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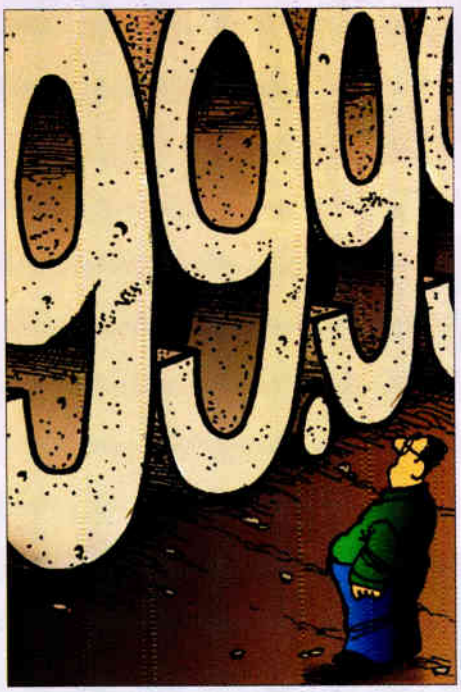

Illustration by Rob Pudim

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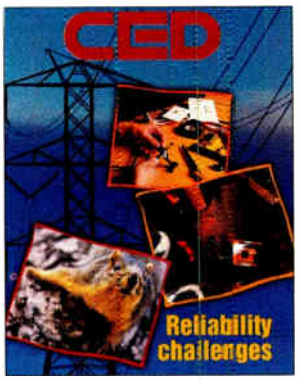

About the Cover

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Return on investment.

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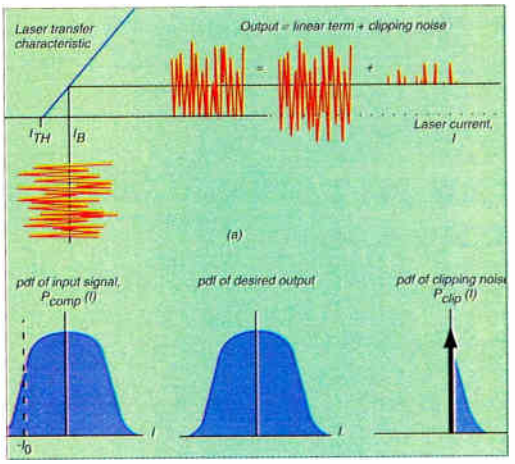

FiberLine (page 26).

Is ingress making your return path a road to nowhere?

Ingress is the major roadblock to getting your return path up and running. Fortunately, there's the new HP CaLan Sweep/Ingress Analyzer. It's the only test gear that allows you to quickly and accurately troubleshoot your system, regardless of the presence of ingress.

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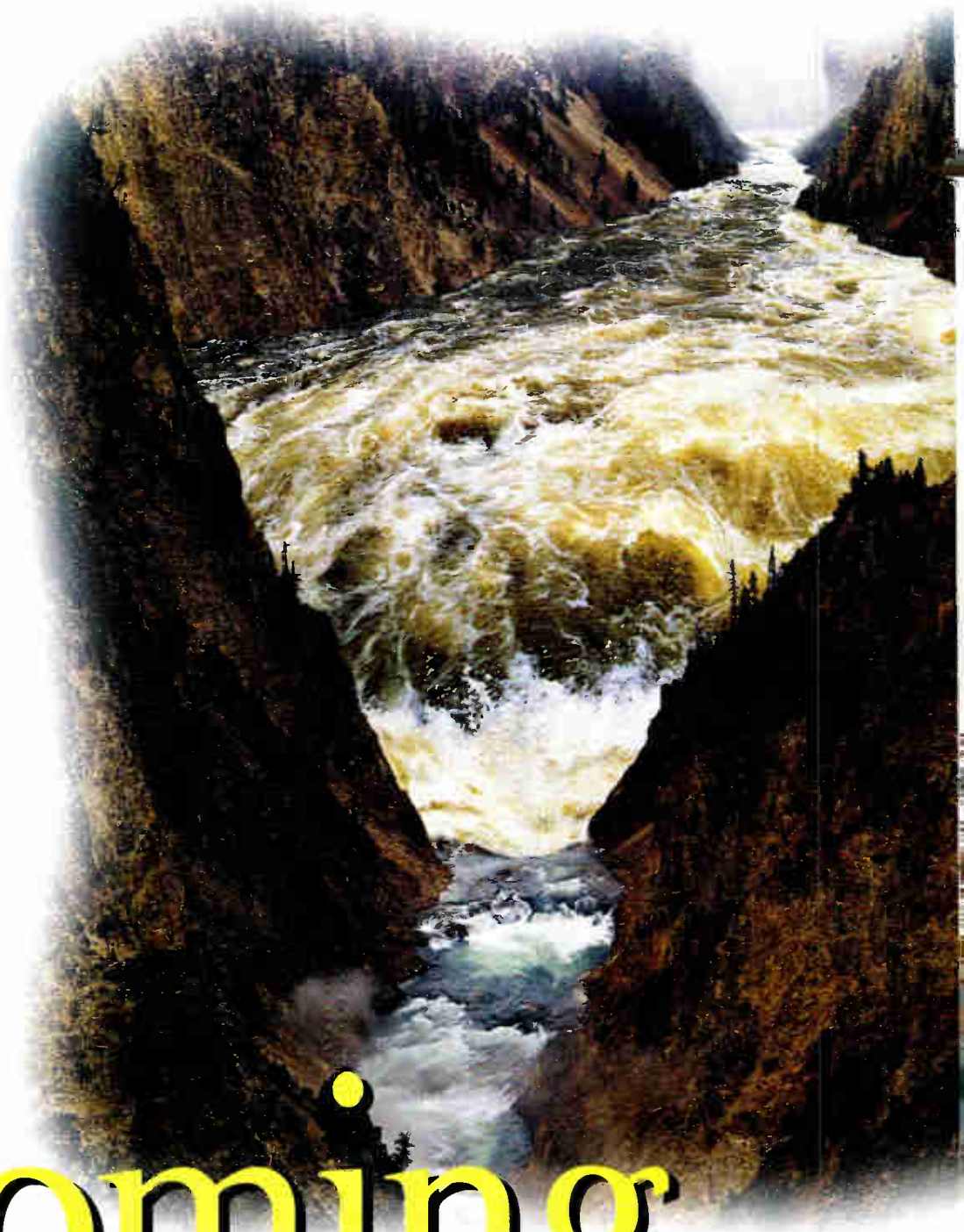

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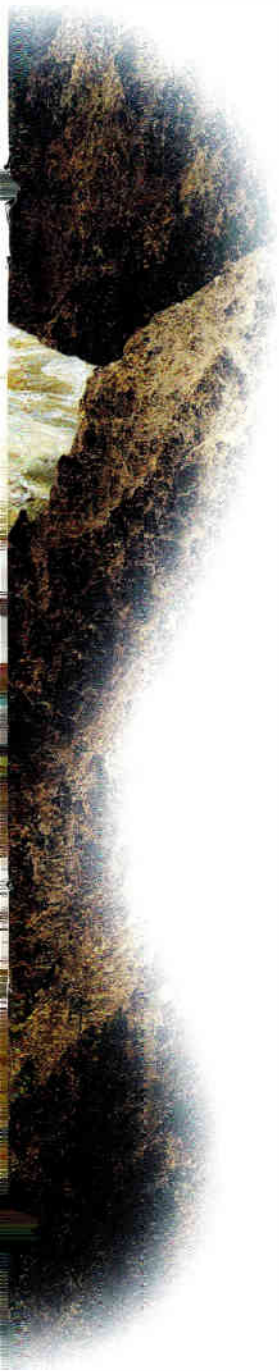

Partnership[3]

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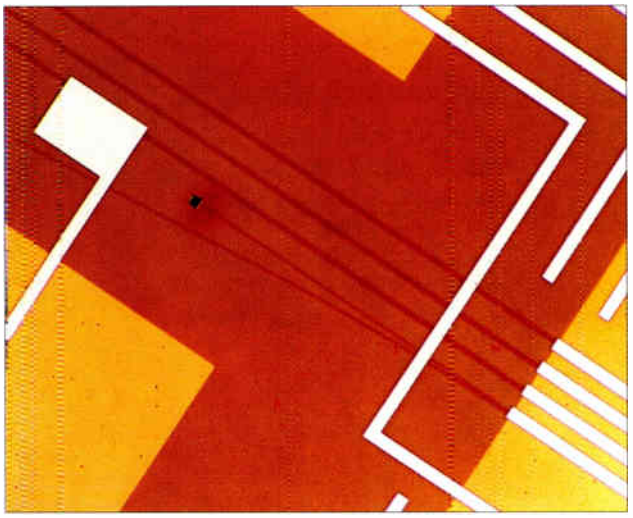
cable?

3Com® SYSTEMS

New fiber optic start-up company puts Dense WDM onto a chip



The waveguide structure on the Lightwave Microsystems IC; the black square is a tiny mirror that reflects light up or down into the waveguide on the IC.

Lightwave Microsystems, a Silicon Valley-based research and development company, has achieved breakthroughs in polymer optical technology that enable a new set of ultra-fast, yet low-cost, dense wavelength division multiplexing (DWDM) products that could help cable companies dramatically increase the number of signals they transport, according to company executives.

The company's new "HiBit" technology platform allows it to fashion optical integrated circuits that can send voice, video or data signals over 16 different wavelengths within the 1550 nanometer operating window. Lightwave intends to sell the chips to manufacturers of WDM transmitters and receivers, optical add-drop multiplexers and optical cross-connects.

Unlike current WDM products that use either phased-array waveguides, Bragg grating or interference filters to separate the "colors" of light and send them separately, Lightwave's product line uses waveguides that are etched via photolithography and then coated with a polymer. While the technology has been known for some time, Lightwave engineers were able to overcome thermal stability problems and make the devices more optically "active," said George Ballogg, vice president of marketing at Lightwave.

The result? Fast DWDM products at prices that are dramatically lower than those of competitors' devices, according to Ballogg. For example, he said that a single link can be reduced in price from roughly $32,000 to $12,000 with the company's "LightWeaver MDM-16" mux/demux. Furthermore, with volume, Ballogg said Lightwave intends to "knock the price down a heck of a lot more" over time.

The news should be welcomed by the cable industry, which is increasingly eyeing the 1550 nm optical technology as a way to effectively interconnect systems and serve entire regions with a full suite of voice, data and video services.

The 16-channel system is scalable to 32 channels and can deliver 40 gigabits per second throughput over an OC-48 link, and up to 160 Gbps at OC-192.

Lightwave Microsystems was founded in 1989 as ROI Technology and developed optical ICs for a wide array of uses, including high-speed computing backplanes for military applications.

Cablevision wins NESC battle with SNET

The Connecticut battle of wills between Cablevision Systems and Southern New England Telecommunications was won by Cablevision last month as the regional telco's unique high-power cable design was ruled to be in violation of National Electrical Safety Code provisions.

The issue came to a head in January, when experts from Cablevision and SNET testified before the Connecticut Department of Public Utilities Control (DPUC) about whether the cable met certain NESC provisions regarding bonding and grounding. Cablevision maintained that the cable didn't meet those provisions and therefore represented a hazard to its employees, who must also work in the communication space on telephone poles.

The SNET cable design carries 480 volts over nine internal conductor wires that are wrapped around an innerduct through which a fiber optic cable is pulled. The conductors act as a power bus to provide electricity for the integrated voice, video and data network.

Cablevision argued that the cable either had to be brought into compliance with NESC specs or be moved and placed higher in the poles so as not to present a hazard to Cablevision craftsmen. SNET, on the other hand, argued that the cable was safe, but admitted it needed an NESC clarification (which it voluntarily sought) before the cable could be deployed widely.

"We still stand by the fact that we think our cable is safe," said SNET Network Services President Fred Page during a telephone question-and-answer session with reporters.

At the end of January, a vote by an NESC subcommittee ruled that the SNET cable was indeed in violation of the Code, and that it must be redesigned or moved out of the "communication space" on the pole. Further, the panel rejected SNET's request for a Code "clarification" that would have allowed it to string the cable throughout the state.

A short time later, SNET said it would redesign the cable and would dismantle the 10 miles of cable that was originally energized in October 1995, at a cost of about $200,000, according to Page. SNET will also wreck out another 70 miles of cable that had been placed but never energized.

The decision will set SNET back between three and six months in its effort to provide telephony over coax to Connecticut residents, Page said. However, he said the roll-out of cable TV services, expected to begin later this year in Unionville, Conn., would not be affected because a different, non-powered cable design will be used initially.

SatCon gets order from electric utility

Flywheel manufacturer SatCon Technology Corp. will be working with San Diego Gas and Electric Company to demonstrate and evaluate a flywheel that will act as a standby power energy source for Time Warner Cable in San Diego. The utility company intends to use the flywheel technology as a way to offer Time Warner "premium," or high-quality, power at a slightly higher kilowatt-hour rate.

The agreement between SDG&E and SatCon calls for the utility to integrate two flywheels into a single cable TV "node" sometime later this calendar year. Already, at least two cable companies–Rogers Cablesystems and tiny WindBreak Cable–are slated to test the flywheels later this year as well.

The flywheel, which is buried in a protective vault in a location near a power supply,

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takes the place of battery arrays that are typically found in standby power units. The flywheel, which spins continuously at roughly 30,000 rpm while commercial power is available, transfers its kinetic energy into electrical energy if the power is lost, providing roughly two hours of backup.

The units are essentially maintenance-free and are forecast to have a life of about 20 years.

"What SDG&E is doing is a unique opportunity for cable operators," says William Bauer, owner of WindBreak. By purchasing and deploying flywheels throughout its network, a utility could let a cable operator concentrate its capital spending on network components instead of power supplies and costly batteries. "It effectively gets us out of the power business," Bauer says. That's an important consideration in this day when capital is in short supply, and cable MSOs are highly leveraged.

Museum names president, relocation progresses

The National Cable Television Center and Museum, which was relocated to Denver from Penn State University, has named Marlowe Froke as its president. Froke had been serving as acting president and was a co-founder and co-organizer of the Museum when it was first established by the Cable TV Pioneers at Penn State.

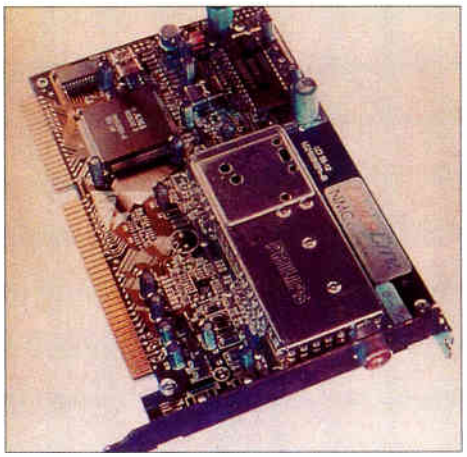
The new Cable Television Center and Museum will be a free-standing, independent institution located on a site provided by the University of Denver. It is scheduled to open in the fourth quarter of 1999 with affiliations with other educational and cultural institutions around the world. Planning for the Center has been underway for more than two years. A strategic master plan, made possible through financial support from Bill Daniels, one of the cable industry's most well-known figures and a long-time advocate of the center, was recently accepted by the Center's board of directors.

Froke stated that a first step has been taken toward introducing both the industry and the public to the Center's potential with the establishment of its website (www.cablecenter.org). Key features of the website will include a historical overview of cable telecommunications called "Cable Milestones," and an on-line library that will contain collections of photographs, personal papers, oral histories, journals and other materials now being catalogued and digitized. This will augment a searchable database that is also under development.

"In future years," says Froke, "when advanced software is more widely available, our website will be a 'virtual museum.' Visitors to the site will experience all the exhibits and other features from the convenience of their own computer screens. We want to be perceived not as a place, but rather as a resource, more a tool for research and learning, than just a concrete edifice."

CellularVision plans to offer data services

New Media Communication (NMC) of Israel recently announced it has reached an agreement to sell 100,000 super-high capacity internal PC modems over the next few years to CT&T (formerly CellularVision Technology & Telecommunications). The $30 million deal will pave the way for high-speed wireless Internet service over CT&T CellularVision Digital Network (CVDN) delivered via local multipoint distribution service (LMDS) technology.



New Media Communication's high-speed internal PC modem.

LMDS uses the high-frequency 28 GHz band to transmit voice, video and data services. The LMDS industry in the United States has run into a variety of regulatory delays, and while there is currently only one operator up and running in the United States, observers expect auctioning of the spectrum for the rest of the country to take place later this year.

CellularVision of New York, a subsidiary of CellularVision USA, is the exclusive FCC-licensed LMDS provider of multi-channel broadband wireless cellular television (currently 49 channels) in the 11,000-square-mile New York Primary Metropolitan Statistical Area (PMSA). The company claims its signal currently passes more than 700,000 homes in Brooklyn, plus an additional 200,000 homes in Manhattan.

New Media's present "CyberCity" modem system provides a network speed of 5.5 Mbps and individual user speeds of up to 550 Kbps (four times faster than ISDN lines). By mid-1997, the CyberCity system is expected to run at 35 to 54 Mbps (25 to 40 times faster than T-1 lines and up to 1,800 times faster than conventional telephone modems).

NMC's CyberCity modems have been tested and used successfully in Israel, Germany and Belgium since 1994. The modems were developed in conjunction with the IBM Science & Technology Development Center in Israel. The CT&T telecommunications platform is licensed to operators worldwide, including the United States, Canada, Thailand, Russia and the Phillipines.

CAI given OK to operate in Boston

CAI Wireless Systems Inc., the operator of six Eastern MMDS systems, has been granted permanent authorization from the FCC to use its spectrum for fixed two-way video, voice and data services in Boston.

The grant authorizes CAI to transmit and receive information to and from 16 commercial customer sites served by two cells that feature overlapping eight-mile radiuses in and around the Boston metro area. Two additional cell sites were also authorized and can be used by CAI to serve future customer locations.

The four cell sites were "substantially completed" last year, according to CAI officials.

The authorization will now allow CAI to develop a digital "Wireless Information Network" platform over which the company can offer an integrated suite of services, said Jared Abbruzzese, CAI's chairman and CEO, in a statement.

"Once developed, we will have the ability to deliver two-way services in targeted areas of Boston, while simultaneously delivering one-way data and digital video to other areas of the market," said John Prisco, CAI's president. Just which services are offered where and when will be dictated by market economics, Prisco added.

CAI presently operates six analog-based wireless systems in New York City, Rochester and Albany, N.Y.; Philadelphia; Washington, D.C.; and Norfolk/Virginia Beach, Va. It also owns channel rights in eight additional markets.

The company had previously announced an affiliation agreement with Bell Atlantic Corp. and Nynex, an arrangement that was mutually suspended for one year.

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Reader Service 7

Internet security system offered to cable MSOs

With more and more large U.S. companies planning to use the Internet to send corporate data, and the trend toward ever-greater dependency on electronic commerce, TimeStep Corp. is launching an Internet security program designed for Internet Service Providers, cable TV systems and telcos.

TimeStep's "InterSec" program provides end-to-end network encryption and firewalling, with central management and certificate distribution to keep confidential transmissions from being intercepted. The system is built around the company's "Permit" family of secure virtual private networking products, which are available to secure a wide variety of applications—including a single workstation or server, a remote office, mobile users or large installations.

TimeStep has already signed on two charter customers, including iStar, Canada's leading ISP, and Genuity, a subsidiary of Bechtel that provides Internet solutions for medium- to large-sized businesses, governments and educational customers.

Chambers Cable to deploy interdiction

While most of the largest cable system operators are planning to deploy large numbers of analog and digital addressable set-tops, Chambers Communications Corp. has chosen to install consumer-friendly interdiction technology from Scientific-Atlanta.

Chambers intends to deploy the technology to all subscribers in two of its five cable systems which will be undergoing rebuilds. These systems–in suburban Seattle and San Francisco–comprise 600 miles of plant and serve 40,000 customers. In addition to more than doubling the current channel capacity of the two systems, the rebuilds will also offer digital music, multiple channels of pay-per-view and other technologies.

Company officials chose to implement the interdiction system for two primary reasons: as a method to cut operating costs, while offering customers whole-house service without a set-top in sight. "We can implement new services to all customers instantaneously without sending out a single truck," said Scott Chambers, president and COO, in a statement. "In addition, customers clearly prefer to have whole-house services without set-top boxes."

Interdiction has been in S-A's portfolio of technology for several years, but has been only rarely deployed. Operators in the past expressed concern over higher powering costs; the need to place hardware in front of all homes passed, even if they were not subscribing homes; and potential theft of signals, which are sent "in the clear" to jamming devices located near the residence.

Chambers, conversely, intends to use interdiction to reduce piracy. "We're hoping to reduce service theft substantially and to achieve cost efficiencies through headend control of connects, disconnects and service changes," said Chambers. As part of the contract, S-A will also supply headend, RF distribution and optoelectronics equipment.

With some cable systems now heavily penetrated within certain markets, and operators increasingly searching for a way to differentiate themselves from other video providers such as DBS, S-A officials are actually seeing a renewed interest in interdiction, according to David Alsobrook, interdiction product manager at S-A.

"In some respects, it's surprising–even to us," said Alsobrook, who says he's been "swamped" by operators who are interested in the technology, now that remote control and additional outlet revenue has been severely curtailed by legislation.

Primestar satellite blasts into orbit

Primestar, the direct-to-home satellite video provider owned by several cable TV MSOs, will soon be able to add 65 channels to its present lineup following the successful launch of the GE-2 satellite built by Lockheed Martin. The additional satellite will allow Primestar to offer consumers 160 channels of programming.

GE-2 is a medium-power satellite that sports a new design and features 48 C- and Ku-band transponders. Primestar is expected to use up to 24 of the 60-watt Ku-band transponders.

The new bird replaces the aging Satcom K-2 satellite, which has been beaming Primestar services to consumers from the 85 degree west longitude location. In March, TCI Satellite Entertainment, which holds a 20 percent stake in Primestar and serves roughly 700,000 subscribers, will launch a high-power satellite from Cape Canaveral. That unit will be parked in the 119 degree west longitude orbital slot.

Jottings

Chances are, a large percentage of the people reading this are members of the **Society of Cable Telecommunications Engineers** (SCTE). If you're a member, don't forget to return the ballot you received recently to elect members of the national board of directors. Members in five regions will be voting to elect a local representative, while all national members will be selecting one at-large member. If you haven't already, mail your ballot today . . . **IBM** recently won contracts with 10 different small telecommunication companies to provide billing and customer care services. The Integrated Customer Management System offered by Big Blue allows companies that offer voice, video and data services to share databases and get a complete "view" of a customer's history . . . Could the end be near? No, we're not talking Armageddon, but the end of the long feud between the **NCTA** and the **Consumer Electronics Manufacturers Association** over the consumer interface issue. In mid-January, the two groups finally agreed to a set of features and functions that would define a "cable-ready" TV or VCR and an additional set of features that would define an "advanced cable/media-ready" appliance. The basic interface allows a receiver to descramble a picture and support a host of recording options as well as picture-in-picture. The advanced interface adds remote control pass-through, text over video (such as electronic program guides) and home theater requirements. Now, if we could just get peace in the Middle East . . . **WorldGate** was the recipient of an $11 million cash infusion from Citicorp, **Motorola,** two investment firms and former **Cablevision Industries** leader Alan Gerry recently. WorldGate, which is planning to offer Internet access via cable TV set-tops later this year through a service known as TV Online, is scheduled to be tested by several MSOs in the next few weeks . . . **Lucent Technologies** was chosen by **Ameritech** to implement its Location Routing Number technology to provide local number portability to customers who choose to switch telecom carriers. The software routes calls using service control points, or database computers for intelligent networks . . . Following the lead established by its Hatboro, Pa.-based cousin, the **NextLevel Satellite Data Networks Group of General Instrument Corp.** recently broke ground on a new, $47 million office complex that will house the 1,300 employees based in San Diego, Calif. As in Hatboro, the company is consolidating several buildings into a campus-like facility in San Diego. Initial plans call for two buildings to be constructed, giving the company 330,000 square feet of space for offices, labs and a fitness center. Move-in is expected to take place in January 1998 . . . Those of you in California shouldn't forget to attend the annual **SCTE Vendor's Days** at the Concord Hilton Hotel in Concord. For more info, call Steve Allen at 916/786-4353 . . . . CED

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Reader Service 8

Self-reliance is the father of invention

John B. (Jack) Terry

At the tender age of 16, Jack Terry left his home near London to join the ranks of the famous Marconi company. By the time he was 21, he was building a chain of interconnected television stations crossing the rugged mountains of Venezuela, where he had at his disposal a Cessna 172 aircraft, and a retired Pan Am pilot to fly it; two jeeps; and three mules—all to conquer the harsh terrain.

Undoubtedly, Terry learned to be self-reliant at a very early age, as he spent his early adulthood crisscrossing the world to set up communications systems. At that age, "You're not a leader," says Terry. "but you have to pretend to be a leader."

In fact, Terry has worked all over the world—from the Arctic Circle to the equator—designing, engineering and building cable and broadcast television stations. Back in 1959 and 1960, he installed the first two television stations in all of Africa, and in 1960, he constructed one of the world's first two-way cable systems for an independence day celebration in Nigeria.

Today, as assistant vice-president, access architectures and technologies for Nortel (Northern Telecom), Terry runs a sort of business within a business, as his "intrepreneurial" activities cut broadly across all of Nortel's future broadband access products. He oversees the technical direction, implementation and field verification of prototype systems, as well as the management of external engineering resources and technologies. He also plays a role as an advisor to some of Nortel's cable customers, as they ponder their options in future services architectures.

"I would like to continue to influence the cable industry in the direction of an efficient, common services platform on cable," Terry explains. "And common platform means switched digital video, Internet and Intranet access and telephony. All on the same technical platform . . . In other words, blending the signals digitally, through a common channel structure—not putting together a number of disjointed RF systems on the same cable."

In furthering his role as an informal advisor, Terry volunteered many hours of his time last year to establish, on behalf of the IEEE and SCTE, an engineering conference on hybrid fiber/coax which brought together leaders in both the cable and telephony industries. Currently, Terry is working with the SCTE on plans for HFC '97, the follow-up to last year's conference in Arizona.

"We found the cable people went to the cable conferences; the telco people went to the telco conferences; and we couldn't get them to mix," says Terry. "So we decided to create a conference for both of them." The conference proved to be so popular that final attendance was nearly double what was first projected (HFC '97 will be held in Phoenix this coming September; for more information, contact the SCTE at 610-363-6888).

The foundation of digital switching

Both the cable industry, and the telecom industry as a whole, are richer for Terry's technological and leadership contributions. In the telephony realm, while working for BNR (Bell Northern Research) in Canada in the early 1970s, Terry designed the hardware for Nortel's DMS-100 central office switch, specializing in its line circuit technology and electrical integrity. That work, in turn, led to the invention of the first commercial integrated PCM Codec-Filter silicon devices. Today, more than 60 million line circuits based on this work are in service throughout North America.

"The challenge was to develop technology to make the line circuit so economical," recalls Terry, "that the cost of the line circuit, plus the actual electronic switch, was less than the cost of the old-fashioned metallic switch." Later-generation switching products which are currently being deployed in the backbone of many cable systems are based on Terry's pioneering steps into digital switching.

In total, he holds more than 20 patents, including those related to improvements in pulse code modulation and in adjustable voltage sources, as well as patents in echo cancellation circuits and "transformerless" line interface circuits. And in 1995, Terry, already a fellow of the IEEE, received one of the highest honors which the engineering world can bestow–the IEEE recognized him with its Engineering Leadership Award for his contributions to digital switching and line circuit technology. To put the honor in perspective, winners of the prestigious award in other years have included pioneers of silicon chips, supercomputers and minicomputers, and the creator of Bellcore.

From the ground up

All of his life, Terry has become accustomed to making something out of not much of anything. Back when he was working in Nigeria, he wanted to own a sailboat but had "no funding," a typical state for young adults. So in his spare time, using nothing but hand tools, Terry built an 18'6" sailboat out of local mahogany. "Today, if I break my circular saw, I go to the store and get another one," he notes. "But in those days, in England, you had to save a year if you wanted to buy a tool like that."

First being christened off the coast of England, the boat has followed Terry all the way to Georgia, where he currently resides with his wife of 32 years, Dorothy. An avid sailor, Terry races both dinghies and catamarans, though he notes that his wife prefers a cabin cruiser to dangling out over the water. His current projects include building a kit PC, and constructing a solar heating system for his pool—"That's what I have all laid out in the basement," he notes, which undoubtedly makes Dorothy very happy.

So the elder Terry, like his younger self, continues to invent wonderful things out of spare parts.

–Dana Cervenka

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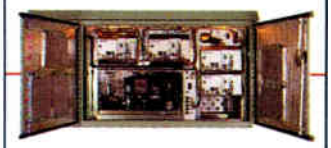

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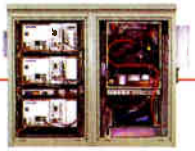

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The people behind the National Show

By Wendell Bailey, VP of Science and Technology, NCTA

Chances are good that you may be reading this issue of *CED* at the NCTA National Show in New Orleans. On the assumption that you might want to know who the hardworking people are who helped to bring you this extravaganza, I have decided to describe my co-workers at the National Cable Television Association (NCTA).

The National Cable Television Association has made the trek to New Orleans for its 47th annual convention and exposition. We are expecting one of our largest shows ever. The first one, just for a little historical perspective, took place in a hotel, and all of 40 people showed up. I'm told that a fine time was had by all.

At NCTA headquarters in Washington, D.C., the department that is primarily responsible for the creation and organization of this event is Industry Affairs. This department is headed up by Barbara York, who works with a very talented team. And, they, in turn, work with Dan Dobson and Carol Sullivan of Dobson and Associates, who manage the exhibition. This department spends the majority of the year getting this event into shape with the help of anyone who it can nag, whine or cajole into helping. No one, thus recruited, does nearly as much to make this show a success as Barbara and her staff.

Just because we are here in New Orleans with thousands of our closest friends doesn't mean that the day-to-day work of the NCTA stops. You will see members of the NCTA legal department not only escorting around important government officials, but they will also frequently stop to discuss important regulatory or legal issues with NCTA members who catch them between assignments. The legal department is headed by Dan Brenner, and it is said that he runs one of the best, small inside law firms in the city.

The NCTA Government Relations department has a similar set of duties at the National Show; that is, squiring about important dignitaries. The head of this department, Pam Turner, has a dedicated and talented staff. As you can imagine, hardly an hour goes by that one or the other of their charges doesn't need something that is difficult to deal with. Pam and the crew handle any and all challenges without complaint or apparent effort.

One of the things that makes the NCTA successful in the Washington arena is that we speak with one voice on all important issues. This is remarkable, when you consider that the membership of the association includes operators, programmers and equipment vendors. The ability to find common ground among these different entities requires that we do more than pay lip service to their particular points-of-view. To that end, we have a couple of departments that bear the extra burden of representing the policy needs of such diverse interests as the programming community and the smaller system operators. Jadz Janucik (the most senior in terms of service of the NCTA department heads) runs Association Affairs and several sub-departments, each headed by a senior member of the staff, that deal with the special policy concerns of some of these constituents.

The newest department of the NCTA is the Programming Policy department, which is ably run by Jill Luckett. Jill has the sometimes daunting task of trying to get all of the other segments of the industry to understand where the programmers stand, and what they need in order to help their side of the business. All of the other departments work closely with both Jadz and Jill, but the burden of making it work falls on them. Here at the National Show, you will see these two talking to a wide array of industry leaders, and Jadz will also run the annual membership meeting.

Getting the word out

The big show sheds light on a lot of stuff, but the cable industry and its leading companies are doing important things all year long. Getting the word out and helping the industry to help itself is the job of the Public Affairs department of the NCTA. Torie Clarke and a hard-working staff handle that job at home, and here at the convention, they spend countless hours taking care of the hundreds of press representatives. The stories that come out of this effort will be with us for some time.

The exhibit floor and the education tracks (both technical and management) are the things that most people see. They also see the registration booth and the other administration activities that are needed at an event of this kind. Those items are handled by Phylis Eagle, NCTA's vice president of administration. Day in and day out, this department makes things run at the NCTA, and of course, most don't notice. It's the same here at the show.

Then of course there is the Science and Technology department. That's the one that I head. We (my small but powerful staff and I) put on the technical program (actually, Katherine Rutkowski does all of the work, and Andy Scott and I do what we can to help), and generally handle anything that looks like a Hertz or a dB.

The department heads all report to June Travis, NCTA's executive vice president. And of course, Decker Anstrom is our president and CEO. All of these people work for you all year long. They do not make a single decision without you in mind. At the National Show, they are busy, overworked and tired. They are also unbelievably knowledgeable and helpful. If you see them in the halls or on the floor (they wear green ribbons), make them aware that you know who they are, and what they do. This group and the other staff members in New Orleans this week are hoping to have a little fun and put on a great show. If anybody can do it, this crew can. CED

Have a comment?
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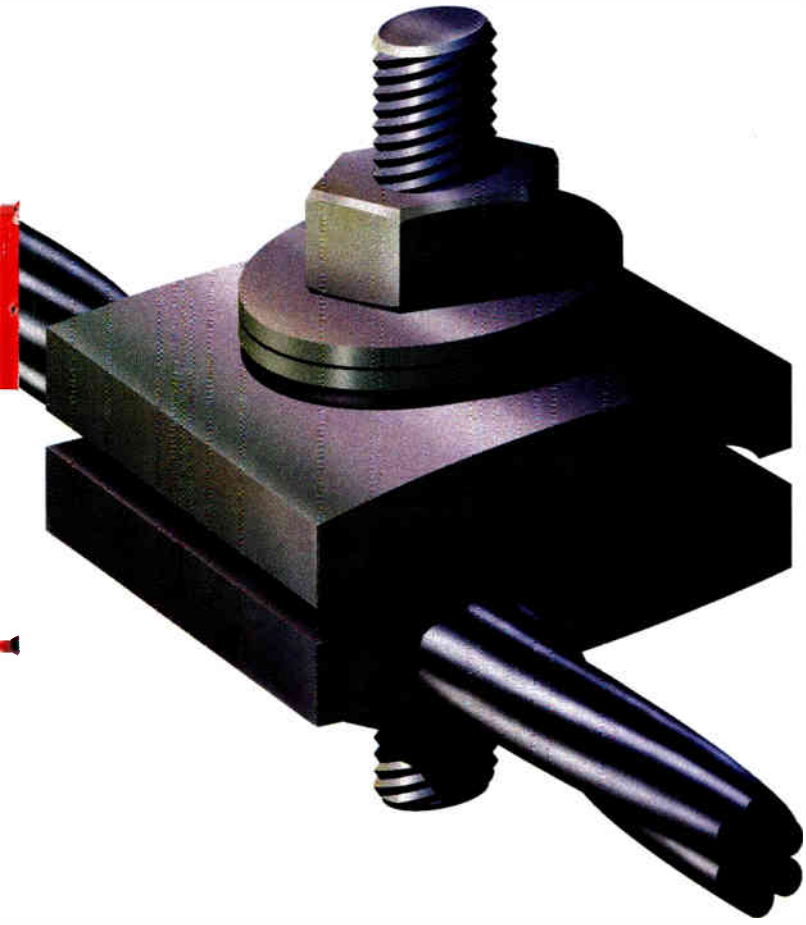

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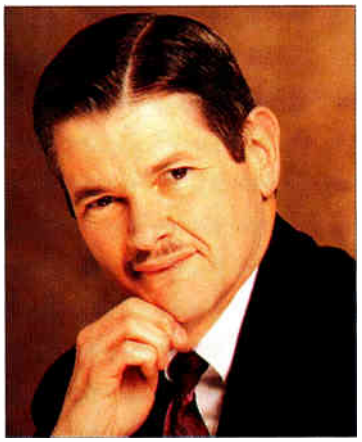

By Jim Farmer, Chief Technical Officer, Antec

The column planned for this month must wait. Last Friday, I heard the two discoverers of Comet Hale-Bopp talk, and I can't get what they said out of my mind. You surely know Hale-Bopp; its closest approach to the earth will be on March 22, 1997. By the time you receive this magazine, it should be bright in the evening sky.

For the rest of our time on earth

Tom Bopp spoke first, of how he discovered the comet on July 22, 1995. An amateur astronomer, he had planned a casual evening of stellar observation with a friend at a remote observing point (remoteness is a hazard of the hobby, because city lights are anathema to astronomers). He almost didn't go out that night, because his car wouldn't start.

If his father had not agreed to lend him his car, Bopp's name wouldn't be on the comet for the remaining time humans are on the earth.

That night, he was swinging his telescope around to another place in the sky because clouds were obscuring the area where he had planned to look. His buddy had taken a turn observing, and Bopp had started his turn. Being incredibly familiar with that piece of sky, Bopp knew something was wrong when he saw a bit of light where there should be none.

Had he not been observant, Bopp's name wouldn't be on the comet for the remaining time humans are on the earth.

Of the millions of objects visible in the heavens, Bopp couldn't be sure he hadn't forgotten something. He and his buddy consulted their charts to verify that they weren't forgetting about something that had been there all along. Had he not brought his charts with him that night, Bopp's name wouldn't be on the comet for the remaining time humans are on the earth.

That was when he began thinking that maybe he had found something. But of course, he needed proof. This required patient observation for a long period of time, to see celestial motion against the fixed stars.

After they were sure they had seen motion, Bopp was pretty sure he had a comet, but had no idea whether anyone else had reported it (the first to report a valid observation gets the credit). He had to drive home to call in his observation, because every attempt to phone before he got there ended in frustration. The phone was next to the bedroom, and his wife was irritated that he woke her for some silly phone call.

Had he not been persistent, Bopp's name wouldn't be on the comet for the remaining time humans are on the earth.

He collapsed into bed, only to be awakened in the morning by his wife saying, "Someone's calling about some comet thing." The call was to inform him that he had, indeed, discovered a new comet!

Dr. Alan Hale just happened to look in the same one degree or so of the sky that night. Again, being familiar with the region of space, he saw something unexpected. He was home, and simply sent in an e-mail report. Had he not been familiar with that part of the sky, had he not been observing that spot, and had he not questioned what he saw, Hale's name wouldn't be on the comet for the remaining time humans are on the earth.

This story reminded me that significant discoveries are often made by accident; someone was in the right place at the right time. But, just as importantly, the discovery is critically dependent on the observer's alertness and ability to question what he or she is seeing. This is true of the discovery of a comet, but it is just as true for the discovery of a leak in the plant, a bad cable or a loose connector.

My friend John reminded me that an engineer should never look at a waveform or a signal level unless he knows what to expect. If he doesn't see what he expects, he finds out why. If you are reading a signal level, know what it should be. If you read something else (outside of tolerance), then question why. The fact that the level is not as expected is probably trying to tell you something important. It may be that your understanding is wrong, but more likely, it is telling you that something is wrong.

When something's not working, listen to what it's telling you. I once heard of a tech who was trying to get a piece of two-way gear running. It ran fine at most locations, but the installation at one house wouldn't work, no matter what.

He got everyone all excited about the "fact" that the gear wasn't good enough to work at this particular house. Had our friend thought about what the symptoms were trying to tell him, he might have avoided the embarrassment he suffered later. He had forgotten to install the reverse module in one line extender.

Missing important clues

Often, we tend to concentrate so much on the problem that we are trying to solve, that we miss the solution, or we miss something that's even more important. We do much better work when we really know the job well, and when we think about everything we see, hear, feel and even smell. If it doesn't seem right, it probably isn't, and it had better be investigated. If you're observant, inquisitive, prepared with the proper materials and equipment, and persistent, you might not discover a comet, but you can clean up a picture. Your name might be on that repair for the remaining time humans are on the earth! Right. CED

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Standards, strategic value and the SCTE

In the past, I've written that technical standards are strategically important to companies because they can be used to achieve or maintain market leadership. But standards are also important to industries, because they can be used to maintain or to move industry boundaries and competitive relationships. This column explains the strategic value to the cable industry of the standards activities of the Society of Cable Telecommunications Engineers (SCTE). Although these activities have only been underway a short period of time, they have already produced extremely valuable strategic benefits to the industry in digital video transmission standards and cable modem standards.

By Jeffrey Krauss, technical standards strategist and President of Telecommunications and Technology Policy

Strategic role of standards

Technical standards are potentially very important to high-tech companies. In order to participate in a market, either your products must comply with existing standards, or you must be big enough and powerful enough (like Microsoft) to create your own de facto standards. A company that invents a new technology, and gets that technology adopted as a standard, wins in two ways. First, it can charge royalty fees to others that use its technology. Second, it has better technical know-how than its competitors because it has more experience using the technology, and can bring products to market sooner.

Standards that cut across industries can have important strategic implications both for the industries as well as for the companies within those industries. One recent example was the fight between the broadcasting and computer industries over interlace vs. progressive scanning. It might not have been apparent to everyone, but what they were really fighting over was eyeballs—viewership—not merely technical issues. The hottest new "product" on the Internet now is "Webcasting," a name given to services like PointCast that automatically gather information on topics that you select and deliver it to you along with advertising. It is customer-tailored, special-interest broadcasting. The computer industry believes you will be more likely to watch this computer industry product on your digital TV if the TV uses progressive scanning, rather than interlace scanning. But progressive scanning is more expensive for broadcasters, because progressive scanning cameras are more expensive than interlace. The industries will continue to fight that battle, in one forum or another, because it is strategically important to both.

Until recently, the cable industry didn't have an accredited standards organization to develop industry standards, but now it does—the SCTE. ("Accredited" means approved by the American National Standards Institute; approval requires that the standards development process be open to the public and no standards be adopted without "due process" procedural safeguards. In contrast, there are non-accredited standards bodies like DAVIC and the ATM Forum, which are open only to paying members.)

The SCTE really displayed its value to the cable industry when it adopted QAM as the modulation method for digital TV on cable. Remember the dispute between VSB and QAM modulation for digital video transmission? Broadcasters will use VSB because that's what the Advanced Television Standards Committee (ATSC) adopted, but cable can use higher order QAM modulation because it operates within a better-controlled closed transmission medium. As a strategic matter, cable TV could have been hobbled by a requirement to use the more robust but less efficient modulation required by the noisy, hostile, over-the-air transmission medium. Cable TV capacity would have been constrained, and cable's ability to innovate would have been stifled.

A dispute existed so long as it was merely a few large cable operators who said they wanted to use QAM. Once the SCTE adopted QAM as a standard, QAM had a "seal of approval." The dispute went away. It was that simple. Nobody can argue with a standard that has been adopted by an accredited standards body. This is particularly true at the FCC, where the current philosophy is that technical standards should be developed by industry, not by the government. The FCC is not about to create a fight between two industries, with itself in the middle.

Similarly, the SCTE has played an important role in cable modem standards. Until recently, cable modem standards were being developed by a committee sponsored by the IEEE and dominated by computer industry interests. While they may have understood the strategic significance of a cable system's large bandwidth, the IEEE failed to appreciate the problems of the return channel or the value of commonality of components with digital video equipment. Nor did they ever consider that the cable industry might decide not to implement technical solutions thrust upon it by outsiders. Now that the SCTE has taken the lead in cable modem standards, downstream specs have been adopted having much in common with digital video standards. More work is needed on the return channel, and perhaps a single standard is too much to hope for. But at least the work is in the right hands.

