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Official trade journal of the Society of Cable Television Engineers

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Satellites: Today and tomorrow

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April 1992

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Lightning photo © Stock Imagery.

Geri Saye

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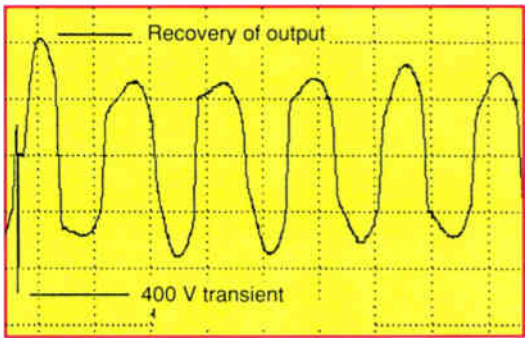

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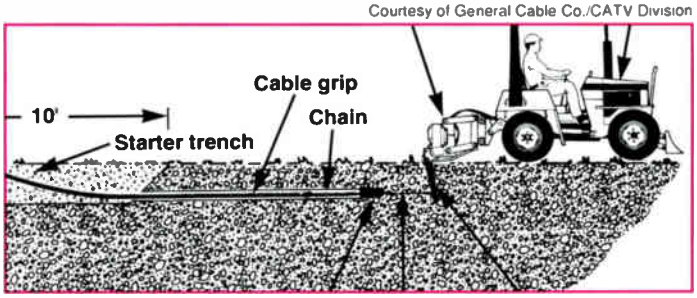
Courtesy of General Cable Co./CATV Division



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Satellite chart
A pull-out wall chart with the latest data on domestic C-band satellites.

ONI OPTICAL NETWORKS INTERNATIONAL

Optical Network News

The following highlights are from Optical Networks International's quarterly newsletter.

■ ONI begins work on Star-Star-Bus architecture

Using externally modulated lasers by Harmonic Lightwaves, Optical Networks International has begun working on a "Star-Star-Bus" architecture which enables operators to position cable systems for future services, such as alternate access, PCN and video-on-demand. The 500 home per node architecture increases reliability, simplifies powering, reduces micro-reflections, and allows for an easier upgrade to higher bandwidths.

(See related story in the April, 1992 issue of *Communications Engineering & Design (CED).*)

■ Technical agenda set for NCTA

NCTA Technical session attendees can look forward to an unprecedented program this year. Be sure not to miss these:

Technical Implications of Alternate Access and the Cable Operator	Andy Paff, ONI
Digital Transmission Fundamentals for Cable Engineers	Ed Callahan, ANTEC
Leading Edge Photonic Technologies	T.E. Darcie, AT&T
The Evolution of CATV to Broadband Hybrid Networks	Carl McGrath, AT&T
Planning PCN Networks for Cable TV Networks	Lawrence Gitten, AT&T
A Comparison of Leading Edge Image Compression Technologies	Arun Netravali, AT&T
Passive Optical Network Architectures and Applications	Clive Holborow, AT&T

■ ONN readers rate Optical Tech Tips "must read"

In a recent survey, ONN readers repeatedly listed Optical Tech Tips as the section most often turned to when receiving the newsletter. Optical Tech Tips deals with fundamentals of equipment use, such as the article on OTDRs in the Winter 1991 issue. For the upcoming Spring issue, the column will discuss the correct way to use a fusion splicer.

(Please mail or FAX your suggestions for future topics to ONI.)

■ "FiberLoop" used to store fiber cable

In today's aerial fiber optic installations, storage of an extra length of fiber cable for future use is not only desirable, it is essential. ONI's FiberLoop provides a means of storing an extra length of fiber cable along the support strand for later use. The unit permits operators to establish installation practices for storage of fiber and ensures installers do not violate the minimum bend radius of fiber cable.

(For more information call 1•800•FIBER•ME.)

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EDITOR'S LETTER

A day in the classroom

I've just finished speaking to two of the most challenging groups I've ever had the opportunity to stand in front of. Both of them were a classroom of elementary school students!

My wife, Denise, a reading and writing specialist for a school in one of the Denver area school districts, asked me to participate as a speaker in a series of writing workshops for the students. I was one of several professionals who had a chance to share writing experiences, tips and encouragement with the kids.

While this pair of presentations wasn't specifically related to CATV engineering, I did pass around copies of *Communications Technology* to help the students see the results of writing and editing as a profession. I think that provided a little hands-on credibility for what I was talking about.

But just what was it that made these kids challenging? Believe it or not, it was the level of their participation and questioning. These fourth graders knew most of the basic steps of the writing process, and had no difficulty listing them for me: The idea stage, outlining (they called it "story webbing"), the first draft (one student called this step "sloppy copy"), editing, additional or final drafts, final editing, and publication. I suggested that they also take advantage of peer review and the old "set it aside for a while before editing it" as a couple of additional steps.

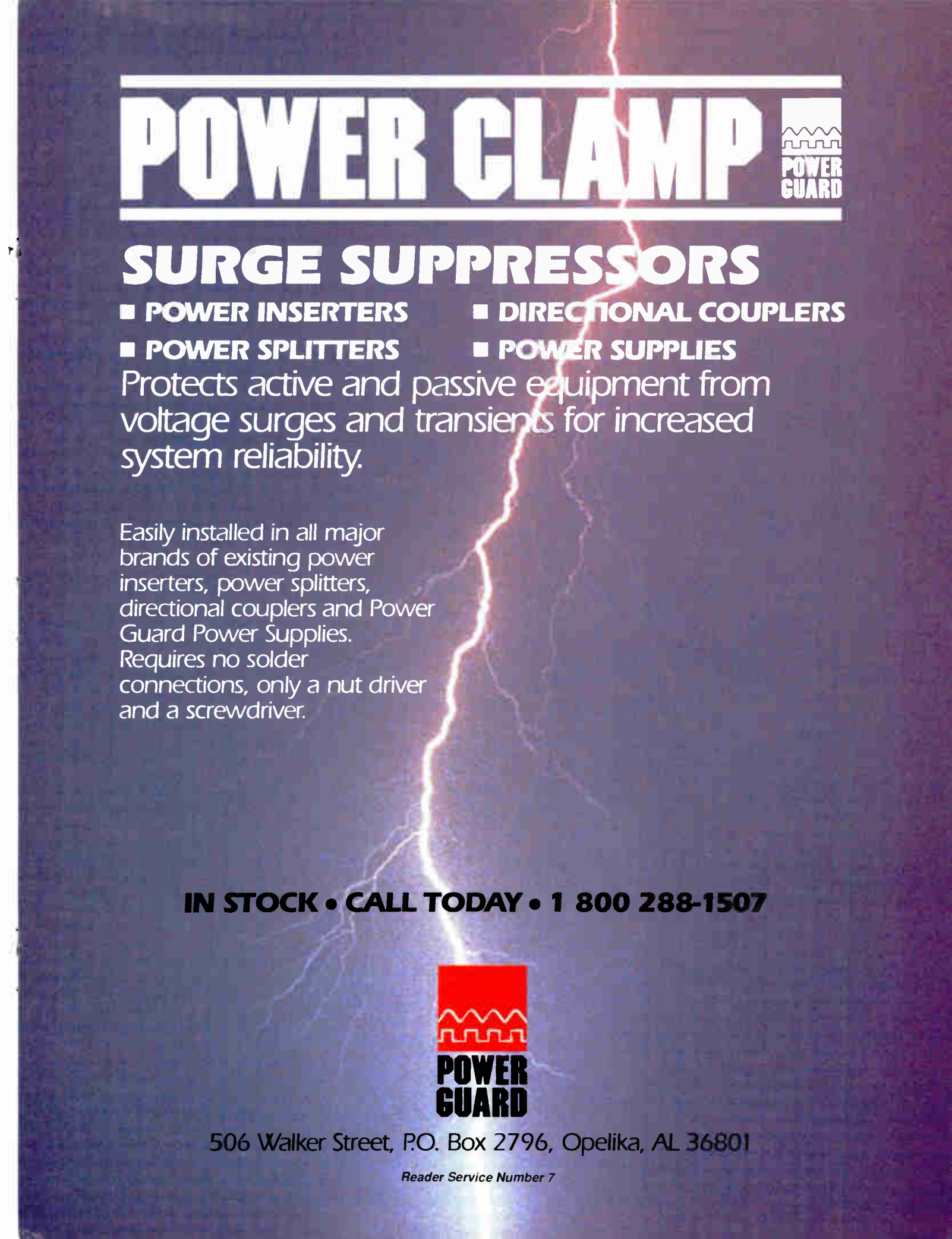
Their questions were every bit as probing as those I get when I speak at Society of Cable Television Engineers seminars. I have to say that it was extremely encouraging to see the level of interest and participation that I did. They asked good questions about the writing process itself, how a magazine like *CT* is put together, and even expressed curiosity about cable and some of the things they saw in the magazine. This level of inquisitiveness — and the student's highly encouraged creativity — is something that is sorely missing from a lot of schools. We've all read about the problems in education, including the training problems that exist in our own industry. But the kids at Jefferson County's Stein Elementary have what amounts to a great head start on many others their age: an understanding of the importance of written communication.

Odds and ends department

Speaking of reading, I get a chuckle out of the following warning in the airlines' safety information card: "If you are sitting in an exit row and you cannot understand this card or cannot see well enough to follow these instructions, please tell a crew member." I think this one must have been written by some government committee. If an individual was unable to "understand this card" or "see well enough to follow these instructions," do you suppose that person would be reading the warning to begin with? Just wondering ...

This next one is for ham operators: As you know, an unofficial CATV on-the-air net has been held on 20 meters the second and fourth Wednesday of each month at 0200 UTC. With summer approaching, propagation conditions are changing, and the net control, ATC's Al Dawkins, would like your input on the net's current time and frequency. If you have suggestions for other times or another amateur band, please let him know. You can reach Al at ATC's National Training Center in Denver. The telephone is (303) 753-9711.

Ronald J. Hranac
Senior Technical Editor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Senior Technical Editor, Ronald J. Hranac
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LETTERS TO THE EDITOR

SCTE seminar kudos

I spent three days attending the "Technology for Technicians II" seminar in Phoenix, Ariz. This training course is sponsored by the Society Cable Television Engineers and instructed by Ralph Haimowitz.

Thirty-five engineers and technicians from Florida, Colorado, Arizona, New Mexico, Nevada and California were reintroduced to basic math and led through the steps upon which the formulas for such items as signal-to-noise, carrier-to-noise, hum, system powering, cable loss, DC loop resistance, cumulative leakage index (CLI) and most of the engineering equations are based. These are equations we use daily in system maintenance and are fundamental in preparation for the SCTE BCT/E examinations. From basic algebra through logarithms, Haimowitz built an understanding of simple and complex math, giving each student the time and assistance to assure they understood the problem, its solution and the correct answer.

This is an outstanding course and I cannot understand why MSOs don't have this session held at their national or regional headquarters, requiring each of their regional engineers to attend and pass the course.

I am a promoter of training for CATV technicians and engineers, having given money, time and effort to ensure education for the industry. The SCTE is to be congratulated for having "Technology for Technicians" as part of its program to help train the CATV technical personnel.

As a final note, I was surprised to see 35 techs and engineers attend this course but no attendance by the local manufacturers or suppliers from Arizona or the adjoining states. I heard plenty of problems discussed during these three days that could have been solved with good products or good service. Where are you vendors who claim to be so concerned with the field problems? Many of you could stand to "brush up" on math and cable troubleshooting. I know — I was one of you for many years.

Rex Porter

Misleading article?

In the October 1991 issue I would draw your attention to the feature on page 73, "Getting the most from your antenna system — Part 1."

Figures 1 and 2 on page 73 are totally wrong. I think that I know what they are intended to portray, but there is no consideration of their intention. Words like "pattern and "efficiency" are used indiscriminately without explanation.

A very serious incorrect statement is made on page 73 and repeated subsequently. The statement reads that the antenna is "of specific design that acts to couple radio frequency energy from a transmission line to the atmosphere, or from the atmosphere to a transmission line. The greater coupling an antenna has, the greater is its efficiency in transferring energy." Radiant energy is not passed to the atmosphere or "from the atmosphere to a transmission line."

Much is made of adjacent channel interference without reference to directional discriminations and service planning.

R.S. Roberts
Consultant Electronic Engineer

Author's response: R.S. Roberts is correct in noting that Figure 2 could have been identified more fully. The figure printed is an exaggerated illustration to demonstrate the cancellation effect of the reflector element and should have been explained. In fact, the rear lobe would be similar to the forward lobe, but reduced in level. I regret any confusion this illustration may have caused readers.

Roberts also had a number of other comments relating to the technical content of the article. I expect that his level of understanding of the subject is greater than the audience for which the article was intended. The intention of the article was to provide the CATV technician who has had limited exposure to antenna theory with a basic introduction to the types of antenna that are used in the cable industry and how they work. In the course of conducting seminars for CATV technicians, I have found that this approach to be the most successful. To the more informed reader the level of technical detail provided may appear insufficient or too condensed. However, this article was not intended to provide a comprehensive test on antenna design and path analysis.

J. Patric Murphy
Wade Antenna Ltd.

Generically wrong

In the article "Pulling the plug on lightning strikes" (June 1991) you used the term "dissipation array" twice as a generic term. "Dissipation Array" is a registered trademark of Lightning Eliminators & Consultants and I am requesting that in the future you not use this term generically.

Ralph L. Auer
Lightning Eliminators & Consultants Inc.

Out of date

I read with interest and appreciated the article in your February 1992 issue regarding planning antenna sites and tower heights (page 80). The information regarding tower design and specifying is often foreign to a cable operator and can become confusing.

However, the information presented in this article, while being beneficial, is out of date. In 1987, the Electronic Industries Association revised its standard RS-222-C "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures" and was reissued under the title "ANSI/EIA-222-D" as an approved American National Standard. This standard currently appears as ANSI/EIA/TIA-222-E, dated March 1991.

Significant changes were made in methods and formulas used in tower design, one of the more obvious changes being in the method of specifying wind loading. The current wind loading map for the continental U.S. indicates that this important design parameter be specified as a basic wind speed (taken as a steady-state wind speed 10 meters above grade). Tower shape factors, gust response factors, exposure areas and wind speed escalation due to tower height are other important variables included within the revised standard.

A copy of this standard is available from the EIA Engineering Department, 2001 Pennsylvania Ave., N.W., Washington, D.C., 20006.

Allen Estes
UNR-Rohn

Editor's note: It's our fault. When the authors submitted the article to us some time back it was correct. Unfortunately, by the time we put it in print the standard was revised.

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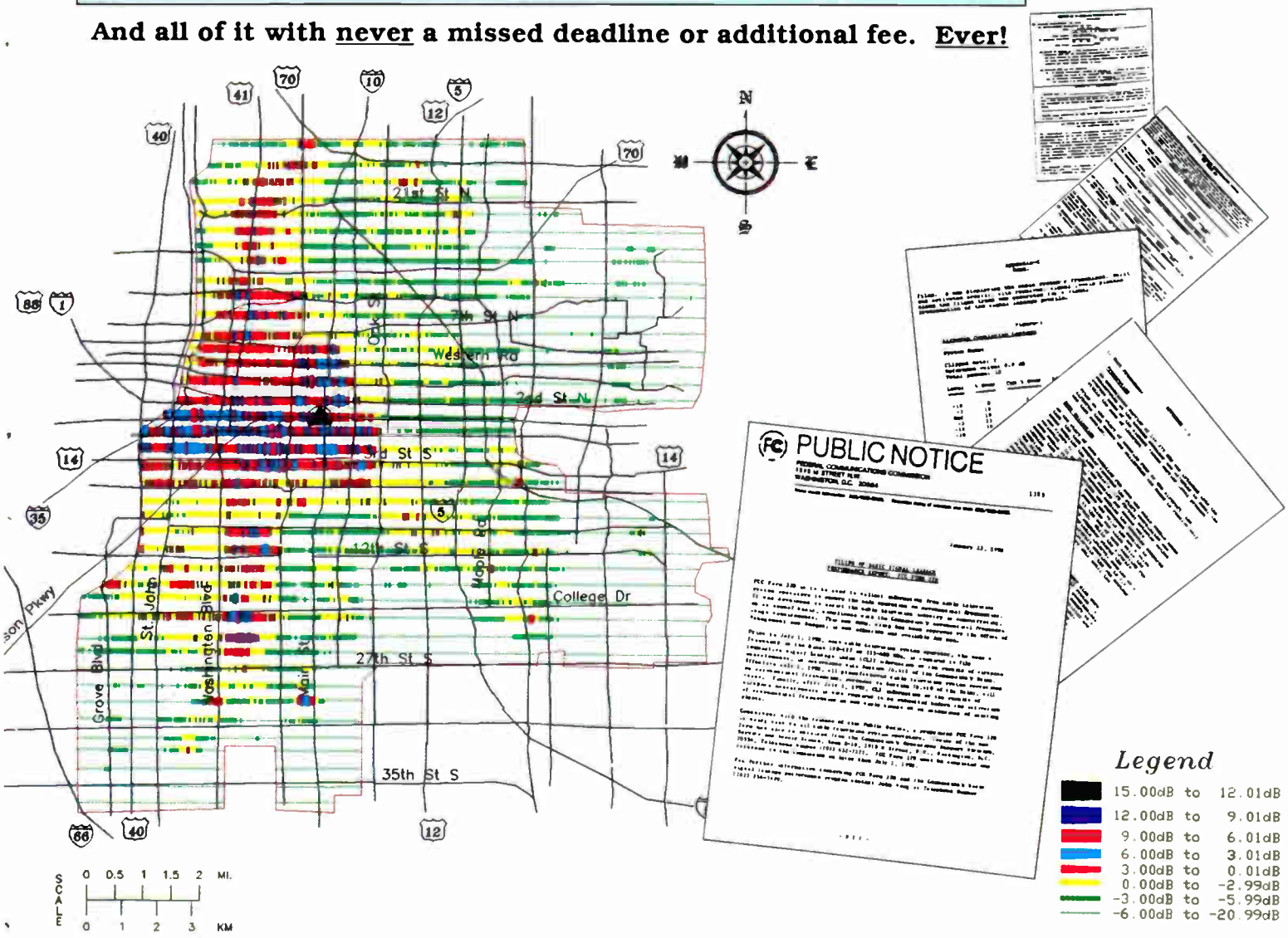

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Tech boom: Texas Show sessions

SAN ANTONIO, Texas — CATV technical types at the 1992 Texas Show had the opportunity to get the latest on cable's hot issues as the Society of Cable Television Engineers packed its technology wallop into the following three neat packages:

• *Technical issues update* — Attendees were offered a sneak preview at the then-unpublished new technical standards for CATV adopted by the Federal Communications Commission earlier in February. William Riker, SCTE executive vice president, introduced the speakers, starting with Wendell Bailey. The National Cable Television Association's science and technology vice president was part of the team that negotiated the specifics of the rule making with the FCC. Bailey's overview of the standards to the session's audience was called "generally correct" by the FCC's Assistant Bureau Chief John Wong. Wong was hamstrung on what exactly he could reveal since the actual text of the rule making was not officially released, but he was willing to respond directly to specific questions about the standards. His presentation at the session mainly focused on the FCC's concern with periscope antennas and cumulative leakage index (CLI).

Jonathon Kramer of Communications Support Corp. was the co-chair of the task force for cable during the drafting of the FCC standards. He emphasized that the standard were very reachable and "not for where engineering should be" but rather what operators should provide to subscribers "at a minimum."

Prime Cable's Dan Pike pointed out that since the standards were developed so operators could use their existing equipment, there was no need to fear huge capital outlays for new test equipment. Tom Elliot of Tele-Communications Inc. also took a positive stance toward the rule making saying that most operators already are meeting the standards that Bailey had overviewed and with competition for CATV looming, the standards were "healthy."

• *Technology explosion, session 1* — SCTE President Wendell Woody moderated this session that kicked off with Jerrold's Geoff Roman detailing his company's DigiCipher technology. He said the first phase of digitally compressed video is as close as this summer. Magnavox CATV's Lou Corov switched the focus to echo cancellation, reporting on the history and the basics of the technology and reminding the audience that the United States is set to adopt an echo cancellation standard sometime this year. Shifting gears again, Steve Necessary of Regal Technologies tackled the usual hemming and hawing affiliated with 1 GHz: "It won't work"; "OK, it'll work but I can't fill 1 GHz"; and "But I'll never sell it." Necessary said 1 GHz passives are "cheap insurance" for an impending future. Balancing out the technical smorgasbord, US West Cable Communication Division's Earl Langenberg covered switched video. He showed how an overlay network design (such as is used extensively in U.K. integrated CATV/telephony) takes up a huge amount of cabinet space and explained the benefits of

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DX ANTENNA

Reader Service Number 13

an integrated broadband network design.

• *Technology explosion, session 2* — This forum was not to be outdone by the earlier session's forward-thinking approach to the many cutting-edge CATV technologies in the works.

Home Box Office's John Vartanian spoke on the next generation of CATV satellites, including Galaxy V. He overviewed what programmers planned to be on each satellite and covered details on 2° spacing. Richard Covell of Texscan played fast and loose with the "FTF" acronym and spoke on "fiber-to-the-future." It's hard to believe that the Texas Show tech sessions just two years ago had many attendees pondering the industry's new favorite buzzword "fiber optics" and wondering "how will it work in my system?" With fiber thoroughly embedded into our CATV vocabulary, Covell's talk reiterated fiber's rosy future. C-COR's Colin Horton spoke next and considered the question: Extended bandwidth and compression — coexistence or competition?" His answer: "The future requires both and its very, very important to allow for both." Finally, Bob Luff of Scientific-Atlanta retackled a subject that had been covered in the earlier session — digital compression. He agreed with Jerrold's Geoff Roman that digital compression shouldn't be considered a far-off technology and added "this is very much right around the corner."

Cox demos first CATV PCS call

SAN DIEGO — Operating under an experimental PCS license granted by the Federal Communications Commission, Cox Enterprises demonstrated the nation's first personal communications services phone call through a cable TV system. From a residence here, the company's CEO, James Kennedy, placed a call to Alfred Sikes, chairman of the FCC in Washington, D.C. The FCC is considering the establishment of the new service.

Previously, Cox and Scientific-Atlanta announced an agreement to jointly design and test the device called the Cable Microcell Integrator that allows microcells in a personal communications network to be connected on pre-existing cable TV plant.

NCTA lines up show tech sessions

DALLAS — The National Cable Television Association's National Show to be held here will feature several technical sessions/seminars May 4-6. Subjects include: high definition TV (HDTV), fiber, future network options, digital TV, solutions for outages, cable/consumer electronics concerns and the Federal Communications Commission technical standards. A full agenda will be published in next month's issue.

CableLabs contracts interference study

BOULDER, Colo. — Cable Television Laboratories has contracted Stern Telecommunications Corp. to perform analytic studies characterizing the RF interference environment experienced by TV receivers and videocassette recorders in typical U.S. and Canadian TV households. In other news, CableLabs recently sponsored a seminar on digital technology. Such seminars are held as part of the Labs' mission of serving as a technology information exchange for CATV.

☛ Contec International completed arrangements for increased financial commitments from Westinghouse Credit Corp. A dollar amount was not disclosed.

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Membership in Society tops 9,500

EXTON, Pa. — The national membership of the Society of Cable Television Engineers has passed 9,500. This represents an increase from 1991's year-end membership of 9,000, which represented an increase of 1,500 members over the 1990 year-end figure of 7,500.

The figure of 9,500 takes into account the Society's 8,000 active members, as well as the more than 1,500 members that have joined the Society at the installer level since the introduction of the Installer Certification Program in 1989.

This growth can be partially attributed to the popularity of the Society's numerous programs and services, including the chapter development program, Broadband Communications Technician/Engineer (BCT/E) and installer certification programs, annual Cable-Tec Expo, annual fiber-optics conferences and the "Technology for Technicians" national training seminar program.

Since SCTE's formation in 1969, it has established programs that have become invaluable to the industry, such as its chapter development program, which promotes the establishment of regional groups of technical personnel, providing much-needed forums for technical instruction and discussion at the local level.

SCTE now has a total of 72 local groups, with 58 chapters and 14 meeting groups. These groups expand each member's knowledge of the industry as well as aiding in individual professional development.

LO returns to Cable-Tec Expo

SAN ANTONIO, Texas — This year, for the second time, the SCTE will sponsor several workshops pertaining to local origination equipment usage at its annual Cable-Tec Expo. The workshops will be held June 15-16 at the convention center here.

They are designed for production and maintenance personnel interested in or currently operating local origination facilities at cable TV systems. The planned workshops include:

- Establishing quality control, production and maintenance standards
- Local ad insertion in a tight budget war
- Local implementation of network technical updates
- Local origination production trends
- Pay-per-view technology from the headend to subscriber

The workshops will be conducted during the normal expo workshop schedule. Also, a number of manufacturers and vendors of local origination equipment have been invited to display their products at the expo exhibit hall. For more information, contact SCTE at (215) 363-6888.

SCTE offers up Texas-style Games

(Contributed by Laura Hamilton, "Communications Technology")

SAN ANTONIO, Texas — The shoot-'em-up at the Alamo almost 150 years ago may have been (to say the least) a one-sided blowout, but the shoot out at the Society of Cable Television Engineers Cable-Tec Games held here at the Texas Show was about as close as you could get without bloodshed. After

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the competition, everyone involved got to ride off into the sunset (or at least into the cocktail party).

Three teams squared off at the Games, which were sponsored by Anixter Cable TV, *Communications Technology*, and the Texas Cable Television Association. Teams were: the SCTE Ark-La-Tex Chapter team, the SCTE Southeast Texas Chapter team, and a band of CATV mercenaries with technical skills who called themselves the Competitors.

Winners of the splicing event (hosted by Gilbert Engineering and Comm/Scope) went as follows: Bert Carbo (Ark-La-Tex) — first; Hughston Anderson (Southeast Texas) — second; and Robert Hagan (Ark-La-Tex) — third. Riser-Bond hosted the cable fault location event and the results were: Bobby Nichols (Competitors) — first; Hagan — second; and Bill Warner (Competitors) — third.

Nichols also won the terminology event, sponsored by the National Cable Television Institute. Second place went to Southeast Texas' Tom Rowan and third went to the Competitors' Rodney Chappel. Ark-La-Tex bagged another first place during the safety inspection event (hosted by Sachs Communications and Sammons Cable) thanks to Joe Masterson, but Southeast Texas made up points with Harold Null taking second and Rowan adding a third place score.

