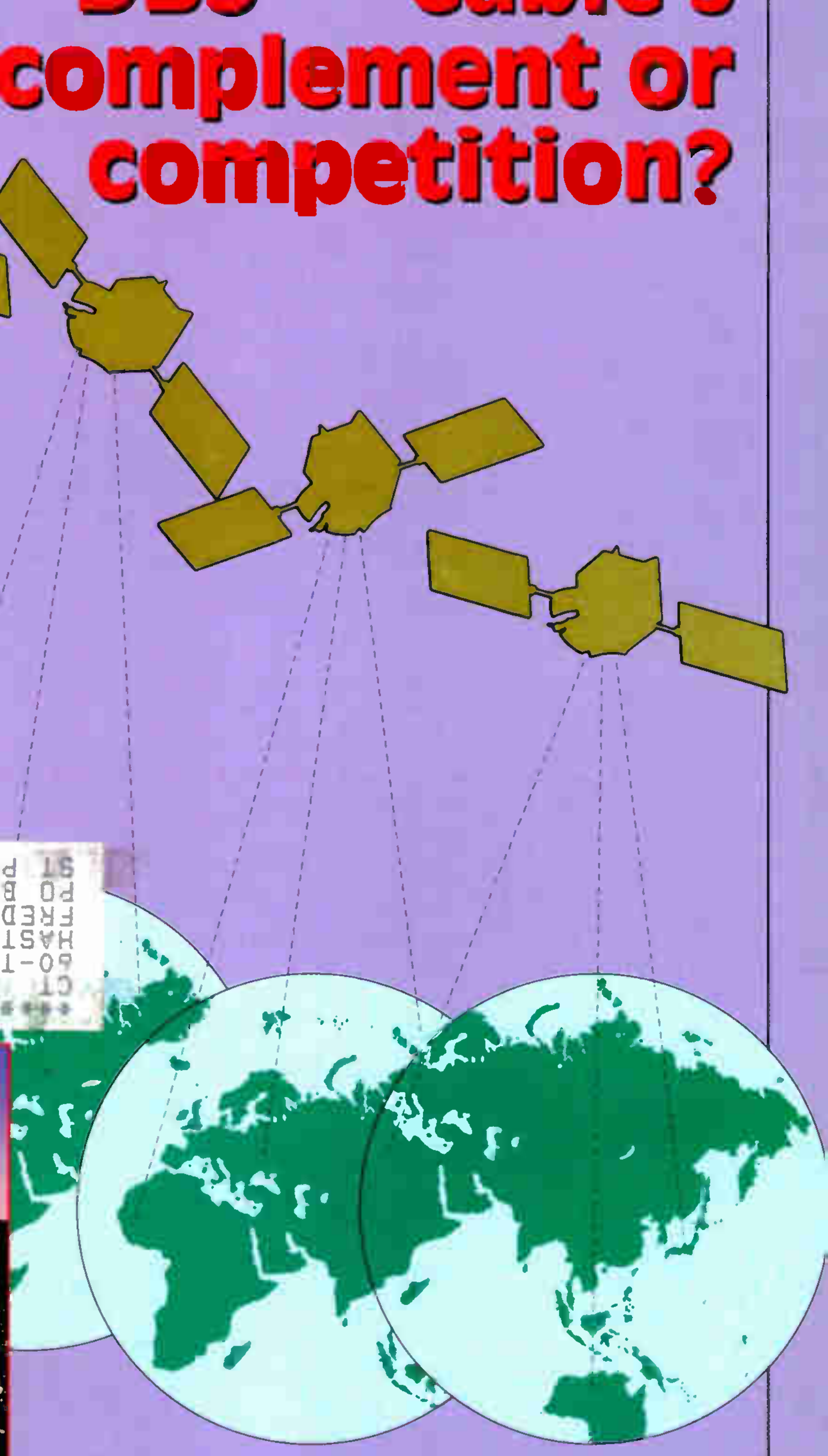
COMMUNICATIONS TECHNOLOGY

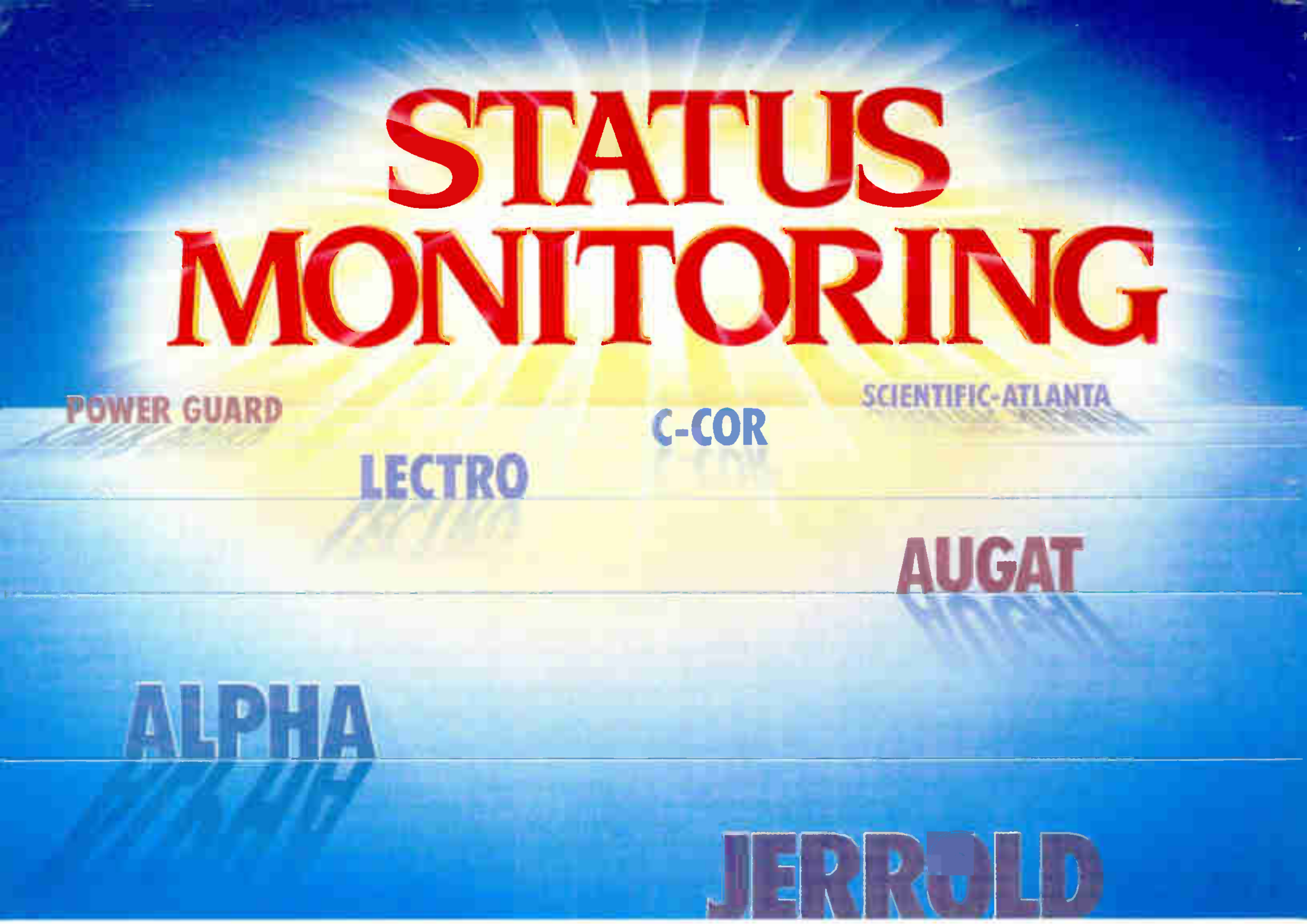
Official trade journal of the Society of Cable Television Engineers

DBS — Cable's complement or competition?



Cable-Tec Expo: An SCTE jackpot

August 1991



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Features

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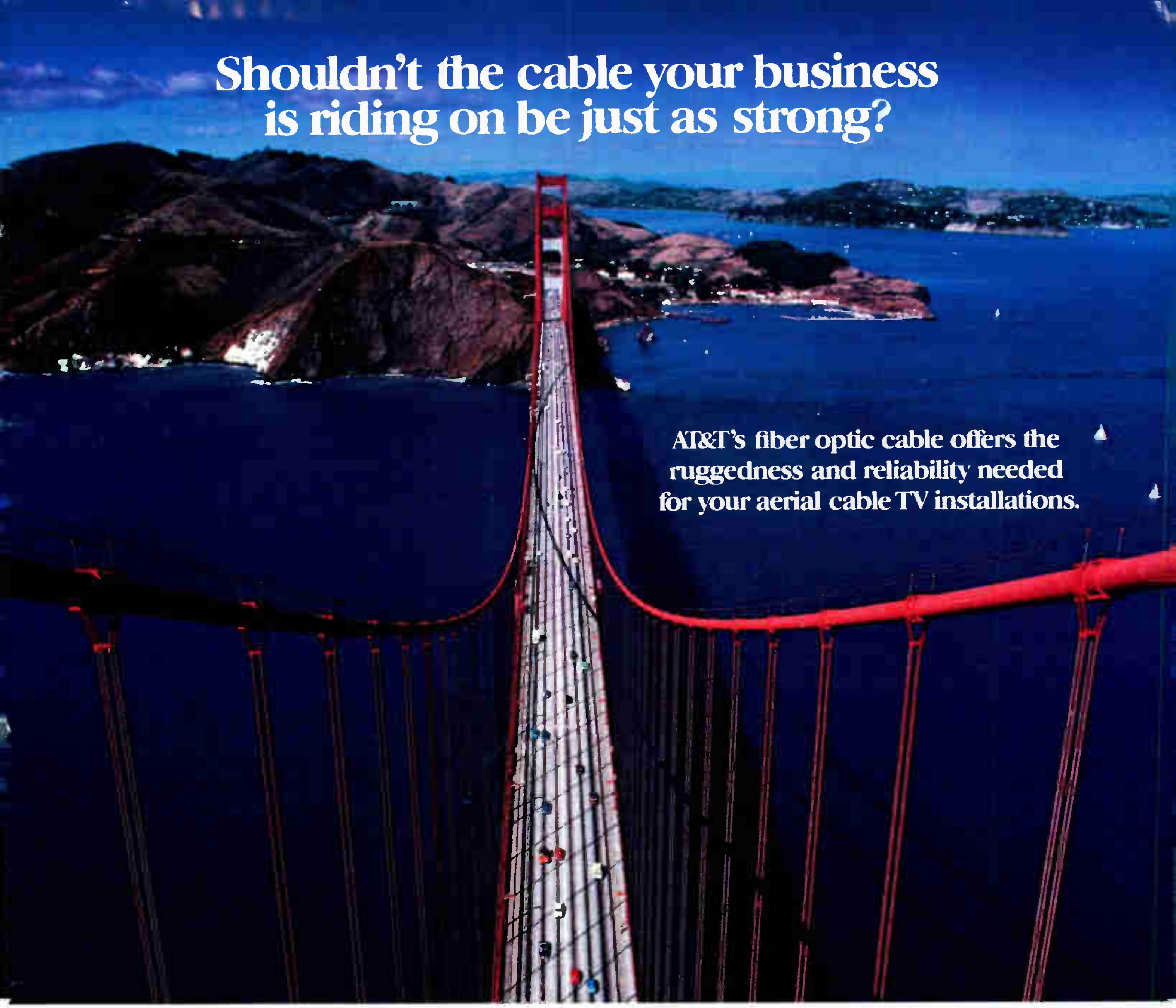

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Reader Service Number 5

EDITOR'S LETTER

Another great expo

If you weren't there, you missed what was once again the best technology confab in the business — the Society of Cable Television Engineers' Cable-Tec Expo. This year's gathering was in Reno (that's Nevada with an "a," which sounds like the one in "at," not Neva*h*da like some folks back east say.)

At a time when almost every other show has been plagued with declines in exhibitors and attendees, this year's expo saw better than a 15 percent increase in attendance over last year. Not bad, considering that many regular participants had previous commitments at the Canadian or Montreux shows, both of which unfortunately occurred about the same time as the expo. Add to that a National Cable Television Association Engineering Committee meeting held a couple weeks before Reno to avoid conflicts (that particular meeting has been held at past expos) *and* an industry recession ... and the show still posted an increase in attendance!

Wished you were there

So what did you miss if you didn't go? The details are covered in this month's wrap-up, starting on page 34, but the Engineering Conference portion began appropriately with a look back at our industry's early days. By the end of the day we were looking at the future of cable and technology. I think Thursday's Engineering Conference alone was worth the price of admission.

Friday and Saturday (June 14 and 15) featured the expo's very popular technical workshops in the morning followed by two afternoons of a pretty crowded exhibit hall. This year's Broadband Communications Technician/Engineer (BCT/E) exams were given on three days instead of on just one as in the past.

Every expo is better than the previous year's, and 1991 was no exception. If you weren't there, you did indeed miss the best of SCTE. Of course, there's always next year! By the way, I'd like to say thanks to

SCTE's national staff for a job well done. Those folks worked their proverbial buns off to make Cable-Tec Expo '91 the success it was.

Clarifications

If you caught the article "Does your headend have 'sound' audio" by Leaming Industries' Kim Litchfield in our June issue, you might have noticed a small blooper that slipped through. On page 64 she was discussing the impedance of audio circuits, and what should have been "Ω" (for ohms) came out "W." Along the same vein, June's "Correspondent's Report" by Lawrence Lockwood had a similar snafu on page 126. In the paragraph on the ADTV receiver's ability to cancel ghosts, what should have been "µs" (for microseconds) appeared as "ms." Sorry about that, Kim and Lawrence.

This month's "Lab Report" is taking a break. It's bad enough that I travel as much as I do (this is coming to you from overseas), but the lab where we do most of our product evaluations packed up and relocated to a larger facility. By the time you read this, everything should be unpacked and operational.

And finally, what would you think of *Communications Technology* reviewing new technical publications, books and manuals of interest to the cable industry? I come across some very good ones from time to time; if you feel it would be useful to hear about them, let us know.

Ronald J. Hranac
Senior Technical Editor

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Reader Service Number 8

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Alert: FCC's proposed rule making

The following is taken from a Federal Communications Commission Notice of Proposed Rule Making on cable TV technical and operational requirements adopted June 13, 1991 (released June 27). This installment covers performance tests; the technical standards' portion will be covered next month.

Part 76 of Chapter I of Title 47 of the *Code of Federal Regulations* is proposed to be amended to read as follows:

1. Section 76.601 is proposed to be amended by revising paragraph (b), adding paragraphs (c), (d) and (e), and by removing the concluding note to read as follows:

§ 76.601. Performance tests.

(b) The operator of each cable television system shall maintain at its local office a current listing of the cable television channels which that system delivers to its subscribers.

(c) The operator of each cable television system shall conduct complete performance tests of that system at least once each calendar year (at intervals not to exceed 14 months) and shall maintain the resulting test data on file at the operator's local business office for at least five (5) years. The test data shall be made available for inspection by the Commission or the local franchisor on request. The performance tests shall be directed at determining the extent to which the system complies with all the technical standards set forth in § 76.605(a). The tests shall be made on each analog NTSC downstream video channel carried on the system pursuant to § 76.605(a), and shall include measurements made at no less than six widely separated points within each mechanically continuous set of cables within the cable television system. Within each mechanically continuous set of cables, at least two measurement points shall be representative of terminals most distant from the system input in terms of cable distance. The measurements may be taken at convenient monitoring points in the cable network: **Provided,** that data shall be included to relate the measured performance of the system as would be viewed from a nearby subscriber terminal. An identification of the instruments, including the makes, model numbers, and the most recent date of calibration, a description of the procedures utilized, and a statement of qualification of the person performing the tests shall be set forth.

(d) Successful completion of the performance tests required by paragraph (c) of this section does not relieve the system of the obligation to comply with all pertinent technical standards at all subscriber terminals. Additional tests, repeat tests, or tests involving specified subscriber terminals may be required by the Commission or the local franchisor to secure compliance with the technical standards.

(e) The provisions of paragraphs (c) and (d) of this section shall not apply to any cable television system having fewer than 1,000 subscribers: **Provided, however,** that any cable television system using any frequency spectrum other than that allocated to over-the-air television and FM broadcasting (as described in § 73.603 and § 73.201 of this chapter) is required to conduct all tests, measurements, and monitoring of signal leakage that are required by this subpart. Compliance with the monitoring, logging and the leakage repair requirements of § 76.614 combined with the maintenance of the leakage log for a period of five (5) years will satisfy the leakage tests, measurements, and monitoring requirements of this section.

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Reader Service Number 11

SCTE board elects 1991-1992 officers

The board of directors of the Society of Cable Television Engineers elected the Society's officers for the coming year at its meeting held June 12 in conjunction with Cable-Tec Expo '91 at Bally's Reno Hotel in Reno, Nev.

The Society's officers for the 1991-1992 term are:

- **President: Wendell Woody**
- **Eastern Vice President: Michael Smith**
- **Western Vice President: Ted Chesley**
- **Secretary: James Farmer**
- **Treasurer: Leslie Read**

This year's executive committee consists of Woody, Smith, Chesley, Farmer, Read and additional Executive Committee Member Victor Gates.

The current SCTE board of directors consists of: Region 1 Director Tom Elliott, Catel, serving California, Hawaii and Nevada; Region 2 Director Ron Hranac, Coaxial International, serving Arizona, Colorado, New Mexico, Utah and Wyoming; Region 3 Director Ted Chesley, Rock Associates, serving Alaska, Idaho, Montana, Oregon and Washington; Region 4 Director Leslie Read, Sammons Communications, serving Oklahoma and Texas; Region 5 Director Wendell Woody, Anixter Cable TV, serving Illinois, Iowa, Kansas, Missouri and Nebraska; Region 6 Director Rich Henkemeyer, Paragon Cable, serving Minnesota, North Dakota, South Dakota and Wisconsin; Region 7 Director Vic Gates, Metrovision, serving Indiana, Michigan and Ohio; Region 8 Director Jack Trower, WEHCO Video Inc., serving Alabama, Arkansas, Louisiana, Mississippi and Tennessee; Region 9 Director Jim Farmer, Scientific-Atlanta, serving Florida, Georgia, Puerto Rico and South Carolina; Region 10 Director Michael Smith, Adelphia Communications, serving Kentucky, North Carolina, Virginia, West Virginia and the District of Columbia; Region 11 Director Diana Riley, Jerry Conn Associates Inc., serving Delaware, Maryland, New Jersey and Pennsylvania; Region 12 Director Walt Ciciora, Ph.D., ATC, serving Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont; and At-Large Directors Wendell Bailey, NCTA; Richard Covell, Texscan; and Tom Elliot, CableLabs.

Expo draws record attendance

Registered attendees numbering 1,850 and 1,600 exhibitor personnel gathered at the Reno/Sparks Convention Center in Reno, Nev., from June 13 to 16 for the Society of Cable Television Engineers' Cable-Tec Expo '91. It was the most well-attended and widely acclaimed SCTE expo to date.

It began with the Annual Engineering Conference, which was held June 13 at Bally's Reno Hotel and consisted

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Reader Service Number 14

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of a full day of technical and management papers and panel discussions that were presented to a capacity crowd by many of the industry's engineering leaders. Many important topics currently facing CATV were discussed, including the history and future of the industry, fiber-optic architectures, interdiction and signal security.

SCTE's Annual Awards Luncheon also was held June 13 and featured keynote speaker Richard Smith, chief of the field operations bureau of the Federal Communications Commission.

Following the conclusion of the Engineering Conference, the Society held its second Annual Membership Meeting, allowing SCTE members to pose questions and concerns directly to the national organization's board of directors.

Cable-Tec Expo '91 officially began on Friday, June 14 with the opening of 10 educational workshops. The workshop periods also offered (for the first time at any expo) workshops devoted to the technology of local origination networks.

Approximately 190 industry companies were on hand to exhibit at the expo's sold-out exhibit floor, which opened Friday, June 14 at the convention center.

An exhibitor training center was set up near the exhibit hall allowing companies that exhibited at the show to offer formal presentations of their products and related technologies. Among the exhibitors that took part in such presentations were CaLan, ComSonics, Hewlett-Packard, Multilink, Optical Networks International, Sumitomo Electric, Superior Electronics and Trilithic.

Friday's Expo Evening, sponsored by Anixter Cable TV, AT&T, Comm/Scope, Jerrold Communications, Raychem, Scientific-Atlanta and SCTE, saw more than 1,800 attendees converging to take part in the first national Cable-Tec Games. This is a competition based on the performance of tasks requiring technical skills. Expo Evening also allowed attendees to enjoy a variety of "carnival-type" events, including a dunking booth and obstacle course.

On Saturday evening, two receptions (one for ham radio operators and the other for international attendees) were held along with the first meeting of the SCTE House of Delegates (a group of representatives from the Society's 66 chapters and meeting groups, who posed questions and discussed their concerns with the SCTE board of directors and national headquarters staff).

Additionally, 150 attendees participated in the Broadband Communications Technician/Engineer (BCT/E) and Installer Certification Programs testing sessions held June 14-16. For the first time, SCTE offered testing during workshop periods on Friday and Saturday based upon the requests of attendees of previous expos. This met with great success, as 60 people on Friday, and 40 on Saturday took tests.

Technical papers and workshop materials presented during the engineering conference and expo have been collected in the *Cable-Tec Expo '91 Proceedings Manual*, a deluxe trade paperback that is currently available from the Society. For ordering information, contact SCTE national headquarters at (215) 363-6888.

Overall, the expo was a resounding success that generated very positive response. Cable-Tec Expo '92 will be held June 14-17, 1992 in San Antonio, Texas, and the Society's next national conference, "Fiber Optics Plus," will be held Jan. 8-9, 1992 in San Diego.

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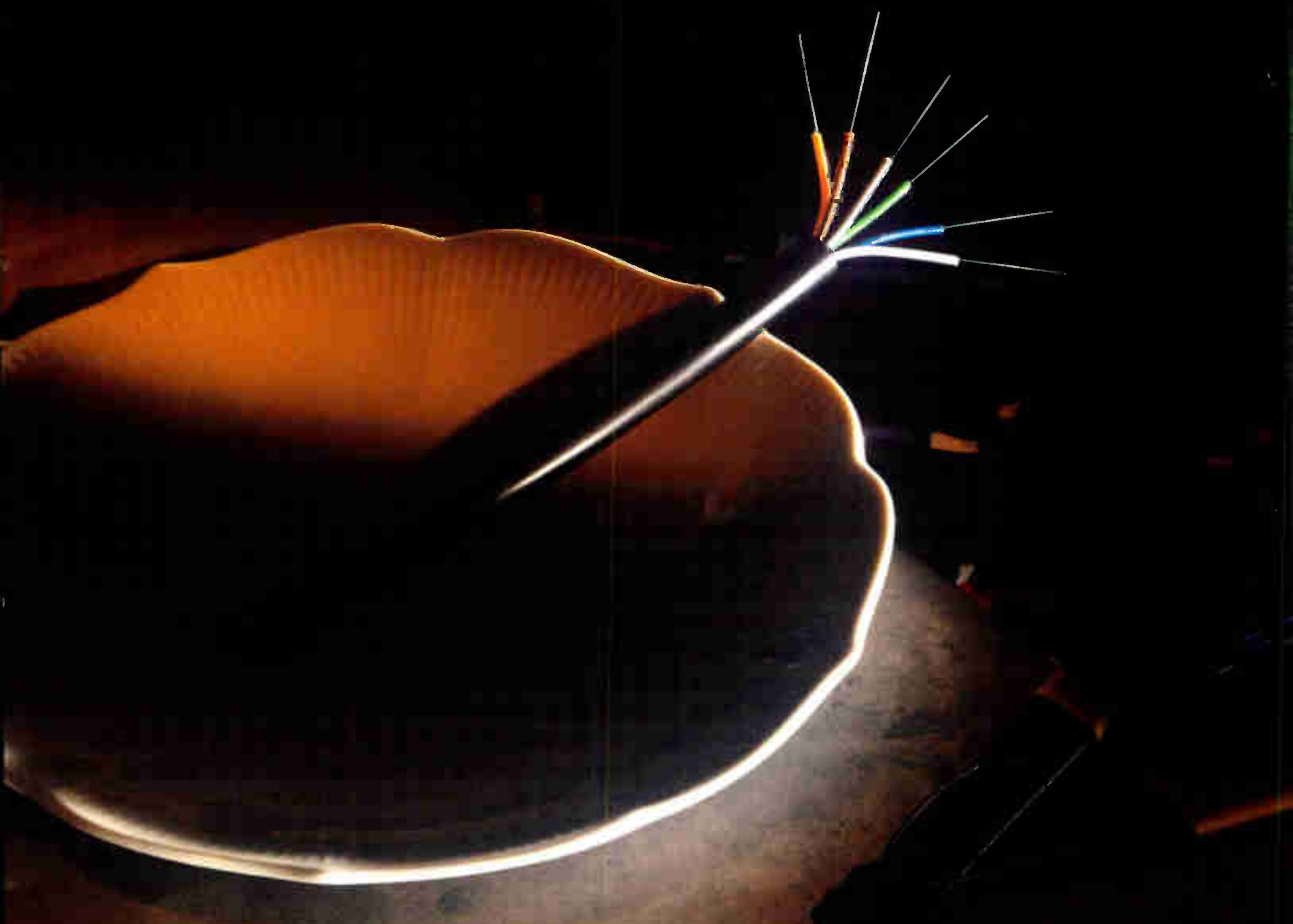

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Reader Service Number 16

Direct broadcast satellite technologies

By J.P. Godwin
DBS Network Systems
Hughes Communications Inc.

Today in the United States satellite-delivered TV is received at over 3 million households by C-band "backyard" dishes. This TV audience continues to grow at the rate of approximately 30,000 households per month. Although the backyard dish industry evolved somewhat haphazardly during the '80s, its success established low power C-band as a defacto standard for direct-to-home TV. However, many believe continued commercial development is limited because of the unsightly 10-foot antennas, zoning restrictions and the cost of the large antennas.

