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ABSTRACT

Many schools across the United States have been using distance learning technologies to help them meet new state-mandated curriculum requirements. Distance learning refers to the live, simultaneous transmission of a master teacher's lessons from a host classroom or studio to receive site classrooms in distant locations. Schools with the most to gain from distance learning technologies are rural and small schools--those with low student enrollments and/or those lacking trained personnel. This paper summarizes present technologies that allow live, two-way audio and/or visual interaction between two or more sites simultaneously for educational purposes. Emphasis is on programs specifically benefitting students in rural and small schools. Descriptions are given for the four most widely used instructional television satellite systems, two-way interactive television systems, Instructional Television Fixed Service (ITFS) systems, audio-graphic teleconferencing, and audio-teleconferencing. Appendix A lists addresses of successful, on-going distance learning projects that interested readers can contact for additional information. Appendix B presents names, addresses, and brief descriptions of 57 telecommunications vendors in the United States. (JHZ)

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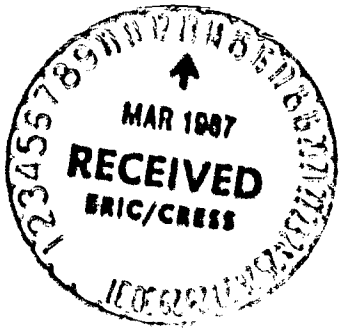
USING INTERACTIVE TECHNOLOGIES TO INCREASE COURSE OFFERINGS IN SMALL AND RURAL SCHOOLS

Paper Presented at the Seventh Annual Conference for Microcomputers and Technology in K-12 Education

"Technology in Today's Classroom"

March 12-13, 1987
Southern Illinois University
Carbondale, Illinois



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USING INTERACTIVE DISTANCE LEARNING TECHNOLOGIES TO INCREASE COURSE OFFERINGS IN RURAL AND SMALL SCHOOLS

Today's technologies have given birth to a new pair of educational buzz words -- "distance learning." With limited fanfare, many schools across the United States have been using distance learning technologies to help them meet new state mandated curriculum requirements. Distance learning refers to the live, simultaneous transmission of a master teacher's lessons from a host classroom or studio to receive site classrooms in distant locations. Two-way audio communication (in some cases two way-video) between the teacher and students makes the instruction interactive. Ideally, students are able to both see and hear their "distant" teacher as well as "call in" for questions or feedback. In most cases, students at any one site are able to maintain audio or video interaction with students in other distant sites as well. Schools with the most to gain from distance learning technologies are those with low student enrollments and/or those lacking trained personnel.

Distance Learning Technologies

Distance learning technologies make it possible for rural and small schools to offer a full and varied curriculum, as well as quality teacher inservice training, without consolidating schools and without physically transporting teachers from one location to another. Several approaches are available. The most common seem to be some form of audio teleconferencing linked with microcomputers, videotapes, and/or print materials; or interactive television which integrates satellite, fiber optics, microwave, cable, slow scan TV, or ITFS (Instructional Television Fixed Service), technologies.

The purpose of this paper is to (1) provide a brief description of some of the more popular distance learning technologies being used, and (2) present a list of successful program/projects interested readers can contact for further information.

Satellite Transmissions

Four instructional television satellite systems are presently broadcasting instruction to high school students scattered throughout the continental United States. One-way full-motion video is transmitted from the uplink studio to

subscribing schools. Audio talk-back by participants is over regular telephone lines, thereby making the systems interactive.

The largest system, the TI-IN Network, operates out of Texas. At the beginning of the 1986-87 school year, TI-IN was beaming lessons for 17 different high school credit courses five days each week to over 145 subscribing high schools in 12 different states. In addition, the network beams extensive inservice training for teachers and enrichment programs for students across the K-12 curriculum.

The second largest network is comprised of schools subscribing to Oklahoma State University's Arts and Sciences Teleconferencing Service. OSU began broadcasting a single semester of German language instruction in January 1985. At the beginning of the 1986-87 school year, broadcasts were received by 101 districts in six states and offerings had been expanded to two full years of German and a full year of high school physics. New courses planned for 1987-88 include pre-calculus, Russian language, and chemistry. Unlike the TI-IN Network, OSU's satellite courses are broadcast only three days each week rather than five. On the non-broadcast days, students work individually at their schools on computer assisted lessons which have been specifically designed by OSU educators. Extensive inservice training and K-12 student enrichment programming is also provided by the network.

The third largest instructional satellite system is operated by the Utah State Department of Education with support from the IBM Corporation and Bonneville International Corporation. Utah's satellite system is distinctly different from each of the other instructional satellite systems now in operation. Instead of broadcasting live instruction, previously recorded videotapes are beamed to the receive site schools. Furthermore, there is no audio talk-back component to allow students to pick up the telephone and call their TV teacher to ask questions or seek information. Over 800 students in six states were participating on the network at the start of the 1986-87 school year. Lessons are broadcast every other day. On the non-broadcast days, students complete individual work assignments on IBM PC Junior microcomputers which include voice synthesis capabilities. Spanish language is the only course offered.

The most recent entrant into the high school instructional satellite market is Eastern Washington University located outside Spokane. In conjunction with Education Service District #101, the network began the broadcast of four high school courses to 15 schools in

Washington in the Fall of 1986. The operation of this network most closely parallels the TI-IN Network. Live instruction is beamed to subscribing high school five days each week. Inservice training to teachers is also provided.