The SCTE has more work to do, particularly in digital video standards. Not all the specifications for the digital broadcasting signal are appropriate for cable. For example, according to the ATSC standard, emergency messages are carried on digital broadcast signals in a way that would require complex equipment to perform insertion of the messages at cable headends. A simpler, more reliable approach is under review at the SCTE. Another area that the SCTE might look at is a user-friendly way to number and navigate around the multiple standard definition video programs that are carried within a digital TV channel.

Meanwhile, the strategic value that the SCTE has achieved for the cable industry in less than a year is quite remarkable. If they keep it up, the SCTE's management and the standards committee chairmen will deserve the highest accolades from the industry. CED

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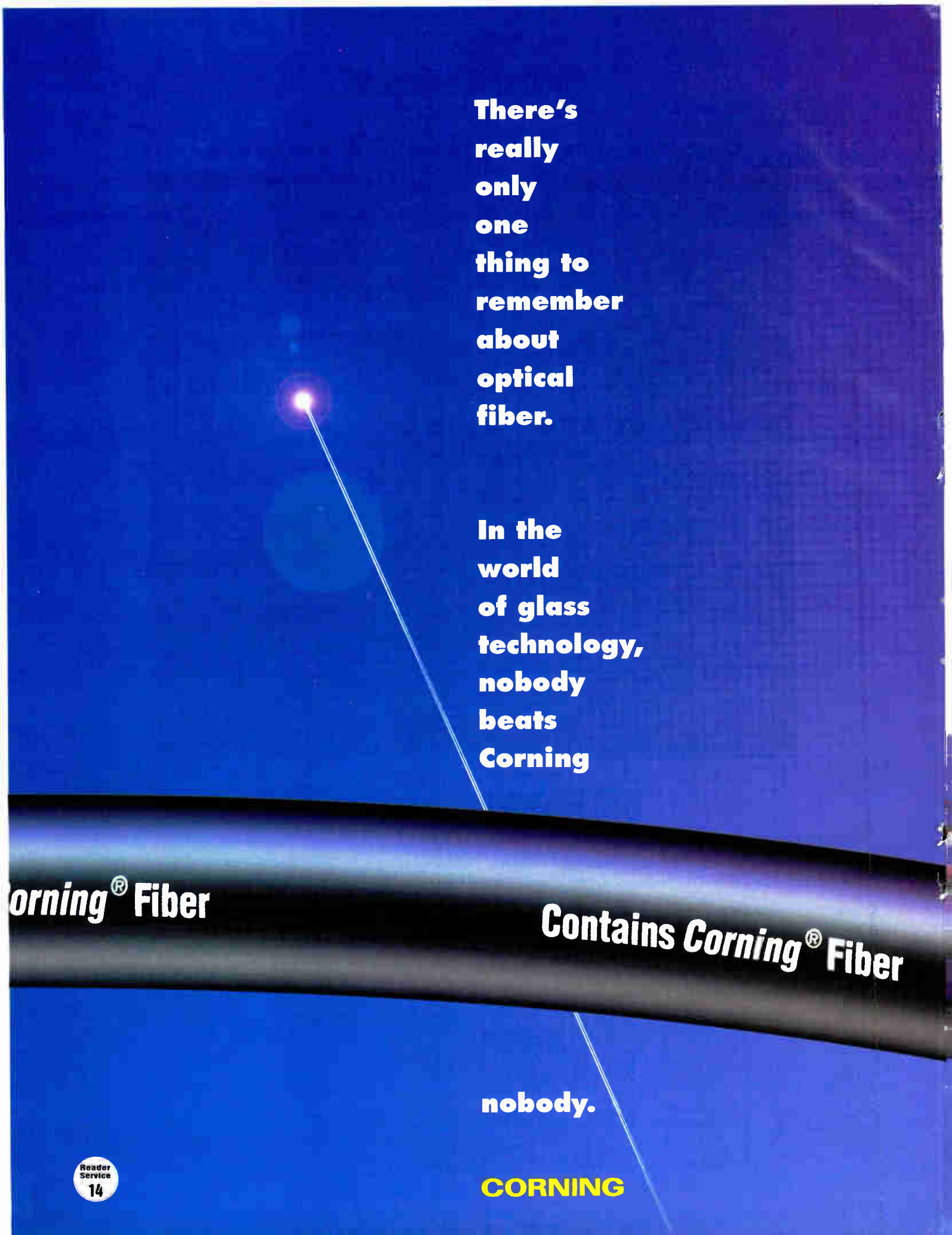
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We may now define an RMS modulation index, μ, analogous to that used for forward traffic [2-4].

$$\mu = \sqrt{\sum_{i=1}^{N} \frac{m_i^2}{2}} \qquad (5)$$

Statistical model of the reverse signal

It has been shown [5-6] that the probability density function, $p_i(I)$, and characteristic function, $\Phi_i(\omega)$, of the signal current of the form associated with *i*th subcarrier are given by

$$p_i(I) = \begin{cases} \dfrac{1}{\pi\sqrt{A_i^2 - I^2}} & -A < I < A \\ 0 & other \end{cases} \qquad (6)$$

$$\Phi_i(\omega) = J_0(A_i|\omega|) \qquad (7)$$

where J_0 is the Bessel function of the first kind of index zero. The composite density function, $p_{comp}(I)$, is given by

$$p_{comp}(I) = p_1(I) * p_2(I) * \ldots * p_N(I) = \frac{1}{2\pi}\int_{-\infty}^{\infty} \Phi_{comp}(\omega) e^{-j\omega I} dw \qquad (8)$$

where * represents convolution in the *I* domain and $\Phi_{comp}(\omega)$ represents the composite characteristic function, given by

$$\Phi_{comp}(\omega) = \prod_{i=1}^{N} \Phi_i(\omega) = \prod_{i=1}^{N} J_0(A_i|\omega|) \qquad (9)$$

A graph of a sample composite density function is shown in Figure 1(b). Numerical methods may be used to evaluate $p_{comp}(I)$. Either convolution of the individual $p_i(I)$'s or inversion of the composite characteristic function may be used for this evaluation.

Once the composite density function is calculated, it is possible to determine the probability that the peak value of the composite current will exceed a given limit.

Clipping occurs when the peak negative excursion of I_{comp} exceeds I_B-I_{TH}, as shown in Figure 1(a). The probability of laser clipping, P_C, may be determined by

$$P_C = \int_{-\infty}^{-I_0} p_{comp}(I) dI \qquad (10)$$

Consider the output of the optical link. This output results from the detection of the laser output optical signal and is composed of the desired signal plus clipping noise and broadband link noise. For simplicity of analysis, we have assumed that below clipping, the link has unity current gain. The pdf of the desired output is identical to $p_{comp}(I)$, as shown in Figure 1(c). It has been shown in [5] that the pdf resulting from the output of a hard limiter (such as the laser transfer characteristic) consists of a truncated version of the input signal pdf plus an inpulse of amplitude equal to the area under of the deleted portion of the input signal pdf. If we apply this technique to the components of the optical link output, we find that the pdf of the clipping noise signal, p_{clip}, is given by

Assume clipping noise power falls with a flat spectral density across the passband

$$p_{clip}(I) = [p_{comp}(-I - I_0) \cdot U(I)] + \left[\delta(I)\left(\int_{I_0}^{\infty} p_{comp}(I) dI\right)\right] \qquad (11)$$

where $U(I)$ is the unit step function and $\delta(I)$ is the unit impulse function. A sample clipping noise pdf is shown in Figure 1(d).

The ratio of composite output signal power to composite output clipping power, (*P/C*), is given by

$$\left(\frac{P}{C}\right) = \frac{\int_{-\infty}^{\infty} I^2 p_{comp}(I) dI}{\int_{-\infty}^{\infty} I^2 p_{clip}(I) dI} \qquad (12)$$

Based on the nature of the digital modulation used for reverse system traffic [7-8], we assume the clipping noise power falls with a flat spectral density across the passband of the reverse signals. We define Γ as the ratio of clipping power that falls within the reverse signal band (typically 5 MHz to 40 MHz for subsplit systems) to the total clipping power.

The individual carrier-to-clipping distortion ratio of the ith subcarrier, CND_i, will be given by

$$CND_i = \frac{1}{\Gamma}\left(\frac{P}{C}\right)\left(\frac{BW_{REV}}{BW_i}\right)\left(\frac{P_i}{\sum_{k=1}^{N} P_k}\right) \qquad (13)$$

where BW_{REV} is the reverse signal bandwidth. Now consider the broadband link noise, N_0, in watts per Hz. The primary sources of this noise are laser relative intensity noise (RIN), shot noise and receiver noise current. The carrier-to-link noise ratio of the ith subcarrier, CNL_i, will be given by

$$CNL_i = \frac{P_i}{(BW_i)(N_0)} \qquad (14)$$

From equations (13) and (14) it can be seen that CNL_i increases and CND_i decreases as RMS modulation index, μ, increases. CND_i and CNL_i may be used in conjunction to determine the overall carrier-to-noise ratio, CNR_i.

A typical example

Consider the case of reverse subcarriers consisting of one high-speed data carrier (QPSK at T-1 rate with BW=1 MHz) and 25 telephony carriers (QPSK at 72 kbps with BW = 50 kHz). The subcarriers are transmitted across an optical link with broadband link noise at a level of -122 dB/Hz with respect to a single carrier with peak current I_0. We choose a level for the data carrier that is 19 dB higher than that of the individual telephony subcarriers. This difference in level is based on two factors. The first factor is the relative bandwidth of the carriers and results in an amplitude difference of 13 dB. The second factor results from the combining of the outputs of multiple reverse optical receivers in the headend. For economic reasons, it is desirable to use certain individual reverse signal demodulators to receive signals from multiple optical nodes.

A similar analysis was done with 25 equal amplitude telephony carriers

Consequently, the RF outputs from multiple optical receivers may be combined before demodulation. In our example, we assume that the outputs of four optical receivers are combined before demodulation. The resulting noise funneling dictates a carrier power increase of 6 dB. The overall difference in carrier power thus becomes 19 dB.

For the purposes of the analysis in this article, we have utilized a technique developed by Mazo in [9] to determine the amount of clipping distortion power that falls within the reverse signal band. A typical result from the Mazo technique is Gamma = 0.475 for the 5 MHz to 40 MHz subsplit band when $\mu = 0.3$. However, an error is introduced by the use of the Mazo technique because of its assumption that the input signal has a flat power spectral density. A Monte Carlo simulation of the clipping noise and the associated power spectral density was carried out for this example to determine the magnitude of this error. The error was analyzed from $\mu = 0.1$ to $\mu = 2$. The worst-case error of 20 percent (< 1 dB) occurred at $\mu = 2$.

The resulting composite probability density function of this scenario is shown in Figure 2. A technique proposed by Shi [2] is used to determine bit error rate (BER). BER vs. RMS modulation index, μ, is shown in Figure 3. Based on this figure, a range of acceptable μ may be determined for a given BER requirement.

A similar analysis was done with 25 equal amplitude telephony carriers. The resulting composite pdf and BER are shown in Figure 4. The composite pdf does indeed approach Gaussian. Therefore, in this case, the Mazo technique of determining (will result in no error.

The BER curve for this example differs substantially from that of the previous example. Clearly, the Gaussian pdf assumption that is normally applied to forward path subcarriers gives an incorrect result when applied to certain combinations of reverse path subcarriers.

Figure 2: *The composite probability density function resulting from one high-speed data carrier and 25 telephony carriers. The high-speed data carrier is at an amplitude 19 dB higher than the individual telephony carriers. Note that this pdf is clearly* not *Gaussian.*

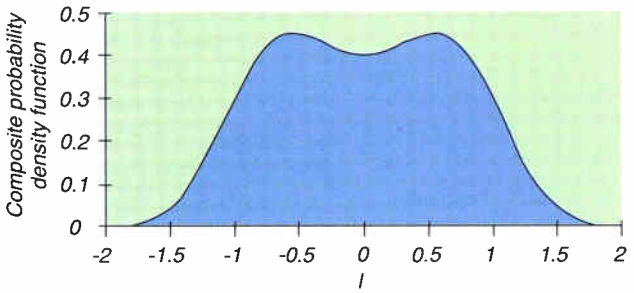
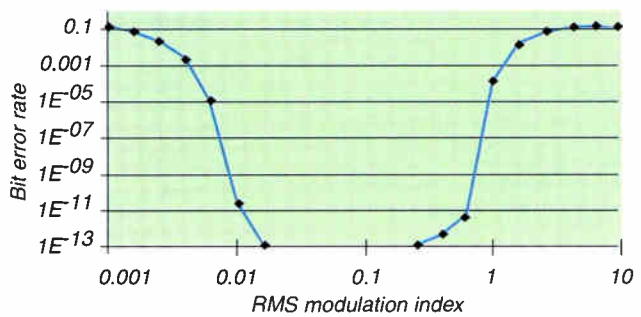


Figure 3: *BER vs. RMS modulation index (μ) for a link carrying one high-speed data carrier and 25 telephony carriers. The predominant factor limiting performance when μ is less than 0.01 is broadband link noise. The predominant factor limiting performance when μ is greater than 0.15 is clipping noise.*



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This technique permits the generation of a more accurate probability density function model

Ingress considerations

The introduction of additional signal loading by ingress must also be considered in the design of the HFC reverse path. A detailed study of the reverse path ingress problem has been carried out by CableLabs Inc. [10]. This study indicates that the ingress consists of both narrowband interference and electrical impulse noise.

Shi has proposed a technique in [11] to consider the effects on ingress in modeling the reverse path. Shi suggests that the equations given in [2] be modified by replacing the overall RMS modulation index by $\mu = \mu_c + \mu_I$, where μ_c is the composite signal RMS modulation index, and μ_I is the overall RMS modulation index of the ingress interference across the upstream spectrum. The total signal-to-noise (Gaussian background noise plus ingress noise) is given by

$$\Gamma^{-1} = \Gamma_g^{-1} + \beta\Gamma_I^{-1} \qquad (15)$$

where Γ_I represents the carrier-to-ingress noise ratio, and β represents the fraction of ingress noise power that falls within the band of interest.

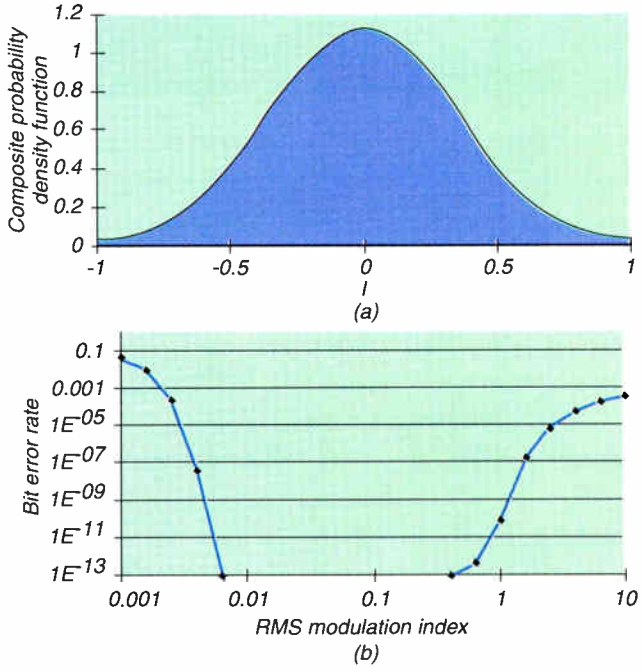
Conclusion

It has been shown that it is inappropriate to use a Gaussian probability density function to model the subcarriers and to predict levels of clipping in the reverse optical link of HFC networks where the number of subcarriers is small, or a small number of subcarriers may take on amplitude significantly greater than the remaining subcarriers.

A technique has been shown that permits the generation of a more accurate probability density function model and the determination of bit error rates based on this pdf.

An examination of the bit error rate (BER) requirements and predictions for each type of traffic will yield a range for the RMS modulation index that is optimum. CED

Figure 4: *Probability density function vs. I and BER vs. RMS modulation index (μ) for a link carrying 25 equal amplitude telephony carriers. Note that the pdf is substantially different than that shown in Figure 2. Similarly, the BER curve differs from that shown in Figure 3.*



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Reader Service 18

The 'four 9s': More style than substance?

It's within reach, but is it needed?

By Roger Brown

It's every cable operator's nightmare: It's Super Bowl Sunday. Millions of viewers are camped out in front of their TVs. Parties have been organized around what is arguably the premier TV event of the year. Then the cable goes out.

A scene like that could cost a cable company dearly in its fight for respectability in the customer service war, undoing several years of efforts to improve network reliability, picture quality and service levels. It's the type of problem newspapers and TV stations love to report, and contributes to cable's image as an outage-plagued service.

It doesn't have to be that way. Improved products and components, fiber-rich architectures, back-up power supplies and new policies and craft procedures are now putting the 99.99 percent reliability benchmark within a cable operator's grasp. But is that important? Do cable systems have to actually reach that lofty mark to be perceived as reliable? And where did this perhaps unrealistic goal come from, anyway?

Addressing the latter question first, the 99.99 percent figure came from specifications written by Bellcore as a goal that manufacturers should engineer their equipment to achieve. But the number was chosen arbitrarily as opposed to being mandated by either government regulation or carrier request.

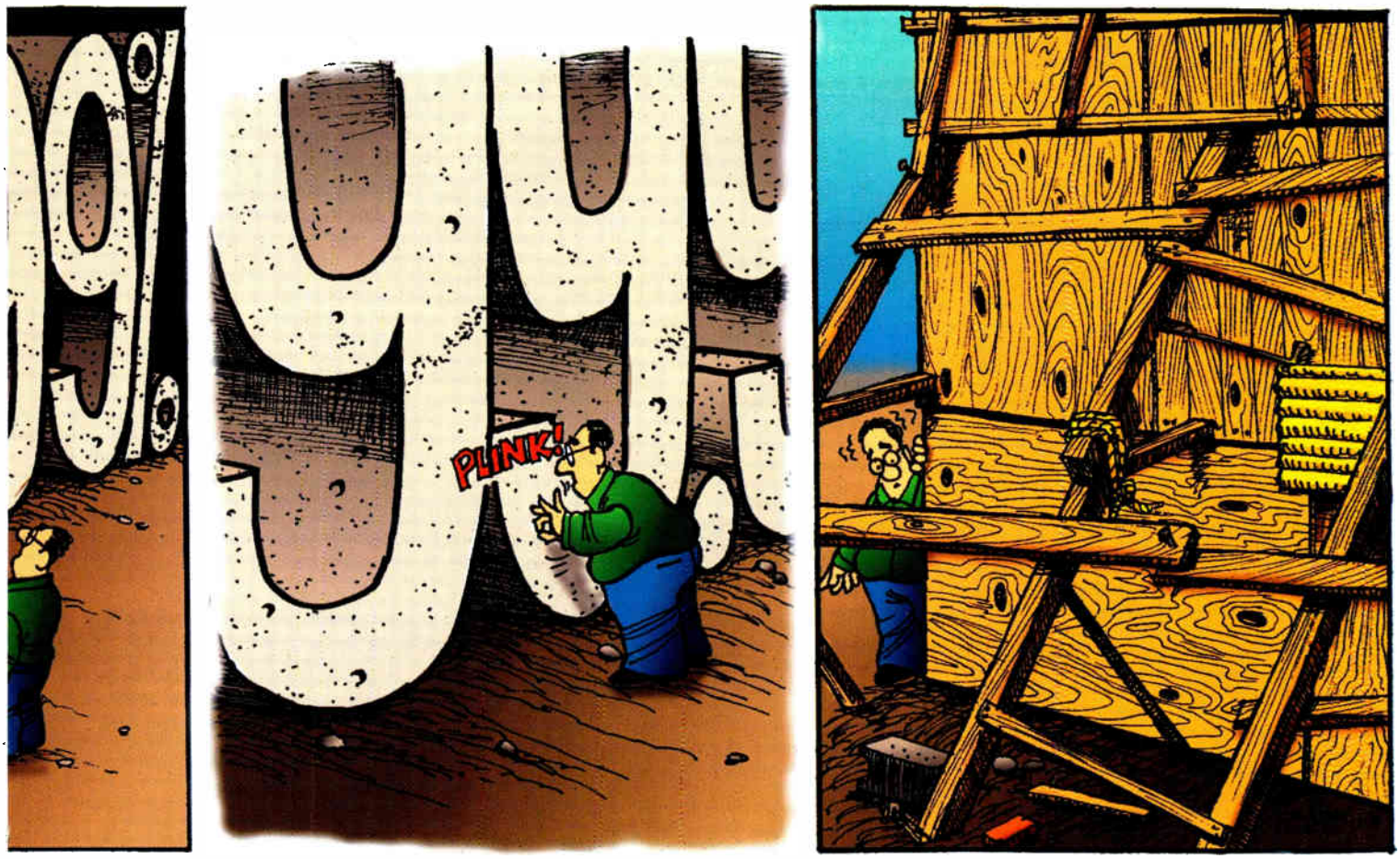
Nevertheless, the telephone companies have done a masterful job of implying that their networks routinely reach the "four 9s," but in reality, they probably don't even come close to achieving that mark, which equates to 53 minutes of outage time per year. No one outside of the telephone companies knows for sure, because they're not required to report overall availability figures to anyone.

In fact, when measuring system availability, telco mathematicians factor out the network switching fabric, as well as the customer premise equipment. Problems with commercial power also don't count. And the clock doesn't start ticking until the first customer calls to report an outage.

The cable industry, on the other hand, is faced with a number of challenges before it will ever be perceived as a reliable network. First, people watch TV much more than they use the telephone, so they're more likely to notice a cable outage. If there's a problem with the phone, the caller is greeted with a fast busy signal and simply redials to re-establish a conversation; but with a TV outage, the viewer has forever missed a portion of the event.

Research and some early studies of cable systems has shown that significant strides can be made in network availability by shoring up four major areas: plant power, network architecture, replacing aging coaxial cable and simply altering craft practices and procedures to be more mindful of their effects on the plant.

By far, the biggest bugaboo for operators is power. Commercial power quality varies greatly by location,



and many areas are prone to short outages that might go unnoticed by consumers, but can interrupt bitstreams or telephony conversations.

"Most of our outages are of short duration," notes Tony Werner, vice president of engineering at TCI Communications. That's where strategically-placed standby power units come into play. "A lot of times, just by converting 10 percent to 15 percent of your plant to standby power, you can make a huge impact."

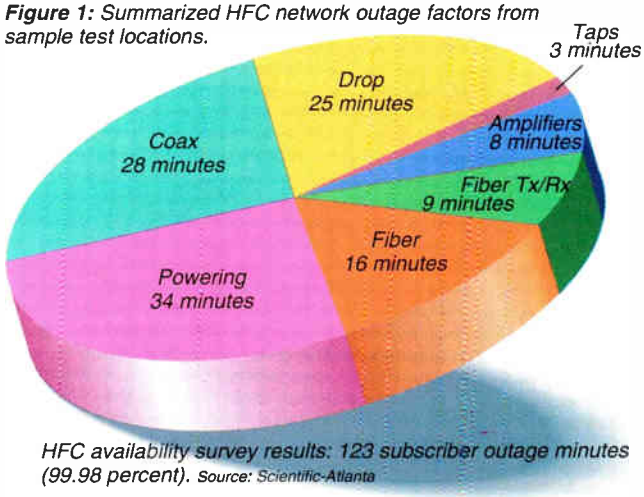
But adding standby power is just half the equation. Proper maintenance of the batteries that are used for backup is critical, too. Engineers contacted for this article routinely tell of stories where the standby unit kicked on properly, but the batteries were either dead, or so weak that they offered no backup. One person even said that he knows of cases where batteries were removed to be serviced and then never returned to the cabinet.

Other power-related issues include proper grounding and bonding, using surge arrest devices and proper documentation, according to Tim Wilk, director of strategic planning and technology at Scientific-Atlanta.

In late 1995, S-A undertook a study of three large, two-way active hybrid fiber/coax (HFC) networks that were located in different parts of the country. The sample areas covered about 3,600 miles of plant (3,000 miles of coax, and 600 miles of fiber) and passed about 375,000 homes. All had been recently upgraded, and management at each system emphasized good repair and maintenance.

"We were flat surprised at the level of reliability these guys were already achieving," says Wilk. On average, the three systems were achieving 99.98 percent availability. Translated to outage time, these systems were only off-the-air for about 123 minutes per year. The main outage culprits were power-related failures (27 percent), followed closely by hard-line coax and drop failures (see

Figure 1: *Summarized HFC network outage factors from sample test locations.*



HFC availability survey results: 123 subscriber outage minutes (99.98 percent). Source: Scientific-Atlanta

Table 2: *Availability sensitivity analysis summary.* Source: S-A

	Typical MSO design	LEC full-service design
Measured outage minutes	123 minutes	123 minutes
Design improvements:		
Node-size reduction to 500 HP	48	48
Power improvements	4 (with 3-hour stand-by)	9 (centralized generator)
New coax	4	4
Redundant fiber system	–	12 (fully redundant)
Drop improvements	16 (MTTR and 50% fiber connection)	18 (MTTR and 75% fiber connection)
Net minutes improved	72 minutes	91 minutes
Projected subscriber outage time	51 minutes	32 minutes

These NOCs will enforce change control procedures for all network maintenance activities and make sure that service restoration is being performed within the prescribed timeframes–all while continuously tracking and reporting network performance.

Generally, it's safe to say that most cable operators track outages and their root causes, but few see a need to quantify network availability on a percentage basis. In fact, while overcoming outages is a high priority for most cable systems, most don't have the software or modeling information it takes to quantify how they're doing, according to Wilk at S-A. Equipment manufacturers and some consulting companies can take the raw data and come up with a number, but the formulas are not typically available off-the-shelf.

Reaching 99.99 percent availability "is a goal that most (MSOs) are talking about, but it's not driving their day-to-day business," notes Wilk. "Most operators have a ton of data about outages, but no idea how to convert it into availability figures." Not that they need to. Outside of using it to gain a competitive advantage against telephone companies and other competitors who tout their reliability, there is currently no reason to calculate network availability. But then, even the telcos don't do a good job of it–because they don't have to.

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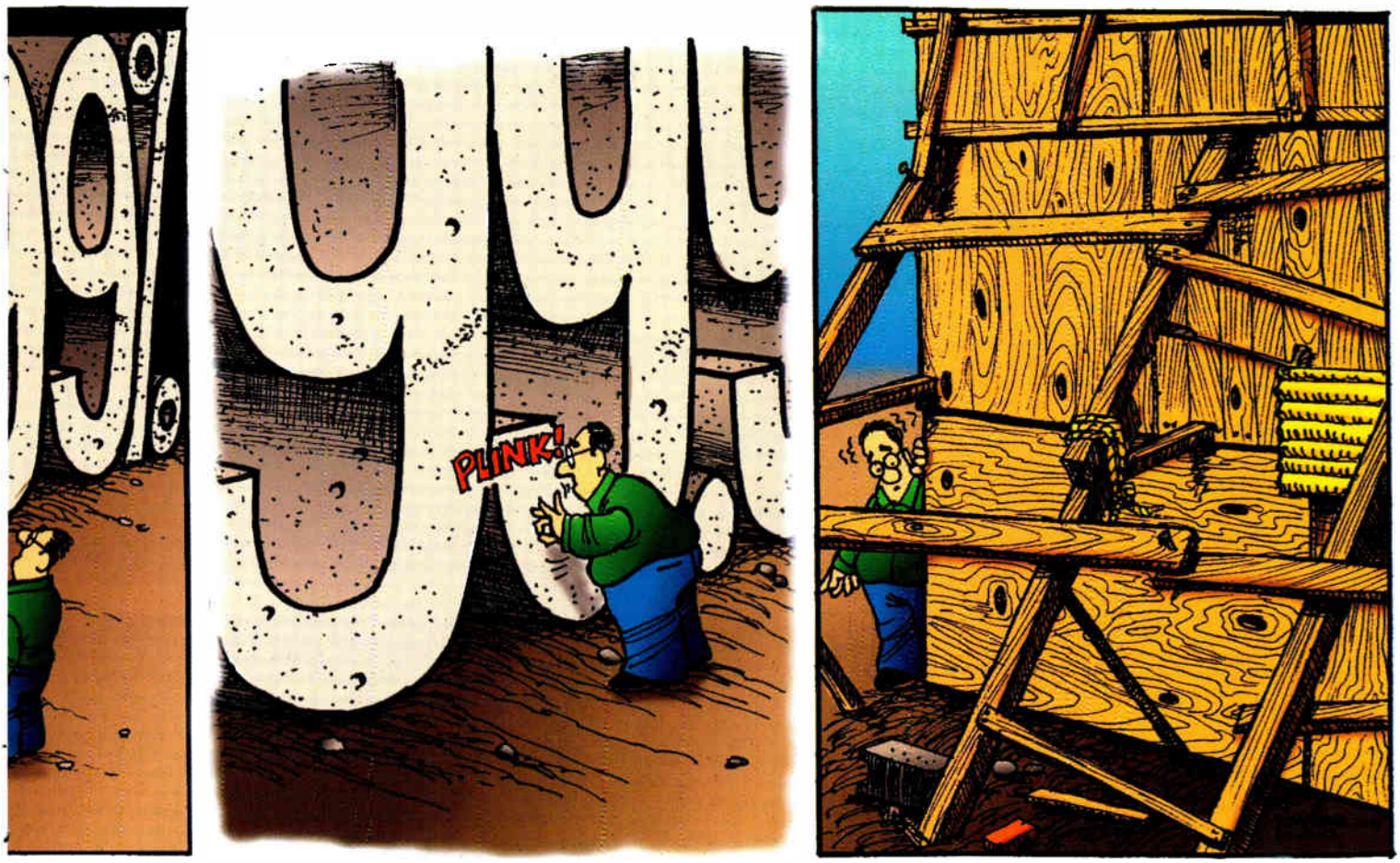

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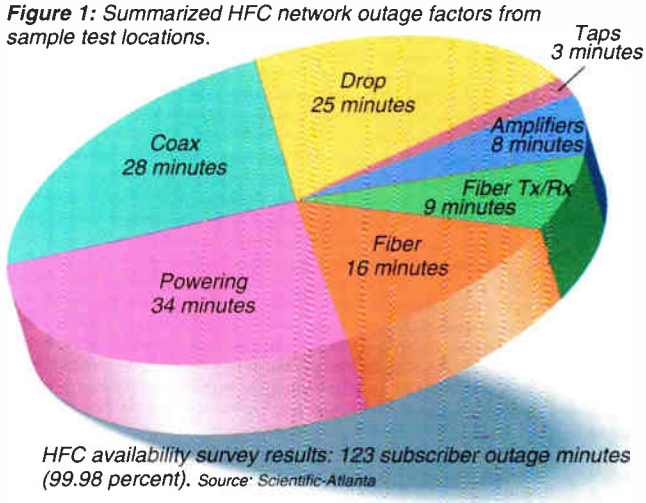

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Figure 2: *From the point-of-view of a single customer the reliability model for typical HFC plant would look like this.* Source: AD Little.

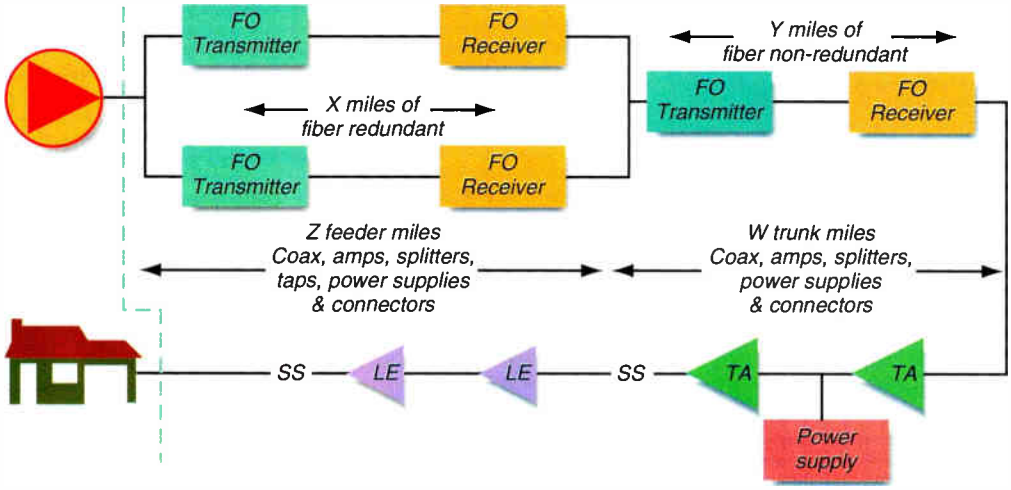

Figure 1). "It's surprising how many times per year that commercial power just isn't there," summarizes Wilk.

Although those availability figures were good (and some would argue were abnormally high), Wilk was able to identify some areas, outside of the addition of standby power, where significant improvements could be made. One chief area was reduction of node sizes.

By reducing node sizes to roughly 500 homes, the downtime of all components within a node could be reduced by 39 percent, according to a model that examines component failure rates and mean time to repair statistics for network devices in an HFC network. Why? Primarily because the reduction in node size eliminates the need for a second power supply.

Taken together, Wilk's research and modeling shows that HFC networks as presently architected for cable-TV applications can indeed be brought up to 99.99 percent availability (see Table 2).

Similar work performed by Arthur D. Little that excludes power from the equation shows that fiber transmitters and receivers are also major contributors to downtime (see Figure 3). But with power as the biggest cause of outages, HFC operators must use backup power to achieve the Bellcore benchmark of 99.99 percent. In fact, according to a presentation made by AD Little's Stu Lipoff during the SCTE/IEEE HFC '96 reliability conference last fall, HFC network operators would need in excess of 12 hours of backup power to meet the 53 minutes per year goal.

North of the border, Rogers Cablesystems undertook a year-long outage study of its system in Newmarket, Ont., where the Rogers "Wave" data service was rolled out. As outlined by the Canadian Cable Television Association's guidelines, the goal for Wave service availability, after accounting for all service interruptions, is 99.9 percent, or a maximum of 525 minutes of downtime per year. Eventually, the goal is to reach 99.99 percent reliability.

While the results of the Newmarket availability study were mixed, Rogers officials seem to be encouraged. Network availability ranged from a low of 99.13 percent to a high of 100 percent. Annualized, the network achieved 99.79 percent availability, or nearly 1,100 minutes of downtime for the year.

Factored into the availability calculations were outages caused by network maintenance, new plant construction activity, headend and fiber-related equipment failures, trunk and distribution failures, reverse noise and power failures.

A high percentage of downtime was attributable to human intervention. In Rogers' case, maintenance activities accounted for 21 percent of all incidents resulting in network downtime. Although Wave scheduled maintenance is restricted to Sundays between 2 a.m. and 6 a.m., it still accounted for much of the downtime. Other major contributors were trunk and distribution problems (24 percent), power outages (22 percent) and excessive reverse path noise (15 percent).

Of course, one key component to limiting outage time is mean time to repair (MTTR) statistics. The faster an outage is detected and service is restored, the better. Rogers' track record was, generally, quite good, but was skewed by a single construction-related incident that caused a three-day outage. But that was clearly an anomaly: roughly 70 percent of all equipment failures that caused outages were repaired in less than one hour.

Although the Rogers network is one of the few that is actively supervised by a sophisticated network management system, executives there have realized that a new model for network management must be implemented to reach high reliability levels. To gain improvements, Rogers intends to establish a network of regional network operations centers to monitor the HFC network.

Table 1: *Summary of annual failure rates and mean time to repair.* Source S-A

	Southeast		Northwest		Northeast		Average	
	AFR	MTTR	AFR	MTTR	AFR	MTTR	AFR	MTTR
DFB transmitters and receivers	15.1%	1.6	2.7%	0.2	3.7%	2.2	7.1%	1.3
Fiber cable and passive (miles)	2.1%	1.1	1.4%	16.0	1.2%	1.7	1.6%	6.3
Optical node	6.2%	1.0	8.3%	0.3	3.0%	1.8	5.8%	1.0
Power supplies	10.7%	0.8	3.6%	1.2	11.7%	1.1	8.7%	1.0
Power company power outage	24.0%	1.0	30.4%	1.0	3.9%	1.1	19.4%	1.0
Amplifiers	3.1%	1.2	2.6%	0.5	2.8%	1.0	2.8%	0.9
Coax cable (miles)	1.6%	1.4	9.3%	1.0	36.3%	1.2	15.7%	1.2
Taps	0.02%	0.8	0.3%	0.5	0.2%	0.8	0.2%	0.7

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In preparation of a paper he presented during the 1996 SCTE Conference on Emerging Technologies, TCI's Werner sought information about how the local telephone companies actually perform against their

own objectives. He came up mostly empty.

The FCC and PUCs mostly gather data about lengthy outages and how quickly installations are performed, and the local companies, while acknowledging they didn't actually get four 9s, were reluctant to offer much else.

According to one Bellcore document, digital loop carrier availability in 1988 was reported to be equal to 99.94 percent availability, or about 316 minutes of downtime, Werner says. And that number, it should be noted, did not factor in any power-related failures.

To sum up, it's clear that cable's HFC networks are capable of providing high service levels, even when compared against a telephone network, which is actually used only about one-tenth as much. But there are additional strides that can be made, in both powering and internal maintenance policies. The former can be addressed with standby powering, use of better components, improved grounding and bonding and fusing. The latter will require diligence, strong policymaking, documentation and training–and perhaps improved network monitoring.

"With surveillance technology, we know if a technician interrupts the communication path," notes Werner. "Without it, you don't know that a tech is out there, pulling a pad or something."

But all those people gathered to watch the Super Bowl sure will. CED

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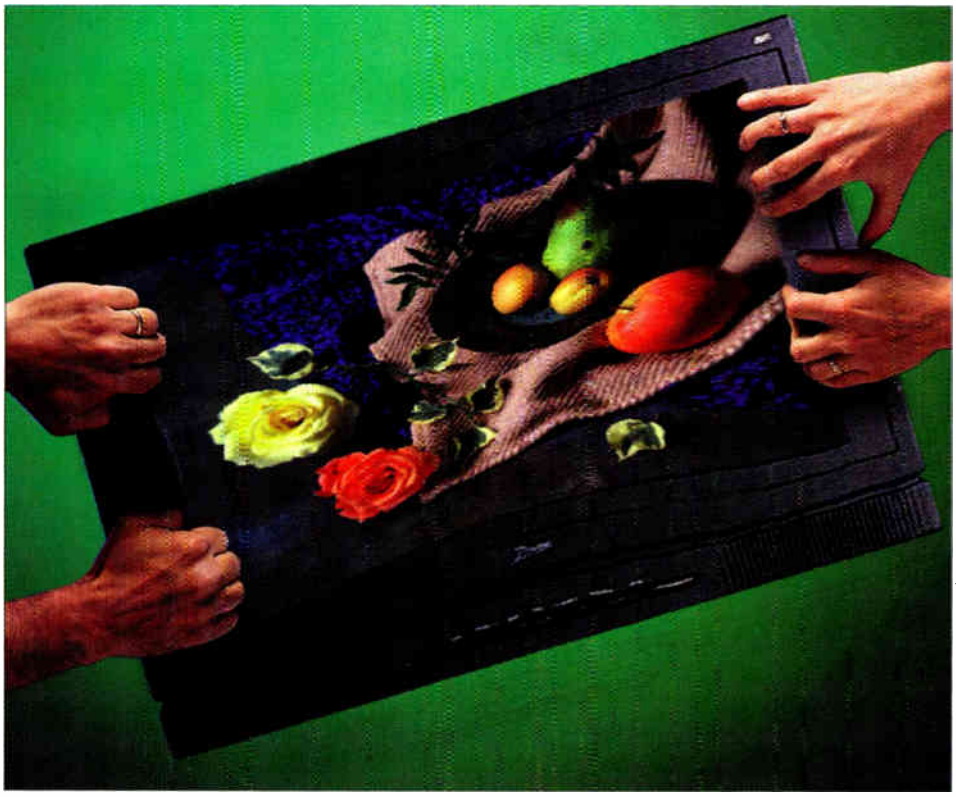
Figure 3: *Failure rates are based on a composite of field data from several sources, while repair times are based on discussions with several MSOs not using status monitoring.*

Component	Failure rate (%/year)	MTTR/HE (Hours)	MTTR/Plant (Hours)
FO transmitter	2.33	1	2.5
FO receiver	1.396	1	2.5
Fiber/mile	0.439		4.5
Trunk amps	0.514		2.5
LE amps	0.599		2.5
Split/coupler	0.13		3
Tap	0.13		3
Hard connector	0.28		3.68
Coax/mile	0.439		3.5
Power supply	2		2.5

Source: AD Little



HANDS PHOTOGRAPHED BY DON RILEY, DESIGNED BY DON RUTH

Stretching the HDTV envelope with a standard

Nagging regulatory, technical issues still exist

By Michael Lafferty

Depending on one's view, the FCC's Christmas Eve ruling on a high definition television (HDTV) standard was either the tastiest gift the telecommunications industry received this past holiday season, or it is a recipe that is doomed to failure because it has been spoiled by too many cooks in the HDTV kitchen these past nine years.

Not surprisingly, those involved with the North American research consortium that developed the standard (the Digital HDTV Grand Alliance) claimed it as a "major victory for American television viewers." Speaking with one voice, as alliances are prone to do, the Grand Alliance partners—General Instrument Corp., Lucent Technologies, the Massachusetts Institute of Technology, Philips Electronics North America Corp., the David Sarnoff Research Center, Thomson Consumer Electronics and Zenith Electronics Corp.—boasted the FCC's approval of the Alliance-based standard "means that the United States has entered the digital television age, and will lead the world toward delivering the benefits of the technology for consumers."

Yet, there are those who take issue with this "innovative and uniquely flexible system," as the Alliance describes it. Dale Cripps, publisher and editor of the HDTV Newsletter (http://web-star.com/hdtv/hdtvnews.html/), has been following the HDTV saga for nearly a decade and doesn't believe it's such a clear-cut victory for those involved in the effort, or more importantly, for consumers in general.

"Let's put it this way," states Cripps, "you can be a real schizophrenic character with this standard. You can take the public line of the (television set) manufacturers, broadcasters and even the computer people, which is 'Well, we've all won on this one.' But, what they've won is a very vulnerable position for everybody."

While some may dispute various HDTV standard particulars, most agree its wide-ranging flexibility, especially when it comes to the conflicting (and non-mandated) video formats, puts a great deal of faith in the forces of the marketplace.

And that marketplace, says Cripps, has a massive vested interest in the NTSC status quo. That represents a massive installed base (with an average of 2.7 televisions in 98 percent of American homes) that is fueled by sales of 25 million television sets a year, representing an $8.5 billion market.

With such a massive monetary stake in this entrenched market, and with no real grasp on how much the HDTV conversion is going to cost, let alone how it will be accepted by the public, it's no wonder those involved are just beginning to inch forward along the HDTV path. While the FCC's ultimate anointing of the standard may have finally given HDTV the push it needs to get started, the path is far from smooth.

A flexible standard?

For some, the idea of a flexible standard is an oxymoron. For many in the telecommunications industry, a flexible HDTV standard not only makes perfect sense, it's a prerequisite if the new technology is to succeed.

