Communications Technology

Official Trade Journal of the Society of Cable Telecommunications Engineers

April 1998

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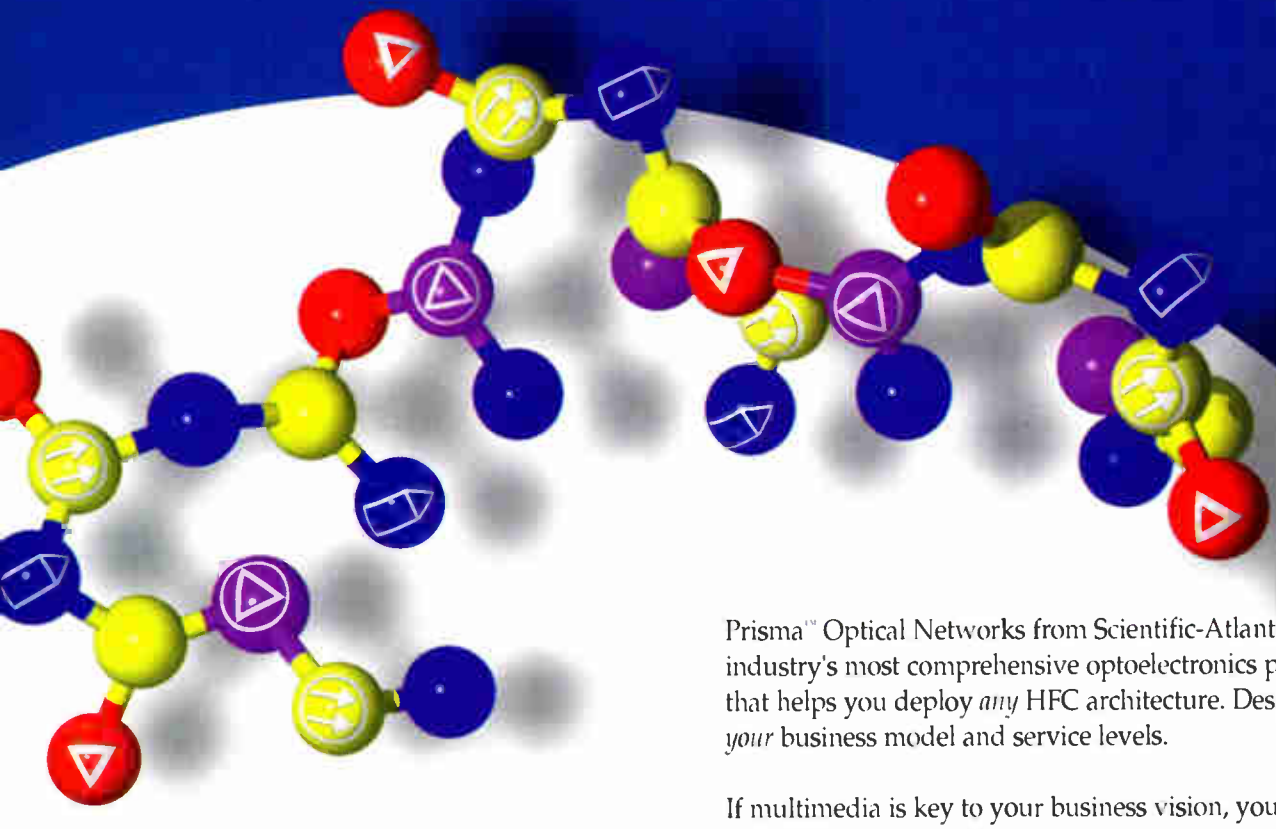

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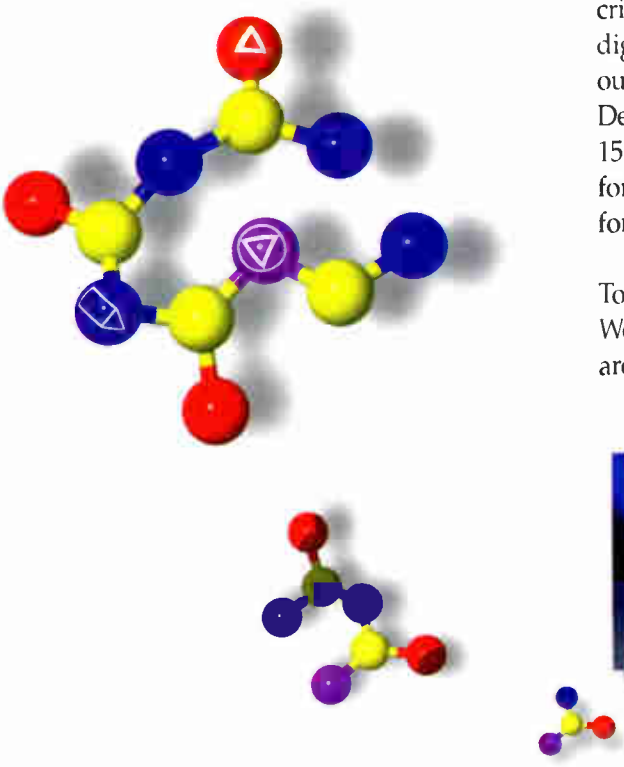

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FEATURES

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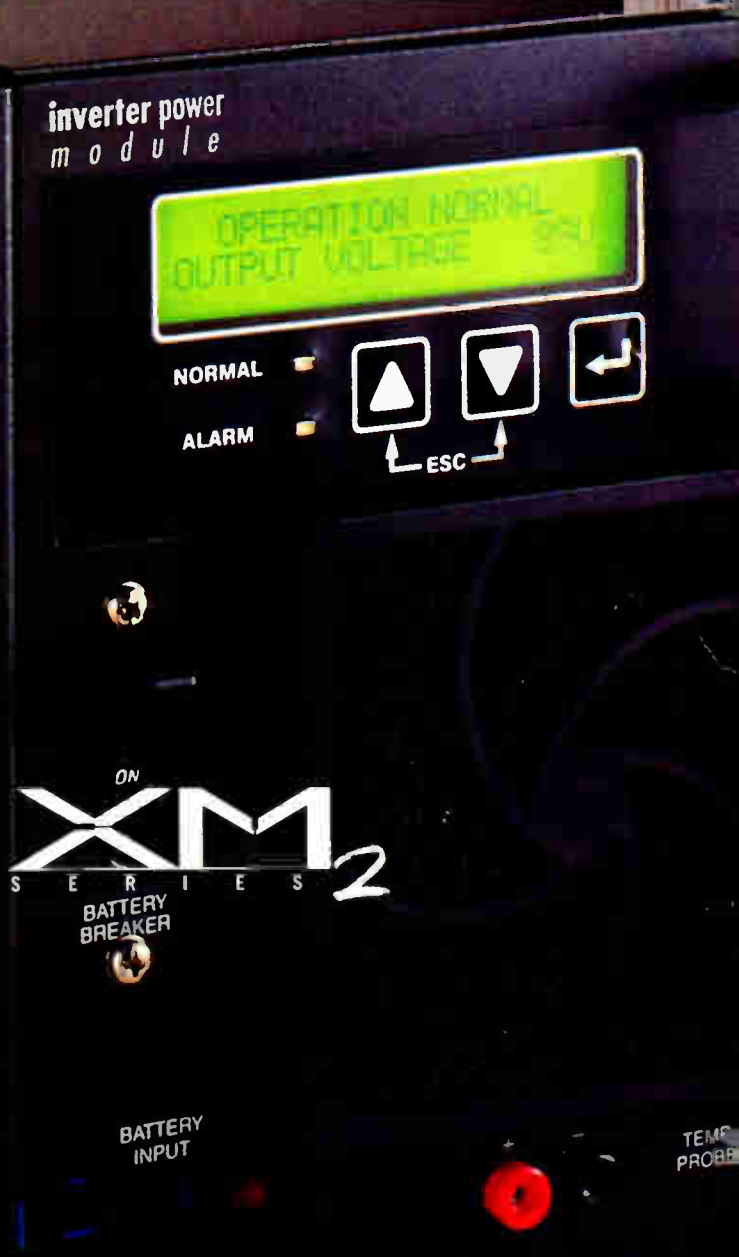

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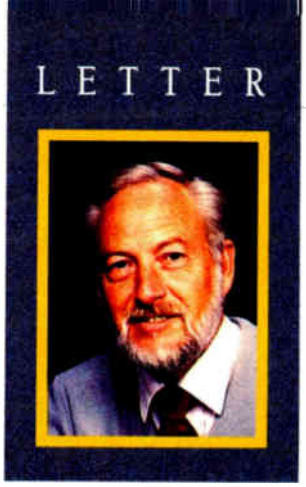
By Rex Porter



Selling to the Decision Makers

Recently, I spoke with two companies that have decided to concentrate on markets other than cable because they can't get their products accepted for purchase.

When I queried them further, one company representative knew the names of only two top MSO engineers. The other company had a list of CEOs but couldn't get in to see them. Neither had a Cable Fact Book of any kind.

The bad old days

In 1969, when we formed the Society of Cable Telecommunications Engineers, there was a rush to keep engineers out of decisions involving specifications or purchase of electronic equipment.

Before 1969, I had experience both as an owner/operator and a cable engineer. As a cable engineer, I have almost cried as I tried to make inferior equipment work, simply because the owner bought "stuff" so he could qualify for an all-expense paid vacation from that supplier.

Later, as an owner/operator, I bought equipment based on the recommendations of my chief technical officer, Randy Fraley, who retired a few years ago after a long Time/Warner career in Fayetteville, NC.

Gradual enlightenment

As we moved into the 70s, I was pleased that equipment purchasing in other MSOs was a function of engineering, directed by their chief technical officers. Obviously, owners can purchase anything they wish.

Today's owners hire qualified technical officers to decide whether equipment is compatible and depend on them to approve equipment that will interface with their system needs.

Cable products are very sophisticated today. We're not building 12-channel networks now. We deal in the complexities of high-speed cable modems, routers, switches, filtering networks and Internet protocol (IP) telephony.

Today's owner/operators have other concerns, mainly business management. Although some owners and CEOs are degreed engineers (Ph.D.s in some cases), they depend on engineering staff to study, test, evaluate and approve electronic gear. I doubt any CEO would hire a chief technical officer and then make his own decisions about high-tech products.

Even when the final budgets are decided by committee, the person most knowledgeable about hardware and software excellence is the chief technical officer.

Budding recidivism

Why am I concerned about this now? I see new companies entering this industry, introducing sophisticated digital, data and telephony gear. We certainly need them, but they may not be aware of "approved vendor lists" or purchasing responsibilities.

Especially from advertising agencies, I hear such comments as: "We want to get our message to operations managers—they sign the purchase orders. They will tell the engineers what they can buy." I shudder to think this might even be close to the truth.

We cannot allow this misconception. When you meet suppliers at conventions, conferences and vendor-appreciation days, make sure they understand you are responsible for buying electronic gear.

Then, if they persist in taking their message to the wrong people, they are responsible for their own lack of sales. CT

Rex Porter
Editor

What you need when you need it.

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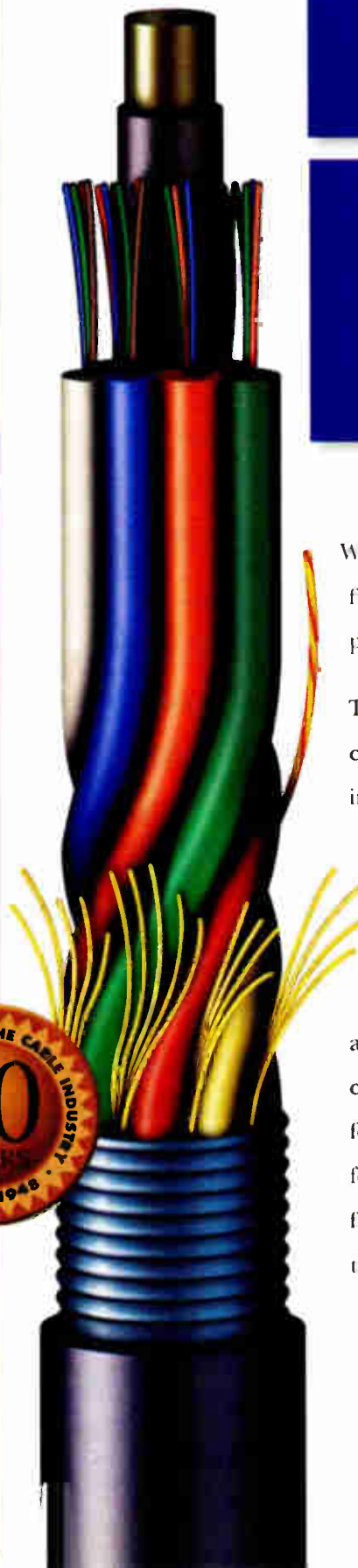

When your technician can't distinguish the blue fiber from the aqua fiber, you're looking at a potentially expensive mismatch waiting to happen.

That's why we think Alcatel's exclusive AFC™ fiber coating with ColorLock™ is the brightest new idea in optical fiber since, well, optical fiber.

Instead of applying color to the outside surface of a coated fiber, Alcatel integrates color into the coating. There are no inks to wipe off, and no inconsistent or uneven applications of ink affecting color or geometry. ColorLock guarantees consistent color throughout the length of the fiber, for the life of the fiber. Call TeleWire Supply today for immediate delivery of AFC3 with ColorLock from Alcatel. One look, and we're sure you'll see the light.

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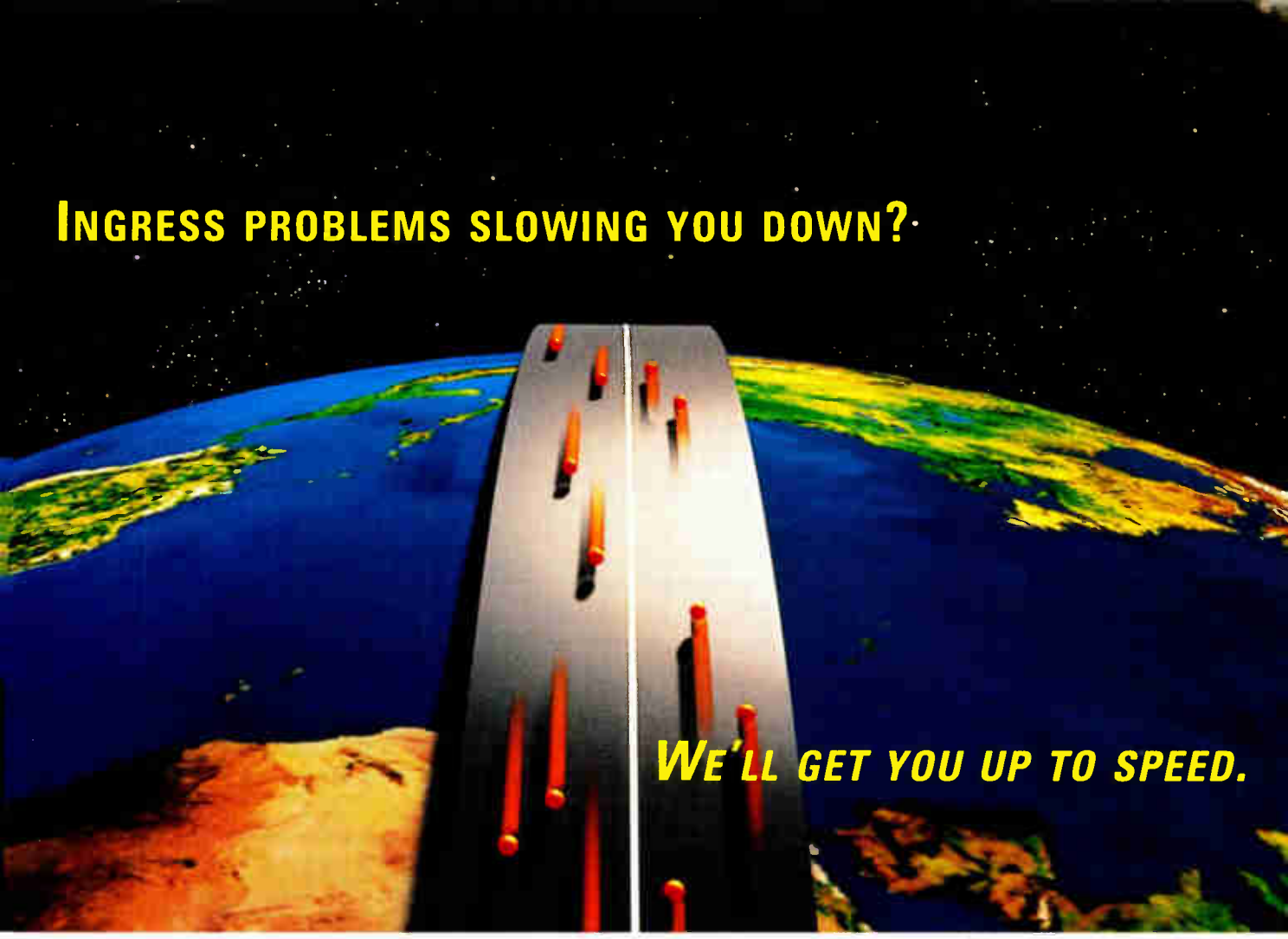
INGRESS PROBLEMS SLOWING YOU DOWN?



Speed has never been as important in the race to install and maintain your return path as it is today. So the last thing you need is a problem with ingress. That's where the HP CaLan 3010R/H Sweep/Ingress Analyzer comes in.

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- ***Ingress Detection***
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- ***Dual Path Sweep***
  New! One headend box for both forward and return sweep means more efficient use of bandwidth, more space in the headend and less equipment to buy.
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LETTERS TO THE EDITOR

No More Digital Excuses?

Recently, our engineering and technical department manager, Luis J. Cuenca, gave me a copy of the November 1997 *Communications Technology* article, "Channel Capacity '98: No More Digital Excuses?" by Senior Editor Laura Hamilton.

I personally found your write-up to be most interesting and an eye-opener.

We operate a cable TV system in the central Philippines and belong to one of the three largest MSOs in our country. Can I request more details, especially on digital set-tops at the subscriber end? I would like to use this as a possible argument with management the next time we meet on budget aspects of our proposed expansion into hybrid fiber/coax (HFC).

I look forward to your reply and more power to you and your magazine.

Gerardo G. Villanueva
Sun Cable Systems
Bacolod, Philippines

Thanks very much for the insightful article you wrote in the November 1997 issue of *Communications Technology* concerning digital cable.

Last year when our feasibility study was conducted, we based our numbers of a digital-to-analog signal conversion at the headend. Obviously now there is potential for us to consider using strictly digital and the set-top box. We also have incorporated interdiction into our initial design specifications.

Can you give me an idea what the cost differential will be by pursuing strictly digital? Which companies have digital technology to offer over analog systems?

Grant N. Johnson
Indianola Municipal Utilities
Indianola, IA

Editor's response: A good resource for information on digital set-tops is the collection of papers presented at a conference held last June by the Institute of International Research. You can order the proceedings manual at (800) 345-8016.

Several set-top manufacturers' representatives spoke, including those from NextLevel, Scientific-Atlanta, TV/COM and Zenith.

Operators were on hand as well. Of particular note was a presentation given by Ron Martin of cable operator Buford Television (which is small-to-medium sized). He outlined the reasoning behind their decision to "go digital" and why it was cost-effective. His paper should interest you both.—Laura Hamilton, Senior Editor

Kudos Generally

Communications Technology is truly one of the best sources of information around. With it arriving once a month, I make a point to give it some of my time. This helps me stay on top of the newest technologies and get some great ideas.

Bob Lippert
Technical Operations Officer, TCI Cable
Redding, CA

Praise from History Buffs

Congratulations on a great Editor's Letter in the February issue. "The Very First Cable Engineer" was certainly appropriate material for an engineering magazine while containing historical and human interests. I found it extremely enjoyable.

James Lepsch
Director of Marketing, Monroe Electronics.

Your column on Ed Parsons was just right. I made a copy and put it in the file so the next time we write about him, we can have that perspective, too.

Marlowe Froke
President, National Cable Center and Museum

Write to Us

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CT reserves the right to edit letters for clarity and/or space.

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Reader Service Number 11

Agreement Seeks Fiber-Optic Standard

To facilitate growth of fiber-optic communications through standardization at the component level, several companies have entered a multisource agreement to define standards for small-form-factor fiber-optic transceivers.

Principals in the agreement are AMP Inc., Hewlett-Packard Co., Lucent Technologies, Nortel, Siemens Corp. and Sumitomo Electric Lightwave Corp. The agreement specifies mechanical package dimensions, circuit board layout footprint, pin size, positioning and functions of a compact internationally compatible family of transceivers.

Transceivers manufactured under the agreement will be 0.535 inches wide, while today's standard transceivers are 1-inch wide.

Cablevision, TCIC Swap Customers

Cablevision Systems Corp. and TCI Communications Inc. intend that Cablevision acquire TCIC's Connecticut cable TV properties for assets, cash and securities. The purchase will more than double Cablevision's Connecticut operation, adding TCIC's 250,000 customers to the 202,000 that Cablevision already has in that state. The exchange also involves TCIC's previously announced acquisition of Cablevision's Kalamazoo, MI, system and additional equity in Cablevision for TCIC, bringing TCIC's stake in Cablevision up to approximately 36%.

Microware, OpenTV Join Forces

Microware Systems Corp. and OpenTV Inc. have agreed to work together to advance the interactive TV industry as a whole. The two companies plan to combine Microware's OS-9 real-time operating system with OpenTV's hardware- and platform-independent software into a cross-compatible off-the-shelf solution for digital interactive TV applications and services.

Alcatel, Hydro Quebec Make Deal Worth $50 million

Hydro Quebec has chosen Alcatel Canada Inc. to fill its multi-gigabit fiber-optic transmission digital microwave and network management needsfor the next five years—a deal worth about $50 million.

Alcatel will supply 1648 SM and 1603/12 synchronous optical network (SONET) multiplexers, Optinex long-haul terminal optical amplifiers, MDR-4000 and MDR-6000 digital microwave radios, and the 1320 NM network management system for all operations, administration, management and provisioning functions.

Hydro Quebec's province-wide network carries communications necessary to control production and distribution of the electricity the company produces, mainly at hydroelectric dams. T

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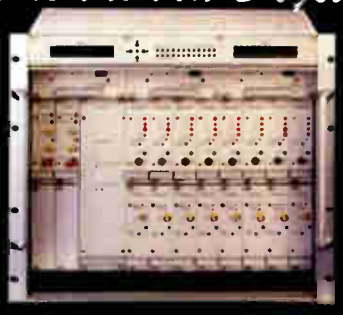

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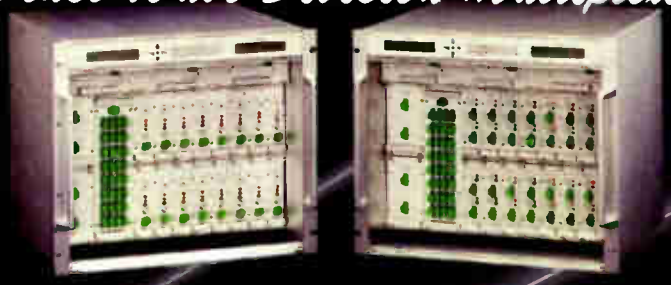

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Reader Service Number 13

SCTE UPDATE

SCTE Changes North American Rates

The Society of Cable Telecommunications Engineers has announced that it has altered its rate structure for the benefit of international members within North America.

The SCTE Board of Directors voted in December to extend the Society's annual active member dues of $40 to include all members in North America.

The decision recognizes the rising number of new members in Canada and Mexico, and the growing interest in SCTE technical training opportunities, as well as lower international shipping costs to those countries.

SCTE Manager of Membership Services Patricia Zelenka said: "Over the last several years, the Society's mission and influence has greatly expanded in the global marketplace. We hope that by changing the borders of our international dues, we can not only better serve our members, but encourage the positive worldwide communications trend that SCTE and the broadband industry in general have established."

Prior to Jan. 1, when the new rates went into effect, all SCTE members living outside the United States paid the international rate of $60. To continue to offset the costs of overseas shipping fees and insurance, currency exchange rates and international postage, the Society's international member rate for all other countries will remain $60.

The new rates apply to regular active membership within the Society. Annual dues for all other membership categories will remain unchanged.

SCTE Staff Members Promoted

The SCTE has announced that three members of its professional staff recently were promoted to more responsible positions in their respective areas.

Anna Riker, who joined the SCTE staff in 1985, has been named director of special projects.

She previously held the position of manager in that department. Riker's duties will include coordination of the annual Cable-Tec Expo and all other national SCTE conferences, as well as supervision of advertising sales for the Society's *Annual Membership Directory and Yearbook*.

Former Manager of the Membership Services Department Patricia Zelenka now will serve as that division's director.

In her new position, she will be responsible for overseeing the processing of membership applications and invoices, processing orders and maintaining inventory for SCTE publications and videotapes, accounting and payroll functions, and responding to membership information requests. Zelenka, who is celebrating 12 years with the Society, also serves on the SCTE Scholarship Subcommittee.

Howard Whitman has been named Senior Production Editor for the Society's Editorial and Promotion department; he previously held the position of manager.

A member of the SCTE staff since 1987, Whitman's duties include managing the overall production of SCTE's monthly newsletter, *Interval*, and its *Annual Membership Directory and Yearbook*. He also oversees the Society's publicity and advertising plans, in addition to coordinating outside publishing projects. In addition to his work on the professional staff, Whitman serves on the SCTE Marketing Subcommittee.

SCTE Partners with Local Chapters to Offer Technical Training

The SCTE will partner with several local chapters next month to offer two technical training workshops to all levels of broadband personnel.

On March 23, SCTE, in conjunction with its Southern California Desert and San Diego Chapters, will launch a "Train the Trainer" seminar series in Alhambra, CA.

The three-day event, open to anyone interested in learning effective training methods, will instruct attendees on how to use the Society's training materials to conduct successful training sessions on-site, as well as a discussion of learning theory.

Training Consultant Bari Edstrom will teach the class with assistance from SCTE Director of Training Development Alan Babcock. Attendees will gain practical training experience through a minimum of two hands-on training exercises. The workshop will be based on the Society's Installer Certification training program, but the information presented can be applied to all SCTE training programs and easily customized to address specific company needs.

The deadline to pre-register for this workshop is March 16. Tuition for pre-registered SCTE members is $195; non-members' price is $225. On-site registration is $225 for members, $250 for non-members. For more information, contact Southern California Chapter Board Member Chris Ewing of Western CATV Inc. at (310) 539-8030.

SCTE Vice President of Technical Programs Marv Nelson will present "Data Technology for Technicians," a two-day seminar specifically designed for cable telecommunications engineers, on March 26.

As part of the SCTE Great Plains Chapter's Fifth Annual Telecommunications Vendor Show and Workshop in Omaha, NE, this event will provide attendees with an introduction to the basic concepts and language of data communications, as well as the special considerations necessary to facilitate this technology over private and common carrier networks.

To register for this workshop, contact Lori Grzywinski in the SCTE Special Projects department at (610) 363-6888, ext. 239. The deadline to pre-register is March 11. Tuition is $195 for SCTE members, $235 for non-members. On-site registration also is available, but space is limited in both seminars.

For more information about these events or other SCTE technical training opportunities, contact Marv Nelson at (610) 363-6888, ext. 229, or E-mail to mnelson@scte.org. T

Compatibility

"My hybrid fiber/coax system is a mix of four different equipment manufacturers from the headend out. Where can I find a compatible network monitoring system?"

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But compatibility is only one of the many problems facing you today. The best way to prevent cable system headaches is to call in AM before they start. AM's OmniStat system monitors headend, optical equipment, amplifiers, power supplies and end of line performance. OmniStat can be customized so that it meets the most demanding needs of your cable system making it a solid foundation for integrated system management that is modular, expandable and cost effective. All of this and an easy-to-use Windows environment means you can forget the aspirin – and the headaches.

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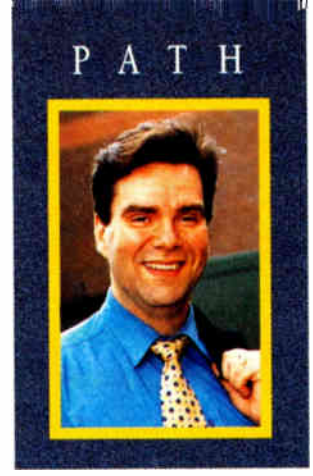
By Alex Zavistovich



Building a New Magazine

Communications Technology magazine is about to have company, and cross-competition between cable, telephony and the power utilities is making it happen.

For years now, people have worried about "convergence," as if all telecommunications providers are melding into a faceless Orwellian mass. Sure, some cable and telco companies have joint ownership, but this isn't Star Trek. I don't think anyone has to worry about some Borg-like monolith absorbing every independent cable operator and competitive local exchange carrier (CLEC): "Relinquish your infrastructure; surrender to the Borg. Resistance is futile." Unless we're talking about Microsoft, that's not going to happen.

What's really going on is not convergence; it's diversification. Thanks to the Telecom Act of 1996, any business with a telecom network can find ways to offer video, voice and data services as a unified package, regardless of its previous specialties. Cable operators are getting into telephony and data; telephone companies are getting into video and data. Power utilities are using what had been a private network to deliver all three services for the first time ever—witness the Potomac Electric Power Company's plans to get into telecom later this year.