School administrators interested in investigating instructional satellite systems for adoption in their district should consider two cost factors: (1) equipment costs, and (2) annual subscription fees. Required equipment for each of the satellite systems includes a downlink or satellite receive dish, a TV monitor, and assorted telecommunications devices. In addition, schools joining either the OSU or Utah networks will need to acquire, unless they already have them, one microcomputer for every two students enrolling in coursework. The microcomputers must be compatible with software produced by the respective network. OSU uses Apple IIe's. Utah uses IBM PC Juniors and one IBM XT. Initial equipment costs vary among vendors, with ranges between $4500 to $15,000. Interested readers should contact the networks directly for information on current prices and for help in identifying precise equipment needs. Annual subscription fees also vary. Typically, fees for high school programming are separate from fees for teacher inservice training, etc. Depending on the extent of programming desired, annual subscription fees may be as low as $1600 or as high as $10,000.

The application of satellite technology for interactive television instruction in public schools is still in its infancy. The future will undoubtedly see more program producers enter the airwaves. Already school officials in Missouri and Kentucky have proposed statewide systems. As existing networks grow and new networks begin beaming instruction, interest in other states is expected to mushroom.

Two-Way Interactive Television

Many model two-way video and two-way audio interactive television systems are becoming operative in small schools. Successful projects are underway in Illinois, Iowa, Wisconsin, New York, Minnesota, and other states. In most systems, each school on the network has a fully equipped television classroom which allows a teacher in one location and students at one or more locations to both see and hear each other during the instructional broadcast. Transmission may be over cable, fiber optics, microwave, etc. The typical model is a cooperative arrangement between five to eight districts to form a telecommunications network. The network coops human, financial, and equipment resources to provide interactive television programming over several channels

between member schools. Programming usually includes elementary/secondary courses and inservice training for teachers. A variety of other courses may also be offered such as vocational instruction, library programs, community education classes, story hours, general interest topics, etc. Instructional television permitting two-way video and two-way audio interaction between cooperating school districts is one of the fastest growing -- and most promising -- distant learning alternatives available for small and geographically isolated rural schools. The fact that participating schools maintain local control of their programming is also an appealing aspect of this technology.

Costs for two-way video/two-way audio instructional television systems are very expensive. Among the cooperatives which have been organized, total equipment investment has ranged anywhere from $400,000 to two million dollars. Costs are shared among cooperative members. In most cases, they have been offset with sizeable federal, state, or private grants. Partnership arrangements between schools, cable companies, and rural telephone companies have also resulted in a significant reduction of direct costs to some schools.

Instructional Television Fixed Service (ITFS)

ITFS systems are FCC licensed, low power line-of-sight TV broadcast stations that transmit omnidirectional signals a maximum distance of about 40 miles. In most cases, ITFS stations are located in large metropolitan areas, benefiting large schools in urban and suburban settings. Small rural schools near or adjacent to the respective metro area may also benefit by receiving the signal. Most ITFS systems are one-way video with the possibility of two-way audio interaction. The audio interaction is typically over regular telephone lines.

ITFS has inherent advantages and disadvantages over other instructional television systems. Advantages are that four channels are usually licensed to one operator. Only one antenna is needed by receive site schools to pick up signals for all four channels. Hence, the host site is able to broadcast on four different channels simultaneously, enabling distant schools to receive a variety of programs. Disadvantages center on (1) the limited broadcast range due to the low power broadcast, and (2) on the expense of the technology. Initial equipment costs for the broadcast site can range from $100,000 on up. Receive sites will need to purchase an antenna, down converter, and possibly repeaters if they are a long distance from the station. Costs for

receive sites can range anywhere from $1000 to $4000; more if a repeater is added.

ITFS systems are operative in many of our large cities. Examples of two large systems are the InterAct system in Houston and the Regional Instructional Television Consortium (RITC) in Richardson, Texas. Both systems, discussed in more detail below, are characteristic of others like them across the country.

The Region IV Education Service Center in Houston operates the InterAct Instructional Television Network. Using closed circuit microwave technology, video and audio signals originate from the InterAct studios. From there, they are dispersed via omnidirectional microwave to subscribing receive sites in the seven county Gulf-coast area. Receive sites are equipped with a tower, antenna, down converter and an audio talk-back converter. The receive classrooms are equipped with modified television sets and talk-back instruments. Over 30 school districts subscribe to the network, including several small schools in the area. Program offerings include selected high school courses, K-12 student enrichment viewing, staff development, and college credit courses.

The Regional Instructional Television Consortium is a cooperative effort of almost 50 public and private schools. The purpose is to provide high quality instructional television to schools and communities in North Texas. Again, participants are chiefly large schools located in the Dallas-Fort Worth metroplex, yet numerous small schools in outlying areas are also members. RITC broadcasts eight hours of instructional programming each school day across the K-12 curriculum. The evening hours are devoted to college courses and continuing education. Most RITC programs are one-way video and one-way audio only.

Audio-Graphic Teleconferencing

Microcomputer networks and electronic mail systems are becoming common place in many schools. A relatively new approach to microcomputer networking is to intergrate PC's with live, telephone interaction. Microcomputers are linked via modems over regular telephone lines coupled with an audio bridge over a separate set of phone lines.

Audio-graphic teleconferencing is a PC-based system that incorporates a graphics tablet which functions much like an electronic chalkboard. The system requires specially designed software. Once on-line with other compatible PC's, the system operates on a "common screen"

basis -- that is, whatever graphic or print material is executed from any one screen (location) shows up on all the other screens (locations) at the same time. The technology is capable of operating in either a "preechi" mode or an "interact" mode. The teacher (or students) can prepare pages prior to "class" and store them on disk. During instruction, disk content can be distributed electronically to each user simultaneously. Audio-graphic teleconferencing also permits real time interactive writing and/or annotation on blank or existing screens. Along with graphics/print interaction, an audio bridge permits immediate voice interaction between all users.