The American effort in HDTV started in 1987 as a knee-jerk reaction to Japan's development of the "MUSE" system, an interlaced, 1,125-line HDTV system that was being proposed as a worldwide standard for the next generation of television. That year, at the request of American broadcasters who feared Japanese domination of a fundamental new technology, the FCC initiated its HDTV rulemaking and created the Advisory Committee on Advanced Television Service (ACATS) to recommend a broadcast standard.

The various factions within the telecommunications industry who felt they had a vital self-interest in the outcome, began weighing in on the issue. It wasn't long before terrestrial broadcasters, cable operators, consumer electronics manufacturers, computer manufacturers and even Hollywood movie interests started drawing lines in the digital sand, staking out their various areas of concern.

By September 1988, ACATS had 23 system proposals (with six actually building prototype hardware) on its desk. In 1990, General Instrument became the first to announce an all-digital system. It wasn't long before others (MIT, the Philips/Thomson/Sarnoff consortium, and Zenith/AT&T) joined the high definition fray with their own versions of an all-

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digital HDTV system.

In 1991 and 1992, six systems (including the four all-digital systems) underwent extensive testing at the Advanced Television Test Center (ATTC) in Alexandria, Va. Testing participants included CableLabs, which tested the systems over a cable test bed at the ATTC, and the Advanced Television Evaluation Laboratory in Ottawa, Canada.

In 1993, ACATS limited itself to studying the four all-digital systems. They also encouraged the remaining participants to find a way to merge their four systems into one "best-of-the-best" system. By late May that year, the Digital HDTV Grand Alliance was formed to carry out the consolidation task.

By March 1995, the Grand Alliance had a combined system ready for testing at the ATTC facility. After eight months of exhaustive tests, ACATS unanimously recommended that the FCC adopt the entire Advanced Television Systems Committee (ATSC) standard based on the Grand Alliance system as the basis of a new digital television broadcast standard for the United States.

Finally, after a tentative approval in May 1996, the Commission gave its final OK on Christmas Eve this past year. What have the Grand Alliance and the FCC wrought?

✔ The Grand Alliance/ATSC standard will feature a digital compression system based on MPEG-2 (Moving Pictures Experts Group) Main Profile parameters, including the use of B-frames.

✔ Likewise, the approved standard includes a packetized data transport system that allows for the transmission of virtually any combination of video, audio and data packets that will concentrate on features and services of MPEG-2 that are applicable to HDTV and provided for in the MPEG-2 transport layer.

✔ The approved standard will employ the 5.1-channel Dolby AC-3 audio technology.

✔ The Grand Alliance settled on the modulation subsystem developed by Zenith Corporation. The 8-VSB (vestigial sideband) transmission technology, says proponents, assures a broad HDTV coverage area, reduces interference with existing analog broadcasts and provides immunity from interference into the digital signal.

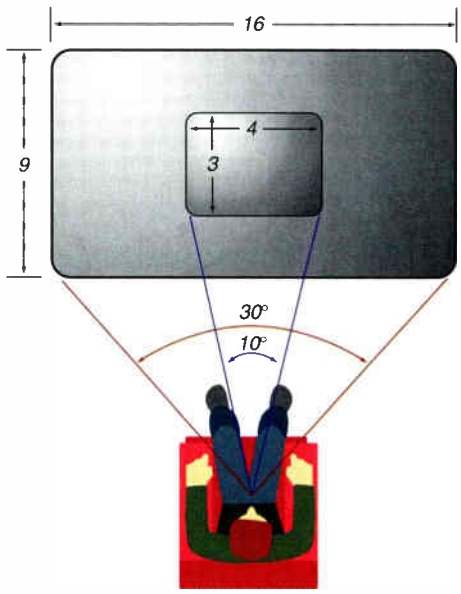
One of the most hotly debated issues, interlace vs. progressive scanning, came out as a regulatory draw with both scanning technologies just being "referenced", not mandated, in the standard. The formats are 24-, 30- and 60-frame-per-second progressive scan with a pixel format of 1280 x 720 (number of active picture elements per line times the number of active lines); and 24- and 30-frame-per-second progressive scan with a pixel format of 1920 x 180.

The system will also be capable of 60-frame-per-second interlaced scan with a pixel format of 1920 x 1080. These formats are expected to provide a good foundation for the migration to a 60-frame-per-second 1920 x 1080 progressive format as soon as technically possible.

Nagging questions

Some of the biggest areas of concern with the standard deal with the interlace/progressive scan issue and, especially important for cable operators, the insistence of the standard to support the VSB modulation technique. While one issue will likely be decided by the marketplace, the other will probably be taken care of by cable engineers and the vendors who supply them with technology.

The interlace/progressive dispute almost scuttled the standard effort at the last minute. According to Brian James, vice president of the TAC Test Centre for Rogers Cablesystems Ltd. and a major participant in the HDTV testing effort, this was because both camps had entrenched reasons for insisting their scanning technique was best for them in particular, and HDTV in general.



Source: HDTV Newsletter

The human ocular system is particularly keen in the center for high detail (NTSC 4:3 ratio). HDTV's 16:9 ratio includes peripheral vision for a heightened sense of reality.

"The computer people," said James, "took the attitude that they didn't think interlace would work for them, so therefore, no one should use it. The consumer electronics manufacturers took the view that the larger the screen, you are better off with an interlace display because it requires less power and produces a brighter picture. It's the way to go. When you get to a flat panel display, you probably have to go progressive. And the standard, as it was written, accommodates this."

James says during the testing of the Grand Alliance standard they transmitted interlace images that were then converted to a progressive format, and vice versa. "The conversion," says James, "can be done both ways and works quite well. They did an analysis to determine how much extra cost it would be to do that conversion, and it was deemed to be a reasonable price to pay to give people flexibility. The expectation was that the TVs will have the convertors in them."

At least one television manufacturer sees no problem with that and likes to remind people there is a difference between receiving and displaying either format. The ultimate display decision, says John Taylor, vice president for public affairs and communications at Zenith, will be made by the marketplace.

"Remember, you have to separate in your mind the concept of receiving all formats and displaying all formats," states Taylor. "Receiving all formats, we think is a given based on the voluntary process at the ATSC. We will make receivers that receive both formats. There's no question.

"The display is really more of a marketplace issue. Will the market gravitate toward full progressive displays? Are there opportunities, especially in smaller screen sizes, to stick with interlace because it is less expensive?"

To be VSB, or not to VSB

For cable operators, the VSB/QAM modulation situation is a more immediate concern. While there are many arguments both for and against each modulation technique (See "Which is the best modulation? QAM vs. VSB," *CED*, December 1994), the fact is that the cable industry has settled on QAM as the defacto modulation of choice, in large part because of its efficiencies in creating more capacity in the cable pipeline.

"To the extent that we can," says Dick Green, president and CEO of CableLabs, "obviously we want to carry the modulation that's best for our systems. Since we can carry higher data rates, we want more aggressive modulation than broadcasters can use. We want to optimize our networks, and that would vary from what would come in over the air.

"It (VSB) uses capacity unnecessarily, and I think the FCC clearly understands that. So what we want to put on our cable systems is optimum modulation. We believe that modulation is, in the end, 256 QAM."

The option to just pass the VSB signal through the cable pipe exists (possibly with some

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error correction), and in fact could be assisted by a circuit developed at CableLabs. The circuit, which could be put in televisions economically, would allow sets to receive either VSB or QAM modulated signals. But that circuit doesn't address the capacity VSB signals waste.

"The reason why you try to push toward a QAM format," says Nick Hamilton-Piercy, senior vice president engineering and technology for Rogers Cablesystems Ltd., "is that if you leave it in a (VSB format) of 6 MHz for one HDTV channel, many (cable) companies just don't have the capacity for that. If you put it into the QAM format, you can go to 256 QAM, which allows you to squeeze two (HDTV) broadcasts into one 6-MHz slot. Of course, that's very important."

Hamilton-Piercy notes that managing the modulation conversion at the headend (possibly through a modified transcoder/IRT), while important for those who have the money to optimize their system's capacity, may be too expensive for smaller operators. "The best for everyone, of course, is if the TV set manufacturers have what they call a dual mode receiver, which does QAM and VSB," says Hamilton-Piercy. "If they do that, then the

Broadcasters: The inevitability of HDTV beginning to take hold?

Just six weeks before the FCC's Christmas Eve acceptance of the fluid HDTV standard, an independent study conducted for Harris Corporation showed that a majority (79 percent) of the nation's broadcasters plan to convert to digital within five years after an FCC standard is established.

The two-month study, conducted by Systems Research Corporation (SRC) of Rochelle Park, N.J., questioned 400 television executives, representing 479 of the 1,551 stations in the United States. Harris Corporation is an international communications and electronics company with worldwide sales (including digital transmitters) of more than $3.6 billion.

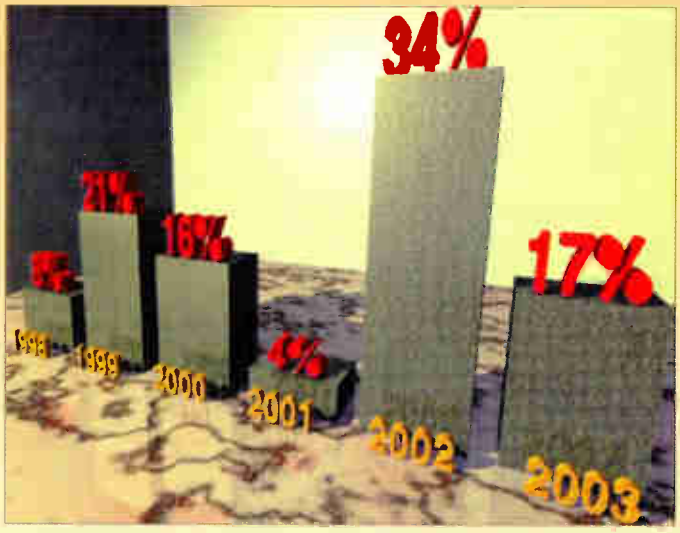

Figure 1: In how many years do you think digital TV receivers will be available on the market? (Average 4.5 years)
Source: Systems Research Corp: Harris Corp. Digital TV Survey-Stations.

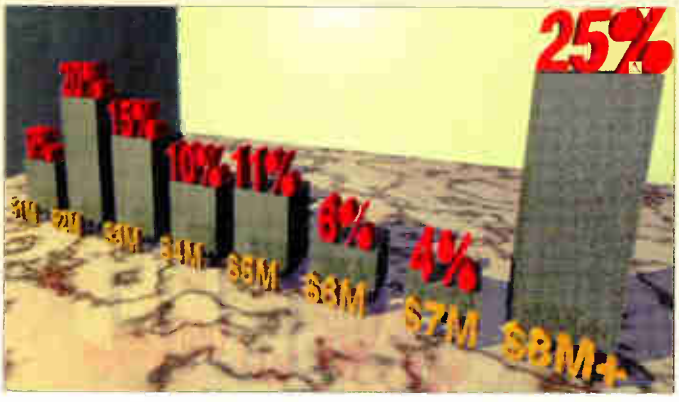

Figure 2: How much do you think the conversion will cost your station? *Source: Systems Research Corp: Harris Corp. Digital TV Survey-Stations.*

Officials at Harris found the study's results to be somewhat surprising. "The point that we found to be the most interesting," said Neil Stein, media relations specialist at Harris, "was the fact that an overwhelming majority of the respondents wanted it to happen. And also, the overwhelming majority, in talking about the timeframe, said they will be converting to digital television within the next few years."

Of the 79 percent who expect to change within five years after the government sets a conversion timeline, 28 percent expect to convert within two years, while 51 percent of that total expect it will take them between two and five years to make the digital conversion. And, while 17 percent believe it will take them more than five years to make the change, 4 percent said they may never convert.

The idea of a required timeline for digital conversion was not rejected out of hand by those broadcasters surveyed. While 31 percent believed there is no need for a digital conversion mandate, a majority seemed to accept the concept. Only 7 percent believed the mandate should be less than five years. Of those questioned, 32 percent stated the mandate should be between five and seven years, while the remaining 30 percent believe a 10-year digital conversion mandate was in order.

What's motivating these broadcasters to go digital? According to the survey, it's not more ad dollars (3 percent), a raise in the ratings (3 percent), pioneering a new market (5 percent) or even providing a better signal (17 percent). What's got a big majority (72 percent) of these broadcasters contemplating the digital dash is their urge to be a viable competitor in the rapidly evolving marketplace.

The broadcasters' bullish attitude on their digital changeover seems to be reflected in their belief that they will actually have some digital receivers to broadcast to when their conversion is complete. While a very optimistic 8 percent of those questioned believe digital television receivers will be available on the market within a year (see Figure 1), the vast majority (75 percent) believe it will take between two and five years for the receivers to hit the market.

Of course, going digital is going to cost (see Figure 2). Of those broadcasters questioned, only 9 percent thought the entire conversion would cost $1 million, while a quarter of the broadcasters were on the other end of the scale, saying they believed it would cost more than $8 million to make the change. However, the majority seemed to fall somewhere in between those two extremes with 55 percent saying it would cost between $2 and $5 million, and 10 percent stating the digital price tag would be between $6 and $7 million.

Yet, long before the survey results were released, the Harris Corporation and others began lining up future digital broadcasting customers. Given the recent FCC acceptance of a standard, digital equipment manufacturers may finally be seeing the dawning of their, and everyone else's, digital future.

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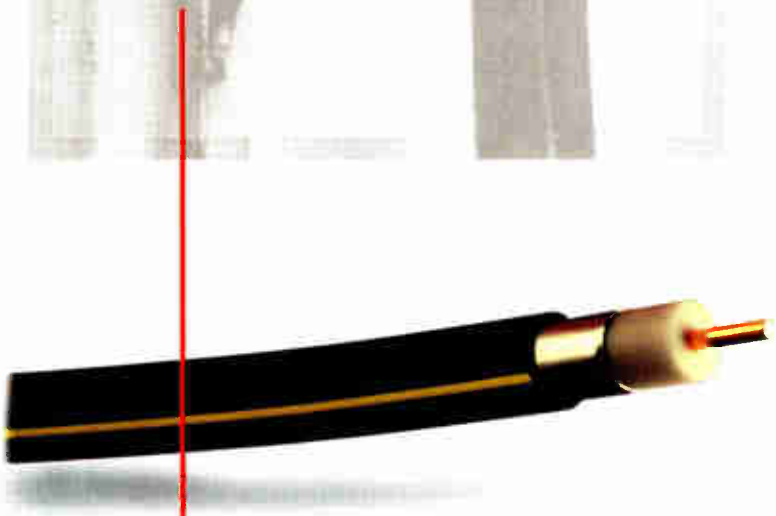

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small cable operators can pass the signal right through at VSB and the TV set will sort it out. The larger cable operators can convert to QAM, and the TV set will still sort it out. Except it will be far more efficient for the (larger) cable operator."

He estimates the cost of just passing the VSB signal through the system may be $1,000 a channel, vs. several thousands of dollars a channel for converting VSB to QAM at the headend. That cost difference, says Hamilton-Piercy, causes "a real messy situation, because it doesn't give them (small operators) any flexibility for migrating into further channels later on."

Vital decisions on HDTV

Yet the decision whether or not to manage the VSB signal at the headend may be moot by as early as next month (April) when the Supreme Court is expected to hand down its decision on the validity of existing must-carry regulations.

"Say that must-carry is upheld," explains Hamilton-Piercy. "The definition is that you're not allowed to change in any way the format of the broadcasted signal. You have to pass it through. If that occurs, you may have to leave it in VSB format until it hits the TV set, and then the TV set does the necessary processing.

"However, there is the argument that cable has always actually tampered with the format of off-air broadcasts. In particular, what they've done is adjusted the aural or sound carrier level. So, we've already tampered (with off-air signals), and you probably could use the same argument of why we should put it in QAM (at the headend) rather than leaving it in VSB. Basically you're saying, 'I know it's changing the format, but it's not changing the content, and it's making it suitable for retransmission in cable'".

The must-carry conundrum gets confused even further if broadcasters are allowed to use the new spectrum that was originally designated for HDTV to multicast a variety of lower resolution digital NTSC signals. This, according to Jeffrey Krauss, president of Telecommunications and Technology Policy, raises a disturbing question. "If a broadcaster," says Krauss, "is doing six channels of video, and one of them is free television, and the other five are pay or scrambled services, then does must-carry require the cable operator to carry all six of those channels? Or is it OK just to carry the one that's free?"

Broadcaster multicasting in the new spectrum, whether must-carry is upheld or struck down, may also add to operator headend costs, says Hamilton-Piercy. "One of the things that may add to an operator's capital costs," notes Hamilton-Piercy, "is if a broadcaster decides to provide four or five channels of regular definition digital signals when they're not doing HDTV. In all likelihood, one or more of those channels will be in direct competition with the cable operator's existing service. So a cable operator may have to strip off those additional channels. And that will require an add/drop multiplexer. And that's a fairly expensive piece of equipment."

Cripps notes that FCC Chairman Reed Hundt has already expressed the opinion that the government should not mandate how the new spectrum should be used. There are those who strongly disagree, including Cripps, who believes digital multicasting by the networks will complicate HDTV's roll out.

Zenith's prototype HDTV with a 16:9 aspect ratio

Hamilton-Piercy expresses a common concern about the issue: Once the networks are allowed to multicast more of what's already being provided by others like cable and DBS, there's little incentive for them to do anything else.

"From a regulatory view," states Hamilton-Piercy, "if they're (the FCC) looking at the overall picture, it would be good for them to push it in that direction (mandated usage). Because if the broadcasters are allowed to have multiple channels, they can very easily get used to doing that, and will never launch an HDTV signal. And I think that's the worry for Congress, a worry for the FCC, and I think it's a worry for us from a technical point-of-view as well. It's very easy to get complacent and just do multichannel (broadcasting) and hope to get more market share that way."

A cable-ready HDTV?

While everyone is waiting for the various spring rulings from the FCC and the Supreme Court, Hamilton-Piercy and his NCTA high definition television committee and CableLabs are busily working to help TV manufacturers prepare for an HDTV future.

"The first thing we have to do," says Hamilton-Piercy, "is to work with the committees that are interfacing with the EIA/consumer electronics people and develop a narrative definition of a cable-compatible HDTV receiver. It's hardly a spec, but it describes what's needed from our point-of-view. That has to happen literally in the next couple of months or so.

"We need to get that to the TV manufacturers sooner rather than later because they're starting their development cycles now. Their resistance to any changes is low now, and anything we might suggest still has a chance of being included. If we wait another six months or a year, they will be too entrenched to get any changes in."

There seems to be a growing consensus among set manufacturers, broadcasters, cable operators and content providers that the first wave of HDTV products and content will break anywhere from mid- to late 1998. The January 1998 Consumer Electronics Show should see the unveiling of a number of HDTV sets. In fact, a senior executive from Thomson Consumer Electronics recently told a National Association of Broadcasters (NAB) conference that annual sales of digital high definition TV receivers are likely to reach an impressive one million sets by the year 2002.

Meanwhile, a handful of broadcasters (e.g., WRC-TV/Washington, D.C.; WCBS-HD/New York, N.Y.; WRAL-TV/Raleigh, N.C.; and KOMO-TV/Seattle) have already launched or have announced near-term plans to launch limited HDTV broadcasts. Hamilton-Piercy is confident that cable will be right in the middle of it with everyone else next year.

"I think we'll have at least one, possibly two, HDTV signals carried on cable networks, at least in the larger cities, by the last quarter of 1998," says Hamilton-Piercy. He says he has talked to a number of programmers and "they may even do a closed feed to start with by giving us a direct connection. If they do that, then the VSB/QAM issue won't be there, because they'll be giving us a feed which we can do QAM with."

Which programmers? He prefers not to name names, but "all I can say is that movies and sports seem to be on the leading edge."

Of course, he explains, "that's all assuming that there will be at least a very small population of commercial TV receivers available then. You'll probably be able to get some sort of 50-inch projection-type TVs. That will probably be the first market, and you'll probably see that sports bars might have some of these sets at first. I think some people (in the industry) see this scenario as one of the drivers to get it (HDTV) moving, and they may underwrite that initiative in some way. That's about all I can tell you."

Anyone who's actually seen an HDTV display (CableLabs has a great viewing room with cable, DBS and HDTV displays all lined up in a row), knows that Hamilton-Piercy's scenario will more than likely do exactly what it's supposed to do—start whetting the public's appetite for a technology that could quite literally change the face of television. CED

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networks that feature a "ring" design that eliminates a single point of failure? Are you using Sonet technology anywhere, or do you plan to?

Best: As far as I know, we are the only cable operator who has deployed fiber optics in a route diverse or ring fashion, down to a 1,000-home-node level. And before we offer telephony, we would activate both sides of the ring . . . .

We are deploying Sonet in three ways. One is, around fiber rings in large systems from headend to hubs to interconnect the switch to all the hubs. Secondarily, in CAP networks, we use Sonet for voice. Thirdly, for large MDU complexes where we offer shared tenant services, we use Sonet to deliver the voice services to the MDU.

Chiddix: We use rings to what we call distribution hubs. Distribution hubs are points where we then feed an area of up to about five miles in radius. We do not run rings out to each node. We don't think that is justified in terms of cost vs. reliability. We are using Sonet rings, or are building Sonet networks in a fair number of our markets in order to provide telecommunications services, primarily to businesses. Alternate access to long distance points-of-presence, and other kinds of high-speed data services to commercial customers. Where we have such facilities, we take advantage of them to provide interconnection for our Roadrunner service, for example.

CED: Which of the new revenue opportunities (i.e., telephony, data, new digital video services) is the highest priority for your company?

Best: I would put data as number one, for several reasons. There are no regulatory hurdles. It offers a service—meaning high-speed—that is just unavailable anywhere else. The modems are available, and with the access issues that are occurring using dial-up modems, cable modems look especially attractive.

Chiddix

Digital video would come in second. Once again, no regulatory hurdles. The primary hurdles are programming, which of course, is now available from HITS, and boxes, which are now available from GI. The reason I put telephony third is, you have to have interconnection agreements; you need number portability sooner or later, or it will limit penetration; and you need to overcome the powering issues.

Chiddix: It's hard to say that one dominates the others. Residential telephony is something that we are not deploying in additional markets because of regulatory uncertainties. We are not sure when that will be clear. Having said that, we are proceeding aggressively with it in Rochester to learn all we can about that business.

The most immediate business for us is the cable modem business. And we are going to roll it out in a fair number of cities this year. We also think that digital video roll-out is extremely important. It won't happen quite as soon as the modem rollouts, but when it hits, it will be a much more broadly-based service.

Werner: All three are a priority with us, but I guess we think that digital TV is a huge opportunity. Telephony and data, we are still putting significant efforts into those. But they are going to be a slower market to harvest. In the short-term, we can get digital set-tops out in a ubiquitous manner, because you don't need HFC two-way plant to operate them, where for telephony and data, you do. CED

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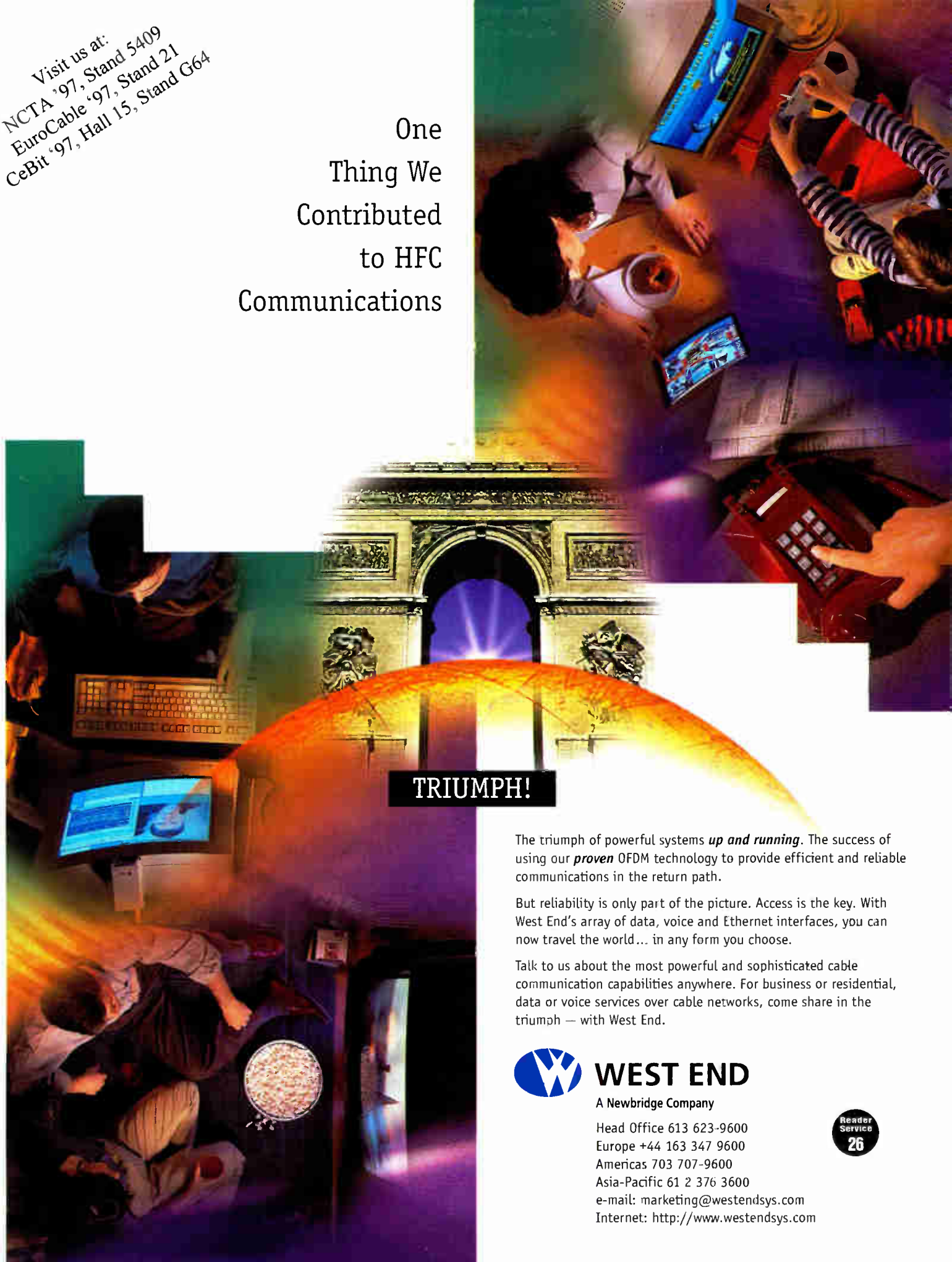

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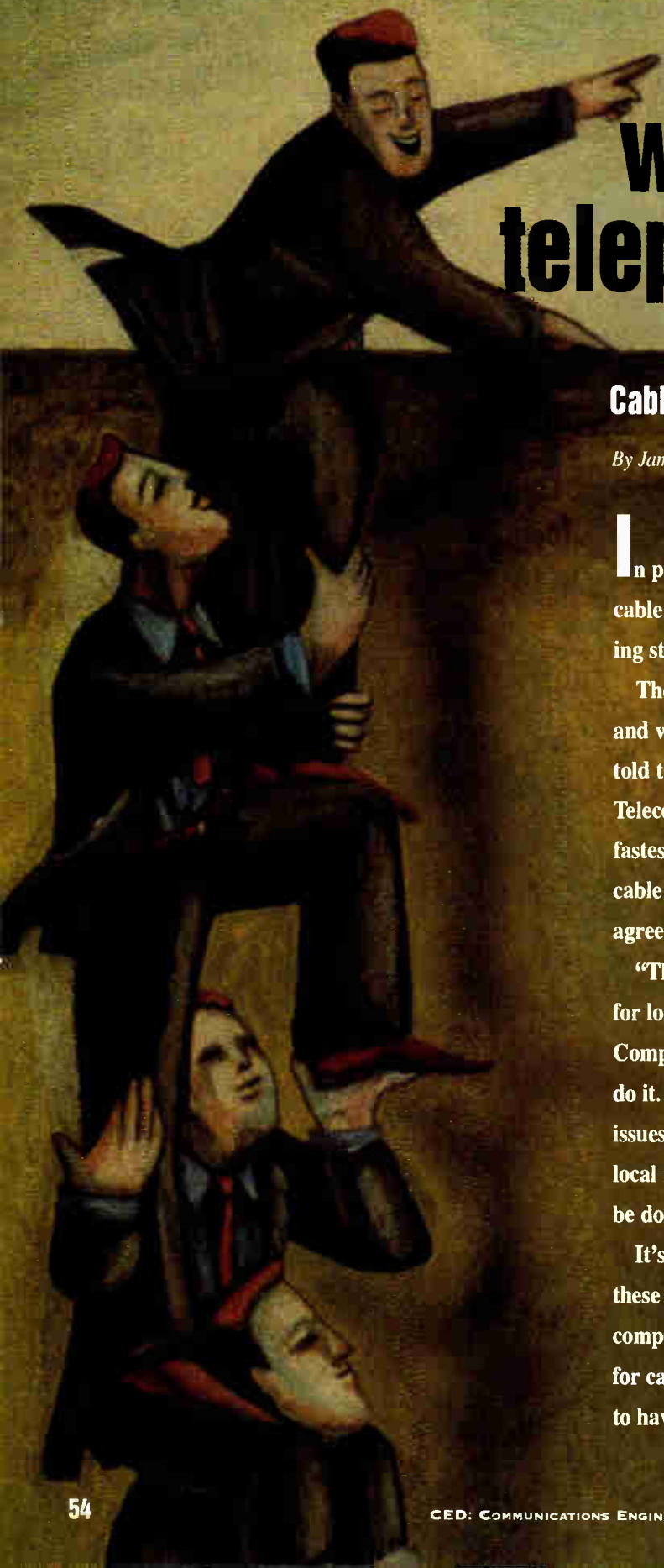

Arch-rivals work together on telephony standards

Cable and telcos scale the standards barrier

By James Careless

In public, they're arch-rivals, but behind closed doors, Canada's cable and telephone industries are quietly working together, developing standards for local competitive telephone service.

The reason they're doing this–in league with other long distance and wireless telephone service providers–is because a regulator has told them to. That's because the Canadian Radio-television and Telecommunications Commission (CRTC) has decided that the fastest way to get competition opened up in both local telephony and cable is to get the players together to hammer out as many mutually-agreed upon standards as they can.

"There's an awful lot of technical stuff that has to be figured out for local competition," explains Don Bowles, the CRTC's director of Competition and Social Policy, "and it's going to take a long time to do it. So we initiated the industry working groups to work on (the issues related to) local number portability. It was considered that local number portability was the most complicated thing that had to be done for local competition."

It's worth noting that the CRTC uncharacteristically established these working groups before it released its rules on local telephone competition, says Ken Engelhart, vice president of Regulatory Law for cableco Rogers Communications Inc. "In this case, they decided to have their technical interconnection

ILLUSTRATION BY A. RUGGIERI, THE IMAGE BANK

meetings start even before the decision is out—that is the carrier interfaces proceeding–which is going on right now," he says. "It's looking at how the network and operational interfaces will work for local telephony." That this unique state of affairs has even taken place is a measure of how intense the pressure is to get local competition on-line, while getting the rules right for governing it.

Still, this approach comes with a cost, which is that the working groups can't tackle any of the policy issues still being considered by the CRTC. However, Engelhart says that, "I anticipate the decision to be out by May, so if I take an optimistic view of the world, I'd say that between now and April we work as hard as we can on the things that we can agree on; the decision comes out in May, and then we work on those things. But yes, it would be much more logical, and better, if we had the luxury of being able to work on all of this once the decision came out. We don't have that luxury, so we can't."

Engelhart

What they're doing

As chair of the Business Systems Working Group, Engelhart is in the thick of this process. So is Jacques Sarrazin, Stentor's general manager of Local Network Interconnection and Numbering (Stentor is the coordinating alliance formed by Canada's nine major established telephone companies), who heads up the Networks Working Group.

"The Network Working Group is really looking at the physical connection of the wires and the components of a competitive network to the phone company network," says Engelhart.

"As well as the network interface standards, they're also looking at network planning issues—how do the two carriers communicate to each other about their plans without revealing what those plans are, but at the same time, giving enough information that each one can plan appropriately—and also network operations: when something breaks, how do we decide if it's on their side of the line, or our part of the line?"

"In the business systems group, which I'm doing, we're looking not at how the networks connect together, but at how the business systems connect together," he adds. Issues being covered in the various subcommittees include operator services ("If you're calling your sister, her line is busy, and you want to barge in on a call–which you can do today–how does that work if you have a different phone company than she does?," asks Engelhart.), directory issues, 911 access, transferring customers between phone companies, local number portability and billing/ordering.

So how are things going? Well, when the process started last year, "There were something like 35 issues that we had identified," says Jacques Sarrazin. "We've come to consensus on about 15 of them."

He adds, "I must admit that a lot of those are technical issues such as the routing algorithm we're going to use, the switch generic document, types of components that will be

included in the cost recovery, and so on. So it's primarily technical issues."

A case in point: according to Engelhart, right now, the telcos and their potential rivals can't agree as to whether the telephone company should be given advance warning when one of its clients is about to switch. The reason is simple: if Stentor is warned, it will have time to unleash its marketing people on wavering clients, begging them to stay with the promise of special deals and discounts.

"However, we can both agree that there are some circumstances where there must be communication," says Engelhart. "Three that leap to mind are where number portability is taking place, where the new entrant is a reseller, or where the new entrant is using an unbundled local loop from the phone company. In all three of those cases, there has to be coordination between the new carrier and the old carrier, so we are working out how the details of that communication will take place, while we're agreeing to disagree whether there needs to be any communication in other cases." Other areas of agreement include making sure that 911 works for all telephone customers, whatever their carrier; directory services and operator assistance. As Engelhart says, "Our operators have to be able to talk to their operators."

Neutral territory

Still, there are other technical issues where the subtleties of an old monopoly fending off new competitors is hampering agreement. For instance, there's the issue of interconnection between networks: how will the old and new telephone companies link with each other? The newcomers, such as cable, favor what's known as a 'central meet point,' where everyone trunks their networks into a new and likely third-party operated neutral interconnection point. However, "Stentor doesn't really support that architecture," says Sarrazin. "I think that if you look at the efficiency of interconnection, in our view, it would be more efficient if competitors interconnected at each individual central office." Of course, the competitive carriers would have to pay for this access–and pay dearly, fears Engelhart, which is why he and other potential telco rivals want neutral meeting points instead.

Obviously, this is the sort of divisive issue that could tear the working groups apart.

That's why both sides take a very hands-off approach in dealing with them.

"'Since we don't agree that there should be meet points, we don't want to talk about it'," says Engelhart, when asked to describe how the telcos have been handling this issue. "'Or, at least, if we do talk about it, we want to leave that for the last issue, so we don't give it any priority'." That's a position the other working group members are willing to accept, if only for the sake of maintaining good relations overall.

How it's going

The calmness with which both Sarrazin and Engelhart discuss the differences within their groups tends to downplay a remarkable fact: namely, that the cable and telephone industries are sitting down together at all.

What makes this remarkable is the long history of bad blood between the two, one that goes back to the early days of cable and disputes over access to telephone poles for stringing coax, to the current day when both sides snipe at each other regularly in the public press. It would perhaps be overstating the situation to compare it to the Mideast peace talks, but the sense of simmering distrust that hampers those meetings exists between Canadian cable and telephony as well.

Ultimately, these recommendations will be tested in a unique joint industry trial

Which brings us to the big question: just how well are the two sides getting along?

"Actually, it's working very well," says Jacques Sarrazin. "I think there's been a sort of healthy discussion and healthy conflict, which was expected, but I think that it's been–let me say that it's been a lot better than I thought it was going to be from the beginning."

"I don't want to tell you there haven't been any fights and arguments; there have been," says Engelhart. "There have been some good ones. There have been some differences of opinion, and there are some things we're never going to agree on, and that the CRTC has to decide. But, in the general context of my experience in negotiating these kinds of things with the phone company and with other parties, I would say the level of cooperation has been good.

"There have not been any final reports or final process maps to date, so nothing has been concluded or resolved," he adds. "However, the phone companies have been good about sharing some information on how their existing processes work, and making, I think, realistic proposals about how things should work in a competitive environment."

Sharing information doesn't come easily for Stentor, which doesn't want to tip its hand more than necessary to its competition. That's why ironing out mutually-agreed upon standards "is difficult from the perspective of information that could be sensitive in certain cases," says Sarrazin. "I think what's important, though, is to understand what could be sensitive information, and what isn't sensitive information. So once you've sorted through that process, I think it becomes a little easier."

In short, despite occasional disagreements, the consensus process is working, says Engelhart, thanks to "a good level of cooperation to date." He adds, "I think that a lot of that can be attributed to the wisdom of the government policy makers in their convergence policy, because what they've said is the phone companies can't get into cable until all of this stuff is done.

"So instead of having an incentive to perpetually drag their heels, they now have an incentive to make all this stuff happen, because they're so anxious to get into the cable business. I'm very worried that if there was ever a relaxation of the convergence policy and a relaxation of the Head Start rule, we might see the cooperation that has existed to date begin to evaporate."

What's next

So far, there's no sign of the government changing its strategy, however, and so the working groups continue to make progress toward making recommendations for local telephony standards.

Ultimately, these recommendations will be tested in a unique joint industry trial. Says Engelhart, "We will be proceeding to form a

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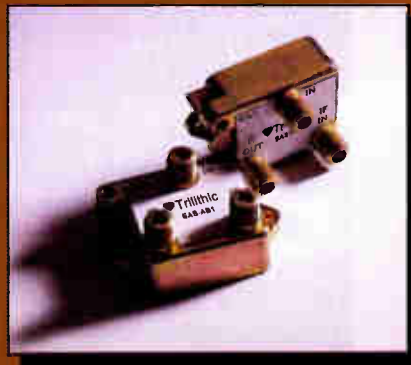

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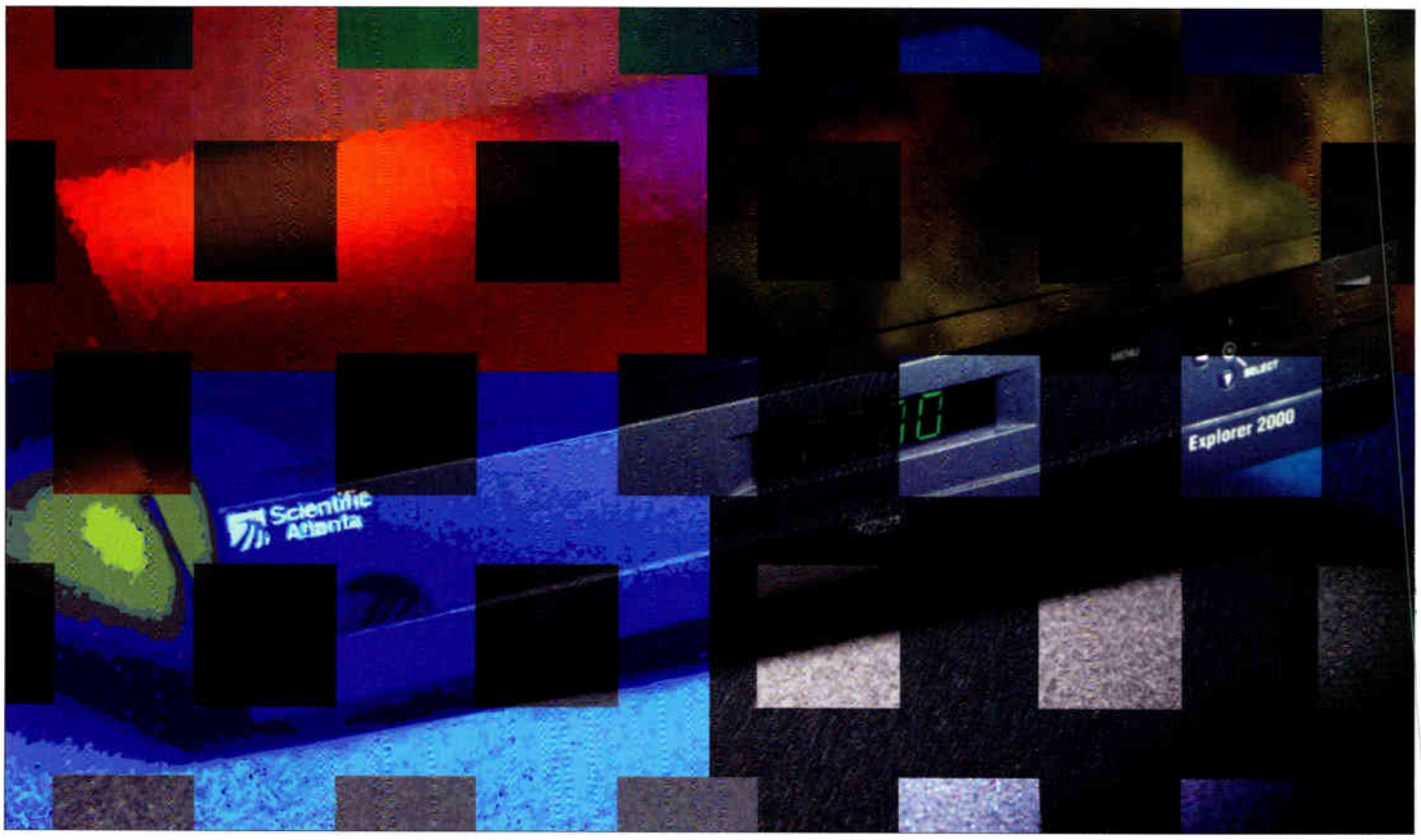

Stylized photo of Scientific-Atlanta's Explorer 2000 set-top.

Getting ready for cable's digital era

Set-tops begin their roll-out

By Roger Brown

Pity the poor cable TV set-top box. For at least the past 10 years, everyone from consumers to legislators have been trying to rid the planet of the devices, but "the box" that resides on top of millions of TVs refuses to go away. They have remained ubiquitous simply because of their utility—first as a way for operators to offer more than 13 channels, then as a method to provide volume control. Now, the newest thing is the digital set-top, and this time, it's bringing more than just TV. This computer on top of a TV is a true service enabler.

Cable operators were the first video providers to boldly announce that they were embracing the digital revolution and would offer the equivalent of a 500-channel universe. They were beaten to the punch by DBS providers, but, true to form, operators are now rolling out digital boxes that are so fully featured, they promise to rewrite the way systems roll out new services.

General Instrument is now about six months into its production cycle for the DCT1000 digital set-top, and has shipped roughly 200,000 units to several MSOs, including Tele-Communications Inc., Cox Communications, Comcast and several others that prefer not to be identified for competitive reasons, according to Denton Kanouff, vice president of marketing at GI's digital network systems business unit.

Waiting in the wings to take its bow is Scientific-Atlanta, which won a major contract from Time Warner Cable to deploy the "Explorer 2000" set-top, which features real-time reverse for interactivity.