Masters of ceremonies were: Ron Wolfe of the ATC National Training Center, Diana Riley of Jerry Conn Associates (and SCTE Region 11 director), and SCTE President Wendell Woody of Anixter Cable TV.

When the dust settled on the time domain reflectometers and everyone had holstered their cable splicers, gold, silver and bronze medals were handed out for event and overall winners. Hagan of Ark-La-Tex added another gold medal as the overall winner of the Texas Games to the impressive collection he's acquired at other Cable-Tec Games. Second and third went to Southeast Texas' Null and Anderson, respectively. As a team, Southeast Texas tallied up the most points, but Ark-La-Tex finished an excruciatingly close second (only 12 out of 1,600 points behind).

Subcomittees round up in Texas

(Contributed by Laura Hamilton, "Communications Technology")

SAN ANTONIO, Texas — Three of the SCTE engineering subcommittees met in conjunction with the Texas Show in late February. (For more information on the next meetings at the Cable-Tec Expo here in June, see "President's Message" on page 86.)

The Interface Practices Subcommittee meeting was somewhat historic in that after many months of deliberation, it finally approved a standard for the female port of the F interface. It now continues work on the F interface male port.

President Bush may have been headed to town for a drug summit, but one of his stated concerns — EBS — was also being considered in San Antonio. The EBS Subcommittee was addressed by William Browning, chief of the Federal Communications Commisssion's EBS department, who emphasized that the president as well as Congress and the FCC would support the industry's EBS efforts. The subcommittee decided to ask for an extension for a response to the FCC's notice of inquiry about CATV EBS.

The In-Home Cabling Subcommittee examined very preliminary possibilities for a set of standards. It recognized that it probably would have overlap with the interface practices subcommittee and thus should keep the lines of communication open.

Reducing plant outages

In response to heightened awareness of the need for better outage detection and control, pressure from cities, and guidelines established by the National Cable Television Association, Cable Television Laboratories established an Outage Control Committee last year under the chairmanship of Brad Johnston, senior vice president of Warner Cable. The committee has several working groups, each charged with one aspect of outage detection, quantification and reduction.

The crowbar device was identified as one of the most powerful and spectacular reducers of outside plant outages. As part of the committee's mandate, CableLabs funded the hiring of a third-party laboratory with its personnel and equipment to determine a suitable test that could be applied to several of the various types of devices ranging from fuses through metal oxide varistors (MOVs) to crowbars (which are, or have been used in the cable industry to try to control lightning-induced transients, power company-generated sheath currents, and other switching transients). CableLabs personnel were also present during the determination of the test.

As it turned out, the proposed test ("ANSI/IEEE C62.41-1980 Parts A and B," formerly designated as "IEEE Standard 587-1980") was adjudged to be very suitable. Some devices failed and others passed, thereby indicating which had the necessary robustness to continuously withstand repeated severe "hits" and drain away the harmful amplifier-killing transients without deterioration. A full review by CableLabs and its full Outage Committee is taking place with a view to recommending the test as being suitable for cable operators, manufacturers and vendors alike, so that they may use it to assure themselves that any outside plant outage control devices they may wish to purchase, manufacture or sell will, in fact, meet expectations.

I chaired two of the Outage Committee's working groups and was asked to relate how the crowbar device came into such widespread use and some of the success stories associated with it. What follows are my comments on the device.

By Roy Ehman
Former Director of Engineering, Jones Intercable

It all began in Virginia. When several successive severe storms swept through the 2,500-mile Chesterfield County system in 1986, they left a trail of burned and impaired amplifiers. The chief engineer appealed to me for suggestions and I, in turn, went to Alpha Technologies of Bellingham, Wash., and asked if it could build us a very fast, very robust switch that would short out longitudinal sheath currents (LSC) and other transients that were burning or impairing the amplifiers. This is shown conceptually in Figure 1.

Alpha came up with a design and hand-made three units. We installed one in aerial plant, another in a pedestal and saved the third as a souvenir. The results were spectacular, to say the least. In the next three storms the protected plant went unscathed while extensive damage occurred in adjacent sections. This success led to repeat requests and a highly refined product, which came into universal use under the name of the Alpha AmpClamp.

Generically, this device is called a silicon-controlled rectifier (SCR) crowbar. SCR is a generic semiconductor-type designation. The SCR crowbar acts in less than 1 microsecond to gobble up almost all of the harmful energy, whether it be from lightning or power company fault currents or transients, and restores itself and the plant to normal condition in 8 milliseconds or less, after the crises has passed. Cable customers don't even see a flicker since amplifiers stay operating for about 100 milliseconds on their own stored energy.

Figure 2 shows what started out as a 400 volt spike, sufficient to damage an amplifier, caught by the crowbar at ±104 volts and completely shorted to sheath in about 1/2 microsecond. The 60 VAC power continues at the next half cycle when the polarity reverses. Because it acts more like a switch than a resistor, it has to dissipate very little power within itself and can therefore handle enormous surges of up to 500 amperes for 16 milliseconds or 35 amperes for an indefinite period. For 1 microsecond it will even shunt off 1,000 amperes!

In order to see how robust this crowbar was, we did some crude tests. First we applied 115 VAC to it and then 240 VAC. All that happened was that there was a loud bang, a flash and the circuit breakers popped. Subsequently, Alpha did the appropriate ANSI/IEEE test. This test applies a unipolar pulse of

(Continued on page 39)

Figure 1: Silicon-controlled rectifier crowbar

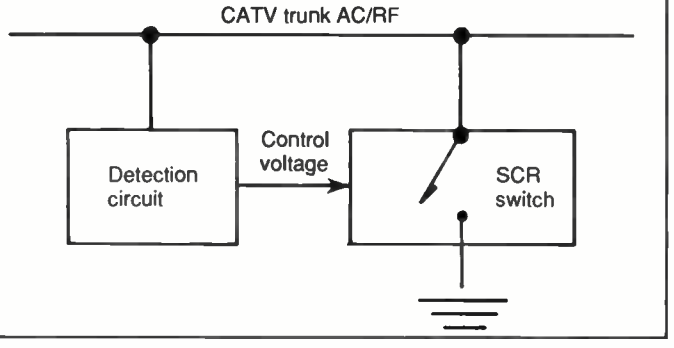
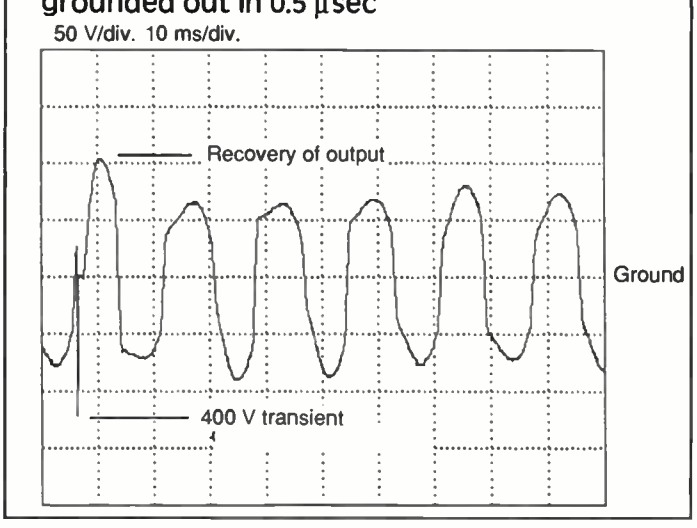
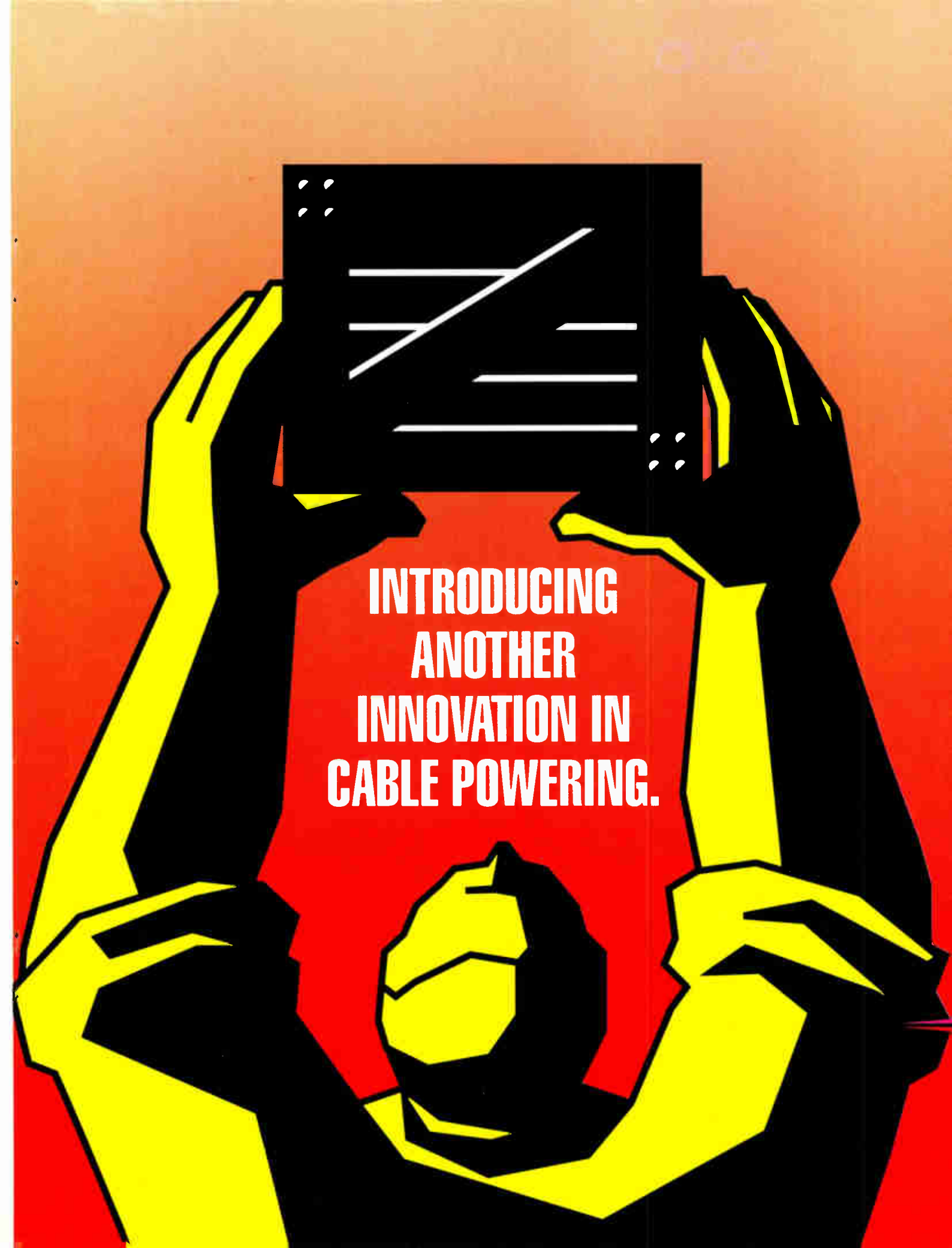


Figure 2: 400 V spike caught at 104 V and grounded out in 0.5 µsec




INTRODUCING
ANOTHER
INNOVATION IN
CABLE POWERING.

What if you could prevent lightning damage?

By Jack A. Riehle
Senior Consulting Engineer,
Lightning Eliminators & Consultants

Have you ever considered the terrible impact of lightning on a modern technological society? If not, it would be understandable. If you have not been a personal or business victim of lightning, you might not give it much thought. Nevertheless, lightning causes untold damage to human life and property worldwide every year. The financial and equipment losses mount into the millions of dollars.

Scores of lives are lost every year to lightning and its secondary effects. Still, most people seem to take it in stride as a normal course of events or an act of God. It's unpredictable and unavoidable. After all, anyone who has ever seen or been close to a lightning strike can attest to the terrible power and wrath of Mother Nature demonstrating her power in the form of blasts of heat, light and the smell of ozone. But is it unavoidable? Technology has been used to tame much of our environment. In this case, technology may have an answer for businesses that are vulnerable to lightning damage.

Substantial equipment losses and hundreds of hours of down time are experienced every year by cable companies due to lightning and its related problems. Nevertheless, lightning somehow remains a mystery in the minds of most people, especially engineers.

Lightning is no mystery

Lightning, no matter how terrible a visual and destructive display it presents is, after all, just electricity in motion. Spectacular yes — a mystery, certainly not. Lightning must obey all of the laws of electricity, including Ohms law. It follows orderly and well-understood rules of physics, including conductivity, impedance, capacitance and inductance. Lightning is not particularly random either. In fact, it is almost always predictable. The parameters for lightning conditions as well as how and where it will strike are well-known to science.

Certain geographical areas tend to be far more susceptible to lightning than others. The isokeraunic value (the average number of lightning days per year for an area) varies in the United States from a low of five days in the southwestern U.S., to a high of up to 100 days a year in Florida. Certain equatorial parts of the world have even higher isokeraunic values of more than 250 days. Figure 1 is an isokeraunic map of the United States. The combination of the isokeraunic value and the height of a structure can be used to roughly predict the probability of a strike.

The fallacy

Engineers and architects have been lulled (and encouraged) into a safe and secure design approach for lightning protection systems based on a concept using a 200-year-old technology to "protect" modern structures. Ben Franklin invented the lightning rod over 200 years ago. His design concept is intended to attract and then safely arrest lightning strokes without damage to the protected structure. This is not a bad system if you are protecting a barn.

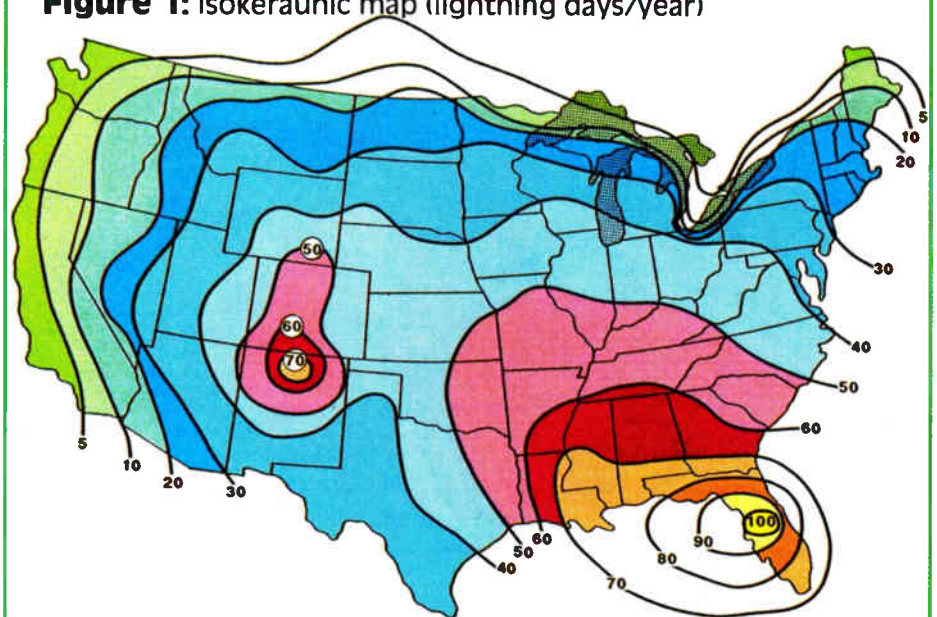
Time and technology have moved on. Modern structures are filled with sensitive electronic equipment and internal conductive paths especially susceptible to the secondary effects of lightning. A thoughtful engineer today should seriously question the idea that we should intentionally attract and channel a multimillion volt lightning stroke right into our building structure and near the sensitive equipment we are attempting to protect.

If you refer to a lightning rod handbook, it will tell you to install a series of steel rods of some length on top of your building, clamp a No. 6 wire to them and fasten the other end to your water pipes or building steel. You and all of your equipment will be safe from lightning, right?

Whoops! What about Ohms law? What about the secondary effects of a

(Continued on page 40)

Figure 1: Isokeraunic map (lightning days/year)



Bell Labs' calculation for discharges (in square miles) = 0.37 x isokeraunic number

Designed by Chris O'Neil of Jones Intercable

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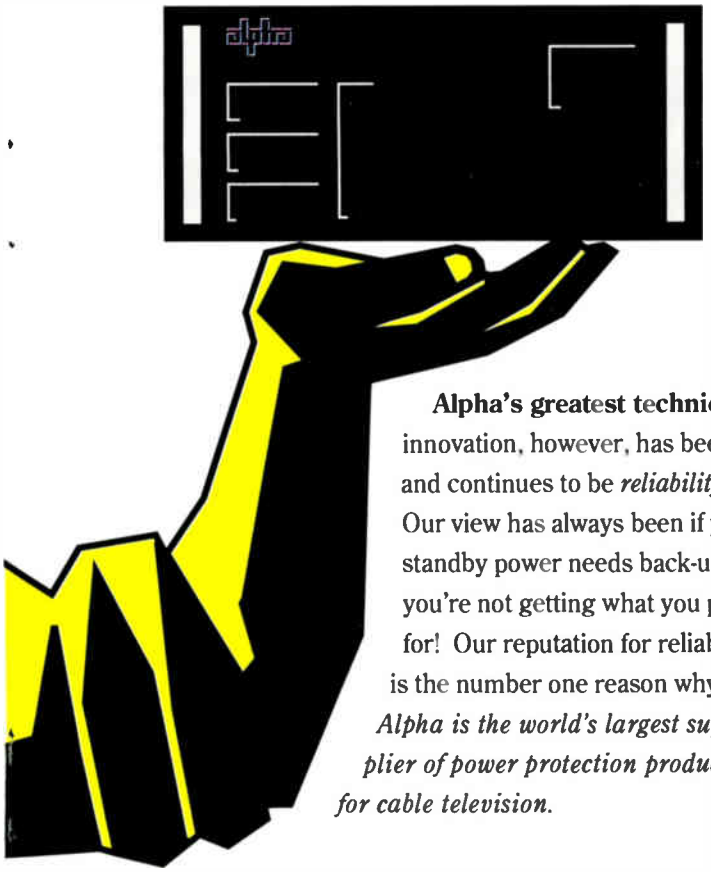

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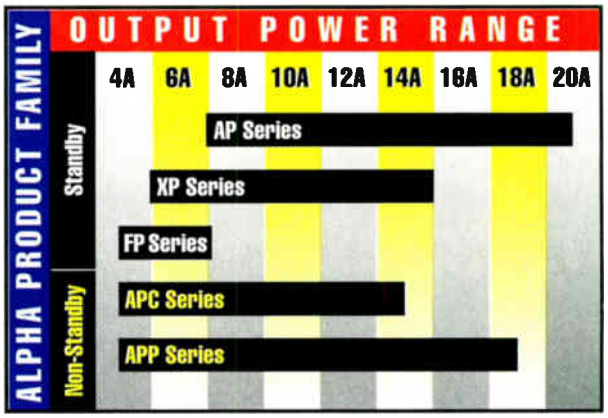

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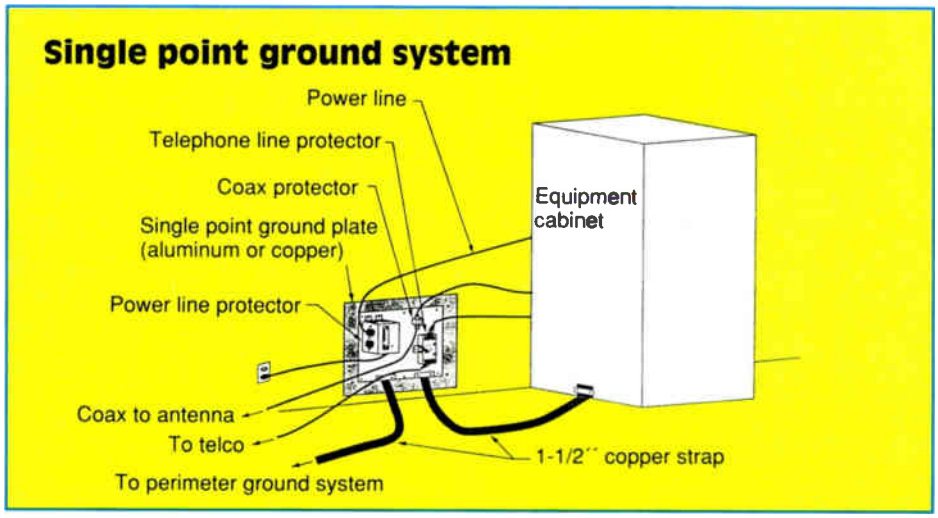
Equipment protection: Location is everything

By Roger Block
President and Chief Engineer, PolyPhaser Corp.



One of the most basic precepts in developing a protection strategy for your electronic equipment is to keep stray energy from flowing through the equipment. There are a couple of ways to effectively accomplish this. One is to totally disconnect the equipment. This is effective, but not very practical, and it could lead to other destructive problems. Another is to provide some form of impulse protector for each of the equipment's input or output (I/O) ports. These generally consist of the connection to the AC power line, telephone or control line, and antenna transmission line. A protector on each of the I/Os will protect that path from damage. However, it also is necessary to be careful of voltages that may exist between the I/Os at the instant of a strike event.

Potential for damage

For example, if each of the protected I/Os for remote equipment are connected to a different ground (which could happen very easily in the best of installations) the following situation will exist during a strike event, possibly damaging your equipment. The transmission line is grounded at its protector as the line enters the building. The power line to the equipment is protected and grounded at the distribution panel where the power line enters the building. The telephone line is protected and grounded where it enters the building. The protection on each of the I/Os at the building entrance is good and keeps the strike energy toward the outside of the building and away from the equipment.

However, since all the I/Os are attached to a separate ground, each of the I/Os are an equally likely entrance point for strike event energy. Upon the occurrence of a strike, the energy will propagate along a conductive path (power line, transmission line or telephone line) until it meets the protector. The protector will shunt the majority of the strike energy to the earth ground. The earth immediately surrounding the ground point will begin to take up the energy charge and dissipate it by propagation. This process will last a few microseconds.

Meanwhile, for a brief instant, one side of the transmitter is elevated above ground while the other sides are at ground due to the other protector connections. As the surge energy attempts to go to ground using the transmitter as a connecting path to the other grounds, it is likely to also use some of the internal circuitry as a conductor and thus cause equipment damage. A complication factor is that the other I/O protectors are at a distance with respect to the equipment. The greater the distance between the protectors, the worse the problem.

Another complication in this scenario is the inductance existing in the connection between the I/O protector and the ground system. The inductance will determine just how much of the strike energy is conducted into the ground system and how much is left to elevate the equipment chassis. Since strike energy is a high frequency pulse, a low inductance path to ground becomes a critical factor. It is for this reason that copper strapping is preferred over large diameter wire as an interconnecting media. The strike energy, like water, will follow the easiest (least inductive and resistive) path to ground. The quality of the ground system will determine the speed at which we can disperse the harmful energy away from the equipment.

Making rearrangements

The solution is easy to talk about but a little more difficult to implement. From the previous scenario it should be clear that one of the problems with the installation is that each of the I/O protectors is connected via its own path to ground. This can be rectified, but will require some physical rearrangement of the equipment installation.

First and foremost, there needs to be but one ground system. Second, the individual I/O protectors need to be located on the same electrical ground plane. This will necessitate establishing a single point ground system within the equipment building. The primary advantage of the single point ground reference is that all of the equipment I/O protectors are at the same level with respect to the ground system. Any impulse energy present from a lightning strike raises the panel and each of the I/O protectors to the same level. Since the levels are the same, no destructive energy will flow between the I/Os or through your equipment. Third, the transmitter equipment chassis also must be connected to the ground plane using a low inductive connector.

Single point grounding and proper location of your lightning protection products for all I/Os is important. It can be the difference between surviving or not surviving a direct strike. **CT**

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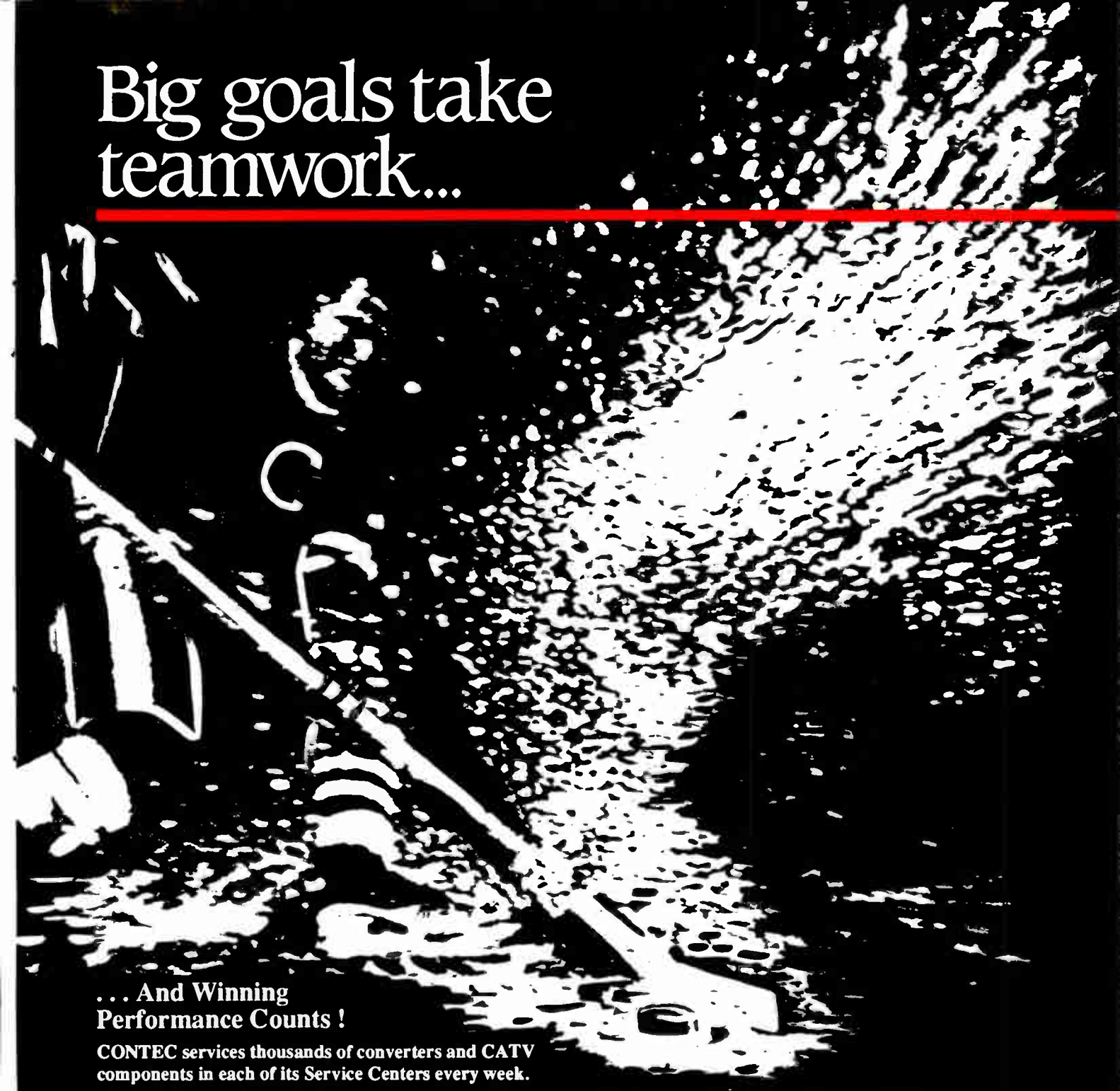

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Cable satellites: The next-generation

The following is reprinted with the National Cable Television Association's permission from the "1991 NCTA Technical Papers."