Successful audio-graphic distance learning programs have been piloted in Utah, Pennsylvania, and New York. One disadvantage of this approach is that the teacher cannot see the students nor can students see the teacher. Oral communication over the audio bridge and visual communication in the form of computer graphics or print, of necessity, must be well designed inorder to maximize instruction. Proponents of audio-graphic teleconferencing claim that this necessity gives this approach to distance learning its most positive feature, the necessity for teacher/student interaction. In order for audio-graphic teleconferencing to work well, students must be actively involved in the learning process. They must be more than recipients of instruction -- they must also be participants.

Costs for audio-graphic teleconferencing include equipment charges as well as long-distance phone service for the audio bridge. Hardware, speaker phones, and associated communications software can be expected to run between $9000 to $11,000. Long distance phone charges will vary between geographical regions, but are likely to range between $.15 per hour (for Watts line) to $.45 per hour for prime time commercial use.

Audio-Teleconferencing

The correspondence study department at the University of Nebraska-Lincoln offers several advanced placement and dual credit (high school credit and college credit) correspondence study courses to rural high schools. The program differs from traditional correspondence study in that five times during the semester in which students are enrolled in a course, site visits are made by the instructor to meet with students and assist them in their coursework. In addition, participating students are linked at their school by a speaker phone with the at-a-distance instructor from the University for scheduled audio instruction. The cost to individual schools is about $220 for the hook-up and

speaker phone, plus the cost of long distance telephone service. The tuition cost for students enrolling for dual credit is $147 per semester hour.

UNL also offers tele-language instruction in German, French, and Spanish. The program was initiated in the fall of 1985 to assist Nebraska schools in providing the 20 hour foreign language requirement mandated by educational reforms. The program is for high school credit only (no dual credit), and is available in both Nebraska and elsewhere. Participating schools pay a site fee of $300 per course per semester. The tuition fee is $30 per student per semester. At the local school, a certified teacher (not necessarily in the foreign language) serves as the supervisor for the class. Regularly scheduled telephone conference calls are offered in conjunction with print materials and audio tapes supplied by the University.

Recommendations to School Administrators

We live in an age of ever increasing change and advancement. School administrators today do not need to become technological experts, but there is wisdom in becoming technologically astute and aware of current and emerging technologies that will enhance learning opportunities for students. School officials must keep abreast of what is happening technologically as it relates to applications for student instruction

How do interested administrators bring their schools on-line to distance learning? The best approach is to contact others who have experienced success. Addresses of some of the programs mentioned in this paper are listed in the Appendix. Interested school officials should carefully assess needs and resources -- specifically student curriculum and inservice training needs, and budget capability. Once a decision on a system is made, support should be sought from other school leaders, the community, and key groups before investing in expensive technologies. It would be wise to contact the state office of education and seek advice from state education leaders. Some states have restrictions on telecommunicated instruction, especially when in originates from out-of-state. It is also important to remember the diverse nature of rural America and of rural and small schools. No one distance learning model or practice necessarily "fits all sizes." Modification of existing practices or models may be needed in order to determine the best approach to meet local needs.

Another consideration is the matter of maintenance and warranty. Anyone who drives a car knows that technology

doesn't always work. The more technology you hook together to form a system, the greater the possibility that things can go wrong. Who is going to fix things when they break? Maintenance agreements and equipment warranties are important considerations when setting up a system of subscribing to a program product.

Remarks and Conclusion

The intent of this paper has been to briefly describe present technologies which allow live, two-way audio and/or video interaction between two or more sites simultaneously for educational purposes. These have generally focused on programs specifically benefiting students in rural and small schools. Another purpose has been to present addresses of successful, on-going distant learning projects that interested readers can contact for additional information. Addresses are listed in Appendix A. It should be understood that the specific programs discussed herein are not inclusive. Still, many other exciting applications of technology are occuring in small and rural schools around the county. Appendix B of this paper presents names, addresses, and brief descriptions of many telecommunications vendors in the United States. The list was first published in Teleconference: The Business Communication Magazine, volume 5 number 5, September/October 1986. It is reprinted here with permission.

As administrators in rural and small schools strive to deliver quality education to their students, the obstacles of teacher availability, low student enrollments, and geographical isolation beg for solutions. In the past, approaches such as pairing agreements, traveling teachers, correspondence study courses, and school district consolidation were seen as possible answers. These practices still have value; however, new -- and in some cases better approaches -- are now available through technology. The concept of distance learning is sweeping this country. Among the chief beneficiaries will be our nation's rural and small schools. This is not to suggest that distance learning is an educational panacea. Quality instruction by a certified teacher in the classroom is still the ideal way to educate students. Yet in remote and isolated schools where a certified teacher is not always available or in small schools where limited student enrollments make hiring teachers for low incident courses cost prohibitive, instruction via distance learning technologies may be the "next best thing to being there."

APPENDIX A

APPENDIX

For more information on distance learning technologies mentioned in this paper, interested readers are encouraged to contact any of the following.