The thing is, no matter who signs their paychecks, engineers are beginning to think the same way about constructing the physical network that delivers video, voice and data. Some companies are building new plant to deliver these services. Others are rebuilding or upgrading their networks to handle the demands of true two-way communications. Because these concerns cut across the market segments, techniques and tactics are becoming standardized. You dig trenches, raise towers, lay or lash cable, arrange for new electronics on utility poles.

That's been a boon to construction companies who used to market only to one

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Reader Service Number 16

segment. Somewhere along the way, some smart marketers realized that if their companies standardize construction operations, they could go after a market three times bigger. The utilities themselves acknowledge standardization; in the booming telecom market, engineers are jumping from one utility to another, bringing their ways of doing things with them.

Magazine publishers have noticed the same thing, which explains why *CT* has been running a quarterly supplement called *Telecom Construction & Management*; other companies also are looking at the construction side of the market. More than a year ago, we realized the time was right for a magazine looking at standardized practices. What could be easier?

That's when you begin to understand that success is about compromise. For example, I wanted to take a chance on a name for this magazine that was like nothing else in the market: *The Build*. I've always understood "the build" to be the phrase most engineers seem to use for both the project and the process of constructing telecommunications networks.

To say that *The Build* didn't go over with the people above me would be like saying the high definition TV (HDTV) Grand Alliance is "a bunch of gearheads"—an understatement of epic proportions.

About that same time, I started getting friendly help in the form of group meetings to "lock in" the marketing position of this magazine. We worked like a finely tuned machine, coming up with names (some of which I admit were not my best work):

- *Holes and Poles*—Conjures up some mental images I'd care not to elaborate on.
- *Trenches and Wrenches*—Who's the rapmaster coming up with these rhymes? This is about engineering. Let's get serious.
- *CommStruction*—This sounds more like a medical condition than a magazine. "I'm sorry, Mrs. Zavistovich, I'm afraid your husband is suffering from acute *CommStruction* of the brain. That accounts for the massive size of his head."

We knew the content of the magazine was right on; we were just struggling for the phrase that would most accurately address the topic of communications construction. After months of scrupulous creative debate, we arrived at the perfect name:

Communications Construction.

OK, I'm the first one to admit it's a marketing name, not a newsstand name. Marketers like to make sure people are clear on the purpose of a product and what makes it unique. That's why Heineken is a "beer" and Colt 45 is a "malt liquor." These guys can sell you the difference between "toothpaste" and "dentifrice." I love 'em.

If you read last year's issues of *TCM*, you'll love what you get with *Communications Construction*: real-world, hands-on information that you can read today and use tomorrow. It's launching with a May/June cover date. Ask for it by name. CT

Alex Zavistovich is executive editor of "Communications Technology." He can be reached in Potomac, MD, at (301) 340-7788, ext. 2134.

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Reader Service Number 18

By Ron Hranac

Spring Cleaning

This past winter was particularly harsh in many parts of North America. For instance, Colorado's Front Range was hit with two to three feet or more of snow in a late October blizzard. California was ravaged by El Niño-related rain and floods in January and February, and much of the South and Southeast suffered similar bad weather, including devastating tornadoes across central Florida. The Northeast had its share of bad winter weather, accompanied by ice storms and lengthy power outages. The past few months certainly made the record books, tragically in many cases.

Now that spring is upon us, it's a good time to do a little spring cleaning. I've put together the following checklist, which includes some of the usual springtime cleanup items, plus a few not-always-so-obvious ones.

✔ Bury drops: New underground installations during the winter months often mean the pedestal-to-house drop cable must be left on top of the snow or frozen ground and scheduled for burial in warmer weather. Unfortunately, paperwork gets lost, or drop burials are put on the back burner because of other seemingly more important issues.

We all know that "temporary" in cable TV terms really means "permanent," so many drops still will be draped along fences or lying in subscribers' yards for a long time, in some cases for years. Now is the time to get in-house or contract installation crews out in the field burying last winter's drops, possibly even some that have been around since before that.

Before burying a drop, check for damage and replace the cable and connectors if necessary. It's a lot cheaper to put new cable in now than to have to come back later and bury a second drop during a trouble call.

✔ Pedestals: In areas subject to heavy snowfall, it's not unusual to find pedestal damage after the snow melts. Streetside pedestals can get hit by snowplow blades or skidding vehicles, or get smashed under big piles of snow left by the snowplows.

If lids or covers were left off inadvertently during routine winter maintenance and installation work, taps and other components inside the pedestal may have been damaged by ice or water. Local staff may have had to cut or break off hasps because frozen locks couldn't be opened.

> "Inspect all ground and bond connections in underground and overhead plant, and repair any problems found."

Do a driveout or walkthrough to find out which pedestals need to be replaced or repaired, and take care of it now.

✔ Grounding/bonding: Now that the ravages of winter are for the most part gone, it's just about time for spring and summer thunderstorms. That means lightning!

Inspect all ground and bond connections in underground and overhead plant, and repair any problems found. I suggest you also do some spot-check ground resistance measurements with a Megger or similar instrument.

✔ Water damage: If your system was subject to some of the recent floods, now is a good time to check for hidden flood damage. This includes pedestals and vaults full of mud, underground passives and actives that may be full of water, and connector and/or cable damage because of missing or improperly installed weatherproofing.

Don't forget that overhead equipment may have been damaged by heavy rains.

✔ Temporary cables: If you had outages or other problems that required installing a temporary span of cable (you know, that 75-foot piece of 11-series drop cable between two pedestals), go out and replace it with the proper permanent cable.

✔ Towers and antennas: If tower-leg weep holes were clogged, you may find that water inside the tower legs froze during the winter and split one or more of the tower legs. If this happened, you've got some expensive tower work on your hands. Leave this to experienced tower crews. Split legs mean replacement of the damaged tower section will be necessary. Moral of this story: Keep the weep holes clean.

Ice can damage antennas and feedlines at the headend. Look for bent, broken or missing antenna elements, broken lightning rods, kinked or otherwise damaged

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feedlines, broken lenses on tower beacons, and faded or chipped tower paint.

If you don't have ice shields protecting horizontal cable runs between the tower and building, cables and hardware may have been damaged by falling ice. That damage may not be apparent from below. Get a ladder and look at the upper side of the exposed cables. Make sure tower and building ground connections are intact. If necessary, have an experienced tower crew check guy-wire tension, tower plumb and the fasteners holding the tower together.

✔ Span sag: Did you notice that some overhead spans were a little on the tight side and that expansion loops had flattened out during cold temperatures, or maybe a couple connectors pulled completely out of housings? That may be an indication that the spans originally had insufficient sag during plant construction.

Find those problem areas, check span sag, and correct if necessary. Cable manufacturers have available some handy technical bulletins and guidelines for determining proper sag and tensioning. A ballpark guideline is 1.5% to 2% sag, assuming suitable clearance is available.

✔ Water in everything: It's not unusual for moisture to condense inside fuel tanks during cold winter weather. You may be surprised to find water in your trucks' gas tanks, the backup generator's fuel supply, fuel filters and even engine crankcases.

Change the oil and filters on all of your vehicles as well as your backup generator(s). Check all fuel tanks, filters and lines for signs of water. Some fuel additives can remove water, but in some cases you may have to flush the tank and/or fuel lines.

If you or any of your crew drove vehicles through flooded areas, it's a good idea to drain and change the differential lubricant. Water in the differential will damage bearings, seals and other parts. Check transmissions (and transfer cases on four-wheel-drive vehicles) for signs of water in the fluid.

✔ Road damage: If you have a remote antenna site or headend, it's a good possibility that wintertime visits to the site resulted in ruts or other road damage caused by spinning tires. Get the road graded or otherwise repaired before the ruts turn into the Grand Canyon.

✔ Critters: During colder temperatures, critters such as mice, rats, skunks, raccoons, various reptiles, insects and spiders may take up residence in the headend, warehouse and other buildings. After all, it's a lot warmer inside than it is outside. If you're not comfortable with pest control, call in professionals.

✔ Surplus cable: If your system's warehouse or yard has filled up with partially or nearly empty cable reels, first determine if you can use any of the reel ends for maintenance, replacement of temporary spans, short feeder extensions and so on.

If not, before this stuff winds up in the dumpster or at the local scrap yard, consider donating some of it to local ham radio clubs. Hams love 100-foot to 200-foot pieces of 75-ohm hardline. You might even think about throwing in a couple pin connectors and helping them get the appropriate pin connector-to-UHF or type N adapters. (Gilbert and LRC both have these adapters available.)

✔ Power supplies: Even though you should be doing at least quarterly maintenance visits to all power supply locations, pay special attention to potential winter-related damage. Look for signs of corrosion, loose internal wiring and connections, problems with external connections to the power company (if you do find a problem here, call an electrician or the power company), swelled or cracked battery cases, lock damage, malfunctioning metering, and burned out indicator lights.

I hope you find this list useful. It's by no means comprehensive, especially since different regions will have specific needs following winter weather. The important thing is to recognize that it's time to do this sort of spring cleanup before it, too, gets lost among the many lists of things to do. CT

Ron Hranac is senior vice president of engineering for the Denver-based consulting firm Coaxial International. He also is senior technical editor for "Communications Technology" magazine. He can be reached via e-mail at rhranac@aol.com.

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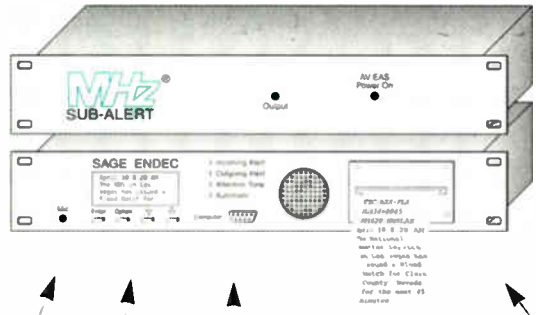

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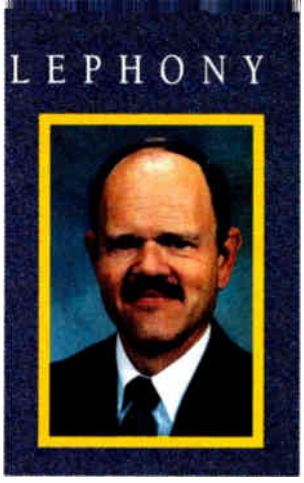
Reader Service Number 21

By Justin J. Junkus



Regulatory and Legal Concerns

Opportunity and Danger Wear the Same Face

We all know technology is an important driver of the changes in our industry. Most of us also are aware that markets are just as important. However, recent events in telecommunications illustrate that those in the business of cable telecommunications need to pay close attention to a third driving force—regulatory and legal considerations.

To understand why regulatory and legal are becoming more important, we first need to consider some market strategies in the Regional Bell Operating Companies (RBOCs). It's no secret that there has been a decline in their emphasis on the video market. Some observers would even say that that they are proceeding relatively slowly with new high-speed data solutions. They are hesitant about the costs and commitments of new technology. Their attention, therefore, has been focused on expanding their core competency, basic telecommunications, to the more closely related long distance market, while protecting their local telephony market from interexchange carriers (IXCs).

Let's review the reason the RBOCs even can think about entering the long distance market. Their doorway comes from the same legislation that opened the telecommunications market for cable, the 1996 Communications Reform Act. Under one provision of the Act, local RBOCs can provide long distance service, but only after satisfying the Federal Communications Commission that they have opened their local market to competition. Independent telephone companies (those that were not part of the pre-divestiture AT&T) are not subject to these constraints.

Opening local telephony markets

The Act provides three ways for the RBOCs to open the local market: resale-based entry, unbundling-based entry and facilities-based entry.

Resale-based entry essentially is a wholesaling operation. The RBOC sells its access in bulk (quantities to be set mutually by the RBOC, the state in which it operates and the reseller). The RBOC must guarantee that the service it provides under resale will be the same quality as its regularly priced service. Pricing is based on state commission implementation of national guidelines set by the FCC.

> "Cable needs not only to protect its traditional core business, but also to continue its emphasis on new telecommunications applications."

Unbundling-based entry provides any requesting carrier nondiscriminatory access to network elements on an unbundled basis at any "technically feasible" point. This means that the RBOC must provide the carrier access to a minimum of seven network elements:

- Local loops
- Network interface devices (NIDs)
- Local and tandem switches
- Interoffice transmission facilities
- Signaling and call-related database facilities
- Operations support systems (OSS) and functions
- Operator and directory assistance facilities

This provision of the Act, incidentally, is what allows a cable telecommunications company to purchase operator and directory assistance from the RBOC.

Once again, the state commissions approve the rates charged by the RBOC, based on rules set by the FCC. Since these rules require detailed cost calculations, the FCC also provided interim cost proxies to be used by the RBOCs.

Facilities-based entry is accomplished when a carrier deploys its own network and requires interconnections to the RBOC. The FCC defines interconnection as the physical linking of two carriers' networks for the mutual exchange of traffic, independent of the transport and termination of traffic. This linkage is at any "technically feasible" point. Per the FCC, there are a minimum of six such points:

- The line side of a local switch
- The trunk side of a local switch
- The trunk interconnection point for a tandem switch

- Central office cross-connect points
- Out of band signaling facilities
- Points of access to unbundled network elements

In addition to helping a long distance carrier enter the local market, this provision provides the way for a cable operator who has purchased a switch to interconnect with the public switched telephone network (PSTN). Pricing is similar to that used for unbundling-based entry, with the state commissions once again approving the rates charged, based on FCC guidelines.

The Legal Battlefield

Finally, let's look at the legal part of "legal and regulatory." Several RBOCs have tried to prove competition exists as that prerequisite to entering the long distance market, and all have failed to satisfy the FCC. Most noteworthy, in late 1997, a request by SBC Communications (formerly Southwestern Bell, and since expanded through mergers) to provide long distance service was denied. A Texas judge sided with SBC in its attempt to enter the long distance market and ruled that the Communications Reform Act was unconstitutional and therefore invalid. His opinion is that it discriminates against the RBOCs with respect to allowing them to enter the long distance market because the independent telcos do not have to prove an open local service market. If his ruling stands, RBOCs would not need to prove they had opened the local market before they could provide long distance service.

An appeals court added agreement of sorts when it ruled that the states, and not the FCC, should determine how much an RBOC can charge a long distance carrier to buy its local service wholesale, for the purpose of resale and market entry. This opinion further weakens the position of the FCC in its pricing-regulatory role.

In January, the U.S. Supreme Court entered this argument when it began reviewing the rules governing when an RBOC may provide long distance. No decision is expected until 1999, in effect keeping everything status quo for the market relationships between the RBOCs and the IXCs. This includes the issue of how much the RBOCs should be able to charge an IXC to connect to its customers, or to pay for wholesale local service to resell at retail to potential IXC local telephone service customers.

What it means to cable

We have a technical solution to broadband communications that includes local telephone access: hybrid fiber/coax systems, complete with high-speed internet access. Some operators have purchased and installed local switching equipment or have formed alliances with alternate access providers who already have a switch. In many cases, our service franchises overlap those of the RBOCs.

As I see it, there are at least three implications to the recent legal actions in telecommunications:

There's opportunity here for cable operators. The long distance providers still would like to get into the local residential telephone market, and cable is an alternative. While it is true they still could overbuild the telephone company networks with their own plant, or go to a wireless access solution, a cable company's local access and a joint venture agreement could prove less risky and more cost-effective.

There also could be danger here. Cable needs not only to protect its traditional core business, but also to continue its emphasis on new telecommunications applications. If the RBOCs can't enter the long distance market, perhaps they will accelerate their efforts to gain broadband markets. Technology is ripe, with asymmetrical digital subscriber line (ADSL). If cable does not continue marketing new services aggressively, it may be faced with consumers who can't decide which company has the broadband solution.

This is a lesson. The use of the legal system to either gain market entry or slow competition is a weapon the RBOCs understand. It has been used by them and against them. Cable needs to watch its flank. CT

Justin J. Junkus is President of KnowledgeLink Inc., a training and consulting firm specializing in the cable telecommunications industry. To discuss this topic further, or to find out more about KnowledgeLink Inc., you may email him at jjunkus@aol.com.

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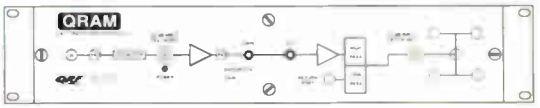

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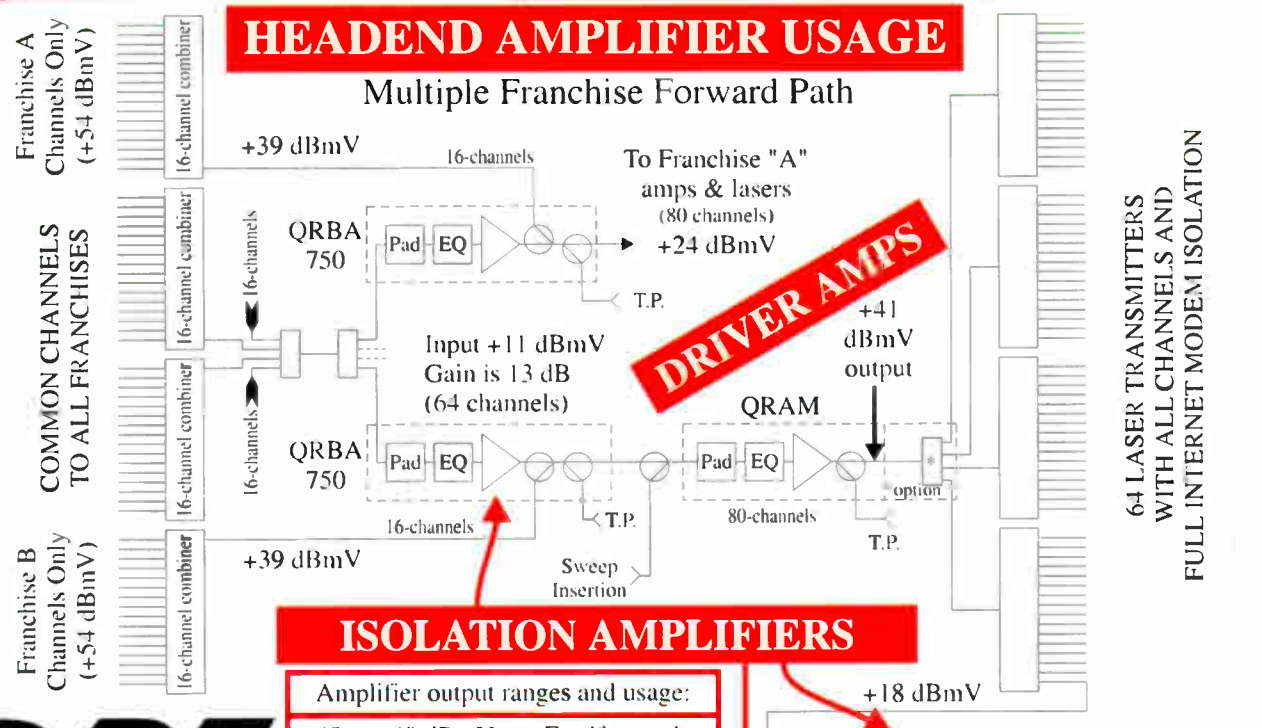

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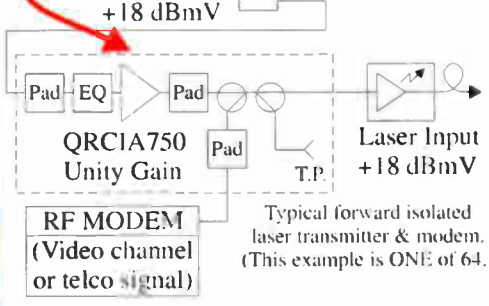

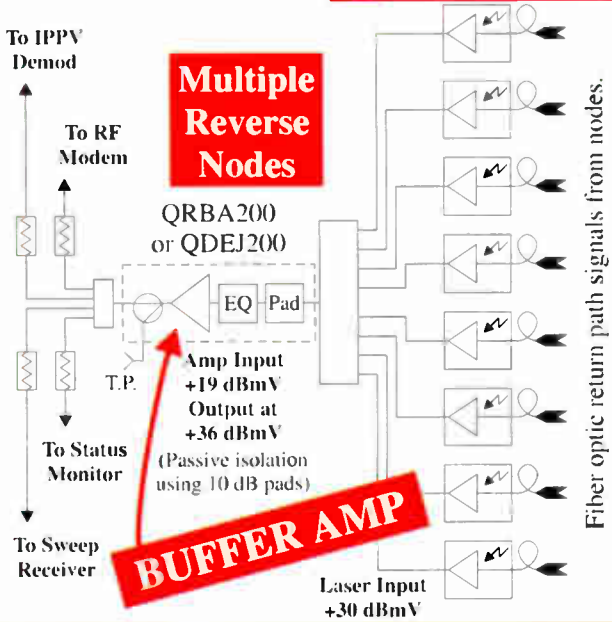

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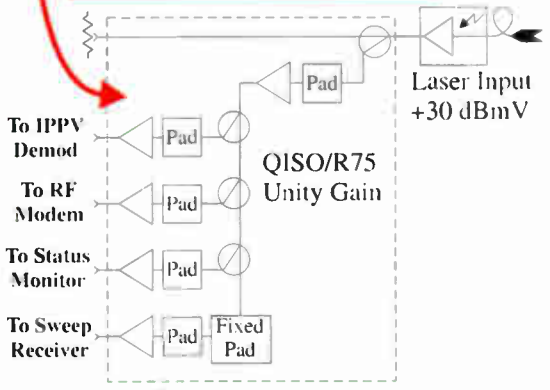

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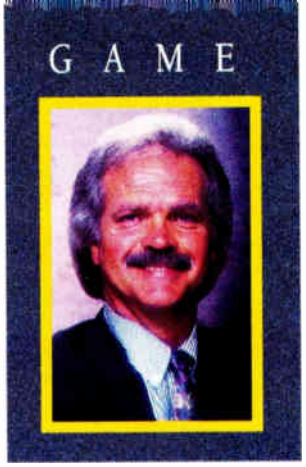
By Terry Wright



The Real Debate

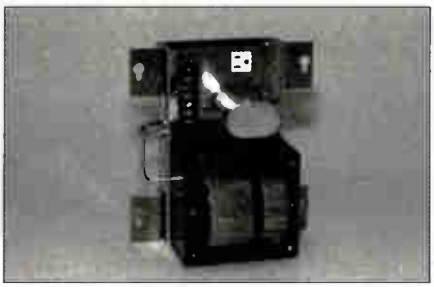
A rather strange race is afoot, where all the entrants are destined to collide in a big heap at the finish line.

Traditional TV (NTSC), digital TV (DTV), and high definition TV (HDTV) are the main entrants. Something odd about this race is that each entrant's pace depends on exactly the same type of fuel (the marketplace's preference for viewing televised entertainment), although this fuel drives significantly different engines. Even more odd is that this fuel comes from a common reservoir of finite capacity, namely, the marketplace's time and budget for viewing entertainment on television.

We all know that digital TV delivers higher quality than analog TV. It can be reproduced/regenerated numerous times, typically without error; stored in digital form; and multiplexed with other digital information streams (with appropriate networking). It also allows real-time routing decisions, depending on the transmission methodology employed.

But it's not perfect; we've all probably noticed frozen pictures when a Moving Pictures Expert Group (MPEG) frame is lost or some other anomaly occurs. We also know that standard NTSC TV was developed when electronics were expensive and affordable receivers were the primary goal; the idea then was to open the market for cable. Few programs were available back then, so hardly anyone second-guessed the industry's decision to trade spectrum efficiency for hardware cost savings in the receiver.

But now things are different. We have more programs than spectrum to air them, electronics keep increasing in functionality while decreasing in cost, and bandwidth efficiency is sought like the Holy



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Grail. But amidst this war of TV formats, must-carry questions, interlaced vs. progressive scan display arguments, and compression and line encoding schemes, demand for this thing called the Internet could be the spoiler in the big race.

The Internet and other increasingly popular data services (telecommuting, Internet telephony, collaborative work, online shopping and so on) are imposing requirements on the same spectrum that underlies the TV battle.

Isn't the real race between entertainment services and data services, and not between differing forms/qualities of entertainment? Cable represents the highest-capacity deployed distribution network to the residential market in existence. It probably passes a good many institutions and businesses along the way. All these market segments represent potential subscribers to data/Internet services, whereas entertainment services appeal almost solely to residential subscribers.

Has anyone contemplated whether the popularity of high-performance Internet, and the need for competitive local transport services among businesses and institutions, could make the TV debate a moot point? Not a chance, you say? While it's still too early for a definitive answer to this question, it might prove interesting (even surprising) to look at the characteristics, drivers, and attributes of entertainment TV vs. high-performance Internet and other local data services.

This analysis must be rooted in the dominant element common both to existing and emerging TV formats and high-performance Internet/data services: the time and monetary budget of the market segments. (Note: For this comparison, Internet/data services are high-performance and delivered via cable modem.)

In general, entertainment TV has its limits: its content is limited; service packages come in basic and premium only; scheduling and availability are static and determined by the provider; and its target audience is mainly residential. Internet and data services are another story: content virtually is unlimited, service packages generally are performance-oriented; scheduling and availability are dynamic and user-driven; and the target audience is much larger (homes, businesses, institutions) with a corresponding revenue base. Further, Internet/data is a multifacted interactive research and communications tool, rather than simply entertainment, and entertainment TV advances are costly (HDTV sets/set-tops), while computer and network appliance costs are falling.

The point here is to illustrate the basis of my question of whether NTSC/SDTV vs. HDTV is the right debate to have. The increased user choice and control criteria that drove acceptance and growth of cable TV also underlie the acceptance and growth of the Internet, only in spades. CT

Terry Wright is chief technology officer at Atlanta-based Convergence Systems Inc. He can be reached at (770) 416-9993 or via e-mail: tlwright@convergence.com.

ADVERTISMENT

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"Priced So That the Tech Can Personally Afford To Own One"

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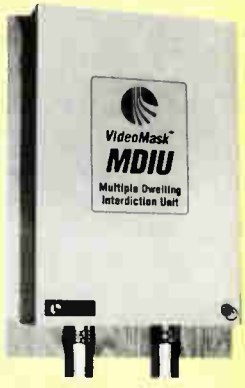

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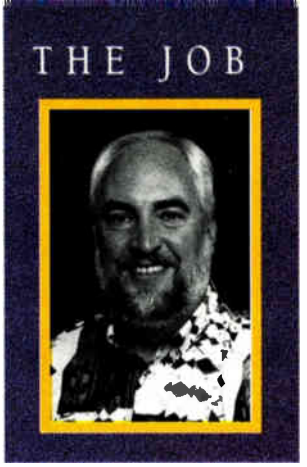
Reader Service Number 28

By Alan Babcock



Share the Wealth—of Knowledge

OK. Please respond to these questions by raising your hand.

How many think you need to better train your staff to handle technological change? I see most of you raised your hands.

How many have a person dedicated to do that training? Ah, not all, but a respectable number.

How many are responsible for doing or coordinating the training yourselves? Again, a fair percentage.

Now, do you or the dedicated trainer have enough time to develop the training materials you need? Is there enough money for it? Only a couple hands went up on that one.

Would you rather spend your time and dollars developing the training or doing it? I see that most prefer to train.

Well, help is available from the Society of Cable Telecommunications Engineers, but first let's see what it takes to develop your own training.

40-to-1 benchmark

The American Society for Training and Development has determined that it takes about 40 hours to develop one hour's worth of training.

Creating training isn't just outlining some ideas, making some transparencies from a textbook and stepping into the classroom. Good training development is much more involved.

Ask yourself about your last training. Did exercises help transfer knowledge to the job? Did the training target necessary job skills? Was the material logical, building on existing or newly learned knowledge or skills? Did you understand why you needed to learn the material? Could you measure your performance after completing the training? Was the material presented in ways to

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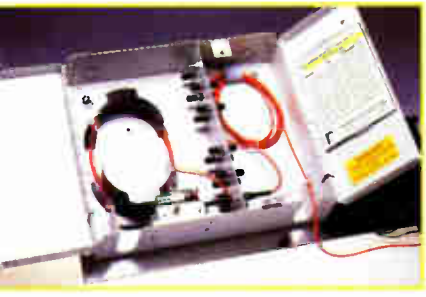

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Reader Service Number 207

address your dominant learning style?

Modern training development must consider all of the above. No one wants to waste time, and we shouldn't waste time on ineffective training development. We need to learn what we need to know, when we need to know it, and apply it quickly to the job. Failure to do so begs the question, "Why did we learn that?"

Learning how to learn

Most of us learned to learn in public schools. We sat in classrooms with other students, where teachers lectured and pounded ideas and concepts into our brains.

Job training is different, however. We can't afford to learn things that are merely nice to know. Adults must be motivated to learn something before making the effort to do so. Modern training development addresses motivation up front.

Probably the most difficult consideration is finding ways to transfer the learning to the job. Motivating students and providing appropriate application of the learning consume much time in training development.