And of course, Zenith is busy developing and manufacturing a digital set-top for the Americast consortium of telephone companies, while Hewlett-Packard is awaiting an opportunity to show its stuff. And finally, companies like Pioneer, Toshiba and Pace Technologies are now signing up as licensees of either GI or S-A to second-source set-tops, now that the industry has developed a standard set-top design around the MPEG-2 protocol.

Not plug-and-play, yet

Predictably, TCI and some of the other operators are still getting used to deploying the new-fangled digital boxes. Although the nation's largest MSO is rolling out in Hartford, Conn., the process is still far from plug-and-play installs, according to one source familiar with the roll-out, who asked not to be identified.

Nevertheless, there are no major concerns,

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according to Kanouff, who reports that the roll-out is progressing "very well." In fact, by the time this article is read, GI will have shipped 200,000 set-tops and installed at least 30 digital headends, he adds.

In fact, GI believes the market has already matured a little—at least to the point where a wider range of digital products can be supported. That's why the company intends to show two new digital set-tops at this month's National Cable Show in New Orleans.

Slated for debut are a new, broadcast-only box that could sell for $50 less per unit than the DCT-1000, and a new, "advanced interactive" box that will sport a next-generation microprocessor and a TDMA-based return channel that is more conducive to file transfers and session-oriented gaming, Kanouff says.

These set-tops are so new that names hadn't even been decided for them by the time Kanouff was interviewed for this story.

In the meantime, S-A is busy developing the Explorer 2000 for Time Warner, who bought 550,000 set-tops, all headend and network control software and system integration expertise from the Atlanta-based manufacturer and expects to begin deploying units by the end of 1997. This unit features real-time reverse and has been built from a data-centric point of view, according to Bob Van Orden, S-A's Digital Video Systems business unit director. "We focused our efforts on (helping operators) build a digital network to match DBS first, while providing a platform to offer even more services," he says.

S-A isn't going to be as aggressive as its arch-rival in its plans to offer a suite of digital products, says Van Orden. He says S-A has no intention to pursue the low-end portion of the market.

Instead, S-A's efforts will be focused toward designing cost out of the box components. But that doesn't mean anyone will soon see a less-expensive device—instead, buyers will end up getting more features, greater graphics and better processors for their money.

Included in the Time Warner purchase is the PowerTV set-top operating system, which recently announced a new release of its software that supports near-video-on-demand applications, secure digital broadcasting and a host of other audio and Internet Protocol compliant features. Release 1.1 especially adds more Internet capability—the company has already worked with Spyglass to develop a Web browser and has shown a complete Java environment operating over the new software release. "We have made significant improvements over the past 12 months that will make advanced television applications even easier and more powerful

Scientific-Atlanta's 8600x set-top.

to implement," says J. Bowmar Rodgers Jr., chief operating officer at PowerTV.

The new release builds on PowerTV's first offering, which was specifically designed for the set-top and advanced TV applications. That release was small in footprint, yet offered advanced graphics support, especially when married with the company's Eagle graphics chip.

Some new faces, too

Included in the Time Warner deal were orders for S-A licensees Pioneer and Toshiba, who intend to provide a total of 450,000 more set-tops based on the S-A/PowerTV platform.

But GI also has a few licensees that stand poised to build digital set-tops for the burgeoning market. Just last month, Pace Micro Technology plc, a London-based manufacturer of set-top hardware, licensed GI's MPEG-2 system, including its DigiCipher II conditional access system.

Pace, which is already producing DVB-compliant receivers for deployment in Europe, intends to pursue the U.S. cable TV market as a second-source of GI hardware. Pace officials recently disclosed that they have been holding exploratory discussions with MSOs and can now move forward with development, with an eye toward having product available by the end of 1997, according to a statement released by the company.

Apparently left out in the cold, at least for now, is Hewlett-Packard, which made quite a splash a couple of years ago by licensing the GI system for its Kayak set-top. In fact, HP had a letter of intent from TCI to purchase roughly 250,000 boxes. But, to date, that agreement has not advanced beyond the LOI stage.

"Our fate rests in the hands of the cable operators," says Casey Sheldon, brand manager for interactive broadband products at HP. She says cable operators' digital deployment plans are apparently in flux, given that even TCI issued a request for proposals as late as last October seeking a set-top that would pass through analog signals offered by TCI, and receive Primestar digital signals as well.

"We responded in depth to that," says Sheldon. "Cable operators seem to be changing their plans—their thinking has changed. We simply need to know what they want."

But Sheldon is quick to point out that the demand for more service offerings hasn't fallen off. "We don't see consumer interest waning at all," she says. But while cable operators go back to the drawing board to decide if high-speed data or digital video is the key priority for their new-service rollouts, HP is content to wait.

"We have become masters of living with ambiguity," Sheldon says light-heartedly. "We are eager to get started, but willing to wait."

Are the MSOs ready?

So, if the vendors are ready and willing to provide product, what are the operators' plans?

Necessary

Van Orden

While TCI and Time Warner have made very public announcements about backing off their telephony plans, digital TV deployment continues to be a high priority for them. At TCI, which has been suffering lately through severe economic hardships, digital TV has become the number-one project.

In fact, while TCI intends to do less telephony, it will more than make up for it by deploying digital video systems, according to insiders. Internally, TCI engineers are working to understand everything they can about digital bitstreams and how they are affected by cable networks. Once those parameters are understood, TCI will roll out digital boxes in a vast majority of its systems, an inside source said recently.

The rest of the Top 5 MSOs, which control the lion's share of the cable subscribers, also have aggressive rollout plans. Cox, for example, plans to place digital set-tops in front of about 5 percent of its subscriber base by the end of 1997, and will double that to 10 percent by the end of 1998, according to Alex Best, senior vice pres-

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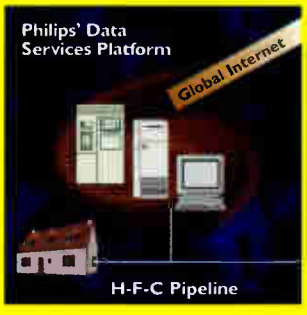

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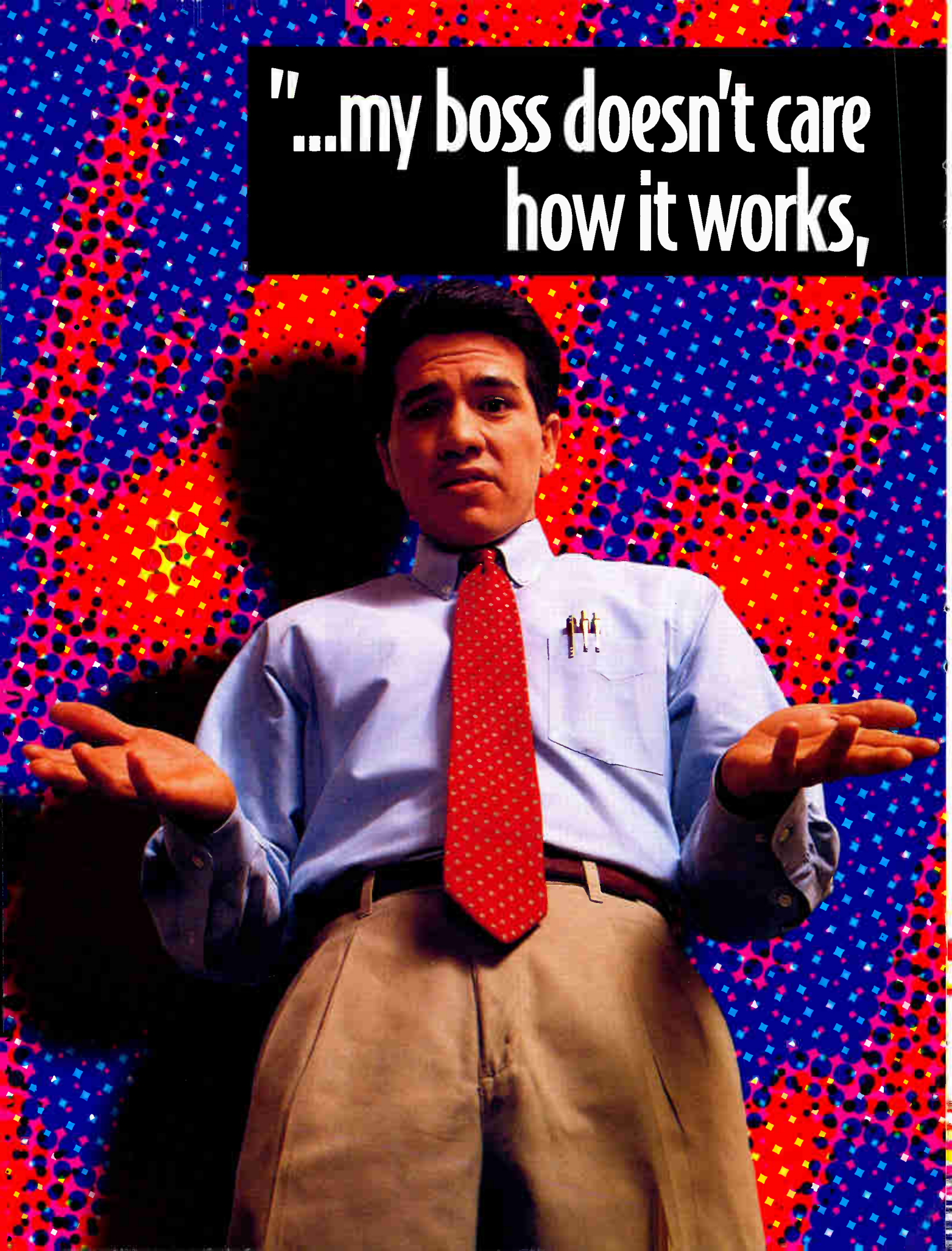

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The SUPERCOMM conferences and exhibition bring the whole world of communications directly to you! Educational programs begin Sunday, June 1 and conclude Thursday, June 5.

For up-to-the-minute information about the SUPERCOMM '97 exhibition and conferences, visit www.super-comm.com!

Exhibitor list as of December 20, 1996

3COM (formerly OnStream Networks)
3M Telecom Systems Division
4-1-1 Systems, Inc.
A.C./Data Systems of Idaho, Inc.
Abacon Telecommunications
ABB CEAG Power Supplies
Absolu Technologies
AccessLine Technologies, Inc.
Accugraph Corporation
ACE*COMM, a subsidiary of Am. Computer & Electronics
Acoustics Development Corp.
ACT Communications, Inc.
ACT Networks, Inc.
ADC Telecommunications, Inc.
ADS The Power Resource
Adtech, Inc.
ADTRAN
Advance Power, Inc.
Advance Technology Consultants
Advanced Fibre Communications
AG Communication Systems
AIMetrix, Inc.
AIMS Technologies, Inc.
Alcatel Telecom
Alcoa Fujikura Ltd.
Allied Comm. Eq. Supply Co. Inc.
Alpha/Argus Technologies
Alpha Equipment Co.
Amati Communications Corp.
AMD
America's Network
American Mobile Satellite Corp.
Americatel Corp.
Ameritec Corp.
Anritsu Wiltron
APDG
Applied Digital Access
Applied Innovation, Inc.
Applied Learning Systems
Architel System Corporation
ARGO Systems
Ariel Corp.
ARNCO Corporation
Ascend Communications
Ascom Nexion, Inc.
ATIS (Alliance for Telecom. Ind. Sols.)
AT&T Paradyne
ATx Telecom Systems
Augat Communication Products
Auspex Systems
Autodesk, Inc.
Aydin Telecom
B-Line Systems, Inc./Telecom Division
Badger Technology
Barco, Inc.
Barco Visual Systems
BatteryTest Inc.
Bay Networks
BEA Systems
Belden Wire & Cable Company
BELGACOM North America
Bellcore
Benner-Nawman Inc.
Bern Communications
The Berry Company
Bosch Telecom, Inc.
Bowman Manufacturing Co., Inc.
Bridgeway Corporation
Brite Voice Systems
BroadBand Technologies, Inc.
Bull Information Systems
Business Communications Review
Bussman, Div. Cooper Industries
C&D Charter Power Systems
Cabelcon Connectors
Cablewave Systems
CADTEL Systems, Inc.
Canoga-Perkins Corp.
Carlingswitch, Inc.
Carlon Telecom Systems
Carolina's Partnership
Carrier Access Corp.
Cascade Communications Corp.
Caterpillar Inc.
CEECO (Communication Equipment and Engineering Company)
Celcore
Centigram Communications Corp.
Central & Southwest Corporation
CHA Systems
Champion Products, Inc.
Channell Commercial Corp.
Charles Industries, Ltd.
Chesilvale Electronics Ltd.
The Chilton Communications Group
CIDCO Incorporated
CIENA Corporation
Cisco Systems, Inc.
Citel America, Inc.
Clark Specialty Co. Inc.
Clauss Fiberoptic/Telecom Div.
Clear Communications
CMC Industries
CN-Communications News Magazine
CNA Insurance Companies
Cognitronics Corporation
COMDISCO, Inc.
Commercial Electric Products
Commscope-General Instrument
COMMSOFT – Communications Software Consultants, Inc.
Communications Manufacturing Co. (CMC)
Communications Products
Communications Test Design, Inc.
Communications Week (A CMP Publication)
Communico Supply/Protel
Compu-Aire
Computer Products
COMSAT RSI Plexsys Wireless Systems
Comverse Technology, Inc.
Conductive Containers, Inc.
Consultronics
Cordell Mfg. Inc.
The Courtney Company
CrossKeys Systems Corporation
The Crown Divisions
Crystal Group Inc.
Crystal Semiconductor Corp.
CSI/Suttle Apparatus
Curtis Instruments Inc.
Cylink Corporation
Daleen Technologies, Inc.
Data Aire
Data Kinetics Ltd.
Datum, Inc.
Deutsche Telekom, Inc.
Diamond Lane Communications Corp.
Digital Lightwave
Digital Link
Digital Microwave
Digital Sound Corporation
Digitech Industries
DPS, Inc.
Drake Communications Products, Inc. (DCPI)
DSC Communications Corp.
DSET Corporation
DuPont
Dura-Line Corporation
Dynatech Communications, Inc.
E/O Networks
Eagle-Picher Industries, Inc.
Eastern Research, Inc.
East Penn Mfg. Co., Inc.
Eaton Commercial Controls
ECI Telecom Inc.
Elcotel, Inc.
ELDEC CORPORATION
Electric Motion Co., Inc.
Electrodata, Inc.
Electronic Tele-Communications, Inc.
Ellipsys Technologies, Inc.
ENA (Enterprise Network Applications)
Energy Electric Cable, Inc.
Enthone-OMI Inc.
Ericsson, Inc.
ESRI Inc.
Euristix Ltd.
Evans Consoles Inc.
EXCEL, Inc.
EXFO E.O. Engineering
Exide Electronics, Emerging Technologies Group
Federation of Electronic Industries
Fiber-Conn Assemblies Inc.
Fibrebond Corporation
Force Computers
FORE Systems
Fortec, Inc.
France Telecom
Frost & Sullivan
Fujitsu
GE Capital
Generac Corporation
General DataComm, Inc.
General Instrument/Next Level Communications
General Signal Networks-Tautron
General Signal Networks-Telenex
The George-Ingraham Corp.
GETAC
GFRC Shelters
Gilbert Engineering Co., Inc.
GL Communications
GLA International
Glenayre & Western Multiplex Inc.
GN Nettest Inc.
GNB Technologies
GNP Computers
Gnubi Communications, Inc.
Gordon Publications' Fiberoptic Product News
W.L. Gore & Associates, Inc.
Granite Systems Research
Graybar Electric Co., Inc.
GRC International, Inc.
GTE Supply
Hadax Electronics
Haddcomm International
Harmonic Lightwaves
Harris & Jeffries, Inc.
Harris Corporation
Hartwell Corporation
Hendry Telephone Products
Henkels & McCoy Inc.
Hennessy Products, Inc.
Hewlett-Packard Company
Hughes Network Systems
IBM
ICBS/Inter-Commercial Bus. Sys.
IDB Systems
Ideal Industries
IEEE Communications Society/IEEE Press
IEX Corporation
IHS Communications Products
Inchcape Testing Services
Independent Technologies Inc.
InDepth Magazine
Industrial Technology, Inc.
Industry.net
INET, Inc.
Instruments SA, Inc.
Integrated Network Corporation-Multimedia Division
Integrated Network Corporation-Central Office Products
Integrated Systems, Inc.
Intelect, Inc.
IntelliNet Technologies
InterDigital Communications
International Communications Association (ICA)
International Engineering Consortium (IEC)
Interphase Corp.
Intertec Publishing/Cellular Business/WirelessWorld
InterVoice, Inc.
IPITEK
ISR Global Telecom
ITEC Solutions, Inc.
IXC Long Distance, Inc.
JDS FITEL Inc.
Johnson Controls, Inc.
KDD America, Inc.
Keptel, an ANTEC Company
Klein Tools, Inc.
Kluwer Academic Publishers
Kohler Co., Power Systems
Korea Telecom
Kullman Industries, Inc.
KVX Corporation
L-Com, Inc.
La Marche Mfg. Company
LaBarge, Inc.
Larscom
Larus Corporation
Learning Tree International
Leitch, Inc.
Level One Communications, Inc.
LEXCOM Telecommunications Co.
Libby Corporation
The Light Brigade, Inc.
LIGHTWAVE
Linear Switch Corporation
Linmor Technologies, Inc.

Litton-FiberCom
Litton Light Wave Products
Litton Winchester Electronics
Loop Telecommunication Int'l.
LSI Logic Corporation
Lucent Technologies, Inc.
Lynx Real-Time Systems
Magellan Systems Corp.
MagneTek
MAPCOM Systems, Inc.
Masterack Division of Leggett & Platt, Inc.
Maxtech USA Co., Ltd.
McGrath RenTelco
McLean Engineering, A Zero Corporation Co.
MDSI (Mobile Data Solutions, Inc.)
Metalink LTD.
MetaSolv Software, Inc.
MET Laboratories, Inc.
Metro Tel
Metromail Corp.
Metrotech Corporation
MGE UPS Systems, Inc.
Microsoft Corporation
Microtronix Systems Ltd.
Midtronics, Inc.
MIL 3, Inc.
MIS Labs
Mitel Semiconductor
Mobile International Co., Inc.
Mobile Systems International
Molex Fiber Optics
Motorola Inc.
MPR Teltech Ltd.
Multielectrica Industrial S.A. De C.V.
Mustang Enterprises, Inc.
N.E.T. (Network Equipment Technologies, Inc.)
NACT
National Cable Television Institute (NCTI)
National Computing Centre
National Telephone Cooperative Association (NTCA)
NEC America, Inc.
NetEdge
Network Analysis Center
Network Communications Corp.
Network Design & Analysis
Newbridge
NewNet
Newton Instrument Co., Inc.
NMF
NORDX/CDT
Nortech Fibronic, Inc.
Nortel (Northern Telecom)
Northern Technologies, Inc.
Noyes Fiber Systems
NTT
Nuera Communications
NUKO Information Systems, Inc.
Objective Systems Integrators
Objectivity, Inc.
Odetics Telecom
Dki America, Inc.
Dmnitronix, Inc.
Dnan Corporation
DPASTCD
Dpen Development Corporation
OPTAPHONE Systems
Optelcom Pacific
Optical Solutions, Inc.
Oracle Corporation
Orckit Communications
Outside Plant Magazine
PACER International
PairGain Technologies
PanAmSat Corporation
Paramount Designs, Inc.
PCS Telecom, Inc.
Peco II, Inc.
PenCell Plastics
Performance Telecom
Periphonics Corporation
Philips Broadband Networks, Inc.
Philips Speech Processing
Philips Technologies – Airpax Protector Group
Phillips Business Information, Inc.
Phoenix Contact Inc.
Phoenix Power Systems, Inc.
Photonics Spectra/Laurin Publishing Co., Inc.
Pike & Fischer, Inc.
Pirelli
Plug-In Storage® Systems, Inc.
Positron Fiber Systems, Inc.
Power & Telephone Supply Company
Power Battery Company
Power Conversion Products Inc.
Powersafe Standby Batteries
Powertel Global, Inc.
Prairie Systems
Preformed Line Products
Premier Metal Products Co.
Premisys Communications, Inc.
Prentice Hall
Primex Manufacturing Corp.
Pro-Log Corp.
Progressive Electronics, Inc.
Proto-Tel Inc.
PSI Telecom
PTT Telecom Netherlands, US Inc.
Pulsecom
Pylon Electronics Inc.
Pyramid Industries, Inc.
Q-Tel Subsidiary of GTE
QPS Technology
QUALCOMM Incorporated
QUINTREX DATA SYSTEMS CORP.
R.J. Enterprises
RAD Data Communications
Radiodetection Corporation
RCR Publications, Inc.
RE America, Inc.
REDCOM Laboratories, Inc.
Reference Point
RELTEC
Rifocs Corporation
Riser-Bond Instruments
Roadrunners International
RDHN
RDXSYSTEM
Royal Dutch Jaarbeurs
ryan.hankin.kent, Inc.
RYCDM INSTRUMENTS, INC.
Sage Instruments, Inc.
Samsung Telecommunications America
SaskTel International
SatCorp Communications Inc.
Sattel Communications
Schroff, Inc.
Securicor Telesciences Inc.
Seiscor Technologies Inc., a Raytheon Electronics Company
Sequel Systems, Inc.
SHL VISION Solutions
Siecor Corporation
Siemens Stromberg-Carlson
Siemens TTE
SL Corporation
Smallworld Systems, Inc.
SNC Manufacturing Co., Inc.
SNI Innovation, Inc.
SONET Interoperability Forum (SIF)
Sourcecom
SOURCE, Inc.
Southwestern Bell
Specialized Products Company
SpectraLink Corp.
Speedware Corporation
Sprint North Supply
Stanford Telecom
Starvision Multimedia Corp.
STET-Societa Finanziaria Telefonica p.A.
StockCap
Stonehouse & Co.
Stratus Computer, Inc.
Sumitomo Electric Lightwave Corp.
Summa Four, Inc.
Sunbelt Telecommunications, Inc.
Sun Microsystems Computer Co.
Sunrise Telecom, Inc.
SV-Systems, Inc.
Swiss Telecom PTT
Syndesis, Ltd.
SyntheSys Research, Inc.
Syntu Technologies Corp.
System One
T-COM Corporation
Tadiran Telecommunications
Talarian Corporation
Technology Marketing, Inc.
Tekelec
Tekno Industries, Inc.
Tektronix, Inc.
Telamon Corporation
Telco Systems Inc.
tele.com
Telecom Solutions
Telecomm Power Systems
Telecomms. Resellers Association
Telecommunications Industry Association (TIA)
Telecommunications® Magazine
Telecommunications Research Associates
Telecommunications Training Division, The Texas A & M University System
Teleconnect Magazine
Telecrafter Products
Telect
Telelogic
Telephone International
Telephony
Telesync, Inc.
Tele/Systems Inventory Mgmt.
Tellabs, Inc.
Teltrend, Incorporated
Tempo Research Corporation
Teradyne Software & Systems Test
Texas Instruments, Inc.
Texas Microsystems
Thinking Machines Corporation
Thomas & Betts
Tii-Industries, Inc.
Traffic USA
TranSwitch Corporation
Trend Communications Inc.
Trilogy Communications, Inc.
Tripp Lite Manufacturing
Trompeter Electronics
TrueTime, Inc.
TTC (Telecomm. Techniques Corporation)
Tut Systems
TUV Product Service, Inc.
TW Comcorp
Tyton Corporation
U.S. Dept. of Commerce-Office of Telecommunications
UMI Company
Underwriters Laboratories Inc. (UL)
Unisys
United States Telephone Association (USTA)
University Booth (ICA)
U.S. Robotics
Valpey-Fisher Corporation
Vari-Tronics Company, Inc.
Verilink Corporation
VERO Electronics, Inc.
Vertel (formerly Telegenics)
VFP, Inc.
Virgo Publishing, Inc./PHONE + Magazine
VIR, Inc.
Visual Networks
VIVE Synergies Inc.
Voice Cue Technologies, Inc.
Voiceware Systems
W. H. Brady Company
Walker & Associates, Inc.
Wandel & Goltermann
Warren Power Systems
Wavetek Corp.
Weatherguard/Knaack Mfg. Co.
Weidmuller Inc., Paladin Tools
Westell Technologies, Inc.
West End Systems Corp.
Western Kansas Rural Econ. Dev. Alliance
Western Rural Telephone Association
White Mountain Cable Construction Corp.
John Wiley & Sons
Wiltron Telecom
World Access, Inc.
Wyle Laboratories
Wyle Laboratories Electronic Enclosures Div.
Xinex Networks Inc.
Yuasa-Exide, Inc.
Yurie Systems, Inc.
Z Microsystems Inc.
Zarak Systems Corporation
Zomeworks Corporation/Cool Cell, Inc.

SUPERCOMM

NEW ORLEANS

SCHEDULE AT-A-GLANCE

SUPERCOMM Free Programming

SUPERCOMM offers many free educational programs. These distinctive sessions are designed to explore leading-edge technologies and profit areas for the next millennium. The top minds from academia, industry organizations, government and business will discuss their views and insights on a number of topics central to the world of communications. Take advantage of the opportunities that these complimentary programs offer on Monday, June 2:

Fundamentals and Industry Updates

Building upon SUPERCOMM's successful "primers" format, SUPERCOMM and IEC have created Fundamentals and Industry Updates that will focus consecutively on: Broadband, Wireless, Software and the Internet – topics of great interest to all facets of the industry. Each of the Fundamentals will be followed by an Industry Update session to provide more in-depth coverage of the four topics. Be sure to explore the pavilions dedicated to wireless, software, the Internet and other key technologies when the exhibits open on Tuesday, June 3.

Global Telecom Round-Up

As an adjunct to the Global Telecom Market (GTM) Forum, TIA, the United States Telephone Association (USTA) and Phillips Business Information will offer all SUPERCOMM attendees a free introductory session to kick off the GTM Forum's day-long packed agenda. The Global Telecom

Exhibit Hours

Tuesday
June 3, 9:00 a.m. - 6:00 p.m.

Wednesday
June 4, 9:00 a.m. - 6:00 p.m.

Thursday
June 5, 9:00 a.m. - 1:00 p.m.

SUNDAY, JUNE 1

	ICA	SUPERCOMM/ PHILLIPS
8:00	Education	
8:30		
9:00		
9:30		
10:00		
10:30		
11:00		
11:30		Global Telecom Market (GTM) Forum
12:00		
12:30		
1:00		
1:30		
2:00		
2:30		
3:00		
3:30		
4:00		
4:30		
5:00	ICA Orientation	
5:30		
6:00	Reception	Global Telecom Market (GTM) Forum Reception
6:30		
7:00		
7:30		
8:00		
8:30		
9:00		
9:30		

MONDAY, JUNE 2

	SUPERCOMM	ICA	IEC	IEEE	MMTA	TIA/ COMMITTEE T1	SUPERCOMM/ PHILLIPS
8:00	SUPERCOMM Free Fundamentals & Industry Updates & MWBE		TecForum	Internet Tutorials			
8:30							
9:00		Education			Workshop I		Free GTM Round-Up
9:30							
10:00						Wireless Interconnection & Standards Issues	
10:30							
11:00							
11:30							Global Telecom Market (GTM) Forum
12:00		Annual Business Meeting			Workshop II		
12:30							
1:00	SUPERCOMM Free Fundamentals & Industry Updates & MWBE						
1:30							
2:00		Education	TecForum	Internet Tutorials			
2:30							
3:00							
3:30							
4:00							
4:30							
5:00							
5:30							
6:00		Fellowship Dinner					
6:30							
7:00							
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8:00							
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9:00							
9:30							

Round-Up will feature guest speakers who will give an overview of today's global telecommunications trends. The free session is from 9:00 a.m. to 10:00 a.m. on Monday, June 2.

Minority and Women-Owned Business Enterprise (MWBE) Program

It makes excellent business sense for information industry companies to utilize the talent, quality and efficiency of MWBE companies as suppliers of goods and services. Many enlightened companies are doing just that and are furthering the deployment of the information age in the process. Attend the free MWBE Program on Monday, June 2 to learn about partnerships, experiences and successes.

10:30 a.m.- 12:00 p.m. MWBE Plenary Session
A noted MWBE leader will paint a picture of the directions, challenges and opportunities for today's industry.

1:30 p.m.- 3:00 p.m. Workshops
Select from two workshops to hear about actual experiences, challenges and successes of partnership with MWBE companies.

3:30 p.m.- 4:30 p.m. Panel Discussion
Participate in the panel discussion to cap the day's presentations and to focus on any issues you'd like to raise with the experts.

NOTE: See following pages for paid affiliated programming descriptions.

TUESDAY, JUNE 3

	SUPERCOMM	ICA	IEC	SPECIAL	IEEE	MMTA
8:00	Free SUPERCOMM Keynote Address, F. Duane Ackerman, Chairman & CEO, BellSouth					
8:30						
9:00	Exhibits Open	Education	Seminars	Executive Program	Internet Tutorials	
9:30						Sessions
10:00			Seminars			
10:30						
11:00						
11:30						
12:00						
12:30			IEC Information Industry Luncheon			
1:00					Internet Tutorials	
1:30						Sessions
2:00			Seminars			
2:30						
3:00						Sessions
3:30						
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9:00						
9:30						

WEDNESDAY, JUNE 4

	SUPERCOMM	ICA	IEC	MMTA
8:00	Free SUPERCOMM Plenary Session			
8:30				
9:00	Exhibits Open	Education	Seminars	
9:30				Sessions
10:00			Seminars	
10:30				
11:00				
11:30				
12:00			Luncheon	
12:30				
1:00				
1:30				Sessions
2:00			Seminars	
2:30				
3:00				Sessions
3:30				
4:00				
4:30				
5:00				
5:30				
6:00	Free SUPERCOMM Plenary, Lawrence J. Ellison, President & CEO, Oracle			
6:30				
7:00				
7:30				
8:00				
8:30				
9:00				
9:30				

THURSDAY, JUNE 5

	SUPERCOMM	ICA	IEC	MMTA
8:00			TecForum	
8:30				
9:00	Exhibits Open	Education		
9:30				Sessions
10:00				
10:30				
11:00				
11:30				
12:00				
12:30				
1:00			TecForum	
1:30				
2:00				Sessions
2:30				
3:00				Sessions
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For up-to-the-minute information about the SUPERCOMM '97 exhibition and conferences, visit www.super-comm.com!

EDUCATIONAL PROGRAMS

International Communications Association (ICA)
ICA Annual SuperConference
1-972-620-7020, ext. 138
http://www.icanet.com
E-Mail: intlcoma@onramp.net

International Engineering Consortium (IEC)
Communications Forum
SUPERCOMM Executive Program
1-312-559-3725
http://www.iec.org

The breadth and depth of educational programming at SUPERCOMM '97 is unprecedented. More than 200 sessions, seminars, tutorials and workshops will be offered by eight prestigious organizations affiliated with SUPERCOMM. To receive a comprehensive schedule of affiliated educational programs and fee information, please indicate which organizations you are interested in on the exhibition registration form on the inside back cover of this brochure. You may also request this information by contacting the organizations directly (see above).

International Communications Association

The International Communications Association (ICA) Annual SuperConference is your solution for gathering information on the latest technology, public policy and management issues that impact your operations and your bottom line. Presented by the end user for the end user, it is the premier technology management conference in the telecommunications and information systems industries.

The program is clearly designed to provide telecom/IS managers and end users with high-level training and strategic solutions. In-depth coverage of important topics gives attendees hands-on, "go home and use it the next day" information. The conference also offers a convenient schedule and format, so that you can enter the SUPERCOMM exhibition informed and better able to maximize your time. Excellent social programs for informal networking with your peers are another benefit of this event.

The ICA conference program will consist of:

3 Conferences Focusing on Intranets, Network Management and Customer Care Solutions Call Centers

13 Tutorials Addressing Fundamental User Interests and Industry Issues

28 In-depth Break-Out Sessions and "How-To" (go home and use it the next day) Programs

International Engineering Consortium

The International Engineering Consortium (IEC) presents a high-quality educational experience at SUPERCOMM '97. This program brings together information industry managers and executives for professional development and a rich exchange of ideas as a catalyst for progress throughout the industry. The Consortium's cooperative planning process ensures that the program is focused on the topics most critical to the future of the communications industry.

Monday, June 2 – TecForums

The comprehensive program begins Monday with full-day TecForums designed to present both business issues and fundamental technical information in a tutorial format.

TF1 8:00 a.m. - 5:00 p.m.
Full Service Networks: Services and Technologies

TF2 8:00 a.m. - 5:00 p.m.
Wireless Interoperability and Interconnection

Tuesday and Wednesday, June 3-4 Communications Forum

Tuesday and Wednesday will include focused seminars on the information industry's most important topics. These 90-minute seminars, 60 in all, make up the heart of the Communications Forum. Presenters will represent all industry sectors and include senior executives and managers who are driving many positive changes and advancements.

Tuesday, June 3 – SUPERCOMM Executive Program

Highlighting Tuesday's events is IEC's SUPERCOMM Executive Program, featuring an exceptional workshop designed for industry leaders. Panelists at the very top of their field will provide valuable interaction with executive participants. Bell Atlantic CEO Ray Smith will be the featured speaker at the combined SUPERCOMM Executive Program and Communications Forum Industry Luncheon.

Executive Program Workshop

9:30 a.m., Tuesday, June 3

Featured Speaker: Jagdish N. Sheth, Charles H. Kellstadt Professor of Marketing, Goizueta Business School, Emory University

Panelists: Jeffrey A. Schlesinger, Vice President and Senior Wireless Equipment Analyst, UBS Securities; Jennifer Taylor, Partner-in-Charge - National Telecommunications Industry, Price Waterhouse

Thursday, June 5 – TecForums

IEC's educational program culminates with two exciting and in-depth Forums on Thursday.

TF3 8:00 a.m. - 5:00 p.m.
Competing Internet Transport Technologies
TF4 8:00 a.m. - 5:00 p.m.
Surviving and Thriving in the Unbundled Network Environment

IEEE Computer Society
Internet Computing
Conference - IC '97
1-202-371-1013
http://www.computer.org

MultiMedia Telecommunications Association (MMTA)
MMTA New Annual
Conference
1-202-296-9800
http://www.mmta.org

TIA/Committee T1
Wireless Standards Program
1-703-907-7735
http://www.tiaonline.org

SUPERCOMM/Phillips Business Information
Global Telecom Market Forum
1-202-383-1480
http://www.super-comm.com

EXPLORE THE WHOLE WORLD OF COMMUNICATIONS .97

IEEE Computer Society

IC '97, presented by the IEEE Computer Society, will feature tutorials on Internet-based computer applications and supporting technologies. IC '97 offers full- and half-day tutorials on Monday, June 2 and Tuesday, June 3, for engineers, scientists and technical managers. The tutorials will cover Internet and intranet applications and development tools.

These sessions feature leading experts who will share their expertise and offer a technology road map with new ideas, practical tools and informative case histories. Tutorials will include applications of current and future technologies in Internet computing such as World Wide Web services, Java programming and Internet-based agents.

MultiMedia Telecommunications Association

The New Annual Conference of the MultiMedia Telecommunications Association (MMTA) will feature sessions on these topics and much more:

- New product opportunities for the delivery channel – from Computer Telephony Integration (CTI) to wireless and Internet to voice messaging
- CTI market opportunities: Who offers them, who needs them, how do you sell it?
- Voice Platforms for Multimedia: What's new for PBXs? What happens when voice is viewed as just another "application" like E-Mail, video or file/image transfer? What can voice LANs do and who can deliver them?
- Network Services Integration Opportunities: Sales Agency and Resale
- Management and Partnership Opportunities for Businesses in the Delivery Channel
- Emerging Broadband Networking Solutions

TIA and Standards Committee T1

The Telecommunications Industry Association (TIA) and Standards Committee T1, sponsored by the Alliance for Telecommunications Industry Solutions (ATIS), present a one-day seminar entitled "Looking Ahead: Wireless Interconnection and Standards Issues in a Post-Telecommunications Act Environment." This seminar focuses on the wireless standardization issues as a result of the passage of the Communications Assistance for Law Enforcement Act of 1994 (CALEA) and requirements for Enhanced 911 calling. The most recent developments in wireless local loop and satellite Internet connections will be discussed. An update on the Federal Communications Commission's Network Reliability and Interoperability Council will also be provided.

This seminar is offered on Monday, June 2. Industry experts from TIA and Standards Committee T1, the premier developers of telecommunications standards, will present the program, which is organized into three panels with a luncheon presentation.

Panel I – Wireless Interconnection: Issues Raised by the Telecommunications Act of 1996

Panel II – Protection on the Airwaves: Safety, Security and Toll Fraud

Panel III – What's New: Emerging Technology in the Wireless Market

SUPERCOMM/Phillips Business Information

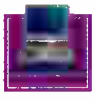
The worldwide telecommunications market is growing at 20 percent annually with almost $600 billion to be invested in network infrastructure over the next five years. This dynamism is fueled by a number of interwoven trends. The Global Telecom Market (GTM) Forum at SUPERCOMM, co-organized by TIA, USTA and Phillips Business Information, is an essential event for anyone who wants to capitalize on these trends that are completely changing the landscape of the global telecom marketplace. Questions that will be answered include how the new multilateral telecommunications trade agreements in equipment and services will grow opportunities for U.S. providers.

The GTM Forum will begin at 1:00 p.m. on Sunday, June 1, with a series of workshops devoted to topics such as financing, global equipment certification deregulation and export control reform. Monday, June 2, will commence with a free Global Telecom Round-Up session that will set the stage for a full day of three concurrent tracks on market opportunities in the most dynamic regions in the world: Latin America, Asia-Pacific and Europe-CIS. Each track will give practical advice on how to take advantage of the technology, regulatory and industry trends shaping the marketplace.

On-site registration for the GTM Forum opens at noon on Sunday, June 1.

The COMMERCIAL SERVICE International Buyer Program

SUPERCOMM '97 is endorsed by the U.S. Department of Commerce International Buyer Program



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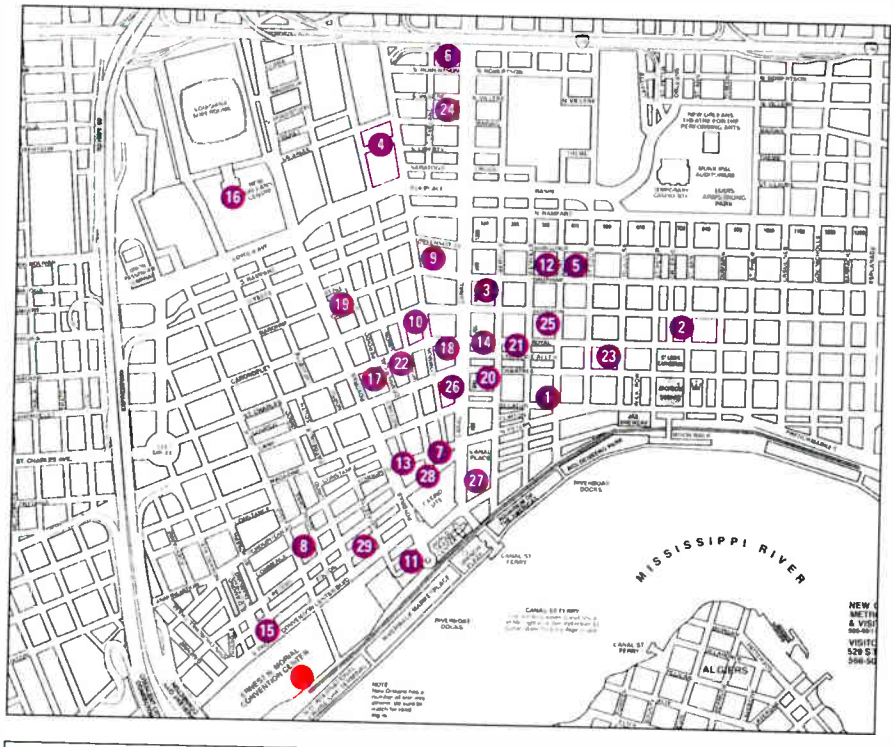

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12.	Holiday Inn Chateau LeMoyne	139/162
13.	Holiday Inn Crowne Plaza	147/170
14.	Holiday Inn French Quarter	139/162
15.	Holiday Inn Select	140/160
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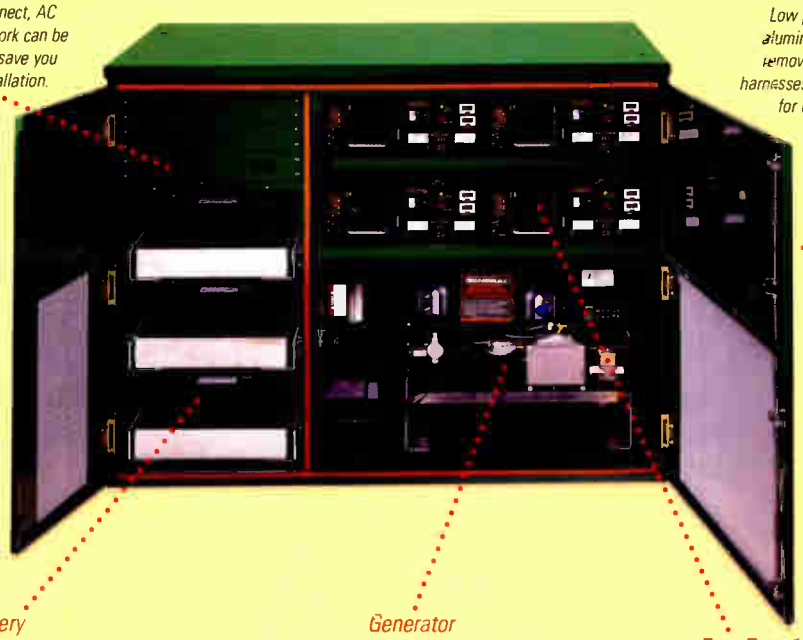

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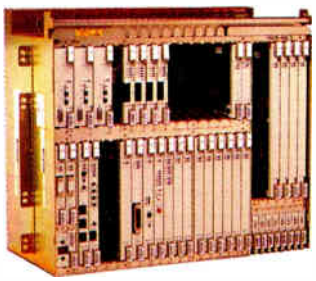

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ident of engineering at Cox.

At the same time, analog addressable box purchases will fall from 350,000 units to about 200,000 next year, Best says.

US West/Continental Cablevision hasn't yet publicly disclosed its digital rollout plans in detail, but is rumored to be close to deals with both GI and S-A for purchase orders, which could be announced by the National Show.

Naturally, cable operators say the digital roll-out would accelerate with a more aggressive pricetag attached to the set-tops. While some cost reduction can be expected from greater integration that will reduce chip counts and make manufacturing more efficient, as Van Orden noted earlier in this article, the industry shouldn't expect a $200 box anytime soon. But that doesn't mean the operators won't continue to press for one.

"I don't see why they should be greater than

S-A's Explorer 2000 will feature a built-in transmitter for real-time "reverse path" communications.

$200 apiece," says Best. "Depending on the bells and whistles, they can be twice that today. We need multiple suppliers, and of course, the vendors have to come down the learning curve. So, I'm optimistic that someday we'll get there."

