Approved January 30, 1985
Date

MINUTES OF THE SENATE COMMITTEE ON WAYS AND MEANS.

The meeting was called to order by Senator August "Gus" Bogina at
Chairperson

11:00 a.m./~~p.m.~~ on January 24, 1985 in room 123-S of the Capitol.

All members were present~~except~~:

Committee staff present:
Research Department: Mary Galligan
Scott Rothe
Revisor's Office: Norman Furse
Committee Office: Judy Bromich, Administrative Aide
Donna Collins, Secretary

Conferees appearing before the committee:

Dr. Russell Getter, Director, Division of Information Systems and Communications

Senator Bogina introduced Dr. Getter who distributed a packet of information to committee members. (See Attachment A). The packet contained charts, articles and correspondence pertaining to the State Telecommunications System.

Using a flip chart, Dr. Getter explained the information covered in the packet. He detailed the various options open to the state and stressed the benefits it would gain from having a state of the art telecommunications system. The operation of a digital system would offset some of the costs of the installation and operation. The phased implementation of a plan would begin July of 1985 and would be completed in September of 1987.

Senator Bogina announced the appointment of members to a joint sub-committee to review the Computers and Telecommunications Plan. The senate members on this committee will be Senator Werts, Vice-Chairperson, Senator Winter, Senator Johnston, and Senator Harder.

The meeting was adjourned.

GUEST LIST

COMMITTEE: Ways & Means DATE: 1/24/85

NAME (PLEASE PRINT)	ADDRESS	COMPANY/ORGANIZATION
Dave Larson	4th SOB	KCC
DENNIS DEHN	TOPEKA	SEN. WERTS' INTERN
Neal Goodson	TOPEKA	AT&T Communications
Mark Thompson	Topeka	SW Bell
Barbara Pasechka	Topeka	DISC - S.O. Bldg.
RICK EMERWOLD	"	AT+T
JEFF RUSSELL	TOPEKA	UNITED TELE.
Russ Getter	124 S. SOB	DISC
Ed Schaub	Topeka	SWBT
Jerry Sloan	"	OJA
Laura Enderson	Kansas City	AT+T - IS
Don Howe	Kansas City	AT&T - IS
Dennis Wilhamm	Topeka	Div. of Budget
Pat Myers	Topeka,	KCC
Mark Jamison	Topeka	KCC
David Brenty	Topeka	KCC
Faith Foster		DOA
Jim Pyle	Topeka	KBI

GLOSSARY

3270	IBM's designation for a series of terminals, printers, and data communications controllers used mostly on its large mainframe computers.
3274	IBM's designation for its cluster controller used to hook terminals to its mainframe computers.
3278	The IBM designation for one of its most popular terminals for mainframe computers.
3705	The IBM designation for it's communications controller used as a front-end processor. This is a specialized computer designed to handle data communications for the 370-series computers.
ACOUSTIC COUPLER	A type of low-speed modem frequently used with portable terminals. It sends and receives data using a conventional telephone handset and does not require a permanent connection to the line.
ACU	See AUTOMATIC CALLING UNIT.
ANALOG	Refers or pertains to a signaling technique in which a transmission is conveyed by modulating (varying) the frequency, amplitude, or phase of a carrier. An analog signal is typified by a continuous wavelike pattern. Analog signaling is generic to the public switched telephone network, as well as to certain other audio frequency and radio frequency facilities. A digital baseband signal generated by a business machine must be converted to analog form in order to transmit that signal over an analog facility, e.g., a voice-grade telephone line.
ASCII	American National Standard Code for Information Interchange. (1) A coded character set consisting of 7-bit coded characters (8 bits including parity check) used for information interchange among data processing systems, data communication systems, and associated equipment. The ASCII set consists of alphanumeric characters, control characters, and graphic characters. (2) A widely used asynchronous protocol based on ASCII code.
ASYNC	Asynchronous Communications. This is a mode of transmission that uses a start and stop bit to frame a character. Generally bits within a character occur at well-defined intervals, but they are not precisely timed in synchronous transmission. In asynchronous communications, characters do not recur at any predictable interval.
ATTENTUATION	A decrease in magnitude of current, voltage, or power of a signal in transmission between points that may be expressed in decibels.
AUDIO FREQUENCIES	Frequencies that can be heard by the human ear (usually 30 to 20,000 hertz).

Att. A
1/24/85

AUTOMATIC CALLING UNIT	A device which permits a computer to dial calls automatically.
BACKUP FILE	A copy of a file created for protection in case the primary file is unintentionally destroyed.
BANDWIDTH	The range of frequencies that can pass over a given circuit. The bandwidth determines the rate at which information can be transmitted through the circuit. The greater the bandwidth, the more information that can be sent through the circuit in a given amount of time.
BASEBAND	Pertains or refers to a signal in its original form and not changed by modulation. A baseband signal can be analog (e.g., originating from a telephone set) or digital (e.g., originating from a business machine).
BAUD	A measure of data rate, often used to denote bits per second. A baud is equal to the number of discrete conditions or signal events per second. There is disagreement over the appropriate use of this word, since at speeds above the 2400 bps, the baud rate does not equal the data rate in bits per second.
BCD	Binary Coded Decimal. A binary-coded notation in which each of the decimal digits is represented by a binary numeral, e.g., in binary-coded decimal notation that uses the weights 8-4-2-1, the number "twenty three" is represented by 0010 0011 (compare its representation 10111 in the pure binary numeration system).
BEL	Transmission units giving the ratio of two powers. The number of bels is equal to the logarithm to the base ten of the power ratio.
BERT	Bit Error Rate Test. A test conducted by transmitting a known pattern of bits (commonly 63,511, or 2047 bits in length), comparing the pattern received with the pattern transmitted, and counting the number of bits received in error. Also, see BIT ERROR RATE. Contrast with BLERT.
BINARY CODE	A code using two distinct characters, usually the numbers 0 and 1.
BINARY SYNCHRONOUS COMMUNICATIONS	A half-duplex, character-oriented data communications protocol originated by IBM in 1964. It includes control characters and procedures for controlling the establishment of a valid connection and the transfer of data. Also called bisync and BSC. Although still enjoying widespread usage, it is being replaced by IBM's more efficient protocol, SDLC.
BISYNC	See Binary Synchronous Communications.
BIT	The smallest unit of information used in data processing. It is a contraction of the words "binary digit."

BIT RATE	The speed at which bits are transmitted, usually expressed in bits per second (bps).
BIT STREAM	A continuous string of bit positions occurring serially in time.
BNA	Burroughs Network Architecture.
BPS	Bits Per Second.
BROADBAND	Refers or pertains to an analog circuit that provides more bandwidth than a voice-grade telephone line, i.e., a circuit that operates at a frequency of 20KHz or greater. Broadband channels are used for high-speed voice and data communications, radio and television broadcasting, some local area data networks, and many other services. Also called wideband.
BSC	Binary Synchronous Communications. A half-duplex character-oriented data communications protocol. Although still widespread, it is being replaced by SDLC.
BTAM	Basic Telecommunications Access Method. IBM's lowest level I/O macro-routine support for providing communications programs on a host computer.
BUFFER	(1) A temporary storage area that can be a special register or an area of storage. Buffers are often used to hold data being passed between processes or devices that operate at different speeds or different times. (2) An isolating circuit used to prevent a driven circuit from influencing the driving circuit.
BUS	(1) A wire or group of wires that allows memory, central processing unit and I/O devices to exchange information. (2) A conductor used for distributing power to various elements of the system. DC power distribution and ringing voltage distribution conductors are referred to as buses.
BUSY HOUR	The continuous one-hour period which has the maximum average traffic intensity.
BYTE	(1) A group of 8 bits handled as a logical unit. (2) The smallest memory-addressable unit of information in a memory system. (3) A sequence of adjacent binary digits operated upon as a unit; usually shorter than a word.
CCITT	International Telegraph and Telephone Consultive Committee. A group within the International Telecommunications Union (ITU) that recommends data communications standards.

CELLULAR RADIO	A technology for advanced mobile telephone service in which a geographic area is divided into hexagonal cell sites that fit together to form a honeycomb. Each cell contains a radio transceiver and a controller, which under the direction of a central switch manage the transfer of mobile phone calls from one cell to another.
CHANNEL	(1) In data communications, a one-way path along which signals can be sent between two or more points. Contrast with circuit. (2) In telecommunications, a transmission path (may be one-way or two-way, depending on the channel) between two or more points, provided by a common carrier; also called a link, line, circuit, or facility.
CICS	Customer Information Control System. IBM's software tool designed to simplify the on-line communications interface between user-written applications programs and the IBM operating systems.
CLUSTER	A group of terminals or other input and output devices that share a common communications path from a computerized system.
CODEC	An acronym for COder-DECoder. A circuit that converts analog (audio) signals to digital code, and vice versa. Refer to pulse code modulation (PCM).
CONCENTRATOR	A switching entity for connecting a number of inlets to a smaller number of outlets.
CONDITIONING	The transmission which alters the electrical characteristics of a transmission facility (i.e., a telephone line) in order to improve the quality of the signal. When a telephone line is conditioned, excess noise is reduced, and its ability to carry a clear data signal is improved.
CROSS-BAR SWITCH	A switch having multiple vertical paths, multiple horizontal paths, and electromagnetically operated mechanical means for interconnecting any one of the vertical paths with any of the horizontal paths.
CSMA	Carrier Sense Multiple Access. A local area network access technique in which multiple stations connected to the same channel are able to sense transmission activity on that channel and to defer the initiation of transmission while the channel is active. Sometimes called contention access.
CSMA/CD	Carrier Sense Multiple Access with Collision Detection. A refinement of CSMA in which stations are further able to detect the interference caused by simultaneous transmissions by two or more stations ("collisions") and to retransmit colliding messages in an orderly manner.
DAA	See Data Access Arrangement.
DATA	A general term used to denote any or all facts, numbers, letters, and/or symbols.

DATA ACCESS ARRANGEMENT	A small wall mounted box containing an isolation transformer designed to prevent signals harmful to the network from being sent down the network from un-registered communications devices. These units are rarely used now that FCC registration of communications devices has become standard.
DATA BASE MANAGEMENT SYSTEM	A scheme used to create, maintain, and reference a data base.
DATA SERVICE UNIT (DDS)	A device that replaces a modem on a Dataphone Digital Service (DDS) line. The data service unit regenerates the digital signals for transmission over DDS.
DATA SET	A synonym for modem used by AT&T and a few other vendors.
db	See Decibel.
DCO	Digital Central Office. A telephone central office capable of digital communications.
DDCMP	Digital Data Communications Message Protocol. A synchronous protocol developed by Digital Equipment Corporation.
DDD	See Direct Distance Dialing.
DDS	Dataphone Digital Service. An AT&T leased line service offering digital transmission at speeds ranging from 2400 bps to 1.544 bps.
DECIBEL	A tenth of a bel. A unit for measuring relative strength of a signal parameter such as power, voltage, etc. The reference level must always be indicated, such as 1 milliwatt for power ratio.
DEMODULATION	The opposite of modulation: the conversion of a signal from analog to its original (e.g., digital) form.
DEMULTIPLEX (DECONCENTRATE)	A reversal of multiplex action. A group of separate signals derived from the complex multiplex signal.
DIBIT	A group of 2 bits. The four possible states for a dibit are 00, 01, 10, 11. In four phase modulation each possible dibit is encoded as one of four unique carrier phase shifts.
DIGITAL	Referring or pertaining to a signaling technique in which a transmission is conveyed by generating pulses of electromagnetic energy in a discontinuous (i.e., on/off) coded pattern representing, for example, bits in a data stream. Contrast with analog.
DIGITAL SIGNAL	A series of pulses or rapidly changing voltage levels that vary in discrete steps or increments.

DIGITAL-TO-ANALOG (D/A) CONVERTER	Circuitry which changes digitally encoded data into an analog signal. A modem.
DIGITAL TRUNK INTERFACE (DTI)	A subsystem that provides direct digital interfacing between the DCO and T1 span lines. When a T1 span is not fully utilized, trunk additions to its maximum capacity of 24 are made by software program updates.
DID	See Direct Inward Dialing.
DIRECT DISTANCE DIALING	A telephone exchange service which enables the telephone user to call other subscribers outside his local area without operator assistance.
DIRECT INWARD DIALING	This service allows an incoming call from the exchange network to reach a station off a Centrex or PBX without operator assistance.
DOWNLOAD	Send a file from a larger or remote computer to a smaller or local one.
DSU	See Data Service Unit.
DTMF	Dual tone multifrequency signaling. A method of signaling in which a combination of two frequencies, each from a group of four, are used to transmit numerical address information.
EBCDIC	An acronym (pronounced ip-sa-dik) for extended binary-coded decimal interchange code. This is the code that IBM uses for representing characters and control values on its large computers.
EIA	Electronic Industries Associations.
EMULATE	To imitate one system with another, so that the imitating system accepts the same data, executes the same computer programs, and achieves the same results as the imitated system.
EQUALIZATION	The introduction of components to an analog circuit by a modem to compensate for attenuation or delay distortion. Generally, the higher the transmission rate, the greater the need for equalization.
ETHERNET	A local area data network, developed by Xerox Corporation and supported by Intel Corporation, Digital Equipment Corporation, and Hewlett-Packard.
FACSIMILE	A system for the transmission of images. The image is scanned at the transmitter, reconstructed at the receiving station, and duplicated on some form of paper.

FAX	See Facsimile.
FDM	See Frequency Division Multiplexing.
FIBER OPTICS	Technology that uses light as a digital information carrier. Fiber optic cables (light guides) are a direct replacement for conventional coaxial cables and wire pairs. The glass-based transmission facilities occupy far less physical volume for an equivalent transmission capacity, which is a major advantage in crowded underground ducts. The fibers are immune to electrical interference. In addition, the cable can be manufactured for far less and installation and maintenance costs are less.
FIRMWARE	(1) A computer program that is incorporated, at least temporarily, as machine hardware; for example, instructions contained in a read-only memory (ROM). Sometimes referred to as microprograms. (2) A permanent program stored on ROM in an I/O page. Used for bootstrap operation.
FOUR-WIRE CHANNEL	A circuit containing two wire pairs (or their logical equivalent) for simultaneous (i.e., full-duplex) two-way transmission. Contrast with two-wire channel.
FRAME	A complete series of encoded bits containing the necessary information to reconstruct the sampled data for all channels of the digital group.
FREQUENCY DIVISION MULTIPLEXING	FDM partitions a limited bandwidth communications channel into a group of independent lower speed channels, each of which utilizes its permanently assigned portion of the total frequency spectrum. Each channel in the sharing group thus uses one frequency slot which contain the unique pair of frequencies needed for transmitting its binary data signals.
FRONT END PROCESSOR	A computer used to enter, check or compress data before it's sent to a mainframe for further processing.
FSK	Frequency Shift Keying. A method of modulation that uses two different frequencies to distinguish between a mark (digital 1) and a space (digital 0) when transmitting on an analog line. Used in modems operating at 1200 bps or slower.
FULL DUPLEX	(1) Describing a communications channel capable of simultaneous and independent transmission and reception.
GARBAGE	Meaningless signals or bit patterns in memory.
GATEWAY	A connection between two dissimilar networks. One way of connecting PC's to mainframes is through a local area network (LAN) of PC's hooked up through a gateway to a mainframe network.

HALF-DUPLEX	Pertaining to a communication system in which two-way communication is possible, but only one way at a time; for example, a ham radio or radio telephone with a pushbutton on the mouthpiece.
HDLC	High-level Data Link Control. A bit oriented protocol developed by ISO (International Standards Organizater). It is the basis for SDLC, VDLC, etc.
HERTZ	A measure of electromagnetic frequency; the number of cycles.
HZ	See Hertz.
IEEE	Institute of Electrical and Electronic Engineers.
IEEE-802	An IEEE committee developing a standard protocol for local area networking.
INFRARED	Pertains to the frequency range in the electromagnetic spectrum that is higher than radio frequencies but below the range of visible light.
INTERACTIVE	A technique of user/system communication in which the operating system immediately acknowledges and acts upon requests entered by the user at a terminal.
INTERFACE	A shared boundary connecting two subsystems.
INTERRUPT	A signal that, when activated, causes a transfer of control to a specific location in memory, thereby breaking the normal flow of control of the routine being executed. An interrupt is normally caused by an external event, such as a "done" condition in a peripheral. It is distinguished from a trap, which is caused by the execution of a processor instruction.
ITU	International Telecommunications Union. The parent organization of the CCITT.
LAN	See Local Area Network.
LIGHTWAVE COMMUNICATIONS	See Fiber Optics. The term "lightwave communications" is sometimes used in place of "optical" communications to avoid confusion with visual information and image transmission such as facsimile or television.
LIMITED DISTANCE MODEM	A short-haul modem or line driver that operates over a limited distrance. Some limited distance modems operate at higher speeds than modems that are designed for use over analog telephone facilities, since line conditions can be better controlled.

LINE CONDITIONING	An adjustment of the properties of a leased communications line to bring the line's characteristics within the limits specified in a tariff. Line conditioning generally improves the frequency response and delay considerations of the line. Line conditioning services provided by the telephone company are designated as Type C (e.g., C1, C2, or C4) or D.
LINE DRIVER	An alternative device to a modem when transmitting via EIA cable over short distances, e.g., a few hundred feet. The line driver amplifies the signal and reshapes distorted pulses.
LINE HIT	A disturbance causing a detectable error on a communications line.
LOCAL AREA NETWORK	A user-owned, user-operated, high-volume data transmission facility connecting a number of communicating devices (computers, terminals, word processors, printers, mass storage units, robots, etc.) within a single building or campus of buildings.
LSI	Large Scale Integration.
MACRO	An instruction in a source language that is equivalent to a specified sequence of machine or assembler instructions. An acronym for MAChine ROutine.
MACRO FILE	(1) An ordered collection of macro instructions. (2) Macro source in machine-readable format.
MHZ	Megahertz. A unit equal to 10^{+6} hertz; a measure of analog frequency.
MICROCOMPUTER	(1) A computer whose major sections - CPU, control, timing, and memory - are all contained in a single, integrated-circuit chip, or, at most, a few chips; in other words, an LSI computer. (2) A general term used to describe small computers. In this sense, small usually implies both the computer's physical size and its work size (data-path width). Most microcomputers are designed with a 16-bit word size, but sizes from 8 to 18 bits are considered in the microcomputer range.
MICROWAVE	Pertains or refers to the upper portion of the radio frequency range, specifically 890MHz and higher.
MODEM	A contraction of modulate and demodulate; a conversion device installed in pairs at each end of an analog communications line. The modem at the transmitting end modulates digital signals received locally from a computer or terminal; the modem at the receiving end demodulates the incoming signal, converting it back to its original (i.e., digital) format, and passes it to the destination business machine.

MODULATION	The application of information onto a carrier signal by varying one or more of the signal's basic characteristics (frequency, amplitude, or phase); the conversion of a signal from its original (e.g., digital) format to analog format.
MULTIPLEX	(1) To interleave, or simultaneously transmit, two or more messages on a single channel. (2) The technique by which a single communications channel is shared by a number of users, either by time-sharing or by frequency separation.
MULTIPLEXER	A device that combines inputs from two or more terminals, computer ports, or other multiplexers, and transmits the combined data stream over a single high-speed channel. At the receiving end, the high-speed channel is demultiplexed, either by another multiplexer or by software.
MULTIPOINT	Pertains or refers to a communications line to which three or more stations are connected. It implies that the line physically extends from one station to another until all are connected. Contrast with point-to-point.
NAILED-UP CONNECTION	A special circuit which has a reserved timeslot in the bit stream and the matrix so that a path is always available.
NETWORK	A system of mutually-communicating devices (e.g., computers, terminals, peripheral devices, process controllers) connected in common and for a purpose by one or more transmission facilities.
NODE	In a topological description of a network, a node is a point of junction of the links. The word has also come to mean a switching center in the context of a data network, particularly in packet switching.
NONRETURN TO ZERO	A digital signal that remains at a constant level until a change of logic state occurs.
OFF-LINE	(1) Pertains to equipment or devices not under direct control of the CPU. (2) The mode of operation of a system that is intentionally brought about by maintenance personnel, or by the system itself, in which certain circuits, units, etc., are not available for normal operations.
ON-LINE	(1) Pertaining to equipment or devices directly connected and under control of the CPU. (2) That mode of operation of a system that is intentionally brought about by maintenance personnel, or by the machine itself, in which certain circuits, units, etc., are made available for normal operation.
PABX	Private Automatic Branch Exchange. A private branch exchange that provides access to and from the public telephone network without operator intervention. See PBX.

PACKET SWITCHING	A technique in which a message is broken into smaller units called packets, which may be individually addressed and routed throughout the network possibly using several different routes. The receiving end node ascertains that all packets are received and in the proper sequence before forwarding the complete message to the addressee.
PARALLEL TRANSMISSION	The simultaneous transmissions of all the bits making up a character or byte, typically, between a computer and directly connected peripherals. Parallel transmission requires a separate data path for each bit. Contrast with serial transmission.
PARITY	A constant state or equal value. Parity checking is one of the oldest error checking techniques. Character bit patterns are forced into parity (total number of one bits odd or even) by adding a one or zero bit as appropriate, as they are transmitted; the parity (odd or even) is then verified upon receipt by the receiving device.
PARITY BIT	A check bit appended to an array of binary digits to make the sum of all the binary digits, including the check bit, always odd or always even.
PARITY CHECK	(1) A check that tests whether the sum of all the bits in an array is odd or even. (2) A check that tests whether the number of ones (or zeros) in an array of binary digits is odd or even.
PASSWORD	A word or string of characters that is recognizable by automatic means and that permits a user access to protected storage, files, or I/O devices.
PBX	Private Branch Exchange. A telephone exchange on the user's premises with access to the public network. In some countries it refers to a manually operated exchange; in modern American terminology it refers to a manual or automatic exchange.
PBX TRUNK	A PBX trunk is subscriber line or loop trunk circuit used to provide service between a PBX and the CO that serves it. Refer to private branch exchange.
PCM	See Pulse Code Modulation.
PCM WORD	An 8-bit code group representing a specific quantized level.
PEAK HOUR(S)	Those hours that have an average calling rate that is 30 percent more than during a busy hour.
POINT-TO-POINT	Pertains or refers to a communications line to which exactly two stations are connected. Contrast with multi-point.
PORT	An access at the I/O position of a circuit that allows transmitted or received signals to enter/exit.

POTS	Plain Old Telephone Service. An acronym used by the telephone industry for conventional telephone service.
PROTOCOL	A set of procedures for establishing and controlling transmissions. Examples include BSC and SDLC.
PROTOCOL CONVERSION	The process of translating the protocol native to an end-user device (e.g., a terminal) into a different protocol (e.g., ASCII to BSC), allowing that end-user device to communicate with another device (e.g., a computer) with which it would otherwise be incompatible. Protocol conversion can be performed by a dedicated device (a "protocol converter"), by a software package loaded onto an existing system, such as a general-purpose computer, front-end processor, or PBX system, or by a value-added network, such as Telenet.
PSK	Phase Shift Keying. A method of modulation that uses the differences in phase angle to indicate a certain bit of dibit. A reference oscillator determines the phase angle change of the incoming signal, which in turn determines which bit or dibit is being transmitted.
PULSE CODE MODULATION	Representation of a voice or other analog signal by sampling at a regular rate and converting each rate to a binary number. 8,000 samples per second is standard for telephone speech.
RADIO FREQUENCY	A frequency that is higher than the audio frequencies but below the infrared frequencies.
RANDOM ACCESS MEMORY (RAM)	(1) A memory that stores information in such a way that each bit of information can be retrieved within the same amount of time as any other bit. (2) True RAMs are static devices; for example, core memory and solid-state memory. Many so-called random access devices, such as floppy disks and magnetic tape units, are, in reality, cyclic access devices.
READ ONLY MEMORY (ROM)	(1) A memory that can be read from, but not written into. (2) A memory in which information is stored permanently; for example, a math function or a micro-program. A ROM is programmed according to the user's requirements during memory fabrication and cannot be reprogrammed.
REDUNDANT	A system that contains duplicate components for backup support in case of malfunctioning of the single operating unit.
REGISTER	A device capable of storing a specified amount of data, such as one word.

REPEATER	(1) A device whereby currents received over one circuit are automatically repeated in another circuit or circuits, generally in an amplified and/or reshaped form. (2) A device used to restore signals, which have been distorted because of attenuation, to their original shape and transmission level.
RETURN TO ZERO	A digital signal that returns to a reference level after each bit.
RF	See Radio Frequency.
RJE	Remote Job Entry. The entering of data through a remote terminal onto a mainframe for batch processing.
RO	Receive-Only. A teleprinter terminal without a keyboard for data entry.
RS-232-C	A specification published by the EIA that establishes mechanical and electrical interface requirements between computers, terminals, modems, and lines. The standard applies to both synchronous and asynchronous serial, binary, data transmission at speeds to 20 Kbps in full or half duplex mode. It is terminated in a 25 pin connector.
RS-449	An EIA standard that provides more extended interface than RS-232. It is designed to slowly replace RS-232, although RS-232 seems to be quite entrenched and shows no sign of retiring yet. Transmission rates up to 2 mbps are possible using RS-449.
SDLC	Synchronous Data Link Control. An IBM communications line discipline or protocol associated with SNA. In contrast to BSC, SDLC provides for full-duplex transmission and is more efficient.
SERIAL	(1) Pertains to the time sequencing of two or more processes. (2) Pertains to the time sequencing of two or more similar or identical processes, using the same facilities for the successive processes. (3) Pertains to the time-sequential processing of the individual parts of a whole, such as the bits of a character.
SERIAL TRANSMISSION	The transmission of a character or byte of data one bit at a time. Contrast with parallel.
SIMPLEX	(1) In communications, pertaining to a channel that operates in one direction only. (2) In signaling, an arrangement where a supervisory signals are transmitted in a balanced manner to both conductors of a conductor pair.

SNA	Systems Network Architecture. IBM's standardized relationship between its Virtual Telecommunications Access Method (VTAM) and the Network Control Program (NCP/VS). SNA comprises the logical structure, formats, protocols, and operational sequences that govern information transmission through an IBM network.
STAR	A network topology in which each station is connected only to a central station by a point-to-point link, and communicates with all other stations through the central station.
START BIT	Asynchronous transmission, a signal used to signify the beginning of the transmission of a character.
STATISTICAL MULTIPLEXING	A time-division multiplexing technique in which timeslots are dynamically allocated on the basis of need, i.e., to equipment with data to be transmitted.
STOP BIT	In asynchronous transmission, the quiescent state following the transmission of a character; usually required to be at least 1, 1.42, 1.5, or 2 bit times long.
STORE AND FORWARD	Pertains or refers to a method of queueing messages and transmitting them when a facility becomes available. Synonymous with message switching.
SUBSCRIBER LINE CONCENTRATOR	A remote switching system providing the first stage of switching near a group of subscribers.
SUBSCRIBERS LINE	The telephone line connecting the exchange to the subscriber's station.
SYNCHRONOUS	Having a constant time interval between successive bits, characters, or events. Synchronous transmission uses no redundant information (such as the start and stop bits in asynchronous transmission) to identify the beginning and end of characters, and thus, is faster and more efficient than asynchronous transmission. The timing is achieved by transmitting sync characters prior to data; usually, synchronization can be achieved in two or three character times.
TCAM	Telecommunications Access Method. An IBM language for creating communications applications programs and message control.
T-CARRIER (BELL SYSTEM)	A hierarchy of digital systems designed to carry voice and data signals in digital form. T1 carrier has 24 PCM channels with a line rate equal to 1,544,000 bits per second.
TDM	See Time Division Multiplexing.
TELEPHONY	A system of telecommunications set up primarily for the transmission of speech.

