunications also has the potential to provide support services to students. In the placement area, a satellite-transmitting video "job fair" will reach students at approximately 25 campuses next October. The recruiting forum will be sponsored by BPI Source (a Minneapolis, Minnesota, "satellite communications recruiting network") and is described as "a pioneering effort to match students and employers by videoteleconference" ("Job Search" 1984, p. 3). The implications of such an application in an era of shifting population and job displacement are easily derived.

Issues in Instruction and Training

Programming

The limited availability of programming and funding for development currently appears to be a major detriment to the use of satellite video capacity in vocational education. While the lack of programming has been cited as "one of the 21 telecourse myths" (Luskin 1983), it is true that vocational educators will not be able to locate broadcast-quality audiovisual materials on many specific topics of interest. Resnick of PBS, Koffarnus of CEN/PSEC, members of the Alaska and Wisconsin vocational staffs, and others particularly cite the lack of available training materials.

There are, however, video materials (particularly at the postsecondary level) that are useful in explicating the common core skills and functions that cut across a number of jobs--notice the number of entrepreneurship/small business topics cited in chapter 4. While course development along these more generalized lines was probably originally prompted by a desire for maximum flexibility in use and the need to recoup development costs among the largest possible audience, such materials are certainly consistent with vocational education trends toward less job specific, more flexible curricula. (Note--New York's current revamping of its vocational curricula as a response to the challenge of vocational education's future.)

As an example, Sea School--Alaska Fisheries Series (1983) is a series of eight video programs designed to increase awareness of Alaska's fish and fishing industry. It covers basic biology, management issues, the different commercial fisheries, career opportunities, and the cultural significance of the fisheries. The eight 14 1/2-minute programs can be used individually or as a series.

When used with the teacher's guide, the various classroom lesson components, and the slide show, this video series is an excellent example of how combining telecommunications with in-school activities can introduce and orient students to a major vocational area, its opportunities, and its problems. The series was produced for the Alaska Department of Education's Office of Educational Technology and Telecommunications by the Arctic Environmental Information and Data Center. The State Office of Vocational and Adult Education was also closely involved in its planning and development.

In addition, Rice's caution about "glorified orientations" may underestimate the value of the orientational teleconference--common in professional development--in introducing students to new technologies. "Computer Graphics--Art Technology of the Future" is being produced in June 1984, by UTN, the University Television Network (associated with WE Productions, a commercial concern in Hollywood, CA). The goal of UTN's summer teleclass schedule is to encourage learning and participation by artists "who wish to develop skills relevant to the market place."* Informational teleconferences with similar aims have a role in introducing new technological developments to students and making scarce expertise available to a greater number of instructional settings.

Hands-on Needs and Distance Learning

In the past, the need for hands-on experience when learning a specific trade or skill, as well as the trend toward competency-based or individualized instruction, has mitigated against vocational education's involvement in distance education. Linda Resnick** of PBS observes that resistance to telecommunications continues with academic subjects, but is overcome once a faculty starts utilizing distance technologies. Vocational educators, however, have traditionally been at a disadvantage in regard to programming, since the costs of production--even when done "on a shoestring"--are still fairly expensive. Such high costs are at odds with the small group of trainees that such programming would attract in a given locale and the lack of appeal to a general or casual viewing audience. From a broadcast point of view, this narrow audience appeal has foreclosed the possibility of broadcast time; lack of a broadcast outlet, in turn, has mitigated against production. Such circumstances tend to reinforce those who want to rely primarily on a hands-on approach.

Resnick suggests that, with many skills, television can produce results equal to or better than a hands-on approach. Televised video, for example, can give intense close-ups, enlarging visuals and illustrating manipulations

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*Eric Tietelbaum, Academic Coordinator/UTN, personal correspondence, 3 February 1984.

**Phone interview, 10 May 1984.

in ways that focus attention best. These can be valuable additions to hands-on training. Resnick believes that, through NNS, vocational education can deliver important aspects of training and apply person-to-person and equipment resources in a more cost-effective way.

In the future, growing reliance in training on simulations such as the microprocessor-driven videodisc--suggested by Lipson to allow "more trials, more systematic development, and more explanation of the consequences of various options" (1984, p. 9) than possible when training on actual equipment--will pave the way for the incorporation of a wider range of educational components, including distance technologies, into the training environment.

Further, a wide range of configurations for interactivity can be considered in utilizing telecommunications for training:

- o When the British Columbia Institute of Technology (BCIT) produced an 8-hour series on people and processes in the British Columbian forest industry, one of the programs showed a forest fire suppression simulation which was a part of the BCIT training program for forest technologists (Ruggles et al, 1982).
- o The format of "Heartsaver--C.P.R." (Knowledge Network) included a practice session at a local college in addition to a telephone-interactive broadcast (Knowledge Network News 1984).
- o The electronic circuitry series produced by the Wisconsin Board of Vocational, Technical and Adult Education combines broadcast/video materials with a laboratory component.
- o The effective integration of video segments and hands-on laboratory activities to show technical applications has been a guiding concern in the development of AIT Principles of Technology series.

Satellite technology can also be looked to to supplement and update videodisc-based training. The proposed training and maintenance system currently under development at McDonnell Douglas combines several technologies in an up-to-the-minute, user-driven, and geographically flexible delivery system. As visualized, interactive initial training (on microprocessor-driven videodisc) in aircraft maintenance and repair will be supplemented and updated on the job when actual maintenance situations occur. When a technician on an aircraft carrier encounters an unfamiliar or unusually complex repair, details will be relayed back to McDonnell Douglas via ship-to-shore radio. At the maintenance center, the repair will be videotaped as it is demonstrated by a master mechanic. The videotape will then be sent by satellite to the carrier, with the videotape available for incorporation into the next pressing of the training disc if warranted. The capacity for on-demand "video updating" and on-call expertise demonstrated in this model has the potential for numerous applications in an on-the-job training--even on dry land.

Satellite telecommunications holds great potential for vocational instruction and training. Richard Maresco, director of education of the Mechanical Contractors Association (Chevy Chase, Maryland) further feels that entry-level people will be the prime beneficiaries (Gillette 1983). Teleconferences have a role in introducing new technological developments and in sharing scarce or highly specialized instructor expertise. Overall, expanded access to training opportunities--for more people at more sites--must be cited as a major potential benefit.

Current trends toward "systems-oriented" vocational curricula as well as toward the expanded use of simulations in training will contribute to the expanded utilization of distance technologies, including satellite telecommunications, in vocational education. Several promising models are under development nationwide. Since the National Narrowcast Service, for example, is predicated on the well-established Public Broadcasting Service, vocational education involvement may be highly expedient and cost-effective.

Before the full potential of satellite in the instruction and training areas can be achieved, however, the issue of limited programming must be confronted. The popular expectation of hands-on learning also stands as a persistent issue in light of the growing interest in distance technologies. The role of telecommunications as a complement to, or substitute for, these hands-on experiences must be thoroughly explored.

CHAPTER SEVEN

APPLICATIONS IN PERSONNEL DEVELOPMENT

Personnel Development through Videoconferencing: Case Studies

The educational uses of communications satellites to date have centered largely on continuing education for professionals. A number of these are of interest to vocational educators due to content or format, which have consisted of various forms of interactivity within and among receiving sites.

- Teachers in eleven states can receive the National Education Association's (NEA) first regular television program, NEA Chronicle, Mondays at 2 p.m. EST via EdNet. The program includes news, information, and motivational segments (both live and pretaped). From NEA's TV production center, where the show is assembled, the signal is transmitted by laser beam to a nearby building for uplinking. During live segments, affiliates can phone in with questions or comments.

  State affiliates tape the broadcasts for later use at meetings or training sessions. The Texas State Teachers Association has arranged to distribute NEA Chronicle on tape to cable companies throughout the State for broadcast directly into members' homes.

- Ku-band satellite and ITFS were the media for distributing 32 hours (8 days, 4 hours daily) of inservice programming to high schools in 5 cities. Mathematics and the teaching of gifted students were the focal point of the series, which was sponsored by National University of the Air and the Center for Excellence (Williamsburg, VA). Videostar Connections coordinated the event, which was scrambled (PSSC case study).

- "Laboratory Testing: New and Future Procedures" (4/20/83) demonstrated state-of-the art techniques to 6,000 pathologists, technicians, and laboratory administrators. Bio-Dynamics, Inc., sponsored the event, which was received in 31 cities (PSSC case study).

- Robotics was the subject of a 5 1/2 hour telecourse that was produced by South Carolina ETV studios and sent to 3,000 engineers (16 sites). The Learning Channel also distributed the program to its cable TV affiliates. The Institute of Electrical and Electronics Engineers sponsored the telecourse and awarded professional credit.

- o A point-to-point transmission between two sites in New Hampshire and Kentucky enabled NASA's Dr. Robert Jastrow to address outstanding high school seniors on the subject of space technologies. The event, part of Kentucky's Governor's Scholars Program, was again distributed further by The Learning Channel to cable systems (PSSC case study).

- o American Library Association (ALA) Midwinter Conference (1/26/82), as described in figure 8, was extended to professionals who could not otherwise have attended.

- o The WOSU (Columbus, Ohio)-produced Use of Microcomputers in Education was transmitted to 17 interactive and 40 receive-only sites in the United States and Canada (via land line and Anik B) on 10/29/82. The 2,000 participants communicated by computer terminal--the first time ideas had been exchanged in this way at a videoconference.

Other videoconferences have directly involved vocational education constituencies:

- o A need to explore collaborative economic development strategies was addressed during an October 1983 vocational education videoconference originating in Stillwater, Oklahoma and Washington. The group was addressed (pretaped) by Michael Annison, vice-president of the Naisbett Group, as well as by AVA, NASDVE, and other vocational education leaders. After a preproduced segment discussing Oklahoma's economic development approach and a question-and-answer session (during which the audience could query the Stillwater speakers, the Washington group, or both), on-site panels extended the discussion of economic development and its implications for vocational and technical education to the individual States.

The experience was designed to check the value of the method. In the videoconference evaluation, the Columbus participants were asked to rank six modes of conference attendance in terms of preference and in light of their current professional responsibilities, opportunities, and restrictions. The question and results are shown in figure 9.

This audience, then, while hesitant to abandon out-of-state travel as their first preference, evidently considers an in-state videoconference a viable alternative--with almost one-third of the group preferring it or compromising to accommodate budget and travel restrictions.

CASE STUDY
NATIONAL SATELLITE NETWORK VIDEO-TELECONFERENCE
FOR
THE AMERICAN LIBRARY ASSOCIATION
TRANSMITTED ON
JANUARY 26, 1982
PUBLIC SERVICE SATELLITE CONSORTIUM
REPORT TO MEMBERS

Purpose: To distribute in real time a key session from the American Library Association's 1982 Midwinter Conference and demonstrate the viability of a library-based network of receive sites.

Concept: The ALA wanted to involve its members in the Denver conference who were not able to attend, and to demonstrate that libraries, through cable systems, are a viable programming network. The ALA chose a session titled "Marketing: A Key to Surviving and Thriving," to distribute via satellite to 62 library receive sites.

PSSC: The ALA contracted with PSSC to provide the preliminary network assessment, acquire satellite time, solicit, acquire and coordinate library receive sites, provide studio and uplink(s), provide creative production support, register participants, develop a program evaluation, and summarize the results.

Time Line: Initial discussions began in June 1981, with authorization to proceed on acquisition of services on December 21, 1981.

Planning: (1) Discussion of viability with PSSC, (2) preliminary network assessment, (3) network acquisition/coordination, (4) event, and (5) post event evaluation.

Configuration: The two-hour program originated at Public Service Satellite Consortium and Rocky Mountain Broadcast Center facilities in Denver and was transmitted by PSSC to Westar I. The Appalachian Community Service Network received the signal in Lexington, KY, and simultaneously retransmitted it to its transponder on Satcom III-R. The majority of the receive sites were libraries connected to cable systems receiving ACSN's transponder. One public television station received the Westar I signal for pass-through to a library, and one transportable earth station was used as a viewing site. An AT&T landline was used to transmit the signal from PSSC to the Denver Hilton for viewing by ALA conference participants.

Funding Source: Internal American Library Association.

Budget: $27,653

Evaluation: The transmission was of excellent quality and there were no technical problems.

Outcome: ALA has reported being pleased with the results, and many participants reported being satisfied with the method of information dissemination.

Figure 8. ALA video conference case study (Public Service Satellite Consortium. Case studies. n.d.)

Considering your current professional responsibilities/opportunities/restrictions, RANK each of the following in order of your preferences. Rank 1 is the highest, 2 is second, 3 is next, and so forth.

( ) Participate in a telephone (audio) conference
( ) View/listen to a videotape of a teleconference
( ) Attend a conference in person out of state
( ) Read a document of the proceedings of a conference
( ) Attend a videoteleconference in person within the State
( ) Listen to audiotapes of conference speakers

Mode:	Audio-conference	Video-tape	Attend conf. out-of-state	Read Proceed-ings	Attend in-state teleconf.	Hear conf. audio-tape
Priority #1	6	2	20	0	14	1
Priority #2	5	9	6	4	20	0
Priority #3	10	19	3	3	7	1
Priority #4	11	12	6	5	0	9
Priority #5	9	1	3	7	2	22
Priority #6	2	0	5	22	0	11

Figure 9. Preferences among vocational educators for attendance modes.

Source: Halasz (1983, p. 50).

o "Sewing by Satellite II" (11/5/83) was the second video seminar held by the American Home Sewing Association, New York City. It was part of an ongoing effort to encourage home sewing, especially among teenagers. The primary target audience was high school home economics teachers, with school administrators, fabric retailers, and other sewing groups (9,000 participants total) attending at 63 sites. The format included pretaped and live lectures, demonstrations, and seminars (Gillette 1983; PSSC case study).

Len Ennis, AHSA Executive Director, points out that many attendees still require an orientation to the medium. "You must tell [them] that they're not going to see a television show, that the hardware is reliable, that they will be able to participate, and that the satellite is not going to fall out of the sky" (Gillette 1983, p. 95; PSSC case study).

- The Vocational Education Data System (VEDS) was the topic for a 6-hour staff development videoconference held on August 25 and 26, 1981. The National Center for Education Statistics (NCES) and the Corporation for Public Broadcasting assisted in producing the event. Despite numerous technical difficulties (including substandard video and inconsistent audio), many of the participants viewed the program as "informative and helpful" (from a PSSC case study).

As an example of private sector involvement around military priorities, the American Program Bureau, Inc., located in Chestnut Hill, Massachusetts, has conducted two satellite videoconferences through its High Technology Management Group. The first program (October 1983), entitled The World Of Ada, introduced 4,000 participants at 49 corporations, military bases, and public sites to Ada, a Software system likely to have great impact on software development in the next several years. (By 1990, Ada is expected to be the required language for all embedded military computer systems.) Subsequently, The World Of Ada, Part II was transmitted (April 1984) as a videoconference providing participants with an expanded opportunity to ask questions during the broadcast. Prior to air date, the American Program Bureau had solicited questions from downlink clients so as to get correct responses first from appropriate experts.

Issues in Satellite Assisted Personnel Development

The issues raised by teleconferencing per se have been exhaustively catalogued. It would appear, in fact, that just as much effort in recent years has been devoted to writing about teleconferencing as has been spent on actual events.

As professional development via telecommunications moves past the pilot stage and becomes routine, the question of the most cost-effective level of technology becomes more pressing. To date, the most common format has been one-way video with interactive audio. The potential of audioconferencing does not appear to have been fully explored in this regard.

"The Regional Forum on Distance Learning" was recently coordinated by the Southwest Educational Development Laboratory (Austin, Texas). Planned for SEA staffs, its objectives were to provide information on costs, current practices, and resources in distance learning as well as address instructional and policy questions. The forum further sought to provide a distance learning experience by utilizing audio delivery--especially appropriate since the State agencies involved had requested a nonvideo emphasis for the forum itself.

In general, teleconferencing as an inservice tool helps to minimize the staff time involved, give even "coverage" and more standard information across a district, and provide the teacher with state-of-the-art and time-sensitive information (both curricular and administrative) as needed. New York State, for example, is utilizing ITFS to provide inservice training to the 40,000 staff members affected by their current curriculum revision. The National Diffusion Network (NDN) regularly utilizes teleconferencing as a means of introducing model programs for potential adoption.

Teleconferencing has also been demonstrated as an effective tool for extending the reach of professional organizations and maintaining networks in an era of dwindling travel funds. In both cases, the net effect is <u>not</u> necessarily less money spent; rather, it is the sharing of more consistent, up-to-the minute information among a wider number of people.

CHAPTER EIGHT

APPLICATIONS IN ADMINISTRATION AND GOVERNANCE

Satellite-transmitted communication can contribute to greater administrative efficiency and cost savings in exchanging and reporting information. This potential for efficiency will increase as applications such as data transfer by satellite become commonplace. While institutions may tend to first employ technology systematically for centralized administrative functions (Turner 1984) the implementation of those systems can become as complex as the situations they were intended to facilitate. This section examines some of the administrative and governance applications and the issues raised by satellite solutions.

Current and Potential Uses

Administrative teleconferencing, becoming fairly commonplace in the business world, is certainly not unknown in the not-for-profit sector. Recent examples would include the following:

- The Council of Jewish Federations held a "telemeeting" in June, 1983, for budget review and related purposes. The interactive 2 1/2-hour video event, produced by MTI, originated in New York and was received at 13 sites (PSSC case study).

- Part of an American Federation of Teachers news conference on discrimination (6/82) was beamed directly to news organizations through PubSat, an organization that distributes electronic press releases via satellite to TV and radio stations (PSSC case study).

In education, the use of computer and audio conferencing for administrative purposes is common: Alaska's satellite-based audio and computer systems have high utility for administrative purposes, as explained in chapter 4.

In the "lower 48," such audio- and computer-based systems are accessed primarily by telephone. Wisconsin's Educational Teleconference Network (ETN), linking 200 sites, is heavily used for administrative purposes. Its 20-line "Meet Me" dial-in service has been utilized in the past for statewide, nationwide, and international meetings. The Statewide Extension Education Network (SEEN), a dedicated freeze-frame network linking 26 sites, transmits still images to black-and-white monitors. Its two-frame memory (i.e., an image can be viewed while another is being transmitted) cuts down on the "waiting time" associated with slow-scan technologies. (This system also receives heavy instructional use.)

Such systems, as well as computer-based electronic mail and bulletin boards, are currently telephone based: the user dials a long distance call or accesses a dedicated telecommunications network such as Telenet or Tymnet. Any utilization of satellite is not apparent to the user. In the future, however, satellite may be more directly accessed as a means for cutting telecommunications costs (the one expense of information access that is not falling in price) and speeding response.

INC Telecommunications (McLean, VA) is currently testing a system that will transmit electronic mail via radio airwaves. Eventually a satellite-linked network of such local nodes may be developed. When the State of Virginia explored the use of such a system, interested agencies pinpointed 50 potential applications involving over 2 million document pages annually ("Implementing" 1983). George Hall, telecommunications director for the State Department of Education, noted that this would allow schools to receive rapidly updated information, as well as computer software, "at a fraction of the cost" of modem transmission ("Virginia Pioneers" 1983).

Equatorial Communication's system involving satellite transmission of videotex and teletext (explained in chapter nine), with its capacity to handle relatively low rates of data transmission cost-effectively by satellite, should also be examined for its administrative implications. Educators should look to these roles for satellites as being of primary importance in cutting the cost of administrative functions.

Issues

Issues relating to administration and governance are not unique to satellite; rather, they overlap a number of telecommunications media. Several issues, however, surfaced repeatedly during this study.

Foremost is the issue of meeting real needs and not merely developing a delivery system, no matter how appealing the technology, for its own sake. Educational practitioners and industry both stress the user-driven, user-friendly system. Responding to these needs is not as straight-forward as it sounds, however. Demmert* notes that the initial surveying of needs can be a problem, as potential users often do not know enough about the technology to articulate their needs. This lack of knowledge can interfere with the "bottom up" process she sees as necessary for any dynamic telecommunications system. Stages of development differ and priorities change, as well.

Concurrently, the organization will have to develop a clear sense of mission if it does not already possess one. As Koffarnus (1984) states:

> Perhaps the biggest question vocational/technical institutions need to ask themselves before venturing into the satellite communications field is "What business are we in?" Recently, when the American Library Association was asked that question, they replied (after

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*Jane Demmert, Statewide Director of Learn/Alaska, University of Alaska, personal interview, Fairbanks, 28 February 1984.

careful needs assessment) they were in the business of being centers for learning. They saw themselves as broadly based centers for information exchange and mediated learning. (p. 1)

After needs assessment, capacity building is a major concern. Dimond (1984) characterizes two approaches to acquiring telecommunications capacity:

(1) great leapers--those with special insight, extensive staffs, and deep pockets; and

(2) great financial handlers--those who "take precise and calculating steps and get to where they want to go in measured, fiscally responsible terms. They would rather have it work than amaze . . . ." (p. 45).

Obviously, it behooves most of us to take the second approach--especially since the first is characterized by "more failures than successes."

Locating funds for basic equipment does not appear to be a problem. Language in the current vocational education legislation allows such telecommunications purchases. School districts have been using Chapter II and other noncategorized funds to purchase "dishes." Many States also have provided funds under "high technology" initiatives. In Minnesota, the utility of the dishes already in place at area vocational-technical schools is also being enhanced by expanding curricula in the satellite technician area.

To develop or utilize more elaborate systems, administrators will undoubtedly find themselves cooperating with a variety of other organizations and agencies. The vocational education division of the Texas Education Agency, for example, is currently cooperating in that State's agency-wide assessment of telecommunications needs and goals. To that end, the Texas Education Agency has appointed an Advisory Committee on Information Technology and Telecommunications Systems.* Teleport utilization (see appendix D) or

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*Paul Meyers, Texas Education Agency, telephone interview, 12 April 1984.

utilization of subcarrier or other "piggyback" systems would require similar forms of cooperation.

The rapid pace of hardware development and the intense competition of an increasingly deregulated marketplace will exert a different set of pressures on the educational organization. To expand their networks, the telecommunications network consortia serving education today need equipment investment and in-kind contributions (parking, meeting rooms, support staff, etc.) for receiving sites. Member receipt of some programming may also be mandated. The considerable expense and the rapid proliferation of networks make these choices confusing. In addition, the prospect of excess capacity and network advice on how to use it to boost institutional revenues may tax the managerial capacity of schools or centers dealing in new and unfamiliar territory. (See "Satellite Stations Could Boost College Revenue" 1983). Hence, while opportunities for capacity building exist, they must be carefully assessed for consistency with the mission of the vocational education organization.

Allocating funds for hardware, software, and in-kind requirements, however, is merely "the tip of the iceberg" in terms of telecommunications financing. Goldstein (1984) notes that the relative cost of instruction is more complex in the telecommunications arena: distance programs are not automatically less expensive or more cost-efficient than classroom programs and have a decidedly different cost composition. Financing the cost of third party intermediaries--nonschool organizations such as satellite networks or cable system operators--can be especially difficult. Goldstein concludes: "With the advent of efficient telecommunications-based distance learning systems, the entire configuration of financing . . . must be reexamined" (p. 10).

The organizational prerequisites that underlie all educational applications of satellite technology are addressed in chapter 10.

CHAPTER NINE

APPLICATIONS IN RESEARCH AND DEVELOPMENT

F. W. Lancaster (January 1983) describes the impact of electronics and telecommunications on publishing. While the computer already has been applied to the production of conventional publications, the emergence of electronic databases and databanks for which no print-on-paper equivalents exist represents a newer phase of purely electronic publications.

Hundreds of diverse electronic publications are accessible through conventional online facilities via, for example, videotex technology, videodisc, videotape, and audiocassette for use with microcomputers. Lancaster notes further that electronic publications, while all dependent on some type of "equipment," actually are available in two different ways. Some are distributed via telecommunications, while others are accessible online to users through some telecommunications network.

Equatorial Communications Company (Mountain View, California) offers teletext via satellite as an alternate means of subscriber delivery for digitized databases that, in the past, relied on high-cost leased telephone lines. Database publishers such as UPI, Reuters, and Dow Jones transmit data to Equatorial, where it is uplinked to subscribers who receive information on small earth stations (2-foot antennae and receivers) with their microcomputer, printer, or display terminal providing storage and display.

The $2,500 (approximate) cost of the earth station is roughly comparable to the price of a 9,600 baud (high speed) modem. While subscription rates vary according to the time sensitivity of the data, Spigai (1984) notes that the company has changed the economics of digital transmission: "Using this system, a network with 1,000 subscribers could send a database the size of the Wall Street Journal for less than 60 cents per month per subscriber" (p. 26 and 5) utilizing an overnight rate. Network reliability is cited as an additional advantage. Short-term plans for Equatorial, all with potential benefits to the educational community, include--

- o teletext-to-microcomputer delivery for local storage and processing (recently piloted with Merrill Lynch);
- o introduction of an interactive product line, again utilizing microcomputers, in mid-1984; and
- o a planned satellite launch (Equastar) in 1988.