High-power satellite "direct broadcast" systems have been in planning since the mid-1970s. Under the auspices of the International Telecommunications Union (ITU), a worldwide direct

Figure 1: Ground antenna isolation at 12 GHz

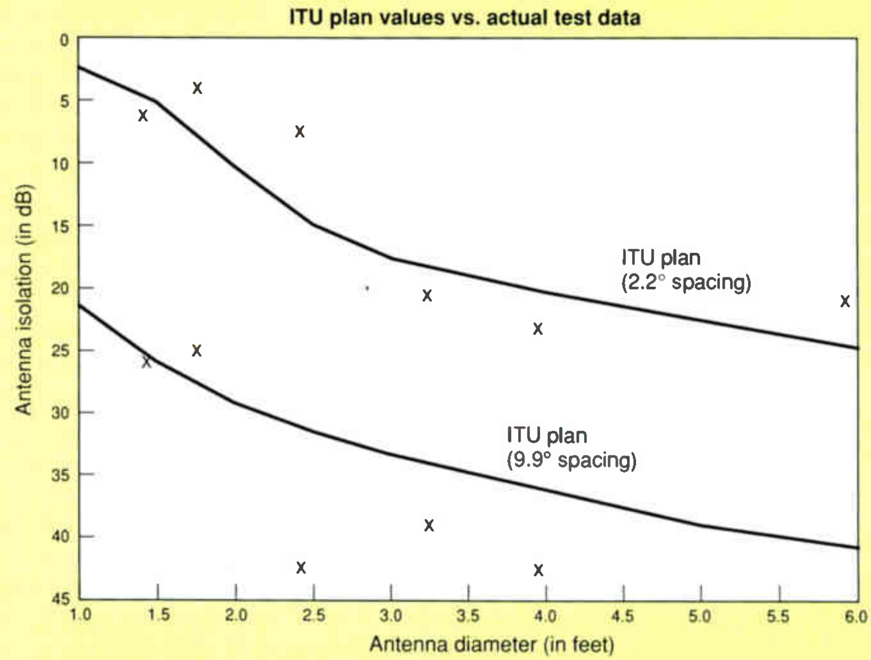


Figure 2: U.S. direct broadcast satellite frequency plan

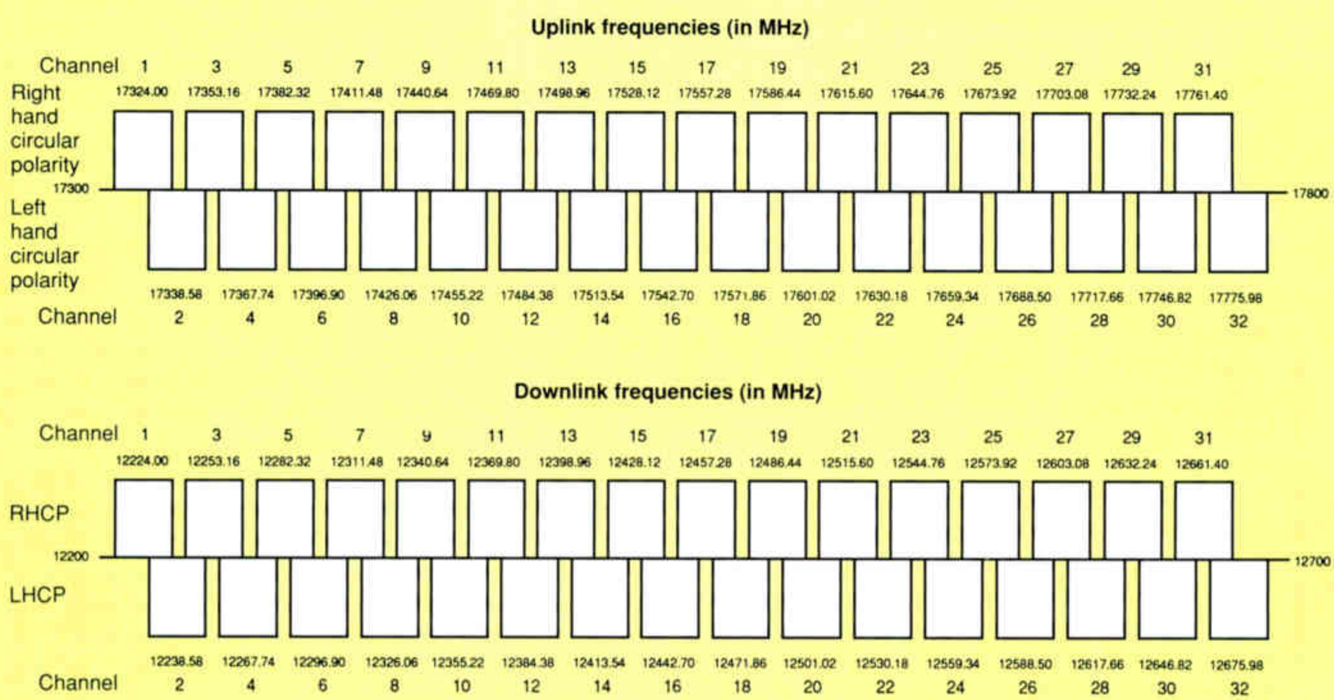


Figure 3: Visibility for DBS satellite at 101°W

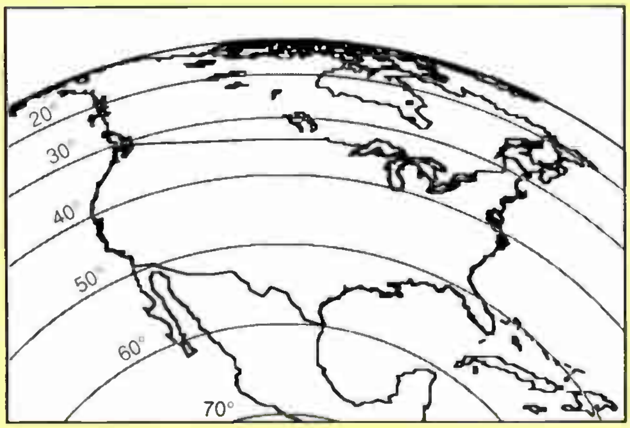
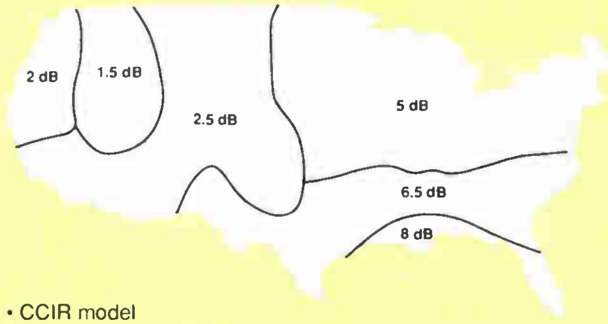


Figure 4: Typical downlink margin requirements



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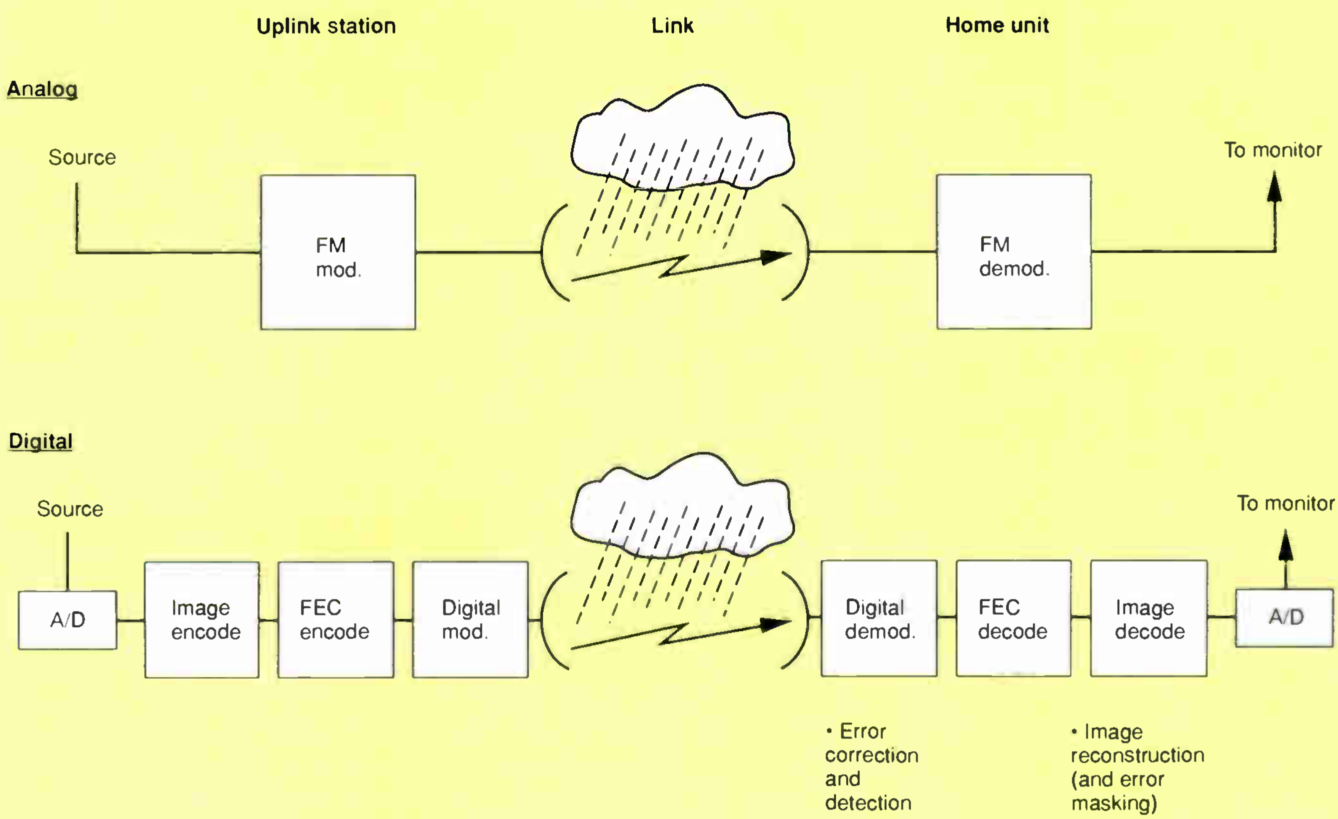
- 99.7 percent availability
- Receiver system temperature of 125°K
- Uniform EIRP distribution

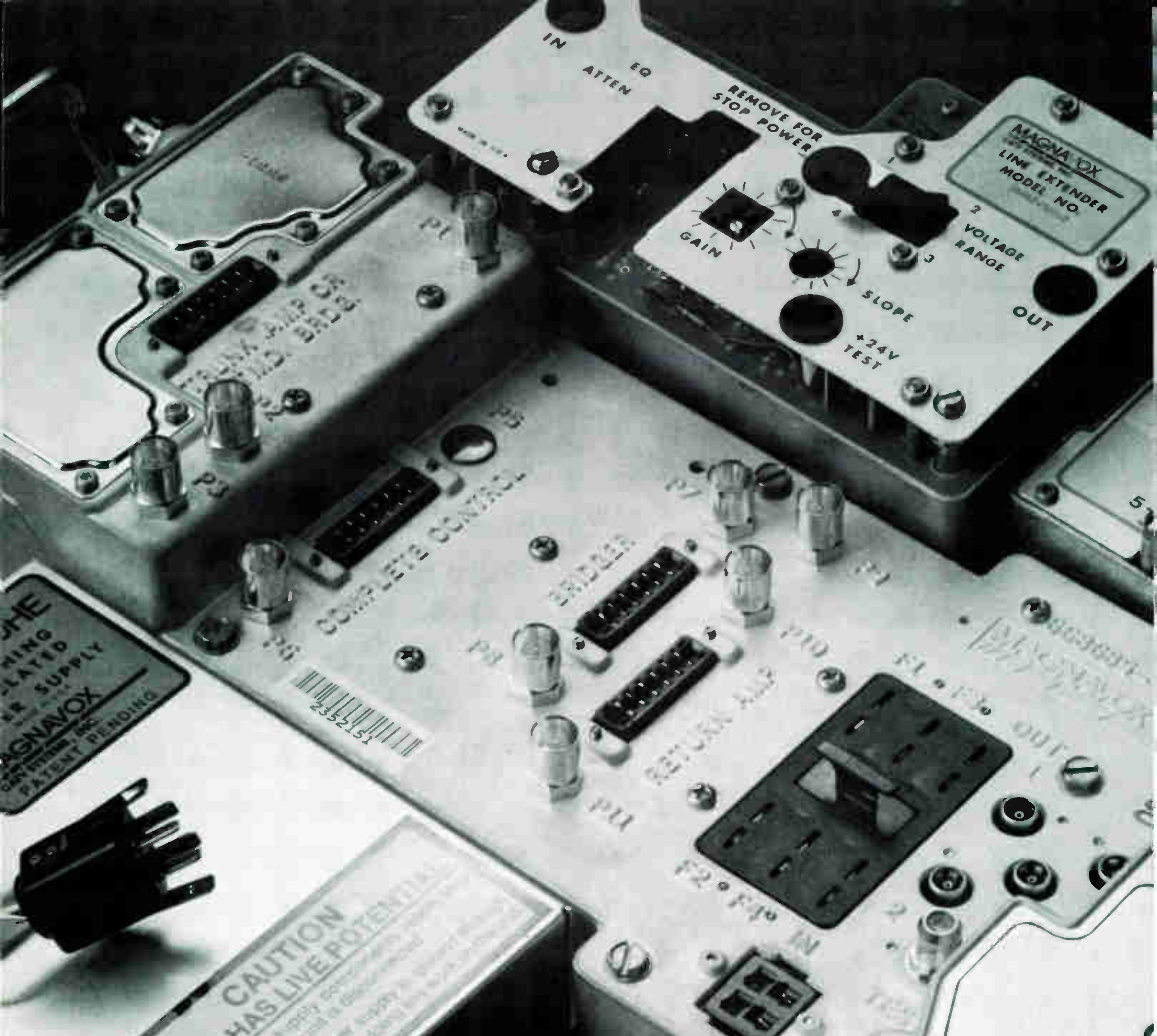
broadcast satellite (DBS) frequency and orbital spacing plan was established that will make possible the use of antennas as small as 1-foot in diameter. It is anticipated the low purchase cost and easy installation of DBS dishes will increase the popularity of direct-to-home satellite TV.

Although DBS systems have sometimes been viewed as a technology competitive with cable delivery, the technology also can be effectively used to augment cable. The positioning of DBS technology as a force in the marketplace depends upon the business arrangements established between the cable and DBS operators. For example, DBS with channel expansion by digital compression could be used to increase the effective channel capacity delivered by cable. Satellite delivery also can be used to enlarge geographic service areas, to provide HDTV or to develop impulse pay-per-view (IPPV)

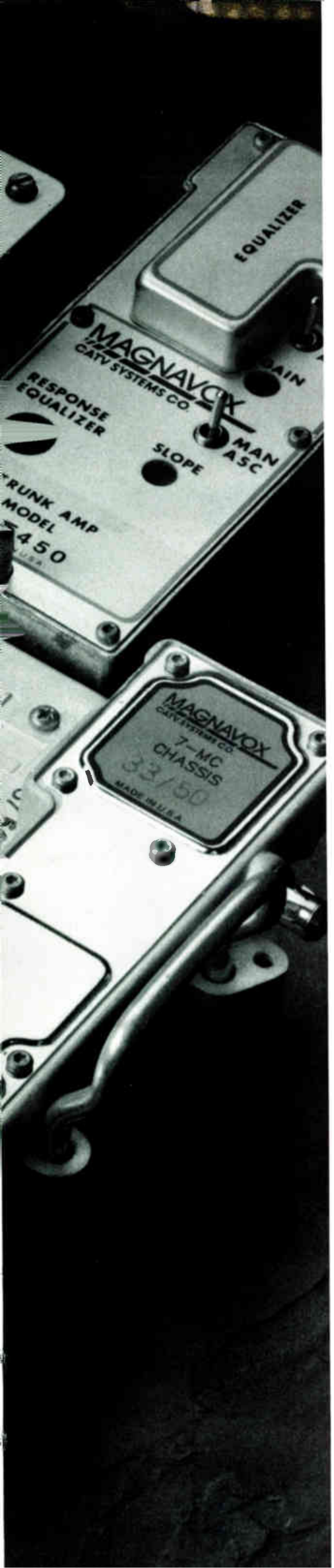
(Continued on page 68)

Figure 5: Analog and digital implementation comparison





Contest Rules: No purchase is necessary. Entries accepted from authorized representatives throughout the United States faxing their name, title and phone number and the phrase "Please enter us in the Midwest CATV NFL Pro Bowl Contest" on his/her company letterhead to 1 303 643-4797. Contest entry is limited to cable television system companies only. The prize will be awarded in the company name. The winning company will determine the individual to be given the prize. Midwest CATV, its suppliers, parent companies, subsidiaries and ad agency are not eligible. This contest is void where prohibited by law. Only one entry per company is permitted. The odds of winning will be determined by the number of entries received. Contest entries will not be accepted if received by Midwest CATV after August 31, 1991. Total value of the prize is $3,180. Prize includes airfare from anywhere in the Continental United States to Honolulu, Hawaii, hotel accommodations for 3 nights, tickets to the Pro Bowl and roundtrip transportation to and from the game. Certain restrictions apply. No cash or prize substitutions. For more information contact Midwest CATV at 1 800 MID-CATV or write: Midwest CATV Sweepstakes, Fairways II at Inverness, 94 Inverness Terrace East, Suite 310, Englewood, CO 80112. The winner's name may be obtained by writing Midwest CATV after September 20, 1991.



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This month's Midwest CATV Customer Incentive Contest is featuring a trip to the NFL Pro Bowl! It's football in February in Honolulu, Hawaii.

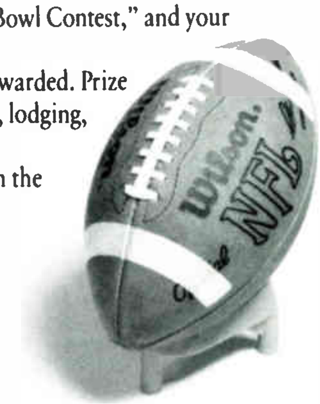
You can enter the contest two ways. First, place your order for Magnavox equipment during August, and write the phrase "Please enter me in the Midwest CATV NFL Pro Bowl Contest" on the bottom of your purchase order, and your company is entered. Easy!

We have a complete line of Magnavox distribution electronics. Equipment housings constructed of rugged die-cast aluminum alloy. Trunk and feeder cable center conductor seizure assemblies and gaskets, which seal against weather and RF ingress/egress. Power supply modules are mounted in the housing lid and fully isolated from all RF circuitry. Line extenders featuring cover plate cutouts offer easy access to controls and provide for insertion of equalizers and attenuator pads.

The second way to enter is for you, the company's authorized representative, to send us on company letterhead, via fax machine, your name, title, telephone number, and the phrase "Please enter me in the Midwest CATV NFL Pro Bowl Contest," and your company is entered.

Only one prize will be awarded. Prize includes roundtrip airfare, lodging, ticket to the Pro Bowl and transportation to and from the game.

So hurry and enter!



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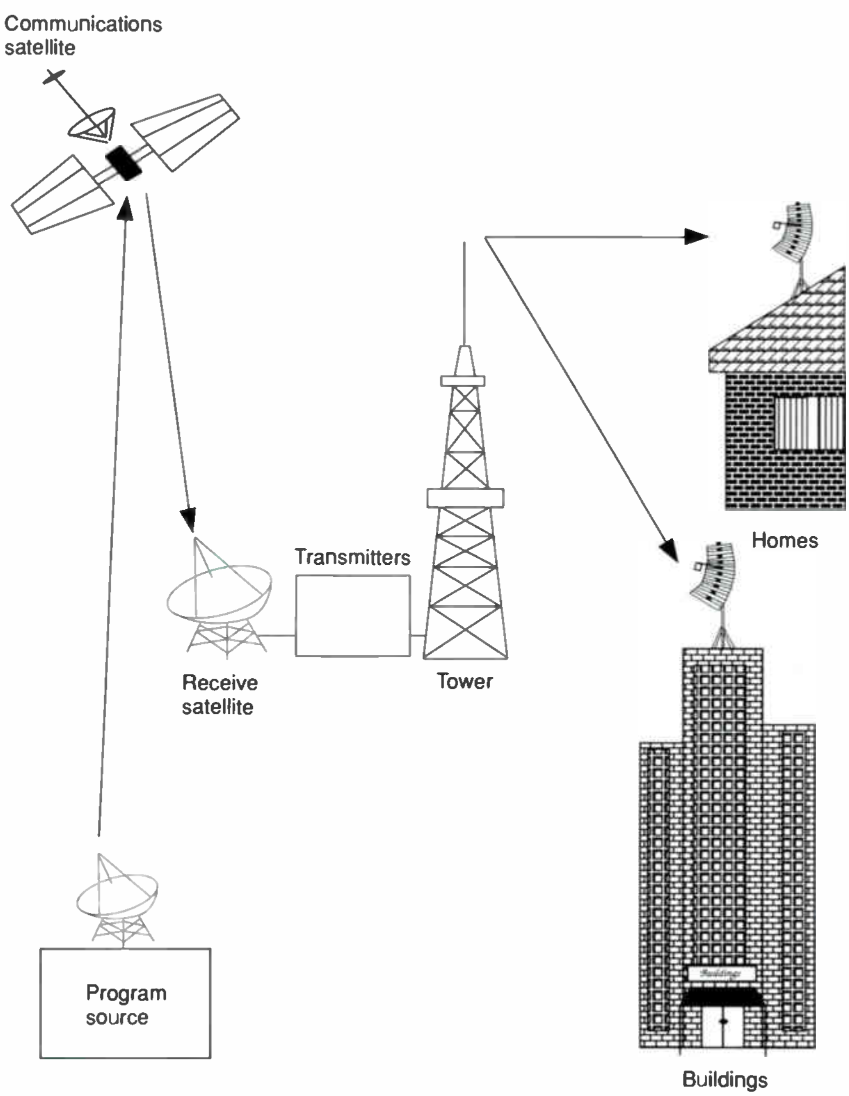
Reader Service Number 17

Wireless cable: A competing technology

Figure 1: Typical wireless cable system



By Glyn Bostick
President
And Elizabeth Buck
Marketing Research and Publicity
Microwave Filter Co. Inc.

The picture still remains rose-colored for the growth of wireless cable (WC), despite the gray landscape painted by the economic climate this year. Over the last three years, WC systems have been materializing in all regions of the country where few if any previously existed. The *Wireless Cable Report* (May 29, 1991) cited that WC systems currently exist in the top 10 TV markets. While traditionally urban areas have been ideal settings for WC, the medium also is becoming more popular out in the country.

"There are few rural systems at this point. However, some system developers are looking at rural areas and see great potential. We're working on close to 100 rural systems right now," said Lawrence Behr of Lawrence Behr Associates, a consulting engineering firm specializing in WC and other telecommunications areas. "With the proper business plan you can do business anywhere. The emergence of WC systems closely resembles the development of FM radio in rural areas — an audience has to be developed," he said.

Two schools of thought have traditionally existed with respect to WC. The first is the medium should locate in areas where CATV would never venture because low population densities

Setup of transmitters for a 21-channel wireless cable system.

would make laying cable cost-prohibitive. The other is to locate in an urban area and take away a percentage of CATV's customers.

"At the present time competition is at best marginal," said Behr. "However, it's possible to examine the demographics of an urban area with several million people and cherry pick away 10 percent of CATV's subscribers by offering a new service to unhappy CATV customers," he added.

Congress wants competition

Anti-cable sentiment in Congress has facilitated the growth of WC. There is a commonly held belief among some members on Capitol Hill that there should be some competition to CATV. WC is perceived as one of those alternatives. Over the last few years WC has been struggling to acquire programming at the same rate card as CATV systems. Some progress has been made. There is current legislation in Congress concerning access to programming. The WC industry also now has access to all cable programming except for TNT and a few operator-owned regional sports services. However, this programming is not always available at "fair and equitable prices," according to information published in the previously mentioned issue of *Wireless Cable Report*.

The positive political sentiment and growth of systems throughout the United States also has inspired confidence within a previously reticent financial community. This is despite the fact that MetroTEN, a WC company in Cleveland, filed for Chapter 11 recently and last year Microband also faced financial problems.

"Both companies were burdened by programming contracts. It's possible to cut deals at better prices now. MetroTEN also set up a system with the anticipation of selling the same service as CATV when it would have been better to market itself as a lower cost alternative," said Behr.

Some changes in Federal Communications Commission filing rules also have offered a boost to the growth of the WC industry. Cable TV operators are precluded from applying for multichannel multipoint distribution service (MMDS) frequencies in their franchise area. One applicant may now file for both MMDS Groups E and F, whereas previously these frequency groups could not be held by one party. A one-day filing rule also has substituted the public notice waiting period. As well, WC is allowed to transmit up to 100 watts with maximum allowable output now defined in terms of effective isotropic radiated power.

CATV and WC are odd bedfellows in that they compete and complement each other. Both have weaknesses technologically and neither one is designed for installation in all areas of this country. In one instance where a CATV and WC system compete, the wireless system has 31 channels and a large MSO-owned system has 35. The WC system charges $2 less per month for basic rate.

WC is a less expensive medium to install. "At significant penetration the cost per sub could be one-third to one-half of that for cable. It may cost CATV $1,000 per sub vs. $350 for WC," said Behr.

However, WC is limited to only 32 channels in the majority of areas while CATV can offer around 60. CATV is impeded by the high cost of coax while WC, as a line-of-site transmission medium, is easily hindered by obstacles in its broadcast path. CATV is subject to occasional outages provoked by weather conditions and WC experiences occasional signal fade as a result of atmospheric conditions. It is easier to some extent to repair problems on WC systems because the entire system is above ground, however expertise in maintenance must be standardized.

"There is a commonly held belief among some members (of Congress) on Capitol Hill that there should be some competition to CATV."

"CATV has a trade association that concerns itself with system standards. This is an area WC needs to develop because individual installations are more intense. You risk your business if you use untrained installers who mount rooftop antennas incorrectly or have no knowledge of grounding," said Behr.

The emergence of wireless cable

The origin of wireless cable dates back to the mid-1970s when the FCC allocated two channels in the 2,150 to 2,162 MHz band for multipoint distribution service (MDS). MDS 1 is 6 MHz wide and capable of video carriage. MDS 2 is 6 MHz only in the top 50 markets of the country. In remaining markets, channel width is 4 MHz and it is used only for data or voice delivery.

In the late-1970s, MDS was a video delivery system used to provide single-channel programming (such as HBO) to subscribers. The service rapidly lost appeal when cable came into town and began offering multiple channels of programming. Since MDS was broadcast over-the-air, it also was prone to pirates who intercepted the then unscrambled signal. However, an ability to offer more channels became the primary concern of the MDS industry.

In the mid-1980s two groups, E and F, consisting of four channels each (2,596-2,644 MHz) were reallocated for entertainment video delivery. Originally these channels were part of the instructional television fixed services (ITFS). ITFS, which consists of five groups of four channels (A, B, C, D and G), is a

(Continued on page 76)

Wireless cable emerges

By Ronald L. Barnes
President, Triad Communications

One of the new buzzwords these days is "wireless." Actually, wireless cable (WC) has been around for a number of years, only under a different name — multichannel multipoint distribution service (MMDS). In recent years, however, the Federal Communications Commission has lifted previous restrictions and increased the number of channels that can be licensed in a particular area, thus WC evolved.

Wireless equipment

Before discussing the future of this emerging industry, an overview of the hardware involved is in order. The transmit site is generally located on a mountaintop or a building, much the same as other terrestrial broadcast systems. The transmitters are smaller and several are located in a single equipment rack, much like cable headend modulators. The transmitters are fed from satellite receivers or STLs. This is where the cable similarity ends. The output of each transmitter is fed to a channel combining network and then to a common MMDS antenna (instead of amplifiers and miles of coaxial cable) to the subscribers' homes.

Another thing that makes WC different is the frequency by which it is distributed. Wireless operates in the microwave region, which in itself masks the programs from a normal TV receiver. However, pirate (illegal) microwave antennas are available, causing a big problem — theft of service. This is counteracted in some systems by adding encoders (scramblers) with each transmitter. A subscriber decoder box also is installed at the home to decode the scrambled information. This adds considerable costs to operating a system but it could save the operator thousands of dollars a month in lost revenue. The wireless operator has to make the decision to scramble the signal when the system goes on-air, otherwise it could be even more expensive after the fact because each subscriber would have to be revisited to install a decoder.

The subscriber installation consists of either a rod, dish or paraflector microwave antenna, which is mounted on a mast or the roof of each home, building, motel or other structure. Also mounted with the antenna is a frequency downconverter, which changes the 2.5 GHz to 2.7 GHz frequencies from the transmitters and converts them to much lower cable frequencies. This is where the similarity to cable once again resumes. The lower cable frequencies are fed via a downlead to a converter box and/or optional decoder box and the subscriber television set (much the same as the cable drop from the pole).

One of things that has kept WC from becoming more popular in the past is the fact that microwave frequencies have the inherent "line-of-sight" characteristics, which mask the signal from areas where tall buildings, trees and other structures shadowed the potential subscriber's location. Today this can be overcome with something called a Beambender, which is a microwave repeater that receives the main signal and then rebroadcasts it at a low level to the subscriber's home. This is not always the answer in every case, but it can allow otherwise shut-out subs to receive the signal. Sometimes something as simple as relocating the receive antenna, trimming a tree in the subscriber's yard or adding an additional amplifier or larger antenna can alleviate reception problems.

The additional channels opened up by the FCC, that were mentioned earlier, are instructional television fixed services (ITFS) channels generally operated by colleges and universities. Arrangements can generally be made with the license holder to lease time on their channel for additional programing at prearranged times. This requires a simple change of input to the transmitter such as switching in a different satellite receiver. With the availability of ITFS channels, a wireless operator could as many as 33 channels (see accompanying table). This makes wireless very competitive with traditional cable TV.

Wireless cable frequencies

Group	Channel number	Frequency (MHz)
MDS	1	2,150-2,156
	2	2,156-2,162
	2A	2,156-2,160
Instructional TV fixed services		
Group A	A1	2,500-2,506
	A2	2,512-2,518
	A3	2,524-2,530
	A4	2,536-2,542
Group B	B1	2,506-2,512
	B2	2,518-2,524
	B3	2,530-2,536
	B4	2,542-2,548
Group C	C1	2,548-2,554
	C2	2,560-2,566
	C3	2,572-2,578
	C4	2,584-2,590
Group D	D1	2,554-2,560
	D2	2,566-2,572
	D3	2,578-2,584
	D4	2,590-2,596
Multichannel MDS		
Group E	E1	2,596-2,602
	E2	2,608-2,614
	E3	2,620-2,626
	E4	2,632-2,638
Group F	F1	2,602-2,608
	F2	2,614-2,620
	F3	2,626-2,632
	F4	2,638-2,644
Group G	G1	2,644-2,650
	G2	2,656-2,662
	G3	2,668-2,674
	G4	2,680-2,686
Operational fixed services		
Group H	H1	2,650-2,656
	H2	2,662-2,666
	H3	2,674-2,680

Rural opportunity

Although several wireless cable systems are operational in large metropolitan areas, they have far less chance of signing up subscribers because of the traditional cable TV influence in these areas. Wireless can do very well in rural areas and small markets since cable does not serve these markets as well as the larger ones. People in rural markets are more willing to pay for the service since they often times have trouble getting even local TV stations.

Program services such as HBO, CNN, ESPN, etc., were not available initially to the wireless operators, but Congress recently ruled that program suppliers must make programing available to them (as well as cable TV companies) at a fair price. This should help ensure that healthy competition prevails in the industry, which will mean a better product to the consumer.

There are many entrepreneurs out there today looking to get into the wireless business. However, they must realize that it takes about $500,000 to $1 million to get a system up and running. Venture capital is rather scarce these days, but if they stick with it, wireless could be very rewarding if they do their homework and have a viable business plan. **CT**

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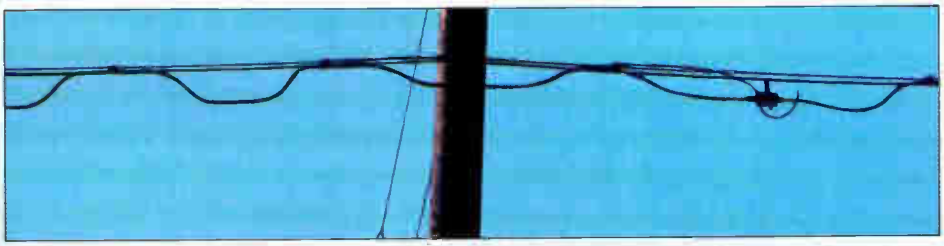

Multiple splices like these were all too common before Northern Cable began installing Quantum Reach.

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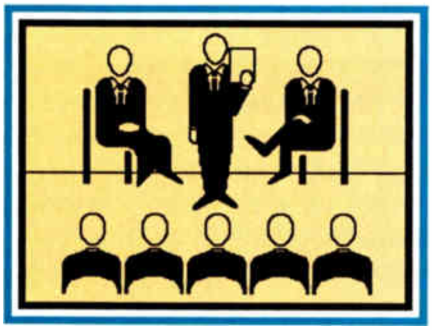


Cable technical training in the '90s

By Tom Brooksher
General Manager, National Cable Television Institute

It is impossible to consider the technical training challenges of the next decade without first accounting for the advances we're likely to see in cable technology in the '90s. Over the last six months we've seen a major change in the industry's attitude toward the cable plant. Prior to the first of the year, the technical operation was seen as a necessary evil — we needed it to deliver programming, but it was overhead. It wasn't exciting. It was a limitation. It didn't allow us to reach the full potential our services promised.

We've known for a long time that a high-capacity cable plant could give us the potential to provide services hardly imagined in the past. But the capacity needed to accomplish that seemed like a pipe dream to 36-channel cable systems already bursting at the seams.

The change in attitude began when we started installing fiber in our plant. At that point the potential we dreamed about seemed within reach — well in the future, but within reach. Then, early this year, with fiber component prices dropping and breakthroughs in digital compression being announced, several of the industry's top executives began to talk about the coming "third generation" of cable TV, featuring video-on-demand, high definition TV (HDTV), interactive services and greatly expanded program selection. This new generation would be made possible by a "new" tool in cable's arsenal: the high-tech, fiber-driven cable plant transmitting digitally compressed signals.

And while the third generation represents a quantum leap forward in the services we offer and the transportation system required, it also represents a major step ahead in terms of the level of technical workers needed to maintain this third-generation plant. We've already been grappling with making RF-based, coaxial-cable literate workers optical- and fiber-fluent. We have made significant strides in this area, but there is still a lot of work to be done. But while we're completing that task, we're now talking about adding digital to our previously analog-only plant.