Satellite Transmission

The TI-IN Network
100 East NASA Road, Suite 201
Webster, Texas 77598
Telephone: (713) 554-5545

Arts and Sciences Teleconferencing Service
Arts and Sciences Extension
206 Life Sciences East
Oklahoma State University
Stillwater, Oklahoma 74078-0276
Telephone: (405) 624-5647

Instructional Technologies
Utah State Office of Education
250 East 500 South
Salt Lake City, Utah 84111
Telephone: (801) 533-5573

Telecommunications Project
Education Service District #101
West 1025 Indiana
Spokane, Washington 99205
Telephone: (509) 456-7660

Two-Way Interactive Television

Tele-Systems Associates, Inc.
11995 Singletree Lane, Suite 210
Minneapolis, Minnesota 55344
(612) 829-5881

Director
Knowledge Interactive Distribution System
St. Peter High School
Lincoln Drive, Room 130
St. Peter, Minnesota 56082
(507) 931-4210

East Central Minnesota Educational Cable Cooperative
Westview High School
Braham, Minnesota 55006
(612) 396-3674

Carrol Instructional Television Consortium
200 South School Street
Lanark, Illinois 61046
(815) 493-6301

Trempealeau County Kellog Project
205 Offeo Road
P.O. Box 326
Independence, Wisconsin 54747
(715) 985-3004

Communicasting Project
Woodland Cooperative Center
N.E. 5th Street
Staples, Minnesota 56479
(218) 894-2438

Morning Sun Community School District
P.O. Box 129
Morning Sun, Iowa 52640
(319) 868-7702

Instructional Televison Fixed Service (ITFS)

Regional Instructional Television
8221 Towns Street
Dallas, Texas 75243
(214) 235-7770

InterAct Instructional Television Network
Region IV Education Service Center
P.O. Box 863
Houston, Texas 77001
(713) 462-7708

Audio-Graphic Teleconferencing

Tele-Learning Network
Garfield County School District
Box 398
Panquitch, Utah 84759
(801) 676-8821

Tele-Teaching Project
Mansfield University
Mansfield, Pennsylvania 16933
(717) 662-4578

Interactive Tele-Learning Network
Delaware-Chenango B.O.C.E.S.
RD 3, East River Road
Norwich, New York 13815
(607) 336-6514

Optel Communications Inc.
322 8th Avenue
New York, New York 10001
(212) 741-9000

Audio-Teleconferencing

Division of Continuing Education
33rd Holdrege Street
University of Nebraska-Lincoln
Lincoln, Nebraska 68583
(402) 472-1926

APPENDIX B

The following list of vendors were exhibitors at TeleCon VI, the world's largest trade show and conference devoted entirely to teleconferencing, October 27-29, 1986, Anaheim, California. This list of vendors was published in Teleconference: The Business Communication Magazine, Vol. 5, No. 5, Sept./Oct. 1986. Used with permission.

AMERICAN SATELLITE, A CONTEL COMPANY
1801 Research Blvd.
Rockville, MD 20850
(800) 638-8514
Booth # 802

ASC provides a wide range of custom tailored services for voice, data, video, fax and international communications to more than 750 major businesses and government agencies. Service is provided through ASC's owned and leased satellite capacity and a ground network of more than 380 earth stations nationwide

AMERICAN VIDEO FACTORY
4150 Glencoe Avenue
Marina Del Rey, CA 90292
Andy Maisner, Jacqueline Marsall
(213) 823-8622-(800) For Video
Booth # 1200, 1202

American Video Factory's talented staff, utilizing over 4 million dollars of the most sophisticated video production and post production equipment, ensures clients such as ABC, NBC, Showtime, Xerox and Hughes the quality and reliability that comes from 250 man years of experience. AVF provides backup for everything, thus ensuring reliability.

AMERICAN VIDEO TELECONFERENCING CORPORATION
110 Bi-County Boulevard, Suite #115
Farmingdale, NY 11735
Neil Lewis
(516) 420-8080
Booth # 803, 702

American Video Teleconferecing Corporation (AVTC) is a public company engaged in the development, manufacture, and sales of teleconferencing systems, products, and support services which serve the needs of business, government, educational institutions, and health care facilities. AVTC provides practical, cost-effective teleconferencing systems. The company's principal products are the INFORUM™ Teleconferencing System, the EMCEE™ Teleconferencing Room Controller and In-synch™, the PC to PC conferencing Connection.

AT&T
295 N. Maple Drive, Room 524C2
Basking Ridge, NJ 07920
Gary White
(201) 221-7138
Booth "C"

AT&T will be presenting their full range of teleconferencing products and services, in this, the first teleconferencing show since their integration of Communications and Information Systems

AVELEX
5100 G Philadelphia Way
Lanham, MD 20706
Julianne Wallace
(800) 872-6332
Booth "F"

Avelex manufactures a full-motion video codec based on its patented coding or compression technique. This technique offers a high quality signal at transmission speeds ranging from 56 Kbps to 1.5 Mbps. The Avelex codec combines audio, video, and high resolution graphics on one transmission line at every speed.

BONNEVILLE SATELLITE CORPORATION
19 West South Temple
Salt Lake City, Utah 84111
Blaine D. Cotton
(801) 534-8031-L.A. (213) 467-8900
Wash., DC (202) 737-4440
N.Y. (212) 935-5150
Booth # 209

Specializes in the design and implementation of analog and digital private networks. Offers turnkey transmission services for ad hoc videoconferences. Owns and operates transponders on Westar, Spacenet and G-Star in C, Ku-Band. Operates uplinks, studios, microwave, rentable videoconferencing facilities, technical centers in Washington DC, Los Angeles, New York, San Diego and Salt Lake City.