In vocational education the establishment of highly specialized electronic "publications" or data centers can continue to grow with satellite and other distance telecommunications offering the promise of ready access to such publications by users working (for example) in research, development, or teaching. Vocational educators already familiar with how to conduct an online search of existing computerized databases can look forward to the continued proliferation of even more specialized electronic publications that they may either access or receive via satellite-assisted telecommunications. Such a scenario does not, however, inevitably preview a paperless future for vocational educators (Lancaster, January 1983) since no claims are made for the superiority of electronic publishing and data storage in all circumstances.

With an increase in the use of electronic publishing, the medium clearly can have a significant effect on many facets of the production and distribution of information (Lancaster and Warner 1983). In vocational education one might anticipate major differences in how authors work, what they produce, how they interact with referees and publishers, how information is packaged and distributed, and how it is used.

As vocational educators become further involved in electronic publishing via telecommunications and, in some cases, satellite transmission, they will need to participate in designing innovative ways to maximize the superiority of electronic publishing in given situations. Lancaster, for example, explains that narrative text might become much less important in electronic publications in which animations, electronic models, moving picture, and sound can be employed by the authors (Lancaster and Warner 1983). The notion of combining interactive satellite television transmission capabilities with those of electronic publishing (including animated graphics, sound, and branching instructional sequences) opens an entirely new set of possibilities. The research, development, publication, dissemination, and use of vocational education curricula, as well as administrative communications, will all be affected.

Lancaster (January 1983) explains that virtually any electronic medium will permit the use of analog models to simulate physical events including experiments involving physics, chemistry, or mechanics, flights of aircraft, or the variable operation of equipment. Certain vocational education publications might be truly interactive, programmed to allow users to manipulate electronic models or even to rework raw data provided by the author to realize a "hands on" learning experience--delivered, perhaps, through satellite telecommunications.

Lancaster (November 1983) observes that probably no "true" electronic publications have yet appeared. Current electronic publications have been designed to look like print on paper with a page of an electronic publication being virtually the same as a page in a printed book. Electronic publication will establish itself as a new and entirely different genre when their design capitalizes on the true capabilities of electronics, such as interactivity.

Satellite telecommunications developments are leading to still further applications for vocational education. Polcyn (1981) previews on-board data processing, which involves computational functions within the satellite. With such developments the satellite does more than process a microwave signal and retransmit it. The satellite capable of on-board processing engages in "packet switching" where data streams are divided into packets and routed to their destinations in the most cost-effective manner, either to points on earth or to other satellites. Polcyn further describes "demand assignment," a type of on-board processing whereby information is stored on board the satellite's computer and provided to users as required, in much the same way that current earth resource and weather satellites collect, store, and provide data on request. Polcyn visualizes this as invaluable to the establishment of centralized databases that could store and supply data for members of research consortia at a fraction of today's costs.

The potential of on-board data processing in vocational education appears considerable since it will permit the movement of massive amounts of data. It may, for example, permit the establishment in vocational education of regional or centralized film, videotape, videodisc, or microcomputer software database libraries capable of rapid-fire, low-cost transmission of information.

CHAPTER TEN

REQUISITES FOR SUCCESSFUL IMPLEMENTATION

Before satellite-based solutions to vocational educational needs can be implemented, many factors must be considered and issues confronted. A number of these can be grouped under the familiar rubrics of software, "peopleware," and hardware, as well as legal issues and organizational structure.

Software

According to Smith and Stroud (1982), software (in this case, courseware) for television and radio--the predominant technologies of the seventies--was largely inadequate. They predict that developing and selecting courseware that is "pedagogically sound for its medium" will become an even more pronounced problem with the growth of distance learning applications. For example, only the pretaped segments of teleconferences can be previewed in advance, and consortia relying on member-originated programming must stress quality content. Reviewers of "canned" video programming see only one or two--often the best--segments of a series. Adequate production values are also important, although audiences readily accept less-than-elaborate productions when the value of the information received is high.

Two recent projects funded by the Fund for the Improvement of Postsecondary Education (FIPSE) addressed evaluation concerns in telecourses and the related question of accreditation. "Assessing Long Distance Learning via Telecommunications," Project ALLTEL, was designed to "concentrate on eliminating unnecessary interstate barriers while preserving consumer protection and quality assurance" ("Association Updates" 1982, p. 4). The project issued assessment guidelines for State departments of education and other accreditation agencies ("Telecommunications Brief" 1983). Data on institutional capacity and activities in telecommunications are also being collected for the use of accrediting bodies and State agencies (ALLTEL Update 1984). Another set of guidelines, issued by the Coordinating Board of the Texas College and Universities System, recommends approval of telecourses once they are attested to be "equivalent in quality to on-campus, resident courses" ("Telecommunications Brief," p. 4).

Carol Koffarnus (1984) of CEN-PSEC stresses the primacy of developing appropriate, quality software:

> I cannot stress enough the need to put your best minds into the development of the software that is to be delivered on the hardware. As usual, the hardware is a full ten years ahead of the software and so it is imperative that you do not try to "play catch-up" across all the hardware options made available to you. That diffusion would give you little impact in the long haul. Rather, once you have ascertained the business you want to be in, then look at the technology options at your disposal, now and ten years from now, and then begin the instructional design process for developing interactive educational programming packages that can be delivered over the satellite. (pp. 2-3)

Quality series development can be costly. The consortium budget for the Principles of Technology series includes for example, almost $630,000 for instructional design and $1,500,000 in production costs from a $2.5 million dollar budget.

A final technical requisite that must not be overlooked is the formatting of video materials. Koffarnus explains the requirements for satellite transmission:

> Format requirements for quality broadcast transmission of programming via satellite should be the 1" videotape format. Although all transmission was once done on 2" quad videotapes, the industry has been switching over to the less expensive 1" videotape because of its advantages over the 2" format (i.e., high resolution, less size, weight and less shipping costs).

By broadcasting on satellite with a first generation 1" master videotape, off-air recording by vocational-technical schools and other receiving sites would give a quality second generation master on 3/4" VC or 1/2" VHS or Beta to use for subsequent dubbing of these programs. Although there are times when a 3/4" broad cast quality videotape is used to feed a program or programs on satellite, it is primarily done for preview purposes only and dubs made from these feeds onto 3/4" videotapes are significantly lower in quality. It will depend on your usage of these programs and what level of quality you want to pass on to your adult learner. If more than the off-air record programs need to be dubbed from the satellite feed, then we in the industry would strongly recommend 1" video tape for your master source.

You will be able to deliver your service via these formats into your main and branch campuses, hospitals, industry, prisons, high schools, senior citizens, community centers and others. Satellite distribution makes national educational program schedules technically possible and financially cost effective. (p. 1)

"Peopleware"

"Peopleware" is a concern equal to or larger than software, although not in relation to satellite reception per se, since training for the personnel responsible at the local level for downlinking seminars, previews, and interactive teleconferences is minimal. Usually, the manufacturer of the satellite receive dish conducts a 1/2-day staff training seminar, which is ample to handle downlinking. Any training required for a host site coordinator is supplied through guidelines provided by the companies or institutions offering the teleconferences (Koffarnus 1984).

In a broader sense, however, the crucial concern cited by sources is the inability of today's educator to "think video"--to operate comfortably in front of a TV camera, to accommodate taping of classes, to write promotional video into curriculum proposals, or to require video expertise of future teachers (Connett, n.d.; Lewis, n.d.; Polcyn 1981). Polcyn asserts that both secondary and primary institutions will be utilizing communications satellites "sparingly" as late as the 1990s. His reasons revolve around both personnel and organizational factors:

> Of all educational institutions, they are the most conservative, most protected and staffed with personnel least prepared of all potential users to take advantage of communications satellites. (p. 242)

The need to develop these skills in current and future educators cannot be overstressed. Dr. Bernard Luskin (president, Coastline Community College) notes that the expanded use of high-quality broadcast courses "now looms as a major educational and communications technology breakthrough," and that "our concept of literacy, which emphasizes reading and writing skills, is expanding to include elements of visual literacy as well" (A Decade, n.d., p. 11).

In addition to the development of visual and video literacy, plans must be made to integrate into the system the instructional roles that accompany an increased reliance on distance learning. Telecommunications specialists, other technologists, or site facilitators may be utilized to a greater extent. Systems for integrating these roles smoothly into the delivery system--perhaps similarly to the multidisciplinary teams that now work cooperatively to develop telecourse materials--must be found. Only after such steps have been taken can student viewers be expected to approach video and other distance technologies with an open mind.

Hardware

Of course, hardware selection must follow determination of needs and the selection of satellite as the appropriate medium. According to George Nolfi (Senior Management Analyst, Education and Training, Office of the U.S. Secretary of Defense)*, the use of satellite communications as a problem-solving technique is routinely evaluated by that office. When satellite appears to be an inappropriate level of technology--when face-to-face contact seems

*Telephone interview, 23 May 1984.

preferable or when audioconferencing appears sufficient--the alternative solution will be implemented.

In those cases where satellite use is deemed to be an appropriate level of technology, educators in the future can expect to benefit from the availability of less expensive receivers and the cost reductions that result from increased satellite capacity, greater competition among vendors (Gustafson 1983), and the availability of media alternatives.

In the era of deregulation, however, most standards are set in the marketplace. This leads to a technology-driven situation with a number of manufacturers trying to establish their product as the de facto standard. As educators have found in the microcomputer arena, this can lead to lack of compatibility between hardware components and other problems.

The technology of a receive-only earth station, however, is not particularly complex. The recommendations of the National University Teleconferencing Network for receive-only earth stations, which give a general indication of the costs involved for a teleconferencing facility, are included as figure 10. The Campus Conference Network estimates a total earth station cost, based on manufacturer's bids, of $18,000-25,000. This cost includes the following expenses:

- Preliminary site survey and frequency clearance
- Earth station (complete)
- Twenty-four channel frequency agile receiver
- Basic installation exclusive of fencing, trees, or other shielding
- Licensing of the earth station with the FCC

The CCN bid package also indicates other incidental costs that may be incurred:

A. Fixed Site C-band

Recommended

5 Meter Antenna with Dual Pole Feed

With Redundant Electronics including Modulators

Approximate Cost Plus Installation	$13,000.00

B. Transportable - C-band

5 Meter Transportable Antenna

With Redundant Electronics including Modulators

Approximate Cost Plus Delivery	$17,000.00

C. Transportable - C-band

12 foot Antenna

With Redundant Electronics and Modulators upgradable to Ku-band Service

Approximate Cost Plus Delivery	$15,000.00

D. Fixed Site Ku-band

12 foot Antenna

With Redundant Electronics and Modulators

Approximate Cost Plus Delivery	$14,500.00

E. Transportable Ku-band

12 foot Antenna

With Redundant Electronics and Modulators

Approximate Cost Plus Delivery	$18,000.00

Figure 10. Recommendations for earth station equipment

Source: VideoStar Connections. Selecting an Earth Station. Atlanta: VideoStar, n.d., p. 5. Reprinted by permission.

- o Security system, such as a fence with locking gate
- o Local environmental clearances or filings, including zoning filings
- o Enhancement of conference facilities (TV monitor purchase, installation of audio jacks)
- o Costs of adapting facility for handicapped access
- o Costs of needed personnel

Of course, receiving dishes for a school or similar site can be acquired at a much more modest price. KLM's X-11, an 11-foot parabolic antenna priced at $2,995 for the complete system, is motorized and steerable to track different satellites. It is designed to be installed by 2 people in 2 to 3 hours. Decker* notes that a number of those earth stations, in addition to receiving programming, are routinely disassembled and reassembled by vocational classes as a part of their microwave technology curricula. A similar small antenna designed by Teague (Oklahoma City) has been chosen as the hardware to be mounted at Oklahoma's regional vocational-technical centers.

After the selection of hardware, an installation site must be selected. To receive the satellite signal, the site must afford an unobstructed view of the southern sky (SatServ 1984). Avoiding interference from terrestrial microwave is also a primary concern. Installing the antenna on the ground to take advantage of shielding from buildings or shrubbery can help to minimize interference from microwave networks. Frequency coordination services, who maintain records of microwave coverage, are usually hired to perform a pre-installation site study. Local zoning can also influence the choice of a site in some cases.

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*Robert H. Decker, Director of Satellite Education, KLM Electronics, Personal interview, Columbus OH, 28 March 1984.

While FCC licensing of receive-only earth stations is not required, licensing does provide some safeguards: it certifies that the location is interference-free and provides a legal basis protection should another installation create interference in the future (SatServ 1984).

One set of suggested specifications for downlinks is included in this report as appendix G, Selecting an Earth Station. Specifications that should be noted include the following:

- o The antenna should be fully steerable and motorized to allow receive signals from various satellites (SatServ 1984).
- o The objectives for video quality should include a 50 dB minimum signal-to-noise ratio, which gives a TV picture that 90% of viewers would consider "excellent" and 10% "fine."

On the other end of the cost continuum are those institutions that want to equip themselves to uplink programming. Koffarnus (1984) describes that capital outlay and in-kind costs:

> If uplinking of programs to a satellite is a possiblilty, then considerable time, money and personnel will be needed. An uplink dish is being sold these days for approximately $735,000.00. To have a full time engineer, other staff, and maintenance would require an additional $280,000 annually. This does not include producing or acquiring programs to transmit to the satellite. Training of production personnel would entail the same costs as any television production house. (p. 5)

Koffarnus cautions that such costs could impede full utilization of the telecommunications options.

Cost Factors

In addition to the hardware and programming costs mentioned earlier, the networking costs of satellite transmission must also be taken in account. Sample costs for the scenarios presented in chapter 5, as calculated by the Public Service Satellite Consortium/SatServ, are as follows.

o The Voc Ed 120 Minutes news magazine could be uplinked from Washington, D.C. to the fifty State capitals for a total network cost of $49,496 ($700-$900 per site).* A third hour of transmission could be added for $9070. Facsimile capacity could be added to each site at a cost of $380 per unit leased or $550 per unit purchased. Increasing the frequency of broadcasts from quarterly to monthly yields no savings per event in this calculation.

Production costs for preproduced video programming for the news magazine (assuming basic production valves) could be estimated at $300-$700 per minute of finished product once creative consultation, production, graphics, editing, and all personnel costs are included.

o The Sat Train scenario, in which four origination sites (Kansas City, MO; River Grove, IL (Chicago); Davenport, Iowa; and San Francisco) uplink "round robin" fashion for one hour apiece to the National Center, represents a total network cost (with audio bridge) of $32,220. The cost of adding an additional receiving site (in this case, Princeton, New Jersey) for one hour is $2,340, plus $130 for three-way audio. An additional hour of transmission time from the San Francisco site would add a marginal cost of $1000. Networking costs would remain the same for subsequent events held at three and six month intervals.

From these two scenarios, it can be seen that point-to-multipoint transmission is still the most cost effective way to use satellite-although network costs involved in the four-uplink Sat Train scenario are less expensive than one might expect. And while increasing the frequency of events from quarterly to monthly may not lessen per-event network costs under an ad hoc networking arrangement, the marginal costs of adding additional hours per event represent significant savings. Hence opportunities to "piggyback" events that can use the same network configuration should be explored. For example, with proper coordination, a vocational education videoconference (or videoconferences) might be linked with one of the video events that the National Diffusion Network holds on a regular basis. The advantage of utilizing a dedicated network of receive sites to lower costs can also be seen in these examples. The Campus Conference Network (CCN), for example, projects a standard network use fee

*Mary Roybal, Operations Support Manager, SatServ, correspondence, 27 April 1984.

of $700 per site for the first three hours total, with a $125 charge per additional hour. Use of CCN locations (or those of NUTN or a similar network) would certainly be recommended when network sites are convenient and appropriate for the videoconferencing audience. The high costs cited for programming production also indicate the need to achieve maximum diffusion of the video footage currently being produced by community colleges and departments of vocational education.

The third scenario, the Job Skills network, presented a dedicated network for ongoing communication and curriculum exchange rather than a series of discrete events. As such, it raises a number of general questions about the cost of a dedicated network and comparative data transmission costs for satellite in comparison with other media.

1. What is the annual cost of leasing a transponder or transponder time?

   According to the Public Service Satellite Consortium/SatServ information,*

   > The annual cost of leasing transponders varies somewhat by satellite, by terms (protected vs. nonprotected, preemptible vs. nonpreemptible, etc.), as well as by length of contract (1 year vs. 5 years vs. 10 years, etc.). However, typical costs currently being quoted for a fulltime transponder range from $100,000-150,000 per month.
   >
   > Transponder capacity can also be leased in lesser amounts, such as dedicated blocks of time. For example, typical costs currently being quoted for leasing the time period 10:00 a.m.-6:00 p.m. E.S.T., Monday-Friday, range from $40,000-$60,000 per month.

2. What scale is needed for video courseware distribution by satellite to be cost-effective?

   To bicycle tapes, the following charges would apply (assuming a one-hour tape):*

*Roybal, correspondence, 27 April 1984.

Tape stock:	$25 per tape
Dubbing of copies:	$65 per tape
Shipping average:	$ 2.70 per tape
Total:	$92.70 per tape

To distribute by satellite (assuming all downlinks are the responsibility of the client and are not being paid for):

Tape play back:	$ 50
Uplink service:	$135
Satellite time:	$300 (daytime hours)
Total:	$485

With a breakeven point of 5.2 tapes, it would be cost-effective in this case to distribute as few as 6 tapes by satellite to clients with downlink facilities.

3. <u>What are some general guidelines for comparing the costs of satellite transmission of data to "terrestrial" media, such as phone lines?</u>

Roybal* indicates that the following parameters must be considered when evaluating satellite transmission for cost-effectiveness:

- o What is the required data rate (9,600 bits per second (bps), 56,000 bps, 1.54 megabits)?
- o What is the required integrity of the data (the allowable bit error rate)?
- o Is there a need for immediacy? (Could discs/tapes be shipped?)
- o What total volume needs to be transmitted?
- o What is the allowable down time? (Redundancy affects cost.)
- o Would the company own a satellite data system or lease from a carrier like Amsat or SBS?

Telephone data transmission costs are easily obtained. Not so for a satellite system. Cost alternatives to consider would include the following:

o Telephone direct distance dial	approximately $20 per hour
o Dedicated line, e.g., SF to NYC, 100 hours per month	$1,860 per month

*Roybal, correspondence, 27 April 1984.

o Value added network @ 9600 bps	$1,000 installation $1,400 per month traffic charges additional
o 56 kbps satellite channel (exclusive of ground equipment)	$1,300 per month
o 1.5 Mbps satellite channel (exclusive of ground equipment)	$12,500 per month
o Earth station equipment (depending on data rate and type of network)	$1,000-$50,000

While network concepts must be specified before cost comparison can be workable, Roybal gives the following general guidelines.

- o Data rates up to 9,600 bps can be handled by the dial-up telephone network, using a modem.
- o Similar data rates can be handled by value-added networks which offer electronic mail, store-and-forward, and similar services.
- o The only commercial low-speed data network by satellite is operated by Equatorial (see chapter nine). The system may be cost-effective for data send at 9,600 bps, 24 hours a day.
- o Analysis of the cost trade-offs for data rates of 56 kbps to 1.5 Mbps must be done carefully, since there is a delicate balance between satellite and telephone at these rates.
- o Data rates higher than about 1.5 Mbps are generally cost-effectively by satellite, depending on the extent of the network.

Hence, the cost trade-off for data transmission depends on numerous factors, such as speed of transmission, number of receivers, hours of operation, frequency of use, nature of message (text or graphics, digitized voice or video, and so on), and the life of the information (immediate, short-term, long-term). Roybal stresses in conclusion that satellite systems will only be cost-effective when high-volume, high-speed data is needed in a limited time frame.

Organizational Factors

"While the satellite captures everyone's attention, the heart of the matter is the institutional organizational problem" states Lionel Baldwin,* President of the National Technological University. For example, some feel that while educators may see "considerable potential" in extendng education to midcareer workers at their work location, "the social, economic, and political roots of the institutions are so deep that there is little prospect of change" (Kochen 1981, p. 155). This is certainly not a new discovery: during the ATS demonstrations, the three countries involved (the United States, India, and Canada) found that not only the international, but also the national political aspects, were "far more difficult to deal with than the technology" (Polcyn 1981, p. 236).

Polycn further states that when educational responsibility falls to political subdivisions--as it does in the U.S.--"considerable problems" are created for the potential use of communications satellites for information sharing.

The state of the technology and the interconnections between technologies have sufficiently advanced to address some of these problems. Digital technologies process information into a form that is compatible between media. Direct broadcast satellites and the "narrow beam" technologies of the near future will expedite reaching small areas at less cost than the coverage of a national footprint. The National Narrowcast Service's satellite/ITFS network is being developed specifically to allow "national distribution and coordination" ("National Narrowcast Service" 1983, p. 1), with the resulting economies of scale and more effective utilization, to respond to local needs. Kochen

*Personal correspondence, 3 February 1984.

concludes that, while "it has been widely believed that advances in communication and control technology favor centralization . . . if optimization of responsiveness and minimization of costs are valued, however, the new technologies can favor decentralization" (1981, p. 155). With the caveat that the value of any network is proportional to the number of people it reaches (hence compatibility between systems and formats should be a primary goal), decentralized use of formerly "centralized" technologies is attainable.

Such orchestration is not automatic, however. Facilitating such efforts calls for a number of organizational responses. First, organizations must build on skills and structures already in place.

During the CTS/Hermes satellite experiments, Stanford professors--who were already used to an ITV network--were more "system wise" than their Carleton counterparts (Richmond and Daniel 1979). Pennsylvania State University found that the organizational structure already in place for traditional mail correspondance courses greatly facilitated an expanded approach to distance learning. The University of Texas at Austin has used existing correspondence courses as the basis for TNT (Teleconference Network of Texas) audiocourses (Hudson and Boyd 1984).

Hooper notes that the team responsible for implementing the technology should be "integrated into the institution and not a peripheral tack-on" (Richmond and Daniel 1979, pp. 108-112).

New interorganizational, subsidiary, and consortium arrangements should be explored. For example, Coast Telecourses distributes materials developed not only by Coast Community College District and their PBS affiliate, but by a geographically scattered "consortium of producers" (A Decade, n.d., p. 13). This arrangement accomplishes a number of goals:

- o Assures quality instructional design and production value
- o Assures development of an array of courses on nonoverlapping subjects
- o Assures some compatibility between institutions in awarding of credit and other areas.

Jane Demmert* (Statewide Director, Learn/Alaska) points out that the joint sponsorship of that system has helped aggregate a larger user base and promoted better bridging between educational constituencies.

The most responsive approach to incorporating new technologies into education would be to amend the standards for the accreditation or approval of educational programs to take into account differences inherent to telecommunications-based distance learning (Goldstein 1984).

The current emphasis on student achievement and other output evaluation favors the development of such systems. Projects such as ALLTELL are working on these accreditation concerns and on establishing uniform measures of organizational capacity to deliver education via communications technologies.

Finally, an orientation to thinking in terms of telecommunications needs (and developing the "telecommunications infrastructure" that Rice (1983) indicates has already developed in many corporations) would be a useful prerequisite in overcoming the organizational barriers that intrude upon education's utilization of satellite and related technologies. Demmert* adds that attention must be given to change strategies in developing any focused telecommunications program. Hooper (cited in Richmond and Daniels 1976) posits some additional factors which facilitate the assimilation of new technology in educational organizations, spanning the hardware, software, and "peopleware" areas:

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*Jane Demmert, Statewide Director, Learn/Alaska, University of Alaska, personal interview, Fairbanks, 28 February 1984.

- o The technology answers real needs related to the primary objectives of the educational institution.
- o The technology blends in with technology already being used.

Legal Issues

Attorney Michael Goldstein (1984) notes that, although "it serves little purpose to devote energy and resources to the design and development of an instructional system which the legal and regulatory framework will not support" (p. 1), system developers often fail to consider legal constraints until implementation time. His study on telecommunications-based learning, which excluded adult clientele, nevertheless points out a number of issues he feels that should be considered when projecting instructional services for the Nation:

- o Federal standards of eligibility and laws governing provision of services to special populations
- o Funding formulas based on physical attendance, which "discriminate" against technological systems
- o Compulsory attendance regulations at the secondary level
- o Questions of teacher and other certification in "interstate" situations
- o The Federal role in telecommunications, including regulations that predate technologies and restrictions (unrelated to education) on the use of the medium, and the present movement toward deregulation
- o Tension between Federal preemption of telecommunications and State/ local control of education

Randall Bretz,* however, feels that educators who attempt to answer all the legal questions before they start will never get started, and that it is more realistic to approach such issues as they arrive.

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*Randall Bretz, Media Director, Indian Hills Community Church, Lincoln, Nebraska, personal correspondence, 7 May 1984.

