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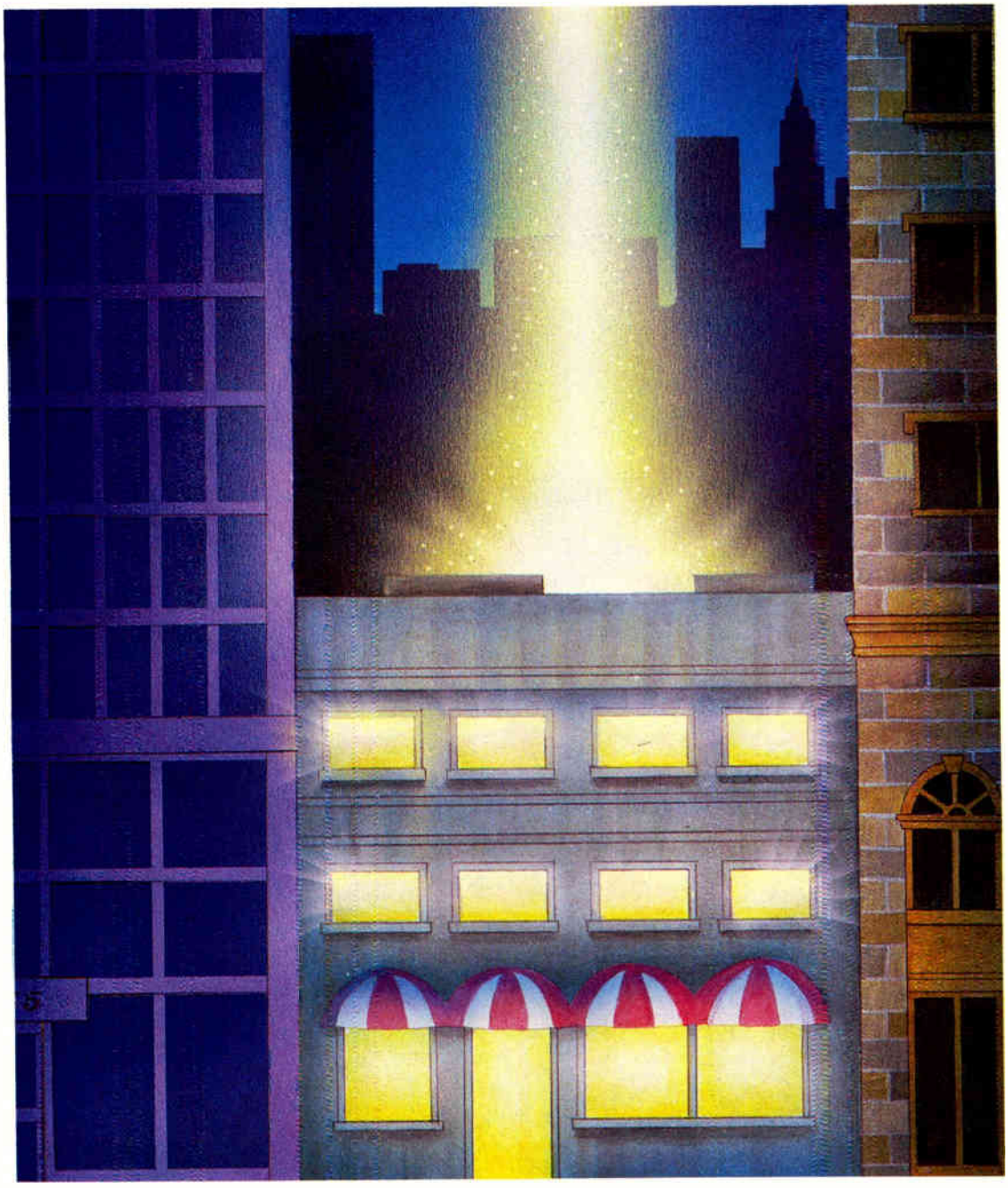

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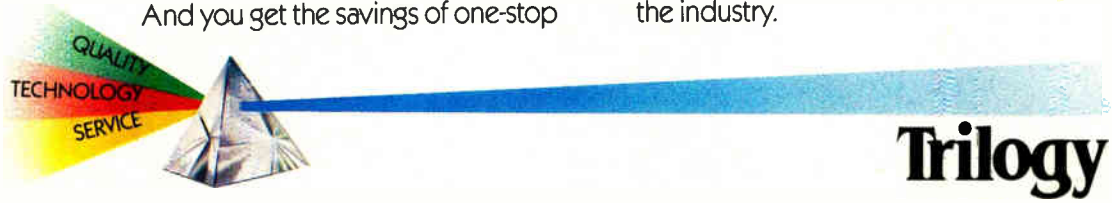