BOOK NOOK
Applied Business teleCommunications
PO Box 5906
San Ramon, CA 94583
Lisa Robinson
(415) 820-5563
Booth # 1400, 1401

Books on teleconferencing can be purchased from Aplied Business teleCommunications at the conference, or by mail. Call for more information.

BOTA CONSULTING
950 Gladstone Avenue
Ottawa, Canada K1Y 3E6
Dr. Radamis Botros
(613) 722-0037
Booth # 902

BOTA: Teleconferencing and Acoustics Consulting Ltd. specializes in audio teleconferencing. Activities include research and development in voice telecommunication, development, manufacture, marketing and servicing of audio teleconferencing hardware, acoustic consultation in interior room acoustics and noise control, especially for conference rooms, board rooms and auditoria.

COLORADO VIDEO, INC.
PO Box 928
Boulder, Colorado 80306
Jim Dole
(303) 444-3972
Booth # 700, 801

Colorado Video, Inc., headquartered in Boulder, Colorado, has designed and manufactured freeze-frame video communications systems for over twenty years. The company offers a wide variety of analog/digital units. Related teleconferencing products include a computer-based image storage system (similar to an electronic slide file) and a video multiplexer used in full-motion video teleconferencing systems.

COMPRESSION LABS, INC
2305 Bering Drive
San Jose, CA 95131
Carol Fuller
(408) 946-3060
Booth — See ESI Corporation

Compression Labs Inc offers video teleconferencing equipment including the REMBRANDT™ for digital video compression and a variety of room packages. The REMBRANDT features a wide range of transmission rates between 384 Kbps and 3.136 Mbps for full motion color videoconferencing. It provides compatibility between NTSC, PAL and RGB video signals in addition to combining the audio, graphics and data on the same channel.

COMPUTECH INTERNATIONAL
2801 Youngfield, Suite 240
Golden, Colorado
William R. Drykos
(800) 525-8244
Booth # 215

"Premiering the new TEMPO, digital audio/audio graphic teleconferencing system. Features include remote operator terminal and wide range of options"

CONNEX
12 West Street
Danbury, CT 06810
Bobbi Heyel
(800) 243-9430
Booth # 808

An independent telephone conferencing service that provides bridging capabilities to link multiple locations for audio teleconferences domestically or worldwide. Also offers audiographic conferencing, audio connections for video conferences, user training, annual seminar, and Private-Label services. Consulting services available from subsidiary, Connex Associates.

DAROME INC.
5725 N. East River Road, Suite 735
Chicago, ILL 60631
Bob Stewart
(312) 399-1610
Booth # 107

Darome, Inc. manufactures and markets audio teleconferencing equipment. The Darome Connection, an audio teleconferencing service, can link up to the 600 locations in one telephone call. Offices are located throughout the U.S., Canada and Europe.

DATABEAM CORPORATION
3256 Lochness Drive
Lexington, Kentucky 40503
Pete Gammon
(606) 273-3204
Booth # 1[illegible],111

DataBeam CT 2000 is a high resolution graphic communication and display system, equipped with control keypad and transportable cabinet. Images of written or graphic materials, or PC data, are transmitted via standard phone lines or high speed digital circuits for point-to-point or multipoint conferences. The system provides pointers and interactive annotation with a 2,048 x 2,048 line resolution display, digital scanner and laser printer.

DATAPOINT CORPORATION
9725 Datapoint Drive M/S T-60
San Antonio, TX 78284
George Leonard
(512) 699-5267
Booth "H"

Datapoint Corporation develops, manufactures and markets worldwide local area network (LAN) - based information systems. Datapoint's MNX product family offers full integration of video, voice and data information in a single workstation and local area network solution, with a full range of long distance dial-up communications options.

E.S.I. CORPORATION
7300 York Road
Baltimore, Maryland 21204
Hank Schlitzer
(301) 821-7030
Booth "D"

ESI is a videoconferencing Terminal Equipment Supplier which manufactures, integrates and markets a full line of videoconferencing systems for business, industry, education and government entities. ESI has facilities in Baltimore, Maryland and Atlanta, Georgia.

GEC VIDEO SYSTEMS
106 Purdy Avenue
Port Chester, NY 10573
Edward Dary
(914) 937-7450
Booth "B"

GEC Video Systems will display their new "Madison" rollabout — a complete videoconference system housed in a single mobile unit. The system contains dual cameras and monitors, infrared controls, audio system, optional split screen, and the GVS 3 full-motion duplex video codec with switchable data rates of 768 kbits and 1.544 Mbits.

GENERAL INSTRUMENT CORP.
6301 Stevenson Avenue, Suite 1211
Alexandria, VA 22304
Polly Rash
(703) 461-9279
Booth # 200

General Instrument Corporation is demonstrating Star-Lok IV, the industry's fastest, most secure video scrambling system. Star-Lok IV digitally encrypts the video using a proprietary algorithm with constantly changing key. Star-Lok IV offers superb quality, fully secure transmission and high speed addressability for corporate video conferencing, direct broadcast satellite, pay per view and any cable or satellite application. Come to GI's booth for a demonstration.

HANNOVER FAIR - CEBIT
P.O. Box 7066
Princeton, NJ 08540
Donna Hyland
(609) 987-1202

Hannover Fair - CeBIT is the world's largest show and conference on office, data and communication technology.

HI-NET
3796 Lamar
Memphis, TN 38195
Jim Hines
(901) 369-5254
Booth # 300

Hi-Net is a nationwide network which provides services for ad hoc videoconferencing including planning, production, networking, room facilities, video and audio equipment, food and lodging accommodations.

