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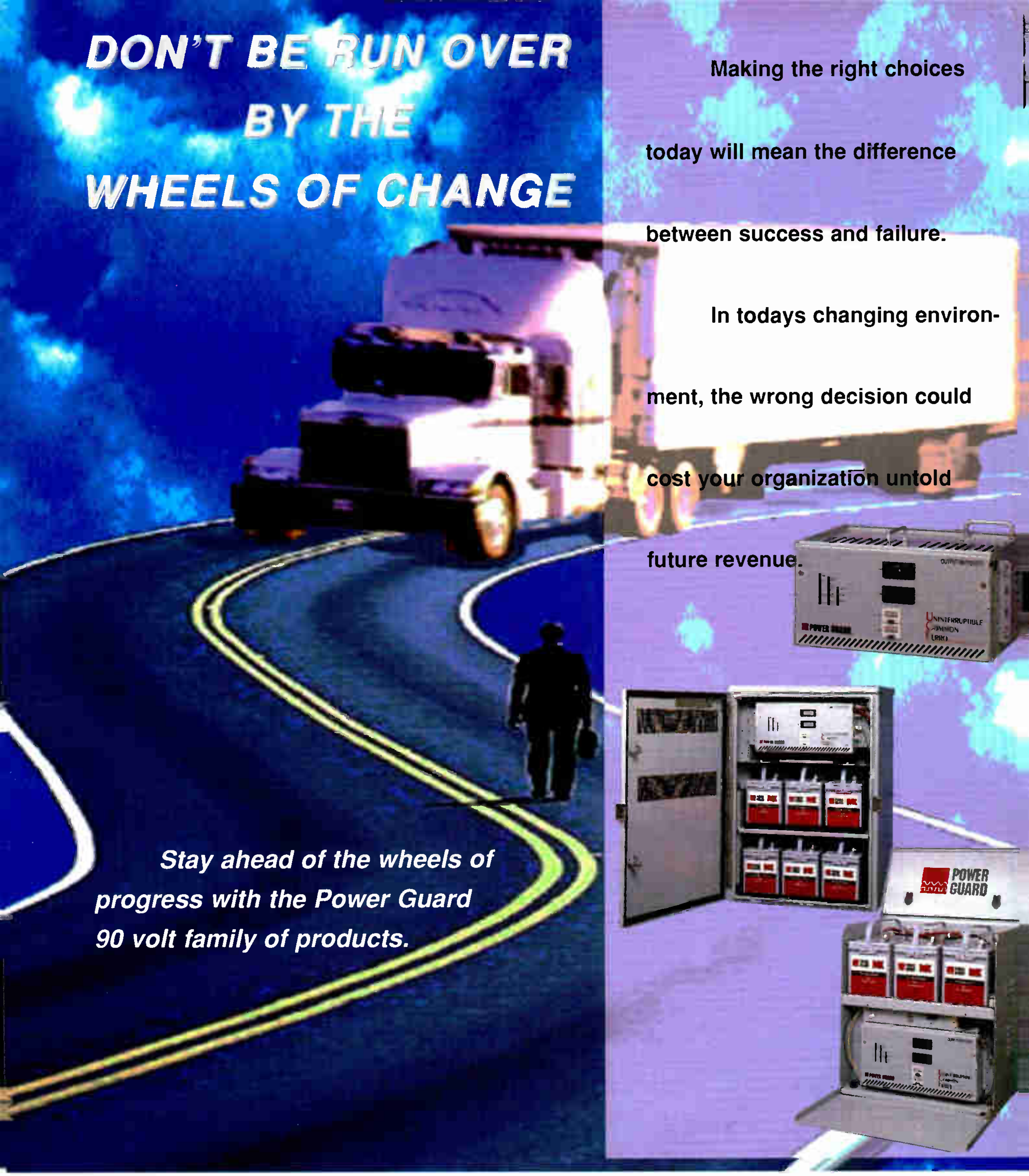
October 1996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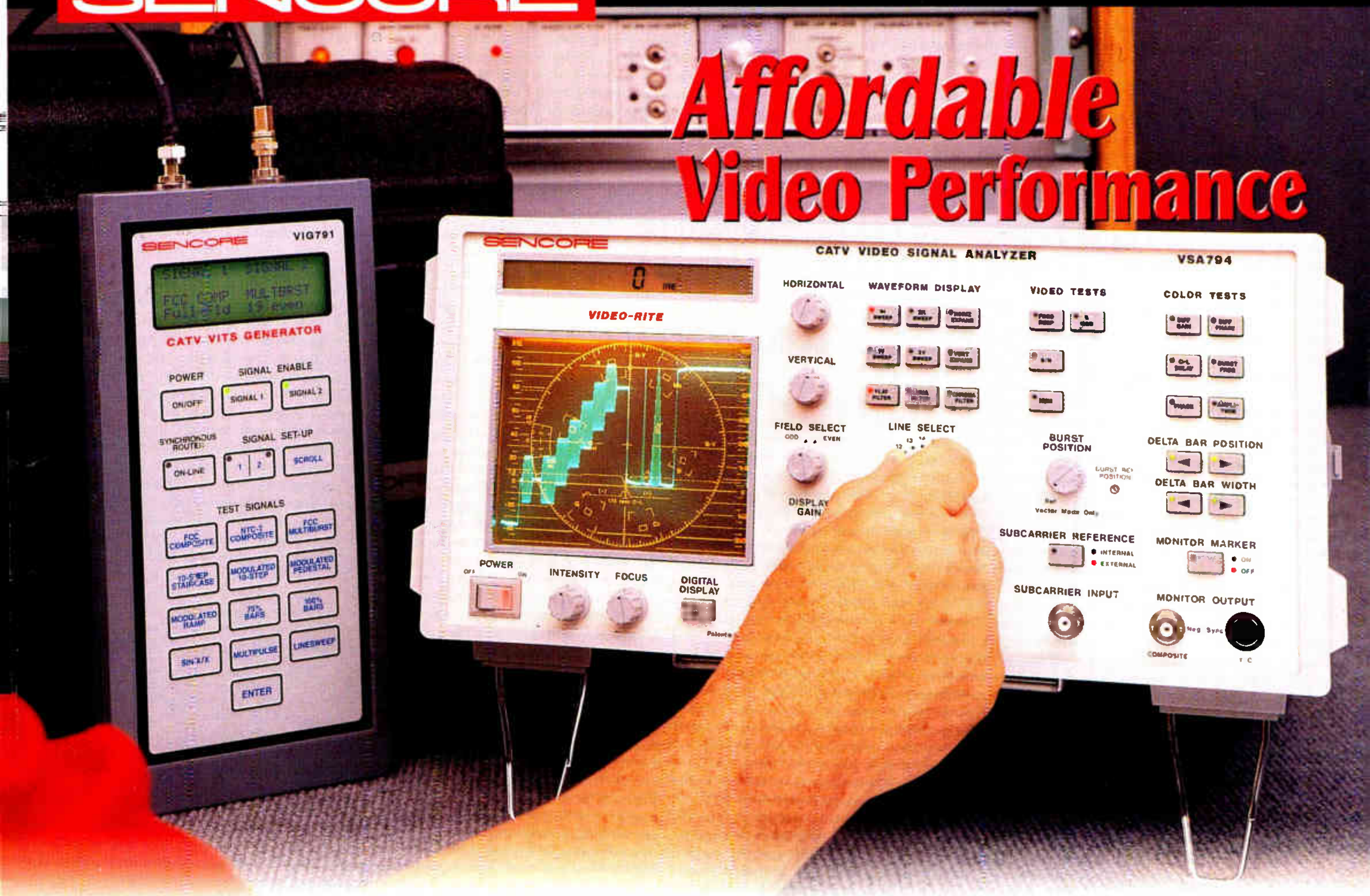

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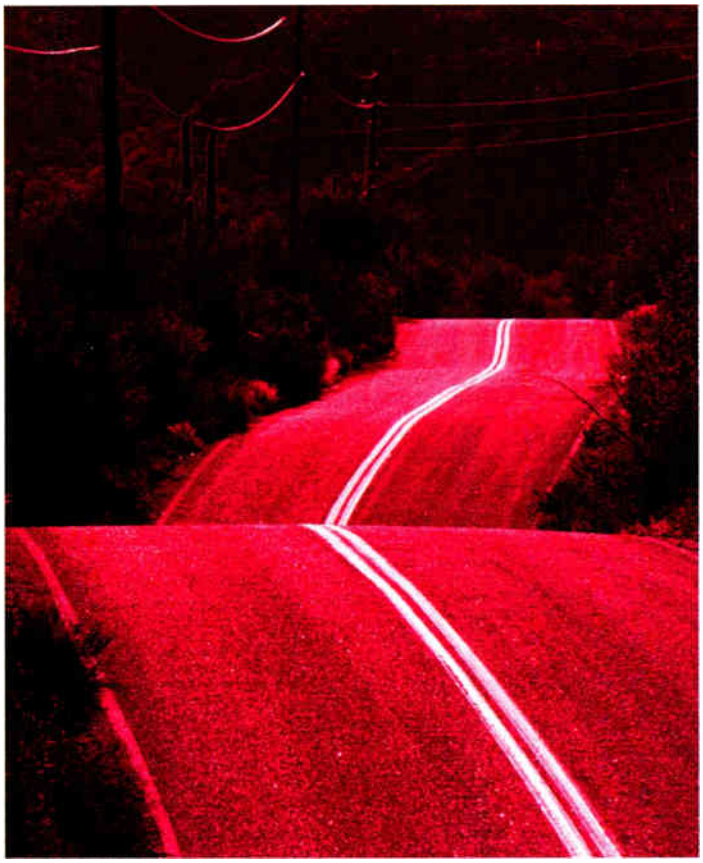

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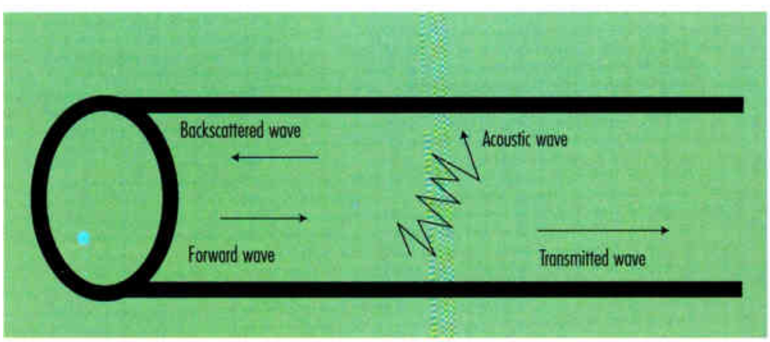

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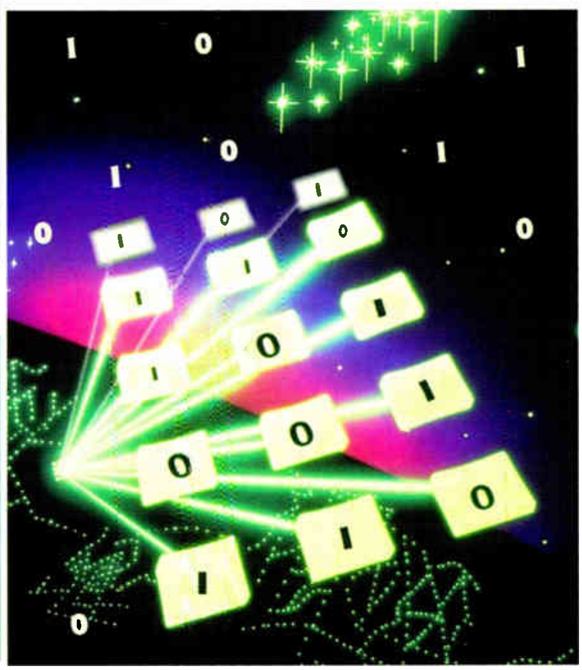

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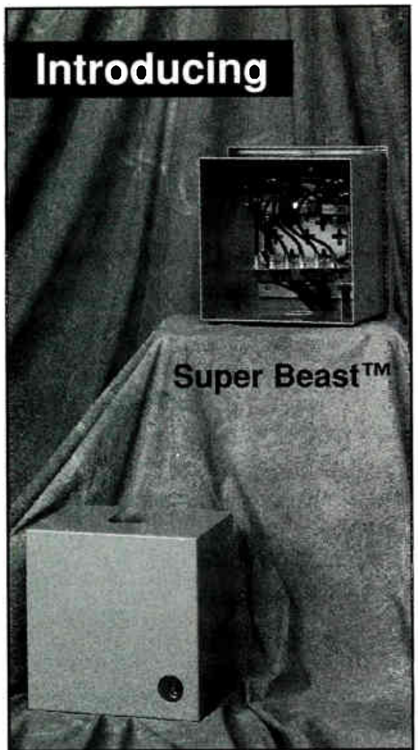

Who owns the airwaves?—Part 2

Part 1 of this editorial ran in last month's "Communications Technology" on page 6.

The scene we are about to enter is the boardroom of one of the mega-sized communications companies that is celebrating winning an auction for some of the public airwaves.

The CEO rises before the company executives and calls the meeting to order: "The first order of business is to plan how we will recover the $380,000 we paid the Federal Communications Commission for the frequencies. As we all know, the public must continue to think these auctions to be in their best interest. So I'm calling on our vice president of finance to explain just how we are going to recover the costs of these frequencies."

"Serving the public interest does not mean serving up the public interest!"

The vice president of finance addresses the group: "It's obvious that the expense will have to be added to the public's monthly bill for the use of the airwaves. Now, we can prorate the costs over a five-year period and finally satisfy the debt in such a way that the public will not become enraged over the rate hike."

The CEO thanks the vice president of finance and turns to the vice president of public relations and marketing. "Sam, I want to make sure the public never thinks of this as money out of their pocket—even though it really is. How can we cover our tracks on this one?"

Sam scratches his head for a moment and replies, "That's a tough one. I guess the less said, the better off we are."

The CEO thunders at Sam, "Baloney. I don't pay you your salary to be as naive as the public. You get the "spin" people working on this problem. We can't have the public ever wondering how we acquired their property by paying a government agency like the FCC. Tell your people to handle this the same way those cereal manufacturers used television and radio to make the public believe they lowered their prices out of concern for mothers and their kids. We are smart enough to know that they really only did it because Congress had them on the carpet and were threatening to force them to lower their prices. Now, this meeting is adjourned!"

The moral of this story: *Serving the public interest does not mean serving up the public interest!*

Rex Porter
Editor

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East Coast Regional Sales Manager, Tim Hermes, (301) 340-7788, ext. 2004
Account Executives
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Subscription/Client Services
(800) 777-5006

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CT Sales and Editorial Offices
1900 Grant St., Suite 720, Denver, CO 80203
(303) 839-1565 Fax (303) 839-1564
e-mail: CTmagazine@aol.com

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SCTE National Headquarters
(610) 363-6888 Fax (610) 363-5898

Corporate Offices
Phillips Business Information Inc.
1201 Seven Locks Road, Suite 300, Potomac, MD 20854
(301) 340-1520 Fax (301) 340-0542

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Reader Service Number 13

TI completes digital video trial

Texas Instruments concluded its six-month technology trial with Bell South using wireless local multipoint distribution service (LMDS) to deliver digital video services to customers in Dunwoody, GA, a suburb of Atlanta.

Twenty-five apartment residences received up to 160 broadcast and near-video-on-demand channels, as well as 32 video-on-demand (VOD) channels.

TI Communications & Electronic Systems integrated its MulTIpoint system, a twoway wireless digital transport product, into BellSouth's headend and remote serving offices to deliver these enhanced video services.

Bill Eversole, vice president and general manager of TI, said the trial "confirms that two-way and broadband wireless delivery is a viable solution for interactive video services."

During the LMDS trial, high-fidelity MPEG-2 digitally compressed video was delivered from MulTIpoint nodes over-the-air to residences equipped with roof-top antennas within a 5 km serving area. Signaling and control messages were transmitted both ways to control video access and user interaction with an on-screen program guide.

Last summer in Brazil, TI demonstrated a broader range of capabilities—integrated, two-way delivery of voice, video and data—in conjunction with BellSouth International. In this trial, telephony, facsimile services, digital broadcast video, VOD and videoconferencing were transported simultaneously over a 28 GHz radio link. TI reports that the trial, conducted over a two-month period during Brazil's heaviest rainy season, achieved full operation at a 99.9% delivery success rate.

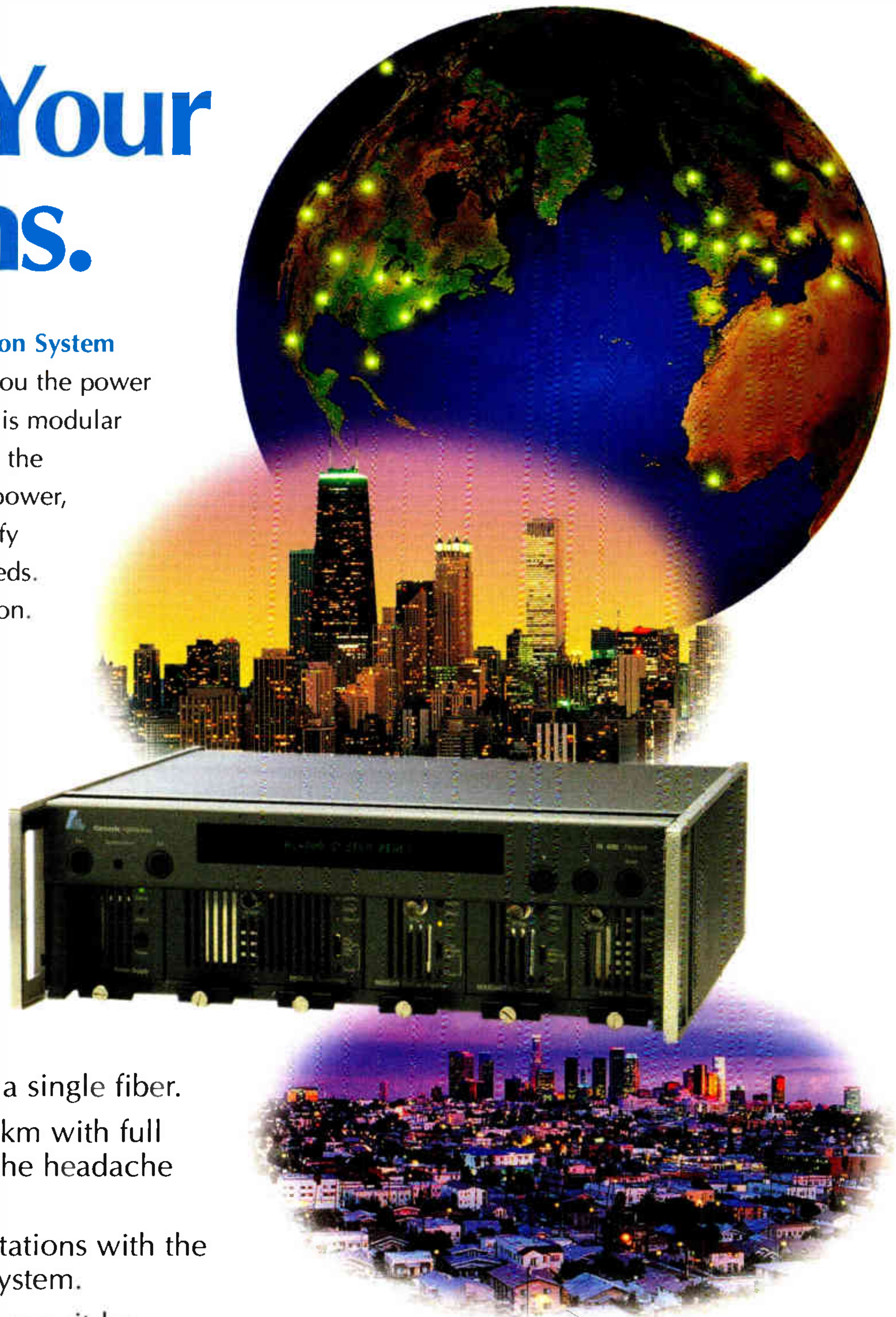
Americast buys 3 million set-tops

Americast, the programming venture of Ameritech Corp., BellSouth Corp., GTE Corp., SBC Communications and The Walt Disney Co., signed a nonexclusive contract for the purchase of at least 3 million Zenith Electronics digital set-top boxes for its home entertainment service. The contract is valued at more than $1 billion.

Zenith Network Systems Division President William Luehrs said that with the Zenith boxes, Americast will be able to deploy four kinds of video networks: wireless cable, hybrid fiber/coax, switched digital video (fiber-to-the-curb) and direct broadcast satellite. Production of the digital set-tops is scheduled to begin in the first half of 1997.

FCC adopts video dialtone transition

Video dialtone (VDT) operators have until Nov. 6, 1996, to elect one of four permissible options under the Telecommunications Act of 1996 in



order to continue providing video programming services: wireless, common carrier video, cable or open video system.

The Federal Communications Commission believes that requiring election of one of the four options is fully consistent with Congressional intent. The FCC is not requiring VDT operators to cease providing video services to their subscribers, but simply to provide service in compliance with one of the statutorily recognized video programming delivery options.

NY cable ops plan digital system

The New York Interconnect, which represents seven major cable system operators, announced that it will create a state-of-the-art digital delivery system to more than 4.2 million homes in tri-state metropolitan New York.

The system will enable advertisers served by the Interconnect to insert commercials on 16 cable channels rather than the present 10. This capacity can be expanded further in the future. Resulting efficiencies will enable the cable operators to compete more effectively against broadcasters.

Completion of the upgrade is expected in the first quarter of 1997 at all 43 individual cable system headends served by the Interconnect. The cable operators selected SeaChange International's Video Server 100 platform for the project.

Paul Freas, president of TKR Cable and chairman of the Interconnect's executive board, said the metropolitan New York cable market is by far the largest in the U.S. to have undertaken such a digital upgrade program.

AT&T leases Jones Chicago fiber route

AT&T signed an agreement with Jones Intercable, calling for Jones to install nearly 50 miles of fiber-optic cable in several Chicago suburbs that AT&T then will lease and use to provide local and long-distance service to customers.

The announcement is part of a larger agreement, announced July 23, under which AT&T will create 350 miles of high-capacity, fiber-optic facilities in the Chicago metropolitan area over the next two years. AT&T says the new agreement supports its strategy of working with a variety of companies to enable it to provide local service and give customers in monopoly markets a choice of carriers.

Jones sells its satellite subsidiary

Jones Intercable Inc. sold its subsidiary, Jones Satellite Programming Inc., to Superstar/Netlink Group LLC, a Delaware limited liability company.

JSP distributes satellite-delivered TV services to single, private U.S. households for receipt by TV receive-only (TVRO) earth station dishes.

The sale of the TVRO programming service is part of the company's intent to simplify its corporate structure and to concentrate on its core communications business. In June,


DX
SATELLITE RECEIVER
MODEL DIR-657
DESCRAMBLER ON
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SIGNAL STRENGTH
VIDEOCIPHER II PLUS COMMERCIAL DESCRAMBLER EQUIPPED
H 241

Jones Intercable sold another nonstrategic asset, Jones Galactic Radio Inc., which operates two audio programming services.

Statewide CATV approved in CT

The Department of Public Utility Control approved the nation's first statewide cable TV company for the state of Connecticut. The DPUC released a draft decision that would give SNET Personal Vision Inc., an affiliate of the state's major local telephone company, an 11-year license to provide cable TV service throughout the state and real competition to existing monopoly cable companies.

The draft, expected at press time to be finalized in late September, came a week after the DPUC certified Cablevision as a local telephone provider in the state. The two decisions, along with a pending decision expected to certify Tele-Communications Inc. to provide local telephone service, keep Connecticut at the forefront in bringing telecommunications competition.

NOTES

• **Jones Intercable Inc.** reported 16% growth in cash flow for second quarter 1996, ended June 30, 1996, compared to second quarter 1995. This increase disregards the effect of the company's acquisitions since second quarter 1995 of cable TV systems in Augusta and Savannah, GA; Dale City, Manassas and Reston, VA; and Prince Georges County, MD.

• **Blonder Tongue Laboratories Inc.** reported second quarter 1996 revenues of $11.69 million, compared to $15.39 million in second quarter 1995. Net earnings and net earnings per share for second quarter 1996 were $807,000 and 10 cents, respectively, compared with $1.47 million pro forma net earnings and 25 cents pro forma net earnings per share for second quarter 1995.

• **Tele-Communications Inc. (TCI)** reported total revenue of $2.022 billion for second quarter 1996, ended June 30, a 22.7% increase over second quarter 1995 revenues of $1.648 billion. Components of the current second quarter revenue include: Liberty Media Group, which contributed $322 million; TCI Group, which added $1.72 billion; and $20 million in intercompany eliminations.

• **The 1997 Northern California Vendors Day** will be moved from Fairfield to the Concord Hilton in Concord, CA. Moving to the new location will more than double the exhibit space to 8,000 feet, accommodating more than 100 vendors and 500 expected attendees. Over 25 technical training sessions will be offered. **Philips Mobile Training** also is scheduled to be at the same location.

• **Superior Electronics Group Inc.** appointed **Alan Gordon** director of its Analog Video Business Unit. Gordon will be responsible for the specification, development coordination and marketing of hardware and software products for the network monitoring of analog video systems. Most recently, Gordon was director of systems marketing with **Scientific-Atlanta**.