Most educators concur, however, on the importance of those legal concerns that revolve around the use of satellite-transmitted programming.

"More flexible rights agreements" and clarification of legal restrictions on use are seen as necessary for wider use of the broadcast and other materials that already exist ("Future Priorities" 1983). Demmert of Learn/Alaska gives one example: Alaska is a member of the Minnesota Educational Computing Consortium (MECC), but the implications of distributing consortium software via teletext are unclear.

The November 1983 vocational education telecommunications conference described earlier illustrates one variation on this theme: a last-minute schedule change at the originating site left the Columbus, Ohio audience (and undoubtedly others) with the choice of missing the last 15 minutes of the transmission or eating a cold lunch. The terms of broadcast had prohibited taping of the conference, and those terms (or their interpretation by the local sponsor) resulted in hot chicken but an interactive question-and-answer session that was lost forever. (At a National Diffusion Network teleconference the previous month, freedom to videotape for later viewing compensated for a temporary transmission interruption between the portable downlink and the TV monitors, as well as extended the benefits of the event to other educators in the state.) Such arrangements must be clarified and made workable, especially in cases involving real-time transmission.

Licensing agreements for delayed use or retransmission of telecourses can vary widely. For example, institutions offering the series The Computer Programme through PBS can tape the series off the air for an additional fee per set of tapes (in addition to licensing and student fees). The videocassettes can then be used in classrooms, libraries and learning centers (on-or-off-campus), and on campus-based closed circuit systems. Further use of the series by broadcast or cable, however, is not included (Public Broadcasting Service 1983). For most PBS courses, however, the license fee includes off-air viewing of programs by enrolled students for make-up or review purposes. Available cable rights may vary as well ("The Partnership" n.d.).

Finally, educators must also be careful about retaining programs taped off the air (even for limited periods) if those materials have established mechanisms for short-term rental ("Federal Judge" 1983).

In the case of satellite transmission, the basic legality of reception of off-air programming is sometimes in question. Decker* (KLM Electronics) urges officials with concerns about receiving programming on school "dishes" to write program suppliers concerning the school's intent. In all cases to date, he says, permission has been received at no charge. (Canadian suppliers, however, cannot grant permission due to lack of jurisdiction). If the home market is analogous, however, automatic permission cannot always be guaranteed: Home Box Office (HBO) suppliers view any dish reception of their programming as "piracy of copyrighted materials," even though they lack the capacity to bill in such situations ("Dish Antenna," May 1984).

In implementing any satellite-based approaches to vocational education program improvement, care must be taken to properly address the requisites for successful implementation in the areas of software/programming, hardware, "peopleware," and organizational structure. Caution must be exercised to distribute appropriate programming with sufficient production values to an

*Personal interview, 28 March 1984.

audience of vocational teachers and students who are prepared, both psychologically and in terms of media literacy, to use the transmissions productively. While the mechanics of locating and installing the hardware need not be overly complex, the developmental steps required of people and organizations are extensive. The earliest possible involvement of end users as planners or developers, and the application of appropriate change strategies over time, will result in the full realization of the benefits of satellite telecommunications for vocational education.

CHAPTER ELEVEN

CONCLUSION AND RECOMMENDATIONS

Today, vocational educational institutions must try harder than ever before to keep up with technological change, pursue excellence, and maintain equity. Resources, always scarcer than the needs they are intended to meet, rise and fall with an economy whose full recovery is not yet complete. In the context of the information age, as Kochen (1981) notes, the whole question of "how to distribute the costs and benefits, access and control, and the resources of the new technology is assuming increasing importance" (p. 155). Hence vocational educators can only afford to pursue those delivery systems that meet highest priority needs, utilize high-quality software, and are cost effective in use.

Satellite technology can fulfull those criteria--alone or in tandem with other media--in a number of situations in vocational education. In instruction and training (which is anticipated to be an area of high growth for teleconferencing and its variations), the basic potential of satellite to aggregate small, specialized groups into a nationwide audience has yet to be exploited in vocational education. The potential of this capacity in an era of increasingly specialized workers and high competition for teachers in technical areas cannot be overemphasized. Such potential is reinforced by the variety of models for interaction with both distant content experts and peer groups that have been slowly evolving since the days of the first telecourses--although realization of the best possible interaction remains a continual challenge.

Programs such as the National Technological University are currently seeking to capitalize on the capacity of satellite in these areas. The upcoming delivery of PLATO software by satellite will be the first broad-scale demonstration of the potential of the medium to reduce the telecommunications costs associated with computer-assisted and computer-managed instruction on mainframe computer. Lastly, the National Narrowcast Service, or NNS--a satellite/ ITFS network conceived to meet a multiplicity of unmet needs in training and personnel development--may be an unprecedented opportunity for vocational education to cooperate in the development of a delivery system that, by its very nature, strengthens the business and industry linkages that vocational educators are working to develop. As the case studies in this report illustrate, videoconferencing for professional development is widespread. It is becoming more common as a means of teacher inservice and professional organization extension. Again, the net benefit to communicators is not necessarily less money spent, but rather the opportunity for more timely, more consistent dissemination of information among a greater number of people.

The benefits of satellite in the administrative and governance area can be summarized as (in addition to the administrative videoconference) potential cost savings in the administrative computer and audio conferencing and the utilization of satellite for reporting and other data transfer. Developments such as the "space modems" that may replace the familiar modulator/demodulators currently connecting computers via telephone line with computer/satellite interfaces, as well as the growth of the teleport concept, will contribute to these administrative uses.

Full benefits in the areas of vocational education research and development may be a somewhat more extended scenario over time. Someday, the combination of packet switching and demand assignment technologies may allow the instantaneous exchange of information from highly centralized databases among members of research consortia. The success of satellite-based resource exchange from the days of the experimental satellites suggests that such "interlibrary loan" arrangements among decentralized locations may also merit re-evaluation and resurrection. The most immediate benefit in the area of research and development in vocational education involves the current expansion of the interfaces between satellite and evolving forms of electronic publishing.

Optimal use of satellite in these ways, however, will not occur without resolution of a number of issues, or without adequate incentive for a change process that must be coordinated on local, State, and Federal levels. Education will continue to look, to a great extent, to the business community as a major source of telecommunications product and service innovations adaptable for public sector use. The military can be a fruitful source of innovative applications as well, in addition to its role in telecommunications research and development. Valuable lessons can also be gleaned from the public sector activities on the experimental satellites of the 1960s and 1970s. To this day, projects such as the satellite-mediated exchange of curricula and the utilization of satellite equipment at rural or remote sites remain among the most pertinent ways vocational education can use the medium. Those experiments also document the lessons--such as the effort demanded to achieve effective interactivity and the importance of "consumer" input into system development and programming--that remain priorities, regardleas of technical advance.

Effective utilization of satellite capabilities also requires that vocational decision makers become more aware of current activity in the spheres of distance learning and educational telecommunications at large. A good senae of the organizational actora and their ongoing activities in program production, telecommunications networking, and the aupport services will maximize collaborative opportunities and allow vocational decision makers to apportion scarce financial and human resources to best advantage.

Finally, requisites for successful implementation must be addressed in the areas of software, "peopleware," and hardware. Foremost among these are location and selection of pedagogically sound programming with good production values and high interactive capacity. It means the preparation of personnel that are visually and media literate, as well as prepared to execute cooperatively the inatructional roles involved in distance learning. In the hardware arena, it means not only becoming sufficiently knowledgeable to ensure technology selection that matches educational needs, but also becoming involved enough that educators, as a group, can influence the design and standards of the marketplace. A number of fundamental problems must be resolved, however--such as the tension between the perceived need for primarily hands-on training and the potential of telecommunications-assisted educational technologies in vocational and technical education. While growth in the use of microprocessor-driven videodisc may lead to an expanded role for simulation in training, research must continue to address exactly how vocational skills are learned in order to define an appropriate role and realistic expectations for telecommunications mediated technology in this process.

Organizational structures have been characterized as the factor most apt to hinder the use of satellite technology in education. Technical advances, such as direct broadcast satellite and narrow beam technologies, are contributing to a "decentralization" of the technology that may render satellites more compatible with the local and State administrative loci of education in the United States. Decision makers must complement these trends by addressing accreditation, interinstitutional and school/work articulation, funding, copyright, and other issues that currently hinder the expanded use of satellite and related media in distance education. Vocational education agencies may find that their experience in accommodating work site learning, meeting the demands of accreditation agencies, and developing short-term programs for employers (among other activities) has given them a base of structures and procedures--and the flexibility of approach--that is highly amenable to incorporating distance technologies. Postsecondary institutions, for example, appear to be highly responsive and increasingly active in this regard.

A Look to the Future

In the longer-term future, we should take a more global attitude that anticipates emergence of electronic labor and the exportation of services as new business/industry forms with which vocational education must be loosely connected. Already one can find the electronic exporting and importing of services via satellite from one country to another: low-cost computer key punch operations in the Philippines are being imported to Australia; word processing services in the Caribbean are doing work for the U.S. and Canadian markets. Telerobotics and interactive videodisc technologies involving new artificial computer intelligence will also play a role in the industrial world (Daggett 1984).

Lastly, we should expect a host of new satellite applications that go beyond telecommunications and that will have inescapably important implications for vocational education (Pelton 1983). Meteorological satellites and earth-remote sensing satellites now play an increasingly important part in the global economics, and soon a global environmental monitoring satellite system might help restore ecological balance. Other imminent possibilities include the industrialization and colonization of the moon and other "off earth" enterprises, including scientific research colonies, power-generating systems, space mining, and even the terra forming of other planets. Humankind, once considered occupationally earthbound, may eventually work for a living away from the earth.

An important conclusion resulting from this study is that further planning toward the use of satellites and related technologies in vocational education should be based on survey information about users who would use such telecommunications to resolve specific problems or realize clearly defined programmatic objectives. Who are they? What are their agendas and programmatic needs? How are various participants in the vocational education inter-related as potential users of satellite-related telecommunications? How might the intergroup telecommunications needs of particular user groups evolve? Where will financial support for possible strides in satellite-related telecommunications come from? These and other issues represent design factors which must be addressed in order to decide which configurations of telecommunications technologies will be the most workable, affordable, and satisfying solutions to the diverse problems of improving vocational education programs, management, administration and governance, and research. The background information presented in this study can only be a first step in that process.

The technology already has developed far beyond the current capacities of potential users to apply it, in part because those users have not been instrumental in helping to "find" the various telecommunications media available as tools to help their work. Now the task becomes one of applying available technology to meet the carefully articulated needs of vocational educators. Satellite-related telecommunications need to be applied intelligently and creatively to describable objectives and functions in vocational education. No solution should be put in place merely by administrative or legislative fiat, for then they will become costly solutions in search of a problem; and instead of being readily embraced, they are likely to be resisted or--even worse--ignored.

Recommendations

Specific recommendations of this study are as follows:

- o Any planning for further use of satellite telecommunications should take the increasing diversification of the field into account. New ventures already reflect this trend. Private venture capital projects, governmental projects, and even new types of public/private consortia will evolve with this diversification.

- o Vocational education must be primed--and informed--to take systematic advantage of such developments. Educators must be actively involved at national, State and local levels if they want to participate in the decision making process--a process that will otherwise be controlled by industry and, to a lesser extent, government.

- o Developments must be tracked not only in the satellite industry, where developments such as DBS should be monitored, but in related telecommunications areas as well. Especially in urban areas, satellite has a lot of "competition" with fiber optics and wave guide technologies being prime examples.

The lack of adequate programming in a range of vocationally related areas presents a "chicken and egg" problem in terms of assessing the utility of distance strategies in vocational education and training. Hence, this shortage must be addressed.

- Efforts to develop quality software, including new funding initiatives, must be supported. Lack of adequate funding and other constraints on the development of video programming was consistently cited throughout this study as practitioners' greatest deterrent in utilizing satellite capacity in vocational education.

- Efforts to develop models for less costly but still effective telecourse formats should be especially encouraged.

- Copyright and related issues must be fully explored and restrictions articulated, as they must be for all forms of electronic publication, transmission, and storage. Legal developments in this area must be monitored and implications for vocational educators must be derived and disseminated.

- A concentrated effort should be made to identify video materials developed by industry and to arrange for their wider availability when mutually beneficial.

Further research and ongoing evaluation will be essential in at least two areas:

- Research efforts should stress how people learn vocational skills and seek to determine the appropriate role of telecommunications-assisted learning in this process.

- The appropriate level of technology (computer, audio, or video) must be continuously evaluated for all telecommunications-assisted activities to determine the best possible match between the technology and educational need.

Although this study did not seek to recommend a specific network configuration, the question of a dedicated network for vocational education as opposed to "ad hoc" utilization on a contractual basis must be considered.

- Cooperation with existing systems and networks in educational telecommunications must be explored and encouraged. Despite a trend in the industry toward customized networks, the recommendation of a dedicated system--before collaborative alternatives are exhausted and the constituency well-versed in the technology and its applications--would be premature.

- Exploration of full participation in the National Narrowcast Service, as a nationwide, satellite-based system linking educational and work sites, is especially encouraged.

Vocational education must also respond to the ramifications of satellite technology in the job market.

- Vocational educators must be prepared to train technologists in the area of satellite and microwave telecommunications. Today's occasional classified ad for a satellite technician, for example, is expected by one industry source to "multiply by the thousands" by 1990. Cooperation with the National Telecommunications Advisory Council, a nonprofit association whose members from industry and education seek to meet industry needs for trained personnel, would be one step toward meeting this goal.

This conclusion is consistent with the National Commission on Employment Policy's finding that approximately 55 percent of all U.S. workers in 1980 were employed in information-related jobs, including the transmission of data (Sherman 1983).

The greatest potential for satellite communication is in facilitating greater interaction between parties. Today, that function consists largely of distributing programming to multiple sites, which then interact locally and through audio links. Someday, that interactive capacity may be expanded to encompass full video, audio, and graphics between homes, schools, workplaces, and other locations. Vocational education should move to position itself to take advantage of both of these scenarios and begin deriving the benefits available from satellite and its related telecommunications media in the instruction and training, personnel development, administration and governance, and research areas.

TELECOMMUNICATIONS: A USER'S GLOSSARY

Adapted from the Public Service Satellite Consortium/SatServ and other sources as cited.

addressability: the capacity of a [cable or other service] system to control, through special boxes attached to a subscriber's television set, the electronic distribution of programming so that only those authorized are able to receive it in viewable form (Delson and Michalove 1983, p. 15).

analog signal: an electromagnetic wave encoded so that its power varies continuously with the power of a signal received from a source (e.g., a source of sound or light) (Lazer et al. 1983, p. 201).

bandwidth: the space between the top and bottom limits of airwave frequencies that are transitted over a communications channel (Delson and Michalove 1983, p. 20).

bit: "binary digit" (0 or 1), the smallest unit of information processed by a computer.

broadcasting: transmitting electronic signals over the air. Typically implies point-to-multipoint distribution for public consumption.

byte: a unit of computer memory typically consisting of eight bits. 64k means that a computer has 64 thousand bytes or 64 kilobytes of memory.

c-band: the name for the frequency bands of 4-6Ghz (gigahertz) that are used for current satellite/earth station transmission (Delson and Michalove 1983, p. 23).

cable television: system that transmits original programming, and programming of broadcast television stations, to consumers over a wired network.

channel: refers in television to the spectrum space, measured in megahertz, used for the transmission of associated video and audio signals. A television signal is 6 MHz in bandwidth.

communications satellite: a radio relay station that receives video, audio, data and other transmissions from uplinks on the earth, then re-transmits them to downlinks on the ground.

complexity inversion: the principle whereby the use of larger, more powerful satellites allows the use of smaller, less expensive receiving earth stations.

digital recording: a system of recording whereby electrical voltages are converted to a series of numerical equivalents (Delson and Michelove 1983, p. 31). A digital signal is subject to less interference than an analog signal.

direct broadcast satellite (DBS): high-powered satellites authorized to relay programming directly to small (four feet in diameter or less) home receiving dishes.

dish: the "dish-shaped" antenna that sends or receives satellite signals.

downlink: satellite receiving earth station. Also called Television Receive Only (TVRO).

duplex transmission: transmission in which signal can flow in both directions at the same time (Lazer et al. 1983, p. 203).

earth station: the term used to describe the combination of satellite antenna, LNA, downconverter, and receiver electronics used to successfully pick up a signal transmitted by a satellite in space. Earth stations vary in size from 8-foot miniaturized arrangements to gigantic 90-foot INTELSAT systems (Easton 1983).

encryption: the electronic "scrambling" or coding of a signal so that it can be viewed only by receivers with decoders.

facsimile: a form of telegraphy for the transmission of fixed images, with or without half-tones, with a view to their reproduction in a permanent form (1984 Satellite Directory, p. 906).

fiber optics: a technology that transmits voice, video, and data by sending digital pulses of light through hair-thin strands of flexible glass ("What's What" 1983, p. 66).

footprint: area on earth within which a satellite's signals can be received (antenna coverage).

frequency reuse: a technique to expand the capacity of a given set of frequencies or channels by separating the signals either geographically or through the use of polarization techniques . . . 24-transponder satellites use vertical and horizontal polarization techniques to reuse the same frequencies on the same satellite, allowing 24 television signals to be squeezed into the space normally capable of carrying only 12 (Easton 1983).

geostationary orbit: the circular orbit lying in the equatorial belt 22,300 miles above the earth's surface with an orbital period of 24 hours. A satellite in geostationary orbit appears fixed from the earth because its orbit matches the rotation of the earth. Signals from satellites in geostationary orbit can be received by fixed receiving antennas (1984 Satellite Directory, p. 907).

geosynchronous orbit: the orbit having a period of revolution equal to the period of the earth's rotation around its axis. A satellite in geosynchronous orbit will not appear fixed from the earth (geostationary) unless the orbit lies in the earth's equatorial belt (1984 Satellite Directory, p. 907).

Hertz (Hz): a unit of frequency equal to one cycle per second. One kilohertz is 1,000 Hertz; one megahertz is one million Hertz; one gigahertz is one billion Hertz.

interference: in a signal transmission path, extraneous energy that tends to interfere with the reception of the desired signals.

instructional television fixed service (ITFS): ITFS is a two GHz service that uses microwave signals to transmit programming to television installations within a 50-mile range equipped with a special signal converter. However, FCC rules restrict the 20 video channels allocated to ITFS in the 2500-2690 MHz band for use by nonprofits for instructional, cultural or other educational programming. FCC allows leasing of ITFS channels to for-profit organizations. ITFS is technically identical to MDS.

ka-band: the range of frequencies (18 to 30 gigahertz) on which future generations of satellites are anticipated to send and receive signals.

ku-band: the name for the frequency band of 12-14GHz presently allocated for direct broadcast satellites/earth station transmission (Delson and Michelove 1984, p. 40).

low-power television: LPTV stations are authorized by the FCC for broadcasting to a small geographic area. Because a weak signal is used, LPTV stations can be "squeezed" between existing channels without creating interference ("What's What" 1983, p. 67). Traditionally, LPTV stations were limited to "translating," or rebroadcasting, the signals of a full service TV station.

master antenna television (MATV): a delivery method for pay programming to multi-unit dwellings.

microwave: method of transmitting television signals at frequencies above 1,000 MHz over the air from an orgination point to a receiver within its line of sight.

modem: contraction of "modulator-demodulator," a device that facilitates telephone communications between two or more computers ("What's What" 1983, p. 67).

multipoint distribution service (MDS): uses omnidirectional microwave signals in the 2 GHz band to transmit video or other services to subscribers. MDS is regulated as a common carrier, and its operators generally lease most of their station time to pay movie programmers. Because of its growing popularity, MDS operators would like to obtain some of the allocated ITFS channels.

narrowcasting: programming aimed at a specific target audience.

polarization: a technique used by the satellite designer to increase the capacity of the satellite transmission channels by reusing the satellite transponder frequencies. In linear polarization schemes, half of the transponders beam their signals to earth in a vertically polarized mode and; the other half horizontally. Although the two sets of frequencies overlap, they are 90° out of phase, and will not interfere with each other. To receive and decode these signals successfully, the TVRO earth station must be outfitted with a properly polarized feedhorn to select the vertical or horizontally polarized signals as desired (Easton 1983).

satellite master antenna systems (SMATV): SMATV systems, cloned from cable systems, look like CATV systems, and, in most cases, are operated like them. The difference is that SMATV systems operate on private property--apartment buildings, condominium complexes, etc. Instead of getting a franchise from local governments, SMATV operators sign contracts with property owners, allowing them to bring cable television into the homes on that property, usually through a link to a TVRO pointed at SATCOM IIIR to a multi-unit dwelling's master antenna.

slow scan: a television process using greatly reduced bandwidth for the purpose of transmitting pictures generally over telephone wires rather than coaxial cable. Each new picture requires several seconds to be displayed (Delson and Michalove 1983, p. 54)

simplex transmission: transmission in which signal can flow in only one direction (Lazer et al. 1983, p. 205).

spot beam: a focused, high-power satellite signal that covers only a small region. Outside that area, the signal is undetectable, and will not interfere with other use of the same wavelength (1984 Satellite Directory, p. 910).

subcarrier: a radio frequency signal on which another radio signal has been placed where both are a part of a television or FM signal. This process enables the transmission of more than one audio or radio frequency signal over one channel (Delson and Michalove 1983, p. 57).

subscription television: the major difference between STV and conventional TV is that you have to pay for the former. STV stations are standard VHF or UHF TV stations. Most broadcast regular free programming during the day, then start scrambling their signal to offer pay programming at night. The STV customer is equipped with a special decoder to unscramble the signals on their TV sets.

teletext: a one-way technology in which textual and graphic information are broadcast to TV sets equipped with decoders ("What's What" 1983, p. 67).

transponder: electronic package aboard a communications satellite that receives the transmission from earth, changes signal frequency, amplifies signal and retransmits it to earth.

uplink: satellite transmitting earth station, also capable of receiving.

vertical blanking interval (VBI): the 21 unused lines in the TV signal, which appear as a heavy black line when the horizontal hold slips. Some of these lines are used to transmit teletext, others to transmit closed captioning for the hearing-impaired ("What's What" 1983, p. 67).

videotex: an interactive technology that has traditionally used telephone lines or coaxial cable to connect the TV set to a central computer for transactions or information retrieval.

APPENDIX A

DEVELOPING SCENARIOS FOR FUTURE VOCATIONAL EDUCATION

USES OF SATELLITE COMMUNICATIONS

March 19 — 20, 1984

AGENDA

<u>Monday, March 19</u>

8:30 - 8:45 a.m.	Pick up participants at Hilton Inn, 3110 Olentangy River Road, to go to Room 1C, National Center (1960 Kenny Road)
9:00 a.m.	INTRODUCTION AND ORIENTATION • Who's here and why • Capsule review of the project • Goals and objectives for 2-day session TAPE: "Live via Satellite" (NASA Uses of Technology series) 15:30 Applications segment from "Satellite Technology: Technology for the Future" (NASA) BREAK TELECOMMUNICATIONS NEEDS/PLANS from various organizational perspectives -- all participants
(as time allows)	BRAINSTORMING TEAMS: How might telecommunications-at-large be used to satisfy those needs/plans? FORMULATE and RECORD descriptive hypothetical scenarios.
12:00 -1:00	LUNCH
1:00 p.m.	BRAINSTORMING TEAMS: begin or continue scenario building WHICH OF THESE SCENARIOS POTENTIALLY INVOLVE SATELLITE? DISCUSS/APPLY "feasibility quotients" for scenarios: • What would it take? (generic requirements) • What already exists? • What would facilitate? • What are the roadblocks?

3/19 p.m. con't.	BREAK	
	The Alaskan Telecommunications Network and tape, "THE LEARN/ALASKA NETWORK"	Norm Singer (10:00)
3:00	Audio consultation with William Bramble	
no later than 4:30 p.m.	ADJOURN FOR DAY	

TUESDAY, MARCH 20

9:00 a.m. Review progress/developments

"SECOND ROUNO" SCENARIOS based on:

- How would you utilize a dedicated network?
- How would/could you utilize free telecommunication time over a two-year time frame?
- Configurations (to be specified) in the instruction, training, administration, governance and personnel development areas

BREAK

DERIVE FROM SCENARIOS:

- Unique requirements
- Organizational involvements
- Common technical, financial, and organizational building blocks
- Etc.

12:00 - 1:00 p.m. LUNCH

1:00 p.m. NEXT STEPS: further recommendations and implications to include in report to U.S. Department of Education, Office of Vocational and Adult Education

(Examples only)

- What's needed re: programming?
- What are the implications for teacher education?
- What initiatives should be taken?

2:30 p.m. ADJOURN

FEASIBILITY OF SATELLITE APPLICATIONS IN VOCATIONAL EDUCATION

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APPENDIX B

TECHNOLOGICAL TRENDS FACING VOCATIONAL EDUCATION

Public Service Satellite Consortium/SatServ., Inc.