Because of all this, few companies develop their own materials. If someone could create materials suitable for adult learners and covering the desired topics, probably many of you would pay for them. After all, it's cheaper than footing the bill yourself.

SCTE lends a hand

SCTE has completed a series of training materials that support the textbook *Cable Television* written by Bill Grant, with which many of you likely are familiar. Now another option is available to help provide this valuable training to your workforce. A series of leader guides is available to help trainers present the concepts of *Cable Television* in a classroom. Additionally, student workbooks help apply the concepts to the job. These materials were designed to work in any of three complementary approaches.

First, students can self-study the material by reading *Cable Television*, perhaps viewing the videotapes and doing the workbook exercises. Second, a group may wish to study together by reading, viewing videos and completing the workbooks. Third, a trainer may elect to enhance group learning via the leader guides.

The leader guides are designed for easy use by both inexperienced and veteran trainers. A leader may wish to view the videotapes in preparation or use them to supplement the text and workbooks.

The student workbooks and the leader guides, collectively known as the Broadband Technology Course, represent a new direction for SCTE training materials. Check them out and tell us what you think. Share the development cost rather than bearing it alone. Implement training that will improve your operation. Save your most precious resources—time and money. CT

Alan Babcock is director of training development for the Society of Cable Telecommunications Engineers. He can be e-mailed at ababcock@scte.org.

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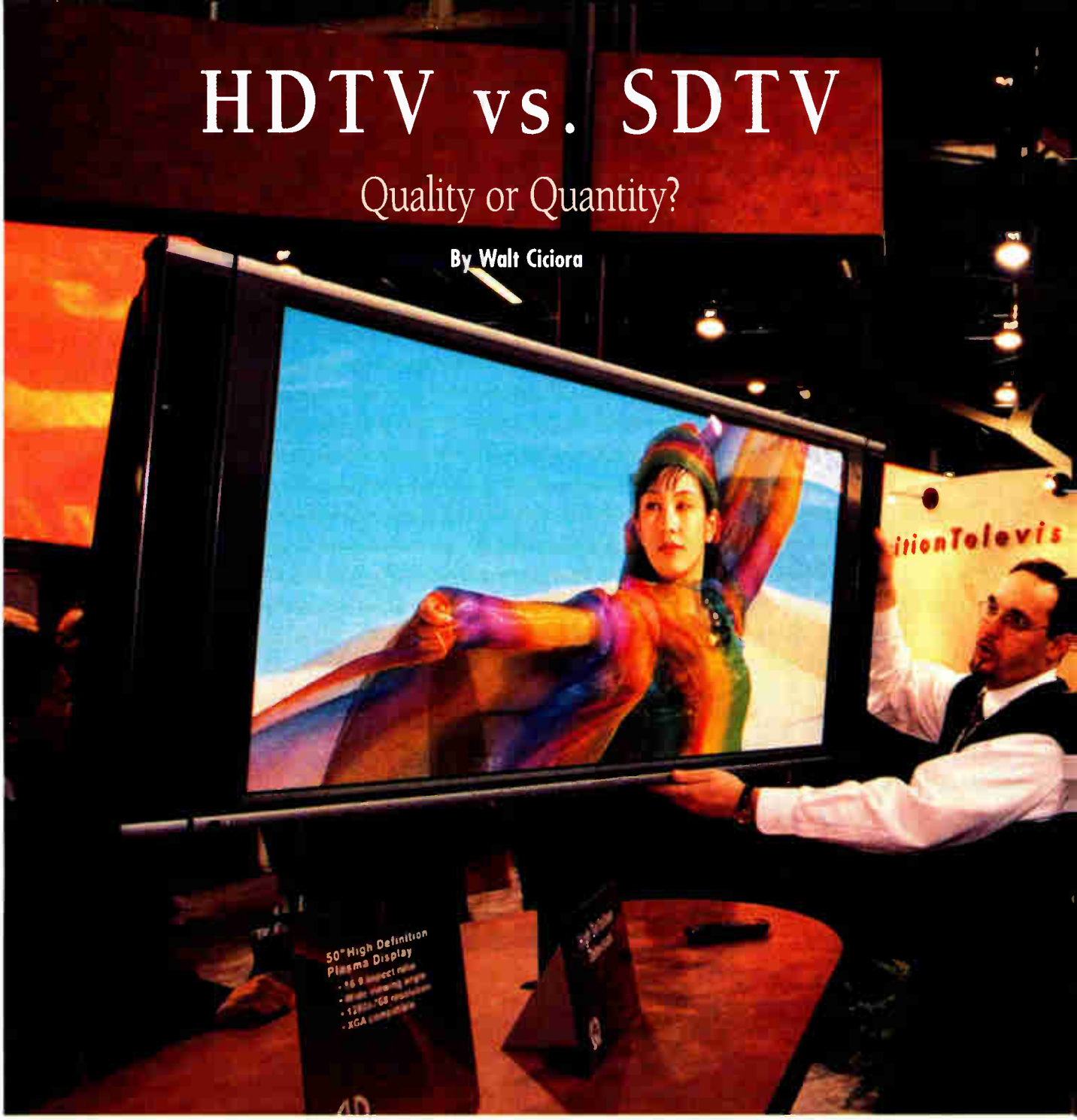
NCTA BOOTH # 1906

HDTV vs. SDTV

Quality or Quantity?

By Walt Ciciora



Digital TV is the hot topic of the day. It comes in two versions, high definition TV (HDTV) and standard definition TV (SDTV).

In this article, the differences will be explored along with their ramifications. I also will discuss the issue of "must-carry" and new methods of hiding large amounts of data in analog signals.

What is HDTV?

HDTV is the "ultimate" version of television. It has twice the horizontal resolution, twice the vertical resolution, a 16 x 9 aspect ratio, CD-quality surround-sound and a significant reduction in visible artifacts. The goal of HDTV is wall-sized television with dramatically increased realism, often approaching the quality of projected motion pictures.

The analog signals that come out of an HDTV camera approach a bandwidth of 90 MHz. If these analog signals are converted directly to digital signals, a data rate of more than one billion bits per second—a gigabit per second, (Gbps)—is required.

Clever technology has managed to squeeze the HDTV signal into around 20 Mbps and pack it into 6 MHz of TV bandwidth. The consequence of this is that only about 2% of the original

Photo courtesy of CEMA

information is used, and 98% is thrown away as redundant.

What is SDTV?

It didn't take very long for the realization to hit home that if HDTV signals could be compressed by this tremendous ratio, NTSC signals could be compressed as well. Multiple NTSC signals then could be squeezed into the same 6 MHz that could carry one HDTV signal or one NTSC analog signal. These multiple signals took on the name "standard definition TV" (SDTV).

Using techniques that share capacity between multiple programs, it is possible to apply the "statistical multiplexing" used in the telephone industry for decades to further increase capacity. The trade-off between quantity and quality offers bewildering choices. The American consumer has long voted for quantity over quality.

Bait and switch?

There is a growing feeling that the broadcast industry has played a game of "bait and switch." They insisted they needed the spectrum for HDTV to be competitive with the rest of the world and to provide the best possible service. Now some of them are much more interested in SDTV.

Now that broadcasters have delayed the loss of spectrum, they are not sure they want to go to digital TV. The costs are significant, the market demand is nonexistent, and the time for a return on investment is very problematic.

STV all over again?

The problem for the broadcaster is that programming is expensive. More programming is more expensive. Having multiple channels divides up the viewers and makes advertising sales more difficult. Costs go up and revenues go down—not a happy prospect, unless the dependency on advertising can be relaxed or broken. This would be possible if viewers paid directly for the programming.

There are several difficulties with this assumption. First, the operation of pay and pay-per-view (PPV) services requires expensive infrastructure. When the number of channels is relatively small, the cost per channel is excessive. While broadcasters can pool their efforts or use third-party service suppliers, the problems of competitors' cooperating remain.

Another serious problem is that the marketplace already is saturated with providers of pay and PPV services. Cable has an upper sixties penetration and passes over 90% of TV households. There are two (or three depending on how you count) strong and one growing direct broadcast satellite (DBS) suppliers. Prepackaged video is readily available, and that business' growth has slowed. Digital video disc is on its way.

Over-the-air subscription TV (STV) was implemented a couple of decades ago with unsatisfactory results. It would be prudent to investigate the details of those unpleasant experiences before experiencing them first-hand all over again. ➤

BOTTOM LINE

Digital Means HDTV and SDTV

Digital TV is coming to a broadcaster near you, and with it come significant challenges. Your subscribers will be confused, looking to you for answers and advice. Those who purchase expensive digital TV receivers will want service. Others may become angry over lost favorite analog channels.

HDTV is the premium service: High definition TV (HDTV) will provide great, wall-sized pictures to those who purchase new receivers. These will be premium service buyers and someday will be an important market segment.

SDTV is just more trouble: Standard definition TV (SDTV) is multiple programs with about the same resolution as ordinary television but occupying only 6 MHz. It is a way for broadcasters to try to compete with cable. But if must-carry rules are extended to these services, they will consume valuable spectrum on our systems and force us to either invest in expensive rebuilds and upgrades or drop current analog channels. Both alternatives will make subscribers unhappy.

Massive digital data in analog TV is possible too: It is possible to hide megabits per second of data in analog TV signals to provide data services and even extra Moving Pictures Experts Group (MPEG) encoded video. For the low-channel capacity system, this will be a way of adding a "compatible digital upgrade."

Track the details: There is a lot to learn and track. Those who fail to keep up will be confused, confounded and see their profitability threatened. Those who eagerly follow these trends will benefit from them.

Must-carry?

Broadcasters have won "must-carry" rights in Congress, and at the third attempt the courts have found this not to be a confiscation of others' property. Emboldened by this victory, broadcasters are claiming digital must-carry rights. Lawyers will do well with this struggle. It will be a long and costly battle. In the end, the consumer may lose variety as he ends up with the same programming on multiple delivery media.

Important questions arise with must-carry:

1) Is the broadcaster entitled to must-carry for digital TV signals?
2) If digital signals enjoy must-carry, do the same broadcaster's analog signals also enjoy must-carry? Is it "either/or" or "both"?
3) Do the same retransmission consent issues apply?
4) What must be carried? Is it 6 MHz or a program?
5) Does must-carry apply to SDTV as well as HDTV?
6) If must-carry applies to SDTV, how many signals are included?
7) Would must-carry apply to a pay or PPV signal?
8) Would must-carry apply to other ancillary service signals?
9) Do the on-channel requirements apply? If so, what does that mean?
10) Can the broadcaster so thoroughly multiplex his signals that a small cable operator could not afford the equipment to separate signals that fall under must-carry from those that do not?
11) Are there any restrictions on the cable operator as he takes advantage of cable's better-behaved spectrum and carries double data capacity?
12) What does the Telecommunications Act of 1996 require in terms of commercial availability of set-top boxes?
13) Is there any relief for small cable operators?

These are just the most obvious questions. There are many more details.

QAM vs. VSB

The broadcast digital standard utilizes a vestigial sideband (VSB) modulation method, which is particularly suited to the problems of the broadcast environment. These problems include extensive multipath, low signal levels in distant locations, interference from other digital signals on the same frequency, interference from other NTSC signals on the same frequency, a requirement not to interfere with other digital signals on the same frequency, and a requirement not to interfere with other NTSC signals on the same frequency. Cable does not suffer from most of the ills found in the broadcast environment. As a result, the heroic error protection measures used with 8-VSB are unnecessary in cable.

The cable industry has chosen quadrature amplitude modulation (QAM)

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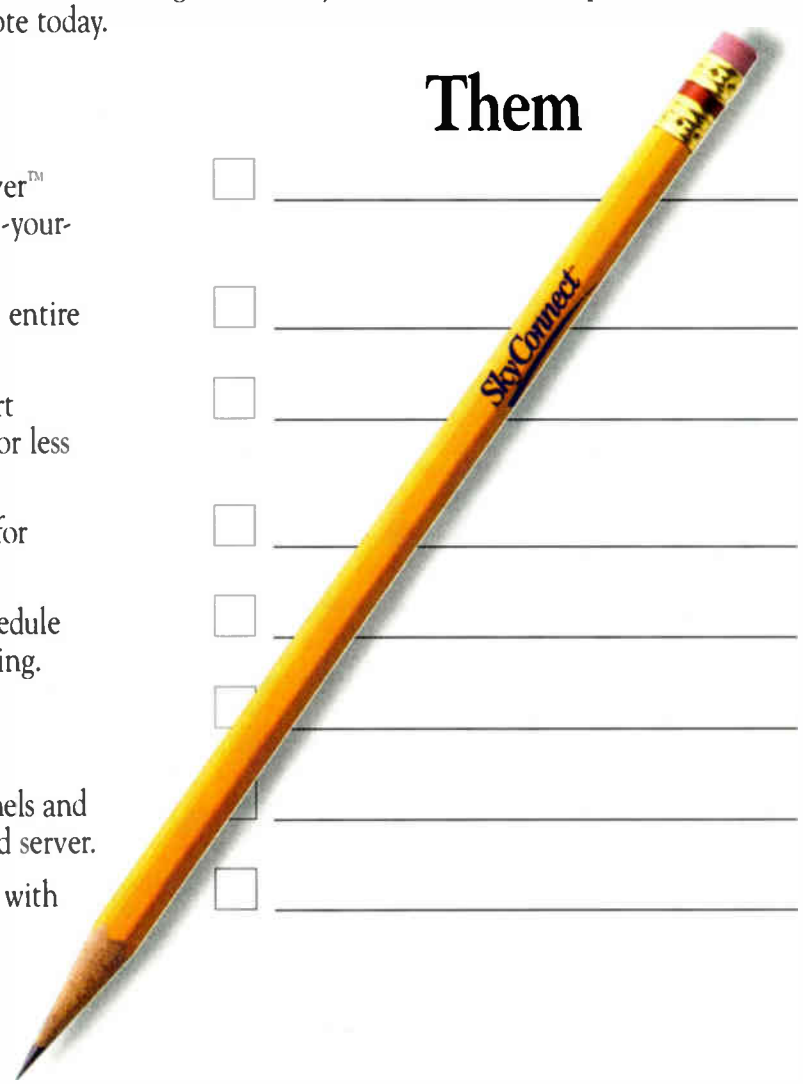

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as the modulation method for essentially all of its implementations. QAM also is available in two varieties: 64-QAM yields one HDTV signal per 6 MHz, while 256-QAM can carry two.

It seems the only practical solution for the consumer is a product that can receive both the QAM and the VSB signal. No such products will be found in the initial offerings. Likely, as costs go down, the marketplace will reward those who offer such features. Eventually, they will become pervasive. Another alternative is the development of chips for set-top boxes that will convert QAM into VSB so that an RF signal can be passed from a set-top to a digital television receiver. Several manufacturers are developing such chips.

Since cable likely will want to utilize the double data capacity methods offered by 16-VSB and 256-QAM, equipment will become available that receives two over-the-air digital signals and combines them into one data stream. Then, either a 16-VSB modulator or a 256-QAM modulator can put the two digital signals into one 6 MHz slot.

SDTV in NTSC!

A fascinating alternative opportunity has arisen. A number of companies and high-tech startups have discussed the compatible inclusion of digital transmission within the analog NTSC signal in a manner that does not impair the NTSC presentation. The data rates achieved range from a few tens of kilobits/second to the multiple megabits/second range.

In December 1996, the Federal Communications Commission approved two such systems and invited others to come forth with other approaches. One company, EnCamera Sciences Corporation of Scottsdale, AZ, has claimed up to 4.5 Mbps hidden in analog NTSC when transmitted over cable. Lower rates are practical over the air, and the 4.5 Mbps rate may be achievable under some circumstances.

These higher data rates will allow one or more compressed SDTV signals to be compatibly included in the analog NTSC signal. In a cable system, multiple channels can be tuned simultaneously and the separate data rates combined. Statistical multiplexing then will allow even larger numbers of programs to be carried. Of course, this data rate also is attractive for Internet-like data distribution. Push services will be a natural for this capability.

Conclusion

The issues of HDTV and SDTV are extensive and complex. There has probably never before been a technical situation in the industry with so many combinations and permutations. It is hard to predict the outcome. But it will be fascinating to watch the progress. CT

Walt Ciciora, Ph.D., is a consultant in Southport, CT. He may be reached at (203) 259-5183.

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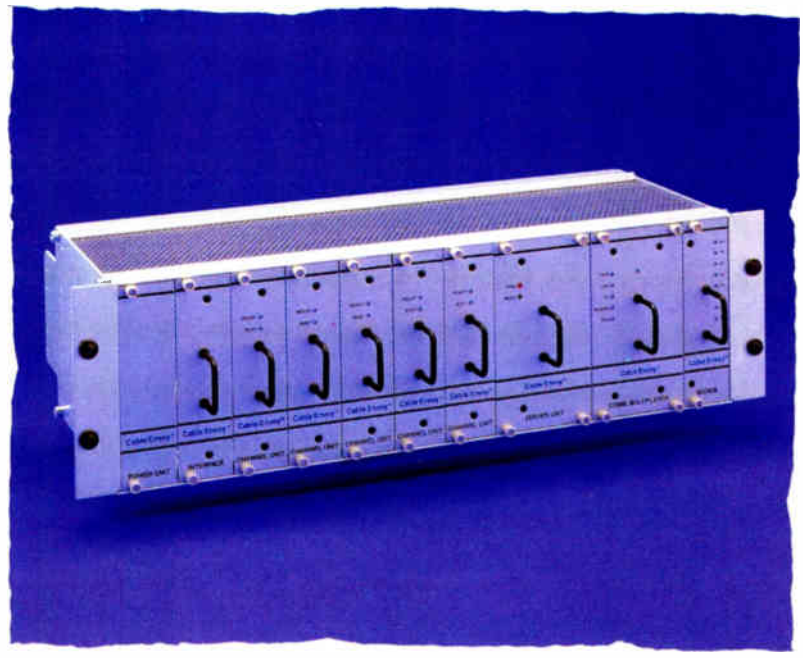

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The Move to HDTV

Issues to Think About Now

By Michael Adams

In the migration from standard definition TV (SDTV) to high definition digital TV (HDTV) in cable systems, many issues must be resolved, such as: digital copy protection, digital signal interconnection, user interface presentation, control and signaling, pay-per-view (PPV) authorization, authentication and format selection. Nevertheless, significant benefits to the consumer, the cable operator and the content provider make the transition to HDTV inevitable.

In fact, a natural synergy exists between the bandwidth-hungry HDTV format and the tremendous bandwidth capacity of modern hybrid fiber/coax (HFC) cable systems.

Some broad guidelines are the differences between various digital TV formats and answers to some of the "frequently asked questions" such as:

- Is HDTV just hype to sell $5,000 TV sets to the unsuspecting consumer?
- What is standard definition and how is it different from NTSC?

Of course, ultimately only the consumer can answer the question, "How much is a higher quality picture worth to me?" Nevertheless, a considerable amount of inaccurate and misleading information is out there.

To answer the question, what does high definition and standard definition really mean, we first have to take a slight detour into the advanced TV (ATV) format.

The table (See page 51) shows the 18 formats standardized by the Advanced Television Systems Committee. There are four different resolutions, but 480 x 640 and 480 x 704 generally are considered standard definition, and the 720 x 1,280 and 1,080 x 1,920 generally are considered high definition. However, not everyone agrees on this. For example, the broadcasters consider only 1,080 x 1,920 to be true high definition (From their perspective, HDTV should be equal to a 35mm theater projection system.) The computer industry has been arguing that the progressive scan displays are superior to interlace systems and that the 480 progressive scan is a good place to start. What is agreed is that the 480 x 704 interlace format is closest to NTSC.

SDTV vs. NTSC

The NTSC standard is 50 years old and

uses analog techniques to generate a 525-line picture. However, only 480 lines are active and used for picture information. To squeeze the NTSC video signal into 4.2 MHz, NTSC had to make some compromises on horizontal resolution and on color depth.

Thus, many claim that the 480 x 704 interlace format is superior to NTSC, except that:

- In almost all cases the only way to send the digital picture to the TV set (the weakest link in the chain) is NTSC. The exception is that a few high-end digital video disk (DVD) players and TV sets now have component video connections.
- SDTV uses Moving Pictures Experts Group (MPEG-2) compression, which is a "lossy" process. A 480 x 704 interlace picture actually requires an astounding 270 Mbps to carry it without any loss, and MPEG-2 compression squeezes this down as much as you want. But the more the picture is squeezed, the more you lose. For example, 15 Mbps might be used within a studio environment, and DVD can use up to 10 Mbps, and the satellite systems may use as little as 2 Mbps.

So, which is better, NTSC or SDTV? It depends. In some cases, the NTSC signal could be either noisy or bandwidth-limited. In other cases, the SDTV could be so highly compressed that annoying artifacts, called macro-blocks, become visible.

This brings us to HDTV. When the ATSC started work, some analog approaches attempted to add quality to the existing analog channel while retaining backward compatibility with NTSC. However, these approaches were abandoned in favor of digital approaches that are not backward compatible with NTSC, which had two fundamental implications:

- The new HDTV channels would require additional spectrum, either over-the-air or carried by a cable system.
- HDTV eventually will make the NTSC TV set obsolete.

While some might view this as a convenient ploy to obtain additional channels and make everyone buy new TV sets, the practical challenges of developing a significantly better TV standard have led directly to this state of affairs.

Current SDTV

Where are SDTV techniques used today? SDTV already is a fact of life for many cable and satellite operators. For example, HBO channels are delivered to cable headends exclusively in 480 x 528 interlace format and converted into NTSC before delivery to the home. DBS providers also use the 480 interlace format, although it is common to use lower horizontal resolution and more aggressive compression ratios.

Transmission formats

The transmission formats for DTV have several different variations. Although the digital format uses MPEG-2 transport in most cases, the modulation of this signal into analog form can be achieved using

quadrature phase shift keying (QPSK), vestigial sideband (VSB) or quadrature amplitude modulation (QAM). Each transmission medium demands its own technique:

DBS uses QPSK because of the tremendous distance from a satellite in geostationary orbit. QPSK is very robust, but not terribly efficient.

Terrestrial broadcast uses 8-VSB, which is approximately three times as efficient as QPSK.

Cable systems employ 64-QAM and 256-QAM, which are approximately four to six times as efficient as QPSK, but they require a well-maintained cable plant, especially for 256-QAM.

Display formats

The display format of all NTSC TV sets is 60 Hz interlaced. *Editor's note: Technically, it's 59.94 Hz for color transmissions.* In fact, instructions for exactly how to scan the picture, including horizontal and vertical blanking to mask fly-back in a cathode ray tube (CRT), are embedded into the NTSC signal. However, it is possible to capture the NTSC signal in a "frame store" and display the image differently. This commonly is done in high-end projection systems where line-doubling, or even line-quadrupling, techniques can increase the display resolution and apparent definition of an NTSC source.

In the digital world, the picture always is reconstructed in a frame store as part of the MPEG-2 decompression process. Therefore, the picture can be displayed in any format quite independently of the transmission format. A standard definition 480-line interlaced picture typically will be "line-tripled" and displayed at 1,080 lines when

BOTTOM LINE

Digital vs. NTSC

Outside of the studio, all digital pictures are compressed to fit the available bandwidth. The more aggressive the compression, the more quality is lost, so there's no pat answer to the question, "Which is better, digital or NTSC?"

HDTV differs from SDTV in that it is capable of near-35 mm motion picture quality in a TV image, requires a new TV set to display that image, and can be very bandwidth-intensive. Only the consumer can decide whether HDTV is worth it, but to provide this choice the cable industry provides high-bandwidth delivery systems and high-definition programming. There is a natural synergy between the bandwidth-hungry HDTV format and the tremendous bandwidth capacity of modern hybrid fiber/coax (HFC) cable systems. Cable companies are investing billions of dollars to upgrade their systems to HFC, and HFC often is the only infrastructure than can support a growing number of HDTV channels.

We need a mechanism to move those new digital pictures (standard or high definition) from one device to another within the home. This "missing link" is a short distance from the cable set-top box to the digital TV set. IEEE 1394 is emerging as a standard for digital interconnection, but it still lacks a standard copy protection and control mechanism.

ATV Format

Active lines	Horizontal pixels	Picture aspect ratio	Vertical scan rate			
1,080	1,920	16:9	60I	–	30P	24P
720	1,280	16:9	–	60P	30P	24P
480	704	16:9	60I	60P	30P	24P
480	704	4:3	60I	60P	30P	24P
480	680	4:3	60I	60P	30P	24P

displayed on HDTV. Hence, some claim that even standard definition pictures will look much better than NTSC on an HDTV set.

Digital interconnection

NTSC is the weakest link in the chain when it is used to connect one device to another. We need a mechanism to move these new digital pictures, whether standard or high definition, from one device to another within the home. The rapidly emerging standard for digital interconnection is the Institute of Electrical and Electronics Engineers 1394. IEEE 1394 already appears on digital camcorders, digital VCRs and computers.

A digital interface brings with it some problems as well as solutions. The movie studios are understandably concerned about unauthorized digital copies of their movies being made and distributed. The Copy Protection Technical Working Group is working on an effective and economical solution to prevent unauthorized copying. Several alternatives are being considered presently.

User interface

If a device, such as a cable set-top box, sends a compressed signal via an IEEE 1394 interface to a digital TV set, the subscriber will see a very high-quality picture. However, there is no standard way to generate an on-screen display, so the cable operator cannot provide a program guide or impulse pay-per-view (IPPV), available today via advanced analog set-tops, or interactive features.

One way of solving the digital interface problem for cable is to make the digital TV set cable-ready. Cable operators would like to provide, at a minimum, the same features as advanced analog set-tops.

The Joint Engineering Committee, with Consumer Electronics Manufacturing Association and National Cable Television Association representation, has released a specification for a National Renewable Security System (NRSS) to support conditional access; however, more work is needed to make fully capable cable-ready receivers:

- The cable signaling system (which uses out-of-band communications channels) must be supported to provide conditional access, emergency alert and program guide information.
- A mechanism is required to download applications to the receiver (for example, program guides, browsers and video-on-demand).

HFC capacity

At the highest resolution (1,080 x 1,920), HDTV will provide true movie-theater quality provided the signal is not compressed too much. This requires considerable system bandwidth. For example, 100 HDTV channels would require 600 MHz of broadcast spectrum or 300 MHz of cable spectrum. The difference stems from more efficient modulation used by cable. Cable companies are investing billions of dollars to upgrade their systems to HFC, and HFC in many cases is the only infrastructure that can support a growing number of HDTV channels.

Conclusion

HDTV is very different from SDTV because it is capable of near-35 mm motion picture quality in a TV image, requires a new TV set to display that image, and can be very bandwidth-intensive. Only the consumer can decide whether HDTV is worth it. However, to provide this choice, the cable industry is stepping up to the plate by providing high-bandwidth delivery systems and high-definition programming. The "missing link" is a short distance from the cable set-top box to the digital TV set, but potential solutions exist in IEEE 1394 and the evolving standards for a digital cable-ready receiver. CT

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HDTV Defies Bandwidth Management

By Paul Harr

The possibility of high definition TV (HDTV) is upon us again. With the Federal Communication Commission's mandate for the 1,600 U.S. broadcasters to begin transmitting digital TV (DTV) with portions of their transmission to be HDTV, cable operators are wondering what it will mean to them.

The FCC's landmark establishment of ATSC standards in December 1996, along with its Fifth Report and Order in April 1997, require that all broadcasters be transmitting digital by the year 2003. By 2006, the government hopes to recover portions of the broadcast spectrum (now being used for analog transmissions) and auction it to the highest bidder to help reduce the country's budget deficit.

DTV, as broadcasters like to call their new service, will be a combination of HDTV and standard definition TV (SDTV). Rather than mandate a single TV format standard, the FCC approved 18 of them, ranging from NTSC quality digital 640 X 480 interlaced (I) SD up to 1,920 X 1,080 (I) HD, with a smattering of progressive scan rates and formats in between. This leaves it up to the broadcasters to choose the format for transmitting their DTV service.

After CBS took the lead in announcing it would begin transmitting HDTV programming, other broadcasters followed suit. Several cable programmers followed with their own announcements to transmit HDTV, as well. Among the cable programmers who said they would deliver HDTV were HBO, Turner, Discovery and MSG. Not to be outdone, Direct TV has fueled the competitive flames by announcing its intentions to transmit HDTV as part of a new service lineup and displayed a working version of HDTV at this winter's Consumer Electronics Show.

What is all this going to mean to the cable operator? Well, first, the fundamental issue of carriage is a battle yet to be fought. If, however, you assume that broadcast HDTV will have to be carried on cable, will there be enough bandwidth? Digital was the promise of virtually unlimited bandwidth for cable. At least 500 channels, right? Now, HDTV is going to come along and require a full cable channel unless the operator invests in the equipment to manage the cable bandwidth inefficiencies created by HD.

Pipe analysis

If we consider the multiple transmission formats or "digital pipes" that affect cable, we quickly see that the inbound and outbound data rates are not the same. Cable's programming comes from satellite and over-the-air broadcast. The digital modulation formats used by satellite, broadcast and cable are all different. In digital, satellite uses quadrature phase shift keying (QPSK) modulation but will use either 36 MHz or 27 MHz transponders. One goal of using different transponder bandwidths is to optimize the transport stream for cable. Broadcast transmission uses 8-VSB (vestigial sideband), which provides an information rate of 19.39 Mbps. Cable's outbound digital pipes use either 64- or 256-QAM (quadrature amplitude modulation).