Someday got a lot closer when the industry managed to hammer out a standard late last year that allows cable operators to populate their systems with digital set-tops from multiple vendors. By separating the core encryption and access control from the modulation, compression and signal transport layers, a system can purchase set-tops from rival companies and have them work in the same system.

Driving costs down

But perhaps more importantly, the standard will attract additional manufacturers, which creates competition and lowers prices for end-users.

The interoperability spec "helps in a couple of ways," notes GI's Kanouff. "Standards in the industry drive the market and drive costs down, because component companies are more willing to jump in and build things (when) the market is expanded."

As for other manufacturers, Zenith is occupied developing and manufacturing digital set-tops for the Americast consortium. The Chicago-based electronics firm has teamed with Divicom to build an MPEG-2 based, QAM box for the telcos.

Meanwhile, the other, nearly defunct consortium, Tele-TV, will have to renegotiate its contract with Thomson, now that Bell Atlantic and Nynex have abandoned their plans to offer video using MMDS technology.

Reportedly, Tele-TV took delivery of only about 200,000 set-tops out of an order that was originally projected to total as many as 4 million units.

According to one source inside the company, however, set-top development efforts within Tele-TV continue. Specifically, Bell Atlantic needs a set-top for its fiber-to-the-curb system it plans to build next year. Tele-TV has reportedly chosen the vendor for the box, but hasn't yet disclosed who it is.

Even analog wins

Despite all the movement—finally—on the digital front, new, advanced analog boxes remain popular among operators and will continue to be for some time, according to Steve Necessary, vice president and general manager of analog video systems at S-A.

In short, cable operators are less hesitant to place a set-top on top of a customer's TV because they offer so many new services, including messaging, virtual channels, on-screen guides and more.

"A year ago, all of that was wishful thinking" (that customers would see the value of these new boxes), admits Necessary. "Now we have some pretty good, hard facts to support it." CED

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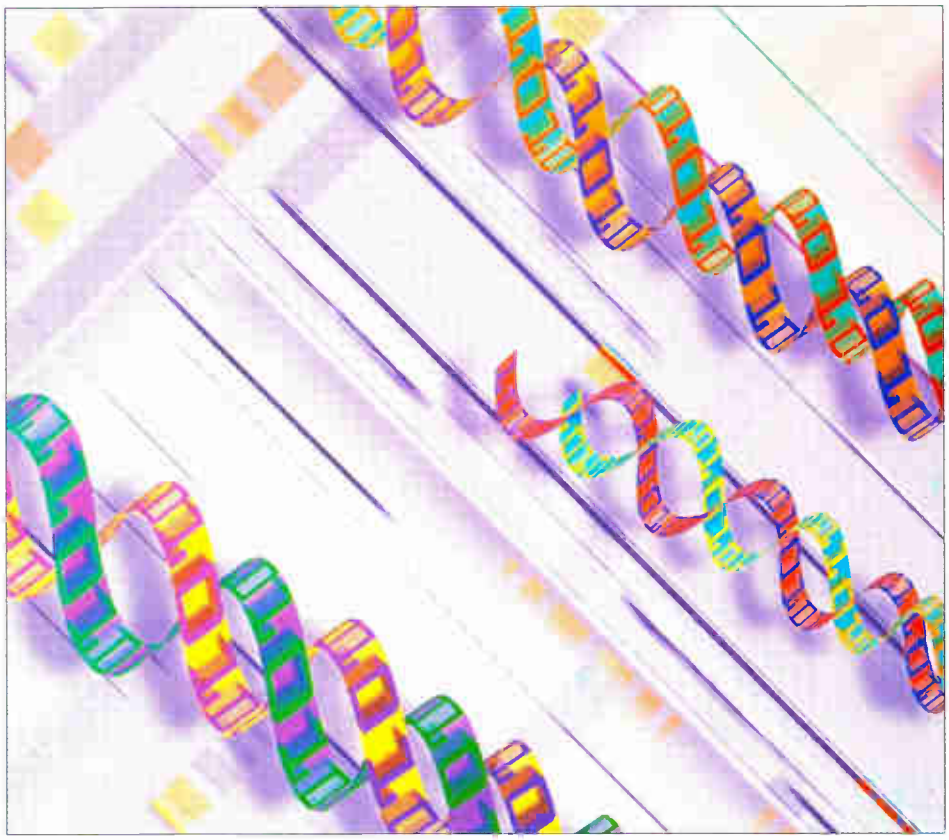


ILLUSTRATION BY STEVEN HUNT, THE IMAGE BANK

Real-time reverse: An upgradable architecture for HFC

Digital migration strategies

By William E. Wall, Ph.D., Chief Scientist, Subscriber Systems Division, Scientific-Atlanta

Deployment of digital technology is beginning to advance more rapidly. The reasons: Interactive trials have proven that the technology works; standards are emerging; costs are coming down; and the success of digital broadcast satellite (DBS) services proves that digital television is in demand. Yet, operators of hybrid fiber/coax (HFC) networks are still determining what type of digital system or architecture makes the most sense.

Early plans for deploying digital set-top boxes on cable networks have focused on "broadcast-only" solutions. The approach has low initial cost and can take advantage of digitally-compressed satellite feeds. However, this approach is only capable of one-way transmission of digital and analog programming.

The broadcast-only approach gives HFC operators few opportunities for incremental revenue. Broadcast services alone, even with the digital advantages of better image and sound quality and greater choice for consumers, will not be enough to justify a set-top that may cost up to $450. Furthermore, the limited life span of broadcast-only set-tops means additional investment will likely be required in the near future to replace them with more advanced terminals.

In essence, a one-way, broadcast-only solution attempts merely to match DBS services. Therefore, the only competitive advantage the broadcast-only architecture offers over a DBS system is its ability to include local channels—and that advantage may be short-lived if providers carry out plans to "spot beam" local network programming to subscribers.

To surpass DBS offerings, MSOs need a digital system architecture that takes advantage of their HFC capabilities and is designed to:

✔Easily access a wide variety of existing and potential sources of broadcast content and programming;

✔Offer data and Internet access services; and

✔Prepare for true video-on-demand with "VOD-ready" set-tops.

Until recently, the only alternative to broadcast-only systems has been a complex, expensive "switched interactive" system. This approach has yet to demonstrate that it is economically feasible for operators, manufacturers and consumers. From the outset, the "switched" system architecture requires not only a set-top with a reverse path, but also ATM switching and expensive servers.

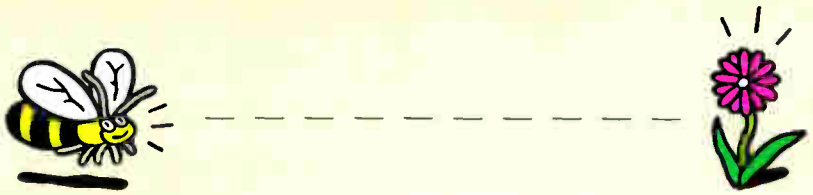
A network computer for the home

A new approach, selected by Time Warner for its Pegasus deployment, is a real-time reverse (RTR) system designed to achieve all three of the above objectives. The RTR approach features a digital terminal designed to serve as a new home appliance: the first true television-centric multimedia network computer. It is being built to support existing analog services, emerging digital broadcast services, data services such as Internet access and future interactive services in a manner that allows the cable operator to upgrade the infrastructure for each new service only when it is economically viable to do so.

Real-time reverse means that the home terminal will feature a built-in RF reverse path transmitter capable of transmitting back to the headend instantaneously, or in "real time," over the HFC plant. The real-time, two-way capability will give HFC operators an unmatched competitive advantage vs. DBS and other wireless competitors. When the operator is ready, two-way services and sophisticated network management and operational support applications can be activated.

The home device will truly be a network computer able to communicate with the consumer. In addition to being a video entertainment device, it is also designed to act as a TV Web browser or a cable modem. So it seamlessly will support both video applications and Internet access via the PC or TV. Sophisticated communications modules within the operating system controlling the RTR transmitter provide a truly "wired" environment for application software.

The device will incorporate a high performance, 32-bit RISC processor with a hardware graphics accelerator tailored to TV displays, along with hardware MPEG-2 audio/video and Dolby AC-3 audio decoders. A real-time, multi-



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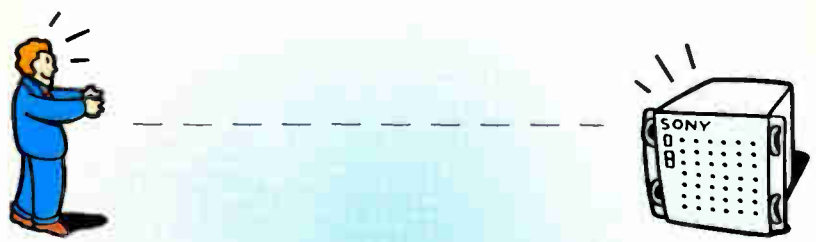

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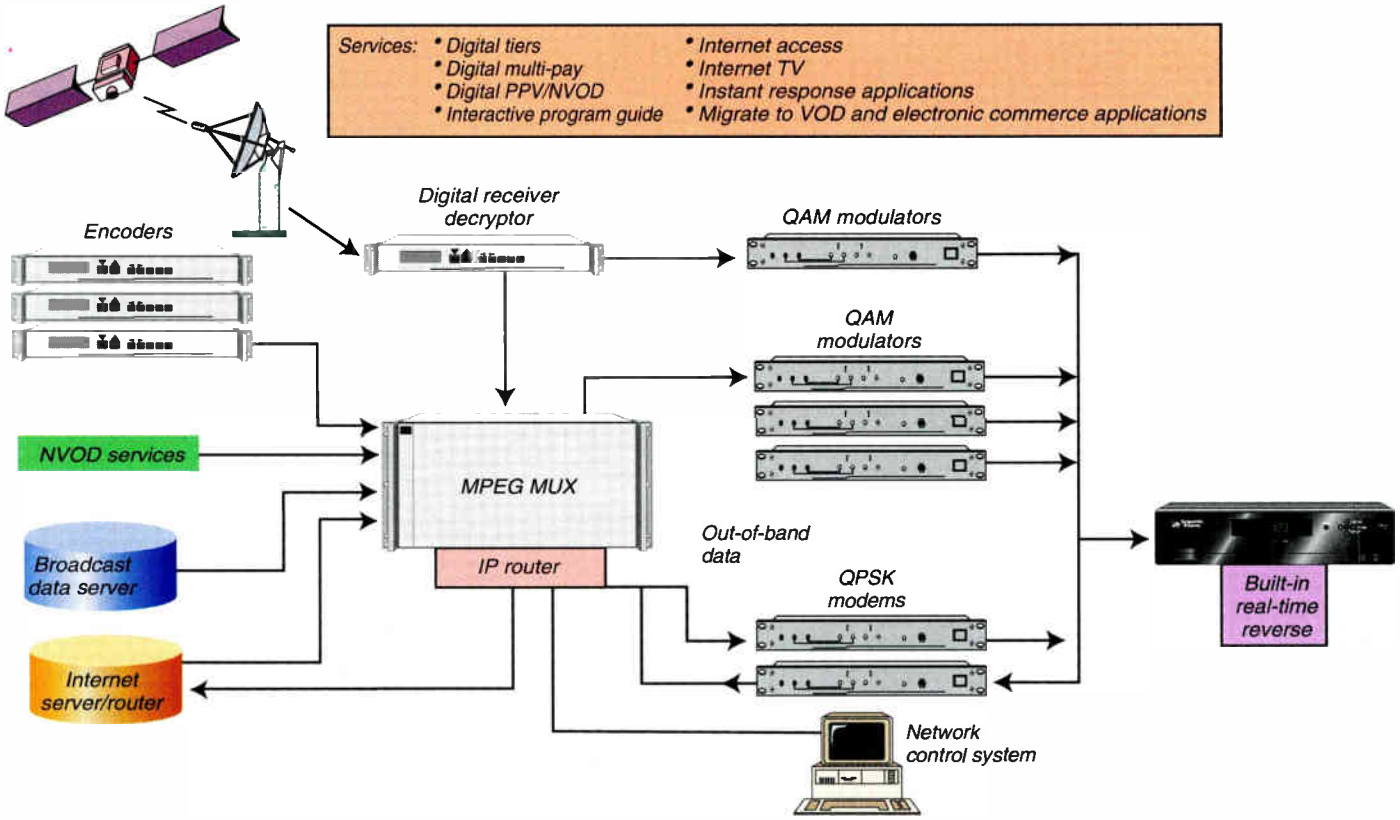
Figure 1: Real-time reverse system with digital broadcast and Internet access services.



tasking, multi-threaded operating system will be incorporated to provide true multimedia capability with playback capability. In addition to MPEG, the device will be designed to play back or execute other standard multimedia data types such as HTML, or optionally, JAVA scripts. The graphics accelerator will provide high resolution, photo-realistic graphics, and full screen animation and video scaling capabilities. An open API will allow a variety of applications to be developed by independent software developers.

The home terminal will include a locally-controlled conditional access system featuring public/private key security, message authentication and digital signatures.

The RTR architecture will provide operators with a practical end-to-end solution for both the home digital terminal and the supporting network. Designed to DAVIC and CableLabs/SCTE standards (or DVB standards in international markets), the system will support well-known protocols at all levels of the communications protocol stack. The RTR approach features full Internet Protocol (IP) connectivity with the home terminal. To ensure high performance communications between the home terminal and the head-end, the system will use a 1.5 Mbps out-of-band forward control channel and a 1.5 Mbps reverse channel with an efficient media access control (MAC) protocol. The home terminal will also implement the Transmission Control Protocol (TCP/IP), allowing direct compatibility with the Internet.

Two other data paths will be supported within the home terminal. The analog channels may contain VBI data; this data may be services related to the analog video, or may be used as a general data path. The home terminal will be able to decode standard VBI formats such as NABTS. The last, and largest data path is the QAM path. Using either 64 or 256 QAM, data may be carried imbedded in the MPEG Transport Stream along with the video and audio. Here, as in the case of VBI, this data may be in the form of IP or other formats. The application running in the home terminal, along with the network control system, will determine which data path is used in the forward direction.

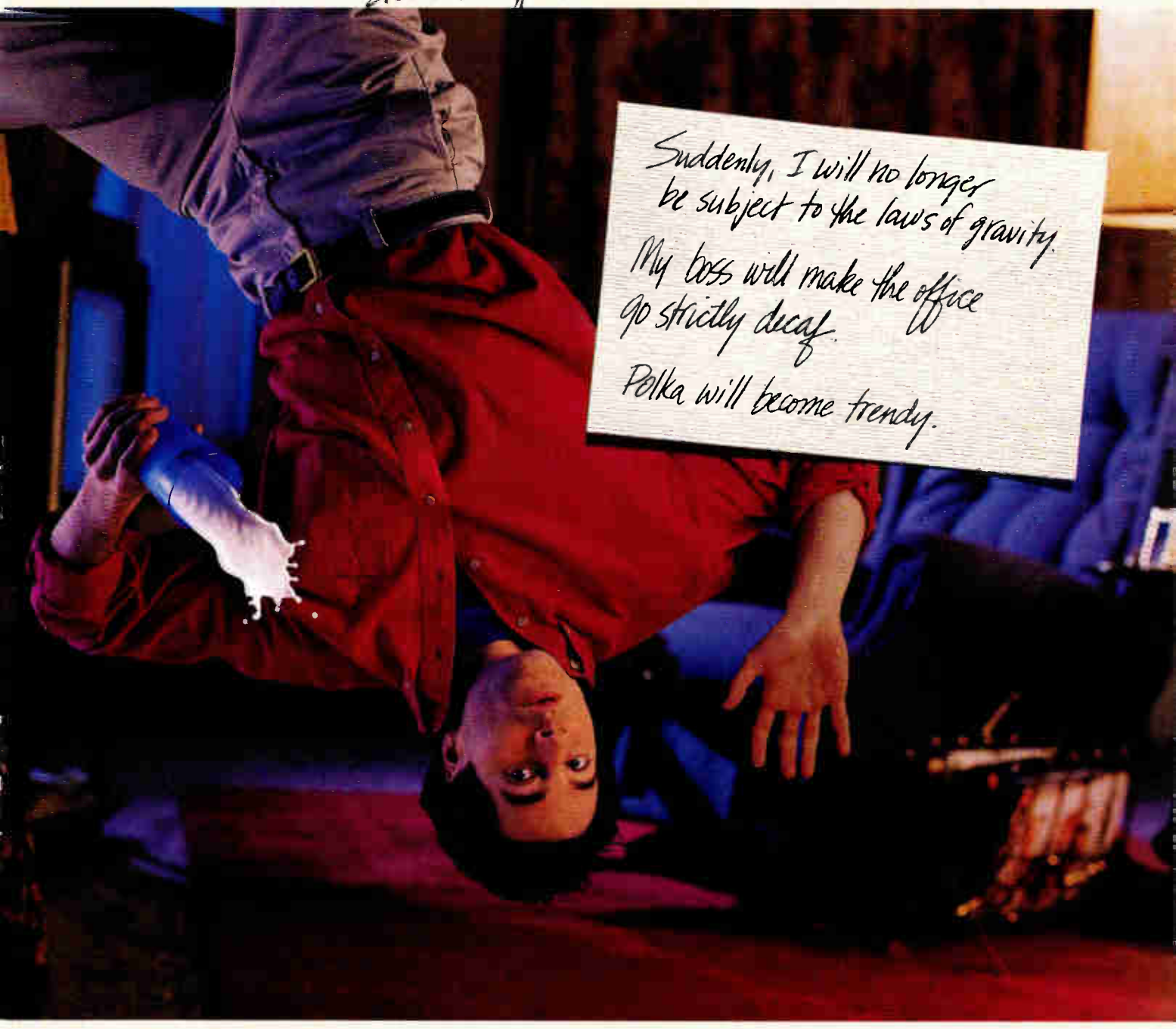
The inclusion of the simple network management protocol (SNMP) in the home communications terminal (HCT) will allow remote diagnostics of the HCT to be performed by the network control system. These diagnostics include not only HCT performance, but measurements of end-of-line cable performance as well. Such methods will allow operators to track system performance, allowing early detection of problems and minimizing truck rolls.

The system will encompass the necessary technologies for both digital broadcasting and high-performance data communications. The building blocks of the architecture are all based either on open standards or available licensable technologies. The system will adhere to MPEG-2 standards for audio, video, systems and signaling—including decompression of Dolby AC-3 and Musicam audio—and will also support the applicable standards of CableLabs/SCTE, DVB, DAVIC, DSM-CC, ATSC, IP, HTML/HTTP and SNMP.

An open-standards approach eliminates dependencies upon a single party; fosters competition and differentiation; increases the likelihood of interoperability and connectivity; and encourages content creation by developers. All of these combine to make new digital services more attractive to consumers.

Because the data network is scalable, the operator will need to deploy only the capacity needed to support the number of installed devices and the new applications. Then the operator can incrementally add network capacity as the number of deployed devices and/or the number or type of applications increase. For example, the system could be initially deployed supporting broadcast analog and digital channels only, without incorporating any data network components except a single out-of-band QPSK transmitter; the network components can be added when an Internet access service is implemented.

THE FEARS OF *Steve Kinger*, CATV NETWORK ENGINEER



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RTR's rich functionality gives operators considerable flexibility to deploy only those services that promise a return on investment. By following a methodical migration path, HFC operators can retain high-revenue subscribers by building a package of services that wireless competitors cannot offer.

Step one: Broadcast

Let's examine how the RTR architecture will support a likely migration scenario. The first step in the strategy, let's say, is to match the key attractions DBS offers subscribers: dozens of new channels, and the superior quality of digital video and audio.

As noted earlier, broadcast-only digital systems can accommodate an operator's desire to merely match DBS. Even in a broadcast-only environment, however, the RTR architecture will have superior capabilities because it is not limited to supporting just the nationally-distributed digital services.

With a "source neutral" architecture from the headend to the home, HFC operators can accept all types of feeds. Therefore, they can create their own digital service tiers from content delivered from satellite services, and also from other sources, such as multiplexed premium channels and server-based local or regional programming encoded real-time. This flexibility to accommodate all sources of programming enables operators to select the best services for specific markets and to negotiate better prices.

Another noteworthy advantage of the RTR architecture: It enables operators to continue to deploy addressable analog services to retain the wider base of subscribers, while at the same time, offering digital services to those subscribers who are most willing to pay for the new services (and therefore are most susceptible to DBS and other competitive offerings).

Step two: Data

As the next step in the migration using an RTR architecture, our hypothetical HFC operator will be able to surpass the capabilities of DBS by implementing high-speed data services. (Although DBS can now include an optional data delivery capability, the downstream throughput is limited, and a telephone line or ISDN is required for the return path. Moreover, all users nationwide must share the DBS provider's available bandwidth for data transmission.)

To support two-way data services, the digital terminal in the home must have extensive capabilities. It needs to have sufficient CPU power, graphics and memory resources to implement compelling multimedia applications. It must also have an open application programming interface (API), contain a powerful operating system and support TCP/IP, HTML, and optionally, Java.

The RTR home device is designed to meet these requirements. It will enable Web browsing, Webcasting services and other data access services to be deployed and displayed to subscribers on their television screens. The high performance graphics capability of the HCT yields the best possible rendering of Web content on a television. A built-in Ethernet port will also allow direct connection to a PC. When connected to a PC, the home device will perform the same functions as a high-speed cable modem, allowing direct Internet access to the PC, while simultaneously allowing the HCT to function normally for television viewing.

Table 1: Communications paths for home terminals

Path	Waveform	Bandwidth	Description
Standard format analog	Analog	6 MHz	Analog video; vertical blanking intervals (NABTS, WST) can support general data
Direct transmission channels	QAM (64 or 256)	6 MHz	MPEG-2 transport stream can carry data as well as video and audio
Forward data channels	QPSK	1 MHz	1.5 Mbps "out-of-band" channels used for transporting data and system messages without interfering with subscriber's services
Reverse data channels	QPSK	1 MHz	1.5 Mbps TDMA channel

Step three: VOD

HFC operators want to continually upgrade their services as new digital services and applications prove their revenue potential. Because the RTR architecture employs a true network computer as a digital terminal, operators will be able to migrate to interactive video services, such as multi-location video games and VOD, without changing anything in the terminal. VOD, especially, is a service that would clearly distinguish an HFC network from DBS competition.

VOD is singled out here because its consumer acceptance has been demonstrated in various trials. The evidence is growing that VOD buy rates would be considerably higher than the one or two buys per month generated by near-video-on-demand. The only remaining obstacle for VOD is getting system infrastructure costs down to an affordable level. When that occurs, RTR is VOD-ready.

As noted, the RTR digital home terminal will be a network computer. As such, it is a system designed to rely on the network, rather than disk drives, to download applications. Two basic methods will be used to retrieve applications or data from the network. The first is a broadcast carousel, where the available applications or data services are broadcast to everyone continuously. When a device needs to download information, it listens to the carousel and picks out the data that it needs. This method works very well for commonly-used data. For data that is rarely needed, or is specific to a single user, a client/server model will be used where the device queries a data server within the network, and that data is directed to the device.

For the home device to be responsive to its user, the network must provide low latency and high-speed performance. The lack of this performance has been a drawback to other devices that claim to be network computers, but rely on telephone connections to the network. One of the keys to achieving this is DAVIC signaling protocols and upstream media access control (MAC) protocols. RTR embodies both.

The reverse path that supports Internet and VOD is further justified through a longer set-top life and additional revenue opportunities—such as games, local information services and electronic commerce. When operators are ready to move even further into the world of digital, additional services can be offered, such as: home shopping, interactive games and interactive education/distance learning.

Future opportunities for digital services—particularly Internet access via broadband networks—are expected to be lucrative, so operators need to develop migration strategies now.

To compete effectively with DBS providers, the HFC digital/analog system architecture must be capable of meeting today's early needs—*and* ready to migrate to higher-end digital services as market demand and content increase. The real-time reverse, "two-way-ready" approach will provide a sound business solution for operators to begin digital deployment. CED

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Noise and ingress performance in the return path

Starting a monitoring program

By Bill Morgan, R&D Project Manager, Hewlett-Packard

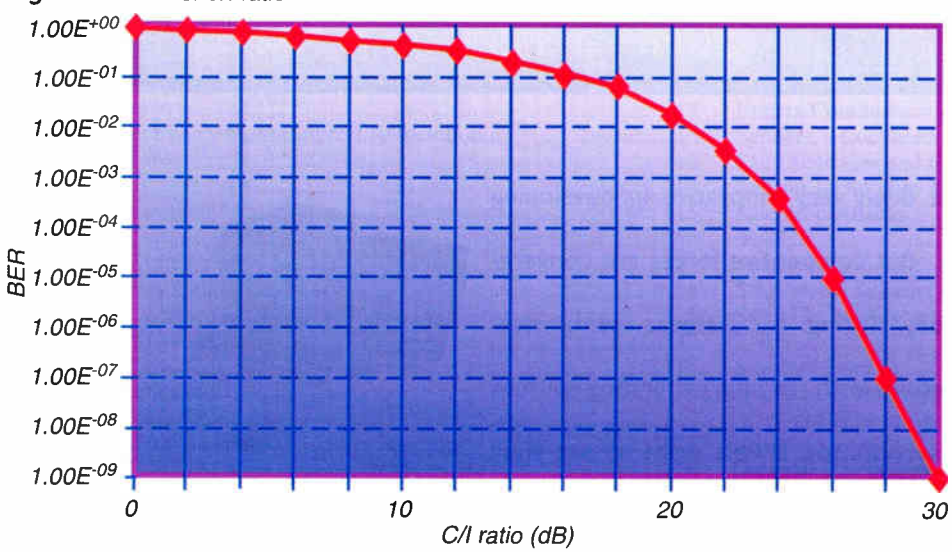
The previous two parts of this series (in the October and November 1996 issues of *CED*) discussed the proper procedures for alignment of the return path, and recommended proactive maintenance practices to keep the return path operating effectively. Cable operators are finding that ingress is the biggest roadblock to offering the two-way services that customers are demanding. This article will recommend several ingress measurements to help quantify the return's performance, discuss the relationship between ingress and BER, and provide some suggestions for data handling. Prior to starting an ingress monitoring program, it is critical that your return path be properly aligned and your technicians understand the importance of maintaining proper gain balance. For more detailed information on this subject, we have provided references at the conclusion of this article.

Spectrum monitoring

The most common method of return path monitoring in use today is to connect a spectrum analyzer to the return path and check it daily or whenever a problem is reported. This can hardly be classified as a proactive maintenance approach, but it is better than waiting for the customer's complaint. As a first level of monitoring, this same spectrum analyzer can be connected to a computer and trace data stored periodically to create a history of your return path's performance. The analyzer can be configured to keep the sweep rate as fast as possible and still have the frequency resolution necessary to identify problems. The data processing should include comparing the data to thresholds and identifying alarm conditions, as well as keeping a running average of the data to characterize the performance of the return path over long periods of time.

By comparing the data samples which fall below a given threshold to the total test time, the user is able to derive a rough approximation of percent availability vs. frequency. There are many things that can be done with the results from this type of test, and there is a potential for generating massive amounts of data. Because of this, it is important to establish good methods for compressing the data into usable archives. Programs designed for this type of monitoring are currently available.

Figure 1: *BER vs. C/I ratio*



BER vs. carrier/ingress

Although spectrum monitoring is a good first line of defense, it is important to monitor other key parameters in the return path and repair problems before customers are affected by slow response times or loss of service. Bit Error Rate (BER) is often discussed as one of the key parameters to use for monitoring return path communication channels, because this is a true measure of the performance delivered to the customer. Each of the services (cable modems, telephony, VOD, LAN, etc.) require varying levels of performance, anywhere from one error per 10,000 bits (10^{-4}) to one error per 10 million bits (10^{-7}). BER is one of the measurements that has traditionally been used in digital communications networks to monitor performance, and in a completely digital network, BER is an excellent metric to monitor. But in a mixed RF/digital network such as the cable TV environment, BER has several disadvantages.

Figure 1 is a typical example of the variation of BER vs. the carrier/ingress ratio (C/I) for a given type of modulation and error correction. The horizontal axis will shift depending on the type of modulation used, and the sharpness of the knee will vary depending on the type of error correction. The important characteristic to notice is the rapid increase in the BER as the C/I degrades near the knee of the curve. With only a 4 dB drop in C/I from 28 dB to 24 dB, the BER increases from 1×10^{-7} to 4×10^{-4}. In an RF network, the advanced warning received as the C/I degrades is limited if BER is the chosen parameter to monitor.

In addition, most of the digital services being carried by the return path today do not carry the reference bit stream required to make a BER measurement. The time required to make a BER measurement can be significant, and is defined by the equation:

$$\text{Time} = \frac{1}{\text{Data Rate} \times \text{BER}}$$

Using this equation, we can calculate that on a typical QPSK return carrier with a data rate of 1.5 Mbps, the time to measure 1×10^{-8} BER will be almost 67 seconds. Because the carriers are typically TDMA, the time required to capture enough data is lengthened even further. Another drawback to measuring BER is that it requires test equipment not currently found in most cable systems.

Another method often used to measure data transmission performance is monitoring packet errors. This is a measure of data packets (as few as 64 or as large as several thousand

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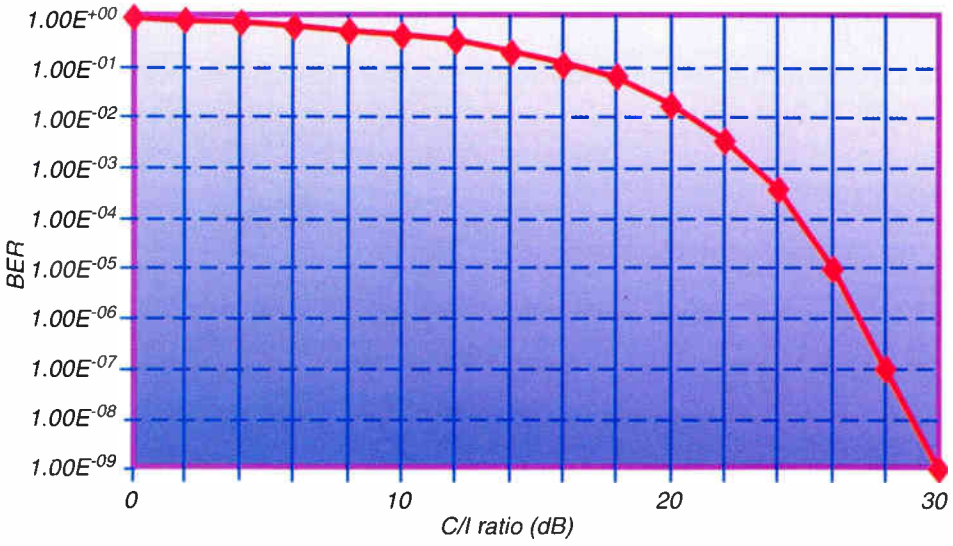

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bytes) which were re-sent because of errors detected by the receiver. Monitoring packet errors has the advantage of measuring the performance of an operating link without requiring embedded test code sequences. But packet errors also have a similar sharp transition from low errors to high errors as the C/I decreases.

A simpler and more effective approach to monitoring data transmission performance in an RF network is monitoring the C/I instead. Once the type of digital modulation and the error correction are defined, the relationship between the measured C/I and potential BER performance can be predicted. If necessary, a specific digital link can be characterized by measuring the BER as the C/I is varied. This data will normally be provided by the test equipment vendor, but should be verified anyway. The sensitivity and advanced warning gained by monitoring C/I is significant.

How do we measure it?

The C/I ratio can be calculated directly by first measuring the average power of the carrier, and then the average power of the noise in the same frequency span. When measuring the return path noise, you are actually measuring a combination of many artifacts. They are, in addition to noise from amplifiers, common path distortion generated from the forward path signals, second- and third-order distortion generated from excessive signal levels, and impulse noise and inducted interference coming from the drop and home. In general, all of these artifacts degrade the performance of the RF/digital communications link.

Figure 2 is an example of a 64 QAM carrier constellation in the presence of noise. As the noise approaches the knee of the BER vs. C/I curve. the points on the constellation spread far enough that they become indistinguishable from each other, and data errors occur.

The biggest difficulty encountered when monitoring noise in the return path is the presence of carriers. One option is to measure the noise in a vacant portion of the return band. Unfortunately, the magnitude of the noise in a typical return path can vary quite a bit with frequency. This approach also misses narrowband signals which fall on the carrier. But measuring noise offset from the carrier will help identify noise problems which cover wider bands, typical of impulse noise.

Gated spectrum monitoring

What is needed is a method for measuring noise in the presence of TDMA carriers. This is an ideal application for a measurement approach developed specifically for bursted carriers. The video gate was developed for the spectrum ana-

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lyzer specifically for measuring intermittent events. In this case, the video gate can be triggered by the envelope of the detected data pulse. An in-depth discussion of gated measurements is beyond the scope of this article, but gated measurements are discussed in several articles referenced at the end of this text. In addition, gated measurement application notes are available from the spectrum analyzer manufacturers.

By using a gated measurement approach, and changing the video gating from the rising to the falling edge of the burst detector, the spectrum analyzer video can be gated both when the carrier is on for the carrier measurement, and when the carrier is off for the noise measurement.

Using currently available test equipment, there are several other tests which can be performed to help quantify the magnitude of the ingress in the return path.

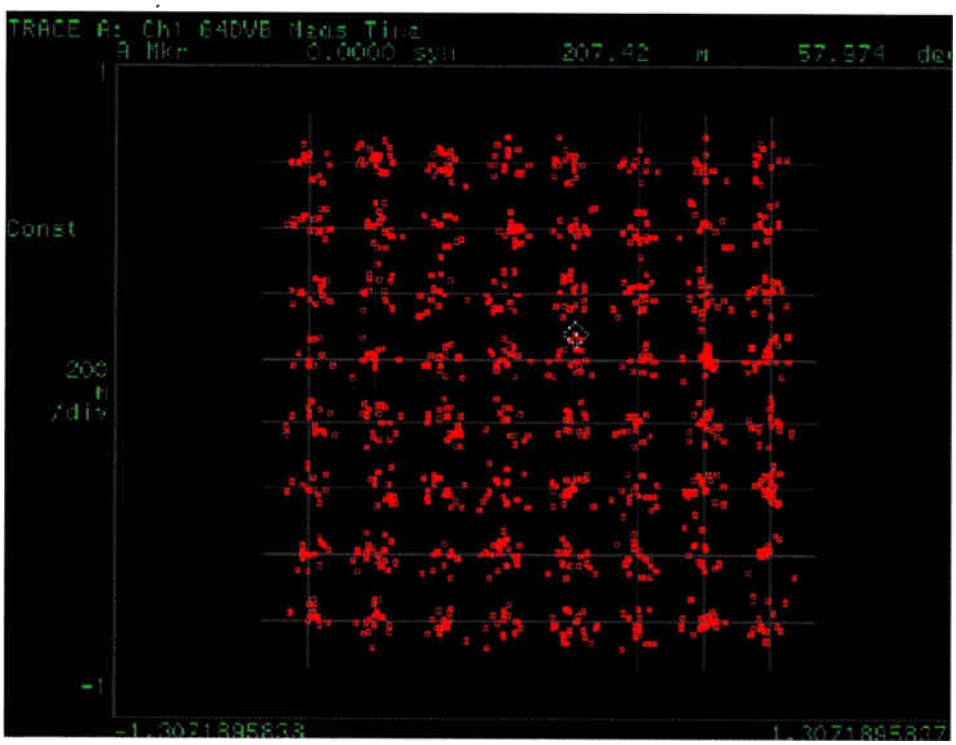


Figure 2: 64 QAM constellation with ingress.

Wide bandwidth average power

An average power measurement set up to measure the entire return band will provide a single quantity result (the ultimate in data reduction) for the average noise performance of the return path. This measurement algorithm is currently available in some spectrum analyzers for measuring the average power of digital carriers. To measure digital carrier power, the analyzer samples the signal in predetermined increments across the bandwidth of the carrier and integrates the samples to arrive at the average power of the carrier.

This same measurement can be used to measure the average power of wide bands of noise simply by increasing the measurement span to the full bandwidth of the return path. Figure 3 is an example of this measurement, with the start and stop frequencies set to 5 and 30 MHz, respectively. If carriers are active in the measured band, they will be included in the average power result, but this measurement can be an effective method for comparing the performance of multiple returns before there are active carriers. This measurement provides a single number for the result which is a good indication of the average noise performance of the measured path. This is not the best measurement for finding impulse problems or very narrowband interference. But it will help spot 2 dB or 3 dB variations in the average noise performance over time, which are difficult to identify by looking at a number of spectrum analyzer traces.

Time domain burst event counting

There are several variations on tests which tabulate burst events. A spectrum analyzer becomes a frequency selective voltmeter with the selectivity determined by the analyzer's IF resolution bandwidth, when it is tuned to a frequency of interest and set to 0 MHz span. The analyzer's video output can be sampled at a high speed by a digital oscilloscope. The samples can then be compared to a user-defined threshold to locate impulse or burst events in the return path which exceed the threshold. If you keep a log of the number, amplitude and duration of the events, you will have a good picture of the burst noise performance of your return path. Figure 4 is an example histogram from the results of a 24-hour test.

The CW Tester™, developed by CableLabs, is a variation on this test that measures the interfering signal's impact on the amplitude and phase of a reference CW carrier. The storage of data by the CW Tester™ is triggered by sensing when the reference carrier is shifted far enough (in phase or amplitude) to cause a data bit error. This additional phase information provides a unique signature of the burst, which may make identification easier. There are additional tests going on in which a high-speed oscilloscope is being used to monitor the return without frequency selectivity. This approach also has merit because the high-speed impulse noise in the return quite often has a wide frequency spectrum. Tom Staniec of Time Warner's Excalibur Group has even gone so far as to capture these impulses with a high-speed digital scope and re-create them with an arbitrary function generator in the lab to simulate return path disturbances.

Stay tuned to these trials, because the evolution of the methods for capturing impulse and burst noise in the return path is just beginning. The NCTA Engineering Committee is in the process of writing an addendum to the Recommended Measurement Practices which will cover the return path. The goal is to provide measurement procedures which rely on currently available test equipment, when possible.

What should I do with all of this data?

The goal of this effort is to provide different methods of ingress measurement which can be used as required, depending upon the nature of the anticipated problems. Ideally, a combination of all of the above should be used to give the broadest picture of the return path's performance. If these measurements are made on the return prior to service activation, you can select where carriers are assigned in the return band to provide the best performance for that carrier. Some carriers, such as IPPV, can tolerate higher levels of noise and can be placed in portions of the band with higher noise/ingress. Telephony carriers, which have the lowest tolerance to impulse noise, can be placed in the portion of the band where the impulse events are at a minimum.

The amount of data captured in a good return path monitoring program has the potential of filling even the largest computer disk drive in a short period of time. It is important to implement data compression which will prevent storing

massive amounts of data which will most likely never be accessed. The spectrum analyzer scans can be stored as the average, peak and minimum of the data over specified periods of time.

Another approach to use when analyzing spectrum scan data is to use a waterfall display, which adds a third dimension to the graphs for easier visualization of performance vs. time. A good example of this was provided by John Mattson and Joe Pendergrass of Arris Interactive in a paper presented at the 1997 SCTE Emerging Technologies Conference. But once again, the amount of data stored is significant.

The wide-band average power data could be stored as a graph of the average, maximum and minimum over time, with time as the horizontal axis in this case. This approach makes it easy to see trends in the data which may indicate gradual performance degradation.The best method for displaying the burst event data is in a histogram, with event length in the horizontal axis and number of events in the vertical axis.

Archival data from any of these measurements can be used to compare the performance of the plant as it grows, and subscribers are added. With a historical perspective of the return plant performance, gradual degradation will not go unnoticed.

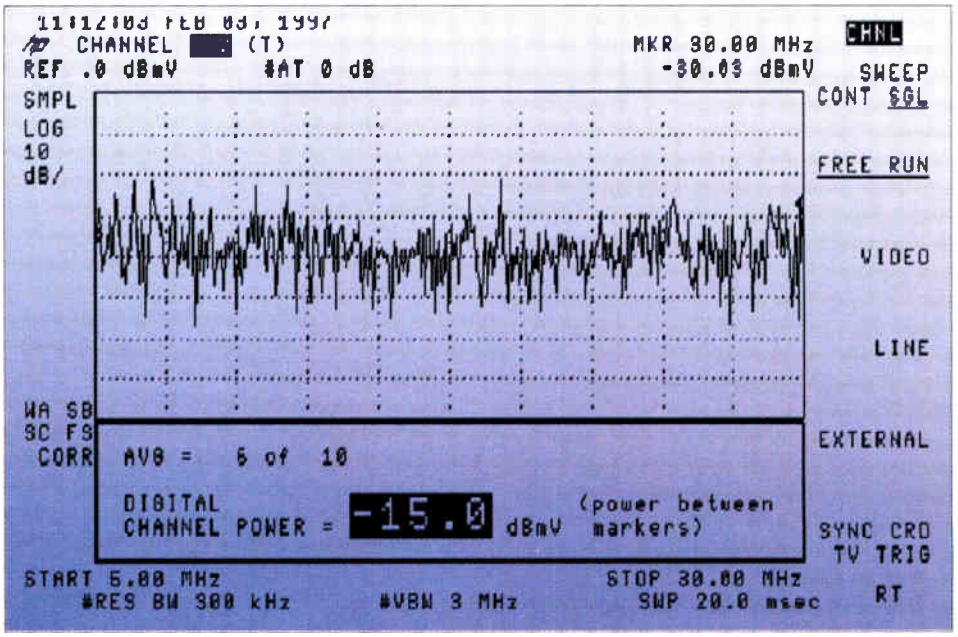
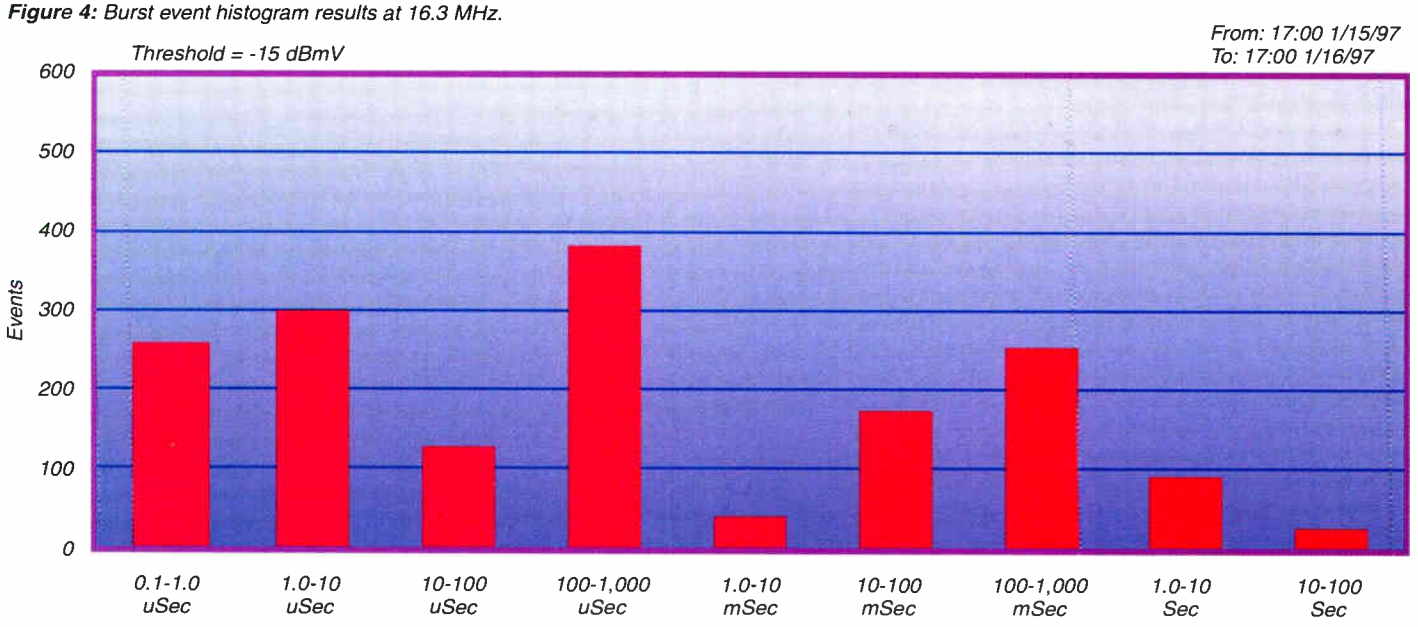


Figure 3: Wideband noise measurement.