IMAGE DATA CORPORATION
Box 380349
San Antonio, TX 78280-9997
Customer Information
(512) 680-2727
Booth # 903

San Antonio based Image Data, developers and manufacturers of the Photophone, introduced their pioneer product in the spring of 1985. The Photophone is a desktop video teleco one that sends clear, crisp images of people, objects, text or illustrations over ordinary dial-up telephone lines in as little as 7 seconds.

IMAGE WI
11846 Ven
Studio Cit
Sue Snyde
(818) 506-
Booth # 1

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J. Robert
(703) 556-
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(312) 940-
Booth # 1

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Mal Sega
(312) 478-
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ly, California 91604
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lest is a full video services company production coordination for tele- cing including uplinks, transponder nlinks, projection systems, venues, dination, remote producing, pre-, post production, crew and equip- rvices, animation, special effects, d graphs and insert stage for ad hoc rence production and transmission.

TIONAL TELECONFERENCING IATION
outside Drive, Suite 101
VA 22102
Brouse
)-6115
allway"

national Teleconferencing Associa- ledicated to advancing the tele- cing profession. The International erencing Association is a non-profit tion founded to provide a clear- for the exchange of information users, researchers and providers in of teleconferencing. The Association, its members and programs, advo- id promotes recognition, research, application and development of in- teleconferencing systems and

NISTRATION SERVICES
nal Road
, IL 60015
Hetzel
)-2133
104

istration Services is a division of ITS., or old Coordinator of large city-wide ions. ITS' on-line teleconferencing tion and account service was ed in 1982 due to customer demand. ides immediate phone confirmation, turnaround in written confirmations mplete accounting and demo- reporting

ID CORPORATION
st Peterson Avenue
, IL 60659
al
)-1700
711, 610

Corporation designs, manufactures rkets a full line of interactive image nications systems under the trade- of DISCON™. DISCON Systems over ordinary dial-up telephone ull images, along with graphic nts, can be rapidly transmitted. e DISCON Systems shorten decision cycles in a few seconds, scattered are converted into a cohesive, hard- and decisive "Tele-Team™ DISCON ogy has been aptly described as "The ogy of Teamwork™"

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LATCOM
10741½ Westminster
Los Angeles, CA 90034
Gary Carter
(213) 837-2456
Booth # 1308

Latcom Inc. sponsors international conferences with exhibits for computers, telecommunications and satellite technology. Presently, conferences are held in Mexico, Puerto Rico, Venezuela, Argentina, and Colombia with new shows opening in South America in 1987-88.

LUMA TELECOM, INC.
3350 Scott, Building 49
Santa Clara, CA 95054
Jeff Richey, Ray Elkins
(408) 970-9555
Booth # 912

LUMA is a visual telephone for everyday calling. LUMA sends still image snap shots over unconditioned - none lines. A speaker phone, 100 name scr. een directory, auto dialer and multiline accessories are included.

M/A-COM MAC, INC.
5 Omni Way
Chelmsford, MA 01824
Maureen Martin
(617) 272-3100
Booth # 301, 303

The MA-23DR is an alternative to cable transmission of data and voice at standard T1, T1C, T2 data rates. Data at any of these rates is inputted at baseband via twisted pair or coax to the transmitter and is outputted in exactly the same form. The MA-23DR, a true digital radio, reconstitutes the input baseband data bits at the transmitter before modulation and regenerates noise-free data bits at the receiver. The MA-23DR provides reliable short range data and voice communication links in the 21.2 to 23.6 GHz frequency band. The MA-23DR is FCC type accepted for operation throughout the common and private operational fixed bands.

MARCOM
P.O. Box 66507
Scotts Valley, CA 95066
Martin Jackson
(408) 438-4273
Booth # 713, 715

MARCOM began supplying teleconferencing systems in early 1980 after having spent nearly one year evaluating the market and developing its first system. Approximately $2.5 million in teleconferencing systems have been shipped to clients including Bechtel, Hughes Aircraft, TRW, Vitalink, and the U.S. Air Force. MARCOM builds both freeze-frame and full-motion systems.

MITSUBISHI INTERNATIONAL CORPORATION
520 Madison Avenue
New York, NY 10022
Peter Noble
(212) 605-2659
Booth # 703, 705, 707

Mitsubishi International Corporation presents the MVC-3000 Codec. The MVC-3000 offers a quality, full motion color picture at an economical price. Flexibility is an attractive feature of the CODEC as transmission rates are user selectable and range from 56-384 kbps.

MODERN OFFICE TECHNOLOGY
1100 Superior Avenue
Cleveland, OH 44114
John B. Dykeman
(216) 696-7000
Booth # 1300

Modern Office Technology serves executives and managers responsible for evaluating, buying and managing business information processing equipment and systems, office operations, white collar personnel and the design and furnishings of the office environment.

MULTILINK INCORPORATED
One Market Street
Lynn, MA 01901
Marty Burke
(617) 595-7577
Booth # 101

MultiLink Inc. is the manufacturer of the MiniLink, Links TCX52 and 54 conferencing switches. The company also operates the multilink electronic meeting service which provides multipoint audio and data based conferencing. Through the service, customers can accommodate incidental remote meetings, formulize remote electronic training and reverse telemarketing.

NATIONAL UNIVERSITY TELECONFERENCE NETWORK
332 Student Union
OSU Campus
Stillwater, Oklahoma 74078-0653
Dr. E. Marie Oberle
(405) 624-5191
Booth "Hallway"

NUTN is composed of over 170 colleges and universities dedicated to sharing technology and programming via audio, live video and computer conferencing. With experience in more than 100 ad hoc teleconferences, NUTN provides training, consultation and networking for members and outside groups. NUTN is also involved in cross networking with other program providers.