What this means is that, because of different spectrum bandwidths and modulation efficiencies, digital bandwidth will not easily be optimized over cable. Consider Table 1.

Cable programmers likely will decide how they transmit their service to the cable operator. They must consider the number of services they are trying to deliver vs. the transponder spectrum bandwidth available. For example, if the programmer is planning to deliver eight channels each at 5 Mbps, then he will be providing the cable operator a 40 Mbps multiplex transport stream.

Broadcasters, on the other hand, will be using 8-VSB, which provides a maximum of 19.39 Mbps information rate at the full transport level. They will carve up this data with either HD or SD programs. Only one HD program at the highest scan rate of 1,920 X 1,080 I can fit into the broadcast transport stream, whereas four or five SD programs are possible in the same bandwidth.

HDTV pass-through

Initially, cable operators will want to pass-through signals received from satellite and broadcasters because it requires a minimum amount of equipment. (See Figure 1 on page 55). Programming from satellite will be received by an integrated receiver decoder capable of decoding all programs, simultaneously. The output of this multi-decoder will be the complete transport stream at the full transport rate, ready for adding local conditional access and for modulation on the cable in the format of QAM.

Programming from broadcasters will be received either over-the-air or from a dedicated link from the broadcaster. If the signal is received over-the-air, then it will be received by an 8-VSB demodulator capable of providing the transport stream from the broadcast signal. This output will be re-modulated onto 64- or 256-QAM. Conditional access will not be needed for the broadcast signal, at least initially.

Bandwidth analysis

So why then is simply passing-through the signals a big problem? The cable operator can use the digital equivalent of satellite receivers, modulators and signal processors to convert satellite and broadcast signals to cable format. Unfortunately, digital compression has changed all the rules. An analog video signal is the same whether it is satellite, broadcast or cable. In digital, the same video signal can be 19 Mbps of HD, 5 Mbps of high-quality SD or 2 Mbps of VHS quality, depending on the content originator. ➤

Table 1: Digital pipes' information rates

	Inbound		Outbound	
Pipe	**8-VSB**	**QPSK**	**64-QAM**	**256-QAM**
Broadcast	19.39Mb	-	-	-
Satellite (36 MHz @-40dB)	-	42.74Mb	-	-
Satellite (23Mhz @-40dB)	-	27.27Mb	-	-
Cable	-	-	26.97Mb	38.81Mb

Table 2: Example of bandwidth analysis

			Unused bandwidth	
Service*	**PES**	**Inbound bandwidth**	**64-QAM**	**256-QAM**
CBS	1	19.39Mb	7.54Mb	19.42Mb
ABC	1	19.39Mb	7.54Mb	19.42Mb
NBC	1	19.39Mb	7.54Mb	19.42Mb
FOX	4	19.39Mb	7.54Mb	19.42Mb
HBO	2	27.27Mb	-.3Mb	11.54Mb
Discovery	3	27.27Mb	-.3Mb	11.54Mb
Turner	2	42.51Mb	-15.54Mb	-3.7Mb
MSG	2	42.51Mb	-15.54Mb	-3.7Mb

* Hypothetical cable systems

BOTTOM LINE

Pass-Through and Grooming?

Broadcasters and cable programmers will begin distributing programming in high-definition TV (HDTV) starting this year. DirectTV has announced plans to deliver HDTV programming as well, creating a competitive challenge to the cable and broadcast industries. While digital is supposed to extend bandwidth to provide more video services, HD will consume full 6 MHz channels unless operators implement bandwidth management techniques.

Two simplified methods exist to carry broadcast and satellite digital signals on a cable system: pass-through and grooming. Pass-through simply takes the incoming transport stream and re-modulates it onto the quadrature amplitude modulation (QAM) channel. For a single channel, this is not much to worry about. However, as the number of digital channels grows to be five or 10 channels and unused bandwidth reaches 9 Mb or higher, then bandwidth waste adds up.

Grooming, on the other hand, provides a way for the operator to optimize his bandwidth utilization. By employing multiplexers, the operator can add, drop or combine program streams and create an optimized transport stream that minimizes unused bandwidth.

The bandwidth that HD will consume will necessitate that operators find ways to reduce inefficiencies and squeeze every bit out of their systems' spectrum. Digital bandwidth will be an important asset in the future, and operators will need to manage this asset in a way to extract the most value from it.

What this means then is that, depending on the content data rate and whether it is received from satellite or broadcast, the cable operator may be sacrificing more bits than necessary. Table 2 (on page 53) illustrates a hypothetical cable system with the option to use 64- or 256-QAM. The cable operator's outbound pipe is compared to the satellite and broadcast inbound pipes. What becomes noticeable is that in a pass-through implementation the unused bits begin to add up to real digital bandwidth.

For example, the information rate difference between a single 8-VSB broadcast signal and one 64-QAM cable signal is 9.46 Mb, enough bandwidth to carry at least two program streams of reasonable quality video. At 256-QAM, the difference is more dramatic. As cable systems begin to carry digital signals, operators cannot afford to waste bandwidth and must examine ways to recover this unused bandwidth.

Grooming

Grooming is a technique that is receiving a lot of interest lately. It provides a way for a packager of digital programming, such as a cable operator, to optimize bandwidth usage. Conceptually, it allows an operator to receive an array of program streams from different sources and multiplex them in his own unique way.

Of course, it requires more equipment to implement grooming and, therefore, is a more expensive option. However, operators are likely to reach a point where delivery of digital programming dominates their bandwidth. When it does, operators will need a way to squeeze out every possible bit for more services, whether it be video, audio or data. (See Figure 2.)

With the use of multiplexers, operators will employ bandwidth management of a digital network. Multiplexers allow operators to "cherry pick" program streams in a way that maximizes the data in the transport stream. Program streams that are not desired can be deleted easily. Transport streams that do not fill up the "cable pipe" can be combined with other transport streams. Where bits are left over, data can be inserted, provided the digital set-top box or TV set has a resident application that can receive it.

The bones of it

This time HDTV actually may be here to stay. The FCC has put the wheels in

Figure 1: Pass-through

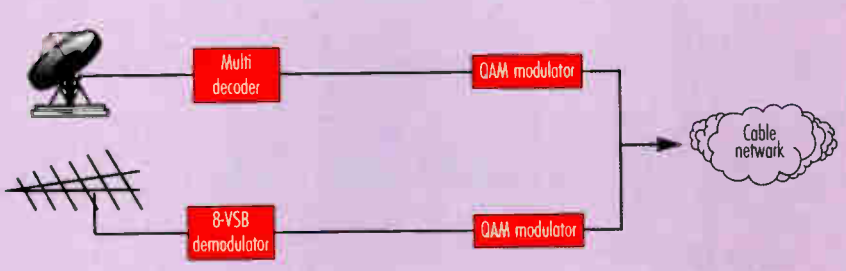
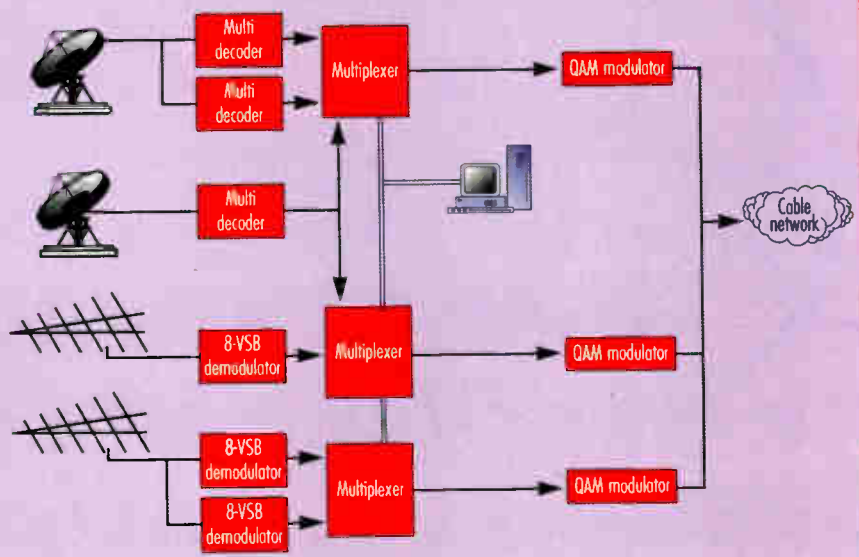


Figure 2: Grooming



what appears to be unstoppable motion with its mandate for broadcasters to start transmitting in digital later this year, along with plans to transmit at least some HD programs. Cable and satellite programmers have responded to broadcasters' plans with their own HD services. The result is the likelihood that in the near future cable operators will deliver some HD programs over their systems.

HD, however, creates a problem for operators because of the varied demands on bandwidth. At times, bandwidth requirements will be as much as 19 Mb for HD and other times less than 5 Mb when broadcasters transmit their signal in SD. Without a way to recover unused bandwidth, it becomes a wasted asset to cable operators.

The challenge for operators is recovering this unused bandwidth and then adding or combining other services. Pass-through does not allow operators to recover unused bandwidth, but it does save costs in equipment needed to trans-modulate digital signals from broadcast and satellite to cable. To overcome the limitation of pass-through, operators will employ multiplexers with grooming capabilities to manage systems that will add, drop and combine program element streams and optimize the digital pipe.

Digital TV, and HDTV in particular, will require operators to manage their bandwidth assets more closely. In the past, a cable system's infrastructure has been one of its most important assets. In a digital future, bandwidth will be the most important asset. Tools such as multiplex systems will help cable operators manage this asset and make a future that includes HDTV more endurable. CT

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six SITES TO hit

Clicks For the Cable Technology Obsessed

By Laura K. Hamilton

Feeble Web sites are out there en masse. Often they're easy enough to spot before you make the fatal click from a specific site link or a search engine. Other times they'll slither up on your computer monitor, and before you know it, you've been duped into loading what seems like an interminable amount of exactly what you weren't looking for.

Type in technical key words relating to cable topics, and sometimes the popular Internet search engines will spit up directions to pages and pages of drivel with no technical solidity whatsoever. Of course, there is a lot of great information about cable telecommunications out there on the Internet—it's just a matter of knowing what to hit or where to go for good links.

So, if you'd like to avoid the likes of pages that promise to tell you how to build your very own set-top box for $8 to avoid paying cable bills, what follows are some of the more dependable places to point your browser.

Rather than focusing on the sites that you've probably already been to (like the Society of Cable Telecommunications Engineers, CableLabs, our own www.ctinfosite.com, and vendor offerings), this article highlights some you might not have visited yet. Most of them offer plenty of technically sound links themselves.

Happy clicking. ➤

Camp David Accords, 1978

MAKING SURE YOU GET THE PICTURE

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Network Technologies

CloverCable

From one of the usual suspects in the cable engineering community, David Devereaux-Weber, comes an absolute must to bookmark: CloverCable Cable Telecommunications Page at: clover.doit.wisc.edu/cable_telecommunications.html.

Devereaux-Weber, who's best known for launching and maintaining the SCTE-List Internet mailing list, has put together an amazing resource here that you must see for yourself.

Can't find a particular vendor's Web site? CloverCable links you to around 300 of them. Baffled by an unfamiliar abbreviation, acronym or term? This site can help.

CloverCable also has a fantastic pool of very useful links that relate to cable technical issues including regulation, telecommunications labs and high definition TV (HDTV).

Mailing lists

Devereaux-Weber's site also offers information on some excellent cable telecommunications Internet mailing lists. Information on subscribing to any of the following is available at CloverCable:

- *SCTE-List*. Not on this yet? What are you waiting for? It's as simple as this: If you are on the technical side of this industry, you should subscribe. Hundreds of your fellow cable engineers are on it, and they're more than happy to offer real-world answers for virtually any technical question you can come up with. And once you're up on the list, you very well might find you've got some experience and advice to offer to this wonderfully active and lively forum.
- *TelecomReg List*. Living up to its name, this is a list for the discussion of telecommunications regulation.
- *Telecom Digest*. This calls itself an electronic journal devoted mostly but not exclusively to telecommunications topics. Subscriptions are available to qualified organizations and individual readers.
- *ipcdn*. This covers issues pertaining to Internet protocol (IP) over cable data networks.
- *Broadband Bob's Cable Modem List*: Focusing heavily on technical and market issues from an industry perspective, this list avoids end-user and telecom enthusiast postings. In addition to list traffic, subscribers are e-mailed "The Broadband Bob Report." (More on this later.)

BOTTOM LINE

Roundup of Site Addresses

- CloverCable Cable Telecommunications Page: clover.doit.wisc.edu/cable_telecommunications.html
- Telecommunications Links: www.ee.umanitoba.ca/~blight/telecom.html
- Cable Modem Links: rpcp.mit.edu/~gingold/cable/
- CATV CyberLab: www.catv.org/
- Ben's Cable Box: www.geocities.com/SiliconValley/Park/3254/cabletv.htm
- Cable Addicts Broadband Lounge: www.cabl.com/

More links

If your favorite search engine didn't deliver and you exhausted all of Devereaux-Weber's links at CloverCable, your mouse finger probably is pretty tired by now. However, there's definitely more good stuff, and here's another site to check out: www.ee.umanitoba.ca/~blight/telecom.html.

David Blight has put together an extensive list of WWW links to sites that detail high-speed networks, asynchronous transfer mode (ATM), integrated services digital network (ISDN), network management and simple network management protocol (SNMP). Listed is everything from general reference pages to technical reports and archives, as well as product and vendor links.

Cable modem links

For another collection of Web links, this time focusing on cable modems, dial up David Gingold's rpcp.mit.edu/~gingold/cable/. You won't be alone if you do. Gingold says it's an "insanely popular topic," drawing 200 hits a day since he put it together in January.

Features include:

- Specific cable modem manufacturers and their products
- Alliances
- News on launches and trials
- Papers, articles and discussions

CATV Cyberlab

Broadband Bob caretakes the CATV CyberLab—"your cyber to the curb connection to the CATV industry." The address is www.catv.org/.

Main features include "The Broadband Bob Report," Cable Modem University, "Cable Carrier News," and Cable Call Connection.

The "BBB Report" offers the latest news on high-speed data over cable, two-way hybrid fiber/coax (HFC) networks and related services.

According to the CyberLab, "Cable Modem University is an ongoing online project providing the cable telecommunications industry and Internet community with compilations of market data, news and resources pertaining to cable modems and data services delivered over cable networks. The project has been recognized for its extensive and sometimes exhausting lists of cable modem vendors and trials."

So if you're looking for the latest launch or a list of modem manufacturers, check this out.

"Cable Carrier News is a semi-monthly publication on technology and market developments affecting the HFC telephony industry.

"It is the world's only news source exclusively tracking the emergence of cable telephony technology and services," says Broadband Bob.

It is published online at the CATV CyberLab and also is distributed twice a month to members of the Cable Carrier Mailing List. Hit the site for information on subscribing.

CATV CyberLab takes up the call for the cable telephony topic further in an area dubbed Cable Call Connection. Focusing on the plans of MSOs such as Cox, MediaOne and Adelphia, and highlighting the technology's vendors, this area of CyberLab promotes the idea that telephony over cable is very much alive and happening today.

Continued on page 110

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Progressive vs. Interlaced Scanning Formats

By Richard S. Prodan

Nine years ago, the Federal Communications Commission mandated the Advisory Committee on Advanced Television Service, with the charter to select, test and recommend a new high definition TV (HDTV) system in an open industry competition for the next American broadcast standard. After numerous analog system proposals, followed by several digital system proposals, a richly featured digital TV system incorporating the "best of the best" by an industrial coalition dubbed the Grand Alliance has been adopted as the American Television System Committee Digital TV Standard.

One important aspect of this HDTV standard is the multiplicity of source scanning formats supported, using local display conversion to one choice from these multiple scanning formats at the TV receiver. The question arises as to the technical and economic viability of supporting several different source-scanning formats with a single display-scanning format selected from these several possibilities. Specifically, either a progressive or an interlaced scanning format may be chosen and utilized by the display device.

TV scanning

A TV system conveys a projection of the continuous four-dimensional world (length, width, depth and time) into a mostly discrete projection in three dimensions: horizontal, vertical and temporal. Scanning in TV systems at both the source (tube or CCD cameras and telecines, and electronic graphics generators) and display (receiver cathode ray tube or CRT, liquid crystal display or LCD, flat plasma panels, light valves, and digital micro-mirror device or DMD) serves to map the continuous world into this three-dimensional representation that is discretely sampled in the horizontal (pixels), vertical (scan lines) and temporal (fields and frames) dimensions.

The TV imaging and scanning process is illustrated in Figure 1 (on page 67). The horizontal direction along a scan line continuously integrates or sums the luminous intensity within a small sampling aperture ("spot" in tube cameras or "pixel" in CCD cameras) to produce an amplitude value proportional to luminous intensity with a constant velocity read out at the scanning line rate. This line scanning of the image is repeated with small but fixed displacements in the vertical direction in successive scan lines until the entire picture area has been sampled. The process then is repeated with small but fixed displacements in time (the temporal direction) in successive pictures (temporally sampled images). In this way, the scanning process converts the multi-dimensional (horizontal, vertical and temporal) video signal at the source into a scalar (one-dimensional) amplitude analog signal for storage or transmission and reconstructs the original video signal at the display by reversing this process.

Two distinct scanning formats are defined for temporally sampling these successive images or pictures. Progressive

BOTTOM LINE

The Question of Scanning Formats

The Federal Communications Commission has selected high definition TV (HDTV) for the next broadcast standard. One important aspect is its 18 source scanning formats, using local display conversion to one choice from multiple formats at the TV receiver. But is it viable?

Comparing progressive and interlaced scanning formats shows that interlaced scanning utilizes bandwidth more efficiently, producing higher spatial resolution, though requiring additional system design principles to suppress artifacts.

Display scan conversion to a single display format (either progressive or interlaced) may be used satisfactorily to display either source originated format with low complexity and cost at the display device. The broadcast, cable, consumer electronics and computer industries agreed to scan convert either source format at the display to the single display format supported by an HDTV receiver designed to work in either interlaced only or progressive only display mode. This approach reduces the complexity and cost of multiple scan displays, obviating the technical need to choose one source and display format. This leaves the marketplace to decide where each scanning format finds the best fit.

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Scanning format	Max. limiting resolution (TVL)		Apparent resolution (TVL)	
	Horizontal	Vertical	Horizontal	Vertical
NTSC 483 interlaced	335	483	270	270
HDTV 480 progressive	400	480	320	360
HDTV 720 progressive	720	720	575	540
HDTV 1,080 interlaced	1,080	1,080	865	610

scanning samples every scan line in the same vertical positions in each successive picture termed a frame. That is, all lines are scanned in sequence, so all picture elements are included during one vertical sweep of the scanning process. Interlaced scanning samples every other scan line, first in the odd numbered line positions in the first picture, then in the even numbered line positions in the next picture. An interlaced frame comprises two successive fields—an even and an odd field. The entire image area is sampled in alternate vertical scanning lines with interlaced scanning. Such a scanning structure substantially reduces transmission bandwidth without substantially reducing the resolution in the displayed reconstructed video image sequence, as explained in the subsequent sections.

Video resolution and bandwidth

Resolution determines the amount of fine detail that can be displayed in a video format. Both horizontal and vertical resolution contribute to the amount of picture detail and should be approximately the same for balanced presentation. Both resolution capabilities are expressed in the same units of TV lines per picture height (TVL), although their limits are determined independently by different mechanisms. Each TVL corresponds to the smallest detail or transition discernible in the image in either the horizontal or vertical direction of the picture (for example, one black to white transition equals two TV lines of resolution).

The maximum limiting vertical resolution equals the number of active (visible) scanning lines per frame. Apparent vertical resolution is slightly lower than the number of scan lines because of the finite size of the scanning aperture or pixel. This is known as Kell factor and results in apparent resolution of about 75% of the number of vertical scan lines per frame. This factor applies to both interlace and progressive scanning.

The apparent vertical resolution is degraded further in interlaced scanning because of the imperfect integration by the human eye of the two temporally displaced fields in an interlaced frame. This degradation is known as interlace factor, and it results in an additional limiting resolution of approximately 75% of the number of vertical scan lines per frame. Thus, an interlaced scan format requires approximately 33% more scan lines for the same apparent vertical resolution as a progressive scan format. However, interlaced scanning uses only half the number of lines per vertical scan (a field), requiring only half the transmission bandwidth. Even with the additional 33% in the number of interlaced scan lines compared to progressive scan lines for the same apparent vertical resolution, interlaced scanning is more bandwidth efficient by about 33%.

Horizontal resolution is proportional to the electrical bandwidth of the video signal. This bandwidth is expressed in hertz, or cycles per second. A cycle is a sinusoidal variation from black to white and therefore is equivalent to two TV lines. The number of TV lines in the horizontal direction therefore would be equal to twice the bandwidth times the active (visible) scanning line period for a picture with equal horizontal and vertical size (such as a square picture display). Since

BIG NEWS FOR BIG SYSTEMS

EAS UPDATE

FCC'S SECOND REPORT AND ORDER RELEASED.

December 31, 1998

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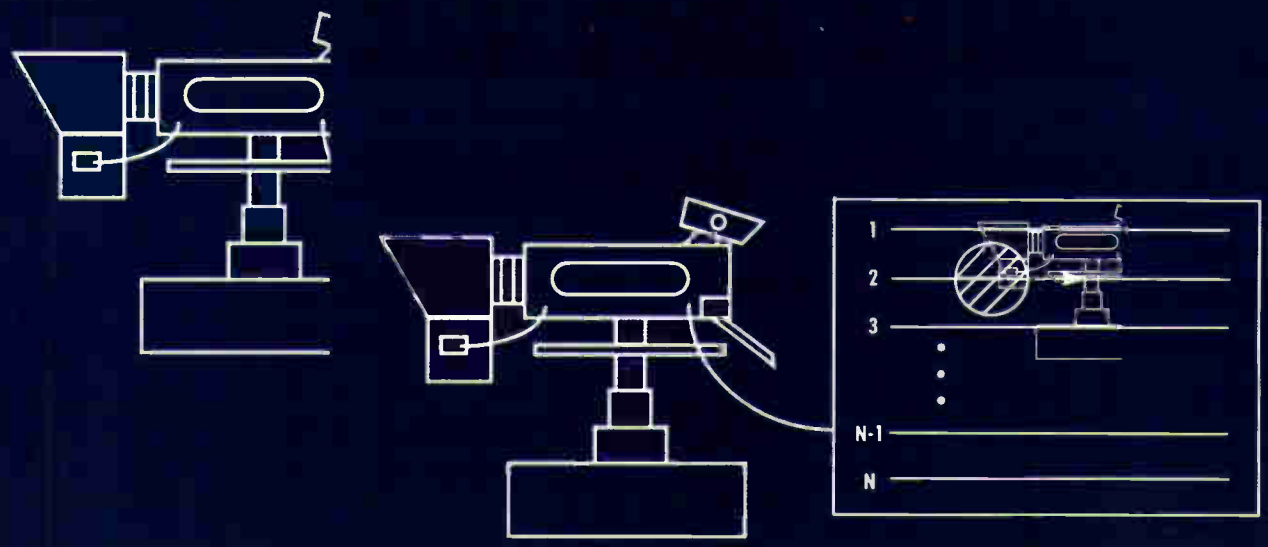
Figure 1: Television imaging and scanning a) Progressive scan: 1, 2, 3,..., N-1, N; b) Interlaced scan 1, 3 ,5,..., N-1,...2, 4,...N.



the resolution represents the number of TV lines per picture height, the above product must be divided by the aspect ratio, defined as the picture width to height ratio. Conventional standard definition TV (SDTV) has a 1.33 aspect ratio (4 to 3), while the new HDTV formats have a 1.78 aspect ratio (16 to 9). Therefore, a wider aspect ratio picture requires more

Figure 2: Sampling effects due to scanning

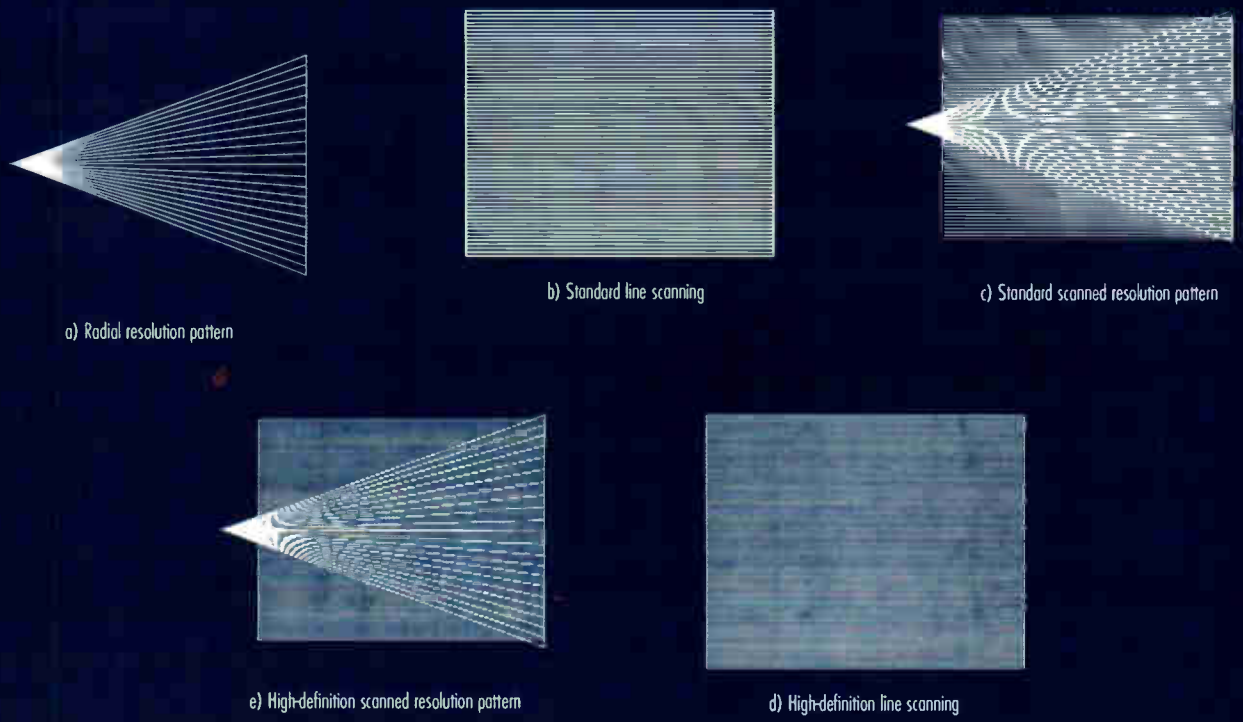
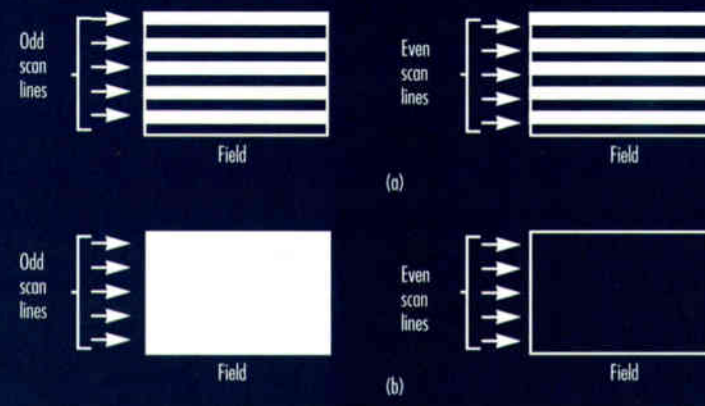


Figure 3: Line flicker due to interlaced scanning equating a static high vertical spatial frequency with a flat field alternating at the frame rate: a) Static high vertical frequency pattern; b) Time varying low vertical frequency pattern (alternating flat fields in time).



bandwidth for the equivalent horizontal resolution of a narrower picture. The apparent horizontal resolution accommodated within a given electrical bandwidth is reduced by approximately 20% because of the effects of filtering to prevent interference and reduce ringing.

Using these derived resolution calculation methods, the table (on page 64) shows the maximum limiting resolution and the apparent resolution of conventional NTSC and the new HDTV formats.

The apparent horizontal and vertical resolutions are matched similarly for the NTSC and both HDTV scanning formats, and a 480-line progressive HDTV format, although each is different in actual magnitude (see the table). This is the result of adopting sound, well-understood engineering principles in the overall design of the scanning formats of a TV system.

Source and display

As described previously, the effects of the source aperture of the pickup tube scanning beam (or CCD sensor pixel area, display aperture of the CRT scanning beam or LCD pixel area) reduce the apparent resolution to less than the maximum theoretical limit. This is highly desirable to reduce artifacts inherent in the scanning process because of sampling. In theory, samples of the continuous analog signal must have infinitesimal aperture to preserve the limiting resolution, corresponding to infinitesimally thin scan lines on the source and display image. This would resemble "venetian blinds" and produce an unnatural-looking image.