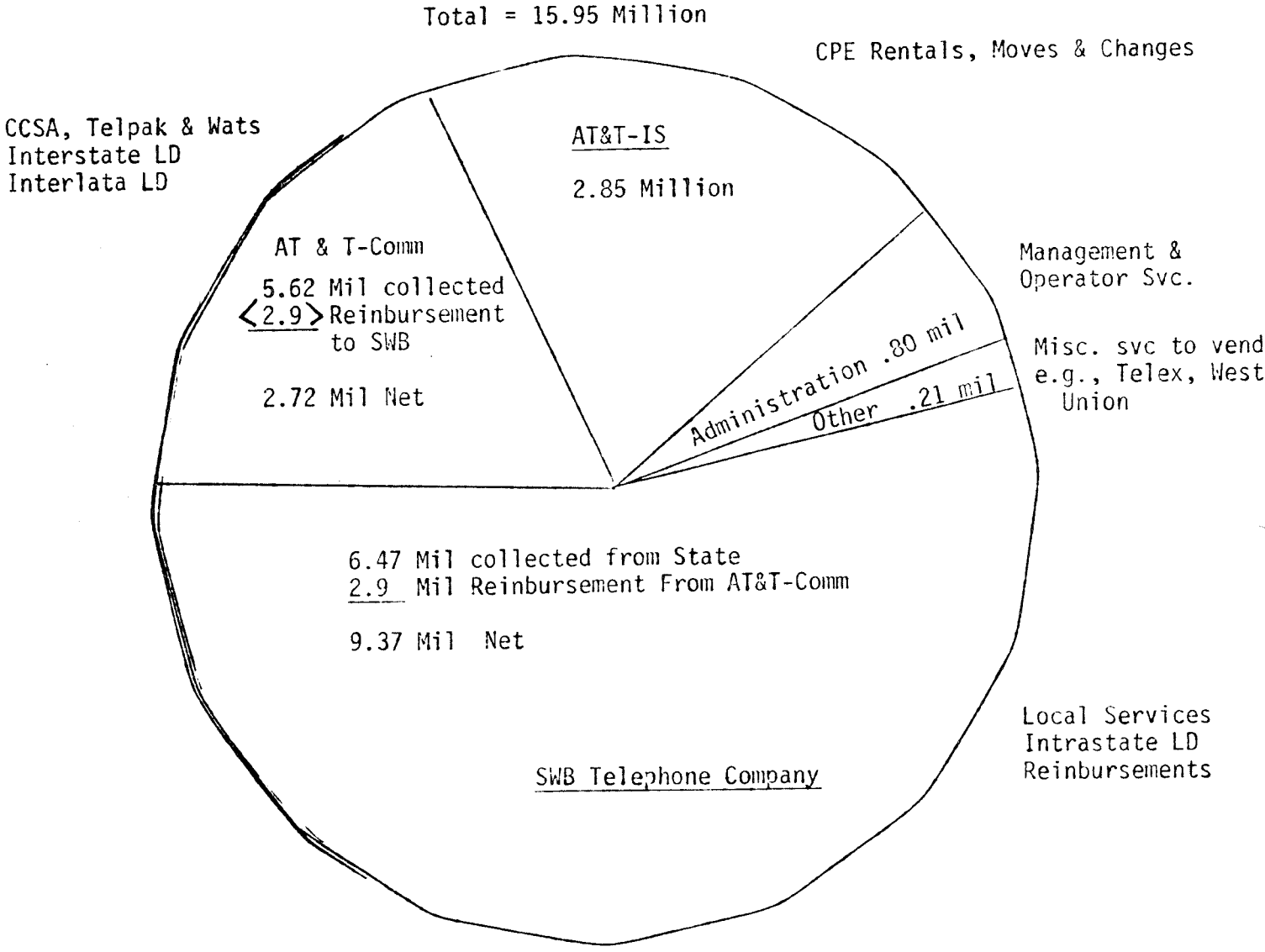
TERMINAL	(1) A point at which information can enter or leave a communication network. (2) An I/O device associated with a particular program; usually one capable of two-way communications. (3) An I/O device, such as a teletypewriter, that includes a keyboard and a display mechanism. A terminal is used as the primary communicating device between a computer system and a person.
TIE LINE	A private line communications channel of the type provided by communications common carriers for linking two or more points together. Called interswitchboard line or tie trunk.
TIME-DIVISION MULTIPLEXING (TDM)	A technique for sharing a single communications line among several data streams by dividing the channel capacity into time segments. Contrast with Frequency-Division Multiplexing.
TOKEN PASSING	A local area network access technique in which participating stations circulate a special bit pattern (the token) that grants access to the network to each station in sequence; often used in networks with a ring topology.
TTL	Transistor-Transistor Logic. A type of signaling in which a nominal +5V is equated with the logic 1, and a nominal OV is equated with logic O.
UDLC	Universal Data Link Control. A bit-oriented protocol based on HDLC developed by Sperry Univac.
UPLOAD	Send a file from a smaller computer or local one to a larger or remote computer.
VALUE ADDED COMMON CARRIER	A corporation that sells services of a value-added network (VAN). A network that provides services beyond point to point communications.
VAN	Value Added Network. A public data communications network that provides basic transmission facilities (generally leased by the VAN vendor from a common carrier) plus additional ("enhanced") services such as computerized switching, temporary data storage, error detection and corrections, electronic mail services, etc.
VOICE-GRADE CHANNEL	Channel with bandwidth equivalent to a telephone line obtained through the public telephone network. The maximum potential bandwidth of a voice-grade channel is approximately 20K hertz; however, most voice-grade channels in a transmission facility are usually spaced 4000 Hz apart, and not all of that bandwidth is generally available to a user due to the presence of noise-limiting loading coils; the telephone network itself is usually defined in terms of channels with frequencies of from 300 Hz to 3400 Hz.

VTAM	Virtual Telecommunications Access Method. An IBM communications I/O control programming software that uses virtual techniques.
WATS	Wide Area Telecommunications Service. A voice-grade service from AT&T. Usage charges for WATS are based on fixed monthly rates for specified service access, rather than on per-call rates.
WORD	(1) The number of bits needed to represent the largest data element normally processed by the computer. (2) Sixteen binary digits treated as a unit in the PDP-11 processor memory.
WORD LENGTH	The number of bits or other characters in a word.
X.21	A CCITT technical spec that describes the interface used in X.25 protocol and in certain types of circuit-switched data transmissions. It is comparable to RS-232.
X.25	A CCITT standard for packet switching procedures. It describes the construction of each packet. It uses the procedures of the HDLC protocol for the link layer and X.21 (a functional equivalent to RS-237) for the electrical connection.

as1/AS2/ee

TELECOMMUNICATIONS OVERVIEW
January 15-31, 1985

I. Current distribution of telecommunications dollars



II. Costs may rise from $16 million to $17.5 million in FY86 and $19 - $21 million in FY87 if no action is taken.

A. Telpak (the intercity portion of KANSAN) ends in December, 1985.
B. The costs for moves and changes are rising dramatically.
C. Maintenance on obsolete systems will rise and/or become impossible.

III. Many telephone key systems and localized installations (e.g., Emporia) are obsolete.

IV. Agency demand for voice, data, and video network continues to grow.

- A. Old system is designed for voice only.
- B. Data transmission is slow and very costly.
- C. Video transmission is nearly impossible.
- D. Many substantive areas affected.
  1. Education
  2. Hi-Tech
  3. Industrial development
  4. Public TV
  5. Instructional TV
  6. Electronic mail
  7. Video conferencing

V. Divestiture and deregulation have created an entirely new structure for telecommunications services (Judge Green)

- A. "Ma" Bell is no more.
- B. It has been replaced by
  1. SWB-Tel (regulated)
  2. SWB-Telcom (unregulated)
  3. AT&T-Com (regulated)
  4. AT&T-Info Systems (unregulated)
  5. Numerous independent long distance suppliers, e.g.,:
     a. MCI
     b. GTE-Sprint
  6. Some in-state long distance suppliers (e.g., Kansas Power and Light)
  7. Independent Telephone companies (e.g., United Telephone)
  8. Numerous unregulated equipment suppliers.
     a. Centel
     b. Rolm-IBM
     c. Contel
     d. Northern Telecom, etc.
- C. New model is comparable but not identical to other utilities
  1. Services (e.g., electric power, natural gas, phone transmission lines) are delivered to customer's premises.
  2. Customer owns equipment on premises (e.g., house wiring for electricity and phones).
  3. Customer owns appliances (e.g., stoves, water heaters and terminal phones).
  4. "Switching" services for phones may be either wholly purchased (SWB & AT&T) or partially owned through costomer owned PBX switches on customer's premises.

VI. Legal and other factors result in a new six part delivery system (puzzle) for telecommunications services.

A. Outside-the-state long distance.
B. In-state, Inter-Lata long distance.
C. Intra-lata long distance.
D. Terminal equipment.
E. Building wiring and cabling.
F. Switches and switching.

VII. Major public policy issues attendant to the new environment

A. Management - state vs. purchased service.
B. Ownership - which parts state and which parts private.
C. Operation - which parts state and which parts private.
D. Maintenance - which parts state and which parts private.
E. Comparative costs - to state government oeprations.
F. Comparative costs - to other consumers.
G. Cost avoidance - for state government operations.

VIII. Framework for decisions - Telecommunications

	Extra State Communi-cations	Intrastate Interlata Communi-cations	Intrastate Intralata Communi-cations	Switches and Wiring	CPE
A. Management-- State vs. Private	1	2	3	4	5
B. Ownership-- State vs. Private	6	7	8	9	10
C. Operation-- State vs. Private	11	12	13	14	15
D. Maintenance-- State vs. Private	16	17	18	19	20
E. Comparative Costs To the State	21	22	23	24	25
F. Comparative Costs To Other Consumers	26	27	28	29	30
G. Cost Avoidance To the State	31	32	33	34	35

IX. These 35 decisions can be reduced to 5 overall strategies.

A. Do-nothing.
B. Have a state-owned and operated system.
C. Have a general contractor owned and operated system.
D. Cooperate with existing private sector service providers.
E. Some combination of these.

X. Draft specifications have been circulated to agencies, institutions, and vendors for their comment. Major features of those specifications are as follows:

A. End-to-end digital system, with performance rather than hardware oriented specifications.
B. Provide for six major local area networks.
   1. Topeka based agencies.
   2. KUMC.
   3. KU - Lawrence.
   4. KSU.
   5. WSU.
   6. FHSU.
C. Set of specifications are divided into two parts:
   1. Building wiring and cabling (state-owned).
   2. Switching services.
D. Phased implementation schedule (July, 1985 to December, 1986).
E. Written to provide maximum competition.
F. Ten year commitment/financing.
G. Reasonableness test applied.

XI. PSU has been converted and will tie into the state network.

XII. ESU needs to be converted from old to new PBX switch and/or be added to the network.

XIII. Request for information was issued last summer. Information was provided by eight bidders. Annualized comparisons are as follows:

A.	SWB-Tel	$17.8 - 18.8
B.	Contel	18.5
C.	Rolm	17.0
D.	Centel	16.8
E.	GTE	16.0
F.	SWB-Telcom	16.7
G.	AT&T - IS	18.9
H.	Comcoa	16.9
I.	AT&T - Com	?

XIV. We now have competition and/or regulation in all parts of the telecommunications puzzle; Illustrations

- A. Extra-state long distance (equal access decision on May 1).
  1. AT&T - Com
  2. MCI
  3. Others
- B. Intra-state, inter-lata long distance.
  1. AT&T - Com
  2. KP & L
- C. Intra-lata long distance (regulated)
- D. Switching and/or switches
  1. SWB - Tel
  2. United - Tel
  3. AT&T - IS
  4. Rolm
  5. Northern Telecom
  6. SWB - Telcom
- E. Building wiring and cabling.
  1. All of the above, plus some others.
- F. Terminal equipment
  1. Numerous companies

XV. Proposed Timetable, by issuance of RFP's

A.	Wiring, cabling, and jacks	February, 1985
B.	Intra-lata networks (3)	July, 1985
C.	Inter-lata transmission	July, 1985
D.	Network Switching	July, 1985
E.	Network control services	October, 1985
F.	Terminal equipment	October, 1985
G.	PBX's and large key systems	As needed
H.	Multiplexing equipment	October, 1985
I.	Billing Services	November, 1985
J.	Small key systems	December, 1985

XVI. Proposed timetable, by implementation schedule

		Begin	End
A.	Wiring, cabling and jacks	July 85	Sept 87
B.	Networks and switching (B, C & D above)	July 86	Sept 87
C.	Control services	July 86	Sept 87
D.	Terminal equipment	Oct 85	Sept 87
E.	Billing services	July 86	Sept 87
F.	Multiplexing equipment	July 86	Sept 87
G.	Small key systems	As needed	
H.	PBX's and large key systems	As needed	

XVII. Some unanswered questions.

A. Can the state sell phone service to dorm residents and M.D.'s who are on a state government network?
B. Who may legally supply intra-state, inter-lata transmission services?
C. Who may supply intra-state, inter-lata switching services?

XVIII. Recommendations

A. Pass HB 2027 (an RFP followed by negotiation, for the provision of telecommunications services).
B. Review draft specifications for the first phase of the telecommunications project.
C. Pursue answers to major unanswered questions.

CCT:OVERVIEW:bdv

The Big Breakup: A Report Card

JANE BRYANT QUINN

What a difference a year makes. My friendly telephone is now my enemy. I tussle with the bills, doubt the wisdom of my own long-distance choice and fall back in fright from the alarming size of the instruction books that come with the new, high-powered telephones. I suppose I'll get used to it. But it's clear that, like most other users, I'm paying more and getting less.

Your Local Rates: If you haven't had a rate increase, expect one soon. And then another and another. Using survey data from the U.S. Commerce Department, Eli Noam of the Columbia University Graduate School of Business figures that, from January to August of last year, local telephone rates rose by 12 percent for city users and 17.6 percent for those in the country. The consumer price index puts the rise at 17.4 percent as of November, including such things as one-time surcharges, higher phone-rental rates and fees for repairs. The only good news is that the real, pocketbook impact on consumers may not be so bad. The average bill for local service still runs only $15.70 a month in the city and $10.59 in the country. (Rural rates are subsidized by city dwellers and likely to remain so.)

Local phone bills will rise again this June, when all residential and single-line business subscribers start paying a new government-imposed charge of $1 a month. This higher fee for local service is supposed to allow for a cut in interstate long-distance rates. Another $1 charge will be added in June of 1986. You may also have to pay a monthly fee of 35 cents in '85, and another 35 cents in '86, to offset discounts for big-business users. On top of all this, your state may allow the telephone company an additional flat-rate charge to help finance price cuts on long-distance calls within the state.

Even so, it could have been worse; at the time of the breakup, much higher monthly charges had been planned. Political pressure thwarted that move and may continue to keep local rates from rising as much as was originally feared.

But there's more than one way to skin a cat, or a customer. The local companies are in the process of changing the way that you pay for local calls, and their new approach could raise your costs.

Today, most consumers get an unlimited number of local calls for a flat monthly rate, or pay per minute for each call above a ceiling. Some pay a flat rate for each call they make. But more than 34 states now allow local measured service (LMS), where the size of your phone bill depends on how many calls you make, what time of day you make them, how long they last and how far you call. You pay more to call a friend across town than a neighbor next door; more to call in the afternoon than late at night. Light users of the telephone, and people in a position to time their calls, may be able to use LMS to cut their bills. But overall, the new billing system is expected to raise consumer costs. Right now, LMS is optional in most places. But as flat rates rise, you may feel forced to switch. To save money, telephone users may become as reluctant to make a local call as they are now to telephone long distance.

> To save money, phone users may become as slow to make local calls as they now are to call long distance.

Small Businesses: Local businesses have been getting the worst of the new tariffs. Noam estimates that the average bill for small urban businesses with a single telephone line now tops $35 a month for flat-rate service, up 12.4 percent from the rate before divestiture. If local measured service becomes mandatory instead of optional, businesses' bills could really jump—because they have to call by day (the most expensive time) and cannot easily control the length of calls. Big companies can offset the higher costs of local service with cuts in their long-distance bills. But most small businesses will be stuck because they don't use so much long distance.

Long Distance: The cost of interstate long-distance calls dropped 4.2 percent last year, as measured by the consumer price index, and is expected to drop some more. But this hardly matters to a majority of telephone users. Three-quarters of all residential customers spend $10 a month or less on long-distance calls. The reason they aren't beating down the doors to find a cheaper company than AT&T is that, after all the trouble of the search, they might save only a dollar or so a month.

But if you're ready for a change, the surveys by Consumers' Checkbook, a nonprofit advisory service, tell you where to look. SBS, US Tel, Telesaver, Pace-Net and Save-Net usually prove to be among the lowest priced, often beating AT&T by 30 percent or more, depending on your calling patterns. MCI and Sprint tend toward the middle of the pricing range. AT&T usually costs the most, except for its bare-bones Reach Out America service—$10 a month for an hour's worth of late-night or weekend calls. (Checkbook, at 806 15th Street N.W., Washington, D.C. 20005, will analyze your phone bills and steer you to the cheapest company. It charges on a sliding scale—for example, you pay $30 if your long-distance phone bills run from $40 to $70 a month.)

One interesting question is whether the non-AT&T companies will remain markedly cheaper over the long run. They'll face sharply higher costs of doing business over the next couple of years as they gradually hitch into the mainstream telephone network. As a matter of survival, they have to keep prices lower than those of AT&T, but the gap between them will probably narrow.

You may not save any money by switching away from AT&T if all your long-distance calls go to nearby cities within the state. Price competition is mainly for calls between two different states. State regulators control long-distance calling within a state, which may remain in the hands of the local telephone monopoly or be shared, at set prices, among a few long-distance companies. The cost of these calls actually rose last year by 4.8 percent. Virginia allows the most in-state competition, followed by Maryland, Mississippi, Ohio, Oregon and South Carolina. The states with the least pricing flexibility are Connecticut, Delaware, Maine, New Hampshire and Vermont.

Consumers haven't many strategies for defending themselves against these tides. Substantial long-distance users save money by leaving AT&T, but everyone else can only pay more or use the telephone less.

Associate: VIRGINIA WILSON

Bell request for higher access charges deferred

Lawrence Journal-World Thursday, Dec. 19, 1985

TOPEKA (AP) — The Kansas Corporation Commission on Wednesday denied Southwestern Bell Telephone Co.'s request to increase its access charges to AT&T Communications by $3.8 million, preferring to wait for a Federal Communications Commission decision early next year.

Bell wanted to implement the higher charges Jan. 1, 1985, citing the need to "achieve parity" between rates for long-distance calls between within the state with rates charged on out-of-state calls.

Bell, which is the largest public utility in Kansas serving about 785,000 customers in 177 cities, said the change would bring AT&T charges into alignment with rates for smaller long-distance companies.

AT&T competes with smaller companies such as MCI, GTE-Sprint and Western Union to handle calls placed between the state's three long distance service areas — which basically are the two areas codes, 913 and 316, and the Kansas City metropolitan area. Long-distance calls made within the service areas are handled exclusively by Bell.

Also Wednesday, the commission, which regulates utilities in the state, issued its formal order which prohibits businesses from reselling local telephone service to the public.

A tentative decision was handed down in October and at that time, the commission said it would look further into the issue of landlords, such as building owners, who want to resell telephone service to their tenants or business partner sharing the cost of telephone service.

A hearing on that issue is scheduled for March 12.

In addition, the commission formally approved a request to permit businesses other than regulated telephone companies to provide coin-operated telephone service. However, hearings will be held to determine the conditions of the alternative service.

The resale issue is complex and includes questions about whether landlords reselling phone service should be required to pay higher rates to Bell to compensate for the business the company loses.

LAWRENCE JOURNAL-WORLD Thursday, December 13, 1984

KCC OKs fees for Bell phone services

TOPEKA (AP) — Telephone callers will begin to pay for certain assistance from local operators under a plan approved Wednesday by the Kansas Corporation Commission.

The commission, at an administrative meeting, gave Southwestern Bell Telephone Co. approval to proceed with its plans to implement charges for certain operator-aided calls in hopes of generating about $900,000 a year in additional revenues to offset the increased cost of providing the service.

"People who use these services should have to pay for them," Keith Henley, one of three KCC members, said during discussion. "I think we should approve the charges as submitted."

ALSO WEDNESDAY, the commission gave United Telephone Co. approval for its request to offer customers a chance to pay for local phone calls on an individual basis and cut their basic monthly service charge in half.

And the commission said AT&T Communications can proceed with its plan to offer rural customers the chance to save money on long distance phone calls made between the three long distance service areas in the state under a program called Reach Out Kansas.

The commission also agreed to make permanent the bulk of a $56.7 million rate increase granted last December. Under the decision, $23 million of the total will remain subject to refund.

"It's clear Southwestern Bell is experiencing a revenue deficiency of some magnitude," sadi Mike Lennen, chairman of the commission.

"It's clear Southwestern Bell is experiencing a revenue deficiency of some magnitude," sadi Mike Lennen, chairman of the commission. "They have attempted to bring stability to basic local service rates and they should be complimented for that because universal service does exist in the state.

"IN THE INTEREST of preserving stable local service rates, I think we should make the rate permanent, holding open to refund that amount still subject to review, and consider the charges requested for local operator services."

Lennen favored lower rates for operator assistance than proposed by Bell, but Henley said the amounts were not unreasonable.

Under the Bell plan, callers will be charged $1.25 to get an operator to check a local line to see if it is busy, off the hook or out of order and $1.50 to interrupt a conversation at the request of the caller.

The firm proposes to charge $1.05 for assisting in local station-to-station calls and $2.40 for operator-assisted local person-to-person calls. In addition, Bell wants to collect 35 cents when it is asked to charge local hotel and motel calls to a calling card.

"I THINK WE ought to move toward more cost-based pricing and preserve basic local service," Lennen said. "We all know the pricing of these discretionary services is a trade-off to increases in local service rates."

Emergency telephone systems will be exempt from the charges for local line interruption and busy signal verification but not the other categories.

Only about 28 percent of United's 65,000 customers statewide will be given the option of paying on a per-call basis. The experimental service will be offered to residents of Ellinwood, Russell, Junction City and Fort Riley.

Under the experiment, which will last until April 1986, the basic monthly rates would be slashed in half and callers will be billed per call at a rate of 4 cents for the first minute of a call and 1 cent for each additional minute.

Bell had a similar experiment which lasted two years and ended about a month ago.

THE REACH OUT Kansas program will let Kansans pay a $10 monthly fee to AT&T to pay for an hour of long distance phone calls during night and weekend periods. The company hopes to entice 9,500 Kansans to sign up for the plan in hopes of generating $192,000 a year revenue.

However, people who do not make a lot of calls covering distances more than 100 miles on nights and weekends will be advised not to sign up.

Customers who normally talk for an hour or more each month during the night and weekend time periods can sign up and pay the flat $10 monthly charge. According to AT&T calculations, the normal charge for an hour's long distance calling during those time periods is $10.68, based on eight phone calls of approximately the same length.

There would be further savings for customers who make more than one hour's worth of long distance calls in a month. AT&T would charge about 13.6 cents for each minute over the one hour limit, or $8.20 for each additional hour.

In addition, subscribers would get an extra 15 percent discount on calls made during the evening time period. A 35 percent discount currently applies to calls during those times.

KCC OKs rate plan to reduce state phone bills

TOPEKA (AP) — The Kansas Corporation Commission on Tuesday approved a rate restructuring plan submitted by AT&T Communications which the company said would save Kansas consumers $4.1 million a year.

However, it will result in higher charges for people using long distance directory assistance and selected operator-assisted calls.

In addition, the three-member commission, at an administrative hearing, rejected a request by Cities Service Oil and Gas Corp. of Tulsa, Okla., to restrict the scope of an upcoming investigation of the company's request to begin "infill" drilling in the nation's largest natural gas field in southwest Kansas.

And the commission rejected a franchise fee agreement between the Gas Service Co. and the city of Pittsburg which called for the utility's residential customers to pay a 5 percent tax based on their monthly bills to the city. The franchise fee is paid by the utility for the right to use city streets and alleys and easements in servicing customers.

The agreement was rejected because it would only charge industrial customers 1 percent and commissioners viewed that as discriminatory against residential customers. Also, Mike Lennen, chairman of the commission, said the 5 percent was too high, pointing out the commission has not approved any franchise fees higher than 3.5 percent.

AT&T requested the reduction in its per-minute charges to allow it to compete with MCI, GTE-Sprint, Western Union and other companies in the long-distance telephone field.

The telephone case involved a request by AT&T to reduce its per-minute long distance phone rates by more than 6 percent for customers calling from one of the state's three long distance service areas to another.

THE SAVINGS is the result of a decision to require customers who use special long distance services to pay for them.

AT&T requested the reduction in its per-minute charges to allow it to compete with MCI, GTE-Sprint, Western Union and other companies in the long-distance telephone field.

The commission traditionally has agreed to charge actual costs for actual services, such as operator assistance, rather than subsidizing such services with higher rates for long-distance calls.

Under the plan approved Tuesday, AT&T will charge 50 cents for each call to long-distance directory assistance. Currently, those calls are free but AT&T pays about 70 cents to Southwestern Bell for the service. Every customer would continue to get two free calls per month, providing the customer also makes two long-distance calls on AT&T equipment.

In addition, AT&T increased its rates for operator-assisted, station-to-station calls. Under the plan, the rates will increase:

— From $1.05 to $1.50 for station-to-staton calls.

— From $2.40 to $3 for person-to-person calls.

— From 35 cents to 60 cents for AT&T credit card calls.

ALSO, AT&T will charge 7 cents per minute for calls on telephone lines businesses establish in cities where they do not have offices. The local lines allow customers in those cities to call the businesses, essentially a long-distance call, with no long-distance charges.

There has been no charge to the businesses for those types of calls since divestitutre took effect more than a year ago.

The rate changes apply only to calls made between the three service areas in Kansas — basically the 913 and 316 area codes and the Kansas City metropolitan area. The rates do not apply to people calling within the three service areas because those calls are handled almost exclusively by Southwestern Bell.

According to AT&T, rate reductions vary depending on the time a long-distance call is placed and the destination of the call within the state.

Here is an example of the per-minute reductions on calls made during the overnight period, between 11 p.m. and 8 a.m., Sunday through Thursday, and from 11 p.m. Friday through 5 p.m. Sunday. An approximate 60 percent discount normally applies during those periods.

A 10-minute, direct-dialed call from Kansas City, Kan. to Dodge City would drop 14 cents to $1.61 from the current rate of $1.75. The same length call from Kansas City, Kan., to Topeka would drop 7 cents to $1.24. For the same length call from Topeka to Wichita, the cost would drop 15 cents to $1.52.

ON CALLS made during evening hours of 5 p.m.-11 p.m., Sunday through Friday, a 35 percent discount applies. A similar 10-minute call from Kansas City to Dodge City will drop 24 cents to $2.61. The same call from Kansas City to Topeka will drop 11 cents to $2.02 and a similar call from Topeka to Wichita will drop 23 cents to $2.48.

Under current daytime rates, the 10-minute call from Kansas City to Dodge City would drop 33 cents to $4.03 and the call from Kansas City to Topeka would drop 18 cents to $3.11. For the call from Topeka to Wichita, the cost would drop 36 cents to $3.82.

In addition, Tuesday's decision will result in a discount for AT&T customers signing up for its Reach Out Kansas promotion.