Broadcasting

Historical Overview

In 1921, broadcasting was officially "on-the-air" with the granting of the first broadcasting license to a radio station. A little over 60 years later, 1983 statistics show 4,828 AM radio stations, 4,970 FM radio stations, and 1,276 TV stations have been authorized by the FCC. As a result, there is no dearth of public broadcasting reception equipment. The Nielson Company estimates some 83.3 million homes, or 98% of all U.S. homes, (excluding Alaska and Hawaii) have television sets. Nearly 90% of those sets are color. Even more, 84.3 million U.S. homes (99%) have radios.

While commercial broadcasting is supported by advertisers, the FCC ensured that non-commercial radio and tv would also have a reserved slot in the frequency spectrum. More than 600 channel assignments have been reserved for non-commercial tv stations and 20 frequencies between 88-92 MHz in each U.S. region are reserved for non-commercial radio. Non-commercial stations in the FM band are licensed primarily to schools and post-secondary institutions, many for learning experiences, while the remainder are mostly National Public Radio affiliates. In 1953, educational tv was born with the first ETV station on air (KUHT, Houston). Several years later, Alabama established the first state ETV network. As with educational radio, non-commercial tv stations are mainly affiliated with educational institutions or the Public Broadcasting Service.

The Public Broadcasting Act of 1967 established the Corporation for Public Broadcasting whose primary task has been to funnel Federal funds into qualified non-commercial radio and tv stations through its Community Service Grants. The creation of the Public Broadcasting Service in 1970 and National Public Radio a year later provided the nearly 600 public tv and radio stations with programming and interconnection. With financial support from CPB, both PBS and NPR were able to switch from terrestrial program distribution to satellite-based distribution in 1978-79. Other agencies providing public broadcasting support include the U.S. Department of Commerce's National Telecommunications and Information Administration whose Public Telecommunications Facilities Program has awarded millions of dollars to public entities, and the Annenberg School of Communications Project which provided CPB with a $150 million grant to dispense to worthwhile higher education oriented projects over a 15 year period. A variety of telecourses and alternative methods of delivering higher education coursework to the busy adult learner have been funded by the ASC grant since 1981.

Trends

Broadcasting has inspired a number of emerging technologies, including low power television (LPTV), subscription television (STV), subsidiary communications authorization service (SCA), teletext/videotex service, and high definition television (HDTV). Of these, LPTV, SCA service and teletext/videotex service have the greatest implications for vocational education broadcasting. Expanded definitions for each are given below:

Low Power Television (LPTV): The FCC authorized LPTV in 1982 to allow for the creation of "mini-tv stations" whose signal would be limited to 100 square miles broadcasting in the 1-5 kilowatt range (as compared to full power stations which cover 5,000 square miles with a 50-100 kw signal). Most of the 8000 LPTV applications flooding the FCC were proposing to use tv translator stations (which had previously been limited to rebroadcasting signals received from full power stations). Through LPTV, they can originate programming as well, either advertiser-supported or as a pay tv service The FCC has approved only several hundred LPTV applications thus far as it has frozen applications until it can begin processing the backlog. Some 4,000 stations are expected to be in operation by 1986.

Because LPTV stations are less expensive to build and operate, educational institutions are interested in both constructing and programming these stations. LPTV stations, designed to fulfill a need for free local broadcasting but not licensed to schools, are often in the market for locally-produced programming. While LPTV stations may not be in the position to support the development of vocational education programming, they can be an ideal outlet for program distribution. Vocational education groups can look at LPTVs as one means of reaching non-metropolitan and rural audiences, people who are generally in need of this type of programming. Just as their full power counterparts, LPTV stations will most likely install satellite earth stations for program reception and be able in the next few years, when the FCC again begins actively approving applications, to participate in receiving and airing any nationally satellite-distributed vocational education programming in the mid-1980s. In addition, Bonneville Satellite Corp. in Salt Lake City recently began transmitting The Genesis Network which is entertainment programming targeted exclusively to the LPTV market. Such events indicate that by 1986-88, the LPTV technology, coupled with satellite technology, will offer the vocational education arena an opportunity to reach the rural student in his/her home or in school with general types of educational programming (along the lines of a PBS service,) particularly agricultural and home economics-oriented fare. The Low-Power Television Guidebook, produced by CPB, presents a comprehensive review of all aspects of LPTV for the non-profit community.

Start-up costs for LPTV: 1) a 10-watt VHF LPTV station (12-15 mile radius coverage) could cost as little as $24,000. 2) a 1-kilowatt UHF LPTV station (same coverage) could cost $82,000. 3) regular high power tv station can cost 1.9 million.

Low Power TV: Educational Case Study

Eagle Bend, MN, Population 550, joined the technological revolution the fall of 1980. The rural community was not satisfied receiving three radio stations, one clear TV station and three snowy tv stations--all from outside cities. The town newspaper was Eagle Bend's only local media.

Led by Eagle Bend School's principal, Richard Lundgren, the town submitted funding applications to a variety of sources to establish a local low power tv station. Amid skeptical townspeople's and out-of-townspeople's comments, Eagle Bend's LPTV planning committee received Federal, state and private foundation grants.

By 1980, the station was operational and largely used for educational purposes. Using LPTV, cable and other technologies, EBS was able to link up with two neighboring schools. Since EBS is a rural school, its curriculum was more limited than the educational administration liked. Through an interactive link, the three schools were now able to share classes with students participating from the remote sites. Furthermore, home-bound students (and parents) could view the classes from their home tv sets.

Subscription Television (STV): Often referred to as wireless cable, STV began using broadcast television channels (usually UHF), which are idle or available at certain hours of the day/night, in 1968 to distribute its encoded signal to subscribers with special converters. Programming normally consists of cable-type entertainment and pay-per-view specials. STV subscribers are often located in areas void of cable tv. Nearly 2 million subscribers view one of over 30 STV operations. We do not envision this technology as suitable for educational applications. Sports and unedited movies are STV's bread and butter. The prognosis for STV is nearly terminal; many companies have gone bankrupt as their one channel of service can't compete with cable's multi-channels.

Subsidiary Communications Authorization Service (SCA): In 1955, the FCC authorized the special use of unused portions of FM channels (subcarriers) to deliver a variety of audio and print-based services. Any information that can be carried over standard audio lines, including facsimile, slow scan tv, or computer data, can be transmitted via subcarrier.

The most common non-commercial use of this technology is a reading service for the blind. Those owning specially equipped sets are able to receive these special transmissions. One common SCA service which has been available for years is Muzak, a commercial service which broadcasts a special audio service often found in stores, offices, elevators and even now when a caller is placed "on hold".

Another use of SCA service which can be of interest to the vocational education community is foreign language programming. Should the voc ed community wish to initiate a special handicapped program, SCA service can also be used to provide supplemental language programming, so that the Spanish speaking student in Texas, the French-speaking student in the North, and the Vietnam refugees scattered across the U.S. can all receive a nationally distributed program in his/her language.

Satellite technology has expanded SCA opportunities beyond the FM station broadcast area. Most all major radio networks, including NPR, are now distributing their national radio programming via satellite. Consequently, some of these networks are currently experimenting with nationwide SCA services. The two most popular experiments are paging and data delivery. (Due to funding problems, NPR has abandoned these ventures for the moment.) Paging appears to be the most popular venture. Attachment C outlines the paging plans of five groups, most of which require a satellite link. Several academic organizations have expressed their interest in searching for funds (perhaps, through Annenberg) which will enable them to experiment with educational applications of SCA service beyond handicapped and minority programs.

Vocational education groups might compare this technology with traditional videotex/teletext services to determine if satellite-delivered SCA services might offer a more cost-effective alternative for distributing an audio or print-based voc ed program nationwide. While the technology has been in place for almost 30 years, the educational, and to an extent even the private, sector have only begun seriously proposing and testing SCA applications. The introduction of commercial satellites and the growing number of satellite-based ground networks are largely responsible for this new surge of SCA interest. Voc ed groups will generally consider this as a broadcast (one-way) medium when considering its applications, although interaction via telephone or computer is possible.

SCA Services

There are approximately 85 reading services for the blind using FM subcarrier technology. Receivers needed to pick up and decode these services cost the user $75.

- o InTouch Networks of New York uses Columbia University's radio station (WKCR-FM) to deliver a 24 hour (13 on weekends) reading service to those with receivers in a 50 mile radius. The Network, in operation since 1977, uses 300 volunteer readers reading a variety of magazines, newspapers and other print materials in several languages. InTouch uses cable systems and their microwave relay towers to extend the programming beyond the 50 mile radius. In addition, WNYC-FM, a New York City NPR station, distributes 2 hours of InTouch programming daily via satellite to a national audience.

Teletex/Videotex Services: Data services can be provided on a broadcast one-way (teletex) or interactive two-way (videotex) basis for willing home, school and business subscribers: Most often the scenario involves the user selecting from "pages" of electronically transmitted (computer generated) text, using his/her tv set to view and read these pages. Access to the teletext/videotext data base is accomplished most often by "calling up" the service via telephone or personal computer with the tv set serving as the video monitor. The simplest form of teletext has been used by cable tv systems for over a decade. Rather than the viewer having control, he/she must wait for news, weather, etc. to be scrawled across the screen.

The last several years have witnessed more than 20 broadcast licensees experimenting with teletext as they've discovered a new use of the vertical blanking interval (VBI). VBI, often referred to as "line 21", is that dark line out of the 525 lines which make up a tv picture that can sometimes be seen when a tv picture rolls. Some years ago the old U.S. Department of HEW, PBS, ABC, NBC and Sears joined forces to use the VBI to deliver a closed-captioning service to the deaf public. The captions are encoded into the VBI and can only be seen with the use of special Sears decoder units which display the captioning at the bottom of the screen. While more network programming is being closed-captioned, the process is still expensive and not often used by occasional broadcasters. However, teletext providers have teamed up with broadcasters to test the use of VBI for delivering a pay information teletext service including news, home shopping and banking, transportation schedules, community announcements, weather, sports scores, stock quotes and local/national data services as imaginative video games and children's magazines.

Most broadcast-based teletext is still experimental as broadcasters awaited the 1983 FCC authorization to offer teletext as a service. CPB has funded non-commercial public television station experiments in teletext. WETA-TV, the Washington, DC PBS affiliate, used the most advanced teletext technology available in the early 80's to test the applications of teletext in the private home and public place. WETA moved its 50 decoders from place to place to study public interest in receiving a full-time teletext service. CPB and WETA are evaluating this experiment. WHA-TV, a public tv station in Madison, WI, has also been funded by CPB to experiment with a multi-phased "INFOTEXT" service designed to deliver agricultural information to the rural Madison community. A combination of cable tv, videotext, broadcast tv and teletext technologies are being evaluated. The commercial broadcast community has been increasing its experimentation with teletext. Both NBC nad CBS (Extravision) have national teletext services in various stages of operation. Again, satellites have influenced the growth of this technology. KEYFAX National Teletext Magazine has embedded its teletext service into the VBI of WTBS, the Atlanta independent super station. WTBS is a popular service distributed to cable systems nationwide via satellite, enabling KEYFAX to piggyback its textual service with the WTBS video program for 24-hour program delivery. Time, Inc. is currently field testing its planned national teletext service which will use a full cable tv channel. Because a full channel has 50 times as much capacity as the VBI, this service will be able to offer 5,000 full-color "pages" of service.

While teletext often employs a keypad to select the "page" desired, the videotex keypad allows the user to directly interact with the data. Videotex generally uses two-way coaxial cable on telephone lines for delivery of its service. Now the user can not only search the text for product information but can also place an order for the product and pay for it through videotex.

Because the cable industry did not have to wait for FCC authorization, its experiments (KEYFAX) have become operational services a little sooner. This past year, the Knight-Ridder/AT&T videotex experiment (VIEWTRON) in Coral Gables, FL felt successful enough to start-up a commercial service. Dozens of other videotex experiments are currently testing the rapidly evolving technology and using these demonstrations to evaluate the market. Forecasters are predicting that up to half of all American homes will have a videotex service available to them. Large communications companies, including New York Times, CBS, Times Mirror and Warner Amex, are betting on the success of videotex and project the industry will be $5-10 billion business by 1990. IBM is investigating business videotex-based information systems which it may market to other corporations. In-house video systems may provide an effective distribution medium.

How will teletext/videotex impact on vocational education? Voc ed groups can participate as "information providers" furnishing part of the daily teletext/videotex program schedule. Interactive videotex is more easily adaptable to a learning scenario, enabling the student to interact with the videotex course. As with SCA, the vocational education community might choose to investigate the cost-effectiveness and value of delivering special voc ed courses in an interactive textual (with graphics) format nationwide through the use of the VBI of a satellite-distributed broadcast tv signal. With the growth in the number of personal computers, however, a computer conference allowing the course to be delivered to and discussed by students is an alternative textual method of interactive instruction. Local voc ed groups may find a more immediate educational use of teletext/videotex technology using local broadcast and cable tv channels for delivery of courseware. Yet, the vocational education community as a whole, should watch and perhaps participate in the development of this technology to ensure that it is an educational, as well as informational, service. Vocational education groups may wish to join efforts with a local PBS affiliate and search for grant money (such as Annenberg) to test an education-based videotex service. The two major technical teletext/videotex decisions facing voc ed are which industry standard to use and which transmission medium (broadcast tv, cable tv or telephone) to employ. Voc ed groups should also keep in mind that only a small amount of consumer hardware is in use.

High Definition Television (HDTV): American television sets currently present 525 lines of picture information as dictated by the National Television System Committee's standards. Foreign technology has demonstrated a television picture comprising 1125 lines. The extra lines provide higher resolution, better color fidelity, wider aspect ratios, and stereo sound. Proponents of this HDTV technology in America are investigating transmission technologies which might be used in distributing HDTV. CBS is interested in using either direct broadcast satellites or multi-channel multi-point distribution systems. In addition, band width compression techniques may enable HDTV to enter the American marketplace more easily (current HDTV demonstrations have been using 5 times as much bandwidth as a standard tv channel.) HDTV technology, if ultimately accepted in the U.S. at a reasonable consumer cost, will enhance any detailed transmissions--such as intricate training or development broadcasts. More than likely, however, the technology, if it successfully evolves in the U.S., will not greatly affect voc ed applications and any educational planning which may occur over the next several years.

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Narrowcasting: Technological Trends

While broadcasting technologies were serving the masses, narrowcasting technologies were designed to discretely reach special audiences. For the most part, these technologies developed commercially: their promoters evaluating these specials audiences as "paying viewers." As a result, the 1980's have witnessed a growth in the availability of narrowcast systems, some of which have been around for years. Here, we will examine cable television, instructional television fixed service, multipoint distribution systems, local area networks.

Cable Television (CATV)

Depending on whether you live on the east or west coast, the first CATV system was created in 1948-49 in Pennsylvania or Oregon. Either way, the original purpose of CATV (community antenna television) was to import distant tv signals to communities able to receive few or no tv channels due to the interfering terrain or distance from a tv station. The technology remained largely rural until the mid-1970s when satellites enabled cable programmers to cost-effectively distribute their special programming nationwide. Home Box Office started the satellite distribution revolution in 1975 when it began transmitting its pay movie service via SATCOM I. As the number of CATV systems with earth stations grew, additional cable programmers followed until other satellites had to be employed to carry the overflow. Today, over 50 cable programs are carried by six primary U.S. satellites causing the old rural twelve-channel CATV systems to upgrade to 30, 40, 50 or more channels. Cable programs are able to target special audiences for all news, all sports, all music, all movie channels.

It is no surprise, then, that urban areas now found a reason to demand cable. The competition among cable companies to win the urban franchises enabled cities to reap huge gifts in exchange for the coveted franchise. The Lexington Public Library, for example, became the beneficiary of a $200,000 automated circulation system with special interface to the cable system as a result of that city's franchise award.

Many times, the cable system's gift will result in the CATV's agreement to provide "access channels" (and the personnel, facilities and equipment needed to run them.) Access channels are channels set aside on the cable system for originating local programming. These channels are usually programmed by governmental, educational and/or public groups. Most often the local schools and libraries inherit the responsibility of keeping the channels programmed. Consequently, more educational/informational institutions are adding studio facilities, tv equipment and production training courses.

In an effort to keep the channels programmed by staffs limited in number and tv knowledge, initial access programming often took the form of school board meetings and local sports events. The power of the coaxial cable medium was not fully understood or appreciated by the public sector which ultimately resulted in the Federal ruling removing the requirement from CATV systems to reserve channels for local access. However, and increasing number of communities are operating successful access channels offering up to eight or more hours of daily programming. Access programming has become much more creative, thanks in large part to organizations such as the National Federation of Local Cable Programmers, who offer assistance to fledgling access groups.

One of the more elaborate success stories is Sara Hightower Regional Library in Rome, GA. Since the 1970s the library has gathered both TV production expertise and a loyal viewing audience, not to mention its generation of interest in community participation both in front of and behind the cameras. Beginning with not much more than a strong desire and friendly prodding by the cable system, the library now narrowcasts its programming from its own studio to the CATV for distribution throughout the local system. The library's newest innovation is the redesigning of a bookmobile into a mobile ENG (electronic news gathering) unit which now allows the library to microwave live remote programming back to its studio or the cable system for editing or immediate distribution. Programming consists of local history, exercise, news, religious programs, community events, topical talk shows, educational programs and a children's story hour which finds local officials competing to be storybook characters.

Yet, straight video access programming is but one use of cable technology. The 1980's are finding more educational groups experimenting with non-video applications, interactive programming, integrated cable-based networks and special cable networks. Coaxial cable has become a two-way transmission conduit rivaling telephone wires for cost-effectively carrying audio and data communications. The next five years should find these experiments becoming implemented as operational systems. Voc ed groups will want to closely examine cable as a "local loop" option for carrying satellite delivered programming from the earth station to the final destination. Cable's ability to cost-effectively interconnect facilities with multiple broadband channel capability is unmatched--except, perhaps, by a technology which is becoming increasingly more available in long haul networks: fiber optics.

A coaxial cable can carry up to 50 or more tv signals and the entire FM band, a capacity which is 225,000 times greater than the copper telephone wire. Currently, over 30% of the U.S. tv households subscribe to cable service with more than 5,000 U.S. cable systems in existence. A trend toward offering no less than 30-40 channels is growing among cabled communities. Cable operators have no problem filling those channels with distant broadcast signals, satellite-delivered ad-supported and pay programming, local acceaa programming, teletext, videotex, tele-courses, library access, and even emergency alarm and monitoring services. Yet, the cable marketplace has witnessed some cable systems declaring bankruptcy and defaulting on promised services due to the high cost of cabling cities, competitive technologies such as STV or SMATV (see "Satellite" section), and an economic climate finding cable service a luxury. Voc ed must monitor closely these distressing cable trends--trends which are forcing cable companies to be more profit-oriented and less civic-minded. Access channels are apt to disappear in favor of a pay service (unless Federal cable legislation is passed guaranteeing the provision of local access). Educational opportunities in using local cable technology may become scarce or, perhaps, bear hefty price tags. The AT&T break-up can potentially bring a breath of life back to the cable industry as consumers look for less expensive methods of communicating; however, this could easily translate into public sector vs. private sector competitions for cable access which would presumably be leased by the CATV operator to the highest bidder.

The aforementioned optical fiber technology is challenging not only coaxial cable, but also satellite technology. Fiber optics, a transmission medium consisting of laser beam broadband analog or digital signals travelling through glass fiber tubes, is boasting greater signal capacity and lessened signal loss and overall expense. AT&T has already installed 750 miles of optical fibers interconnecting points on the East Coast. Major cities, such as New York, are choosing fiber optics over coaxial cable in providing the "local loop" interconnection between downtown offices and suburban satellite transmission facilities. Voc ed may want to track thia technology if it considers establishing its own private telecommunications network.

There are those who feel "bullish" about the cable market and its development of more sophisticated telecommunications applications.

A. Interactive Cable Video

- Berks community Television, the public access group in Reading, PA, are pioneers in the use of interactive cable video, developing an innovative program for senior citizens. They now produce 15 hours a week of live programming.

- Warner Amex's QUBE interactive cable system was first installed in Columbus, OH in 1977 and has offered the home viewer a variety of opportunities to interact with the cable programming via a special hand-held keypad. Consequently, WA now operates 7 interconnected QUBE systems.

- Cox Cable, CBS, AT&T and others are establishing interactive cable systems through videotex experiments.

B. Interactive Non-Video Services

- A number of public libraries including Lexington, KY; New Orleans, LA; Atlanta, GA; Iowa City, IA; and Columbus, OH are experimenting with the assistance of their cable systems in providing library reference and circulation services via interactive cable.

- Libraries and educational institutions are investigating the use of cable for telecommunications applications, including phone service and data transfer:

C. Integrated Cable Networks

- Warner Amex, among other cable systems, is investigating interactive cable services involving telephone technologies. MCI is field testing "Cablephone," a system that will use cable as an alternative local link for long-distance service.

- "Teleports," large sophisticated satellite communications antenna farms are using fiber optic and coaxial cable, among other technologies, to link downtown user facilities with their long haul transmission facilities to deliver "first mile" or "final mile" connectivity.

- Professional associations, such as the American Library Association, are delivering continuing education programming to their national constituencies using a combination of satellites and cable. (See attachment 4 for other examples.)

- Postsecondary institutions, such as Coast (CA) Community College and Dallas County (TX) Community College, have been producing telecourses for distribution by a combination of video technologies including cable.

- Connecting cable with computers for transactional services is gaining popularity.

  --The NABU network which uses a high speed, high capacity computer to program cable systems, is undergoing tests in Ottawa, Canada's cable system. The network includes four tiers: Family--variety; Personal Productivity--home management and professional programs; Education--children's informative programs, including computer literacy; and Games--over 30 arcade games.

  --Hitech Enterprises' Cabletix allows cable subscribers to see facility diagrams for special local events and order tickets through a toll free number.

D. Special Cable Networks

Cable technology makes it possible for special cable networks to branch off a local system. Most often these "institutional networks" will interconnect businesses, schools, libraries, or other public/private institutions for the purpose of enabling these institutions to communicate discretely with one another.

- o Colleges may wish to offer extension courses on educational institutional networks.
- o Libraries may transact interlibrary loan business among local branches.
- o Businesses may share corporate CE via a business cable network

Daniels and Associates, a major cable MSO (multiple system operator) forecast these cable trends for 1984 and beyond:

--signal scrambling of major cable programmers (HBO is leading the way with its M/A Com linkabit encryption system.)

--pay audio will emerge as an experiment in profitable cable services

--home computers will be more widely integrated with cable systems

--increasing programming fees (which will be passed along to the consumer as higher monthly subscriber fees)

--new programming services, particularly pay programming, will emerge (and most likely bump less profitalbe programming on smaller cable systems)

--addressability will be more available to cable operators enabling them to offer more "pay per view" services.

E. Additional Educational Uses of Cable

- o Close-up foundation of Washington, DC uses the facilities of C-SPAN to beam special live government programs to teachers and students nationwide whose cable systems offer C-SPAN (currently 11 million homes and schools). The audience is able to phone in questions of the presenters. While the close-up foundation has traditionally brought high school students to DC for a government seminar, the Foundation uses cable and satellites to outreach to those students not able to come to Washington.
- o In Rockford, Il 10 firehouses used one-way and two-way cable tv for fire fighter education consisting of basic skills instruction and simulation games.

- o Nursing home personnel in Peoria, IL use cable to receive in-service training.

- o In the mid-70s, the Rand Corporation experimented with interactive cable for live adult CE classes in Spartansburg, SC as an alternative to the traditional classroom setting. Courses, offered by a local college, prepared students for GED exams. Cable students did just as well as classroom students on their exams.

- o Parks Department in Everett, WA offers a cable course on baby-sitting.

- o Learning Resource Center of the Danville, IL Public Schools uses cable to deliver a series on individually guided education.

- o Ozark Guidance Center in Springdale, AR runs a psychological treatment center. OGC has begun to produce video for use in its counseling. In 1982 with grant money from the State Office of Alcohol and Drug Abuse Prevention, OGC worked with its problem high school students to produce a special program which was carried on the local cable access channel. The production experience has been so successful, more programs are being produced by the students. The video medium has encouraged them to begin to take pride in themselves.

- o Late night Casper, WY school board meetings are televised the next day before school on the local access channel to keep teachers informed.

Overall, cable with its ability to offer an enormous amount of channels should be able to compete effectively with STV, SMATV and DBS if cable systems can continue to offer competitive subscription fees and keep the local folks relatively happy with their service.