Sampling theory demonstrates the need for an analog low pass reconstruction filter to restore the original analog signal representation by removing the sampling structure and harmonic spectral repetitions at multiples of the sampling frequency. Such a filter is not present or possible for a TV display in the vertical scanning direction. These spectral repetitions can produce Moiré patterns in the image.

The radial resolution pattern shown in Figure 2a (on page 69) contains lower spatial frequencies at the periphery and higher spatial frequencies toward the center of the pattern. The sampling pattern of Figure 2b corresponds to line scanning with a square aperture with a spacing of twice the aperture width (50% duty cycle). The effect of sampling by line scanning is demonstrated in Figure 2c by superimposing the sampling pattern on the resolution pattern. Note the presence of large, low-frequency Moiré patterns of the radial resolution pattern near the maximum resolution limit.

The sampling pattern of Figure 2d depicts the same type of sampling pattern as Figure 2b, but at twice the sampling frequency corresponding to doubling the number of scanning lines per image. Note again in Figure 2e the presence of large,

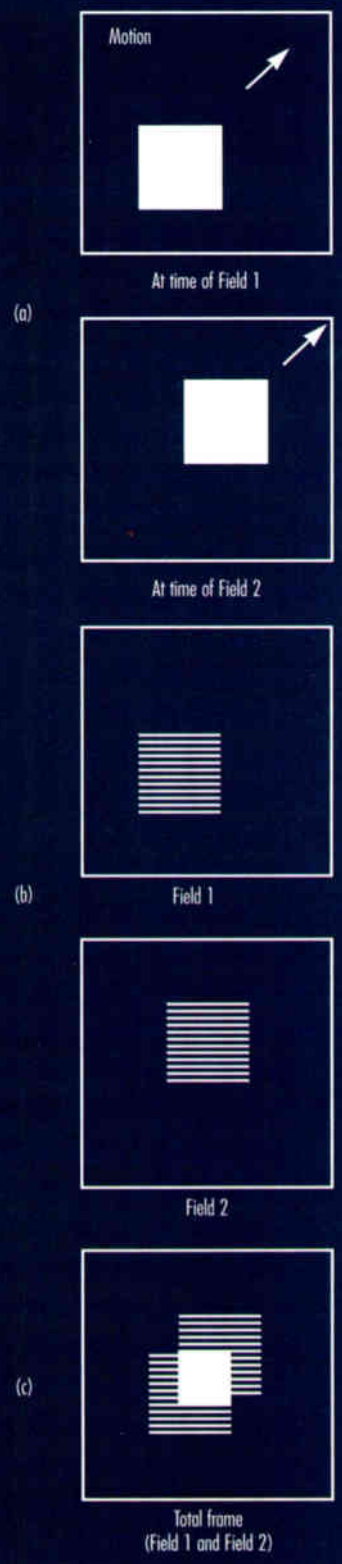
low-frequency Moiré patterns of the radial resolution pattern near the maximum resolution limit. However, the interference is reduced and limited to the areas that are double the frequency regions of the previous case of Figure 2c. Thus, increasing the number of lines per scanned image reduces the effects of sampling artifacts left over from line scanning, both for interlace and progressive scanning formats. This reduction results from the use of a higher sampling frequency (more scanning lines per frame) which separates repeat spectra at harmonics of the sampling frequency. Therefore, HDTV scanning formats will have reduced scanning artifacts proportional to the number of scan lines employed, independent of scanning format.

The square aperture used in this example is not optimum to reduce the artifacts demonstrated. Such an abrupt aperture would produce a "stair-step" aliasing pattern along diagonal edges of objects where the scanning lines are inclined with respect to the object edge. In practice, both discrete and continuous sources and displays use aperture profiles such as overlapping Gaussian spot beam profiles (analog) or nearest neighbor sample averaging filters (digital) to effectively low pass filter the image for a more pleasing image reconstruction. These techniques lead to the reduction in apparent resolution previously described but have the benefit of also greatly reducing the scanning artifacts just demonstrated.

Additional artifacts inherent only to interlaced scanning arise from the nature of alternate field scanning line positions. Interlacing the vertical scan line positions into odd lines in the first field and even lines in the second field uses the same number of lines per frame as progressive scanning (with double the bandwidth). However, the temporal separation (16.7 milliseconds) of the two fields must be integrated visually by the viewer.

A well-designed source and display will nominally produce this desired result at all but the highest vertical frequencies of very fine, high-contrast vertical detail, where an aliasing phenomenon known as line flicker may occur. Scanning a stationary vertical pattern equal to the field line scan spacing is indistinguishable from a patternless picture alternating between black and

Figure 4: Motion causing a spatial alias manifest as a serration along object edges: a) Moving object at each field time; b) Scanned fields; c) Resultant interlaced frame



white at the frame rate, as illustrated in Figure 3. Notice that either pattern produces all dark scanning lines in the first field followed by all light scanning lines in the second field 1/60th of a second later. Thus a high vertical frequency pattern flashes at a 30 Hz rate.

A related (in fact the same spatio-temporal alias) artifact can occur on moving large (low spatial frequency) objects, where the leading and trailing edges will have a serrated appearance at the field line scan spacing. (SeeFigure 4 on page 72). Since these effects are pronounced at the highest vertical frequency with large amplitude or contrast, smoothly rolling off the incoming video near the highest vertical frequencies will reduce these effects substantially in both static and moving artifacts illustrated in these two examples.

A conventional NTSC monitor with only 480 active scanning lines per frame will display this characteristic on very abrupt, high-contrast vertical transitions. As previously discussed, a higher number of lines per frame as employed in HDTV will reduce this problem greatly.

Computer graphics generated in a naive way almost certainly will display this problem because the software filling the video display pixel positions across adjacent scanning lines can produce abrupt discontinuities with maximum brightness change. However, using vertical filtering (anti-aliasing) to soften the transitions alleviates the line flickering problem with only small impact on the perceived resolution of the displayed image. Softening or blurring moving object edges in the same manner that a camera integrates motion over a picture period alleviates motion-induced artifacts. These techniques are not adopted universally by software designers, but they could be employed in computer video display hardware to alleviate the need for such a software interface.

Scanning format trade-offs

As previously discussed, interlace scanning requires one-third more scanning lines per frame for the same apparent vertical resolution as a progressively scanned display. For an equal number of lines per frame, progressive scanning always will produce a higher apparent vertical resolution than interlaced scanning.

However, this is not a relevant basis of comparison for optimizing the design of a TV system. The electrical bandwidth of the progressive scan format will be double the interlace scan format using an equal number of scan lines per frame and the same horizontal resolution. This significantly impacts TV system performance because the video bandwidth is proportional to such system characteristics as transmission channel bandwidth, electronic storage capacity and compression efficiency.

Bandwidth is a very precious resource. Interlaced scanning was invented to increase the efficient use of video bandwidth. As previously discussed, interlaced scanning will allow twice the number of scanning lines per frame for the same electrical bandwidth. Even though the apparent vertical resolution

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of interlace is only about 75% of progressive, this results in a 50% higher apparent vertical resolution for interlaced scanning in the same bandwidth. Given a fixed video bandwidth, some of this increase in vertical resolution can be reapportioned to the horizontal direction by a more modest increase in the number of interlaced scanning lines and concurrently increasing the number of pixels per line. Thus, interlaced scanning always will produce higher spatial resolution than progressive scanning for a fixed bandwidth. The apparent horizontal and vertical resolutions calculated for the progressive scan and interlaced scan HDTV formats in the table demonstrate this property, since the bandwidth of the two formats is identical.

Display scan conversion

The possibility for satisfactorily interchanging source, transmission and display scanning formats has been demonstrated successfully for decades, since film scanning with telecine for video transmission and display. In fact, display conversion of source captured in an alternative format originated with film being shot at 24 frames per second and then converted to 48 frames per second in movie projectors by double shuttering (showing each frame twice before advancing to project the next). This conversion is required because of the strong perception of flicker at or below 30 frames per second.

This film source to video display conversion process uses a technique known as 3:2 pulldown to convert 24-frame-per-second, progressively scanned film to 60-field-per-second, interlaced video by repeating the first of the two interlaced fields every other film frame. The extension of this film source conversion process to a 60-frame-per-second video display format is trivial. A progressively scanned video frame would replace each interlaced video field in the 3:2 pulldown process.

For either the interlaced or progressive display format, the progressive source format frame rate of 24 Hz is well below the perceptible flicker frequency. Therefore, the film source must be scan-converted at the display to a higher picture rate (field rate for interlaced or frame rate for progressive). This conversion customarily is done before transmission for NTSC analog TV and after transmission for digital compressed SDTV or HDTV. Virtually all movies and prime time programming are shot in film and converted in this manner.

The film source to video display conversion process involves a temporal interpolation process as just described. For video source originated in one of either the interlaced or progressive scanning formats, the video display may be converted satisfactorily to the alternative scanning format at the display in a spatial interpolation process. The display scan conversion process, starting with a well-engineered source in either alternative format, can be accomplished with classical sample rate conversion signal processing algorithms involving interpolation and decimation with appropriate digital filtering in the vertical direction (across scan lines). The

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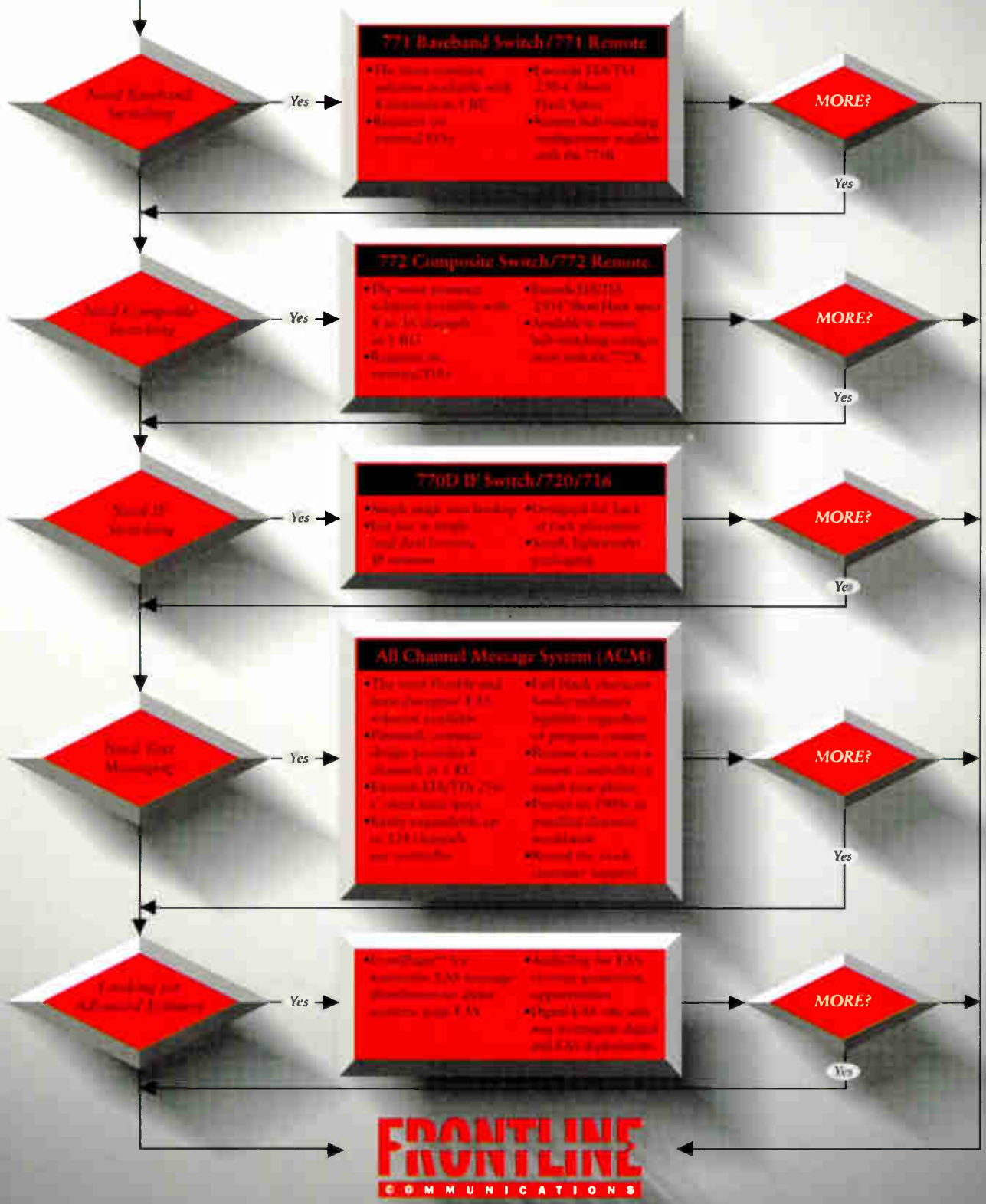

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display scan conversion between the 1,080 interlaced and 720 progressive HDTV scanning formats can be accomplished with excellent results. These spatial based filtering algorithms can be implemented with low complexity and cost at the display device using only time coincident source fields or frames without temporal processing involving frame memories and motion compensation.

Such display conversion techniques were demonstrated to perform with excellent results prior to the ACATS recommendation and FCC adoption of both an interlaced and a progressive scan format. This led the broadcast, cable, consumer electronics and (at the time) computer industries to agree to scan convert either source format at the display to the single display format supported by an HDTV receiver designed to work in either interlaced only or progressive only display mode, as described in the ATSC digital TV standard documentation. The local display scanning format need not be the same as the source format, but conversion has to be accommodated at the receiver, thereby significantly reducing the complexity and cost of multiple scan displays.

The impact of these two scanning formats on video resolution and bandwidth for transmission show that interlaced scanning utilizes bandwidth more efficiently, producing higher spatial resolution, though requiring additional but reasonable system design principles to achieve excellent results.

Well-designed source and display scanning apertures and aliasing reduction using digital filtering in the scanned (vertical) direction yield high-resolution, low-artifact pictures. The use of a higher number of scanning lines per video frame in the HDTV formats significantly reduces the impact of both progressive and interlaced scanning artifacts.

Display scan conversion to one display format (either progressive or interlaced) may be used to show either source originated format by incorporating spatial interpolation with low complexity and cost. The implemented solutions demonstrated prior to adoption of a multiple scanning format digital TV standard adhered to all these guidelines with excellent results.

The question as to the technical and economic viability of supporting several different source scanning formats with a single display scanning format has been answered. Either a progressive or an interlaced scanning format may be chosen and utilized by the display device. This approach obviates the technical need for the choice of a single source and display format, leaving the marketplace to decide where each scanning format finds the best fit for different applications and products incorporating the newly adopted American digital broadcast television standard. CT

Richard Prodan is senior vice president and chief technical officer of Cable Television Laboratories in Louisville, CO. He can be reached via e-mail at r.prodan@cablelabs.com.

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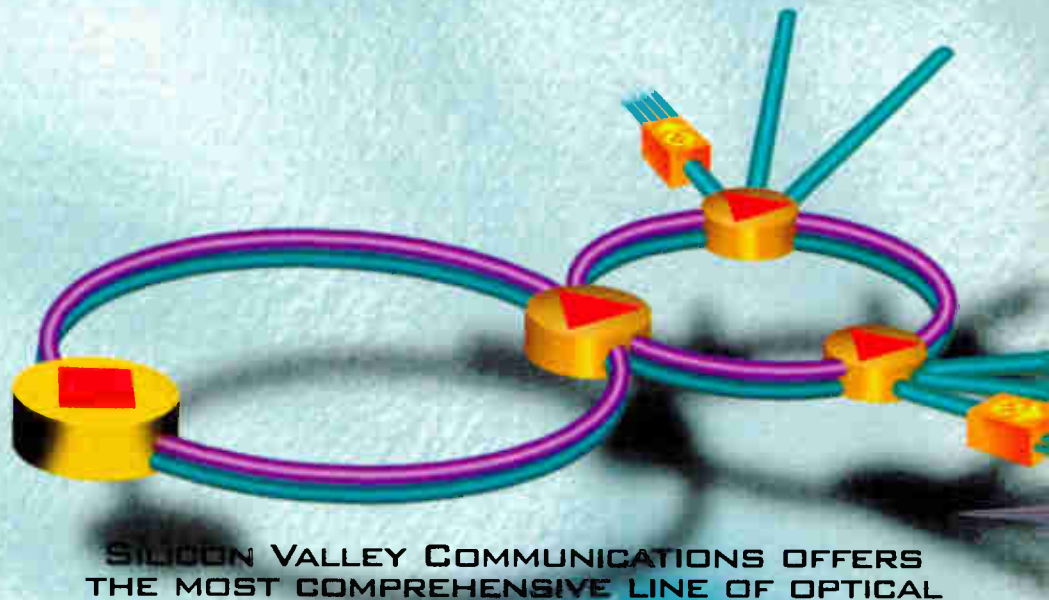

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Reader Service Number 64

Talk Your Way Through Your Next

Communication Eases Construction Projects

By Jeff Weech

You hear it said a lot, "We're a communications company, but no one here ever communicates." Well, if you are about to start an upgrade, or are in the process of one, it's necessary to evaluate your company's communication skills.

As with most other things in life, good communication will improve your effort—the more people who have a view from the top of the mountain, the better. Everyone involved in the upgrade needs to know where the upgrade is headed and what the final outcome should be. As we all know, this is easier said than done.

First steps

There are plenty of steps that need to be completed at the start of an upgrade. For our purposes, we will assume that budgets are completed and approved.

From design to final reverse activation, each department first must know what the specifications are for each task and who will handle such work. Setting up the communication flow right from the beginning is the best way to go.

The designer sets the pace by the amount of design that can be produced. Design determines the node and power supply locations. However, the permitting department must be able to make design changes to move power supplies as needed to facilitate their placement. The fiber engineer must be able to move node locations so the nodes are maintainable. Permitting and fiber design need to communicate their issues back to the design group to correct the maps as required. Having open communications between departments and empowering the individuals who do the work are keys to getting the job done.

With regard to the construction efforts, each department must convey what their goals are and in which direction they are headed. This is where communication needs to be tight. You cannot have the coax and fiber crews jigging in one hub and the splicing staff stabbing in a different one.

Let the splicing staff set the schedule as to which hubs or nodes will be done first. Break the schedule down to nodes per day. Consequently, you will have the construction department placing cable ahead of the upgrade, rather than fighting with the pace of the splicers.

Internal communication

Weekly meetings are of the utmost importance, first at the supervision level, then at the management level. Make sure to pass all information along so that everyone gains a view from the top. Holding these meetings ensures that all efforts are in the right direction.

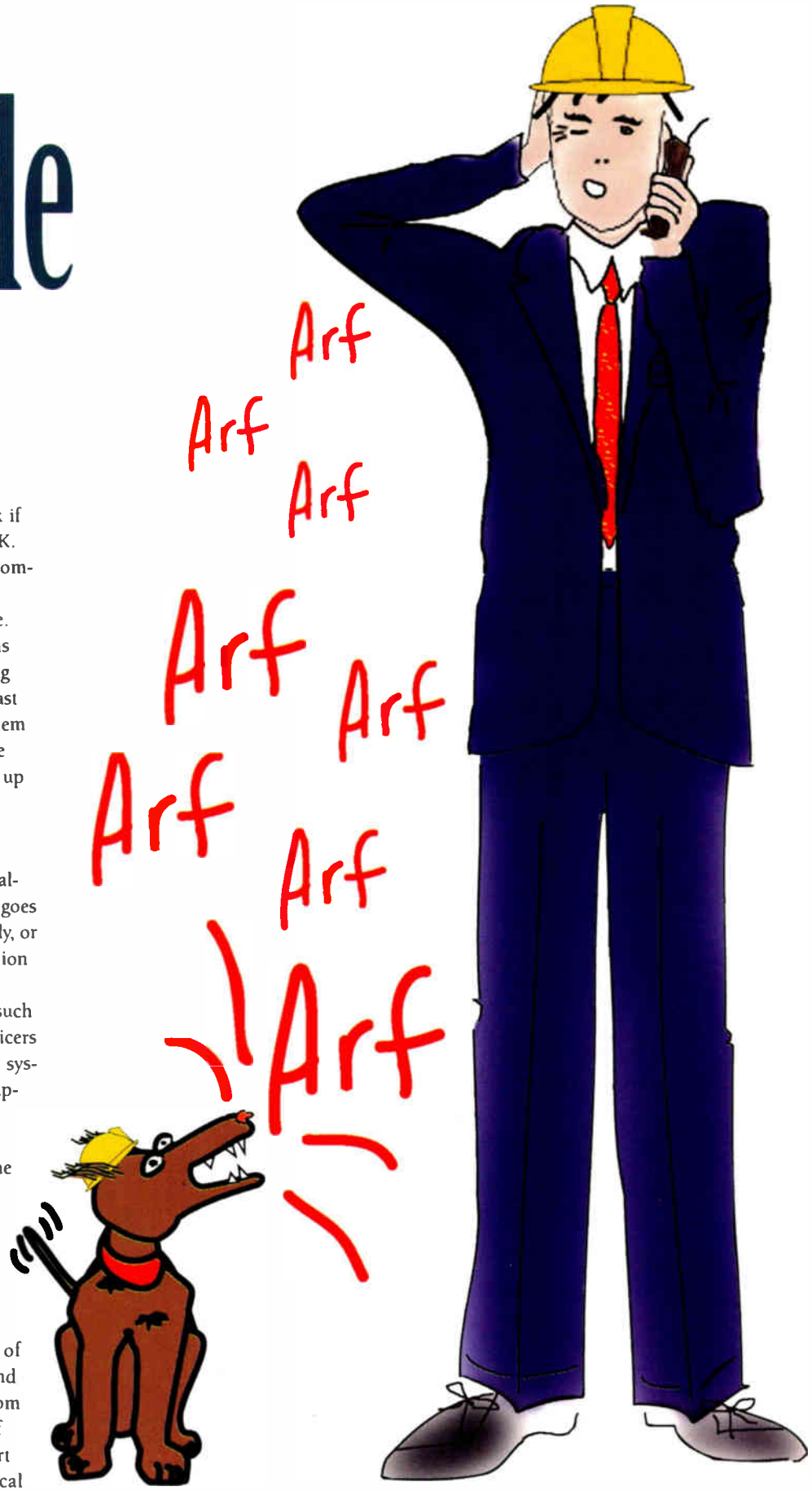
Management's role should be to guide supervisors in the right direction, not to run each department. Following this philosophy gives everyone the power to do their jobs.

Communications in the field are critical during the coax-splicing activity phase of the upgrade. The system-level technical staff and the contractor splicing staff in the field must communicate well because they are responsible for reactivating the system at the end of each day. The system techs then pass this information on to dispatch, who in turn passes the information on to customer service.

Including the customer

Customer service then can give customers the proper updates on the status of their cable service when they call in. Toward the end of each day, the system techs can call dispatch with percentages of the splicing completed. Let's say that only one feeder leg is left to be checked for end-of-lines signal levels. The system tech calls in with a 90% completion for that node and gives the street name and block numbers for the feeder leg that is not completed yet. Then dispatch and customer service can start ringbacks (calling some of the customers

Upgrade



who called in during the day) to ask if their cable service is back on and OK. Customers then feel that the cable company cares about them because you called back to check on their service.

Dispatch calls back to the field techs with any problems encountered during the ring-back procedure. While that last feeder leg is being completed, the system techs can start working on any picture quality problems that may have come up during the ring-back process.

Murphy's Law

During upgrades, problems nearly always occur at night. New equipment goes bad, something wasn't spliced properly, or a splicer left off a drop. This information needs to be transferred to the system techs who are on call to take care of such problems. Require that contractor splicers also be on call so that they may assist system technicians in the repair of any upgrade-related service calls.

The sharing of information between departments is paramount to the success of the upgrade. Communicating through the open chains of command and empowering the field staff to make corrections to problems as needed will result in a more effective upgrade project.

Using and maintaining a number of basic lists and charts can quickly and effectively update all employees, from management down, on the status of the upgrade. An organizational chart shows reporting structure and vertical

BOTTOM LINE

Communicate your upgrade

Communications from department to department during an upgrade could be the most important aspect that you will encounter during the upgrade process. Each department must understand the goals and objectives of the upgrade, as well as where the project is headed, in order to complete their task on schedule.

When all employees have a view from the top of the mountain, this not only gives them an understanding of the big picture, but also makes them feel like part of the entire project, not just their one part of it.

Using some basic charts and lists and distributing them to everyone does make a difference.

Organizational chart:
- Vertical lines of communication
- Reporting structure
- Updates as needed

Responsibility check list:
- Assign work tasks.
- Cover all items to ensure that each task is accounted for.
- Update as new tasks are developed.

Gant Charts:
- Time lines that work needs to be completed by.
- Allotment of resources.
- Let the splicing department set the pace.

lines of communications. Responsibility check lists ensure that each work assignment is covered. Gant charts work well to show time lines as to when each department will complete its part of the project.

Through these tools, communication is achieved during the upgrade, allowing for a more efficient and cost-effective project. CT

Jeff Weech is project manager of Time Warner Cable's construction division. He can be reached at (813) 572-1775.

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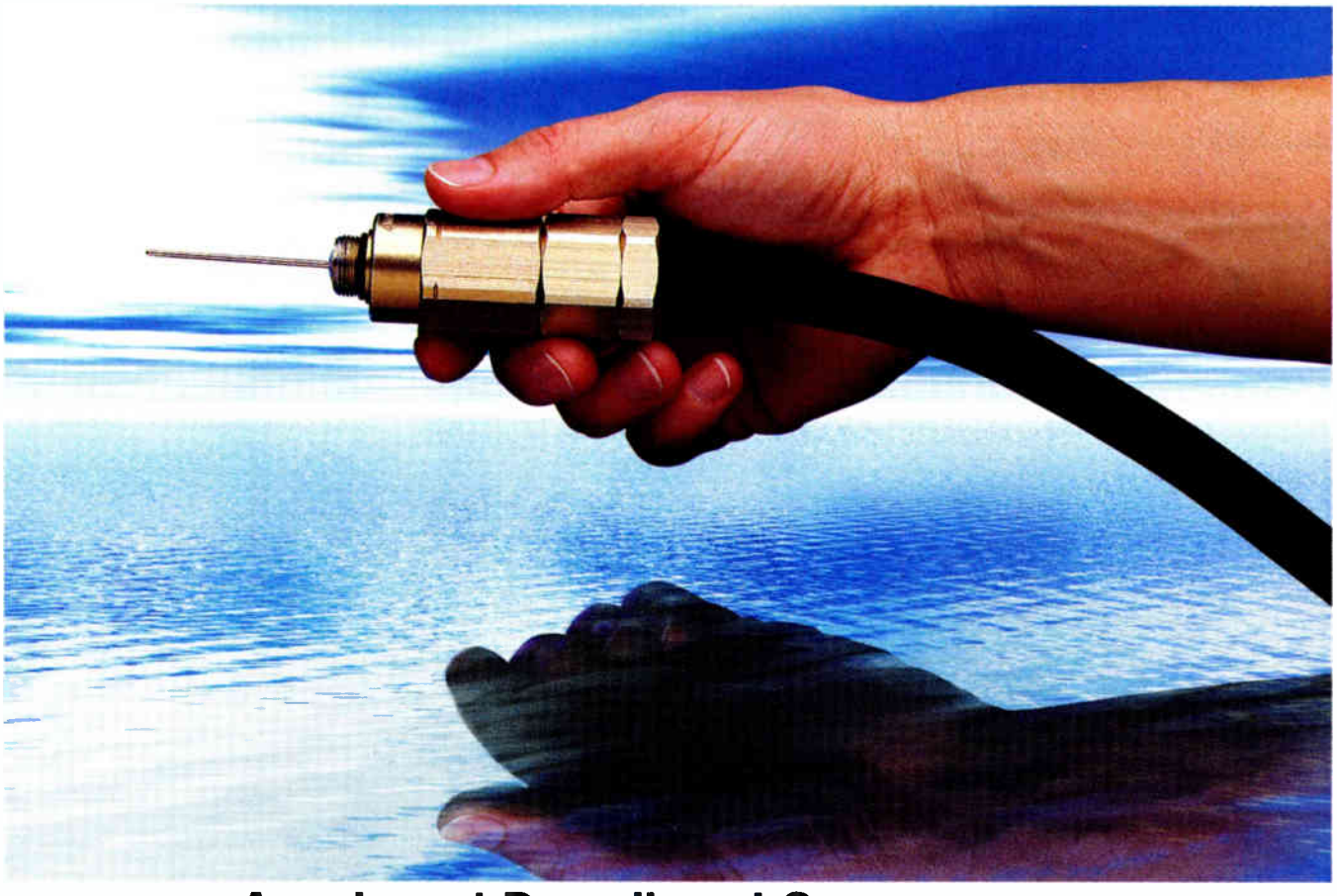

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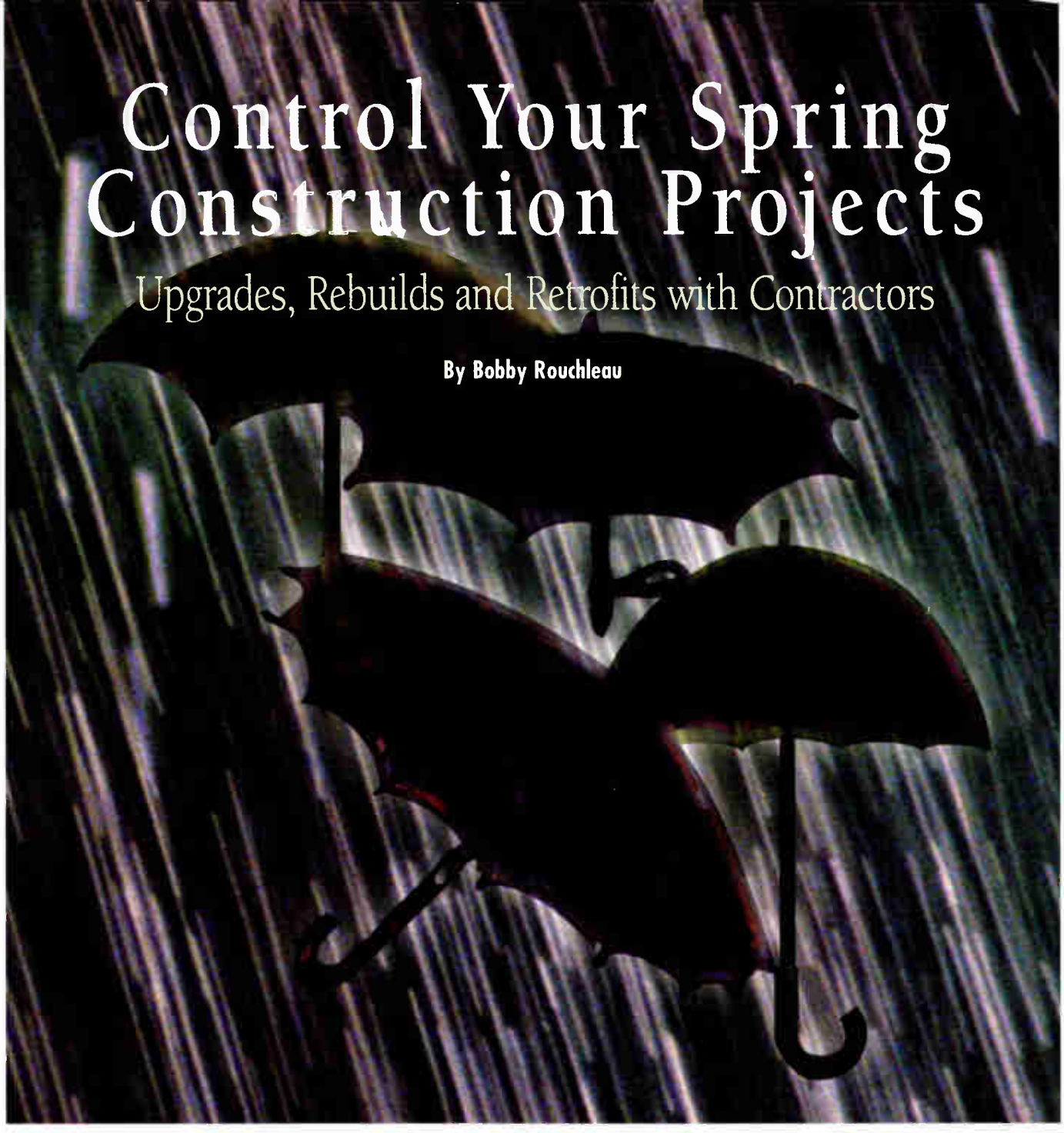
Reader Service Number 67

Control Your Spring Construction Projects

Upgrades, Rebuilds and Retrofits with Contractors

By Bobby Rouchleau



Venturing into a system upgrade takes a lot of pre-planning and pre-engineering. Decisions are made regarding type of architecture to build, at what bandwidth, what services to offer and types of equipment to install.