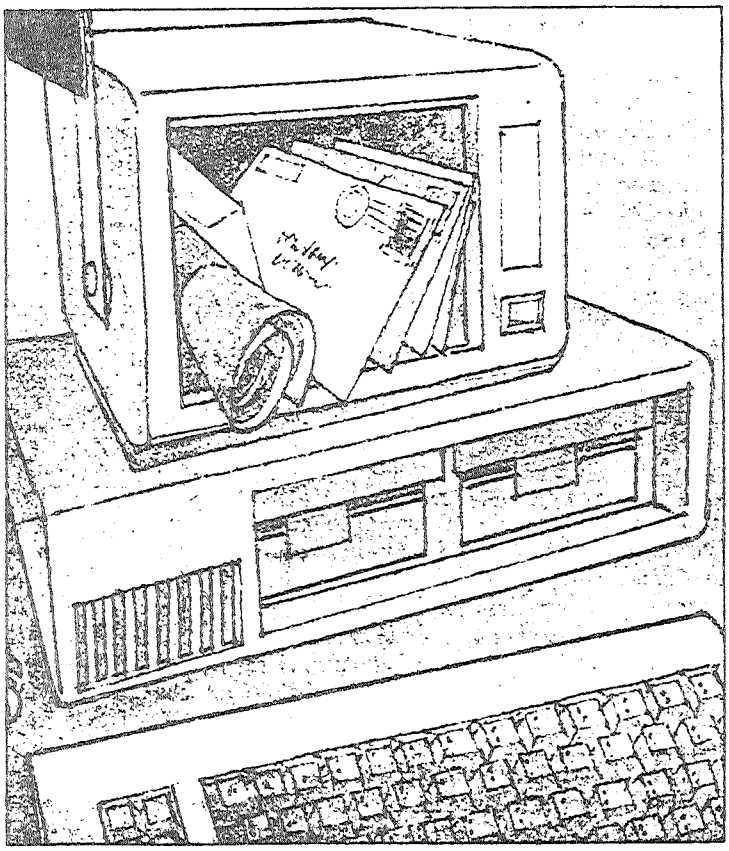
The program gives rural customers the opportunity to pay a flat fee each month for an hour of long distance phone calls during the night and weekend periods. The company hopes to entice 9,500 Kansans to sign up and generate $192,000 in new revenue.

The original program called for participants to pay $10 each month for the first hour of calls but that will be reduced to $9.25 under Tuesday's decision. In addition, customers get a break on each additional hour of calls, paying $8.20 per hour.

Electronic Mail: The Emerging Connection

The benefits of electronic mail are elusive. But after nearly a decade, the need is becoming obvious

by Henry Fersko-Weiss



In 1984, computer-using businessmen and women sent more than 100 million electronic messages through the computers of public service companies such as Western Union, ITT, General Electric and MCI. This is twice the number of messages sent the previous year. The jump in usage reflects the spread of electronic mail to a broad spectrum of businesses. Some large corporations, like Westinghouse and Manufacturers Hanover Trust, now have thousands of electronic mailboxes connecting employees as far away as Kuala Lumpur and Amman–or as close as the office next door.

But the emergence of electronic mail as a business tool has not occurred

overnight. It has taken nearly ten years for electronic mail to capture the corporate imagination. This development did not take place until personal computers began to penetrate the corporate front line and white collar productivity became an issue of burning contention. The benefits of electronic mail go to the heart of the productivity issue–offering better control of time, faster dissemination of information and a more open communication flow. These advantages do not come without a substantial price tag, however.

Furthermore, the benefits of electronic mail are often elusive and intangible. Dr. John McQuillan, a Cambridge, Mass., consultant, calls them "soft benefits." That is, they require further managerial steps to be fully realized as bottom line dollars and cents. Specifically, electronic mail systems require careful planning and active support from top management in order to pay off.

It has been hard for some companies to understand or to justify the cost of electronic mail systems. But the need for electronic mail–and its potential payback–is becoming ever more obvious. Communication experts can now document a startling amount of time wasted in trying to exchange information over the telephone or through physical delivery. Studies by Booz Allen & Hamilton, a research and consulting firm in New York City, show that it takes an average of four tries to complete one phone call; to arrange a meeting between six business professionals takes 100 phone calls. As for the United States Postal service, it is pitifully slow; courier services, although much faster, are quite costly.

These statistics and impressions show that electronic mail is a corporate tool to be reckoned with. "If there are people in your company who need to work together frequently, people whose communication has high time or money value, and yet who find communication difficult because they are geographically dispersed or because they are too active to be easily reached, or, if the company is always falling behind with communication-dependent projects (such as price updates to customers or product announcements), then it is time to be using electronic mail," McQuillan states.

In 1978, Manufacturers Hanover found that it mirrored McQuillan's portrait of an organization in need of electronic mail. "We had spent 25 years automating the back office transaction processing environment, but little had changed in the front office technology since the telephone, even though our communication needs were tremendously magnified," says Richard Groppa, vice-president of technical staff services for the New York City-based bank. After introducing word processing, Groppa spearheaded the use of electronic mail at the bank in late 1979–using ITT's Dialcom service. Within 14 months the pilot group had grown from six users to 800; what began as an experiment had become an indispensible communications conduit–it had reached critical mass. Today there are 5000 users.

It is easy to see how a bank the size of Manufacturers Hanover would have the kind of communication needs that cry out for electronic mail. But Groppa adds that numbers alone don't tell the story. "Critical mass can be two people–if one of them is in London and the other is in Hong Kong, because they would have to stay up to 4 a.m. in the morning to communicate." This is hardly acceptable when a bank has to disseminate CD rate information to its customers, nor is the alternative of waiting until the next day.

While critical mass can occur between two people, if their communication needs are intense enough, Groppa thinks two to three levels of management depth almost always guarantee critical mass because of the degree of interactivity between levels. This was the case at Manufacturers Hanover when the electronic mail service expanded beyond the pilot group to include everyone who reported to Groppa or to his boss, thus extending across three levels of management. What made the group of 30 bankers even more ripe for electronic mail was their geographical separation into six different buildings in Manhattan.

The American Bar Association is another large user of Dialcom. The Association's executive director, Thomas H. Gonser, thinks that our whole business society has reached critical mass. "People are on what we lawyers call 'inquiry notice.' The technology has developed to the point where it is relatively inexpensive to use, secure and efficient. It is a serious mistake to ignore it [electronic mail] because the risk is minimal if you are already using a personal computer or terminal. Everyday stories in the newspaper show how crucial rapid communi-

Top Electronic Mail Services

FEATURES	COMPANY AND PRODUCT					
	GEISCO/ QUICK COMM	GTE/TELEMAIL	ITT/DIALCOM	MCI/MCI MAIL	TYMSHARE/ ON TYME	WESTERN UNION/ EASY LINK
Full Mailbox	▲	▲	▲	▲	▲	▲
Telex/Twx	▲	▲	▲	▲	■	△
Courier	●			△		■
Postal Delivery	●	●		△	■	▲
International Network	△	●	△	▲	▲	▲
Business Forms		△	◆		△	
Computer Interface	△		▲	▲	△	▲
Security						
User changeable passwords	▲	▲	▲		▲	
Passwords on messages	▲		▲	▲		
Encryption	▲	▲	▲	▲		
Timed delivery	▲	▲	▲		●	▲
Average PC Cost per Month*	$51.00	$31.34	$23.60	$102.50	$50.19	$34.89

*Price explanation: According to the Sept. 4, 1984 EMMS (Electronic Mail & Micro Systems) newsletter, Norwalk, CT

▲ Available △ Specialty ● Planned ◆ Limited; to be expanded ■ Available through a third-party vendor

cation is and how much information is now electronically accessible." Gonser now uses electronic mail for 30 percent of his communication needs. "I do a minimum of 50 transactions a day through the service. I can't imagine managing the organization without it," he says.

Many people in the communications industry relate the recent, sharp growth in electronic mail use to the ongoing proliferation of the personal computer. "The force behind personal computing is explosive and it's going to remain powerful in the future," says Jack Naughton, vice-president of Western Union's EasyLink service. "Aside from spreadsheets and modeling, one of the most important uses of personal computers is in the communications world. From a distributed or network point of view, electronic mail with personal computers offers a remarkable fit."

Although users like Groppa and Gonser and industry representatives like Naughton are enthusiastic about electronic mail, they caution that top management of a company must be wholeheartedly behind it. "If there is resistance to the use of electronic mail in your organization then it is doomed to failure even before you start," says Stephen Caswell, a principal of Trigon Systems Group in Toronto, Canada, and an international consultant on electronic mail. "Implementing a leading edge chain system [a system that interactively links people together] can be impossible if half the people won't use it. People have to be willing to experiment, to try it. It changes your communications habits so you have to take a positive attitude in checking your mailbox, otherwise, messages are sent into black holes, and don't help anyone."

Such was the sad experience of a large, diversified manufacturer of agricultural and industrial chemicals. The company tried electronic mail even though some top managers were against it. Eventually the system collapsed; now only a few stubborn pockets of users remain.

If, however, electronic mail use is properly encouraged and supported from the top, it offers compelling benefits. Primary among these is the time saved in communicating. Instead of hunting someone down by telephone, an electronic-mail message can be sent directly from a personal computer to an electronic receptacle on one of the service company's computers, where it will wait to be retrieved, read, and if necessary, responded to at the receiver's convenience.

The ability to communicate quickly and at his own convenience has been very important to Charles Balsly, president of Perle GSD, a Chicago manufacturer of protocol converters. "Electronic mail [he uses the MCI Mail service] has been very good to me," Balsly says. "I have two investors who helped finance the company and are on the board of directors. They are very active businessmen in Cincinnati and are hard to get in touch with. But if there is a problem, for example, with a supplier, and I'm going to commit major funds in the solution, I have to run it by the board. With electronic mail I don't have to hunt them down in a meeting or on the golf course. I know if I send a fully explained message I'll get answered."

It's much cheaper to send a document of up to 10 pages by electronic mail rather than by overnight courier or express mail.

Balsly says the speed of electronic mail also makes it a great sales tool. "Frequently someone will call at 3 p.m. asking for a customized system. I can work up the specs and get them out by 6:30—normally too late for Federal Express—and still have it on the customer's desk by the next morning, even if they're not on MCI, because MCI will deliver hard copy."

Groppa also talks about the savings in time, but he looks at it from an even wider angle. His interest is in the ability electronic mail offers to control time, rather than in the raw savings of minutes and seconds. "It allows you to manage your time better—you can get on the system at your own discretion. The outcome of this, of course, is that you can take time not wasted on futile communication and use it for something else." Because the service is being used by professionals, Groppa says there is no doubt that found time is turned into productive pursuits.

In 1982 Manufacturers Hanover conducted a study of its electronic mail user population—at that time 1500 people. Half the users, about 800, responded. The average daily communication savings from the use of electronic mail was 36 minutes. That is roughly seven percent of a normal working day. Active users did much better than the average, some reporting saving up to two hours a day. "We didn't strip off the low end users, those new to the system, and that has to be factored in when looking at those 36 minutes," Groppa says.

Time savings through the use of electronic mail accounts for half of the productivity gains expected or promised by office automation in studies done by research groups like Booz Allen & Hamilton. In case after case, electronic mail has provided a numerically verified five to 10 percent gain in productivity. "Electronic mail on one side of the scale, by itself, stacks up against word processing, calendaring and all the other bells and whistles of office automation," Groppa says.

In addition to saving time, electronic mail users can turn formerly unproductive time to useful purposes. Gonser, for example makes heavy use of electronic mail while traveling and at home—when it would normally be impossible to reach someone else. "I wouldn't go on a plane without my little Model 100 [Radio Shack Model 100, a lap-size portable computer]. I can write messages or set up files, sending them when I reach the ground. And I often use it from my house on the weekends, because that's where I do my best thought pieces. When I'm done I send it to my mailbox. The first thing Monday morning my secretary downloads it into my Wang word processor for further work when I get in."

Perhaps the second most talked about benefit of electronic mail is lower communications costs. It's certainly much cheaper to send a document or a letter of up to 10 pages by electronic mail rather than by overnight courier or express mail. In comparing electronic mail to normal mail, Walter Ulrich, a consultant in Houston, Tex., says the average electronic message costs 86 cents to send. (Since the average user sends three messages a day, this works out to just over $50 a month.) Of course, the average let-

ter, notes Ulrich, requires only a 20 cent stamp to send, "but a recent study shows the actual cost of a business letter is about $10 when all the preparation and handling expenses are added in. Electronic mail cuts out the handling expenses and has the added advantage of cutting out two to three days in delivery time."

A couple of years ago, Westinghouse, presently one of the largest users of an electronic mail service (Dialcom) did a cost analysis comparing electronic messages to the traditional interoffice memo. While the company would not release the results, Charles E. Winschel, manager of data communication systems in the productivity and quality center of Westinghouse, said the electronic mail costs were "more attractive." He adds, "If that study were done today it would look even better. The cost of mail services have come down and a lot of message preparation time has migrated from on-line terminals to personal computers being used off-line–so users are not billed for being connected to the service until the message is actually transmitted."

Electronic mail compares even more favorably to the telephone in cost, points out Ulrich. "The average long-distance telephone call is at least three minutes, or about $2. This doesn't count the cost of incomplete calls to reach that party and the time you might spend on hold." Nor does it count the time spent in getting the telephone number or the time spent afterward recapturing the continuity of work that came before it. But Ulrich says this applies only to telephone calls that are one-way transfers of information, such as a manager's call to request an inventory report by the end of the day. This type of phone call accounts for about 50 percent of all calls. "If you are trying to negotiate something, or express strong emotions, "then the telephone is very effective. There is an interactive give and take, with subtle voice signals, that can't be mimicked adequately by electronic mail."

Other benefits of electronic mail include the ability to send thousands of messages with only one preparation procedure and the ability to communicate with Telex machines around the world–without the rather high cost of renting a Telex machine and a dedicated phone line. "In one shot we can deliver a statement of corporate philosophy to 5000 people in 40 countries and they will all have it on their desks the first thing the following morning in their own time zone," says Groppa. "We could never do this before. It would take weeks to arrive

Tips For Starting Out With Electronic Mail

The easiest way to discover what an electronic mail service can or can't do for you is to actually use it. With a personal computer as your electronic mailbox, such a hands-on trial is relatively simple and inexpensive. Here are some basic tips to get you started.

1. Set up your system. The first thing you need is a modem. If your computer doesn't come with one built in you can buy an internal modem board, or a stand-alone, external modem, which requires a serial interface board ($100 to $150).

Modems operate at diferent speeds, typically 300 baud or the faster 1200 baud. A 300-baud modem costs between $80 and $250, depending on features; a 1200-baud modem costs $300 to $600. Next you will need communications software to operate the modem. There are quite a few choices here including free software from user's groups; packages bundled with a modem purchase; programs written for a specific electronic mail service that are available from the vendor; and generic, asynchronous communication programs. If you are buying either of the later two types it will cost between $75 and $200.

2. Get connected. The only other costs involved in getting started with electronic mail are the usage charges. You can generally use an electronic mail system for several dollars a day, depending on how much messaging you do. Studies have come up with $50 a month as the average cost for using a public service electronic mail system.

Some vendors even offer special trial deals to large prospective customers. For example, ITT will let a new Dialcom user who is signing a one-year contract with monthly minimums of $2500 have the first month of service free–no matter how many messages are sent. In addition, usage charges for the following three months will have a graduated ceiling.

3. Seek out help. Manuals are often complex or convoluted. The best way to learn enough to start sending and receiving messages is by asking an experienced user to walk you through the system. If you don't have access to such a person then consult the service hot-line number. Sometimes the representatives can be helpful. Other times you will feel like you've stumbled into Kafka's Castle–but don't give up. If you aren't satisfied with a hotline operator, ask to speak to a supervisor or marketing representative.

4. Broadcast your presence. Let people on the system know of your new electronic address. Getting out the word that you are on-line will give you good practice sending messages, but it also will ensure a steady flow of mail–usage breeds usage.

5. Keep messages short. A frequent complaint is that new users of electronic mail send messages that are too long and that circle the point. Reading from a display screen is entirely different than reading from a paper document–a reader's attention span with glowing green characters is much shorter.

6. Establish a schedule. The time and frequency of checking your mailbox should suit your working habits and messaging needs. If you check your mailbox too often you can become frustrated by finding it empty most of the time. If you don't check it regularly you can miss important information. A good starting schedule is twice a day–mid-morning and mid-afternoon. In this way you can catch the late starters in the morning and still have enough time in the afternoon to act on early afternoon information. The schedule should be adjusted as you become more familiar with the pattern of your mail.

7. Send messages regularly. The only time to avoid the electronic mail system is when you need to have a lengthy tete-a-tete. Otherwise, you should discipline yourself to use it regularly. Because electronic messaging is an acquired habit, you have to remind yourself not to grab the telephone or start off down the hall when you want to pass along a tidbit of information, set up an appointment or relay a work progress report. This works both ways, so remind others to use the system if they interrupt you with an informational visit or telephone call.

–H.F-W.

in printed bulletins." An unlooked-for extra benefit of this ability, adds Groppa, is that employees stationed far away from the corporate headquarters no longer feel cut off. "It's been a terrific morale booster."

While the benefits of using electronic mail–the savings in time, lower cost and wider spread of information–are impressive, users and consultants alike caution against casual implementation. Services, they say, must be tested, planned for and actively supported to be successful. One company that seemed to know this almost from the beginning is Westinghouse. It began using electronic mail in 1980 with a test group of 100 employees. Winschel says the company has a distributed management philosophy for its businesses, but it wanted to prevent the proliferation of incompatible devices in the corporation, so it chose one service company, ITT. After the test period, which the company feels was important for charting the goals of electronic mail use, Westinghouse decided to move ahead with carefully controlled growth.

"We learned an important lesson from that first pilot," Winschel says. "You don't pick users because they are nice or because they like computers. You have to start with people who need to communicate frequently–in other words, a community of interest." After that the growth of the system was monitored closely, even at the highest levels of usage. When the service's growth seemed to be getting out of hand, Winschel put a freeze on additional users for three to four months, until tight guidelines could be issued on who should use the system, for what purposes and with what equipment. The guidelines are supported by internally developed applications forms for getting on the service, and management forms for approval.

Now there are 6300 users in Westinghouse. The success of its implementation can not be attributed to careful planning alone. The obvious enthusiasm of top management played just as crucial a role.

"It's essential to have top down endorsement of an electronic mail project," says one user in a company that was not as forward thinking as Westinghouse. "If you don't have that it's difficult to use electronic mail facilities the way they were designed to be used." When the spectrum of opinion in the upper echelons runs the gambit from, "it's the greatest thing since indoor plumbing," to "it's as ridiculous as pet rocks," you might as well give up–for the time being.

Along with the psychological backing of management must come active support. To McQuillan this begins with adequate training. From there it is important for managers to "seed mailboxes with messages. If the flow of messages is weak the users will get bored. All kinds of tricks should be used–call a meeting through the service and say something important so those that missed the meeting, because they didn't check their mailbox, won't let it happen again. There's nothing magical here, just common sense."

Most electronic mail managers advise slowly building up the user population and gradually adding new features.

EasyLink's Naughton points to the importance of getting people over the initial fear of the technology. "I've see people approach electronic mail as timidly as they approached personal computing or word processing. Getting past the barrier of the first two or three messages is the critical part. After that people should move at their own pace." This is how Naughton introduced electronic mail to his own department. "I told them this is the direction we want to go in and I didn't threaten them with the amount of work that would have to go through the system by a specified time. Our productivity is substantially greater today and everybody is pleased at having the service."

Most managers of electronic mail systems advise slowly building up the user population. They also suggest gradually opening up the system to new mail features. "We found it useful to start with intelligence updates," says Groppa. "These are matter-of-course items, which would have been an interruption if passed on without electronic mail–such as, 'Did you hear that Chase just bought a thousand personal computers?' The next step would be to allow a user to report the same information to a group of people at the same time. A next step would be letting the user arrange a meeting."

Glen Meander, who is the head of the telecommunications user group of the Boston Computer Society, and a user of Western Union's EasyLink where he works, Data Language Corp., in Billerica, Mass., has some suggestions that may help the individual user over the initial aloofness with electronic mail services. "The first thing to do is write a script for what you expect to see on the screen and what the answers should be," he says. "Write it down line by line. If there is any deviation from this script the first time you use the service it should be corrected for the next time. That way you won't have to look through a manual when you are connected to the system.

"Next," Meander suggests, "get familiar with the communications package used to connect you to the service. One good way of doing this is by connecting to free local bulletin-board systems–there are a number of books that list these, like The Computer Phone Book (New American Library), by Mike Cane. Use the service as much as possible; find excuses to send messages, and above all, enjoy it."

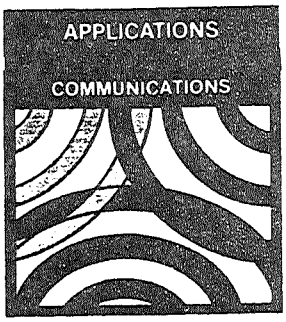
Until the last few years, electronic mail was an unfulfilled promise of futurists who predicted we would all soon be hooked up to the "network nation." Electronic mail was slow to catch hold, however, because it had to await the spread of the personal computer to front-line managers, executives and professionals. When enough of these people needed faster, more efficient communication, electronic mail was a natural.

Now some of that promise is being realized. Not only large companies like Westinghouse and Manufacturers Hanover, but also medium and small companies are enthusiastically embracing electronic mail because of its ability to save time and increase the flow of information across the confines of corporate structure. There is ample, consistent evidence that its use leads to a five to 10 percent productivity gain. And on the intangible side, it may lead to a more creative, happier work environment.

Without a doubt, if electronic mail is properly managed, its time has come. ■

Teleconferencing comes of age

Electronic meetings enter a new era, thanks to personal computers, video printers, slide projectors, and bright graphics, among other tools



It is 9 a.m. in New York, 2 p.m. in London, and an important teleconference is about to begin between a corporate headquarters in New York and the company's branch in London. More than a dozen executives and their staffs gather at each end to confer conveniently using high-quality audio and visual fidelity.

An assortment of aids are on standby, including bright graphics, high-resolution facsimile machines, personal computers, video printers, and slide projectors. Teleconferencing has come a long way in a relatively few years.

The teleconference is becoming a routine feature of business life, and new developments have significantly expanded what can be done in such meetings. Noise levels are significantly lower, audio is signficantly better, graphics are better, and video images are brighter and larger. The use of fiber optics promises further enhancement of video teleconferencing at reduced cost.

The audio teleconference, however, remains the most widely used form of these meetings, and it is here that several recent improvements have had their widest impact. New microphones, for example, make it unnecessary to have several microphones cluttering the conference table in larger rooms.

A vastly improved microphone

One example is the Linear Array Microphone, part of the Quorum teleconferencing product line of AT&T Information Systems. In its stalk 28 electret microphones are carefully arranged to make the array sensitive to sound in the horizontal plane, thus rejecting reverberations and noise from the ceiling and table and improving the effective signal-to-noise ratio for voice. If reverberations off the side walls are not severe, the microphone is effective at a radius of 12 feet or more, about twice the distance formerly available, and in a larger room the single assembly can replace several microphones.

The "phased array" concept is also used in many radar systems, because it permits control of the sensitivity pattern of the system. Here a horizontal sound would reach all the microphones at the same time—with the same phase—and the summed microphone signals would be strong. A sound from above the stalk, on the other hand, would generate signals of different phases at the several microphones. As a result of their phase differences, the signals would cancel each other, giving the desired rejection to nonhorizontal signals.

The most important differences between phased-array microphones and radar are that the speed of sound is quite different from the speed of light and that the acoustic frequency varies over a wide range—300 to 3000 hertz, a 1:10 variation—causing wide differences in the phase differentials. Further, the source of the waves is generally close to the microphone, making the waves nonplanar. Achieving a horizontal pattern under these conditions requires skillful choices in the number of microphones used and their physical arrangement.

Gordon Heffron AT&T Bell Laboratories

Blocking the echoes

A second major recent improvement in audio teleconferencing has been the development of echo cancellation. On a New York-to-London call over a satellite circuit, echoes from the distant end return to the speaker some 600 milliseconds after they have been spoken—an interruption that can be annoying. This problem is averted in satellite circuits using digital very large-scale integrated chips that cancel the echoes.

Echoes that might originate in the New York terrestrial circuits are canceled by a chip at the New York end before they can go to London. Another chip in London nulls the echoes from circuits there. Several conventions have featured audio teleconferences with simultaneous participants in Alaska, continental United States, Australia, Great Britain, and India. The absence of echoes has made the connections acceptable and bodes well for future large-scale audio teleconferences.

Electrical echoes return generally in less than 16 ms: at the standard digital rate for voice of 64 000 bits per second, only 1024 bits of storage are needed for that interval. This is not much for modern chips. The incoming voice is digitized and pushed into the storage unit, and the oldest sample is pushed out so that only the most recent 16 ms of voice is stored. The logic unit then converges on the right amount of delay and the right intensity of the echo. It subtracts this from the signal coming back from the other end and passes on only the true signal without an echo. The concept has worked so well that the chips are being applied to terrestrial long distance circuits as well.

In a teleconference room, however, acoustic echoes are more troublesome than electrical ones. The major problem is to keep the sound coming from the loudspeaker from pouring into the microphone at too high a level, in order to prevent not only echoes, but also "singing" (oscillations resulting from too much round-trip circuit gain). The common practice is to use voice switching: if one end is speaking, the microphone at the other end is cut off and cannot break in until the incoming signal becomes small. Switching from one direction to the other is done smoothly and quickly, between syllables: most of the time it is not noticed, but loud talkers do dominate the telephone connection, as well as the conference.

The path between loudspeaker and microphone is not only a direct path: reverberations from the walls, from the furniture, from the people themselves all come in, all with different delays. Acoustic echoes in conference rooms last for more than 200 ms in a good room. At less than this the room is "flat"; at too much more it yields noticeable echoes.

Echo-canceler chips have been applied to these acoustic echoes, making voice switching unnecessary. The implementation uses the same chips made for electrical echoes, but several are cascaded to build up the longer memory necessary. The con-

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vergence logic still works and is dynamic, so that the system can adjust to the movement of people in the room.

On-premises audio bridges

When more than two sites participate in an audio teleconference, bridges (voice-signal summers and switchers) are used to make the connections and to regulate (voice-switch) the flow of signals, since the echo problem is even more severe with multiple sites.

At first this was done by special circuits within the telephone network, operated by a conference attendant. More recently, on-premises bridges have been offered with great success, permitting the owner full control over the conference, along with additional features. One feature that is especially attractive is called the "meet me" conference setup, in which all the parties call at the same time and are automatically connected to the bridge. This is much quicker than if the conference attendant has to dial all the parties in turn.

The circuitry is also now quite sophisticated, so as to overcome several problems, one of which is called "loss contrast" when one connection is much "lossier" than another. To overcome loss contrast, automatic gain control is included in each circuit of higher performance on-premises bridges. The amount of AGC available varies from 12 to 15 decibels and is dynamic, with quick reaction to changes in signal volume. All the voice signals then reach the bridging point at about the same power level, regardless of the actual loss in the circuit, thus eliminating loss contrast.

AGC has to be used carefully, however, so that only speech, not noise, is amplified. Consequently, a noise pad is inserted to attenuate noise. The control circuit decides if the signal is noise or speech and increases or decreases the pad's loss accordingly. If the control circuit decides that the signal is speech, it also operates the voice-echo pad, increasing the pad's loss so that the speaker cannot hear the voice echo. Adjusting this pad is a bit more delicate: if the loss in the voice-echo pad is too great, the speaker will not hear anyone else either and will therefore be hard to interrupt.

The final elaboration is to squelch the echoes produced in the hybrid circuit where the transition is made from the two-wire station loops (which carry signals from both ends in the one pair of wires) to the four-wire trunks (which have one pair for each direction). This is done by increasing the loss in the hybrid.

To make the transitions smooth as the losses in the pads are increased or decreased, an optoisolator is now used in the operational amplifier circuits in some bridges. The optoisolator contains light-emitting diodes, in which the emission of light is controlled by the signal. The light "shines" on a silicon phototransistor, and the latter's effective resistance changes the gain of the operational amplifier and thus the loss in the circuit.

Audio network bridges

Despite improvements in on-premises bridges, network bridges still carry most of the traffic, and a new system capitalizes on the echo-canceler and digital signal processor chips to offer improved audio performance. In each leg of the bridge, the voice signals are first digitized and echo-canceler chips are applied to prevent echoes from returning to the source connected to that leg of the bridge.

Then the digital signal processor works on the signal samples on that leg, looking for speech amid the noise on the circuit. The processor, another VLSI chip, contains 1024 16-bit words of read-only memory, 128 20-bit words of random-access memory, and an arithmetic unit that can perform 16-by-20-bit multiplications and 40-bit accumulations at about 1.25 million operations a second.