Instructional Television Fixed Service (ITFS):

Originally, ITFS was created to provide frequency spectrum space for private use by nonprofit educational organizations. The FCC had reserved 28 tv channels in the 2500-2690 MHz band "for the transmission of visual and aural instructional, cultural and other types of educational material to one or more fixed receiving locations." Receiving sites require special antennas and downconverters to pick up the microwave signals. Sites are generally school districts and academic institutions. However, one of the largest users of ITFS is the Catholic Church which has created a number of school/church ITFS networks across the country. Modes include one-way or two-way tv, or tv in one direction with an FM audio talkback link from the classroom.

On May 26, 1983, the FCC reallocated ITFS channel space, giving 8 of the 28 ITFS channels to Multipoint Distribution Service (MDS). (See MDS section for more MDS information.) Even with vigorous nonprofit protests, the FCC's decision was based on the under-utilization of ITFS channels in many U.S.

markets. The FCC counted 300 ITFS licensees (many of whom operate blocks of 4 ITFS channels). In addition, PBS applied for a block of 4 ITFS channels in 102 markets for their National Narrowcast Service in 1982. After a long debate between PBS and Microband Corp. of America, the FCC finally granted 82 of the PBS applications on December 30, 1983.

The FCC's May decision did grandfather in existing ITFS systems and those applicants through to May 26, 1983. The FCC also ruled that ITFS licensees could lease excess system capacity to commercial groups on a non-common carrier status as long as the ITFS system was "substantially" used for educational purposes.

As a result, ITFS is gaining a new popularity in U.S. markets. Microband, CBS and other MDS operators and programmers have vigorously negotiated with a number of ITFS operators in an attempt to establish multichannel MDS in major markets. (See MDS section.) New Trier (IL) school district was one of the first ITFS licensees to strike a deal. Microband, selected over CBS, leases bulk time (all non-school hours) of New Trier's four ITFS channels as of the end of October 1983. In return, New Trier will receive a minimum annual payment of $100.000 (percentage of MDS subscription fees) and Microband will pay for the upgrade of New Trier's ITFS studio and transmission equipment.

The "selling out" of existing ITFS channels by licensees is causing a debate among educational groups. On one hand, groups maintain that ITFS must remain educational, especially at a time when groups are becoming more sophisticated in their production of educational tv. Other groups point out that leasing excess capacity to the commerical sector enables them to receive revenues which maintain their levels of ITFS service. Most educational groups are united in their opposition to nonprofits which "front" for the commercial sector as ITFS licensees. To this end, educational organizations are asking the FCC to either specifically define "substantial" educational use of ITFS or to carefully review all new ITFS applications to ensure systems will be legitimately used in compliance with the new FCC rules.

Below are examples of ITFS applications, some of which use ITFS as part of a hybrid telecommunications system. As with the other terrestrial based, localized technologies, satellites can be employed to extend and link together domestic networks.

- Illinois Institute of Technology in Chicago operates 8 ITFS channels. IIT uses its channels to microwave graduate courses in engineering and computer science to downtown corporate offices. IIT receives course tuition for this service.

- Association of Higher Education in North Texas in Richardson operates an ITFS network reaching a number of northern Texas institutions and several corporations, such as Texas Instruments. AHENT programs its channels with academic courseware. Linked to its ITFS network is a satellite TVRO which can receive outside special programming for redistribution on its ITFS system. AHENT has also explored the potential of adding satellite <u>transmission</u> capability enabling it to share its programming nationwide AHENT makes its ITFS network available for the redistribution of satellite video-teleconferences.

- California State University at Chico also programs it ITFS system with special courses. Its ITFS network includes school districts, educational institutions and some corporations in the northern California area. Computer courses are popular ITFS credit programs. CSU also operates both satellite reception and (shortly) transmission equipment. CSU, like AHENT, has used its ITFS network to redistribute continuing education interactive video-teleconferences.

- Eagle Bend (MN) School combined ITFS with LPTV to develop its own hybrid multi-school network which EBS calls "Communicasting." The LPTV studio and equipment is located in a portable classroom outside the school building while the other 2 participating schools house ITFS transmission equipment. When EBS originates programming, it uses its LPTV station to distribute the classes to the other schools and the surrounding local communities. The other 2 schools use the ITFS equipment to originate their programs and send them to EBS who, in turn, redistributes the programming via LPTV. EBS principal, Richard Lundgren, points out that this network was designed to serve the schools and general communities with educational/informational programming. The 3 schools have also been able to share faculty (particularly in the voc ed areas where each school alone did not have the student population to justify hiring individual teachers). In addition, EBS has proposed to the Minnesota legislature that the network be expanded statewide.

- Medical Care Development in Augusta, ME, in conjunction with funds from the Veterans Administration, operates a hospital microwave network linking 6 area hospitals. The network is used for medical courses, meetings, seminars and is also capable of receiving satellite video-teleconferences aimed at medical professionals. This is one of several hospital tv networks.

- Association for Continuing Education in San Francisco, CA uses Stanford University's ITFS network to reach corporate nodes with certificate and degree programs. While ACE is not an institution, it does work with accrediting institutions to offer degree programs such as an MBA in Management in cooperation with Golden Gate University. Some 50 ACE-affiliated corporations are part of the Stanford ITFS network. Given the new ITFS climate, ACE has applied to construct and operate its own ITFS system. Its logical next step is to form partnerships with similar corporate-supported high tech educational centers in the pursuit of building "an industrial television network" using satellites to provide the long haul interconnection.

- Center for Excellence in Williamsburg, VA combines ITFS with cable tv, FM subcarriers, and telephone to deliver both pre-produced and interactive teacher in-service training. ITFS is specificslly used for delivering Project GETT-UP (a training program for teachers of gifted students) into the schools for the teachers.

- Catholic Telecommunications Network of America (CTNA) based in New York City is aggregating the large number of diocesan ITFS networks among other facilities, for subscription to its national programming. TVROs are placed at the head-ends of ITFS networks to receive the satellite delivered programming which is then redistributed on the ITFS system and on some cable systems.

- Similarly, the Catholic Television Network is using ITFS to deliver special educational programs targeted at senior citizens in the San Francisco Bay area. CTN operates the Senior University of the Bay Area, who in conjunction with the Archdiocese of San Francisco, the ITFS licensee, uses the ITFS network, including some 170 neighborhood sites, to deliver low-cost non-credit awarding adult education to seniors unable to travel to campuses or unable to pay for expensive academic courses.

- Shortly after the new FCC ITFS rules were effected, Dicom contracted with SatServ to evaluate existing linkages and redistribution systems available for reaching U.S. secondary schools i major markets. Dicom wanted to investigate the technical feasibility of delivering a commercially supported educational satellite video teleconference to its target audience: secondary students. SatServ surveyed redistribution systems (including ITFS) in the top 50 markets to evaluate network configurations. In some cases, a TVRO would be needed to receive the satellite signal. However, major obstacles to Dicom's efforts were not technical, but rather programmatic, administrative and logistical (a point to be considered in the design of any voc ed network or program).

- University of Florida College of Engineering at Gainesville coordinates the Florida Engineering Educational delivery System, which combines ITFS with microcomputers, telephones and videocassettes to deliver courseware in a variety of formats.

- As mentioned previously, the Public Broadcasting Service has been given approval to build and operate ITFS networks nationwide for the local redistribution of its proposed satellite-delivered National Narrowcast Service PBS describes NNS as providing "instructional, educational, cultural professional training and informational video materials," Programming will fall into five major categories:

  1) formal course materials to students in local educational institutions;

  2) in-service training and instruction to provide special skills and courses on professional development;

  3) current information and development in professional, technical and various specialized fields;

  4) educational and cultural exchanges outside the context of courses and classrooms; and

  5) administrative.

Multi-point Distribution Service (MDS):

Like ITFS, MDS is a 2 Ghz microwave service. Until May, the FCC had restricted MDS to 2 channels per market in the 2150-2162 MHz band. Under conditions described in the previous ITFS section, the FCC reallocated eight ITFS channels to MDS: Two four channel blocks will be made available to 2 MDS operators in each market, enabling this primarily entertainment delivery system the opportunity to offer multiple channel service (thus being somewhat more competitive with cable tv and direct broadcast satellites).

MDS is regulated as a common carrier and is used to transmit video, audio and data programming services. MDS channels have traditionally been leased to pay-tv entertainment programmers. The FCC named 355 MDS licensees in 1982. Normally, a primarily one-way video entertainment medium would be of little value to a group such as those interested in voc ed. However, the new FCC ITFS/MDS ruling has entangled many educational and commercial organizations as MDS operators try to position themselves with ITFS licensees to lease excess ITFS channel capacity. New applications of ITFS systems by voc ed groups could conceivably be thwarted should ITFS licensees opt to deal with MDS companies.

Microband Corp. Of America, the largest MDS operator in the U.S. (with systems in over 70 of 150 markets), was a driving force in encouraging the FCC to consider ITFS channel reallocation. With the FCC providing MDS a new green light last May, Microband is introducing a new interactive MDS-based (but cable-like) programming service that promises to include an educational component.

Microband has met with competition for major MDS markets. Over 25,000 MDS applications were submitted on the one day (September 9, 1983) the FCC had set aside to accept applications for the 8 former ITFS channels. To make its service offerings unique, Microband has created "Urbanet™" to offer five tv channels plus five 56 kbps data channels (using the VBI). The tv channels can also be reconfigured to be used for broadband data services only. Programming will include pay-tv services, such as HBO and Showtime, as well as advertiser-supported programmers including ESPN and MTV. Microband has also indicated it will include instructional programming from local academic institutions.

MDS signals are downconverted to an open VHF channel. The downconverted signal is then processed by electronic equipment (much like the cable tv "black box"). Additionally, Urbanet™ subscribers will be able to lease decoders for unscrambling pay-tv, special pay-per-view events, teletext/videotex and sterio audio programminq.

By adding telephones in conjunction with intelligent packet network facilities (such as Microband's parent, Tymshare Corp.) interactive services, similar to those offered by cable tv, can be introduced including electronic mail, home banking/shopping, security and information retrieval.

Will multi-channel MDS services be useful to voc ed? Microband claims its service can be offered more cheaply because, unlike cable tv, it can use existing telecommunications technologies and facilities. Yet, MDS does need for its subscriber' antennas to be in line of sight of the transmitter. MDS is also limited to a 15-25 miles radius for signal coverage. Thus, vocational education use of an MDS instructional channel might not be as flexible or as available as a cable tv access channel. It is not known if educational programmers will have to pay a fee to use an MDS channel, or if Urbanet™ simply plans to incorporate existing ITFS programming in its multi-channel system.

Voc ed will also need to see if Urbanet™ will offer any unique educational/informational data services worth subscribing to. It seems unlikely at this point that Urbanet™ will offer any data retrieval services not already available to those with communicating terminals.

MDS describes itself as an entertainment delivery medium. It seems use of this technology for voc ed purposes is inappropriate. Voc ed programmers, however, should keep abreast of MDS activities, particularly as they affect ITFS.

Local Area Networks (LAN):

Many organizations, particularly corporations, are faced with the problem of "first" mile or "final" mile delivery of a satellite distributed signal. Local area networks interconnect satellite facilities with the transmitting or receiving facilities to enable the origination or reception of signals directly in-house (i.e., to complete a dedicated network.) LANs are also useful in interconnecting local facilities for broadband communications. While LANs are primarily used by the private sector, voc ed groups should be aware of what is available in LAN technology in case a voc ed communications network is pursued.

The design of a LAN depends primarily on the types/formats of communications used. Costs and network management are other considerations. The first decision is the type of communications conduit to select.

Currently, four LAN media are being used:

1) twisted-pair wire:

The most commonly used LAN media as it is virtually the telephone network which is accessible to all offices: It is best used for point-to-point, dedicated communications requiring low data rates. Both audio and data can be carried.

2) baseband:

This single channel cable medium is another commonly used LAN conduit. The ETHERNET system, developed by Xerox, is the best-known baseband LAN. While baseband can be used like twisted-pair wire, it is also capable of handling very high data rates. An increasing number of baseband suppliers are encouraging competitive prices and the establishment of standardized protocols.

3) fiber optics:

A growing number of LAN users requiring transmission, reception and pass through communications capabilities are considering fiber optics. This medium becomes the most cost-effective when very high data rates are needed in a "ring" communications network configuration.

4) coaxial cable:

Since coaxial cable has been developed and improved, over the past 40 years, it offers a flexible medium for many LAN users. When compared with twisted pair and baseband technologies, a signal can travel 35 miles through coaxial cable without experiencing degradation as compared to their one-to-two miles. Coaxial cable is competively priced at $1-3 per foot (although fiber optics is promising better prices). One of the major advantages is coaxial cable's ability to handle 120 channels on a single network. Data, video and voice can all be transmitted/received together. Sytek's localNet is one example of commercially available coaxial cable LANs. Brown University has installed a Sytek LAN and is recouping the costs through sharing fees. Other non-profits are using LocalNet as well, including Carnegie Mellon University, Cornell University, Indiana University, NASA, NPR, Stanford University, University of California' University of Illinois and University of Wisconsin.

Once voc ed programmers have determined the format, duration, frequency and user audience for their programming, they can begin to evaluate if and how LANs should be incorporated into the overall delivery system.

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Satellite

Very simply, satellites provide the long distance link for broadcasting and narrowcasting technologies. HBO found it more cost-effective to use satellites to distribute its cable programming to a national audience, rather than bicycle tapes to thousands of subscribing cable system operators. Satellites have enabled Ted Turner to expand WTBS' Atlanta coverage to countrywide. Most all commercial and public tv and radio networks are switching from expensive and complicated terrestrial microwave to a more affordable and reliable satellite-based system.

It is no longer rare to see satellite earth stations. Hospitals are joining satellite networks, such as Hospital Satellite Network to receive programming packages including medical/patient education and patient entertainment. At the beginning of this decade, Holiday Inn became the first hotel chain to discover that the TVROs installed to offer guests in-room movies could also be used to attract organizational video-teleconferencing clientele. Marriott, Hilton and other national hotel chains have followed suit recognizing a new non-overnight business market. A growing number of planned or renovated convention centers, such as those in Des Moines, IA; Toledo, OH and Santa Clara, CA are adding sophisticated telecommunications equipment, including satellite ground systems. A trend based on placing satellite hardware at academic institutions for the reception of both educational and entertainment programming is reflected in networks such as SatServ's Campus Conference Network™ (ad hoc video-teleconferencing); the National University Teleconferencing Network (tele-courses); and the Campus Network (student entertainment).

Both commercial and public sector organizations are investigating and installing private satellite networks. Dedicated network vendors, such as Satellite Business Systems and American Satellite Company, are providing private networks for those groups who use satellites for more than occasional ad hoc teleconferences. Oil companies, insurance and financial institutions are major corporate dedicated network users. The U.S. Chamber of Commerce's American Business Network (BIZNET) has been operational several years providing subscription business programming and teleconferences to local chambers and corporations. Labor is also using satellites. After experience with ad hoc videoteleconferencing, the AFL-CIO formed their own media unit, Labor Institute of Public Affairs. LIPA's plans include producing programming for broadcast and cable tv, forming a satellite network of local unions and advising unions on new communications technologies. Other public sector organizations investigating their own private networks include American Library Association, National Education Association, and American Law Institute-American Bar Association.

One interesting satellite-based dedicated network provides educational, entertainment and special programming to one state: Alaska. Operated by ALASCOM, Inc. and the State of Alaska, the network facilitates telephone, radio and video services which would normally be cost-prohibitive using terrestrial distribution media.

The trend in private satellite networks is to integrate a variety of equipment to suit a variety of applications. It is not uncommon to see dedicated networks incorporating all or some of these technologies: slow scan tv, facsimile, high speed computer and digital video. Should vocational education decide it is in need of a dedicated network, it should consider the experience of those using such a network. A full scale integrated network can be planned with capabilities added in an organized piecemeal fashion to accommodate budgets and applications.

As satellite communications has "grown up" over the past 25 years, it has sparked a number of technological and applications trends. These are discussed in subsequent paragraphs.

A. Technological Trends

Orbital Spacing

When geostationary orbit (22,300 miles in space) became the status quo for positioning communications satellites, it didn't take long for the world to experience a satellite "parking lot" problem. The rapid increase in applications to launch commercial domestic satellites caused the FCC to investigate the feasibility of moving the satellites (located 4° apart) closer together (either 2° or 3°). Finally, in 1983, the FCC sanctioned the two degree spacing of satellites. While this move will obviously enable more satellites to be launched into geostationary orbit, two degree spacing also has implications for ground systems. Consequently, the physical proximity of satellites at 2° can cause interference with one another's signals when received by some earth stations with larger antennas. Thus, earth station technology is being modified to work with the new orbital spacing. This becomes important to any group(s) who is (are) planning to purchase an earth station. The group must be assured their "dish" will successfully interface with satellites spaced two degrees apart.

Frequency

Until the last few years, all U.S. commercial communications satellites operated at C-Band (4/6 GHz). The majority of current U.S. satellites and their ground systems still use that frequency. However, many satellite authorities predict the higher frequency KU-Band (14/12 GHz) will be the trend of the 80's. Satellite Business Systems launched the first commercial Ku-Band bird in 1981. Since then SBS has launched more Ku-Band Satellites with plans to launch 3 more within the next five years. Virtually all future systems will have a Ku-Band component.

One major advantage of Ku-Band over C-Band is its ability to penetrate urban areas without absorbing microwave interference. Ku-Band earth terminals are also smaller, more portable and ultimately less expensive. Broadcast networks, such as NBC, are leading the way in establishing Ku-Band networks. Some dedicated corporate networks, such as Hewlett-Packard, are also opting for Ku-Band. Direct broadcast satellites (discussed later) will combine the Ku-Band frequency with much higher power. The only real drawback of Ku-Band as compared with C-Band appears to be rain attenuation (interference due to rain). Ad hoc satellite network users have traditionally used C-Band networks for their events since no ad hoc Ku-Band networks have been available. This is changing, and both ad hoc and dedicated network voc ed users will have to determine which frequency will be chosen. For ad hoc users, the selection of the frequency will continue to be based on satellite and ad hoc network availability for dates, times and geographical areas needed. The availability of hybrid satellites operating in 2 or more bands will make it easier to match satellites and ground systems.

The latter 80's will witness the launch of Ka-Band (30/20 GHz) satellites, both commercially and experimentally (if NASA's funding is restored for its Advanced Communications Technology Satellite Program.) American Satellite has even proposed a satellite operating at C, Ku, and Ka-Bands. Ka-Band technology will further develop on-board signal processing, spot beams, small earth station and digital satellite communications technologies. Should the NASA ACTS experimental satellite be launched on schedule in 1988, voc ed groups might want to become involved as experimenters, proposing and implementing an applications experiment. Satellite time will be free to approved experimenters (who must supply the personnel and ground systems resources). While no ground systems have been built, commercial Ka-band service providers are estimating a Ka-Band uplink will cost around $200,000 and TVRO will be less than $50,000.

Video Compression

The use of an entire transponder to handle a full-motion analog video signal is inefficient use of a limited spectral resource. As a result, companies such as Compression Labs, Avalex, Bell Labs and Widcom are perfecting and manufacturing video compression systems. These "codes" enable full-motion video to be transmitted digitally from 56 kbps to 1.544 mbps. Using video compression, many more video users will be able to share a transponder which will reduce costs involved in leasing space segment for video events. Codecs cost from $15,000-150,000 depending on the degree of picture quality needed. Digital video is not completely smooth in its simulation of full-motion. However, should voc ed users be faced with a decision between analog or digital video, the users should consider the degree of motion involved in their video applications. For most educational uses, the simulated full-motion digital video would suffice without too much distraction. Currently, digital video has been incorporated in dedicated networks only. Many corporate networks demand a system capable of handling high speed data transfer and large volumes of long distance telephone traffic. The logical video link in those networks is digital. The relatively high cost of the codecs is also a factor to be weighed by any voc ed groups considering the installation of a dedicated network. Current cost and availability aside, future satellite communications will require video compression techniques in order to satisfy the growing demand for transponders. Frost and Sullivan reports have estimated the video compression market will nearly quadruple in five years from $8.7 million in 1983 to $32.6 million in 1987. Technological innovat'ons will continue to appear heavily in this area.

Satellite Signal Encryption

With so much commercial video programming available on satellite transponders, it is not surprising that an increasing number of home viewers are installing backyard TVROs to enhance their nightly tv viewing opportunities. In the beginning, the number of these enthusiasts were small enough not to alarm pay tv programmers such as HBO. Today, however, the Society for Private and Commercial Earth Stations (SPACE) estimates over 150,000 dishes are installed at residences with another 2000 operational each month. Technology and commercial enterprise have allowed "homebrew" TVROs to be widely available for under $2000. Consequently, HBO and other cable programmers are taking action to stop unauthorized (i.e., non-paying) people from intercepting their signals: Just as HBO led the way in 1975 in using satellites for program distribution, HBO is now pioneering in the use of encryption. After extensive testing, HBO is preparing to launch its scrambled service (using M/A Com's Linkabit encryption equipment) by the end of this year. Other cable programming networks, such as American Business Network (BIZ-NET) and Catholic Telecommunications Network of America are also scrambling their services; these two groups using Oak's Orion encryption system.

Individual ad hoc video-teleconferences can be encrypted as well as the private satellite networks. Voc ed groups will need to assess the degree of sensitivity and privacy of their transmissions to determine if their communications warrant the added expense of using encryption.

The average cost of leasing a signal encoder for an event at the transmission origination point is $2100/unit. A signal decoder must also be at every receiving location and rents for about $800/unit.

Encryption particularly becomes an issue when exchanging proprietary data. Voc ed satellite applications will also influence encryption decisions. Unless voc ed groups anticipate transmitting extremely private communications, they might consider merely using the "less popular" satellites, that is, satellites which are void of cable and other video programming, as a means of discouraging unauthorized viewers who frequently scan the published video programming on the "cable satellites." Overall, voc ed groups most likely will find that their ad hoc uses of satellites will not require encryption.

Earth Stations

Rapid advances in microelectronics have been responsible for the dramatic size and price decreases of satellite earth stations. Additionally, the discovery and use of geostationary orbit enabled manufacturers to eliminate expensive tracking equipment which was previously required on earth stations which had to follow the lower orbiting satellites as they passed overhead.

These 25 years of satellite communications have watched a large million dollar earth station evolve into backyard 10-12' television receive-only (TVRO) earth stations available from some department stores for under $2000. More powerful satellites, such as those DBS service providers will be launching in the mid-to-late 80's will drive cost and antenna size down even further. Home DBS subscribers will be able to purchase roof-top "dishes" some 3' in diameter bearing a price tag well under $1000.

These aforementioned technological trends, coupled with new satellite policies, are reflected in the design of earth stations and will multiply the number of options from which voc ed groups or their network coordinators will have to select for satellite ground systems. If voc ed groups consider a private network, the earth stations will need to work with 2° spacing; to operate with either C, Ku-Band or both frequencies; and possibly to interface with video compression or encryption systems. Voc ed groups most likely will want a steerable earth station which can be pointed toward the satellite needed (as opposed to a fixed station which remains locked on one satellite only). Similarly, it would be wise to select electronics, such as frequency agile receivers in TVROs, which enable the user to access any transponder on the satellite.

Technology advances have also created the multi-beam antenna which allows the user to access a range of satellites in a given orbital arc simultaneously. While this is good news for cable systems who need to receive 24 hour programming from three or four satellites simultaneously, the communications traffic levels for most organizations are not heavy enough to require multi-satellite capability.

If distributing analog video, it is important for voc ed groups to be aware of the cost difference between uplinks (transmitting earth stations) which sell for $200,000-500,000 and TVROs which can retail for $10,000-20,000 for a reliable unit. For this reason, the number of TVROs in the

U.S. far outnumber the video uplinks. Many program distribution networks will have very few uplinks while supporting a multiplicity of TVROs. Most videoteleconferences use a point-to-point configuration in which one uplink is used to transmit the event to any number of downlink sites. However, should voc ed groups explore a dedicated digital network, they will find most earth stations will have transmission capability. This is because these networks are often limited in size (usually a corporate HQ and several branch offices) and find it necessary to send information from any one office to any one other office. Expense has influenced private network users to share facilities or lease facilities from common carriers and other service providers. PSSC/SatServ has found that those public sector groups considering an investment in a private analog satellite network are eager to share the network as ad hoc videoteleconferencing facilities to help make the network self-supporting. Voc ed groups may want to entertain alternatives, such as facilities sharing, to help finance a satellite network.

A major trend in this area has been growth in the "teleport" industry. A teleport may be likened to an industrial satellite communications park where a parcel of land is used for the location and operation of multiple earth stations. Since microwave interference and tall buildings have hampered direct urban satellite communications, more metropolitan areas are building these "antenna farms" outside of town with fiber optic or cable links back to the downtown area. Individual groups may locate their earth stations at the teleport, or share teleport facilities, depending on the service and space offered by each teleport. The New York teleport pioneered this trend, but many other cities have followed suit. As a result, a teleport association has been formed to share information.