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1997 SCTE board: Call for nominations

The Society of Cable Telecommunications Engineers currently is seeking nominations for candidates to run for seven positions on its national board of directors: Region 1—Serving California, Hawaii and Nevada; Region 2—Serving Arizona, Colorado, New Mexico, Utah and Wyoming; Region 6—Serving Minnesota, North Dakota, South Dakota and Wisconsin; Region 9—Serving Florida, Georgia, Puerto Rico and South Carolina; Region 11—Serving Delaware, Maryland, New Jersey and Pennsylvania; and At-Large Directors—Two positions open. The nominees can be from any region and are voted upon by all members.

Interested parties should contact Bill Riker or Roberta Dainton at (610) 363-6888 no later than Oct. 3.

Foster scholarship presented to Liebig

The 1996 Ken Foster Scholarship Award was presented to Greg Liebig of Harron Communications of Granville, NY. The award presentation occurred at the Second Annual Northeast Telecommunications Technical Seminar, held May 20 in Lake George, NY.

A 12-year industry veteran, Liebig entered the field as a contract construction worker, was hired as a system technician and has advanced to lead technician. The Foster Award will provide full tuition and expenses to allow him to attend courses at the Time Warner Training Center in Denver.

This scholarship program was established in 1992 in honor of Ken Foster, the late director of the New York State Commission on Cable Television's telecommunications division.

It has previously been awarded to Ricky Knapton of Adelphia Cable in 1992, Raynald Chevrier of TCI of New York in 1993, Ulderico Vecchio of Staten Island Cable in 1994 and Vincent Jacona of Time Warner of New York City in 1995.

SCTE was selected by the New York State Commission on Cable Television to oversee the award program in conjunction with its Technical Scholarship Program. Contributors to the Ken Foster Scholarship Award include NewChannels, Lyn-Lad Trucks, Albert Richards, the New York State Commission on Cable Television, Harron Cable TV of Utica, NY, and Adelphia Communications.

"The Foster Award has been a very satisfying and popular program," reports the New York State Commission's Assistant Chief for Video and Broadband Systems, Albert Richards. "It has been well supported by the industry and New York state SCTE chapters. We look forward to continuing this very special program and thank the Society on behalf of all cable operators in New York State for establishing and maintaining the fund."

Shapp Scholarship: Butters first winner

The 1996 SCTE Awards Luncheon, held June 10 in Nashville, TN, saw the presentation of the first scholarship to be awarded under General Instrument's Milton Jerrold Shapp Memorial Scholarship Program, which is administered by SCTE. The winner, Joshua Butters, a student of Chandler High School in Chandler, AZ, will receive a total of $20,000 for college tuition over a four-year period.

The annual scholarship, which will be awarded to the 12th grade children of cable employees who have been in the industry for at least three years, was established this year in memory of former

Pennsylvania governor and Jerrold Electronics founder, Milton Jerrold Shapp.

Having no idea that Joshua was going to win the award, the Butters family fortunately had chosen to bring their children to SCTE's Cable-Tec Expo '96 in Nashville so they could see what their father does for a living. Joshua later commented, "I am extremely thankful and honored to be the first recipient of the Milton Jerrold Shapp Memorial Scholarship. I am proud that you felt I was worthy to follow in the footsteps of such a person as Mr. Shapp. I know his accomplishments will help to motivate me to do my best. This very prestigious award has already impacted my life and future."

Joshua is the son of Gilbert Engineering International CATV Product Manager Alan Butters and his wife Kathie, who works at a local school library. Joshua holds a 3.98 grade point average in addition to working as a lifeguard and running a volleyball league. He will be attending the University of Arizona to work toward a degree in mechanical engineering.

Llaño Estacado hosts its first Cable-Tec Games

The Society's Llaño Estacado Chapter, which serves members in west Texas and eastern New Mexico, held its first Annual Cable-Tec Games event on June 29 in Lubbock, TX. The games were combined with the chapter's first "Vendor's Day."

The games featured competitions in "Cable Jeopardy," "Splicing," "Field Strength Meter Readings" and "Go Fetch." Competition was tough, with ties being broken in two events solely due to the elapsed time for the completion of the activity.

Contestants came from various MSOs from an approximately 125-mile radius of Lubbock. New Region 4 Director M.J. Jackson was present and judged the splicing event.

Vendors and suppliers came from all over the United States to display their wares in the "Vendor's Day" program. A majority of them presented the latest in test equipment and upgrade hardware and software.

Awards in the "Cable-Tec Games" were presented immediately following a cookout hosted by the vendors present.

Medals were awarded as follows: *Overall:* Alan Springer, TCI; *Cable Jeopardy*: First—Alan Springer, TCI; Second—Sam Luna, Cox Cable; Third—Drue Harvey, TCA Cable. *Splicing:* First—Sam Luna, Cox Cable; Second—John Knight, TCI; Third—Alan Springer, TCI. *Field Strength Meter Reading:* First—Steve McIver, Cox Cable; Second—Alan Springer, TCI; Third—Gary Langford, TCA Cable. *Go Fetch:* First—Sam Luna, Cox Cable; Second—Rey Gomez, Cox Cable; Third—Alan Springer, TCI.

By Ron Hranac

Digital standards: Hello, is anybody home?

A few months ago there was a lively—and occasionally inflammatory—discussion thread on the Internet SCTE-List about digital TV transmission formats. Much of the discussion centered on why variants of quadrature amplitude modulation (QAM) are being hailed as the de facto transmission standards for cable systems. While the industry can debate the merits of various technologies, the thread's comments brought up a good point: Are we headed for a digital version of NTSC, PAL and SECAM? Perhaps worse, are we resurrecting the consumer-unfriendly converter/descrambler vs. cable-ready TV/VCR issue all over again? I think the answer is yes to both questions.

Ron Hranac is senior vice president, engineering, for Denver-based consulting firm Coaxial International. He also is senior technical editor for "Communications Technology."

Analog terrestrial standards

Those of you who do business abroad are acutely aware of the problems with analog terrestrial broadcast standards. The world has lived with these multiple standards for years, and technology has helped us deal with format conversion when necessary. Still, the fact we even have NTSC, PAL and SECAM is, at the very least, inconvenient.

When high definition TV (HDTV) was first proposed several years ago, early proponents suggested a global production standard would avoid the problems of the existing multiformat environment. This goal had merit, but egos, politics and the "not invented here" syndrome resulted in major rifts, particularly in the area of 60 Hz vs. 50 Hz field rates. So much for a global HDTV standard.

As digital transmission formats developed, an opportunity for uniform standards, perhaps even global, once again became available. In the area of advanced TV (aka terrestrial broadcast digital HDTV), the U.S. format of choice is 8 VSB. Eventually we'll see TV sets and VCRs with built-in capability to receive broadcasters' analog NTSC and 8 VSB digital signals.

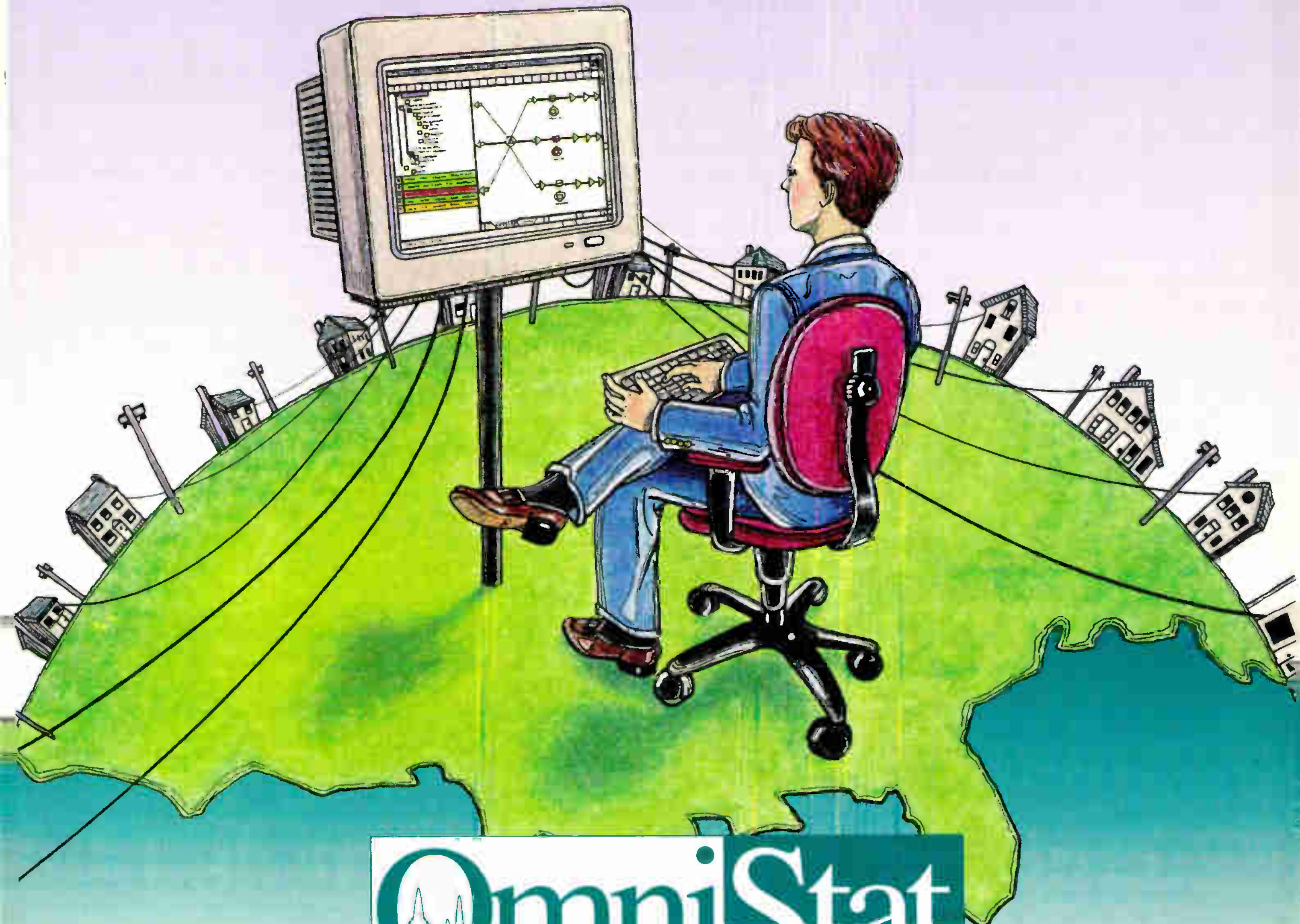
But what about cable? Well, here the water gets a little muddy. You see, there has been a push for 64 QAM, or maybe even 256 QAM, as the format of choice for cable. Interestingly, the Digital Audio-Visual Council (DAVIC) has chosen QAM as the recommended digital modulation scheme, despite the fact that it is incompatible with the U.S. terrestrial broadcast digital VSB standard. To put this in perspective, imagine this analogy: Broadcasters transmit their over-the-air programming in NTSC and cable operators transmit their cable programming in PAL.

Incompatibility

I'm not going to argue about which is the better technology. My concern is that we're brewing up an incompatibility mixture that will drive consumers and cable operators nuts. Consider this plausible scenario: John and Jane Public plunk down $1,500 for a big-screen TV set. After a year or two, one of the local TV stations begins simulcasting its analog programming in the 8 VSB digital format. The Publics go back and spend a few hundred more for a box that will allow them to watch the 8 VSB programming. About the same time, their local cable company introduces its lineup of digital pay-per-view (PPV) programming. The Publics think it might be nice to have PPV so they request a service upgrade. The local cable operator sends a technician out to install yet another set-top that allows reception of the 64 QAM format being carried on the cable system. The confusion and discontent mounts when the Publics try to watch a program in one format and record a different one in another format, not to mention the fact that two boxes reside on top of their TV set.

If the cable operator carries the broadcaster's 8 VSB signal (especially if the 8 VSB programming is not 100% simulcast, but includes some

CONTROL YOUR WORLD



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specialty programming not broadcast in the NTSC format), will the cable version be in the original 8 VSB format, will it be converted to NTSC, or will it be converted to 64 QAM?

Can you see where this is headed?

More confusion

The MMDS industry has been testing 2 VSB, 4 VSB and 8 VSB formats for its own digital TV transmission. At least this is relatively close to what broadcasters will be doing.

The confusion doesn't end in North America. An entirely different digital format—coded orthogonal frequency division multiplexing, or COFDM—probably will be the European digital TV standard.

This mess isn't limited to broadcast vs. cable differences, either. Consider the direct broadcast satellite consumer, faced with a variety of providers: DirecTv/USSB, PrimeStar, EchoStar and AlphaStar. All use quadrature phase shift keying (QPSK) for transmission of their satellite signals, but just try to receive PrimeStar with a DirecTv box or vice versa.

Broadcasters and programmers face similar problems, especially those who will use digital feeds in the occasional-use satellite market. While organizations such as the Inter-Union Satellite Operators Group are making progress, there is still no guarantee that two products labeled MPEG- or DVB-compliant are in fact compatible. The standards are simply too broad.

DVB, by the way, stands for digital video broadcast. The concept of DVB "establishes a common set of methods of delivering digital television to the home using a range of different delivery systems." This is nice, but DVB's "common set of methods" don't ensure across-the-board compatibility.

So where is all of this headed? First, we're going to have analog NTSC in North America for a long time. Digital technology, despite its many advantages, will not obsolete 150 million or so analog TV sets and VCRs. Terrestrial digital transmission—both broadcast and MMDS—will use the VSB digital format. The cable industry will move ahead with QAM. The satellite community will continue to use QPSK. Cable operators will indeed bring back subscriber hate and discontent with the new digital set-top boxes. Eventually, TV and VCR manufacturers will be forced to create all-new "broadcast- and cable-compatible" equipment, providing the ability to receive analog NTSC transmissions, as well as VSB and QAM digital formats.

The sad thing is that all of this confusion could have been avoided. I say "could have been" because of the politics involved in the standards-setting process. Cable operators are usually not well-represented in the standards-setting process; it's almost always manufacturers and industry associations. John and Jane Public don't even know what standards are, so forget consumer input.

Manufacturers have a lot at stake in the standards process. They want to defend their investments, so compromise plays a major role in standards development. In many cases the standards become so loosely defined that they really are nothing more than a label on the box.

Once again, I fear the cable industry will get the black eye, at least from the consumer's perspective. **CT**

By Justin J. Junkus

Telephony modems live on!

With all the talk about cable modems and the associated high-speed access to Internet applications, I thought it might be useful to discuss that antiquated piece of hardware known by the rest of the world as the modem. After all, not every cable system has "the data channel," even when telephony service is being offered. Even with a high-speed data offering, many subscribers will be bringing laptops home from the office and road trips where the only tie to an information service is the conventional telephone modem. Most likely, this knowledge worker will want the convenience of both types of access at home, rather than having to reload files from the laptop to the home-based PC. A large embedded customer base, low prices and widespread support also will contribute to keeping the technology alive. Like it or not, we're stuck with the conventional telephony modem.

This type of modem was originally called a data set, was available only from the telephone company and only as an external device. It was, and still is, the link between the telephone network and data terminal equipment such as dumb terminals, PCs and mainframe computers. After divestiture, consumers could purchase a non-Bell modem from any supplier, and connect it themselves between the data terminal equipment and the telephone line. With large-scale integration, the external box has evolved into an internal PC card, or a credit card-sized PCMCIA module that inserts into a laptop. The external modem is still available, but when expansion card slots are available in the PC, or the PC has PCMCIA capability, the consumer usually prefers the convenience of an internal device.

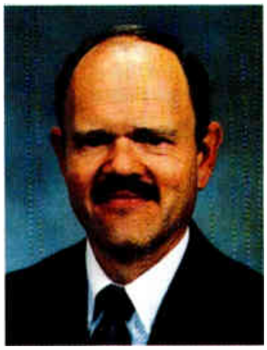
The physical interfaces between the modem and the rest of the world are simple connectors. On the telephone network side, there is the standard RJ-11 wall jack, the same as found on plug-in telephone outlets. In most modem configurations, there is a second RJ-11 for connecting the voice phone, so that both voice and data calls can use the same line. The computer, or data terminal equipment, side of the modem connects to the computer or terminal via an RS 232 interface. For an external modem, this standard jack is either a 25- or nine-pin connector, designated as the COM port of the PC. For internal modems or PCMCIA cards, the connection is through a plug-in for the PC card.

"Like it or not, we're stuck with the conventional telephony modem."

Justin Junkus has over 25 years experience in the telecommunications industry. Previously the AT&T cable TV market manager for the 5ESS switch, he is currently president of KnowledgeLink Inc., a telecommunications training and consulting firm. If you want to contact him, Jay Junkus may be reached at his e-mail address, JJunkus@aol.com.

Modulation schemes

The prevalent telephone network connection to the subscriber is an analog line designed to pass frequencies in the 300 to 3,800 Hz range. This means that for communication between digital machines to occur over analog telephone lines, any digital signal from the PC or terminal must be converted to an AC signal in that frequency range. Modulation accomplishes this conversion. Modems use amplitude modulation, frequency modulation or phase modulation. All of these schemes work by changing one or more characteristics of a sine wave carrier, or tone, in the voice frequency range.



Amplitude modulation consists of changing the amplitude of the tone. Since the signal doing the modulating is either on or off to represent the digital values of 1 and 0, respectively, the amplitude will be varying between two values—sort of like a volume control with only two positions.

Frequency modulation keeps the tone at a constant volume, but changes the frequency between two values. The result is a signal with two distinct sounds corresponding to the times that the digital pulse is a 1 (on) or a zero (off).

Phase modulation keeps both the amplitude and frequency constant, but changes the point in time where the signal has a value of zero. Continuing with the audio analogies, phase difference is what is used in surround sound systems to simulate different placement of sound sources, so that you perceive the violin sound coming from the right of the drum, for example.

Given these three schemes, let's look at the maximum possible data transfer rate in bits per second. A mathematician named Shannon proved that you need a minimum of one-half cycle of a sine wave to identify any of the characteristics just mentioned. If the highest voice frequency accepted by the telephone network is 3,800 Hz, the maximum number of times we can change that signal per second and still recognize amplitude, frequency and phase is 2 x 3,800, or 7,600 times per second. Since the purpose of the modulation scheme is to code digital signals onto the analog sine wave, that means we could in theory code 7,600

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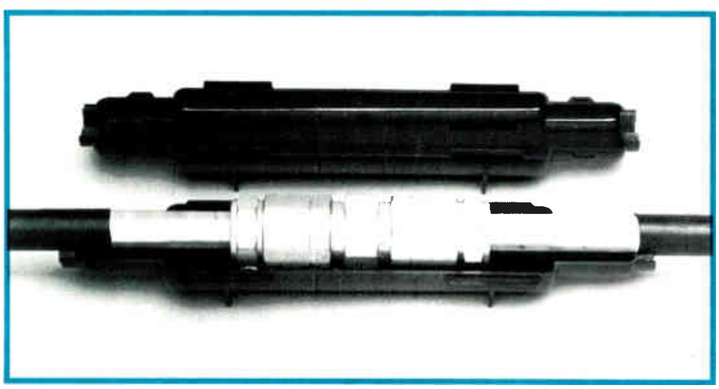

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Soil Chemical Resistance	30 day immersion in: 0.1N Na_2SO_4 0.1N NaCl 0.1N H_2SO_4 0.1N NaOH
Fungus Resistance	per ASTM G-21

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changes per second, or 7,600 bits per second, using any *one* modulation scheme at the maximum voice frequency. That's not lightning speed, but it's a start.

What actually happens, however, is that modem design constraints limit the number of changes per second to the frequency of the carrier sine wave, and only lower frequencies such as 1,200 Hz are used. The result is that the maximum practical data transfer rate from any one modulation scheme alone is 1,200 bits per second. For today's applications, that's a lot slower than lightning!

Combining modulation schemes

The cure to this snail's pace transfer for telephony modems comes in two pieces. First, allow more than one level of change per modulation scheme—perhaps letting the carrier sine wave's phase change between 0, 90, 180 and 270 degrees during any one cycle. Second, combine modulation schemes—for example, use amplitude and phase modulation together. For clarity, we will look at each piece separately, then examine the combined effect.

If we allow phase to vary between four values rather than just two, the number of possible states of the signal in any one cycle increases from two to four. We can then create a coding scheme that groups binary digits into pairs, and assign each pair to one of the phase states. For example, 00 would generate a sine wave with 0° phase shift, while 10 might generate a sine wave with a 90° phase shift. There would be four possible binary combinations per cycle of the modulated sine wave. Remembering that we can change the signal's state once during any one cycle, this new scheme results in a maximum data transfer rate of four times the frequency. For our 1,200 Hz example, this brings us to 4 x 1,200 Hz, or 4,800 bits per second.

Now, let the amplitude of the carrier sine wave change, as well as the phase angle. To keep it simple, only vary between two levels of amplitude, say between -3 and 0 volts. This gives us two possibilities for each phase state, increasing the number of combinations from four to eight.

The next highest grouping of binary digits is in threes, which conveniently works out to be eight possible binary numbers (000 through 111). Assigning each of those eight numbers to one of the combined amplitude-phase states of the modulated sine wave gives us eight possible states per cycle of the sine wave. Once again using the 1,200 Hz sine wave as an example, we can now code 2 x 8 x 1,200 Hz, or 19,200 bits per second. The technology we have just described is known as quadrature amplitude modulation (QAM), and can be extended to achieve speeds up to 38,400 bits per second. That's a lot closer to lightning!

Lest this columnist be accused of oversimplification, telephony modems at these speeds also require extensive error detection and correction techniques, as well as signaling between modems just to determine compatibility and line connections on both ends. The majority of these techniques are detailed in standards such as V.34 and V.42.

The practical limits to the process of combining modulation schemes are the line characteristics of the typical telephone pair at voice frequencies and the cost of electronics in the modem used to detect the various changes. The highest telephony modem data transfer rate in common use today is 38,400 bits per second. A PCMCIA card with that capability costs about $300. For most e-mail and text applications, this data transfer rate is more than enough for the consumer. For image transfer over the Internet, however, it is painfully slow, and that's what drives the need for cable modems with megabit-per-second data rates. **CT**

If you are interested in further information on telephony and cable modems, and the details of coding and error correction techniques, look into the new SCTE monthly publication, "DigiPoints." This monthly tutorial on data communications is available from the SCTE by annual subscription for about the cost of your favorite magazine. Call the SCTE at (800) 542-5040 for details.

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PLANNING '97

By the CT editorial staff

Turn back to the front cover of this issue of *Communications Technology*. If you're a cable telecommunications engineer or a company that sells products to cable systems, most if not all of those words are continually on your mind as you position yourself for the challenges of 1997.

Cable modems. Digital. Network management. Hybrid fiber/coax (HFC). Training. The return path. Reliability. All these issues and more are vying for attention in a cable system's '97 budget. What follows is the first in a two-part *CT* special report on how MSOs are planning their purchases and how vendors are positioning themselves to fulfill 1997's purchasing needs. This part focuses on the MSO side while next month will spotlight vendors' plans.

Data delivery: Visions of sugarplums

Where are some of the top MSOs planning to invest their technology budgetary dollars in 1997? It doesn't take much of an industry pundit to see what's happening. These days, there's one word playing on the lips of cable operators, and making visions of sugarplums dance in their heads.

Data.

More than telephony, interactivity or video-on-demand (VOD), data delivery via cable modem is weighing heavily in MSO engineers' budgetary planning for new technology. Fueled by announcements at last year's Western Cable Show of large-scale purchases of the computer peripherals and Internet access trials at systems across the United States, engineers are preparing to offer data delivery as a revenue generator. Some operators, including Time Warner with its Roadrunner (formerly Linerunner) service, TCI with @Home and Comcast with Comcast Online have already made a sizable investment in infrastructure and hardware for commercial ramp-up of the technology. Others are in beta test, with plans for larger scale deployment through 1997.

> **"Once people have had (Internet access via cable modems) you just can't take it away from them."**
> **–Jim Chiddix, Time Warner**

Chris Bowick, group vice president of technology and chief technical officer of Jones Intercable, noted that his company is working on some seven separate trials, the most visible of which is in Alexandria, VA, where 40-50 customers now subscribe to the service.

"Next year we'll see more commercialization of the service, in both asymmetrical and symmetrical data rates," said Bowick. "I think we'll grow it rather substantially next year. We've got a good business ahead of us here, at least based on what we've seen so far."

The allure of Internet access via cable modems is the remarkably roomy data throughput rate offered by hardware vendors. Many boast of up to 10 Mbps from the headend. Upstream, however, is another matter. The data rate of cable modems is, by design, asymmetrical. For operators using the return path, 1 Mbps upstream is considered generous. Some modems offer return rates of 128 kbps or slower; others carry their return payloads

Eric Butterfield is associate editor, Laura Hamilton is senior editor, Rex Porter is editor and Alex Zavistovich is executive editor for "Communications Technology." Also contributing to this article was Alex Swan, editor of "International Cable" magazine.


Tomorrow
JONES
INTERNET
ROAD RUNNER
@Home

over telephone lines. While telco return is useful for systems not yet capable of two-way traffic, some feel the full power of data over cable will not be unleashed until the upstream issues have been resolved.