To find speech, the digital signal processor first establishes a noise "floor" by low-pass-filtering the rectified signal and storing the minimum values. The instantaneous low-pass rectified signal is then compared with this floor and is determined to be speech when it is above a certain multiple of the noise floor or, in high noise conditions, when it is simply greater than an arbitrary value.

The signal processor also screens out echoes in deciding speech or noise, adding to the effectiveness of the echo-canceler chip.

Thus when the signals are bridged, there is a high probability that they are speech and not noise. The results of this processing

Defining terms

Bandwidth compression: techniques that attempt to reduce the transmission bandwidth without loss of information. One familiar method used in television is single-sideband modulation of a carrier signal. Modulation normally causes signals at frequencies above and below the carrier frequency; one of these can be suppressed at no loss.

Electret: a microphone that depends on the variation of capacitance between two plates to pick up sound. The special feature is that the dielectric is permanently polarized, eliminating the need for an external voltage to charge the capacitance.

Frame store: a digital storage unit for one entire frame of a television image. Analog-to-digital converters supply the data to be stored. The image can then be processed, if desired, or that image can be displayed over and over, in a "freeze frame" effect.

Hybrid circuit: connects the two- and four-wire circuits at the central offices, merging the one-way circuits into the two-way circuits. Another version is in the telephone set, sending the incoming voice to the ear piece and putting the microphone's output onto the line and not into the ear piece.

Lumen: a unit of light intensity in the International System of Units (SI). It measures total flux. One lumen per square foot is one foot-candle.

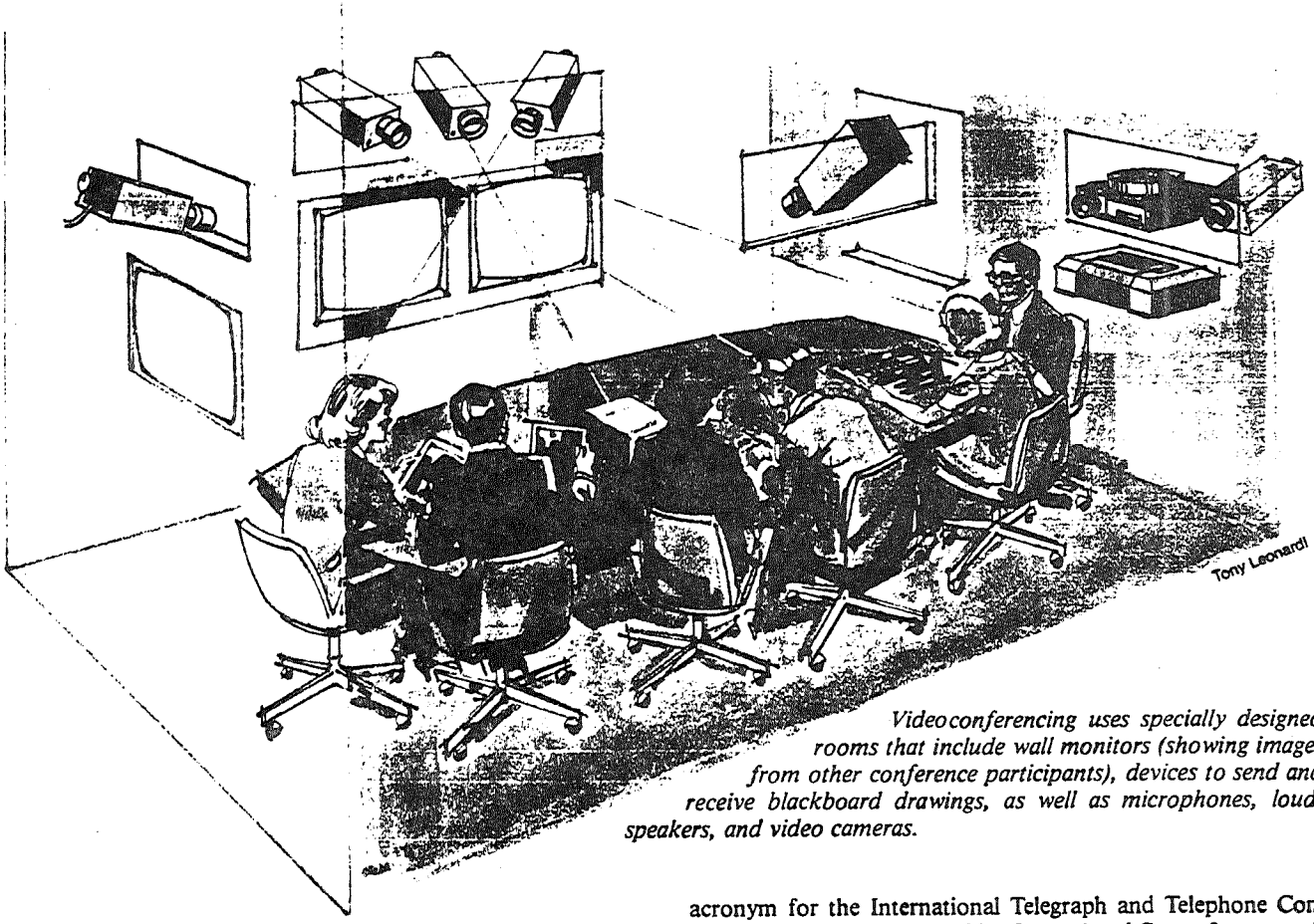
Network bridge: located within the network, not on a customer's premises. It is used to bridge together the voice signals from the several locations in an audio teleconference.

Packet protocols: current popular methods of sending digital data from one location to another. A packet, particularly according to the International X.25 standard, includes bits that define the start and end of the packet, bits in the front that identify the sender and receiver and supply other control information, the data bits themselves, and check bits that enable the receiver to determine if bits have been transmitted correctly. In the X.25 method, data can be transmitted in both directions at the same time: a packet contains not only data but acknowledgements of successful (or faulty) receipt of packets from the other end.

Run-length coding: used to reduce the number of binary bits in a transmission, by replacing patterns of bits by a smaller pattern which, by agreement at both ends of the circuit, stands for the longer run. The simplest example is in a facsimile system where a single bit could stand for a completely white line (in the space between lines of characters), rather than the long strings of "0"s (for white) that would otherwise be required.

Schlieren lens: uses diffraction gratings to control the transmission of light from the source to the receiver. Two gratings are carefully matched so that the second set blocks the light transmitted through the first when there is no signal. A television projector uses this to control a strong light with a small signal—the video electron beam "dents" an oil film between the gratings, which deflects the light so it is no longer blocked by the second grating.

Two- and four-wire circuits: used in the telephone network. Two-wire circuits carry voice in both directions on the one pair of wires and are commonly used as the loops between the central office and the telephone sets. Four-wire circuits are used within the network, as trunks between central offices, and have a separate pair for each direction of voice. Four-wire circuits yield the higher-quality transmission necessary for long distance calling.



Videoconferencing uses specially designed rooms that include wall monitors (showing images from other conference participants), devices to send and receive blackboard drawings, as well as microphones, loudspeakers, and video cameras.

are claimed to be good enough to permit up to five simultaneous speech signals to be added (not voice-switched) with up to 60 sites participating in a conference.

Interactive graphics getting better

Some time during most conferences, graphics are used, because they are often the only effective way to present a complicated subject. Many clever ways have been developed to transport graphics from one conference site to another, or to several sites. Many of these use a television system for display, gathering the image in various ways.

The newest wrinkle is to use a personal computer, video cameras, and the computer's storage disk to display either images from the cameras (documents or hand-drawn diagrams) or figures or text stored on the floppy disk. New software enhances the images and reduces the transmission time of the bits in the picture.

Similar systems have been available for some time, the concept usually being called "freeze frame." What is needed is a video camera, an analog-to-digital converter, a digital storage unit (the frame store) to hold the image, and modems to transmit the bits from one end to the other. Many systems permit the signals from special "tablets" to be added in, so participants can annotate figures being displayed or simply send handwritten material.

One advantage is that a voice bridge will generally also bridge modem signals, and the cost of separate graphics circuits can be avoided. This is important because most market forecasts suggest that the greatest volume in the teleconferencing market is in audiographics.

Facsimile machines and techniques are also often used in teleconferencing. What is new here is higher resolution and the ability to project a high-resolution image on a large screen. Four facsimile groups are now defined by the CCITT (the French acronym for the International Telegraph and Telephone Consultative Committee). The older Group 1 and Group 2 types took 6 and 3 minutes per page, respectively, and offered a resolution of only 100 lines per inch (four lines per millimeter). The new Group 3 machines offer both 200- and 400-lines-per-inch resolution. They save transmission time by using one-dimensional run-length encoding in which special bit patterns represent longer strings of bits. For example, the long blank lines between lines of characters are easily symbolized by a single character. Times as low as 20 seconds per page are offered.

Even newer are the Group 4 facsimile machines, which use a new two-dimensional bit-compression technique and transmit these using a version of the X.25 packet protocol.

Some of the success of these later machines is due to the CCD chips now used in the scanners. A band of light is moved from top to bottom across the paper and is reflected onto the 1728-element (8.5 inches by 200 elements per inch) or 3452-element (8.5 inches by 400 elements per inch) CCD chip. The elements are read out rapidly, digitized, and compressed for transmission.

The high-resolution image can also be displayed with a special video projector. The resolution is generally 1024 horizontal lines and 1024 picture elements per line. At these levels a typewritten sheet can be read on a 5-ft diagonal display, which is considered excellent performance.

Computer conferencing at a leisurely pace

Personal computers and video-display terminals have also been used in teleconferencing. So-called computer conferencing offers two major advantages: one is that there is a written record of the conference, the other is that not all conferees need be present at the same time. A typical computer conference may last several days or even weeks, and the contributions of the individuals come in as they see fit. Software packages for the service are often homegrown, but they are also available from com-

panies that specialize in the field.

One person typically calls the conference, by using computer mail to invite others to participate. The host states the problem to be solved and sets up the "mailbox" where contributions are to be placed. When a participant logs into the conference, the contents of the mailbox are made available to him. Most services offer additional features, such as a bulletin board for administrative messages; private note pads for the participants; and status, control, and management-report functions.

How dynamic and interactive the service is depends on the terminal and computer configurations. In a system where all terminals are accessing the same computer, the connection can be quick and the conference dynamic. When terminals connect to different computers and messages have to flow between the computers not just for the single conference, but for many other functions as well, the connection is generally slower and might take overnight. In these cases there may be full copies of the conference mailbox in each computer to permit fast access to what is available.

Television fostering special conferences

Television conferences are another option. Many hotels first put satellite antennas on their roofs so that they could offer added television entertainment to their guests, but that is no longer the chief reason for the antennas. Many hotels now offer promotional packages that include broadcast conferences, food, and lodging. In these conferences one site is the source of the video and audio, and the others are receivers. The receivers generally have telephone connections back to the origination site for questions and other communication.

These meetings are called *ad hoc* conferences because often the connections exist only for the one event, which may be the announcement of a new product, the signing of an important contract, a special seminar about a technical subject (the IEEE frequently sponsors such seminars), or the stimulation of investment and trade abroad.

Satellites are the principal transmission systems, partly because hotels (Holiday Inn offers Hi-Net Service at many of its locations) with antennas solicit teleconferencing business. But there also are organizations that supply portable antennas at the place and time needed. The transmission is generally one way, not so much because of the cost of the satellite channel, but because of the cost of the up-link antenna system. The up link must be larger than the receive-only equipment; consequently it costs considerably more.

Estimates are that an average of four such conferences occur

Bandwidth compression paves the way

The key to long-distance video teleconferencing is bandwidth compression, since the transmission cost is proportional to the bandwidth of the channel. Transmitting normal (4.2-megahertz-bandwidth) video images digitally requires a data channel capable of handling 100 megabits per second. Such channels are expensive, and their availability is limited.

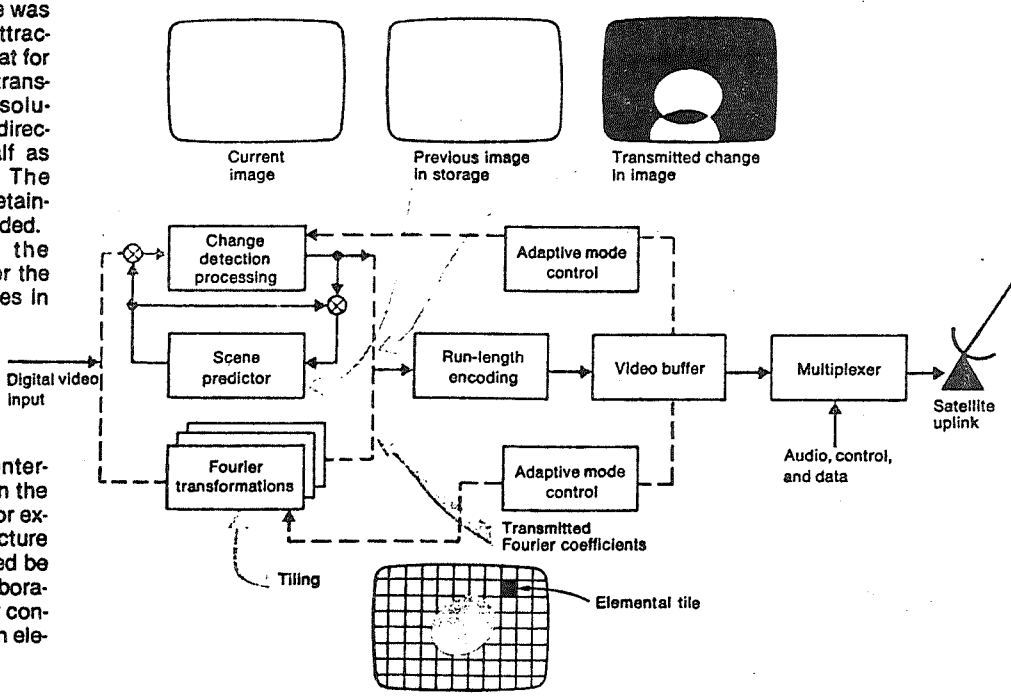
The secret to bandwidth compression is to remove unnecessary information from the image. Designers have developed a number of different methods of doing this. Modern compression techniques allow the bandwidth to be reduced a hundredfold with little loss in image quality and even cut a thousandfold if considerable loss in quality can be tolerated.

When American Telephone and Telegraph offered person-to-person video in the 1960s and 1970s, it recognized that the video bandwidth had to be reduced for below 4.2 MHz if the service was ever to become economically attractive. Extensive tests showed that for the types of scenes normally transmitted—peoples' heads—resolution could be halved in both directions: half as many lines, half as much resolution per line. The 60-fields-per-second rate was retained, since flicker had to be avoided.

To better this 4:1 ratio, the technology has had to wait for the maturation of digital techniques in image processing, data compression, and transmission. Image processing seeks to reduce the redundancy in the picture and to transmit only key information. One approach, called interframe, works on the changes in the picture from frame to frame. For example, the background in the picture might be constant and not need be repeatedly transmitted. An elaboration of this technique looks for constant motion between frames in elements of the image.

The other major approach, called intraframe, looks for redundancy within a single frame. The frame is divided into multiple "tiles"—smaller areas in which the probability of redundancy is higher than over a larger area. This approach might find, for example, that a tile in the picture's background is uniform and is describable simply as a single coefficient in a two-dimensional Fourier series. Elaborations on this approach look for changes in the Fourier coefficients from frame to frame: even though a complex tile may require several Fourier coefficients for its description, retransmission of the coefficients is unnecessary if the tile doesn't change in succeeding frames.

The results are spectacular: Instead of 100 Mb/s, images can now be sent at 1.5 Mb/s or less, even at rates as low as 56 kb/s. Image quality is only moderately reduced at 1.5 Mb/s, com-



weekly in the United States, most produced by organizations specializing in this field.

These large conferences require a bright video display system, brighter than the cathode-ray-tube systems used for smaller conferences. As the market has improved, so have the available systems.

The system from General Electric Co. in Fairfield, Conn., uses a brilliant 1600-watt xenon lamp with a Schlieren diffraction grating system [see Fig. 1]. In this system the first grating diffracts the light and, in the absence of a signal, the second grating blocks it so that the display is blank. When there is a signal, the electron beam falls on an oil film between the gratings and, as it were, dents it enough to deflect the light, allowing it to pass through the second grating and display the image.

Color is available, with the advantage that one set of small lenses carries the complete picture. This makes for excellent focus and registration in the image.

Images 20 ft wide and 15 ft high are possible with low room light, because the units produce around 1000 lumens (color) or even 3000 lumens (black and white). Versions for high-resolution graphics and facsimile, at 1024-by-1024-line resolution, have been used successfully. A variant on this concept is the use of a liquid crystal display (LCD) instead of an oil film in the optical path. The system from the Hughes Aircraft Co. in Culver City, Calif., uses a CRT with light fibers in the faceplate to stimulate photosensitive material outside the CRT enough to operate the LCD crystals. The system has light output at the 500-lumen level.

The brightest display is produced by the Eidophor system, most commonly used for events like closed-circuit boxing. These are light valve units similar in principle to the GE system that deliver as much as 7000 lumens.

Improvements in interactive video conferencing

Two-way interactive television conferencing has been developing since it was first demonstrated by AT&T in 1927. Person-to-person television was the goal for many years, changing to room-to-room TV in 1975. Unlike broadcast video conferences, these interactive meetings have two-way video and generally involve 6 to 12 people in each room. Only two rooms can be involved in a conference, since network arrangements for multiple sites are not yet offered.

The arrangements in the conference room vary widely. The AT&T design uses two standard video monitors on the front wall, one for the outgoing picture and one for the incoming picture. Since the images are not large, only two people can be shown at a time. The design calls for three cameras in the front

pared with broadcast standards, but it is reduced further as the bit rate is cut.

The accompanying figure shows the principal elements of an interframe video codec (coder-decoder). The incoming video signal is digitized and compared with the output of the scene predictor. If a change occurs, it is sent to the distant receiver and to the scene predictor. (To keep the two ends synchronized, it is common also to send a complete description about some of the lines in each field, so the whole picture is completely updated every several frames.)

The major design tradeoffs are in the image quality to be delivered (which in part determines the processing power required) and the data rate required to transmit the information.

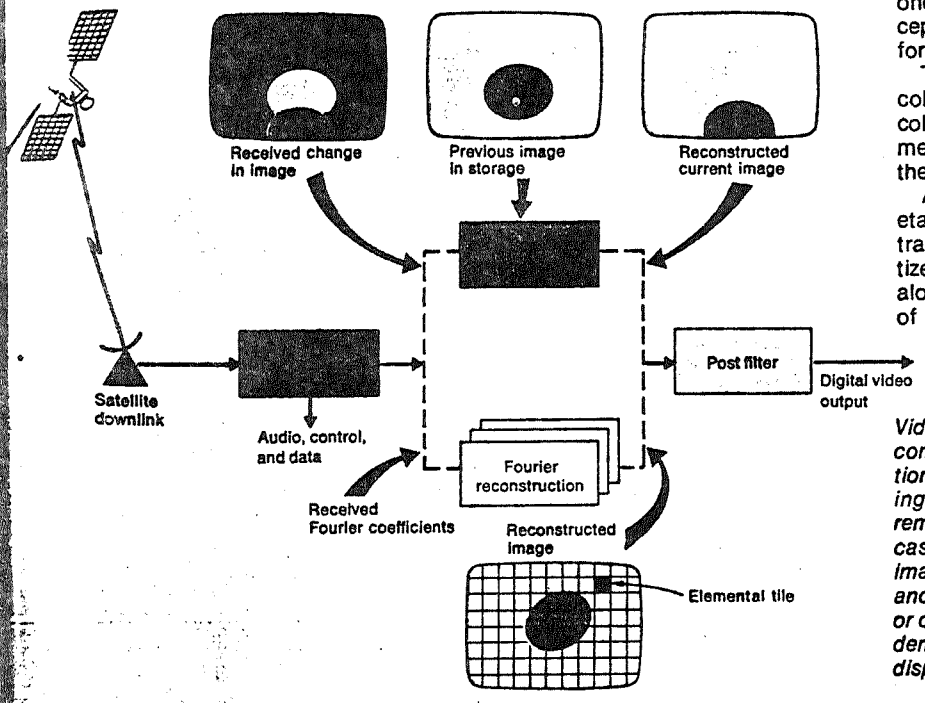
When the image is simple, the codec's buffer may become almost empty, and it is common then to give as high-quality an image as possible. When there is much new information in the image, the buffer fills, and alternative processing modes are often used to save bits and keep the buffer from overflowing.

Some alternative modes are reducing the picture element resolution, reducing the number of samples treated in each line, processing only half of the fields, or, when these are not enough, skipping frames and giving a freeze-frame display. Deciding which modes to use and when to shift from one to another is an important design tradeoff.

In both kinds of systems, digital transmission is always used for the accurate transmission of information. To reduce the number of bits transmitted, it is common to use some form of run-length encoding, in which the patterns of the bits are transmitted, not the bits themselves. Huffman codes, one of several techniques in use, are based on the concept that the most likely bit sequence should be coded for transmission as the shortest pattern.

Taking advantage of the reduced bandwidth of the color components, all codecs in use today also include color. (In NTSC video, the luminance bandwidth is 4.2 megahertz, but the light colors use only 1.5 MHz and the darker colors use only 0.5 MHz.)

All codecs also include pre- and post-filtering proprietary schemes that make the incoming signal more tractable and the display picture clear. All of them digitize the audio signal and include it in the bit stream, along with provisions for temporary or permanent use of some of the bits for other purposes. —*W.G.H.*



Video-conferencing technology encompasses image compression, communications, and image reconstruction. Image compression employs interframe processing (upper tier) or intraframe processing (lower tier) to remove redundancies from the video input. In either case, run-length coding can be applied. The composed image is buffered and multiplexed with audio, data, and control signals and then transmitted via satellite or over land lines. At the receiving end, the signals are demultiplexed and the image is reconstructed for video display.

wall and an audio system that activates the camera pointed at the person speaking. Four other cameras are available for graphics and other purposes.

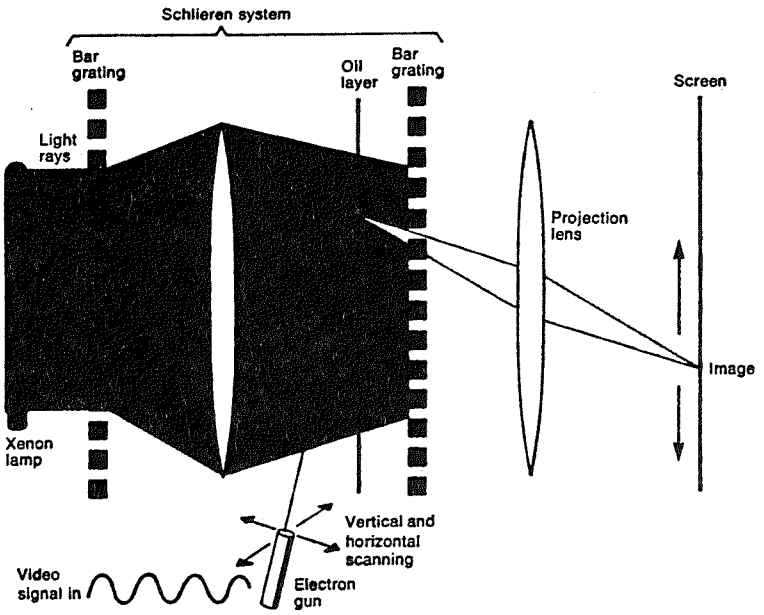
The Satellite Business Systems design (pioneered by Aetna Life Insurance Co. in Hartford, Conn.), in which all the participants normally appear on the screen at the same time, has a large display—generally the GE light valve—to get images large enough to be useful. A second large screen is used for a high-resolution graphics display.

Yet another variant exists in systems used by British Telcom and in a system developed by the ARCO Oil Co. in Los Angeles, Calif. These systems use a split-screen approach, with three participants on the left display and three on the right. The vertical dimension is only one half the usual height. For transmission, the outputs of the two cameras are mixed (stacked), the people on the left being put in the upper half of the composite image and the people on the right at the bottom. The British use standard monitors, whereas ARCO uses projection video systems.

Finally, the Pierce-Phelps Co. offers a cylindrical, anamorphic lens that is similar to the one used in the Cinemascope process. Instead of the usual 3:4 height-to-width ratio, the lens gets 3:7, almost twice the horizontal field of view. Put on a camera, all participants are captured in one image for processing and transmission. On the distant end, the lens is put on a GE light-valve projector to produce a large (3:4) color display of all the participants.

What's also novel in most of these services is that they use digital channels and not the more customary wideband analog channels. The video and audio signals are digitized, and then the redundancy in the image information is reduced by a large factor. For example, just digitizing the video signal without compression requires a bit rate of some 100 megabits per second, whereas current video codecs reduce the required rate to 1.5 megabits per second and even to 56 kilobits per second. The image quality is dependent on the bit rate, but it is effective for conferences.

The signal can even be carried by undersea cable, and a 1.5-Mb/s tariff is now effective between New York and London. The initial demonstration was in 1982.



[1] Light-valve systems are used to present a video image with adequate brightness for a large audience. The system from the General Electric Co. sends light from an intense source through a Schlieren lens. In the absence of an image, the lens focuses the light on the blocking grating, so that it does not go through to the projection lens and screen. When an image is present, an electron beam falls on an oil layer and "dents" it enough to deflect the light rays so that they are no longer blocked by the grating. The intense light is then projected on the screen.

A look down the pike

What does the future hold? Perhaps the best indications come from experiments in Biarritz, France, where optical fibers will go to some 1500 homes. In Germany, an optical-fiber network is reaching into selected homes in seven cities, offering a wide variety of services.

Both systems are designed so two to four video channels carry broadcast television to homes, with the user instructing a central office switch what to put into each channel. A two-way video channel is provided for person-to-person video transmission. Other channels provide high-fidelity audio and stereophonic music, Telex, teletext, data, or other information, as well as telephone service.

The argument that optical-fiber advocates use is that the cost per house of such services will, in time, not be much different from the cost of telephone and cable-television services combined and thus will be economically feasible. Further, the bandwidth will make new services practical, thereby further expanding use and reducing cost.

To probe further

Echo cancellation and digital signal processing were the topics of a special issue (March 1984) of the *IEEE Journal on Selected Areas in Communications.* The *Bell System Technical Journal* of September 1981 (Vol. 60, no. 7, part 2) was also a special issue on the digital signal processor and its applications.

Digital signal processing was also addressed in the article "Network Services Audio Bridge" (the bridge uses these chips) appearing in the *IEEE International Conference on Communications (ICC 1982) Conference Record*, written by J.H. Bobvsin, M.A. Marouf, and P.J. Rutkowski.

Video image processing was the subject of a special issue (Vol. COM-29, no. 12, December 1981) of the *IEEE Transactions on Communications.* Chen and Pratt described their intraframe codec in the March 1984 issue (Vol. COM-32, no. 3) of the same journal, while the intraframe codec concepts first appeared in "Intraframe Coding of Videotelephone Pictures" by B.G. Haskell, F.W. Mounts, and J.C. Candy in the *Proceedings of the IEEE* Vol. 60, July 1972. Motion compensation is treated by A.N. Natravali and J.D. Robbins in "Motion Compensated Television Coding—Part 1" in the *Bell System Technical Journal* of March 1979.

A comprehensive teleconferencing guide is an annual offering of TeleSpan of Altadena, Calif., which also offers a monthly newsletter. In addition, the Center for Interactive Programs of the University of Wisconsin—Extension, in Madison, publishes a teleconferencing newsletter and sponsors a conference in May of each year.