This article discusses the satellite and orbital changes that are expected to occur in the near future, and presents some critical issues and challenges facing satellite programmers and cable operators.

By Robert Zitter
Senior Vice President of Technology Operations
Home Box Office Inc.

The deployment of next-generation satellites in compliance with the Federal Communications Commission's uniform 2° spacing plan, together with the movement of cable programming occurring over the next couple years, compel the cable industry to examine the future performance of existing facilities. A discussion of the transition scenario, the technical differences in the new satellites, and ground station requirements reveals that cable TV and SMATV facilities will require reconfiguration and in some cases replacement may be necessary.

C-band satellites have become a reliable means of delivery for cable TV programs and have played an important role in the phenomenal growth of the industry. We have seen numerous operational, technical and regulatory changes together with technological advances in satellite and ground station equipment that led to significant reduction in overall costs. The cable industry has demonstrated its ability to successfully deal with such changes over the years.

A development that will impact the cable industry is the FCC mandate to phase in a uniform 2° spacing between U.S. domestic satellites. The intent of the plan is to alleviate overcrowding in the U.S. orbital arc. It times the deployment of next-generation satellites with improvements in ground station receiving characteristics in order to control the ensuing increase in adjacent satellite interference.

Time of replacements

In the early days, 4° of separation within the two segments assigned to U.S. domestic communication satellites — 70° to 104° and 117° to 143° West Longitude (°WL) — consisting of 15 satellite slots were found adequate. (The central portion from 104° to 117° has been reserved for Canadian and Mexican satellites.) But as the popularity and importance of satellite-delivered services increased, the separation provided in the usable orbital arc for U.S. domestic satellites was found inadequate for planned spacecrafts.

Hence, in 1983, the FCC adopted a plan to essentially double the number of orbiting domestic communications satellites by gradually reducing the spacing between satellites, so that over approximately 10 years, a uniform 2° spacing would be achieved. This evolutionary approach was chosen because: It prevented early obsolescence of existing satellites; it granted manufacturers sufficient time to design and construct antennas that can better discriminate between adjacent satellites; and, it permitted cable operators to amortize their existing facilities. The FCC's 2° spacing plan guided most of the technical, regulatory and economic developments that we experienced during the past decade.

Table 1 shows the launch dates for the next-generation satellites from Alascom, AT&T, GE Americom, GTE Spacenet and Hughes Communications. The cable industry has committed to basically two satellite vendors — Hughes and GE Americom — involving four satellites.

Table 1: Next-generation satellites

Carrier/ satellite	Frequency band	Orbit	Launch date
Alascom			
Aurora 2	C	139	May 1991
AT&T			
Telstar 401	C	97	May 1993
Telstar 402	C/K	89	March 1994
GE Americom			
Satcom C-1	C	137	July 1991 ■
Satcom C-4	C	135	Sept. 1992
Satcom C-3	C	131	Nov. 1992
Satcom H-1	C/K	79	1994
GTE Spacenet			
GStar 4	K	125	Nov. 1990
Spacenet IV	C/K	101	April 1991
Spacenet IR	C/K	103	May 1993
ASC 1R	C/K	129	Sept. 1993
Spacenet IIR	C/K	69	Sept. 1993
GStar 1R	K	121	June 1994
Hughes			
SBS 6	K	99	Oct. 1990
Galaxy VI	C	99	Oct. 1990 ■
Galaxy V	C	125	March 1992
Galaxy IR	C	133	Late 1993
National Exchange			
Spotnet I	C/K	93	March 1993
Spotnet II	C/K	127	Sept. 1993

Key
Cable satellites
■ In-orbit backup for cable satellites

Transition

The preparations for launching the next-generation cable satellites and the accompanying movement of programming actually began in 1988, as Galaxy I and Satcom F3R approached their designed end-of-life terms. Recognizing that approximately three years of lead time is required to design, construct and launch a satellite, the FCC and satellite vendors developed a transition strategy with the goals of ensuring uninterrupted service and minimize inconvenience to users.

The transition timetable for the deployment of satellites is illustrated in Table 2 (page 44). Note that Satcom F3R (131°WL) was temporarily replaced by Satcom F1R in 1991 and will remain there until Satcom C-3 (131°WL) becomes operational in 1993. Satcom F1R (originally at 139°) moved its traffic to

(Continued on page 44)

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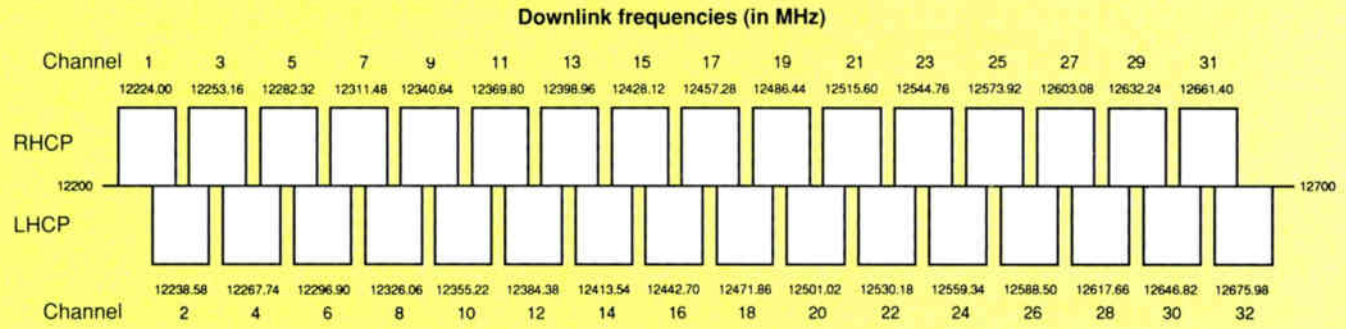
Figure 1: U.S. direct broadcast satellite frequency plan



DBS: A new approach for SMATV systems

By Robert Dennison
Group Leader, CATV Systems
Teleste Cablevision Ltd.

This article is written on the assumption that true DBS (direct broadcast satellite) in the United States becomes a reality; that is, 100 or more channels using digital video compression and digital modulation from one or more co-located high-power satellites. Refer to the many articles written recently extolling the bandwidth compression virtues of various digital modulation formats for satellite transmission along with digital compression of the video signal.

Figure 1 shows the 32-transponder FCC frequency plan for DBS. Now that four video channels per transponder has been successfully demonstrated, 128 TV channels are possible. This is certainly sufficient for most SMATV systems.

Consider the proposed headend shown in Figure 2. The satellite antenna at the headend receives the DBS satellite signals. A dual polarized LNB (or OMT with 2 LNBs) outputs each polarization at 950-1,450 MHz. The outputs from the two LNBs are then simply block converted from 950-1,450 MHz down to 50-550 MHz using a 1,500 MHz local oscillator. (A 1,500 MHz LO is preferable to 900 MHz for image considerations.)

Dual-cable distribution (one for each polarization) is then employed in the normal manner throughout the SMATV system. Bandwidth distribution at 550 MHz is now commonplace with trunk amps, bridgers and line extenders readily available.

At the subscriber end, shown in Figure 3, the subscriber receives a dual-cable drop. The output from one of the cables is selected in a standard H/V switch (I guess for DBS it should be called an LHCP/RHCP switch) controlled by the satellite receiver. The switch output feeds a simple block up-converter converting 50-550 MHz signals to 950-1,450 MHz. These signals are then fed to a satellite integrated receiver/descrambler (in this application the IRD becomes the set-top box) just as if the customer were a DBS subscriber. The SMATV subscriber can now receive 128 satellite channels.

Pros and cons

The advantages of such a system may be summarized as follows:

1) Customers have the capability to receive 128 satellite channels — probably many more than currently available.

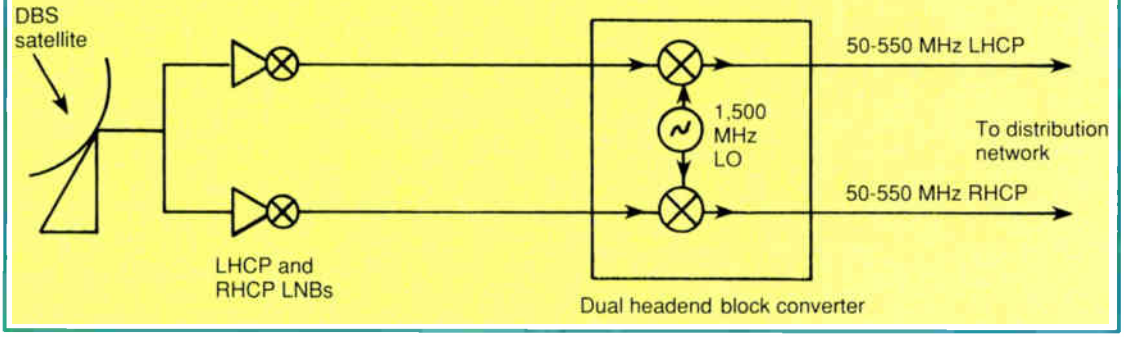
2) The SMATV operator merely charges $20 or so per month for providing signal with no scrambling or signal processing to worry about.

3) Subscribers buy premium channels directly through the DBS control center. The system operator cannot lie about the number of premium channel subscribers he has. (You wouldn't do that, would you?) This feature alone should encourage the popular programmers to participate in the DBS system. The medium-power pseudo-DBS services tried so far have suffered from lack of popular name-brand programming.

4) Subscribers buy their own satellite receivers instead of the operator being burdened by the cost of set-top boxes.

5) The headend cost is extremely low (merely a satellite antenna,

Figure 2: Basic headend



Ordering Information

RNB Series

Model Number	Exterior Width	Exterior Height	Exterior Depth	Lid Width	Lid Height	Lid Depth	Knockouts	Knockout Sizes 2-3/8 & 1-5/16	Knockout Sizes 1-3/4", 1-3/8", 1-1/8", 7/8"
RNB-B126	8-1/8"	12"	6-1/8"	8"	12"	19/32"	2 Bottom	0	2
RNB-12126	12-1/8"	12"	6-1/8"	12"	12"	19/32"	3 Bottom	1	1
RNB-12188	12-1/8"	18"	6-1/8"	12"	18"	19/32"	3 Bottom 1 Each Side	2	1
RNB-24188	24"	18"	8-1/8"	18"	24"	19/32"	3 Bottom 2 Each Side	2	2

RNH-Hinged Series

Model Number	Width	Exterior Height	Depth	Knockouts	Knockout Sizes 2-3/8 & 1-5/16	Knockout Sizes 1-3/4", 1-3/8", 1-1/8", 7/8"
RNH-10126	10"	12"	6"	2 Bottom	1	1
RNH-12186	12"	18"	6"	3 Bottom	2	1
RNH-20246	20"	24"	6"	3 Bottom	2	1
RNH-20248	20"	24"	8"	3 Bottom	2	1

RNBB-Box-In-Box High Security Series

Model Number	Width	Exterior Height	Depth	Knockouts	Knockout Sizes 2-3/8" & 1-5/16"	1-3/4", 1-3/8" 1-1/8", 7/8"0
RNBB-12128	12"	12"	8"	2 Bottom/Back	1	1
RNBB-12188	12"	18"	8"	2 Bottom/Back	1	1
RNBB-18248	18"	24"	8"	3 Bottom/Back	2	1

RNHL-Hanging Lid Series

Part No.	Size W x H x D	Multiple Knock Duts On Bottom 2-3/8" & 1-5/16"	Multiple Knock Duts On Side 1-3/4 & 1-3/8 & 1-1/8 & 7/8"
RNHL-12128	12" x 12" x 8"	1	1
RNHL-12188	12" x 18" x 8"	1	1
RNHL-18248	18" x 24" x 8"	2	1

RNT-Overhead-Entry Door Series

Model Number	Width	Exterior Height	Depth	Knockouts	Knockout Sizes 3" & 2"	2" & 1-5/16"	7/16"	7/8"
RNT-12188	12"	18"	8"	4 Bottom	1	1	1	1
RNT-18248	18"	24"	8"	5 Bottom	1	2	1	1

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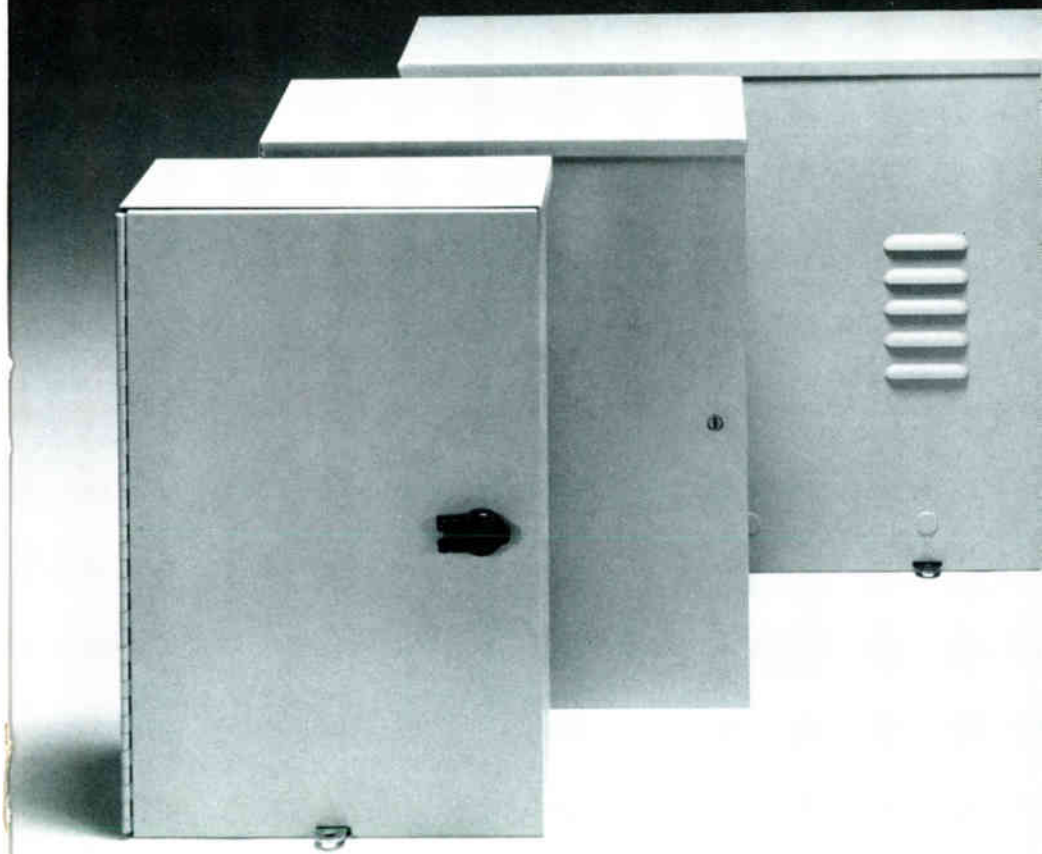

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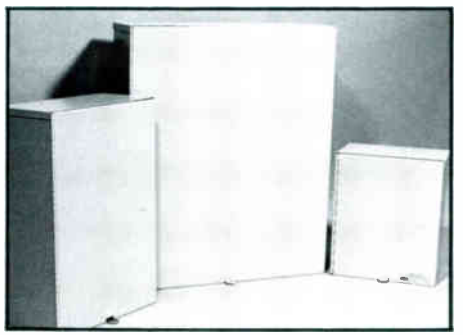

Benefits Safety Cover™

- Hinged Cover
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- Gray baked on polyester powder coating, UL 50 standards outdoor box rating, High corrosion resistance
- Knockout for optional cam lock
- Oxboard interior backing standards detachable 1/2"
- Multiple entry knockouts
- Mounting holes 5/16" indented
- Drain Holes
- 3/4" D Knockout

RNBB-Box-In-Box High Security Series

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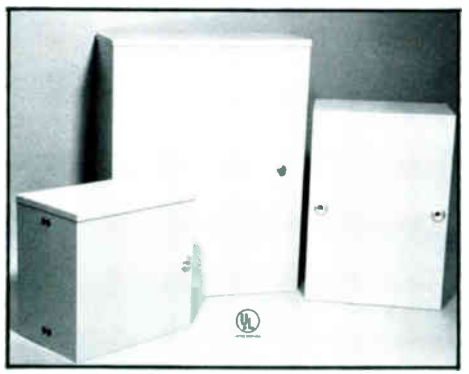

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- High security bearing sleeve at locking point
- 16 gauge galvanealed steel
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- Full back with multiple entry knockout
- Key style holes to mount box to wall
- Drain Holes

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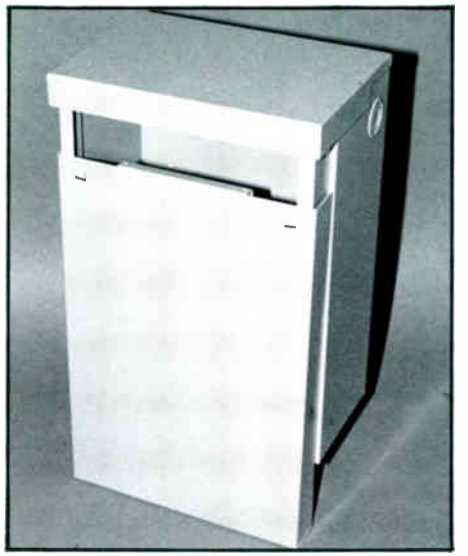

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- Can lock with an Intertite Lock, add 1 to the end of part number – Special Order
- Can lock with a Tamper Proof Screw, add T to the end of part number – Special Order
- Drain Holes

RNT-Overhead-Entry Door Series

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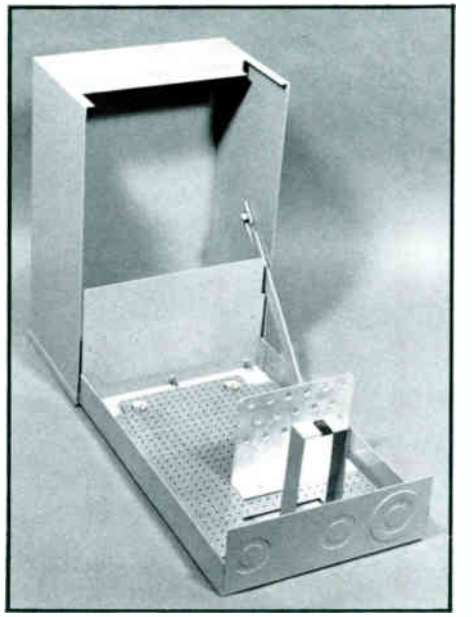

Benefits Safety Cover™

- 16 gauge galvanealed steel
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- Key style holes to mount box to wall
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two LNBs and two block converters).

The distribution network is extremely rugged since the customer only requires a C/N comparable to that received from satellite, say 15 dB. Compare that with the C/N required for conventional AM VSB NTSC of approximately 43 dB or more. As a further consequence, cascades could be much longer, extending the reach of the system. Alternatively, it would be very economical to arrange the system with numerous headends and SMATV islands.

The disadvantages of such a system are:

1) It is a dual-cable system.

2) The VCR or additional outlets also would require an IRD (as a set-top box).

3) Provision must be made for the addition of local off-air channels. This could be handled in a number of ways:

- Customers could provide their own local off-air channels.
- Distribution at 750 MHz could be used. In this case it would be better to have local off-air signals in NTSC format at 54-216 MHz and satellite signals with their greater ruggedness at 250-750 MHz.
- Less desirable transponders (such as wrong time zone feeds) could be notched out and local channels added in their place. At the subscriber end, the local programming in NTSC format could be either diplexed off the cable and fed directly to the TV set, or (more desirably) it could be transcoded into the digital satellite format at the headend and also be received through the IRD.
- An additional third cable could be used for the NTSC off-air signals.

Many variations on this approach are possible. One that appears particularly attractive and uses only a single-cable 550 MHz distribution system is: 54-216 MHz (up to 23 NTSC off-air and locally generated channels, plus FM radio), 250-550 MHz (40 satellite modulation format channels, including premium channels for reasons of billing as previously described, using either cherry-picked transponders with simple frequency conversion or recoding at the headend).

If 750 MHz distribution was used, 250-750 MHz could carry a complete 500 MHz wide block of 64 channels from one polarization. At the headend, this would require only a simple block converter from 950-1,450 MHz to 250-750 MHz. If all East Coast programming was transmitted on one polarization and West Coast programming on the other, this would represent a near ideal solution.

The customer connection is shown in Figure 4. Note that the use of European-type remodulators in the satellite receiver and VCR gives greater flexibility. These pass all the antenna input channels to the output and add in the one modulator output channel at UHF. If the signal from the VCR's output is split and distributed to additional outlets, it includes all NTSC channels, plus

(Continued on page 48)

Figure 3: Basic subscriber connection

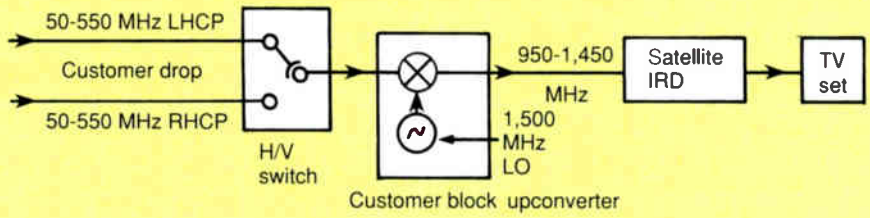


Figure 4: Subscriber connection (NTSC 54-216 MHz, satellite 250-750 MHz)

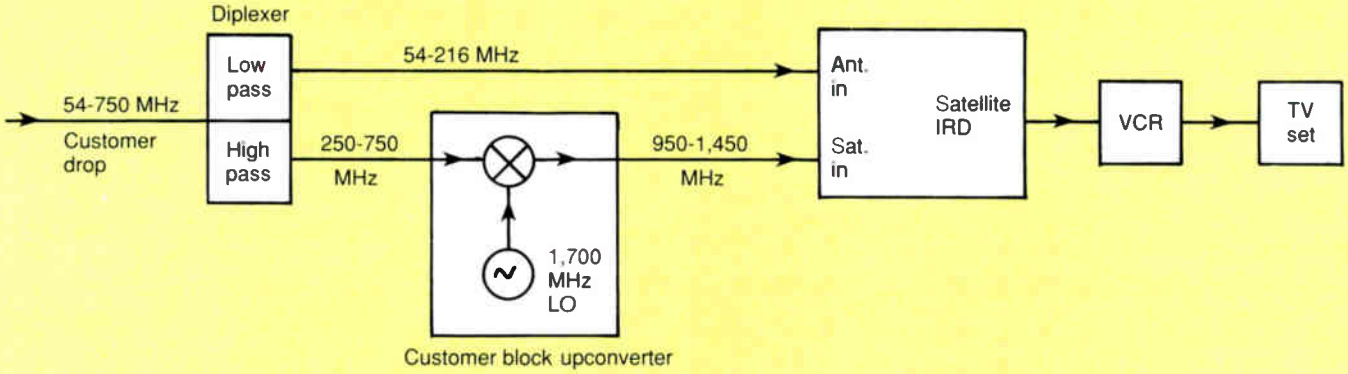
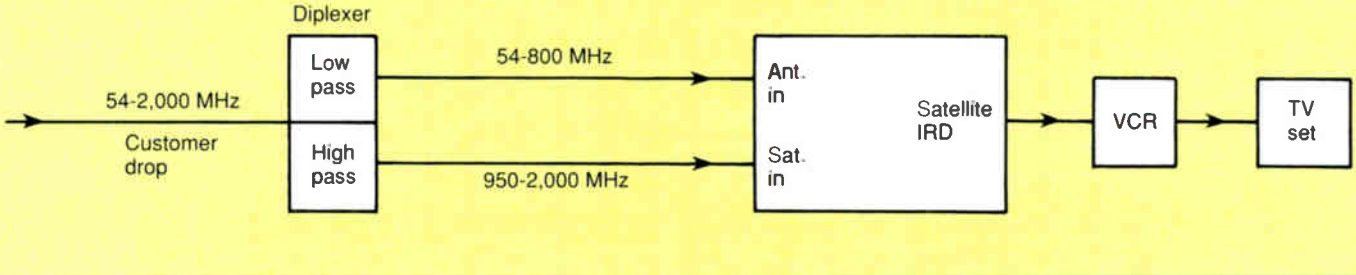


Figure 5: Subscriber connection (NTSC 54-800 MHz, satellite 950-2,000 MHz)



The virtual channels subscriber interface

By David P. Beddow
Executive Vice President and COO
Primestar Partners L.P.