"We're using both one-way and two-way product in our trials," explained Bowick. "One of our trials is not just for Internet. It's a work-at-home application in the Chicago area using asymmetrical technology with telephone return." According to Bowick, "the industry has to face the fact that over the next several years only a small percentage of our plant will be going be two-way. There will be many areas of the country where you'd want to introduce a service like this without the need for investing in two-way plant."

One of Bowick's areas to watch will be the asymmetrical data rates of cable modems. "If you ask for a development in the next year that's going to help us to focus on what, where and how to spend, it's going to be that."

Jim Chiddix, chief technical officer of Time Warner, was enthusiastic

"We have a lot more telephone customers now than modem customers."

—Jim Chiddix, Time Warner

Psychology and sales: An open letter to vendors

By Rex Porter, Editor, *Communications Technology*

When the cable industry was in its infancy, selling was easier than it is today. Cable TV was a small town industry. A local pharmacist, theater owner or other local businessman could see the opportunity of owning a cable system in his own town. He would apply for the franchise and depend on a "turnkey" supplier to actually build the system. Under this arrangement, the system owner would contract for the system to be constructed with the equipment manufactured or selected by the turnkey supplier.

In the early days, almost all manufacturing companies like Jerrold, Magnavox, Ameco, Vikoa and Entron would incur close to 80% of the costs of building the system and the owner would cover the other 20%. Then, over the next few years, the owner would repay the supplier until the system would be his debt-free. Financing played a big role in the purchasing of equipment.

Later, the cost of financing caused all of the manufacturers to stop offering system turnkeys. Then the franchise holders were forced to begin negotiating with the salespeople on a direct basis. Thus began a new learning experience for the system owner/operator. He or she had to develop a new understanding of the equipment and how it operated. In the early '60s, system operation became even more complicated, cable systems got larger and, with the purchase or construction of many systems under one ownership, the multiple system operator (MSO) was born.

The MSOs found it unwise to allow each individual system to purchase its own equipment. Better pricing could be arranged by negotiating for all equipment and services from regional offices or the MSO headquarters. Electronic equipment and services had become so technical in name and use that system managers found in many instances that they could no longer keep up with the technology. MSOs and the larger independent systems organized separate departments to define roles and responsibilities.

The approval of electronic equipment and services fell to the chief engineering officer of the company, while the day-to-day operation of the systems was controlled by the chief operations officer. Today, each of these departments is responsible for approving purchases of specific equipment and services. The chief operations officer is concerned with the "business" side of cable and the chief engineering officer is concerned with the technical side. In short, the operations manager defines "what needs to be done" and the engineering manager defines "how to engineer the system to get that job done." (There are other departments but I mention these two because they seem to be the source of greatest confusion involving marketing and selling.) Since neither manager can perform his job and handle the necessary volume of purchase orders, a purchasing department became integral to modern MSO operation.

(Continued on page 30)

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about the revenue potential for Internet access via cable modems. "Customers love it," he said. "We've had the Roadrunner service up for more than a year in business trials in Elmira, NY, and we're rolling it out in some other markets. Once people have had it,

> **"We are planning on having two-way capability in front of 2,500 homes by the end of 1997."**
>
> ***—Alex Best,***
>
> ***Cox Communications***

you just can't take it away from them."

The appeal, Chiddix said, is that "the speed is very high and it's a connectionless service. For a flat monthly rate, it's always there. You can leave your computer turned on all the time. Just like a LAN, you're always on line. There's never a phone call to make as there is with ISDN or a dial-up modem. You're not tying up any other communications facilities."

The Roadrunner service was recently extended from Elmira to Corning, and first true commercial roll-out began in Ohio (Akron and Canton) in early September.

In the coming year, Time Warner is budgeting for many more network upgrades. According to Chiddix, Time Warner is moving along at a furious pace—more than 30% of the company's subscribers have already been upgraded. Chiddix expects 1997 upgrades to take place at the same rate as last year. "We bought well over 600,000 km of fiber last year, some for our HFC network and some for our synchronous optical network (SONET) ring as well. I'm told that makes us the largest single customer for fiber-optic cable."

Data trials also are taking place at Cox Communications. Alex Best, the company's vice president of engineering, noted that Cox is wrapping up trial access to the Prodigy on-line service in San Diego, CA,

Psychology and sales

(Continued from page 28)

All equipment and services used by an MSO must be approved by the head of each department. Approved equipment and services are then published in an "approved buyers list/guide." The purchasing agents purchase from that list. Salespeople who wish to sell products not on the existing guide have to present their products to the office, which evaluates them and, if they pass, submits them for approval and addition to the approved guide. However, simply making it to the buyers guide does not mean the product will be ordered. Price, delivery and packaging also affect its selection for a purchase order. What is the biggest mistake companies make in trying to introduce a new product or service? They advertise it and/or try to sell to the wrong person at the company.

An electronic device is understood by and approved by the engineering side of the company. Programming is understood and approved by another department. And, when the product is an item used daily by the technician or installer, a salesman's best or worst friend can be that technician or installer. If they do not like the product, the installer or technician will inform the approving officer and it won't be ordered. Vice presidents will not force their workers to use inferior products. And I am aware of installers and field technicians who are lucky enough to visit a convention for one full day or half day. They may be wearing their work uniforms instead of suits and ties. Sometimes I see them shown less respect than they truly deserve. After all, these are the people who actually use your products. They may not be able to approve the product but they can make sure it isn't on that purchase order.

When you call on purchasing agents, what do they expect? They are extremely busy. They are responsible for buying a wide range of products for a large group of systems. First, they don't want their time wasted. They expect you to know your equipment and what other equipment will interface with it. They expect you to know your industry. They expect you to go through proper channels when you call on other offices. Of course they expect the best price for your product. But if your price is higher than your competitor's, they expect you to be fully prepared to sell the higher price. The product has been approved already! Anything less is a waste of your time and the purchasing agent's time. Wasted money may be recovered—wasted time can never be regained.—*RP*

using Zenith 0.5 Mbps modems. In Phoenix, AZ, Cox offers access to the Internet, work-at-home, and CD-ROMs (located at cable headend) to 100 beta test sites using LANcity 10 Mbps modems. This trial will be offered as a standard service in October 1996. Just begun this summer was a trial in Orange County, CA, using Motorola's 30 Mbps modem product.

"Budgeting for cable modems is

On the fast track: Behind the scenes at NCTA

One operator's plans to provide high-speed Internet access contributed to a recent success in the cable industry's national commitment to student education.

It was a spectacular show in the nation's capital this past July, when the National Cable Television Association treated journalists, politicians and industry leaders to the splashy multimedia demonstration dubbed "Cable's High Speed Education Connection." With a video wall as a backdrop, NCTA President Decker Anstrom announced the industry's voluntary effort to equip schools wired under the Cable in the Classroom project with computers and cable modems offering high-speed Internet access.

To illustrate the importance of cable modem technology to this industry commitment, the presentation featured a live comparison of the broadband peripherals to ISDN and standard telco lines as conduits of information. The cable modem setup—a Motorola CyberSURFR modem connected to an AST CPU and NEC color monitor—easily outpaced its telco competition for sheer handling capacity.

A transcendant moment for the NCTA, the presentation featured gushing enthusiasm from notables including Larry Pressler (R-SD), chair of the Senate Commerce Committee, and FCC Chairman Reed Hundt. Brian Roberts, president of Comcast, Brendan Clouston, president of TCI Communications, and Joe Collins, chairman and CEO of Time Warner, each reported on their current successes and pledged their support for cable's investment in education.

What's interesting about all this, from an engineering perspective, is that Washington, DC's cable operator, District Cablevision, provides neither Internet access nor data delivery service, not even on a beta basis.

That's true, acknowledged Rob Flynn, senior director of advertising and special projects for NCTA. Making the technological portion of the presentation happen was a challenge unto itself.

The first obstacle was simply finding a venue for the event. According to Flynn, surprisingly few hotels in Washington are wired for cable. The exception is the Grand Hyatt, on H Street across from the city's convention center, which has a cable drop in its sports bar. Working cooperatively with NCTA, District Cablevision ran another cable drop down two flights to the hotel's Constitution Ballroom, where the presentation was conducted.

NCTA paid to have District Cablevision set up for Internet access, Flynn said. A T-1 line from Capital Area Internet was installed at the headend, along with cable modems and a Netscape proxy server. An audio server and a CU-SEEME server also were running at the headend, enabling "simulcast" of the presentation in cyberspace.

Coordinating the effort was Atlanta-based Convergence Systems. The company's previous claim to fame was the wiring of a TCI Internet service project in East Lansing, MI—with over 500 homes using either Zenith or LANcity modems, the installation is among the largest standing application of Internet access over cable, predating TCI's own @Home service.

Convergence Systems President David Ames noted that District Cablevision gave his company "great cooperation" in assembling the system. According to Ames, the District Cablevision HFC cable plant is "tight and can handle data traffic with no problem."

NCTA's Decker Anstrom.

The modems used in the NCTA presentation operated asynchronously: The downstream speed was 30 Mbps; upstream was approximately 900 kbps. According to Ames, the upstream speed "could have been bumped up without affecting the downstream rate" because of a large capacity router installed at the headend, allowing 6 MHz of bandwidth to be used in up to 12 channels. The router required by the modem vendor and the headend cable modem were inserted in the signal path as if they were a channel at the headend, said Convergence's Vice President of Engineering Toby Ayre. A drop from the reverse network was used as the return path to the headend router.

Terry Wright, the company's chief technical officer, noted that the router that makes the modem work is not a matrix switch. Rather, it uses Routing Information Protocol 1 (RIP-1), routing across the flat cable modem network.

The NCTA project was not without its technical challenges. These challenges, according to Wright, had to do mostly with signal strength at the headend and sensitivity of the equipment to adjustments in the field. Typically, the signal is injected downstream into the normal combiner network. In this case, Wright explained, "we had to inject into the first amplifier beyond the combiner network." Wright shrugged off the inconvenience, noting that the vendor "is still refining the product."

All of this is fascinating, of course, but it begs the question of what District Cablevision stood to gain in the project. According to NCTA's Flynn, District Cablevision was anxious to prove to its parent company, TCI, that the DC plant was robust enough to offer two-way services. It's not the first time the two organizations have worked together to this end, either, Flynn noted. At the NCTA's demonstration of new technology in September 1995, District Cablevision also was provided with a T-1 line. Subsequently, the system operator moved its headend across the street and had to disconnect its line. "This time looks like the charm," Flynn said.

Communications Technology placed several calls to District Cablevision's chief engineer Fitzroy Francis in July. The calls were unreturned. A source close to the project, however, predicted that District Cablevision will begin offering Internet access to beta test sites in the city in the coming few months. LANcity cable modems may be used.—*AZ*

being handled in our Atlanta corporate headquarters," Best explained. Two-way network needs also are being budgeted for in Atlanta. "We are planning on having two-way capability in front of 2,500 homes by the end of 1997," he said.

Best predicted three major growth opportunities for cable operators: data modems, wireline telephony and digital TV. "These three will remain the major focus for the next several years," he said, adding, "somewhere out in the future is interactive TV. We are presently budgeting for data, telephone and digital TV. We are not budgeting for interactive TV."

Century Communications Corp.'s Senior Vice President of Engineering Michael Harris noted that his company has tested and is now offering point-to-point data transmission in various cable systems. "In the long term," said Harris, "Century is planning for residential two-way data transmission utilizing, among other devices, high-speed cable modems.

High-speed data service on Century systems includes Colorado Springs, CO, with DEC/LANcity, Los Alamos, NM, using Zenith, Los Angeles using DEC/LANcity and San Juan, Puerto Rico, using Phasecom and Restor Industries products. Numerous other sites are under active development, including working with local schools and city locations.

"Our solutions include fiber as well as HFC networks," Harris said. "We are developing a detailed business plan encompassing, among other services, high-speed data transmission.

"Century is planning to launch a business that integrates different elements of telecommunications services. Our business plans take into consideration all aspects including marketing, operations, administration and network capital requirements. We have issued two detailed RFPs to the major vendors/manufacturers involved. We are in the evaluation process." →

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Harris noted that Century has plans to fund commercial roll-outs of data transmission services, "including current capital expenditure budgeting for various upgrades and rebuilds that will provide the network infrastructure for, among other types of services, data transmission."

According to Harris, "Century consistently updates its long- range planning for changing technological developments, although clearly the focus for 1997 will remain the continued development of fiber-rich networks capable of delivering a wide array of services, such as data transmission, digital video, telephony or other bandwidth utilizing commercial or business telecommunication services."

Like many others involved in data delivery trials, Harris believes that "content will ultimately drive the market acceptance of high-speed data services."

"Before cable modems can be successfully retailed as consumer electronics, the applications that will drive the use of cable modems into a large number of homes need to be developed. While we (at Century) concur that Internet access is an immediate application, we believe the basic nature of the business will change.

"The focus for 1997 will remain the continued development of fiber-rich networks capable of delivering a wide array of services."
—Michael Harris, Century Communications

"As the market begins to learn to use this technology, new

Q: Is there enough digital training?

Alex Best, Cox: "Between the vendors, CableLabs, and our own effort, we will be ready when the boxes become available."

Chris Bowick, Jones Intercable: "I think it's available. What we're having trouble with as an industry is taking advantage of what is already available, especially through our vendor base."

Michael Harris, Century Communications: "It is our experience that vendors are providing an adequate level of education to the cable industry with regard to digital transmission. However, access control and other network security issues continue to be items that require additional research and study."—*EB*

multimedia applications will emerge. Century is taking several courses of action, including the development of business Intranets as well as delivery of content," Harris said.

Harris's view of the changing face of the Information Age? Unequivocal. "We believe that high-speed cable modem technology will be the preferred mode of data delivery in the future."

Cable telephony

While 1997 will be the year to get an early jump on the data delivery market, it also will see limited rollout of cable telephony.

Hoping to win new customers, cable operators plan to package telephony with television and high-speed Internet access. As cable systems are upgraded to handle these high-bandwidth services, interconnection agreements are being inked between MSOs and traditional telephony providers.

The interconnection agreement between Jones Intercable and Bell Atlantic in Virginia is the first such agreement with a regional Bell. As outlined by the Telecommunications Act, Bell Atlantic has opened its local telephone networks to competition so it can offer long-distance in its service areas.

By connecting its cable TV systems with Bell Atlantic's local phone network, Jones will be able to provide competitive local residential and business telephone service over its local exchange network. In addition, the agreement allows customers to keep their phone number if they switch companies, and enables services such as caller ID to work across the two networks.

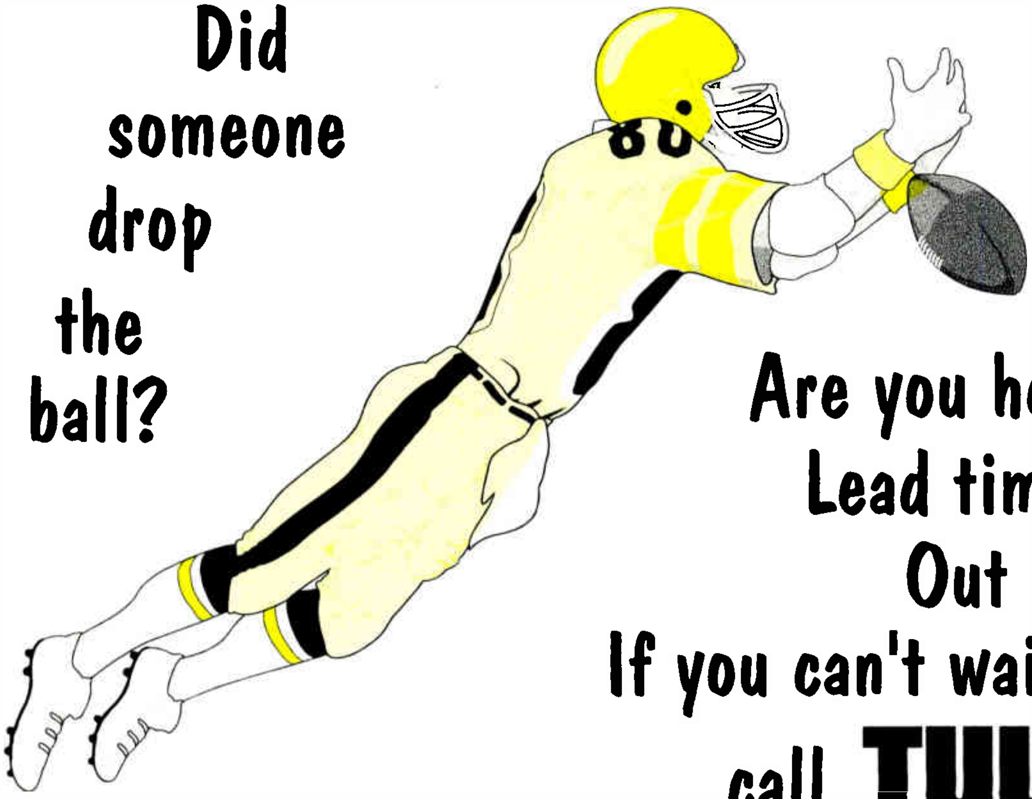
Chris Bowick of Jones Intercable, says the company will be increasing telephony budgeting next year. "We anticipate significant growth in telephony subscribers in 1997."

In the Chicago area, Jones has agreed to lease 50 miles of fiber-optic cable to AT&T Corp. Jones will lay the fiber as part of a 350-mile network AT&T plans to complete by late 1997 for offering local phone service. AT&T is negotiating to connect with Ameritech's local phone network. Jones hasn't said whether or not it plans to pursue local telephony in Illinois.

TCI Telephony Services, on the other hand, plans to launch local wireline services in Arlington Heights, IL, as well as in Connecticut and California by the end of the year. For local switching, says Terri Bryan, director of marketing for TCI Telephony Services, the company is working through its partner, TCG Teleport, of which TCI owns 30%.

Also approved to compete in local telephony is Continental Cablevision whose subsidiary, CCI Telecommunications Inc. of New Hampshire, has been given authority to deliver telecommunications services over its existing broadband network.

Foreshadowing similar U.S. projects, in June Continental launched telephone service over Australia's nationwide advanced



broadband telecommunications network.

The revenue potential of cable telephony is certainly not lost on Time Warner, which delivers voice and data communications in over 18 of its markets nationwide.

"Telephony is very important to us, both business and residential applications," says TW's Jim Chiddix. "We have a lot more telephone customers now than modem customers." He adds that the company plans to roll out residential telephony in the additional markets of Memphis, TN, Honolulu, New York and others.

Likewise, smaller cable operators are looking to get into the game. Michael Harris, senior vice president of engineering at Century Communications Corp., says his company has preliminary plans to fund commercial telephony roll-out, including the necessary upgrades and rebuilds to the network infrastructure.

Screen captures from Jones Internet Channel service in Alexandria, VA.

PCS

This year promises to be both a white and wireless Christmas in Denver. The digital wireless communications venture backed by TCI and Sprint Corp., called Sprint Spectrum, plans to make digital wireless phones this year's stocking stuffer in the Colorado capital.

The venture will open three retail outlets as well as sell the personal communications service (PCS) handset in chain stores. Competing with

The learning curve: Staying ahead with vendors, training

Owing to the passage of the Telecommunications Act of 1996, the cable industry has more to worry about than ever in 1997. Cross-competition may add dollars to the bottom line, but are vendors traditionally tied to the telco industry providing the level of service cable engineers have come to expect? That concern crosses back over to the cable vendor community: Are cable modem manufacturers meeting the demand created by prospects of lucrative data delivery business?

And what of training? Data delivery experts don't spring fully formed from the ranks of today's cable installers and technicians, after all. How are MSOs preparing their engineering staffs for the specialized skills required in the fast-developing field of high-speed Internet access?

Jones' Bowick said cable modem vendors are doing a good job providing hardware for data delivery business. As for working with telco vendors on telephony and related issues, Bowick is not at all apprehensive.

"I don't have any reluctance at all" working with telco vendors, said Bowick. "They have come up to speed very nicely. People like Northern Telecom, Motorola and others have done a very good job of understanding the needs of the cable industry and jumping right in."

Some vendors may miss a deadline now and then. Alex Best at Cox sees it as part of the process of bringing new services to market. "As is typical of any new product or service, (cable modem vendors) are late with their products and solutions and unanticipated problems occur when they are deployed in the field," he said. However, Best pointed out, such delays are "the primary reason for technology trials—to deal with these issues and solve them before commercially rolling out the products." Cox sees itself as in the problem-solving mode prior to commercial roll-out.

Like Bowick, Best has no qualms about dealing with telco vendors. "Motorola is a leading supplier of both cable modems and wireless telephone equipment," he said. "In fact, we are pleased to have world-class manufacturing organizations such as Motorola, Lucent, H-P, and others (delivering) hardware to the cable industry."

Although he reserved comment on vendor performance until the technology moves from testing to commercial applications, Century's Harris said he was "encouraged" by vendor progress so far in "developing a generation of equipment that we can use to build a cost effective service." Century Communications Corp. has always been comfortable with telco vendor relationships, due to its major equity stake in Centennial

(Continued on page 47)

Reader Service Number 209

Reader Service Number 197

cellular for billions in conversation dollars, PCS hopes its high-frequency clarity and easier connection will give it an edge.

Talk isn't cheap. At last year's auctions, Sprint Spectrum paid $2.1 billion for PCS licenses covering 190 million potential customers. The venture also is backed by Comcast and Cox Communications, which launched its first wireless service last November in the Washington, DC, area.

Other cable operators, such as Time Warner, plan for now to remain in the background and offer PCS transport to those with licenses. Similarly, Bowick says Jones is keeping an eye on PCS technology, but hasn't budgeted for it for 1997: "We believe that we can play a role, not necessarily in the short term of being a PCS operator because we certainly haven't been in on any of the bids for licenses, but we've got infrastructure in place."

Digital

Look for the push for digital set-tops to heat up in 1997. In particular, Cox signed a contract with General Instrument for 350,000 digital boxes over the next three years. But the move is happening sooner than later.

"We plan to deploy some digital converters in the fourth quarter of this year," says Jones' Bowick. "And I don't think that's going to be a difficult thing to do. And if we don't get to it the last quarter of this year, we will certainly be getting to it the first quarter of next year."

Likewise, Time Warner plans to deploy digital set-tops in 1997. Chiddix describes its Pegasus box as "a real-time two-way box with intelligent memory management. So if we're not using memory for full B-frame, full resolution decompression, we can reassign it to other kinds of applications." Chiddix says the company expects the boxes to be delivered next year to a number of its systems.

While most acknowledge that direct broadcast satellite (DBS) and wireless are quickening the move to digital, Best is confident that digital compression will allow cable to exceed the competitors' offerings. Similarly, Chiddix cites cable's ability to offer things

that DBS and wireless can't: interactive services and two-way TV. (For more on the competition, see the article on page 48.)

Also on the digital set-top front, in late August the Americast joint venture (consisting of Ameritech, Bell South, GTE, SBC Communications and The Walt Disney Co.) announced a contract to purchase 3 million digital set-tops from Zenith. William Luehrs, president of the Zenith Network Systems Division, says the boxes will enable Americast to deploy four kinds of video networks: multichannel multipoint distribution service (MMDS), HFC, switched digital video and DBS. The contract is valued at more than $1 billion. Production of the boxes will begin in the first half of 1997.

VOD

While VOD may not make the splash the hype once promised, this next year will see considerable roll-out of near-video-on-demand (NVOD).

Best says that NVOD will be one of the product offerings of Cox's digital roll-out in the first quarter of 1997. "VOD plans are not yet formulated," he adds, "due to a lack of an economically viable technical delivery system."

Similarly, Harris says Century plans to deploy NVOD within the

Q: What are your requirements for video servers?

Michael Harris, Century Communications: "Video servers need to be technically resilient, economically priced (relative to expected incremental cash flow contribution) and high-capacity."

Jim Chiddix, Time Warner: "We're installing a lot of digital ad insertion equipment in many of our divisions. We're tracking video server capabilities and costs very closely because that's an important element in allowing Pegasus-type set-tops to move to high-bandwidth interactive services, including video-on-demand."

Q: Is scalability important, so you can do VOD and ad insertion from the same platform?

Chiddix: "My gut feeling is that's a real mistake. I know a lot of companies use that as part of their sales pitch. If the same server is used for both ad insertion and VOD, I think it will be kind of by accident. There's no reason why a device optimized for one service will be optimized for another as well. They are conceptually similar, but I think it may waste a lot of energy and money trying to use the same hardware for separate applications.