About the author

Gordon Heffron (M) headed the teleconference department, which included both audio and video teleconferencing, at AT&T Bell Laboratories and then at American Bell Inc. after the divestiture. Some other assignments have been the design of the Transaction Networks System, an early message-switching system, and systems engineering for the Digital Data System. At Bellcomm Inc., the systems-engineering organization for the National Aeronautics and Space Administration's Apollo space program, Dr. Heffron headed the guidance and navigation department. He now directs the defensive systems studies department at Bell Labs. He obtained the D. Sc. degree from George Washington University, and earlier degrees in electrical engineering from Tulane and Purdue Universities. ◆

datapro newsbriefs
Communications Management
Vol. 6, No. 11 November 1984
COMMUNICATIONS SOLUTIONS
solutions series

Highlights Inside This Issue

Exploring Bypass Technologies

For many corporations with heavy data communications requirements, the possibility of circumventing the operating company's local loop appears most attractive. Technologies such as optical cable, point-to-point microwave, satellite transmission, CATV, and even FM, are currently being investigated as methods of moving data to long distance carriers or directly to remote corporate locations. These technologies, generally referred to in this context as "bypass," have created considerable waves in the telecommunications industry. The operating companies are predicting huge profit losses (since their major customers are the large corporations that are most likely to use bypass), and are requesting prohibiting legislation. This argument is strengthened by the figures: in the state of New York alone, 0.3 percent of the customers contributed 33 percent of Bell Operating Company revenues. On the other hand, operating companies are seeking to bypass themselves by providing the necessary technology to users. AT&T is also moving into this market, as are the other long distance carriers, and even realtors are getting into the act with provision of ready-made shared communications systems in buildings. Meanwhile, the issues are being hotly debated in Congress and in state legislatures, since the end result of bypass may be a higher residential telephone rate.

For the data communications manager, the highly publicized bypass controversy has a more immediate effect. The technology to eliminate the local loop exists, and there can be strong emotional reasons for taking advantage of it, particularly with the frustrations experienced by many during a lengthy post-divestiture reorganization period. Substantial cost savings can also be realized—provided that bypass technology is incorporated with careful planning.

One factor that is often omitted in discussion of bypass is the percentage of

(Continued page 2, column 1)

Northern Telecom Increases Capabilities of PBX

The TCA show, held in September, was the setting for announcements by Northern Telecom on new products and enhancements for its SL-1 PBX and SL-100 PBX.

Products announced for the SL-1 system include the following: the SL-1 System 36 Gateway, the Asynchronous/Synchronous Interface Module (ASIM), and the SL-1/X.25 Gateway. These products are intended to improve the networking capabilities of the PBX systems and lower costs.

The SL-1 System 36 Gateway lets personal computers, printers, and other ASCII terminals integrate with IBM System 34, 36, and 38 host computers. Using this gateway, the SL-1 can transmit and switch data from these ASCII terminals to the host computers at speeds up to 9600 bps. Connecting the SL-1 System 36 Gateway to numerous computers over twisted-pair wires allows users to access local databases, as well as databases in other cities or countries.

The ASIM permits asynchronous and synchronous terminals to communicate with numerous databases through the SL-1. This interface module permits users to alternately operate data terminals in synchronous and asynchronous mode without needing different interfaces to support the protocols. This module also eliminates the need for modems in local data networks.

The SL-1/X.25 Gateway allows digital format access from asynchronous ASCII terminals to packet switched networks via the SL-1. A packet assembler/disassembler provides the access to the SL-1. Once the data has been assembled, the SL-1 routes it to a public or private packet switched network. This connection to the network lets the terminals communicate with host computers and workstations over a large geographic area.

Products and enhancements for the SL-100 digital PBX include the SL-100 System 36 Gateway, the SL-100 X.25 Gateway, the SL-100 PC interface card, the SL-100 3270 coax elimination and switching feature, and the SL-100 3270 terminal emulation feature. These products are part of Northern Telecom's Open Protocol Enhanced Networks (OPEN) World, a research and development project aimed at a single integrated system of business equipment and office communication functions.

(Continued page 2, column 2)

Exploring Bypass Technologies

(Continued from page 1)

corporate lines that are actually subject to this strategy. Bypass really only applies to situations where traffic is constant, or where routing is to a long distance carrier. For local calls outside the company, bypass is impossible. Since these calls may make up as much as 40 percent of a company's telephone usage, the potential revenue loss to operating companies may have been somewhat misrepresented. In determining bypass savings, these calls must be removed from consideration.

In addition to cost savings, bypass technologies can offer significant improvements in service, particularly in the dedicated line situation. Through use of advanced technology such as optical cable, a broader channel can be made available, allowing significant improvements in high speed data transmission. These improvements must, however, be balanced against the initial high costs of any bypass method. The costs can include immediate outlays for cabling, antennae, and switches, plus hidden factors such as ongoing maintenance and additions to technical staff.

The politicization of bypass is unfortunate, since it obscures the real potential that is now becoming available. It is also unlikely that progress will be halted. In response to escalating communications costs, corporations must seek to optimize outside links. Data transmission is demanding ever more speed and capacity, and bypass is becoming affordable. Even smaller businesses are becoming involved through the use of shared tenant services provided by real estate developers, and through facilities such as New York's Teleport. Digital Termination Services continue to grow in popularity, and suppliers such as CATV and even the local FM station are beginning to move into the bypass field.

It is certain that bypass will put a dent in the local operating company's revenue, but the broader implications remain obscure. The operating companies will, most likely, provide similar facilities to make up for lost profits. For the most part, bypass is a sensible solution and a means of upgrading communications capabilities for improved efficiency.

Northern Telecom Increases Capabilities of PBX

(Continued from page 1)

The SL-100 System 36 Gateway works in the same way as the SL-1 System 36 Gateway mentioned above. The terminals, connected by this gateway, use the SL-100 PBX to communicate with standard SNA/SDLC protocols. Data can be transmitted and switched by the SL-100 PBX to host computers at speeds up to 9600 bps over twisted pair telephone wiring.

With the SL-100 X.25 Gateway connected to the SL-100 PBX, ASCII asynchronous terminals can communicate directly over X.25 public and private data communications networks. The terminals are connected to the SL-100 PBX using an asynchronous interface module, a personal computer interface, or a low-speed data unit. Data, carried over twisted pair wiring to or from the X.25 Gateway device, is translated to or from the international standard X.25 packet format. A packet assembler/disassembler within the device does the translations. The X.25 Gateway device does protocol translation, code conversion, and speed matching.

The SL-100 PC Interface Card permits direct connection of the IBM PC or IBM PC-XT to the SL-100 PBX. A telephone wire connects the card to a telephone jack, which is then connected to the SL-100 PBX over twisted pair telephone lines. Standard IBM data communications software is used with the card, and data is transmitted using the RS-422 interface. With the PC interface card, the IBM PC can access other terminals, PCs, host computers, and databases. The PC interface card eliminates the need to use an asynchronous communications adapter, a modem, or an integral modem card for local access.

The SL-100 3270 Coax Elimination and Switching feature allows IBM 3178 or 3278 terminals to access multiple computers and their databases through the SL-100 PBX. This feature eliminates the need for a one-to-one direct coaxial cable connection between terminals and IBM 3274 or 3276 controllers. Standard twisted-pair telephone wiring is used instead of the coax cable.

Integration of terminals using ASCII asynchronous communication protocols and systems using IBM 3270 series products with SNA/SDLC or bisynchronous protocols can be accomplished using the SL-100 3270 Terminal Emulation feature. Use of the emulation feature allows SL-100 digital PBXs to switch and communicate data from asynchronous terminals to asynchronous or synchronous host computers over twisted-pair lines. Switching and concentration of numerous ASCII asynchronous terminal devices into multiples of seven configurable asynchronous ports is allowed. This feature provides access to the computer as well as eliminating the need for an IBM 3276 or 3274 cluster controller.

Timeplex Introduces Enhanced PAD

Timeplex has announced its enhanced packet assembler/disassembler, the Microplexer MX.25 PAD. Security and flexibility are among the features of the Microplexer MX.25. According to Timeplex, the MX.25 is a response to requests and suggestions from end users. It offers features beyond what are required by international standards and is designed to make communications faster and more secure.

For speed and convenience in establishing connections, two alternatives to manual keying of the network address are offered each time a terminal is used. (A network address can be as many as 15 digits.) Mnemonic calling permits a terminal operator to access a specific computer by typing an easily remembered word, name, or acronym. For placing data calls, mnemonics are interchangeable with numerical addresses. Auto Connect can be used for dedicated terminals that require access to the same port for each connection. A virtual circuit connection is established by the Microplexer MX.25 when the terminal raises the data terminal ready (DTR) at the interface connector, or when the operator sends a carriage return. A terminal

connected through Auto Connect can only request connections to one port. This type of connection adds to network security by preventing unauthorized access to other ports. A dial-in port configured for Auto Connect will permit a caller to make only the preassigned call, even if the correct password is used.

A separate supervisory port on the PAD controls the type of addressing on a user port. User port addressing can be set from a either a remote or local station. Access to the supervisory port is obtained through a password, which is similar to password protection that can be individually assigned to each user port. Additionally, the MX.25 PAD can insist on a password in the text area of an incoming call request packet before accepting the call for the network side of the connection. This feature adds another obstacle to unauthorized entry, and prevents a wrong number from busying out a user port.

The Microplexer MX.25 uses dual data links which are individually addressable by both the network and the user. Each link can offer backup for the other, and maximizes throughput to and from the network. The Microplexer MX.25 PAD appears to the network as two separate PADs, each with as many as 48 ports. MX.25 PADs can connect to the same or to different networks; however, each port can be connected to only one network at a time. Either network can call any port.

DCA Unveils Series 900 Modems

DCA unveiled its line of modems at the TCA show in San Diego this September. The Series 900 product line includes five modems (DCA 910, 911, 920, 930, and 940) which operate at speeds ranging from 1200 bps to 14,400 bps. The DCA 910 is a CCITT V.26, V.26 bis compatible modem designed for use in four-wire, leased line, point-to-point or multipoint applications. This model operates over unconditioned lines and provides full-duplex, synchronous data transmission at speeds of 1200 or 2400 bps.

The DCA 911 is a two-wire, full-duplex modem that operates in a dial-up, switched, voice grade, telephone network. It conforms to the CCITT V.22 bis standard for 2400 bps transmission and to the CCITT V.22 and AT&T 212A standards for 1200 bps transmission. The unit supports both synchronous and asynchronous data transmission. Features of the 911 include auto-call and auto-answer capabilities, with support for Touch-Tone and pulse dialing, and an integrated call progress monitor.

Designed for use in point-to-point or multipoint applications, the DCA 920 provides half- or full-duplex synchronous data transmission at a rate of 2400 or 4800 bps. The interface is CCITT V.27 bis/ter compatible.

The DCA 930 transmits data synchronously at switch-selectable speeds of 2400, 4800, 7200, or 9600 bps. The four-wire, full-duplex unit operates over leased lines in point-to-point or multipoint configurations. The interface is CCITT V.29. Optionally, this model can be configured with an integrated four-channel time division multiplexer that can handle any combination of port speeds up to 9600 bps.

The CCITT V.29 compatible DCA 940 provides full- or half-duplex, synchronous data transmission at speeds of 4800, 7200, 9600, or 14,400 bps over leased lines. The unit is designed for use in four-wire, point-to-point, point-to-point multiport, or multiport polling applications. The DCA 940 features an integrated six-channel time division multiplexer which supports channel speeds of 2400, 4800, 7200, 9600, or 14,400 bps.

Models 910, 920, 930, and 940 operate over unconditioned lines, and feature an adaptive equalizer to compensate for changes in line conditions. Another standard feature on these models is an LCD display which allows a non-technical operator to monitor the unit's operation, check signal quality, and perform local and remote loopback tests. The operator can also observe and change local and remote strap settings as well as downline load settings and speed changes. The LCD display and strap settings are controlled by eight front panel push buttons.

These models also feature seven LED indicators which permit the continuous monitoring of any selected port interface. The LEDs indicate error count when the units are set in a test mode. These units can implement six different test loops including CCITT V.54 Loops 1, 2, 3, and 4 for network testing. In addition, they provide an integral test pattern generator and bit error rate detector which permit a complete test of the bit error rate without the use of external equipment. They can also automatically perform testing on a multidrop network by testing the individual point-to-point configurations and sequences through each modem in the network.

Models 920, 930, and 940 have an integrated eye pattern generator which can be used with an external oscilloscope for system troubleshooting.

AT&T-IS' Dataphone II Product Line Increased

The TCA show provided the setting of yet another announcement: AT&T Information Systems unveiled four modems and four data service units (DSUs) in its Dataphone II product line. Two of the modems, the standalone 2212C and the rackmounted 2212D, are designed for use in switched networks. These models support transmission speeds of 300 and 1200 bps and are compatible with terminals and personal computers which have a standard RS-232-C interface.

The 2024T modem, which is a replacement for the 2024A modem, is designed for remote Dataphone II network sites. The unit transmits at 2400 bps and supports an RS-232-C interface as well as a standard telephone jack interface.

The 2001A is a tertiary channel modem designed for use in banking and financial applications. The unit is particularly suited for use with automated teller machine security equipment. The 2001A transmits data at a rate of 110 bps.

Each 2500 Series DSU, 2596 A and B, and 2556 A and B, is available in tabletop and rackmounted versions. These models offer transmission speeds of 2400, 4800, and 9600 bps,

and are designed for use in multipoint configurations.

GTE Sprint Offers WATS Service

On September 17, at the Tele-Communications Association (TCA) conference in San Diego, GTE Sprint announced an innovative, nationwide, business service. The service, Sprint Advanced WATS, offers 26 different rates, subject to distance, and guarantees Sprint's lowest WATS rate for each call.

Sprint Advanced WATS provides access to all areas of the country currently served by AT&T. Conventional WATS service is provided over lines designated for Band 1, 2, 3, 4, 5, or 6 traffic. If an organization places four Band 1 calls and only three Band 1 circuits are available, the fourth call overflows and is completed on a higher band, which results in higher rates. With GTE's WATS service, subscribers can make an unlimited number of calls without risking overflow to a higher band rate. Because each of GTE Sprint's WATS circuits can serve all bands, calls can be priced according to the termination point, rather than the band used.

IBM Announces New Products

Big Blue made its presence felt once again when, in September, it announced its new network controller, and enhancements to its 3725 Communication Controller. The network controller, the IBM 3710, concentrates BSC, SDLC, and selected start/stop protocols over SNA/SDLC and/or X.25 communication lines at input speeds ranging up to 64K bps. Enhancements to the IBM 3725 Communication Controller include the following: upgrading of the 3725 Model 2 to support increased medium-speed and high-speed lines, channel adapters, and more storage; new clock control features that offer internal clocking of start/stop lines at speeds up to 19,200 bps and direct attachment of synchronous devices at 245,760 bps; and high speed adapter RPQs supporting line speeds up to 1.544M bps for the 3725 Model 1.

The IBM 3710 will connect to another 3710, an IBM 3705, or an IBM 3725 and SNA lines may be shared with multiple 3710s or SNA devices. SNA supports the IBM 3710 as a cluster controller. Up to 32 lines can be supported by the IBM 3710 (upstream plus downstream).

Protocol enveloping for designated non-SNA devices is supported by the IBM 3710, as is full-screen protocol conversion for the IBM 3270 through an attached IBM 7426 Terminal Interface Unit, Model 2. The 3710 also extends SNA networking facilities to chosen BSC/RJE devices, extends LPDA modem diagnostics (using IBM 386X modems) from the IBM 3705/3725 to the network downstream of the 3710, and supports a control terminal that permits installation without having a great impact on host software.

The enhancements to the IBM 3725, Model 2, permit up to 80 medium-speed lines, or up to 16 lines at 56K bps to be supported, as well as supporting up to four channel adapters in a single frame, and increased main storage of up to two megabytes. Other new features for the Model 2 include a channel and line attachment base (CLAB) that has a microprocessor-based communication scanner and a physical base that supports up to 24 additional lines, a line attachment base (LAB) Type A or B, 14 additional line interface couplers for installation in the optional CLAB or LAB, up to six storage increments of 256K bytes, and up to two internal clock controls.

An enhancement to the IBM 3725, Model 1, includes high speed adapter RPQs which permit Model 1 users to transfer data between 3725s at speeds up to 1.544M bps. The RPQs connect one nonswitched facility for duplex or half-duplex communications between IBM 3725s controlled by ACF/NCP.

A new internal clock control feature is available for both Models 1 and 2. This feature offers added business machine clocking capabilities for start/stop terminals along with a higher speed for synchronous devices that are directly attached. The speeds available for directly attached synchronous devices are up to 245,760 bps. The internal clock control feature (ICC-2) also provides clocking for operation with or without a DCE at data rate from 75 to 19,200 bps.

Equinox Systems Offers Data PBX

In today's world of communications, the "smaller is better" theory is the darling of the industry. Equinox Systems embraced this theory when it designed its Data PBX, the DSS-1. The DSS-1 uses programmed array logic to reduce its size, but not its capabilities, and is one-sixth the size and one-seventh the weight of conventional systems. Modular in construction, the DSS-1's basic central unit can accommodate up to 360 lines. By increasing the number of line boards and expansion units, the system can be expanded to hold up to 1,320 asynchronous lines operating at 9600 bps. The nonblocking architecture of this system allows for simultaneous transmission of the lines connected.

Standard PBX type connectors and cable are used in the installation; the system can be installed by the user. An asynchronous terminal is used for system configuration and integration, with menus and help screens available to assist the user.

The DSS-1 supplies user-controlled switching between computers, access control, network management, port contention to increase utilization of the ports, and an RS-232-C supervisory printer port for connection of an ASCII asynchronous serial printer. The DSS-1 features switching logic and backplane, hot standby power supplies, and automatic switchover. □

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NTU got off to a modest start this year, with 48 degree-seeking students and 600 students auditing courses at 30 customer sites. Next year, with satellite delivery, the number of sites is expected to double and the total enrollment to triple. Within 10 years, NTU expects to reach 20 000 students and to award over 550 M.S. degrees each year. The university would then rank in the top five U.S. schools in number of engineering M.S. degrees conferred annually.

The U.S. Department of Defense has been a prime mover in lending assistance to NTU. NTU has also enjoyed widespread financial support from industry and indeed could not have been started without such aid. Donors include Alcoa Aluminum Inc., Allied Corp., Control Data Corp., Eastman Kodak Co., General Electric Co., General Motors Corp., GTE, HP, IBM Corp., John Wiley & Sons Inc., NCR Corp, RCA Corp., Weinschel Engineering Co., and Westinghouse Electric Corp. Industry executives also comprise the majority of the board of trustees that governs the NTU.

To conduct its academic functions, the National Technological University relies upon a participating faculty consisting of consultants selected from the instructional faculty of each participating institution. For this service, the faculty are paid at professional consulting rates. These faculty consultants are organized in discipline groups to form graduate faculties, typically with one representative in each discipline from each participating institution. The graduate faculties in each discipline are supported by three standing committees: the curriculum committee; the admission and academic standards committee, which also oversees academic advising; and, finally, the staffing committee.

Many members of the Association for Media-Based Continuing Education for Engineers have signed letters of intent to cooperate in NTU programs. In the current academic year, the following institutions are originating courses: Colorado State University, Northeastern University, Michigan Technological University, and the Universities of Alaska, Arizona, Maryland, Massachusetts, Minnesota, and South Carolina. Several others are likely to be represented in future catalogs, among them the Georgia Institute of Technology, Illinois Institute of Technology, North Carolina State University, Purdue University, Southern Methodist University, and the University of Kentucky. ◆

THE EDUCATION MARKETPLACE

Instructional television

Last year 70 000 engineers enrolled in 2000 courses delivered by video technology; over 3000 Master of Science degrees were earned via TV in the last two decades

Engineers at the Hewlett-Packard Co. plant in Palo Alto, Calif., who want to stay on top of their fields are going to school—and they are doing it without leaving the HP plant. The school, Stanford University in Palo Alto, comes to them via television.

Taking courses by video allows engineers to keep up with their fields or to pursue advanced degrees at convenient locations and times. Instead of sacrificing work or leisure time to get to class, engineers enrolled in instructional television, or ITV, simply walk to a conference room in their laboratory or plant. If an engineer has to miss an ITV session because of a business trip, it is no great problem; the student simply watches a video tape of the missed session. ITV distracts engineers less from their duties than conventional on-site instruction and tires them less. It thereby increases engineering productivity.

Spurred by advances in electronics that have slashed the price of equipment drastically while improving quality dramatically, ITV is growing. In the last two decades two dozen major universities have awarded over 3000 Master of Science degrees to engineers who completed all their requirements as part-time ITV students. And such students get good grades; a recent Stanford University study found that they perform at least as well as full-time students.

Today about 36 ITV systems are operated by engineering colleges for practicing engineers in their regions. In fact, a school has just been established for ITV exclusively [see "The National Technological University," p. 108]. The number of systems has grown steadily from about five in 1967 and is expected to exceed 50 by 1990. The number of students enrolled in ITV courses has grown exponentially from perhaps 2000 to 70 000 over the same period, and the number of course offerings has climbed from 200 to 2000.

Stanford University's system, in service since 1969, is a prime example of ITV. The system provides four video channels from the Stanford campus to 120 classrooms in plants within a 35-mile radius. Each channel has a return audio channel so the in-plant students can talk directly with the instructor. Participating employers include Hewlett-Packard, which played a major role in instituting the service, and many Silicon Valley integrated-circuit manufacturers. Since 1975, Stanford has delivered video-tape lectures to 30 plants outside its telecasting range.

Lionel V. Baldwin National Technological University

Classes usually small

Typically a group of perhaps half a dozen students will gather on a prearranged schedule for ITV classes. Usually their employer provides a room in the plant for the meetings. The video input may be a prerecorded video tape or a live transmission by an instructor from a distant location. The course material may be developed by a college, the employer, or commercial video publishers.

Usually the students will be able to communicate with a distant instructor by telephone or electronic mail, either in real time or between classes. Often an on-site tutor will attend the ITV sessions to answer questions, lead discussions, and guide the students. Usually the students will take a break at 10- or 20-minute intervals during a 50-minute session to discuss the current topic among themselves. Graduate courses meet two or three times a week on a semester schedule, whereas continuing education courses usually have from three to ten sessions.

One instructor can handle 8 to 12 small ITV gatherings for a single course when students' questions have to be answered and their assignments reviewed. This is usually the case for graduate instruction. For short courses, however, such interaction is often greatly reduced—homework usually is not required, for example—and many more sites can be addressed simultaneously.

The students may participate for academic credit toward a Master of Science degree or simply for continuing education. Regardless of their goals, ITV students respond with overwhelming favor to the method. Students cite convenience as the main feature they like. A designer of digital control systems working toward an MSEE degree gave "time saved in travel to class" as

the major reason for selecting ITV. For another engineer, a designer of power converters, ITV is the "only way available." An engineer responsible for dealing with subcontractors for an electrooptical system found the ability to "make up classes missed while on business travel" an overriding asset of ITV. A packaging engineer studying for an MSME reported that ITV "fits my work schedule." Short-course students are no less enthusiastic than the M.S. candidates. Older on the average than the graduate students (39 versus 28 years), they welcome the convenient opportunity for professional development.

ITV may well reverse the trend for young engineers to end their education with the B.S. degree. Each year the fraction of engineers who enter the U.S. work force with training beyond the baccalaureate degree declines. In 1984, for example, fewer than 30 percent of new engineering graduates sought Master of Science degrees through full-time study—down from 40 percent in 1976. The trend is understandable; B.S. graduates are offered high salaries, they are weary of intensive study, and they often do not know which advanced courses would be most useful on the job.

Multiple advantages offered

With ITV, new graduates find it much easier to continue their studies while working; the time and the place are right. Moreover they can select from a much greater variety of courses than a traditional school could offer and can find a better match for their needs.

With continued acceptance, ITV is likely to affect students and their employers in several ways:

- The proximity of the job site to a college will be less important. Employers now in remote areas will find it easier to attract engineers who want to further their education, and employers will have much greater freedom in selecting new plant sites.
- Students will be able to transfer their credits more readily from school to school if they change jobs or are transferred, because many ITV graduate programs are cooperative offerings by various colleges.
- Since they are not limited to the course offerings of a single school, engineering graduate students will have a more varied choice of specialties.
- Engineers will come to expect on-site ITV as a standard fringe benefit, and many employers will therefore offer it as an inducement even at sites convenient to a college.

Employers pay the tuition

ITV is not inexpensive. Indeed, its tuition may be higher than on-campus tuition, to cover the additional cost of the delivery system and to make up for the lack of Government support (states generally do not subsidize off-campus instruction). But this is balanced by the convenience factor. By far the dominant cost of education is a hidden one—that of the participating engineer's time; commuting to school is costly. For many engineers there is no nearby university offering the continuing education programs they want.

The tuition for ITV courses is always borne by the employer. Similarly the employer provides the equipment for TV reception and playback, as well as classroom space. Some firms give time off for classes during the workday and pay all costs directly to the originating school, although study and assignments are not usually done on company time. Perhaps the majority of companies expect engineers to attend ITV classes after hours or to make up working time spent in class. Such firms reimburse the engineer for tuition and books on completion of a course.

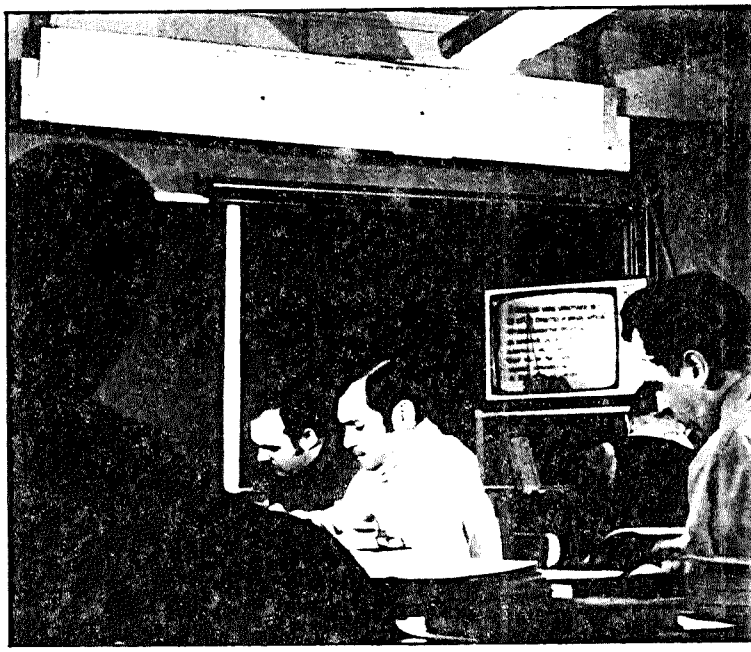
Whether delivered by live transmission or video tape, most ITV sessions employ "candid classroom" techniques: video and sound originate in specially equipped classrooms with a live student audience and present not only lectures but also student questions and discussions. This relatively low-cost production method, in comparison with TV studio production, allows costs to be shared by both on- and off-campus students.

The choice of delivery medium for ITV depends largely on the distribution of participating locations and the number of students. Broadcasting, called Instructional Television Fixed Service (ITFS), is the most economical medium for a relatively small area containing many sites, although the 4-megahertz bandwidth allocated by the Federal Communications Commission limits the resolution of the TV picture somewhat. Closed-circuit microwave links are best for somewhat larger areas containing fewer sites; fiber-optical systems compete for this business today. When classes are small and widely dispersed, and real-time interaction with the instructor is not essential, video tape is the medium of choice. Video tape allows students to choose their

Milestones of video technology in engineering education

Date	Hardware	Early application and/or user
1965	Leased microwave network	University of Florida (Gainesville) linked with Daytona Beach, Orlando, and Cape Kennedy
1967	Ampex 1-in. reel-to-reel video-tape recorder	Colorado State University Surge program
1969	Instructional television fixed service (2.5-gigahertz broadcast)	Stanford University School of Engineering
1969	Modular, studio-produced courseware	Massachusetts Institute of Technology Center for Advanced Engineering Study
1973	Sony ¾-in. cassette VCR	Quickly became standard
1976–77	NASA Communications Technology Satellite	Stanford shares courses with Carleton University, Ottawa, Ont., Canada
1982	Satellite-based C-band transponder	IEEE teleconferences begin
1984	Satellite-based Ku-band transponder	Amcee offers short course over six-week period on Hewlett-Packard network

Collection of Lionel V. Baldwin



Engineers at RCA take an ITV course in the late 1960s. The company was one of the early producers of video tape for continuing education.