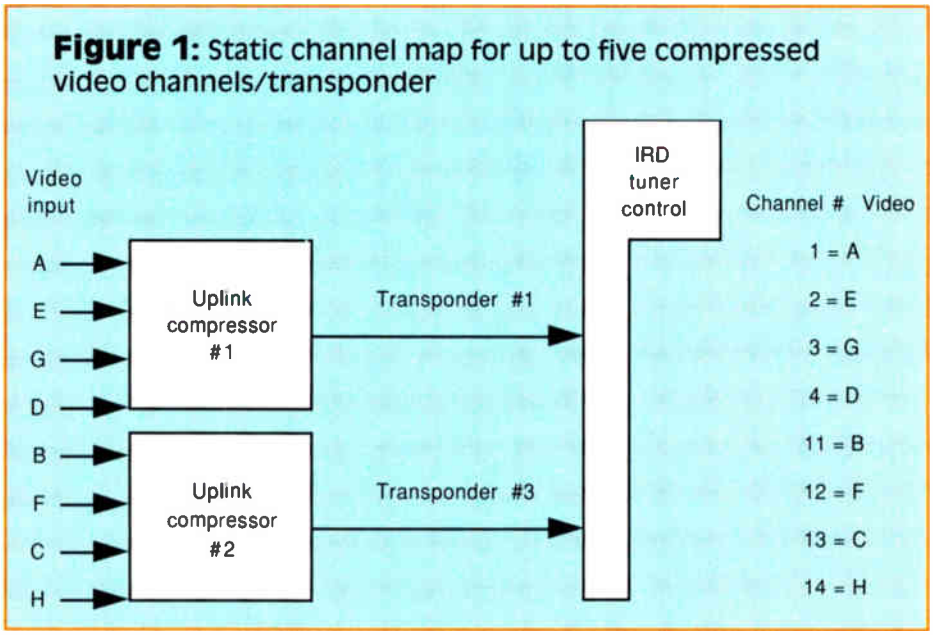
The melding of video, audio, teletext and data services into a fully featured direct broadcast (DBS) or cable TV consumer package may well prove to be the most challenging video game of the '90s. With the maturing of digital video compression technology that expands channel capacity by four or five to one, (and perhaps eight or 12 to one for services requiring lesser picture quality), we can soar to new creative horizons. The system operator's radar indicates unlimited visibility bound only by the programmer and marketer's imaginative deployment of incremental revenue producing channels, including pay-per-view, and alternate uses for bandwidth fed by compression.

However, the viewing subscriber flies in a less forgiving environment. Consumer perception of the benefits of this explosion in available services is often clouded by confusing computer menus, impossible-to-read guides and intimidating hardware. As Primestar approaches the procurement of its second-generation of home equipment, we find ourselves cautioning many potential suppliers that we are installing a receiver/decoder in homes, not cockpits of an F-111.

A new concept

Primestar began addressing this challenge more than two years ago with the specification of our first-generation integrated receiver/decoders (IRDs). We say "began" because we believe no one has demonstrated the ultimate solution. With the creation of a new concept in subscriber interface techniques, called "virtual channel mapping," we took the all-important first step. Virtual channels for the subscriber is a simple and transparent method of relating a viewer's entertainment and information choices to channel numbers rather than complicated multilayered menu options. Subscribers for years have remembered their favorite stations (television and radio) by numbers. Under the virtual channels concept, all choices are assigned a number. This numbering includes not only video services but audio, text and data services as well.

Figure 1: Static channel map for up to five compressed video channels/transponder



At first blush, the change seems simple. For most systems, you could expand the range of available channel assignment numbers and change a few software commands such that pressing in a channel number on your remote control would emulate the same instructions issued when stepping through a table of computer-like menus. Indeed, this is only the first in a series of changes that ripple through the entire control system.

Nevertheless any static channel numbering system rapidly becomes obsolete. In the best case, even the most exhaustive effort at carving up segments of transponder or cable bandwidth and assigning channel numbers will result in the right solution for the initial program offering. When lineup changes and additions are made, the numbering convention is likely to no longer fit without a massive restructuring of the assignment of input signals to the group of transponders or cable channels involved. In any large system (and particularly a DBS service with multisite uplinks), this could prove to be a costly and disruptive task.

Now, we certainly do not advocate frequent or unwarranted changes in channel lineup. However, we do recognize that a system that is destined to grow is eventually going to reach the point of no return and be forced to overhaul its lineup to provide a logical package. Compression only compounds this problem since the efficient grouping of signals for transmission will probably never match the logical grouping of channels for home viewing.

The solution

Our solution is to insert an uplink/headend programmable, dynamic channel map between the IRD's broadband input tuner and the subscriber interface electronics. This is best illustrated by a case using only video channels. For example, marketing decides that programming Chs. A through H should appear as Chs. 1 through 8 on the subscriber's terminal. Engineering needs to uplink these signals using 4:1 compression to two transponders. For logistical reasons, the most efficient way to package these signals for transmission is shown in Figure 1. A simple receiver with a static channel map designed to work with up to five compressed channels per transponder would likely output to the subscriber an illogical package of channel numbers.

(Continued on page 49)

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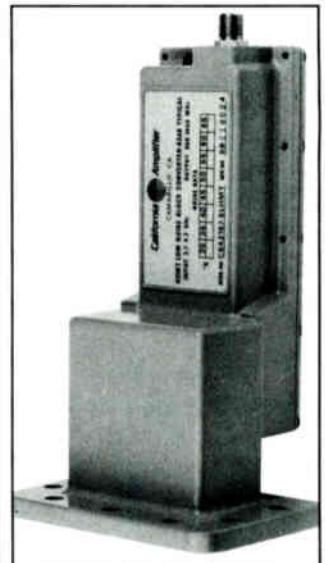

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Reader Service Number 23

Underground coaxial construction — Part 2

The following is adapted from the National Cable Television Institute's lesson, "Underground Construction, II," which is part of the NCTI Service Technician Course. The first part of the lesson, which ran last month, covered chain trenchers, burying cable and conduit in trenches, and backfilling the trenches. This installment will cover vibratory plows, plowing coaxial cable and conduit, and backfilling starter/ending trenches.

By the National Cable Television Institute

Coaxial cable or conduit can be plowed underground with a vibratory or pull plow. Since cable or conduit burial and backfilling both occur as the plow cuts through the ground, cable plowing is not as time-consuming as trenching in open terrain. However, there are limitations to plowing and safety precautions to observe during the plowing operation. Only those CATV personnel trained in machine operation safety procedures and guidelines should operate a vibratory plow. All safety equipment — hard hats, work boots, safety vest (if required), cones, etc. — should be used by the plow operators and their assistants.

Vibratory plows

The vibratory plow is used to directly bury the coaxial cable or conduit underground. The basic cable plow is either a self-contained unit or a modular unit that can be connected to several different sizes of tractors.

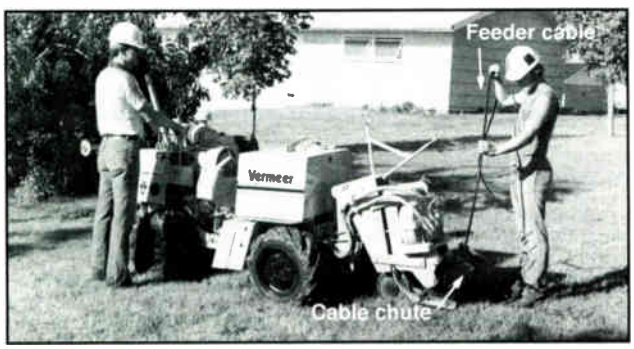
The self-contained plow in most cases is a non-riding unit. This means the operator either walks behind or alongside the plow while steering it (Figure 1). These units are narrow enough in width to fit through a standard 36-inch yard gate. These cable plows typically bury the coaxial feeder cable or conduit 18 inches below ground and travel on small tractor-style tires to reduce damage to lawns. The cable or conduit can be fed into the ground through a chute connected to the plow blade or pulled into the ground by using a plow blade with a pulling hook instead of a chute.

The modular plow units normally are used with medium- and large-sized riding tractors. Some large plows are attached to "caterpillar-style" tracked vehi-

NOTE:

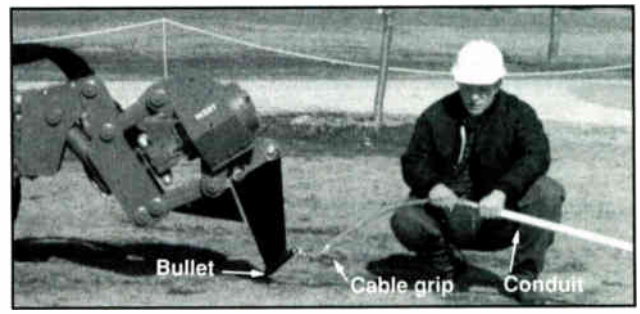
All construction activities in your system may be governed by OSHA standards set forth in Title 29 Code of Federal Regulations 1926. Always follow your state and local regulations governing all construction activities.

Figure 1: Self-contained vibratory plow



Courtesy of Vermeer Manufacturing Co.

Figure 2: Plowing in conduit with a modular vibratory pull plow

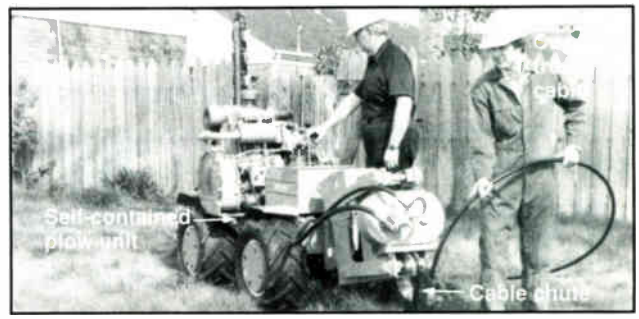


Courtesy of The Charles Machine Works Inc.

Figure 3: Plowing in cable with a vibratory feed (chute) plow

Courtesy of The Charles Machine Works Inc.

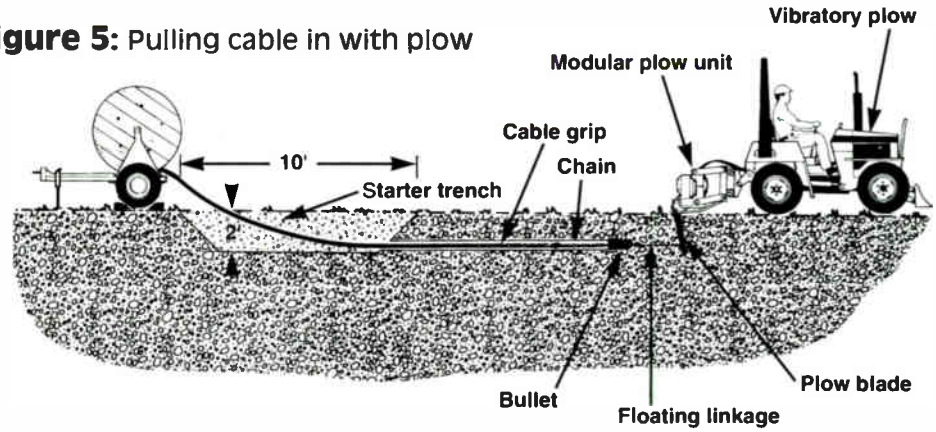
Figure 4: Feeding cable by hand



Courtesy of Burkeen Manufacturing Co.

cles. These modular units permit using the tractor body with trencher and backhoe attachments, or modules, as well as with larger cable plow modules. These modular plows typically bury the coaxial cable or conduit at depths ranging from 18 to 35 inches. These units also will feed or pull the conduit (Figure 2) or feeder cable (Figure 3) into the ground as the plow blade cuts through the ground.

Figure 5: Pulling cable in with plow



Courtesy of General Cable Co./CATV Division

Using the cable plow for coaxial cable or conduit burial is much more economical than trenching. However, in developed areas its value is generally limited, except for making runs across open yards or vacant lots. The limited use of the plow is due primarily to the existence of surfaced streets, surfaced alleys, curbs, gutters, etc. However, for long trunk runs or for the burial of coaxial cable in undeveloped areas, a large cable plow pulled by a crawler can be extremely economical. It also is very difficult to plow in hard, frozen and/or rocky soil. Although it is very difficult to plow in rocky, semi-frozen or hard ground, it is sometimes possible to run the plow along the cable route by itself to break up the soil and then make a second run to place the cable into the ground.

Figure 6: Feeding cable from reel mounted on plow

Courtesy of The Charles Machine Works Inc.

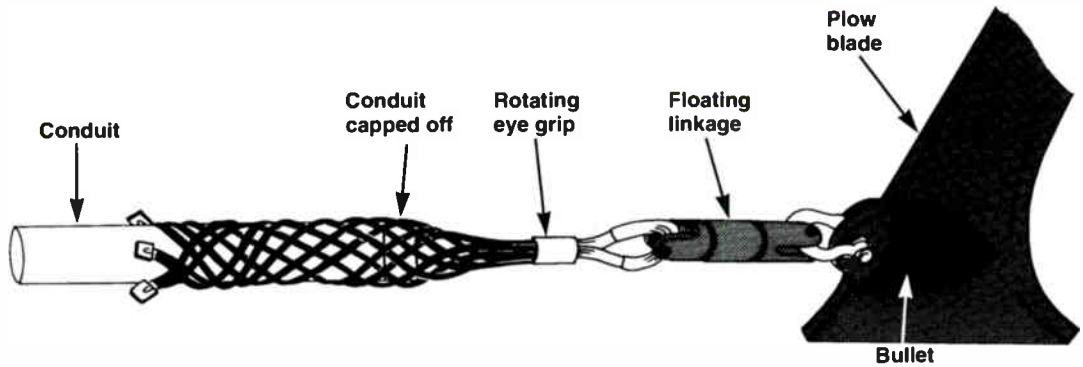
Plowing coaxial cable

Before plowing coaxial cable, locate all underground utilities (electric, gas, water and telephone) by contacting the utility and telephone companies, or the state's one-call system. This utility location step is very important in the prevention of electrocution, gas explosion, waterline breakage or loss of telephone/electrical service, and will help to ensure personal safety. Be aware that the maps of underground sprinkler systems may not always be accurate. Ask the homeowner the location of all underground water sprinkler system lines. If there is a question of sprinkler line location and direction, dig down at the sprinkler head to determine the direction of the underground sprinkler system water lines.

To begin plowing coaxial cable underground, use a backhoe trencher or shovel to dig a 3-foot starter trench 18 to 36 inches deep for trunk and feeder cables. The depth of the trench depends upon the specifications determined by the cable system, city, county or state.

There are three methods to bury the coaxial cable directly into the ground with a vibratory plow. The first method lays out the coaxial cable along the plow route under all obstacles between the pedestals and the cable feeds by hand through the cable chute into the ground as the plow cuts through the ground between the pedestals (Figure 4). The second method hooks the coaxial cable to the bottom of the plow blade and pulls the cable into the ground from a cable reel as the plow cuts through the ground between the pedestal sites (Figure 5). When encountering an obstacle, pull enough cable off the reel to go from the obstacle to the next pedestal site. Move the cable plow to the starting trench on the far side of the obstacle, reconnect the plow blade, and begin plowing again to pull the rest of the coaxial cable through the ground to the next pedestal location. The third method feeds the coaxial cable from a cable reel carried on the plow through the cable chute into the

Figure 7: Conduit attached to plow blade

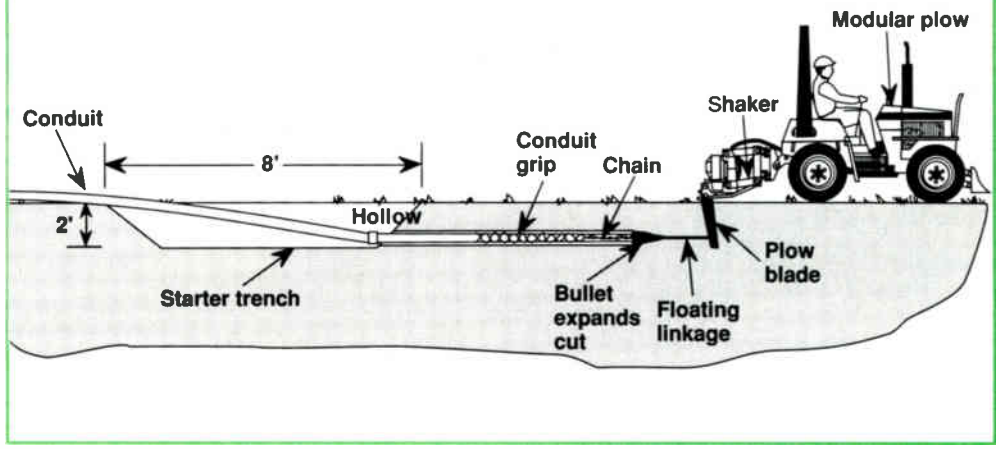


Courtesy of General Cable Co./CATV Division

ground (Figure 6 on page 33) as the plow cuts through the ground between the pedestal sites. This last method works best unless obstacles are encountered that would require following the first method from that obstacle on to the next pedestal.

At a pedestal location, hand dig or machine dig a 3-foot starter and ending trench at the required depth along the plow route. If you encounter a fence, sidewalk or other obstacle along the route between the pedestal sites, hand dig or machine dig an ending trench that is three feet long plus the length of the cable plow in front of the obstacle. Also dig a 3-foot starting trench behind the obstacle along the plow route. To prevent cutting the telephone drop with the plow when the plowing path crosses over a buried residential telephone drop, hand dig a trench around the indicated telephone location until the buried telephone drop is uncovered.

Figure 8: Burying conduit with a vibratory plow



Courtesy of General Cable Co./CATV Division

Plowing conduit

To bury conduit with a vibratory plow: 1) dig a 3- to 8-foot starter trench; 2) plug or tape the end of the conduit; 3) attach a long continuous length of polyethylene conduit to the plow blade with a pulling grip (Figure 7 on page 33); and 4) pull the conduit into the ground using the vibratory plow (Figure 8). Be sure to pull the coaxial cable into the conduit before backfilling the starter trench.

Backfilling starter/ending trenches

After plowing the coaxial cable or conduit into the ground and pulling the coaxial cable into the conduit, carefully feed the two ends of the coaxial cable into their respective pedestal sites without kinking or damaging the cables. Add the conduit 90° elbows to the conduit ends before backfilling. Backfill all the ending and starter trenches with a shovel. Next, tamp and water the trenches and plowed route. Continue this procedure from pedestal to pedestal all along the cable plow route. **CT**

Technical consultation provided by: Lance K. Bolan, construction manager for ATC in Colorado Springs, Colo.; Paul Broeckert, construction manager for United Artists Cable; Bill Collins, plant manager for Tele-Communications Inc.; Jeff Geer, product manager for Alpha Technologies Inc.; Paul Kelly, construction supervisor of multiple dwelling units department for Continental Cablevision of St. Paul; K. Charles Mogray, applications engineering manager for Comm/Scope Inc.; Jim Neil, plant manager for Multimedia Cablevision; Tom Prichard, MSO sales representative for Midwest CATV; Barry Smith, connector specialist for Times Fiber Communications Inc.; Joseph Thill, construction supervisor for Paragon Cable of Minnesota; Jerry Trautwein, president for Dynasty Communications Inc.; Gary Wesa, chief engineer for Green Bay Cablevision; Tom Wimler, plant manager for Triax Midwest Associates; and Frank Wiseman, technical communications coordinator, David Bazzell, manager of technical training, and Dr. Gerald Stengl, new product research and development manager for The Charles Machine Works Inc.

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(Continued from page 19)

resistivity with moisture content. When thoroughly dried these two samples of soil became very good insulators, having a resistivity of more than 10^9 ohm-centimeters.

The resistivity of the soil is influenced by temperature. Table 3 on page 19 shows the variation of the resistivity of sandy loam, containing 15.2 percent moisture, with temperature changes from 20° C to -15° C. In this temperature range, the resistivity is seen to vary from 7,200 to 330,000 ohm-centimeters.

In some locations, the resistivity of the earth is so high that low resistance grounding is attained only at considerable expense and with an elaborate grounding system. In such situations, it may be economical to use a ground rod system of limited size to reduce the ground resistivity by periodically increasing the soluble chemical content of the soil. Table 4 shows the notable reduction in resistivity of sandy loam brought about by an increase in chemical salt content.

The current-carrying capability of the ground rods and grounding and bonding

Table 4: Effect of salt content on resistivity of soil (sandy loam, moisture content 15% by weight, 17°C)

Added salt (% by weight of moisture)	Resistivity (ohm-cm)
0	10,700
0.1	1,800
1.0	460
5	190
10	130
20	100

Salt, in this case, refers not only to sodium chloride, but copper sulfate, sodium carbonate and others.

connectors is verified by a surge current test such as described in *ANSI/UL467*. This test assures that the connectors will conduct, without damage, a short duration current almost sufficient to fuse the associated conductor.

Materials used to manufacture ground rods and clamps will determine the integrity and life of the grounding system. The U.S. National Bureau of Standards tests show copper to be the most corrosion-resistant of all metals tested, in most soils. Buried clamps and sectional couplings must be manufactured of high copper content alloy (minimum 80 percent) per *ANSI/UL467*.

The most comprehensive specification developed for copper jacketed rods is the "standard for safety grounding and bonding equipment," published by UL as *ANSI/UL467*. This specification requires the following:

- A heavy, pure copper jacket having 0.010-inch minimum thickness
- A copper jacket adherence test
- A bending test with no cracking of the copper jacket

The NBS determined the required thickness of the industry standard copper jacket and published it in NBS *Circular 579*. Table 48 in the circular contains a compilation of weight loss per year of copper specimens buried in 43 different soils for periods of eight to 13 years. By dividing these values by the density of copper, an average penetration per year was established. Extrapolating the average penetration figures to 30 years showed that a 10-mil solid copper-plated rod resists corrosion penetration in virtually any type of soil.

Therefore, ground rods with a copper thickness of 0.010-inch or greater would

guarantee a minimum 30-year installation service life. This is the basis of the present requirement of UL.

It also is important that the copper be metallurgically bonded to the steel core to achieve the long service life required of a ground rod. Without this integral bond, any electrolyte that enters the copper/steel interface could implement rapid corrosion. This phenomenon exists with any unbonded, bimetallic ground rod.

The steel core of the ground rod has sufficient strength such that the rod is installed with negligible bending of the end. The diameter of the rod, and therefore the strength, will depend upon the type of soil into which it is to be driven.

As in any installation, the adherence to nationally accepted codes is a must as is the proper selection of the material and equipment to achieve that same goal. The objective of the power company is to maintain a low level of resistance for personnel safety reasons, equipment safety and reliability. These same reasons also are very important for proper grounding of cable TV installations.

Only when adherence to these codes (and local, state, etc.) is achieved will the credibility of grounding systems be a lesser issue in the industry. This is not to imply that the issue of bonding and grounding is purposely overlooked. Instead the need to emphasize bonding and grounding must be addressed with the same amount of attention that other important issues are dealt with when designing installations and developing standards.

The design or specifications engineer can establish a system using charts and known criteria when soil conditions are available for the use in the derivation of a system. However, with the installation of high-tech equipment in a cable TV distribution system, the installation should be verified to assure that it is in compliance with the objective of the designer.

Meters are available that permit testing of ground systems to verify that a low resistance ground, according to the needs of the particular installation, are achieved. One only need review any of the major trade journals and you will see that the subject of grounding continues to be a major issue.

In the overhead distribution system, the supporting strand and equipment should be bonded to the power utility grounds if possible. A No. 6 solid copper conductor may be connected between the steel strand and the power pole grounding conductors using UL-approved parallel groove K-clamps or split bolts. Alternatively, the No. 6 solid copper conductor may be connected between the strand and separately driven ground rods with UL-approved ground rod clamps. Suitable ground rods have been previously discussed. Also, be sure to check your local and state codes. **CT**

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1) *National Electrical Code,* NFPA 70, 1990.

2) *National Electrical Safety Code,* ANSI C2, 1990.

3) "Standard for Grounding and Bonding Equipment," *ANSI/UL467.*

4) "Proper Grounding of Cable TV Systems," T. Bernstein, *Communications Engineering & Design,* June 1982, pages 41-47.

5) *Getting Down to Earth,* James G. Biddle Co., 1978.

6) *Grounding and Bonding of Cable Television Services — Comments, Questions and Answers,* New York State Commission on Cable Television, Fifth Edition, June 1990.

This article is dedicated to the memory of John (Jack) Cain who passed away on Feb. 5, 1992.

Outages before and after SCR crowbar deployment

Outage type	1988	1989	1990*
Blown fuses	29	37	3
Tripped breakers	5	11	0
Shorted gas diodes	8	5	0
Bad AC power supply	7	8	2
Bad DC power supply	20	16	1
Shorted passives	4	8	4
Shorted actives	7	13	4
Total outages	80	98	15

*Fully retrofit with SCR crowbars.

Reducing outages

(Continued from page 20)

6,000 volts at 3,000 amps. The AmpClamp survived repeated "hits" without deterioration. Jones Intercable and others have since duplicated these results.

So where are we?

The Florida cities of Tampa/Sarasota, Orlando and Melbourne are the lightning capitals of the United States. These and most of the rest of Florida statistically have 80 to 100 lightning days a year. A recent well-researched paper on lightning stated that lightning in this region and the surrounding areas is more intense, and typically contains far more than the median lightning stroke current of 20,000 amperes. But even where there are much fewer lightning days (such as in New York, Michigan, Wisconsin and California) the protection from LSC and transients from switching and pumping centers and other causes have been most pronounced.

A case in point is Cablevision Industries' West Valley, Calif., system that was being troubled not by lightning, but by massive power company switching operations. CVI has superb outage records, and kindly provided "before and after" hard copy shown in the accompanying table above for two test bed hubs in its West Valley system. Note that 1990 had the benefit of a full retrofit of SCR crowbars.

CVI Senior Vice President of Engineering Joe Van Loan, said "These results speak for themselves and it is now our policy to have 100 percent crowbar deployment throughout all our systems."

Jones Intercable system engineering managers at Tampa and Augusta, Ga., feel that lightning- and transient-related outages have declined anywhere from 50 to 80 percent after retrofitting AmpClamps throughout their plants. At the Jones system in Pima County, Ariz., System Engineering Manager Allen Showalter contacted the local office of the National Weather Service after a particularly virulent storm and learned that his franchise area had taken 800 lightning strikes. During this time his 1,100-mile system had zero outages and he attributes this entirely to his 100 percent installation of AmpClamps.

Nick Worth, executive vice president of engineering for TeleCable, has been using AmpClamps for about two years now. Worth said, "The AmpClamps have been so rewarding that we are now routinely installing them in all new plant and progressively retrofitting them in all of our 21 existing systems."

At least two major cable amplifier manufacturers have made their own tests in their own labs and have, or will soon introduce, their amplifier lines with optional SCR crowbars already built right into them. **CT**

Editor's note: Roy retired from Jones Intercable last month to pursue a new course he's charted with his wife Betty. See "Keeping Track" on page 82.

Preventing lightning damage

(Continued from page 22)

lightning stroke such as electromagnetic and electrostatic pulse? What about ground and atmospheric transients? What about the bound charge hazard? These are all unpleasant things that happen to buildings, equipment and even people, ostensibly protected by conventional lightning rod systems.