"The servers that are being sold now for digital ad insertion are good enough, and we're buying them. For VOD they need to be cheaper per stream, and they're getting cheaper faster."—*EB*

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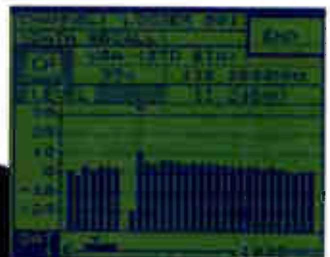

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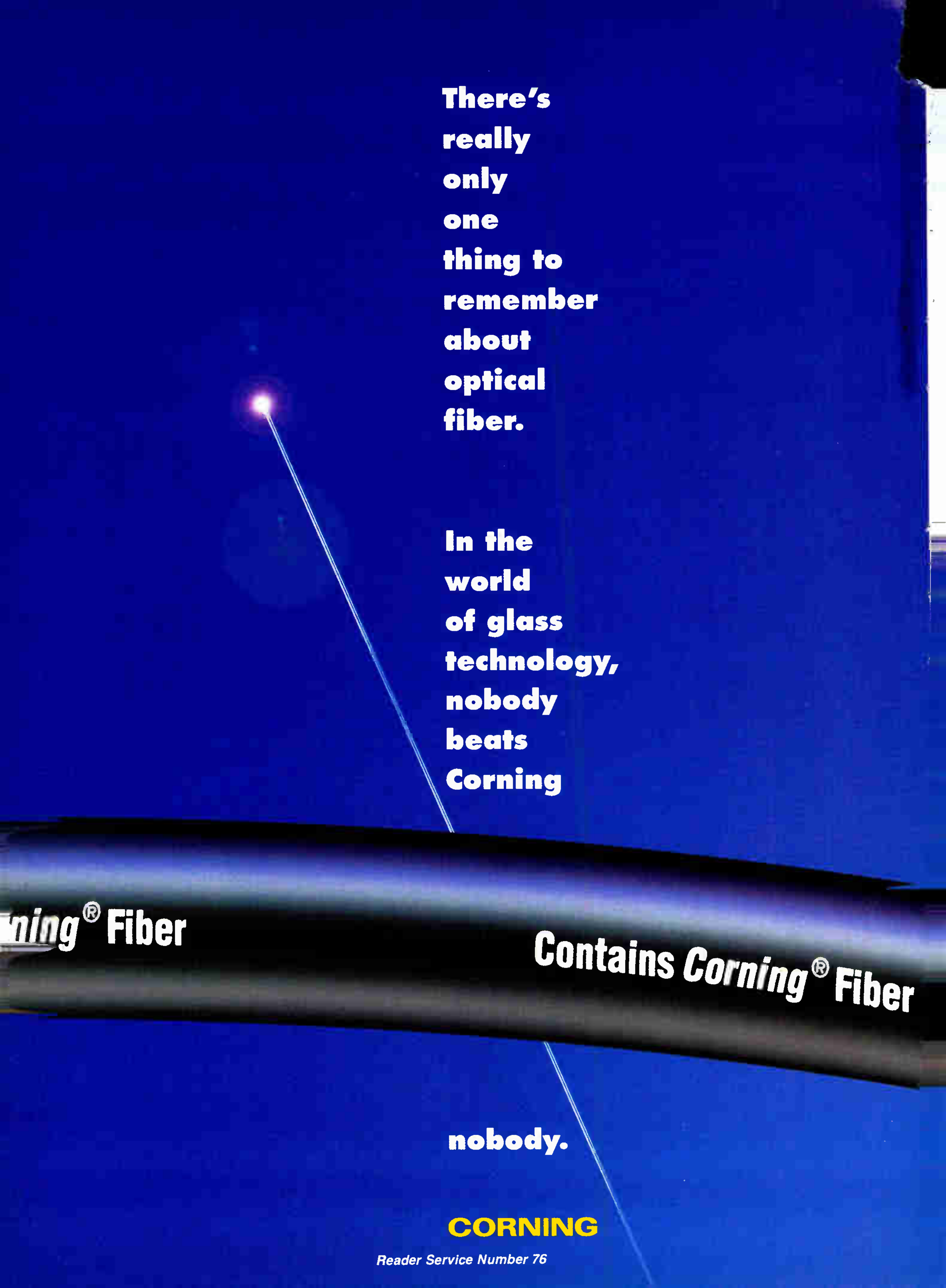
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The learning curve

(Continued from page 40)

Cellular, Harris explained. The company now operates a CAP/CLEC business and holds the "B" group PCS license in Puerto Rico.

Time Warner's Chiddix noted that equipment vendors have "come a long way" in supplying cable operators. "We have a couple of vendors supplying the headend component of our PC modem systems, including Hewlett-Packard," Chiddix said. "We also have a fair number of Motorola, Zenith and LANcity modems in our systems. We've come to the point where we can indeed do mass deployment of service." So far, he said, the vendors are doing a good job with keeping up with demand.

Chiddix doesn't feel squeamish about using companies traditionally thought of as telco vendors for these cable-specific applications, "as long as they realize this is a competitive market, and that we care passionately about getting good quality equipment at a good price.

"Some telco vendors live in a world where price is not so important, and gold-plating everything is acceptable," Chiddix continued. "In a world that provides high return on rate base, that may be fine, but that's not the world we see coming. The vendors I've mentioned see that the world is changing." He added that both Tellabs and Nortel have met his expectations in providing telephony products to Time Warner's service in Rochester. "They've done a fine job providing HFC telephony terminal equipment, both for the home and the headend."

In the realm of training, most MSOs contacted by *Communications Technology* are planning a combination of in-house and out-sourced training for their employees. At Cox, Best said, in-house training for our system technicians will take place in the field and in the company's Atlanta facilities. Outside seminars must be requested and justified by system employees, according to Best. "The Cable-Tec Expo is very popular and attended by most system technical management personnel," he added. "NCTI training is encouraged but participation is a personal training decision and not company-sponsored."

Training for Jones Intercable personnel is provided "primarily by the equipment manufacturers," said Bowick. "We get those guys with us out in the field to help us in the initial throes of working with a new product." One of the benefits of this kind of partnering, Bowick noted, is "you're out there in the field together, you're understanding the operational concerns and requirements together. Then they're able to take that back to the labs and feed that back into the design, and we're able to modify our process accordingly." SCTE and NCTI training "are always part of our tool kit," he added.

For Harris, training in data delivery involves vendors, industry conferences, trade organizations and publications as a means of augmenting hands-on field experience. Like Harris and Bowick, Chiddix noted that vendors are providing some training. He added that "we've also developed some internal training resources for return path alignment, modem installation and so forth."

Most importantly, the engineers polled agreed that training is a process involving hiring skilled technicians to supplement programs developed internally. "As the industry develops, we will continue to add technical professionals with a variety of data and telephony skills," he said. "In addition, Century will continue through our in-house training programs to upgrade the expertise of our present staff."—*AZ*

next year, but that it hasn't budgeted for VOD.

Jones, on the other hand, won't be delivering NVOD. Bowick says the company's initial focus will be on the capability of multiplexing, "very similar to what HITS will be able to provide to us."

While nothing has been announced, it is Bowick's belief that multiplexing is something Jones might be taking full use of in the future: "And that might be in conjunction with a roll-out of digital boxes in the fourth quarter of this year or first quarter of next year." **CT**

By Laura K. Hamilton

DBS and MMDS: Packing digital punches

Cable's competition doesn't seem to be taking as much of a David vs. Goliath tact anymore when it comes to presenting its technology to the public. Although direct broadcast satellite (DBS) and multichannel multipoint distribution service (MMDS) sometimes still like to slam cable as the Big Bad Monopoly in TV and radio ads, that attack doesn't work as well since passage of the Telecommunications Act.

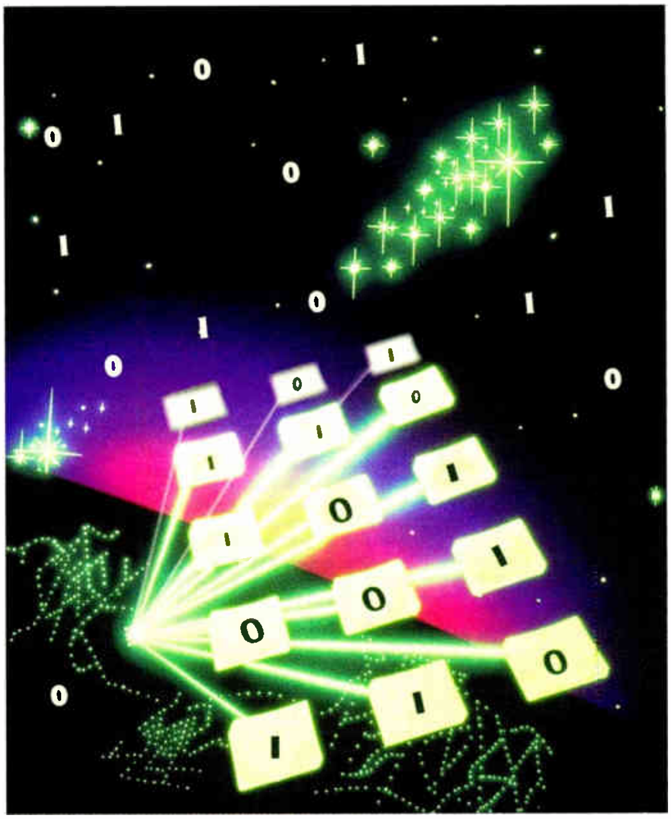
DBS and MMDS are taking more of a Goliath vs. Goliath approach now. And their weapon of choice is digital technology.

First, let's take a look into the DBS pocket where there's that nice compact dish you might have seen popping up around town over the last couple of years. This little piece of technology can be as small as 18 inches and provides all those pretty digital pictures, not to mention enough channels to numb the remote control finger of even the most seriously entrenched of couch spuds.

Laura Hamilton is senior editor of "Communications Technology." She can be reached at (303) 839-1565, ext. 43.

How does DBS work?

As a quick overview of how DBS technology ticks, consider DirecTV's DSS system, which includes an 18-inch dish, a digital set-top decoder box and remote control. More than 175 channels of digital quality programming and



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pay-per-view are offered with the system. Manufacturers of the hardware presently include Thomson Consumer Electronics (under RCA and GE brand names), Sony and Hughes Network Systems.

The system uplink is located in Castle Rock, CO, and features eight satellite receiving stations and four 13-meter transmit dishes. Programming is delivered to the uplink facility via satellite over fiber and through the use of digital videotape. The programming is digitally compressed and encrypted, then transmitted to three high-power Ku-band DBS satellites, built by Hughes Electronics. They feature sixteen 120-watt transponders that operate from the 101° W longitudinal position.

The receiving dish at the subscriber's home can be installed in almost any outdoor location as long as it has an unobstructed view to the south. Although professional installation is available, DirecTV helps its do-it-yourselfer customers with an on-screen satellite locator and signal strength meter to help simplify the dish positioning process.

The price factor

But what about the cost of all this technology? Traditionally, that's been one of cable's retaliations to the threat of DBS. As recently as two years ago, DBS subs were staring down the barrel of a $700 price tag for a basic package. That's hardly the case anymore. Take for example EchoStar Communications Corp., which recently announced a suggested $199 for its new Dish Network digital satellite system with the purchase of a $300 annual programming package. Subs will get a bang for their buck, too: The company plans to offer 200 digital channels by the end of this year.

Cable still has some powerful advantages over DBS, however. Cable can always lay down its high bandwidth trump card, which of course makes it the odds-on favorite for interactive services like high-speed Internet access. DBS requires the use of telephony lines to provide a return path, and thus is hampered by slower speeds when it considers offering Internet access over its network.

Another DBS stumbling block is that it requires extra equipment (and an extra cost) to hook up additional TV sets in a customer's home.

Yet another DBS disadvantage much lauded by the cable industry is that DBS can't provide local programming. However, this may be a weak competitive argument since a rooftop antenna collocated with the DBS dish lets subs receive local networks in areas where broadcast reception is good. Where broadcast signals aren't so great, the regional broadcast network offered by DBS most likely will be the sub's local station.

The DBS industry doesn't seem intimidated by these technical disadvantages and continues to hype itself and its "superior digital pictures" right up against cable's offerings. And it isn't afraid to openly ogle cable's market share, as a recent push for the multiple dwelling unit (MDU) market attests.

DirecTV, which launched its DBS service in June 1994, predicts it will pick up 2.5 to 3 million subscribers by year end and says it won't stop there. It is planning to go after the 25 million homes in the MDU market and predictions of 10 million MDU subs by the turn of the century are being flung about.

DirecTV is presently accepting applications from independent operators to construct its MDU DSS system. The DSS package, which starts at $499, offers MDU customers a link to a 24- or 30-inch common dish and 175+ channels. Here again, however, the ugly cost specter could loom before DBS' competitive hopes.

"The $500 for the box is going to be a negative," Malarkey-Taylor Associates Senior Consultant Leigh Admarin told *CT*'s sister publication *CableFAX*, "It depends upon what kind of dwelling. In lower income that's not going to fly at all."

The MMDS dark horse

It's not just DBS eyeing cable's business either. As Tom Elliot, senior vice president of engineering and technical services, put it, "Wireless and DBS are both major threats to the core cable business in plants where we are not doing a first class-job from A to Z."

Elliot added, "We must get on with doing the best possible job of delivering high-quality picture to our customers, now." →

That sentiment of top-notch pictures is one that cable's competition has taken very seriously as well. MMDS (often referred to as wireless) has long been sniffed at for "line-of-sight" technical woes and its 33-channel limitations. But like DBS, it's placing its bets on consumers' voracious appetites for digital technology. Digital is powerful addition to the wireless industry's tool box, promising lots more channels and more robust signals (even through dense foliage).

MMDS has an advantage in that it can implement digital quicker and at a much lower cost than a cable system can. Cable must rebuild or upgrade its networks, so wireless companies might have the benefit of touting their digital pictures first in a market where the cable system is still upgrading.

MMDS doesn't seem content with just living off the cable industry's scraps anymore. Once almost purely viewed as something of a frumpy technological wallflower—a service people subscribed to only if there wasn't a cable system around—wireless with its new-found digital confidence is sending out rumblings of head-on competition.

Robert Schmidt, who was the founding president of the Wireless Cable Association in 1988 and who now is focusing on a private business venture to provide high-speed Internet access over wireless systems, said, "It's clear to me that the next steps for the wireless cable industry include the rapid deployment of digital technology, thus enabling us to deliver 100-plus channels and compete with cable and direct-to-home (DTH)."

If you don't think that MMDS has deep enough pockets to go digital, you might want to think again as the regional Bell operating companies (RBOCs) align themselves with the wireless industry. Some familiar telco names that are now players in wireless include NYNEX, Bell Atlantic, PacTel, Bell South, and Southwestern Bell (through its merger with PacTel).

Those names with their powerful recognition factor could add a competitive branding problem for cable. David Fellows, senior vice president of engineering and technology at Continental Cablevision, said, "When you have RBOCs investing in wireless, their promotion and distribution capabilities are cause for concern, even if the product is weak."

Perhaps another good indication of the blooming MMDS/RBOC alliance is the Wireless Cable Association's election of its new president—Richard Alston, a former Bell Atlantic vice president.

Alston doesn't seem content to lead an association in an also-ran industry shackled by regulatory agencies. Look for the wireless voice to grow only stronger in the regulatory arena. Alston said one of WCA's main pushes will be to promote the growth of the industry "by continuing efforts to ensure a legal and regulatory framework that provides fair access to the marketplace for companies within the industry."

Wireless, although regulated by the Federal Communications Commission, is excluded from the hurdles of being defined as "telecommunications" and "telecommunications services." Wireless does not require a local franchise, which eliminates local franchise fees and makes the industry subject to fewer FCC regs than cable.

However, wireless is subject to Federal Aviation Administration regulations regarding construction, marking and lighting of transmission towers. The industry hopes more and more regulations will be implemented that will pre-empt local antenna restrictions, allowing MMDS to place antennas more freely for better sub reception.

How MMDS works

Using a network made up of a main transmitter and multiple repeaters, MMDS microwave signals are transmitted to small receiving antennas on subscriber rooftops where the signal is routed into homes through a coaxial cable into a TV set-top descrambler. Primary transmitters are placed on top of tall buildings or tower to provide clear line-of-sight transmission. Here's where dense foliage and further obstructions become a problem. But some of those worries can be circumvented using high-powered repeaters or low-powered "beambenders."

When beambenders, boosters or synchronized multiple transmitters are put in with a digital system, still more of MMDS' problems are solved. A

digital MMDS signal passed through a bunch of trees has a better chance of getting to the sub satisfactorily than does its analog counterpart.

What follows is a description of a digital MMDS system presently being tested. This system is offered by TelQuest and CAI Wireless Systems and includes the ability to offer high-speed data to subs equipped with wireless cable modems. (Telequest is a programming provider that originates from an encoding facility in Neptune, NJ. CAI is a wireless operator that has a strategic relationship with RBOC heavy hitters Bell Atlantic and NYNEX.)

After receiving programming from a variety of orbiting satellites, TelQuest digitizes and compresses the multiple signals into a single signal, which in turn is retransmitted via satellite to independent MMDS operators.

MMDS ops receive the programming at local headend facilities in each market and combine the digitized signals with digitized over-the-air local programming. The combined signal is routed to the systems main transmitter. The signals from the dedicated server and router equipment that provides CAI's Internet service also are routed to the main transmitter.

The signals are transmitted to subs from the main antenna and through a series of boosters, which are said to ensure that the signals reach a minimum of 75% of homes in the market. CAI subs receive the signals through a small, flat-panel antenna mounted on the home. The signals are routed to the set-top or the computer's wireless cable modem.

In May, CAI began testing in Washington the first Internet access product delivered by a wireless TV company. Data is send to customers at a rate of 10 megabits per second. CAI hopes that by the end of the year that figure will nearly triple to 27 Mbps as wireless modems advance. However, like DBS, the catch is in the return. Traditional telephony lines are used for that and therefore return speed is limited.

Cable's digital response

Obviously the cable industry is not just sitting around while the competition touts the wonders of its digital wares.

Richard Green, president of Cable Television Laboratories, looks at it this way: "DBS has done some of the market research in digital for us. Customers have shown they want digital pictures."

And digital pictures they'll get. In late August, General Instrument offered a preview of digital TV over cable nets in preparation for consumer launch later this year by major cable MSOs. This "Digital Deployment Day" included demos of digital set-tops and a live MPEG-2 satellite feed for broadband network operators. GI said it has received commitments from some of the larger cable MSOs including TCI, Comcast, Cox, Jones, Rogers and Shaw as well as from ops "representing virtually every size system in North America." **CT**

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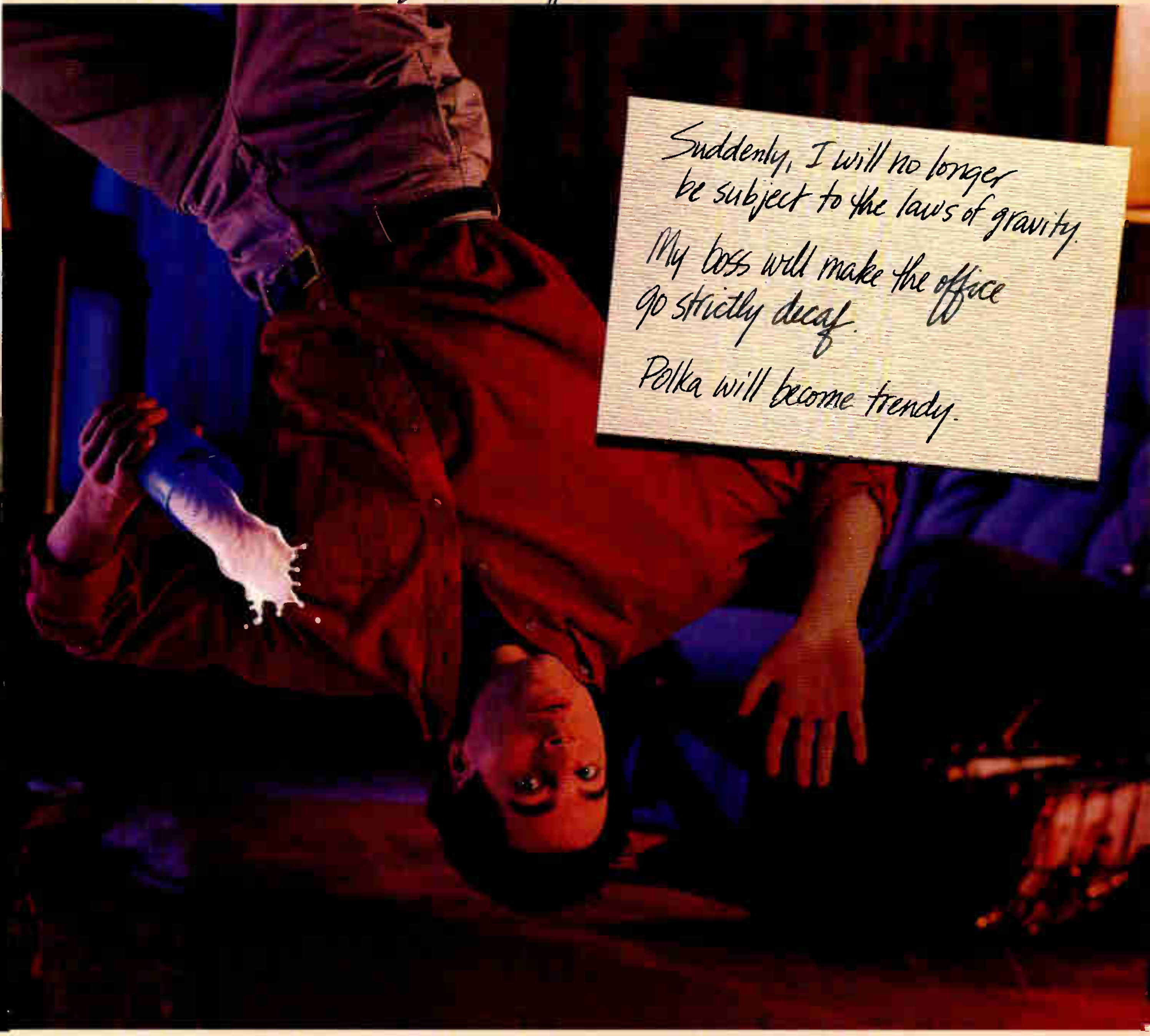

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Reader Service Number 67

By J.R. Anderson

Shared tenant services

Several cable operators have taken the plunge into the brand-new market of shared tenant services (STS). But STS is not focused on video or data communication services, and cable modems usually aren't involved. Operators are instead commonly focusing on plain old telephone services (POTS) and have turned to a technology that has been around for 100 years: the traditional twisted-pair telephony network.

J.R. Anderson is director, engineered products group, of Integration Technologies, an engineering and systems integration firm based in Englewood, CO. The author can be reached at (303) 799-7780 or (800) 211-8424.

There are two reasons:

1) Cable operators are planning a defensive against competition from local telephone companies, multichannel multipoint distribution service (MMDS), satellite and third-party providers; and

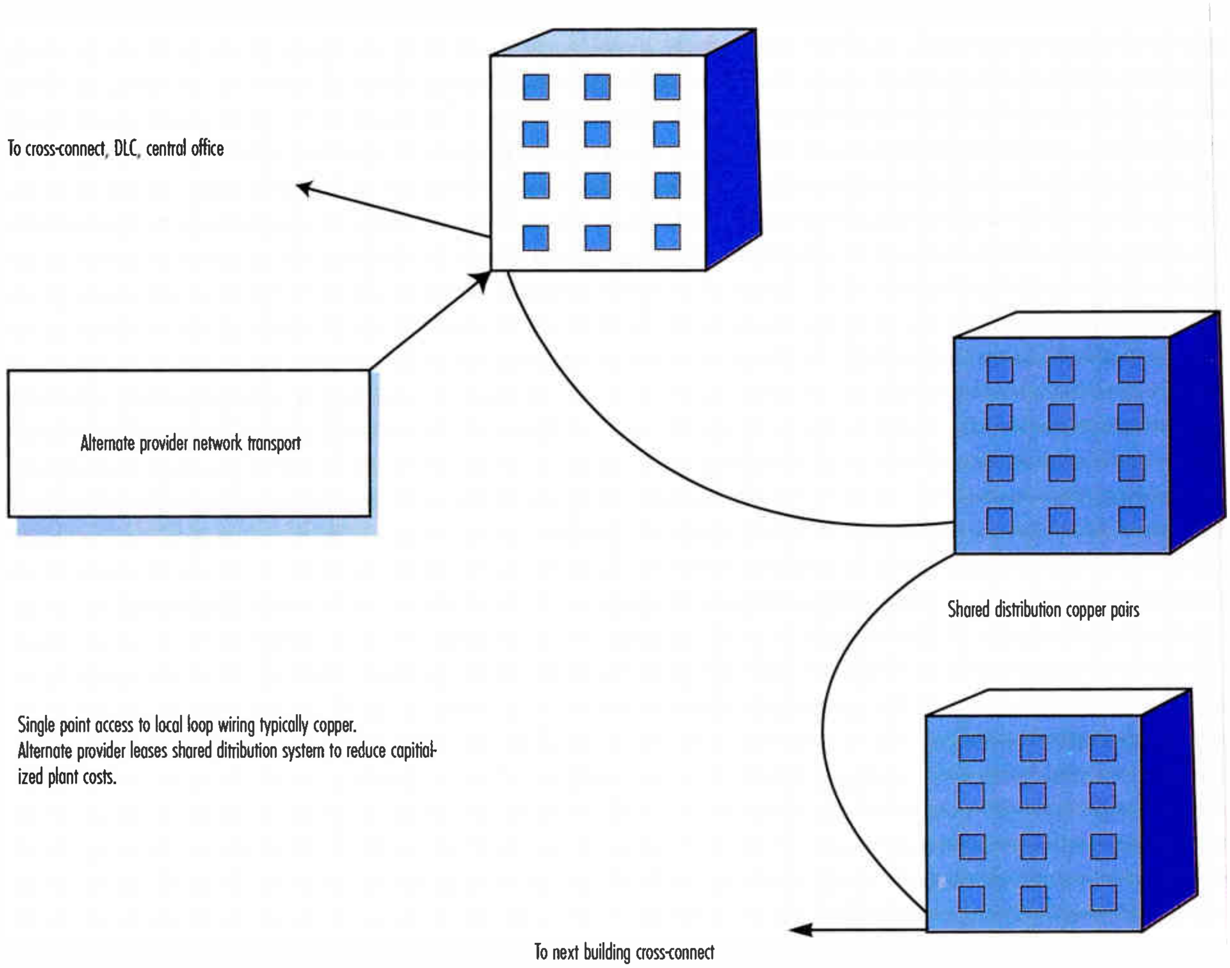
2) They're interested in establishing new revenue streams.