Training CATV wants and needs

To help quantify the extent of the training challenge that poses, the National Cable Television Institute has conducted two research projects among the industry's technical work force. The first one consisted of a survey of students who have taken NCTI's "CATV Fiber Optics" course. Nearly half of the respondents (49.5 percent) had been in the industry more than 10 years, and almost 80 percent had been in the industry more than six years. The majority (62.7 percent) had either engineering or management titles, as opposed to being technicians. So, as a body they represented our most experienced, upper-level technical work force. Even so, only a third of them had technical college degrees, and the majority of those were associates: 20.9 percent technical AA degrees; 6.6 percent four-year technical degrees; and 5.5 percent graduate technical degrees. Thus, our upper-level technical work force is light on formal technical education. The assumption here is that we are much more likely to hire technical workers with no formal education, or with trade school or military training, than we are to hire electronics graduates from two- and four-year colleges. That's probably not a revelation to you, but does quantify the situation.

In another study we asked key technical managers at the corporate, regional and system level about the amount of digital background in the cable work force, and the need for digital training. We found that only 25 percent of the work force has a general knowledge of the basics of digital theory, yet every one of the people surveyed said they felt digital would be a good thing to know about for career cable technical workers. We also asked them, on a scale of 1-10 (with 10 being highest), to rate the industry's need for CATV-specific digital training and 77 percent rated the need as a seven or higher. On another question, 86 percent of the respondents said they expect the industry to be using digital technology within five years. So digital is another area where we are starting with a largely untrained work force but expect to need to provide training in the future.

Where, how and when

Where do we start, how deeply do we have to go and how soon? Alan Babcock, corporate technical training manager for Warner Cable Communications, sees the real need at the upper levels. He says we need to work first with the employees who are going to have direct contact with the advanced technologies. With fiber implementation limited to the trunk and

(Continued on page 81)

Leakage detection and measurement — Part 2

Last month's installment provided an overview on FCC regulations regarding cable system signal leakage and CLI requirements for the annual ride-out and antennas. Part 2 continues with a discussion on dipoles and monopoles, and also covers equipment calibration and setting up a calibrated leak.

By Steve Windle
Product Marketing Engineer
And John Vendely
Senior Design Engineer
Wavetek Corp.

Vehicular antennas for patrol applications fall into two categories: dipole types and monopole types. Vehicular dipole antennas are similar in many respects to the hand-held dipoles described earlier. They are ordinarily half-wavelength, horizontally polarized and may be fixed in length or adjustable. However, they are mounted in close proximity to the vehicle roof (which is essentially RF ground) and this changes the antenna's impedance, directivity pattern and antenna factor. For this reason, vehicular dipoles must be calibrated in place on the vehicle with which they are to be used.

The monopole is another popular mobile patrol antenna. Commonly called whip antennas, they are mounted vertically on the vehicle roof and are typically either one-quarter wavelength or five-eighths wavelength.

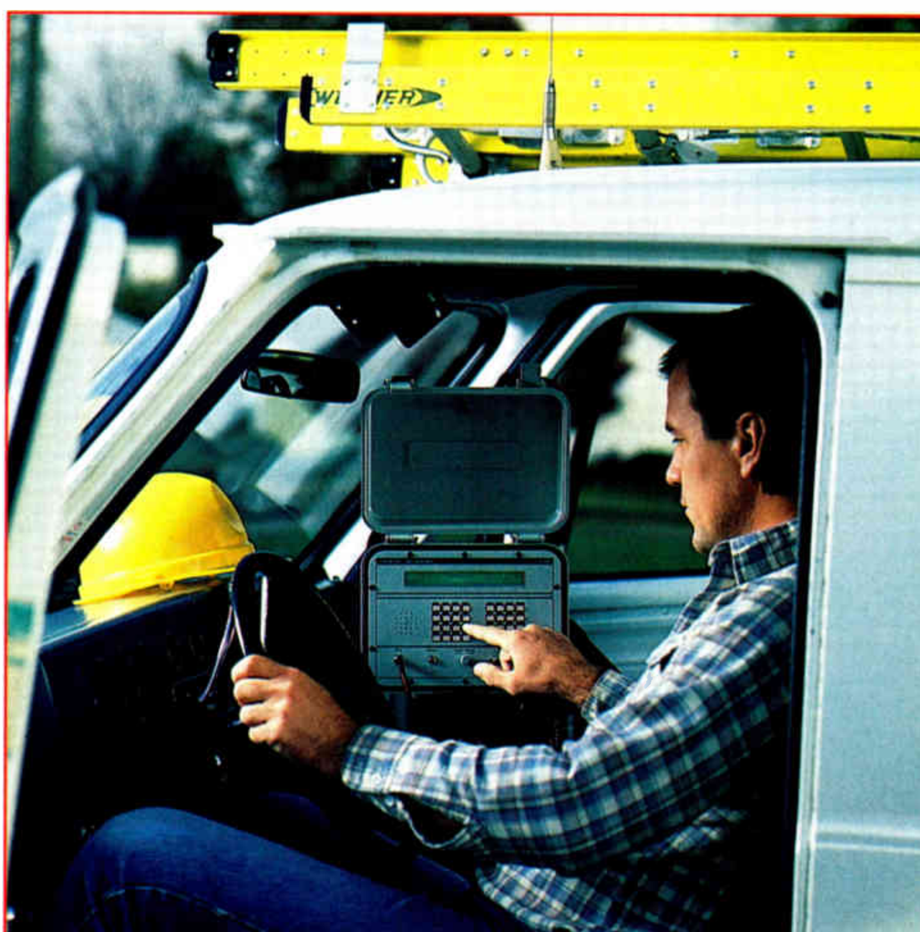
The monopole is vertically polarized and is therefore sensitive only to that portion of the leakage field that is vertically polarized. Although the cable is oriented horizontally, the polarization of cable leaks may consist of both vertical and horizontal fields, depending on the nature of the leak itself. Field tests have indicated that significant amounts of energy in the vertical plane may exist, making the monopole a useful patrol antenna.

Unlike the roof-mounted dipole, the monopole antenna works best when mounted directly upon and electrically connected to a vehicle roof. Best results are obtained when the antenna is centered in the middle of a roof that extends at least one-quarter wavelength out from the antenna in all directions.

The major difference between the one-quarter wavelength and five-eighths wavelength types is in the vertical radiation pattern. The quarter-wave monopole is probably the better overall choice, but the five-eighths wavelength monopole may have some slight advantages in some situations. Its directivity pattern favors radiation arriving from lower vertical angles. This could be useful when patrolling must routinely be done at large distances from the cable plant (perhaps 75 feet or more).

Although the monopole works best when mounted on a vehicle roof, its characteristics are still influenced by the exact way in which it is mounted. Therefore, like the dipole, it must be calibrated on the vehicle. The calibrated test field must be vertically polarized, of course. This can be accomplished by vertically orienting both the source dipole and the reference dipole in the calibrated field setup. The centers of the two dipoles should be at the same height as the vehicle's roof as will be discussed later.

The choice of dipole or monopole patrol antennas is largely a matter of personal preference. Each



A technician calibrates the cable leakage meter in his vehicle.

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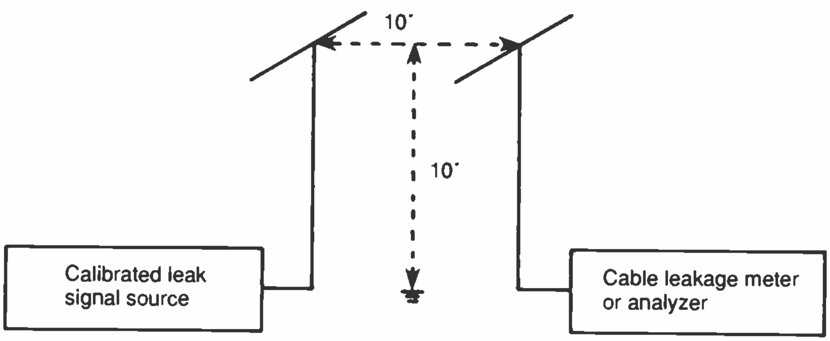
Figure 4: Using a signal generator to calibrate a cable leakage meter

Figure 5: Calibrating a reference leak signal



has its advantages and disadvantages. The monopole is typically cheaper and simpler to install than the dipole. However, it has been found that the monopole is somewhat more susceptible than the dipole to noise sources such as vehicle ignition noise and AC power line noise. The monopole antenna depends on the vehicle roof for its RF ground. Therefore, monopoles will not work properly when mounted on a vehicle with a fiberglass roof. In close proximity to a vehicle roof, the dipole is usually slightly less efficient than the monopole but is far less susceptible than the monopole to interference from aircraft communication signals, which are always vertically polarized.

In some locations, the cable easement may be spaced as much as 100 to 150 feet from the street. Path losses across these distances plus any additional attenuation by obstructions can reduce the leakage energy received by the patrol vehicle to very small values. This situation can be worsened by the presence of extraneous noise sources (such as power lines, auto ignitions, etc.), some of which may well be closer to the vehicle (and therefore stronger) than the leak source itself. Antennas with directivity and gain are useful in these situations as well as for the purpose of determining leak direction.

This class of antennas encompasses a wide range of types, but all share the common characteristic of increasing the received signal strength by "focusing" the antenna's directional pattern in primarily one direction. Signals arriving from the favored direction are thus increased in level, while signals arriving from other directions are significantly attenuated.

Gain antennas are typically rated in terms of forward gain, front-to-back ratio, and front-to-side ratio. Gain is an indication of the amount of signal increase that a given antenna will provide. Gain is usually expressed in decibels with respect to some reference antenna, typically a dipole. The front-to-back and front-to-side ratios are measures of the amount of attenuation of signals arriving at the back and the sides of the antenna, respectively. These are typically specified in decibels with respect to the antenna's response to signals arriving in the direction of its main lobe (the antenna's favored direction).

Perhaps the most familiar gain antenna is the Yagi. It is comprised of a dipole "driven element" with one parasitic reflector and one or more parasitic director elements. Yagis are characterized by fairly high gain for their size as well as good front-to-side and front-to-back ratios, but have a relatively narrow bandwidth, typically covering at most one cable channel.

Another common gain antenna is the log-periodic. It consists of a group of dipole elements of different lengths and varying spacings, all fed at varying phase angles from a common transmission line. The forward gain, front-to-side and front-to-back ratios are generally less than a Yagi of the same number of elements, but the bandwidth is very wide. A log-periodic antenna of reasonably small size can be made to cover the range of 220-400 MHz with several decibels of gain over a dipole. Log-periodic antennas are generally too large for vehicular use in the 108-136 MHz band.

Directional, gain type antennas are calibrated while in place on a vehicle in much the same way as described earlier. (For more on calibration see the "Setting up a calibrated leak" section of this article.) The reference field is set up in the usual fashion, the vehicle is parked on the appropriate spot and the antenna is aimed directly at the source antenna. The standard distance should be measured from the source antenna to the front element of the vehicle antenna. Some unavoidable variation of antenna characteristics may occur as it is aimed in different directions. Hand-held directional antennas can be calibrated while being held on their mounting poles at the standard 3-meter height and distance as in the case of the dipole.

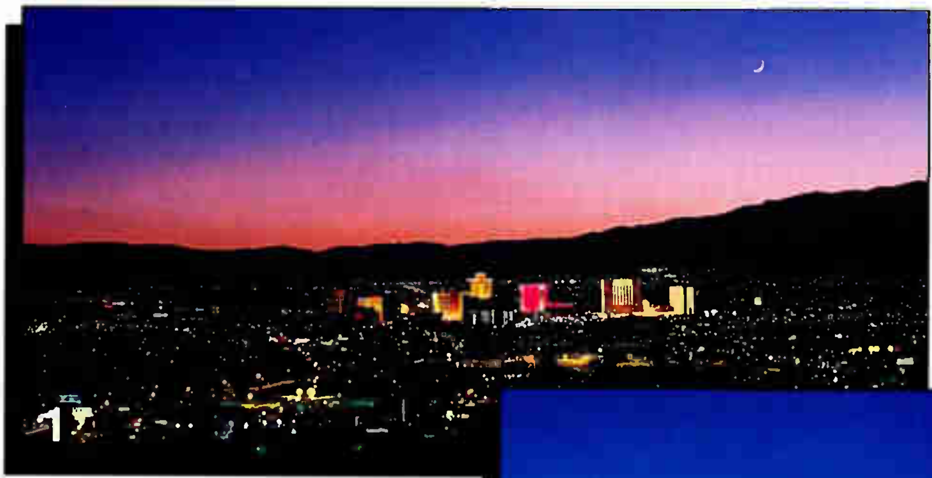
Regardless of the vehicular antenna system chosen, keep in mind that according to strict interpretation of the FCC regulations, CLI measurements cannot be made from vehicles because the antenna positioning requirements cannot be met under these conditions. However, any good leakage control program requires mobile patrolling for the purposes of discovering and locating leaks and then grading them into field strength categories.

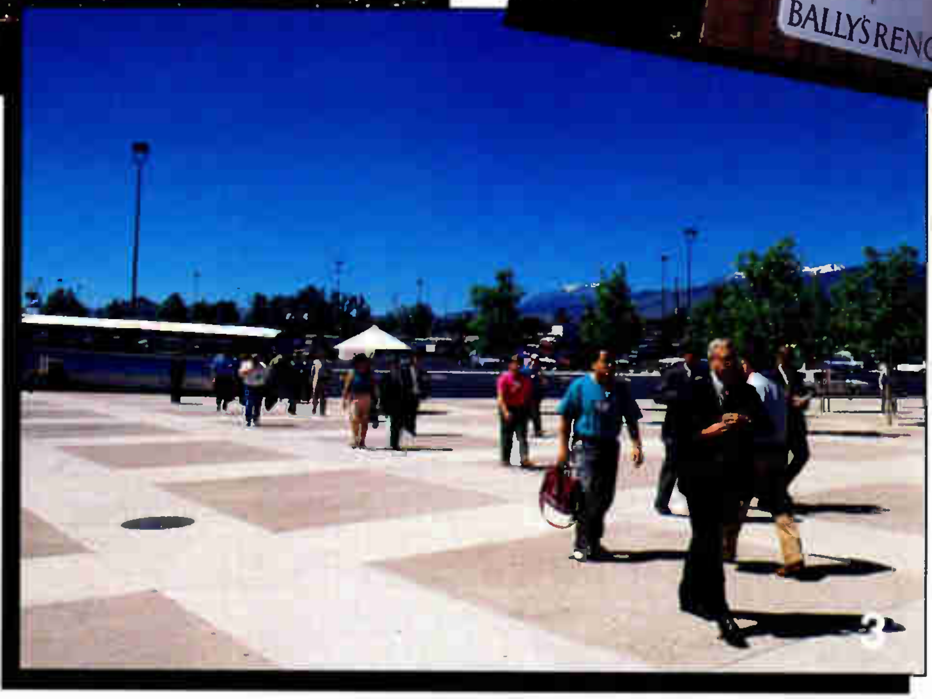
Once a leak has been located and measured, the cause must be determined and the leak eliminated. This generally requires pinpointing the leak. For this purpose, near-field antennas are especially useful. These are small, low sensitivity antennas designed primarily for close-up work in determining the exact location of maximum signal leakage on a cable, around RF connectors, gaskets, etc.

Near-field antennas fall into two categories: magnetic loops and E-field probes. The magnetic loop is a small coil of a few turns of wire, often molded in plastic into a circular or square shape. It is sensitive to the magnetic portion of the leakage field and is held close to the cable and moved along its

(Continued on page 86)

Cable-Tec Expo '91: An SCTE jackpot





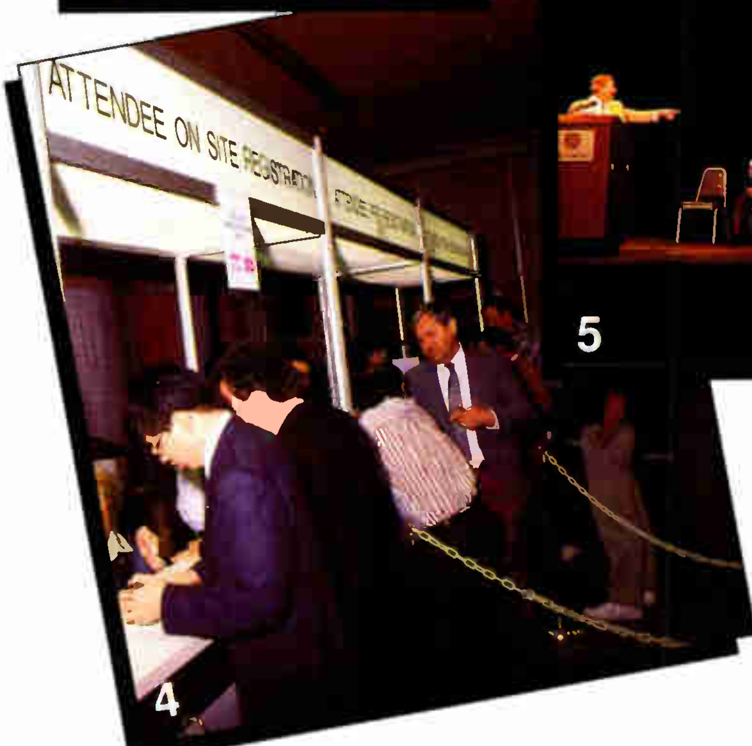
By Laura K. Hamilton
Photos by Bob Sullivan

Odds are good that if you were in Reno, Nev., June 13-16 with a pocket full of casino chips and Society of Cable Television Engineers' Cable-Tec '91 badge pinned to your shirt, you left with a jackpot of technical information even if you lost all the chips (and subsequently, your shirt). This year's expo proved again to be your best bet for technical training and education as the following highlights reveal:

- This year's show broke the bank (or attendance records of previous expos). Up 250 from last year, there were 1,850 registered attendees; and up 100 from last year, 1,500 exhibitor personnel made it a full house.
- Expo '91's exhibit space at Reno/Sparks Convention Center saw

***1)** The sun setting in Reno didn't stop the Cable-Tec Expo from heating up. **2)** SCTE's Bill Riker kicked off the show with a recap of the Society's growth and highlights of the Reno area. **3)** Attendees make their way from complimentary shuttle to expo action at the Reno/Sparks Convention Center. **4)** Exhibit space was up 20 percent over last year.*

***1)** Expo Program Co-Chair Steve Allen introduces the opening panel — Ed Allen, Stratford Smith, Archer Taylor, Ken Simons and Len Ecker — to begin the Engineering Conference. **2)** SCTE President Wendell Woody offered Awards Luncheon attendees a record of achievements that the Society made in the last year (see "President's Message," page 98). **3)** Richard Covell presents Steve Allen with the Member of the Year Award. **4)** Attendance increased 15 percent over last year. **5)** The SCTE board fields members' questions at the Annual Membership Meeting. **6)** The second Hall of Fame inductee, Len Ecker (center), receives a plaque from Diana Riley and Bill Riker.*



last year's and raised it 20,000. That is to say, 189 exhibitors (up from 179 last year) covered 100,000 square feet (up from 80,000 last year). See page 56 for more on-the-floor details.

• Attendees packed the huge Goldwyn Ballroom at Bally's Reno Hotel for Thursday's Annual Engineering Conference. Read more about the birth of broadband, fiber architectures, interdiction and security, and CATV's future on page 38.

• Figures aren't in on just how much expogoers raked in (or paid out) playing blackjack, keno or craps, but it was all winners at the awards luncheon. Turn to page 46 for the accolades.

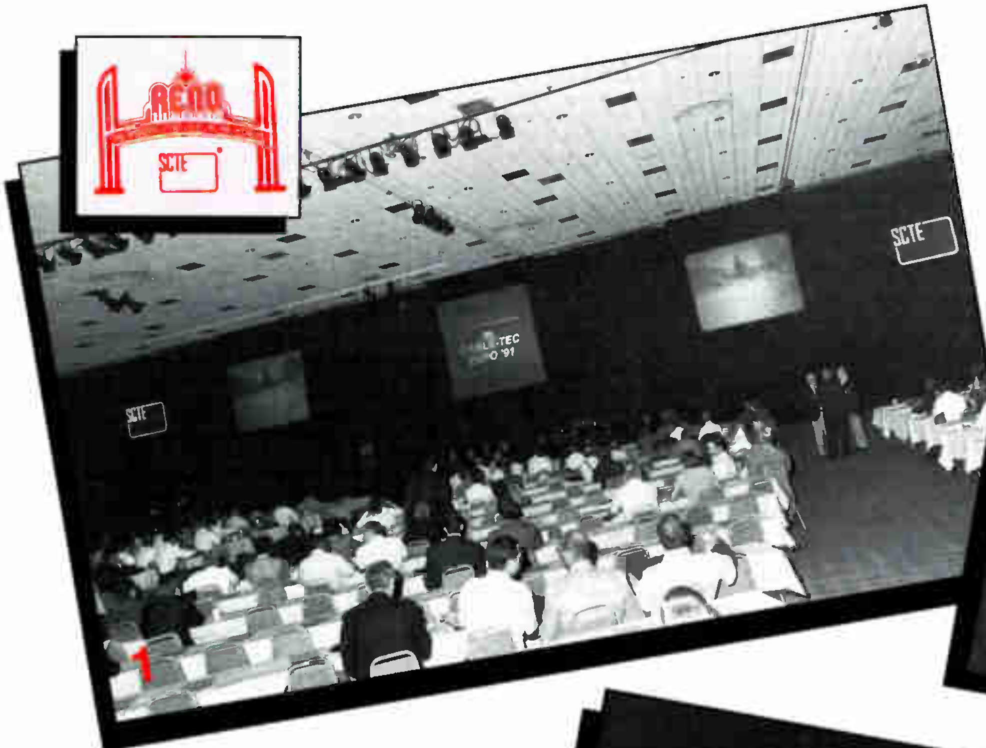
• The slots weren't the only hands-on attraction for attendees. Thirteen workshops dealt out technical training on Friday and Saturday (see page 50).

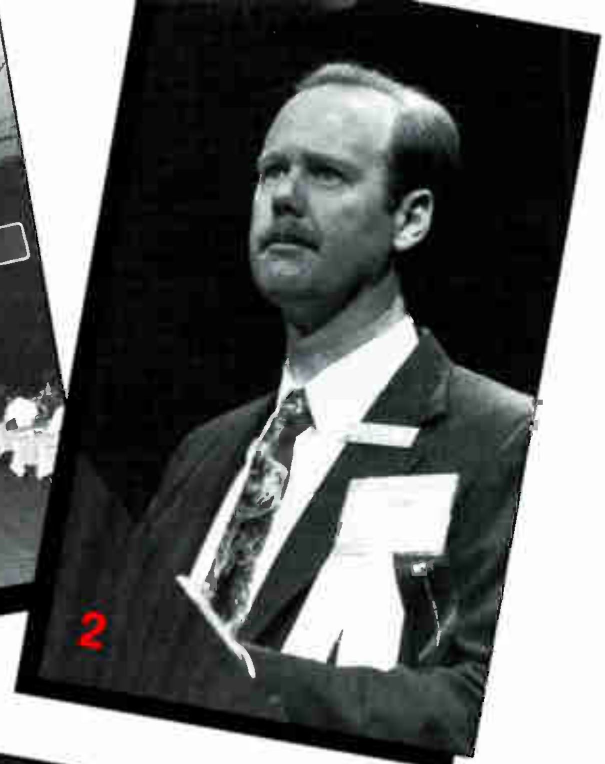
• No visit to "the Biggest Little City in the World" would be complete without some well-intentioned partying. Starting on page 58 you can see how everyone recouped after a busy day at the show, including details on the International Good Neighbor Reception, the ham operators reception, the first national Cable-Tec Games, Expo Evening and more.

This wrap-up was written with assistance from Shelley Bolin, Wayne Lasley and Rikki Lee.

***1)** Paul Levine (right) helps Ron Wolfe, Wendell Woody and Bill Riker display their "I survived the SCTE Cable-Tec Games" T-shirts. **2)** FCC's Richard Smith gave the keynote address at the Luncheon Awards. **3)** The first International Good Neighbor Reception provided a casual atmosphere for those from in and outside our borders to meet. **4)** Pete Petrovich presents a plaque to Ron Hranac honoring him as the first to attain Fellow member status in the U.S. SCTE.*

1) Accepting this year's President's Award from Wendell Woody on behalf of CableLabs were Brain James, Aleksander Futro and Scott Bachman. 2) Vendor literature was there for the taking in the registration area. 3) NCTI helped in keeping the eyes open. 4) CT's 1991 Service in Technology Award was presented to NCTI's Roland Hieb and Byron Leech by Paul Levine. 5) No Expo Evening peril was to great for those daring enough to try. 6) Taking their turns, Rex Porter and Richard Covell man the membership booth.

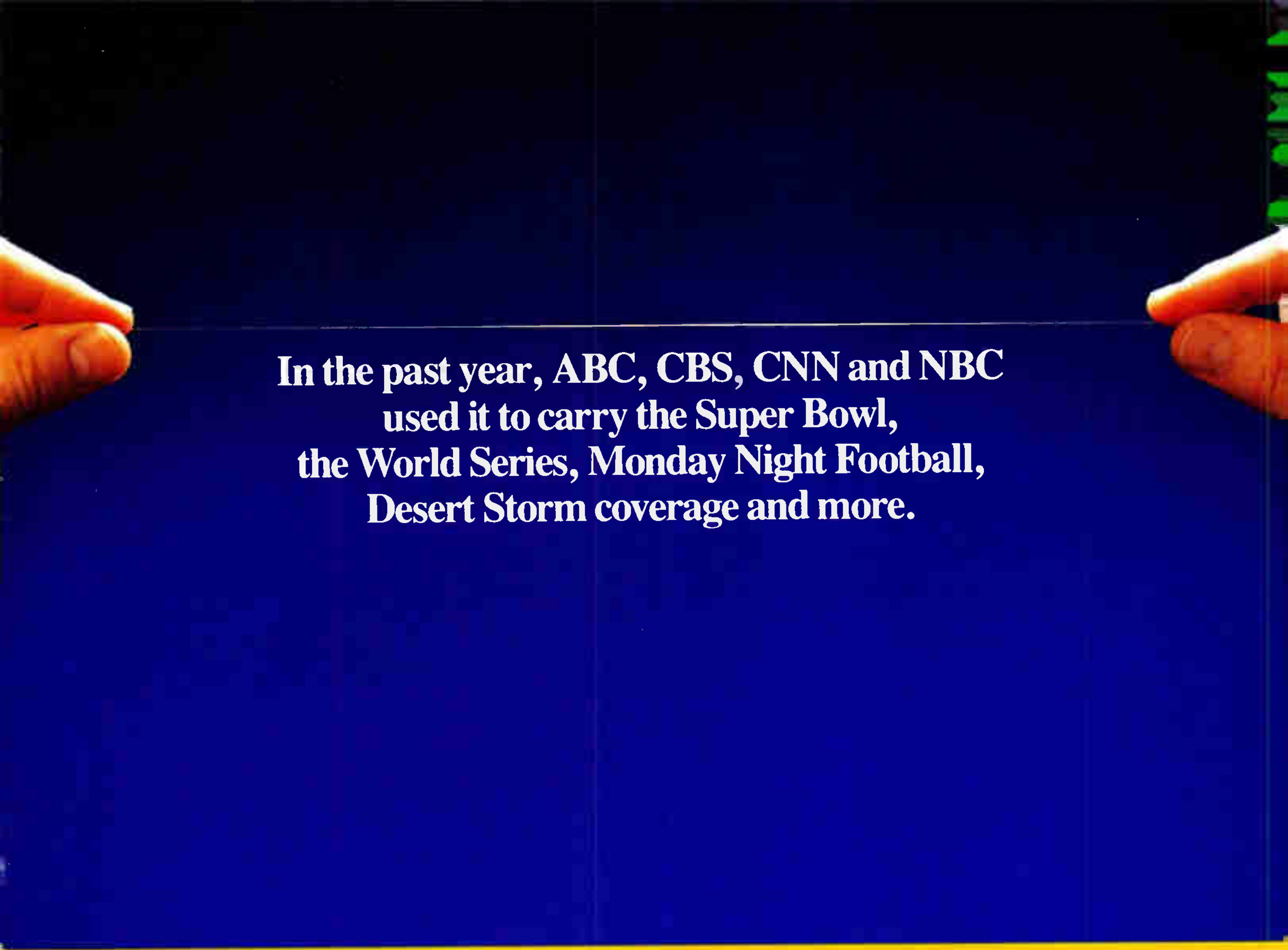




Annual Engineering Conference: Back and to the future, too

It had to happen sooner or later: The never-ending change of CATV technology has been too fast and furious. As a result, many of us have forgotten our roots. So this year's Annual

***1)** Engineering Conference attendees heard much on CATV's colorful past and future. **2)** Jones Intercable's Steve Allen kicked off the Engineering Conference. **3)** Ed Allen (Intermedia Capital Management) moderated the "A look back — The birth of broadband communications" session. **4)** Stratford Smith of NCTCM also spoke in the first session. **5)** Len Ecker (The Len Ecker Corp.) recalled early CATV systems. **6)** How it all began was considered by Malarkey-Taylor's Archer Taylor.*



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Reader Service Number 23

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Engineering Conference addressed our memory problem with the first session, "A look back — The birth of broadband communications." As Conference Program Co-Chairman Steve Allen put it, "Let us reflect on where we have come from."

Allen introduced five cable pioneers for the first panel: Len Ecker (president, The Len Ecker Corp.), Ken Simons (consultant), Stratford Smith (director, Oral Histories Project, National Cable Television Center and Museum), Archer Taylor (senior vice president of engineering, Malarkey-Taylor Associates) and Ed Allen (general partner, InterMedia Capital Management — and the co-chairman's father).

As moderator, the elder Allen alluded to the fact that there was a total of 365 years of age on the panel of "dinosaurs," with 194 years of cable experience. He mentioned that the group would cover the past 43 years — given that CATV started in 1948 — despite cable's true geographical beginnings (Astoria, Ore., or somewhere in Pennsylvania — or was it Arkansas?).

Smith, who perhaps originated the term "CATV" for "community antenna television," gave a unique personal view of the early days from his perspective as an FCC counsel. He provided a history lesson of the convoluted legal issues of the 1940s and '50s, including the first cases on jurisdiction of retransmission and copyright. "The FCC had jurisdiction over cable as an ancillary service to television broadcasting," he said, citing a landmark Supreme Court case.