In recent years, there has been an attempt to design even better and more efficient lightning collectors. These new systems can be classified as "early streamer generators." That is, they are intended to be even more efficient at collecting a strike from an even larger strike zone than a so-called Franklin rod. There are even some that use a radioactive element to increase the attraction zone.

The problem with all these systems — even if they do what they say — is that the basic approach takes the exact opposite and inappropriate protective approach; attracting a lightning strike right into your facility is exactly the wrong idea. Each year, hundreds of lightning-related catastrophes occur to protected facilities.

The thoughtful observer is then forced to ask: If a Franklin rod system won't protect our facility, what will? The answer lies in understanding how and why lightning is attracted to any particular structure. Scientifically, it follows that, once having discovered the necessary elements for lightning to occur, we should be able to develop a methodology to prevent it from happening, at least within a limited zone.

The lightning stroke mechanism

When an electrically charged thundercloud moves over the earth, it induces a positive charge into an area on the surface of the earth not unlike an electrical shadow. The shadow area is about the same size as the cloud. Depending upon the height of the cloud above the surface of the earth, the induced charge may develop a differential potential as great as 30,000 volts per meter of separation between the cloud and the earth. Charge potentials as large as several million volts are not uncommon.

The largest recorded stroke is on the order of a quarter of a million amperes. The average lightning stroke, however,

"A thoughtful engineer today should seriously question the idea that we should intentionally attract and channel a multimillion volt lightning stroke right into our building structure."

contains only about 20,000 amperes. A typical stroke demonstrates an average current rise time during the stroke of about 40,000 amps per microsecond. Moreover, lightning is fast, traveling at about 107 meters per second in a sea level atmosphere. Naturally, the negative charged cloud and the positively induced earth will attempt to discharge the differential charge through any conductive path it can establish.[1]

The dynamic process of developing that conductive path is the key to understanding how and why lightning will strike any particular point on or above the surface of the earth. Through a natural process called single point ionization, any sharp object protruding up from the surface of the earth will act as a partial conductive path and begin to generate a microcurrent flow during storm conditions. This flow begins to dissipate or ionize the positive charge into the surrounding atmosphere, thereby reducing the overall charge potential between the cloud and the surface of the earth. The natural process of charge dissipation or ionization can occur from nearly any object protruding up from the surface of the earth such as building corners, trees, poles or even a ship's mast.

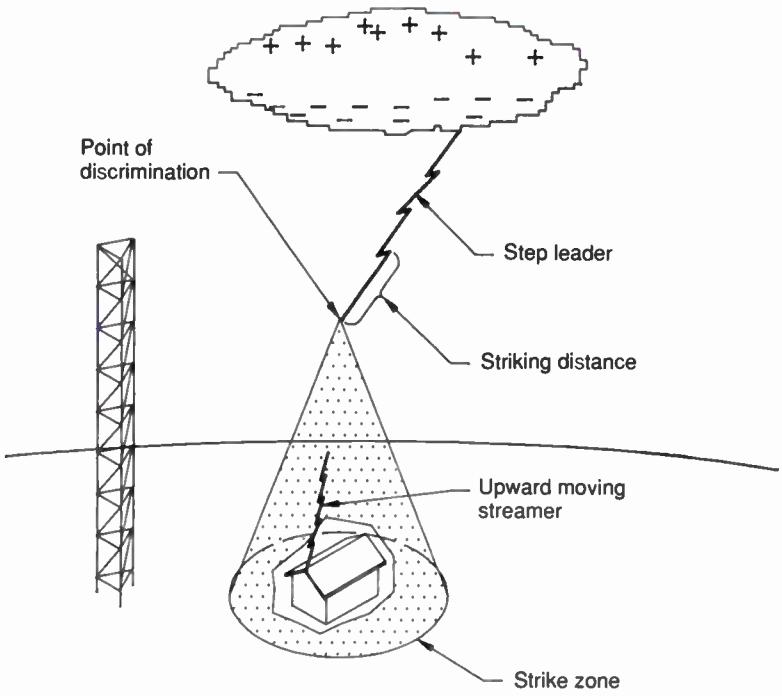
At moderate current flow rates, the discharge process phenomena is sometimes even visible in low-light conditions. The visible plasma discharge from the tip of a point ionizer is sometimes referred to as St. Elmo's fire. This natural point discharge is so effective at dissipating the charge potential between clouds and earth that it accounts for from five to 20 times the total amount of charge neutralization that occurs from lightning.[2]

As a thunderstorm matures, it reaches charge potentials approaching 108 volts, plus or minus an order of magnitude. At this point, the cloud begins to develop and send out step leaders, which are emitted from the cloud base moving towards the earth. This is much like lowering a wire towards the earth. These step leaders move in steps ranging from 20 to 200 meters in length. This accounts for the jagged edges of lightning we all see.

As the step leaders approach the surface of the earth, the electrostatic potential on elevated structures like buildings and trees increases dramatically. The increased potential creates a saturation effect in the point ionizer causing an upward moving streamer. The streamers emanate from single point ionizers such as lightning rods or building corners within the strike zone.

Figure 2 on page 42 illustrates this dynamic phenomena geometry. As these upward moving streamers approach a step leader, the natural capacitance of the atmosphere is overcome, the step leader and the streamer connect and a conductive path is established. A single or multipulse stroke will then occur along the conductive path and partially discharge the cloud-to-earth potential. The efficiency of the streamer generator (how much current is flowing from it) determines which point ionizer will effectively compete for and attract the step leader and the

Figure 2: Strike zone factor



stroke. This accounts for the strange phenomena of a stroke hitting a small building at the base of a tall tower equipped with a lightning rod.

Corrective methodology

Now that we know how and why lightning happens, we can concentrate on how to prevent it from happening (at least within a limited area). For the sake of argument, assume for the moment that a mechanical zone can be created within which at least one of the necessary conditions for lightning can be prevented, thus eliminating the possibility of a strike.

Fundamentally, there is no physical limit to the size of a protective area that can be created. There are, however, some practical limitations, primarily associated with hardware costs that tend to limit the size of a preventive zone.

It is clear that meteorological systems containing multiple storm cells can be very large, often covering whole geographical areas. Even small thunder cells will cover many square miles. It also is important to note that no individual preventive system, no matter how effective it is, could completely neutralize the huge electrical potential that builds up under even a small storm. Preventive expectations must therefore be adjusted to preventing strikes to individual structures or limited geographical areas.

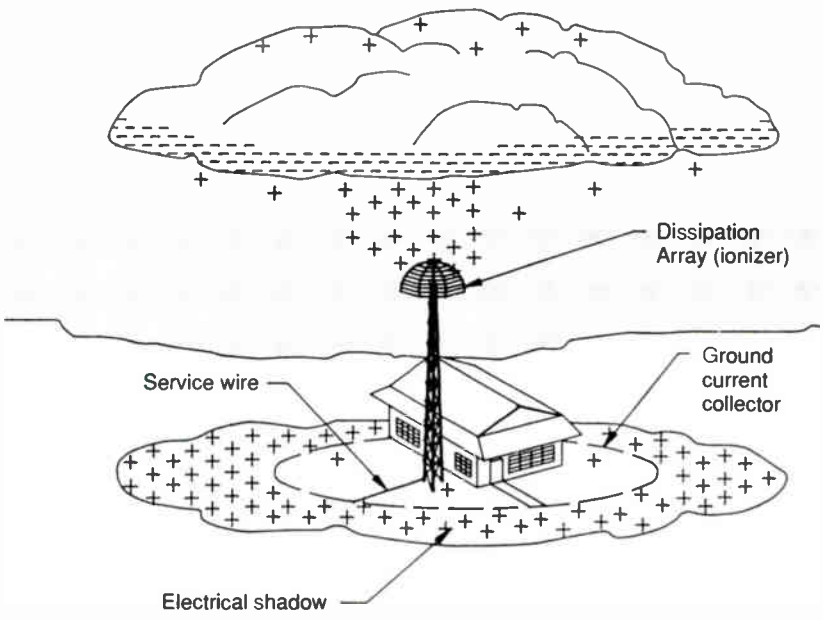
In designing a preventive device for lightning protection, one can look to Mother Nature for her example for how it can best be accomplished. Empirically, we see that any single point ionizer can safely dissipate a specific amount of charge current into the atmosphere without attracting a strike. Also, the dissipation process reduces the overall charge potential in the immediate vicinity of the ionizer, thus reducing (to some incremental extent) the potential for a strike. That is, unfortunately, only up to a point.

Any single point ionizer may eventually reach a saturation point after which the point begins to generate and emit upward moving streamers. Saturation varies somewhat, but it is most often reached when the charge potential exceeds 50,000 volts. It is this precise saturation phenomena that must be avoided if we are to prevent a lightning stroke directly to the point ionizer.

If one point can safely dissipate n microamperes of current into the atmosphere (thereby reducing the overall potential), it follows then that with more points carefully arrayed in a matrix, we are able to dissipate enough current to prevent the area surrounding the array from going into saturation. Thus, this prevents the emission of any upward moving streamers. It can therefore safely be concluded that if we can create a zone within which we can prevent upward moving streamers, we can also prevent lightning within that zone.

That is exactly what has been accomplished with the Dissipation Array system (DAS). A lightning strike is prevented within the zone by keeping the array and the surrounding area below the saturation point, thus preventing the generation of upward moving streamers. No streamers, no lightning! Figure 3 depicts a typical hemisphere-type DAS application for a tower.

Figure 3: DAS concept (charged cloud phenomenon)



DAS as an applied prevention concept is neither new or original. As alluded to earlier, Mother Nature beat us to the idea. She uses the concept very effectively and as a matter of overall effectiveness, still does it best. As a functional concept, the Dissipation Array finds its roots in NASA and Rockwell International research as far back as 1968. The concept was discovered and refined more than 20 years ago to prevent lightning from striking the Apollo moon rocket on the pad at Cape Kennedy, Fla.

The number of individual points in the array, the height of the array above the earth surface and the physical configuration and shape of the array are important parameters in array design. Precise calculations for how many dissipation points per cubic volume of space that are required to prevent that volume of space from going into saturation are as yet only approximate. In a practical sense, however, we can assure a successful application for nearly any structure by applying the maximum number of dissipation points possible, consistent with the mechanical constraints of the protected structure.

Dissipation Arrays can literally take nearly any size and shape. To be specific, the array must be designed to assume the general shape of the structure or tower to be protected, in order that the shape of the protective zone include all of the structure. A number of large installations (such as the four-acre Federal Express facility in Memphis, Tenn., and the Grand Gulf nuclear electric generating plant) have been successfully DAS-protected and lightning-free for several years. To protect large facilities, several different types of DAS are employed.

Dissipation Arrays have been in continuous and successful use for more than 20 years. With this history and nearly 1,000 major sites protected, the DAS has proven its effectiveness in preventing lightning.[3]

The best argument of all

DAS technology certainly does not represent the conventional wisdom in lightning protection. It is, however, based on a natural phenomenon that has been optimized and effectively applied to modern technology situations.

There are many individuals who would argue that if lightning rods were good enough for Ben Franklin, it should be good enough for us now. I would counter their argument with facts.

The facts are that lightning rods are not only based on an inappropriate concept for today's protection needs (i.e., attracting a lightning stroke right into your facility), they simply don't protect a modern facility from lightning damage. The only test for any technology is simply: Does it work or not? Positive, successful results over a broad range of field applications are the only ones that count. **CT**

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[1] *Lightning protection*, J.L. Marshal, 1973.

[2] *Atmospheric Electricity*, Chalmers, 1967.

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For more information or to discuss the content of this article, readers may contact the author at Lightning Eliminators & Consultants, 6687 Arapahoe Road, Boulder, Colo. 80303; (303) 447-2828 or fax (303) 447-8122.

Next-generation satellites

(Continued from page 26)

Satcom C-1 (139°WL) and then Satcom F1R was repositioned to 131° to take over traffic from the retiring Satcom F3R (131°). Satcom C-3 will take over when Satcom F1R retires. Although the changeover and spacecraft maneuvers between Satcom F3R, F1R and C-3 are complicated, most transfer activities will be transparent to cable operators because antenna repointing would not be required. Minor polarization skew adjustments needed to be performed when Satcom F1R was relocated due to the finalization of the orthogonal interleaving of adjacent satellites, which was not supported by Satcom F3R.

Galaxy I was moved by 1° from 134°WL to 133°WL in 1991 in compliance with the FCC uniform 2° spacing plan. This movement required antenna repointing. The schedule was announced to the industry ahead of time so that multiple-beam antenna feeds unable to be used in the 2° spacing plan could be replaced or new antennas with better specifications could be installed.

To minimize service disruptions, the bulk of the satellite movement was set to occur on weekdays. Only one or two repointing procedures would be normally required, depending on antenna size, antenna directivity and system noise margin.

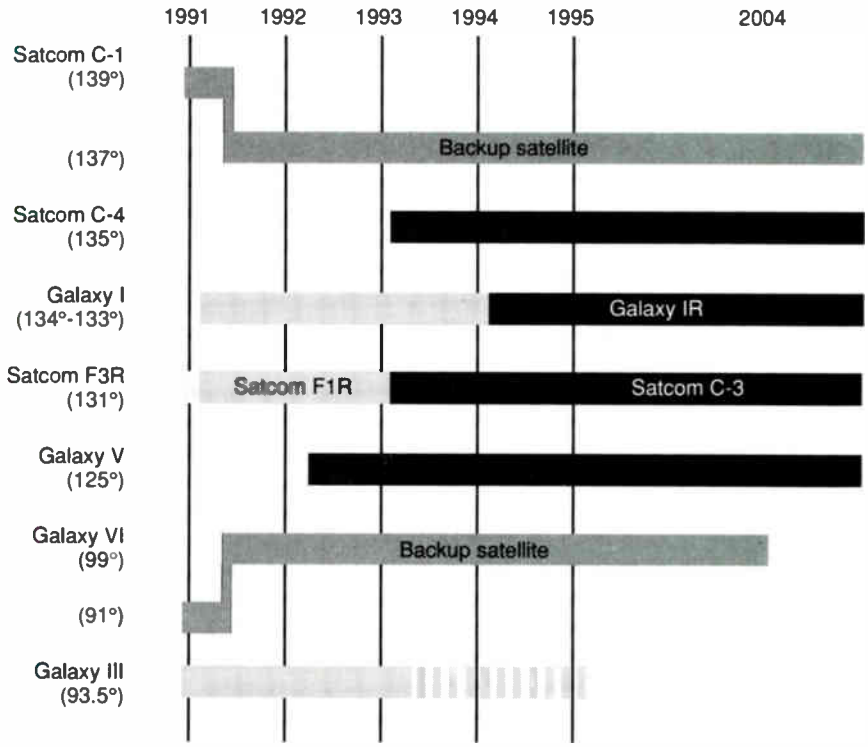
Galaxy V (125°WL) launched in March of this year and will become operational later in 1992.

In the middle of 1993, Galaxy IR (133°WL) will replace the retiring co-located Galaxy I (133°WL) and remain there until its end of life in 2005.

Another cable satellite, Galaxy III (93.5°WL), will remain in its current orbital location until its end of life in 1995. The broken line in Table 2 depicts a possible transition of programming from Galaxy III to other satellites as transponder leases expire in 1993.

While these transfers are happening, both GE Americom and Hughes will maintain two C-band fleet spare satellites Satcom C-1 (137°WL) and Galaxy VI (99°WL) respectively. These in-orbit spare satellites were launched in advance (1990) to provide restoration in case of launch failures of the four primary cable satellites. The spare satellites will contain pre-emptible programming to accommodate protected cable services in the event of fleet satellite failures.

Table 2: Deployment of next-generation cable satellites



Where will programming wind up?

As the new fleets of next-generation satellites become fully operational, the programming lineup will transition as well. The transfer of programming will take place over the next couple years. HBO and Turner Broadcasting, joined by USA, ESPN, Disney and others will anchor Galaxy V and Galaxy IR. Viacom Networks, joined by other programmers will anchor Satcom C-3 and Satcom C-4. After the switchover to the next-generation satellites, the cable programming lineup will most likely appear as in Table 3.

To minimize service interruptions, the programming networks will most likely dual-feed each of their services for a certain period. Cable operators are encouraged to stay in touch with programmers to keep abreast with developments and to determine the exact timing and location of simultaneous feeds. It is imperative for cable operators to find out where the programs currently carried will wind up. In order to determine how the transition will impact individual cable system operations, you should become familiar with the future satellite plans of each programmer.

2° spacing — timing, implications

The process of retiring satellites and launching new ones has been carefully planned to ensure a smooth transition. Actually, the space segment procedures have already started. For example, the two spare in-orbit satellites have already been launched and are now operational. Next-generation satellites are now either approaching final design stages or under construction and some spacecraft maneuvers have been accomplished. There are more activities that are planned to take place soon, and more ground segment activities can be expected.

The eventual reduction of satellite spacing to 2° will require careful examination of several ground segment technical issues. Of utmost importance is the earth station's ability to avoid interference from signals coming from undesired adjacent satellites. The parameters that affect interference are: Satellite transmit power (the effective isotropic radiated power or EIRP), antenna directivity, receiver sensitivities, signal formats, type of modulation, frequency offset, IF bandwidth and filtering techniques. Of these, satellite EIRP and antenna directivity are major factors that determine acceptable or objectionable levels of interference.

The majority of C-band satellite re-

Table 3: Programming on current and next-generation satellites

Current satellites

Galaxy I (133°)	Satcom F1R (131°)	Galaxy III (93.5°)
A&E	AMC	ACTS
CMTV	BET	C-SPAN 1
CNN	Bravo	C-SPAN 2
Cinemax E	CNBC	Comedy Central
Comedy Central	Cinemax W	EWTN
Discovery	E!	Home Shopping
Disney E	Encore	Lifetime E
Disney W	HBO W	MEU
ESPN (2)	Home Shopping	MTV E
Family Channel E	Inspirational Network	MTV W
Galavision	Learning Channel	Nickelodeon E
HBO E	Lifetime W	Nickelodeon W
Headline News	Request	Nustar
Movie Channel E	STN	QVC
Movie Channel W	TBN	VH-1
Nashville Network	Travel Channel	Viewer's Choice 1
Showtime E	Univision	Viewer's Choice 2
Showtime W	USA W	Weather Channel
TBS	VISN	
TNT		
USA E		
WGN		
WWOR		

Primary next-generation satellites

Galaxy V (125°)	Galaxy IR (133°)	Satcom C-3 (131°)	Satcom C-4 (135°)
A&E E	Cinemax E	A&E W	AMC
BET	Comedy Central	Court TV	Bravo
CNBC	Disney W	C-SPAN 1	C-SPAN 2
CNN	ESPN	Discovery	Discovery
Cinemax W	EWTN	E!	Family Channel W
Disney E	HBO E	Home Shopping 1	Home Shopping 2
ESPN (2)	Inspirational Network	Learning Channel	Lifetime W
Family Channel E	Nostalgia	Lifetime E	MSG
Headline News	Univision	Movie Channel W	Movie Channel E
HBO E	USA W	MTV W	MTV E
HBO W		Nickelodeon W	Nickelodeon E
MEU		QVC	Nustar
Monitor TV		Showtime W	Prevue Guide
Nashville Network		Viewers Choice	QVC
Showtime E		Weather Channel	Request 1
TBS			Request 2
TBN			Sci-Fi Channel
TNT E			Travel Channel
USA E			Viewers Choice
WGN			WWOR

ceiving antennas serving the cable industry are of parabolic design and pick up signals from a single satellite. Since 1983, antenna manufacturers have been improving their designs in anticipation of the 2° spacing scenario. Cable operators should find out from antenna manufacturers which designs need modification or replacement. In addition, proof-of-performance tests should be undertaken to ensure that antennas currently meet design specifications after many years of use. Corrosion, warping and misalignment degrade antenna performance.

Smaller diameter antennas such as those serving SMATV or smaller cable systems are particularly susceptible to increased interference from adjacent satellites due to their wider beamwidths.

Other antenna configurations such as those having multiple feed horns could be seriously affected if individual C-band feed horns can not be physically moved closer to one another. To correct this problem, some antenna manufacturers devised new assemblies and/or feed horn designs that are claimed to function under the 2° spacing plan. In some cases, parabolic antennas that were retrofitted with dual or triple feeds might have to return to single-feed configurations.

Technical differences

The technical parameters of next-generation C-band satellites have improved significantly. Traveling wave tube amplifiers (TWTAs) have progressed from 5 to 8 watts, and now to 16 watts. The latest in antenna beam-shaping techniques also allow a more uniform concentration of power to desired coverage areas. Furthermore, other spacecraft improvements such as better power subsystem design, better heat management, decreased intermodulation distortion (IMD), and improved transponder protection schemes ultimately yield a significantly improved next-generation C-band satellite system.

These improvements are all well and good, but the forthcoming uniform 2° spacing environment will negate the benefits if appropriate steps at the ground segment were not taken. Table 4 on page 47 shows how the signal quality would change if satellite spacing is reduced to 2° using the next-gen-

Table 4: Comparison of signal quality

Antenna size	Retiring satellites	Next-generation satellites
3.0 m	C/N = 11.4	C/N = 14.4
	C/I = 23.1	C/I = 19.7
	C/N + I = 11.1	C/N + I = 12.4
	VSN = 48.3	VSN = 49.6
3.7 m	C/N = 13.2	C/N = 16.2
	C/I = 24.9	C/I = 21.5
	C/N + I = 12.9	C/N + I = 14.2
	VSN = 50.2	VSN = 51.4
4.5 m	C/N = 14.9	C/N = 17.9
	C/I = 26.6	C/I = 23.2
	C/N + I = 14.6	C/N + I = 15.9
	VSN = 51.8	VSN = 53.1
7.0 m	C/N = 18.8	C/N = 21.8
	C/I = 30.5	C/I = 27.1
	C/N + I = 18.5	C/N + I = 19.8
	VSN = 55.7	VSN = 57.0

Where:
C/N = Carrier-to-noise ratio
C/I = Carrier-to-interference ratio
C/N + I = Total carrier-to-noise plus interference calculated as power summations and taking into account slight EIRP differences among adjacent satellites. The separation of 3° was used for retiring satellites and 2° for next-generation satellites.
VSN = Weighted video signal-to-noise ratio

Given:
Antenna efficiency = 65%
Antenna temperature = 25° K
LNA temperature = 70° K
IF bandwidth = 28 MHz
EIRP (retiring) = 34 dBW
EIRP (next-generation) = 37 dBW

eration satellites. It can be seen that larger antennas (4.5 m or larger) would be less affected by adjacent satellite interference and therefore would yield signal-to-noise ratios (S/N) in the mid to upper 50s (dB) of video S/N. These high values are desirable when feeding TV signals to cable distribution systems, even more so as fiber reduces its distribution plant degradation and improves video S/N in subscriber delivery.

What's the impact on operators?

Satellite and cable operators are now faced with the inevitable challenges that next-generation C-band cable satellites, 2° spacing mandate and the accompanying movement of cable programming present. Cable operators using antennas smaller than 4.5 meters or those using multiple-beam feeds could be affected. Everyone will experience the inconvenience of antenna repointing, so break out the Liquid Wrench! Some will face equipment reconfiguration and perhaps in some cases, replacement. The transition plan is set, but there is ample time to prepare.

Members of the industry need to work closely with each other to raise awareness of the need to ascertain the future performance of existing facilities. Specifically, there is a need to:

1) Determine the migration plans of programmers currently carried by the system,

2) Determine the impact of 2° spacing on existing facilities, and then

3) Come up with a system-specific technical plan and transition timetable.

By doing so, we will ensure a successful transfer of services to the next-generation satellites and maintain the excellent signal quality that we strive to provide to all our subscribers. **CT**

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2) "Fixed Service: No Surplus in Sight," P. Lambert, *Broadcasting*, July 30, 1990, pages 48-51.
3) Hughes Communications and GE Americom press releases.

SMATV and DBS

(Continued from page 29)

one satellite channel in NTSC format, plus the VCR output. A basic tier of NTSC channels could be offered by placing a 216 MHz low-pass filter in the customer's drop.

Small SMATV systems

In Europe, IF distribution of satellite signals at 950-1,750 MHz is becoming increasingly popular. The higher signal losses and more critical distribution network at IF means that it is only really suitable for up to 100 outlets or so within a single building.

In the United States, such SMATV systems also would be possible with all local off-air NTSC TV and FM radio plus both satellite polarizations using the following frequency plan and being distributed on a single cable: 54-800 MHz (local off-air NTSC TV and FM radio), 950-1,450 MHz (left-hand circular polarized satellite channels), 1,500-2,000 MHz (right-hand circular polarized satellite channels).

Satellite receiver front ends are readily available from the popular Japanese manufacturers with a 950-2,000 MHz tuning range. Care needs to be taken when combining the three frequency blocks, particularly in regard to bandpass filtering of the two satellite frequency blocks to prevent LNB noise degrading the C/N of UHF NTSC channels or the opposite polarization satellite channels. The customer connection could then conveniently take the form shown in Figure 5 (on page 29).

From the CATV operator's point of view, the carriage of signals in the same digital modulation format as on the DBS satellite (most likely QPSK) is not so desirable. CATV operators will most likely use 16 QAM (as will terrestrial HDTV broadcasters) since this is more efficient in terms of digital bits carried to bandwidth occupied (bandwidth being the CATV operator's most precious commodity).