Delivering POTS within apartment complexes is, however, a complicated business. There are regulatory concerns regarding network access and availability, most of which vary state-to-state. There's the often thorny issue of hammering out the contractual arrangement with the apartment complex, property owner or developer. Finally, there's the actual network topology, manpower requirements, liability and security issues that arise in offering lifeline telephony services to the public.

Why compete?

A common carrier's main advantage is its ability to charge users of its

Figure 1: Minimum point of entry



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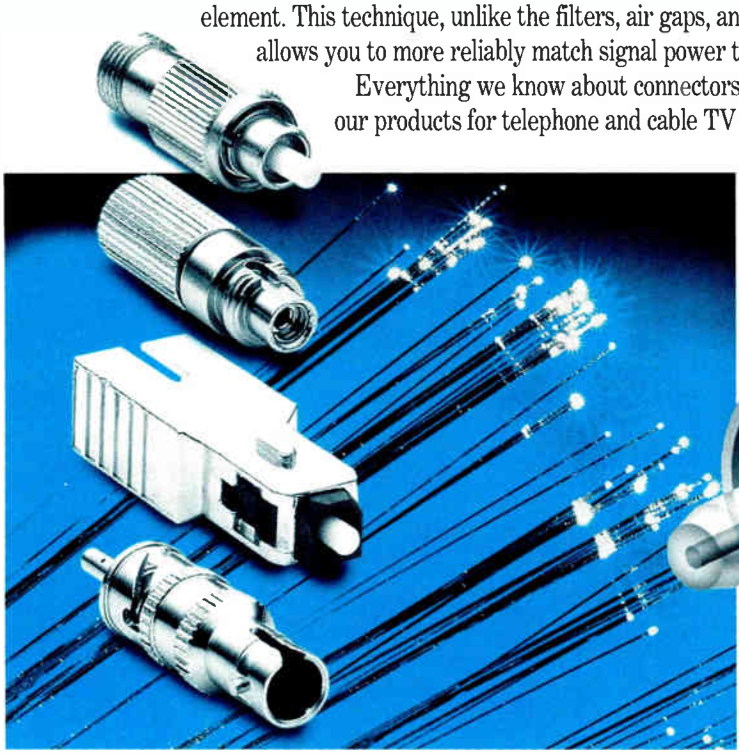

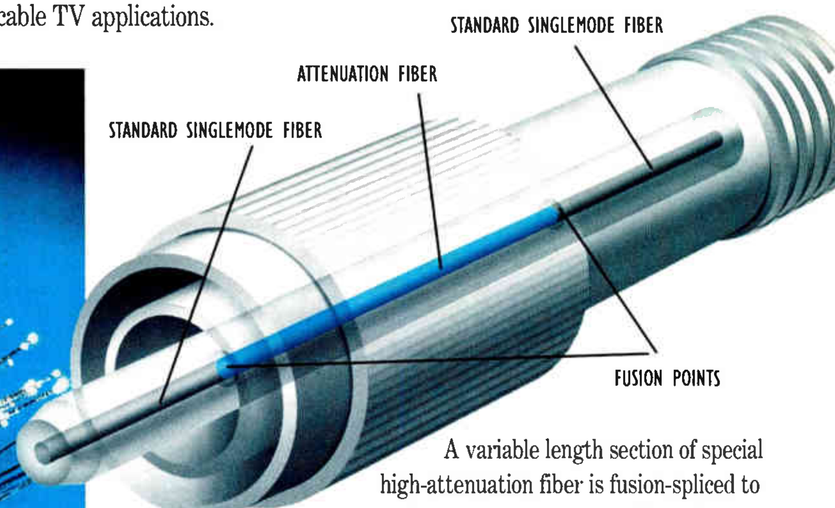

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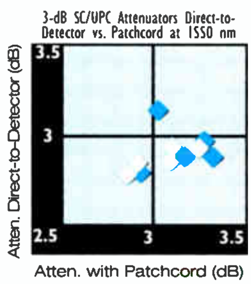
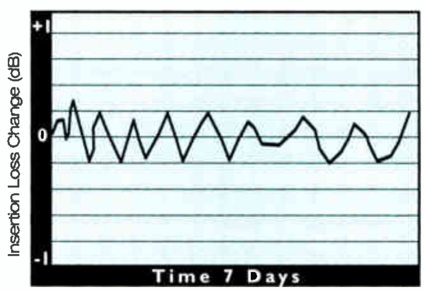


Consistent attenuation is achieved either with patch cables or when connected directly to the detector. The attenuator element does not strongly guide cladding modes that would produce different loss values when connected with or without a patch cable.

The absence of epoxies and index matching materials in the optical path results in more stable and rugged devices. Change in loss over the specified temperature range is shown.



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Reader Service Number 41

network on a foot-by-network-foot basis. Many local telephony companies are encouraging competition in the local loop because local competition may open the doors for them to compete in the long-distance market, which they see as a highly lucrative business opportunity.

The regulatory concerns do, however, need to be understood prior to exploring STS POTS. The local public utilities commission (PUC) governs the tariffs associated with access charges on the common carrier's network and establishes the rules for network access. One state may set high access tariffs but mandate maximum network access; others may curtail access charges but allow an operator to more effectively control network access by others.

Network access

Assuming that the PUC's tariffs and access requirements prove attractive, operators should select a flexible architecture that provides the lowest cost per passing.

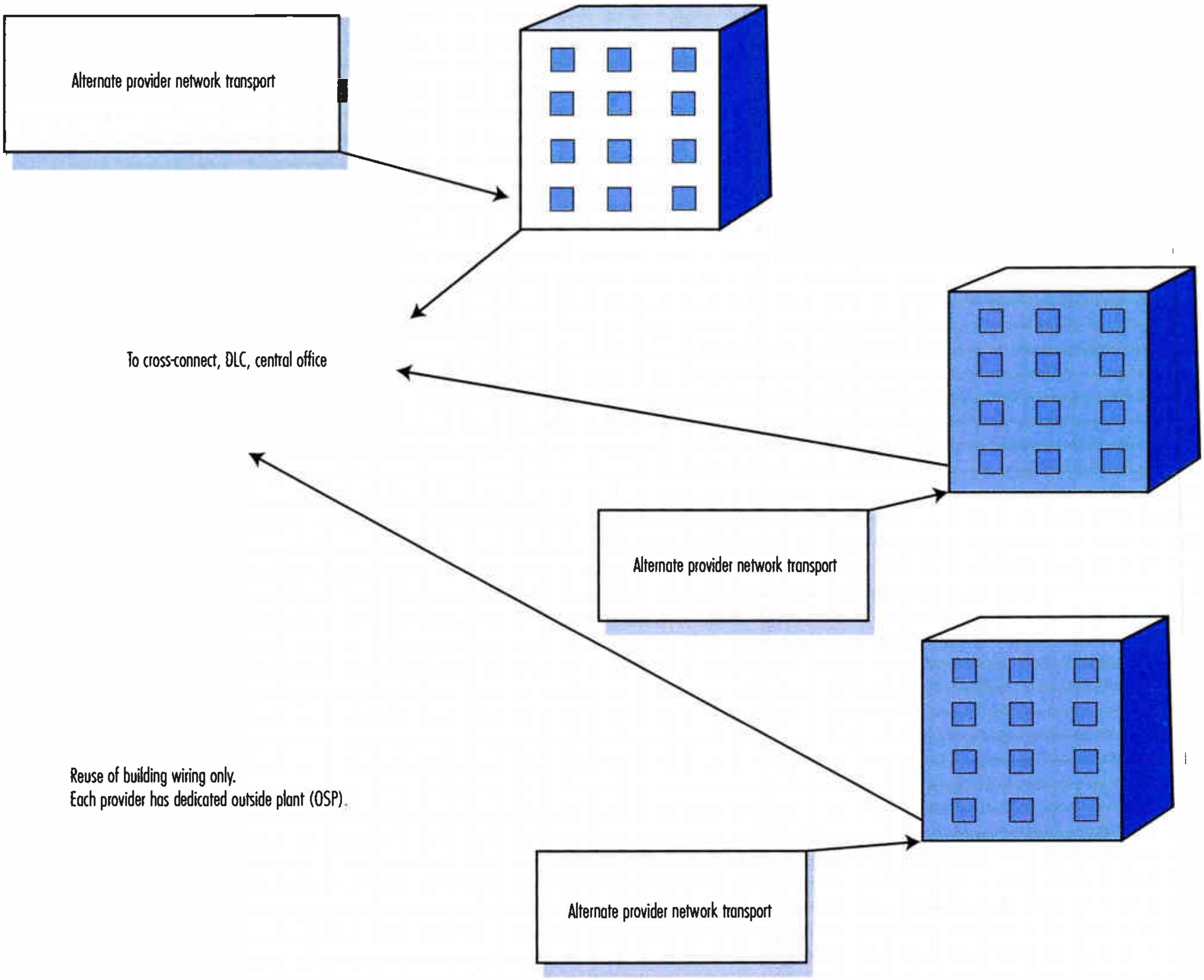
In the first potential network topology, as shown in Figure 1 on page 56, an operator would establish a minimum point of entry in which competitors are allowed access only at a single point within the complex. Any user of the network would then pay access charges to reach each building and each individual resident, and the operator would be responsible for any maintenance performed on the network. In this scenario, an operator may choose a digital loop carrier (DLC) or similar type of multiplexing scheme and locate it at the minimum point of entry site to offer traditional telephony services within the complex. In this case, the network's secure; others can't accidentally damage your wiring.

In the second scenario, an operator would offer a maximum point of entry, as shown in Figure 2. Here, the operator would wire each building location, distribute signal processing at several locations and provide access at these multiple points. Obviously this scenario proves less attractive because it translates into lower access fees. However, this type of topology and access may be mandated by the state PUC; it also may be the only route other telephony providers may take from a competitive angle.

Cutting the deal

Negotiating the deal with the property owner/developer may be one of the stickiest issues. In some cases, a network provider may provide a kickback to the developer on revenues generated; in other cases, developers may ask for services at more attractive rates than the operator's

Figure 2: Maximum point of entry



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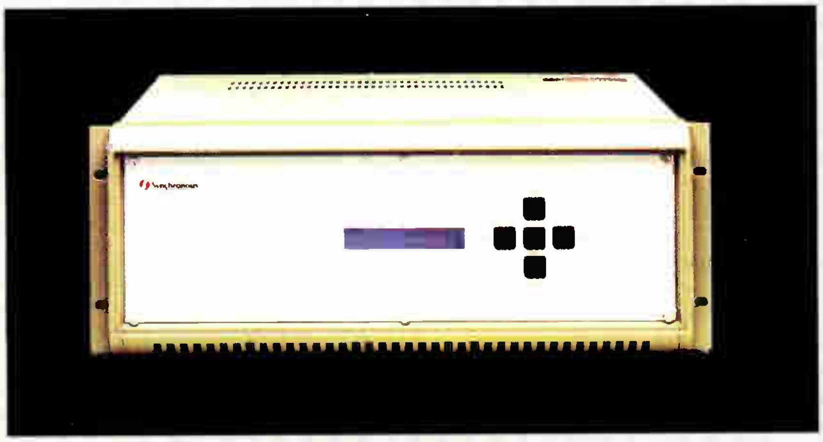

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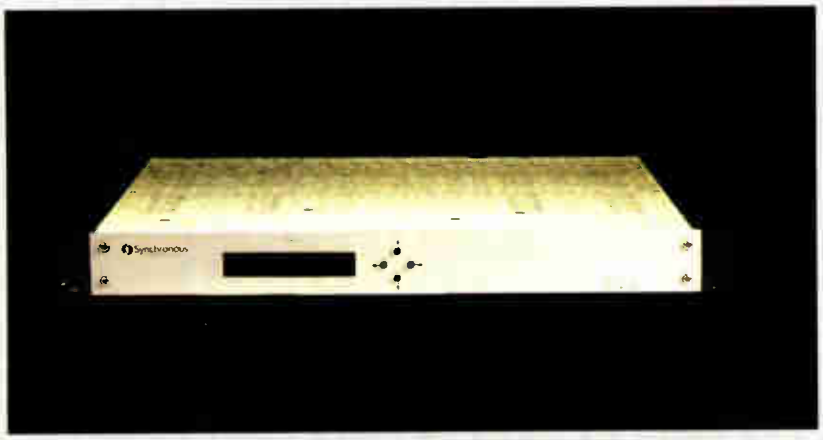

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competitors. Deals will vary, but one clear issue stands out: Any cable operator approaching the developer of a new apartment complex should negotiate very early in the construction planning to participate in the joint trench.

Joint trenching allows the operator to install both the cable TV and telephony network in a single pass, which in many cases can trim the cost of construction by 20% to 40% over building dedicated plant. Negotiating this early would set the stage for the cable operator to own the telephony network and simply provide access to other service providers.

The goal is to ensure that the cable operator is the only provider—other than the power company—within the joint trench. Achieving this will, however, rely on correct wording in the contract. Also, understand the long-term implications to ownership of the wiring itself. Few operators will welcome spending thousands on installing twisted-pair wiring only to have the network revert to the developer's ownership at some future time.

Outsourcing

Billing for access is another critical point. Most of today's cable TV billing systems will be unable to cope with the highly complex transactional business of access charges, systems which typically grow very large, very quickly.

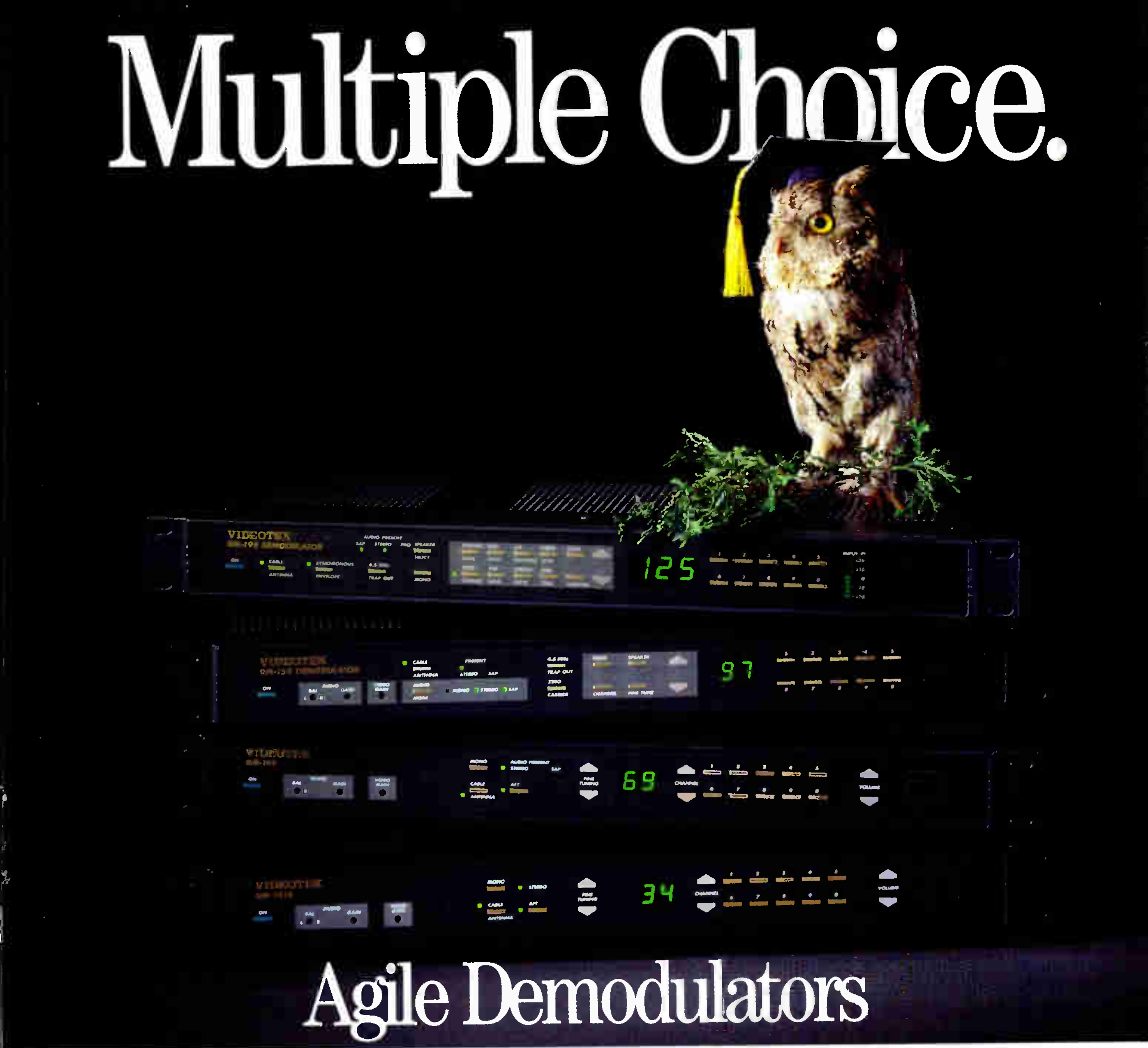
Telephony switches record the necessary billing information. If your initial plan calls for use of the local telephone company, alternative access provider or long-distance company switch, it may make sense to give them the billing business too, although outsourcing both switching and billing will cut into profits.

As the business grows and the operator begins looking into the purchase of a switch, it will be equally important to look at how the billing system will work, as well as the new facilities and manpower requirements the switch and its maintenance will necessitate.

POTS is a very different business from cable TV, and the last big issue facing cable operators' entry into the market will be the need for trained, responsive staff. Most of today's existing cable TV technical staff won't have the skills required to run the telephony network, so special training may become an issue. Recruiting new talent may be equally time-consuming and potentially costly.

Plan properly

The importance of understanding all aspects involved and properly planning your course of action cannot be stressed enough. Operators contemplating this market must understand all of the implications, including the color of the wallplates (which may increase your installation costs), and which entities are responsible for what transport gear. (Remember, you're dealing with a lifeline service that will set a new standard on network availability). The STS POTS market will generate new revenues, but hidden costs in manpower, security and grade of service must be taken into account when entering a new market with a new network. **CT**



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Reader Service Number 110

By Robert Mason

The great debate revisited: HFC vs. SDV

It is difficult to imagine how the switched digital video (SDV) vs. hybrid fiber/coax (HFC) debate could have been more acute than at the outset of last year. Vendors were making glowing claims about the merits of their respective technologies, while an emerging group of nontraditional providers were lauding the advantages of nontraditional approaches to broadband service delivery.

To suggest that this issue is not as contentious as it was last year would be unfair. At the same time, it is reasonable to suggest that the overall character of the debate has changed. Rather than relying on simplistic economic comparisons of cost-per-home-passed, the broadband cognoscenti have become more aware of the softer, noneconomic issues that make for a more telling comparison of the two technologies. Reaching a new level in the debate between HFC and SDV means revisiting some of the product characteristics associated with last year's debate and recasting some of the underlying distinctions between these decidedly disparate approaches to a service delivery.

"System reliability is still heavily debated, with few opportunities to qualify real-world field results."

Robert Mason is director of North American marketing at General Instrument / TNS.

Service creation

One of the more interesting issues when comparing HFC with SDV is in the area of service creation. Creating a single service set for a single user under either model is not an unduly complicated process. The real challenge involving service creation is how to provision a variety of different services that start off with thin and uneven penetrations and scale in a discontinuous fashion to substantially higher take rates.

A good example of this phenomenon can be found in the area of HFC telephony. Here, most major analysts are projecting wireline offerings from the multiple system operator (MSO) community to capture 15% to 20% of the served market by the middle of the next decade. Despite these numbers, the MSO will not be able to isolate this penetration to specific subsets of nodes, except by design. This suggests that the HFC provider will need to provide power, optical and RF infrastructure for narrowband services on a broad basis, and enable telephony through a combination of switching intelligence and side-of-home devices at opposite ends of the network.

Creating these narrowcast services for the HFC provider and scaling them appropriately will mean managing a complex array of return path media, splitting and combining signals in an increasingly complex fash-

ion, and providing straightforward approaches to associating the physical media with the service of interest through spectrum management. Additional network intelligence and new products like active combining networks may reduce this burden, but cannot eliminate the fundamental bus nature of the outside plant.

In the SDV/fiber-to-the-curb (FTTC) arena, the service creation process is somewhat more digestible. Network intelligence resident at a mininode level with star fiber facilities enables services to be turned up for individual residents with little regard for composite impact on the physical plant. The FTTC model emphasizes more processing intelligence in the node-like device for routing and service derivation and makes the whole idea of service creation a more software-rich activity. Going forward, the distinction in service creation capabilities between the architectures will blur as more sophisticated element management capabilities come on line. For the near term, however, service creation appears somewhat more favorable under the SDV model.

Reliability

A second area that receives a great deal of attention is reliability, in the sense that new models of access systems will need to meet the "gold-plated" service standards already in place from the embedded telcos. While this is a valid concern, it understates an important concern. Many major cable operators feel that it is precisely these gold-plated networks that make the regional Bell operating companies (RBOCs) vulnerable. These operators feel strongly that many of these network standards can be compromised without undue effects on availability.

Reasonable techniques exist for constructing very reliable HFC systems that still provide satisfactory cost/performance trade-offs. In the area of fiber nodes, offerings include the capability of A/B redundancy for fiber transport, as well as support for backup power supplies. RF-based equipment can be monitored very effectively with proven techniques, and other approaches are being developed to isolate renegade home users that are affecting the bus performance from the premise. Exposure to fiber cuts also has been considered a limitation of broadcast networks because

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large fiber bundles emanating from centralized headends can be especially vulnerable. Recent HFC designs have mitigated this effect as well, with discrete sets of fibers routed to optical transition nodes. This permits a reduction in overall fiber media and offers a coincident reduction in service impairment due to fiber cuts.

From the perspective of failure group size, FTTC still offers significant advantages because its double star architecture feeds very modest "node" sizes potentially as small as 12 homes. The dedicated baseband fiber runs associated with this model also make for straightforward, segmented testing of digital circuits, a process that is more elegant in an HFC system. System reliability is still heavily debated, with few opportunities to qualify real-world field results.

As a telephony-centric platform, FTTC will need to continue to supply very high reliability numbers or risk exclusion from the carrier community. While HFC may have some different reliability challenges, more sophisticated HFC architectures with redundancy of media and components are rapidly closing the reliability gap.

The Internet

Another important shift in the HFC/SDV debate has been the dramatic shift in interest in the Internet. A year and a half ago, the Web was a curious phenomenon, but not nearly as interesting as the promise of video-on-demand. While trial experience still speaks to the longer term potential of video-on-demand, the current mind-share of the Web has become overwhelming. Building networks to satisfy browsing mania will require new approaches to scalability that leverage the existing infrastructure.

In the FTTC model, the high utilization of Internet services is very favorable because the secondary effects can be very beneficial. One of these well-known effects is the sluggishness of the Internet itself, which at times contributes more to Web browsing delays than does the bandwidth limitations of the access system. This has spawned ventures like @home, which essentially aim to construct shadow Internets, providing the same rich content without the Internet working choke points. Relying on technologies like synchronous optical network and asynchronous transfer mode (ATM), these shadow Internets could be a "Trojan horse" for ATM in the access system. If so, then a native ATM access system like FTTC has some distinct advantages because it will not require any type of interworking to plug into this new Web hybrid. SDV networks also promise more bandwidth on a per-home-served basis, positioning them for content types that are still being conceived.

HFC networks, of course, have not ignored the need for serious data capabilities. The fundamental asymmetry of HFC and the current spate of Internet offerings is aligned very nicely. Cable modems are headed into production and HFC will allow operators to test the waters of high-speed data without committing aggressively to tenuous economic models of premise data utilization. HFC also offers the promise of low-tech approaches to Web browsing by using analog delivery to a TV set rather than digital delivery to a PC. HFC is well-suited to an incremental deployment of Internet access and has the ability to scale by downsizing the nodes or changing modulation schemes and serves both the TV and PC models with enmity. Both platforms are capable of being modified if the delivery of residential data becomes overwhelming and both can satisfy a variety of physical media and bandwidth options. The need for a high bit rate upstream is still questionable, although that chapter is far from written. Video telephony can present some real challenges to HFC, but the demand for the service remains unproven.