Then Taylor (the "consultant's consultant," according to Ed Allen) recalled "how it all began" with a description of the first TV stations, broadcast technology and cable systems. He suggested that CATV began from the grass roots because of the efforts of hobbyists and small entrepreneurs to provide broadcast to remote areas. "Perhaps this is a tribute to the ingenuity and creative imagination of the amateurs, hobbyists, electronics repairmen, appliance dealers and the other small business people who did the job," Taylor said.

After this, Simons took a personal glimpse of his experiences as an engineer with a fledgling Jerrold Electronics from 1951. His guided tour down Memory Boulevard (complete with a slide presentation of the evolution of Jerrold facilities) included work on an early

***1)** The second session of the Engineering Conference, "Exploring fiber-optic architectures," featured (from left to right) Ed Callahan (Anixter), Earl Langenberg (US West Cable Communications Division), Jay Vaughan (ATC), Bob Luff (Jones Intercable) and Dave Willis (TCI). **2)** Luff considered PCNs in the session. **3)** Langenberg discussed U.K. telco fiber architectures. **4)** The fiber session was concluded by Willis with an update on TCI's fiber projects.*

1) The "Interdiction and other signal security techniques" session had (from left to right) Continental Cablevision's Terry Mast, NCTA's Roger Pience, Continental Cablevision's Leonard Falter and S-A's Paul Harr. 2) Signal security technologies were scrutinized by Harr.

oscilloscope, a high/low converter and other equipment. He mused, "I was in television ... before there was television. And I installed a set for Barbara Stanwyck and showed her how to use it."

Ecker recalled his adventures and anecdotes with Jerrold (since 1956) in early cable systems in various Pennsylvania communities. In 1953, he was in Reno, Nev., building a system that required burying cable made of a modified RG-11; the construction crew eventually had to close up the street with sand. "There are a million stories in this industry," he said, after finishing Story #6,283.

Finally, InterMedia's Allen advised the audience — still in awe from the teachers who presented valuable lessons of the past — that the next 10 years would bring more innovations than the previous 43 years. "The people in this room are on a journey to the stars," he said.

Building tomorrow's fiber-optic systems

In the second session, "Exploring fiber-optic architectures," Anixter Cable TV Vice President of Technology Ed Callahan (moderator) started with a few questions: "What is the best architecture? Is one better suited for a particular application than another? Will new technologies affect current architectures? Is there a way to make an architecture in effect technology-proof?" He maintained that anyone expecting the death of tree-and-branch would have quite a long wait.

Earl Langenberg (vice president of engineering and technology, US West Cable Communications Division) mapped out the telco's fiber architecture in the United Kingdom. Constructed in partnership with U.S. cable operators and others, the US West fiber-to-the-feeder system allows for cross-connect of CATV with telephone service. U.K. telco Mercury currently handles the switching plant. "We started out designing the telephone portion of our network to accommodate 18 percent telephone penetration. We found that this is not enough; we have to now design our system to 25 percent," he said.

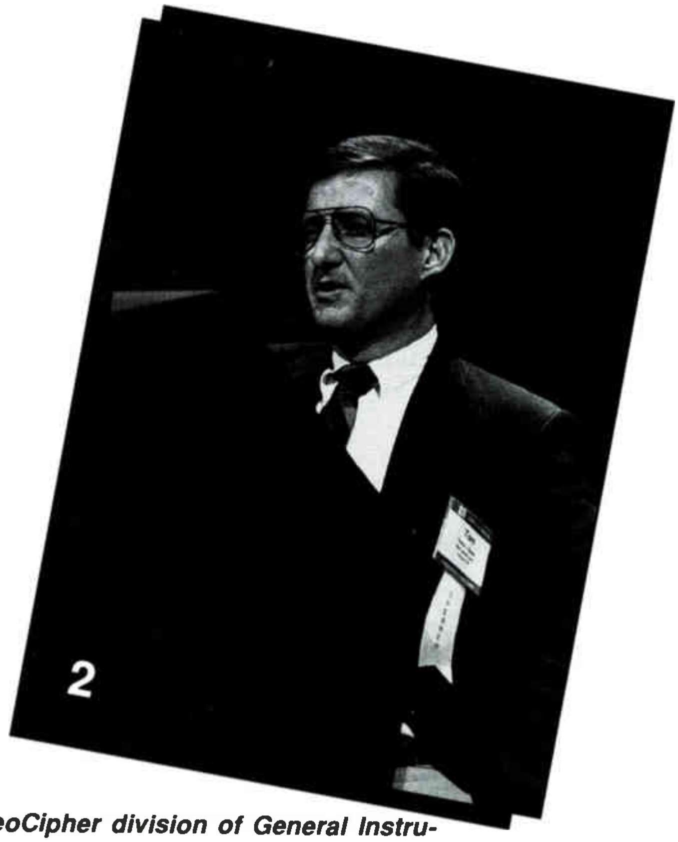
Then Bob Luff (chief technical officer, Jones Intercable) addressed the future promises and problems of personal communications networks aka PCNs. He gave a primer of today's cordless technology and extrapolated it to tomorrow's needs. Luff warned, "It's clear that it's very important to properly diagnose and construct the system in the network. Because it's possible, based on revenues that you would expect from PCN, that you can overdesign a network and have capital costs so great that the revenue simply would never pay back your investment."

Jay Vaughan (senior project engineer, American Television and Communications) discussed fiber networks possible for system upgrades. Among other architectures, he described the fiber-to-the-feeder plant using a single-cascade high output load as well as the MSO's 1 GHz project in Queens, N.Y. He said, "One of the things that isn't directly addressed in the architecture but is important is how to handle the 150 channels once you get to the subscriber's home. ... The cost of set-top converters when you look at widespread deployment gets quite expensive. We've been looking at an on-premises approach to the addressable converters."

Finally, Dave Willis (director of engineering, Tele-Communications Inc.) briefly updated the audience on his company's fiber projects and philosophies. He suggested that it is better to have less fiber in more systems than more fiber in fewer systems. With future technologies like compression, PCN and interactive, fiber allows the engineering community to "let your imagination take flight," Willis said.

Addressing the need for security

After the Awards Luncheon, attendees returned to the conference. The



1) Robert Rast (VideoCipher division of General Instrument) explained the company's HDTV technology in the final session of the Engineering Conference, "A look ahead — The future of broadband communications." 2) Alternate access to the phone company for video, data and voice carriage was outlined by Tom Staniec (NewChannels) in the last session.

third panel, "Interdiction and other signal security techniques," was introduced by Terry Mast (vice president of engineering, Continental Cablevision).

Roger Pience (director of engineering, National Cable Television Association) substituted for Office of Cable Signal Theft Director Jim Allen. Pience gave statistics of the lost revenue incurred by signal theft, a combined total of over $3 billion annually. Among the methods to fight theft, Pience offered, "Develop working relations with local and federal authorities. Announce an amnesty program, then follow through with suits against pirates."

Leonard Falter (general manager, Continental Cablevision of Sierra Valleys) described from an operator's perspective how to set up a theft-of-service program. He outlined how "to catch a thief": measures designed to lower the number of non-authorized connects, educate subscribers about theft policies, reduce leakage and strengthen in-house procedures. "We didn't want to create a public relations nightmare with the community. ... We needed to meet with elected officials to tell them what was going on," Falter said.

Finally, Paul Harr (applications engineering manager, Scientific-Atlanta) described and gave advantages/disadvantages of five signal security technologies: traps, sync suppression, video inversion, interdiction and digital video compression. On interdiction, Harr said, "It provides new marketing opportunities once you've populated the system with interdiction devices you can market non-subscribers on a per-week or per-weekend basis, or on a per-event basis."

Following the panel presentations, Mast led a question-and-answer session with the audience. Attendee queries included the availability of future technologies, power requirements and penetration of interdiction, and many other topics.

The broadband crystal ball

Moderating the final session ("A look ahead — The future of broadband communications") was Gary Kim, technical editor of *Multichannel News*. The first speaker, Robert Rast (vice president of new business development/advanced television, VideoCipher division of General Instrument) described his company's DigiCipher digital high definition TV technology. He also explained the process of compressing digital signals and the transmission of digital HDTV. Providing evidence of digital's lowering distortion characteristics, He said, "There are some very real transmission benefits of digital — and it's not just compression."

Next, Tom Staniec (chief engineer, NewChannels Corp.) defined the concept of alternate access to the phone company for carriage of video, data and voice for business customers. He outlined the types of markets available, customer expectations, regulatory concerns and possibilities of teleconferencing, video delivery and network. Staniec reminded his listeners, "This is a very specialized operation. It is not the kind of operation that you are going to take a guy who does 18 installs a day and say, 'I want you to fix Corporation A's data input because it seems to be screwed up.' It's just not going to work that way."

Finally, Archer Taylor returned with a presentation titled "Where are we going?" He gazed into a crystal ball for predictions on greater competition to (and from) cable, telco entry into video, digital HDTV in five years and so on. Appropriate for a casino environment (or weather forecasting), he affixed odds or a percentage chance to each of his predictions. In true Tayloresque form, he said, "I defy you to prove that I'm wrong." — *RL*

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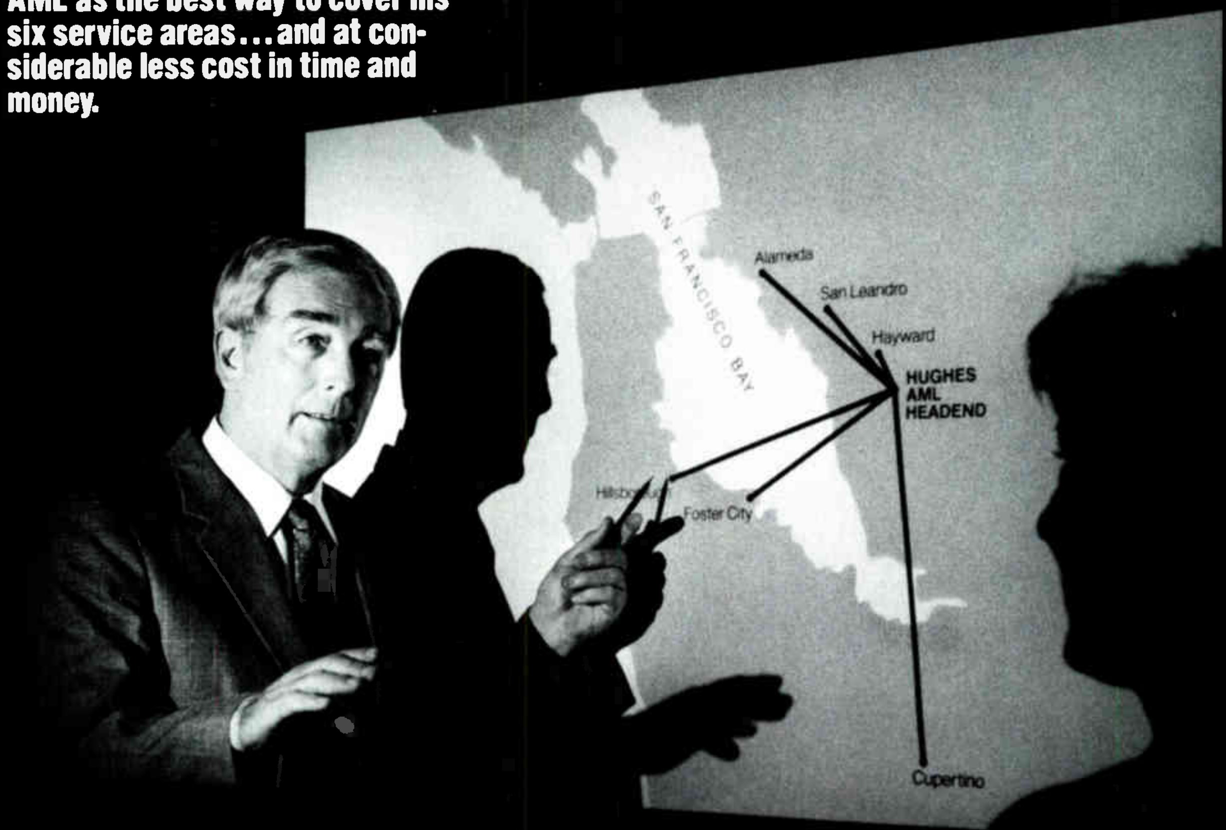

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Reader Service Number 26

SCTE honors members, friends

Rex Porter accepted SCTE Scholarship Fund donations from: 1) Texscan's Richard Covell, 2) Scott Warren of Warren, Morris & Madison and 3) Paul Levine of CT Publications Corp.

The Society of Cable Television Engineers held its Annual Awards Luncheon June 13 at Cable-Tec Expo '91 in the Grand Ballroom of Bally's Reno Hotel. A large crowd gathered to enjoy sustenance and speeches and to honor the Society's best.

FCC keynote speaker

The luncheon featured keynote speaker Richard Smith (chief of the Federal Communications Commission's Field Operations Bureau), who gave an address titled, "It's Noon Time — Do You Know Where Your Signals Are?" He also announced the issuance of a FCC Notice of Proposed Rulemaking.

In the first part of his speech, he cited CATV's ability to reuse the valuable resource of the the RF spectrum. Smith also discussed three topics of concern to the FCC today: the continuing problem of signal leakage, safety of towers and the rules for painting/lighting, and the emergency broadcast system. On the latter, Smith mentioned that the cable industry "should move to add EBS capability."

As for the proposed rulemaking on technical standards, Smith said it had just been made in Washington, D.C., and would seek comments on revised technical standards for CATV video signal quality. The proposal would extend standards to analog NTSC video signals on all classes of cable channels, but systems with fewer than 1,000 subscribers would be exempt. However, local authorities could adopt less stringent standards.

SCTE recognition

Smith's address was not the only highlight of the luncheon. The new 1991-1992 SCTE officers that had been elected the day before in the Society board meeting there in Reno were acknowledged: Wendell Woody of Anixter Cable TV was re-elected to continue as the Society's president for another year; Adelphia Cable's Michael Smith took the new Eastern vice president helm; the Western vice president position went to Ted Chesley of Rock Associates Inc.; Jim Farmer of Scientific-Atlanta was elected secretary; and the treasurer post went to Leslie Read of Sammons Communications.

The following SCTE members and organizations also were recognized:

• Outgoing members of the SCTE board of directors: Pete Petrovich, Bill Kohrt and Bob Luff.

• The Program Committee of the Fiber Optics 1991 Conference was recognized for its efforts in the planning of the successful January 1991 conference. Receiving awards were: Jim

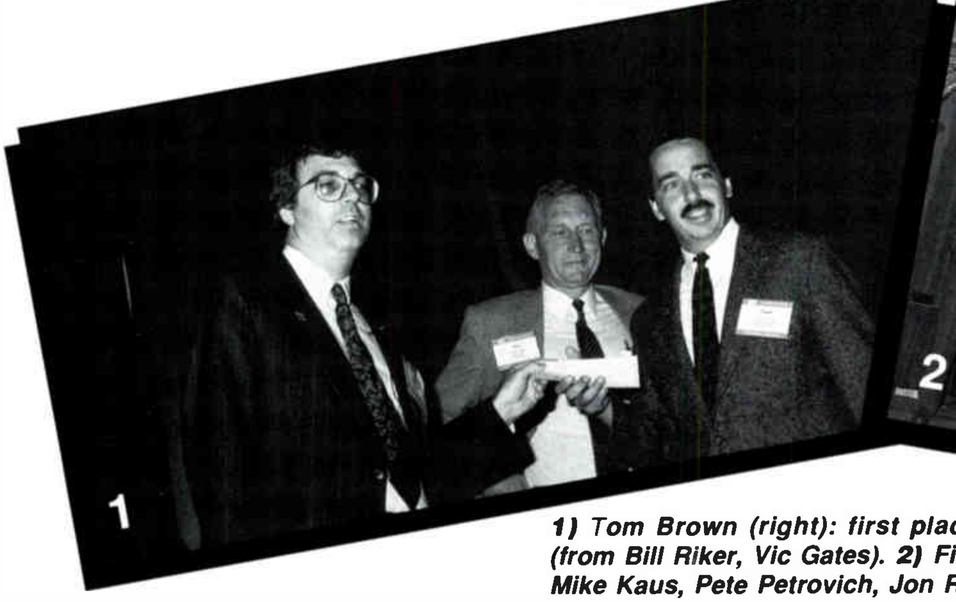
Ralph Haimowitz presents plaques to elevated chapters: 1) Big Country Chapter accepted by Region 4 Director Les Read, 2) Lake Michigan Chapter reps and Region 7 Director Vic Gates, 3) New York City Chapter reps, 4) Desert Chapter reps and Region 1 Director Tom Elliot, and 5) Snake River Chapter reps and Region 3 Director Ted Chesley.

Chiddix (co-chairman), Pete Petrovich (co-chairman), Scott Esty, Dave Fellows, Mike Kaus, Bob Luff, Richard Rexroat, Jon Ridley, William Riker, John Walsh and Norm Woods.

• Expo Program Committee members William Riker (co-chairman), Steve Allen (co-chairman), Ted Chesley, Sally Kinsman, Paul Levine, B.J. Toner and Dave Willis received awards for their efforts for Cable-Tec Expo '91.

• Five SCTE meeting groups were elevated to full chapter status in the Society: Big Country Chapter — Abilene, Texas; Desert Chapter — Palm Desert, Calif.; Lake Michigan Chapter — Grand Rapids, Mich.; New York City Chapter — Rockville Center, N.Y.; and the Snake River Chapter — Twin Falls, Idaho.

• Ron Hranac of Coaxial Communications and senior technical editor with



1) Tom Brown (right): first place Field Operations Award (from Bill Riker, Vic Gates). 2) Fiber-Optics Program Committee: Bill Riker, Mike Kaus, Pete Petrovich, Jon Ridley, Bob Luff, Richard Rexroat. 3) Expo Program Committee: Bill Riker, Dave Willis, Ted Chesley, Steve Allen, Sally Kinsman, Paul Levine. 4) Personal Achievement Awards: Rikki Lee, Rob Marshall, Mark Wilson, Jennifer Hays (by Dave Franklin, left). 5) Senior Member status: Steve Allen (from Ron Hranac, left). 6) Ed Allen with Member of the Year and son Steve Allen.

CT Publications became the first SCTE member to receive fellow member status within the Society.

- Steve Allen of Jones Intercable was elevated to senior member status.
- Thomas Brown of Staten Island, N.Y., received first place in SCTE's Field Operations Award competition. He won for his presentation on "Preventing Planned Outages." Randy Baker of Bartlett, Tenn., and James Hockin of Williamsburg, Mich., were the second and third place winners respectively.
- SCTE Personal Achievement Awards — a new awards program based upon the SCTE Outstanding Achievement Awards, which were presented in 1986-87 and established to recognize technical personnel in our industry for outstanding job performance — were presented to Jennifer Hays of MetroVision, Rikki Lee of CT Publications, Rob Marshall of the Mid-America Cable TV Association and Mark Wilson of Air Capital Cablevision.
- The second inductee into the SCTE Hall of Fame, Len Ecker, was named. In 1988, SCTE created its Hall of Fame and honored the late Cliff Paul as its first inductee.
- CableLabs was the recipient of the 1990 President's Award in recognition of its support of the Society through the sponsoring of an SCTE technical training videotape on Category VII of the Broadband Communications Technician/Engineer (BCT/E) Certification Program, "Engineering Management and Professionalism," as well as a variety of planned cooperative efforts between the two organizations.
- Steve Allen of Jones Intercable was the 1991 recipient of the Society's Member of the Year Award in recognition of his service to the Society. Included among his SCTE activities are serving as co-chairman of the Expo '91 Program Committee and co-founding and coordinating numerous events with the Society's Sierra Chapter.
- Donations to the Scholarship Fund were presented by Paul Levine of CT Publications, Scott Warren of Warren, Morris and Madison, and Texscan's Richard Covell (in memory of Ed Faust). *CED*'s Bill McGorry and Rob Stuehrk presented a check representing half the revenue generated from the *SCTE Membership Directory*. — LH

Educational opportunities abounded in workshops including: 1) "Maximizing benefits from basic test equipment" with Coaxial International's Ron Hranac and 2) TVN Entertainment's Paul Beeman; 3) "System maintenance and troubleshooting" with Wavetek's Steve Windle; and 4) "Satellite proof-of performance measurement" with HBO's John Vartanian.

Getting technical: Expo '91 workshops

Cable-Tec Expo '91 attendees in Reno weren't just playing games. As a matter of fact, on Friday and Saturday the roulette wheels and the video poker machines in the casinos lost a good bit of their following to the likes of CATV test equipment and fiber optics at the expo workshops.

Attendees toted in their hot-off-the-presses proceedings manual (a book of technical papers from the workshops and Engineering Conference), steaming cups of coffee (courtesy the National Cable Television Institute) and a burning quest for technical knowledge. Texscan and Jerrold Communications provided working amplifier cascades to make the workshops truly hands-on.

Ten workshops were presented three times a day each with three special sessions of local origination workshops being provided once a day each. Hopping from workshop to workshop was easy enough since they were held in close proximity to each other in the Reno/Sparks Convention Center, but the hard part was picking the six you wanted to attend most.

CLI Ninjas return

Just when you thought it was safe to return to the expo, John Wong and company returned with "CLI Ninjas II: The sequel." Les Read of Sammons Communications began with an overview of Federal Communications Commission requirements including offset frequencies, routine monitoring and ground-based CLI. He covered the two elements of a leakage program: measuring the leaks and recording what's been measured. Finally, he cautioned attendees of the dangers of inadequate training in leakage detection, lack of test equipment maintenance, use of improper or poor quality materials and especially not putting enough emphasis on CLI.

Wong began his portion of the workshop with the warning to "avoid sloppiness" on the Form 320. The FCC has

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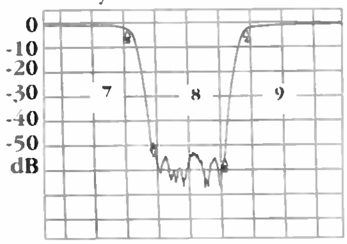

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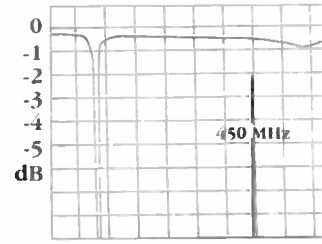

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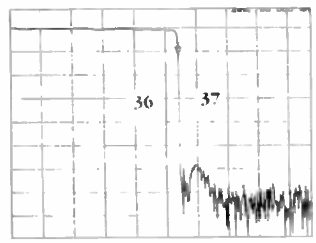

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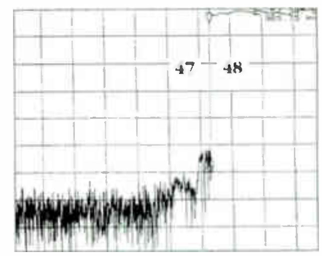
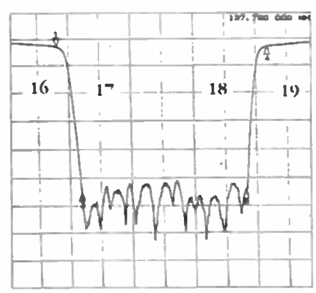


Brickwall HPF 6211HP-47/48 Passes Channel 48 Up, 50 dB Channel 47 Down



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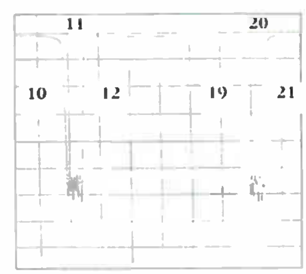

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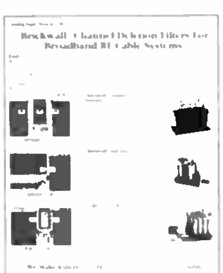

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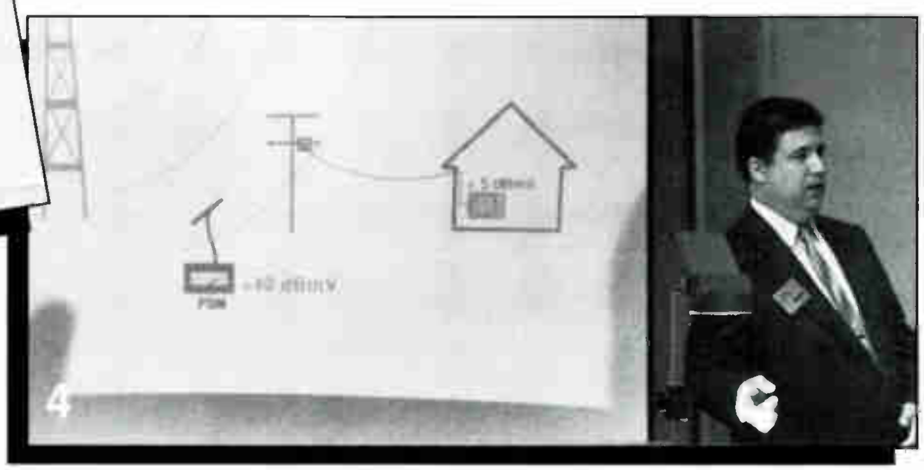
*Other workshops included: **1)** "System sweep techniques" with CaLan's Jon Lander (left) and Tektronix's Bill LeDoux; **2)** "OSHA regulations: Safety in the workplace" with SCTE's Ralph Haimowitz and **3)** NCTI's Roger Keith; and **4)** "Tap to TV: Strengthening the weakest link" with Comm/Scope's Bob Glass.*



made 5,000 telephone calls for forms missing numbers, signatures, etc. He said the FCC is converting to a new computer system that will allow it to compare data by state, company name, etc. "We're looking for trends," he said. He then made reference to the fact that the FCC had adopted a notice of proposed rulemaking to reimpose technical standards on the CATV industry the day before.

The FCC's Bill Browning discussed the Emergency Broadcasting System (EBS) and said that with 60 percent cable penetration, it can no longer be effective without cable's cooperation. Frank Lucia, also of the FCC, described how the EBS works on a national and local level, and presented a listing of voluntary EBS activations and national participants. Ted DeLozier of the Federal Emergency Management Agency said that it is looking at funding cable stations for backup equipment, program equipment and shelters needed for EBS participation. He invited operators to stop by the EBS booth to share their ideas.

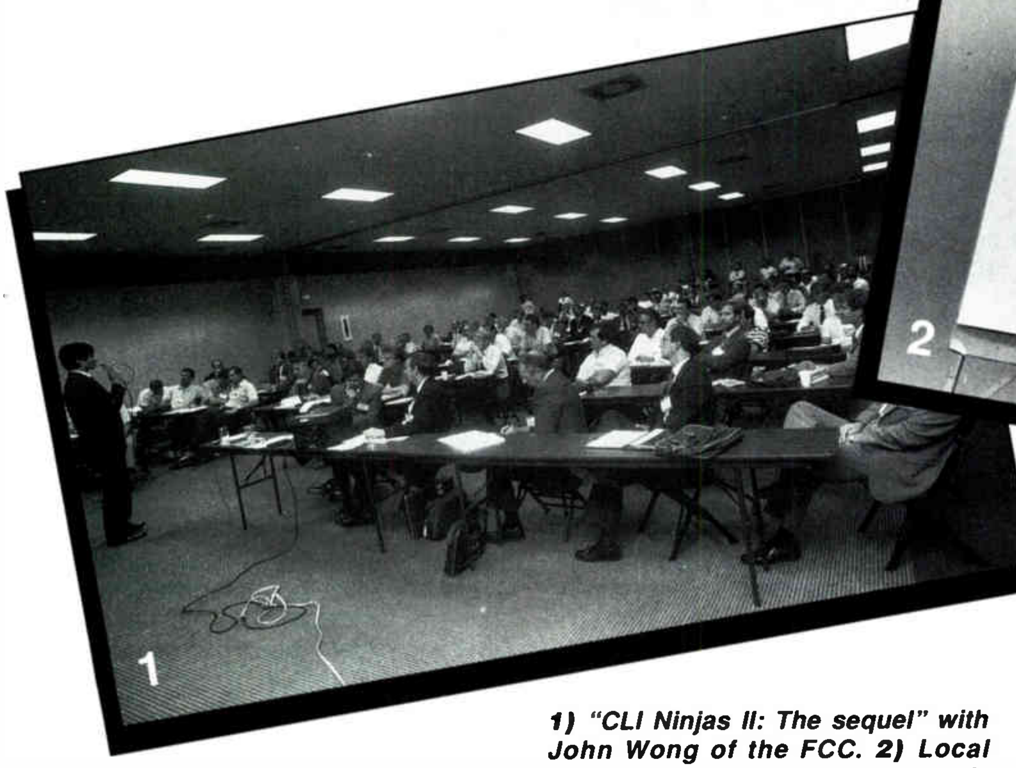
FCC's Tom Hora reminded ops to periodically check their antennas, and said it would look at such details as truck conditions and record keeping during an inspection. He urged attendees to make comments on the proposed rulemaking discussed earlier by Wong.

Fiber restoration

The "Fiber-optic trunk restoration" workshop looked at requirements, recommendations and restoration materials for quickly and effectively repairing fiber damage. AT&T's Ron Causey outlined how to develop a restoration plan, including tool, personnel, training and practice requirements.

Charles Mogray of Comm/Scope discussed how to identify the problem and described typical faults in fiber cable. He also described how to use an OTDR and optical power meter. Finally, he noted the importance of maintaining proper identification.

Dave Johnson of Siecor covered procedures to follow once the fault was located, including site evaluation, cable placement inspection, damage assessment, cutting out the damaged section and setting up the restoration kit. He



1) "CLI Ninjas II: The sequel" with John Wong of the FCC. 2) Local origination workshop "Future trends in video/audio production" with Sony's Ken Kokubun. 3) Local origination workshop "Quality control of the video signal using test equipment" with John Nielson of Tektronix.

then went over the restoration process. Causey returned to outline the permanent repair procedure. Attendees were then invited to make temporary splices.

Test equipment tips

Ron Hranac of Coaxial International and TVN Entertainment's Paul Beeman took a tag-team approach to the workshop, "Maximizing benefits from basic test equipment." Hranac began by describing how to measure video using a waveform monitor and oscilloscope. VideoCipher tips were given and the use of a true spectrum analyzer for measurements was discussed. Beeman described how to set audio levels with a VU meter, power meter and persistence meter. Adjusting audio levels at the source and loudness problems related to commercial insertion also were covered.