To summarize the approach, the carriage of satellite signals on a system in unprocessed format and the use of a DBS satellite IRD as the set-top box offers huge possibilities for SMATV. The $10,000 (make that $10 billion) question is: "Will all the desirable name-brand programming be available from one DBS satellite?" If the answer is yes, then both DBS and SMATV will undoubtedly see an explosion! **CT**

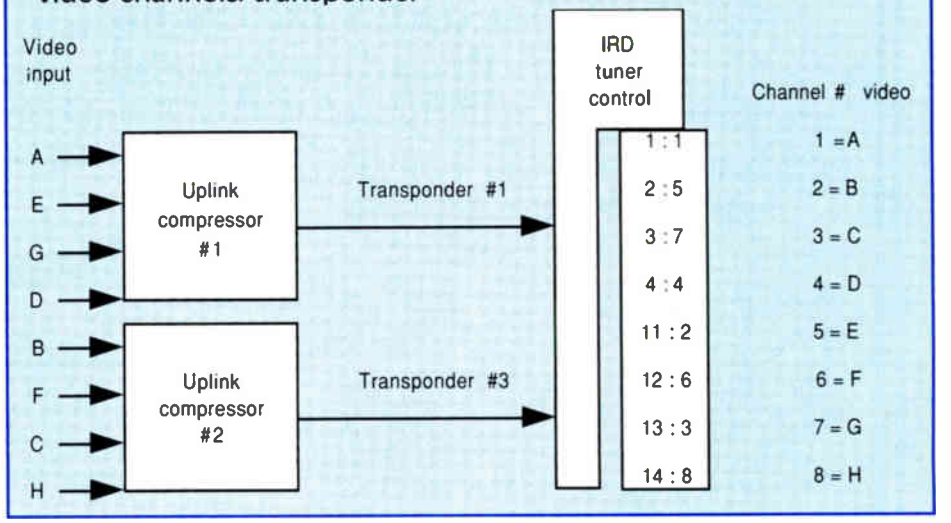
Subscriber interface

(Continued from page 30)

Let's look at the situation when uplink programmable, dynamic channel mapping is added to the IRD. As shown in Figure 2, an uplink-generated command is sent as part of the systems control and addressing stream to reprogram the cross-mapping of input channels to the consumer interface. The result is the channel lineup marketing desired with the efficiency sought by engineering.

It is important to remember from our example, that although we use only video channels for simplicity, Signals A and C could have been CNN and Headline News with Signal B being a news videotex magazine positioned between the two live channels. Every signal source can be assigned a virtual channel number regardless of its content. Obviously, the next trick is to drive the commands for creating virtual channel definitions from the same computer that generates the program schedules for all channels. Using the same relational data base also allows for up-to-date videotex program guides to be created. The combination of an easily obtainable solution to logical channel numbering incorporated with the heavy use of on-screen guides is a major step in turning the confusing array of video, audio text and data options into viewer satisfaction.

Figure 2: Dynamic channel map for up to five compressed video channels/transponder



With the real time implementation of virtual channels, a system operator has the ability to "edit" channels on the fly at an individual subscriber's IRD. Every IRD, in effect, becomes a routing switcher. Events and programs, regardless of the origination site or transponder, can be made to appear on a single designated channel without backhaul to a central transmission facility. Conversely, video signals transmitted on the same transponder can alternately be caused to appear on different channels at the subscriber's set. Programmers, marketers and engineers can simultaneously optimize operations with little or no compromise in efficiency or on-air look. The application of virtual channels is in itself a video game. **CT**

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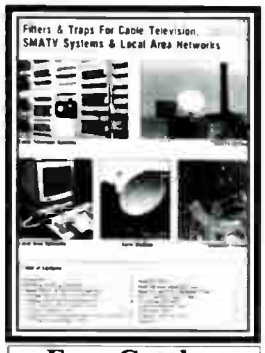

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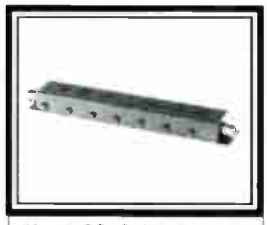

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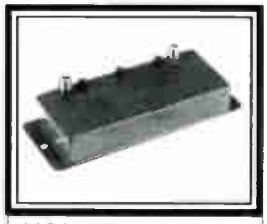
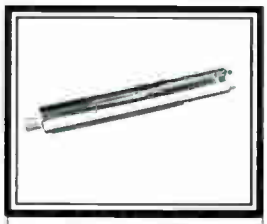
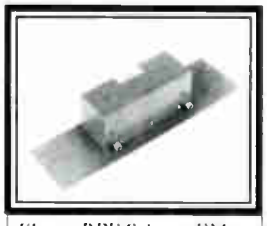


3328 BPF for Leakage Receivers.

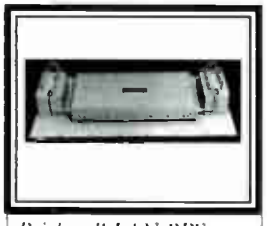


Pay-TV BPF is Pole Mounted.



Sharp BPF Selects FM Channel.

CARS Band Channel or Full Band BPF.



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April 1992

Preventive maintenance

BACK TO BASICS

The training and educational supplement to Communications Technology magazine.

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Columbia Cable of Oregon's Don Williams explains why its so important to remember to properly maintain the drop.

Hands On 55

Jud Williams of Performance Cable TV Products shows how to identify unknown hybrids.

Don't forget the drop!

By Don Williams
Technical Services Supervisor
Columbia Cable of Oregon

Our industry spends an immense amount of manpower sweeping trunk and balancing feeder for optimum flatness, carrier-to-noise and distortion performance, and we should. But as most of us will admit, there is little or no preventive maintenance on one of the key parts of the delivery system — the drop. It directly provides our customers with the service they pay us for, yet it probably receives the least amount of preventive maintenance.

Many of us are guilty of conducting our technical efforts as though the headend and trunk system are the only hardware that make the system work. But when you stop and think about it, these good efforts resulted in a very narrow focus on the long-term reliability to the customer. If any component in the system fails, the end result is a customer with a bad picture or no picture at all. We need to broaden our focus and realize one component in a cable system is no more prestigious than another.

Check the F-connector

Our service call efforts will not be effective if we fail to check the F-connector(s) and end up leaving in place one that is defective or improperly installed. This problem alone can cause as much as 40 percent of the truck rolls and 95 percent of the return service calls we make in the very near future. The most common and talked about preventable cause of failure is simply the loose F-connector.

Another area of concern is a drop that has been spliced either underground or overhead. The splice creates a classic time bomb waiting to cause a call to our customer service line.

Most of our systems have employed hundreds of in-house and contractor field personnel over the years, and this has often resulted in many different installation procedures for F-connectors, drop equipment and splicing. This area needs continued focus, support and education.

Much of the hardware designed today for use in the drop system is of high quality. Although many redesigns on the F-connector have appeared over the last two years, I think some of them are more clever and costly than really needed to ensure long-term reliability.

Our technical and installation staff look for ill-fitted crimped connectors in the customer's home, and check the ground block at every job to ensure proper bonding, tightness, weatherproofing and signal levels at the set-top rather than just fix the problem at hand. A visual check is made at the tap and if proper weather protection is missing they take the extra few minutes to prevent a future problem.

The bottom line is this: If the connector, no matter what type, is installed correctly the first time, tightened and weatherproofed where appropriate, the connector will last the life of the drop.

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Reader Service Number 42

system implemented a program we call "One Call Does It All." Our intent was to establish with our technical personnel the need to correct any customer problem on the first visit and ensure the signal is free of ingress/egress. By following this program, we hoped to avoid service calls for drop-related failures for several years.

Our system replaces any cable that has been damaged. We also upgrade the drop with quality RG-6 and bury it to the correct depth of 12 inches so future yard work won't be cause for an immediate trouble call and a customer without service. While the cost initially appears high, if you compare the cost of a service call with a time bomb fix to the cost of replacing and correctly burying the drop, the two costs are very similar. A shallow drop that is cut once will probably get cut twice! Chances are you'll be running a truck again in the near future for another cut drop or corroded splice if you leave it shallow and spliced. I personally removed underground drops with as many as three corroded splices before implementing our replacement program.

Our goal is to look further ahead than just fixing the original service problem. Every call to a customer's home creates an opportunity for preventive maintenance and a quality assurance check.

To curb any fresh problems related to new installs we now perform quality control inspections on 10 percent of all installs and also require our contract install company to perform inspections on 10 percent of its work. This helps us identify any areas in need of additional education in craftsmanship and proper installation.

The success of our program is already noticeable. Our drop-related service calls have decreased by 5.5 percent in the last two years. Our service call-to-subscriber ratio for the same period has fallen 0.6 percent, even after adding 9,542 customers! It takes teamwork and dedication from all field personnel to make a program like "One Call Does It All" successful. I am convinced that after two years it has made a significant difference in the quality and reliability of our service. The extra few minutes at each call has proven to be well worth the time spent.

A book to look at

The first ingredient to any effective preventive maintenance program is a foundation that reinforces correct procedures. Our company uses a corporatewide installation/technical manual. Instead of being a book that is never looked at, it is one that is often referred to.

I will be the first to admit that some areas covered in our company manual had become fossilized and needed a little refreshing. I feel this is one of the main reasons procedures become ignored and underutilized. We admitted our failure and made it one of our goals to submit updated revisions wherever we felt necessary. By providing our staff with a complete and up-to-date procedural manual, we gave them a clear target to focus on. Not only does it reinforce the right way to do each task, it also shows the expectations we have for craftsmanship.

Perhaps the worst sin of all is keeping the manual hidden where no one can access it. You need to get it out where everyone can use it. Encourage periodic reviews with your staff to keep the correct procedures and focus clear. Remind yourself daily that the field staff will support what they are made a part of. **BTB**

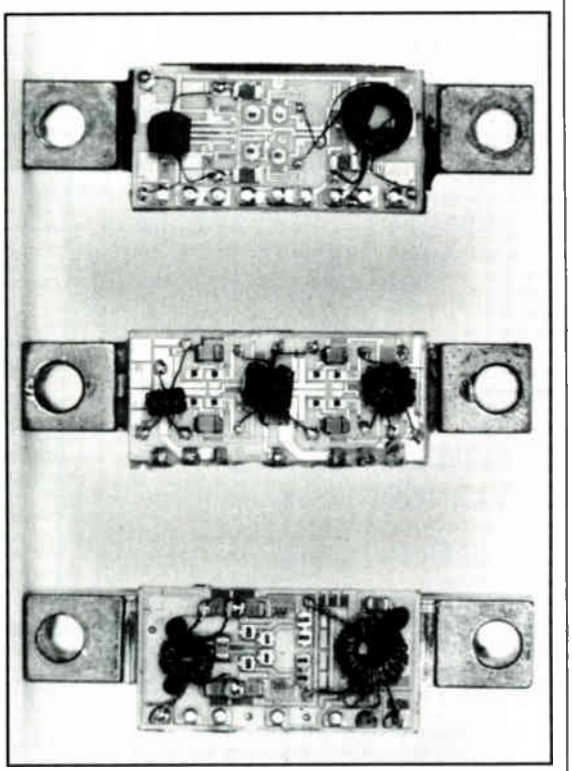
Hands On

Identifying unknown hybrids

By Jud Williams
Owner, Performance Cable TV Products

The other day I came up against the problem of having to identify a faulty hybrid whose part number I was unfamiliar with. The situation came about when I received a number of amplifiers for repair. Their covers, containing information as to the kind of hybrids used, were either missing or switched around to other amplifiers. Some of the amplifiers were using conventional hybrids while others had power doublers, and due to the cover situation I was unable to determine which was which. To top things off, the part numbers did not correspond to the manufacturers' data.

It occurred to me that there must be some visible differences in the internal construction of the hybrids, so I dug out a bunch of defective units and opened them up. They are constructed with a substrate bonded to a header with a plastic cover glued onto the header for protection. The cover was removed by clamping the header into a vise and using a pair of locking-type pliers to twist it off.



Configurations for amplifier hybrids.

After opening several modules I began to see a pattern emerge and it became evident that there were three distinct configurations. The three different types of amplifiers are shown in the accompanying photograph.

- The amplifier hybrid at the top of the photo is a 17 dB unit and may be identified by noting that there is an array of four transistor devices clustered in the middle of the substrate. There are two torroidal RF transformers, one at the input and the other at the output.
- The middle photo illustrates what a 34 dB module typically looks like. There are two clusters of four transistors separated by a torroidal RF transformer, which is located in the middle. This unit has two 17 dB stages in tandem so it has twice the number of transistor devices as the 17 dB unit shown above it.
- Finally, at the bottom of the photograph is a power doubler (also know as parallel hybrid). This device is similar to the 34 dB hybrid except the transistor stages are parallel to each other rather than being in tandem. The identifying feature is a cluster of eight transistors, all grouped together.

So, there you have it. The next time you run across a defective hybrid and you are unsure what type to replace it with, just pop the thing open and the answer will be right before your eyes. **BTB**

Readers with questions or wishing to discuss the content of this article may contact the author at (404) 475-3192 or P.O. Box 947, Roswell, Ga. 30077.

PRODUCT NEWS

Mini OTDR

ANDO Corp. announced its AQ-715X series mini-optical time domain reflectometers that is said to offer fiber-optic cable installation and maintenance personnel the power of a traditional OTDR without the associated size, complexity and cost. It features a dynamic range of up to 18 dB at 1,310 nm. Push-button operation provides fiber fault location in less than 30 seconds at the 10 km range. As well, the unit provides reflective loss measurements.

Two modes of operation allow either the display of an OTDR cable trace or the automatic listing of all splices and return loss calculations. The results can be displayed on an internal display, sent to an external printer or stored in an optional credit card-sized solid-state memory card for future use. The unit is said to be designed for harsh field use and can operate continuously on a rechargeable battery for up to eight hours. It has a backlit display for use in poorly lit conditions and is available in 1,310 nm single-mode and 1,310/1,550 nm switchable versions.

Reader service #204

Monitoring enhancement

The Auto Star Level module, an enhancement for the recently introduced Comet remote monitoring system for broadband networks, was introduced by CaLan. The ASL module has a measurement bandwidth of 40-550 MHz and acts as the heart of the Comet system, monitoring the full-time carriers and sending the field data gathered to the computer for processing. It is compatible with all equipment used in the broadband network regardless of the manufacturer, according to the firm.

The ASL can be installed in any one- or two-way broadband network and can work alone or with other Auto Star modules. Placed at any feeder port or coupled into any location in the trunk or feeder lines, it sweeps designated sections of the broadband network by monitoring existing carriers. The module is contained in a compact, weatherproof housing that can be mounted on the strand, pedestal, wall or rack. The main circuit board accepts two plug-in devices (a factory-installed attenuator and a fuse). The chassis is said to contain the latest advances in SMD technology and its built-in microcomputer controls a synthesized tuner and calibrator reference circuits. A 16-byte addressing scheme enables 65,000 different addresses over a single data link.

Reader service #202

Hand-held power meter

Tektronix made available its TFC200 FiberChamp hand-held optical power meter that provides ±3 percent (±0.1 dB) accuracy, which is said to be the highest of any hand-held optical power meter available. The unit weighs about a pound and features an intuitive human interface and a large backlit LCD. It is calibrated to 780, 820, 850, 1,060, 1,300, 1,310 and 1,550 wave-

lengths and can make measurements in either a logarithmic scale (dBm) or linear scale (watts) on either single- or multimode fiber. These measurements are unaffected by ambient light.

The loss in a fiber link can be measured by comparing the power at the transmitter/source against the power at the receiver. The transmitter absolute power measurement can be stored in the product as the reference. Using the selectable dB threshold setting, the unit allows quick go/no go testing of multiple links. The analog output provides a linear signal for input to an external recorder to record optical power levels over time to determine stability and drift.

Reader service #203

Disposable traps

Intercept Communication Products announced that a time-limited signal conduction system integrated into circuits of its positive trap (Model DF) enables the company to introduce disposable positive traps for pay-per-view events. The DPTs provide trapping action for only a predetermined length of time, after which the transmission of signal becomes increasingly degraded requiring its removal. The period of viewable transmission is factory set and can be set to last from 5 hours to weeks, depending on the length of the PPV event.

The DPT has a set control that lets the subscriber initiate view time and once set, transmission cannot be stopped until its designated view time is exhausted. This provides sufficient assurance to the cable operators that DPT cannot be used for another PPV event.

Reader service #200

Satellite feed system

New from Antennas for Communications is the Multiple Satellite Feed system for 2° satellite spacing, which is said to provide an economical alternative to installing multiple antennas for simultaneous reception of up to five adjacent 2° satellites. The system is free of any RF power suck-outs and high losses over the complete satellite frequency band.

The systems are designed specifically for the intended size antenna. With the Multi-Sat feed extension, existing AFC or Microdyne MSF users can upgrade their feed to receive signals from multiple 2° satellites. Installation requires replacement of spars and brackets of the feed support hardware. The feed extension upgrade comes with all necessary gaskets and hardware. The system provides isolation between beams better than 20 dB with a loss of 0.25 dB at 2° and 0.75 dB at 4°. Cross-polar discrimination is typically better than 30 dB.

Reader service #198

FO restoration kit

ACT Communications says its ACTivator fiber-optic restoration kit is unlike other restoration solutions because it is offered with a variety of options for cable configurations from 12-96 fibers. The kit uses the company's fiber splice closures, splice trays and GTE Fastomeric mechanical splices for either aerial or buried applications.

No special tools are required to complete the restoration, but there is an optional tool kit available. All closures, trays, tools and cable are packed into a locking, foam-filled carrying case.

Reader service #197

Ground clamp

The meter box ground clamp from Diamond Communication Products functions as a ground for CATV system drop wire and runs at a customer's meter box. It can mount vertically or horizontally on any rectangular or square meter box and will not restrict cover operation. It comes in two adjustable sizes: 7 to 10.25 inches and 10.25 to 15.25 inches.

The product has a two-piece steel construction, including dual steel points on slotted bracket and a shallow, pointed bolt to ensure positive ground with no damage to meter box connections. It is galvanized to ASTM specifications A 153 and B 695. Installation is accomplished with a single 1/4-inch stainless steel bolt. The ground screw (slotted head) in a cup washer accommodates #12 through #6 ground wires.

Reader service #194

Drop clamp

The universal messenger drop clamp SC02MFA was improved, according to Sachs Communications. The design of the clamp preserves the cable's coaxial configuration and characteristic impedance because the cable

is installed into the body of the clamp and is protected in such a way that problems of sheath damage, reflections and signal leakage are eliminated.

The product is used for suspension of integrated messenger drop cables at the tap, at the house, at the service pole and will fit all sizes of drop from RG-59 to RG-11 (including dual). The new slot design allows the messenger cable to be installed into the drop clamp from the side. At the service pole application, only one drop clamp needs to be installed. Using the new L slots to attach the messenger wire, the messenger wire and cable jacket are not cut, increasing the life of the drop. Broken messenger wire due to corrosion, wire fatigue or other causes is eliminated because the bail of the clamp replaces the messenger wire at common failure points. An optional stainless steel bail is available for marine environments.

Reader service #196

Antenna controller

Research Concepts Inc. announced its RC2000A dual axis antenna controller. It features total solid-state drive circuits, dual speed capability, memory capacity for up to 50 satellite and polarization positions, built-in Polarotor control, and a fault monitoring system to detect overload conditions.

As well, a serial port is included that can be interfaced to a user's PC or RCI's downlink control software, which is called Autopilot. With this software, a user can perform scheduled movements of the unit plus control Standard Communications' MT810 and MT830 receivers.

Reader service #195

Fiber cleaver

The new FBC-006 precision fiber cleaver was introduced by Siecor. The product's accuracy is said to ensure smooth, flat, perpendicular fiber end faces necessary for low-loss fiber splicing. The unit with standard fiber guides can cleave 250 micrometer and 900 micrometer coated fibers to lengths required for fusion or mechanical splicing.

No special training is required to operate the cleaver, according to the company. There are no complicated series of flaps, levers or slides to move sequentially and length scales are included to permit accurate cutting to any desired length between 5 and 15 mm. The unit is compact and includes a diamond cutting blade. Cleave accuracy is reported to average less than 0.7° from perpendicular. The cleaver can be used with the company's fusion splicers as well as the CamSplice mechanical splice.

Reader service #192

Vehicle track

The line of all-steel, self-cleaning easy-on and easy-off Tire Crawler flotation tracks for rubber tired equipment from Loegering Manufacturing has a new series of track: the J series. It features a double pivot design, increased tire protection, and replaceable links and pins.

Reader service #193

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Reader Service Number 47

ComSonics' WindowLite signal level meter

By Ron Hranac
Senior Technical Editor

Most hand-held signal level meters (SLMs) introduced to the CATV industry over the years have been relatively low-cost units designed primarily as installer meters. That is, they have had limited functions and measurement capability. Although convenient for checking the RF level of a few key channels on the subscriber's drop, they haven't really been suitable for much of anything else.

Surface-mount technology and the power of the microprocessor have been changing this, however. It's now possible to squeeze quite a large amount of sophisticated electronics into a fairly small space, and provide microprocessor-controlled features and capabilities usually left to larger devices.

ComSonics has taken advantage of this in its recently introduced WindowLite SLM. This new product is indeed a hand-held meter — albeit somewhat larger than most other hand-helds — that puts a lot into a relatively compact package. Even though smaller than you may be used to, the WindowLite is definitely not an installer meter. It's a full-fledged test instrument that can be used for maintaining just about every part of the RF plant in a CATV system.

We obtained a WindowLite for this month's "Lab Report," and put it to the test on the bench and in the field.

The product

ComSonics has managed to take a field-grade SLM and squeeze it down to 2.5 pounds, with an overall size of just 10.6 x 4 x 3.1 inches. The lower two-thirds of the meter (calling an LCD-equipped instrument a "meter" seems a bit strange these days, considering that the familiar meter movement is gone) is just over 3 inches wide, and the upper third that contains the display is 4 inches wide. The WindowLite's thickness varies from 3.1 inches at the top, sloping to about 1.75 inches at the bottom. Compare this packaging to an old 727!

As with most of today's SLMs, the F-connector on this unit is a replaceable F-81 barrel. Operating power is provided by a rechargeable NiCad battery pack that snaps out of the rear of the case. The battery pack includes a receptacle for the accompanying wall charger, and can be recharged in or out of the meter.

The case itself is made from high-impact ABS plastic, providing pretty rugged construction (it survived our impact test — more on this later). An adjustable strap on the back allows the WindowLite to be hand-held comfortably, and there is also a metal ring on top of the case for attaching a utility lanyard.

The accessories that accompanied our test unit included a heavy-duty padded nylon carrying case with an integral D-ring suitable for attaching a strand hook to. The carrying case also has a loop on the back for belt mounting. The lanyard, wall charger and instruction manual rounded out the other items.

The meter's display is a 2.25- x 2.25-inch LCD, with switchable backlighting for use when ambient lighting is insufficient. The 2.75- x 4.75-inch keypad has six function buttons (softkeys), left/right arrow, on/off, light (for the LCD), exit and enter buttons, plus a numeric key selection. Like so many of today's microprocessor-controlled instruments, numerous functions are embedded in the keypad. The moderately few front panel buttons are deceiving: ComSonics includes a very helpful — and necessary — keyboard menu map (the company calls it a menu navigator) in the instruction manual, and by the time you read this, there also should be a laminated pocket version. You'll quite likely be referring to the menu map the first few times you operate the WindowLite, at least until you become familiar with the embedded functions you use most often. Completing the front panel is a small audio speaker below the keyboard.

As far as SLMs go, the WindowLite provides the usual basic capabilities: measurement of RF signal level, carrier-to-noise ratio (C/N) and hum modulation. Two versions are available: Model 1 covers 50 to 860 MHz, and Model 2 from 5 to 860 MHz. We tested the 50 to 860 MHz model. Table 1 summarizes the manufacturer's published specifications.

Table 1: WindowLite specifications

General

Frequency range: Model 1 — 50 to 860 MHz
Model 2 — 5 to 860 MHz
Input level range: -45 to +60 dBmV
Maximum RF input power: 1 watt
Input impedance: 75 ohms nominal
Measurement passband: 280 kHz
Display dynamic range: 30 dB or 10 dB, user-selectable
Absolute display units: dBmV or dBμV, user-selectable
Relative display units: percent, dB
Display resolution: 0.1 dB, 0.1 percent
Operating temperature: 0 to 120° F (-18 to 49° C)
Storage temperature: -20 to 150° F (-29 to 66° C)
Power requirements: 6 watts maximum supplied from a rechargeable 9.6 volt, 1.2 amp-hour NiCad battery pack
RF input 50/60 Hz isolation: 250 VAC

Signal level accuracy

At 68° F (20° C): ±1 dB
Worst case over operating temperature: ±2 dB

Carrier-to-noise accuracy

At 68° F (20° C): ±2 dB
Worst case over operating temperature: ±4 dB
Maximum dynamic range: 55 dB

Low frequency disturbance (hum):

At 68° F (20° C): ±1.25 percent
Worst case over operating temperature: ±2.75 percent
Measurement range: 0.5 to 10 percent
Measurement passband: 2 to 1,000 Hz

Mechanical

Weight: 2.5 pounds (1.1 kilograms)
Maximum dimensions: 10.6 x 4.0 x 3.1 inches (269.2 x 101.6 x 77.7 mm)

Table 2: WindowLite frequency plans

Australia	Netherlands (two versions)
Belgium	Poland
China	Sweden
Hong Kong	Switzerland
Israel	Taiwan
Japan	United Kingdom (two versions)

U.S. Standard EIA, HRC EIA, IRC EIA, Standard Historical, HRC Historical, IRC Historical, over-the-air VHF/UHF

Aside from the basic measurement capabilities, the WindowLite can be user-configured for different CATV system operating characteristics, user function preferences, and the start-up display and operating mode. The meter has four primary measurements modes: Video Sweep, Tags, Zoom and Tune.

The default Video Sweep in our test unit was set to display the channels stored in memory Group 1, which had been set by the factory as the entire range from 55.25 to 823.25 MHz. This particular setting is called "STD EIA" and covers EIA cable Chs. 2 through 129. (All of them are displayed simultaneously while in Video Sweep.) Six different groups can be stored in the WindowLite's non-volatile memory. You can define any of these groups with any of the available frequency tables that are included in the WindowLite. Table 2 summarizes the frequency plans that were available in our test unit.

Each of the six groups can hold up to 128 channels, including video and audio frequencies as well as channel numbers. The Video Sweep mode will allow you to take a quick look at your system's entire spectrum, and get an idea of the approximate frequency response based on carrier amplitudes. Vertical and horizontal cursors can be used to tune through the channels or get an idea of peak-to-valley variations among the levels of the carriers. As you move the vertical cursor across the LCD, it will go from channel to channel, and the channel the cursor is positioned on is identified along with its video carrier frequency (not the actual frequency, but rather the channel's allocated frequency according to the frequency plan currently in use). You can move the cursor either with the left/right arrow key, or by keying in the channel number or frequency directly. The left/right arrow key also is used to change the position of the horizontal cursor.

The Tags mode will simultaneously display any five channels that have been previously programmed into the meter by the user. This is handy if you want to regularly check the same small number of channels that can be considered representative of the spectrum, for example, your low and high pilots, and two or three channels in between. ComSonics has programmed default Tags channels into each of the frequency plans, but you can easily change any of them to your own choice.