The debate between the two platforms is far from over. FTTC will remain a strong player in the long-distance era for the RBOCs. Wireless deployment as a transitional branding strategy in advance of full service platforms is sensible. HFC will remain a solid approach to satisfying a variety of service requirements on a global basis and has an embedded base that is enviable. Cable modems are shipping now and the use of telco return can allow MSOs a differential first-mover advantage. The large number of new HFC variants that have arrived since last year indicates that the winning platform may be a hybrid network that is yet to be deployed. Recalling the reason we all got into this debate in the first place, the real winner is likely to be the consumer. **CT**

By Tim Wilk

Reverse traffic considerations on HFC node size migration

One of the key trends characterizing hybrid fiber/coax (HFC) design has been a continual reduction in the number of homes served by the optical node. Driven by cost and performance, node sizes have fallen over the past six years from 10,000 homes to present new-build averages of 500 homes passed. As a myriad of new interactive services begin to be deployed over this broadband network, questions arise concerning reverse path capacity. What amount of interactive service penetration will the 5 to 40 MHz reverse spectrum support? And just as important, what steps should an operator take to assure that a migration strategy has been planned to increase return capacity over the life of the network?

An optimal reverse path migration strategy is influenced by three factors. First of all, an operator must have a vision of the service to be offered and anticipate subscribers' usage and traffic patterns. Second, a preliminary product analysis should be completed to identify the capacity of potential network elements. Although global standards work is progressing in several areas, bandwidth efficiencies and modularity vary by vendor, particularly in cable telephony products. And finally, current upgrades and rebuilds must incorporate the hooks to support future migration.

The purpose of this article is to analyze the factors that influence reverse path capacity and to identify appropriate migration strategies best suited to increase capacity. The methodology will:

- Establish a reverse path frequency allocation model based upon an analysis of new interactive services penetration rates, traffic and bandwidth efficiency; (the spectrum allocation models are based on site engineering rules, which are dependent on specific site and service requirements);
- Determine the node size capacity of existing 5 to 40 MHz returns under various service take rates; and
- Compare the capital costs of alternate reverse path migration strategies.

"What steps should an operator take to assure that a migration strategy has been planned to increase return capacity over the life of the network?"

Tim Wilk is director of strategic planning of Scientific-Atlanta Inc.'s Transmission Systems Division.

Interactive service

Despite general perception that HFC reverse transmission is a new and emerging technology, cable operators

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have been using reverse spectrum since the 1970s. RF impulse pay-per-view (IPPV) and status monitoring and control (SM&C) systems comprise the majority of today's reverse path signaling. These polled signals require nominal bandwidth (less than 1 MHz) and can be operated over an activated return path with little regard to node size and number of cascades.

New interactive voice and data services differ from traditional reverse signals in that they occupy a larger spectrum window for a longer duration. A uniform spectrum map does not exist for these services, and the spectrum windows of various vendor products vary in modularity and size. Therefore, the first step in defining a reverse path migration is to establish a reverse frequency allocation plan for the 5 to 40 MHz spectrum. (This is an objective for site engineering analysis. This analysis will use product and network engineering parameters to define the spectrum allocation for the service mix as predicted by market analysis for this node.)

Figure 1: PC data peak usage model

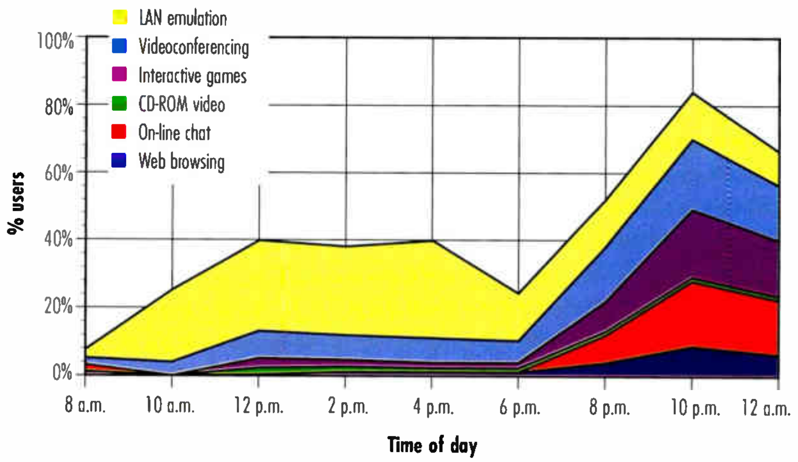
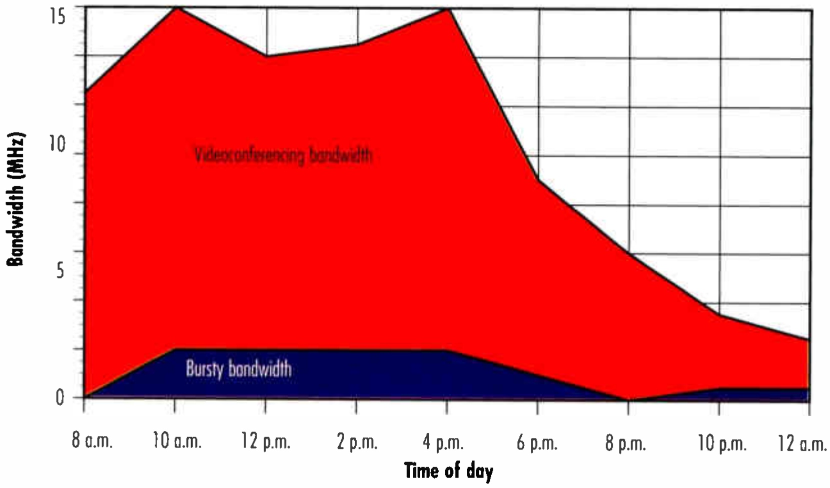


Figure 2: PC data peak bandwidth model



Cable telephony

Given its symmetrical bandwidth requirement, cable telephony will require the greatest reverse bandwidth in the HFC plant. Many HFC operators are targeting an aggressive 20% to 30% market penetration of existing telephone subscribers, assuming second-line service for domestic MSO applications. Penetration rates will be much higher for international and domestic applications where HFC will be the primary telephony delivery means.

From a network design perspective, however, a higher penetration capacity should be planned for individual nodes. Cable telephony field trials have shown that telephone service tends to be sold in small geographic cluster by neighbor with word of mouth. As a result, one node may experience a 50% take rate compared to another node with minimal subscribers. Operator strategies, such as targeting apartment complexes, also will lead to penetration variances in specific nodes.

Cable telephony product performance varies widely among vendors. The two key areas that impact reverse capacity are bandwidth efficiency and modularity. By selecting different modulation techniques and protocols, the number of simultaneous lines that can be supported in 1 MHz of reverse spectrum ranges from 12 to 60 lines. This translates to a range of reverse bandwidth of 5 to 22 MHz.

The products' bandwidth modularity determines spectrum placement. At both the high and low ends of the reverse spectrum, group delay from amplifier cascades increases. For example, a 2 MHz carrier operating from 38 to 40 MHz will experience an approximate 200 nanosecond delay over a three-amplifier cascade. The delay increases as cascades grow. As a result, many cable telephony products that require 2 or 3 MHz carriers may not be able to use the high end of the reverse spectrum.

PC data reverse characteristics

Application	Packet size	Traffic shape	Query time	Average rate
Web browsing	800 bytes	Bursty	15.00 seconds	0.427 kb/s
Web chat	300 bytes	Bursty	5.00 seconds	0.480 kb/s
Games	250 bytes	Bursty	0.25 second	8.000 kb/s
LAN emulation	750,000 bytes	Bursty	300.00 seconds	20.000 kb/s
Videoconferencing	48,000 bytes	Constant	1.00 second	384.000 kb/s

PC data and cable modems

Although a number of operators are trialing various types of HFC cable modems,

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high-volume deployment will be contingent upon asynchronous transfer mode-based (ATM) modems entering the market in late 1996. Their reverse channels will use some form of quadrature phase shift keying (QPSK) modulation, with proposed data rates of 256 kb/s, 1.544 Mb/s and 2.048 Mb/s mentioned in the various standards groups. The service will be provisionable in 1 or 2 MHz channels that can be scattered over the reverse spectrum. Various manufacturers' cable modems typically will provide a range of 8 to 10 MHz in which the service may be allocated.

The basic applications that may shape the PC reverse data usage are:

- Internet access/Web browsing;
- On-line chat;
- Interactive games;
- Work-at-home/local area network (LAN) emulation; and
- Desktop videoconferencing.

The accompanying table summarizes the reverse characteristics of the target PC data services.

Reverse bandwidth allocation is based upon peak demand. Figure 1 on page 72 illustrates how the service mix may vary over the course of the day. During business hours, work-at-home will drive LAN emulation and desktop videoconferencing. The desktop videoconferencing is projected to be associated with 20% of the work-at-home users. The evening reflects a gradual transition to Internet browsing and chat activities. At peak daytime and evening hours in the model, up to 60% of the PC data subscribers contend for the service.

The impact of the burst vs. constant data mix becomes apparent when the usage profiles are translated to bandwidth requirements. As illustrated in Figure 2 on page 72, the peak bandwidth requirements occur during work-at-home sessions in the morning and early afternoon. With a 50% service penetration over a 500-homes-passed node, interactive services will require a nominal 3 MHz of reverse bandwidth. However, if videoconferencing service is added, constant bit rate requirements increase required bandwidth by nearly 500% to 15 MHz.

PCS over HFC

Portions of the 5 to 40 MHz are assumed unusable or degraded due to ingress from CB, ham or shortwave radio. This is particularly apparent from 26 to 28 MHz and in the lower frequencies (5 to 12 MHz) which, coupled with poor signal-to-noise characteristics, are unusable for most services.

One notable exception, however, is the distributed antenna array (DAA) technology used to transport wireless personal communications services (PCS). The DAA technology is a network of RF repeaters that acts as an extension to a base station antenna. The system operates by converting wireless 1.9 GHz PCS signals to frequencies compatible in the HFC network. The PCS CDMA protocol is immune particularly to the ingress and noise found in the lower HFC return spectrum, and therefore can be provisioned in this unused window. Typically, the PCS DAAs require 8.25 to 12 MHz of bandwidth.

Frequency spectrum allocation

Based on the service characteristic previously described, a frequency spectrum allocation model can be constructed. This model is constructed with engineering rules for an assumed product and network configuration with the described example service mix. In addition to the services discussed, several narrow carrier services, such as IPPV or SM&C, must be included.

The frequency model illustrated in Figure 3 on page 76 reflects both upstream and downstream allocations. In the downstream, 48 MHz has been planned for interactive voice and data digital services, allowing the operator to offer an expanded analog service to 700 MHz. Once the reverse spectrum has been proposed, calculation of the reverse capacity may begin.

Node size and traffic capacity

The services that consume the greatest bandwidth require a constant bit rate for each session: voice and videoconferencing. In modeling the nodal capacity, voice and videoconferencing are treated as variable. Voice penetration is varied from no voice to 120% of the subscribers (considering second-line take). Desktop videoconferencing is viewed as not offered or at 20% of the active PC data users.

Reverse capacity, stated in homes passed, is displayed in Figures 4 (on page 76) and 5 (on page 77). Without videoconferencing and telephony, a single reverse path will sustain full interactive PC data service over a node size in excess of 1,500 homes. As telephony penetration increases, the single reverse path loses capacity. Based on a 50% telephony penetration, using Scientific-Atlanta's CoAxiom cable telephony, sufficient bandwidth is available in a single reverse spectrum to support over 500 homes passed.

Also noted in the graph is the impact on the forward laser capacity. With a robust analog offering up to 700 MHz, the forward path supports digital interactive services at roughly twice the capacity of the reverse. This indicates that an operator may split the transmit laser over two 500-homes-passed nodes.

Videoconferencing has a significant impact on the reverse capacity. A high take on videoconferencing may generate traffic requirements in excess of a single cable modem spectrum window. Subsequently, the maximum planned capacity for a single return path supporting video conference and 50% voice is 265 homes, as illustrated in Figure 6 on page 78. For serving areas with full telephony, videoconferencing will reduce the single reverse segment capacity to approximately 165 homes.

Several conclusions may be drawn from this traffic analysis. First of all, the 500-homes-passed nodal architecture is well-suited for the targeted service penetration for voice and interactive data in the near term. Secondly, new services are on the horizon, i.e., desktop videoconferencing, which will reduce the 5 to 40 MHz return capacity by up to 50%. And finally, as a result of initial telephony service penetration, a local exchange carrier's (LEC) nodal design and migration plans will differ from a traditional HFC operator.

Reverse path segmentation

The concept behind reverse path segmentation is to reduce the bandwidth requirements on the 5 to 40 MHz return by limiting the number of potential users on a single segment. To do this, multiple segments are required. Three methods of nodal segmentation are proposed: block conversion, dedicated fiber returns and wave division multiplexing (WDM).

Block Conversion: In this technique, the coaxial 5 to 40 MHz return legs at each node port are upconverted, or

Figure 3: HFC frequency allocation for a full service network

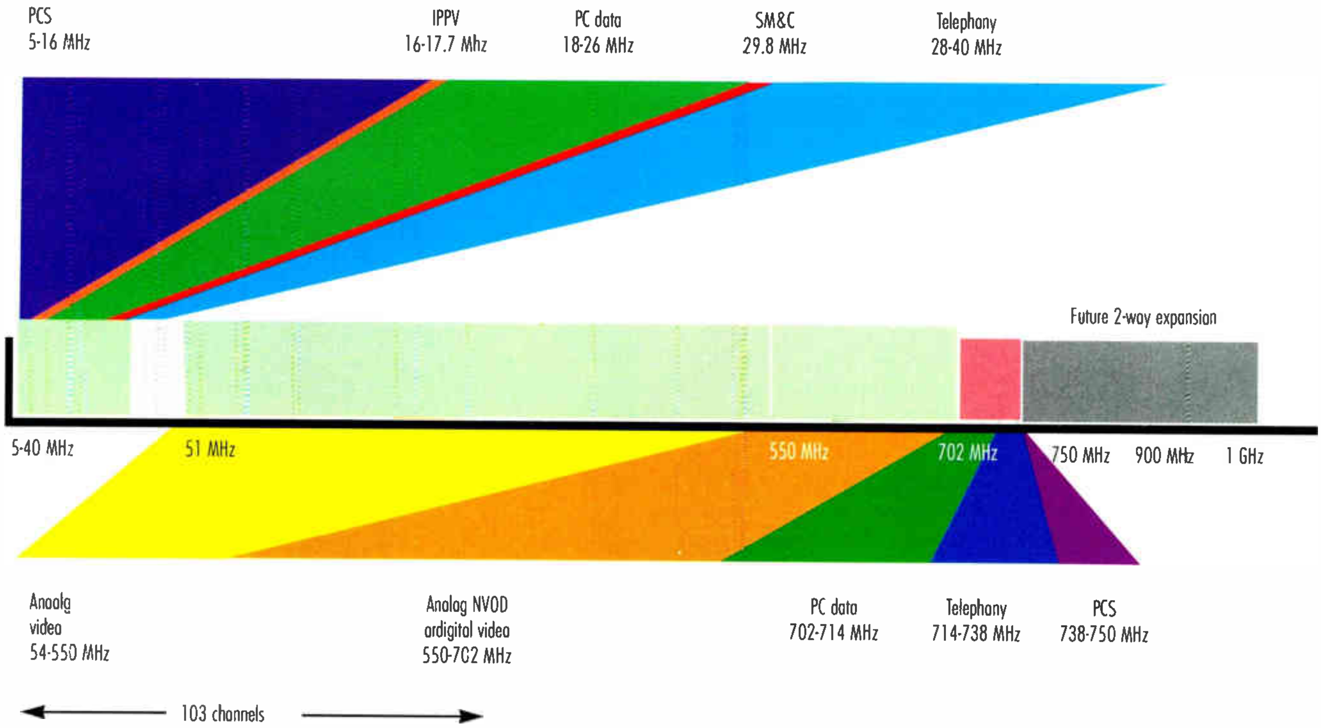
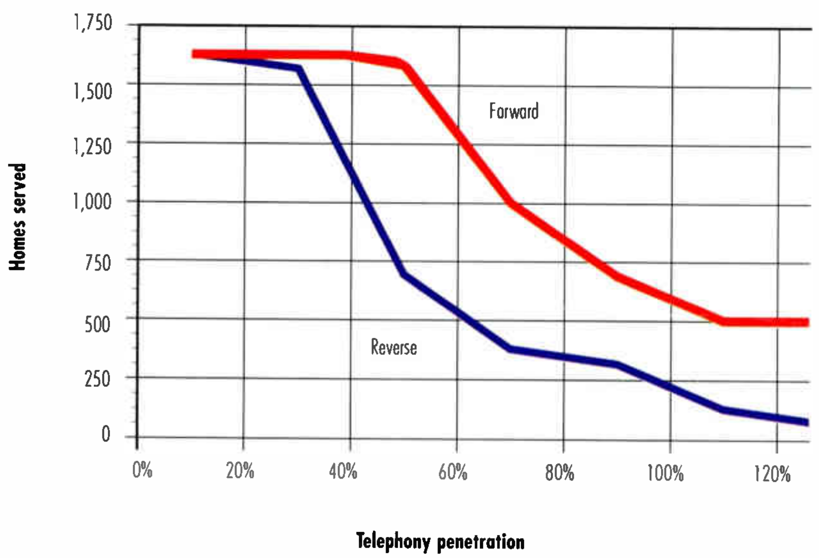


Figure 4: HFC capacity with telephony and PC data without videoconferencing



stacked, in frequency blocks for transmission to the office over a single return laser. Although this technique makes efficient use of existing fiber, additional design costs are incurred when the nodes are initially established. Because the segmentation is implemented at the nodal location, each port of the node must serve an approximate equal number of homes. This balancing results in higher amplifier active counts on the coax plant. Additionally, increased distortion products result from the multiple return path carriers, thus requiring a higher cost distributed feedback (DFB) laser instead of the typical low-cost Fabry-Perot. (Some applications require upstream and downstream clock phase synchronization. Block conversion must be performed with a network supplied to maintain this phase relationship.)

Dedicated Fiber Returns: Some RF amplifiers have the ability to be upgraded to an optical node by simply replacing the lid of their housing. This flexibility provides an opportunity to equip individual amplifiers with a *reverse-only* fiber upgrade. With the nodal segmentation occurring at the amplifier, operators may focus the upgrades directly to the high-traffic segment without incurring the penalties associated with balancing the output legs. The key to this strategy is the planned availability of expansion fibers during the initial upgrade. In underground locations, the operator may choose to co-locate fiber tails along the express coax in the trench.

WDM: The WDM migration is similar to the dedicated fiber return, but rather than dedicating fiber from the office to the reverse-only fiber node, a WDM technique is

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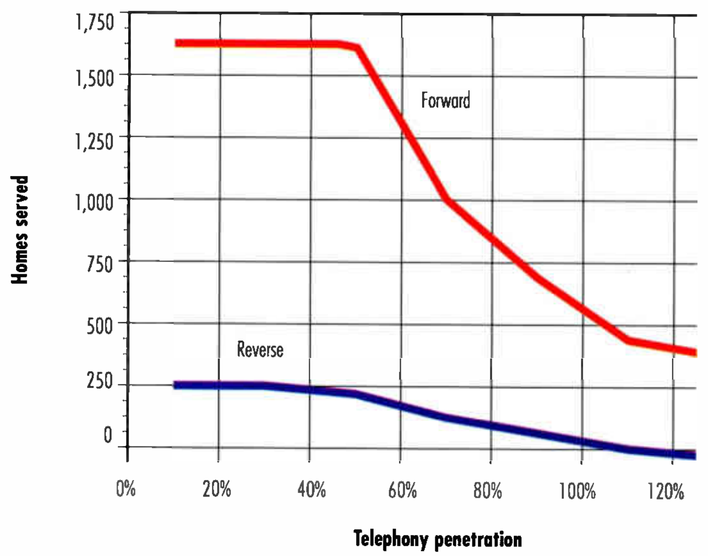
used to optically couple the fiber legs to a single fiber at the original node site. Similar to block conversion, the aggregate noise floor will increase with multiple lasers, dictating an upgrade to DFB return lasers.

The cost analysis for the three reverse segmentation strategies is summarized in Figure 6. Traditional nonredundant designs as well as the redundant architectures favored by the LECs were evaluated. The economic model considers the preparatory costs in the initial node installation to allow future segmentation and the subsequent partitioning costs for the second, third and fourth segments.

The up-front preparatory costs favor a dedicated fiber migration in both cases. Costs for additional fibers enabling this strategy were significantly less than the high up-front costs associated with WDM (DFB laser premium) and block conversion (DFB laser premium and higher active counts). As the return paths begin to segment in the nonredundant model, the dedicated fiber approach was clearly favorable for up to three return segments and approximately the same cost as block conversion for four reverse segments. The WDM migration was lower cost than block conversion at two nonredundant segments, thus offering a viable solution to those traditional HFC operators not planning sufficient fiber.

For redundant applications that require up to two reverse segments, the dedicated fiber migration again offers the low-cost solution. However, as the number of returns reaches three and four, the costs associated with dual fiber transmitters, receivers and fiber to each location allow block conversion to offer favorable upgrade economics. It should be noted, however, that although they are used in the redundant design, block converter modules have not been designed for redundant backup compatibility.

Figure 5: HFC capacity with telephony and PC data with desktop videoconferencing

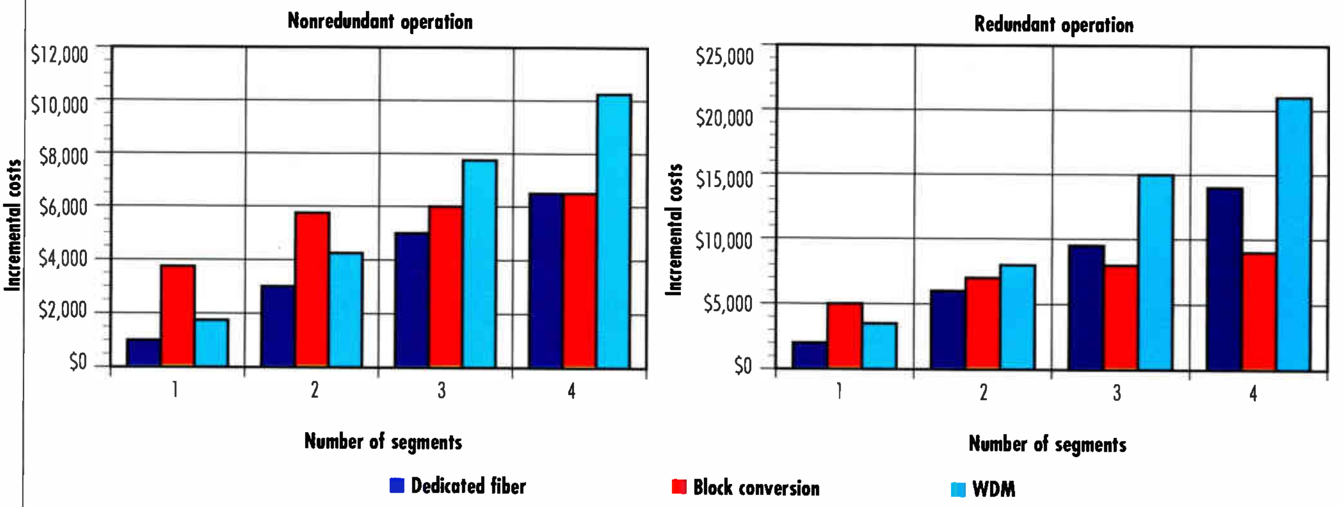


Summary

Not surprisingly, reverse traffic expectations for new interactive services will continue to drive fiber deeper into traditional HFC designs. A single 5 to 40 MHz return in current 500-homes-passed architectures can provide sufficient bandwidth to support cable telephony, interactive PC data and wireless PCS for up to 50% of the homes passed.

Within a few years, however, new services such as desktop videoconferencing may emerge and begin to saturate this nodal return capacity. By planning a dedicated *return-only* fiber at one or two of the amplifier locations, the operator using HFC will not only implement the most cost-effective upgrade solution, but also take another step in positioning the plant for an all-passive network. **CT**

Figure 6: Cost comparison of reverse segmentation alternatives



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Reader Service Number 12

By Peter Roach

PCS dictionary: Terms at a glance

When anyone discusses the future of the cable TV industry, one subject that often enters the conversation is personal communications services (PCS). A major problem in discussing PCS, however, is that definitions change depending on who you are talking with. One person may say PCS is a microcellular network that offers a pedestrian-only service while another person might believe that it is a cellular look-alike with cable TV networks providing the transport. Another person would even say that PCS is already here in the form of cellular.

Conversations about PCS (especially those that are technical in nature), can quickly become awash in alphabet soup. The mini-dictionary that follows should help.

• **ANI (automatic number identification):** A feature of the telephone network that identifies the billing telephone number of the calling party. It was originally used for automatic billing purposes, but now is available for numerous other applications.

• **APC (adaptive power control):** A technique to extend battery life and reduce radio interference by controlling the radiated power level of mobile radios so that the power received at the base station is sufficient to maintain the desired quality level.

• **CDMA (code division multiple access):** Usually a direct sequence spread spectrum technique using unique codes to spread the carrier signal.

• **Cellular:** A general methodology and system concept for mobile/portable radio system planning.