OSHA standards

Do you have your *Title 29, Code of Federal Regulations, 1900-1910*? Is your Occupational Safety and Health Association poster up? Where's your OSHA Form 200? And then there's the matter of the HAZCOM program and the "competent person requirement." If you're lacking, you're well on your way to getting a stiff OSHA fine, said Roger Keith of the National Cable Television Institute and SCTE's Ralph Haimowitz in the "OSHA regulations: Safety in the workplace" workshop.

Keith gave an overview of the forms and publications you must have as an employer as required by OSHA and recommended attendees get up to date with standards. (NCTI offers a course on OSHA that will teach you "more than you ever wanted to know about OSHA," according to Keith.)

Haimowitz went over OSHA's competent person requirement. According to this standard all employers must assign a person to the task of overviewing and implementing OSHA requirements. This person must have a good knowledge of the industry, must understand OSHA standards, must perform daily inspection of tools and safety equipment as well as vehicle and safety equipment, and finally must have the authority to stop a job when unsafe conditions exist and issue immediate corrective action.

"Painless" speaking

In the workshop "Painless technical speaking," CT Publications Special Correspondent Rikki Lee discussed the techniques that prospective speakers should apply in preparing, rehearsing and giving a talk. Ex-schoolmarm Lee frequently used off-the-wall humor on the audience, showing a David Letterman-style top 10 countdown of fears in the United States as she analyzed stage fright.

Doug Ceballos, technical trainer for the NCTI, continued the workshop with hints on using audiovisual materials. He described some advantages, disadvantages and tips on working with the overhead projector, video, white/blackboard and other AV equipment. Ceballos concluded with a discussion on the use of questions by the speaker to increase audience comprehension and participation.

Tech calculations

Much of the information needed for Category IV of the SCTE's BCT/E Certification Program was covered in the "Practical technical calculations made easy" workshop as Texscan's Richard Covell made the numbers come alive

Attendees took a closer look at "Fiber-optic trunk restoration" during this workshop.

with his practical examples. Topics covered included logs (both base 10 and 20), decibels' relationship to power and voltage, return loss, calculating noise voltage and numerous distortions (X-mod, second-order, composite second-order and discrete third order). When calculating carrier-to-noise, Covell stressed the importance of knowing the actual noise figure(s) of your amp(s) and cited a few ways to interpret manufacturers' spec sheets — "read the fine print." He pointed out that as the quality of subscribers' in-home equipment improves, the C/N delivered must keep pace as well.

Satellite performance

The changing universe of satellites and the factors in keeping their performance up was the topic of the "Satellite proof-of-performance measurements" workshop. HBO's John Vartanian kicked off the discussion with the next generation of CATV satellites including "the major cable satellite of the next generation" — Galaxy 5, which will be up in 1992. He also discussed the Federal Communications Commission 2° spacing plan, and the impact of 2° spacing on earth stations.

Jeff LaRoche and Gary Hatch of Antenna Technology gave maintenance tips. LaRoche covered inspection of antennas and components, weatherizing the antenna and repeaking the antenna and feeds. Hatch continued with ways to field test.

Doyle Catlett of Superior Satellite Engineers concluded the workshop with comments on 2° satellite spacing and new high-powered satellites. He also covered the effects on current generation satellite antennas and multiple satellite feed systems.

System maintenance

Steve Windle of Wavetek and John Cecil of Hewlett-Packard considered the benefits of consistent system monitoring in the "System maintenance and troubleshooting" workshop. Windle explained how to recognize and resolve such system distortions as hum modulation, carrier-to-noise, intermodulation distortion and frequency response. He concluded by demonstrating how some of the tests would be run on Wavetek equipment.

Preventive maintenance through CATV system monitoring using a spectrum analyzer was the subject of Cecil's discussion. He demonstrated an automatic measurement on H-P equipment and listed the benefits of CATV system monitoring on a regular basis. Cecil recommended finding system problems before they become customer complaints, simplifying testing, and testing more often.

Sweep techniques

Jon Lander of CaLan opened the "System sweep techniques" workshop by answering the question "Why sweep?" Maintaining system quality by improving picture quality, doing preventive maintenance and doing system alignment and proof of performance were the answers. He then gave a brief history of sweep technology, highlighting the high level sweep, low level sweep, sweepless sweep and integrated sweep measurement. Advantages and disadvantages of each type of system were discussed as well.

Bill LeDoux of Tektronix described his company's normalized sweep system, and said that normalization gets rid of error by correcting flatness and variations by inverse power additions. He then revealed how to sweep fiber backbone, AML and high-power AML systems. Lander and LeDoux then took questions from the audience and invited them to look at the sweeps on cascades set up at the front of the room.

Tap-to-TV

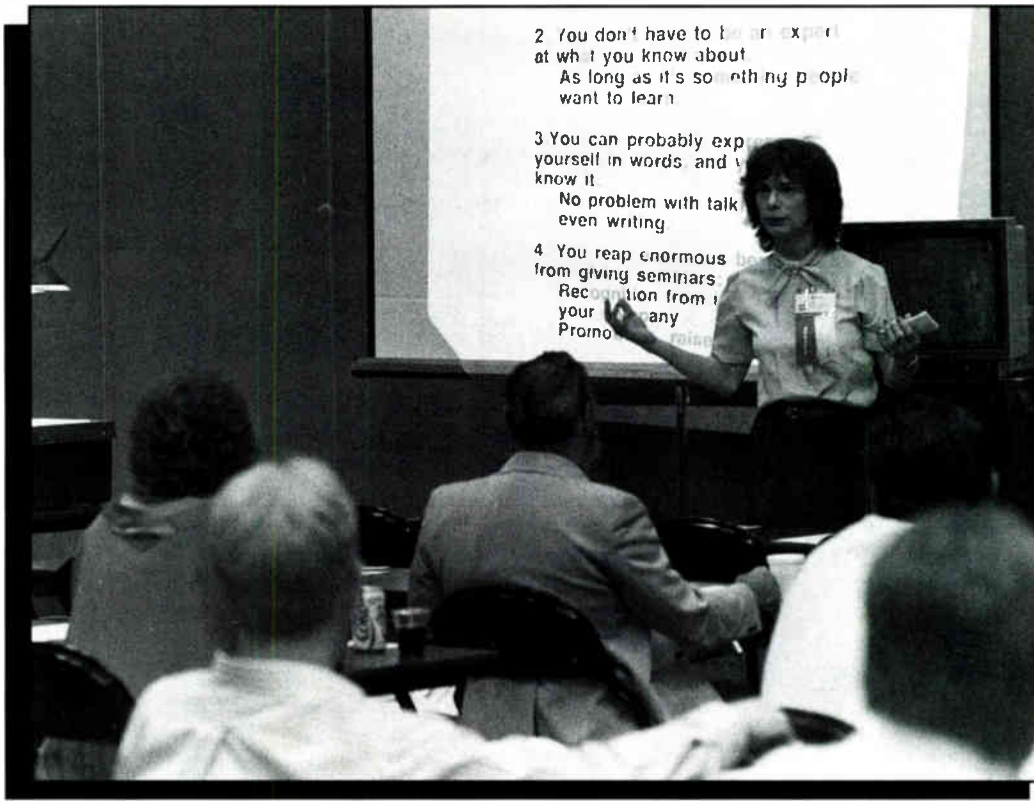
The "Tap-to-TV: Strengthening the weakest link" workshop featured Comm/Scope's Bob Glass and Pam Nobles of Jones Intercable tackling the problems of realizing and maintaining a good tap-to-TV set connection. Glass covered the drop cable concerns of shield effectiveness, NEC ratings, and grounding and bonding. In addition, he passed around several types of cables to illustrate effective troubleshooting of underground and aerial drop concerns.

Nobles went over her company's "Qualified Installer Program," which she said resulted in a 24 percent drop in service calls and an estimated savings of around $3 million a year for "doing it right the first time." Attendees were able to get a hands-on look at an interactive video program on laser disc and use the program to try their knowledge on installation in a "video game" setting.

LO format wars

In the "Format wars of the '90s" local origination workshop, Panasonic's Tom James led off by telling attendees that equipment reliability and compatibility are important issues to be dealt with before you buy. He stressed knowing your needs today and then considering where you want to go in the future.

His sentiments were echoed by Sony's Adam Shade, who said to let your applications help dictate which format to use: VHS, S-VHS, U-matic, 8mm or, at the high end, Betacam. He



CT Publications Special Correspondent Rikki Lee gave tips for "Painless technical speaking."

emphasized using the highest video/audio quality that makes sense, especially with on-air system playback equipment.

Juan Martinez of JVC discussed the physical makeup of various film formats and exactly how the video and audio are captured on it. The session ended with moderator Dave Kerr of Viacom lamenting the fact that with so many cable systems using multiple formats, it is difficult to know just how to handle them all without proper training, which is hard to find.

Video quality control

You need the right test equipment and know what you're looking at, said John Nielson of Tektronix as he provided a step-by-step look at video signal quality in his "Quality control of the video signal using test equipment" local origination workshop. While discussing test equipment needs he said the picture monitor is the most important piece when doing productions; however, it must be properly calibrated (the same goes for waveform monitors and vector scopes). The difference between picture monitors with split-field vs. SMPTE color bars and how each is adjusted with respect to chroma, hue and brightness were covered. In addition, following the calibration procedures, setting up cameras and time base correctors as well as system phasing were dealt with.

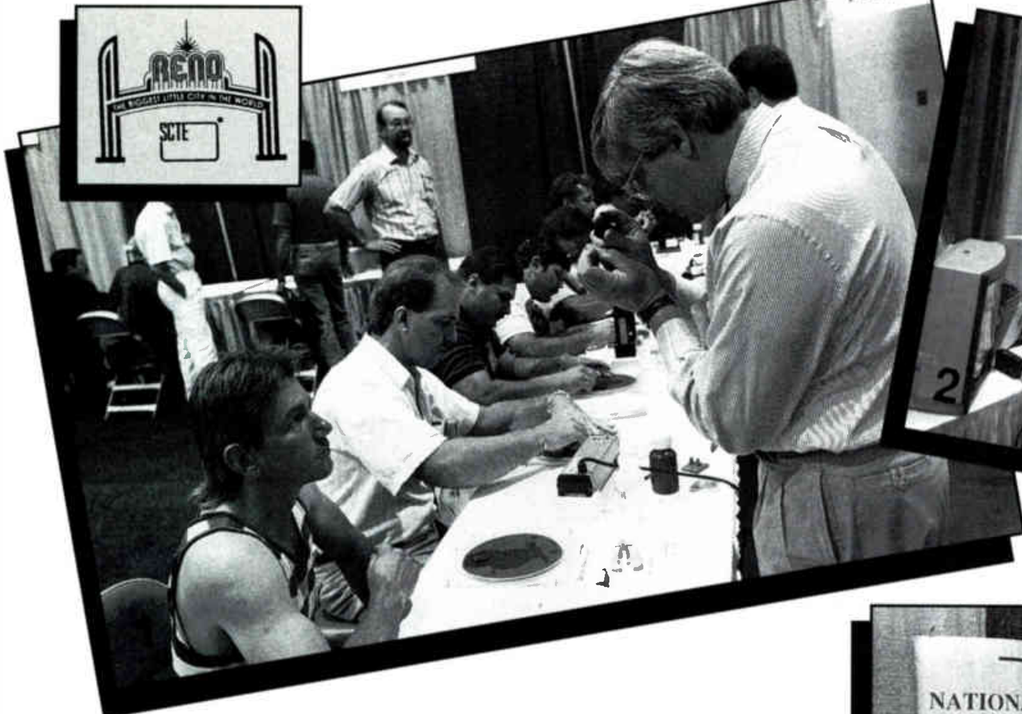
LO future

The local origination workshop on "Future trends in video/audio" began with Sony's Ken Kokubun telling attendees when it comes to your picture, start with the highest quality possible, especially any video that's going to be duped (because with each generation, quality degrades). In equipment using composite recording (where the individual RGB signals are combined into one signal and then separated before being captured on film) bandwidth is saved; however, quality suffers. On the other hand, component recording doesn't mix the signals, which helps maintain purity. When it comes to analog vs. digital, cost likely will be digital's drawback in most LO operations. Even though a digital signal isn't degraded by the introduction of noise (as is analog), the digital recorder needs to process 240 Mb/s of information, thus the high cost. Here, video compression should provide some relief via the need for less processing speed.

Next up was Juan Martinez of JVC, who said it's easier to implement advances in audio first because of its lower bandwidth. Serial transmission of digital signals "is here now" and is capable of handling different formats, but it's not perfect. In equipment using filter configurations following analog designs, degradation occurs due to the effects of group delay in the feedback loop. This is being alleviated, though, by new technology in filter designs.

Covering advances in production facilities was Panasonic's Tom James, saying more control will come with the infusion of computers using multitasking. Some of the things to look forward to in the marriage of computers and video: the vector*screen* instead of vectorscope; editing on a computer, not a tape deck; and the fact that technology will continue at such a pace that it will be very difficult to keep up with.

The final presenter, Paul Snopho of Zenith, took LO to its heights — high definition TV (HDTV). Not that LO need worry about HDTV video production right now (it will take 20 years after HDTV reaches a 1 percent household penetration to be at approximately a 60 percent penetration), but taping HDTV for future play will occur much sooner, using equipment very similar to current S-VHS recorders. If you're putting together your LO budget and feel the need to go high definition, Snopho provided some current numbers: cameras — they're only one third of a million dollars each; VTR — $0.5 million; edit facility — $1 million; and be sure to leave lots of rack space for the video encoder — Zenith's takes three full ones. — *SB, LH, WL, RL*



On the floor and more

Twenty percent bigger than last year and covering 100,000 square feet, Cable-Tec Expo '91 had 189 exhibitors unveiling and debuting their new equipment (buzzwords "interdiction," "1 GHz" and "fiber") and demonstrating their tried-and-true. On June 14 and 15 at the Reno/Sparks Convention Center in Reno, you could tweak, gaze upon and handle the likes of amplifiers, line extenders, connectors, mapping and management software, converters, bridgers, remotes, modulators, signal level meters, descramblers, OTDRs ... and you get the point.

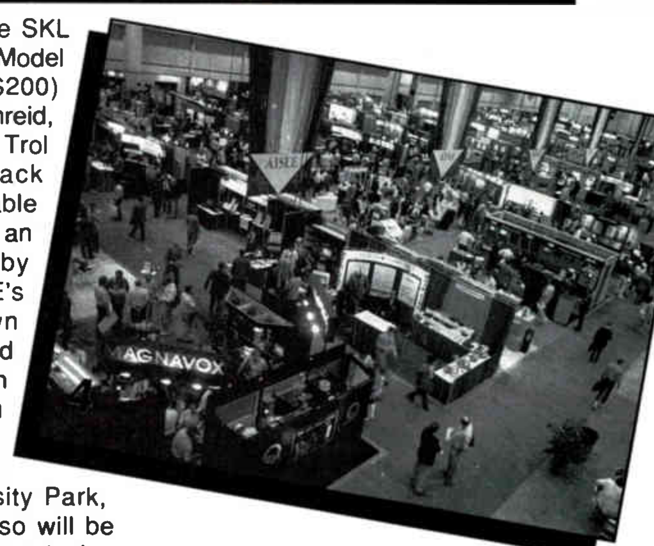
Historic equipment

If the advanced technology on the exhibit floor had your head spinning or you were feeling a bit nostalgic after the "A look back — The birth of broadband communications" session of the Engineering Conference on Thursday, the National Cable Television Center and Museum booth provided a way to look at yesterday's CATV equipment. There, donations of old cable equipment were being accepted for possible inclusion in the Society of Cable Television Engineers Room of the center and museum, which is at Pennsylvania State University. Ancient (or at least extremely old) equipment was put on display and a contest was run by SCTE and NCTCM to select the most historic items and award cash prizes to winning donors.

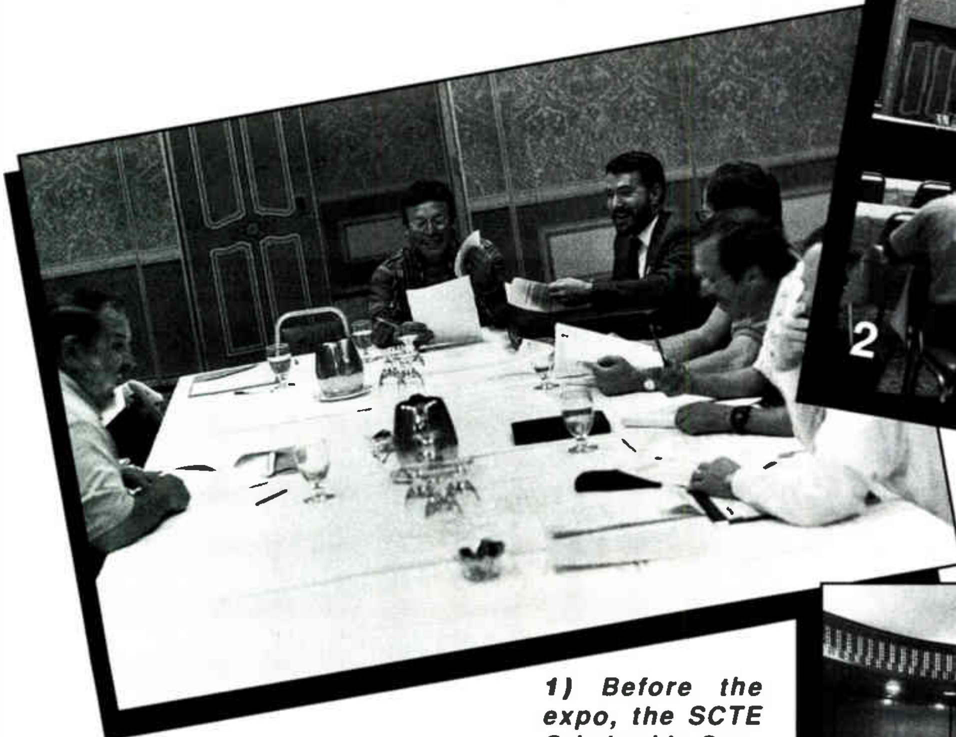
Par Peterson of Western Communications was $300 richer for his first prize SKL 12-channel trunk amplifiers Model 222 entry. Second prize ($200) went to TCI's Ken Degraffenreid, who entered a Jerrold Tele Trol Model TM modulator. Jack Gobbo of United Artists Cable won the $100 third prize for an early 1960 power supply by Ameco. Judges were SCTE's Bill Riker and well-known cable and engineering and technical consultants, Len Ecker and Jim Stilwell. You can see the three winning entries on display in the center and museum in University Park, Pa., through 1991. They also will be entered in the collections for cataloging and preservation.

Training lounge

If you ventured to the back of the exhibit hall, you had the opportunity to see demonstrations of interactive training techniques on computer in the training lounge. Mind Extension Institute demonstrated its interactive train-



1) Mechanical and fusion fiber-optic splicing in the training lounge. 2) The training lounge also featured interactive video programs. 3) A contest for cable equipment of yesteryear was run at the NCTCM booth. 4) The exhibit floor sprawled over 100,000 square feet.



1) Before the expo, the SCTE Scholarship Committee met. 2) The SCTE Interface Practices Committee considered new drop cable nomenclatures. 3) Prior to the show, the SCTE board met.

ing videos, the National Cable Television Institute showed its course offerings and information, and Gilbert Engineering displayed F-connector installation on computer. Scientific-Atlanta's interactive video on distribution architecture and balancing techniques was shown, and Alpha Technologies featured its Cat Pak computer-aided power supply maintenance. Rounding out the computer demonstrations was the ATC National Training Center, which highlighted its course offerings and information.

Finally, if you were able to keep your gambling fever in check in Reno but just couldn't manage to go without splicing some fiber, AT&T, Optical Networks International and Sumitomo provided relief by letting you perform your own splice in the training lounge. The companies awarded personalized certificates recognizing your splicing expertise.

SCTE booth

Located in the registration area just outside the exhibit hall, the national SCTE membership booth had plenty of Society goodies for sale. More than a few attendees had to find room in their suitcases for Expo '91 T-shirts, SCTE binders, golf shirts, mugs, design templates and Society publications.

Additionally, attendees could pick up a SCTE Interface Practices Committee survey form at the registration area. (The IPC, like the SCTE board of directors and Scholarship Committee, was one of the busy groups that met even before the show started.) The IPC discussed the outmoded "Mil-spec" or "RG" nomenclatures for drop cables and proposed a new set of designations. The survey was the result of the IPC's concern for how the CATV industry would accept the new designations. *CT* will keep you up to date on how the survey went and further developments with the proposed drop cable nomenclatures.

Vendor demonstrations

Just outside the exhibit hall, vendors held in-depth technical demonstrations of their products in the exhibitor training center. Exhibitors and their wares included the following:

- Rich Ellis and Kent Brown of Sumitomo Electric Fiber Optics discussed the company's Type 35 single-fiber fusion splicer.
- Rex Billinger and John Cecil of Hewlett-Packard described how to get more use out of their company's new HP-85716A spectrum analyzer through CATV system monitoring.
- Optical Networks International's Andy Paff considered cable TV's role in the evolving telecommunications infrastructure.
- Trilithic's Terry Bush discussed signal leakage measurement calibration using the company's PLC-600.
- CaLan's Alan leakage detection equipment and Star signal level meter were put forward as "products of the future" by the company's Syd Fluck and Ian Jones.
- The Cheetah "beyond status monitoring" system demonstration was directed by Superior Electronics' Mike Mills. The company's Doug Sarchet, Rob Heany and Nick Ackerman fielded various questions from attendees about the system.
- 3M's fiber technology including network, outside plant and Photodyne products from Multilink were demonstrated by 3M's G.H. (Gary) Knippelmier.
- The new ComSonics WindowLite hand-held signal level meter was unveiled by the company's Dennis Zimmerman. — *SB, LH, WL*

Biggest little city fun

As if the Oba Oba dancers or the instant-wedding chapels didn't offer enough to watch or do in Reno, Cable-Tec Expo '91 boasted its fair share of receptions and parties. Attendees had the opportunity to socialize and recharge after spending the day taking in a veritable plethora of technical training.

Wavetek RF Products kicked it off by sponsoring the Arrival Night Reception on Wednesday night at Bally's Reno Hotel. Earlier in a press conference, the company announced that Torrey Investments Inc. was acquiring Wavetek with the transaction to be finalized about June 28. On Thursday night at Bally's, Anixter Cable TV, AT&T, Comm/Scope, Jerrold Communications, Raychem, Scientific-Atlanta and the Society of Cable Television Engineers sponsored the Welcome Reception.

Expo Evening

Reno may be a wild town, but on Friday night there was only one place where you could install F-connectors, jump an alligator pit, splice fiber ends, ride a tricycle, perform signal leakage meter measurements or toss the pigskin all under one roof. Anixter Cable TV, AT&T, Comm/Scope, Jerrold, Raychem, Scientific-Atlanta and the SCTE sponsored this year's Expo Evening at Bally's, which featured the First National Cable-Tec Games.

The SCTE Broadband Communications Technician/Engineer (BCT/E) Certification Program and the Installer Certification Program exams on Friday, Saturday and Sunday mornings weren't the only way for techs to test their CATV know-how. The Cable-Tec Games at Expo Evening challenged 30 technicians in four events: splicing (hosted by Gilbert Engineering and Comm/Scope), test equipment (hosted by Riser-Bond and Trilithic), fiber optics (hosted by Optical Networks International and Sumitomo), and safety and terminology (hosted by ATC National Training Center and National Cable Television Institute). The Cable-Tec Games Subcommittee went as follows: ATC National Training Center's Ron Wolfe (who also was a master of ceremonies); NCTI's Tom Brooksher; Pam Nobles of Jones Intercable (who donned the referee's uniform); Bill Down of Gilbert Engineering; and Rikki Lee, special correspondent for CT Publications Corp. Not on the subcommittee, but offering his talents as the other emcee, was Magnavox CATV's Eric Himes.

The splicing event had participants

1) Pam Nobles, Cable-Tec Games referee. 2) Bill Riker and Wendell Woody honor the proud Cable-Tec Games winners. 3) Bill Riker and Wendell Woody congratulate overall winner Jeff Sommers of UA Cable.

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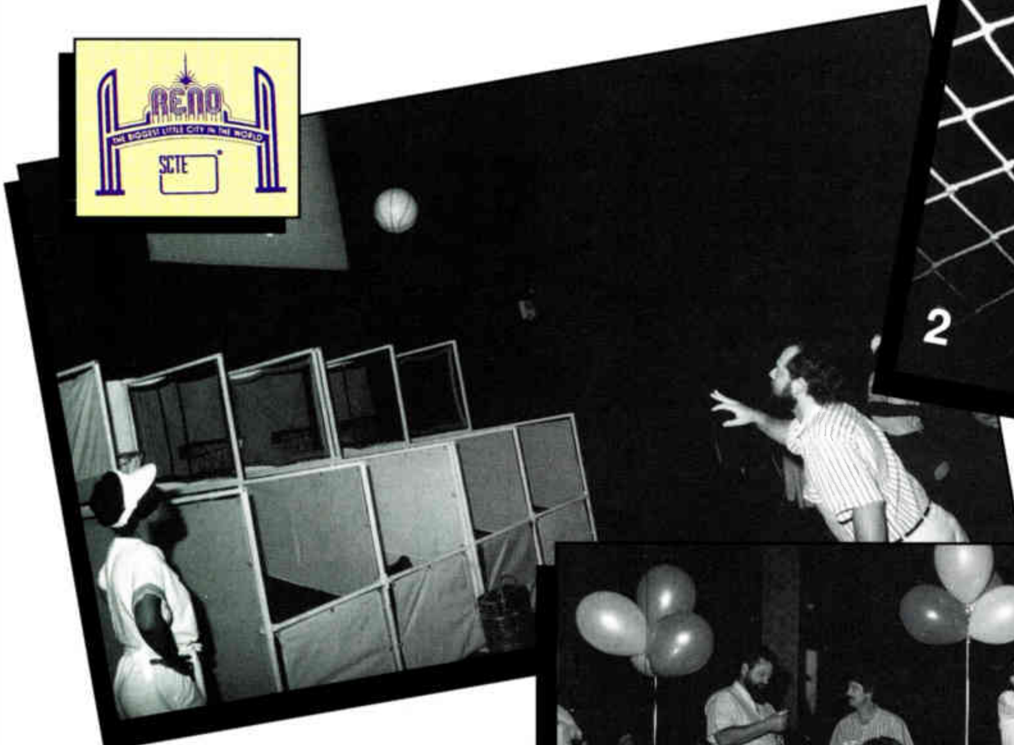
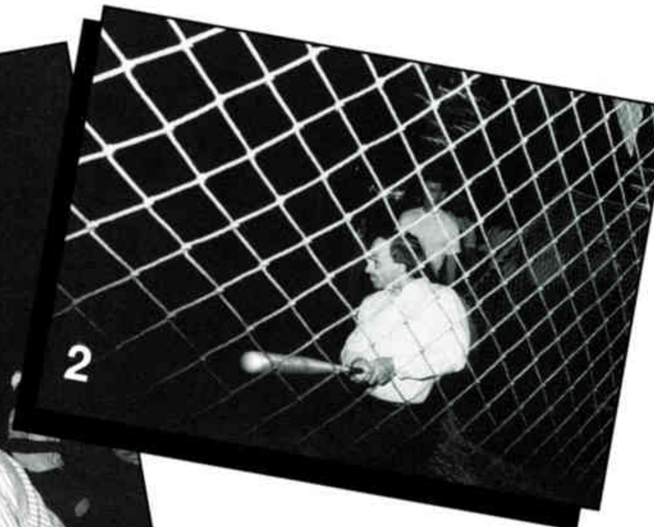




1) Shooting hoops was part of the Expo Evening fun. 2) "Slugger " takes a swing in the batting cage. 3) Attendees try their luck at the ring toss.

installing drop cable F- and distribution connectors. Attention to proper stripping and cutting dimensions, cleanliness of the center conductor, the results of a 40-pound pull-out test as well as cable preparation and quality of connection won points from the judges (Gilbert's Bill Down and Dana Gilstrap).

Locating a fault and making measurements of signal strength and carrier-to-noise quickly and accurately were the tasks in the test equipment event with judging by Trilithic's Bob Jackson, Greg Marx and Terry Bush, and Riser-Bond's Duff Campbell and Deb Nissan.

In the first part of the fiber-optics event, judging by ONI's Dan Morgan, Mike Kelly, Mike Shafer and Sumitomo's Kent Brown was based on proper dimensioning of the stripping and the quality of the cleave of fiber ends. Points were based on the loss of the splice and the time required to make a fusion splice in the second part of the event.

Contestants had to inspect a safety belt and climbers as quickly as possible checking items from a standard list in the safety and terminology event. The second half had the techs sorting out the alphabet soup common in CATV by matching definitions and descriptions with common abbreviations, acronyms and formulas. Doug Ceballos of NCTI and Al Dawkins of ATC were the judges.

When the stripping and splicing, cladding and cleaving, measuring and matching were over, the following event winners emerged with medals provided by Anixter Cable TV and CT Publications Corp.:

- **Splicing:** Steve Drummond of Storer Cable (first); Robert Hagan of Longview Cable TV (second); and Bret Hughes of Illini Cablevision (third).
- **Test equipment:** Merl Morrow of Quality Cable Installation (first); Tom Mack of Tekstar Cablevision and Paul Valiante of Cox Cable (tied for second); and David Kirkpatrick of Continental Cable (third).
- **Fiber optics:** Jeff Sommers of United Artists Cable (first); John Kero of TCI Cablevision (second); and Robert Hagan of Longview Cable TV (third).
- **Safety and terminology:** Lloyd Stewart of TCI Cablevision (first); Kris Wallace of Sacramento Cable (second); and Chris Alexander of B&L Cable (third).

The all-around thrill of victory (and a plaque from Anixter and CT Publications) went to UA's Sommers. He had the highest overall score in the four events with a grand total of 719 out of 800 points.

In addition to watching or participating in the games, Expo Evening attendees could dabble in less competitive, lighthearted sporting events like the obstacle course. Brave participants swung on a rope over very ferocious, very deadly (yet very unreal) alligators, scooted tricycles through obstacles, and shuffled and crawled through tunnels. Other events included a dunking booth, a football toss, a batting cage, and an area to practice your golf swing.

Another highlight of the evening was the announcement of CT's Service in Technology Award. Paul Levine, president and group publisher at CT Publications, presented the award to Byron

1) Amateur radio operators ham it up at their cocktail reception. 2) Hams look longingly at the door prizes. 3) Paul Hagist (Integral Corp.) and Bill Parker (International Cable) chat with Tom and Freda Hall at the International Reception. 4) SCTE representatives talk cable with Japanese delegates.