ITV for the nonengineer

Instructional television has brought lifelong higher education to a multitude of qualified students who somehow missed the traditional college experience: learning within the four walls of a classroom before the age of 21. These older, real-world-experienced ITV students are enrolling in colleges and adding to the number of students paying tuition and supporting the postsecondary-school educational process. Many of these students openly express fear of college classrooms, but adapt readily to the video medium. Even those who already have college degrees are finding that ITV brings unprecedented convenience and accessibility to continuing education.

Clearly, the ITV marketplace for the nonengineer faces growth and innovation. With ITV, the notion that a course must be the same for every learner no longer holds. The content, timing, and delivery of course material can be adapted to a great diversity of student needs. The following ITV efforts illustrate these points:

- Through **PBS Adult Learning Services**, the Public Broadcasting System supplies 142 licensees with postsecondary-school programming, enabling public-television stations to establish liaisons with more than half of the 2389 colleges in their viewing areas, over 300 of which offer enrollment in ITV courses broadcast by their local stations. From 55 000 students in 1982, enrollment will grow to 125 000 in 1985.
- The **International University Consortium for Telecommunications in Teaching**, a partnership of 19 U.S. and two Canadian institutions, uses video-assisted instruction in three curricula: humanities, behavioral and social sciences, and technology and management. Instruction is paced to the student's progress. A student can earn 120 credit hours and graduate in six years. Instructional television is delivered via satellite to cooperating public-television stations, cable systems, and licensed video-tape duplicators for distribution to learners. Enrollment has increased about 50 percent each semester from 374 students in the fall of 1980 and in 1985 will exceed 10 000.
- **The Learning Channel** is a national cable service that offers ITV for course credit every day of the week. In January, The Learning Channel, which reaches 4.5 million homes, will offer round-the-clock programming.
- **Hospital Satellite Network** provides 24-hour ITV and informational programming for health-care professionals in subscriber hospitals, as well as educational and entertainment programming for patients.
- **Campus Conference Network** is a major new service that will have 60 affiliated institutions by the end of the year. It offered its first program Sept. 19. Entitled "Clinical Care of the Elderly," it was delivered by satellite from Harvard Medical School to 21 sites. Participants talked with Harvard's faculty during the five-hour program and received a certificate of attendance from the Harvard Medical School Division of Continuing Education.
- **Northern Illinois Learning Resources Cooperative** is typical of a large number of college cooperatives using broadcast, cable, and video tape to reach students who, for a variety of reasons, cannot attend conventional classrooms. Some institutions report ITV enrollments exceeding 2000 students.
- **Videodisc Consortium** is a fledgling organization of seven public television stations, the Nebraska Educational Television Network, and the Maryland Public Television Division of Interactive Technologies. It is developing uses of interactive video disks (laser-read disks containing video, audio, data, and computer programs that guide students through a course), building on a study by the Corporation for Public Broadcasting, which sees a sizable market by 1990.

Future ITV for the nonengineer will focus more intensely than ever on the individual needs of the learner. Technology used by ITV will make this possible through video tape, microcomputer disks, and eventually video disks. Interactive video tapes and video disks will enable students to proceed at their own rates and levels, allowing them to individualize their courses. Distribution costs will drop drastically. Even now, large-quantity duplication can provide six hours of course material on a video cassette for $5. Education at home will burgeon; already 11 million U.S. homes have video-cassette players; about 25 milion homes will have them by the end of 1985. It therefore should not take institutions of higher education long to support innovative ITV distribution in the video-cassette format.

—Jack C. Everly
Head
Instructional Television
Office of Instructional Resources
University of Illinois

own time for a class. Live delivery via satellite is fairly new; it appears to be best suited to large classes scattered over continental distances.

First efforts in the 1960s

Contemporary ITV has its roots in successful experiments in the mid-1960s. For example, delivery of courses directly to a job site via microwave links began in 1963 between the University of Minnesota in Rochester and IBM Corp., about 80 miles away. For its first three years, this link featured simultaneous two-way video, but the video return link to the Minnesota campus eventually was found to be nonessential for student-instructor communication and was dropped to reduce costs. In 1971, the University of Minnesota added a broadcast system for the Minneapolis–St. Paul area.

The early space program at Cape Canaveral, Fla., provided the impetus for another early ITV system. In May 1965, the University of Florida introduced two-way microwave links between its campus in Gainesville and six extension centers operated by the school in the Orlando area, where organizations such as the National Aeronautics and Space Administration, Rockwell International Corp., and Martin Marietta Corp. served the space program. Florida's Genesys (Graduate Engineering Education System) offered masters-degree programs in several disciplines, such as electrical engineering, aerospace engineering, and mechanical engineering.

The part-time students in Orlando attended ITV sessions at the same time that the class was being taught on campus. Genesys was supervised by a small group of teachers at the extension centers who occasionally would originate classes there for transmission to the campus.

The University of Florida program was the first operational commitment of any scale. Genesys proved the effectiveness of candid classroom techniques and accounted for more than 250 master's degrees awarded by 1972. Operations terminated that year when industries in Orlando, faced with a serious recession, withdrew their support. The University of Florida resumed ITV operations 10 years later in cooperation with several colleges, this time with video-taped rather than live sessions.

Southern Methodist University began ITV service to job sites in the Dallas–Fort Worth region in 1967 with a system called Tager (The Association for Graduate Education and Research). The system operated over microwave links to campuses of several universities in the region as well as to local companies such as Texas Instruments Inc., Collins Radio, E-Systems, and General Dynamics. Although ITV's use for nonengineering courses as well was encouraged, the SMU Institute of Technology program with regional industry dominated the system. Tager is still in service in expanded form, which includes ITFS, cable TV, and satellite service; it now includes links from the University of Texas at Arlington. The University of Texas service from the Arlington campus is unusual in that it offers many electrical engineering

ourses at both undergraduate and graduate levels. In addition, SMU now operates master's-degree ITV programs outside the Dallas–Fort Worth region by using video-tape delivery.

The early ITV work showed how not to teach on video. An instructor would lecture for 50 minutes on a black and white screen, occasionally jotting ideas on a chalkboard, with little interaction between teacher and viewers or among viewers. This format was unstimulating; students quickly became bored and found it hard to concentrate. Today ITV is in color, often graphics are effective, and students take frequent breaks for discussion. They thus find it easier to become involved and remain interested.

Riding consumer-industry coattails

The quality of current ITV presentations is made possible by improved yet less expensive electronic equipment. The growth of this form of education can actually be correlated with the gradual introduction of high-performance, affordable equipment. This is eminently true in the case of video-tape delivery.

Television cameras, for example, were so expensive 20 years ago that they were priced out of the market for most colleges. Video-tape recorders were designed for commercial broadcasters and cost about $100 000 each. They employed 2-inch tape on reels—a costly and awkward recording medium. Today, at as little as $400, color TV cameras are consumer items. They perform well at ordinary light levels and weigh as little as 2 pounds.

The trend toward better, more economical equipment began in 1967 when the Ampex Corp. of Redwood City, Calif., introduced a "portable" $4000 machine that used 1-in. reel-to-reel tape. This machine opened up the possibility of tape-delivered courses and also made it economical to record live transmissions for later use. A couple of years later Japanese manufacturers introduced $1500 machines in the United States. By 1973 the Sony Corp., headquartered in Tokyo, had introduced a recorder using ¾-in. tape cassettes. With its reliability, video fidelity and the convenience and economy of video cassettes, this machine achieved instant popularity. More recently, longer-playing ½-in. video-cassette machines, with programmable recording and playback, have been displacing the larger cassette machines. These latest entries come from a variety of Japanese manufacturers such as NEC Inc., Sanyo Inc., and Sharp Electronics Corp., and they cost as little as $250.

Clearly ITV has ridden on the coattails of consumer electronics; as products become available, educators are quick to exploit them. The market for educational electronics is relatively small —perhaps a few million dollars a year—and could never justify development of advanced technology. Fortunately products for the highly competitive multibillion-dollar consumer market can readily be adapted for educational use.

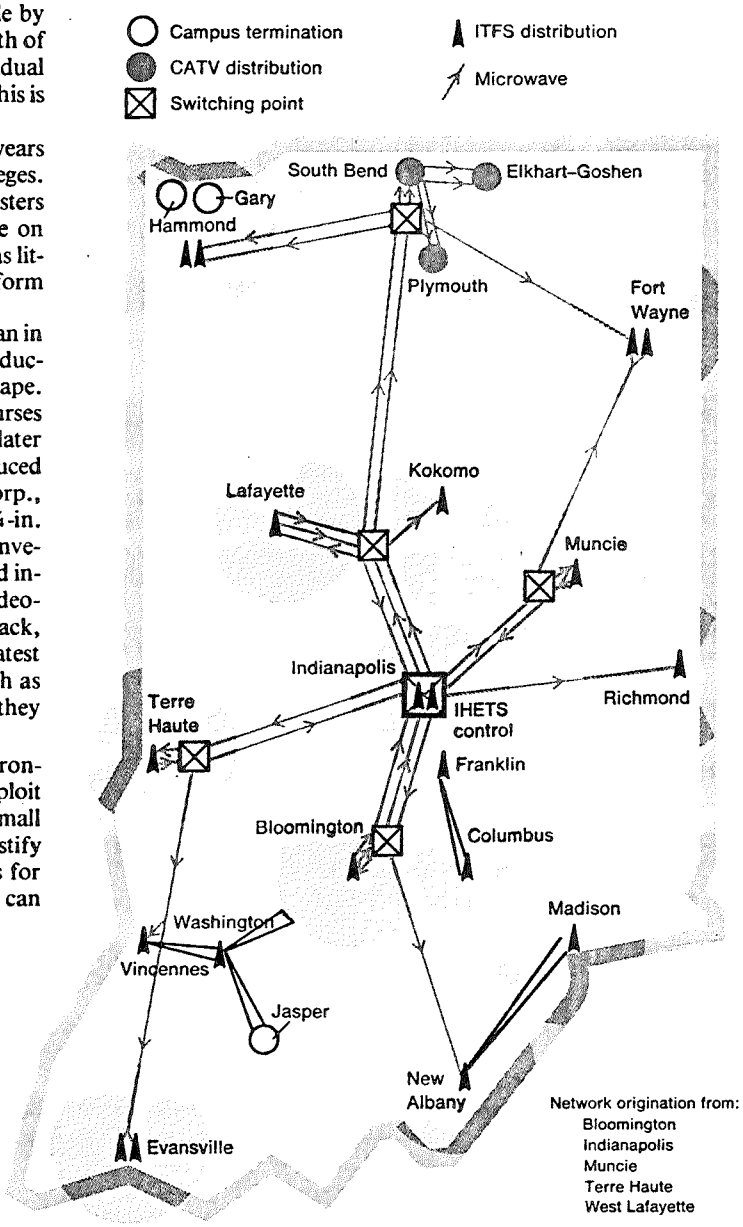
Colorado State University, in Fort Collins, was perhaps the first to exploit the falling prices of video-tape recorders in 1967. It began its Surge (State University Resources for Graduate Education) by serving seven companies from Colorado Springs (120 miles south) to Cheyenne, Wyo. (45 miles north). Participants included Hewlett-Packard, IBM, Martin Marietta, and Honeywell Inc. The university taped M.S. courses given on campus and delivered the tapes within 48 hours by commercial courier to the seven participating plants. ITV students could then watch the tape the day after the class at any convenient time—early in the morning, during the day, or in the evening. They asked questions of the instructors by phone or in person during occasional visits by faculty members.

The Surge system and its video-tape delivery proved popular immediately and the number of company sites has grown steadily. Today Surge serves 45 locations along the eastern side of the Rocky Mountains, largely in Colorado, offering 90 courses annually to almost 1000 students. Engineering accounts for half the enrollment and 70 percent of the courses. Most of the remaining cou. ad to a Master of Business Administration degree, along with a smattering of computer science, statistics, mathematics, and physics courses.

Noncredit courses available, too

ITV in the San Francisco Bay Area is enriched by the Association for Continuing Education, which offers noncredit courses to industry, research establishments, and academic institutions. A user-owned, nonprofit provider of classroom instruction, the association used Stanford's TV network for many years before starting its own broadcast system recently.

Other prominent providers of ITV include the University of



Purdue University offers master's degree programs in engineering as well as noncredit courses over the Indiana Higher Education Telecommunications System (Ihets) Switched Video Network. The network extends from Gary and Fort Wayne in the north to Evansville and Madison in the south. It employs a mixture of closed-circuit microwave links, broadcasts at the instructional television fixed service (ITFS) frequency assigned to education (reaching tan-colored regions on map), and transmissions over cable television (CATV). Switching points allow programs to be directed from several originating campuses to many receiving sites simultaneously.

Southern California, which serves the Los Angeles area and, via a repeater station, Orange County. USC's clients include such major aerospace concerns as Hughes International, Rockwell International, and McDonnell Douglas Corp., as well as small high-technology firms. The service began in 1972.

Since 1976 the Illinois Institute of Technology has broadcast from the Sears Tower in Chicago; it now broadcasts on seven channels to such firms as Bell Laboratories, Motorola Inc., and Northrup Corp. The University of Maryland in College Park has broadcast since 1981 to IBM, National Bureau of Standards, National Security Agency, and Westinghouse Electric Corp., among others in the Baltimore–Washington area. The University of South Carolina in Columbia has since 1969 employed an unusual but effective broadcast setup: it provides live ITV over the statewide public-broadcasting network. The network has many other users, of course, and the university therefore supplements its live broadcasts with video-taped sessions where the network is unavailable.

Perhaps the most far-ranging live ITV system is Purdue University's, which uses a microwave network, the Indiana Higher Education Telecommunications System. From West Lafayette, the Purdue system extends to five other campuses (Calumet, Fort Wayne, Indianapolis, Columbus, and Evansville), as well as to over two dozen industrial and Government sites. Video-tape delivery extends the service to several sites beyond the microwave links. Engineers at Magnavox Electronic Systems in Fort Wayne and Delco Electronics in Anderson are among the enrollees in the degree-granting program.

Cooperation among suppliers

A nonprofit consortium, the Association for Media-Based Continuing Education for Engineers (Amcee), promotes cooperation among ITV suppliers and users as a way of spreading benefits and reducing costs. The following 24 members are up from 12 at the association's inception in 1976: Auburn University, Colorado State University, GMI Engineering and Management Institute, the Georgia Institute of Technology, the Illinois Institute of Technology, the Massachusetts Institute of Technology, Michigan Technological University, North Carolina State University, Northwestern University, the Polytechnic Institute of New York, Purdue University, Southern Methodist University, Stanford University, the University of Alaska, the University of Arizona, the University of Idaho, the University of Illinois at Urbana–Champaign, the University of Kentucky, the University of Maryland, the University of Massachusetts, the University of Michigan, the University of Minnesota, the University of South Carolina, and the University of Southern California.

Members of the association share information on customer needs, cooperate in publishing short courses, and combine marketing efforts to reduce costs. The association has developed guidelines for ITV classroom techniques and produced a set of video tapes to help instructors and support staffs make the best use of the approach.

Satellite-delivered courses

Satellite delivery of single-topic, one-day teleconferences by the IEEE is the latest example of ITV for noncredit continuing education. Since 1982, the IEEE has originated such courses from a university and relayed them by satellite to gatherings of engineers for a modest fee. Two-way communication is possible. Arrangements for receiving stations must be made locally. So far this year the IEEE program has offered courses in personal-computer software, project management, and very large-scale integration. A course in integrated manufacturing is scheduled for Dec. 4.

With the aid of Hewlett-Packard, the Association for Media-Based Continuing Education for Engineers sponsored a satellite-delivered short course last spring sent to more than 50 company sites in the United States. Programs originated at the HP studio in Palo Alto. The newly formed National Technological University, which uses video tape for its courses, plans to use satellites for its graduate programs in 1985. NTU will share this network with Amcee, which plans to expand its series of noncredit courses, workshops, and seminars.

Studio productions

Because the interests of engineers seeking advanced education are so diverse, educators favor candid-classroom techniques overwhelmingly, for both live and video-tape delivery. The material is used for one course only and is updated for subsequent courses. The use is simply too limited, on the whole, to support studio productions. There are important exceptions, however.

Studio-produced continuing-education packages in engineering were first done at the Center for Advanced Engineering Study at the Massachusetts Institute of Technology in 1969. A grant from the Sloan Foundation aided the work. Since then, MIT has produced a variety of course packages, each consisting of a set of coordinated lectures and demonstrations on video tape, printed study guides that include all the visual aids used in the tapes, textbooks, problem books with solutions, and occasionally computer card decks or tapes. The courses usually entail 12 to 15 lectures, each lasting about 30 minutes. The offerings include artificial intelligence and digital signal processing and are often taught by leaders in the field.

The cost of producing these courses can be spread over many students over a period of years; demonstrations and elaborate graphics, including animation, can be justified. Several other engineering colleges are now active in studio productions, including Colorado State University, the University of Massachusetts, and North Carolina State University.

In the last decade modest catalogs of instructional programs on video tape have been assembled by Texas Instruments, Hewlett-Packard, the Lawrence Livermore Laboratories, Union Carbide Corp., IBM, Western Electric Co., and Bell Laboratories, among others. To help defray production expenses many of these organizations make the material available outside for a fee. A few companies specialize in producing video-tape courses for sale to employers, particularly on computing and management subjects. Of these, Advanced Systems Inc. in Arlington Heights, Ill., and Deltak Corp. in Minneapolis, Minn., are probably the largest.

An interesting and potentially important new development is computer-aided instruction with interactive video disks. Students observe the presentation recorded on a video disk for about 15 minutes, break to do programmed exercises on a personal computer, and then alternate between viewing and exercises for a total of one to two hours per session. The cost of preparing the software and producing the presentation is high—about $60 000 per disk. Therefore the medium is economical only for courses with wide appeal.

An example is a course on the UNIX operating system prepared by Interactive Training Systems of Cambridge, Mass. Consisting of 37 disks—6 presenting an overview of the subject, 15 dealing with fundamentals, and 16 devoted to the C programming language—the course employs a Sony laser-disk system and an IBM personal computer.

About the author

Lionel V. Baldwin is president of the newly formed National Technological University, an institution he was instrumental in founding after many years of involvement with instructional television as dean of the College of Engineering at Colorado State University.

He received a B.S. degree from the University of Notre Dame in 1954, a S.M. degree from Massachusetts Institute of Technology in 1955, and a Ph.D. degree from Case Institute of Technology in 1959, all in chemical engineering. He is the former chairman of the board of directors of the Association for Media-Based Continuing Education for Engineers. ◆

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27 December 1984
(12-037-L)

Mr. Robert Haley
Director of Administration
Kansas Department of Transportation
State Office Building, 7th Floor
Topeka, Kansas 66612
BUILDING MAIL

Attention: Larry Morlan

Dear Mr. Haley

We sincerely appreciate your comments regarding the DRAFT of the Telecommunications Specification. We need as much input as possible from all agencies before final preparation of specifications. It is our aim to provide all the communications necessary for efficient operation of state government consistent with agency funds available for this purpose.

The "Key System" type telephones currently in use at certain locations within the Department of Transportation will need to be changed under the plan specifications. This can be done through the use of several kinds of secretarial answering systems presently on the market. These secretarial answering systems will be less expensive and can work high speed data from any phone outline. I have included some examples of products for this purpose and a drawing of how such a system might work.

The question of whether to purchase or lease new equipment or retain current equipment will be determined on the basis of each particular location within the state system. This may depend upon economic variables and upon the serving telephone companies offers to sell in-place equipment. We will help you to make those decisions in light of final specifications.

The Telecommunications Office is also concerned with maintaining operational compatibility throughout the system.

During the implementation period our telecommunications staff will be in contact with your agency to give you specific information as how you can use the new plan to increase automation and reduce costs.

Thank you for your comments and suggestions.

Sincerely,

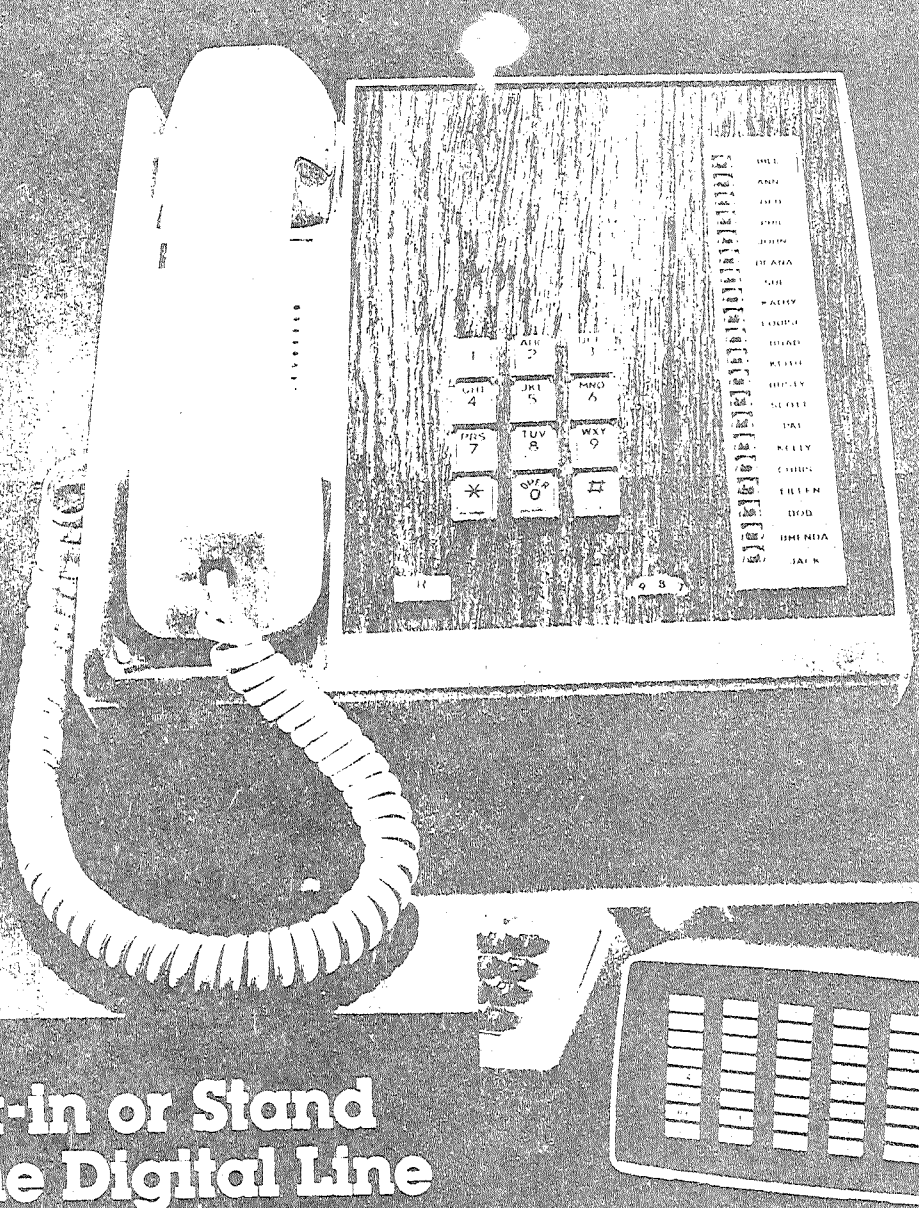
J. L. Jennings
Acting Deputy Director
Telecommunications Bureau, DISC

Attachments - 3

JLJ:LH:djm

cc: Dr. Russell Getter

STATUS at a Glance



Built-in or Stand Alone Digital Line STATUS Indicators

Sta[illegible] V & VII PBX Feature Telephones

Inexpensive but sophisticated solutions to PBX/Centrex monitoring problems

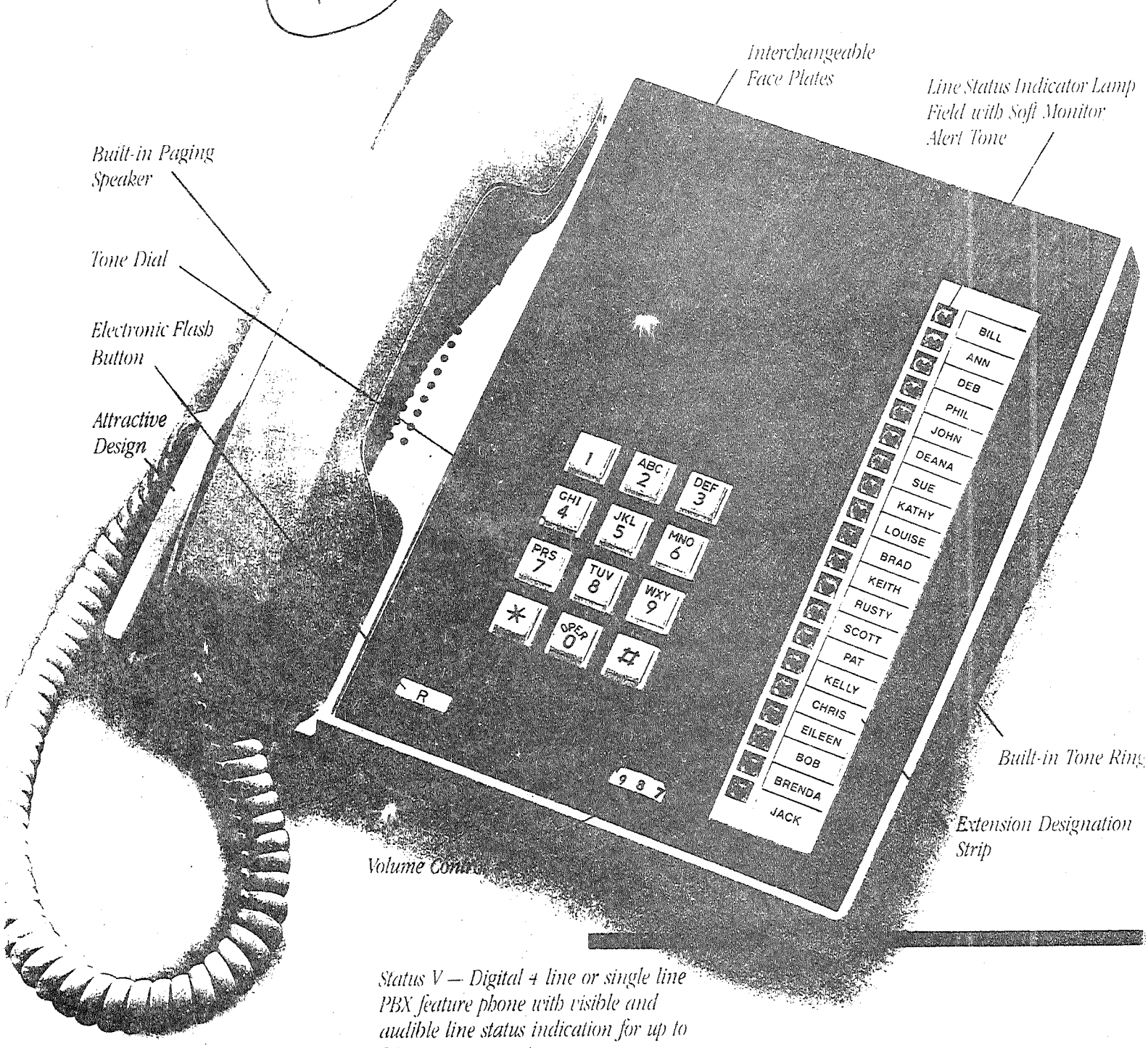
Status telephones give secretaries and receptionists instant visual and audible indication of all extensions being monitored. In addition, the telephones have such features as built-in tone ringer, electronic flash button, transformer coupled paging or music speaker and volume control. These features allow secretaries/receptionists the fastest and most efficient method of intercepting and transfering stations requiring monitoring. *The ability to easily use PBX/Centrex pick-up and transfer codes totally eliminates the need for costly and limited function key systems.*

Individual station LED's indicate whether a station or line is busy, idle, or ringing. In addition to monitoring standard PBX/Centrex stations, the *Status* V or VII will also monitor WATS, FX, DDD's and other special service 48-volt lines.