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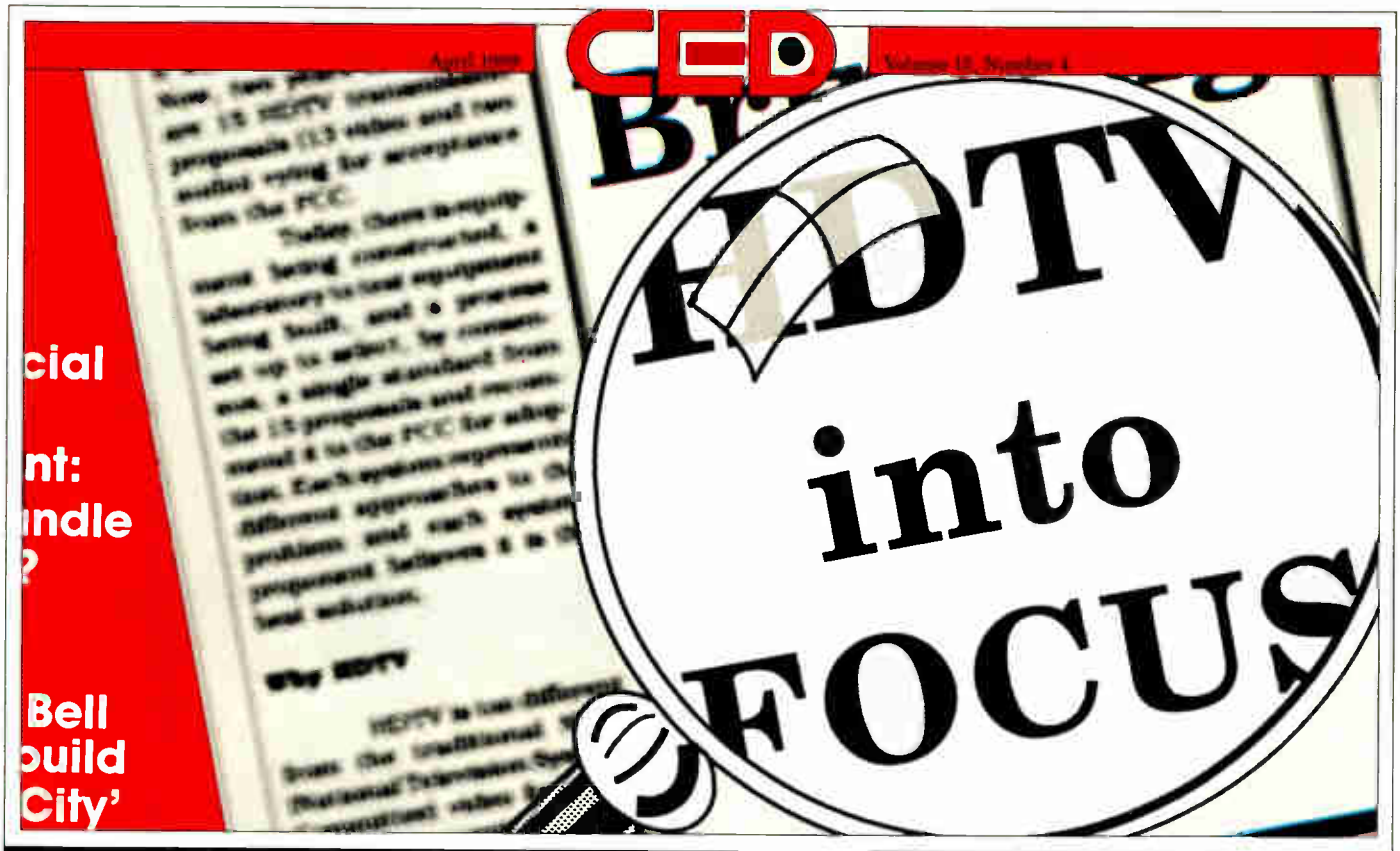

About the Cover:
With stories concerning the evaluation and testing processes surrounding HDTV and how the technology will affect CATV headends, we try to bring HDTV a little more in focus. Art by Don Ruth.