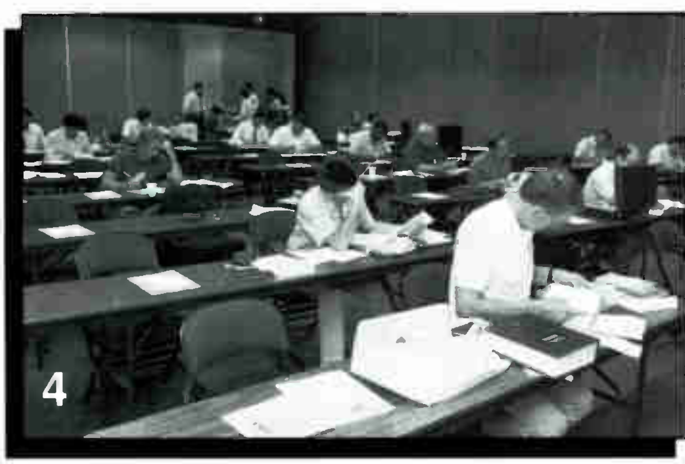
Leech and Roland Hieb of NCTI. The award recognized their efforts to keep CATV installer/techs up-to-date technically and for the NCTI's contributions to the SCTE's Scholarship Committee in which the institute has matched donations to the Technical Scholarship Program with an equivalent in correspondence course training.

Internationals

The interest in cable internationally could be seen even if Cable-Tec Expo '91 attendees took a quick lap around the exhibit floor or a short stroll through Bally's. There they had a very good chance of hearing other expogoers speaking something other than English. This international excitement about CATV was underlined at the International Good Neighbor Reception on Saturday night. Electroline, Lindsay, Nexus and Triple Crown sponsored the event at Bally's to give representatives of the worldwide cable industry a chance to mingle.

In addition, East met West during the expo when 26 cable delegates from the Electronic Industries Association of Japan discussed cable with U.S. SCTE representatives Wendell Woody, Bill Riker, Ralph Haimowitz, Ron Hranac and Steve Ross. Mikio Hojo, leader of the Japanese cable delegation, was impressed with the expo, and felt more Japanese delegates would attend if there were some form of translation provided. He also stated that EIAJ had not yet decided to enter into any formal relationship with the SCTE at this time, but would take it into consideration. The SCTE then discussed the benefits of belonging to the International SCTE Council and offered its assistance to Japan's cable industry.

1) Attendees load up on hot dogs and beer at Wavetek's Arrival Night Reception. 2) AT&T, Comm/Scope, Jerrold, ONI/Regal, Raychem, Scientific-Atlanta and SCTE sponsored the Welcome Reception. 3) The band at the Welcome Reception entertained revelers with a sizzling rendition of "The Love Boat" and other tunes. 4) BCT/E exams tested cable personnel's technical knowledge. 5) SCTE staffers Fran Joullian, Howard Whitman, Anna Riker and Pat Zelenka.



SCTE members then fielded questions from the Japanese delegates on topics including the possibility of competition from direct broadcast satellite (DBS) and telcos, increased bandwidth and performance standards.

Hams

If expogoers were speaking English, then there still was a very good chance they were conversing in ham-speak. Ham-speak? There was plenty of it going on at the SCTE's Third Annual Ham Radio Operators' Reception. Also held at Bally's, it was sponsored by the Scientific-Atlanta Amateur Radio Club.

The CATV industry has a healthy dose of ham enthusiasts and some of them got to meet other amateur radio operators, swap call letters and win door prizes at the reception. Some of the lucky hams were: Ned Mountain (WC4X) of Wegener, who took home the coveted grand prize, a Kenwood 440 HF transceiver donated by Scientific-Atlanta, TCI and ATC; Lectro's Tom Colgrove (WA6QBQ), who won the first prize, a Yaesu FT-470 2m/450 MHz HT donated by NCTI; ATC's Matt Stanek (N0OBE), who received a 10-meter transceiver and mobile antenna donated by ComSonics for second prize; Barry Filippone (N6OGE) of Siskiyou Cablevision won third prize, a Kenwood TH-27A 2m handie talkie; and United Artists' Rey Johnson took home the PK-88 Packet TNC donated by Lectro for fourth prize. In addition, 31 other hams bagged door prizes donated by Lectro, Flight Trac, Jerrold, LRC Electronics, Comm/Scope, Magnavox, Wegener, Denver Ham Radio Outlet, Cadco, American Radio Relay League, Hewlett-Packard, Tektronix, Coaxial International, *73 Magazine*, Wavetek and CaLan.

The parties may be over, but there's always next year. Mark your calendars for June 14-17 for the scheduled Cable-Tec Expo '92 in San Antonio, Texas. — *LH, SB* **CT**

August 1991

BACK TO BASICS

Spotlight on testing

The training and educational supplement to Communications Technology magazine.

Table of Contents

Performance verification of CATV power blocking adapters

This article was written in response to a multitude of inquiries fielded over the years regarding the ability to detect 60 hertz (Hz) source voltage beyond a power blocker under certain conditions. To preface discussion about this apparently anomalous behavior, we will review the function of the power blocker from the component and circuit perspectives. As well, preferred test methods will be detailed, in addition to those that can be implemented when measurement instruments are not readily available.

By Bill McDade
Product Engineer, Gilbert Engineering Co. Inc.

Figure 1

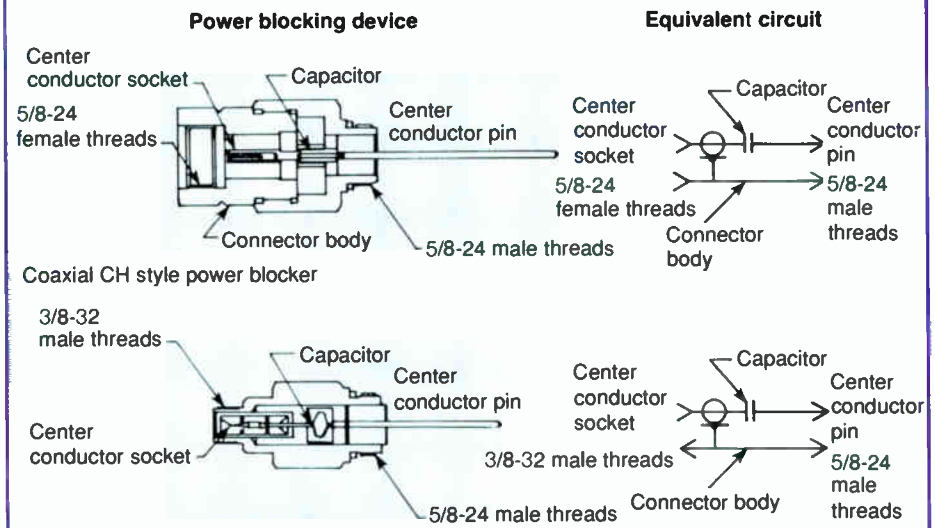
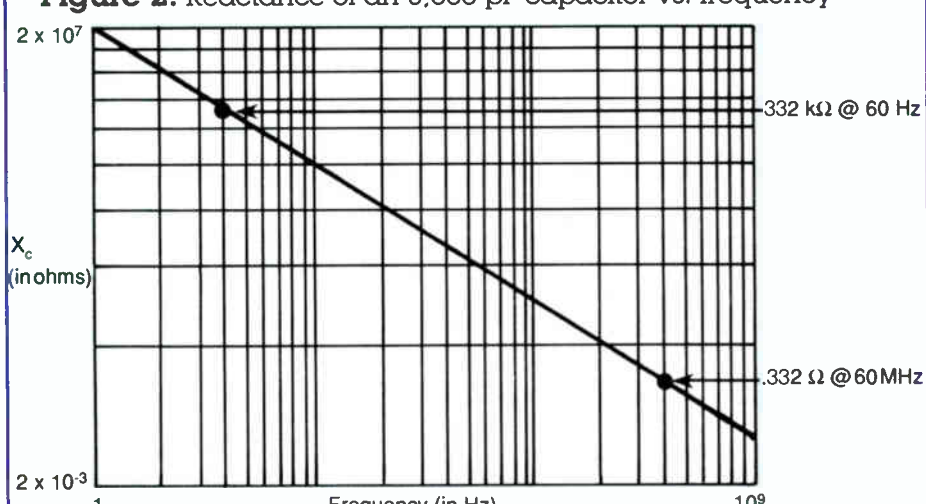


Figure 2: Reactance of an 8,000 pF capacitor vs. frequency



Adapters designed to "block" AC power in CATV plant (commonly referred to as power blockers, DC blockers or simply DCBs) often become a source of anxiety for system or test bench technicians who perform incoming inspection or functional performance testing. Indeed, the device manufacturers are obliged to address return shipments of adapters that are perceived to be faulty, but actually do perform their intended function.

A knowledge of how the power blocker operates and employment of valid performance verification techniques can serve to ensure the protection of expensive equipment and eliminate unnecessary aggravation for the end user and manufacturer alike.

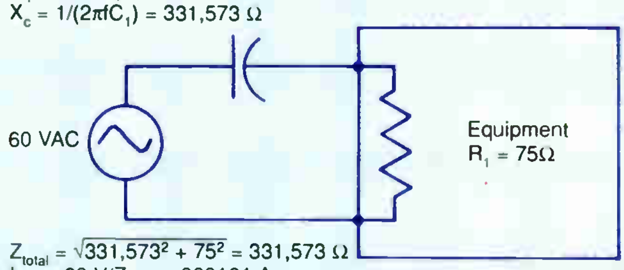
How power blockers operate

Power blocking adapters are employed in numerous areas throughout the CATV plant, as well as on the test bench in situations where passage of RF signal is desired, but not the 60 volt (V), 60 Hz power. The adapter also can be used as a power blocked termination by adding a 75-ohm terminator to the output.

The adapter is a coaxial device that utilizes a capacitor in series connection with other components to comprise its center conductor configuration. (See Figure 1.) The capacitor provides opposition to current flow, somewhat similar to that of a resistor, but which

Figure 3: Operational circuit

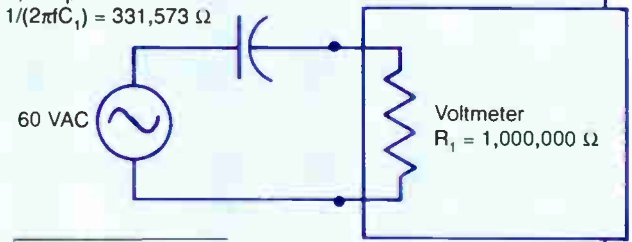
$f = 60$ Hz
$C_1 = 8{,}000$ pF
$X_c = 1/(2\pi f C_1) = 331{,}573\ \Omega$



$Z_{total} = \sqrt{331{,}573^2 + 75^2} = 331{,}573\ \Omega$
$I_{total} = 60\ V/Z_{total} = .000181$ A
$V_{Xc} = I_{total} \times Xc = .000181 \times 331{,}573 = 59.99$ V
$V_{R1} = I_{total} \times R_1 = .000181 \times 75 = .01$ V

Figure 4: Discrepant measurement circuit

$f = 60$ Hz
$C_1 = 8{,}000$ pF
$X_c = 1/(2\pi f C_1) = 331{,}573\ \Omega$



$Z_{total} = \sqrt{331{,}573^2 + 1{,}000{,}000^2} = 1{,}053{,}537\ \Omega$
$I_{total} = 60\ V/Z_{total} = .000057$ A
$V_{Xc} = I_{total} \times Xc = .000057 \times 331{,}573 = 18.88$ V
$V_{R1} = I_{total} \times R_1 = .000057 \times 1{,}000{,}000 = 56.95$ V

varies inversely with the frequency. This opposition is called *capacitive reactance*, and can be calculated according to the equation:

$X_c = 1/(2\pi fC)$

Where:
X_c = Capacitive reactance in ohms
f = Frequency in Hz
C = Capacitance in farads

For a DC current (f = 0), a properly functioning capacitor of any value will appear as an infinite resistance or open circuit. Also, as illustrated in Figure 2, a typical power blocking capacitor with a value of 8,000 picofarads (pF) would appear as a several hundred thousand ohm reactance to a 60 Hz current, while a 60 MHz signal would see a reactance of only a fraction of an ohm.

When placed in a series circuit, the current through the capacitor is inversely proportional to the reactance, hence the circuit current and power are reduced to virtual insignificance. This is why the capacitor passes RF but blocks AC. When used in its intended application the power blocker is, in the truest sense, a power reducer.

Voltage and current in the operational circuit

Figure 3 represents the general case for the operational circuit, showing a capacitor (power blocker) connected in series with a low-impedance, resistive load (equipment). Unlike purely resistive series circuits, in which voltage and current are in phase and the summation of the individual IR drops is equal to the source voltage, the capacitive/resistive series circuit has IR voltage in phase with the current, but the phase of the IX_c drop lags that of the current by 90°. The total circuit impedance must be determined by vector addition, and is therefore equal to the square root of the sums of the squares of the capacitive reactance and the load impedance.

Once the total impedance is determined, the circuit current, IR drop and X_c drop can be calculated similar to that of a series resistive circuit, but unlike series resistive circuits, the source voltage does not equal the sum of the individual voltage drops, rather, the vector sum of the drops.

Finally, power at the load can be calculated as:

Power (in watts) = I^2R

Generally, power beyond the capacitor will be in the neighborhood of a few milliwatts.

The voltmeter, voltage and current in the test circuit

To avoid the sudden need to explore other avenues of employment, most conscientious technicians will endeavor to verify that the adapter is functioning "as advertised," in situ, prior to connecting the active circuit to other plant equipment or test gear. Figure 4 depicts the test circuit that is too often used to determine if the AC power has been effectively blocked by the adapter. The intent is to check for the presence of potential between the center and outer conductors at the output end of the adapter, on the premise that if there is no voltage indicated, then there is no power.

Real concern begins to set in when the meter indicates a voltage where none was expected, and total confusion results when a check of additional blocking devices nets the same indication. Are all of these devices faulty? Probably not. To better understand why voltage can be detected in the discrepant measurement circuit we need to take a closer look at the voltmeter, and its role in the circuit.

Simple voltmeters are just current meters with a resistance in series with the current detection circuit or mechanism. This internal resistance is termed "input impedance" or "sensitivity," and serves to limit current into the meter and augment the measurement circuitry. Older, analog-type voltmeters generally provide an input impedance of approximately 5,000 ohms/volt, whereas modern digital voltmeters are available with input impedances ranging anywhere from 1 megohm to 1 gigohm. High input impedance is a desirable voltmeter feature, for when placed in parallel connection with the test circuit, the meter is able to play the role of the "passive observer" and have minimal effect on the circuit.

Our discrepant test circuit differs from the operational circuit only in that we have substituted our voltmeter in place of the low impedance equipment, but its effect on the circuit parameters is quite dramatic. In our zeal to configure a measurement circuit that we can "get our probes on" we have not only ignored replicating the low impedance load of the operational circuit, but have placed our high impedance voltmeter into position as the only load.

Again, we have a capacitive/resistive series circuit, but now the voltmeter is accorded the lion's share of the voltage drop due to the magnitude of its internal resistance as compared to that of the power blocker's capacitor. In the vernacular of the meter manufacturer, this condition is termed *meter loading error* and is the primary source of all the hate, discontent and confusion surrounding this measurement. →

Attributable to some degree by happenstance, the IR drop across the voltmeter, which also is the voltmeter indication, is often so similar in magnitude to the source voltage that one can easily, but mistakenly, conclude that the power blocker is faulty. For this reason, and the fact that the meter manufacturer did not intend the instrument to be used in such fashion, performance verification of power blocking devices aimed at measuring voltage using the test configuration depicted in Figure 4 should be avoided.

"Meter loading error ... is the primary source of all the hate, discontent and confusion surrounding this measurement."

Practical verification of power blockage

Practical methods for verification of power blockage can be either quantitative or qualitative, and may address measurement of capacitor integrity, voltage across a load, current through the blocker or "go/no go" power indication schemes. The number of ways available to verify power blockage are limited only to one's imagination and ingenuity. Here are some examples:

1) Using a capacitance meter or a "Z" meter, and with the blocker out of the active circuit, connect the meter leads at each end of the blocker's center conductor. Expect to see a reading between 1,000-15,000 pF. Should the capacitance value fall outside this range, contact the power blocker's manufacturer for more specific information regarding its specifications. Also, the meter's operating instructions should explain what type of meter indication can be expected in the event of an actual open or short circuit condition.

2) If you have a VOM (volt-ohmmeter) or DMM (digital multimeter) available, you can check for a short circuit condition as follows: Set the meter to the highest ohm range available (unless, of course, your meter is autoranging). With the blocker out of the active circuit, connect a meter lead at each end of the blocker's center conductor. A low resistance or short circuit condition indicates a faulty device. Expect to see a high megohm, infinite resistance or even an open circuit indication for a properly constructed power blocker. (Note that an open circuit indication may be masking a truly open circuit condition existing in the device center conductor configuration, which may attenuate or otherwise inhibit RF signal transmission through the adapter. Also check to make sure the center conductor configuration is not shorted to the outer conductor.)

3) If your meter is capable, configure the circuit depicted in Figure 4 and measure AC current. Current measured through a properly functioning power blocker probably won't exceed a few hundred microamps. Be careful to avoid damaging the adapter's center conductor contacts with the meter's probe. Also, be sure to consult your meter manual concerning your meter's overcurrent protection and the manufacturer's recommended precautions in the event that the blocker is faulty.

4) Attach a 75-ohm (or any low value) resistor between the center conductor and outer conductor at the blocker's output, and measure voltage across the resistor. The meter should indicate low millivolts for a properly functioning blocker. Be cautious when attaching the resistor to a powered circuit. Unblocked power will burn up the resistor and fingers in a New York minute!

5) Using caution, as explained previously, terminate the power blocker output using a common 75-ohm, F male terminator, or connect a 75-ohm resistor from center to outer conductor. If the blocker is operating properly, the terminator or resistor will remain cool. If the power is not blocked, the resistor will quickly heat up and burn out.

6) Fashion a test lamp yourself by attaching test leads to the plug tines or contacts of any 120 V, incandescent-type "night light" or common household light bulb. The power blocked circuit can then be checked by touching the blocker's center conductor with one lead and the outer conductor with the other. Any power of significance will be more than enough to make the lamp glow.

7) This space reserved for you to make up your own test.

Summary

Don't let all the overly technical mumbo jumbo give you the impression that all power blockers are flawlessly manufactured devices that will operate for 10 gigayears without a hitch. By the same token, performance verification of CATV power blocking adapters does not require a degree in electronics. A basic familiarity of the operational circuit, test circuit, and proper meter usage is all that is needed to ensure successful power blocker evaluation. Additionally, manufacturers are generally happy to provide technical assistance if needed. **CT**

Testing batteries

(Continued from page 67)

charge so it is unnecessary to disconnect them.

This particular tester has three LED indicators that illuminate according to the threshold voltage the battery drops to while under load. If the battery holds to between 10.5 and 12 volts, the green LED identifies it as "good." If the voltage drops to between 9.6 and 10.5 volts, the yellow LED identifies it as "weak." Below 9.6 volts the red LED shows "bad." There are also pin jacks for the attachment of a voltmeter.

A "weak" battery should in most cases be removed from service, recharged, and tested for reserve capacity as described in Part 1 of this article. If a battery drops below 9.6 volts as indicated by the red LED, it is generally considered beyond recovery and should be properly disposed of.

Since batteries deteriorate gradually, regular testing with this type of battery tester in conjunction with a voltmeter enables you to log changes as they occur. Having this history lets you know when to do preventive maintenance — before a critical battery fails. Typically a very good battery will drop to between 11 and 12 volts during the test. The voltage level to be on the lookout for is 10.5 volts. If you find that a certain battery has dropped below 11 volts and is approaching 10.5 volts, you may consider replacing it as a safeguard against an untimely failure.

Remember, the guy who fell victim to a battery explosion never thought it would happen to him so *always* wear protective clothing and a face shield when working with batteries. **CT**

Readers with questions or wishing to discuss the contents of this article are invited to call the author at (404) 475-3192 or write to P.O. Box 947, Roswell, Ga. 30077.

The importance of testing batteries, Part 2

The first installment of this article (July 1991, "Back to Basics/Communications Technology") explained the importance of testing 12 volt lead acid batteries by using a device that determines their reserve capacity. Although such a test is probably the most conclusive of all, its implementation is inconvenient and time-consuming and usually has to be done on the bench. Briefly, it involves subjecting the battery to a 25 ampere load, and timing how long it takes for the battery voltage to drop to 10.5 volts. The test establishes the ampere-hour (AH) capacity of the battery, which is a measure of its remaining useful life. This installment of the article will deal with field testing using a battery load tester.

Battery load tester.

By Jud Williams
Owner, Performance Technological Products

Since we deal with batteries in the field, and must make a quick determination of their merit, another approach to testing them (other than on the bench) must be considered. We know that this type of battery is capable of delivering extraordinary amounts of current momentarily. As an example, they are tested at the factory at 1,000 amperes for a second or two to determine the integrity of the internal welds. Thus, we may rightfully assume that load testing them in the field would be a valid means of identifying defective batteries.

Several defects occur in batteries while in service. Many of the problems are related to the method by which they are charged and maintained. As we have pointed out before, high temperature is certainly one of the major causes of premature failure, due in most part from accelerated grid corrosion. Batteries also fail from shorted plates, sulfating, low electrolyte, sedimentation and age.

After a battery has been charging for some time, its level will reflect the output potential of the particular charger in use. When two or more batteries are in series there may be a very distinct voltage difference between the batteries, and although the voltage across the bank of batteries has reached the maximum output of the charger, they may vary as much as a volt or more one from the other. In other words, the charge is not evenly distributed to each battery when charged in series. One of the batteries will measure fully charged while another may appear to be under-charged. This may be due to differences in the internal resistance of the batteries. The question is how to determine which batteries are good and which are bad.

A load tester, when used properly, is capable of determining the relative condition of a battery. One type of tester specifically designed for the problems encountered in cable TV is the Performance Model 1200 shown in the accompanying picture. It draws between 70 and 80 amperes from a battery under test for 10 seconds. Experience has shown that a good battery will drop between 1 and 2 volts during the 10 seconds, even if it is not fully charged, often due to the problem of unequal charging as mentioned previously. By the way, the load test may be made while batteries are under

(Continued on page 66)

DBS technologies

(Continued from page 19)

revenues. The DBS signal is available to every U.S. TV household that has a clear line-of-sight to the satellite. "Hook-up" cost is simply the cost of the home satellite terminal and installation.

As described later, several technological developments important to true high-power DBS recently accelerated deployment of the first systems, currently planned to come on-line in 1994.

Although the "technology explosion" that occurred in 1990 primarily involved digital technology[1], an understanding of direct broadcast requires a review of the basic RF channel that has been established by ITU and Federal Communications Commisssion regulation[2]. The FCC has identified four orbit slots, 61.5°W, 101°W, 110°W and 119°W, as available for broadcasting to the contiguous United States at the 12.2-12.7 GHz downlink band. The minimum longitudinal spacing for U.S. DBS systems is therefore 9° in contrast to the 2° spacing established for fixed satellite service (FSS) systems using C-band (3.7 - 4.2 GHz) or Ku-band (11.7 - 12.2 GHz). This regulatory distinction makes 1-foot dishes practical. The antenna beam sidelobes of typical 1-foot ground antennas at 12 GHz can discriminate between satellites 9° apart. For 2° satellite separation discrimination requires dishes more than 3 feet in diameter. Figure 1 gives typical data on antenna discrimination.

At each DBS orbital location 32 24 MHz RF channels are available as shown in Figure 2. A lengthy licensing process has established a number of companies as potential licensees for these channels. Figure 3 illustrates the excellent visibility provided by the 101°W slot and the elevation angles for subscriber ground antennas. Higher elevation angles are more desirable since propagation degradations are reduced and the likelihood of having a clear line-of-sight to the satellite is enhanced.

The bands dedicated to DBS, downlink of 12.2-12.7 and uplink of 17.3-17.8 GHz, experience propagation degradations compared to C-band — primarily signal attenuation due to rain and the attendant receiver noise increase. Fortunately, more than 20 years of theoretical research and measurement programs have established excellent propagation models for microwave satellite links[3]. For the downlink a target availability of 99.7 percent on an annual basis is assumed within the ITU plan; service operators can, of course, establish a more stringent requirement. Since rainfall is quite uneven across the nation, a goal of equivalent service across the nation requires different "rain margins" for different climatic zones. Figure 4 illustrates how the

Table 1: Progress in home entertainment digital TV

Product announcements
- General Instrument, DigiCipher
- Sky Pix Corp., Sky Pix
- Scientific-Atlanta Inc.

Algorithm standards (in progress)
- MPEG-II

HDTV digital standards (proposed)
- DigiCipher (General Instrument)
- Spectrum-Compatible HDTV (Zenith & ATT)
- Advanced Digital HDTV (Advanced TV Research Consortium)
- American Television Alliance (General Instrument & MIT)

SIGNAL LEAKAGE INSTRUMENT CALIBRATION

VS.

CLI

Many variables affect the accuracy of a signal leakage program. Some variables, such as leak polarization angle, distance correction and antenna pattern disruption, are difficult to control. Other aspects are more measurable and controllable. Instrument calibration is one of the more measurable variables and should be part of your leakage program.

Two classifications of instruments are used to comply with signal leakage regulations. Monitoring instruments include the products that only alarm in the presence of leakage fields. Absolute measurement instruments allow the operator to obtain an accurate measurement of the leak for use in computation of CLI figures. Both types of equipment need regular inspection to verify their conformance to stated specifications.

Inaccuracy in these instruments may have a dramatic effect on the system CLI figure. Inaccuracies in leakage measurements will directly translate into inaccuracies in CLI values. For example, if all measurements used in the calculation of the CLI were low by 3 dB, the CLI figure also would be lower than actual by 3. This could mean the difference between a favorable inspection or a disastrous one.

Trilithic's DLC-600 calibrator for signal leakage instruments allows fast, easy calibration of most makes of signal leakage equipment. Reference signals are available at any CATV frequency and at levels up to 1000 uV or dipole equivalent levels up to 1000 uV/m. When you demand high performance from your system, demand high performance from your equipment - and measure it!

TRILITHIC

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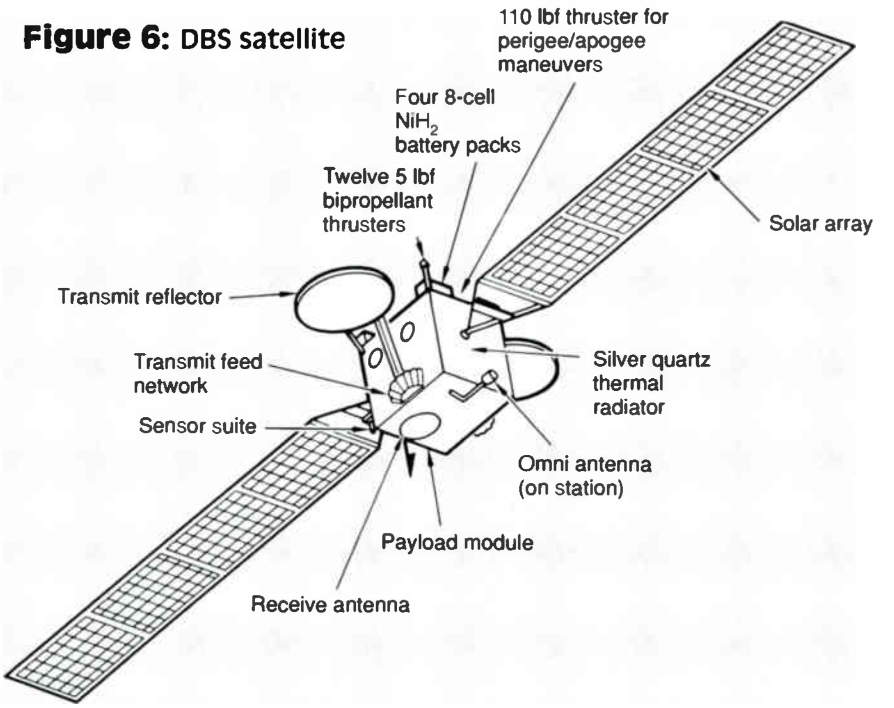
FAX: (317) 895-3613

Reader Service Number 32

Figure 6: DBS satellite



downlink margin should vary in the zones identified by the ITU. In the arid West the link margin can be 2.5 dB less than the nominal value set for the Midwest. The Gulf states require about 3 dB greater margin than that that is needed in the Midwest. Satellite beam designers vary the satellite's transmit power level across the United States in order to ameliorate these differences.

Although the ITU plan for DBS assumed the use of conventional FM modulation, studies at Hughes and other firms have determined that digital transmission is compatible with the plan and can provide numerous advantages. Digital techniques can dramatically increase the number of TV channels per RF channel. On a typical DBS link FM provides only one TV channel per RF channel. Digital technology also can be used to decrease the dish size requirement for a given TV channel capacity. Digital is inherently more flexible in providing a variety of video, audio or data services over a single channel. Figure 5 illustrates that the source and channel coding elements of digital systems add substantial functional complexity with respect to analog FM. Recently, advances in large scale integrated circuits permit a relatively modest growth in the receiver parts cost (after a large non-recurring investment) to implement an enormous increase in functionality.