Will this be an upgrade, retrofit or a rebuild, and of course, how much will it cost? Once these decisions are made, there still is a major consideration. Who will build this multimillion dollar investment for us, and how will we determine who will build it?

With the revenue tied to an upgrade and the short time frame to complete it, it might not be in a cable system's best interest to hire and train an in-house crew. So, the most reasonable decision is to contract the project. Fortunately, there are good contractors out there with a lot of experience in system upgrades. The trouble operators sometimes have is finding the right one with the right expertise. Take measures to ensure a good selection.

Contractor qualification

To begin the process, identify contractors you think can complete the project. Have them complete a questionnaire providing

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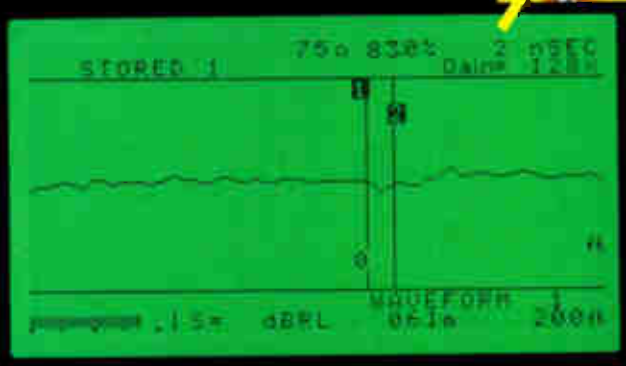

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INSTRUMENTS

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BOTTOM LINE

Pre-Engineer Your Upgrade

Planning a system upgrade takes a lot of pre-planning and pre-engineering, deciding what architecture, bandwidth, services and types of equipment to use. Once these decisions are made, you still need to decide who will build your multimillion dollar project.

Do not fret! There are measures you can take to get a good contractor.

- Identify contractors you think can complete the project. Have them complete a questionnaire providing pertinent information about their company. Through this, qualify your contractors for future work.
- If you included design contractors in the process, get a sample of their work.
- Visit all qualified contractors to verify the information they provided is accurate. Visit the company's corporate office as well as a project in progress.
- As contractors are qualified, develop a database to track important information.
- A detailed Request for proposal (RFP) helps the contractor understand what is expected and provide the most competitive price. Obtain a minimum of three bids for all labor service contracts. Request bids only from approved contractors.
- Explain the project to contractors in a pre-bid meeting.
- Have a system contact track returned-bids and ensure the contractor information is complete.
- Select contractor based on predetermined criteria.
- Once you accept a bid, both your company and the contractor must sign a contract.

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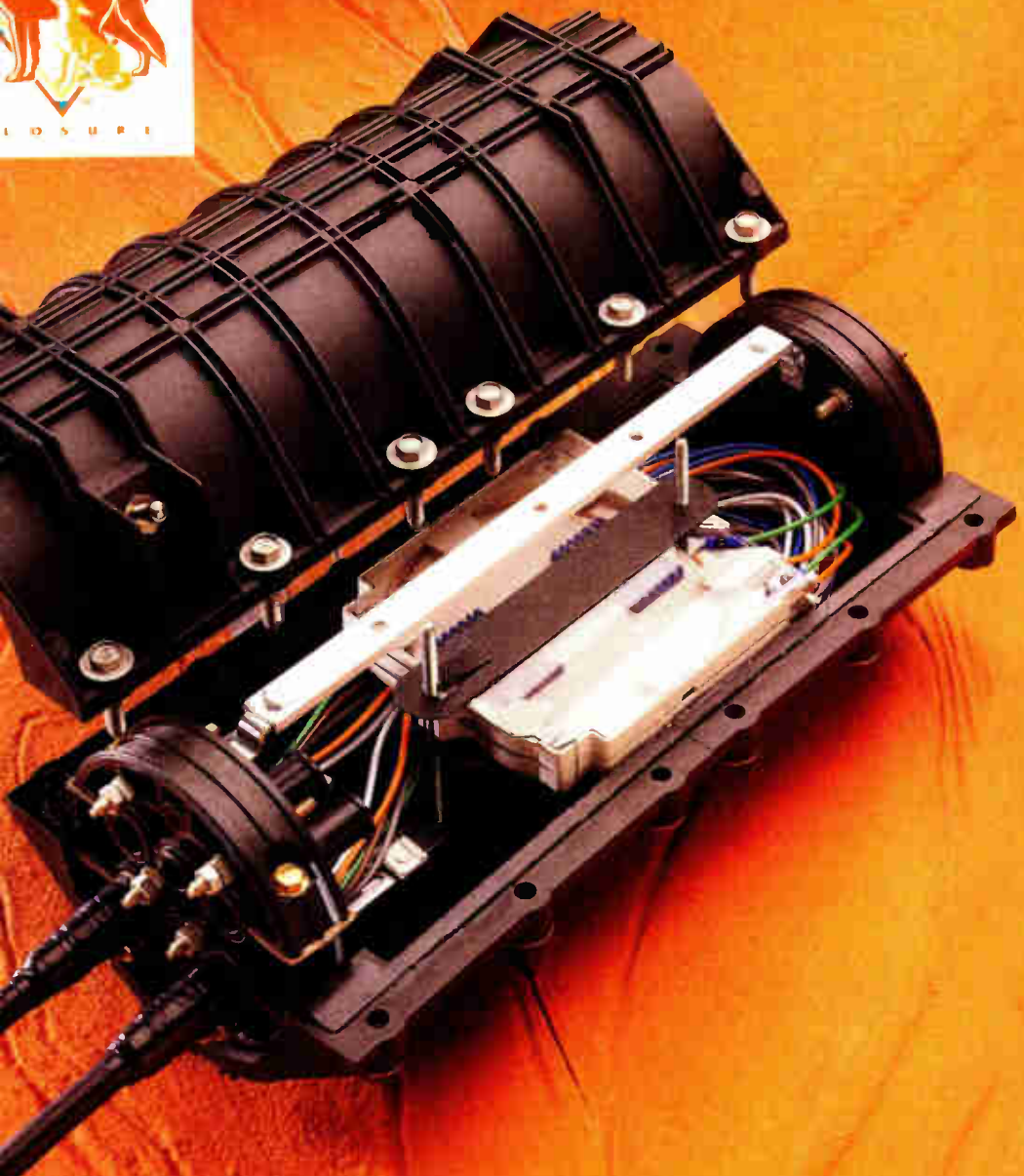
Introducing the COYOTE PUP Closure, the compact closure for low fiber count applications.



Customers loved our COYOTE® Closure so much they asked us to breed another - only smaller.

And so was born the COYOTE PUP Closure (measuring 6" x 17"), the perfect choice for distribution applications of up to 48 fiber splices.

The COYOTE PUP Closure features the same proven design of its larger forebear - durable thermoplastic shells, permanent neoprene gasketing, LOCK-TAPE™ Sealing System, unique fiber management system. Plus, most of its accessories are the same, too, minimizing your need for additional part numbers and inventory. And this compatibility also means that your COYOTE PUP Closure can be expanded to a larger closure at minimal cost.

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ready engineering, permitting, "AutoCAD" capabilities); number of full-time employees; percentage of contract labor utilized for all contract commitments; facilities data (total office space, warehouse space, manufacturing space, outside yard space in square footage); equipment (ask for a current list of all construction equipment, underground and/or aerial, vehicles and test equipment); and

> "The trouble operators sometimes have is finding the right [contractor] with the right expertise. Take measures to ensure a good selection."

computer capabilities (to include names and versions of software used to perform the following tasks: word processing, spreadsheets, database, telecommunications, CATV design, CAD drafting software and tape back-up system).

- Experience and references: Completed contracts (dollar values of the three largest contract commitments completed during the last three years, including the customer's name, contact person and corresponding phone number for each contract commitment); business references (within the last 10 years, has the company engaged in business under a different company name, and have they worked for your company before either as an employee or subcontractor?); litigation (has the company been involved in any litigation with other cable operators within the last five years, or has the company, or any principal of the company, ever been a party to a civil proceeding in which the company was held liable for any of the following: anti-trust violations, securities laws violations, Federal Communications Commission regulations violations, false/misleading advertising?).
- Financial information: Ask for financial statements and balance sheets from the last three years.
- Safety information: Ask the company to provide you with copies of their Occupational Safety and Health Administration 200 logs for the past five years; safety meeting attendance sheets for the past 12 months; safety manual and written safety program; experience modification rate (EMRs) for the past three years; company drug policy and alcohol abuse policy and program.
- Geographic preference: What geographic area does the company want to be considered for contract work?

Once the completed questionnaires are returned, review by an approval team, which could consist of project managers, system engineers and corporate engineers. A grading matrix can be developed for evaluation. This matrix should include a weighted scoring system to emphasis the important items included in the questionnaire. With the completion of these evaluations you have narrowed the field of contractors.

Contract design firms

If design contractors are needed, you would want to evaluate some of their work. Provide the design house(s) with a test design to complete of about five miles. Also, have them supply 10-15 miles of sample mapping. Verify they can convert outdated mapping to corporate standard platform (AutoCAD to Microstation or vice versa). This will allow you to evaluate their ability to provide consistent, cost-effective, quality design and mapping.

Due diligence trip

Due diligence trips are performed on all contractors that have been qualified through the questionnaire approval process to verify the information provided is accurate. Schedule a visit to the contractor's corporate office and to an active project in progress that is similar to the proposed projects to bid. Use their completed questionnaire as a template for verification processes. ➤

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West—Tel. 602/963-2678 Fax. 602/899-1937
www.oldcastle-precast.com

Verify ownership

Ask for documentation on ownership in the company. This will assure you that there is not a partnership with anyone who has been removed from a project within your corporation (someone who has worked for you in the past, who you would not want to work for you in the future).

Verify the following:

- Capabilities: Verify the contractor is capable of completing all functions as described in their questionnaire.
- Employees and subcontractors: Ask for a current employee list and a current list of subcontractors used.
- Facilities and office staffing: Are the contractor's facilities adequate to support the workload? Do they have an office or are they conducting business out of a private residence? Are the offices adequately furnished and staffed to perform administrative support to the company's business and the project's needs both at the corporate level and at the project level? Ask for an organizational chart of its corporate office and a typical project. Does the company present a professional appearance?
- Equipment and vehicles: Ask for a current list of all construction and test equipment, and vehicles owned or leased by the company. Is this equipment adequate to complete the functions needed on your project? What is the condition of the fleet? What are the company's procedures for maintaining their equipment? Are the vehicles identifiable with company logos?
- References: Verify contractor's ability to perform high-quality work while keeping up with the project schedule.
- Project management: How does the corporate office support a project? Ask for a description of how they set up a typical project. For example, what is the time frame for start of construction from the time the bid is awarded? Have the company provide you with a flow chart describing the processes from the time design and bill of materials are issued through invoicing. What do their daily production processes look like? How do they manage materials on a typical project? How do they maintain as-builts?
- Safety program: Ask to review their safety manual. Does it include clear goals, enforcement procedures and requirements for the use of personal protective equipment, and a written Hazcom program? How often are safety meetings conducted? How are safety meetings tracked? Evaluate their safety meeting records for the last 12 months.

Ask to see their OSHA 200 logs for the past five years, to include their OSHA 101 logs for the current year. What are their procedures for accident investigations and reporting? Are on-site safety inspections performed and documented? Review the company's drug and alcohol policy.

- Quality assurance program: Are the standards for construction practices delivered by the customer? Does the company have its own set of standards? What are they? What are the safety and technical training requirements for new-

GOT STEREO?

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MTS-2B

SVM450 SVM450

MTS-4 SAP AGC432

Leaming's line of compact STEREO Audio and Video products offers you a way to add the new channels and improved services your customers want, within your existing rack space and budget.

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AUDIO-VIDEO MODULATORS

• **SVM450** - Stereo Audio-Video Modulator, push-button channel selection, built-in BTSC stereo generator, stereo separation > 26 dB, SAW filter, +60 dBmV output, video AGC, BTSC SAP compatible, two per standard RU.

• **MVM450** - Mono Audio-Video Modulator, same specs as above SVM450 without the stereo.

BTSC STEREO & SAP

• **TSD** - BTSC stereo & SAP decoder.

• **MTS-2B** - BTSC stereo generator, AGC, frequency response flat to 15 kHz, dual inputs, one per standard RU.

• **MTS-2C** - BTSC stereo gen., AGC, frequency response flat to 14 kHz, dual inputs, one per standard RU.

• **MTS-4** - BTSC stereo gen., frequency response flat to 14 kHz, dual inputs, three per standard RU.

• **SG-100** - BTSC stereo gen., frequency response flat to 14 kHz, economically priced, three per standard RU.

• **SAP** - Second Audio Program generator, three per standard RU.

FM TRANSMITTERS

• **FMT415** - FM stereo generator, freq. agile from 88-108 MHz, dual inputs, stereo synthesis, three per standard RU.

• **FMT115** - FM stereo generator, freq. agile from 88-108 MHz, three per standard RU.

AUTOMATIC GAIN CONTROL

• **AGC432** - Protects from over/under modulation, controls one stereo pair or two mono channels independently, provides dual inputs, offers three different output modes, three per standard RU.

• **AGC-100** - Controls one stereo pair or two mono channels, operates in Adaptive Slope Mode, economically priced, three per standard RU.

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Reader Service Number 74

hires and for re-qualifying existing employees? How does the company verify training is adequate to meet the standards? What percentage of work do they inspect prior to invoicing? Are these inspections documented? Are vehicle inspections performed? Does the company's corporate staff play a role in an audit-type capacity of their projects?

- Visit to an active project in progress: During your visit to a project site, verify the processes and procedures are as described to you during the office visit. Evaluate whether construction practices and safety requirements are met in the field. A checklist can be developed to evaluate the workmanship and safety requirements for a project.

Contractor database

As contractors are qualified, a database can be developed to track the following information: Name, address and phone; state or geographic area where contractor is willing to provides services; state licensed to work in; contractor capabilities and characteristics; business classification (i.e., corporation, partnership, sole proprietorship, small business or minority/female owned); date company founded; primary and secondary services provided; number of full-time employees; percentage of subcontractors used; financial condition analysis/report; safety information; comments relative to the contractors performance; contractor's customers and contact person covering the last three years of business; and where originally qualified.

RFP process

Your ability to provide a detailed request for proposal (RFP) bid package allows the contractor to better understand what is expected, and to provide the most competitive price. A good rule of thumb is to obtain a minimum of three bids for all labor service contracts. Request bids only from approved contractors.

Send out bid packages a week or two prior to your pre-construction meeting. Bid package should include: Cover letter inviting a contractor to submit a project price quotation; general information and requirements on how the project will be managed; scope of work (detailed explanation of the proposed contract work, including requirements and specifications); project magnitude (an estimate of the quantity of each work element); time schedule (start and completion dates for the project); and contract unit price schedule, which defines all major work functions, such as trenching (for example, machine trench, 18-inch minimum cover, including backfill and restoration requirements), and the appropriate unit of measure for each work function.

Conduct a pre-bid meeting to provide the contractors with pertinent information regarding the project. All contractor expectations should be outlined at this meeting. Key system project people should be in attendance. The pre-bid meeting should be well organized. The following topics should be discussed:

- General information
- Safety program
- Quality control (QC) program
- Construction specifications
- Technical specifications
- System design: Current architecture vs. proposed architecture. How current are the as-built maps? When was last walk-out performed?

For fiber, what is the proposed amount of fiber placement? What is the average number of splice locations? What are the splice and performance specifications?

For coax construction, what is miles over lashed vs. rebuild? What are retrofit miles? For cable types, what is being replaced? What are the replacement processes?

For powering, consider the transition from 60 to 90 volts. What about non-metered power supplies converted to metered power supplies? What is the availability of support by the power company? What type of permitting is required?

- Scopes of work: Rebuild vs. retrofit vs. upgrade vs. installs vs. MDUs.
- Build rate: Realistic forecast of the project. For example, the project is budgeted to complete 50 miles per month for 52 months. Also consider project startup and completion concerns. What are the available times during the day that work and planned outages can be performed?
- Permitting: Know what types of permits are required to complete the project—railroad, Department of Transportation, city, county, pole attachment agreements, power company agreements and right of entry (multiple dwelling units). Are contractors required to be licensed to work in the state? Understand and

obtain clarification on the interpretation of the permit contracts. For example, are "guided tunneling techniques" required?

- Locates: Local locate services are able to provide a 72-hour window for locates under normal conditions. Depending on the magnitude of the project, this normal 72-hour service might be adjusted to a four- to five-day window. This affects build rate, so plan accordingly.
- Contracts: Define invoicing procedures. Make sure "accepted work" is defined. For example, what is the definition of a finalized node? Does it include as-builts, material reconciliation and performance acceptance? What are the requirements for subcontractors? Weekly project meetings need to be defined as does clean up, safety program and QA program.
- Complaints: A written complaint resolution procedure should be submitted with the contractor bids, including complaint logs, follow-up procedures to ensure satisfactory resolution, and communication procedures with system personnel.
- Outages: A written on-call procedure that describes how outages and service impairments will be handled by the contractor, to include response times.
- Question and answer session: All questions (and your responses) should be submitted in writing by the contractor. All questions and answers should be distributed to everyone in attendance at the pre-bid meeting since this becomes part of the bid document.
- Handouts prepared for pre-bid meeting: Map of the area to be bid. (Highlight areas that represent typical work to be completed. This will allow the contractor to drive out to the system to provide a more accurate bid). Also include an overview of the project broken down by phase (fiber miles, coax miles, rebuild miles, retrofit miles, upgrade miles, MDUs, installation work, projects' daily production schedule, construction schedule, and budgeted miles per month).

Bid packages returned

Bids should be returned to a system contact, who tracks bids. Ensure the contractor information is complete.

Analysis and evaluation

The system review team should independently evaluate each bid. A grading

matrix can be developed in order to evaluate the contractors. The selection of the contractors should be based on predetermined criteria. For example:

- Overall, does the contractor's proposed solution meet the project needs in a cost-effective, timely and appropriate manner?
- What is the contractor's total cost estimate? Is it competitive? How does it compare to the project's budget?
- Does the contractor's proposal meet or exceed your company's standards, quality of workmanship, customer support and professionalism?
- Do the proposed staffing levels appear reasonable?
- Does the contractor meet the required safety standards?
- Can the contractor meet the schedule?
- How is the contractor's previous track record with your company?
- Does the contractor have the required insurance?

Once each team member has independently evaluated the bids, the entire team should meet to discuss, evaluate and rank the contractors. Use the matrix to mathematically weigh each criteria item and quantitatively evaluate each contractor's proposal using the weighted criteria. Discuss both the group and individual selection rankings as a team. The system team should provide the corporate review team with a recommendation.

Contract administration

Once a decision has been made to accept a bid, a contract must be signed. Contracts usually are secured through the legal department. Review the contract with the contractor. Both parties need to sign the contract. Incorporate work modifications, as necessary. Keep it on file, as required.

The author would like to thank Tim Calamusa, project manager for Jones Intercable in Independence, MO, and Andy Healey, corporate director, engineering department, Cablevisions Systems, for their assistance with this article. CT

Bobby Rouchleau is network quality assurance/construction manager for Jones Intercable. He may be reached at (303) 792-3111.

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registration package

Society of Cable Telecommunications Engineers

Denver Convention Center

June 10-13, 1998

Exhibit Dates: June 10-12, 1998

THE FACTS ABOUT CABLE-TEC EXPO® '98

DATES

Registration and Pre-Conference Sessions, June 9, 1998
Annual Engineering Conference, June 10, 1998
Technical Workshops, June 11-12, 1998
Exhibits, June 10-12, 1998
Certification Testing, June 13, 1998

LOCATION

Denver Convention Center
Denver, Colorado

HISTORY

Cable-Tec Expo® '98 is the 16th annual convention/trade show sponsored by the Society of Cable Telecommunications Engineers. The show has proven to deliver the latest information on technological advancements and applications in a format that provides training through technical workshops and instructional hardware exhibits.

The Annual Engineering Conference will be SCTE's 22nd yearly conference dedicated to current engineering issues, including digital technology and data transmission over broadband telecommunications systems. 1998 marks the 29th anniversary of the Society as a leader in technical training for the industry, with this year's Expo offering additional opportunities for exposure to the newest trends in the expanding telecommunications arena.

PROGRAM

The Annual Engineering Conference consists of three hours of panel discussions by the industry's leading visionaries. The annual membership meeting, held Tuesday afternoon, will afford attendees the opportunity to meet with members of SCTE's national Board of Directors and local Chapter representatives.

Cable-Tec Expo® follows the Engineering Conference, and is comprised of technical workshops offering interactive training combined with hardware displays on the exhibit floor. The workshops, practical in nature, feature presentations dealing with the proper design, operation and maintenance of broadband telecommunications systems. No other activities are scheduled during these sessions in order to guarantee maximum participation.

ATTENDANCE

Attendance is open to individuals within the CATV industry as well as those involved in broadband telecommunications who wish to capitalize on the opportunity to learn about the latest industry developments. Over 4,000 registered attendees are expected from all levels of cable television, telecom and related businesses, including non-technical professionals.

TRAINING

As with all SCTE programs, the main purpose of Cable-Tec Expo® '98 is to provide the maximum amount of training opportunities for the lowest possible cost. The event has been coordinated to fulfill this purpose, as it offers a wide variety of informative, up-to-date technical training programs. Additionally, Expo '98 will give attendees the opportunity to prepare for and participate in the Society's Broadband Communications Technician/Engineer (BCT/E), Service Technician and Installer Certification Programs, gaining valuable knowledge and practical skills in the process.

Exhibits

The exhibit floor has a focus on education, with many industry suppliers presenting live technical demonstrations of their products. Over 375 hardware exhibitors are expected to reserve space on the Expo '98 Exhibit Floor. Exhibits will include all types of products, supplies, services and equipment used in the design, construction, installation, repair, maintenance and operation of broadband telecommunications systems. The exhibit floor will also feature a Technical Training Center for additional hardware and test equipment demonstrations.

REGISTRATION

Complete and return the official Attendee Registration Form. Use a separate form for each attendee. Photocopies are accepted. SCTE will not accept registrations by phone.

Payment must accompany forms in order to be processed. SCTE will accept registrations by FAX only when paid by credit card. If forms are faxed, ***do not mail the original***.

Non-members wishing to join SCTE may complete the included membership application and submit it with the registration form. Individuals submitting a completed membership application with payment are eligible for SCTE member registration rates. Annual member dues are $40 within North America, and $60 for International Membership.

Registration Types

Full Registration: Includes Pre-Conference Sessions, Engineering Conference, Technical Workshops, Exhibits and Annual Awards Luncheon.
Expo Only: Admittance to Technical Workshops and Exhibits.
Spouse Registration: Includes Pre-Conference Sessions, Conference, Workshops, Exhibits and Annual Awards Luncheon.

Pre-Registration

DEADLINE: MAY 1, 1998
Registration forms with payment must be received at SCTE prior to this date. Forms received after May 1 will not be processed and individuals must register on-site in Denver at the on-site rate.

Cancellations/Substitutions

DEADLINE: MAY 8, 1998
All requests for cancellation must be received in writing prior to MAY 8. All requests for cancellation will be subject to a $75 cancellation fee. *No refunds will be given after May 8.*

All requests for substitutions must be received in writing prior to MAY 8. After this date, substitutions must be processed on-site at the Registration Assistance Booth. Written company authorization and a $5 processing fee are required.

Dress Code

Since the primary purpose of Cable-Tec Expo is education, we urge you to dress in a manner that is comfortable and conducive to your getting the most out of the program (slacks, jeans, short sleeve shirts – NO shorts or tank tops).

Registration Fees

	PRE-REG Until 5/1/98 Member/Non	**ON-SITE**** After 5/1/98 Member/Non
Engineering Conference and Expo*	$260/$360	$320/$420
EXPO only	$210/$310	$270/$370
Spouse Registration*	$95/$95	$95/$95

* Includes ticket to the Awards Luncheon on June 10. Additional luncheon tickets are available for $35 each.

** Admittance to the Awards Luncheon is not guaranteed, but will be made available as seating permits.

EXPO HOTLINE: 610-363-3822

Admission

Admission to all events will be through color coded badges. Badges are to be picked up at the registration desk upon arrival.

Transportation

SCTE has made special arrangements for discounted airfares to Cable-Tec Expo. Please call Becky Stevens of World Travel at 1-888-464-3639. For US Airways, refer to Gold File #57650582; for United Airlines, refer to #5205A. For car rentals, contact Enterprise Rent-A-Car at 1-800-720-7222 (Denver International Airport location) or 303-293-8644 (Downtown Denver location), and refer to Customer #C14071.

Entertainment

The Denver Visitors Bureau will maintain a booth in the Convention Center and can make reservations for area attractions, dining, nightlife and sightseeing activities.

Attractions

COORS FIELD • DENVER ZOO • DENVER MUSEUM OF NATURAL HISTORY • COLORADO RAILROAD MUSEUM PARK MEADOWS MALL • COORS BREWING COMPANY • BUFFALO BILL'S MEMORIAL MUSEUM AND GRAVE • BUTTERFLY PAVILION AND INSECT CENTER • BLACK AMERICAN WEST MUSEUM AND HERITAGE CENTER

Hotel Reservations

Reservations will be accepted only with paid attendee registration forms. No reservations will be accepted by phone. Hotels are assigned first come, first served based on availability. Every effort will be made to honor your hotel request. However, SCTE reserves the right to place your reservation where rooms are available.
Housing reservations (with accompanying attendee registration form) must be received by MAY 1, 1998.