There are many other details to consider when shopping for a TVRO. Attachment 1 provides a good overview of what to look for in a TVRO. The primary objective is to buy equipment that will not become a white elephant in several years. Armed with knowledge on technological trends in satellite communications, voc ed groups will be able to make wiser choices.

B. Applications Trends

Satellite Master Antenna Television (SMATV)

SMATV, like MDS, is a video entertainment programming distribution system competing with cable tv. Often called private cable, the SMATV operator relays satellite-delivered video programming from his TVRO to the homes of a private subscriber group (most often apartment or condominium complexes) via coaxial cable. Born in 1980, the SMATV industry now boasts up to one million subscribers, or 3% of all pay tv homes.

SMATV was originally created as an alternative for those complexes unable to get cable tv. Now it is agressively pursuing markets where there is no cable franchise in an effort to establish its service ahead of cable. SMATV's primary advantages over cable are its quick and low-cost system installation and its lack of FCC or governmental regulation (being on private property). SMATV has experienced problems in getting programming, but some cable-loyal programmers have had a change of heart and are willing to offer their services to SMATV operators.

The trends for SMATV seem to indicate that this technology will continue to increase its percentage of penetrstion into pay tv homes. We can expect that SMATV will remain a one-way video entertainment medium and ultimately will have no bearing on educational needs.

Single Channel Per Carrier (SCPC) Services

For some long distance communications services, a full wideband satellite transponder is not needed. Instead, these services merely require a small piece of the transponder. To accommodate these requirements, a wideband transponder may be divided into narrowband circuits. Each circuit channel may be accessed independently which is the basis for SCPC services.

Several communications companies have identified and serviced oil companies as SCPC customers. Off-shore drilling and exploration in remote areas have made communications a frustrating experience. No terrestrial communications networks are available and service is usually on a "project" basis for a week or several months. SCPC offers these remote workers a satellite-based alternative for both regular telephone and the relay of data.

Radio services are also handled using SCPC services. National Public Radio uses 12 SCPC channels on its WESTAR IV transponder to deliver its radio programming to its affiliates who receive the signals on their 3.8 meter earth stations. In addition, Mutual Broadcasting, Muzak and others use the NPR transponder for a total of 22 SCPC Services. Many more SCPC services could be accommodated on a single wideband transponder if larger earth stations are used. There is a tradeoff to be considered between power and bandwidth.

Musical events are also using SCPC technology. For example, some rock concerts are broadcasting their musical performances directly out of arenas, onto a satellite as an SCPC signal and finally to an FM radio station for live or delay carriage.

Satellite technological trends are encouraging the increased use of SCPC as a means to efficiently use satellite power and bandwidth. Voc ed groups with radio, voice and data communications requirements will want to track this satellite application.

Cellular Radio/Mobilsat

Anyone who has spent hours in a traffic jam or has gotten lost driving on the way to an appointment realizes the benefits afforded users of the newly available cellular radio technology. Car phones are not exactly novel, yet cellular technology is a more advanced approach.

Traditional mobile phone technology required a single transmitter and receiver, and half the time the user could expect the technology to work improperly.

The schematics of cellular radio divide a local area into a number of "cells," each with its own central transmitter and receiver (cell site). These cell sites are linked by regular phone lines to the Mobile Telephone Switching Office. This enables mobile phone users to continue their phone conversations without fading, interference or interruptions as they pass through new cells. The MTSO performs a tracking function, handing off calls continuously among cells to ensure the maintenance of strong signals.

The FCC approved cellular radio during the middle of 1982 and has accepted applications for service in waves by market size groups. Many applications have now been approved including AT&T, GTE, Continental Telecom and Graphic Scanning Corp., particularly in the major markets. The FCC did stipulate that these services must be compatible with one another to provide smooth service nationwide. AT&T projects the current 55,000 mobile subscribers will grow to 1.5 million by 1990. A variety of partnerships are being formed among diverse telecommunications organizations to offer cellular services. Telescan has forecasted cellular radio industry revenues of $15 billion by the year 2000.

Thus far, the average monthly cellular service bill for major metro areas has been $150. Business, the primary user, feels the service is well worth the charges.

It did not take long for companies to also recognize expanded opportunities for marrying cellular radio and satellite communications technologies. Although the FCC has not yet officially ruled on mobile satellite communications, several companies are preparing for services beginning in 1986 or 1987.

Mobile Satellite Corp. has proposed a land and aeronautical system named Mobilsat. Services are to include nationwide mobile telephone and voice dispatch, paging, interactive data and vehicle position surveillance. Mobilsat will target its services to the estimated 60 million rural Americans not served by other terrestrial-based systems. In addition, Mobilsat projects its specific customers will be trucking companies, bus lines, railroads, airlines, mineral exploration companies and emergency Services. Spacecraft plans are to include an initial two satellite system with a ground spare. Mobilsat has asked the FCC for approval to operate its commercial system on an "experimental-developmental" basis. It claims its mobile telephone service will be cellular compatible in urban areas where cellular services exists.

Skylink Corp. is a second company proposing mobile satellite communications services. Specific services have not been announced, but Skylink has stated that it will operate as a "carrier's carrier." Like Mobilsat, Skylink sees a market in rural Americans who have no terrestrial communications access. Skylink has filed to launch one small satellite and one in-orbit spare. The company estimates its ground system will comprise lightweight, inexpensive ($3000) terminals.

Geostar Corp. has also applied for authorization to operate a mobile satellite communications system. Interactive digital services will include mobile telephone and data, emergency services and tele-location. System creaters claim the satellite will be able to precisely pinpoint user locations. This feature, coupled with an emergency switch, will allow users to automatically call for help and convey exact locations. Geostar plans to launch 3 operational satellites and one in-orbit spare to support these services. Users will purchase or rent transmitter-receivers which will be hand-held keypads with a liquid-crystal display screen. Geostar predicts these units will be able to sell for $450. These keypads will convert user information into a digital signal transmitted directly to the satellites. While Geostar's computers process and relay user data, the satellites will continue to track the user's location. The completed communications will take only seconds. Each regular message is projected to average 40 cents apiece.

Major FCC approval obstacles focus on the frequencies requested for mobile satellites. NASA and mobile satellite carriers are requesting service in the 800 MHz band. The FCC is proposing secondary status be given mobile satellite services in that band with primary status reserved for terrestrial service providers, such as cellular radio. NASA has petitioned against this proposal, wanting primary status to guard against interference from terrestrial services. In addition, NASA has also proposed 3580 MHz in the Ku-Band be set aside for "feeder links" for mobile satellite services. SBS, among others planning Ku-Band satellite services, submitted comments to FCC suggesting such an allocation would be an "unnecessary and harmful incursion into the 14/12 GHz frequency band."

Are cellular and mobile satellite communications technologies useful to voc ed? Voc ed may want to consider its travel volume and amount of field work in rural areas. Voc ed personnel who spend a great deal of time in a car among service areas may want to investigate the utility of a car phone, particularly if timely and vital messages are being lost. Could counseling or tutoring be achieved via cellular radio in emergency or special circumstances?

If voc ed specialists are dispatched to rural areas for site visits, might they find interactive data reporting useful to and from home offices? While most likely not of primary importance, these two technologies should not be overlooked entirely. Cellular phone services are available now in major markets, while mobile satellites won't be launched until 1987 or beyond.

Digital Termination Systems/Digital Electronic Message Services

In July, 1982, the FCC began approving DTS licenses, and a new business was off and running. Digital termination systems (DTS) are the microwave local interconnection delivery systems on which digital electronic message services (DEMS) in the form of telephone and data networks are relayed. Long haul digital services will use a satellite link.

Until these past few years, end users often relied on either on-premise earth stations, or standard phone lines or upgraded telephone facilities for local data distribution. Each alternative had its own distinct set of disadvantages from slow delivery to expensive service and equipment. These factors caused the FCC to allocate 130 MHz of frequencies in the 10.55-10.68 GHz band for high-speed digital transmission. Equipment for a DTS system consists of microwave transmitting antennas, subscriber transceivers and one control station per DTS cell. This equipment, in turn, interfaces with the user's business machines. System startup charges for the user equipment and control station can range from $150,000-500,000.

Benefits of DTS include its low bit error rates, high speed data capacity, cost-competitiveness, flexibility and compatibility with other local networks, independence from the telephone company and efficient use and reuse of its allocated frequencies. M/A Com's Local Digital Distribution Company built a prototypical DTS network serving New York City and San Francisco in 1981 shortly after the FCC had allocated high speed data transmission frequencies. LDD worked with Tymnet, Viacom and Manhattan Cable to provide local service, while SBS provided the satellite connection. Services provided included high-speed facsimile, slow scan tv and 56 kbps computer-to-computer data transfer.

After LDD's successful experiment was completed in October, 1981, more than 30 companies applied for DTS/DEMS authorizations, including SBS, Graphic Scanning, MCI, RCA, Western Union and Tymnet. Icom, Inc. plans to use its 18-city satellite-interconnected DTS network primarily for voice' although data services will be offered. Federal Express has been authorized to construct a 15-city network which will probably be used for high speed facsimile. LDD remains the major supplier of DTS equipment, although NEC America is also building equipment.

Market analysis has identified a growing trend in high speed data communications and distribution, a trend which seems to continuously seek delivery systems with higher speed capabilities and less prone to errors. DTS may currently be one of the best alternatives for delivering DEMS-type services. The scarcity of mass-produced equipment has slowed down construction of systems, but the technology is essentially available now.

Voc ed groups must analyze their volume and types of digital communications and compare DTS with telephone alternatives. Is there enough traffic to cost-effectively justify the need for a higher-speed distribution system? Where are the geographic locations of voc ed end users? Are they predominately rural or urban? If urban, they might be able to piggyback service onto existing systems at a price competitive with local phone networks. Voc ed need for DTS might compare with its need for LANs. Local interconnections, particularly within urban areas, can often be one of the biggest and most expensive problems in sattellite based networks. How do we get the signal from the earth station to the user's facilities? DTS appears to be one solution worth keeping an eye on.

One potential problem worth remembering is standardization and compatibility. Just as some computers can't directly communicate with one another and particular videocassette formats can only be used with particular VCR's the many local distribution systems will undoubtedly encounter compatibility problems based on the communications applications and formats they are designed to deliver.

The common denominator or "plug" for delivering all electronic communications of the future into the home will probably be the Integrated Services Digital Network. However, ISDN standardized services are not targeted for availability until at least the 1990's, probably longer. The main benefit of ISDN will be its ability to merge all forms of electronic communications into one inexpensive conduit, more than likely replacing the telephone line. Whether the home user has computers, VCR's, videodisc players, advanced telephone systems or HDTV sets, ISDN will allow the user to plug it all in to one system without the need for special wires, adapters or installation fees.

Direct Broadcast Satellites (DBS)

The trend in satellites continues to be higher-frequency, higher-powered satellites and smaller, more portable, low-cost earth stations.

In less than 25 years, the world has witnessed price tags for satellite ground systems decrease from the millions to the thousands of dollars. With the dawn of high-powered DBS, earth terminals will be small enough (under 3 feet) to be mounted on home roof tops and could eventually cost as little as a couple hundred dollars.

DBS is exactly what its name implies: a satellite that will broadcast signals directly to the home, eliminating the need for local cable or broadcast systems to redistribute satellite signals as is currently the mode. The FCC has set aside part of the Ku-Band for this service.

Actually, DBS-like service is available now. Many private home owners, are purchasing 3-5 meter C-Band TVRO's to pick up programming being fed to cable and broadcast stations. However, as stated in the "Encryption" section, many programmers are countering what they feel is outright signal piracy by installing signal scrambling systems to discourage this growing practice.

Since true high-powered DBS is not slated for operation until 1986 at the earliest, some companies are beginning to offer lower powered DBS services to both capitalize on the market for home satellite equipment/service and to get a jump on video programming system competition. In 1982, the FCC authorized eight companies to proceed with construction of high-powered DBS systems. These eight included Satellite Television Corp.; RCA; Western Union; Graphic Scanning; United States Satellite Broadcasting Co,; Video Satellite Systems, Inc.; CBS and Direct Broadcast Satellite Co.

The issue having the most impact on the viability of DBS is programming. What can DBS programmers offer which will attract a sufficient number of subscribing viewers? The medium, to be competitive, is dedicated to entertainment. What programming the DBS licensees will offer is a well guarded secret. STC has invested huge sums of money in its own Las Vegas production facility. Other groups are negotiating deals with Hollywood and cable programmers.

A potential new DBS player has mentioned educational programming in its FCC application. Advanced Communications Corp., which submitted its DBS applications January 12, 1984 to the FCC is targeting its proposed service to the "entertainment and informational interests of the majority of the population residing away from the large urban cities." An informal ACC survey of Arkansas students found a "demand exists for informational, entertainment programming relating to natural science and wildlife, travelogs, children's educational specials, expanded dramatic presentations and supportive educational classes."

Should ACC or other DBS groups propose a DBS system containing educational programming, voc ed groups will want to track it closely and try to position themselves for involvement. One other DBS headache is the aggregation of dispersed rural audiences for marketing the company's DBS service. Cable systems or low power tv stations may become brokers for local DBS services. Perhaps, voc ed organizations could aggregate their potential users in concert with DBS companies offering educational programming. Select voc ed groups may also step forward as potential sources of programming. The small, low-coat TVRO'a required for reception of DBS programming will be more affordable and available to even the most remote and smallest educational institution.

It is still too early to positively predict the success or failure of DBS. There are aa many doom forecasters as there are those who are bullish on the DBS market. An even larger question within the educational community is whether DBS will offer anything to them.

Video Teleconferencing

For years, broadcasters have been using video teleconferencing in their programming. It is not uncommon to watch Ted Koppel interview a world or national figure who is located in a studio many miles away from ABC's New York studio. The viewing audience is both able to see and hear Ted and his interviewee as they diacuss an issue live.

The emergence of commercial communications satellites, however, have made video-teleconferencing more accessible to profit and nonprofit groups and their special viewing audiences. An increasing number of organizations and special interest groups are taking advantage of the power of the live, interactive video medium coupled with the less expensive costs associated with satellites.

Satellites are less expensive than terrestrial communications in many cases. Satellites are both distance and terrain insensitive, enabling the easy and inexpensive participation of remote dispersed sites located in mountainous areas. Such areas are often unserved or underserved by terrestrial communications which must erect a long series of equipment to get a signal in and out of a remote mountainous area. By contrast, the area needs only a satellite earth station for long distance satellite communications. There is also less chance for equipment failure with one satellite earth station as compared to multiple repeater towers. The quality of a satellite-delivered signal is also superior to a terrestrially-delivered signal.

A satellite's distance insensitivity also means the transmission of a signal to and from points 2000 miles apart costs the same as points 2 miles apart. Long distance phone bills reflect a terrestrial system's distance charges.

The declining costs of satellite earth stations have also encouraged organizations to use the technology. Virtually all major markets and many minor markets have a variety of facilities available for use in video-teleconferencing. Public and commercial tv stations, academic institutions, convention centers, hospitals and hotels are among those facilities often made available on an ad-hoc basis to groups wishing to host dispersed groups of video-teleconference participants.

Teleconferencing, used generically, is a meeting between two or more groups facilitated by electronic media, including audio, video, data or combinations of these. Video-teleconferencing is one type of teleconferencing using a live, interactive full-color, full-motion video transmission from one point to another point, or one point to many points. Most video-teleconferences orginate from one point and are transmitted to any number of receiving locations via satellite. Those participants present at these "receive sites" are able to interact with the presenters at the origination site through several types of telephone technologies. Applications are unlimited, but more popular organizational uses of video-teleconferencing include:

- continuing/professional education
- conference extension
- information dissemination
- emergency sessions
- business/organizational meetings
- new product/service introductions
- press conferences/publicity
- membership services
- community awareness/public affairs
- special events

When planning a video-teleconference, these factors (among others) should be considered:

- date/duration of event (hours of satellite time needed)
- number, location(s), type of origination site(s)
- number, location(s), type of receive site(s)
- type of production needed
- type of audio interaction needed

If the organization does not own/operate its own satellite network, it will need to rent ad hoc facilities. Satellite video-teleconferencing coordinators are available to provide networking satellite time, production expertise, receive site facilitators (to host/lead participants), and audio system. This frees the video-teleconferencing sponsor to concentrate on program preparation, publicity and program materials. Coordinators can provide complete end-to-end event services or individual services as needed. Coordinators can also provide potential users with cost estimates to help the user plan a video-teleconferencing budget.

Organizations fund their video-teleconferences using a variety of methods, including:

- organization-supported
- grant-supported
- registration-supported (course fees)
- box office-supported (pay per view fees)
- ad-supported (or underwritten)
- jointly-supported by more than one group

Video-teleconferencing will never take the place of the face-to face meeting or conference, but it does offer a cost-effective alternative for involving more participants who are unable to attend in-person. Video-teleconferencing users are finding glowing reviews in their event evaluations, with many participants feeling they learned as much using an electronic medium as they do attending sessions in-person. Emerging studies are declaring video-teleconferencing to be a positive, effective method of communicating a video message.

Voc ed groups are particularly well-suited potential video-teleconferencing users. Any type of training session requiring the ability to view a procedure is a perfect application. However, those areas requiring "hands on" training may find video-teleconferencing a supplementary tool or effective only if the device to be learned can be available at each receive site. Voc ed users must also decide if a program can be just as effective using a less expensive audio or computer conference.

Voc ed groups are already experimenting with the technology. Professional/continuing education is the most widespread educational video-teleconferencing application. The videoteleconferencing trends project a market increase in the use of the medium. It would be expected that voc ed use will also continue to grow. Another trend is finding repeat videoteleconferencing users opting to install their own dedicated networks. Once an organization has made a commitment to regular video-teleconferencing, the group finds it can be more cost effective to buy its own equipment as opposed to continuing to rent ad hoc facilities. Voc ed users may find their usage patterns and requirements will necessitate the investigation of a national or even international voc ed network. As mentioned in the section on dedicated networks, the American Law Institute-American Bar Association is planning a dedicated network for the regular delivery of legal education video-teleconferences.

Conclusion

It is quite evident that communications satellites are providing an attractive alternative for all types and formata of organizational communications. The NASA experimental satellites of the 1960'a and 1970s have paved the way for commercial satellite usage.

One more possibility for experimental satellite usage will exist in the 1980s. As mentioned previously, NASA has set in motion the planning for its Advanced Communications Technology Satellite (ACTS) program. These plans call for a 1988 launch of the ACTS spacecraft.

ACTS affords the public and private sectors the opportunity to experiment with state-of-the-art Ka-Band (30/20 GHz) satellite technology. The system will incorporate innovative techniques and equipment that will allow experimental users to try a variety of technical and applications oriented communications experiments. The results of these experiments will guide commercial Ka-Band technology as it develops in the 1990s and beyond.

NASA will make ACTS time available free to approved experimenters from 1988-1990. Following the two-year demonstration phase, NASA expects to turn ACTS over to private industry, which will enable successful experiments to continue through the life of the satellite as new operational services. ACTS experimenters will be required to make their own earth station arrangements and provide financial and personnel support for the experiment throughout its planning and experimental stages. This long lead time for planning will enable organizations to determine if and when this type of support will be available for an ACTS experiment.

Recently, however, the ACTS program has met with difficulties in securing an adequate level of funding for FY 85. OMB marked up a NASA ACTS budget request of $92 million dollars to only $5 million. As a result, PSSC (as an ACTS contractor providing experimenter coordination among other tasks), its members, potential ACTS users and some representatives of the satellite industry have made presentations to Congressional committees on behalf of ACTS. A $5 million funding level would most probably cancel the flight program, reducing ACTS to a ground simulation program, suitable at best for technical experiments. It is hoped that outside ACTS support will cause Congress to restore the funding level needed to keep the ACTS program on schedule.

The most current news (4/84) is that the House subcommittee has voted to add $40 million to OMB's original $5 million ACTS budget for FY 85. Other money may become available in 1984 to supplement that figure. If Congress follows this course of action, the ACTS program may slip a bit in schedule, but the overall program would be saved.

Any voc ed group wishing to find out more about ACTS or discuss a possible voc ed ACTS proposal should contact PSSC (1660 L Street, N.W., Suite 907, Washington, DC 20036; 202/331-1154). Experimentation on ACTS would allow voc ed groups to plan, test and evaluate a cohesive satellite activity.

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APPENDIX C

DBS FOR
VOCATIONAL EDUCATION

Submitted to

THE NATIONAL CENTER FOR
RESEARCH IN VOCATIONAL EDUCATION

by

LINDA LEE BOWER

March 23, 1984

TABLE OF CONTENTS

CONCEPT AND TECHNOLOGY OF DBS

The concept of DBS is to provide for direct reception of video and/or audio signals by individual receiving antennas from a satellite, instead of over the air from a local broadcasting station, or through a CATV system or other intermediary. The key to DBS is the high power of the satellite, which allows the use of small, inexpensive receive antennas.

A major difference between the fixed-satellite service (FSS) and the broadcast satellite service (BSS) as defined by the International Telecommunication Union, is transmitting power. The fixed satellites have transponders of low power, generally 5-10 watts. They are defined as FSS because they are designed to work with earth stations which are located in fixed positions. These satellites are generally used to transmit telephone traffic, television programming, computer data, and other electronic information. Because of the low power of the satellites, FSS earth stations are large and costly -- up to 32 meters in diameter for a major earth station carrying heavy traffic loads. Receive-only units are also utilized, for applications such as CATV program distribution; but they are also relatively large and expensive -- on the order of 5-7 meters. Most current fixed satellites operate in the C-band; more recently, however, systems have been launched which operate in the Ku-band.

A DBS satellite, on the other hand, will operate in the Ku-band and will broadcast with a power of 150-250 watts. With the Ku-band, the higher frequency itself allows a smaller antenna. The combination of a high-power transponder operating in the Ku-band offers the possibility of utilizing a very small, inexpensive receive antenna, with a diameter of less than 1 meter. In addition, a "true" DBS system is defined here as operating in the spectrum allocation which the ITU made specifically for DBS use.

There is a tradeoff between power and number of channels on the satellite. Fixed satellites currently carry on the order of 24 transponders. Each transponder is capable of carrying one TV channel or several hundred voice circuits. In contrast, a DBS spacecraft will have a capacity of only a few transponders (e.g., 3) of high power. The cost of the spacecraft, however, is the same. For this reason, the space segment for a "true" DBS system will be high.

The typical cost of the current generation of satellites used in U. S. domestic satellite communications systems is about $50 million. The typical cost for a DBS satellite will also be on the order of $50 million (as demonstrated by Satellite Television Corporation's contract with RCA Astro-Electronics to construct two satellites for STC's first phase system). Thus, the cost per channel on a fixed satellite with 24 transponders is only about $2 million, while the cost per channel on a DBS satellite with only 3 transponders is about $16 million. Lease charges for channel capacity on a

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DBS system would necessarily be correspondingly higher. However, it is the high power concentrated in only a few channels that allows the use of a very small and inexpensive receive antenna. The inexpensive ground segment can make DBS affordable for many individuals and organizations -- good news for the educational community. With a large market, the cost of the space segment can be spread over many customers.

DBS SYSTEMS AUTHORIZED

The technology for DBS is at hand, spacecraft and earth stations have been designed for this service, and manufacturers have products available.

Eight DBS systems have been authorized in the United States, and construction permits for their first phases have been granted. Two of these applicants have so far contracted for the construction of satellites. Launch of the first system, STC, is scheduled for 1986.

Various types of services are planned by the different DBS applicants. The three principal categories of operation are:

- Subscription-supported broadcast service,
- Broadcast system supported by advertising,
- Common carrier service.

The needs of education could be met by the common carrier type operation. In these systems, the operator would not produce or directly provide programming itself, but rather would lease (or sell) transponders to programmers. An educational organization could lease capacity and distribute the desired educational or instructional programming. Applicants planning common carrier services are RCA, Western Union, and Direct Broadcast Satellite Corporation.

DBS SERVICE ON KU-BAND FIXED SATELLITES

Technological changes are expected over the next few years, and the possibility is seen that there might not even be a need for the very high-power satellites. It is very possible that DBS service can be effectively accomplished with medium-power, Ku-band fixed satellites. In fact, it is already being done.

The Canadian government has performed DBS experiments on its Anik B satellites. Anik B is a medium-power satellite operating in the Ku-band. These experiments were successful and demonstrated that even a medium-power satellite can be used for broadcasting directly to small home and community receivers. Extensive field trials were carried out from September 1979 to September 1982. In order to simulate typical situations in an operational system, receivers were located in a variety of situations, and different methods of installation were used. Locations of receivers included individual homes, mining camps, and CATV distribution systems. Performance evaluations were carried out, and it was found that the performance of the receivers was satisfactory under a broad range of conditions. The satellite signals were at least as good as other broadcast signals available in the trial areas, and usually were found to be better.