A size to fit any need

Status telephones are available in both four (4) line and single line configuration with the ability to monitor 10, 20, 30, 40

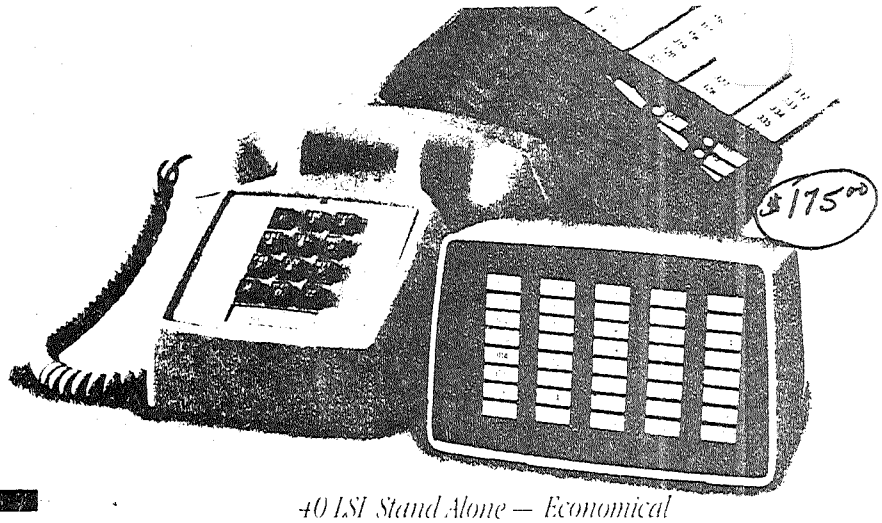
$400.00



Status V — Digital 4 line or single line PBX feature phone with visible and audible line status indication for up to 20 separate extensions.

) or 60 extensions or lines. As many as three *Status* phones ay be simultaneously monitoring the same extensions. All formation on monitored lines is digitized and uses one pair re for each 20 stations being monitored. *Status* telephones e shipped with two 3-pair modular cables.

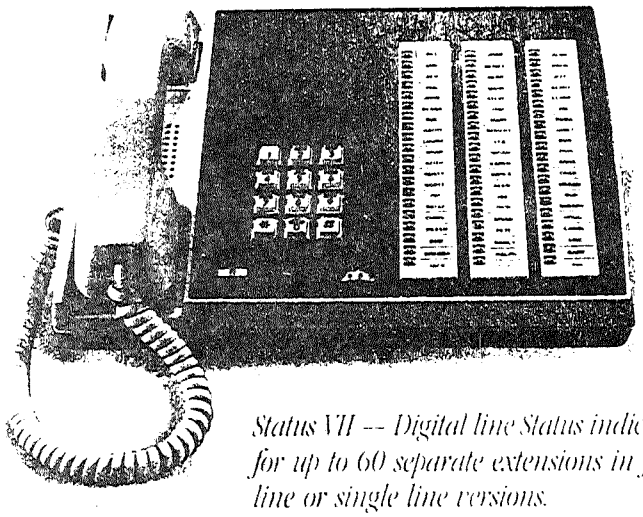
Stand alone *Status* displays are also available for use with -place telephones or key systems, and may be ordered in 10, , 30 or 40 line versions. All digital *Status* displays are ipped with and operate off of standard 4-conductor modular ition cable.



40 LSI Stand Alone — Economical line Status indication for up to 40 extensions.

. PBX feature phone...that looks ke a telephone

The *Status* V and VII PBX telephones not only look like a ephone, they act like a telephone. Secretaries and receptionists e them because of the conspicuous absence of the common array confusing buttons. They are extremely easy to use and the olutionary design and function does not alienate itself from the er. Interchangeable face plates and full modularity make changing upgrading these instruments a snap. The functional design and ssic appearance makes them an ideal choice in any office decor.



Status VII -- Digital line Status indication for up to 60 separate extensions in four line or single line versions.

Digital Status Pac Stand Alone display — no less status

Status Pac stand alone indicators are the perfect economical solution for extension monitoring needs. Containing all that's needed to instantly transform any telephone into a *Status* phone with a monitoring capacity of 40 stations. Face plates may be removed to allow for personal designation of extension numbers or names.

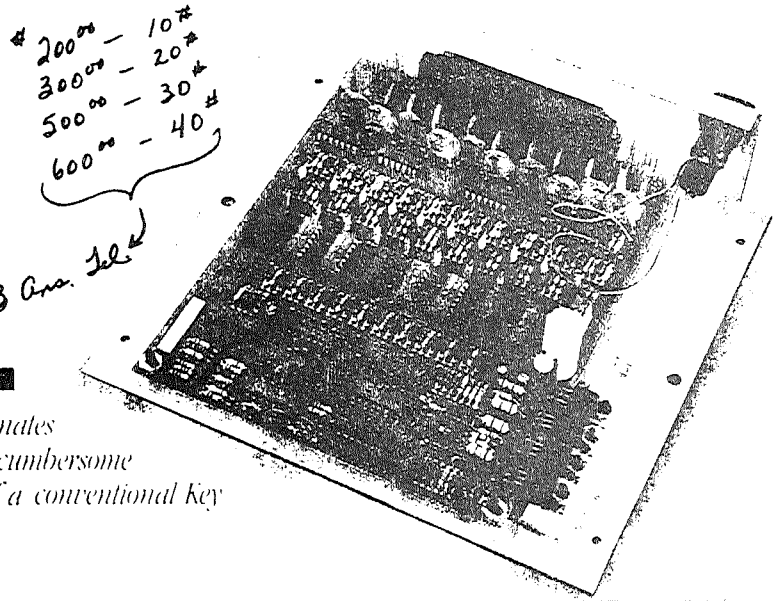
Status Pac control — The "Brain" that eliminates key systems

This inexpensive, sophisticated processor controlled monitor unit totally eliminates the need for costly, unwieldly key systems behind PBX Centrex. At the same time greatly enhancing the ability to utilize modern PBX Centrex features. The *Status Pac* control mounts at the MDF and drives all line monitor functions for up to three *Status* telephones or stand alone displays. The *Status Pac* control will monitor all standard PBX Centrex and CO line terminations. Signals are transmitted to the *Status* phone or display over one pair wire for each 20 lines monitored. *Status Pac* control contains its own power supply and may be ordered in 10, 20, 30, 40, 50 or 60 line versions.

Ring Delay

Status Pac controls are available in a ring delay version which llows programming of ring delay on a line by line basis for 3 ings per line.

Status Pac control is easy to install and eliminate the massive IDF required by key service units. Solid state electronics means greater reliability and ease of maintenance.



Status Pac Control — eliminates the need for the costly and cumbersome installation requirements of a conventional Key Service Unit (KSU).

Specifications

Power Requirements

Voltage	115 Volts AC
Current	½ amp max

Environmental Requirements

Temperature	0°C to 55°C
Humidity (non-condensing)	0% to 85%

Electrical Requirements

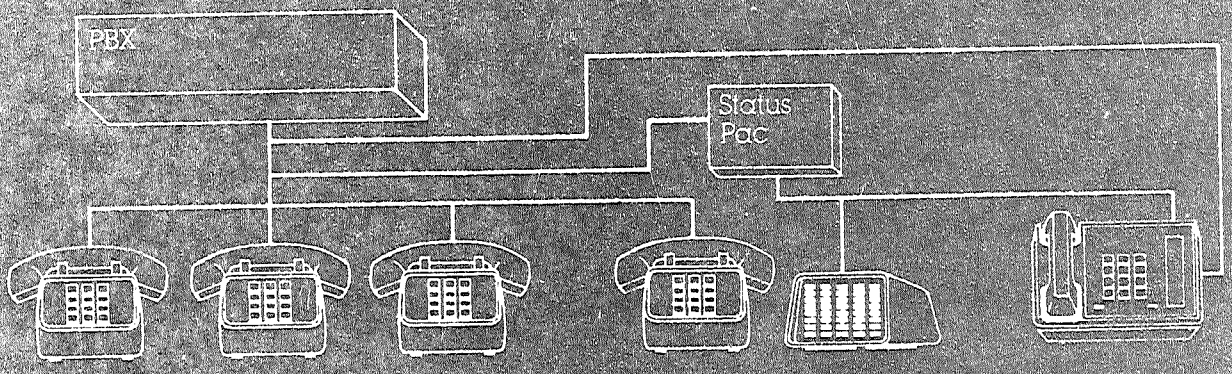
Line Loading – DC	10 meg ohm
– AC	10 meg ohm (meets all FCC part 68 requirements)
Off hook threshold voltage (48 V trunk)	15 Volts DC (adjustable)
Ringing Voltage detector (48 V trunk)	48 Volts AC RMS (Ring side or tip side ringing)
Tone Frequency Duration	1000 hz nominal ½ second on – 1½ second off (volume adjustable)
Controller	may drive up to 3 displays (1 pair wire for each 20 lines)

Mechanical Requirements

Controller	50 pin female connector
Display	2 pair modular with 7 foot cord

	Weight	Size
Status V Telephone	approx. 3½ lbs.	7⅛ x8¾ x8⅛
Status VII Telephone	approx. 4 lbs	4⅛ x8¾ x1 1⅝
40 LSI approx. 1 lb	4⅜ x6½ x4	

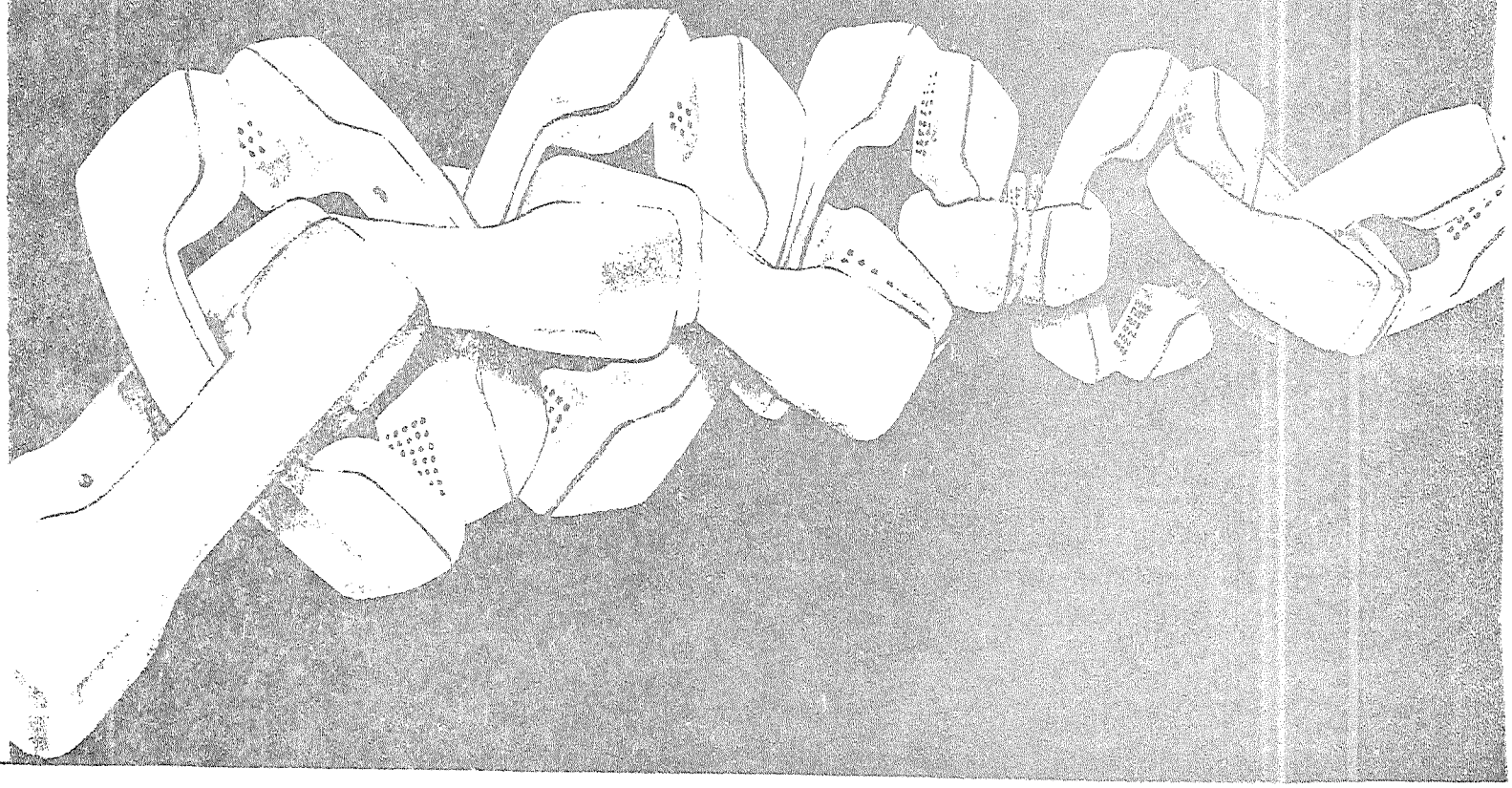
Status Pac Control	Weight	Size
10-20 line	3 lbs	7½ x9 x2¾
30-40 line	approx. 5½ lbs	7½ x17 x2¾



STATUS faction Xtel

3908 N.W. 3RD ST. OKLAHOMA CITY, OKLAHOMA 73107 (405) 946-1500

The Executive-Secretarial Communications Link



Status III & IV Centrex/PBX Voice Terminals and Answering Posi ns

A strong chain of communication is absolutely necessary for business success

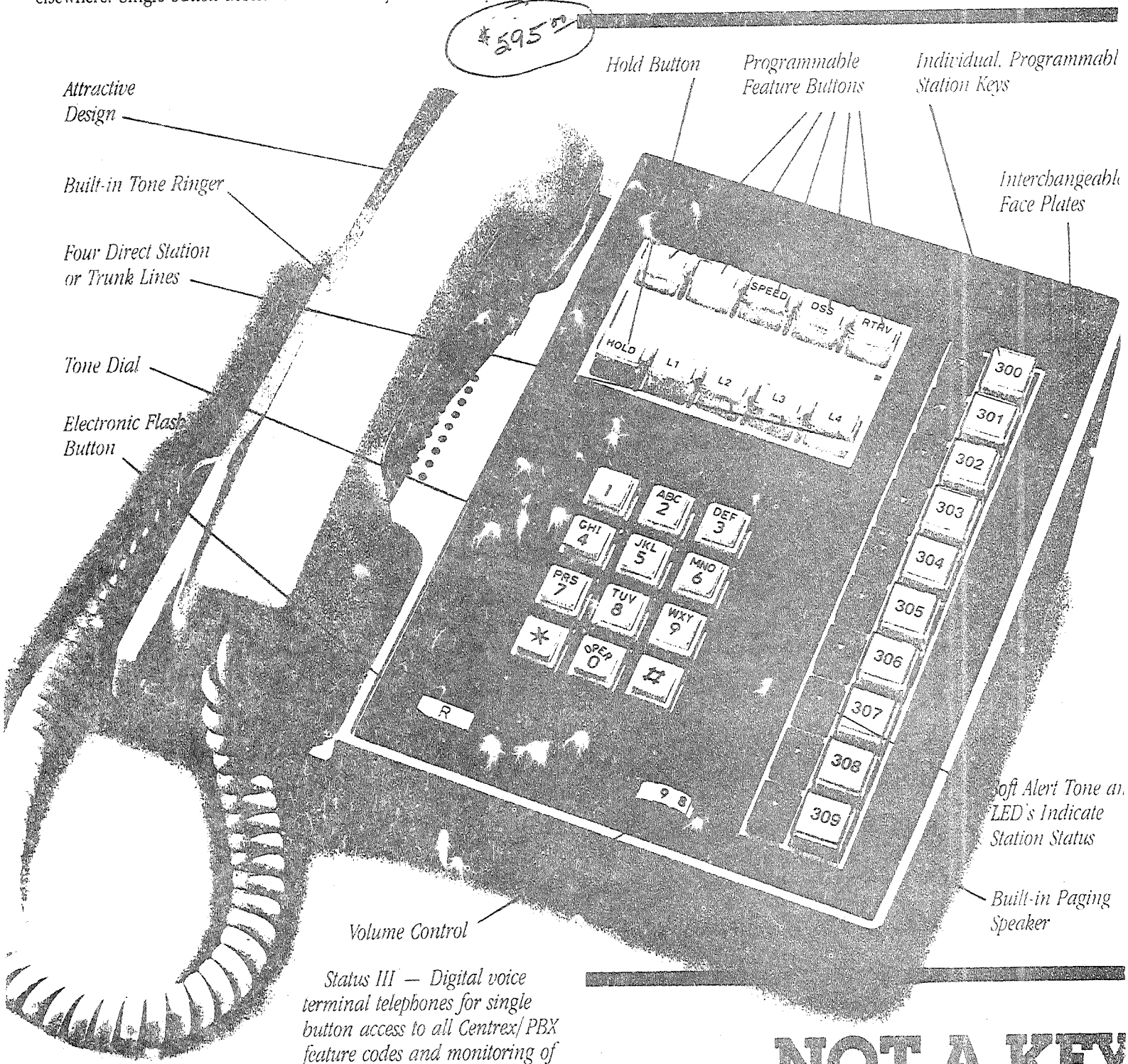
A vital link in this chain, especially in the executive suite, is the telecommunication link between the executive and his secretary.

Status Centrex/PBX feature phone voice terminals will greatly enhance this Executive/Secretary link. Single button access to the power of the modern Centrex/PBX system allows immediate connections to the critical points in the executive suite and elsewhere. Single button access to the Secretary or other important people in the executive suite and immediate connections to common carrier, WATS lines, tie trunks, OPX's and page access greatly increase speed and efficiency.

A true Centrex/PBX feature telephone

These processor driven voice terminals allow full programmability of all system functions including hold, pick-up, transfer, hands-free voice access, secretarial alert etc. Since all keys and buttons may be "end user" programmed for any listed function, the *Status* sets may be customized for the special needs of individual functions. Features such as "Hot Button" Voicepac allows immediate voice

$595.00



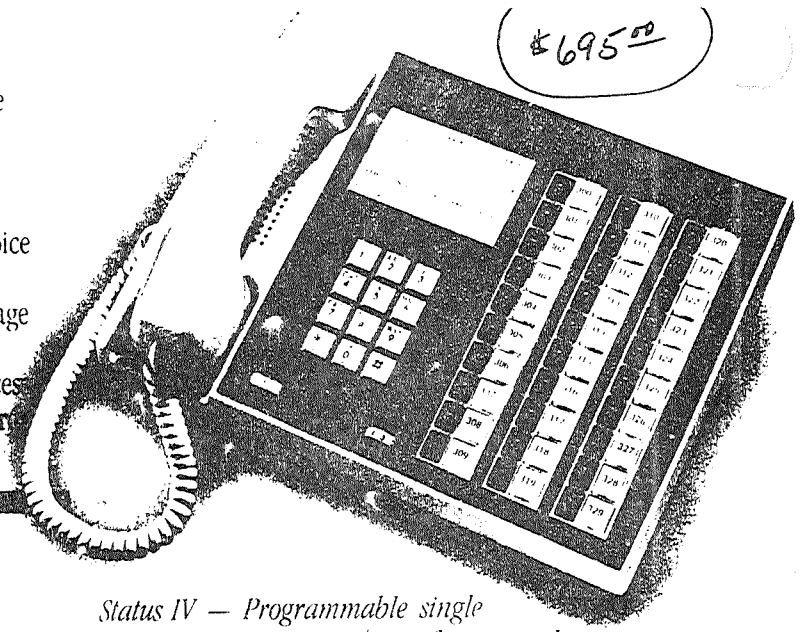
Status III — Digital voice terminal telephones for single button access to all Centrex/PBX feature codes and monitoring of up to 10 executive extensions.

NOT A KEY

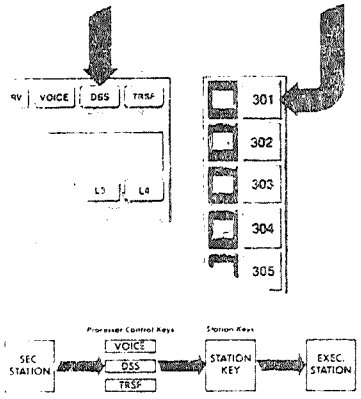
ommunication between executive and secretary even though one
r the other may be on the telephone.

Answering position/message center

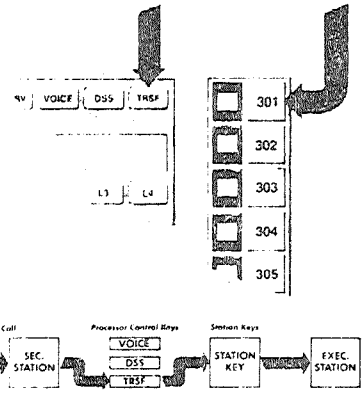
For secretarial intercept or receptionist functions, the *Status* voice rminal may be programmed to monitor and connect up to 10 ecutives or other extensions. As an answering position or message nter, the voice terminal may be programmed to monitor and nnect up to 30 executive or other extensions. Single button acces answer, pick-up, hold, voice announce and transfer are standar *tatus* features.



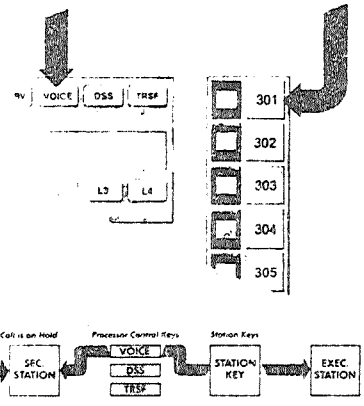
Status IV — Programmable single button access to Centrex/PBX features with monitoring of up to 30 executive stations.



"Direct" Station select provides immediate access between the secretary and the executive. The secretary simply depresses the "DSS" Key, then the Executive's Station Key, ringing the executive's telephone.



"Executive Transfer" provides immediate transfer of any call the secretary has answered for any executive. The secretary simply depresses the "TRSF" Key, then the Executive's Station Key, transferring the call to the executive's telephone instantly.



"Executive Voice Announce" with handsfree reply allows the secretary to hold a call while announcing the call to the executive. The executive may respond totally handsfree, even if he is on the telephone. The secretary simply depresses the "Voice" Key, then the Executive's Station Key, and voice announce the call.

User friendly telephones

Status voice terminals, while being sophisticated in function, have been designed to retain the familiar confidence inspiring appearance of the standard telephone. The sophisticated features and functions accessed by the keys and buttons may be re-programmed or updated within seconds to reflect the changing circumstances or desires within the Centrex/PBX system.

A chain is only as good as its weakest link

The weak link in the communication chain is frequently poorly designed or inflexible station equipment. This problem may be further aggravated by today's low quality "throw away" telephones.

Xtel's *Status* III and IV digital voice terminals represent the ultimate in quality standards. Our *Status* telephone voice terminals are manufactured in the United States using only the finest components and techniques available. This quality standard will assure that the *Status* communication system will be a reliable and hard working member of your staff for many years; not the weak link in the chain.

Modularity

Status voice terminals are completely modular by construction. All modules including buttons, key strips, line cords and handsets are easily removed for change, repair or upgrading.

A size to fit most needs

Status telephone voice terminals are available in both 4-line and single line configurations, with the ability to monitor and connect 10, 20 or 30 Centrex/PBX stations or other special use lines. Each instrument offers 20, 30 or 40 function buttons and keys for rapid access to program features, as many as 122.

YSTEM

The *Status* voice terminal may be programmed for single button access of any of the following features.

Add-on conference
Automatic call back
Busy override
Call forwarding
Call hold
Call park
Call pick-up (directed)
Call pick-up (group)
Call queuing
Call transfer
Camp on
Consultation hold
CCSA access
Dictation access
Direct trunk access
Do not disturb
Handsfree intercom calls
Meet-me paging
Night answer
Paging access
Prime line pick-up
Secretarial call screening
Speed dialing
System speed dialing
Station conference
Trunk conference
WATS access
FX & tie line access

Status Pac controls

Status Pac common control equipment is available in 10, 20, 30 and 40 line configurations. Up to three *Status* voice terminals may share any size *Status Pac* control.

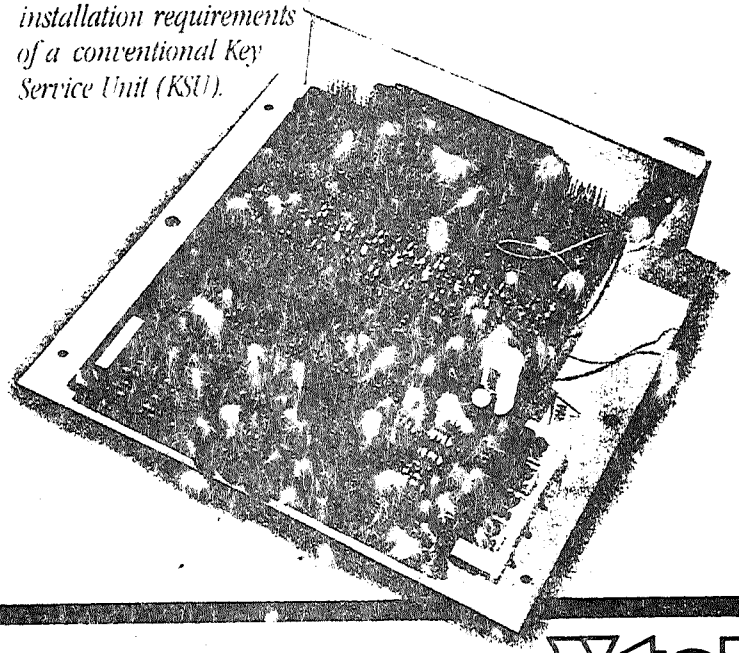
Optional features

Ring delay — *Status Pac* controls are available in a ring delay version which allows programming of ring delay on a line by lines basis, for 3 rings per line.

Secretarial Alert — This option functions as an electronic manual buzzer for up to 10 executive stations; available in 10-line *Status Pac* control only.

"Hot Button" Voicepac — "Hot Button" Voicepac which offers "secretarial alert" with handsfree response and station to station handsfree intercom dialing for up to 10 executives is available in 10-line *Status Pac* control only.

Status Pac Control — eliminates the need for the costly and cumbersome installation requirements of a conventional Key Service Unit (KSU).