The successful delivery of interactive services to your subscribers is contingent upon an efficient ingress management strategy. Know your options for measuring ingress and be prepared to

Figure 4: Burst event histogram results at 16.3 MHz.



be creative. Effective ingress management, along with proper alignment techniques and a proactive preventive maintenance program, will assure that you are ready to provide the new services that your customers are demanding. CED

Acknowledgements

The author would like to thank Beth Armantrout, Syd Fluck and Jerry Green of Hewlett-Packard for their help in creating these three articles.

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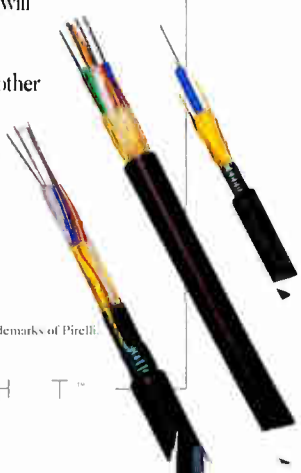

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Developing a GIS-based engineering toolkit

SNET overhauls its OSS infrastructure

By Brian Wade, Director of OSS Planning, Southern New England Telecom; and Peter Batty, Technical Director, Smallworld Systems Inc.

The telecommunications industry is embracing a fundamental transformation from yesterday's narrowband network based predominantly on copper pair transmission, to broadband networks which employ complex mixes of analog and digital transmission through both optical and electrical media. At the heart of this transformation are the engineering and construction disciplines associated with outside plant. The fundamental simplicity of copper distribution compared with broadband technologies is the harbinger of an obvious paradigm shift.

In addition to their transmission characteristics, however, emerging broadband technologies, coupled with their operational support systems, offer opportunities and challenges which implicate all other operational disciplines, including: Cut-over (the transition of the customer base to the new broadband infrastructure), service activation, service assurance, workforce management and network monitoring. These challenges propel the engineering discipline from the back room of current telecommunications operations to the very foundation of the telecommunications business. The approach to the engineering toolkit must, therefore, become one of the most fundamental decisions and will determine the success or failure of the metamorphosis of any telecommunications network.

Southern New England Telecommunications (SNET), a telecommunications provider located in Connecticut, is in the process of a major overhaul of its operations support systems infrastructure to accommodate several significant changes in its operations and business climate:

- ✔ The rapid introduction of broadband and other future technologies as they emerge.
- ✔ Network diversification and distributed control.
- ✔ Rapid, in-house, product and service development.
- ✔ Full and open competition.
- ✔ The provision of wholesale access to the network (a.k.a. unbundling).

At the foundation of this architecture is a geographical information system (GIS)-based engineering toolkit that not only supports the design and engineering process, but also provides the necessary fuel, in the form of derived data, to a suite of tightly integrated downstream applications. These include systems for construction, inventory management, element management, network surveillance, workforce administration and assignment.

Narrowband networks are characterized by the existence of highly complex, highly integrated switching nodes interconnected to the customer base via vast amounts of copper cables, constructed as feeder and distribution networks. In contrast, broadband technologies are moving the boundary of the switching center to the customer's doorstep. Remote terminals housing supervisory electronics will be located on poles and pedestals only feet from the target customer's premises.

In many instances, serving equipment will be located on the side of the customer's building or within the building itself. In effect, the network has become a geographically distributed infrastructure subject to critical design constraints which are a function of media, distance, transmission characteristics and cost. Moreover, the geographical relationship between customers and the switching centers which serve them will change from a many-to-one relationship via a geographically predictable distribution network (Figure 1) to a many-to-many relationship in which the serving terminal's geographical loca-

Figure 1: *Traditional feeder distribution model*

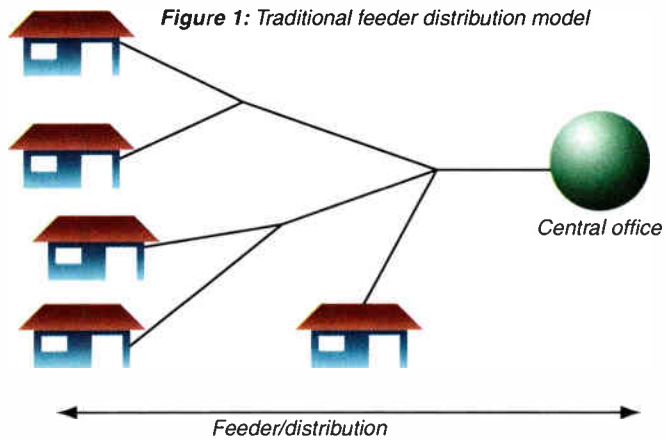
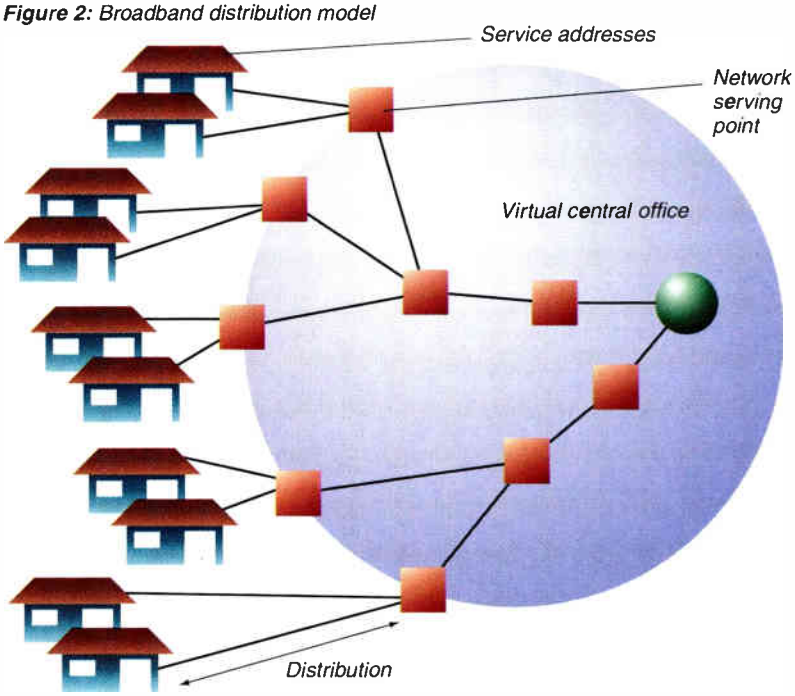
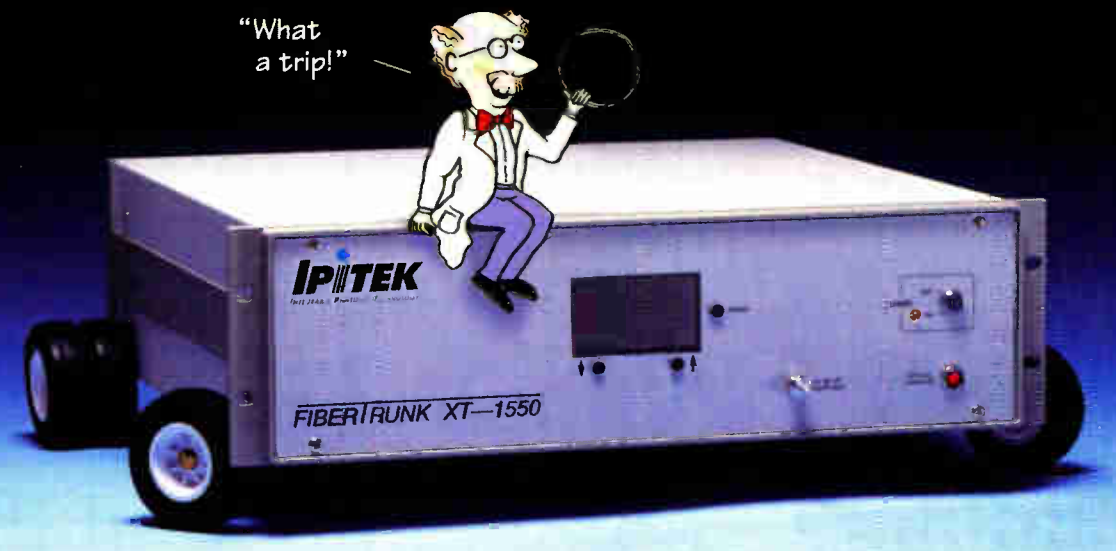


Figure 2: *Broadband distribution model*



Long distance carrier



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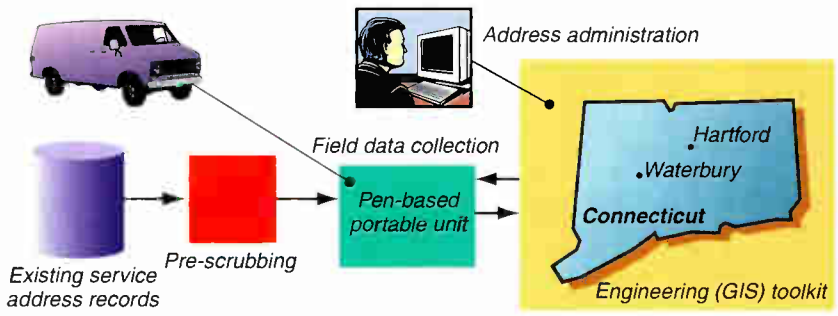
tion is highly unpredictable (Figure 2).

The challenge of the engineering process is twofold. Not only is the engineering tool responsible for the placement, interconnection and configuration of the outside plant, but it must also establish the relationship between all of the service addresses and the network service points. The latter is in fact the definition of the many-to-many relationship outlined above. This relationship must be established prior to the engineering design process and must utilize existing service address records. This information is often inaccurate, having been created and maintained by traditional (non-spatial) operations.

Figure 3: Initial and ongoing address grooming and administration



Managing address information

The purification of service address information and its association with physical buildings within the engineering toolkit becomes a fundamental prerequisite for doing an accurate network design. But how are these relationships established, and what role does a GIS play? Consider the overview provided in Figure 3. Existing service address records are pre-scrubbed and loaded into a portable unit in conjunction with the corresponding section of the GIS database. Field operations must provide:

✔ Information about missing and new support structures, such as poles and pedestals.

✔ Associations between service addresses and structures, typically buildings, on the GIS base.

✔ Updates and corrections when address anomalies are detected.

If final corrections to this information were made prior to its import into the GIS base, then an opportunity to improve the assessment and administration of address information would be missed. This can and should be conducted against a detailed GIS backdrop of towns, streets and so on. This allows address information to be viewed and managed within a powerful geographical context, and thereby maximizes its accuracy and consistency.

Daily operations require that field personnel navigate to service addresses and equipment sites to perform service activations and routine maintenance, and to perform necessary repairs. Equipment sites are locations which support equipment but have no underlying postal address. An equipment bearing pole is perhaps the most obvious example. In order to eliminate address duplication and to optimize the management of address changes, equipment sites will be logically linked to the nearest address-bearing entity and derive their address attributes accordingly. This will enable the set of address changes at any point in time to be readily determined and propagated to downstream systems.

Spatial predicates offer a powerful mechanism to manage geographical ideas. Boundaries can be established to create and maintain attributes of objects within the region they define. Consider the following sequence of actions:

✔ Building information, including address and other geo-political ideas, is imported into the GIS for each structure.

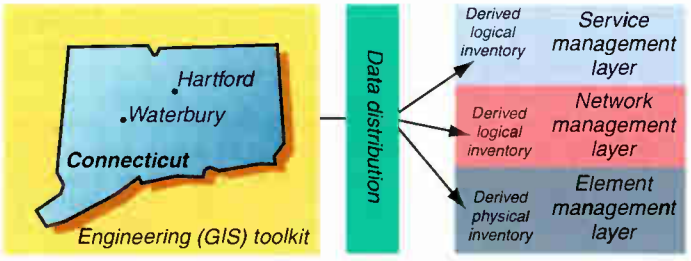
✔ The GIS is subsequently queried interactively to establish specific ideas, e.g., highlight all buildings in a town, tax area, wire center, or area where two technicians need to be dispatched for safety reasons.

✔ Nodal boundaries are created around each set of highlighted entities.

✔ Corresponding attributes are added to the nodal boundaries and eliminated from the entities contained therein.

✔ The attributes of the entities contained within such boundaries now inherit the characteristics of one or more nodal boundaries which contain them. Moreover, if the boundary size or shape is adjusted, attribute propagation occurs automatically and obviates the need for much of today's laborious data administration.

Figure 4: Address and inventory propagation



A typical flow of information from the GIS into the operational support system infrastructure is

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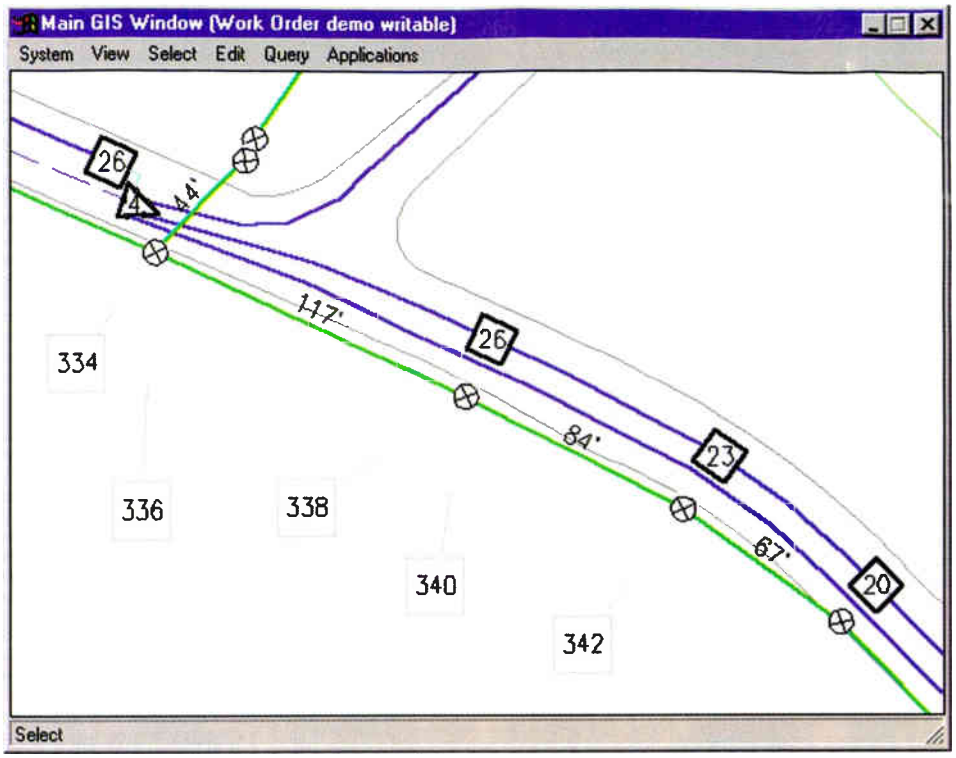

Figure 5: A section of a network designed using automated layout capabilities.

illustrated in Figure 4. The combination of address administration capabilities, the underlying linking between parental and subordinate structures, and spatial query and navigation capabilities herald a paradigm shift from today's operations in which the same process occurs against a classical, non-geographical information base.

Engineering

Broadband networks are complex arrangements of digital terminals, optical, coax and copper signal transmission media, power cables, optical/electrical signal convertors, amplifiers, taps, remote terminals, transformers and power inserters. The configuration of these elements is subject to varied design disciplines and algorithms. Serving areas are well-defined geographical regions served by their own distribution infrastructure. The initial task entails the definition of these areas. Well-defined serving areas will offer effective subscription bases measured by an appropriate balance between anticipated utilization, cost-effectiveness and regional consistency. In addition to economic and engineering factors, serving areas may be constrained by town and other political boundaries. Definition of serving areas is a task well-suited to GIS.

The placement of equipment within these regions determines the overall behavior of the resulting network, because virtually every aspect of the equipment performance is governed or constrained by the physical distances over which the signals must be transported. In designing the network, good engineering performance needs to be balanced against cost.

The ideal solution to the network design problem is the combination of powerful engineering design and analytical tools and geographical information system technology. The former must be inherently flexible in order to accommodate the rapid evolution of the broadband technology. The complexity of the network, and the need to frequently accommodate new types of equipment, means that an object-oriented approach has significant advantages. The development of effective designs is a difficult problem, and experience suggests that an appropriate combination of automation and human intervention provides the most effective solution in terms of both design quality and productivity. The design process consists of the following five major steps:

1) Serving area assessment and geographical definition.

2) RF design of the distribution (fiber node) area.

3) Powering of the distribution equipment including RF adjustments, if necessary.

4) Fiber serving arrangements.

5) Central office power feeder design.

The first phase of the implementation at SNET provides comprehensive solutions to steps two and three, together with some simple functionality to help with step one. The second phase of the implementation will address steps four and five.

Corporate equipment catalog

SNET has deployed an Oracle-based application which is used to create and maintain a corporate equipment catalog. Information stored about equipment ranges from basic

attributes like model name and manufacturer, to accounting information like labor class and account code, and detailed engineering information like insertion loss at different frequencies. This catalog is interactively accessed from the design tool. The implementation completely encapsulates the underlying data structure so that the toolkit can be easily modified to run with different underlying catalog structures.

For example, an internal catalog can be used instead of the SNET Oracle catalog with no change to the rest of the application, although the two catalogs use completely different table layouts. Within SNET's integrated architecture, the use of a single corporate equipment catalog ensures that data flows smoothly from the design tool to downstream systems.

The system automatically identifies the structures along the route and the physical cable layout

The most time-consuming task in laying out an RF network is the placement of the equipment which directly serves the customer (taps and network access units in the current architecture), and the cables which interconnect them. Fortunately, this is a task which can be highly automated. Before the design work is started, a combination of photogrammetry and field unit surveying will have been employed to identify:

✔ The structures available for equipment placement (such as poles, pedestals and manholes).
✔ All possible routes between these structures.
✔ The customer locations, typically buildings, to be served from these structures.

This body of information is known as a strand map. One additional important idea used by the automated tap layout function is a connected network of street centerlines. This is used to determine cable routes.

Once points have been placed at the beginning and end of a section of cable, the system automatically identifies the structures along the route, the physical cable layout, the customers which need to be fed from each structure, and the appropriate equipment to be placed at each structure. Equipment models are affected by various factors, including the input signal level at high and low frequencies, the number of customers to be served, any special services they may require, and the length of the drop cables which will run from the equipment to the customer. For video-only networks, the customer is fed directly from a tap; in full-service networks, the tap feeds a network access unit (NAU).

Various parameters, such as the minimum and maximum acceptable signal levels at the customer's point of service, can be specified by the engineer. The equipment catalog also supports the concept of equipment practices, an idea which constrains the use of a predefined subset of equipment for a given design. For example, equipment supplied by a single manufacturer may be used exclusively within a specific fiber node area. Figure 5 shows an example of a section of a network designed

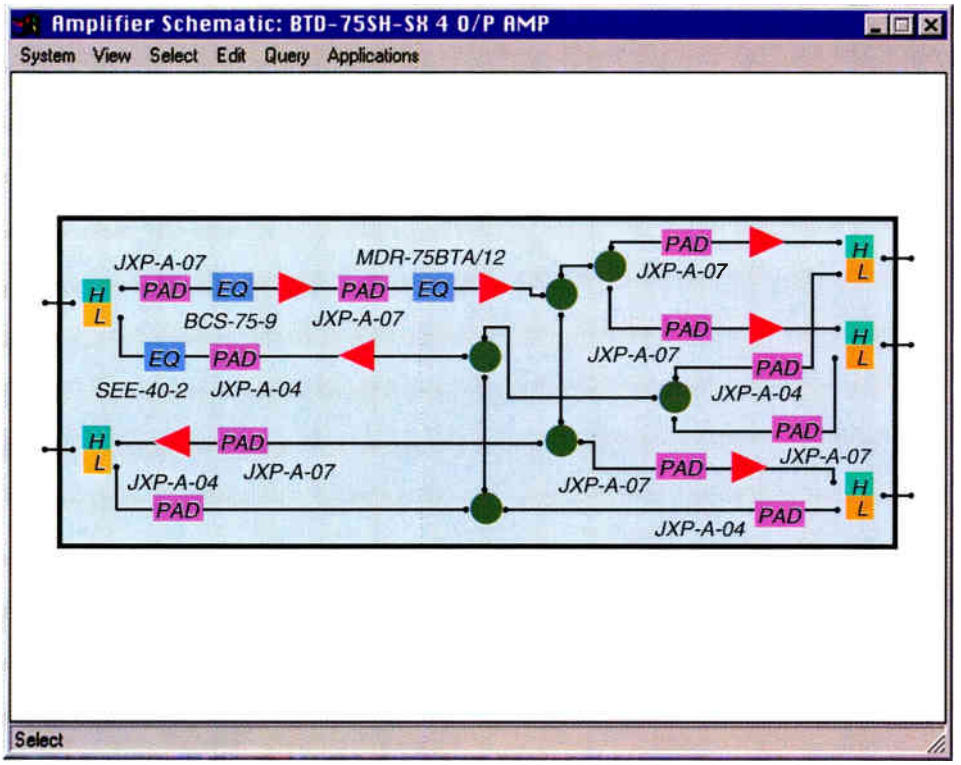

Figure 6: The internal layout of a typical amplifier.

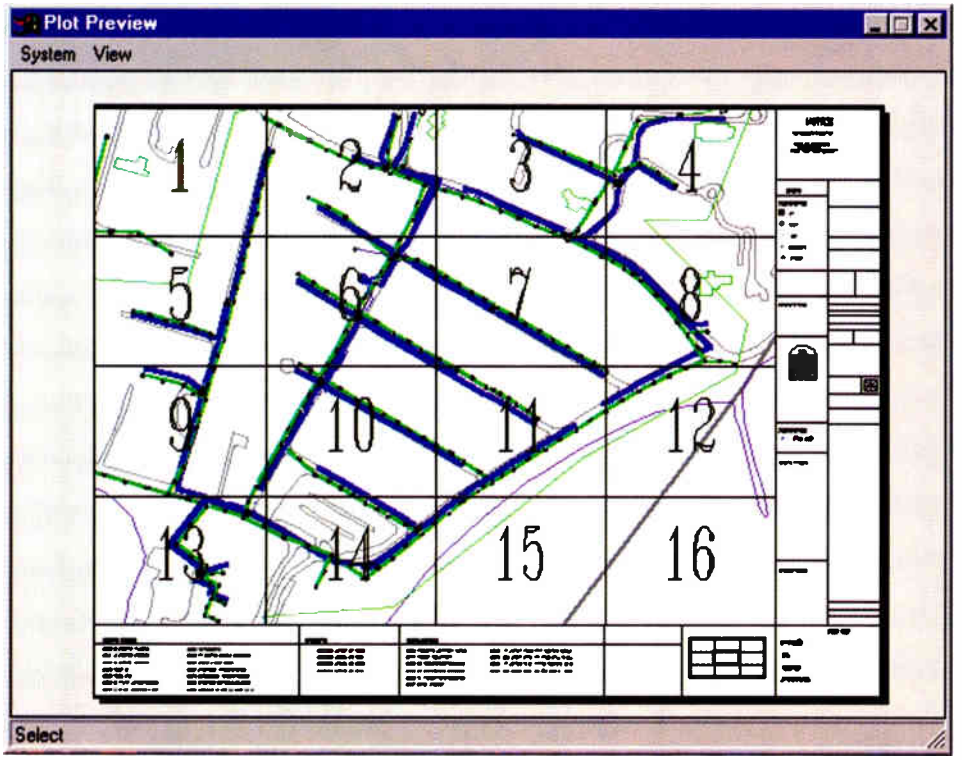

Figure 7: An overview plot for a fiber node serving area.

with the aid of the automated equipment layout function.

Amplifier modeling

Standard engineering practice establishes RF amplifier output signals to a predefined level which may vary depending on the type of amplifier and its position in the amplifier cascade. This level needs to be achieved regardless of the input signal, which may vary significantly. The output signal is adjusted to the required level by the insertion of plug-in components which modify the signal in different ways. Typical plug-in components include pads, equalizers, splitters, cable simulators and flatness boards.

Amplifier technology is changing rapidly; the latest generation incorporates complex internal structures with many options for plug-in components. Traditional engineering analysis tools have been based upon a relatively static and relatively simple amplifier model. In order to accommodate the latest generation of amplifier technology, a powerful and flexible approach to handling amplifiers was developed. The approach modeled the internal structure and internal connectivity of the amplifier within the engineering design tool using the concept of multiple worlds.

When an amplifier is created, its internal representation is copied from a template for that amplifier model. The appropriate plug-in components are then automatically determined by tracing through the internal representation from the input port to each output port on the forward path; and vice versa on the reverse path. Plug-in selection from the equipment catalog ensures that the available input signal is transformed into the required output signal. Figure 6 shows the internal layout of a typical amplifier.

Powering validation

After the initial RF network has been designed, the design and validation of the electric powering equipment is undertaken. All active devices, including fiber nodes (also known as optical network units or ONUs), amplifiers and NAUs consume power. Electrical power runs through the same coaxial cables which transmit the RF signal and is supplied from one or more power nodes connected to the network via devices called power inserters.

Software includes integrated powering validation tools, which run iterative calculations to determine voltage and current at each active device on the network, and check if the values fall within the acceptable range for each device. The system displays graphical feed-

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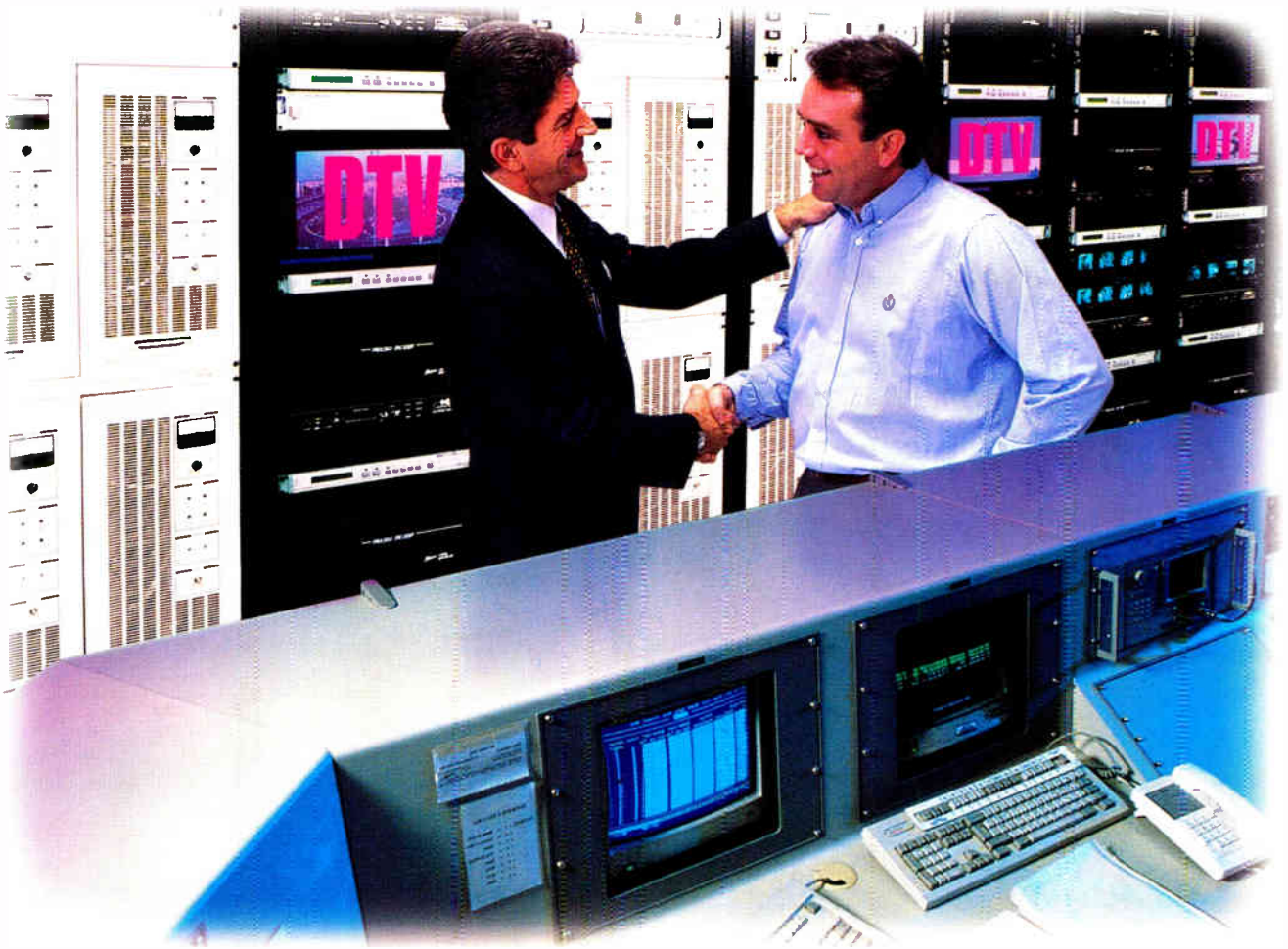

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back on portions of the network which can be powered successfully, and those which cannot. It also displays a list of all active devices with their voltage and current. This list can be used to navigate directly to any device.

A bill of materials and a set of work prints is provided to the construction crew for each completed design. In general, the area of a typical design is too large to fit legibly on a single map sheet, so multi-page plots can be automatically generated. A typical example of an overview plot is illustrated in Figure 7.

The overview map includes a summary of the materials required to construct the job. A detailed bill of material is also generated. It can be sorted and formatted based on financial and administrative criteria such as labor classes, construction type and account codes; and supplies the necessary input to the resource and inventory management processes. All of this information is drawn directly from the corporate Oracle-based equipment catalog.

Construction

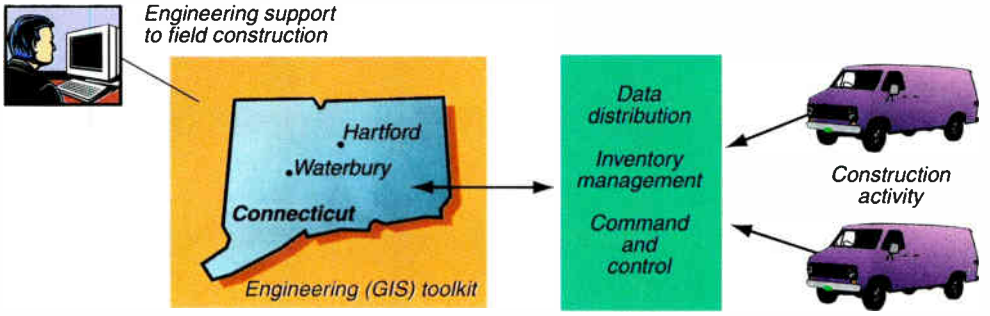
Network realization requires that the design developed during the engineering process can be readily converted into construction activities. The complex nature of broadband networks requires that different skills and approaches are applied methodically to different parts of the construction process. In addition, the necessary components must be purchased and made available in a timely fashion. The role played by the engineering toolkit is the development of the necessary bill of materials and the development of the complete set of construction detail. Downstream applications are then capable of filtering and aggregating individual construction actions into meaningful work tasks for multiple construction teams. In order to achieve this end, the engineering toolkit must be capable of understanding the characteristics of the objects it uses to develop the design, not only from an operational perspective, but also from a construction view.

In a highly object-oriented environment, objects can be programmed to behave in accordance with many operational concepts. The life cycle model is crucial in the context of construction. Construction activity which cannot be completed must be clearly differentiated from work that has been completed successfully. Subsequent requests for work completion will then differentiate between existing equipment and those elements which have been added or temporarily deferred from a particular work order. A viable engineering system must be capable of generating work orders which are limited to additions and/or modifications to extend or complete an existing portion of the network, respectively.

The efficiency of the engineering process will inevitably be put to the test. If conditions in the field preclude the implementation of the original design, rapid adjustment of that design and the development of revised work instruction is necessary if the cost of prolonged suspension of work activity is to be avoided.

At SNET, the design is passed to a construction application developed by Bellcore. The corporate equipment catalog is used to determine information like the labor class for a particular type of equipment, which affects the way in which the construction work is split into different tasks.

Figure 8: *Construction activity*



Cut-over and marketing

Cut-over is the process by which existing narrowband customers are transferred to the new broadband network once it has been constructed. It entails intensive field operations performed on a customer-by-customer basis. As each customer is cut-over, the original copper drop is removed, and a new compound drop is installed between the serving equipment and the customer's premises. Broadband technology cannot be instantly deployed because of the scale of the work involved. The effort will require the management of dedicated construction teams working in specified geographical areas in a carefully orchestrated manner. Construction will be completed on a gradual and progressive basis, concentrating on a set of specific serving areas at any given point in time.

It is extremely important, however, that any installed base be leveraged as quickly as possible, once construction is complete, in order to gain the operational advantages and indirectly generate the necessary capital and human resources for the ongoing construction program. Indeed, the cut-over process is likely to become so pervasive that it will be indiscernible from normal ongoing operational activity. Its challenges are diverse and include:

✔ The identification of the conversion area. Once identified, both cut-over planning and marketing preparations go into top gear.

✔ The identification of the cut-over candidates within that area. First-generation operations support systems will not be capable of managing the conversion and normal service activity across the full suite of products to which customers may subscribe. To prevent unnecessary manual operations, complex products such as DS-1 data circuits will be temporarily maintained on copper

Figure 9: *Cut-over and marketing planning views*

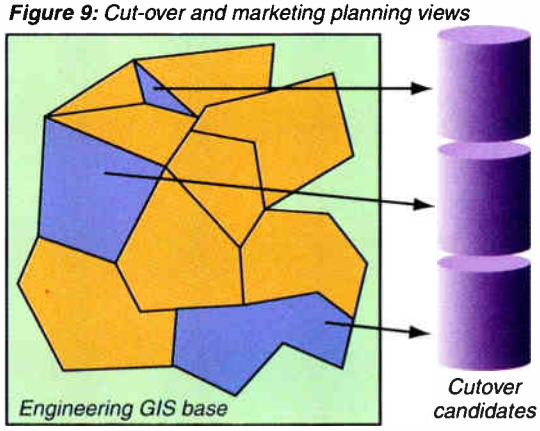
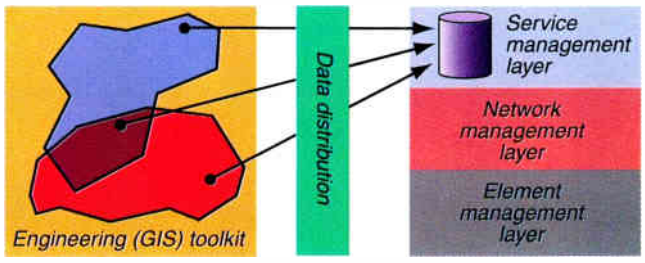


Figure 10: *Propagation of serving opportunities*



CONSTELLATION

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Synchronous

Pegasus

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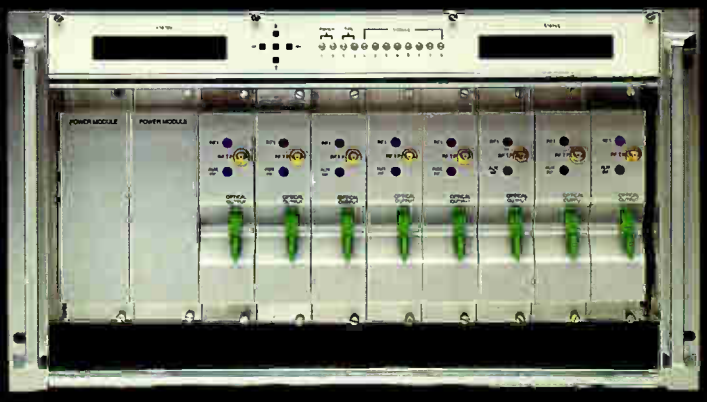

The new 1310 nm DFB laser with power and performance for any network application

The Pegasus 1310 nm DFB Transmitter is another of the new optical elements in the Constellation Series. Designed especially for expanding analog/digital requirements of the CATV industry, Pegasus offers advanced performance and features, such as dual isolated RF inputs, full status monitoring of the Constellation and network management with the new Hercules SNMP Proxy Agent

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GROUP of Companies

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facilities. In addition, construction may be deferred where serving arrangements are complex and expensive. Antiquated underground facilities are perhaps the best example. This means that construction and cut-over for certain areas may be forced to be an iterative process over time.

✔ The accurate selection of specific serving arrangements for each customer, such as which one of several possible remote terminals should be used, which port on that terminal is appropriate, and so on.

Unfortunately, real-world entities do not always conform to conversion boundaries. For example, part of a street may be crossed by a town or a wire center boundary. As a result, the selection of cut-over candidates using basic addressing mechanisms (e.g., all customers on a specific street) is ineffective. The obvious solution is to leverage the spatial query capabilities inherent in the GIS. As with engineering, construction will be managed according to predefined logical nodes or geographical areas. This process is illustrated in Figure 9.

Once construction is complete, these logical boundaries act as the input to spatial queries which will output the conversion candidates within the specified area. The original boundaries defined during the engineering process become the perfect mechanism for managing cut-over.

Managers of the process will have direct access to geographical information, clearly identifying the scope for subsequent cut-over and marketing activity.

Service activation

Service activation lies at the core of telecommunications operations. Consider the database depicted within the service management layer of Figure 10 as a suitably replicated copy of the many-to-many relationships between serving terminals and service address. This database constitutes the prime fuel for the service activation process from which available network connections are drawn. Address consistency with the engineering tool kit is of paramount importance. Given the limited capacity of broadband serving terminals, hot spots of customer subscriptions may lead to capacity exhaustion. When this is encountered, service requests must be temporarily suspended while engineering undertakes the task of capacity relief. Each held order must trigger engineering activity because the addition of additional serving may exhaust signal availability in that part of the network. As a result, engineering forms an integral component of the service activation process and must be capable of rapid reaction to satisfy the inevitable demand for additional capacity.

While initial broadband deployments are expected to be monolithic (i.e., using a single technology such as hybrid fiber/coax), the era of multiple overlaying technologies is not far behind. HFC or switched digital video (SDV) technologies are not optimal for all demographic circumstances. It may be required to overlay regions supporting different technologies, such as HFC and digital loop carrier (DLC). Using the spatial capabilities of a GIS-based engineering system, the regions where overlaps occur are readily identified. Assignment rules can then be established for such regions in order to optimize network utilization on a region-by-region basis. A typical assignment strategy might direct the assignment process to use HFC first, with DLC as the second choice.

or to assign video on HFC while telephony is provided on DLC, if capacity is available.

Element managers in a telecommunications management networks (TMN)-based operations architecture are required to perform filtering and analysis of raw alarm information they receive from the network. The process of reducing this alarm information to unambiguous failure indications is known as root cause analysis. Moreover, TMN guidelines also require that element managers hide the physical details and characteristics of the network elements or network domains they supervise. These responsibilities require that each element manager possesses a complete and detailed structural view of network equipment.

In order to further understand the role of the engineering tool kit, we must consider the likely circumstances for field operations in the broadband era. These circumstances are further predicated on the expected high reliability and inherent defensive mechanisms being incorporated into broadband technologies. Based upon this assumption, we can deduce that:

✔ The field workforce will be subjected to significant reductions in numbers.
✔ Hands-on knowledge of the network's structure and geography will significantly diminish.
✔ Failures can affect large numbers of customers, and consequently, rapid diagnosis and repair capabilities are essential.
✔ Other competitive service providers will offer their customers compensation for network outages and seek recourse from the network providers they leverage. Long outages will have a direct and immediate impact on the revenue stream.
✔ Typically, customers will be immediately aware of network failures because of the extensive holding times associated with entertainment services.
✔ Network failures which are inconsistent with precise root cause analysis will require operational teamwork from inside and outside forces.

To meet these challenges, a comprehensive network management layer must provide highly integrated GIS-based presentation services for the following:

✔ Display of root cause alarm information provided by element managers.
✔ Diagnostic services.
✔ Geographical information to direct the workforce to the right location/s.
✔ Correlation between customers' complaints and network failures.
✔ Service impact assessment for network failures.
✔ The current geographical disposition of available crews.

Furthermore, next-generation presentation services will be required to support both geographical views and schematic views of the network. This should present no problem for an object-oriented, GIS-based system with inherent rendering on-the-fly capabilities.

Conclusion

This paper has described some of the major challenges facing telecommunications providers as they replace their existing networks with new broadband technology in a rapidly evolving business climate of increasing competition and deregulation. The operations challenges are diverse and formidable. Fortunately, state-of-the-art software engineering tools and GIS technology are providing some of the necessary tools to meet and overcome these challenges effectively. CED

NCTA tech sessions focus on return path, modems

Sneak preview of the National Show's technical seminars

ILLUSTRATION BY PAMELA HAMILTON, THE IMAGE BANK

By Roger Brown

More than 20,000 people from the cable industry are expected to be in New Orleans this month for the 46th annual NCTA convention, set for March 16-19 at the Ernest N. Morial Convention Center. Attendance is expected to meet or exceed last year's numbers, much like the physical size of the show. Exhibit space for Cable '97 will total more than 350,000 square feet, populated with more than 300 companies displaying their wares.

Those on the technical side will make the trek to see new technologies, determine how much progress has been made to deploy new services and to gather some useful tips.

As usual, some of the best information will come from the eight technical sessions that have been organized by NCTA Science and Technology VP Wendell Bailey and a committee of operating engineers. Subjects this year range from in-home electronics to return path management; high-speed data modems to network management; and more.

What follows is a listing of the planned technical sessions, including moderators, speakers and topics, and locations. Sessions will take place in the convention center, on the third level, in rooms 97/98 and 99. *(Information listed is subject to change.)*

Monday, March 17
3 p.m. to 4:30 p.m.

"In-home electronics." An update on changes in the cable subscriber's in-home electronics because of deployment of digital set-top terminals, the decoder interface and cable modems.

Moderator: Brian James, TAC Test Centre.