In Zoom mode, the WindowLite will display a bar graph representation of a single channel, showing both the video and audio carriers, as well as the video carrier level and the amplitude difference between the two carriers. The cursor functions can be used while in Zoom mode. The left/right arrow button will allow you to move the vertical cursor from one carrier to the other, as well as tune up or down among the channels on the system. You also can enter the frequency or channel number directly while in this mode.

The Tune mode displays a 7.875 MHz portion of the spectrum on the LCD, and allows you to move the cursor across the screen in 125 kHz increments. As you tune up or down beyond the edges of the currently displayed segment, the meter will automatically reposition the overall display 1 MHz higher or lower in frequency, depending on which way you were tuning.

When you do enter a frequency directly, the meter will tune to the nearest video carrier frequency. For example, entering 56 MHz will result in 55.25 MHz being placed 1 MHz from the LCD's left edge, and the vertical cursor will be positioned at 55.25 MHz. To actually tune to 56 MHz requires using the left/right arrow. The minimum tuning resolution of 125 kHz will limit the specific frequencies that can be tuned, however. This is evident when tuning through the FM band: You can tune directly to 91.5 MHz (a valid FM band allocation) with the left/right arrow, but the closest you can get to the next adjacent FM frequency allocation is 91.75 MHz (two increments of 125 kHz above 91.5 MHz) rather than the desired 91.7 MHz.

When the WindowLite is operating under the HRC EIA frequency plan, it will tune to the HRC offset frequencies of 54.0027 MHz (Ch. 2), 60.0030 MHz (Ch. 3), 66.0033 MHz (Ch. 4), etc., but only while in Video Sweep mode. When you change to Tune mode, you will be limited by the 125 kHz minimum tuning steps. (For example, 54.0000 MHz, 54.1250 MHz, 54.2500 MHz, etc. will be displayed as you press the right arrow to tune upward in frequency.)

The front panel speaker serves two purposes. It will beep

each time a button is pressed, although this feature can be disabled. The speaker also can be used to listen to the channel that the vertical cursor is positioned on in any of the modes. In both Zoom and Sweep modes the WindowLite will demodulate only the audio carrier of the selected channel. In Tune mode, the meter will provide the audio of whatever signal the cursor is positioned over, including the video carrier. (This is useful for identifying unknown carriers.)

The WindowLite has a user-programmable amplifier test point offset function. You can set this level offset to 0, 10, 20 or 30 dB. This is useful if the meter is being used for line maintenance, since the meter has the capability to automatically correct for the test point loss and display the amplifier's output (actually the test point reading plus the amount of offset). If the offset function is being used, a technician would not have to remember to add the test point loss to the meter reading; the WindowLite will do it automatically.

There are two ways to use this feature. One is temporary, and will result in the offset function going back to zero offset when the meter's power is turned off. The second method involves storing the offset in the start-up routine. In this case, the stored offset will always be functional whenever the meter is turned on. Of course, if you wanted to make direct measurements after the offset had been stored in the start-up, you would have to remember to subtract the offset from the displayed reading.

Another interesting feature is the Balance function. This allows you to adjust a WindowLite's readout in 0.1 dB increments so that you can eliminate amplitude differences between meters. This doesn't alter the meter's internal calibration, but instead adds or subtracts a small offset to change the displayed amplitude reading on all channels. Thus, if you had several WindowLite SLMs, you could use this function to make them all read the same.

Other features include an automatic shutdown timer, which can be varied from 0 to 10 minutes in one-minute increments. The WindowLite will shut itself off after the predetermined time has passed and no keyboard activity has occurred. LCD contrast, speaker volume and beep volume also are user-adjustable. The on-screen dynamic range can be set at either 30 dB or 10 dB. Hum and C/N measurements can be made with the meter as well.

The WindowLite has five non-volatile memories that can store up to 128 channels each for later analysis. System measurements at five locations could be taken and stored, then the information evaluated after the measurements have been made. Video Sweep, Tags and Zoom modes can be used to review the stored data. There are no provisions for connection to an external PC for downloading data. The covered data jack on the back of the meter's case is used by the factory for instrument calibration purposes.

At the time of the evaluation, the Model 1 (50 to 860 MHz) list price was $1,595.

Lab test

The first thing we checked in the lab was RF carrier measurement accuracy. We established a CW carrier reference level of 20 dBmV at several frequencies between 50 and 860 MHz, then made the initial set of measurements at room temperature (68° F). After this set of measurements, the WindowLite was placed in an Associated Environmental Systems temperature chamber and cooled

(Continued on page 81)

DEPTH of KNOWLEDGE

Trilithic manufactures a comprehensive line of RF test equipment for the CATV industry. Our innovative approach to product design and development gives our instruments enhanced testing features that are more than bells and whistles. Trilithic's advanced engineering and manufacturing capabilities ensure high performance and accuracy at reasonable prices. Plus, we back all of our products with service and support that is second to none.

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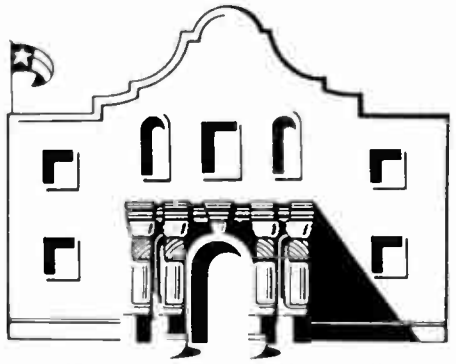
Reader Service Number 48

REGISTRATION PACKAGE for CABLE-TEC EXPO® '92



10TH YEAR!

THE FACTS ABOUT CABLE-TEC EXPO '92

dates Annual Engineering Conference, June 14, 1992
Workshops and Exhibits, June 15-16, 1992
Certification Testing, June 17, 1992

location San Antonio Convention Center
San Antonio, Texas

history Cable-Tec Expo '92 is the tenth annual convention/tradeshow sponsored by the Society of Cable Television Engineers, Inc., combining a wide variety of technical programs, hands-on training and breakout technical workshops with instructional hardware exhibits. The Annual Engineering Conference will be SCTE's sixteenth yearly conference dedicated to current engineering issues, FCC compliance and technical management. In addition, the Society has presented more than 75 national technical programs in cities across the United States over the past twenty-two years, attended by more than 18,000 engineering and technical personnel from the broadband communications industries.

attendance Attendance is open to individuals within the CATV industry as well as anyone involved in broadband communications. Over 1,800 registered attendees are expected from all levels of the cable television and related businesses, including all levels of non-technical personnel.

program The Annual Engineering Conference will be packed with six hours of technical and management papers presented by many of the industry's engineering leaders. The annual membership meeting, held at the conclusion of the conference, will afford attendees the opportunity to meet members of SCTE's national Board of Directors.

The 2-1/2 day Cable-Tec Expo follows the Annual Engineering Conference and combines practical workshops with "hands-on" technical training and hardware displays. The program features many schoolroom-style workshops to choose from. No other activities are scheduled during workshop sessions in order to guarantee maximum attendance and participation.

Once again, this year's Expo will offer a separate series of workshops dealing with topics of interest to local origination engineers and technicians.

As with all SCTE activities, the main purpose of Cable-Tec Expo '92 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 '92 will give attendees the opportunity to prepare for and participate in the Society's Broadband Communications Technician/Engineer (BCT/E) 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 150 hardware exhibitors are expected to reserve space on the Expo '92 Exhibit Floor. Exhibits will include all types of products, supplies, services and equipment used in the design, construction, installation, repair, maintenance and operation of cable television systems. The exhibit floor will also feature a Technical Training Center for further equipment demonstrations.

CABLE-TEC EXPO '92 REGISTRATION FEES

(UNCHANGED SINCE 1986)

	Until May 15, 1992		On-Site**	
	Member	Non-Member	Member	Non-Member
Engineering Conference and Expo*	$195.00	$350.00	$235.00	$390.00
EXPO only	$145.00	$250.00	$185.00	$290.00
Engineering Conference only*	$120.00	$200.00	$160.00	$240.00
Spouse Registration*	$95.00	$95.00	$95.00	$95.00

* Includes ticket to the Awards Luncheon on June 14. Additional luncheon tickets are available for $20.00 each.

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

admission

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

transportation

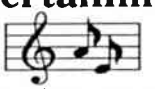
SCTE has designated American and Continental Airlines as the Expo's official air travel carriers. Supersaver and discounted coach air fares have been arranged and Hertz Car Rentals is offering special rates to attendees (see information below). Transportation from the San Antonio Airport to your hotel can be arranged through taxi service outside the baggage claim area.

American Airlines: 1-800-433-1790 (U.S. and Canada)—Refer to Star #S016277

Continental: (US and Canada) 1-800-468-7022—Refer to EZ#6P18

Hertz: 1 (800) 654-2240—Refer to Meeting #9348

entertainment



Most Expo '92 hotels feature a tour desk with brochures covering area attractions, dining, nightlife and sightseeing activities. The discounted hotel rates are in effect for Expo attendees wishing to stay in San Antonio for three days before or after the conference.

event sponsor

SCTE

Society of Cable Television Engineers Inc.
669 Exton Commons, Exton, PA 19341
(215) 363-6888; FAX: (215) 363-5898

PRELIMINARY PROGRAM

Engineering Conference

SESSION A: ***Digital Compression: Expanding Channel Capacity While Enhancing Video and Audio Quality*** with Tom Elliot, TCI (moderator); H. Allen Ecker Ph.D., Scientific-Atlanta; Richard Prodan Ph.D., CableLabs; and Geoff Roman, Jerrold Communications.

SESSION B: ***Technical Compliance: How FCC Reregulation Will Impact Your System Operations and Maintenance Practices*** with Steve Ross, SCTE Of Counsel (moderator); Wendell Bailey, NCTA; Jonathan Kramer, NATOA; and John Wong, FCC.

SESSION C: ***Cable System Technology Meeting Subscriber Expectations*** with Margaret Combs (moderator); Jay Hamm, City of Dallas; Jonathan Kramer, Communications Support Corp.; and Tom Robinson, County of Fairfax.

SESSION D: ***Current Events in Cable TV Technology: Fiber Optics, HDTV, PCN and Outage Reduction*** with Tom Jokerst, CableLabs (moderator); Ed Callahan, Antec; Jim Chiddix, ATC; and Tom Elliot, TCI.

Expo Workshops

☞ ***Assessing Your System's Picture Quality*** with Rich Annabaldi, Pioneer; and Brian James, CableLabs.

☞ ***BCT/E Certification: An Overview of Technical Certification and Related Category Examinations*** with Marvin Nelson, SCTE; and Les Read, Sammons Communications.

☞ ***The Best of "Fiber Optics Plus '92"*** with Dick Mueller, Cox Cable; and Joe Van Loan, Cablevision Industries.

☞ ***Customer Service: Doing the Job Right the First Time*** with Connie Buffalo, Jones Intercable; Ralph Haimowitz, SCTE; and Willis Smith, Metrovision.

☞ ***EBS and the Cable Industry*** with Frank Lucia and Helena Mitchell, FCC; and Ken Wright, Jones Intercable.

☞ ***How Will the New NEC, NESC and OSHA Regulations Impact Your System?*** with James Kearney, Malarkey-Taylor; and Roger Keith, NCTI.

☞ ***One-on-One with the FCC*** with Mike Lance and John Wong, FCC.

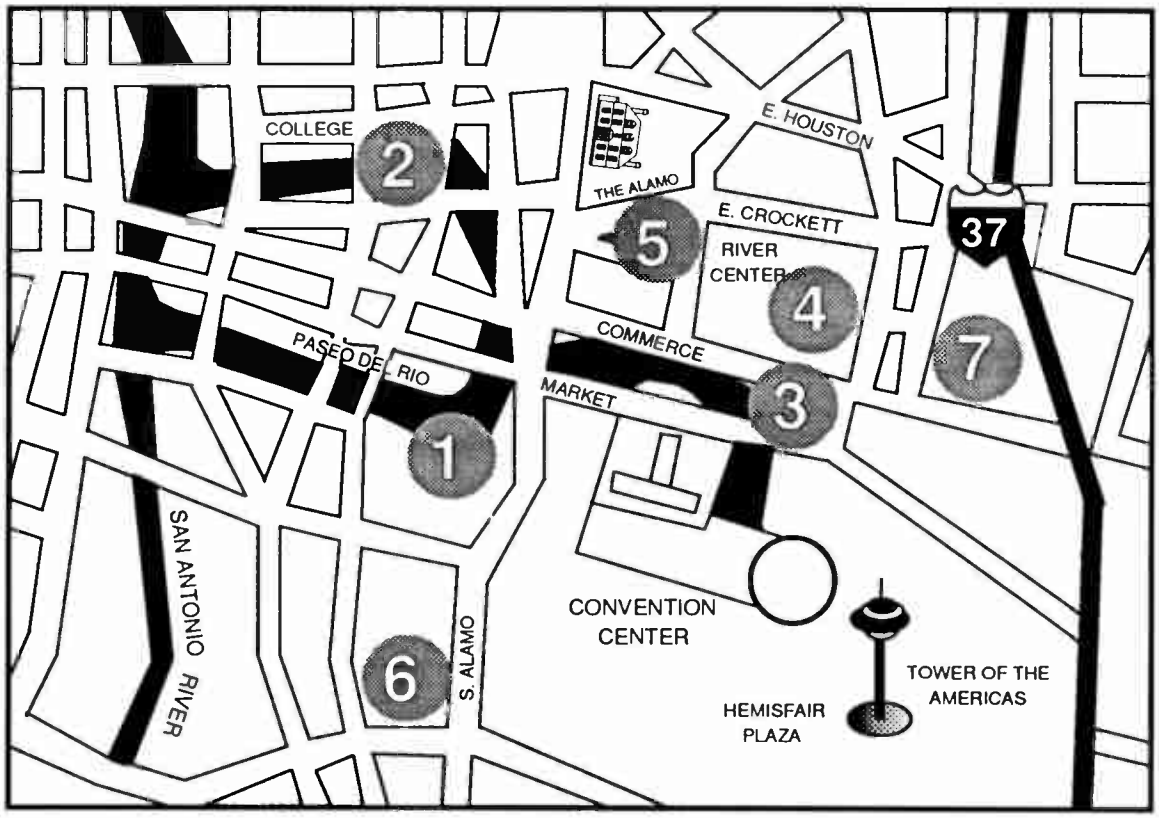
☞ ***Outage Reduction Techniques*** with Scott Bachman, CableLabs; Mark Bowers, Cablesoft Engineering; and Robert Moel, Paragon.

☞ ***Primary Testing Under Technical Reregulation*** with Jim Farmer, Scientific-Atlanta; and Jack Webb, Wavetek.

☞ ***Secondary Testing Under Technical Reregulation*** with Paul Beeman, TVN Entertainment; Ron Hranac, Coaxial International; and John Vartanian, HBO.

CABLE-TEC EXPO '92 SCHEDULE OF EVENTS

	Registration	Training	Exhibits	Testing	Special Events
Friday, June 12					NCTA Engineering Committee Meeting 9 a.m. - 6 p.m.
Saturday, June 13	Attendee Registration 4 - 8 p.m.				Reregulation of Technical Standards Seminar (sponsored by NCTA) 9 a.m. - 5 p.m. Arrival Night Reception 6 - 8 p.m.
Sunday, June 14	Attendee Registration 7:30 a.m. - 3 p.m.	Engineering Conference 8:30 a.m. - 4:30 p.m.			Awards Luncheon 12 noon - 1:45 p.m. SCTE Annual Membership Meeting 4:30 - 5:30 p.m. Welcome Reception 6 - 8 p.m.
Monday, June 15	Attendee Registration 7:30 a.m. - 3 p.m.	Expo Workshops 8 a.m. - 12:15 p.m.	Exhibit Hall Open 12 noon - 6:30 p.m.	BCT/E and Installer Certification Testing 10 a.m. - 2 p.m.	Expo Evening featuring the Second National Cable-Tec Games 7 - 9:30 p.m.
Tuesday, June 16	Attendee Registration 7:30 a.m. - 3 p.m.	Expo Workshops 8 a.m. - 12:15 p.m.	Exhibit Hall Open 12 noon - 5 p.m.	BCT/E and Installer Certification Testing 10 a.m. - 2 p.m.	Ham Radio Operators' Reception 6 - 8 p.m. International Good Neighbor Reception 7 - 9 p.m.
Wednesday, June 17				BCT/E and Installer Certification Testing 8:30 a.m. - 12 noon	Golf Tournament 7:30 a.m. - 1 p.m. In-Home Cabling and EBS Subcommittee Meetings 7:30 - 9:30 a.m. Interface Practices and CLI Subcommittee Meetings 9:30 - 11:30 a.m.



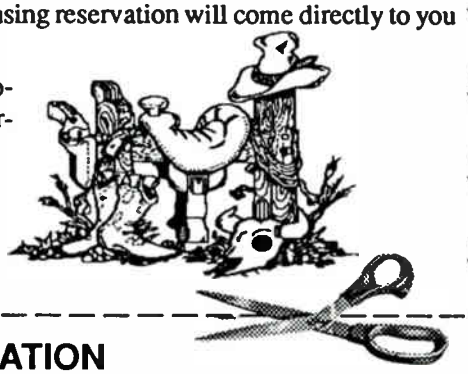
CABLE-TEC EXPO '92 HOUSING

MAP #	HOTEL	RATE	# OF ROOMS
1	Hilton (headquarters)	$108 (S), $112 (D)	400
2	Hyatt	$95 (S or D)	400
3	Marriot Riverwalk	$99 (S), $112 (D)	300
4	Marriot Rivercenter	$99 (S), $114 (D)	275
5	Menger	$65/78 (S), $75/88 (D)	275
6	Plaza San Antonio	$92 (S), $103 (D)	200
7	La Quinta	$68 (S), $78 (D)	100

INSTRUCTIONS

1. **Deadline:** Cable-Tec Expo '92 Registration Forms must be received by SCTE National Headquarters on or before May 15, 1992. Forms received after that date cannot be processed and will be returned to the sender. If you do not preregister for the Cable-Tec Expo in advance, you must register on-site in San Antonio.
   - ☞ Use a separate form for each individual (forms may be copied)
   - ☞ Appropriate registration and activity fees must be enclosed for this form to be processed.
   - ☞ Hotel reservations must be made using the enclosed Attendee Housing Form before May 7, 1992.
2. **Registration Cancellations: All cancellations must be received in writing by SCTE National Headquarters on or before May 29, 1992. A $50 cancellation charge is applicable to all registrations cancelled after May 15, 1992. Substitutions will be accepted until June 5, 1992. NO REFUNDS WILL BE GRANTED AFTER MAY 29, 1992.**
3. Telephone requests for cancellations and substitutions will not be accepted. All requests for cancellations must be submitted in writing and be received before May 29, 1992 and all requests for substitutions must be received before June 5, 1992. (SCTE FAX #: 215-363-5898)
4. Return the Cable-Tec Expo 1992 Registration Form with the appropriate fees to:

   SCTE
   669 Exton Commons
   Exton, PA 19341
   Attention: Anna M. Riker
5. Please make flight reservations through American Airlines, Continental or your local travel agent using the special discount numbers listed on the previous page. Rental car reservations may be made through Hertz.
6. Please use the enclosed Attendee Housing Form to make hotel reservations in San Antonio. Indicate your first, second and third choices of hotel. Confirmation of your housing reservation will come directly to you from the appropriate hotel.
7. EXPO '92 DRESS CODE: The Program Subcommittee has established a dress code for this year's Expo. All attendees are encouraged to wear jeans, boots and Stetson hats (if you got 'em).



PLEASE NOTE DEADLINES

MEMBERSHIP APPLICATION

Make check payable to SCTE.
Mail To:

SCTE®
669 Exton Commons
Exton, PA 19341

☐ I hereby apply for membership in the Society of Cable Television Engineers, Inc., and agree to abide by its bylaws. Additional member material will be mailed to me within 45 days. Payment in U.S. funds is enclosed. I understand dues are billed annually.

☐ Please send me further information on the Society of Cable Television Engineers

SCTE is a 501 (c) (6) non-profit professional membership organization. Your dues may be tax deductible. Consult your local IRS office or your tax advisor.

APPLYING FOR: ☐ INDIVIDUAL @ $40 ☐ SUSTAINING @ $250

Please print or type information. Data will be used exactly as it is submitted here.

☐ MR. ☐ MRS. ☐ MS. TITLE:_____

NAME:_____ TEL. #:_____
First Initial Last Area Code-Number

EMPLOYER:_____ FAX #:_____
Company Name Area Code-Number

CO. ADDRESS:_____
Street/PO City State Zip

USE HOME ADDRESS?_____
Street/PO City State Zip

YOUR SIGNATURE:_____ DATE:_____

Complete the information. Enclose full payment or charge to MasterCard/VISA shown below.

NAME ON CARD:_____ EXP.:_____

MASTERCARD NO.:_____

VISA NO.:_____

SIGNATURE FOR CHARGE AUTHORITY:_____

Applications without payment will be returned. Applications from outside U.S., enclose additional $20 (U.S.) to cover mailing expenses.

SCTE® CABLE-TEC EXPO REGISTRATION

Everyone must register. ID badges **must** be worn and visible at all times in workshops and on the EXPO floor. To avoid delay, fill in all information requested. Full and complete payment must be sent with this registration form. Hotel reservations must be made using the Attendee Housing Form on the reverse side.

Registration Fee includes technical workshops, exhibit hall and hospitality/entertainment events. SCTE Active, Senior and Charter Members must provide Member ID Number. New Members applying at this time must include SCTE Member Application and dues payment.

If you wish to register more than one person, please make copies of this form.

*** PLEASE PRINT OR TYPE** ❑ Mr. ❑ Mrs. ❑ Ms.

YOUR NAME:_____
First M.I. Last

NICKNAME:_____

TITLE: _____ COMPANY: _____

ADDRESS:_____
Street/P.O. Box

_____
City State Zip

TELEPHONE:(_____)_____ SCTE MEMBER #:_____

FAX #:(_____)_____ AMATEUR RADIO CALL SIGN:_____

*** REGISTRATION FEES (until May 15, 1992)** (Please check the appropriate box)

	Member	Non-Member	
Engineering Conference and Expo	❑ $195.00	❑ $350.00	
Expo only	❑ $145.00	❑ $250.00	
Engineering Conference	❑ $120.00	❑ $200.00	
Spouse - First Name:_____	❑ $95.00	❑ $95.00	$ _____

(Spouse registration includes: All Sessions, Exhibit Floor and Awards Luncheon)
Registration forms accompanied by a paid membership application may pay member rate.

#_____ Additional Awards Luncheon tickets @ $20.00 $ _____

TOTAL AMOUNT ENCLOSED: $ _____

*** PRE-REGISTRATION FORM** - must be received **BEFORE MAY 15, 1992.**
*** Cancellation Policy** - A $50 cancellation charge is applicable to all registrations cancelled after May 15, 1992. NO refunds given after MAY 29, 1992.

*** METHOD OF PAYMENT**

❑ Check (Checks to be made payable to SCTE) ❑ MasterCard ❑ Visa

CHARGE CARD INFORMATION - Complete for MasterCard/Visa shown below:

NAME ON CARD:_____ EXP. DATE:_____

MASTERCARD NO.:_____ VISA NO.:_____

SIGNATURE FOR CHARGE AUTHORITY:_____

NOTE: There are no further discounts available. SCTE Sustaining Membership qualifies only ONE (1) person to register at SCTE Member rate. Additional personnel must be registered at Non-Member fee or submit individual application for membership with full payment.

HOUSING RESERVATIONS ON REVERSE SIDE

MAIL THIS FORM TO: SCTE
669 EXTON COMMONS
EXTON, PA 19341
ATTENTION: ANNA M. RIKER

SCTE®

SOCIETY OF CABLE TELEVISION ENGINEERS

CABLE-TEC EXPO® '92

ATTENDEE HOUSING RESERVATION FORM

INDICATE FIRST, SECOND AND THIRD CHOICES

	HOTEL	RATE	# OF ROOMS
_____	Hilton (headquarters)	$108 (S), $112 (D)	400
_____	Hyatt	$95 (S or D)	400
_____	Marriot Riverwalk	$99 (S), $112 (D)	300
_____	Marriot Rivercenter	$99 (S), $114 (D)	275
_____	Menger	$65/78 (S), $75/88 (D)	275
_____	Plaza San Antonio	$92 (S), $103 (D)	200
_____	La Quinta	$68 (S), $78 (D)	100

NAME:_____ COMPANY: _____

ADDRESS:_____

CITY:_____ STATE:_____ ZIP:_____

SHARING ROOM WITH:_____

OF PERSONS:_____ PHONE #: (_____)_____ FAX #: (_____)_____

ARRIVAL DATE

month:_____ date:_____ year:_____

arrival time:_____

DEPARTURE DATE

month:_____ date:_____ year:_____

departure time:_____

Reservations must be received by SCTE no later than May 7, 1992.
After this date, please contact SCTE for information on hotel availability.

RATES SUBJECT TO ALL APPLICABLE TAXES.

ALL RESERVATIONS MUST BE ACCOMPANIED BY A VALID CREDIT CARD NUMBER. (Checks will not be accepted.) To qualify for available block space and rates, reservations must be received by May 7, 1992. Reservations received after this date will be confirmed on a space-available basis at the convention rate.

I will guarantee by: ❑ MasterCard ❑ Visa ❑ American Express ❑ Diner's Club

Please charge to my credit card #:_____

NAME ON CARD:_____ EXP. DATE:_____

SIGNATURE FOR CHARGE AUTHORITY:_____

ADDITIONAL PERSONS ARE $10 TO $15 DEPENDING UPON HOTEL.
PLEASE CONTACT SCTE DIRECTLY CONCERNING SUITE RESERVATIONS.