NEC AMERICA, INC.
2740 Prosperity Avenue
Fairfax, VA 22031
Richard Barale
(703) 698-5540
Booth "E"

NEC America, Inc./Radio and Transmission Systems Group manufactures NETEC-XV 15, Mbs, 768 Kbp and 512 Kbp full motion codec, NEC Electronic Writing Board, AEC-100 Audio Conference Set, Rollabouts and high-resolution graphics.

NORTHERN TELECOM, INC.
9705 Data Park
Minnetonka, MN 55343
Linda Thomson
(617) 932-8568
Booth # 612, 614

Northern Telecom is the world's leading manufacturer of fully digital telecommunications systems, and a major supplier of integrated information systems for the office. Northern Telecom Inc. has its headquarters in Nashville, Tenn. Northern Telecom employs more than 22,000 people in the U.S. in 15 manufacturing plants, 15 research and development centers, and in marketing, sales and service offices across the country.

OPTEL COMM INC.
322 8th Avenue
New York, NY 10001
Michael Mangineri
(212) 741-9000
Booth # 600, 701

Optel Communications has been serving the teleconferencing industry for the past five years. Optel was first to introduce a PC based audiographic terminal, and at Telecon VI will be highlighting new additions to its third generation of Telewriters. The Telewriter 3 PC is a complete audio/video/graphics workstation. It can store, capture, transmit and annotate upon multimedia images captured from a camera, vcr and software packages (i.e. Lotus, D-Base, Wordstar, Storyboard, etc.). T3-PC can also act as an interactive real-time electronic blackboard.

PEIRCE-PHELPS
2000 North 59th Street
Philadelphia, PA 93131
Bob Sidel
(215) 879-7171
Booth "A"

Peirce-Phelps designs, installs and maintains a broad range of teleconferencing systems and manufactures an exclusive line of "Modular" (rollabout) teleconferencing consoles. In addition, Peirce-Phelps designs, installs and maintains all types of professional video and audio systems and represents over 150 video and audio manufacturers. In 1986, Peirce-Phelps celebrates its 60th anniversary and its 25th year in the video systems business.

PICTEL CORPORATION
One Intercontinental Way
Peabody, MA 01960
Jane Casler
(617) 535-7700
Booth "E"

Pictel develops, manufactures, and markets advanced visual telecommunications systems that employ new public digital, dial-up, 56 kbps transmission services. The Pictel C-2000 Video Codec™ running at user-selectable data rates from 9.6 to 168 kbps, and the company's desktop videophone system operate over these public facilities and over private T-1 lines. ►

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PRIVATE SATELLITE NETWORK, INC.
215 Lexington Avenue
New York, NY 10016
Dana Sheehan
(212) 696-9476
Booth # 105, 106

Headquartered in New York City, Private Satellite Network, Inc. installs point to multi-point private business television networks for large corporations such as Merrill Lynch, J.C. Penney, Ford Motor Company, IBM and others using Ku-band satellite technology. In addition to private network services, Private Satellite Network is the nation's largest supplier of professional programming and public network services in the U.S. and overseas. Private Satellite Network also operates a newly formed subsidiary, Business Television™ Client Services (BTV) offering programming applications consultation, video services and facilities/operations management services.

PUBLIC SERVICE SATELLITE CONSORTIUM
600 Maryland Avenue, S.W., Suite 220
Washington, DC 20024
Louis A. Bransford
(202) 863-0890
Booth "Hallway"

PSSC is a unique telecommunications consulting firm representing the interests of a large and diverse group of nonprofit, public service organizations. In addition, PSSC provides support to experimenters on NASA's joint industry/government Advanced Communications Technology Satellite.

RICOH CORPORATION
3001 Orchard Park Way
San Jose, CA 95134
Scott Hoffman
(408) 942-8100
Booth # 905, 906

Ricoh produces unique audiographic systems unlike any other on the market. Ricoh systems permit clear, high quality audio conferencing to be combined with the transmission of documents and transparencies on a single standard telephone line. Any number of sites may be linked together via a bridge.

ROBOT RESEARCH, INC.
7591 Convoy Court
San Diego, CA 92111
Thomas Grogan
(619) 279-9430
Booth # 904

Robot Research, Inc. commercially manufactures freeze-frame phone line video transceivers for use in teleconferencing. The model 3013 features color and/or black and white transmissions at selectable resolution rates. Multi pages of memory permits storage of images for recall during teleconferencing. Quad screen display allows multi-image to [be d]isplayed.

SHURE TELECONFERENCING SYSTEMS
222 Hartrey Avenue
Evanston, IL 60202-3696
J. Richard Williams
(312) 866-2227
Booth # 101, 201

Shure will be exhibiting and demonstrating its audio teleconferencing systems. The ST6000 provides top quality permanently installed audio for video, audio/graphic, and audio teleconferencing. The ST3000 provides portable audio teleconferencing in smaller conference rooms and executive offices.

STANDARD COMMUNICATIONS
108 West Victoria Street
Carson, California 90746
Mason Trutuck
(213) 532-5300
Booth # 109

Standard Communications Corp. is a diversified, high technology communications company enjoying success in Two-way Business Radio, Marine electronics and Satellite Communications. Although the SATCOM group is the newest department, it is the fastest growing and markets a complete line of satellite reception systems for Cable, Broadcasters and Business networks.