In this context, "cellular" is understood to describe a system in which:

1) There is more than one base station;

2) Frequencies are reused, thus making co-channel interference a major system impairment to be dealt with;

3) Supervision and the communications path for a call must be transferred from base to base as a user moves; and

4) Growth is achievable by adding more base stations both at the edges of the system and between existing base stations.

• **FDMA (frequency division multiple access):** A technique for sharing a single transmission medium among multiple users by assigning each to a frequency channel.

• **Hand-off:** Also known as handover. A cellular term indicating the process of passing a radio communication from one base station to another.

• **Macrocell:** The typical cell size in current cellular systems, generally from one to several miles in diameter.

• **Microcell**: A smaller than typical cell size usually from 400 to 2,000 feet in radius. Microcells can be used to fill in dead spots, increase system capacity, or to place antennas where a standard cellular antenna would not be possible. Microcells will most likely be used to provide coverage and increase capacity in areas with high user density. Microcells usually transmit lower power than traditional cell sites.

• **Microcell:** A proposed cell size to be used for PCS. Cell sizes as small as a few hundred feet have been suggested.

• **Mobile cellular phone:** A vehicle-mounted radio-telephone that operates in conjunction with the cellular system. Such a phone typically draws its power from the vehicle battery and is typically capable of operating at the highest nominal power allowable (3 watts in the United States).

• **Mobile terminal:** A voice and/or data terminal that utilizes the radio spectrum for its mobility and that possesses a unique identification number used by the network as part of the call control process. This term would include mobile, transportable cellular, portable cellular, and personal phones, but not cordless phones as defined.

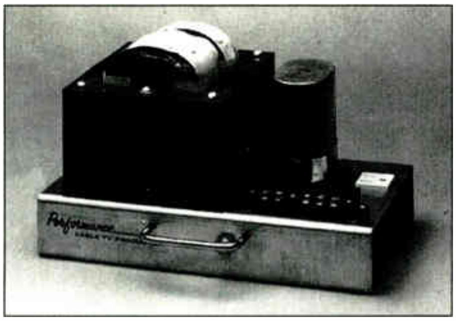
• **MTSO (mobile telephone switching office):** In the U.S. AMPS cellular system, the switch that is the central coordinating network element between all cell sites. The MTSO interfaces with the wired telephone network, controls call processing, and assembles call records for billing purposes. Also known as MSC (mobile switching center).

• **Smart card:** An intelligent device containing an integrated circuit that has the capacity to process information.

• **Spread spectrum:** A technique for transmitting a number of separate voice or data signals simultaneously over a broad frequency band by assigning separate and distinct codes. These codes will be used to encode and decode the radio channel. Different types of spread spectrum are frequency hopping or direct sequence.

• **TDMA (time division multiple access):** A technique for transmitting a number of separate voice or data signals simultaneously over one channel by assigning separate time slots within one digital data stream. **CT**

At the time of this writing, Peter Roach was at Bell South Enterprises in Atlanta.



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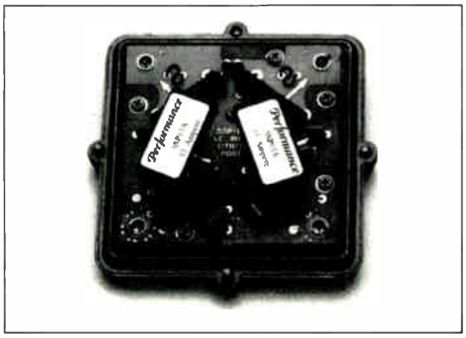

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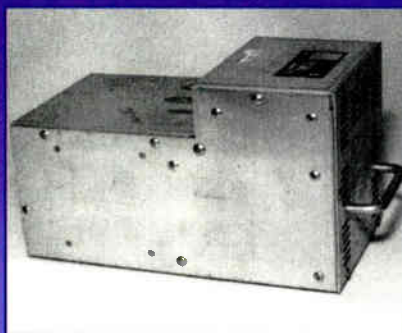

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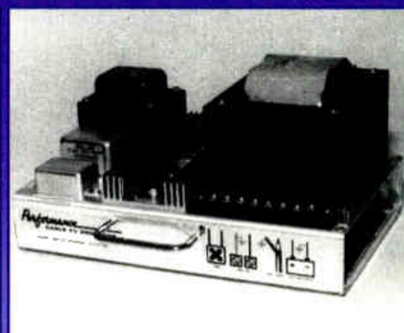

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Reader Service Number 124

By Edward Owen and Pam Nobles

Troubleshooting the trunk

Troubleshooting consists of many techniques with different names. When you boil them all down, these techniques have two things in common. First, you will locate where the problem exists. Second, you will identify the problem so it can be repaired. Repairing common problems requires similar tools but different approaches. To simplify the troubleshooting process, we will look at a cable system's "three Cs": components, cable and connectors. This article will concentrate on total signal loss problems. The steps are summarized in the accompanying figure on page 84.

Components

The technician will need to locate the last point at which the system is good to detect where the problem exists. In densely populated areas, customer calls act as a good fault indicator. The calls generally will locate the problem within one power boundary, or even within one amplifier. Information supplied by customer service representatives and dispatchers on affected customers is key to getting off to a good start. Once this information is acquired, examine your system maps.

Review the power boundaries, active devices and trunk splitter locations. Identify the power boundaries concerned. Look for the power supply in the first power boundary affected. The power supply is a logical stop since active devices require power to operate. This also will help you determine the size of the outage.

A quick glance at the meter on a power supply or the humming sounds generated will indicate whether or not the electric company is experiencing an outage. A slow-turning meter also is an indication that there is no amperage draw and the likelihood of a blown fuse is great.

If the power supply is running properly, review the location of customer calls. Then check for RF signal at the farthest upstream trunk amplifier within the power boundary from this point. Hopefully, the problem is located at this amplifier. If the RF signal is good, move to the next amplifier or power boundary downstream. If there is no RF signal, then check for AC voltage. If there is AC present and the power pack is converting it properly to DC, then inspect the amplifier module. Replace it if necessary.

If there is no AC present, examine the fused devices or the power inserter. Investigate the power inserter next since it is easy and quick. This is accomplished by simply measuring the input and output seizure screws with a volt-ohm meter (VOM). RF signal also can be checked on seizure screws. However, a probe or AC-blocking device may be necessary.

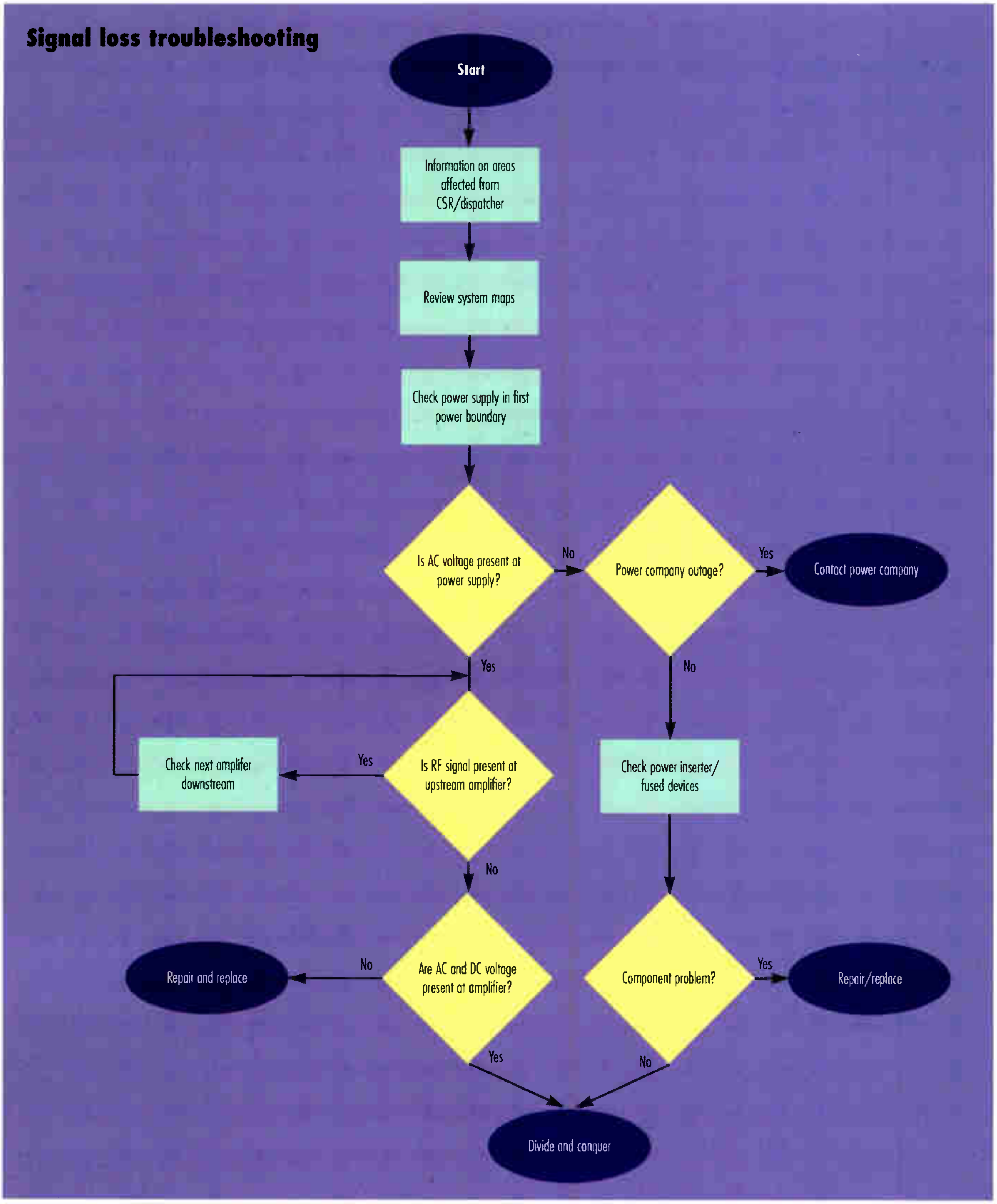
More difficult troubleshooting is necessary when the problem involves a long cascade of amplifiers that has no feeder since a starting point is not identified by phone calls. This is where "divide and conquer," also called "the ABC method" and "the half-step method," is helpful. It is necessary to determine the presence of good RF or AC signal. By cutting the cascade in half, a great deal of time and energy can be saved. If one location indicates a lack of RF on the input, cut the cascade in half again. Continue this process until an RF input is located. At each location check for the presence of AC as well as RF.

Cable

Troubleshooting the cable itself may be more time-consuming and require specialized equipment. For cuts and damaged cable, a leakage detector and time domain reflectometer (TDR) may be necessary. Before breaking out that expensive TDR, look for the obvious. Investigate fresh dig marks, new traffic or election signs in an underground system. Use your leakage detector to identify any signal egress that may indicate a fault. If a TDR is available, shoot the cable from the point of a blown fuse or the last known good output.

This can give the technician the exact distance to the fault. Accuracy is improved if the fault is close to the point of insertion. If the fault is a long distance away, the TDR will help narrow the fault to a span. A new trace can be shot from the closest device to

Edward Owen is maintenance technician and Pam Nobles is senior staff engineer, technical training, of Jones Intercable Inc.



pinpoint a fault. A span of cable containing a short also can be identified by measuring amperage draw with a VOM. Apply the divide and conquer method to again save time and energy. Once the span has been identified, the TDR and/or leak detector can locate the fault. Happy digging!

Connectors

Bad connectors can be identified by checking for good output and bad input, low-end problems. Ensure the seizure screw is tight. The technician may need to take the connector apart for a visual inspection.

Whether troubleshooting a tap or an entire hub, try to keep it simple. Break the system down into the three Cs, use a highly trained support system, and look for the obvious. **CT**

By Dan Harris

What is stimulated Brillouin scattering?

• Lately, I've been hearing about an effect called "stimulated Brillouin scattering" (SBS) that can degrade video transmission over optical fiber. What exactly is SBS, how does it affect picture quality, and how can I avoid it in my systems?

Stimulated Brillouin scattering is a nonlinear effect in optical fiber that results from launching too much power into the fiber.[1] As shown in Figure 1, the injected light creates sound waves that tend to reflect light backward along the fiber. At lower power levels, the sound waves are small and their effect is inconsequential. However, as the input power increases, the strength of the sound wave ultimately reaches a critical level at which the coherent interaction between the light and sound causes the amount of backscattered light to increase abruptly, resulting in a severe degradation to signal transmission quality. The input optical power at which this occurs is called the SBS threshold. To ensure good picture quality, systems must be designed so that the required input power to the fiber is below this threshold.

Figure 1: Stimulated Brillouin scattering in an optical fiber

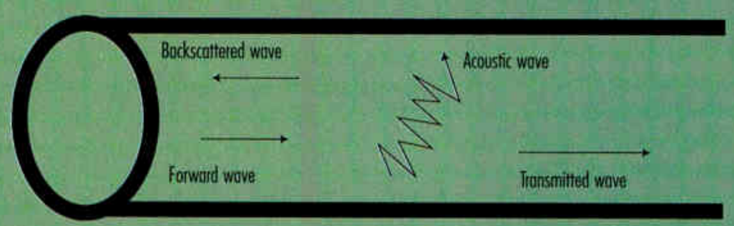
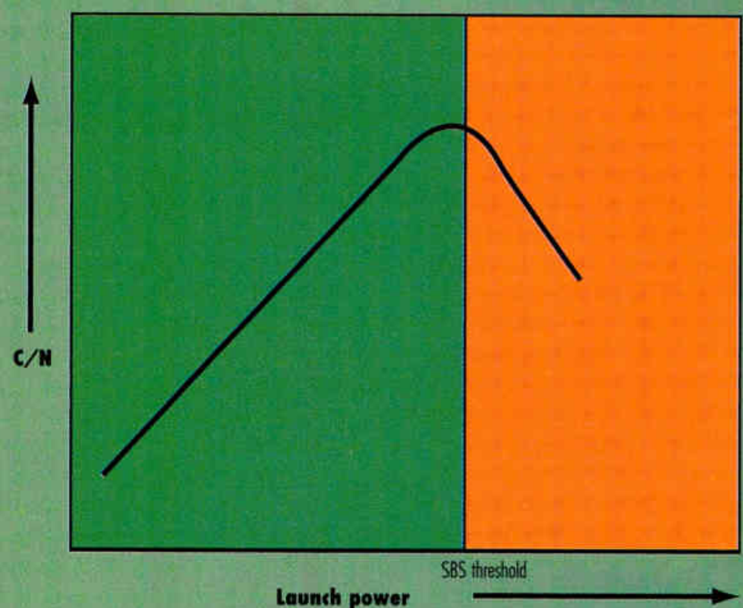


Figure 2: Video signal carrier-to-noise ratio



Picture quality

In video transmission, the effect of SBS is twofold. First, SBS limits the amount of power that can be transmitted through the fiber, since virtually all the power launched into the fiber in excess of the threshold is lost to SBS reflection. A second effect results from a portion of the backward reflected light being randomly reflected again into the forward direction. When this doubly reflected light recombines with the original forward traveling signal, unpredictable variations in power levels occur due to multipath interference. This multipath interference, in turn, creates a type of relative intensity noise that degrades the signal quality.

As shown in Figure 2, carrier-to-noise ratio (CNR) for a video signal usually increases with input power, so long as the input power remains below the SBS threshold; however, once the power exceeds the SBS threshold, CNR falls off rapidly. This decreasing CNR results from the limited transmitted signal power in conjunction with relative intensity noise generation.[2] As visual effects are concerned, SBS-related CNR degradation has been known to manifest itself as horizontal bands in the TV picture. →

Dan Harris is market development engineering manager of broadband technology for Corning Inc. For more details on SBS, contact the Corning Optical Fiber Information Center at (800) 525-2524, send an e-mail to fiber@corning.com, or post your question on Corning's Web site at http://www.usa.net/corning-fiber.

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Avoiding SBS

SBS threshold is dependent on the following fiber and source variables: fiber length, laser linewidth, Brillouin gain bandwidth of the fiber (the optical bandwidth over which SBS occurs, typically around 20 MHz), and effective area of the fiber core, which typically is proportional to the square of the mode field radius.

SBS usually is not a problem in short fibers because the SBS threshold is inversely proportional to the effective interaction length, and interaction length is small for short fibers. In most cable TV applications using standard single-mode fiber, SBS should not be a problem unless the fiber length exceeds 10 km.

For longer fiber systems, laser linewidth comes into play. If the laser linewidth is much larger than the Brillouin gain bandwidth of the fiber, the SBS threshold power is relatively high, typically ranging from several hundred milliwatts up to 1 watt. This is the case for directly modulated distributed feedback (DFB) lasers, where the laser linewidth is of the order of 1 GHz: For these lasers, the SBS threshold power approaches 1 watt, which is much higher than the respective 10 and 100 milliwatt output powers of commercially available DFB lasers and erbium-doped fiber amplifiers. Hence, SBS is not a concern in systems using directly modulated DFB laser sources.

More expensive externally modulated source configurations are sometimes used when we want to transmit at a wavelength far from the fiber zero-dispersion wavelength (e.g., 1,550 nm transmission on standard single-mode fiber); in this case, we avoid dispersion-induced distortion by taking advantage of the very narrow source linewidths in these source configurations, which can be as small as 1 MHz. The narrow linewidth of externally modulated sources, however, can cause SBS threshold power to drop below 10 milliwatts for fiber spans exceeding 10 km. Since 10 milliwatts is well within the output power range of commercial lasers and fiber amplifiers, SBS can be a problem.

In practice, SBS usually is suppressed in externally modulated DFB systems by dithering the optical source.[3] With this technique, the linewidth of the source is broadened by applying a single frequency modulation to the DFB bias current, achieving linewidths in excess of 1 GHz. This raises the SBS threshold power to levels similar to those observed with directly modulated sources. However, care must be taken when using this technique to avoid unacceptably high levels of dispersion-induced distortion for source wavelengths far from fiber zero-dispersion.

Other SBS suppression solutions have been proposed that are based on altering fiber attributes. For example, increased SBS threshold power recently has been demonstrated in a fiber that has an increased effective area.[4] This is achieved by increasing the mode field diameter of a single-mode fiber, which in practice can double the SBS threshold. Nonuniformities of the local Brillouin gain bandwidth in the fiber span also can broaden the overall Brillouin gain, which increases the SBS threshold power. This can be achieved either by inducing irregularities in the fiber[5] or by splicing shorter lengths of dissimilar fiber to create a long span.[6] Both approaches have been shown to increase the SBS threshold power by a few hundred percent. However, we should mention that fiber nonuniformities can compromise performance in other critical areas, such as attenuation and dispersion.

In conclusion, SBS is a phenomenon that degrades the CNR of a cable TV signal and occurs when the optical input power to a fiber exceeds a certain threshold. Usually, SBS is not a concern in cable TV applications when the fiber spans are less than 10 km or when directly modulated DFB lasers are used. For applications where externally modulated DFB lasers are employed on long fiber spans, SBS can be reduced by dithering the optical source. Dithering, however, can cause an increase in distortion for 1,550 nm systems that operate on standard single-mode fiber. Fiber attributes also can influence SBS threshold. Techniques such as increasing the effective fiber core area and inducing nonuniformities in the fiber span can be used to raise the SBS threshold power several times over. Using fiber nonuniformities to increase SBS threshold, however, can result in other fiber-related performance degradations. **CT**

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OTDR

Boonton Electronics Corp. introduced the Lynx optical time domain reflectometer (OTDR), which it says is the lightest, smallest hand-held OTDR available. The unit measures loss and locates faults in 1,310 or 1,550 nm single-mode optical fiber at distances up to 80 km.

The Lynx measures the location, loss and reflectance of every splice in the network and displays them on its internal LCD display. It measures with an accuracy of +/-1 m (+/-10^{-4}) of instrument range. Dynamic range is 22 dB at 1,310 nm and 20 dB at 1,550 nm; loss resolution is 0.1 dB.

Designed to make optical measurements extremely simple, a link budget can be obtained by pressing a single button. Faults and a graphical display of the link are displayed automatically on the backlit 320 x 240 pixel LCD. More complex analysis also can be conducted, including a display of the reflectometer curve, and zooming up to 30 m per division and 0.25 dB per division.

Fault location can be displayed to within 1 m at minimum range and 8 m at maximum range. The instrument automatically numbers faults, their position from the instrument in meters, attenuation and reflection in dB, and link budget. Measurement time ranges from 30 seconds to 10 minutes, depending on the complexity of the test; up to 25 sets of measurements can be stored internally in nonvolatile memory. The measurement data can be downloaded to a PC via the unit's RS-232C serial communications interface, as well as sent to a printer.

The unit operates up to six hours from its removable NiCad battery pack. Recharging takes one hour. The instrument weighs 2.2 pounds and measures 8 x 6-1/2 x 2-1/2 inches. Models are available for 1,310 nm, 1,550 nm, or both 1,310 and 1,550 nm. Standard accessories include a battery charger and AC/DC power supply. Carrying case and spare batteries are optional.

Reader service #312

Broadband access

Siecor Corp. introduced its new FlexWay system, a comprehensive broadband access system providing application solutions for network infrastructure from the service provider through the outside plant to the subscriber location.

Siecor's FlexWay system uniquely offers network flexibility by allowing customers to respond quickly to new opportunities and competitive challenges. The system provides innovative broadband access solutions for the public communications market and the ability to design, build and manage a generic network infrastructure to support new service demands and technologies.

At the service provider access, FlexWay offers high-density fiber solutions to meet the growing need for fiber bandwidth and broadband residential access deployment. These solutions provide enhanced administrative, test and maintenance capability from the host service provider terminal through the fiber frame to the optical splice enclosure.

FlexWay subscriber access solutions are both user-friendly and cost-effective and extend bandwidth capability to the home from the distribution and drop to the subscriber wall box.

Reader service #311

Fiber-optic test

Fiber Instrument Sales' new Optical Verifier is designed specifically for the fiber-optic installer, custom-built for a variety of applications including LAN, telco and cable TV. The unit is unique because it combines in one multifunction unit a zero set power meter, an ORL tester, talk capability, dual laser light source, and visual fault locator/LED source or visual fault locator/laser light source—at 30% of the price if each piece of test equipment were bought separately.

The instrument's power meter provides zero reset (reference) capability for direct loss readout of fiber under test. Three selectable wavelengths

(850, 1,310 and 1,550 nm) are available with 0.1 dBm resolution. Dynamic range is +5 to -60 dBm at 1,310/1,550 nm and +5 to -55 dBm at 850 nm (+3 dB). Laser sources are available in 1,310 and 1,550 nm wavelengths. LED sources are available for 850 or 1,300 nm wavelengths. Standard on all sources is continuous wave (CW) and 2 kHz modulation. The ORL test feature is available in 1,310, 1,550 or dual 1,310/1,550 nm wavelengths with a measurement range of 0 to -60 dB (+2.5 dB). Units supplied with talk capability are supplied a headset/microphone.

When fully charged, the unit provides eight hours of operating time. Units are provided with ST, FC or SC style adapters and operate at 110/120 or 240 volts with four AA NiCad or alkaline batteries. The unit is supplied with an adapter, four AA alkaline batteries, and packaged in a rugged carrying case. **Reader service #310**

RF switching line

QEC's new Q-Switch line of matrix RF switching systems has been optimized for 16 x 16 modular building blocks. The base SRM 1,200/16 x 16 matrix switch includes front panel keypad controller, LCD display, RS-232 interface and all of the splitter, amplifier, switching, control and PSU modules required to switch any one of 16 broadband coaxial inputs into any one or more of 16 outputs, all integrated within a compact 3 RU enclosure.

Based on QEC's patented stack and tier Q-Switch technology, the SRM 1,200/16 x 16 provides the user with the same ease for controlling multiple broadband RF coaxial lines hereto only available for switching audio/video or baseband applications. This advanced realization greatly reduces the size, complexity and cost of large RF switching systems, while enhancing performance and reliability through drastic reduction in the number of switching modules, components, connectors and interconnection cables required to do the job.

The Q-Switch product line extends the automated management and control capability of super-multioctave bandwidths to the 2,300 MHz frequency range for use in cable headends, satellite antenna farms, teleconferencing and redundancy applications, and yields cost savings by multiple, programmed use of receivers, antenna feeds and ancillary equipment.

Also available are 1 x 8 SRF Q-Switch modules and up to (n-128) SRR

routing switch configurations. These advanced Q-Switch products offer near constant insertion loss and phase for each selected switching path, providing superior performance for complex switch requirements through L-band, and rendering automated systems competitive with patch panels and manual switching techniques as currently used for RF/broadband coax signal management.
Reader service #309

Optical system

Pirelli rolled out its 1,550 nm optical cable TV system. The high-performance transmission and distribution optical amplifier system offers longer transmission distances than most conventional electronic systems.