MAIL THIS FORM TO: SCTE
669 EXTON COMMONS
EXTON, PA 19341
ATTENTION: ANNA M. RIKER

CABLE-TEC EXPO '92 EXHIBITORS

(as of February 1, 1992)

ACP International
ACT Communications Inc.
AM Communications
Adrian Steel Co.
Aeroquip Corp.
Alpha Technologies
American Lightwave Systems
Anixter Cable TV
Antenna Technology Corp.
Applied Instruments Inc.
Arcom/Northern CATV
Arena Services
Augat Communications Group
Authorized Parts Co.
Avantron Communications Inc.
Belden Wire & Cable
Ben Hughes/Cable Prep
BUDCO
CATV Services Inc.
C-COR Electronics Inc.
CED Magazine
CT Publications
Cable Converter Service Corp.
Cable Constructions
Cable Innovations Inc.
Cable Man/Cable Marketing
Cable Security/Power Guard
Cable Services Co. Inc.
Cable Spinning Equipment Co.
Cable Technologies International
Cableready
CABLETEK Center Products Inc.
CADCO Inc.
CALAN Inc.
Canusa
Carlon, A Lamson & Sessions Co.
Channell Commercial Corp.
CHANNELMATIC Inc.
Coast CATV Supply
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Comm/Scope
Commercial Electronics
ComNet Co.
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DX Communications Inc.
Diversified Fastening Systems
Dynatech Cable Products Group
Eagle Comtronics Inc.
Electroline
Excalibur Cable Communications Ltd.
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Friction Design
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Newhall Pacific
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U.S. Cable Inc.
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Wavetek
Wegener Communications
Westec Communications
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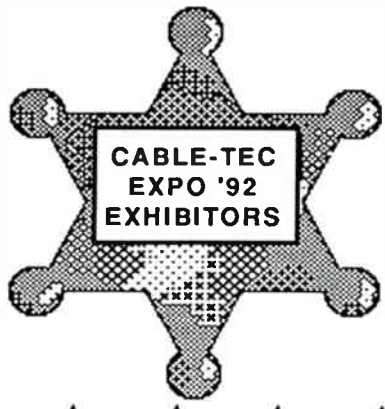
Zenith Electronics Corp.



AD INDEX

It's so simple! To obtain additional information from any of the display advertisers appearing in this issue of ***Communications Technology,*** please use one of the **Reader Service Cards** on the facing page (pass the others along). The ad index below has been expanded to include not only the page number of each advertiser, but also each corresponding reader service number to be circled on the Reader Service Card.

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CLASSIFIEDS/BUSINESS DIRECTORY

Help Wanted

Technical Manager

Palmer Cablevision has a challenging opportunity for a Technical Manager in Palm Desert, CA, a resort community near Palm Springs. This 72,000 subscriber system is currently rebuilding with an extensive application of fiber optic technology.

The successful applicant will supervise technical operations, including installation, service, maintenance, and headend as well as oversee all engineering functions related to rebuild, prepare capital and operating budgets and assist the Operations Manager in project management.

Extensive and demonstrated knowledge of headend and distribution electronics, cable design and a minimum of five years in a technical management role is a must. A BSEE is preferred.

Qualified candidate should send a cover letter and resume, outlining experience and salary history to:

Palmer Cablevision
Operations Manager
41725 Cook Street
Palm Desert, CA 92260

An Equal Opportunity Employer

Contractor Looking For:

•Line technician with sweep and Headend experience. Fiber optic splicing a plus, however will train.

•Construction manager: minimum of 5 years experience and underground background required. Computer literate a plus, or must be willing to learn. Midwest area, some travel required.

Call or fax resume to (313) 729-8437

Position Wanted

Degreed (B.S. Management, MBA in August '92) sales/marketing professional seeks marketing position with established, growth oriented firm marketing to CATV/LAN/telecommunications industry. Strong technical and financial background in addition to domestic and international sales management, marketing communications, advertising, and service management skills. Please respond to: Box #16, CT Publications, 50 S. Steele St., Suite 500, Denver, CO. 80209.

Equipment For Sale

Equipment Repair

(Continued from page 62)

off to a chilly 0° F. Following the cold measurements at the same frequencies, the temperature chamber was turned up to 120° F, and a third set of measurements was made. Table 3 summarizes measurement accuracy over temperature; all were within ComSonics' published specifications.

The next thing we checked was peak detector accuracy. ComSonics does not have a specification in its manual for this, but an indication of a good peak detector is when little or no indicated level difference is noted between CW and modulated carriers. *A note of caution if you use this technique: Some modulators will change their output amplitude when modulation is applied, depending on the type of clamping used.* We made this check with a modulator that does not vary its output with video connected.

The modulator was set to 87.5 percent depth of modulation with a full-field composite test signal applied to the video input. When we connected the WindowLite to the modulator after our setup, the carrier level was measured with and without modulation. We repeated this test several times, and observed measurement differences ranging from 0.1 dB to 0.4 dB, indicating a good performing peak detector circuit.

Following general carrier measurement accuracy tests, we then checked the WindowLite's internal attenuator tracking. For this test we connected an external lab grade 75 ohm variable attenuator between a 60 dBmV signal source and the SLM's input. The input level was then varied in 1, 5 and 10 dB steps over an 80 dB range. The WindowLite tracked the level changes within 0.1 to 0.3 dB over that range.

Hum measurement accuracy was compared against a reference measurement on a spectrum analyzer in accordance with the National Cable Television Association recommended low frequency disturbance measurement procedure. Our "hum generator" was an external amplifier that we were able to vary the input AC voltage to, causing its power supply to go out of regulation and generate hum in a CW carrier passing through the amplifier. The WindowLite easily met the manufacturer's specifications.

The C/N measurement accuracy also was checked, and compared against a known spectrum analyzer measurement. The WindowLite indicated 0.7 dB lower than the analyzer. (For the reference we performed the analyzer C/N measurement manually in a 1 Hz noise bandwidth, then corrected to 4 MHz.) One thing observed here is the range of acceptable input signals. While a typical analyzer measurement requires 25 to 35 dBmV on the carrier being checked, the WindowLite gave us an on-screen warning that the input level was too high. Reducing it to around 15 dBmV resulted in a good measurement. (A ComSonics engineer indicated that the WindowLite C/N measurement is best performed with signals below 16 dBmV).

The final and always last test with SLMs was an impact test. Several years ago while still at Jones I decided to simulate a meter being dropped off of a TV set or falling out of the shelf in the back of a van during all evaluations. My personal opinion is that any SLM should be able to survive a 36-inch drop onto a hard surface. In the case of the WindowLite, the drop was closer to six feet onto a carpeted concrete floor. Even after this abuse, the WindowLite still met spec and continued to operate flawlessly. (Manufacturers have never appreciated this particular test, especially if the SLM was damaged on impact. The easiest way to do this is to slide the meter off the test bench onto a concrete floor. I've found that most of today's SLMs have no problem passing this simple test.)

Table 3: Carrier measurement accuracy (reference levels at 20 dBmV)

Carrier frequency	Indicated level at 68° F	0° F	120° F
55.25	19.1	18.8	19.3
151.25	19.5	19.6	19.9
229.25	19.2	19.4	19.4
343.25	19.8	19.5	20.3
409.25	19.7	19.6	19.8
481.25	19.6	20.1	20.2
547.25	20.6	20.7	20.9
595.25	20.0	20.1	21.0
685.25	20.8	20.6	21.1
745.25	20.6	20.1	19.6

Comments

The WindowLite easily met its specifications, indicating that ComSonics has done a good job of squeezing full-size SLM performance into a hand-held package. The features available with its microprocessor control are considerable, and I found myself referring to to the manual's menu map fairly regularly until I got the hang of the more commonly used functions. The WindowLite's calibration routine takes about four seconds from the time you push the "on" button, which is quite a bit faster than its big brother, the Window.

One thing I noticed that might be a problem in some instances is the meter's maximum measurement capability of 60 dBmV. Unlike a conventional meter that also has this upper level limit, the WindowLite doesn't have a meter movement that will peg once the level actually goes above 60 dBmV. The LCD reading stays at "+60," and does not provide any way for the user to know if 60 dBmV is the actual level, or if it's something greater. An easy, but inconvenient fix to this is to use an external attenuator, but I would like to see the "+60" flash or something else when the level goes above that figure. My only other recommendation is that ComSonics consider somehow providing a small serial data port for connection to an external PC. It would be great to be able to control the meter with a PC (perhaps for some automated testing), or download field data into the computer or external printer.

All in all, the WindowLite is a rugged and accurate test instrument that has managed to stay below the $2,000 SLM "ceiling." For some reason, that price level has been a barrier of sorts to many operators when it comes to SLMs, although it's certainly not an issue here. One other appealing feature is the meter's international flavor. The fact that it is available with so many international frequency plans already programmed into memory should make it attractive to overseas operators as well as domestic operators. ComSonics has AC chargers available for the export market, to provide charging operation at voltages other than 120 VAC. The user-selectable units (dBmV and dBμV) also enhance its usefulness overseas.

For more information, contact ComSonics at 1350 Port Republic Road, Harrisonburg, Va. 22801; telephone (800) 336-9681 or (703) 434-5965. **CT**

Roy Ehman's legacy prevails!

By Pam Nobles
Senior Staff Engineer/Technical Training
Jones Intercable

Roy Ehman has been a familiar sight around Jones Intercable for the last four years. That has changed because Roy and his wife Betty are packing up the necessities (including Roy's 486 computer) and heading out in their new luxurious motor home. Roy retired from Jones and the cable industry on March 31, 1992.

Even if you haven't met Roy personally, you might have hear him speak at cable conventions or read one of his many articles on cumulative leakage index (CLI) or outage reduction. You'll recall his British accent and his precise, no-nonsense manner of speaking.

Toppling into CATV

Roy was born in Canada and schooled in South Africa (thus, the accent). Although Roy received his B.S. degree in physics and chemistry, he just wasn't satisfied and returned to school in his 30s to study electronics. After 11 years of working for the National Film Board, Roy sold everything and, without a job, moved to Calgary, Alberta, Canada, to give his family a better quality of life. As so many of us have done, Roy "toppled" into CATV. There was a technical college in town that had a movie department where Roy thought he might work. When he went for his final interview he discovered the person he was to interview with was unavailable. While on his way home he stopped at the cable company, where he had previously left an application. The reaction he received was: "I remember you! Can you start tomorrow?" As the chief technician, his first assignment was to build the cable system. In 1973 Roy became the operations manager of Community Antenna Television Ltd. in South Calgary.

Roy had always wanted to come to America, but, being a Canadian citizen, this just was not possible without first securing a job. In 1978, he received his opportunity when he was invited to build the Syracuse, N.Y., system. He also received the opportunity to grow in his knowledge and experience, including valuable lessons about leakage. After the build was complete, he was ready to move on, and looked for new challenges in Atlanta.

After Atlanta, he tentatively accepted a job to build the Anchorage, Alaska, system but ended up going to North Miami instead, and began his seven-year stint as director of engineering and subsequently vice president of engineering in Kentucky and Virginia with Storer. Here, his knowledge of frequency offsets was refined.

At that time, offsets were based on

Notable projects throughout Roy Ehman's career

• AmpClamp — The crowbar has been identified by the CableLabs Outage Control Committee as "one of the most powerful and spectacular reducers of outside plant outages." The crowbar device was developed by Roy and Alpha Technologies of Bellingham, Wash., for a system in Virginia that had been deluged with severe storms in 1986. (See related article on page 20.) The results of a test run were spectacular. AmpClamps are now used nationwide, both in Florida (the "lightning capital of the United States") and other areas where protection from longitudinal sheath currents is necessary.

• Leak Manager — The "Leak Manager" is presently in use in well over 100 systems and is working flawlessly. Roy developed this sophisticated program in compiled basic. Data can be input in any units, making it very user-friendly. Providing a real time on-screen CLI figure of merit and its ability to print the entire Exhibit B are just a few of its many attributes. Roy also markets this program to interested individuals.

A related program, "Quick Check" provides just that: a quick check for CLI. If the figure of merit is greater than 64, leaks can be subtracted until the figure of merit falls within specifications. This way, repairs can be identified and prioritized.

• Outage reduction — Roy's early perception and perseverance have really made him a pioneer in regard to work with outage reduction and customer service. Articles written over the last 17 years are still pertinent today. Roy also was a very active group leader in the CableLabs Outage Control Committee.

• Roy's career at Jones Intercable — Probably one of the most valuable contributions Roy has made to Jones Intercable is his "Cable Manager" program. This program tracks CLI dates and outputs reports on demand indicated by anniversary dates within 45 days. It monitors every aeronautical offset frequency within Jones two times a year as well as monitors every license we own and outputs reminders. It's also flexible enough to store specific reports. Additional elements include "City Manager" (outputs coordinates of any populated place in the United States) "Satellite Manager" (outputs an entire arc of satellites in one sweep) and "TV Manager" (outputs TV stations and all parameters including predicted field strength within *x* miles). One program that was especially helpful within Jones — specifically, for Superaudio — was "FM Manager." This program indicates the relative field strength of the strongest FM signal on each channel in the form of a bar graph. This makes it very simple to optimize the FM signals.

whether the Federal Aviation Administration was using certain frequencies within a specified distance. At best, knowing the proper frequency was a stab in the dark. It was not unusual for systems to have channels shut down. Roy wrote the program to manage these offsets, which not only found the correct frequency but also wrote the necessary application. Roy's work with data bases was launched. We at Jones Intercable are very familiar with Roy's data bases and appreciate the way he is able to keep us "in line."

Roy had acquired his interest in computers many years previous while attending a home show. Although he didn't start using computers right away, the bug bit him and never let go.

During his 21-year cable career, Roy also became known as an accomplished writer. It began with an article on grounding and bonding for *TVC*. This research propelled him into the exploration of "AmpClamps." He also is recognized for his work with outage reduction, customer service and CLI. He advocates "The Roy Ehman 'FF' program of leakage control": Find 'em and Fix 'em. He also supports making friends with the ham radio operators and TV trades. He's an avid ham himself, as his vehicle's licence plate will attest to.

Roy has worn the customer's hat for a long time. Back in 1980 Roy was quoted as saying, "Anyone can deliver pictures — when are we going to provide good customer service?" Recent studies have verified that the quality of cable pictures, although very, very important to us techy-types, is number two in the customer's eyes. The number one complaint is outages. Roy's work in this area has been outstanding.

Roy's future

Roy and Betty are looking forward to getting a close-up look at the United States and Canada. After that, he's planning on taking the time to tackle software programs he hasn't yet had the opportunity to poke about with. He's been letting the hams know of his plans so he can stay connected. Of course, there are miles of lakes that might contain a few good fish just waiting to be caught.

In addition, Roy will be leaving his name on the Society of Cable Television Engineers speaker's list for leakage, lightning and outage control consultation. Although Roy will remain closely linked with Jones Intercable, his presence will truly be missed by many. **CT**

CALENDAR

April

16: SCTE Satellite Tele-Seminar Program, *EBS and the Cable Industry* produced by the FCC. To air from 2-3 p.m. ET on Transponder 6 of Galaxy 1.

17: SCTE Mid-South Chapter, installer exams to be administered, Wilson Inn, Memphis, Tenn. Contact Mark Gardner, (601) 393-3366.

17: SCTE San Diego Chapter, installer exams to be administered, Daniels Cablevision, Carlsbad, Calif. Contact Kathleen Horst, (714) 643-9370.

17: SCTE Wheat State Chapter, BCT/E exams to be administered in all categories, Multimedia Cablevision offices, Wichita, Kan. Contact Mark Wilson, (316) 262-4270.

17: NCTI seminar, highway safety, Columbus, Ohio. Contact (303) 761-8554.

20-24: ONI Fiberworks '92 seminar, ONI Training and Product Development Center, Englewood, Colo. Contact Rand Reynard, (800) FIBER ME.

21: SCTE Badger State Chapter seminar, fiber optics, Holiday Inn, Stevens Point, Wisc. Contact Gary Wesa, (414) 496-2040.

21: SCTE Southeast Texas Chapter, BCT/E exams to be administered in Categories I and III at the technician level. Contact Rosa Rosas, (409) 646-5227.

22: SCTE Big Country Chapter, installer exams to be administered, San Angelo, Texas. Contact Mark Gardner, (601) 393-3366.

22: SCTE Greater Chicago Chapter, BCT/E exams to be administered, Willowbrook, Ill. Contact Bill Whicher, (708) 362-6110.

22: SCTE North Country Chapter, Sheraton Midway Hotel, St. Paul, Minn. Contact Bill Davis, (612) 646-8755.

22: SCTE San Diego Chapter seminar, digital compression and PCN technology. Contact Kathleen Horst, (213) 831-4157.

22-24: SCTE Technology for Technicians II seminar, intensive three-day seminar designed for maintenance techs, chief techs and system engineers, Hampton Inn, Willow Grove, Pa. Contact (215) 363-6888.

25: SCTE Cactus Chapter seminar, headend and pay TV concepts. Contact Harold Mackey, (602) 358-5860, ext. 135 or Chris Radicke, (602) 948-4484.

28: SCTE Central Indiana Chapter, BCT/E exams to be administered in all categories. Contact Joe Shanks, (317) 646-9102.

28: SCTE Chattahoocheee Chapter, BCT/E exams to be administered in all categories, GCTV offices, Clarkston, Ga. Contact Hugh McCarley, (404) 843-5517.

30: SCTE New Jersey Chapter seminar, quality control, plant grounding and outage control and BCT/E exams to be administered in all categories, Holiday Inn, Wayne, N.J. Contact Jim Miller, (201) 446-3612.

Planning ahead

May 3-6: NCTA National Show, Dallas. Contact (202) 775-3550.

June 14-17: SCTE Cable-Tec Expo, San Antonio, Texas. Contact (215) 363-6888.

Sept. 8-10: Eastern Cable Show, Atlanta. Contact (404) 252-2454.

Oct. 13-14: Atlantic Cable Show, Atlantic City, N.J. Contact (609) 848-1000.

Dec. 2-4: Western Cable Show, Anaheim, Calif. Contact (415) 428-2225.

BOOKSHELF

The following is a listing of videotapes currently available by mail order through the Society of Cable Television Engineers. The prices listed are for SCTE members only. Non-members must add 20 percent when ordering.

- *Basic Electronic Fundamentals in the Analysis of Cable System Powering* — National Cable Television Institute's Ray Rendoff discusses the fundamental characteristics of AC and DC voltage, AC standby power supplies, coaxial cable and various amplifier configurations that establish overall system powering requirements. Mathematical calculations using Ohm's law are performed on a sample system powering configuration. Typical powering problems and corresponding troubleshooting techniques conclude this technician level program on system powering analysis. (1 hr.) Order #T-1030, $45.
- *One-on-One with the FCC* — Former Federal Communications Commission engineer Cliff Paul and the FCC's Syd Bradfield discuss how to deal with current regulatory changes and answer questions from the audience concerning their own systems compliance in this workshop from Cable-Tec Expo '86. (1 hr.) Order #T-1031, $45.
- *Category IV Review Course: Distribution Systems* — Bill Grant, Category IV curriculum committee member, presents a five-hour review course on the basics of distribution systems in preparation for technician level certification exams. (5 hrs.) Order #T-1033, $130. **B-IV**
- *Category II Review Course: Video and Audio Signals and Systems* — Category II Curriculum Committee Chairman Paul Beeman presents an in-depth look into this BCT/E category. Information concerning both technician and engineering level certification exams is presented in this tape. (4 hrs.) Order #T-1034, $95. **B-II**
- *Engineering and Technical Management Development Seminar* — This seminar, sponsored by national SCTE and its Chattahoochee Chapter, features a university professor and several industry personnel and management specialists in a series of discussions on how to improve your effectiveness as a manager. (5 hrs.) Order #T-1035, $145.
- *Ku-Band Technology and TVRO Calculations* — Viacom International Senior Vice President of Engineering Paul Heimbach discusses the technical characteristics of this new satellite technology and the proper preparations for being able to receive Ku-band transmissions in this workshop from Cable-Tec Expo '87. (1 hr.) Order #T-1036, $45.
- *Interference Elimination with Antennas and Antenna Arrays* — Biro Engineering's Steven Biro conducts a workshop from Cable-Tec Expo '87 on antenna array and phasing techniques for use in interference elimination at headend sites. (1 hr.), Order #T-1037, $45.
- *Performing Measurements on Basic Test Equipment* — Wavetek's Terry Bush reviews operation of cable system test equipment and proper measurement techniques in this workshop from Cable-Tec Expo '87. (1 hr.) Order #T-1038, $45.

Note: The appearance of the symbol **B-** indicates a videotape relating to a certain category (noted by a Roman numerals **I-VII**) of the BCT/E Certification Program. These tapes have been discounted to aid candidates for certification in their studies. All videotapes are in color and available in the 1/2-inch VHS format only. Videotapes 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, 669 Exton Commons, Exton, Pa.19341 or fax with credit card information to (215) 363-5898.

A complete listing of SCTE publications and videotapes is included in the March issue of the Society newsletter "Interval."

PRESIDENT'S MESSAGE

SCTE

making history

By Wendell Woody
President, Society of Cable Television Engineers

The Society of Cable Television Engineers Engineering Subcommittee on Interface Practices voted the final approval on all the revisions to establish the specifications for an SCTE standard on the female port of the F-connector interface. This achievement was accomplished recently at the subcommittee's Texas Cable Show meeting in San Antonio, Texas, on Feb. 25. The first meeting of this subcommittee was on June 15, 1988, at the Cable-Tec Expo in San Francisco.

Over a year ago, an F-connector specification was released by this subcommittee, but it was followed with new revisions for consideration. Consequently this standard took 3-1/2 years to bring to final fruition, which reflects many, many hours of tedious work, discussion, debates, research, compromises and revisions. Simultaneously, this subcommittee also has been working on specifications for drop cables as well as aluminum-sheathed coaxial cables. The work on the male port of the F interface will now be initiated.

The Interface Practices Subcommittee has more members than any other subcommittee of the Society. A small core of the charter pioneering members of this subcommittee remains the most active and dedicated yet today. It is these individuals' exemplary work and devotion that has brought about this SCTE history-making achievement. In addition to Tom Elliot, they are: George Bollinger, George Campbell, Bill Down, David Franklin, Joe Lemaire, Jack Radzik, Andy Szegda, Fred Wilkenloh, Steve Willardson and Ken Williams. They are to be commended! I regret that everyone who has made a contribution to the subcommittee's work cannot also be acknowledged in this column.

CENELEC

The F-connector specifications standard established by the U.S. SCTE Interface Practices Subcommittee have been accepted by CENELEC for consideration of approval as an alternative connector for the IEC-169-2 connector, which is used by most European countries. (IEC is the abbreviation for International Electrotechnical Commission.) This history-making accomplishment is being achieved through the SCTE International Council, which is very fortunate to have three of the U.K. SCTE National Executive Committee members also participating as voting members on the CENELEC Technical Committee. This particular CENELEC committee is CLC/TC-109, "Cabled Distribution Systems for Television and Sound Signals."

CENELEC is the abbreviation for the European Committee for Electrotechnical Standardization. It is a non-profit technical organization set up under Belgian law and is composed of the National Electrotechnical Committees of 18 countries in Western Europe, which (except for Iceland and Luxembourg) also are members of the IEC. The American Institute of Standards is only a non-voting monitoring participant in CENELEC. Consequently, the U.S. SCTE and the International SCTE Council best serve the interest of U.S. cable operators and cable equipment suppliers in the European market. This provides growth and opportunities throughout our Society — even for our grass roots membership!

Subcommitte meetings

There will be four of the engineering subcommittee meetings held at the Cable-Tec Expo in San Antonio: Interface Practices, In-Home Cabling (wiring), Emergency Broadcast System (EBS), and Cumulative Leakage Index (CLI). They are scheduled on Wednesday, June 17, between 7:30 a.m. and noon. You can attend portions of all four or two of them in their entirety.

Election procedures

The ballots for the recent national SCTE election have been received and are being processed by the accounting firm contracted to tally the results. Those results will be communicated to the membership no later than April 15. By the way, word has it that member "turnout" was very active. Thank you for voting!

Newly elected directors will take office at the board meeting immediately prior to the annual general membership meeting. This will be Saturday, June 13, at the Cable-Tec Expo in San Antonio. Election of the 1992/93 national board officers shall be the first order of business at that board meeting. The new officers' terms shall commence immediately at the conclusion of that meeting.

Texas Cable-Tec Games

The SCTE Cable-Tec Games were conducted again this year at the Texas Cable Show. The teams were most talented and skillful and this generated very enthusiastic competition for the gold, silver and bronze Olympic-style medals.

The best overall winning team was from the Southeast Texas Chapter, which edged out the Ark-La-Tex Chapter by 12 points out of 1,600. The winning team members were: Hughston Anderson, Bill Bartley, Harold Null and Tom Rowan.

Making SCTE history is Robert Hagan of the Ark-La-Tex Chapter who now holds the world record for earning the most Cable-Tec Games medals with a total of seven. He earned two medals at the national games in Reno, Nev., and two medals each at both this and last year's Texas games. In addition, he took the best individual record medal at this Texas Show. He is rivaled only by Al Wilke of the Heart-of-America Chapter who earned five medals at the Cable-Tec Games conducted last fall at the Mid-America Cable Show in Kansas City, Mo. *Cowboy Hagan vs. Big Al Wilke* might be Don King's best pay-per-view match this year when these two square off at the Alamo Cable-Tec Games at this year's expo.

Meeting the members

The Palmetto Chapter with Jim Dobbins as president organized the technical sessions for the winter meeting of the South Carolina Cable Television Association in Columbia. At this chapter meeting the Palmetto group also elected new chapter officers. This meeting was preceded with a chapter board meeting with the following in attendance: Jim Dobbins, Harold Williams, Eddie Swing, Melanie Burbank, Powell Bedgood, Ken Creswell, Tommy Belk, Steve Kuk and Butch Roberson. I also had an opportunity to address the management session and review the merits for all general managers and operations managers to authorize and encourage their technical people to attend local Palmetto Chapter meetings. **CT**

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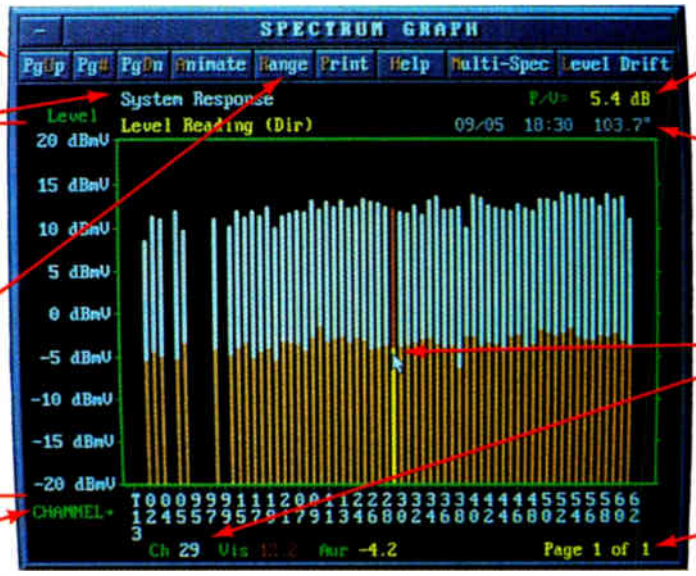

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