Canada's newest commercial satellites are the Anik C series. The C series is designed to operate in the Ku-band and is capable of providing direct reception to homes and other locations with 1.2-meter antennas, with quality comparable to that obtained with the Anik B experiments.

One U. S. company, United Satellite Communications, Inc. (USCI), began offering DBS service to customers in late 1983, using transponder capacity on the Canadian Anik system. Programming is premium entertainment, sports, news, and a video guide. Receive units, costing about $600 (plus installation), with a diameter of 1.2-1.4 meter are being used. Another company, Private Satellite Network (PSN) utilizes capacity on the SBS system and offers institutional DBS service. Other satellite systems will soon be launching spacecraft which will operate in the Ku-band, including GTE Spacenet, RCA Satcom, and Western Union's WESTAR. They will have the capability of transmitting to small receive antennas. In addition, a number of new applications have been filed for satellites to operate in the Ku-band with medium power (e.g., 20 watts) transponders, which will be able to transmit to antennas of about 1 meter diameter.

Thus, DBS capability is available now for the educational community to utilize, and capacity for this type of application will grow rapidly. The way matters stand now, it appears that the "true" DBS satellite will have little, if any advantage over the medium-power Ku-band fixed satellite. The space segment cost would be much higher, while the receive unit cost would be about the same (e.g., STC's plan envisions receive units about 2½ feet in diameter and costing about $500).

EQUIPMENT

A number of manufacturers are entering the DBS receive equipment market and have developed products.

General Instrument, for example, is the exclusive supplier of receive terminals for the USCI DBS operation. These home units include a 1.0 or 1.2 meter dish antenna and associated electronics. The price of the unit is about $600, plus installation. RCA Service Company installs and maintains the equipment; it is marketed through Radio Shack retail outlets.

Alcoa-NEC and other manufacturers have developed similar receive units for DBS applications.

DBS APPLICATIONS FOR EDUCATION

DBS can be effectively used for educational and instructional purposes. To a certain extent, it is already being done by business and government, utilizing fixed satellites. The lower cost of Ku-band technology will make it more available to nonprofit organizations such as the educational community.

For example, the U. S. Army Health Services Command uses the WESTAR system for medical education teleconferences. Live broadcasts are transmitted daily from Brooke Army Medical Center at Fort Sam Houston, Texas, to physicians and other health care professionals at Army hospitals at Fort Hood, Texas; Fort Sill, Oklahoma; and Fort Polk, Louisiana. One-time seminars and teleconferences utilizing one-way video and two-way audio are becoming widespread. Many firms have come into existence in order to assist in the production of teleconferences. Complete services may include network configuration, obtaining transponder time, obtaining transmit and receive facilities, and arranging viewing facilities for the intended audience. A number of hotel chains have installed receive units at various locations and offer teleconferencing facilities. An educational organization could easily avail itself of these facilities and services to carry out instructional programs.

These networks generally use the C-band satellites (such as WESTAR and SATCOM), and the ground segment is costly.

For example, the Holiday Inn chain has installed C-band receive units in several hundred of its motel locations at a cost of about $20,000-$30,000 each, including engineering and installation.

Private business networks utilizing satellite transmission are emerging, many of them utilizing the Ku-band satellites such as SBS. Video teleconferencing was at first viewed as an executive tool. Now, however, these facilities are increasingly being utilized for training sessions and instruction. The educational community could participate in this activity.

A number of businesses have installed Ku-band receive systems for various purposes. For example, Texas Instruments has installed receive units at 22 of its company locations and uses them to receive video transmissions of its annual meeting. In this way, many more stockholders can participate in the meeting than would be able to otherwise. This type of network would be eminently adaptable to vocational education and instructional uses. If, for example, Texas Instruments wanted to instruct assembly line workers in some new techniques, demonstrations could be easily transmitted to the company locations by satellite. This would eliminate the need for heavy expenses which would be incurred in sending all the workers to a central training center.

CONFIGURATIONS AND COST

Table 1 shows various hypothetical configurations for an educational DBS operation, utilizing facilities and equipment now available. Various levels of programming activity are shown for both C-band and Ku-band operations, with a ground segment of 1,000 receive antennas. The annual cost for the various configurations is shown. The programming cost is assumed at $5,000 per hour. The transponder lease cost is based on actual tariffs charged by U. S. domestic satellite systems. The receive unit cost for the Ku-band operation is assumed as $750 ($600 for the unit plus $150 installation), with a 10-year amortization period, or $75 per year annualized. The recei e unit for the C-band is assumed to be just the basic antenna system type utilized in CATV applications, amortized over te years, for an annualized cost of $550.

With programming 1 hour weekly, the ground segment dominates the cost, and the C-band operation is more than twice as expensive as the Ku-band operation. With one hour of programming daily, the programming cost dominates, but the C-band operation is still more than 25% higher than the Ku-band operation.

In the next level, programming 12 hours per day, five days per week, 52 weeks per year is assumed. The transponder lease cost for the Ku-band is based on an SBS tariff for use of a transponder 24 hours per day, 5 days per week, 52 weeks per year. This rate is used instead of the hourly rate because, even if the customer uses the transponder only 12 hours per day, the total lease charge is less with the full-time lease than with the hourly rate. The remaining 12 hours daily could be used for repeating material. At this level of programming, it is the transponder lease charge that becomes the pivot, and the Ku-band operation is slightly more expensive than the C-band operation.

Table 2 compares the same programming levels, but with a ground segment of 10,000 receive units instead of 10,000. With the larger ground segment, the Ku-band operation is clearly more cost effective at all levels of programming.

Full-time educational programming on Ku-band with a ground segment of 10,000 receive units could be accomplished for approximately $18 million per year. This amount is only 0.2% of the $8.1 billion that the Federal Government spent on vocational education in 1980.

The reader can posit different assumptions regarding programming cost and ground segment cost and calculate the results.

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Table 1

ANNUAL COSTS
EDUCATIONAL DBS OPERATION
HYPOTHETICAL CONFIGURATIONS

GROUND SEGMENT: 1,000 RECEIVE UNITS

	C-Band	Ku-Band
Programming: 1 hour per week, 52 weeks per year (52 hours/year)		
Programming cost	$ 260,000	$ 260,000
Transponder lease	15,600	31,200
Ground segment	550,000	75,000
Total annualized costs	$ 825,600	$ 366,200
Programming: 1 hour per day, 5 days per week, 52 weeks per year (260 hours/year)		
Programming cost	$ 1,300,000	$ 1,300,000
Transponder lease	78,000	156,000
Ground segment	550,000	75,000
Total annualized costs	$ 1,928,000	$ 1,531,000
Programming: 12 hours per day, 5 days per week, 52 weeks per year (3,120 hours/year)		
Programming cost	$15,600,000	$15,600,000
Transponder lease	840,000	1,680,000
Ground segment	550,000	75,000
Total annualized costs	$16,990,000	$17,355,000

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Table 2

ANNUAL COSTS
EDUCATIONAL DBS OPERATION
HYPOTHETICAL CONFIGURATIONS

GROUND SEGMENT: 10,000 RECEIVE UNITS

	C-Band	Ku-Band
Programming: 1 hour per week, 52 weeks per year (52 hours/year)		
Programming cost	$ 260,000	$ 260,000
Transponder lease	15,500	31,200
Ground segment	5,500,000	750,000
Total annualized costs	$ 5,775,600	$ 1,041,200
Programming: 1 hour per day, 5 days per week, 52 weeks per year (260 hours/year)		
Programming cost	$ 1,300,000	$ 1,300,000
Transponder lease	78,000	156,000
Ground segment	5,500,000	750,000
Total annualized costs	$ 6,878,000	$ 2,206,000
Programming: 12 hours per day, 5 days per week, 52 weeks per year (3,120 hours/year)		
Programming cost	$15,600,000	$15,600,000
Transponder lease	840,000	1,680,000
Ground segment	5,500,000	750,000
Total annualized costs	$21,940,000	$18,030,000

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APPENDIX D

ORGANIZATIONS RELATING TO TELECOMMUNICATIONS
AND
DISTANCE LEARNING

From the ROME database

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BRS
1200 ROUTE 7
LATHAM, NEW YORK 12110

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AN 001969 8312.
FN 000775.
RT ORGANIZATION.
TI CENTER FOR INTERACTIVE PROGRAMS (CIP).
DI PARKER, LORNE, DIRECTOR.
CI LORNE PARKER, DIRECTOR
CENTER FOR INTERACTIVE PROGRAMS
OLD RADIO HALL
975 OBSERVATORY DRIVE
MADISON, WISCONSIN 53706.
PH (608) 262-4342.
FS GRANTS. COST RECOVERY PRODUCTS.
OT INFORMATION - RESOURCE - INSTRUCTIONAL MATERIALS CENTER.
DE ONLINE-SYSTEMS. TELECOMMUNICATIONS. TELECONFERENCING.
TELEPHONE-COMMUNICATIONS.
IO INTERACTIVE SYSTEMS.
AB THE CENTER FOR INTERACTIVE PROGRAMS (CIP) IS AN INTERNATIONAL TRAINING AND RESOURCE CENTER ON TELECONFERENCING AND TWO-WAY ELECTRONIC COMMUNICATIONS ESTABLISHED TO CENTRALIZE INFORMATION ON INTERACTIVE MEDIA.

FOUNDED IN 1977 BY THE UNIVERSITY OF WISCONSIN-EXTENSION, THE CENTER, WITH A STAFF OF NINE SERVES PROFESSIONALS AND OTHERS INTERESTED IN INTERACTIVE MEDIA.

PUBLICATIONS OF THE CENTER INCLUDE AUDIOVISUAL MATERIALS, BOOKS, PAPERS, HANDBOOKS, AND A NEWSLETTER.

THE CENTER HOLDS SEMINARS AND CONFERENCES AND PROVIDES TECHNICAL ASSISTANCE THROUGH PROFESSIONAL DEVELOPMENT AND ONE-ON-ONE TRAINING PROGRAMS.
SO UPDATE (SAW NOV 83).

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AN 002425 8403.
FN 000569.
RT ORGANIZATION.
TI CENTER FOR LEARNING AND TELECOMMUNICATIONS (CLT).
DI KRESSEL, MARILYN, DIRECTOR.
CI MARILYN KRESSEL, DIRECTOR
CENTER FOR LEARNING AND TELECOMMUNICATIONS
AMERICAN ASSOCIATION FOR HIGHER EDUCATION
ONE DUPONT CIRCLE, SUITE 680
WASHINGTON, DC 20036.
PH (202) 293-6440.
FS GRANTS. MEMBERSHIP FEES.
OT NETWORK. PROFESSIONAL ASSOCIATION.
DE ADULT-EDUCATION. BROADCAST-TELEVISION. CABLE-TELEVISION. COMMUNICATIONS-SATELLITES. COMPUTERS. DIAL-ACCESS-INFORMATION-SYSTEMS. EDUCATIONAL-TECHNOLOGY. HIGHER-EDUCATION. TELECOMMUNICATIONS. TELECONFERENCING-X.
AB THE CENTER FOR LEARNING AND TELECOMMUNICATIONS (CLT) PROMOTES INFORMATION COLLECTION AND DISSEMINATION ABOUT THE POTENTIAL OF TELECOMMUNNICATIONS IN HIGHER EDUCATION.

THIS PROFESSIONAL ORGANIZATION SERVES ADMINISTRATORS, MANAGERS, EDUCATORS, TECHNICIANS, STUDENTS AND OTHERS INTERESTED IN THE POTENTIAL OF TECHNOLOGY-BASED INSTRUCTION THROUGHOUT THE UNITED STATES. THE CENTER IS AFFILIATED WITH THE AMERICAN ASSOCIATION FOR HIGHER EDUCATION.

PUBLICATIONS OF THE CENTER INCLUDE A NEWSLETTER.

RESEARCH AND DEVELOPMENT ACTIVITIES OF THE CENTER FOCUS ON TELECOMMUNICATIONS IN HIGHER EDUCATION.

THE CENTER FOR LEARNING AND TELECOMMUNICATIONS CONDUCTS AN ANNUAL MEETING AND OFFERS TECHNICAL ASSISTANCE.
SO "TELESCAN" REC SEP 81 (LMJ DEC 81).

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AN 003790 8308.
FN 001272.
RT ORGANIZATION.
TI CENTRAL EDUCATION NETWORK-POST-SECONDARY EDUCATION COUNCIL (CEN-PSEC).
DI WEAVER, JERRY D., ACTING PRESIDENT.
CI CAROL A. KOFFARNUS, VICE PRESIDENT
CENTRAL EDUCATION NETWORK-POST-SECONDARY EDUCATION COUNCIL
4300 WEST PETERSON AVENUE
CHICAGO, ILLINOIS 60646.
PH (312) 545-7500.
FS GRANTS. MEMBERSHIP FEES. COST RECOVERY PRODUCTS.
OT NETWORK.
NT CONTACT CEN-PSEC FOR MEMBERSHIP CATEGORIES AND FEES.
DE EDUCATIONAL-MEDIA. EDUCATIONAL-TECHNOLOGY. EDUCATIONAL-TELEVISION. FILM-PRODUCTION. POSTSECONDARY-EDUCATION. PRODUCTION-TECHNIQUES. RADIO. TELECOMMUNICATIONS.
AB THE PURPOSE OF THE CENTRAL EDUCATIONAL NETWORK-POST-SECONDARY EDUCATION COUNCIL (CEN-PSEC) IS TO DEVELOP COOPERATIVE SYSTEMS IN THE MEMBER STATES AND TO SHARE EXPERTISE AND RESOURCES WHICH STRENGTHEN POST-SECONDARY EDUCATIONAL OPPORTUNITIES FOR THE ADULT LEARNER THROUGH THE IDENTIFICATION OF PROBLEMS, ISSUES, AND SUCCESSFUL MODELS IN THE USE OF EDUCATIONAL TELECOMMUNICATIONS.

FOUNDED IN 1967, THIS NETWORK WITH A STAFF OF 11 SERVES PUBLIC TELEVISION MANAGERS, PROGRAM MANAGERS, SCHOOLS, AND VOCATIONAL-TECHNICAL INSTITUTIONS IN THE UNITED STATES.

PUBLICATIONS OF CEN-PSEC INCLUDE A NEWSLETTER, "PSEC MEMO" (10 PER YEAR, FREE TO MEMBERS), A BIMONTHLY NEWSLETTER, "CENTRAL FOCUS" (FREE TO MEMBERS), ANNUAL REPORTS, BIBLIOGRAPHIES, AND ORGANIZATIONAL BROCHURES.

THE PSEC CONDUCTS AN ANNUAL NEEDS ASSESSMENT FOR ITS MEMBERS, EVALUATES WITH THE MEMBERS OVER 65 INSTRUCTIONAL TELEVISION AND RADIO SERIES EACH YEAR, AND SURVEYS THE MEMBERSHIP FOR CONSORTIUM PRODUCTION DEVELOPMENT.

THE CEN-PSEC HOLDS WORKSHOPS AND PROVIDES CONSULTATION SERVICES.
SO CEN-PSEC PROFILE REC MAR 83 (NMG MAY 83).

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RUTH 05/09/84 ROME
QUERY 0106 APR 1984

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AN 001475 8312.
FN 000089.
RT ORGANIZATION.
TI EDUCATIONAL RESOURCE INFORMATION CENTER CLEARINGHOUSE ON INFORMATION RESOURCES (ERIC-IR).
DI ELY, DONALD P., DIRECTOR.
CI DONALD P
ERIC CLEARINGHOUSE ON INFORMATION RESOURCES
SYRACUSE UNIVERSITY, SCHOOL OF EDUCATION
130 HUNTINGTON HALL
SYRACUSE, NEW YORK 13210.
PH (315) 423-3640.
FS GRANTS.
OT CLEARINGHOUSE. INFORMATION - RESOURCE - INSTRUCTIONAL MATERIALS CENTER.
DE BIBLIOGRAPHIES. EDUCATIONAL-MEDIA. EDUCATIONAL-RESEARCH. EDUCATIONAL-RESOURCES. EDUCATIONAL-TECHNOLOGY. INFORMATION-DISSEMINATION. INFORMATION-PROCESSING. INFORMATION-SCIENCE. INFORMATION-SCIENTISTS. LIBRARY-ADMINISTRATION. LIBRARY-EDUCATION. LIBRARY-INSTRUCTION. LIBRARY-RESEARCH. MULTIMEDIA-INSTRUCTION. PROGRAMED-INSTRUCTION.
ID ERIC CLEARINGHOUSE ON INFORMATION RESOURCES (ERIC-IR).
AB THE CLEARINGHOUSE IS RESPONSIBLE FOR IDENTIFYING, ACQUIRING, SELECTING, AND PROCESSING EDUCATIONAL DOCUMENTS AND JOURNAL ARTICLES FOR INCLUSION IN THE ERIC SYSTEM AND FOR ANNOUNCING THEM IN "RESOURCES IN EDUCATION" (RIE) OR "CURRENT INDEX TO JOURNALS IN EDUCATION" (CIJE). THE SCOPE OF THE CLEARINGHOUSE INCLUDES (1) MANAGEMENT, OPERATION AND USE OF LIBRARIES; (2) THE TECHNOLOGY TO IMPROVE THEIR OPERATION AND THE EDUCATION, TRAINING AND PROFESSIONAL ACTIVITIES OF LIBRARIANS AND INFORMATION SCIENTISTS; AND (3) EDUCATIONAL TECHNIQUES INVOLVED IN MICROTEACHING, SYSTEMS ANALYSIS, AND PROGRAMED INSTRUCTION EMPLOYING AUDIOVISUAL TEACHING AIDS AND TECHNOLOGY, SUCH AS TELEVISION, RADIO, COMPUTERS, CABLE TELEVISION, COMMUNICATION SATELLITES, MICROFORMS, AND PUBLIC TELEVISION.

FOUNDED IN 1974, THE CLEARINGHOUSE WITH A STAFF OF SIX SERVES ADMINISTRATORS AND EDUCATORS INVOLVED WITH INFORMATION RESOURCES, AS WELL AS RESEARCHERS, AND BOTH PRIVATE AND GOVERNMENTAL AGENCIES THROUGHOUT THE UNITED STATES.

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THE CLEARINGHOUSE MAKES PRESENTATIONS ON THE USE OF ERIC TOOLS AND MATERIALS.
SO ERIC-IR UPDATE (SAW NOV 83).

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RUTH 05/09/84 ROME
QUERY 0105 APR 1984

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AN 004554 8312.
FN 001414.
RT ORGANIZATION.
TI INTERNATIONAL COUNCIL FOR DISTANCE EDUCATION (ICDE).
DI DANIEL, JOHN, PRESIDENT.
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INTERNATIONAL COUNCIL FOR DISTANCE EDUCATION
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MONTREAL: CANADA H3G 1M8.
PH (514) 879-2864.
FS GRANTS. MEMBERSHIP FEES.
OT NETWORK. PROFESSIONAL ASSOCIATION.
NT ANNUAL MEMBERSHIP FEES; INDIVIDUAL, $40.00; INSTITUTIONAL, $100.00; LIBRARY, $35.00.
DE CORRESPONDENCE-SCHOOLS. CORRESPONDENCE-STUDY. EXTENSION-EDUCATION. HOME-STUDY. INDEPENDENT-STUDY. NONTRADITIONAL-EDUCATION. PROPRIETARY-SCHOOLS.
AB THE PURPOSE OF THE INTERNATIONAL COUNCIL FOR DISTANCE EDUCATION (ICDE) IS TO PROMOTE AND IMPROVE ALL FORMS OF EDUCATION IN WHICH TEACHER AND LEARNER CARRY OUT THEIR ESSENTIAL TASKS APART, REPLACING CLASSROOM CONTACT THROUGH OTHER MEDIA. MEMBERS REPRESENT A WIDE VARIETY OF APPROACHES TO TEACHING AT A DISTANCE. THESE APPROACHES INCLUDE: PROPRIETARY AND GOVERNMENT CORRESPONDENCE SCHOOLS; RURAL DEVELOPMENT PROJECTS; EDUCATIONAL BROADCASTERS; EXTENSION OR EXTERNAL STUDIES DEPARTMENTS; TELECONFERENCING NETWORKS; OPEN UNIVERSITIES; CONSORTIA OF TRADITIONAL INSTITUTIONS; COMMUNITY EDUCATION PROJECTS; PUBLISHERS; INSTRUCTIONAL PACKAGES FOR COMPUTERS; AND SATELLITE LINKAGES.

FOUNDED IN 1938, THIS PROFESSIONAL ASSOCIATION IS ADMINISTERED BY AN EXECUTIVE COMMITTEE OF 7 (REPRESENTING 7 NATIONS) AND A SECRETARY-TREASURER AND A PUBLICATIONS SECRETARY. THE COUNCIL HAS 40 INSTITUTIONAL MEMBERS AND 444 INDIVIDUAL MEMBERS IN 50 COUNTRIES, WHICH ARE SERVED BY THE ORGANIZATION. ICDE WAS FORMERLY KNOWN AS THE INTERNATIONAL COUNCIL FOR CORRESPONDENCE EDUCATION.

ICDE PUBLISHES BOOKS AND THE "BULLETIN OF ICDE" (3 ISSUES PER YEAR, $35.00). IT ALSO MAINTAINS CONSULTANT FILES AND A SPEAKERS BUREAU. THE RESEARCH COMMITTEE MONITORS CURRENT RESEARCH AND SCHOLARSHIP ON DISTANCE EDUCATION AND PRESENTS A REVIEW OF ICDE'S WORLD CONFERENCE (HELD AT INTERVALS OF 3-4 YEARS).

ICDE ALSO CONDUCTS WORKSHOPS, SEMINARS AND MEETINGS.
SO ICDE PROFILE REC OCT 83 (JCB OCT 83).

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AN 002412 8304.
FN 000762.
RT ORGANIZATION.
TI PACIFIC TELECOMMUNICATIONS COUNCIL (PTC).
DI BARBER, RICHARD J., DIRECTOR.
CI RICHARD J
PACIFIC TELECOMMUNICATIONS COUNCIL
1110 UNIVERSITY AVENUE, SUITE 303
HONOLULU, HAWAII 96826.
PH (808) 941-3789; (808) 949-5752.
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AB THE PACIFIC TELECOMMUNICATIONS CENTER (PTC) IS DEDICATED TO THE DEVELOPMENT, UNDERSTANDING, AND BENEFICIAL USE OF TELECOMMUNICATIONS IN THE PACIFIC AREA.

FOUNDED IN 1980, THIS PROFESSIONAL ORGANIZATION WITH A STAFF OF 4 AND A MEMBERSHIP OF OVER 130 ORGANIZATIONS AND INDIVIDUALS SERVES THOSE INTERESTED IN TELECOMMUNICATIONS IN THE PACIFIC AREA.

PUBLICATIONS OF PTC INCLUDE A NEWSLETTER, RESEARCH REPORTS, ANNUAL CONFERENCE PROCEEDINGS, AND ORGANIZATIONAL LITERATURE. THE COUNCIL ALSO PROVIDES A FORUM FOR DISCUSSION AND EXCHANGE OF INFORMATION.

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PTC CONDUCTS MEETINGS, SEMINARS, AND OFFERS TECHNICAL ASSISTANCE.
SO PTC BROCHURE REC SEPT 81 (LMJ APR 82).

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RT ORGANIZATION.
TI PUBLIC SERVICE SATELLITE CONSORTIUM (PSSC).
DI YOUNG, ELIZABETH L., PRESIDENT.
CI ELIZABETH L. YOUNG, PRESIDENT
PUBLIC SERVICE SATELLITE CONSORTIUM
1660 L STREET, NW, SUITE 907
WASHINGTON, DC 20036.
PH (202) 331-1154.
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OT COALITION - CONSORTIUM - COOPERATIVE.
DE COMMUNICATIONS-SATELLITES. INFORMATION-NETWORK. TELECONFERENCING.
AB THE OBJECTIVES OF THE PUBLIC SERVICE SATELLITE CONSORTIUM (PSSC) ARE TO ASSIST PUBLIC SERVICE ORGANIZATIONS TO DELIVER THEIR SERVICES MORE EFFICIENTLY THROUGH THE USE OF NEW COMMUNICATIONS TECHNOLOGIES; TO EXPRESS INTERESTS OF MEMBERS AT NATIONAL AND INTERNATIONAL FORUMS; AND TO INFLUENCE THE FUTURE DEVELOPMENT OF SATELLITE TECHNOLOGY. PSSC PROVIDES VIDEO AND AUDIO DISTRIBUTION OF PROGRAMMING ON ITS NATIONAL SATELLITE NETWORK.

FOUNDED IN 1975, THIS CONSORTIUM SERVES ITS 105 MEMBER UNIVERSITIES, LEGAL ASSOCIATIONS, STATE AGENCIES, RELIGIOUS GROUPS AND LABOR UNIONS. THE CONSORTIUM'S FOR PROFIT, WHOLLY OWNED SUBSIDIARY, SERVICES BY SATELLITE (SATSERV) OFFERS SIMILAR SERVICES TO CORPORATE CLIENTS AND RECENTLY LAUNCHED CAMPUS CONFERENCE NETWORK, A NETWORK OF EARTH STATION AND VIDEO-TELECONFERENCING FACILITIES ON COLLEGE CAMPUSES.