Speakers: Gaylord Hart, XEL Communications, "An evolutionary view of ATM-based cable television residential architectures;" Joseph Glaab, General Instrument, "Hardware and operating considerations of the decoder interface;" Samuel Reichgott, General Instrument, "Downloadable firmware in advanced set-top terminals;" and Ralph Brown, Time Warner Cable, "Pegasus set-top terminal."

"Network currency." Think you know everything there is to know about crafting better, cheaper, newer architectures? Catch these up-to-the-minute approaches to system design for even more useful insights.

Moderator: Carl Podlesny, Scientific-Atlanta.

Speakers: C.M. Breevoort, Ph.D., Antec/ESP, "A new paradigm for a multi-services cable communications system;" Michael Adams, Time Warner Cable, "Pegasus network architecture;" and Farr Farhan, Scientific-Atlanta, "Requirements of an advanced hybrid fiber/coax transmission system to meet a certain quality of service."

Tuesday, March 18
Noon to 1:30 p.m.

"Foundations for interoperability." Will multi-vendor set-tops call for multi-architectures in your system? Get recommendations and standards updates on the technically challenging security and access control areas.

Moderator: Jay Vaughan, Time Warner Cable.

Speakers: Claude Baggett, CableLabs, "Approaches to security and access control for digital cable television;" Gerry White, Bay Networks Inc.–LANcity Cable Modem Division, "Security in hybrid fiber/coax-based networks;" Michael Adams, Time Warner Cable, "Multiple conditional access systems;" and Paul Hearty, Ph.D., General Instrument Corp., "SCTE's Digital Video Subcommittee: Introduction and update."

"Return path management." Techniques and tests for optimal return path performance.

Moderator: Robert Burroughs, Panasonic Technologies Inc.

Speakers: John Kenny, Ph.D., Antec Technology Group, "Characterization of return path optical transmitters for enhanced digitally modulated carrier transmission performance;" Tony Werner, TCI Communications Inc., "Signal level optimization in the reverse path–coaxial and optical transmission systems;" Luiz Fernando Bourdot, Tele Design Co., "Power allocation strategies for the return path;" David Large, Media Connections Group, "A proposed method for quantifying upstream ingressing carriers;" and Richard Prodan, Ph.D., CableLabs, "Results of return plant testing."

Tuesday, March 18
3 p.m. to 4:30 p.m.

"Cable modems at warp speed."

ifyou.com to this session (sic), you'll learn everything in the World Wide Web that you'll need to know about modems and the technology that supports them.

Moderator: Dan Pike, Prime Cable.

Speakers: Jonathan Fellows, General Instrument, "High-speed Internet access using cable modems with telephone return;" Christopher Grobicki, Bay Networks Inc.–LANcity Cable Modem Division, "IP address provisioning in a cable TV data network;" Robert Cruickshank III, CableLabs, "Performance of cable modem systems;" and Esteban Sandino, Rogers Cablesystems Ltd., "High-speed data services and HFC network availability."

"Improving network management and operations for delivery." Be prepared for the future. Catch these talks on preparing the plant for the reliable carriage of new services, strategies for reducing operating costs and the service profile for near on-demand video.

Moderator: Nick Hamilton-Piercy, Rogers Cablesystems Ltd.

CABLE '97

Speakers: Gordon Bechtel, Stout Technologies, "An open specification for hybrid fiber/coax outside plant status monitoring equipment;" Dom Stasi, Request Television, "NVOD–The premise behind the promise;" Oleh Sniezko, TCI Communications Inc., "Fusing in modern HFC networks for improved network availability;" and Louis Williamson, Time Warner Cable, "Lower cost alternatives to on-demand network architecture."

Wednesday, March 19
9:30 a.m. to 11 a.m.

"Directing digital content." What does it take to manage digits for dollars? Myriad decisions. These talks can help you draw the smartest conclusions in the dawning digital environment.

Moderator: Craig Cuttner, Home Box Office.

Speakers: John Beyler, Home Box Office, "MPEG-2 digital program stream compatibility: Programming to DCT/Pegasus/telcos;" Yvette Gordon, Time Warner Cable, "Operational management of digital content;" Mukta Kar, CableLabs, "Subjective effects of bit error on MPEG-2 video;" and Joseph Duggan, Waller Capital Corp., "Internet access provider cable television business plan."

"Applied science." Explore the near-term future with these techno-seers as they examine possible cable uses of emerging enabling technologies.

Moderator: Alex Best, Cox Cable Communications Inc.

Speakers: Walter Ciciora, Ph.D., Consultant, "Digital data in analog signals;" John Holobinko, ADC Telecommunications Inc., "Optical network technology: Future impact on CATV networks;" Matthew Waight, General Instrument, "Wireless telephone industry opens doors for cable;" and Shahram Ghandcharizadeh, Panasonic Technologies, "Cable networks and distributed video repositories." CED

The 1997 National Show

3Com Corporation 1085
408-764-5533
3Com will be demonstrating complete end-to-end system solutions for cable data networking services such as Home Internet Access, Small Business Networking, Telecommuting, and Metropolitan Area Networking at the National Show. 3Com offers complete solutions from the switches and routers in the cable infrastructure through the cable modem, Ethernet network interface cards and LAN solutions at the subscriber side. Come and see our solutions at booth 1085. Call (408)764-5533 for more information.

ADC Telecommunications, Inc,.....5219
612-938-8080 or 800-366-3891
ADC will display its Homeworx™ access platform, a fully integrated broadband loop transport system. In conjunction with the Homeworx system, ADC offers cable data modems for data transport across HFC networks and the Osworx line of network management products. In addition, ADC will feature its RF Worx™ system, a line of modular, high-performance RF distribution and management products designed to meet changing headend needs.

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Alpha Technologies is the world's leading manufacturer of power solutions for voice, video and data communication systems. Alpha's full line of power products include: standby, non-standby and uninterruptible power supplies, surge suppressors, status monitoring, enclosures and batteries. Visit show booth 5145 for the latest-breaking news on broadband powering– including the all new Centralized, Power Systems.

AM Communications Inc. 5600

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Amphenol Communication & Network Products Division 1145
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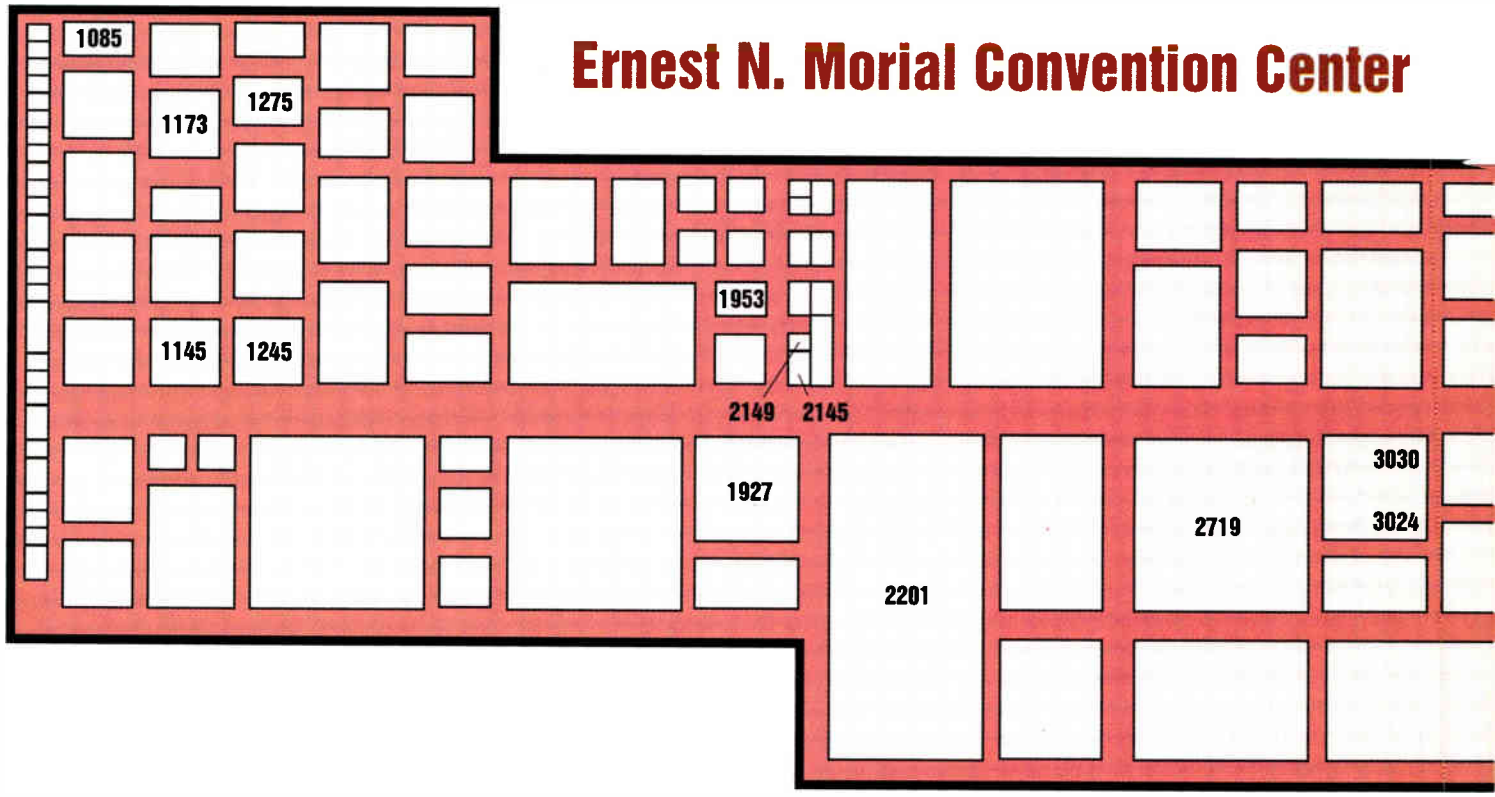
Amphenol Communication & Network Products Division manufactures a complete line of semiflex/hardline and drop cable connectors, adaptors and tools for broadband communication interconnects applications. Semiflex connectors feature a unique non-rotational three piece design with a minimum 40 dB return loss at 1 GHz. Meeting all SCTE, Bellcore and other industry performance and environmental specifications. Call 1-800-881-9913, fax: 203-796-2032. Web: http://www.amphenol.com.

Antec Corporation.....2719
847-439-4444 or 800-TO ANTEC (862-6832)
ANTEC Corporation is an international communications technology company that specializes in the design, engineering and manufacturing of hybrid fiber/coax (HFC) broadband networks and the engineering, manufacturing, product development and dis-



tribution of products for these networks. Publicly traded on the NASDAQ exchange with the symbol ANTC, ANTEC has an employee base of 2,000 with several office and warehouse facilities located worldwide.

Integration Technologies

Antec/Integration Technologies.....3024
800-211-8424
Integration Technologies is a vendor-independent network engineering, systems and software integration firm focused on providing "best of class" solutions for operators seeking to provide advanced services to consumers. We provide analog and digital network design, facilities and applications engineering, technical services, industry research, technology review, project and program management, and advanced software products and Operational Support System integration services to clients worldwide.

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Arbitron.....4523
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Bay Networks

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End-to-end Data Over Cable Solution -
Bay Networks provides a complete, end-to-end solution for high speed data transmission over cable TV networks. The Bay Networks solution includes the industry's fastest cable modems, from LANcity, along with the world's most advanced routers, switches, and network management system. Implemented using existing cable infrastructures, this proven, scalable solution is available today.

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Blonder Tongue is a quality manufacturer of a full line of pre-fabricated headends, antennas, earth station receivers, low noise block down converters, channel converters, modulators, digital and analog IRDs, demodulators, power supplies, signal processors, broadband CATV and MATV amplifiers, preamplifiers, passives, 18 GHz microwave systems, satellite dishes, NTSC, PAL B/G and D/K modulators and processors, RF test equipment and MDU interdiction products.

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C-COR offers digital and AM fiber optics, RF amplifiers, network management systems, modems, passives and 90 volt powering options. Services include network design, field engineering, technical training, equipment repair, 48-hour emergency repair service and a 24-hour emergency hotline. C-COR is ISO 9001 registered.

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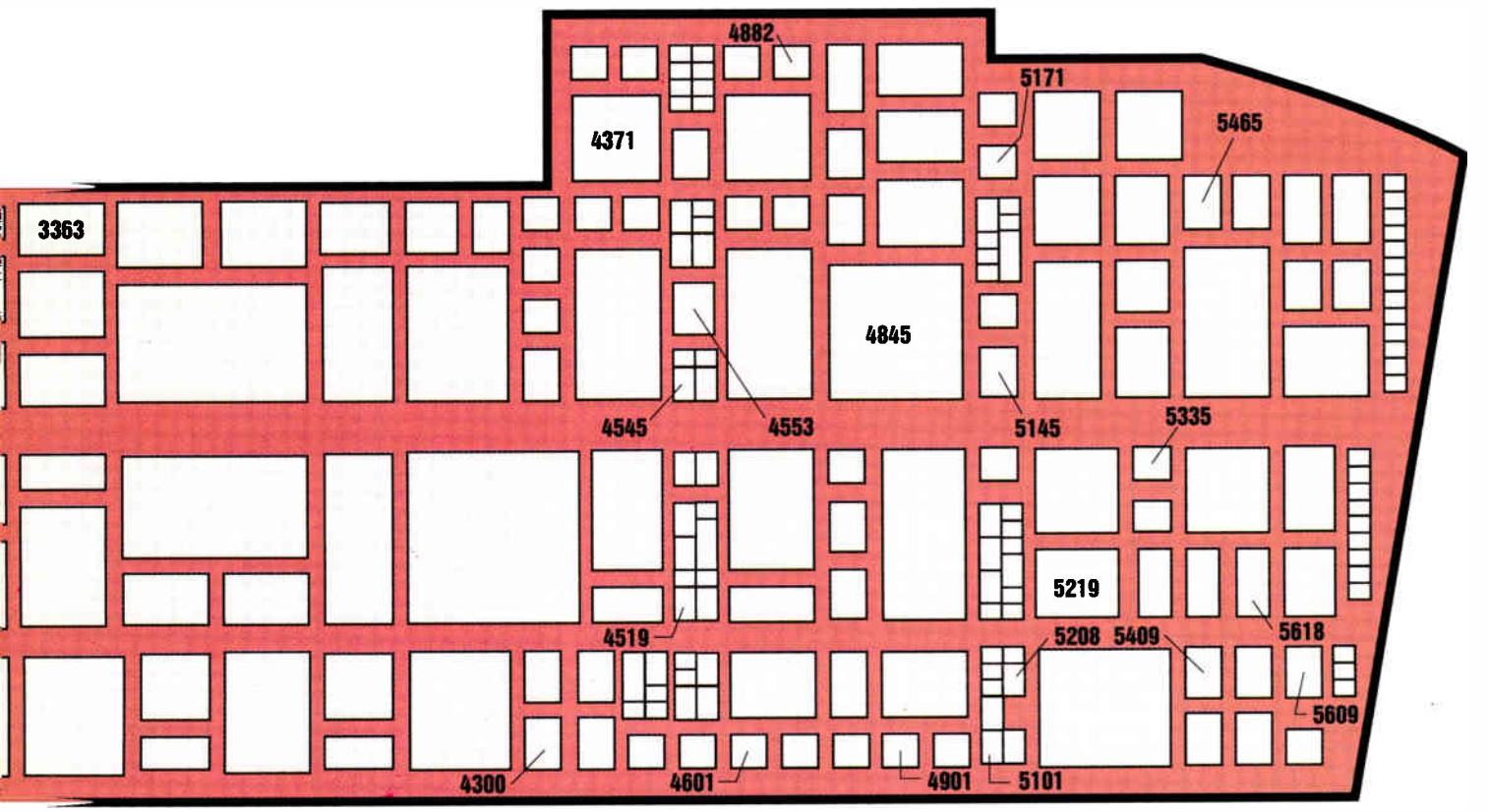
Cadco Systems, Inc. 584



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Cheetah Systems.....1953A
Cincinnati Bell Info Systems/CBIS.....5345
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CommScope is an ISO 9001 registered quality manufacturer of cables for telecommunications and for voice, video, data and other digital applications; the only US manufacturer of a complete line of coaxial and fiber cables for use in HFC networks and a world leader in cable innovation. Products include: NEW PowerFeeder™; a NEW family of Cables-in-Conduit; QR®; PIII®; Optical Reach® and a full line of drop cables including many that are available in EZ-Pak® packaging. Web: http://www.commscope.com, Fax: 704-328-3400.

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Harmonic *Lightwaves*

Harmonic Lightwaves 1275
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Harmonic Lightwaves is a worldwide supplier of highly integrated fiber optic transmission, and element management systems for the delivery of video, voice and data over broadband networks. Harmonic's fiber optic products include the MAX Link™ 1550nm Transmission System, the PWRLink ™ DFB transmitter family, optical nodes and receivers with a full line of return path equipment. Harmonic Lightwaves also provides complete network element management with the Windows™-based NETWatch™ element management system. In early 1997, look for Harmonic Lightwaves to introduce the new TRANsend™ family of digital video products.

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Hewlett-Packard will have on display a comprehensive offering of cable TV test and measurement products as well as a wide variety of products that will enable customers to enjoy two-way services in the home. At our booth you will find the HP CaLan Sweep/Ingress Analyzer and the 8591C Cable TV Analyzer as well as our new data management software which will help you to find trends and predict failures in your cable TV system. Also on display will be cable modems, video servers and more.

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Hybrid Networks, Inc.....5664
IBM Telecommunications & Media.....3019
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ICTV Inc.....4571
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Macrovision develops technologies to protect electronically transmitted and prerecorded video programs from unauthorized copying or viewing. The Company's digital set-top decoder technology is licensed by DBS and

cable TV systems, providing subscribers with a greater variety of time sensitive PPV programming. Macrovision also offers scrambling technologies, components and systems for a range of broadcast, business and military/law enforcement surveillance applications.

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Microsoft Corporation 3501
Mitsubishi Electronics America, Inc. 4319

Mega Hertz 4545
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The Mega Hertz "Sub-Alert", on display, is the first complete "Audio and Video" Emergency Alert System specifically designed to interrupt baseband "Audio/Video" sources, composite "IF" or separate A/V "IF" loops, as well as, 4.5 MHz audio loops individually or jointly and simultaneously. The "Sub-Alert" can be activated via touch tone telephone or automatically by the sage "ENDEC", encoder/decoder.

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Motorola's proven CableComm technology has already been deployed in over 50 cities worldwide. So visit booth #4845 and see what all of the excitement is about. TheCyberSURFR™ cable modem offers data transmission rates of up to 10 Mbps and can download information in a fraction of the time required by conventional modems. See what it's like to race along the infobahn at such speeds, and find out what new products are joining the CableComm family.

Multilink, Inc. 1022
NEC America, Inc. 5663
Nortel 5373
Objective Systems Integrators 1075

Ortel Corporation.....4300
818-588-3753
Ortel Corporation's display includes the all-new Platinum Performance™ Series of products, featuring 1310nm laser modules, laser assemblies, and photodiode receiver modules; the next-generation DFB return path laser; 1550nm source lasers; 980nm pump lasers; and 1550nm system products. The MirrorCell ™ Fiber Repeater for cable PCS applications is also featured.

Phasecom Inc. 5335
408-777-7799
Phasecom Inc., a California-based high-speed cable modem manufacturer, is demonstrating various revenue generating applications including high-speed internet access, video-conferencing, telephony, on-line shopping and gaming, all over HFC networks. The demonstration highlights Phasecom's complete cable modem product line including SpeedDemon™, the Broadband Bridge and the P446.

Philips Broadband Networks Inc. 3319
Photonic Components, Inc. 2264

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Pico Products offers a complete line of PT mini traps, filters, tier traps, lifeline tier traps, low-pass and high-pass filters. Promo Encode/Decode system, CATV security accessories, low-noise drop amplifier line. At the show, Pico will be featuring its new line of window traps for return plan problems. Pico Macom offers a full line of 1 GHz drop and installation passives, splitters, couplers, switches and connectors for CATV/MMDS/SMATV. Pico Macom is a full line manufacturer of headend components, and will be featuring a new agile modulator, commercial satellite receiver/descrambler, agile demodulator, and an agile signal processor.

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Sanders, A Lockheed Martin Co. 5125
Scientific-Atlanta, Inc. 1719

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Engineers Inc. (SCTE).....5208
610-363-6888
SCTE is a national organization devoted to the training and education of the broadband industry's technical community. Training opportunities offered by SCTE include its national Cable-Tec Expo hardware tradeshow, regional technical seminars, local chapter meetings, BCT/E and Installer Certification Programs, and technical publications and videotapes. Stop by and learn more about the wide variety of programs and services offered by the Society.

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FTTH: Are telcos headed back to the future?

Cost-effective DWDM technology is one enabler

By Fred Dawson

Are the telcos headed back to the future, with fiber-to-the-home turning out to be proving in at about the timeframe originally projected? The answer is yes, says Pacific Bell CEO Dave Dorman. The RBOC chief sees an aggressive fiber-to-the-home strategy taking shape in the telephone industry, with "at least one major telco" planning to deploy all-optical broadband networks in newbuild installations by sometime in 1998.

While hybrid fiber/coax network technology has proven harder to implement than PacBell expected, "fiber-in-the-loop is going to happen faster than previously supposed," Dorman says, adding, "HFC is still emerging as a broadband infrastructure supporting all services."

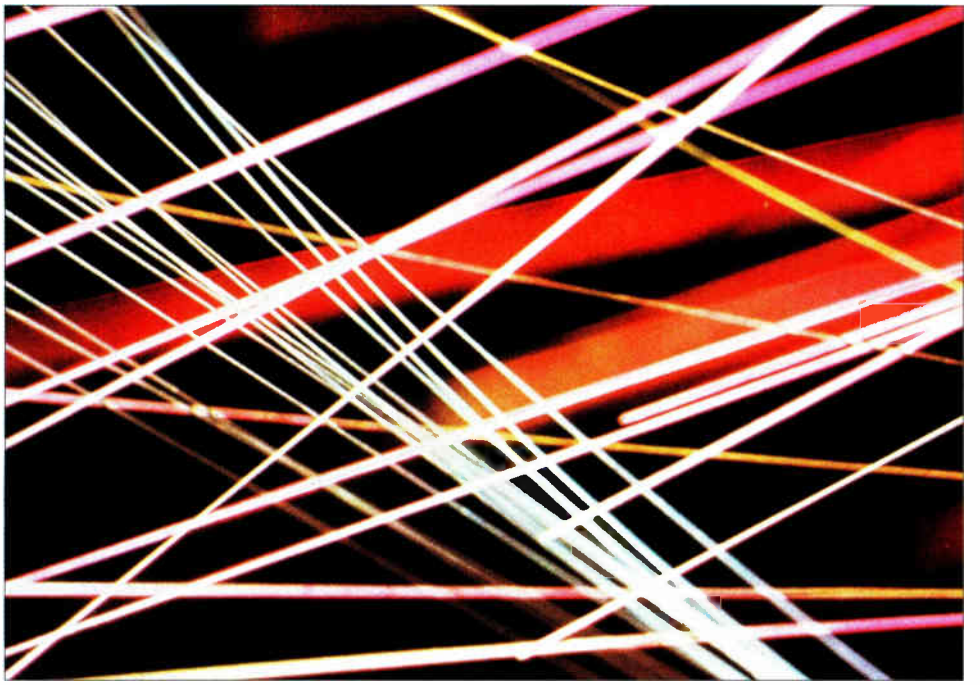

Photo courtesy of Siecor Corp.

More importantly and more accurately, given the fact that HFC is certainly as close to prove-in as FTTH, HFC also means dealing with localities to get permission to dig up the streets, which, says Dorman, "is not easy, as we learned." And, all other things being equal, there's the matter of the bandwidth capacity that comes with an all-optical approach.

"By 2000, fiber all the way to the home will be used to replace local loop routinely," Dorman says. "The idea of 640 megabits (per second) to every household isn't as far-fetched as it seems."

Pacific Bell, soon to be merged with SBC Communications, if California regulators don't balk, is rethinking broadband deployment strategies as wireless cable as well as HFC hit technical and other strategic walls. Pacific plans to launch an all-digital, multichannel multipoint distribution system across the Los Angeles basin in April in a gambit that represents the first real-world showdown between next-generation wireless and state-of-the-art cable. But win, lose or draw in L.A., MMDS options elsewhere are limited or non-existent, officials say.

MMDS is also a limited technical option in regions less ideally suited for wireless propagation than Los Angeles, where flatness of the terrain and minimal building congestion are big pluses. And, in fact, there's a question of how ideal L.A. will turn out to be, despite its line-of-sight accessibility from towers positioned on mountains northeast of the city.

"You've got to wonder how that's going to play in an ocean-walled environment like L.A.," says a veteran of the wireless RF industry, asking not to be named. "Atmospheric reflectivity (in broadcasting) around San Francisco is what made cable TV."

"There are going to be some hard decisions to make," acknowledges Lee Camp, president and CEO of Pacific Telesis Enhanced Services, which has had long-standing commitments to hybrid fiber/coax and wireless approaches to delivering broadband services. Camp's comment is meant to apply to his own company, but it also applies to other local exchange carriers as ever more delays add up to ever more option-sorting in the rapidly changing network arena.

News of telcos changing course in broadband networking strategies is practically routine at this point in the 10-year, and counting, rampup to broadband communications. The twist this time is that the focus is moving back to where it started, where the grand vision was to deliver all the bandwidth the world could use through a single glass pipe.

Realization of that vision in a one-step deployment may not be ready for prime time, but it may be close enough to be worth waiting for, especially if telcos have the time, and they think they do. "It's not going to be the same forced march we were proceeding under before," Camp says. "Whether you look at it from the standpoint of the implementation pace of the Telecommunications Act or the circumstances affecting cable companies, it seems like things have gone from being on a high vertical ramp to a more moderate rate."

"For the companies we deal with, at least, the timeframe is still in question," agrees Greg First, president of Lockheed Martin Telecommunications, which is acting as systems integrator for SBC

A number of FTTH concepts using DWDM are on the drawing board

Communications' switched digital video (SDV) trial in Richardson, Texas and for a broadband service trial scheduled for next year by Toronto-based Telus Corp. The company is also discussing a broader role with americast, the joint venture into video programming supported by SBC, BellSouth, Ameritech, GTE and Southern New England Telecommunications.

Even if everything was ready to roll on the facilities side, most telcos have a long way to go before they're ready to integrate service management and billing across all categories in keeping with the business structure of broadband communications, First says. Until the business structure is worked out, which means first working out unresolved regulatory issues, there can be no integrated management system, and without that, the facilities question remains in play.

"The basic (software) technologies are there to do everything you need to do at trial scales," First says, noting that this now includes integration of internal and external information and operations systems into an overarching network management system. "But the ways to achieving scalability to fully iterated systems serving millions of people haven't been agreed on."

The issue isn't lack of tools. Even when there are no off-the-shelf solutions, they can be invented using established building blocks, as Lockheed Martin has demonstrated in creating some of the "middleware" for americast and SBC that allows their operating, billing and management systems to speak to each other.

Rather, the issue is cost and necessity. "The impetus behind final decisions on the architecture is really a matter of market timing requirements and (of) today's vs. tomorrow's costs," First notes. "You can wait, and save money in the long run by waiting."

Even where telcos are moving aggressively with one-way video services, the message is that the real game to watch is the waiting game. "Mostly, all of this is about what's going to happen in the next decade, not what's happening now," Camp says.

What makes FTTH much more realistic now than it was in its heyday as the wave of the future a few years back is the emergence of cost-effective new technologies such as dense wavelength division multiplexing and optical amplification, which are already building a strong beachhead, along with a descending cost curve, in the long-distance market. These and related technologies open the way for building relatively low-cost passive networks where the price of the optoelectronic conversion at each household is balanced by the elimination of some steps in the broadband time division multiplexing and demultiplexing processes in the distribution plant.

DWDM in the local distribution loop?

A number of FTTH concepts using DWDM, which combines several wavelengths over a single fiber, are on the drawing boards, says Vince Borelli, chairman of Synchronous Communications, a supplier of optical amplification and DWDM systems. But, first, suppliers must be pushed into making low-cost components readily available, and that hasn't happened.

"We'd have to see a tremendous drop in costs to all of a sudden start doing DWDM in the local distribution loop," Borelli says. "And you need light sources spec'd to the ITU wavelengths, which not many people are doing right now."

But, Borelli quickly adds, the technology is there to build a low-cost foundation on if telcos are serious about pursuing FTTH. "I don't see how you can do FTTH unless you use WDM," Borelli says, noting that the concept has been part of telephone industry planning since Bellcore issued its broadband loop specs five years ago.

But the concept has changed. Where once the thought was that analog signals would be transmitted over the less lossy 1550 nanometer wavelength, retaining 1310 nm transmissions for digital, today, the possibility of DWDM at 1550 may mean that 1310, if it is used at all, is used as the analog video conduit, given the fact that the usable transmission region around 1310 offers too narrow a window for multiple wavelengths. Moreover, 1550 signals are more easily amplified, representing an opportunity to minimize optoelectronic conversion costs in the distribution branching process by using various combinations of time division and wavelength add/drop multiplexing.

One of the latest developments with the potential to drive all-optical communications involves use of polymers as substitutes for glass in active and passive components. Where, in the past, thermal instability and high attenuation have been barriers to exploiting the cost advantages associated with polymer waveguides, manufacturers are coming up with new compounds and processes that appear to overcome a significant portion

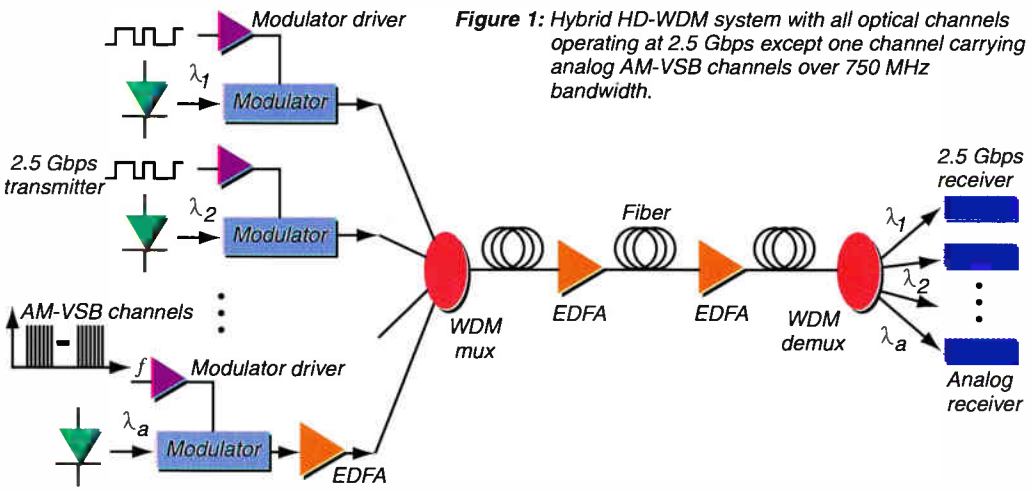

Figure 1: *Hybrid HD-WDM system with all optical channels operating at 2.5 Gbps except one channel carrying analog AM-VSB channels over 750 MHz bandwidth.*

Source: Copyright 1996 Bellcore. This figure is reprinted with permission.

of the drawbacks, while greatly improving the cost equation for things like dense wavelength multiplexers.

"Multiplexers using polymers are starting to look like credit cards laminated on both sides, though much smaller," notes Earl Langenberg, a telecommunications consultant who was formerly a strategic planner for US West. "Based on what we're seeing in this area, it's beginning to look like fiber deep to the home can become a very cost-effective option."

One of the first companies to introduce next-generation polymer devices is a little known Santa Clara, Calif.-based manufacturer formerly named ROITech Inc. and now called Lightwave Microsystems Corp. The company said it will begin shipping a 1 x 16 wavelength multiplexer in April priced at $12,000 per pair in volume quantities, or less than half the per-port price of silica-based waveguides.

"What we're doing is moving the potential for use of DWDM into the local distribution and other networking niches," says George Ballog, senior vice president of LMC.

"These products are compliant with all the ITU (International Telecommunications Union) standards for wavelength division multiplexers, including channel spacing and isolation between channels, polarization dependent loss, insertion loss and optical return loss."

Plastic optical fiber

LMC is coming to market in stride with what promises to be a sizeable outpouring of new polymer-based products in the months ahead. The Optical Fiber Communications Conference in Dallas last month featured a number of special sessions and events devoted to "plastic optical fiber" technology in recognition of the sudden shift in status for polymers within the fiber optics industry.

"We see polymers as offering a way to manufacture relatively low-cost passive devices, so we're looking at producing 16- and 32-wave multiplexers in the near future," says James Bechtel, senior vice president for Integrated Photonic Technology of Carlsbad, Calif. "It's also important to note that polymer waveguide technology allows integration on a silicon substrate."

This facilitates the inclusion of electronic driver circuits and receiver circuits to provide a very high level of component integration, Bechtel adds. Such capabilities lessen the cost of routing optical signals by eliminating optical-to-electronic conversions, opening ways to marry DWDM with add/drop multiplexing.

This, indeed, is where the polymer concept really gets interesting for DWDM, Ballog notes. "We're developing an integrated chip to serve as an add/drop multiplexer for DWDM systems that should be available commercially by the end of this year," he says.

The company uses a class of polymers known as "polyimedes," developed in conjunction with Hitachi Chemical Co., to address the thermal and optical loss problems. Fabrication entails etching of three-micron "trenches" in silicon, a much lower-cost process than today's .35 micron state-of-the-art circuit fabrication, and then adding the polymer at high temperature, forming a core matching singlemode fiber dimensions.

"We're able to produce a couple hundred devices per silicon wafer," Ballog says. "The DWDM 1x16 chips measure three millimeters by six millimeters, which is another big cost advantage when it comes to the amount of space required to put these devices in the field."

LMC has come up with a way to make the waveguide reactive to electronic impulses generated from circuits in the silicon substrate below the polymer trenches by doping the polymer with materials known as "chromophores." "There's a deep polarity sensitivity in the dopant, so that when you apply voltage, you cause the index of refraction in the polymer core to shift, creating a switching mechanism," Ballog says.

One sign that the fiber solution is becoming ever more compelling is the fact that, in the denser markets of some telcos, the case is now being made for deployment of broadband-capable fiber distribution systems on a cost-benefit basis tied to telephony alone. Nynex, for example, is slated to install some 30,000 lines in the Boston area next year as part of a one-million-home buildout over the next five years in Boston and New York on the assumption that this will cost less in the long run than it would to replace aged copper with new copper links.

"First and foremost, the thing we're trying to accomplish is an upgrade of our network for provision of our basic product line," says Walter Silvia, vice president of broadband. But the carrier will be able to turn the platform supplied by General Instrument Corp.'s Next Level Communications into a broadband network offering video and high-speed data services by inserting circuit cards at central and field switching points, Silvia adds.

With PacBell clearly leaning toward fiber-deep topology, and SBC, Bell Atlantic and Nynex already there with FTTC deployment commitments, FTTH, as the next logical step beyond FTTC, has a potential base of market demand among telcos that could make it a cost-effective option, perhaps even within the timeframe suggested by Dorman. And there's no guarantee that telcos currently deploying HFC will stay on that track if the fiber-deep picture changes.

BellSouth, for example, with 10 cable franchises averaging a few thousand households each and plans to deliver wireless cable in New Orleans, Atlanta, and possibly, Miami, is laying dark fiber in its distribution plant as it goes about its routine copper network upgrades and replacements, notes BellSouth spokesman Kevin Doyle.

"We're not closing any doors to fiber," he says.

So far, Dorman is the only top RBOC executive to suggest FTTH will be a factor in widescale network deployments by 2000. But, if he's right, companies now making commitments to FTTC could find themselves doing the network strategy shuffle one more time, only this time, from a position where the engineering learning curves are a little less steep. CED

BellSouth is laying dark fiber in its distribution plant as it goes about routine copper upgrades

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The issue: On-the-job safety

Two years ago, OSHA passed a fall protection standard requiring workers who work at heights above six feet to be protected from falls. Some provisions of the standard affect the cable industry today, and others will have a future effect. This survey, inspired by the SCTE's Safety Committee, examines how your system approaches fall protection.

The questions:

1. Does your company/system require a "personal fall arrest system" to be used by employees while they're working on (check all that apply):

❑ Commercial bldg. roofs ❑ Residential roofs ❑ Ladders

❑ Utility poles ❑ Aerial lifts ❑ Towers

2. My company/system provides training in (check all that apply):

❑ Fall protection ❑ Pole climbing

❑ Ladder use ❑ Aerial lift operation

3. What type of training is provided? (Check all that apply)

❑ Classroom only ❑ Class & pole yard ❑ Pole yard only

❑ Field OJT ❑ Telco or power co. ❑ Other

4. Does your climbing instructor have formal training from a telco or power company climbing school?

❑ Yes ❑ No ❑ Don't know

5. Are employees at your system certified, in writing, as "competent" following pole climbing and ladder training?

❑ Yes ❑ No ❑ Don't know

6. Are employees at your system certified, in writing, as "competent" following aerial lift training?

❑ Yes ❑ No ❑ Don't know

7. Are employees at your system provided with a personal fall arrest system when working on roofs?

❑ Yes ❑ No ❑ Don't know

8. Are employees at your system provided with a personal fall arrest system when working in an aerial lift basket?

❑ Yes ❑ No ❑ Don't know

9. Were you aware that traditional "body belts" cannot be used as part of a personal fall arrest system after Jan. 1, 1998?

❑ Yes ❑ No

10. Were you aware that safety straps used for positioning (such as those used with a body belt or when working on a ladder) must be equipped with locking snaphooks after Jan. 1, 1998?

❑ Yes ❑ No

11. Do your employees attend regular, periodic safety meetings?

❑ Weekly ❑ Monthly ❑ Other ❑ No

Your comments:

Fax us at 303-393-6654

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*Every month, we'll pick one response from those we receive and award $50. See official rules below.

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RESULTS

The issue: Status monitoring

Monitoring network performance and achieving unprecedented levels of reliability are the kingpins of telecommunications networks in a competitive environment. Yet cable TV operators have traditionally avoided use of such monitoring systems. This survey was designed to determine if that's changing.

While it's obvious that those who have actually deployed some sort of network monitoring devices are the ones who were motivated to respond to this survey, they nevertheless provided some good insight into trends and motivations.

For example, all respondents said their system's management sees the value of such systems more than they have in the past, and all also said they believe that network monitoring will be highly important in the future as operators move beyond providing just entertainment video.

For example, system users are deploying equipment that either monitors the entire system, or at least the end of each line, so that hardware problems can be more easily ferreted out. Those who don't deploy network monitoring devices have chosen not to primarily because such systems are costly.

In addition, the FCC's mandate of regular system proof-of-performance testing has sparked a lot of interest in monitoring devices as operators seek to automate those tasks. Also, operators appear to be interested in "smart" systems that are relatively complex in nature and can help them actually manage the cable system, as opposed to simply monitor outputs.

The results:

1. Does your system presently utilize any network status monitoring devices?

Yes	No	Don't know
88%	**12%**	**0%**

2. If so, what type of status monitoring system is used?

Power supply	End-of-line
24%	**38%**

Entire system	Don't know
38%	**0%**

3. If not, why are such devices not used in your system?

Too costly	Don't work	Other
100%	**0%**	**0%**

4. How important will status monitoring systems become to you in the future?

Very	Some	Not at all
100%	**0%**	**0%**

5. Is your system's management more interested in status monitoring as a concept now than it was a few years ago?

Yes	No	Don't know
100%	**0%**	**0%**

6. Have the FCC technical standards sparked an interest in using status monitoring equipment in your system?

Yes	No	Don't know
62%	**25%**	**12%**

7. Would your system prefer to purchase a more expensive and complex monitoring system or a less expensive system that offers simple alarms?

Complex system	Simple system	Don't know
50%	**38%**	**12%**

8. Which features of status monitoring systems are more important: Internal hardware info (temperature, bias, etc.) or external info (carrier-to-noise, etc.)?

Internal info	External info
0%	**75%**

Both	Don't know
25%	**0%**

9. Do you think a standard communications protocol should be developed for all status monitoring systems?

Yes	No	Don't know
88%	**12%**	**0%**

10. Should a monitoring system just provide data, or actually be able to control and manage a system through modules for fleet management, spare parts inventory, etc.?

Provide data only	Help manage	Don't know
38%	**50%**	**12%**

Your comments on status monitoring:

"You must be careful when choosing a status monitoring system (because) some don't work with major manufacturers' equipment. Standby power supplies should also be monitored, but it's expensive."

–Larry Langevin, Greater Media Cable, Ludlow, Mass.

"Monitoring hooks on equipment from different vendors conflict with each other, or compatibility has not been worked out yet."

–Laura Montagano, Continental Cable, Jacksonville, Fla.

Trade shows

March

16-19 National Show '97. Location: New Orleans, La. Call NCTA (202) 775-3669.

April

6-10 NAB '97. Location: Las Vegas. Call the National Association of Broadcasters (202) 429-5300.

May

5-9 Networld + Interop '97. Location: Las Vegas. Call (415) 578-6900.

June

2-5 Supercomm '97. Location: New Orleans, La. Call the U.S. Telephone Association (202) 326-7300.

4-7 SCTE Cable-Tec Expo '97. Location: Orlando, Fla. Call the SCTE (610) 363-6888.

July

28-31 Jornadas de Television por Cable '97. Location: Buenos Aires, Argentina. Call the Argentina Cable Television Association (011) 54-1-342-3362.

August

18-20 Great Lakes Cable Expo. Location: Indianapolis, Ind. Call (317) 845-8100.

September

10-12 PCS '97 (Personal Communications Showcase). Location: Dallas, Texas. Call PCIA at (703) 739-0300 for more information.

21-25 NFOEC '97. Location: San Diego, Calif. Call (619) 467-9670.

28-30 Atlantic Cable Show. Location: Baltimore, Md. Call (609) 848-1000.

MARCH

3-6 Hands-On Fiber Optic Installation for Outside Plant Applications, produced by Siecor Corp. Location: Hickory, N.C. Call (800) 743-2671, ext. 5539 or 5560.

4-6 Cable Television Technology, produced by C-Cor Electronics. Location: Richmond, Va. Call C-Cor Technical Customer Services (800) 233-2267.

5 SCTE Telecommunications Vendors' Day. Location: Omaha, Neb. Call (402) 466-0933.

5-6 Northern California Vendors' Day. Location: Concord, Calif. Call Steve Allen (916) 786-4353.

20 Big Sky SCTE Chapter, Technical seminar and testing session. BCT/E and installer certification exams to be administered. Location: Jackson Creek Saloon, Helena, Mont. Call Marla DeShaw (406) 632-4300.

24-27 IN ComForum, produced by the International Engineering Consortium. Location: Orlando, Fla. Call (312) 559-4600.

27 Penn-Ohio SCTE Chapter, Testing session. Location: Sheraton Inn North, Pittsburgh, Pa. Call Marianne McClain (412) 531-5710.

APRIL

2-4 Philips Mobile Training, produced by Philips Broadband Networks Inc. Location: Dallas, Texas. Call (800) 448-5171 (800-522-7464 in New York State) to register.