DEPARTMENTS

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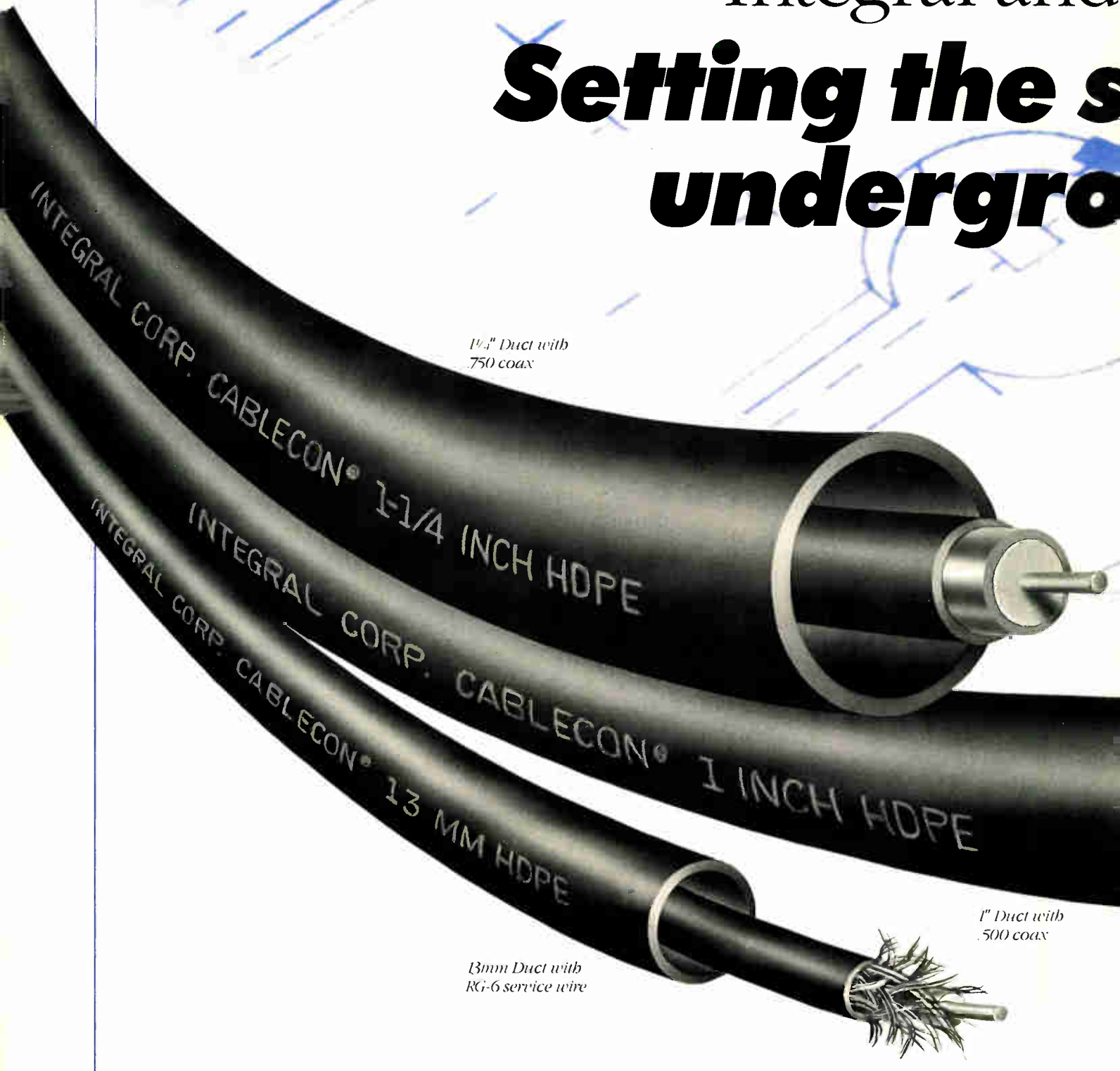