Key space technology, which matured in the late '80s, included the large body-stabilized high-power satellite bus such as the Hughes HS-601 illustrated in Figure 6. This spacecraft measures approximately 90 feet wing tip to wing tip and generates over 4

Figure 7: DBS digital integrated receiver/decoder

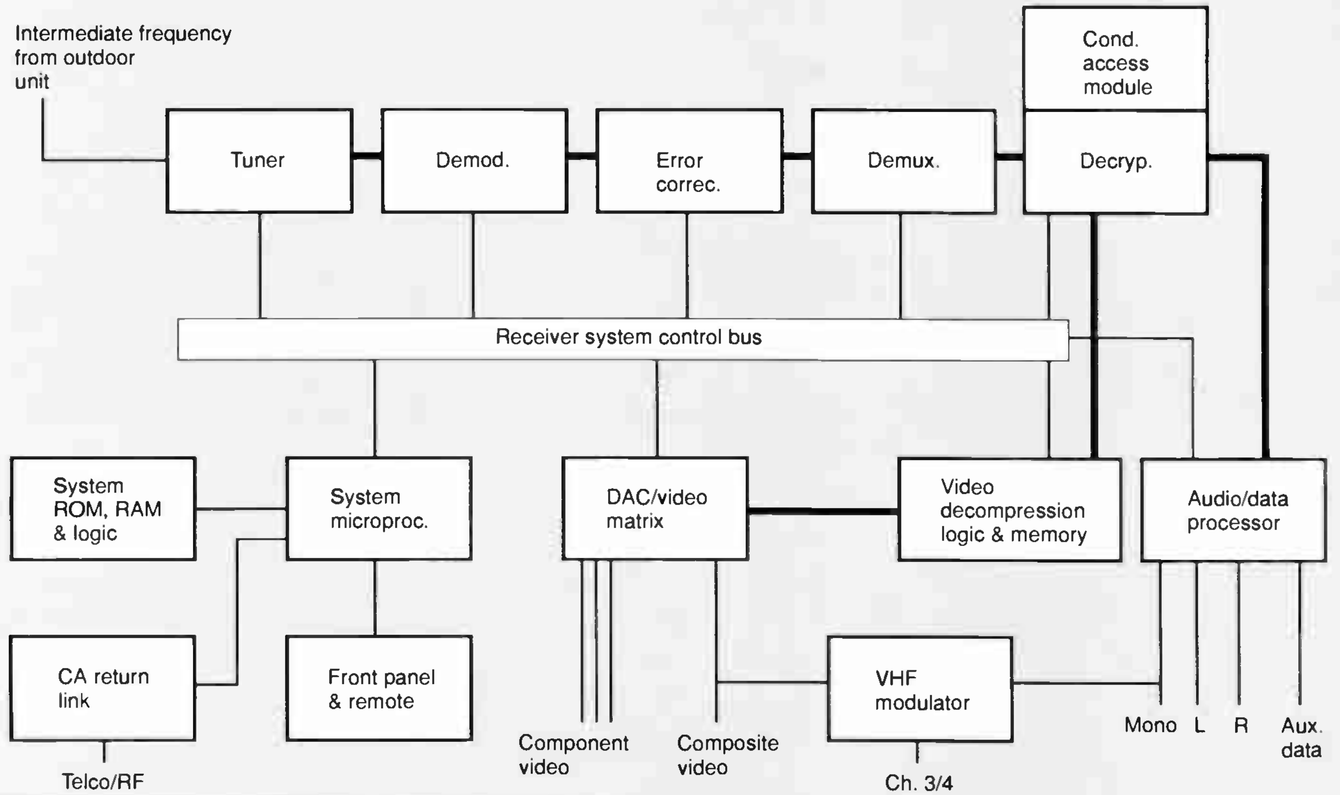
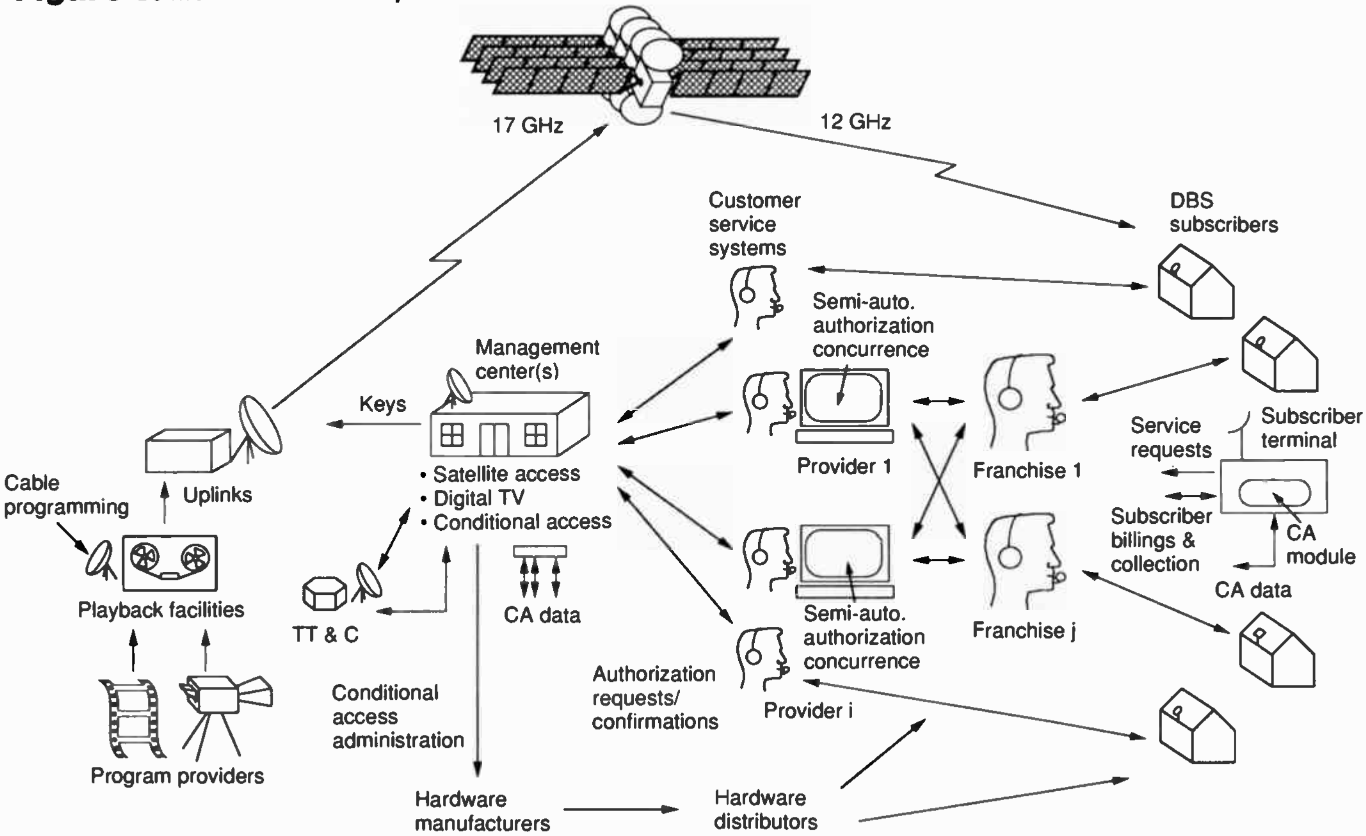


Figure 8: Illustrative DBS system



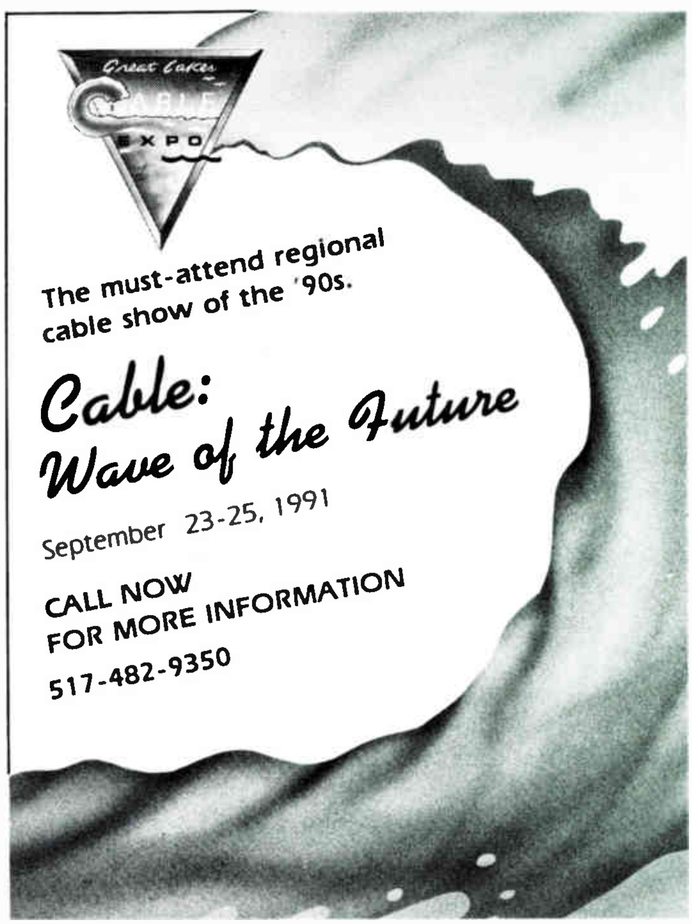


Table 2: Technical parameters for illustrative system

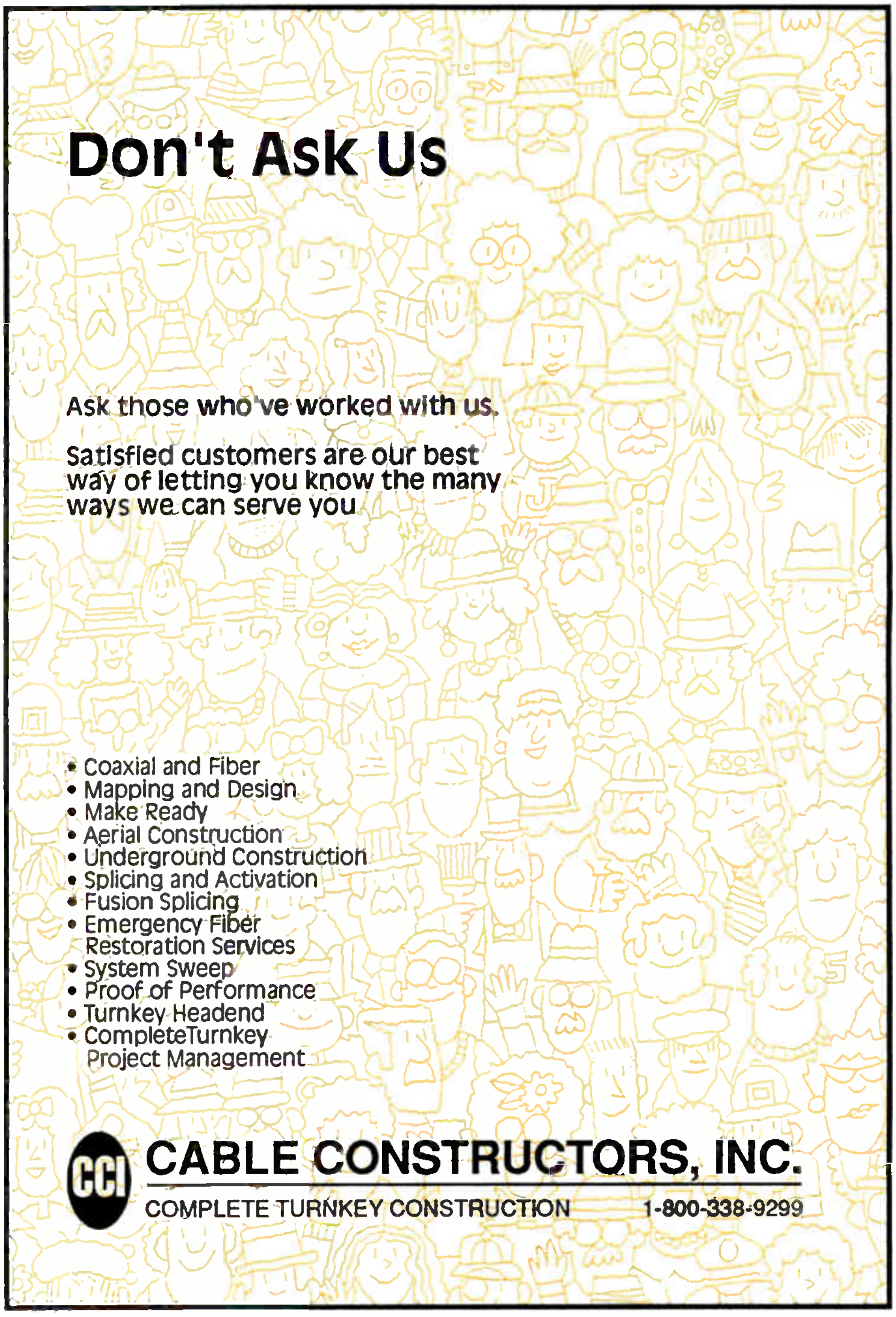
Satellite
- Downlink: 12.2-12.7 GHz, uplink: 17.3-17.8 GHz
- Transponder center spacing: 29.16 MHz
- Polarization: Circular
- EIRP over CONUS: 51-54 dBw

Ground terminal
- Typical G/T: 13 db/K
- Typical system temp.: 125°K

Modulation/FEC
- QPSK with 20 megasymbols per second
- Forward error control: Convolutional and/or Reed Solomon
- Information rate: >20 Mbps

Compression
- 4 video per transponder for "live" sources
- 8 video per transponder for "film" sources
- Stereo audio at 256 kbps per signal pair

Conditional access
- Bit-by-bit digital encryption
- Separate access control for each TV data stream
- "Free," subscription or IPPV service modes

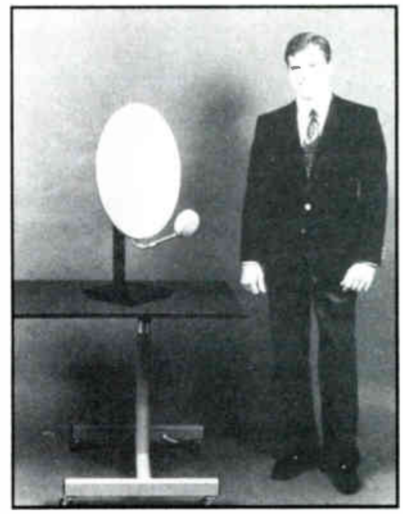


kW of prime power. The reliable transmitting tubes necessary for DBS at power levels of 120 to 240 watts also are now available from multiple vendors. These tubes are N-cathode traveling wave tubes with a direct heritage to the 50-60 W tubes used on conventional FSS satellites.

In ground processing technology the most significant advance is in digital video data compression. Digital video development in the late-1980s concentrated on compression of broadcast *feed* quality TV to a rate of 45 Mbps or the compression of teleconferencing TV to rates below 1 Mbps. In 1990 it was demonstrated that data rates below 10 Mbps could be used to encode home entertainment quality NTSC and rates below 20 Mbps could provide excellent HDTV. Table 1 summarizes some of these recent developments. The three products listed have been demonstrated at cable industry meetings and discussed in this journal[1]. The DigiCipher product is being described by General Instrument as a solution for all three primary transmission channels: broadcast, cable and satellite. The company's documentation of the HDTV offering indicates that intra-frame compression is achieved by use of the discrete cosine transform[4]. The inter-frame compression portion of the algorithm detects, at the encoder, the direction of motion of picture detail; these motion vectors are sent to the decoder where "motion compensation" occurs. A similar algorithm is employed by the Motion Picture Experts Group (MPEG) of the ISO[5]. The MPEG standards effort involves standardization of the compression algorithm only, not a complete processing system. A firm has recently announced implementation of the first very large scale integration (VLSI) of this algorithm[6]. The announcement indicated that excellent quality is achieved when the algorithm is run at 6 Mbps. Four of five proposed systems for the HDTV terrestrial broadcast standard now are all-digital and are believed to utilize compression technology that is suitable for DBS[7].

Other key advances have occurred in forward error control, where large scale integration (LSI) is available for convolutional and block decoding at speeds in excess of 20 Mbps, and in conditional access. Conditional access, in which a customer's access to particular programming is permitted only when certain conditions are met (e.g.,

Figure 9: Typical 18-inch dish



pre-authorized credit) has seen progress in new architectures and new technology. For example the use of a "smart card" as a separable security device permits the system to be easily updated to counter pirate attacks.

Figure 7 illustrates the use of these technologies in an integrated receiver/decoder (IRD) for home use. Production volume will drive the cost of this high-tech unit to consumer price levels during the early '90s.

Illustrative architecture

Figure 8 illustrates a digital DBS system capable of delivering over 128 NTSC channels (four per RF channel) or at least 32 HDTV signals (one per RF channel) with the same quality planned for terrestrial broadcasting. Each signal type can be controlled by a variety of methods including subscription and IPPV. The figure illustrates the uplinking and system control facilities on the left and the consumer service facilities on the right. The service can be provided via a network of franchises and service providers, as in current C-band industry, or it can be provided directly by the DBS system provider. Table 2 lists major technical parameters for the illustrative system.

The 100+ video channels can be received using a small dish like that shown in Figure 9. Figure 10 demonstrates the variety of installations made possible by a dish size below 2 feet. Figure 11 illustrates the convenience of the system's armchair IPPV. The remote control permits selection of the viewer's choice from the on-screen menu. Purchases can be immediate given that the viewer has not exceeded the credit level previously authorized and stored within the IRD.

Conclusions

Technology is now available to develop an all-digital DBS system in the early '90s. The first system, planned by Hughes Communications for 101°W, will be capable of delivering more than 100 channels nationwide beginning in 1994. With subscriber terminals less than 2 feet in diameter, the system will become an important part of the nation's home entertainment TV delivery infrastructure. **CT**

References

[1] *Communications Technology*, May 1991.

[2] *Radio Regulations, Appendix 30*, General Secretariat, International Telecommunications Union, Revised 1988.

[3] *Radiowave Propagation in Satellite Communications*, L.J. Ippolito Jr., Van Nostrand, 1986, pp. 90-91.

[4] "DigiCipher HDTV Systems," General Instrument Corp., June 8, 1990.

[5] "Report of the 13th WG11 Meeting (Berlin)," ISO/IEC JTC1/SC2/WG11, MPEG90/349, December 1990.

[6] "C-Cube Microsystems Demonstrates World's First MPEG Decoder," press release, San Jose, Calif., March 18, 1991.

[7] "The Challenges of Digital HDTV," R.K. Jurgen, *IEEE Spectrum*, April 1991, pp. 28-30, 71-73.

Figure 10: Typical installations

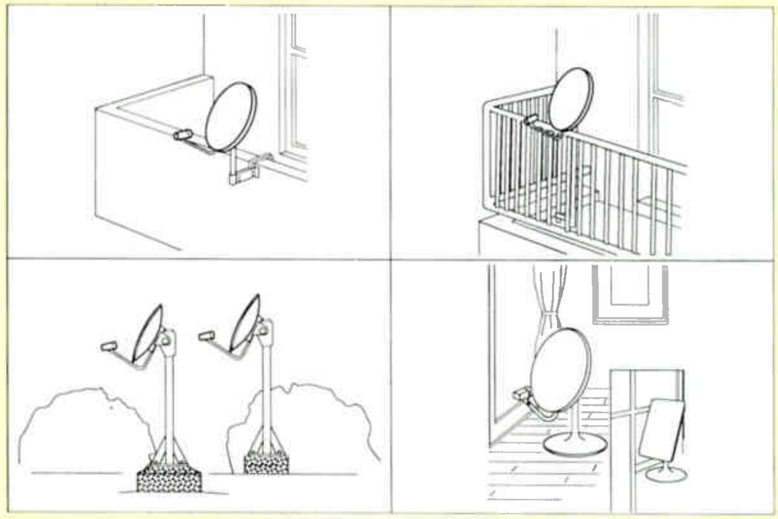
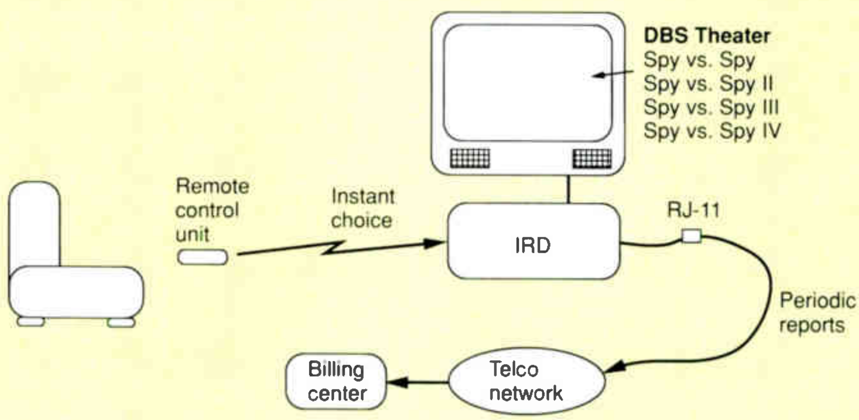


Figure 11: Armchair impulse pay-per-view



Wireless competes

(Continued from page 23)

frequency allocation for educational programming available to educational institutions, hospitals and religious organizations.

In the late-1980s three channels located in the H group (2,650-2,680 MHz) were allocated for operational fixed services (OFS). The intended use for this band was for data communications, but it was not restricted from video delivery. Hence, the OFS became another source for video.

With eight reallocated channels, three OFS channels, special leasing arrangements with ITFS license holders for excess channel space and two MDS frequencies, the new WC market formed. The service became capable of offering 33 channels in the top 50 markets, which have two 6 MHz MDS channels, and can offer 32 channels in all other markets.

A large obstacle faced by prospective WC operators is assembling channels for a system. This requires applying for frequency licenses and/or forming lease agreements with other frequency license holders. In the case of leasing channels from an educational institution, the operator must make arrangements to channel map — provide continued channel service when those frequencies are used for educational purposes. Educational institutions holding ITFS licenses are obligated to use the channels a minimum of 12 hours a week for the first two years, and then 20 hours a week thereafter. WC operators do not have to acquire a franchise although this has been challenged in at least one area.

How wireless cable operates

WC receives most of its programs via satellite and rebroadcasts them over-the-air on microwave frequencies to its subscribers (see Figure 1). A typical transmitter emits one of the channels in the MMDS, MDS, ITFS or OFS groups. Transmitters are made with various wattage outputs, depending on planned coverage, with a maximum of 100 watts visual power.

Effective isotropic radiated power (EIRP) is defined in the direction of strongest antenna radiation in-line with the beam axis. If the antenna radiates power equally in all directions and the total power radiated was 100 watts, then the EIRP, seen at any receiver site, would be 100 watts. However, WC antennas have shaped beams that "bunch" the power in favored directions and increase the power received in the strongest direction by the "bunching" or gain of the antenna. For example, an antenna rated at 20 dBi gain at its peak, increases normal power density at a receiving site in that direction by a factor of 100. Therefore, the EIRP in the strongest direction is 100 watts x 100 = 10,000 watts EIRP. The receiving site, in-line with the beam, "thinks" the antenna is throwing its power equally in all directions and that the total power radiated is 10,000 watts.

The radius by which a receive site may be separated from the transmitting station is proportional to the EIRP of the transmitter/antenna combination. Specifically, it is proportional to the square root of the EIRP. Thus, if the EIRP is suddenly reduced by 50 percent, the maximum receiving distance reduces to 70 percent of the original radius. For the WC operator, maximizing EIRP means reaching the greatest number of potential subscribers. If the system experiences a 50 percent reduction in EIRP, its coverage circle (with a radius reduced to 70 percent) is only half the former areas — and hence, has lost 50 percent of its original potential subscribers. Therefore, it is important that the installation's transmission line system, which connects transmitters to the antenna, dissipates as little of the microwave power as possible. The transmission line system consists, essentially, of the special filter networks that combine transmitters to the tower transmission line and the transmission line itself.

The transmission line is a critical system component whose selection affects coverage and capital equipment cost. Available antennas have relatively high efficiencies with no prospect soon for substantial improvement. Coverage can be optimized only by selecting the type or model that best fits the potential subscriber area. The key parameter of the transmission line is its power dissipation, which reduces the power available to the antenna. Given a mandated coverage, transmission line attenuation is a factor in determining the required transmitter output power. And an increased transmitter power output requirement is a significant cost factor.

Waveguide transmission line is most frequently used because of its lower attenuation in tower runs, which

"A transmitter malfunction removes a single channel from the broadcast menu. If the (transmitting) antenna malfunctions, the entire installation is out."

may be 500 feet or more. The most frequently used type is a flexible, copper, elliptical waveguide EW-20, which has an attenuation of approximately 0.49 dB/100 feet. A 600-foot run of this waveguide would have an attenuation of approximately 3 dB and reduce the transmitter power to only 50 percent of the value leaving the transmitter. To minimize line losses, the actual transmitter room is often located on the top floor of a tall building. Coaxial lines have much more loss than waveguide, but for very short runs it is often used because of its lower cost. Rigid 7/8-inch coaxial line is frequently used for very short runs. This line consists of a copper tube (outer conductor), inner copper rod (center conductor) and air or low-loss foam dielectric.

For an installation broadcasting more than one channel, and hence using multiple channel transmitters (see accompanying photograph), special filters called channel combiners are used to combine the outputs of the channel transmitters to the tower transmission line for transport to the common broadcast antenna (Figure 2). The various brands and schemes of combining filters can be arranged to combine any number of channels from two to 16. The limitation to 16 channels is due to the fact that most current filter techniques cannot combine channels adjacent to one another at low-loss and there are only 32 channels available to WC.

Figure 2: WC broadcast antenna

The important characteristics of wireless broadcast antennas are radiation patterns (to fit the shape of the potential subscriber area) bandwidth (to receive multiple or random channels with high efficiency) power capacity (to withstand the combined power of several channels) and polarization (vertical or horizontal). Antennas with a variety of radiation patterns are available to fit almost any coverage shape.

A broadcast station located in the center of its coverage area would have a horizontally omnidirectional radiation pattern (Figure 3), radiating equally in all azimuth directions. But it would have a very sharp elevation pattern, reducing its radiation sharply above and below the horizon so as not to waste power radiating into the sky and into the ground. The deflection of the beam tip (below horizontal) can be controlled to further concentrate power on subscribers within the exact target area.

Sometimes a suitable tower site is available only on the edge of the desired coverage area. In this case the antenna can be designed with a "lopsided" azimuth distribution to concentrate the power only within the desired area and to minimize radiation in other directions (see Figures 4 and 5).

Many WC broadcast antennas are broadband and can accommodate any channel in the 2,500-2,686 MHz band. They are available with either vertical or horizontal polarization. Omnidirectional antennas (equal radiation in all directions) must be mounted as the highest element on the tower (except for safety lights) to prevent blockage, while antennas of less than 360° coverage may be mounted to the side of the tower or building.

The transmitting antenna can handle up to five full-power (100 watt) channels or a greater number of lower wattage channels. A popular design is tubular and its surface populated with discreet

Figure 3: Horizontal plane radiation pattern for omnidirectional coverage

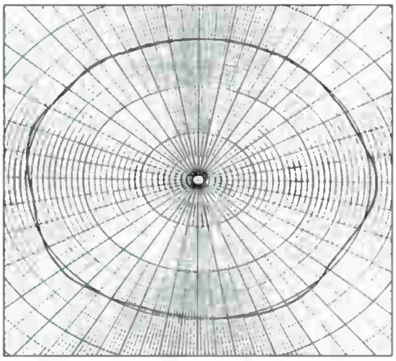


Figure 4: Horizontal plane radiation pattern for hemisphere coverage

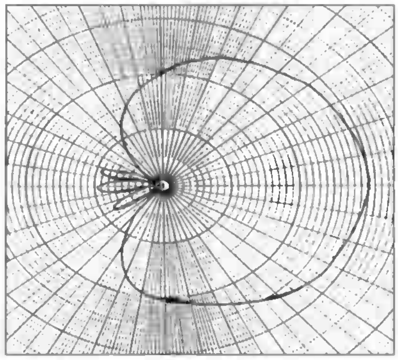
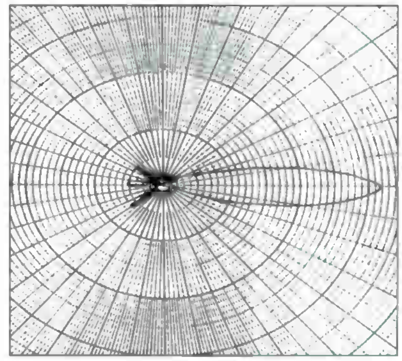


Figure 5: Vertical plane radiation pattern for hemisphere coverage



radiating elements, forming antenna arrays. Elements can be phased to give the various azimuth distributions and beam tilts below horizontal. Increasing gain is realized by stacking an increasing number of "bays" or shorter tubes.

Antennas are available with gains of about 8 to 22 dBi, and with downward tilt angles (for the main beam) to optimize targeting to the coverage area. Antennas with a number of horizontal plane radiation patterns are available. These include those with uniform 360° coverage for centrally located broadcast facilities as well as special power azimuthal distributions to fit situations where the broadcast facility is at the edge of its coverage area or where subscribers are concentrated in two separate areas.

A transmitter malfunction removes a single channel from the broadcast menu. If the antenna malfunctions, the entire installation is out. Therefore, design and construction must concentrate on high reliability and long life. To achieve the necessary ruggedness, each radiating element must be stable during wide temperature swings and sealed against moisture. The all-metal cylinder containing the radiating elements must have a mounting provision to ensure mechanical rigidity against high winds and the entire antenna is usually encased in a tough plastic radome to prevent the accumulation of foreign matter near the radiating elements.

At the subscribers' end

The receiving site antenna (Figure 6) is equipped with a block downconverter, which converts the microwave channels to regular VHF TV channels. The output of the block downconverter is fed into the internal cable system of the building, which may be a private home, an apartment house, hospital, school or campus building. Most subscriber or institutional TV sets are equipped with a channel converter to facilitate adding local off-air TV programming to the receiving network. The converters are similar or identical to those used by CATV systems for their subscribers. In the case of WC, the converter also incorporates a device for decoding or descrambling the signal.

The receive antenna is used in large quantities by WC operators and must be relatively inexpensive. Nevertheless, it must have high mechanical reliability to minimize service calls. Since its function is critical to reception quality and in establishing the maximum operating radius from the system (and therefore maximizing potential audience), it must have good electrical performance as well. Most receiving antennas are parabolic dishes with the surface of the dish formed by a series of parallel metal rods. This construction minimizes wind loading and ice buildup. The feed is usually a dipole with reflector connected directly to the block downconverter to minimize cable loss at the microwave receive frequency.

Antennas are available with gains from about 12 to 27 dBi. The greater the gain, the farther the subscriber can be located from the broadcast tower and still receive clear pictures. Gain is proportional to the capture area of the antenna, which is determined by the physical area. The 27 dBi antenna captures about 32 times as much signal as does the 12 dBi antenna and can therefore be about 5.5 times (square root of 332) the distance from the broadcast station and experience the same reception quality.

Figure 6: Subscriber receive antenna

The antenna is mounted to a mounting mast through a swivel that allows it to be rotated for either polarization — horizontal or vertical — to match the transmitted polarization. Where the broadcast facility radiates some channels on vertical and some on horizontal polarization, the receiving antenna may be rotated 45° to receive all channels. Where the broadcast facility maintains two separate towers, some distance apart, two receive antennas are required (one pointed at each tower).