STACY DESIGN-DEVELOPMENT
7848 Silverton Road, Suite A & B
San Diego, CA 92126
Peter Stacy
(619) 566-2800
Booth # 810

Stacy Design-Development provides consultant services with expertise in all aspects of video conference projects including conceptual design, architectural and interior design, systems engineering, installation, product development, testing and training. SDD also manufactures its own modular video conference system which combines the ambiance, functional capability and human factors of a custom dedicated room.

STEPHEN R. COVEY & ASSOCIATES
226 West 2230 North, Suite 201
Provo, UT 84604
Royce N. Krueger
(800) 331-7716
Booth # 804

Stephen R. Covey & Associates offer results-oriented management training and consulting, leadership development, strategic planning, and senior executive in-house training programs. Many of these programs will be offered via satellite, especially the popular Masters of Executive Excellence course which features authors such as Tom Peters, Kenneth Blanchard, and Stephen Covey.

STROMBERG-CARLSON CORPORATION
400 Rinehart Road
Lake Mary, Florida 32746
Peter Eagle
(305) 849-3000
Booth # 910, 911

Utilizing the following equipment, video transmission through a fiber optic system will be demonstrated: 140 Mbps, 45 Mbps, 565 LTE with supervisory capacity, and 1434E.

TELECONFERENCING SYSTEMS, INC.
Horsham Business Center, Bldg. 3
300 Welsh Road
Horsham, PA 19044
Robert V. Cotton
(215) 657-6310
Booth # 602, 604, 606

Teleconferencing Systems, Inc. Horsham, PA, designs and manufactures high resolution graphics and document transmission systems. HIRES™, the most widely used high resolution system currently available for teleconferencing, scans and transmits 2200 lines by 1700 pixels of information. The systems are used in real time interactive teleconferencing applications with transmission times of 6 to 8 seconds at transmission rates of 56 to 448 Kbs.

U.S. SPRINT'S WORLDWIDE VIDEO TELECONFERENCING NETWORK
The Meeting Channel
1815 Century Blvd.
Atlanta, GA 30345
Kim Jacobs, Tricha Crawford
(404) 982-1723
Booth # 401

U.S. Sprint's Meeting Channel is the world's largest video teleconferencing network. Currently major users in thirty-five U.S. cities and twenty-six locations in Canada and Europe use The Meeting Channel as a regular part of their business communications. The network today is all satellite, but is in transition to a hybrid network which will eventually be mostly fiber optics, but with full satellite compatibility.

VIA SATELLITE MAGAZINE
PO Box 2000-141
Mission Viejo, CA 92690
Jim Marshall
(714) 859-5502
Booth "Hallway"

Via Satellite is the news magazine of satellite broadcasting. Each month the magazine contains a news section on recent industry events, features on new technology, regulatory/legislative concerns, applications, markets, industry leaders, etc. The magazine also features departments on new products available, contracts awarded and received, corporate financial information, personnel changes, satellite programming and more. ►

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VIDEO STAR
3390 Peachtree Road Northeast
Atlanta, GA 30326
Mark Carlson
(404) 262-1555
Booth # 800

Videostar supplies television networking services for both private dedicated on premises and public single event networks. Services for private networks include design, encryption, provision and installation of equipment, operations, maintenance and satellite. Service for single-event networks include a network of earth stations in 200 first-class hotels, transportable Ku and C-band uplink and downlinks, encryption, video projection and interactive audio systems. Specialists in international transmissions.

VIDEO TELECOM CORPORATION
11302 B Metric Blvd.
Austin, Texas 78758
Susan Faust
(512) 834-9734
Booth # 1203, 1205, 1102, 1104

Video Telecom, located in Austin, Texas, was founded in 1985. The company designs, manufactures and markets a family of affordable video communication workstations to enhance management productivity. The first product provides a desktop video workstation which combines full-motion, color video with voice and data communication capability. The availability of all essential information sources in a single device contributes to enhanced distribution of data and graphics, and creates shorter, more relevant video meetings while reducing the travel time to non essential meetings.

VIDICOM
3740 Corsa Avenue, Suite #106
Westlake Village, CA 91362
L. Darrell Bevan
(818) 889-3653
Booth # 913

VIDICOM has for the past ten years specialized in the field of video and audio teleconferencing, and provides a full range of teleconferencing equipment, systems and services including system and room design, assembly, installation, training, documentation and maintenance services. As the first of the few systems integrators in the country VIDICOM is firmly committed to the concept of cost effective teleconferencing systems for industry and government.

VITALINK
1350 Charleston Road
Mountain View, CA 94043
Larry Levy
(415) 968-5465
Booth # 1314

Vitalink uniquely not only integrates full motion, modular, transportable videoconferencing systems but provides both C-band and Ku band digital earth stations, space segment and network control. On premises maintenance is provided from 240 service sites across the country. Service is backed by a 24 hour per day, 365 days per year access to Vitalink's National Operations Center.

WESTELL, INC.
7630 Quincy Street
Willowbrook, IL 60521
Ken Bird
(312) 789-0858
Booth # 812, 814

Westell is a manufacturer of special services and teleconferencing equipment including the Cr1200 conference bridge and the Cr100 portable conference terminal. Westell also operates an audio bridging service under the Westellink® banner.

WIDCOM CODEC
See World-Net Communications, Inc.

WORLD-NET COMMUNICATIONS, INC.
PO Box 1434
Los Gatos, CA 95030
Jim Sullivan
(408) 356-4471
Booth # 812, 814

A new company in teleconferencing integrating Widcom codecs into modular systems. ■