PUBLICATIONS INCLUDE A MONTHLY NEWSLETTER, "REPORT TO MEMBERS" (BIMONTHLY), AND "TELEGUIDE: A HANDBOOK FOR VIDEO TELECONFERENCE PLANNERS" ($34.50).

PSSC OFFERS TELECOMMUNICATIONS CONSULTING, INCLUDING TECHNICAL PLANNING, NETWORK FEASIBILITY, AND SIGNAL DISTRIBUTION STUDIES. PSSC MAINTAINS TECHNICAL FACILITIES IN DENVER, COLORADO, INCLUDING A SATELLITE ACCESS FACILITY WITH NETWORK CONTROL CENTER, EARTH STATIONS, A TELECONFERENCE STUDIO AND ASSOCIATED VIEWING ROOMS, AND A TRANSPORTABLE EARTH STATION.

PSSC CONDUCTS PERIODIC SEMINARS AND WORKSHOPS.
SO PSSC FILE (SAW NOV 83).

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APPENDIX E

MAKING SATELLITE DELIVERY MORE ACCESSIBLE TO EDUCATION: THE BIRTH OF TELEPORTS

Bruce Klopfenstein

In discussing the future of satellite delivery of educational services, one of the limiting factors is the ability to "get on" the satellite system. The number of uplink facilities available to do this nationwide is limited. The Public Broadcasting Service, for example, has seventeen uplinks located across the country. While this may not seem to be a great number of locations, the PBS satellite system is one of the more extensive systems in place. The purpose of this section is to introduce an innovation currently underway which may make accessing satellites easier in the near future.

Background

The explosive growth of satellite communications and recent deregulation in the telecommunications industry are serving as catalysts for the development of a new concept--the "teleport." While the term may be unfamiliar to many today, teleports have already attracted more than a billion dollars of investment capital. Just as airports and seaports have been centers for transportation and trade, teleports promise to be nodes for the electronic trading of today and tomorrow. As we enter the information age, many believe that easy access to telecommunication networks will be crucial to the economic growth of a region. Hence the analogy of the port: rather than handling travelers and shipments of goods, the teleport will handle the movement of information--data, voice, and video.

Definition

Just what is a teleport? A new trade association of teleports has been working on a definition. The key point is that a teleport is a fixed satellite uplink/downlink facility (for transmitting to and receiving from communication satellites) that not only has access to telecommunication networks, but also provides support services (e.g., management, marketing, and maintenance facilities). It is important to note that a teleport is more than an "antenna farm"; the teleport organization services users and its physical facility may be part of a research park or other real estate development project.

Current Teleport Activity

According to Satellite Week, The United States has at least eight cities with operational "teleports": Denver, Seattle, Salt Lake City, Phoenix, Raleigh, Tallahassee, Washington, and Chicago ("National Teleport Association" 1983). Estimates suggest that approximately 50 U.S. cities, including Columbus, Ohio, are involved in some stage of the planning or implementation of a teleport facility. Dayton, Ohio, for example, is in the process of evaluating the potential benefits of a teleport. Among the interested parties is the Dayton-Miami Valley consortium, a group of more than twenty area technical schools and colleges. Sinclair College in Dayton is active in telelearning and continuing education projects and could use a teleport to deliver its materials to students well beyond the reach of Dayton's broadcast and cable television systems (both of which are currently used by Sinclair). Internationally, Great Britain, France, and Japan are among a growing list of about 20 foreign countries currently developing teleport plans. A World Teleport Conference was held recently in New York to help facilitate and coordinate these efforts.

New York Teleport

Perhaps the best known teleport project is the one well underway in New York. Known as "The Teleport," this undertaking is not only a major telecommunications facility but also a massive real estate development project. The $225-$300 million complex is a joint venture of Merrill Lynch (which itself spends over $100 million annually on telecommunications), Western Union (which is constructing, marketing, and maintaining the teleport) and the Port Authority of New York and New Jersey (which controls various rights-of way from the city to the teleport). While the New York Teleport serves a unique market, it nevertheless may act as a model for other teleports across the country and around the world.

Potential Teleport Users

The list of potential teleport users is lengthy. Anyone involved in the electronic transmission of voice, data, or video should be interested: Among the organizations deeply involved in information processing (and thus most likely to be teleport users) are insurance companies, financial institutions, retailers, broadcasters, dataprocessing companies, government agencies, and even telephone companies. A teleport could be extremely useful to those interested in teleconferencing not only because of its uplink capabilities, but also as a possible teleconferencing or telelearning production facility.

Regulatory Environment

The regulatory status of teleports at this point remains unclear. Teleports are part of a growing number of so-called "bypass technologies." This refers to a communication technology used to "bypass" the telephone network. Increased telephone costs due to the break-up of AT&T and technological advances in telecommunications are making it possible for subscribers to develop their own less expensive systems (e.g., private microwave, satellite, and digital termination service, or DTS). Congress has yet to act definitively as to whether or not such systems should be taxed to support the existing loop. Teleports may be subject to such legislation if or when it is enacted.

The FCC could also determine that teleports should be regulated as common carriers, subject to the same rules and regulatiions that govern the telephone industry. Even if the FCC does not act, state public utility commissions may claim jurisdiction over teleports engaging in intrastate service. Teleport regulatory issues are likely to surface as the industry begins to develop.

Conclusions

Much remains to be seen in the area of teleport development. The good news for those interested in the delivery of educational services by satellite is that teleports will offer new competiton in the field of satellite telecommunications. This promises to bring more services and lower costs to satellite system users.

In areas where teleports are being planned (some of which may be publicly owned), those in the educational community should stay aware of developments as well as offer input. While the primary impetus for teleport development appears to be coming from the private sector, teleport developers need all the users they can find in order to make the concept viable. Video users will be especially important because of the large bandwidth necessary for video telecommunication. Education could be an influential voice in the success or failure of the teleport concept.

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APPENDIX F

THE POTENTIAL OF VIDEOTEX IN EDUCATION

Andrew Calabrese

Videotex is a generic term used to refer to the electronic publication of digital text, data, and graphics. There are two general types of videotex. One has been labeled "teletext," and it is the one-way, downstream transmission of a signal, transmitted either over the airwaves or by cable. This one-way flow of information is limited by the size and content of the information being sent downstream at any one point in time. The other type of videotex, called "interactive videotex" or "viewdata," is a two-way technology which provides greater flexibility and choice. The user is able to "call up" the database and specify the narrow topic about which he or she needs information.

A distinct advantage of viewdata over teletext is that there is no limit to the size of the database. With teletext the user must wait for a desired piece of information to "pass by" and then capture it. Consequently, the database for a teletext service must not be so large as to cause the user to wait a long time for the information to circulate. This is not to say that teletext has no value in education, but teletext is not as conducive to student-instructor or student-machine interaction as viewdata.

A very practical application of satellite transmission is possible in distributing a teletext signal. Depending on the size of the satellite's footprint, national or regional distribution of text, data, and graphics is possible. Students registered in telecourses could receive assignments, computer programs, and supplementary materials via direct broadcast satellites, possible in conjunction with live or taped video instruction. An alternative to residential service would be students receiving printouts of the information at various distributed classroom sites. This scenario holds great potential in serving some of the training and education needs of large organizations with offices spread out over the country. Using teletext, the same training "package" could be sent to all of the organization's branches simultaneously.

Viewdata is the form of videotex with the greatest number of subscribers. The popularity of viewdata is so great relative to teletext that the terms "viewdata" and "videotex" generally are used interchangeably in the trade press. Viewdata offers great promise for user interactivity. Viewdata not only makes it possible for subscribers to communicate among themselves (unlike teletext), but also makes it possible for subscribers to send messages upstream directly to host computers for various applications. As a result, it is possible to distribute programmed learning courses and keep accurate, detailed logs of student progress and difficulties.

International Resources Development Inc., a leading information industry research firm, estimates the revenues for "telesoftware" to reach $15.4 billion by 1993 (Videoprint, 6/22/83). The lion's share of this software, much of which will be in the simple form of information retrieval databases (electronic publishing), will be available only through two-way telecommunication channels. Satellites will play a significant role in transmission as long distance communication relies increasingly on such channels. However, as with teletext, commercial and public viewdata venders will not experience a need for satellite transmission unless they are attempting to reach national or regional educational markets.

At present, very little focus has been given to the uses of videotex in education. There are a number of possible reasons. For instance, electronic banking and shopping services are the most heavily promoted and widely known consumer videotex services. Another significant reason is that very little research has gone into studying or developing the potential applications of online database services for consumers (compared with science and industry). Among the educational videotex projects which have been or currently are in operation are the following:

- o OCLC (Online Computer Library Center) conducted a market test in 1981 called Channel 2000. Services included home banking, library services, and catalog shopping. Elementary math and reading were also taught.

- o WETA-TV in Washington, DC conducted a publicly-funded teletext trial beginning in 1981. Federal sponsors included the corporation for Public Broadcasting, the National Science Foundation, and the U.S. Department of Education. The database includes scientific information provided by the Smithsonian Institution.

- o Project Green Thumb in Kentucky, a viewdata service, provides extension education to farmers.

Several other organizations are or have been involved in using videotex for such educational applications as the distribution of instructional programs and reference materials. Companies include Cox Cable's INDAX, Knight-Ridder Publishing's Viewtron, Times Mirror's Gateway, and Compuserve's consumer information service. In addition, several Canadian videotex projects are offering similar educational services.

Tydeman, Lipinski et al. (1982) suggest the following educational uses of videotex:

- o course listings for extension and night school classes, available by subject, location, fee, etc;

- o computer assisted learning, designed to satisfy the individual's speed and ability;

- o interactive courses for homebound students;

- o do-it-your-self training, such as home and auto repair, cooking, etc.; and

- o retraining, using tutorial programs linking new job interests and available positions.

These applications are all here today to one degree or another. Greater expansion in the use of videotex in adult education will continue to occur due to the declining cost of microcomputers, a growing emphasis on self-paced learning, and the increasing demand for time flexibility in the educational marketplace.

The diffusion of many technological innovations tends to occur in the business sector before reaching traditional educational markets. This clearly is the case with videotex. Today, we are seeing a widespread movement towards the use of online information services, currently a $1.2 billion market and growing at the rate of 30% annually (Forbes, 5/9/83). Much of this information is used in science and industry for research and decision making.

Satellite distribution of educational services using both teletext and viewdata has not passed the experimental or introductory stage. However, due to the savings which are possible in providing many types of vocational instruction and support, we are bound to see a greater push in this direction. Presently the safest bet for educational institutions wanting to enhance their vocational curricula through videotex applications is to seek cooperative efforts with other institutions. When the costs are shared by two or more organizations, the benefits of the technology will be more attainable.

State and federal educational programs, private ventures, and public/commercial collaborative efforts should all play important parts in expanding the role of videotex in vocational education. Satellites offer the greatest potential for the larger efforts, due to the economics of scale large geographic markets will help create. Vocational training and education is likely to increase as a priority in the future. The time will never be better for entrepreneurial educators to raise their learning curves in anticipation of the increasing competition for students.

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Periodicals

Note: Below is a listing of magazines and newsletters addressing the topic of electronic media: videotex, teletext, electronic publishing, teleservices, etc.

Broadcasting
Broadcasting Publications, Inc.
1735 DeSales Street, N.W.
Washington, DC 20036
(202) 661-7410
Published: 51 times a year

Byte
Byte Publications Inc.
70 Main Street
Peterborough, NH 03458
(603) 924-9281
Published: Monthly

Cable Age
(Television Editorial Corp.)
1270 Avenue of the Americas
New York, NY 10020
(212) 757-8400
Published: Biweekly

Cable Marketing
Associated Cable Enterprises, Inc.
352 Park Avenue South
New York, NY 10010
(212) 685-4848
Published: Monthly

Channels of Communications
Media Commentary Council, Inc.
1515 Broadway
New York, NY 10036
(212) 398-1300
Published: Bimonthly

Communication News
Harcourt Brace Jovanovich Publications
124 South First Street
Geneva, Illinois 60144
(312) 232-1400
Published: Monthly

Computer Communications Review
Association for Computing Machinery
1733 Avenue of the Americas
New York, NY 10036

Computerworld
C W Communications/Inc.
Box 800
375 Cochitute Road
Framingham, MA 01701
(617) 879-0700
Published: weekly

Data Communications
McGraw-Hill Publications Company
McGraw-Hill Building
1221 Avenue of the Americas
New York, NY 10020
(212) 977-1221
Published: Monthly

Datamation
Technical Publishing (D&B Corporation)
875 Third Avenue
New York, NY 10022
Published: Monthly

Dowline
Dow Jones News/Retrieval Magazine
Dow Jones & Company, Inc.
P.O. Box 300
Princeton, NJ 08540
(800) 257-5714
Published: Quarterly for Customers of Dow Jones News/Retrieval Service

Editor & Publisher
Editor & Publisher Company
575 Lexington Avenue
New York, NY 10022
(212) 752-7050
Published: Weekly

Electronic Media
Crain Communications Inc.
740 Rush Street
Chicago, Illinois 60611
(312) 210-0294
Published: Weekly

Electronic News
Fairchild Publications Inc.
7 East 12th Street
New York, NY 10003
(212) 741-4230
Published: Weekly

Electronic Publishing Review
Learned Information Inc.
Box 550
Marlton, NJ 08053
(609) 654-6266
Published: Quarterly

Federal Communications Law Journal
UCLA School of Law
405 Hildegarde
Los Angeles, CA 90024

The Futurist
World Future Society
4916 St Elmo Avenue
Bethesda, MD 20814
(301) 656-8274

IEEE Transactions on Consumer Electronics
Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street
New York, NY 10017
(212) 705-7018

Infoworld
530 Lytton Avenue
Palo Alto, CA 94301
(415) 328-4602
Published: Weekly

Marketing Communications
United Business Publications Inc.--A Subsidiary of Media Horizons, Inc.
475 Park Avenue South
New York, NY 10016
(212) 683-8430
Published: Monthly

Multichannel News
Fairchild Publications
300 South Jackson
Denver, CO 80209
(303) 393-6397
Published: Weekly

Online Database Reports
Online Inc.
11 Tanney Lane
Weston, CT 06883
(203) 227-8466
Published: 6 times a year

Satellite Communications
Cardiff Publishing Co.
6340 South Yosemite Street
Englewood, Colorado 80111
Published: Monthly

Telecommunications
Horizon House-Microwave, Inc.
610 Washington Street
Dedham, Massachusetts 02026
(617) 326-8220
Published: Monthly

Telecommunications Policy
IPC Business Press Ltd.
205 East 42nd Street
New York, NY 10017
(212) 867-2080
Published: Quarterly

Telephony
Telephony Publishing Corporation
55 East Hackson
Chicago, Illinois 60604
(312) 922-2435
Published: Weekly

Today
CompuServe, Inc.
Information Service Division
5000 Arlington Centre Boulevard
Columbus, OH 43220
(614) 457-8600
Published: Monthly for subscribers to CompuServe

Videodisc/Videotex Magazine
Microform Review Inc.
520 Riverside Avenue
Department 31
Westport, CT 06880
(201) 228-6967
Published: Quarterly

Videotex Canada
Tele-Direct (Publications) Inc.
P.O. Box 8000, Station "A"
Toronto, Ontario, Canada M5W ITA
Published: Monthly with listings of Canadian videotex systems.

Videotex/Teletext
Paul Kagan Associates
26536 Carmel Rancho Boulevard
Carmel, CA 93923
Published: Bimonthly

Viewdata and TV user
LPC Business Press
Room 1203
Quadrant House
The Quadrant, Sutton
Surry, SM25AS England
Published: Monthly, with listings of Prestel services

Newsletters

Cable News
Phillips Publishing, Inc.
7315 Wisconsin Avenue
Bethesda, MD 20814
(301) 986-0666
Published: Biweekly

Cable TV Technology
Paul Kagan Associates, Inc
26386 Carmel Rancho Lane
Carmel, CA 93923
(408) 624-1536
Published: Twice Monthly

Data Channels
Phillips Publishing, Inc.
7315 Wisconsin Avenue
Bethesda, MD 20814
(301) 968-0666
Published: Biweekly

Electronic Publisher
Paul Kagan Associated, Inc.
26386 Carmel Rancho Lane
Carmel, CA 93923
(408) 624-1536
Published: Biweekly

ADP Report (Information and Data Base Publishing Report)
Knowledge Industry Publications, Inc.
701 Westchester Avenue
White Plains, NY 10604
(416) 328-9157
Published: Biweekly

Inside Viewdata
Mills & Allen Communications Ltd.
1-4 Longly Court
Long Acre
London WC2E 9YJ England
Published: Monthly

International Videotex Teletext News
Arlen Communications Inc.
7315 Wisconsin Avenue, Suite 600E
Bethesda, MD 20814
(301) 656-7940
Published: Monthly with special editions

The Seybold Report on Publishing Systems
Seybold Publications, Inc.
Box 644
Media, PA 19063
Published: Twice a month

Talk Teletext
Marketing Solutions Ltd.
70 Salusbury Road
London, NW6 6NU, England
Published: Bimonthly with British Teletext Promotional information

Telcom Insider
International Data Corporation
PO Box 915
214 Third Avenue
Waltham, MA 02154
(617) 890-3700
Published: Monthly

The Next Step: Television and the New Technologies
McCann-Erickson
485 Lexington Avenue
New York, NY 10017
(212) 697-6000

Teleservices Report
Arlen Communications Inc.
7315 Wisconsin Avenue, Suite 600E
Bethesda, MD 20814
(301) 656-7940
Published: Monthly

Telidon Reports
Department of Communications
Government of Canada
Journal Tower South
300 Slater Street
Ottawa, Ontario, Canada K1A 0C8
Published: Monthly

Videoprint
International Research and Development Inc.
30 High Street
Norwalk, CT 06851
(203) 866-6914
Published: Semimonthly

Viewdata/videotext Report
LINK
215 Park Avenue South
New York, NY 10003
(212) 473-5600
Published: Monthly

Viewtext
Information Gatekeepers, Inc.
167 Corey Road
Brookline, MA 02146
(617) 739-2022
Published: Monthly

The Viewtron Newsletter
Viewdata Corporation of America Inc.
1111 Lincoln Road
Miami Beach, FL 33139
(305) 674-1444
Published: Irregularly with corporate information

Worldwide Videotex Update
PO Box 138
Babson Park Branch
Boston, MA 02157
Published: Monthly

APPENDIX G

SELECTING AN EARTH STATION
Prepared for The National University Teleconferencing Network
Videostar Connections, Inc.
Atlanta, Georgia
(800) 241-8850

Contact: Jim Arp

General Information

In selecting equipment for an earth station, whether it be a fixed or transportable type, it is important to purchase from a manufacturer of "commercial grade" equipment. Although less expensive equipment is available for consumer or "home" earth stations, this equipment does not have the long term stability or performance required for commercial teleconferencing service.

Commercial grade equipment can be defined as equipment manufactured for cable television or broadcast applications by leading suppliers. Some manufacturers include Microdyne, Scientific Atlanta, Andrew, Avantek, M/A Com and others. Commercial grade equipment is manufactured for reliable operation over long periods of time and for wide ranges of environmental conditions. The leading manufacturers of commercial type equipment have also established reputations in the industry for equipment reliability, customer support and maintenance.

Money invested in commercial equipment will certainly pay off in reduced maintenance and reliable service over a long period. The following sections will discuss various types of equipment in each catagory to help you decide what is needed for your particular location.

Antenna

Careful consideration should be spent on choosing the best antenna for your particular application. The first decision should be whether to buy a fixed or transportable antenna. To make this choice, one should carefully evaluate the proposed usage of the antenna. If your application requires reception of the satellite signal at several locations which are not served by a common television distribution system, a transportable earth station antenna will be most helpful. However, a transportable antenna usually requires more skilled manpower to operate, and a vehicle is required to move the antenna to each new location. If your location only requires reception of the satellite signal at a central location with signal distribution to several locations via cable or microwave, then a fixed antenna will probably serve best. With a fixed antenna, it is generally easier to re-point the antenna to different satellites from time to time since satellite positions may be marked on the antenna mount or stored in the controller of a motorized system.

VideoStar Connections, Inc. • 3390 Peachtree Road • Atlanta, Georgia 30326 • Telephone 404 262-1555

Another key consideration in selecting an antenna is the size or diameter of the "dish". Antennas for the popular C-band satellites range in size from about 3 meters in diameter (10 feet) to an average of 7 meters for receive-only sites. As a rule, the larger the antenna, the better reception one can expect. Typically, a 5 meter antenna produces excellent reception for teleconferencing or distribution purposes and is recommended for fixed installations. For transportable applications, a minimum diameter of 12 feet should be used. Transportable antennas in the 5 meter size are available and highly recommended, but may present some restrictions in towing, set-up and storage.

Potential interference from terrestrial microwave (generally from existing telephone company facilities) must be considered in selecting an antenna. Your particular site may or may not be exposed to these interferring microwave transmitters. To be absolutely sure, a survey of the proposed site should be conducted. Frequency coordination services, such as Compucon or Comsearch, can produce reports of potential interference sources at your site or conduct on-site measurements of actual interference levels. Probably the best way of determining if interference is a problem at your site is to compare the results of a computerized interference study with a transportable antenna and electronics set up at the site to look at actual performance on several satellites. If interference is present, it can sometimes be minimized by attaching filters to the receivers or taking advantage of natural shielding from buildings or local terrain. In many cases, relocating the site a few feet to take advantage of shielding from a nearby building may reduce interference to acceptable levels. Also, larger antennas are usually more directional and can reduce interference by rejecting signals adjacent to the desired pointing angle of the antenna. Typically, sites located in or nearby downtown areas will be affected to a greater degree by microwave interference.

A recent ruling from the FCC also affects antenna selection. A program to reduce spacing between satellites from the present 4.0 degrees to 2.0 degrees will take place over the next several years. This means that earth station antennas must become more directional with improved performance characteristics to prevent the earth station from receiving signals from two adjacent satellites simultaneously. Generally this requires larger diameter antennas with feeds designed to reject the signals of closely spaced adjacent satellites. Antennas which do not meet this requirement can receive unacceptable interference when adjacent satellites are actually moved closer together in space.

Another consideration in selecting an antenna is the ability to receive Ku-band signals as well as C-band transmissions. Most of the teleconferencing signals today are received on the C-band satellites, but there is an ever increasing amount of traffic on the newer Ku-band. Ku-band reception is not plagued by terrestrial microwave because it operates on different frequency bands. Many downtown locations may only be accessible on Ku-band due to terrestrial microwave interference on the lower C-band frequencies. Purchasing an antenna now with capabilities for both bands will allow expansion at a later date for Ku-band reception.

Electronics

The required earth station receiving electronics consists of two basic components. These are the low noise amplifier, located at the antenna, and the video receiver, which is usually located at some convenient inside location. The low noise amplifier, or LNA, simply amplifies the weak signal from the antenna to a usable level for the receiver. LNAs are rated in different noise temperatures (expressed in degrees Kelvin or °K). The lower the noise temperature, the higher the carrier-to-noise ratio, producing a better picture. Typically, an LNA with a noise temperature of 100-120°K will produce an acceptable picture on a 5 meter antenna. With smaller diameter antennas, at least a 90°K LNA is usually required. LNAs with lower noise temperatures are generally higher in price.

A variation of the LNA is called a Low Noise Converter (LNC) or Block Downconverter (BDC). An LNC or BDC amplifies the signal, as in an LNA, but also converts the high microwave frequencies down to the UHF range and allows some cost savings by utilizing a less expensive interconnecting cable to the receiver. The LNC or BDC configuration also allows longer cable runs which may be required in some locations. BDCs are also available for use on Ku-band, and some manufacturers have designed receivers to operate on both C- and Ku-band, dependant on which BDC is used. This results in a significant cost savings for sites operating in both bands.

Receivers are usually selected on the basis of features available. If you are utilizing an LNA on the antenna, be sure that the receiver accepts a 4 Ghz input. If using an LNC or BDC, be sure that the downconverted output is compatible with the receiver input. Consult the specific vendor for this information. With today's state-of-the-art receivers, many features are usually available. Useful features to check for include 24 channel C-band tuning capability (insure different channel format capability for Ku-band receivers), automatic polarization switching, signal strength display, adjustable video and audio levels and capabilities for receiving multiple audio subcarriers. Again, select receivers of commercial grade from leading manufacturers.

Finally, a very important consideration for commercial earth station electronics is equipment redundancy. All electronic components should be 100% backed up with standby equipment to prevent loss of the teleconference signal due to equipment failure.

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