Designed for MSOs as well as local exchange carriers, the system features high optical power for trunking and distribution, superior noise and distortion performance, and built-in SBS suppression that enables longer transmission distances. It offers 17 dBm of photonic power and allows 70 to 80 km distances between repeaters. With 80 channels of NTSC video, the system has a 52 dB carrier-to-noise ratio, a composite second order and triple order of -65 dBc, and a noise bandwidth of 4 MHz.
Reader service #308

Switcher

Flexibility is the word Leitch uses to describe its new Xpress 12 x 1 serial video and audio switcher. The two are combined in a one-rack unit with a built-in analog video and audio monitoring output option, eliminating the need for external converters where Xpress is used to feed a monitoring station. The unit also comes with local or remote control and is compatible with all previous Xpress routers, allowing users to create mixed format systems.
Reader service #307

Cable caddy

Multilink's new Cable Caddy accommodates wooden reels for RG-59, -6, -7 and -11 cable. The purpose of the Cable Caddy is to allow the installer to easily carry the reel in and around homes or multidwellings without bumping woodwork or doors. In addition, paying cable out of the Cable Caddy avoids any kinks that would inhibit digital signals going through the cable.
Reader service #306

Multitap housing

Antronix and TVC Inc. announced a new dual-compartment multitap housing for use in advanced networks and traditional high-density plant. The product features uninterruptible signal power and vertical or horizontal mounting capability.

Commonly referred to as the 9-inch housing, the unit offers unique flexibility. Backwards compatibility with the popular Millennium MGT Series multitap allows the operator the ability to use existing tap plates in new upgrades and mix standard video plates with plates capable of twisted-pair or F-port powering. This unique feature provides for design flexibility and limits capital investment to those who subscribe to advanced services.
Reader service #305

Modulator

The new Mighty Mod Plus from Passive Devices Inc. is a SAW-filtered, fixed-channel, high-performance, low-cost modulator. The modulator features stable PLL frequency control, a 55 dBmV output, and is available for TV channels from 54 to 550 MHz. Its video AGC circuit ensures 87.5% modulation depth over a wide input range; VSB selectivity allows maintenance-free adjacent channel configuration.
Reader service #304

Translator

For potential customers using other manufacturers' equipment, Leitch has come up with a serial protocol translator (SPT-1000-SXY) that allows Leitch's routers to be controlled by other makers' control systems and vice versa. The unit has two ports: a serial control port to talk to the neighbors and a pair of XY ports to talk to relatives (Leitch switchers and control elements). The translator is housed in a hand-size plastic box and can be mounted to the side of a rack or left in-line along a length of cable. It can store several different protocols simultaneously

and all connections can be locked, including the power connection.
Reader service #303

MPEG-2 analyzer

Hewlett-Packard and Sarnoff announced the HP E6276A MPEG scope DVB, a real-time MPEG-2 analyzer for digital video broadcast systems and networks. It's a PC-based solution that supports real-time testing of the MPEG-2 transport stream layer.

The unit consists of an HP Vectra PC, a Sarnoff-developed ISA analysis card and real-time software running under Windows. It supports a DVB 8-bit parallel input port on a DB-25 connector, which also is buffered to a through connector. Both connectors are accessible through an interface on the back of the PC.

An optional 64-QAM demodulator is available for interfacing directly with 64-QAM cable systems. Performed functions include: program clock reference jitter and interval analysis, T-STD buffer-level monitoring, program identifier bandwidth statistics and DVB-MG23/66 health-check monitoring.
Reader service #302

Backup power

Power Guard announced several new UCF configurations that provide power during utility outages for longer periods of time than conventional three-battery configurations. Conventional three-battery UCF supplies typically output power in standby for about one hour (under full load). These new multiple-battery string configurations are capable of providing power to line equipment for up to 34 hours, depending on load conditions.
Reader service #301

Matrix switching

Tekron Communication Systems introduced the SMC system for emergency remote-controlled IF and baseband matrix switching. The system performs scheduled and controlled channel switching in remote headends or hub sites.

The system can be configured for multimatrix operation to switch either selected channels or all channels in the headend and replace them with one channel in emergency situations. It can be used for channel program substitution, channel substitution during black-out periods, redundancy channel switching, special events and maintenance.

The SMC system is accessible for immediate action from the local control station, remotely from other computer stations, or with direct access touch-tone telephone. All access to the system is restricted to authorized personnel by a multilevel security password.
Reader service #300

Power platform

Rel-Tec announced its Vortex power platform, an integrated power solution designed for the needs of DC-powered wireless and wireline applications. Built for present and future voice, video and data power needs, the Vortex

power platform, an integrated power solution designed for the needs of DC-powered wireless and wireline applications. Built for present and future voice, video and data power needs, the Vortex is a microprocessor-controlled system of power conversion units and modular distribution that provides local and remote access capabilities with proprietary software including Lorain PDQ, Vortex Link and Vortex Manager.
Reader service #299

MDU amps

New from Triple Crown Electronics is the IMX Series single hybrid indoor MDU amplifier. The IMX Series line extenders offer features including power doubling, add-on active or passive two-way operation, and switching power supply. Continuous slope control and attenuation built into the basic module simplifies system setup.

Slope control can be selected to operate at any desired bandwidth below the module maximum, allowing amplifiers to be employed later by plugging in a new slope control. An external AC power pack, available in 117, 220 or 240 VAC is included with the unit.
Reader service #298

Laser modules

Lucent Technologies' Microelectronics Group unveiled two laser modules. The linear laser module is a cooled DFB/MQW laser chip in a hermetic isolated laser module (ILM).

The 270-type uncooled laser works for both analog and digital applications. In analog, it can be used both down and upstream and can support telemetry and system performance checks. In digital, it can be the foundation of a full digital transmitter and can support just about anything running at 1 Gbps or greater.
Reader service #297

UPS powering

Performance Cable TV Products announced its newly developed Magnum UPS centralized powering system. It's designed to provide either 60 or 90 V RMS operating from a true on-line UPS, charger and bank of batteries. Its "low-boy" enclosure is 17 inches tall and can hold a dozen batteries for run times of eight or more hours. The uninterruptible power supply module has an ADC output operating at a 30 Hz frequency rather than 60 Hz.
Reader service #296

Digital RF

Tektronix added new digital channel RF measurements to its portable 2715 cable TV spectrum analyzer. The new measurements augment the unit's existing analog channel measurements. In addition, PC Windows software simplifies channel table setup, creation of downloadable measurement programs, data collection and a variety of new capabilities, including display transfers, limit checking and alarms.

Digital and analog channel measurements can be set up individually or in sequences for push-button operation in the field. Facilities for remote operation allow unattended measurements and automatic collection of system performance data.
Reader service #295

Call EARLY for same day shipping on many items!

QRF

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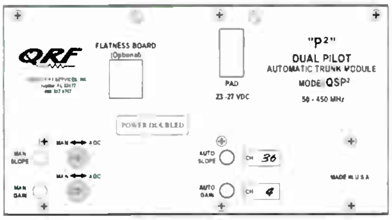
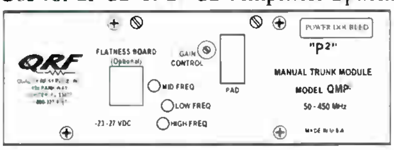
REPLACEMENT MODULES FOR JERROLD SJ & SLR INDOOR DISTRIBUTION AMPLIFIERS TO 750 MHz PATHMAKER 450 MHz UPGRADE KITS

For Jerrold SJ

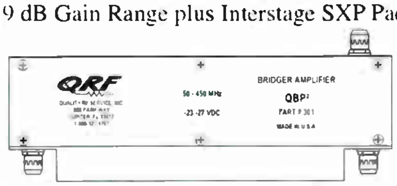
- QSP/QMP trunk modules replace SJ-450B modules w/SIE-450 slope board (4 dB). Flat gain versions also available.
- ALL modules available with Push-Pull or Power-Doubled Hybrids, -23 or -27 VDC



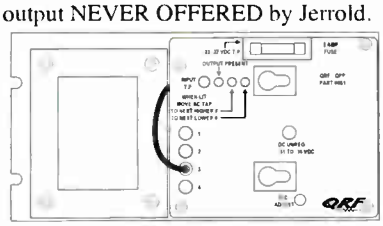
- QSP AGC/Slope module, 30 & 34 dB gain
- Use for 25 dB or 29 dB Amplifier Spacing



- QMP Manual Module, 32 dB Gain (Max)
- 9 dB Gain Range plus Interstage SXP Pad

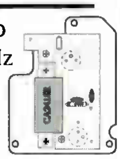


- QBP Bridger has -30 dB Trunk Test Point
- Solid metal design allows Power-Doubled output NEVER OFFERED by Jerrold.



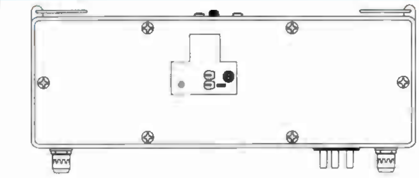
- QPP Power Pack for TWO PD Modules
- Transformer tap indicator LEDs assure maximum efficiency @ -23 or -27 volts.

QTRA Manual Return Amp



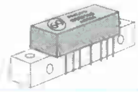
- Push-Pull Hybrid, 5 to 120 MHz
- 18 dB Gain, SXP Pad Sockets
- Replaces Jerrold TRA-30M & TRA-108M. Only $62.50

For Pathmaker



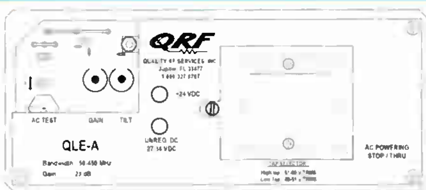
- Full 450 MHz upgrade from 300/330 MHz.
- ALL kits available w/ Push-Pull or Power-Doubled Hybrids, 29 dB to 37 dB Gain.
- QSYLA kits for all Auto/Man Modules.
- QSYLM kits for Bridgers & LE's, gain from 30 dB to 43 dB.

Hybrid Upgrades



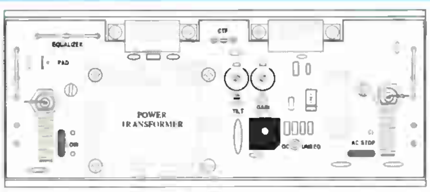
- Upgrades for ALL brands of hybrid CATV amplifiers.
- Many can be Power-Doubled

450 MHz for SLR



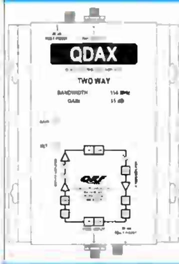
- QLEA 450 MHz low-cost hybrid LE.
- Push-pull module for all SLR housings
- Uses CTF thermal boards, SXP Pads and QEE450 Equalizers. 29 dB or 33 dB Gain.

Power Doubled SLR



- QLEP Dual hybrid 450 MHz line extender.
- Push-Pull or Power-Doubled Modules for SLR housings. 32 dB or 36 dB gain
- Trunk amplifier specs for tap trunk systems
- Passive 2-Way Return Filters Optional

QDAX 750-2W



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- Optional Reverse Amps.
- 5/8 inch cable entry
- U.L. Transformer
- 7" x 9" wall mount chassis

QDE550-2W

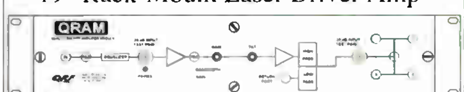
- Standard MDU/Hotel Push-Pull Distribution Amplifiers.
- Plug-in accessories
- Variable Tilt / Gain Controls
- Gain models to 38 dB
- 20 dB return amp optional
- U.L. Approved Transformer
- 5" x 8.25" wall mount chassis

QDEJ 860 MHz 2-way

- Low-cost, 32 dB gain, MDU Hotel distribution amplifier.
- Plug-in pad & Equalizer
- 20 dB return amp optional
- U.L. Approved Transformer

QRAM-750

19" Rack-Mount Laser Driver Amp



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AD INDEX

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Reader Service Number 55

The following is a listing of some of the videotapes currently available by mail order through the Society of Cable Telecommunications Engineers. The prices listed are for SCTE members only. Nonmembers must add 20% when ordering.

☛ *Digital TDRs, an Investment You Can Find Fault With*—Riser-Bond presents a discussion and instruction on the proper use of its line of digital time domain reflectometers. From SCTE's Product-Specific Tele-Seminar Program. (Approx. 20 min.) Order #T-1044 , $30.

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04. ☐ MSO (two or more Cable TV Systems)
05. ☐ Cable TV Contractors
06. ☐ Cable TV Program Networks
07. ☐ SMATV, DBS Operator
08. ☐ MMDS, STV or LPTV Operations
9A. ☐ Microwave
9B. ☐ Telecommunications Carrier
9C. ☐ Electric Utility
9D. ☐ Satellite Manufacturer
9E. ☐ Satellite Distributor/Dealer
9F. ☐ Fiber-Optic Manufacturer
10. ☐ Commercial TV Broadcasters
11. ☐ Cable TV Component Manufacturers
12. ☐ Cable TV Investors
13. ☐ Financial Institutions, Brokers & Consultants
14. ☐ Law Firm or Govt. Agencies
15. ☐ Program Producers, Distributors and Syndicators
16. ☐ Advertising Agencies
17. ☐ Educational TV Stations, Schools and Libraries
18. ☐ Other (please specify) __________

C. Please check the category that best describes your job title: (check only one)
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20. ☐ Management
21. ☐ Programming
Technical/Engineering
22. ☐ Vice President
23. ☐ Director
24. ☐ Manager
25. ☐ Engineer
26. ☐ Technician
27. ☐ Installer
28. ☐ Sales
29. ☐ Marketing
30. ☐ Other (please specify) __________

D. Which one of the following best describes your involvement in the decision to purchase a product/service? (check only one)
31. ☐ Recommend
32. ☐ Specify
33. ☐ Evaluate
34. ☐ Approve
35. ☐ Not involved

☛ *Balance and Alignment Techniques for Scientific-Atlanta Series 6500 and 6800 Distribution Equipment*—Scientific-Atlanta engineers discuss components and proper alignment techniques for this particular series of distribution equipment in this video produced exclusively for SCTE's Product-Specific Tele-Seminar Program. (30 min.) Order #T-1045, $30.

☛ *Implementing Stereo Headend Equipment*—Audio engineers Tom Williams and Steve Fox discuss BTSC stereo technology and its proper testing through specific headend equipment in this workshop from Expo '87. (1 hr.) Order #T-1046, $35.

Note: The videotapes are in color and available in the NTSC 1/2-inch VHS format only. They are available in stock and will be delivered approximately three weeks after receipt of order with full payment.

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October

1: SCTE Southeast Texas Chapter, BCT/E and Installer exams, Houston. Contact Jimmy Smith, (409) 646-5227.
1: Scientific-Atlanta technical course, "Fundamentals of the Hybrid Fiber/Coax Network," St. Louis. Contact Kim Davis-Mitchell, (800) 722-2009, press 3.
1-3: Antec Fiberworks seminar, "Digital Networks Training," Antec Training Center, Denver. Contact Patricia Sturmon, (847) 439-4444.
1-3: General Instrument seminar, "Telecommunications Network Engineering for Technicians," San Diego, CA. Contact Lisa Nagel, (215) 830-5678.
2-3: Scientific-Atlanta technical course, "Understanding Hybrid Fiber/Coax Design," St. Louis. Contact Kim Davis-Mitchell, (800) 722-2009, press 3.
2-4: Philips Mobile Training Seminar, Baltimore, MD. Contact (800) 448-5171.
3: SCTE Great Plains Chapter, BCT/E and Installer exams, Bellevue, NE. Contact Randy Parker, (402) 292-4049.
7-8: SCTE Regional Training Seminar, "Introduction to Data Communications," Springfield, MA. Contact SCTE national headquarters, (610) 363-6888.
7-11: General Instrument seminar, "Plant Maintenance, Proof-of-Performance and Signal Leakage Training," Hatboro, PA. Contact Lisa Nagel, (215) 830-5678.
8-10: SCTE Wheat State Chapter, BCT/E exams, Wichita, KS. Contact Joe Cvetnich, (316) 262-4270.
9: SCTE Bluegrass Chapter annual vendor day and technical sessions, Holiday Inn, Elizabethtown, KY. Contact Max Henry, (502) 753-6521.
9: SCTE Southern California Chapter meeting, TCI Cable Office, Van Nuys, CA. Contact Tom Colegrove, (805) 252-5280.
9-11: Philips Mobile Training Seminar, Charlotte, NC. Contact (800) 448-5171.
9-11: SCTE Regional Training Seminar, "Technology for Technicians II," Springfield, MA. Contact SCTE national headquarters, (610) 363-6888.
10: SCTE Satellite Tele-Seminar Program, "Data Transmission Techniques" from Expo '89, to be shown on Galaxy 1R, Transponder 14, 2:30-3:30 p.m. ET. Contact SCTE national headquarters, (610) 363-6888.
10: SCTE Music City Chapter, BCT/E exams, Nashville, TN. Contact Rodney Lanham, (615) 645-8296.
10: SCTE North Central Texas Chapter seminar, system reliability. Contact Lynn Watson, (817) 790-7557.
10: SCTE Razorback Chapter meeting. Contact Jack Trower, (501) 327-8320.
10-11: Antec Fiberworks seminar, "Broadband Cable TV Technology," Antec Training Center, Denver. Contact Patricia Sturmon, (847) 439-4444.
11: SCTE Oklahoma Chapter, BCT/E exams, Edmund, OK. Contact Oak Bandy, (405) 364-5763, ext. 249.
12: SCTE Cascade Range Chapter, BCT/E exams, Salem, OR. Contact Cindy Welsh, (503) 667-9390, ext. 226.
12: SCTE Llano Estacado Chapter seminar, telephony, Clovis, NM. Contact (505) 763-4411.
13-15: Atlantic Cable Show, Baltimore, MD. Contact (410) 266-9111.
15-18: Antec Fiberworks seminar, "Fiber-Optic System Training," Antec Technology Center, Atlanta. Contact Patricia Sturmon, (847) 439-4444.
16: SCTE Badger State Chapter, seminar, knowing your competition, Holiday Inn, Fond du Lac, WI. Contact Brian Revak, (715) 493-2605.
16: SCTE Big Sky Chapter, BCT/E and Installer exams, Little Big Men Pizza, Laurel, MT. Contact Marla DeShaw, (406) 632-4300.
16: SCTE Inland Empire Chapter meeting. Contact Roger Paul, (509) 484-4931, ext. 230.
16-18: Philips Mobile Training Seminar, Naples, FL. Contact (800) 448-5171.
17: SCTE Big Sky Chapter, BCT/E and Installer exams, Jackson Creek Saloon, Helena, MT. Contact Marla DeShaw, (406) 632-4300.
17: SCTE New England Chapter meeting, Best Western, Marlboro, MA. Contact Tom Garcia, (508) 562-1675.
17: SCTE Northern New England Chapter seminar, safety, Ramada Inn, Portland, ME. Contact Bill DesRochers, (207) 646-4576.
17: SCTE Rocky Mountain Chapter seminar, fiber optics, compression and ATM, Channel 9 Studios, Denver. Contact Mike Phebus, (303) 795-1699.
22: SCTE Heart of America Chapter, BCT/E exams, Overland Park, KS. Contact David Clark, (913) 599-5900.
22-24: Mid-America Show, Overland Park International Trade Center, Kansas City, MO. Contact Patty O'Connor, (913) 841-9241.
23: SCTE New England Chapter, Installer exams, Worcester, MA. Contact Tom Garcia, (508) 562-1675.
23: SCTE Smokey Mountain Chapter seminar, return alignment with bandwidth requirements, Quality Inn, Johnson City, TN. Contact Roy Tester, (615) 878-5502.
23-25: Philips Mobile Training Seminar, Montgomery, AL. Contact (800) 448-5171.
24: SCTE Florida Chapter vendor product showcase, Hotel Royal Plaza, Walt Disney World Village, Orlando, FL. Contact Joice Ventry, (904) 926-2508.
24: SCTE San Diego Chapter meeting. Contact Kathleen Horst, (310) 438-0295.
25: SCTE Wheat State Chapter, BCT/E exams, Great Bend, KS. Contact Joe Cvetnich, (316) 262-4270.
26: SCTE West Virginia Mountaineer Chapter, BCT/E exams, Triax Cablevision office, Milton, WV. Contact Steve Johnson, (614) 894-3886.
29-30: Scientific-Atlanta technical course, "Planning for Cable Telephony," Atlanta. Contact Kim Davis-Mitchell, (800) 722-2009, press 3.
30: SCTE Miss/Lou Chapter, BCT/E exams, Ramada Inn, Slidell, LA. Contact Austin Matthews, (601) 374-5904.
30-Nov. 1: Philips Mobile Training Seminar, Boston. Contact (800) 448-5171.

Planning ahead

Dec. 11-13: Western Cable Show, Anaheim, CA. Contact (510) 428-2225.
Jan. 9-11, 1997: SCTE Conference on Emerging Technologies, Nashville, TN. Contact (610) 363-6888.

CABLE TRIVIA

By Rex Porter

Our historical guru (aka Editor Rex Porter) has provided us with these trivia questions on the cable industry. Answers to the last set of questions appear first. (The last "Cable Trivia" ran on page 114 of the August issue.) Look for answers to this month's questions in a future issue (along with a new set of 10 questions). The person supplying the most correct answers will be awarded a special Trivia T-shirt. You may only win once per calendar year.

To be in the running for a prize, your answers need to be postmarked, faxed or e-mailed to us by the 20th of the month of the issue date that the specific trivia test appears in. The first person who sends in the most correct answers will be the award winner. Good luck!

Your answers need to be sent to: The Trivia Judge, *Communications Technology*, 1900 Grant St., Suite 720, Denver, CO 80203; fax: (303) 839-1564; e-mail: CTmagazine@aol.com.

Trivia #9 answers

1) Brian Lamb
2) Magnavox
3) Spencer-Kennedy Labs
4) Jerrold
5) Ameco
6) Charles Clements
7) Viacom
8) Amp clamps
9) Bartlesville, OK
10) The Pennsylvania Polka Festival

Trivia #10

1) He worked for Ameco, Cascade and Anaconda. While at Anaconda, he is credited with developing the first integrated circuit amplifier in the cable industry. He is:
A) Jack Stone
B) Robert Hayward
C) Jack Arbuthnott
D) Vic Tarbutton

2) Beginning his career with Jerrold in 1959, he worked with Ampex Corp., CPI, and then retired from Times Mirror. A member of the Pioneers Club and the SCTE Hall of Fame, he taught many of us in subjects from proper grounding to fibeAr optics. He is:
A) Barry Stover
B) Bill Stone
C) Jim Stillwell
D) Sandy Summers

3) He was the Jerrold sales manager where I purchased my system equipment for United Video System in Kansas City (circa 1966-67). Before that, he was sales rep for A&J Distributors and Northwest Electronics. After 1967, he was the MSO/national sales manager for Jerrold before finally becoming involved with management of a major MSO. He is:
A) Leonard Tow
B) Harold Tisdale
C) J. C. Sparkman
D) Mark Van Loucks

4) Headed by Ed Taylor III, the first company to put an independent TV station on satellite was:
A) SSS
B) ABC
C) Comsat
D) NBC

5) Graduating with a BSEE from the University of Delaware, he was the engineering assistant to the chairman of the FCC. Known for his expertise in every phase of cable engineering management, he worked tirelessly as a member of the DAVIC standards group. Recently named as COO of a new company, he is:
A) Thomas Elliott
B) Wendell Bailey
C) Robert Luff
D) Walt Ciciora

6) The son of a very famous cable TV father, he entered the same profession, following his graduation from the University of California at Berkeley with highest honors. In addition to his contributions to a major regional cable association, he is a member of the state bar association and a member of his state's law review. He is:
A) Arthur M. Smith
B) William G. Hooks
C) Morris Prizer
D) Spencer Kaitz

7) The first sales rep ever hired by Times Wire & Cable, he was the owner of his Mayban Co. He was purchasing manager for the Boeing Co. and Telecable; then spent 13 years as a system owner and marketer of products. He is:
A) Bill McNair
B) Maynard Polkinghorn
C) Bud Desmond
D) Don Achison

8) With a BSEE and MS in management from Oklahoma State University, he is a valuable member of the SCTE, the IEEE, SMPTE, the AMA and the NCTA. He has authored numerous papers for both the NCTA convention and SCTE Cable-Tec Expo.
A) Bill Riker
B) Dan Pike
C) Hugh McCarley
D) John Vartarian

9) A cable pioneer, he graduated with a BS from Iowa State University. The holder of many patents, he formed a major equipment manufacturing company in the east. Earlier in his career, he worked for General Electric. He is:
A) Larry DeGeorge
B) Frank Drendel
C) James Palmer
D) Sid Topol

10) He worked for Ameco, Anaconda, Cascade, Magnavox and later formed his own company. He developed 39 successful cable products, among them: the first remote cable-powered power supply, the first power inserter, the first all-band transistorized trunk/bridger amp (10 watt), the first plug-in AGC transistorized modules, the first combined trunk/bridger AGC amplifier, and the first midget line extender. As well, he was the builder of one of the first solar amplifiers, which was never marketed. He is:
A) Len Ecker
B) Donn Nelson
C) Vic Nickleson
D) Cliff Paul

And the winner is ...

Steve Allen of Roseville Telephone Co. in Roseville, CA, sent in the most correct answers to Cable Trivia #9. Look for your T-shirt in the mail, Steve!

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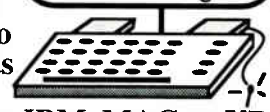

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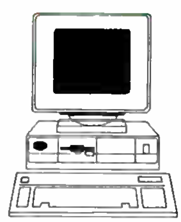

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