Hotel Deposits and Guarantees

Hotels require one night's deposit plus tax in order to guarantee rooms. *Therefore, SCTE will accept housing reservations by credit card ONLY.* Credit card information must be filled out completely. Failure to complete all information will delay the processing of reservations. SCTE and the Denver Housing Bureau are not responsible for the cancellation of reservations due to failure to follow hotel deposit procedures.

Confirmations

You will receive written acknowledgement of your Expo hotel registration from The Denver Housing Bureau. Confirmation of hotel reservations will be sent to you directly from the assigned hotel.
Do not call SCTE for hotel confirmation numbers.

Cancellations and Changes

Hotel cancellations must be received in writing by SCTE prior to MAY 1. Between May 1-8, changes or cancellations must be made through the Denver Housing Bureau at (303) 892-1112, ext. 601. After May 8, cancellations must be made directly with the hotel. After May 8, you may call the Denver Housing Bureau for guest room availability.

Please be sure to read your specific hotel's cancellation policies carefully. SCTE and the Denver Housing Bureau are not responsible for penalty charges incurred by failure to follow hotel procedures.

Photo of the Denver Convention Center courtesy of Denver Metro Convention and Visitors Bureau.

Expo '98 Preliminary Program

Pre-Conference Sessions

Tuesday, June 9, 1998

- *LAN/WAN Basics and the Transport of High Speed Data in CATV Networks*—Robert Harris, ADC Broadband
- *Basics of Cable Modems and MCNS*—Doug Jones, MediaOne
- *Components of Digital - An Introductory Course*—Patrick Harshman, Harmonic Lightwaves; Jay Junkus, KnowledgeLink; and Marv Nelson, SCTE

Annual Engineering Conference

Wednesday, June 10, 1998

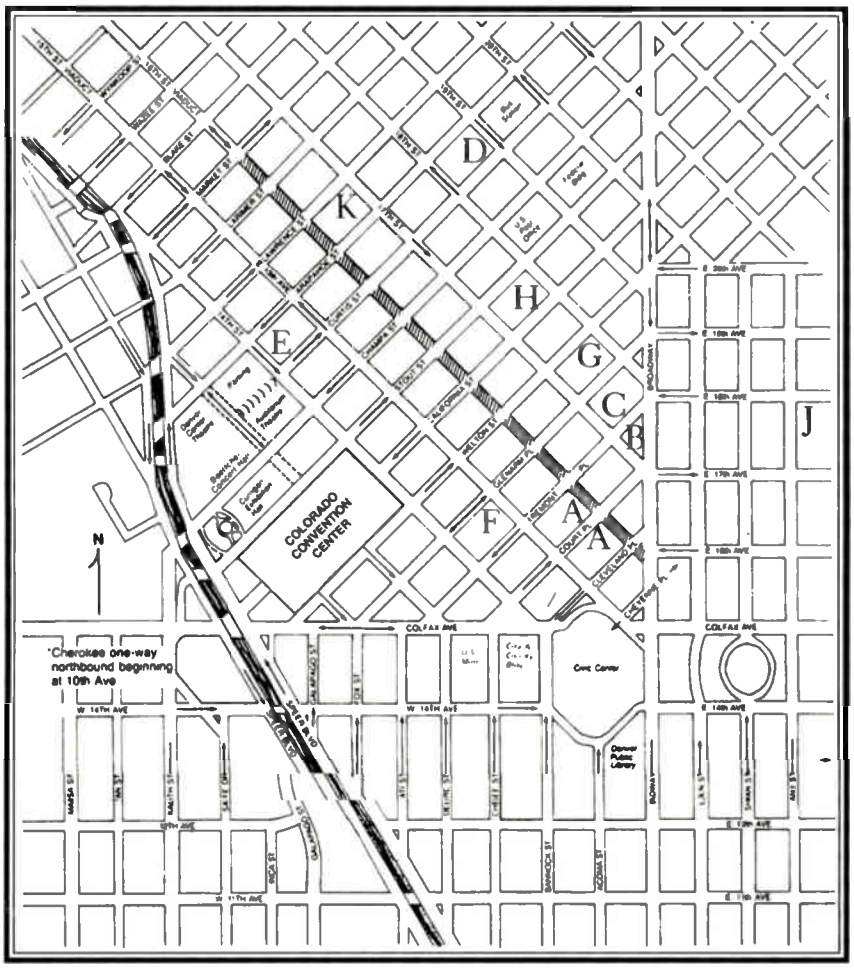
- *SESSION A: A Vision of the Future - Discussion with Industry Leaders*—Dick Green, CableLabs (Moderator); Dr. John Malone, TCI; Plus additional CEOs from CableLab's Board of Directors
- *SESSION B: Technology and Operations - Implementing the Vision*—Chris Bowick, Jones Intercable (Moderator); Alex Best, Cox Cable; Jim Chiddix, Time Warner Cable; Tony Werner, TCI; and Bud Wonsiewicz, MediaOne

Expo Workshops

Thursday-Friday, June 11-12, 1998

- *Return Path Testing*—Tom Staniec, Time Warner; and Dean Stoneback, General Instrument Corp.
- *Return Path - Ingress Mitigation*—Paul Brooks, Time Warner Cable; Earl Manchester, US West/MediaOne; and Thomas Williams, Holtzman Engineering
- *Return Path - Design, Components and Alignment*—Eric Schnettler, Philips Broadband Networks; and Lamar West, Ph.D., Scientific-Atlanta
- *HFC Architectures*—John Dahlquist, Harmonic Lightwaves; Jason Shreeram and Don Sipes, Scientific-Atlanta
- *Excellence Through Customer Service*—Tom Coyle, American Cablevision; Kim Eleck, NCTA; Jim Ewalt, CATA; and Mike McGrail, CableData Inc.
- *Powering Issues*—John Chamberlain, Norscan Inc.; and Thomas Sloane, Alpha Technologies
- *Network Management/Status Monitoring*—Myron Hood and Jeff Schmitz, Tellabs; and Terry Poindexter, Superior Electronics
- *Regulatory Update, EAS*—Frank Lucia and John Wong, FCC; and Steve Ross, Ross and Hardies
- *Digital Video Deployment*—Jerry Harris, Tektronix; Joe Waltrich, General Instrument Corp.; and Rich White, Cox Communications Inc.
- *Digital Services Provisioning*—Ken Ditto, Tektronix

Expo Hotels



Note: All rates are per night, 11.8% Room Tax not included. To inquire about suite availability, call SCTE at 610-363-3822.

A **Adam's Mark Hotel** (Single: $143, Double: $158, Club Single: $178, Club Double: $193)—Colorado's largest hotel. Two restaurants, one lounge; health club, sauna, and outdoor heated pool.

B **Brown Palace Hotel** (Standard: $142, Superior: $153, Deluxe: $164)—National historic landmark and four-star hotel. Three restaurants, two lounges. Eight-story atrium lobby.

C **Comfort Inn Downtown Denver** (Single: $87, Double $98, Triple $113)—Complimentary cable TV, valet parking. Dual phone lines with fax/modem capability. Directly connected to the Brown Palace Hotel with reciprocal dining privileges.

D **Embassy Suites Hotel** (Single: $169, Double: $179, Triple: $189, Quad: $199)—Two restaurants, one lounge, athletic club with indoor pool.

E **Executive Tower Inn** (Single: $115, Double $125)— Two restaurants, one lounge; athletic club with indoor pool, steam room, sauna and whirlpool.

F **Holiday Inn Denver Downtown** (Single: $97, Double: $100, Triple: $110, Quad: $120)—Restaurant, lounge, exercise room and rooftop outdoor
swimming pool.

G **Hyatt Regency Denver Downtown** (Single: $137, Double: $154, Club Single: $162, Club Double: $179)— One restaurant, one lounge; rooftop mini-resort with swimming pool.

H **Denver Marriott City Center** (Single: $138, Double: $148)—Three restaurants, fitness center with indoor pool, whirlpool and sauna.

I* **Renaissance Denver Hotel** (Single: $123, Double: $123)—One restaurant and one lounge; fitness center with indoor/outdoor pool, sauna, steam room. Note: SCTE will provide complimentary transportation between the Renaissance and the Colorado Convention Center.

J **Warwick Hotel** (Single: $115, Double: $125)—Complimentary features include transportation around downtown area, breakfast buffet and health club.

K **Westin Tabor Center** (Single Deluxe: $143, Double Deluxe: $143, Single Executive: $173, Double Executive: $173)— Two restaurants, one lounge; health club with heated indoor/outdoor pool, hot tub, saunas.

** The Renaissance Denver Hotel is located on Quebec Street, near the former Stapleton Airport.*
SCTE will provide complimentary shuttle service between the Renaissance Denver Hotel and the Denver Convention Center.

EXPO '98 SCHEDULE OF EVENTS

	REGISTRATION	TRAINING	EXHIBITS	TESTING	SPECIAL EVENTS
TUESDAY, JUNE 9	Attendee Registration 1 - 7 p.m.	Pre-Conference Sessions 2 - 4:30 p.m.			SCTE Engineering Subcommittee Meetings 2 - 4 p.m. SCTE Annual Membership Meeting 4:30 - 5:30 p.m. Arrival Night Reception 6 - 8 p.m.
WEDNESDAY, JUNE 10	Attendee Registration 7:30 a.m. - 5 p.m.	Annual Engineering Conference 8:30 a.m. - Noon	Exhibit Hall Open 2 - 6 p.m.		Awards Luncheon 12 noon - 2 p.m. Expo Evening with Cable-Tec Games 6 - 8 p.m. *(Sponsored by Antec, CommScope, General Instrument, Philips Broadband Networks and Scientific-Atlanta)*
THURSDAY, JUNE 11	Attendee Registration 7:30 a.m. - 5 p.m.	Expo Workshops 8 a.m. - 12:15 p.m.	Exhibit Hall Open 11 a.m. - 6 p.m.	Certification Testing 10 a.m. - 2 p.m.	Individual Hospitality Events
FRIDAY, JUNE 12	Attendee Registration 7:30 a.m. - 3 p.m.	Expo Workshops 8 a.m. - 12:15 p.m.	Exhibit Hall Open 11 a.m. - 4 p.m.	Certification Testing 10 a.m. - 2 p.m.	Exhibitors' Reception 3 - 4 p.m. Closing Night Reception 6 - 8 p.m. Ham Radio Operators' Reception 6 - 8 p.m. SCTE List Reception 6 - 8 p.m.
SATURDAY, JUNE 13				Certification Testing 9 a.m. - 12 noon	Golf Tournament 7:30 a.m. - 2 p.m. Tours of CableLabs, TCI's Digital TV Center, NCTI and the National Cable Television Center and Museum 9 a.m. - Noon

CABLE-TEC EXPO® '98 EXHIBITORS

(AS OF FEBRUARY 20, 1998)

3 Com
A.B. Chance Co.
ABC Cable Products
ACP International
ACT Communications Inc.
ADC Telecommunications Inc.
AM Communications
AML Wireless Systems
AMP
ATCi
AVO International
AWC/US Fiber Optics Inc.
Action Triangle Inc.
Adams Global Communications
Adrian Steel Co.
Advanced Custom
Alcatel
Alcoa Fujikura Ltd.
Alpha Technologies
Altec Industries Inc.
Aluma-Form/Dixie
American Allsafe Co.
American Digital Cartography
American Polywater Corp.
Antec
Applied Instruments Inc.
Arcom Labs/Northern CATV
Arena Services Inc.
Arguss Communications Group
Aria Technologies
Arnco Corp.
Arrow Fastener Co. Inc.
Arrowsmith Technologies Inc.
Atlanta Graphic Solutions Inc.
Aurora Instruments Inc.
Avalon Technologies
Avantron Technologies
Avcom of Virginia
Barco Inc.
Bashlin Industries
Bekaert Corp.
Belden Wire & Cable Co.
Ben Hughes/Cable Prep
Blonder-Tongue Laboratories
Broadband Networks Inc.
Budco
C-Cor Electronics Inc.
C-Pro Inc.
C.I.S. Inc.
CADD Services Group Inc.
CATV Subscriber Services Inc.
COM21 Inc.
CT Magazine
CTC Joslyn
Cable AML Inc.
Cable Constructors Inc./KES
Cable Converter Service Corp.
Cable Innovations Inc.
Cable Link Inc.
Cable Resources Inc.
Cable Shoppe Inc.
Cable Source International
Cable Spinning Equipment
Cable Systems Technical Services
Cable Technologies
Cable Yellow Pages
Cabletek Wiring Products
Cabletron
Cadco Systems Inc.
California Eastern Labs
Can-Am Services Inc.
Canusa-EMI
Carlon Telecom Systems
Carson Industries
Champion Products Inc.
Channel Master
Channell Commercial Corp.
Clark Wire & Cable
ComSonics Inc.
CommScope
Communication Associates
Comtek Services
Condux International Inc.
Contec L.P.
Contech Systems Inc.
D.A. Technologies Inc.
D.Co. Marketing Inc.
DX Communications
Data Voice Systems Inc.
Dawn Satellite Inc.
Dialogic Communications Corp.
Digitrans
Dur-A-Lift Inc.
Eagle Comtronics Inc.
Earthvision Systems Ltd.
Eastern/Polotec
Electroline Equipment
Epitaxx
Equipment Technology Inc.
Exfo E.O. Engineering
Exide Electronics/Lectro
FM Systems Inc.
Fiber Instrument Sales Inc.
Fiber Optic Network Solutions
Fiber Trucks & Trailers
Fiberdyne Labs Inc.
Fibertek Inc.
Flight Trac Inc.
Force Inc.
Frontline Communications
GLA International/Design Extender
GMI Rental & Lease Inc.
GMP
GN Nettest-Laser Precision Division
General Instrument Corp.
Gilbert Engineering
Golden State Engineering
Gould Fiber Optics Division
Graybar Electric Co. Inc.
Harmonic Lightwaves
Harris Corp.
Heart Interface Corp.
Hennessy Products
Hewlett-Packard Co.
Holland Electronics
Hukk Engineering
I.C.M. Corp.
ICTV
IMMCO Inc.
IPITEK
ISC Datacom Inc.
Insulation Systems
Integral Corp.
Iris Technologies Inc.
Itochu Cable Services Inc. (iCS)
J.L. Matthews Co. Inc.
JM Telecom Inc.
Jameson Corp.
Jerry Conn Associates Inc.
Jesmay Electronics Co. Ltd.
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Jones Broadband International Inc.
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Klein Tools Inc.
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Mitsubishi Chemical America
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Mobile Tool International Inc.
Molex Fiber Optics
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Norscan Inc.
Nortech Fibronic Inc.
North American Cable
Noyes Fiber Systems
Oldcastle Precast Inc.
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Optigain Inc.
Ortronics Inc.
Osburn Associates Inc.
P-T Technologies Inc.
PCI Technologies Inc.
PPC
PTL Test Equipment Inc.
Panduit Corp.
Paramount Designs Inc.
Passive Devices Inc.
Pelsue Co.
Pencell Plastics Inc.
Peregrine Communications Inc.
Philips Broadband Networks
Photonic Components Inc.
Pico Products Inc./Pico Macom Inc.
Pioneer New Media Technologies
Pirelli Cable & Systems
Plexco
Power & Telephone Supply
Power Conversion Products
Precision Valley Communication
Preformed Line Products
Primus-Sievert Inc.
Progressive Electronics Inc.
Pyramid Industries
Qintar Inc.
Quality RF Services Inc.
Quintech Electronics & Communications
R.L. Drake Co.
RDL Inc.
RF Networks Inc.
RTK Corp.
Radiant Communications, Corp.
Radiodetection
Raychem Corp.
Reltec
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Scott Cable Communications
SeaChange International
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Siecor Operations
Sigma Electronics Inc.
Signal Vision
SkyConnect
Smith Advanced Technology Inc.
Sprint/North Supply
Standard Communications Corp.
Stanford Telecom
Steelweld Equipment Co. Inc.
Strongwell (Quazite Products)
Sumitomo Electric Lightwave
Superior Electronics
Synchronous Group Inc.
Synertech Moulded Products
TVC Inc.
TW Com Corp.
Taco/Wade Antenna Products
Tailgater Inc.
Tektronix Inc.
Telecrafter Products
Telephony Magazine
Tellabs
Tempo Research Corp.
Terayon Communication
Terra Tape
Thomas & Betts Corp.
Time Manufacturing Co.
Times Fiber Communications Inc.
Toner Cable Equipment Inc.
Toshiba America Info. Systems, MSD
Transtector Systems Inc.
Trilithic Inc.
Trilogy Communications Inc.
Triple Crown Electronics
Tulsat
Tyton Hellermann
U.S. Cable Inc.
U.S. Electronics
Universal Electronics
Vanner Power Group
Video Data Systems Inc.
Videotek Inc.
Viewsonics Inc.
W.L. Gore & Associates Inc.
WISI-Wilhelm Sihn, Jr., KG
Walker & Associates
Wavecom Electronics Inc.
Wavetek
Wegener Communications Inc.
Worldbridge Broadband Services
Zenith Electronics Corp.

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS

140 PHILIPS ROAD • EXTON, PA 19341-1318 • EXPO HOTLINE: 610-363-3822

OFFICE PHONE 610-363-6888 • FAX 610-363-5834 • SCTE WEBSITE: HTTP://WWW.SCTE.ORG

CABLE-TEC EXPO® '98
ATTENDEE REGISTRATION FORM

Registration Instructions

- SCTE will accept registrations by fax *only* when paid by credit card. Please *do not* mail original if already faxed.
- Registrations received after May 1 will not be processed. After May 1, attendees must register on-site at the on-site rate.
- Name substitutions must be received in writing at SCTE prior to May 8. After that date, substitutions must be processed on-site at the Registration Assistance Booth accompanied by a $5 processing fee and written company authorization.
- Registration forms accompanied by a completed SCTE membership application and dues payment are eligible for the member rate.
- Sustaining membership qualifies only the individual named on the membership to register at the member rate.
- SCTE will send written acknowlegement of your attendee registration.

Badge Information

Complete a separate form for each registrant. Photocopies are accepted. Do not use this form to register exhibitor personnel.

Please TYPE.

Name: _____ Nickname: _____

Title: _____ Company: _____

Address: _____

Street/P.O. Box City State Zip

Phone: (____)_____ Fax: (____)_____

E-Mail (PLEASE TYPE): _____

SCTE Member #: _____ Amateur Radio Code: _____

Registration Fees

	Pre-Registration Until May 1, 1998		On-Site After May 1, 1998		
	Member	Non-Member	Member	Non-Member	
Engineering Conference and Expo	$260	$360	$320	$420	$ _____
Expo Only	$210	$310	$270	$370	$ _____
Spouse Registration	$95	$95	$95	$95	$ _____
Spouse's Name (First, Last): _____					
Additional Luncheon Tickets @ $35 each					$ _____
				Total Enclosed:	$ _____

Method of Payment

Fees are payable to SCTE by check (in U.S. dollars), Visa, MasterCard, or American Express. Registration fees or credit card information must accompany this form in order to process registration. Please do not include hotel deposit with payment.

❑ Check ❑ Visa ❑ MasterCard ❑ American Express

Credit Card Number: _____ Exp. Date: _____

Cardholder's Name: _____ Cardholder's Signature: _____

For SCTE Use Only

Date Received: _____ Date Processed: _____ Amount Received: _____

SCTE Member: ❑ Yes ❑ No Membership fee included: ❑ Yes ❑ No

Batch #: _____ Check #: _____ ❑ Visa ❑ MC ❑ AmEx

CABLE-TEC EXPO® '98
ATTENDEE HOUSING FORM

HOUSING INSTRUCTIONS

- Housing reservations are accepted only with paid Expo registrations. Registration forms with payment and hotel reservation requests must be received by SCTE by May 1, 1998. Hotels are assigned first-come, first-served based on availability.
- A deposit of one night's room rate plus tax must accompany reservation request. Rooms must be guaranteed by credit card only. Please fill out complete credit card information below.
- Housing acknowledgements will be sent by the Denver Housing Bureau.
- All cancellations, substitutions or changes must be submitted in writing to SCTE prior to May 1. Between May 1-8, changes or cancellations must be made through the Denver Housing Bureau at (303) 892-1112, ext. 601. After May 8, 1998, cancellations must be made directly with the hotel. After May 8, you may call the Denver Housing Bureau for hotel availability.

ATTENDEE INFORMATION

Complete a separate form for each reservation. Photocopies are accepted. Do not use this form to request an exhibitor room block. Housing acknowledgements will be faxed between the hours of 11:00 P.M. and 4:00 A.M. Mountain Time.

-Please TYPE.

Name: _____ Nickname: _____

Title: _____ Company: _____

Address: _____
Street/P.O. Box City State Zip

Phone: (____)_____ Fax: (____)_____

E-Mail (PLEASE TYPE): _____ SCTE Member #: _____

HOTEL OPTIONS

Please rank your hotel preferences from 1-11.

___ Adam's Mark Hotel
___ The Brown Palace Hotel
___ Comfort Inn Downtown Denver
___ Denver Marriott City Center
___ Embassy Suites Hotel & Athletic Club at Denver Place
___ Executive Tower Inn
___ Holiday Inn Denver Downtown
___ Hyatt Regency Denver Downtown
___ Renaissance Denver Hotel
___ The Warwick Hotel
___ The Westin Tabor Center

ATTENDEE ACCOMMODATION INFORMATION

Arrival Date (Day and Time): _____ Departure Date (Day and Time): _____

Room type requested: ❑ Two Double Beds ❑ King Size Bed

Number of persons sharing room: _____ Name(s): _____

Special Requests (honored when possible): _____

PAYMENT INSTRUCTIONS:

You must guarantee your room reservation by providing credit card information and signature below.

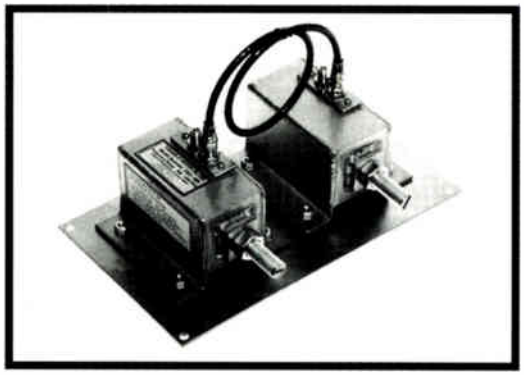
❑ Visa ❑ MasterCard ❑ American Express

Credit Card Number: _____ Exp. Date: _____

Cardholder Signature: _____ PRINT Cardholder Name: _____

Return completed registration and housing forms with appropriate fees to:
SCTE • 140 Philips Road • Exton, PA 19341-1318 • Or fax to: 610-363-5834
Expo Hotline: 610-363-3822

TVRO Filter



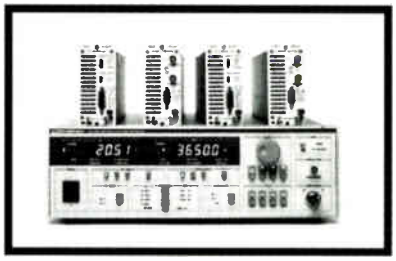
Communications & Energy Corp.'s CEC-459D is a two-cavity bandstop filter for suppressing interference in the TVRO block down conversion spectrum (950 MHz to 1,450 MHz).

The cavities may be factory tuned to a variety of shaped stopband responses to match the notch response to the interference for best performance. The notch can be factory tuned for symmetry or skewed up or down to save nearby information.

Passband is 950 MHz to 1,450 MHz (exclusive of the stopband), with a typical passband insertion loss of 1 dB, and the notch can be tuned for any center frequency within that range. Notch rejection depends on bandstop width and varies between 25 dB and 40 dB for bandstop widths of 5 MHz to 8 MHz.

Standard connectors are either 75-ohm Type F or 50-ohm Type N, and other connectors are available on special orders. The filter is 18 VDC power passing at 1 ampere.

Reader Service #312

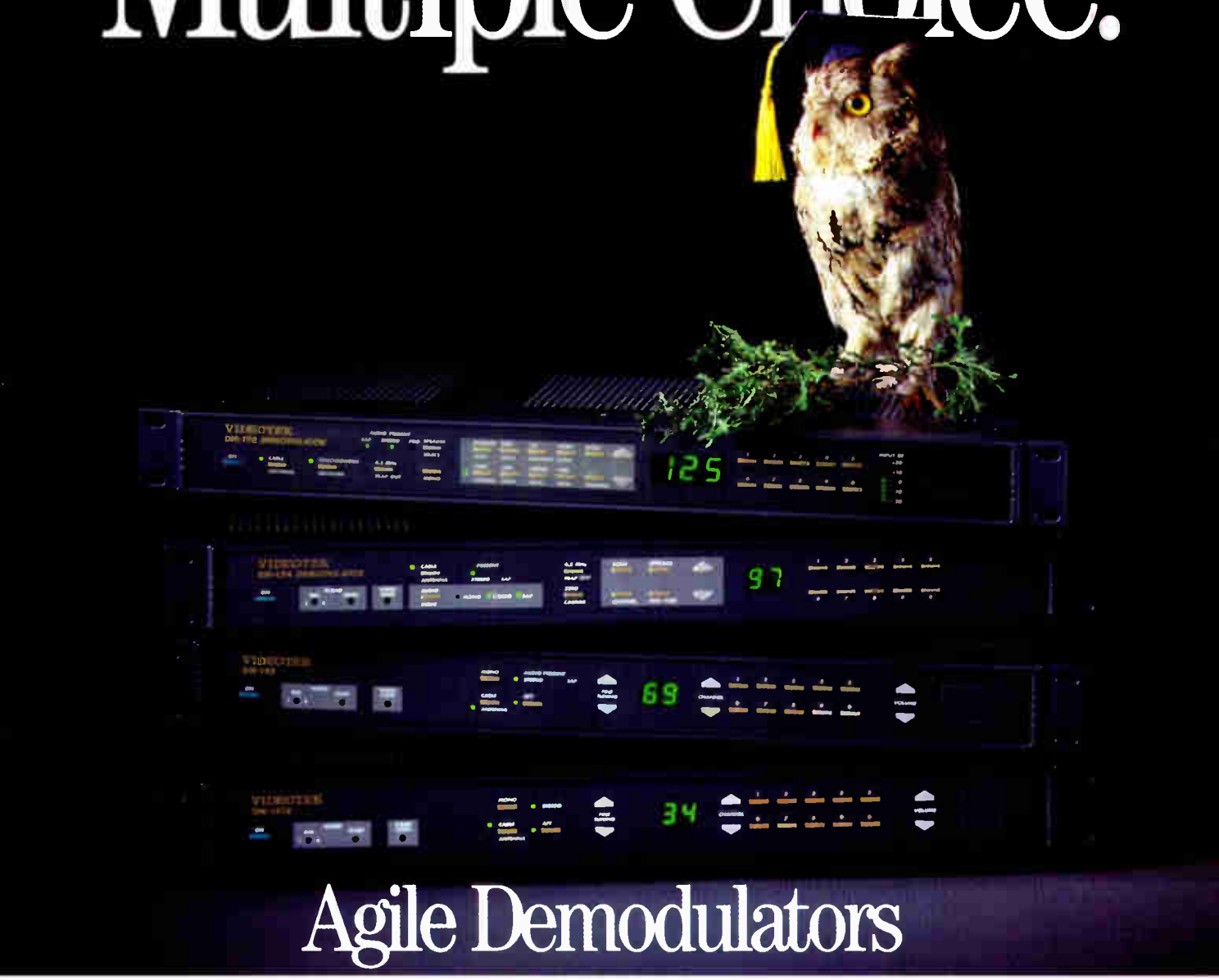


Controller Modules

The ILX Lightwave LCM-39427 and LCM-39437 combination controller modules for the LDC-3900 laser diode controller offer 500 mA or 1,000 mA output current with a 12 W TEC controller in a single bay module. Both modules offer current source modulation over 200 kHz and proven laser diode protection features. The modules are intended for controlling and testing pump laser diodes in EDFA applications.

Reader Service #311

Multiple Choice.



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- *WHO is the largest agile demod supplier in North America?* VIDEOTEK
- *WHO offers a full range of versatile features?* VIDEOTEK
- *WHO combines premium quality & intelligent design with smart prices?* VIDEOTEK
- *WHO offers a FREE 30-day trial?* VIDEOTEK

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Two of the models, the DM-192 and DM-154 have been ***specifically designed*** for FCC compliance testing. For other applications, the DM-145 and DM-141A round out our product family.

Innovation in agile demodulators has been our specialty for two decades, making Videotek the wise choice.

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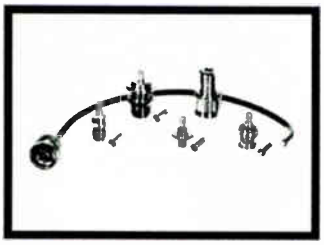
Reader Service Number 82



LMR-195 Connectors

RF Connectors has introduced the LMR-195 cable connectors for the RG-58/U type low-loss coax cable. LMR-195 cable, from Times Microwave Systems, performs with losses comparable to corrugated-copper cable, but at lower cost.

The RFI LMR-195 series of connectors is designed to enhance cable performance in most interfaces: BNC, TNC, N, SMA, MCX, mini-bayonet and Mini-UHF. Many connectors are available in nickel plate, gold plate or silver plate. All are machined brass with gold-plated contacts and Teflon insulation, and custom applications are available by special order. Cable assemblies using the LMR-195 cable and RF connectors are available in stock and custom lengths.