The block downconverter amplifies and changes the microwave signals to VHF channels, in the midband, superband or hyperband so as not to conflict with off-air channels (2-13), which the subscriber may be receiving on a regular TV antenna. Models are available for targeting WC channels to any of these three bands, as well as special dual models where more than one WC receiving antenna is used. The operation of the block downconverter is critical to receiving quality and system range. Its gain, noise figure and other characteristics, together with other system characteristics, establish the noise floor, which determines the minimum useful received signal. Since they must be mounted as close to the antenna as possible to minimize microwave cable loss, they are weatherized.

The set-top converter is similar or identical to those used by CATV subscribers. It allows subscribers to continue to receive any off-air TV channels they have been receiving plus the additional wireless downconverted channels. **CT**

Technical training

(Continued from page 26)

feeder for the foreseeable future, and compression mainly affecting the way the signal is handled at the headend, Babcock says we need to focus on chief techs and trunk and feeder techs.

"In five years we're still going to be faced with some of the same issues with running a piece of wire into a customer's home," notes Babcock. "Those issues won't change much in the next five years. We do need to be sure our senior technical people have a better background in electronics, and stay up-to-date with the progressing technology. While installers and service techs will be working in a very similar environment in five years to the one they're accustomed to today, if they're not careful they will fall behind, too. Because in five years, it will be a much bigger jump to go from service tech to maintenance tech. In five years that will be a quantum jump forward compared to today where it is more a matter of experience over several months."

Pam Nobles, senior staff engineer/technical training for Jones Intercable, says that while technology is moving forward rapidly, "we're trying hard to make everybody aware before it becomes a problem." She says she believes we're doing a good job of keeping up, but can't afford to slow down any.

"We're trying to make material available on advanced technologies to as many of our people as we can," says Nobles. "As an example, at our International Manager's Meeting this month (August), we'll have experts in various advanced technical areas making presentations to the managers — this includes general managers and marketing managers in addition to system engineers."

Both Babcock and Nobles point to our experience to this point with fiber-optics training as being indicative of how we'll probably continue to handle further training in advanced areas of technology. "My guess is with other new technologies we won't launch them in all systems at the same time but use them on a case-by-case basis, which will allow us to get the training support implemented as we go like we did with fiber," says Nobles.

Babcock says that Warner often does its fiber training in a sort of crash course approach just before a system implements a fiber project. As an example, he said the company recently did an extensive fiber training program in one of its systems. It consisted of a series of sessions over the course of a week and included everything from the basics of fiber to restoration techniques. "The training literally occurred the day before fiber went on the poles in that system."

In addition, Babcock and Nobles say the industry needs to work to deepen the technical resource it has in its work force. "I see an increasing need for a more rounded background among technical workers, particularly in optics and digital," says Nobles. "Not so much in basic electronics — the need for that is already there. We're already to the point where techs will get to a stage that they'll have to go back and learn basic electronics, if they haven't already, to continue to advance in their careers."

Tips for training

Worrying about new technologies may seem like a lofty concern if, like most in the industry, you are struggling to provide a good base of training to

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your employees in today's technology. Given the industry's habit of running lean, that's understandable. But it reinforces the importance of making sure that you are getting everything possible out of your current training program and that in any way possible, you make your training sensitive to the future needs of your system. Here are some tips for accomplishing those objectives:

1) *Train smart.* Installation, troubleshooting, customer relations, policies, procedures, work records, electronics, safety, Occupational Safety and Health Association compliance ... the list of training topics is never ending. The key to providing good training over a broad scope of topics is to train smart. This means using all the training options available to you and not reinventing the wheel. Most cable training programs are an amalgamation of training from many sources. That's good. There are a lot of good sources of information out there and you should use the ones that fit your situation best.

Some of the hot buzzwords in the training and education field right now are "distance learning." For all practical purposes, this means bringing the school to the student rather than making the student go to the school. While it is seldom acknowledged, cable TV has been a pioneer in distance learning. That's what the Mind Extension Institute is built on. It also has been the cornerstone of NCTI's self-study training programs since 1968. Distance learning is the beauty of most of the Society of Cable Television Engineer's training resources, from chapter meetings to the extensive videotape library.

The cable industry has long known that it is too expensive and time-inefficient to send employees to school when you can bring the school to the employees. On the other hand, one lesson that cable systems struggle with is not reinventing the wheel. If you've got a good first-day installer training program in place, but don't have a program to provide continuing training to line techs, why start writing a curriculum for line techs if there are excellent programs already available? If you're good at safety training but don't have anything available on fiber optics, find a fiber program that's already in place and available to you. Look at what's out there and use everything you can.

"We happen to have one of the best technical societies (SCTE) in any communications industry. If you're not making use of its educational opportunities ... start today."

2) *Look ahead.* On Monday morning when a class of six new installer recruits reports for duty, the last thing on your mind is that five years from now your system may be transporting 200 channels via the miracle of fiber optics and digital compression. But the fact of the matter is that's probably what's going to happen. And, in five years, one of those new-hire installers waiting in the lobby this morning will probably have worked his way up to a fairly senior technical position and be responsible for a part of the plant that uses the new technologies.

It's not too soon to begin grooming your installers for cable's future, and that future is going to require more well-rounded technicians with deeper backgrounds. Create that awareness in your trainees on the first day on the job. Let them know that cable is moving forward at a rapid pace — that there is a future for those willing to work and develop themselves, but that they must be dedicated to learning and take advantage of every opportunity to advanced their knowledge. And, your installer program has to be broad-based, including a thorough training in areas like safety, customer relations, first aid/CPR, system operations beyond the drop, and the beginnings of electrical theory and troubleshooting, in addition to the how-tos of performing an install.

3) *Hire right.* One of our colleagues is fond of saying, "If you want to take a better picture, start with a prettier face." There's a lot of truth to that. Don't go out and fire your whole crew and start over, but the next time you get the opportunity to hire a new face, look for someone who already has a leg up on the broad background necessary for the competent cable technician of the future. With the prospects of much more sophisticated technologies such as fiber optics and digital compression in our future, and only 12 percent of our work force possessing four-year technical degrees, the cable industry has to become much more aggressive in recruiting degreed engineers.

4) *Don't overlook SCTE.* We happen to have one of the best technical societies in any communications industry. If you're not making use of its educational opportunities, as well as supporting it with your membership and time, start today. Also, if you haven't heard about SCTE's tuition assistance (scholarship) program, call for an information packet today. Despite the fact that dozens of technicians across the country have received free education through the program, it is still one of the industry's best kept secrets. Through the program, national SCTE members can apply to have their tuition paid for any number of educational opportunities. If you're not a member of SCTE national, the tuition assistance program alone is reason to join. Write or call the SCTE at 669 Exton Commons, Exton, Pa. 19341, (215) 363-6888.

Third-generation cable systems will require third-generation training support. It's not too soon to start implementing yours. **CT**

Leakage detection

(Continued from page 30)

length as the operator observes the meter for greatest signal strength. It also may be used to probe about the connectors of trunk amplifiers or any other spot suspected of being a point of egress. The E-field probe is sensitive only to the electric field component of the radiated RF energy and typically consists of a short metal rod of 1 to 3 inches long. It is used in essentially the same way as the magnetic loop. Near-field antennas are not used for making quantitative measurements and as a result, require no calibration.

Equipment calibration

If it is desirable to check the measurement accuracy of the meter, this may be done as shown in Figure 4 by connecting it to a calibrated signal source (a signal generator or a preselected attenuated drop signal). This measurement is made in the AB mode on Wavetek's CLM 1000 cable leakage meter, which displays the RF input terminal voltage in microvolts. (If a CW signal is used to verify calibration, the 2 dB detection error offset must be considered. There is a 2 dB difference in measurement on CW vs. video modulated carriers. The CLM 1000 is calibrated to measure video modulated carriers accurately, and CW carriers will read 2 dB high.)

A conversion chart for dBm, dBmV and µV should be provided in the cable leakage meter manual. If a 50 ohm signal generator is used, a 50/75 ohm matching pad must be used and the output level corrected to compensate for the (5.7 dB) loss of the pad.

Once the measurement accuracy of the cable leakage meter has been verified in this manner, it may be used with confidence as a measurement receiver for setting up a calibrated leak. A calibrated leak is used as a reference when a different type of antenna is used or for correlating vehicle-mounted systems.

Setting up a calibrated leak

Regardless of the type of vehicle-mounted antenna used, there are variables that come into play that could cause a change in measured field strength. The position of the antenna on the truck will affect the ground plane and therefore the pattern of the antenna. There may be reflections from other devices mounted on the vehicle (ladder racks, etc.), and even the length of the lead from the antenna to the meter will have an effect on the measurement. This is why it is recommended that a calibrated leak be used to correlate each vehicle's measurement system.

It is sometimes desirable to use a vehicle-mounted monopole or dipole antenna for monitoring and measuring relative leak intensity. (The distance feature should be used only to rank leaks in order of intensity and not for CLI purposes.) If you are using some other antenna than the dipole provided, you should set up a calibrated leak for verification of the accuracy and the calibration of the system, which includes the cable leakage meter and whatever antenna and configuration you choose to use. The following procedure describes a setup for this method.

The frequency and level of this leak should be given careful consideration to avoid interfering with any off-air service or letting an off-air service affect the measurement. This leak should be generating a signal only during calibration and disconnected at all other times.

A bandpassed cable drop may be used as the leak signal, with a calibrated dipole as the source antenna. (A fixed or tunable dipole may be used for the source antenna.) Be sure the tunable dipole is set to the proper length for the chosen monitoring frequency and that it is mounted with the proper polarization to correspond with the monitoring antenna to be used.

Ideally, the calibration antenna should be mounted at the same level as the vehicle-mounted antenna on a wooden post. If a vertical monopole antenna is to be used, the source dipole also should be vertical. The drop should be fed through a bandpass filter and an attenuator for adjusting the leak to the calibration level.

The leak level may be set as follows: Using a cable leakage meter or other calibrated receiver and a dipole (one-half wavelength) stand 10 feet from the leak reference source and with the antenna 10 feet off the ground and oriented with the proper polarization to the source antenna (see Figure 5). Adjust the drop attenuator until the level on the calibrated receiver matches the desired calibration reference level. (It may be desirable to set the calibration level higher than 20 µV/m if the calibrated reference receiver is not sensitive enough to read a 20 µV/m leak.) The calibration area should be as free from obstructions and conductive reflecting surfaces as possible.

The following is a summary of what should be taken into consideration for a reference leak source:

- Potential reference leak source. This is where system signals are fed through a source frequency bandpass filter and attenuator for the Wavetek 7580. The system signal source enables a test of the video alarm feature of Wavetek CLM 1000.
- Source antenna should be carefully located to isolate it from sources of reflection.
- Source antenna should be properly polarized. This is vertical if a vertical receiving antenna is used.

The following is a summary of what should be taken into consideration for a reference leak measurement:

- Use a half-wave dipole for measurement.
- Place dipole 10 feet from the source antenna and 10 feet from ground, oriented with same polarization as source antenna.
- If using a calibrated CLM 1000, the measurement and calibration can be done simply, since the measurement units (µV/m) are the same.
- If using a SAM or a spectrum analyzer for the measurement, the reference level will have to be expressed in dBmV (75 ohm) or dBm (50 ohm), and the reference level must be converted from µV/m. Take for example a reference frequency of 133.2625 [Ch. 16 (C)] and a level of 500 µV/m (a significantly high-level leak in order to be measured with a signal level meter). First, convert microvolts per meter to microvolts:

$$E_f = 0.021*E*F$$

Where:
E_f = Field strength in µV/m
E = µV
F = Frequency in MHz
$E = E_f/0.021*F$
= 500 µV/m/0.021*133.2625
= 178.7 µV
= -15 dBmV (level to be measured)
= -63.75 dBm

If a 50-ohm receiver (spectrum analyzer) is used for the reference measurement, a matching pad (75/50 ohm) should be used. The pad has 5.7 dB insertion loss, making the reference level: -63.75 dBm -5.7 dB = -69.45 dBm.

- Adjust the in-line attenuator to make the level measured with the calibrated receiver match the determined reference level. When a known field is set up, the vehicle may be driven into the field (with the cable leakage meter set for appropriate distance) and calibrated using the REF function. Press the REF key and use the up and down arrow keys to make the displayed reading match the calibrated reference field. (Keep in mind that a significant amount of compensation may be required when using vehicle-mounted antennas.)

A good leakage preventive maintenance program incorporates the use of equipment designed specifically for leakage detection and measurement. Great care must be taken to ensure the detection/measurement system is properly calibrated and is being used to its utmost capability and efficiency. Using good equipment and following the simple procedures outlined in this article will not only result in compliance with FCC regulations, but in a tighter system and improved service. **CT**

The following are new product highlights from Cable-Tec Expo '91.

Wavetek announced its LineSAM signal analysis meter that automates all signal level measurement functions and stores results in memory. It measures RF signal level, hum, carrier-to-noise ratio and AC and DC power supply voltages.
Reader service #141

Times Fiber unveiled an indoor F-connector with a round diamond knurled coupling nut. Also new is a guarantee of 1 GHz performance for T10 semiflex cable at no premium.
Reader service #104

Optical Networks International introduced a strand-mount Optical Interface Unit. It has a 1 GHz platform, plug-in detector module and local status monitoring.
Reader service #103

Zenith introduced new addressable products. The Event Center mini-headend includes a system controller and three encoders, one for each "Olympics TripleCast" channel. This will be a PPV cablecast of the 1992 Summer Olympics from Barcelona, Spain. Specifically designed for event-based PPV services, the Event Master decoder system offers addressable PPV capability while allowing subs to use their cable-compatible TV sets for viewing other programs. The Shadow addressable cable decoder decodes and provides a pay TV signal directly to a TV set or VCR.
Reader service #140 (Event Center), #139 (Event Master), #138 (Shadow)

The HP 85714A scalar measurements personality card and the HP 85630A scalar transmission/reflection test set for the HP 8590 series spectrum analyzers were introduced by **Hewlett-Packard**. Contained on a 128-Kbyte ROM card and downloaded, the HP 85714A is said to make scalar network measurements easy to perform. The HP 85630A is a 50-ohm scalar transmission/reflection test set that uses a single-port and single-test setup to perform real-time measurements. Operation requires the HP 85714A scalar measurements personality card.

Also new is the HP 85716A CATV system monitor personality card that automates monitoring and recording of CATV system performance using a spectrum analyzer. It is designed for use with the HP 8590 series portable spectrum analyzers.

Also introduced by H-P was the Analog+, an analog display mode that retains digital measurement features and eliminates the need for older analog display technology in most video applications. **Reader service #137 (HP 85714A), #136 (HP 85630A), #135 (HP 85716A), #134 (Analog+)**

The QDAX high gain indoor distribution amplifier was announced by **Quality RF Services**. It is designed for LAN, two-way video and high gain applications.
Reader service #133

WindowLite, a full-function handheld signal level meter weighing 40 ounces for use by field technicians in troubleshooting and tuning cable systems, was unveiled by **ComSonics.** It has a super-twist, high resolution LCD display with excellent contrast and readability even in direct sunlight, according to the company. **Reader service #130**

Regal Technologies introduced its RBA-18 push-pull broadband amplifier for use in multiple dwelling buildings or in applications where a 10-18 dB gain amplifier is needed. The company also announced its Silver Label splitter. Designed for systems in highly corrosive industrial and coastal environments, the splitter has a nickle-plated zinc housing.
Reader service #129 (amp), #128 (splitter)

The Tone Signaling Division of **Monroe Electronics** unveiled its Synopsis software program. It is designed for remote control of the company's Series 3000 program timer.
Reader service #121

Corning released its line of low-loss, double-window, miniature fiber 1 x 4 and 1 x 8 couplers and its FiberGain module. The coupler line is designed to help speed the deployment of optical fiber into cable TV architectures and is optimized for VSB AM cable TV video distribution systems operating at both 1,310 and 1,550 nm. The FiberGain plug-in module delivers more than 10 mW of optical output power in a single pump configuration using a minimum of electrical drive current (250 milliamps).
Reader service #132 (couplers), #131 (FiberGain module)

Magnavox CATV Systems introduced a quad output bridger. This station dedicates a power doubling hybrid to each of four distribution outputs and provides 7 dB higher station outputs over a conventional power doubling bridger. As well, the company announced its Vector video echo canceler, a headend rack-mounted device designed to eliminate steady-state and slow moving echo artifacts encountered in the reception of terrestrial and CATV signals. Finally, a low-cost optical receiver that combines the Spectrum 2000 LE90 Series housing and switching power supply with MagnaHub optoelectronics was unveiled. It can receive up to 80 channels on one fiber strand.
Reader service #127 (Vector), #126 (receiver)

Power Guard announced its Small Simple Standby line of standby power supplies. Available in 3, 6, 9, 12 and 15 amps and 24 V, features include temperature-controlled battery chargers and an insulated battery compartment for extended battery life.
Reader service #122

Scientific-Atlanta unveiled an eight-port interdiction unit for multiple dwelling units, a 450 MHz module, and other related interdiction equipment. The eight-port unit is targeted at outdoor garden apartments, which make up 80 percent of the MDU market. The proprietary jamming technique housed in a new 450 MHz module will help control up to 48 channels. A new cascade seizure board also was introduced. It increases tap efficiency and cuts insertion loss by tying together combinations of four- and eight-port units or two eight-port units.
Reader service #125 (eight-port unit), #124 (450 MHz module), #123 (seizure board)

New interdiction residential plastic enclosures and a complete line of steel

interdiction enclosures were introduced by **Multilink**. As well, the company announced a new trap holder system.
Reader service #120 (plastic enclosures), #119 (steel enclosures), #118 (trap holder system)

The Platinum Series of splitters was unveiled by **Viewsonics.** This series has 5-600 MHz bandwidth and the Platinum Series Plus features 5 MHz-1 GHz bandwidth. Both models are available in two-way, three-way, four-way and eight-way. They have a minimum of 130 dB RFI shielding and housings are tin-plated as well as solder-sealed.
Reader service #117

Ben Hughes unveiled stripping/coring tools that produce a beveled edge on the outer conductor to prevent damage to the connector O-ring. Also introduced was the EZ Squeeze tool used to install Raychem's 6 and 59 EZF connectors.
Reader service #113

A new two-way, 1 GHz house drop amplifier designed for the ATC Queens, N.Y., 1 GHz project was announced by **Augat Communications**. It will be available with both one or four output ports with the gains of 16 and 8 dB respectively.
Reader service #112

A line of RG-11 cables for longer distance drop installations was introduced by Cooper Industries' **Belden** Division. The line was designed with lower attenuation characteristics and features messengered, non-messengered and burial cables.
Reader service #111

Track molding for exterior or interior use was announced by **Cable Security.** Extruded from a specially developed UV stabilized PVC, it is said to remain attractive and impact-resistant for years.
Reader service #109

Channelmatic's Adcart random access ad insertion controller using Panasonic's new LQ-4000 rewritable optical disc recorder was unveiled. It automatically inserts commercials into network programs.
Reader service #105

Panasonic introduced several products including the BT-S901Y, a 9-inch diagonal, S-VHS compatible, rack-mountable color video monitor. Also, it unveiled three 13-inch monitors; one is a multistandard unit compatible with NTSC, PAL, SECAM and M-NTSC. Also new is the AG-A770 multi-event edit controller that allows storage of up to 128 single-cut editing events.
Reader service #108 (BT-S901Y), #107 (13-inch monitors), #106 (AG-A770)

The new ChannelScan software feature for **AM Communications**' LAN-guard end-of-line status monitors was introduced. It is based on EGA color graphics and allows up to 100 video and/or audio channel levels to be displayed simultaneously in a sweep-like display along with minor and major alarm limits for each channel.
Reader service #115

Production Products' new F-O series of connectors interfaces the fiber protective cable to the fiber equipment and enters the equipment housing through a 5/8-24 port. The products take into account a number of requirements including gripping of cable over a long length in such a manner as to prevent twisting and pulling.
Reader service #110

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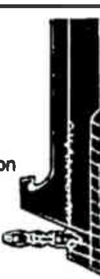

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CALENDAR

August

16-17: SCTE Rocky Mountain Chapter BCT/E review seminar. Contact Pam Nobles, (303) 792-3111.
18: SCTE Southeast Texas Chapter, Houston. Contact Tom Rowan, (713) 580-7360.
19: SCTE Satellite Tele-Seminar Program, *Getting it right the first time: Field supervision techniques*, 1-2 p.m. ET on Transponder 6 of Galaxy I. Contact (215) 363-6888.
19-20: AT&T fiber-optic installation and maintenance testing course, Atlanta. Contact (800) TRAINER.
19-22: AT&T fiber-optic splicing course, Atlanta. Contact (800) TRAINER.
19-28: AT&T fiber-optic installation and splicing course, Dublin, Ohio. Contact (800) TRAINER.
20-21: NCTI OSHA compliance seminar, Biloxi, Miss. Contact Michael Wais, (303) 761-8554.
20-23: Siecor seminar on fiber-optic installation, splicing, maintenance and restoration, Hickory, N.C. Contact Lynn Earle, (704) 327-5539.
21: SCTE Greater Chicago Chapter meeting with BCT/E (both levels, all categories) exams. Contact Bill Whicher, (708) 438-4423.
21: SCTE North Central Texas Chapter meeting with BCT/E Categories V and VII and installer certification exams. Contact Terry Blackwell, (214) 578-7573.
21: SCTE Rocky Mountain Chapter meeting with BCT/E (both levels) and installer certification exams. Contact Pam Nobles, (303) 792-3111.
21: SCTE San Diego Meeting Group seminar on installation, drops and splitters, Elks Lodge, Oceanside, Calif. Contact Frank Gates, (714) 492-4606.
22: SCTE Tennessee Chapter seminar, Senatobia, Miss. Contact Don Shackleford, (901) 365-1770.
23: SCTE Miss/Lou Chapter meeting with BCT/E (both levels, all categories) exams. Contact Dave Matthews, (504) 923-0256.
23: SCTE Great Plains Chapter meeting with BCT/E (both levels, all categories) and installer certification exams. Contact Jennifer Hays, (402) 333-6484.
24: SCTE Golden Gate Chapter meeting with installer certification exams, Pleasanton, Calif. Contact Mark Harrigan, (415) 785-6077.
25-27: Eastern Cable Show, Inforum Exhibit Hall, Atlanta. Contact Nancy Horne, (404) 255-1608. SCTE BCT/E exams to be administered in all categories. Contact Ralph Haimowitz, (704) 297-5432.

Planning ahead

Sept. 23-25: Great Lakes Cable Expo, Cobo Conference/Exhibition Center, Detroit. Contact Diane Drago, (517) 482-9350.
Oct. 1-3: Atlantic Cable Show, Convention Center, Atlantic City, N.J. Contact (609) 848-1000, ext. 304.
Oct. 8-10: Mid-America Show, Hilton Plaza Inn, Kansas City, Mo. Contact (913) 841-9241.
Nov. 20-22: Western Show, Anaheim, Calif. Contact (415) 428-2225.

BOOKSHELF

The following is a listing of some 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.

☛ *Multichannel Cable Converter Alignment* — The setting for this video program is the converter repair bench. Block diagrams, demonstrations of alignment techniques and procedures and final assembly are presented. The videotape stresses the importance of following proper procedure in order to maintain low service call rates. (30 min.) Order #T-1012, $35.

☛ *Cable Television Relay Station (CARS) Application* — This videotape is a step-by-step review of Federal Communications Commission Form 327 and its requirements. The complete series of five schedules included in Form 327 (A through E) are covered in detail. Checklists are provided and relationships of exhibits to required schedules are explained. Federal Aviation Administration requirements, environmental studies, use of government property and tower heights are included. (1 hr.) Order #T-1013, $35.

☛ T-1014, *Developing an Effective Preventive Maintenance Program* — Planning and forecasting problems and formulation of solutions are addressed in this videotape. Distortion, electrical specifications, mechanical bugs, signal leakage and ingress measurement are discussed. Proper testing and test equipment are stressed. Functions of signal level meters, sweep devices, cross-modulation and hum or low-frequency tests are covered. (30 min.) Order #T-1014, $35.

Note: All videotapes from T-1001 to T-1020 were produced in 1981. All SCTE videotapes are in color and are available in the 1/2" 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 post office boxes, please. SCTE pays surface shipping charges within the continental United States only. Orders to Canada or Mexico: Please add $5 (U.S.) for each book or 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 added in addition to air shipping cost. 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 United States. All prices are in U.S. dollars. SCTE accepts Visa and MasterCard. 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.

Growing the Society stronger

Following is Wendell Woody's speech given during the awards luncheon at Cable-Tec Expo in Reno, Nev.

By Wendell Woody
President, Society of Cable Television Engineers

Thank you Bill Riker. Bill continues to do his excellent job in serving our Society, and when teamed up with Anna Riker for fiber-optic seminars and SCTE expos, they become the "untouchables" — they get everything done and done right. How about a hand for Bill and Anna, and the entire SCTE national headquarters staff for a great job this year!

I wish to acknowledge our board of directors and particularly the new members who attended their first board meeting yesterday. I also want to acknowledge our special guests from the state and regional CATV associations who are in attendance, as well as our keynote speaker, Richard Smith, from the FCC.

Working to grow

We started off this year by saying we would work to grow the Society in two areas: First was growth in membership, and second was to grow the Society stronger by adding new programs, changing others and even restructuring the way we function.

As you know, our membership has grown to over 8,000 this year. That's national SCTE membership. We also have about 12,000 technicians and engineers who belong to local chapters and meeting groups but are not national SCTE members.

Therefore, our Society is supporting about 20,000 industry technical people. We believe that is only about half or less of the total 40,000 to 50,000 people available.

As our training programs continue to get strong and our BCT/E Certification obtains greater acceptance, our Society continues to grow! Our new Installer Certification Program could give us a 50 percent increase in national members in one year. Therefore, we have a lot to work on yet, and a lot to look forward to.

Regarding growing the Society stronger: This has been one of the most active board of directors in the history of the Society. A recent review of this past year indicated 41 activities. Just to name a few, we:

- established five major managing committees
- established House of Delegates Program
- established a new *Interval* format
- established a Past Presidents' Council
- established an International SCTE Council
- established the Cable-Tec Games as a national event
- established a special supportive relationship with CableLabs
- established an "Of Council" support position
- paid off our Building Fund
- and the other 32 activities all have to do with our training and awards program for our membership.

In the mud

In closing, I'm saddened to remind you our industry is in the "mud" and not flying very high now. All CATV trade shows held in the past several months have been down in both attendance and number of exhibitors.

Our show here has two major conflicts this week. We are sharing the first part of the week with the Canadian Cable TV Association show in Ottawa. The expo also overlaps with the 17th International Television Symposium and Technical Exhibition in Montreux, Switzerland. We lost the NCTA Engineering Committee that generally meets with us the day before our show opens and 20 percent of our board to the Switzerland meeting.

However, our 1991 Expo Program Committee is not subscribing to conflicts or industry downturns. This year's expo boasts a significant increase in attendance and a significant increase in exhibitors.

Consequently, let me welcome you to the greatest show on earth — the 1991 Cable-Tec Expo here in "The Biggest Little City in the World," Reno, Nev.

I view the directing of our Society as like riding a bicycle: We can't go backward without falling over, nor can we


Bob Sullivan

stop moving without falling over. Instead, we must continue to accelerate forward to advance with the needs for our membership and the cable TV industry.

President's Award

It's now time that I address an annual duty of the SCTE president — that of choosing the recipient of the SCTE President's Award. The President's Award is given annually by the current president to the company, organization or individual that has provided outstanding support to SCTE during his administration.

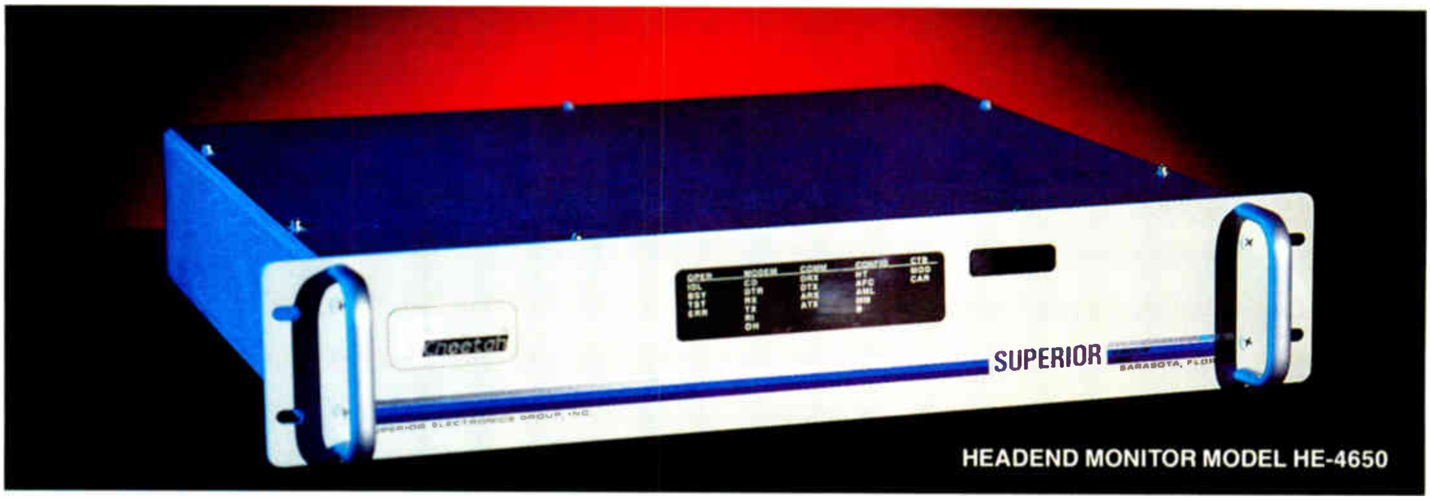
This year I have chosen CableLabs. The reasons are:

1) Its underwriting of a training videotape on engineering management and professionalism that will provide a curriculum for Category VII in the Society's BCT/E Certification Program.

2) The distribution of CableLabs' publications, promoted and sourced through the SCTE's publication and training aids guide.

3) CableLabs will support the SCTE in the future with documented research on many interface practices, equipment standards recommendations, system standards specifications, and test and measurement standards. These are being established for the CableLabs' consortium membership, but will be transferred to the SCTE to develop into SCTE "standards." These, in turn, would eventually be recognized as cable TV industry standards.

Thank you for attending the SCTE Engineering Conference luncheon, and I wish you all a great show! **CT**



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