4 Design, Test and Installation of Cable Television Systems seminar. Produced by Multicom Inc. Location: Orlando, Fla. Call Multicom at (800) 423-2594.

9-11 Philips Mobile Training, produced by Philips Broadband Networks Inc. Location: Denver, Colo. Call (800) 448-5171 (800-522-7464 in New York State) to register.

22-24 Global DBS Summit. Location: Denver, Colo. Call Globex (713) 342-9826.

22-24 Operating Hybrid Fiber/Coax Systems, produced by Scientific-Atlanta Institute. Location: Atlanta. Call SAI (800) 722-2009, press "3."

22-24 Cable Television Technology, produced by C-Cor Electronics Inc. Location: Seattle, Wash. Call C-Cor Technical Customer Services (800) 233-2267.

22-25 Fiber Optic Training, produced by The Light Brigade. Location: Cleveland, Ohio. Call (800) 451-7128.

23-24 Fiber Optic Technical Seminar, produced by ADC Telecommunications. Location: Cincinnati, Ohio. Call (612) 946-3086.

29-30 Activating and Troubleshooting the HFC Return Path, produced by Scientific-Atlanta Institute. Location: Atlanta. Call SAI (800) 722-2009, press "3."

MAY

11-14 Canadian Cable Television Association's Annual Convention & Cablexpo. Location: Toronto, Ontario. Call the Canadian Cable Television Association (613) 232-2631.

13-14 Wheat State SCTE Chapter, Testing session. BCT/E certification exams to be administered. Location: Wichita, Kan. Call Vicki Marts (316) 262-4270.

20-22 Broadband-CATV Laboratory, produced by C-Cor Electronics Inc. Location: State College, Pa. Call C-Cor Technical Customer Services (800) 233-2267.

21 New England SCTE Chapter, Testing session. Installer certification exams. Location: Worcester, Mass. Call Tom Garcia (508) 562-1675.

22-24 SCTE Regional Training Seminar: "Introduction to fiber optics." Location: San Bernardino, Calif. Call SCTE national headquarters (610) 363-6888.

26-29 Fiber Optic Training, produced by The Light Brigade. Location: Toronto, Ontario. Call (800) 451-7128.

JUNE

9-13 Broadband Communications Network Design, produced by General Instrument. Location: Denver, Colo. Call Lisa Nagel at (215) 830-5678.

16-20 Plant Maintenance, Proof of Performance and Signal Leakage Training, produced by General Instrument. Location: St. Louis, Mo. Call Lisa Nagel at (215) 830-5678.

23-25 WCA '97, produced by the Wireless Cable Association International. Location: Anaheim, Calif. Call (202) 452-7823.

25-26 Understanding Hybrid Fiber/Coax Design, produced by Scientific-Atlanta Institute. Location: San Diego. Call SAI (800) 722-2009, press "3."

25-27 Broadband Communications Technology, produced by C-Cor Electronics Inc. Location: Providence, R.I. Call (800) 233-2267.

Sony, Channelmatic win Prime contract

MONTVALE, N.J.–Sony Electronics and Channelmatic Inc., a subsidiary of IndeNet Inc., have won a contract from Prime Cable to provide ad insertion in the Chicago and Washington, D.C. markets. The MVP (managed video playback) VideoStore digital ad insertion system provides Prime Cable with advertising spot management, distribution, insertion and delivery through the IndeNet Digital Spot Network.

The Chicago system includes a two-zone, 24-channel, MPEG-2 digital ad insertion system consisting of Channelmatic's MVP products and Sony's VideoStore multichannel video file server system. The Washington, D.C. system will feature a 60-channel, four-zone capability. Zoning allows different television commercials to run simultaneously on a single channel, in different geographical locations.

Tellabs acquires optical tech from IBM

LISLE, Ill.–Tellabs Inc. has acquired certain wavelength division multiplexing (WDM) and optical networking technology from the IBM Thomas J. Watson Research Center in Westchester County, N.Y.

Under the terms of a technology and related assets agreement, Dr. Paul Green and his optical networking team from the research center have joined Tellabs. Tellabs is also now the owner of several patents and patent applications related to WDM and optical networking technologies.

Other exclusive and non-exclusive rights to IBM's patent portfolio in the field of wavelength division multiplexing and optical networking, including certain sublicense rights, were also granted to Tellabs.

OptiVideo, Corning shake on distribution

BOULDER, Colo.–OptiVideo Corp. and Corning Inc. have entered into an exclusive distribution agreement for Asia. Corning's Global Business Operations is now the exclusive sales agent for OptiVideo products in the Asia Pacific markets, including: Korea, China, Taiwan, Hong Kong, Singapore, Malaysia, Indonesia, Thailand, Philippines, Australia, New Zealand and India. Corning offices in these countries will provide local sales service and customer support on all OptiVideo switching products.

For more information, contact: Allen Chien, regional manager, East Asia, Corning Global Business Operations, Corning Glass Taiwan Co. Ltd., 3FL, 64, Tun Hua North Rd., Taipei, Taiwan; telephone 866-2-721-3482; fax 752-4464.

Vyvx, IXC to swap future fiber rights

TULSA, Okla.–Vyvx Inc. and IXC Communications Inc. have agreed to swap rights to use fiber on future fiber optic routes, adding new markets for each company.

IXC will swap rights to use dark fibers (i.e., fibers without optronics) in its new, 7,000-mile system currently under construction from L.A. to New York, for rights to use dark fibers on a 1,600-mile route which Vyvx plans to build from Houston to Washington, D.C. During the

term of the agreement, the two companies will have unrestricted use of fiber on the exchanged routes.

"The new network will enable Vyvx to expand its video and multimedia service area utilizing the latest technology, while significantly reducing leased circuit costs and capital investment," said Vyvx President Del Bothof, in a written statement.

PCS system earns FCC type acceptance

NASHUA, N.H.–The Federal Communications Commission has granted type acceptance to a PCS-over-cable system developed and produced by Sanders, a Lockheed Martin Company. In addition, Underwriters Laboratories and Canadian Underwriters Laboratories have approved the system for listing.

With the FCC and UL/C-UL approvals, the Sanders system is certified to have met authorized frequency transmission and safety standards for commercial sale of the product. Type acceptance is an equipment authorization indicating compliance with FCC technical standards for conducted and radiated radio frequency emissions as outlined in the FCC Code of Regulations.

The system's Cable Microcell Integrator (CMI) and associated headend equipment were also approved for listing by UL/C-UL.

White Radio forms rep relationships

BURLINGTON, Ontario–White Radio Ltd. will exclusively represent test equipment manufacturer ComSonics Inc. in Canada, according to the terms of a recently-formed relationship.

White Radio announced that it will also become Alcoa Fujikura's exclusive distributor to the Canadian cable television industry (with the exclusion of the Atlantic provinces).

And finally, White has been appointed as the exclusive Canadian distributor and sales representative for Allied Bolt Inc., a manufacturer of drop wire hardware, grounding hardware, and more, for the U.S. cable TV and telco markets.

FrontLine buys EAS product lines

SALT LAKE CITY, Utah–FrontLine Communications has acquired the All Channel Messaging System (ACM) and Dynagen product lines from StarNet Development Inc. (a subsidiary of Lenfest Communications Inc.).

The ACM product, an emergency alert solution, has a current installed base of more than 250 systems, according to FrontLine. Dynagen is a plug-in PC character generator for cable and other multichannel messaging, text and graphics displays.

FrontLine Communications was formed by the core management team from SDI.

NextLevel signs wireless deals

HATBORO, Pa.–General Instrument Corp. announced that its NextLevel Broadband Networks Group has been selected to provide digital wireless systems to People's Choice TV Corp. (PCTV) and CS Wireless Systems Inc., two of the largest wireless cable operators in North America. The two operators have committed to ordering 600,000 DWT-1000 digital wireless consumer set-tops and associated headend equipment over the course of three years. GI will also perform systems integration.

The value of the award is about $240 million.

MCI deploys WDM system from Pirelli

LEXINGTON, S.C.–MCI has deployed a Pirelli bi-directional 40 Gigabit-per-second wavelength division multiplexing (WDM) system in a field trial between St. Louis and Chicago. MCI is testing Pirelli's new T31 2x2 BiDirectional Optical Line Amplifier System, along with Hitachi's OC-192 Sonet transmission equipment, which together, allow an aggregate transmission of 40 Gbps over a single fiber.

"The Pirelli technology that MCI is deploying not only adds speed and capacity to MCI's network," said Fred Briggs, MCI's chief engineering officer, in a statement, "but it does so very efficiently and at a significant cost savings over laying new fiber." CED

People on the move

Dr. Robert Hannemann has been appointed president of Oak Industries Inc.'s Lasertron subsidiary. Hannemann comes to Lasertron after 18 years at Digital Equipment Corp., where most recently, he served as general manager of DEC's Printing Systems Business.

Coaxial International has named **Gerald Yutkin** as president. In his new position, Yutkin will direct day-to-day operations, as well as consult with clients in the areas of strategic planning, budgeting, new business development, programming and operations management. An 18-year veteran of the industry, Yutkin has held positions with several Jones Intercable affiliated companies and American Television and Communications Corp. (Time Warner Cable).

Diba Inc. announced that **Albin Moschner**, former president and CEO of Zenith Electronics Corp., has joined the company as its vice chairman and a member of its board of directors. **Michael Fitzpatrick**, president and CEO of Pacific Telesis Enterprises, has also joined Diba's board of directors. A 22-year veteran of the high technology and consumer electronics industries, Moschner is responsible for business development from the company's new Chicago-based office.

Kenneth Van Meter has been appointed chief executive officer at Celerity Systems Inc. Van Meter joins the company after serving most recently as senior vice president at Tele-TV Systems, where he led the development and deployment of servers, set-top boxes and other system components on ADSL, HFC and MMDS networks.

Artel Video Systems Inc. has named **Thomas Ertel** as vice president of engineering. In his new position, Ertel will be responsible for all engineering development activities and programs, as well as new staff hires during the department's expansion. Previously, he served as engineering director of Chipcom Corp., formerly Artel's parent company, and now a part of 3Com.

Thomas Ertel

Steve Hane has joined ADC Telecommunications Inc. as vice president of sales for the company's Network Services Division (NSD), and **Jim Marino** has been appointed account manager for the company's Southeast region. Hane, who joined ADC in 1991, will lead a new sales group to serve existing NSD customers and introduce the division's products in the area of ADSL/Internet access, Sonet and ATM transport. Marino will be responsible for sales of the company's broadband communications products to the cable TV and CAP markets in Tennessee, Kentucky, Alabama and North and South Carolina.

General Instrument Corp. announced that **Randy Roberson** has been named vice president, engineering for the company's Communications Division, Western Operations. In this San Diego-based position, Roberson will oversee the engineering function for the company's Analog and Digital Satellite Network Systems business, as well as the Private and Commercial Network Systems business.

Philips Broadband Networks Inc. (PBNI) has named two new vice presidents. **John Caezza** has become the company's vice president of engineering, and **Carl Buesking** has taken over as the company's vice president of sales.

John Caezza

Carl Buesking

Caezza holds a B.S.E.E. from Clarkson University and has eight years of experience in PBNI's engineering group, with subsequent positions in sales and product management. Buesking began with the company as a regional sales representative, was promoted to manage inside sales activities, and most recently, serves as associate sales director for major accounts, helping design and implement organizational sales strategies.

Dan Donnelly has been promoted to the position of vice president, service provider business at StarSight Telecast Inc. Donnelly will oversee the company's affiliate sales and marketing efforts with cable operators, telcos and wireless providers. He previously held two positions with the company, including central region director, and most recently, senior director of cable sales and marketing.

Superior Electronics Group Inc. has appointed **Chris Plonsky** as director of engineering. He will be responsible for providing technical direction to the engineering department in the development of hardware and software systems for video status and performance monitoring products. Most recently, he was manager of magnetics engineering for Sensormatic Electronics.

Two new sales directors have been appointed at Vyvx Inc. **Mike Pirrone** has been named director of eastern area sales, and **John Peoples** has been named director of western area sales. Pirrone will be responsible for managing and directing the company's sales efforts in the Northeast, Mid-Atlantic and Southeast regions of the country. Peoples will oversee sales in the Northwest, West, Midwest and Southwest regions (including Alaska and Hawaii) in the United States.

Jay Brown has joined Communications Engineering Inc. (CEI) as senior design engineer. His responsibilities at CEI will include system design and implementation, project management and vendor interfacing. Brown, a 14-year veteran in the broadcasting industry, was most recently senior compression engineer with Tele-TV Systems' Digital Service Bureau in Reston, Va.

Barco Inc. has announced the appointment of **Rhett Caltrider** as sales engineer for cable television products in the western United States. Based in Denver, Colo. for this new position, Caltrider was formerly a consultant with Antec Network Systems.

Brian Edwards

Brian Edwards has joined Yuasa-Exide Inc. as general manager of its Energy Products Group in Garland, Texas. In this new position, Edwards will be responsible for the engineering, manufacturing and marketing of the company's modular DC power systems. Most recently, Edwards, who holds a B.S. degree in accounting, was regional manager for Chemical Associates.

Noyes Fiber Systems has named **Michael Taylor** as a regional sales manager. In his new position, Taylor will be based in Kansas City, Mo.

Mike Giampietro has been appointed vice president and general manager for Cox Communications in Springfield, Ill. Giampietro will be responsible for all operations of the company's Springfield cable system, which serves nearly 50,000 customers. CED

Network monitoring

MANLIUS, N.Y.–AM Communications Inc. and Philips Broadband Networks Inc. have jointly developed network monitoring products which support the Diamond Hub and Diamond Net optical node products.

The newly-released monitoring products are based on AM's OmniStat Control System; specifically, the OmniVU Windows NT-based software and new transponder technology. The monitoring technology, which supports the FOTO-DH and FOTO-DN products, was developed in support of the Philips' network monitoring system.

Key monitoring and control features of the technology consist of: frequency agility, downloadable protocol and control software, redundancy switching, return noise isolation, return switching, bridger switching, bypass and remote testing.

Circle Reader Service number 66

EAS encoder/decoder

GREELEY, Neb.–The HollyAnne Corporation has added the MIP-921 Cable Television EAS encoder/decoder to its family of SAM emergency warning products.

The MIP-921 was developed specifically for the cable television industry and has been recently certified under Part II (emergency alert system) of the FCC rules. It uses SAME (specific area message encoding) protocol, which was developed by the National Weather Service. SAME was first employed by HollyAnne in its SAM products for use in cable headends for weather and other local emergencies, according to the company. The protocol was subsequently adopted by the FCC for use in the new EAS system, says HollyAnne.

In addition, HollyAnne has incorporated a software platform to accommodate most cable override equipment providers' needs.

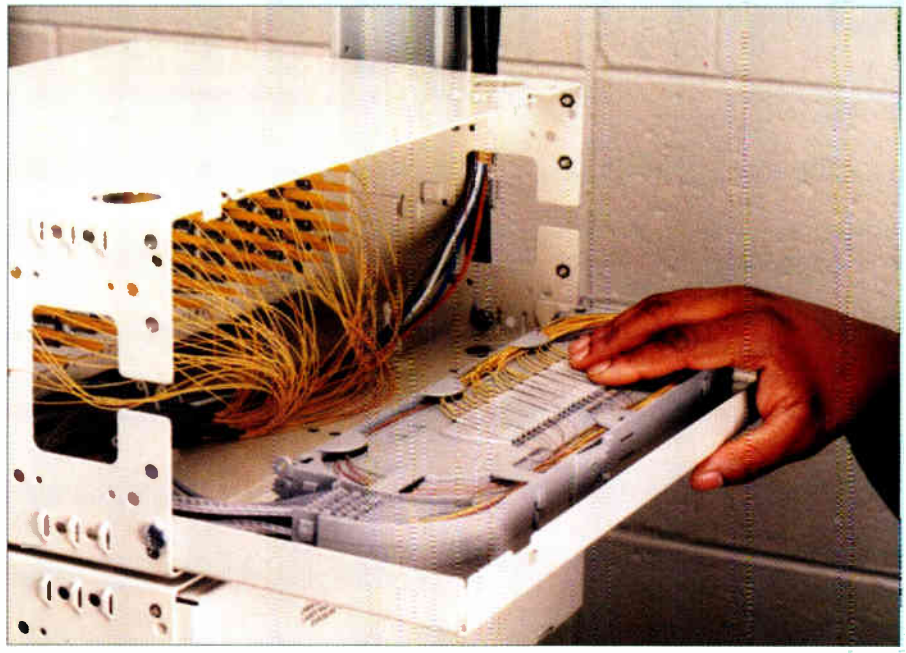
Circle Reader Service number 67

Telecom power protection

RALEIGH, N.C.–Exide Electronics Group Inc. has introduced the LorTec DC Powerboard product family, which is designed to protect telecom switches from power outages and damaging surges and sags. The family ensures continuous operation of critical transmission, switching, radio and wireless equipment, according to the company.

LorTec DC Powerboards range in size from 20 to more than 600 amps with battery backup times from one to eight hours. The units increase mean-time-between-failure (MTBF) by employing a single-stage, conversion switch mode rectifier topology pioneered by Exide Electronics, the parent company of LorTec, according to Exide.

Circle Reader Service number 68



Fiber management system

AUSTIN, Texas–The 3M Telecom Systems Division has announced the availability of its 8400 Series Fiber Distribution System which accommodates a 19-inch or 23-inch equipment rack and provides a 17-inch wide rear floor for easy-access routing and fiber storage.

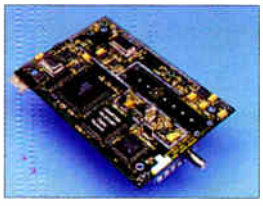
A key part of the fiber management sys-

VSAT broadband receiver

SUNNYVALE, Calif.–Stanford Telecom has announced a new generation, board-level demodulator receiver for very small aperture terminal (VSAT) systems. The STEL-9258 offers variable data rates, thereby allowing the VSAT system to operate at the lowest possible bandwidth, with resultant cost savings, according to the company.

In addition, the variable data rate assembly provides for system expansion by eliminating the need to exchange one fixed data rate receiver for another when data rate requirements increase.

The STEL-9258 is a true, variable data rate demodulator assembly which is user programmable from 19.2 to 1,024 kbps BPSK, or 64 to 2,048 kbps QPSK. Performance is typically within .4 dB of theoretical. It includes an L-Band downconvertor which can be tuned from 950 to 1450 MHz in 1 Hz steps. The assembly can also be supplied without the downconvertor to accept a direct 70 MHz IF input.



Stanford Telecom's STEL-9258

The STEL-9258 can track input frequency drift of up to ± 2 MHz without loss of signal lock, which permits the use of inexpensive DRO (dielectric resonator oscillator) type LNBs, rather than more expensive phase locked LNBs.

Circle Reader Service number 69

Central splice enclosure

HARRISBURG, Pa.–AMP Inc. has introduced the Deluxe Central Splice Enclosure (CSE), which provides easy access to optical fiber

The 8400 Series Fiber Distribution System from 3M Telecom Systems Division.

tem is the 8425 fiber distribution unit. The modular unit, which holds up to 144 fibers, allows fiber to be stored in large sweeping curves, providing a three-inch or greater diameter to prevent crowding and macrobends. To facilitate the use of hose clamps, cable ties or AT&T cableclamps, the cable strain relief is mounted on the chassis.

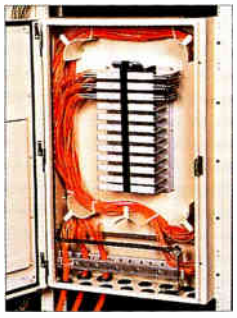
The 8425 distribution unit is preloaded with interchangeable coupling plates that are attached at the top. The bottom plate locks easily into a groove that allows for easier fiber installation without the need to reach under installed fibers.

The 8425-L model is equipped with built-in locks for additional security. The 8425-BP model comes with the 2425-FT splice tray that fits into a drop-down shelf in the back of the unit to accommodate up to 72 fused or mechanically spliced or terminated fibers when used with three 2524-FT splice trays. The 8425-BPL model is a lockable version of the unit.

Circle Reader Service number 65

cable in a durable welded construction, while simultaneously protecting the fiber.

The AMP Deluxe CSE splices optical fiber cables from the headend to the fiber node, and from cabling vaults to mainframes. The locking unit offers up to two grounding and tie-down bars for securing the central strength member of the fiber optic cable. The bars can be removed for access to the six or 12 cable entry ports. Five cable management rings are located around the splice tray holder and supply cable routing paths.



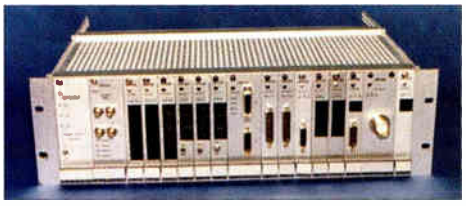
AMP's Deluxe Central Splice Enclosure

For ease of installation, reversible brackets permit 23-inch EIA rack- or wall-mounting. A full-size mounting template ensures proper alignment. While the wall-mounting bracket supports the enclosure, users can install permanent wall anchors in the side-mounting brackets.

Circle Reader Service number 70

Sonet multiplexer

SOUTH PLAINFIELD, N.J.–Private Network Technologies has announced the availability of a new universal STS-1/OC-1 Sonet multiplexer. The multiplexer, which operates either as an STS-1 channel bank or fiber optic counter-rotating-ring OC-1 fiber communications system, is available with numerous data and voice interfaces (Ethernet, DS-1, DS-0, RS-232, RS-422, RS-485, etc.).



Private Network Technologies' STS-1/OC-1 Sonet multiplexer

The numerous interfaces allow for a broad range of applications such as cable TV headend communications, common telecommunications, process control, ITS highway infrastructure, etc.

Circle Reader Service number 71

Modular OTDR

UTICA, N.Y.–GN Nettest, Laser Precision Division, has announced a new OTDR, the CMA4000. The set features true, one-button testing which allows the operator to conduct complete, automated tests including optical return loss, dual wavelength, filename, storage and print with the touch of one button. In addition, the OTDR's preemptive multi-tasking operating system allows most tests to be completed in less than one minute, according to the company.

GN Nettest, Laser Precision Division's CMA4000 OTDR

Available in singlemode, multimode and quad wavelength versions, as well as in a variety of dynamic ranges, the CMA4000 is designed for use in cable TV, telephony and data comm.

Circle Reader Service number 72

Fiber optic output modules

SAN DIEGO–MERET Communications Inc., a wholly-owned subsidiary of Osicom Technologies Inc., has announced that 100 MHz bandwidth fiber optic output modules are now available for the Dynair System 2000 Video Routing Switcher.

The new plug-in module eliminates the need for separate fiber optic transmitters, associated frames and interconnecting cables when delivering video signals to a multimode fiber optic network. Standard Dynair HYPER-Link or DYNA-View compact rack-mount or standalone fiber optic receivers can be used with the new modules. The link exceeds RS-250C short-haul specifications in baseband video applications, according to MERET.

Circle Reader Service number 73

Demodulator system

CHAMBERSBURG, Pa.–Jerry Conn Associates Inc. (JCA) has announced a new television demodulator system from Tektronix. The DS1001 is a demodulator system targeted at cable TV applications which require a low-cost, measurement quality demodulator, says JCA. The system provides accurate, tunable demodulation for cable TV proof-of-performance testing and node monitoring, as well as operational applications such as off-air pickups, translators, or videotaping of off-air signals.

In addition, the DS1001 provides synthesized tunability from 47 MHz to 860 MHz. The unit also features stereo sound with right and left audio outputs. And, the DS1001 can be used as an operational demodulator, taking off-air signals down to baseband for further processing.

Circle Reader Service number 74

Universal closures

HICKORY, N.C.–Siecor Corp. has introduced a new family of Universal Closures (UCN) designed to protect the straight or branch splices of high pair-count, telecommunications copper and fiber optic cables from environmental influences. The UCNs feature a sealing system that is elastic, as well as compressible, and has been designed to ensure long-term reliability in field installations. Simple to install, UCNs can be assembled onto cut or uncut cables and are suitable for direct buried, aerial and underground installation.

Circle Reader Service number 75

Upconvertor

ATLANTA–Barco has introduced the Gemini upconvertor, an alternative to conventional modulators. One rack unit high by a half rack wide, Gemini accepts digital or analog IF inputs (i.e., from a fiber ring) and upconverts the signal for distribution to subscribers. Two units may be mounted in a single, one-rack unit space. The Gemini is available in either fixed channel or agile versions.

Circle Reader Service number 76

Fiber gain module

STURBRIDGE, Mass.–Galileo Corporation has released its Fluorolase fiber gain modules, which incorporate singlemode doped fluoride fiber spliced to standard telecommunications silica fiber. Designed for easing fusion splicing installation, the modules provide a durable, sealed fiber enclosure that lessens or eliminates handling and environmental concerns.

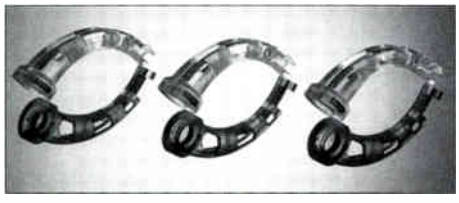
Galileo's Fluorolase fiber gain modules

The praseodymium modules provide all-optical amplification in the 1310 nm operating window and transparency to bit rate speed, as well as support WDM operation. With a much flatter gain spectra, the erbium modules allow access to more usable bandwidth which is ideal for DWDM applications.

Circle Reader Service number 77

Fiber optic connector

HICKORY, N.C.–Siecor Corporation has introduced a new 90-degree boot fiber optic connector that slides over existing connectors



Siecor's 90-degree boot fiber optic connector

which allows it to be placed at any time after connectorization. The boot was designed for bending fiber in a 90-degree arc at the connector in any place where space is limited.

The boot clips onto a connectorized fiber and routes the fiber in a 90-degree arc that maintains the Corning recommended minimum bend radius. For additional flexibility, the boot can be rotated to route fiber in any direction. This is particularly useful in tight places, such as patch panels, where minimal space may affect the bend radius of the fiber.

Circle Reader Service number 78

Upstream test kit

SUNNYVALE, Calif.–Stanford Telecom has announced the availability of the STEL-9251/CE upstream modulation/demodulation kit for evaluation and testing of its modulator and demodulator products designed for HFC systems. The kit contains the STEL-1108 burst modulator and STEL-1208 modulator evaluation assembly, the STEL-9244 headend demodulator, cabling, PC-based software and instructions.

The STEL-1108 is a complete BPSK/QPSK modulator in a single-chip ASIC, designed specifically for the transmission of data from the subscriber modem to the headend equipment. It incorporates an integral numerically controlled oscillator and outputs a spectrally shaped and filtered signal, tunable between 5 and 40 MHz.

Stanford Telecom's upstream test kit

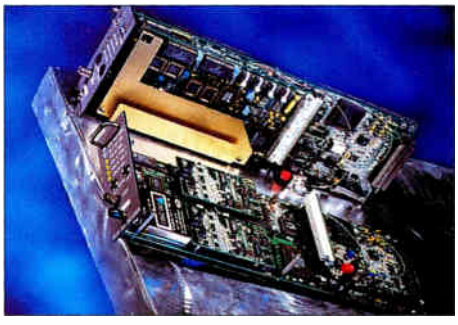
The STEL-1208 provides both burst and continuous modulated output, enabling more timely lab simulations. The STEL-9244 burst demodulator is a board-level assembly for demodulation of upstream burst QPSK signals at the cable headend site.

Circle Reader Service number 79

SDI transport system and modular chassis design

NEWBURY PARK, Calif.–Video Products Group has introduced a new product line (VPG8000) for transporting Component Serial Digital "D1" Video over fiber or coaxial cable, and a universal, modular chassis configuration (VPG6000) that allows for a wide variety of video and audio conversion and transport technologies in one integrated system.

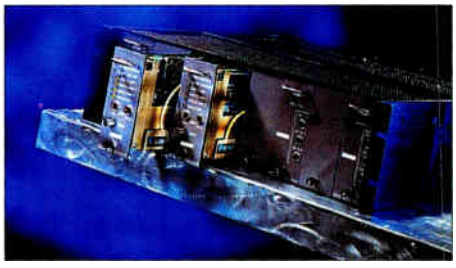
The VPG8000 SDI (Serial Digital Interface) Transport System provides users a way to embed digital or analog program audio and machine controls into SMPTE (Society of Motion Picture and Television Engineers) 259M-compliant or ITU (International Telecommunications Union)-R 601-compliant 270 Mbps bit streams.



VPG8000 Serial Digital Interface modules

The VPG8000 can be chained to support metropolitan-area, regional or country-wide transport networks. It can accept a 270 Mbps bit stream over a distance of up 300 meters (approx. 328 yards) of Belden 8281 coaxial cable and transmit it over a distance of 100 kilometers (approx. 62 miles) of singlemode fiber optic cable without distortion or jitter.

The VPG6000 Modular Universal Chassis employs a "midplane" design that supports both inter-module connections and connections to input/output panels integrated into the chassis. By using a management processor card installed on the power supply, up to 32 chassis can be managed, monitored and controlled from a single terminal.



VPG6000 Modular Universal Chassis

Circle Reader Service number 80

RF transmitters and video line drivers

BERKELEY HEIGHTS, N.J.–The Microelectronics Group of Lucent Technologies has released its latest array of high-performance radio frequency (RF) transmitters and video line drivers targeted at four broadband applications—high-speed cable data modems, cable telephony, network interface units, switched digital video optical network units and set-top boxes.

The V49XX series of silicon integrated RF transmitters are optimized for, but not restricted to, cable modems and cable telephony network interface units. The V4910 transmitter can deliver 66 dBmV from 5 to 42 MHz with harmonic and intermodulation distortion better than -45dBc. Both the V4911 and V4912 feature a programmable gain range of 30 dB, low output noise, "sleep" mode and distortion levels less than -55 dBc, at a rated output of 57 dBmV. The V4914 is a fixed-gain, low-noise, differential amplifier that operates from a single 5-volt supply, delivering 55 dBmV output, harmonic distortion better than -65 dBc, and an output inter-

cept of 44 dBm.

The V50XX series of video line drivers are optimized for, but not limited to, set-top boxes and switched digital video optical network units. The drivers feature a combination of high output current (210 mA), and a high slew rate of 500/Vμsec. These line drivers are designed to be used wherever a high-output-current, high-slew-rate signal is required to drive traditional coaxial cable or unshielded twisted pair.

Circle Reader Service number 81

DWDM couplers

LISLE, Ill.–Amphenol Fiber Optic Products has expanded its optical coupler product line with the addition of 4-channel dense wavelength division multiplexer (DWDM) cou-

Amphenol's 4-Channel DWDM couplers

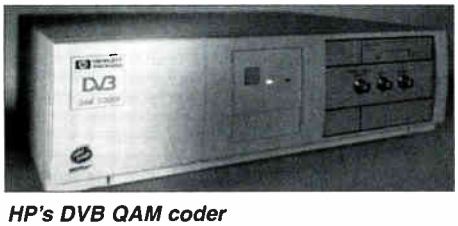
plers. Applications for the couplers include any 1550 nm fiber system with constrained bandwidth capacity.

The inherent wavelength sensitivity of the couplers is optimized to produce devices that perform as WDMs between the 1533, 1541, 1549 and 1557 nm wavelengths. High isolation and low insertion loss are achieved in either unidirectional or bidirectional operating modes. Amphenol's 4-channel DWDM couplers are offered in two, 1x4 module versions —a standard flat pack or the 948 Series fiber management coupler cartridge. Termination options include FC, SC and ST connectors with standard polish choices.

Circle Reader Service number 82

QAM coder

PALO ALTO, Calif.–Hewlett-Packard Company has introduced its HP E4441A DVB QAM coder, designed to help cable



HP's DVB QAM coder

operators optimize network performance and manage interoperability issues.

The HP coder can be configured to perform a variety of tests, allowing users to easily change symbol rate, constellation size and channel coding at the touch of a button. Users can generate extremely accurate QAM (quadrature amplitude modulation) signals that can then be impaired in a calibrated manner. The unit also allows users to test DVB-C network equipment in ideal or non-ideal signal conditions to get "real-world" test data.

Circle Reader Service number 83

Tool kit/briefcase

POWAY, Calif.–Time Motion Tools has introduced its Diversified Tool Kit that stores and organizes frequently-used tools on one side, and a has place to store files, documents, a calculator, pens and more on the other side.

TMT's Diversified Tool Kit

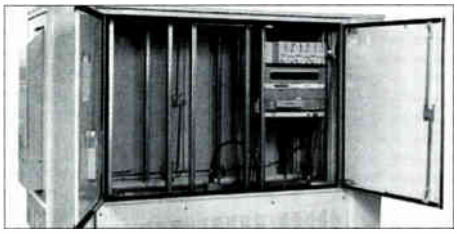
The tool kit/briefcase is made of rugged Cordura. The briefcase portion features a unique built-in clipboard with a convenient surface made for writing. Users can specify individual tools for their kits, and replacements for lost tools are readily available.

Circle Reader Service number 84

Climate-controlled enclosure

FRANKLIN PARK, Ill.–The Reliable Electric Division of RELTEC Corporation has added the CATV112AC cabinet to its full line of environmentally-controlled enclosures.

The cabinet features four isolated chambers: an AC power chamber which includes a UL listed load center and transfer switch with



RELTEC's CATV112AC enclosure

a generator receptacle for emergency connection; a splice chamber containing two cable ports for fiber entry into the cabinet, an 8,000-BTU air conditioner to cool the cabinet, and a second (optional) air conditioner for redundant cooling; a main chamber with six 19-inch/23-inch x 53-inch equipment racks; and a battery chamber that holds up to three slide-out battery trays.

Circle Reader Service number 85

Fiber optic switch

SAN JOSE, Calif.–E-TEK Dynamics Inc. has announced the release of its new 2x2 Mechanical Fiberoptic Switch that features sub-millisecond switching time (<1 ms).

E-TEK's 2x2 switch

The mechanical switch also features a wide wavelength range (1280-1650 nm), low insertion loss (<1.0 dB) and low back reflection—multimode: -25dB (max.); singlemode: -55dB (max.). The 70mm x 36mm x 16mm switch is also epoxy free in the optical path.

Circle Reader Service number 86

Rack-mount receiver, power supply modules

SUNNYVALE, Calif.–Harmonic Lightwaves Inc. has announced the availability of its HRM 3810 rack-mount receiver and -48 volt DC Power Supply Modules for its HLP 4000 platform for its MAXlink and PWRlink transmitter systems.

The HRM 3810 is a full-featured, compact and modular forward path receiver that fits into Harmonic's HLP 4000 platform. The unit offers an RF power detector and alarm that enables detection of system problems before signals reach the optical link. The 3810 supports a wide range of optical input levels from -6 to +3 dBm. It also features GaAs amplifiers for enhanced performance and exceptional flatness and distortions.

Two 3810 receivers can be interfaced for automatic back-up and increased reliability when used in fiber redundant architectures. The 3810 has built-in local and remote management capabilities which are enabled through embedded microprocessors.

Harmonic's -48 volt power supply modules, which are also designed to work with its HTR 2000 return path receiver platform, feature dual inputs for redundant powering applications and voltage sensing to switch between primary and secondary inputs.

Circle Reader Service number 87

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In wireless world, hearing is believing

By Thomas G. Robinson, Director of Regulatory Affairs and Technology Development, River Oaks Communications Corp.

It's amazing how things you can't even see can cause so much consternation. Take wireless communications, for example. Like a number of people, once I got "connected," cellular service became an integral component of my business day. Boldly, I've even scheduled participation in conference calls, knowing I was going to have to take them on the car phone. Such an arrangement, though, has sometimes, put me in significant distress, for just as I'm about to make the critical point that I hope will win the group over to my side, suddenly, the connection gets filled with static, cross-talk, or worse yet, silence (silence is not golden in this situation).

Thinking this through, though, it's the things that we *can* see that also create the consternation. For instance, maybe a few more cell sites would help alleviate my car phone drop-out. Then again, that may require a few more towers or, in the case of PCS, numerous antennas which may enhance my service but which have already created significant consternation for local governments and their citizens. The January exchange of correspondence between the Cellular Telecommunications Industry Association (CTIA) and the Federal Communications Commission (FCC) Wireless Telecommunications Bureau further illustrates the contention between wireless service providers and local and state governments on a wide range of issues, including application of federal electromagnetic radiation emission standards, local fee structures and antenna siting moratoria. At this writing, the Bureau had scheduled a public forum involving the industry and government representatives to discuss these topics.

With all this, one would think that the advancement of wireless communications services was in a national state of disarray. Contrary to this notion, however, in many communities, local governments are working with providers of site transmission and reception facilities so that both the public and the provider benefits. For example, in Akron, Ohio, city officials have been working with service providers to place new antenna facilities on existing structures and utilize city property wherever feasible. In each case where a new tower is needed, the city's policy is to encourage co-location, and therefore, the city pursues with providers the construction of lattice towers instead of monopoles in order to promote multiple providers on a single structure. This has resulted, for instance, in AT&T signing a lease for use of city property where AT&T will build a tower that is sized to also support two other provider platforms. In another instance, the city and Ameritech Wireless are working on a lease to utilize one of the city's current communications towers. Further, both Ameritech and AT&T are reviewing with the city the possibility of utilizing two of the city's water towers. The city is also currently engaged in discussions with Next Wave, the holder of the "C" Block PCS license for Akron.

The city also recently changed its zoning ordinance to facilitate the placement of new towers when needed in industrial and commercial areas and placement of single antennas on private property for PCS applications. At the same time, the ordinance requires significant scrutiny of the placement of towers in residential and retail areas because of the stated concerns of residents and retailers. City officials report that these efforts have currently led to satisfactory placement of facilities and rollout of wireless services in the eyes of both residents and providers.

Since the first monopole . . .

Fairfax County, Va. has been involved with wireless communications issues since the first monopole arrived in the county in early 1984. Located just outside of Washington, D.C., the county's population utilizing wireless services has grown from 2 percent in 1989 to an estimated 95 percent by the year 2005. Like Akron, the county has looked for ways to work with providers to bring needed services to county residents, while also addressing the residents' concerns about the visual impact of tower and antenna structures, negative impacts on real estate values and health issues.

The county also encourages location of antenna facilities on public use sites, on existing structures and on sites amenable to co-location. In implementing this policy, the county has found that 70 to 80 percent of new facilities can use existing structures, and this, in turn, lessens the potential for any kind of negative visual impact. Additionally, through radiation studies, the county has found that current wireless implementations are well within federal standards for radiation emissions.

The county has also found that utility pole and street light owners are working well with wireless providers on location of PCS antenna facilities. School facilities are also reaching agreement with PCS providers for antenna placement. In recent cases, two high schools reached agreement with providers on the lease of space on light standards adjacent to the football fields for antenna placement. The Fairfax County Water Authority has, for years, worked with providers to place facilities on top of water towers. Overall, between 1984 and 1995, the county reports more than two-thirds of all wireless facilities were able to be placed on rooftops and shared structures, as opposed to monopoles and dedicated towers.

The upshot is, in many places, the wireless evolution/revolution is moving forward with the concerted efforts of both local governments and providers for the benefit of their mutual constituents–and is not, as some in the industry have maintained, bogged down in an endless review and lengthy moratoria cycle. Consequently, I am confident, as my wireless provider has assured me, that someday soon, I'll actually be on a wireless conference call for the duration. After all, in the wireless phone world, hearing is believing. CED

Have a comment?
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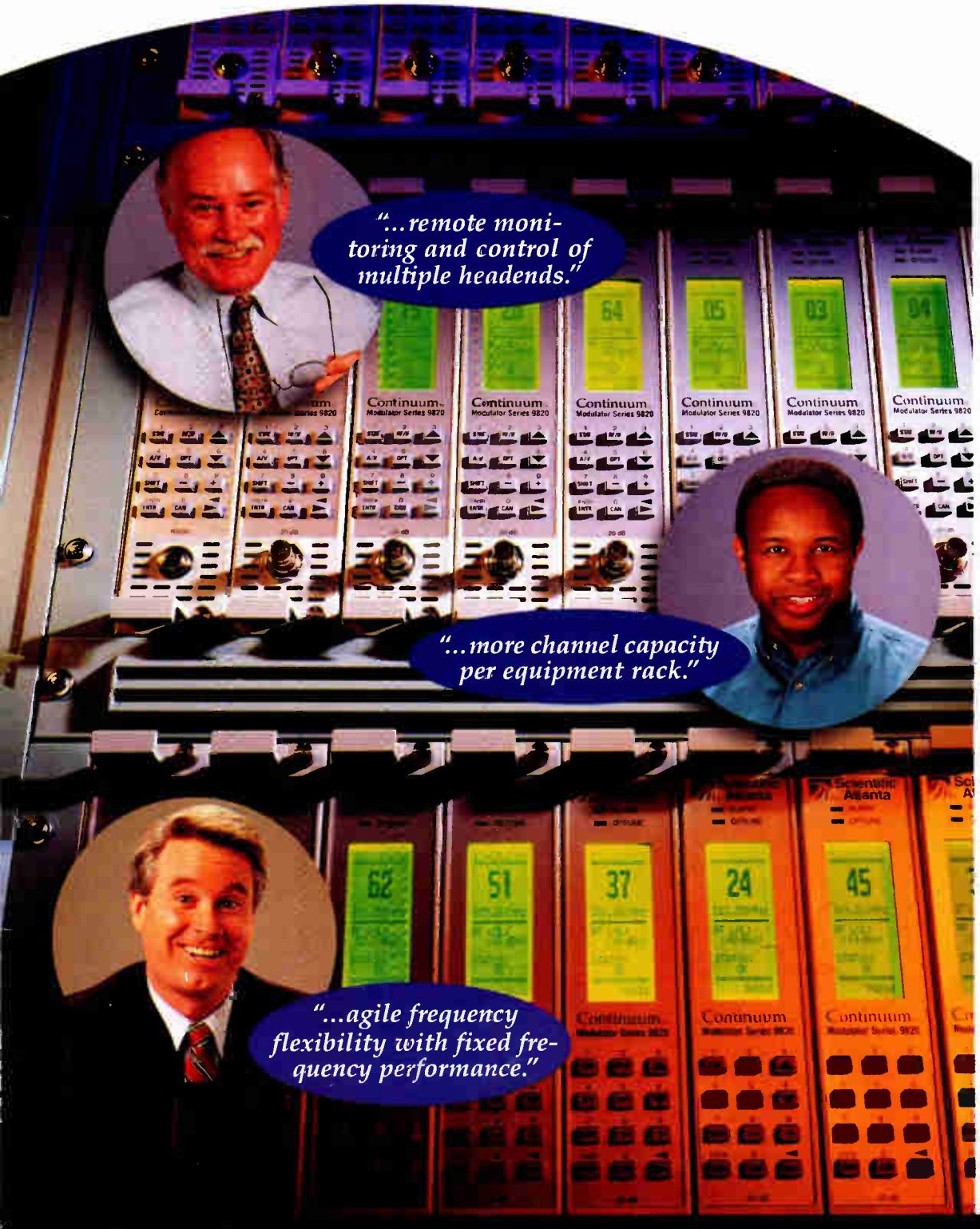

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