Reader Service #310

SCTE MEMBERSHIP APPLICATION

NAME:_____ PHONE:_____
MSO:_____ FAX:_____
COMPANY:_____ TITLE:_____
ADDRESS:_____
CITY:_____ STATE:_____ ZIP:_____
ON-LINE ADDRESS:_____ HAM RADIO CALL SIGN:_____

Affiliation: ❑ Cable ❑ Telephone ❑ Other:_____

Job Description: ❑ Manager/Administrator ❑ Operations ❑ Financial ❑ Installer ❑ Sales ❑ Construction ❑ Engineer ❑ Technician ❑ Other:_____

Membership Type: ❑ Individual @ $40 ❑ International @ $60* ❑ Sustaining Member Co. @ $250
**Applicants from outside the U.S. include an additional $20 for mailing expenses.*

Make checks payable to SCTE, or include MasterCard or Visa information below. Please make payments in U.S. funds, drawn on a U.S. bank. SCTE is a 501 (c) (6) non-profit professional membership organization. Your dues may be tax deductible. Consult your local IRS office or tax advisor. Additional member material will be mailed within 30 days. Dues are billed annually.

An Individual SCTE member will receive all standard benefits of membership. A Sustaining member is listed under the company name and has one contact person who is afforded all benefits of an individual membership. Sustaining member companies are given discounts while exhibiting at the SCTE Cable-Tec Expo.

Type of Card: ❑ MasterCard ❑ Visa Card#:_____

Exp. Date:_____ Signature:_____

Sponsoring Chapter or Meeting Group:_____

Sponsoring Member:_____

Send Completed Application to: SCTE, 140 Philips Road, Exton, PA 19341-1318 or Fax to: (610) 363-5898

Complimentary Subscription Application

❑ YES! I want to receive/continue to receive a FREE subscription to *Communications Technology*, SCTE's Official Trade Journal. ❑ NO

Signature_____ Date_____
(Signature and date required by U.S. Postal Service.)

B. Please check the category that best describes your firm's primary business (check only one):

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

C. Please check the category that best describes your job title: (check only one)
19. ❑ Corporate Management
20. ❑ Management
21. ❑ Programming

Technical/Engineering
22. ❑ Vice President
23. ❑ Director
24. ❑ Manager
25. ❑ Engineer
26. ❑ Technician
27. ❑ Installer
28. ❑ Sales
29. ❑ Marketing
30. ❑ Other (please specify)

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

Ruggedized Coupler Housing

AWC/US Fiber Optics has introduced the 3 mm pigtailed splitter package, in a 20 mm x 100 mm housing. A grade "A" coupler/splitter in 1 x 2 or 2 x 2 configuration is available with ST, FC or SC "UPC" terminations or unterminated pigtails, all in black anodized, machined aluminum construction.

Reader Service #306

Fiber-Optic Software

EXFO has introduced its IQ software development kit (IQ-SDK), a set of programming tools designed to allow even novice programmers to develop fiber-optic test applications using the IQ-200 optical test system. The kit is built around ActiveX controls for each different fiber-optic instrument and allows programming in Visual Basic, Delphi and Visual C++ environments without any external data bus. The instruments are controlled via Windows OLE automation over an internal personal computer (PC) bus.

The IQ-SDK also includes a Step Wizard and Application Wizard to guide the programming, an instrument simulator to help develop and test applications without occupying valuable hardware and command test utilities to help troubleshoot your system.

Reader Service #308

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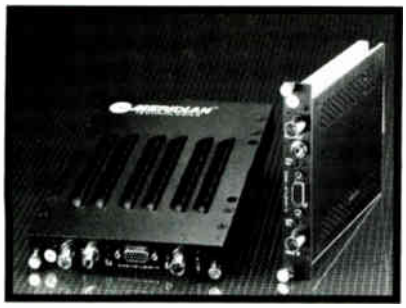
Telecommunications Division

Reader Service Number 83



Single-Fiber System

Designed for video teleconferencing applications, Meridian Technologies' Series 6001 is a frequency modulated fiber-optic bidirectional video, audio and data system on one fiber.

Audio formats include balanced/unbalanced 600, 10 k and 47 k ohm. Data formats include RS-232 and RS-422A.

Multimode versions employ 850/1,300 nm light emitting diodes (LEDs), and laser singlemode versions meet RS-250C medium haul, including 7.5 MHz video bandwidth, greater than 60 dB signal to noise ratio at 25 km up to 36 dB optical budget and 25 dB optical dynamic range. Field units operate on 12 VDC or 24 VAC, and one slot units are rack-mountable in 19-inch subrack.

Reader Service #309

OTDR Tester Upgrade

Hewlett-Packard has announced an upgrade performance test module to extend the dynamic range capabilities of its optical time domain reflectometer (OTDR) test instrument to more than 42 dB. The HP E4324A dynamic range module gives technicians higher measurement resolution when they use it with the HP 8147 OTDR test instrument.

The new module offers a dynamic range of more than 42 dB at 1,310 nm wavelength and 20 µsec pulse width. At 1,550 nm, 41 dB can be achieved, increasing measurement range in field testing. The module provides improved fiber and event characterization even at pulse widths of less than 1 µsec, where it eliminates "ripple on trace" effect.

Reader Service #307

Heterodyne Processor

PDI's processor, the PDI-60AFP, features +60 dBmV output with low spurious response and microprocessor-controlled input tuning for frequency control. It also features nonvolatile channel memories, user-friendly channel selection, wide-output automatic gain control (AGC), standby carrier, composite intermediate frequency (IF) loop-through for Emergency Alert (EAS) insertion, and filtering for trouble-free adjacent channel operation. It is available in fixed output channels 2-78 and A-1 to A-5.

Reader Service #305

BOOKSHELF

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

- *Safety: NEC, NESC and OSHA Regulations*—Your system is subject to heavy fines if you don't have a written policy concerning all aspects of general safety, as well as a hazardous materials program. Ralph Haimowitz, Jim Stilwell and Chris Story discuss safety, National Electrical Safety Code and National Electrical Code requirements. Topics covered include: steps to Occupational Safety and Health Administration compliance, required record keeping, OSHA inspection, most often cited OSHA standards, NESC spacing, ice/wind loading, Span Master program and NEC overview. (70 min.) Order T-1141, $45.
- *Outage Reduction Techniques*—What are our current customers telling us about their need for greater reliability? This presentation by Scott Bachman, Chuck Harris and Mike Miller reports on research conducted by CableLabs and major MSOs. Low-cost techniques for better predicting and identifying potential outages/problems also are discussed. Topics covered include: link between outages and customer satisfaction, number of outages, and automated detection and tracking. (70 min.) Order T-1142, $45.
- *Introduction to Digital Technology*—This program, featuring Kenneth Metz and Randy Reynard, provides an overview of digital technology from both a telephone and video perspective. Topics covered include: analog amplification vs. digital regeneration, analog-to-digital conversion, digital-to-analog conversion, DS1 structure and operation, digital transmission hierarchy and protocols, digital video vs. analog video, advantages/disadvantages, digital video standards CCIR 601 and 656, ANSI/SMPTE 125M, SMPTE 244M and 259M are referenced. (75 min.) Order T-1143, $45. CT

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

Shipping: Videotapes are shipped UPS. No P.O. boxes, please. SCTE pays surface shipping charges within the continental U.S. only. Orders to Canada or Mexico: Please add $5 (U.S.) for each videotape. Orders to Europe, Africa, Asia or South America: SCTE will invoice the recipient for additional air or surface shipping charges (please specify). "Rush" orders: a $15 surcharge will be collected on all such orders. The surcharge and air shipping cost can be charged to a Visa or MasterCard.

To order: All orders must be prepaid. Shipping and handling costs are included in the continental U.S. All prices are in U.S. dollars. SCTE accepts MasterCard and Visa. To qualify for SCTE member prices, a valid SCTE identification number is required, or a complete membership application with dues payment must accompany your order. Orders without full and proper payment will be returned. Send orders to: SCTE, 140 Philips Rd., Exton, PA 19341-1318 or fax with credit card information to (610) 363-5898.

TIMES-LINE

Times Fiber and the Cable Industry Celebrate their 50 Year Anniversary

1948

Times Wire and Cable is Established! First supplier of coaxial cable to the CATV industry.

1968

Times introduces low-loss cables to the industry.

1969

Times introduces copper clad center conductors saving the industry millions of dollars.

1976

Times introduces first commercial fiber optic system for CATV use, installed in NYC, using fiber manufactured by Times.

1978

Times Wire and Cable announces name change to Times Fiber Communications, Inc.

1979

Times advances dielectric state-of-the-art by introduction of low-loss gas-injected foamed polyethylene dielectrics.

Times develops 400 MHz expanded coax for CATV.

1981

Times establishes the world's first fiber optic earth station link.

Times introduces the fiber based MiniHub I.

1983

Times is first to introduce triple bonding for coaxial cable.

1984

Times is first to introduce a full line of CATV coaxial cable with 600 MHz capability.

1985

Times introduces lifeTime, its exclusive non-flowing floodant for aerial, underground and indoor applications.

Times introduces TX low-loss coaxial cable.

1986

Times leads the industry again in introducing a full line of 1GHz cables.

1996

Times is first to develop RF capable 50 Ohm coaxial power cables for the CATV industry.

1998

50 year anniversary of Times Fiber Communications, Inc. and the cable industry.

TIMES FIBER 50 1948 ANNIVERSARY 1998 COMMUNICATIONS INC

Innovation at All the Right Times

TFC

Times Fiber Communications, Inc.
358 Hall Ave., Wallingford, CT 06492
Telephone: 203-265-8500
www.TIMESFIBER.com

Continued from page 58

Other buttons on the site include industry statistics, lists of organizations and a chat forum.

Ben's Cable Box

For those who want to roll their sleeves up and get a little cyberdirt under their fingernails, there's Ben's Cable Box at www.geocities.com/SiliconValley/Park/3254/cabletv.htm.

It's obvious that Ben is extremely proud of being a "Cable Guy" by the amount of time he must spend on the upkeep of this site. His efforts have been rewarded with several "hot site" accolades.

Ben's a cable TV field technician and says: "I'm gonna try to use my site to hopefully enlighten you folks about that little black wire. How you can hook things up to it. How to find and fix your problems."

Answers to frequently asked questions (FAQs) about cable basics, connections and problems are offered on the Cable Box. Also available for the low, low price of a click are wiring diagrams and tricks-of-the-trade tips.

Taking it a bit further, Ben put together an interactive CATV problem locator. By answering simple yes or no questions in a flow chart format, an installer/tech can use this as a resource when stumped on an install or repair question.

If that's not enough, there's "Ask the Cable Guy" at the Cable Box. Ben will use his field knowledge to answer tech questions via e-mail. Tell your technical staff about this site.

Cable Addicts

Welcome to the CABL Bar at the Cable Addicts Broadband Lounge (www.cabl.com/). This forum for exchange of cable technical knowledge is mostly in a mailing list format.

To join the newly revamped CABL-List send an e-mail to listserver@cabl.com, with the text, "subscribe cabl-list-digest" in the body of the message. This will send a compilation of the prior day's messages to your e-mailbox each morning. If you prefer immediate notification (and possibly many e-mails each day), use subscribe cabl-list as above.

The Lounge also features a search engine, links to Web resources and a "Library." The latter offers "Electronics 101—Basic Electronics," "CATV Formulas" and international channel standards.

So there you have it—six great Internet sites for all the engineers and technologists out there passionate about cable telecommunications technology. They're tailor-made for you and definitely worth a visit. And if they don't have the exact information you're looking for, they've got plenty of solid links to steer you clear of most of those frustrating, feeble sites. CT

Laura Hamilton is senior editor at "Communications Technology" in Denver. She may be reached via e-mail at lhamilton@phillips.com.

THE CHALLENGE

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Reader Service Number 89

Communications Technology's

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Hukk Engineering manufacturers digital test equipment for the CATV industry providing bit error rate measurements for QAM and QPR modulated digital signals. The new CR1200 provides users with pre-and post-FEC bit error rate information, signal-to-noise, and shows the constellation. It also does traditional analog testing like signal level, carrier-to-noise and hum.

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KES distributes the "Little Oscar" hand held signal generators permitting easy activation of the return path using two independently controlled CW carriers. Oscar-II has fixed frequencies at 6 MHz and 39 MHz. Oscar-IV is frequency agile from 5 MHz to 50 MHz. A companion unit to the Oscar, Model RPC-III is installed at the headend and translates the return carriers to downstream carriers. Using "Little Oscar" and the technician's field strength meter, one technician can align and maintain the return path.

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MHz has just released its' 1998 CATV product catalog!!

MHz is a leading distributor of "Unique products for the 21st Century cable operators"! Included in this 560 page catalog are products covering; Amplifiers, Antennas (Off Air and Satellite), Character Generators, Commercial Insertion, EMERGENCY ALERT SYSTEMS, Fiber, Generators (Stand-by and portables), Headend Electronics, Interdiction, Microwave, Satellite Electronics, Stereo (BTSC/FM/SAP), Switching & Control and Test equipment.

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James Lepsch
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ME MONROE ELECTRONICS

Reader Service No 119

Multilink's New Adjustable Plastic Sno-Shoe

The Adjustable Sno-Shoe from Multilink Inc. Eliminates the need for figure eighting and when used with the available extensions, larger amounts of fiber can be stored at one time. Also available in four different mounting styles, strand mount, wall mounts, and either vertical or horizontal on the pole. The plastic design of the Sno-Shoe allows for a non-conductive part and comes with a 20 year pro-rated warranty!

Multilink

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Product and Data Showcase

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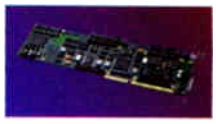

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Riser-Bond Instruments manufactures metallic TDR's for superior cable fault location. Model 1205CX with new sub - nanosecond pulse width (smaller that 1nanosecond) provides increased sen sitivity to identify very small, often unsuspected faults that may be within inches of each other. Troubleshoot and locate faults in truck, distribuition, and drop cables.

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Videotek introduces the BTSC-100 Aural TV Stereo Demodulator for high-quality BTSC and SAP demodulation. This new compact TV Stereo demodulator packs high performance in a small package.
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Fax: (610)327-9295
www.videotek.com

Reader Service No. 132

Wavetek's new PathTrak™ Performance Monitoring System is the first return path monitoring system devoted to monitoring and analyzing multiple return paths in today's advanced HFC networks. The PathTrak system is designed to improve the availability and quality of return troubleshooting and fault location time - PathTrak automatically isolates problems to a single return path. The new PathTrak also stores historical performance records to aid in characterizing return path performance and trend analysis.

Contact Information:
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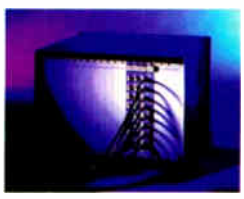
800-62-5515
www.wavetek.com



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ASKA Communication Corp offers variety of connectors, adaptors, splitters, tools and other accessories for broadband drop applications. ASKA excels as one of the worldwide leading manufactures of installation parts and accessories for your CATV, MMDC, or Satellite applications. Whatever your needs, ASKA has the solution.

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Scientific Atlanta

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Stanford Telecom supplies modulator and demodulator products for subscriber and headend interactive HFC equipment. We provide a full function modulator/ demodulator on a single ASIC chip for subscriber modems, and burst demodulator assemblies for reception of upstream signals at the headend.

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VENDOR CONNECTION

Vendor Connection is *Communications Technology*'s resource for up-to-date information on the industry's leading technology suppliers. These vendors have advertised in this issue. Check their ads for products and services that will improve your cable system's reliability, efficiency and capacity.

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fortun01@ssw.alcoa.com
Alcoa Fujikura Ltd. is the market leader manufacturing fiber optic cable for the telecommunications industry, providing products for fiber management systems. AFL also offers EF&I (engineer, furnish, install) services. Fujikura fusion splicers are also distributed.
Reader Service #83

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Brad Halverson
brad.halverson@antec.com
ANTEC Network Technologies, the Atlanta-based manufacturing division of ANTEC Corp., designs, manufacturers, distributes and markets a wide range of active transmission, powering, passives, and interconnection products for fiber optic coaxial and twisted pair networking, worldwide. ANTEC Corp., headquartered in Rolling Meadows, Illinois, is an international communications technology company.
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Reader Service #56, 57

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Reader Service #81

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Avantron manufactures test equipment for the Cable TV Industry. With innovative low cost high quality products like the AT2000R Spectrum Analyzer, Avantron is making it possible for a large number of field technicians to have the tools they need to solve today's challenges.
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Reader Service #89

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John Hitch (765) 983-5238
Belden Wire & Cable Company, a subsidiary of Belden Inc., is a leader in the design, manufacture and marketing of specialty wire, cable and cord products for the electronics and electrical markets.
Reader Service #88

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Reader Service #28

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CT

CALENDAR

6-9: National Association of Broadcasters Convention, Las Vegas. Call (202) 775-4970.
7: Wheat State SCTE Chapter testing session, Wichita, KS. BCT/E certification examinations to be administered. Contact Joe Cvetnich, (316) 262-4270.
7-9: Philips Broadband Networks' Mobile Training Center, Portland, OR. Contact Sarah London at (800) 448-5171, ext. 2273.
9: SCTE Satellite Tele-Seminar Program, Galaxy 1R, Transponder 14, 2:30-3:30 p.m. ET. Topic: "Preparing for Digital Deployment (Part Two)." Contact SCTE national headquarters, Janene Martin, (610) 363-6888, ext. 220.
15-18: Southern California SCTE Chapter testing session, Alhambra, CA. BCT/E certification exams to be administered. Contact Charles Harper, (714) 816-0570.
16: Gateway SCTE Chapter testing session, St. Louis. BCT/E and Installer certification examinations to be administered. Contact Robert Dorman, (314) 997-5858, ext. 3905.
17: Oklahoma SCTE Chapter testing session, Edmond, OK. BCT/E, Service Technician and Telephony certification examinations to be administered. Contact Tom Heddlesten, (405) 348-5750, ext. 312.
22: Badger State SCTE Chapter Vendor Show, Holiday Inn, Fond du Lac, WI. Contact Robert Shugarman, (608) 238-9690.
23: New England SCTE Chapter technical seminar and testing session, Holiday Inn, Boxborough, MA. Topic and speakers TBA. BCT/E and Installer certification exams to be administered. Contact Brian Bedard, (413) 562-9923, ext. 228.
27-29: Internet & Electronic Commerce & Exposition, sponsored by the Gartner Group Inc. and Advanstar Communications Inc. Call (203) 256-4700.
28-30: Philips Broadband Networks' Mobile Training Center, Calgary, Alberta, Canada. Contact Sarah London at (800) 448-5171, ext. 2273. C_T

Planning Ahead

May 3-6: NCTA National Show, Atlanta. Call (202) 775-3669.
May 4-8: Networld & Interop, Las Vegas. Call (415) 578-6900.
May 18-21: Canadian Cable Television Association Convention & Expo, Toronto, ON. Call (613) 232-2631.
June 7-11: SuperComm, Atlanta. Call (202) 326-7300.
June 10-13: SCTE Cable-Tec Expo, Denver. Call (610) 363-6888.
July 8-10: Wireless Cable Show, Philadelphia. Call (202) 452-7823.
July 20-23: New England Cable Television Association, Newport, RI. Call (617) 843-3418.

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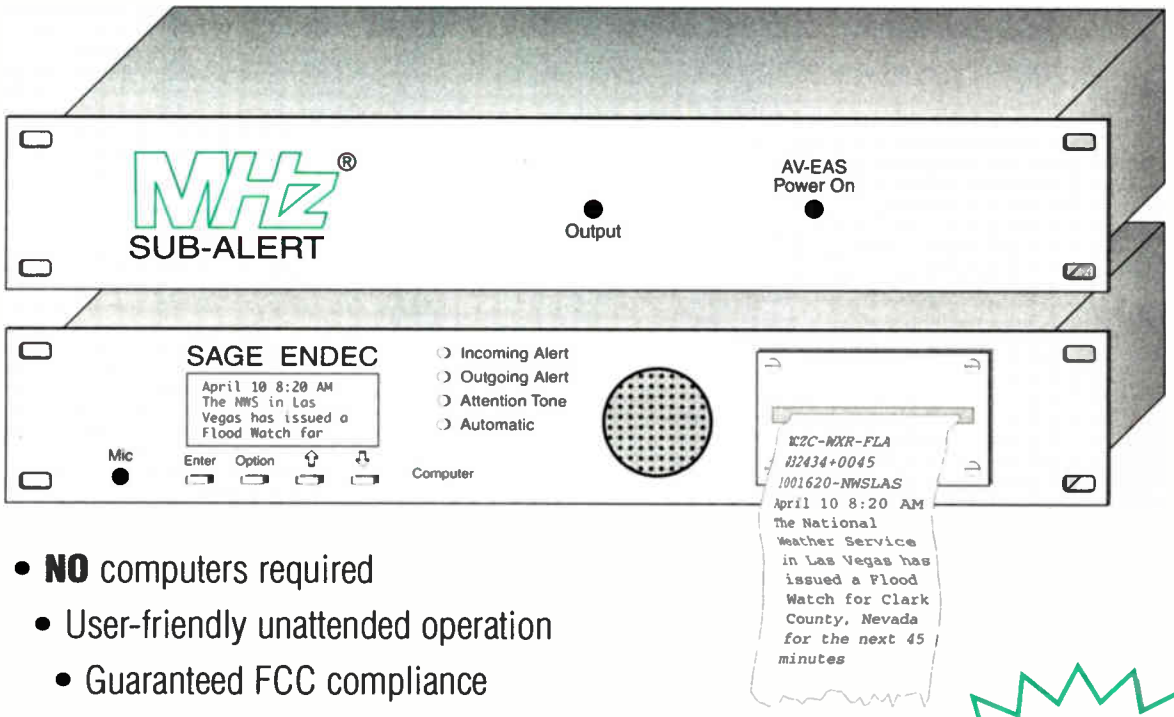

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This month's installment focuses on the six-step technique for drop troubleshooting. The material is adapted from a new lesson in NCTI's Installer Technician Course. © NCTI.

Employing an easy, comprehensive technique for troubleshooting problems ensures resolving service problems permanently and in a timely fashion. This troubleshooting technique is made up of six steps: 1) identification, 2) analysis, 3) location, 4) diagnosis, 5) repair and 6) testing. Remember, however, that going through all six steps may not be necessary for resolving every problem; you should investigate the obvious first.

Identifying the problem

Discussing the problem with the customer is paramount to the whole troubleshooting process. Remember, most customers do not understand the technology involved in delivering broadband cable services, nor are they familiar with the technical jargon that describes many picture impairments.

Confirming reported problem—Using the work order as a guide, confirm the problem with the customer. This verification process can quickly alert you to a possible status change or point out discrepancies in the work order.

Determining general problem type—At this point, determine if the problem is an impairment or an outage. Always have the customer turn on the TV set. If there is a problem with the TV set itself, this helps protect you (and your system) from blame. Always evaluate signal quality on all channels to find out the extent of the problem. Next, measure the signal carrier levels at the cable wall plate with a signal level meter (SLM). If the levels are adequate at the wall plate, you've just narrowed your search for the problem's source considerably.

Questioning customer for helpful clues—Depending on what you have learned thus far, it may be necessary to question the customer for additional clues to the problem. If it is an outage, did its occurrence coincide with a lightning storm, recent landscaping or construction? These clues can be very helpful in locating the problem's source.

If it is an impairment, find out when the symptom(s) first appeared, whether it's intermittent, how often it occurs, its duration and if it only occurs during a particular part of the day/night or certain weather conditions. With impairments, evaluate signal quality on all channels, not simply ones the customer points out. Valuable symptoms may be present that the customer has not noticed. While checking all channels, note distortion patterns in the pictures (snow, ghosting, lines or bars) and listen for audio impairments (scratchiness or buzzing).

Analyzing the problem

Once you've identified whether it's an outage or signal impairment, and hopefully picked up some helpful clues to aid in your search, analyze the problem. At this step find out exactly how the problem is affecting the signal at one or more outlets. This information provides the possible cause(s).

Measuring signals at problem outlet—With signal impairments, always take sample levels of carriers in each forward band (the low, mid, high, super and hyper bands) to identify problem channels or see if a frequency roll-off or notch exists.

Using another outlet for comparison—If the customer has more than one cable outlet, compare the picture and sound quality at a second outlet to the first. If everything is fine at the second outlet, the problem is located somewhere from the common splitter (or directional coupler) to the first TV set. Conversely, if the second TV set exhibits the same problem as the first, the problem usually is upstream from the splitter/directional coupler.

Six-step troubleshooting technique

- ☐ 1. Identification
- ☐ 2. Analysis
- ☐ 3. Location
- ☐ 4. Diagnosis
- ☐ 5. Repair
- ☐ 6. Testing

Creating a list of possible causes—Use all the data collected so far to create a mental list of the possible causes. For example, there is no measurable signal on all channels at the wall plate and the customer just had a sprinkler system installed. It's very possible that the cable was cut. An impedance mismatch is a common culprit of problems associated with a frequency notch. Some causes of impedance mismatches, ingress and band loss include: 1) a bad piece of drop cable, 2) loose and corroded F-connectors, 3) a poor connection resulting from an improperly prepared drop cable and 4) customer-installed equipment. A high-frequency roll-off typically might indicate water inside a drop cable or other device (like a splitter), or that the source of the problem is upstream from the drop system. A defective splitter or directional coupler can cause low signal levels. Knowing what the possible causes are can keep you focused while locating the actual source of the problem. CT

Next month's installment will cover the remaining steps and provide performance training suggestions to reinforce the material in a hands-on classroom setting.

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Gain Knowledge Through SCTE

Knowledge is the key to the success of our business. Whether you're developing new projects in digital technology, maintaining a two-way system or restoring service to your subscribers in the middle of a torrential downpour, you wouldn't be able to fulfill these responsibilities well without a core understanding of how cable TV works and how to put that knowledge to work for you.

The Society of Cable Telecommunications Engineers has built a reputation as the leading provider of technical training and professional certification in cable telecommunications. From the basics of broadband to Federal Communications Commission regulatory updates to standards documentation, we offer both technical and non-technical broadband personnel the information they need to get the job done.

To better serve our industry, the Society has enhanced its popular "Basic Broadband Technology Course" with a new series of student workbooks and leader guides designed to make it easier for all employees to gain a solid foundation of cable TV or strengthen an existing knowledge base.

For those of you not familiar with the course, "Basic Broadband" consists of the third edition of William Grant's textbook *Cable Television* and 24 videotape programs. The series was created to advance industry personnel from entry-level employees to fully trained broadband technicians, and it provides a complete framework for your in-house training programs.

The core of the series is the Grant textbook. In it, Bill presents a tutorial introduction to RF broadband transmission systems utilizing both coaxial cable and fiber optics. The information covered includes terminology, equipment and system design, plus much more.

The original Basic Broadband Course has been available to SCTE members for some time, but in our quest to bring you the best possible technical training packages, the Society has taken it not one, but two, steps further. Now, anyone interested in conducting on-site training sessions for their employees can do so easily and economically with our newest additions to the course: 31 leader guides and student workbooks.

After six months of research and careful planning, SCTE has developed a student workbook and leader guide to accompany each of the chapters in *Cable Television*—which is equivalent to 50 classroom hours of technical training. In addition to our collection of videotapes, trainers now can purchase the leader guides as a curriculum development source for use before they enter the classroom, allowing instructors to concentrate on the training aspect of the experience rather than spending time and energy developing materials to properly support and illustrate the theories presented in Grant's text. In other words, SCTE has done the preparatory work for you.

> "As we all know, today's operators constantly need to train new hires or newly promoted technicians."

The guides offer nearly everything you need to know to successfully conduct your own training sessions. Each leader guide offers a complete checklist of the materials and equipment necessary for the class, as well as videotapes that will complement the classroom presentation. Discussion outlines, visual aids, course objectives and applications are all included in each booklet.

The workbooks give students a chance to practice what they've learned through problem-solving. This hands-on exercise will guarantee that both trainer and student get the most out of the training experience.

These easy-to-use guides and student workbooks can be utilized in three ways. First, in the conventional teacher-and-student method, the instructor may purchase a leader guide for his or her own lesson plan, plus workbooks for each of the students. Second, members of a study group may opt to buy leader guides as a kind of "educational road map" and workbooks as needed. Finally, someone interested in self-study might acquire the series of workbooks for practical application of materials covered in *Cable Television*. These are just a few examples of the many ways industry personnel can use this valuable information while gaining the technical training they desire.

In all three situations, the focus of this program remains the same: to take someone with little technical background from the basics of cable TV all the way through signal distribution via fiber optics. And as we all know, today's operators constantly need to train new hires or newly promoted technicians. Our newest training materials will form the foundation for understanding broadband—for gaining the knowledge you need to succeed in today's fast-paced environment.

Whatever learning environment you opt for, the "Basic Broadband Technology Course" delivers top-quality, highly effective information at a very low cost per student. More importantly, your well-trained employees will help deliver broadband into a successful new millennium. T

Bill Riker is president of the Society of Cable Telecommunications Engineers.

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