Specifications

Ringer Equivalence
0.8A

Hookflash Duration
0.6 Second Nominal
(Other Durations Available)

Paging Speaker Impedance
500, 250, or 8 Ohms
Jumper Selectable

Fully Modular — Cables Included

Digit Storage Capacity
7 to 32 Digits per Button
Depending on Model

Programmable Functions
Hookflash, Pause, "*", "#",
and Numbers up to
Digit Storage Capacity

Feature Buttons
Soft Programmable

Station Buttons
Soft Programmable
4 Levels

Power Requirements
12VDC (Transformer Included)

50 MS or 100 MS Dialing Rate, User Selectable

Non-Volatile Memory Requires No Batteries

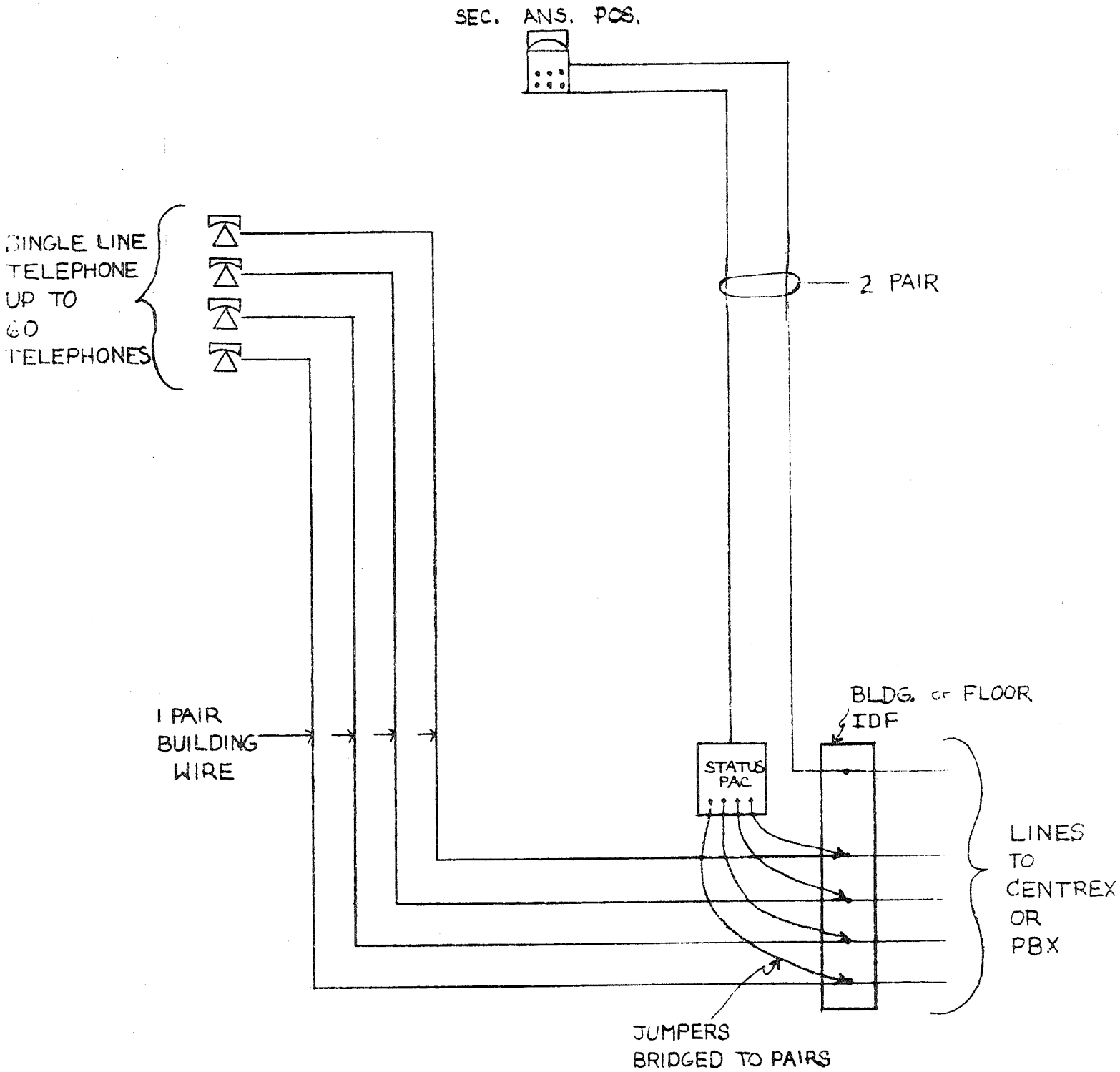
Lamp Flash Timing
Ringing Calls 400 MS On, 400 MS Off
Held Calls 350 MS On, 70 MS Off

STATUS faction Xtel

3908 N.W. 3RD ST., OKLAHOMA CITY, OKLAHOMA 73107 (405) 946-1500

APPLICATION FOR

MICROPROCESSOR CONTROLLED LINE STATUS INDICATORS & SECRETARIAL ANSWERING POSITIONS ON CENTREX OR PBX LINES



12/20/84

KSU
KANSAS STATE UNIVERSITY

Vice-President for University Facilities

Anderson Hall
Manhattan, Kansas 66506
913-532-5967

December 19, 1984

Dr. Russell Getter
Director, Division of Information
Systems and Communications
Dept. of Administration
124-South-State Office Bldg.
Topeka, Kansas 66612-1503

Dear Russ:

Enclosed are recommendations, comments, and questions responding to the Request for Information draft of the proposed Core Project of State Telecommunications.

This document was prepared and approved by the members of the KSU Telecommunications Advisory Group and the assistance of Pete Gonzales. We will appreciate your consideration of the recommended revisions to specific parts of the draft and request that we be permitted to see the Request for Quotation before it goes to bidders.

Sincerely,

Evelyn M. Hupe

Evelyn M. Hupe
Assistant to the Vice President

cc: Dean Ken Gowdy
Tom Gallagaher
Virgil Wallentine
Bob Helgesen
Bill Sesler
Pete Gonzales
Jerry Jennings
Robert Young
Gene Cross
Al Blubaugh

n

TELECOMMUNICATIONS CORE PROJECT
RFI COMMENTS, QUESTIONS, CORRECTIONS AND ADDITIONS

All items are to be bid separately and the Agency reserves the right to accept or reject any or all bids.

1. It is intended we shall have a state-owned cable plant as part of the core system for Kansas State University. This will permit Kansas State University to make other uses of the cable plant than just for services provided by the basic service vendor (e.g. cross connect for direct connections for requirement that the installation of the cable plant utilize the wire centers which were originally proposed.) These wire centers are located at the Power Plant, West Hall, and VMS. (i.e. with locations shown on map 4A.) The vendor could provide equipment or lines at each of the wire centers, or could install the appropriate support for the services under this RFI. Links between wire centers shall be included to support T-1 data and video communications between points served by different wire centers.

   1-A. Existing steam tunnels shall be used for cable interconnect between buildings and wire centers where possible. Cable hangers shall be included for new and existing cable. Because of the variable temperatures in the tunnels, some cables may need heat protection.

2. BASIC VOICE SERVICES

   Call restriction shall be available on incoming calls as well as outgoing. For outgoing calls, call restriction needs to take into account on-net and off-net 8+ calls, local 9+ calls, 91+ calls to toll-free numbers (800, information, etc.), and various 90 and 90+ calls.

   Call forwarding should allow user control.

   The responses to the RFI should include information about the facilities available for secretarial answering positions, the cost of the facilities, and the wiring implications. At Kansas State University, at least one secretarial answering position would probably be required for each department, estimate 100 departments. Answering positions should include station busy lamps as appropriate.

   Similarly, details about night answering facilities should be included. For some departments (such as the Computing Center), night answer from any station for calls to the main department numbers is needed, and many other departments have similar requirements. The switch should be flexible enough to provide such facilities on a department-by-department basis. The RFI should include the wiring implications of such facilities.

   Since it is not clear at this time how departments would use the single line-per-phone concepts, multiple appearance features may be necessary as well, add-on feature costs should be included in response to RFI.

3. DATA 56KB

The loss, noise, and cross talk specifications are not applicable to this type of data transmission, but there are equivalent parameters which should be specified.

It is not clear what auto-speed means. Is this automatic adjustment of the switch to the speed of the associated terminal; automatic matching of terminal speed with computer port speed when selecting lines in hunt groups; automatic setting of speeds on computer ports; buffering for speed matching; or what?

Originating station number should be part of the SMDR data available.

4. IBM 3270 DATA

There are two aspects to the 3270 problem--3270 support through the switch, (which is probably limited to 56KB) and use of the cable plant for 3270 connections without going through the switch itself. References to 3270 should state 3270 category A terminals (e.g. 3278-2) and should not be limited to SNA/SDLC models. This is intended to be the local coax interface which is implemented through the switch or cable plant, and not a BSC or SNA/SDLC interface between a CPU and a remote cluster controller. At KSU our initial requirement would be for use of the cable plant in support of 3270 connections (probably concentrated as well), and the need for switched 3270 support is not immediate.

5. PROTOCOL CONVERTER POOL

Protocol converters are typically assigned to a particular host computer since many of the host-to-controller protocols are not designed for dial-up access (e.g. remote 3274 clusters). Billing information should be available for use of the protocol converters.

MISCELLANEOUS DATA CONSIDERATIONS

Should the modem pool facilities include transparent operation to calls to off-net locations? How does the switch determine which of several modem types to use at a given speed?

The switch should support presentation of multiplexed data streams from asynchronous ASCII devices to supporting host computers (either as a single multiplexed stream, or as a host interface board which emulates the multiple terminals). Typically these are implemented via a T-1 link from the switch to the host computer. Support for Digital Equipment Corp. VAX minicomputers is specifically required.

6. KANS-A-N

It should be possible to make 'forced entry' calls without operator intervention when a touchtone phone is available to enter the authorization number and the called number.

7. WIRING

Is 3-pair specified only to the first IDF or is it required all of the way back to the wire center?

8. POINT-TO-POINT

How are point-to-point links to be implemented between wire centers? Fiber Optic should be installed for this purpose. 3270 means category A devices and should not specifically be limited to SNA/SDLC. The speed of these links is important when designing the links between wire centers. Is maintenance of this facility a vendor, state, or agency responsibility?

9. T-1 POINT-TO-POINT

The same questions apply. Presumably T-1 is set up as point-to-point connections utilizing the exiting cable plant. If the twisted pair plant cannot be used, then projections on number of T-1 connections for each building are necessary so that they can be installed as a part of the cable plant.

10. FIBER OPTIC

Presumably the fiber optic network is a star network from each building to the associated wire center where channels will be cross-connected (possibly including channels on fiber optic links between wire centers).

11. SMDR

Is the SMDR data to be availabale locally also, or only at the NCC?

12. NCC

It's not clear how much the NCC is trying to get involved with existing analog data circuits. The implications is that they want to monitor ALL analog circuits and will require installation of modems with appropriate remote loopback facilities. While this may be desirable in some locations (e.g. DISC's terminal network which reaches outside the scope of the PBX network), not all agencies will want to be forced into this for all analog circuits.

13. CIRCUIT INVENTORY

Hopefully the local agencies will be able to access and update this data as appropriate without requiring intervention by the NCC. (This is dependent on the division of responsibility for cable plant maintenance or for feature updating in the switch between the NCC and the individual agencies).

14. BATTERY BACKUP

Is power failure switchover required on critical lines (e.g. security office)?

15. PRICING

How is the vendor supposed to size the following?

a. Protocol converter pool (including types of converters).
b. Modem pool (including types of modems).
c. T-1 and Fiber Optic channel multiplexing equipment.
d. T-1, Fiber Optic, and voice trunk links between wire centers.
e. 19.2K async vs. 56KB sync data.
f. 3270 connections through switch.
g. 3270 connections through cable plant (including multiplexer requirements).
h. Multiplexed data streams to host computers.

16. GENERAL

What does it mean to provide T-1 capability to a building?

KANS-A-N trunks are presumably 48/96 56KB slots in T-1 links from KSU to the central switching center in Topeka which are dedicated to KSU's use.

17. CORRECTIONS TO RFI

Section III: 4A - 2b

Station lines	Initial	5 Years
2 Switches (56 KB/S)	1500	6000
Operator Consoles		
Section III: 4B - 1Ph	2	4 - (How was this number determined?)

Building Name/Number		Number of Jacks	1.5 mb/s	(Optional) F.O. Video
Ident	Location			
2	Ahearn	OK	X	X
3	Anderson	OK	X	X
6	Art Building	OK	X	X
9	Bushnell	OK	X	X
18	Dykstra	65	X	X
19	East Stadium	OK	X	X
22	Envir. Research Lab	OK	X	X
27	Farrell Library	OK	X	X
33	Gym	OK	0	0
35	Hollis House	OK	X	0
36	Holton Hall	OK	X	0
40	Justin Hall	114	OK	OK
48	Nichols Hall	75	X	X
49	Power Plant	OK	0	X
53	Shellenberger	OK	X	X

Building	Name/Number	Number of Jacks	1.5 mb/s	F.O. Video
62	Umberger Hall	OK	X	X
63	Ward Hall	OK	X	X
64	Wareham Building	64	X	X
71	VCS	OK	X	X
72	VMS	OK	X	X
73	VMT	OK	X	X
75	Recreation Complex	20	X	X
76	K-State Union	OK	X	X
89	Pittman	35	X	0
95	Athletics Other Fac.	4	X	X
95A	Press Box (KSU Stadium)	5	X	X
97	Football Office	OK	X	X
97A	Fred Bramlage Coliseum (Start Construction-Schedule 1985) See attached map 4A for location.	50	X	X
99	LGH-Lower Green House	1		
100	GMB-(Grain Marketing Building) (1515 College Ave.)	15	X	
101	FRC-Agronomy Research Farm (2200 Kimball Ave.)	11	X	

18. ADD THE FOLLOWING EXISTING BUILDINGS TO NETWORK

103	KABSU (1401 College)	10	X	X
104	Elevator Feed Mill (Corner of Kimball/Dension)	1	0	0
105	Horse Barn	1	0	0
106	Sheep Barn (2117 Denison)	2	0	0
107	Swine Research Center (3101 College Ave.)	1	0	0
108	Purebred Beef Barn (1912 Denison Ave.)	1	0	0
109	Poultry Research Center (2000 Marlatt Ave.)	4	0	0
110	Farm Shop (2900 College Ave.)	2	0	0
111	Farm Supervisor House (2900 College Ave.)	3	0	0
112	Beef Research Center (3115 College Ave.)	3	X	X
114	Beef Herdsman's House (North Denison Ave.)	2	0	0
115	UFM - 1221 Thurston	14		
116	Kellogg Building (1627 Anderson)	7	X	X

Building	Name/Number	Number of Jacks	1.5 mb/s	F.O. Video
117	XMTR (KKSU Transmitter) (Located North Denison Ave.)	1	0	0
620	Forestry (2610 Claflin)	17	X	X
621	Forestry Ext. Greenhouse (2610 Claflin)	1	0	0
622	Forestry Extension Shop 2610 Claflin)	2	0	0

STATE OF KANSAS

JOHN CARLIN
Governor

DEPARTMENT OF ADMINISTRATION
Division of Information Systems
and Communications
DIRECTOR
124-South, State Office Building
Topeka, Kansas 66612-1503
(913) 296-3463

Deputy Director
Information Systems
1152-W, State Office Building
Topeka, KS 66612-1503
(913) 296-3343

Deputy Director
Telecommunications
503 Kansas Avenue, Room 240
Topeka, Kansas 66603-3494
(913) 296-4124

21 December 1984
(12-031-L)

Major Stuart A. Elliott
Bureau of Support Services
Kansas Highway Patrol
122 SW Seventh Street
Topeka, Kansas 66603
BUILDING MAIL

Dear Major Elliott:

I sincerely appreciate your response and suggestions regarding the DRAFT Telecommunications RFI. I had not anticipated the need to relocate the Security Office from the State Office Building along with the closed-circuit television monitoring network.

In the final specification we will make arrangements to include high quality transmission paths to each of the locations proposed in your December 7, 1984 letter. Your transmission path requirements for closed-circuit television will probably be included in a common route along with other uses such as DISC, etc that have needs for high capacity transmission paths. It is anticipated that we will ask for a multi fiber - fiber optic cable with ports or jacks at appropriate locations for this purpose.

When your Security Office is ready to move to the Santa Fe Office Building we will work with you to acquire the proper electro-optical interfaces (about $300.00 ea.) for your existing cameras and monitors. Cameras and monitors can then be connected to the appropriate jacks and patch panels of the fiber optic cable. Attached is a description of a typical electro-optical interface.

Thanks for your suggestions.

Sincerely,

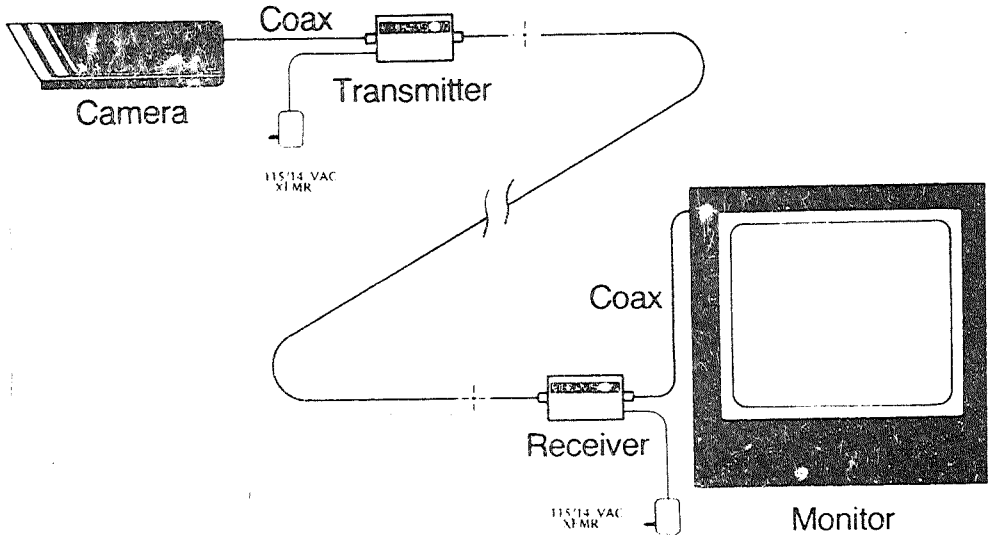
J. L. Jennings
Acting Deputy Director
Telecommunications Bureau, DISC

JLJdjm

cc: Dr. Russell Getter
Attachment - 1

FIBERVISION™

CCTV INSTALLATION

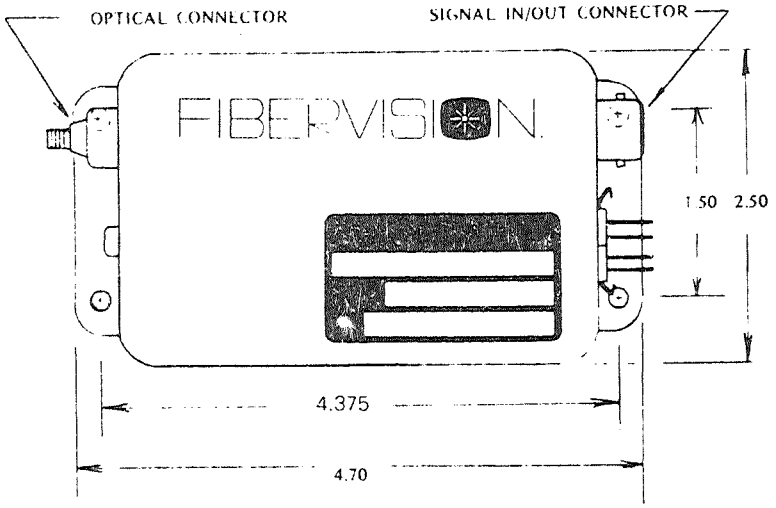


SPECIFICATIONS

COMPLETE SYSTEM BANDWIDTH (+1,–3dB)	10Hz to 8MHz
INPUT/OUTPUT IMPEDANCE	75 ohms
INPUT/OUTPUT VOLTAGE	1V pp
SIGNAL/NOISE RATIO	67dB typ.
LINEARITY	1 percent or better
TRANSMISSION RANGE	up to 3 miles
OPTICAL CONNECTOR	SMA compatible (50u)
POWER REQUIREMENTS* (FX-1000 or FR-1000)	+10.7 to 18 volts DC @50ma. or 12 to 18 volts AC 50/60Hz
PHYSICAL SIZE (per module)	2.5" x 4.7" x 1.25"
OPERATING TEMPERATURE	–20°F to +120°F

* This system can operate from 115V 50/60Hz with an optional XP-1000 plug-in transformer for each module.

SIZE



Price # 297.50
as of 10-12-84

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WICHITA STATE UNIVERSITY

OFFICE OF
PERSONNEL SERVICES

WICHITA, KANSAS 67208
316/689-3066

December 7, 1984

Mr. Russell Getter, Director
Department of Administration
Division of Information Systems & Communications
124 South State Office Building
Topeka, Kansas 66612

Dear Russ:

The Wichita State University Telecommunications Committee has reviewed the "Core Project" Request for Information. Our only response to the general specifications is that we would like to insure that the distribution system provides 3-pair cable to every telephone jack on the campus. It is also our feeling that all wiring and on-campus distribution systems should be owned by the University upon completion of the initial purchase or lease purchase.

We have reviewed the details of Section III: 5B, "Station Distribution Information Telephone Jack Requirements". We have revised that Section and the revision is enclosed with this letter. Mr. Gonzales in your Division has been working with us on the inventory and distribution requirements and our committee would like to schedule another meeting with Mr. Gonzales to review this information. We are prepared to meet with Mr. Gonzales at his convenience either prior to or following the holidays.

Again, I would like to express our appreciation to you for the very positive approach your Division is taking in the development of telecommunication systems.

Sincerely,

Robert D. Warren
Director
Personnel & Administrative Services

ew

Enclosure

xc: Russell F. Adkins
Armin Brandhorst
Roger D. Lowe
Gary Ott
Dr. C. Russell Wentworth

WICHITA STATE UNIVERSITY
STATION DISTRIBUTION INFORMATION
TELEPHONE JACKS REQUIREMENTS

Bldg. #	Location	Number of Jacks	1.5 Mb/s	(Optional) F.O. Video
1	Ablah Library	34	X	X
71	Alumni House	17	X	---
2	Armory - ROTC	10	---	---
38	Business Education	8	X	---
8	Campus Activities Center & Theatre	78	X	X
42	Cessna Stadium	6	X	X
46	Clinton Hall	93	X	X
13	Corbin Education Center	24	X	---
11	Credit Union	7	---	---
15	Duerksen Fine Arts Center & Recital Hall	22	X	X
16	Engineering Building	28	X	---
20	Fiske Hall	33	X	---
23	Grace Wilkie Hall	85	X	---
23	Grace Wilkie, Annex	11	X	---
54	Health Sciences Building-- Ahlberg Hall	154	X	X
25,26	Henrion Gymnasium		X	---
	Henrion Annex	2	X	---
19	Henry Levitt Arena	56	X	X
27	Industrial Education Building	6	X	---
29	Jardine Hall	142	X	X
50	Liberal Arts and Sciences	157	X	X
32	Math-Physics Building	47	X	X
--	Golf Maintenance	3	---	---

31	McKinley Hall	49	X	---
47	McKnight Art Center	30	X	---
33	Morrison Hall	63	X	X
56	Multipurpose Complex-- Heskett Center	38	X	X
54	Neff Hall	49	X	X
37	Physical Plant Complex	35	X	---
55	Police Department	10	X	X
39	President's Residence	5	X	---
49	R. Dee Hubbard Hall	78	X	X
	Residence Halls		X	---
5	Brennan Hall I	74	X	---
6	Brennan Hall II	31	X	---
7	Brennan Hall III	34	X	---
47	Ulrich Museum	*	*	---
35	Visual Communications	4	X	---
51	Wallace Hall	44	X	X
43	Warehouse H.	3	X	---
44	Wilner Auditorium	59	X	X
	Blake Hall		X	X
	Central Power Plant		X	X
	Communications Building		---	---
	Grace Memorial Chapel		---	---
	Lutheran Student Center		---	---
	Marcus Center		X	X
	Preschool		---	---
	Fairmount Towers		X	X
	Shocker Alumni & Faculty Club		---	---

* Included with McKnight

Theatre Services	---	---
Rusty Eck Stadium	X	X

AT&T Communications

Capitol Towers
400 West 8th
Suite 315
Topeka, Kansas 66603

December 17, 1984

Dr. Russell Getter
Director - Division of Information Systems and Communications
State Office Building, 124 South
Topeka, Kansas 66603

Dear Dr. Getter:

Thank you for the opportunity to review the draft specifications for the CORE PROJECT. AT&T Communications is anxious to provide any service to the State of Kansas to help the State meet its goals. In accordance with your request to review these specifications and also indicate any items we may legally be unable to provide the following comments are given.

The desire to acquire services under long term contract or lease agreement is consistent with the decision not to own facilities or equipment. Terms for any agreements with AT&T Communications will be subject to current tariffs and/or the Kansas Corporation Commission approval. We hope your RFI language and evaluation will reflect this reality of regulation.

In section II:1 you request "one vendor assume total responsibility for all services requested in this RFI". Also in the same section you give a description of the State's needs which lump all switching (PBX, local and interlata switching) into one category. In addition, you state that "another RFI for intercity transmission services will be issued shortly. This indicates that interlata vendors will not be allowed opportunity to provide switching. These statements added together with the general description of the Capitol Complex Requirements (Section III:1A) describe the Topeka switch as having the capability to switch local, interlata, and PBX traffic. Under Computer Inquiry II AT&T Communications cannot provide PBX type switching. Further, under the Modified Final Judgement, local exchange companies are not allowed to enter the interlata market by engineering, integrating or marketing interlata switching and routing functions. This

request, by having one switch perform all functions (local PBX and interlata switching), asks for services to be provided by AT&T Communications and/or the local exchange company which they legally cannot provide. This design limits the State's ability to select a vendor from the broadest spectrum of the field. We suggest you modify the RFI to reflect a clear separation of these functions (PBX, Local, interlata switching) and thus allowing the State the full range of options that might be presented.

Thank you again for this opportunity. Please feel free to call me with any questions regarding these comments.

Sincerely,

Neal Goodson
Account Executive

NG:mpo

NY THRUWAY AUTHORITY ADVERTISING TO LEASE RIGHT-OF-WAY FOR REVENUE

The New York State Thruway Authority discovered a new revenue possibility in the road it manages after several communications companies inquired about leasing the highway's right-of-way for their telecommunications networks.

The authority is now advertising for proposals for both carriers and large users who want a "non-exclusive" lease on the right-of-way to lay underground cable. The thruway is 560 miles long, forming a "spine in the state" that passes through 80% of the population, according to the authority's Daniel Garvey.

He said the road connects the state's major cities--New York, Buffalo, Albany, Rochester, Syracuse.

This road system could serve as a hub to branch out toward Pennsylvania, Connecticut, Massachusetts and Montreal.

Garvey declined to reveal which companies had inquired about the thruway, but said some requests were specific about the segments to be leased. He added that "the total thruway is up for grabs," and noted that neighboring states have roads that could blend with New York's in a regional network.

The authority will consider straight monetary leasing payments, or a combination of payments plus transmission capacity for the state government's use. Bids are due March 4, and the authority plans to decide on leasing arrangements by May 3.

Telephone News (ISSN 0271-5430) is published weekly by Phillips Publishing, Inc., 7315 Wisconsin Ave., Suite 1200N, Bethesda, MD 20814. Phone: 301/986-0666. Telex: 358149.

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Supreme Court of Kansas

Kansas Judicial Center
301 W. 10th
Topeka, Kansas 66612

HOWARD SCHWARTZ
Judicial Administrator

(913) 296-4873

November 7, 1984

Dr. Marvin A. Harder
Secretary of Administration
Statehouse, 2nd Floor
Topeka, KS 66612

Dear Mike:

Thank you for your reply of October 25 to my letter concerning state telephone service for the district courts. I would like to take this opportunity to clear up a misconception you may have about the district courts. Although the operating expenses of the courts are paid by the counties, the courts are definitely part of state government. District court employees are state employees on a state judicial branch pay plan. Administrative authority for the district courts resides in the Supreme Court.

A few questions came to mind as I read your letter. Are there now other state agencies without direct access to KANS-A-N? If so, how are their billing arrangements handled? Could something similar be worked out for the courts? If the state assumed the cost of telephone service for the district courts, would that simplify the picture? If the state did not wish to assume cost of the district courts' telephone service, could each district court pay its own bill?

I recognize that there may be obstacles to including all of our district courts on a statewide network, particularly since we may be the only state agency with offices in every county. However, our trial court managers have indicated to us that there is a real need for inclusion on a statewide telephone network. The district courts are not just locally-oriented entities; much of the business they do is conducted at the state level. They must interact with other state agencies such as SRS, the Department of Corrections, the Department of Revenue's Motor Vehicle Division,

and Vital Statistics, to name a few. Clearly, then, in practical as well as statutory fact, the courts cannot be considered strictly county or local agencies. While I recognize that including the courts in such a network will increase front-end costs, I think the long-term benefits to everyone would make these costs worthwhile.

I will look forward to hearing from you further. This issue is of great concern to me, and I feel it is important to maintain a dialogue about it, particularly in the initial planning stages.

Sincerely,

Howard

Howard Schwartz
Judicial Administrator

HS:dkh

cc: Russell Getter ✓