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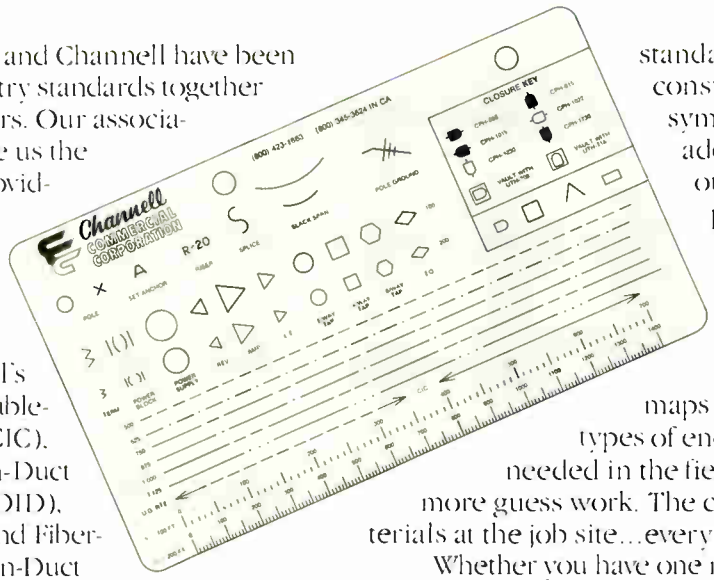

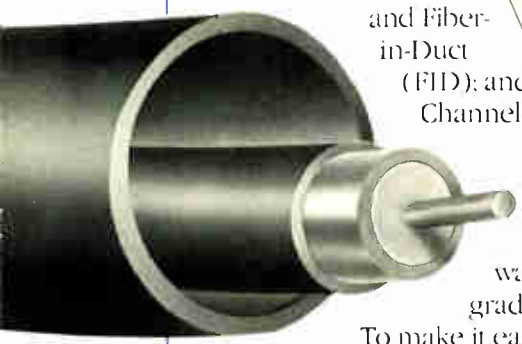

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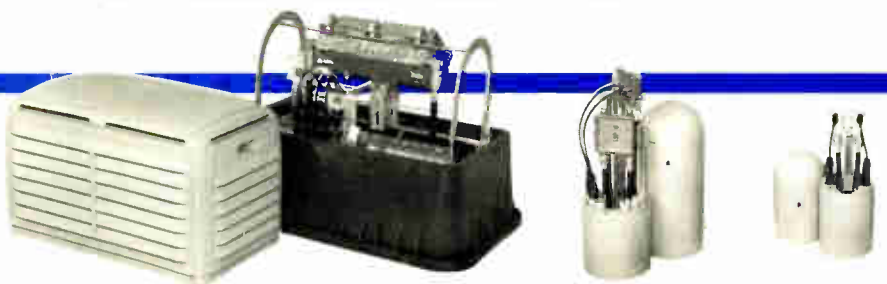

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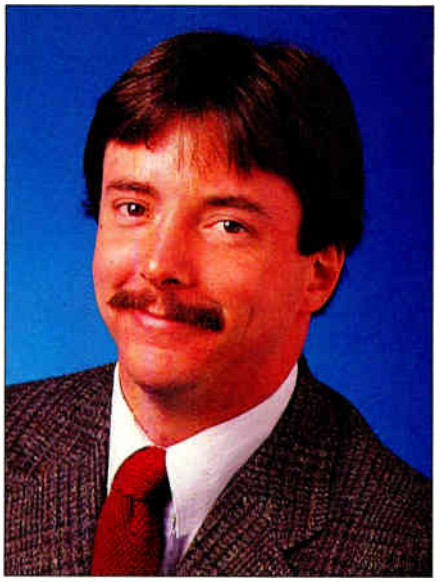
Heads stuck firmly in the sand

Despite all its efforts to be "subscriber friendly" and win the hearts of the general populace, the cable industry is on the verge of losing a golden opportunity to enhance customer satisfaction and win valuable points with the consumer electronics industry.

Ever since the advent of converters, the 'interface" between cable and its customers has become increasingly complex. The set manufacturers, with good intentions, debuted cable-ready sets that were designed to tune all the channels that cable systems offered. Then cable systems began scrambling their signals and introduced descrambling converters. Now, in order to use a TV and VCR simultaneously, a combination of switches and complex wiring schemes has to be employed. It's become so complicated that no normal human being has been able to master the scores of wiring possibilities.



Cable TV, rightly or wrongly, became the bad guy in the customer's eyes because all the features offered on high-end TVs were rendered useless because of the converter bottleneck.

Albeit late, the cable and consumer electronic industries huddled and devised a solution to this interface mess. What grew out of these meetings was the IS-15 device, now commonly called MultiPort. This tiny add-on device was designed to allow cable systems to continue scrambling its signals but returned the control of the TV and/or VCR to the subscriber and his remote control.

Forward-thinking television manufacturers even went so far as to put the plugs on the back of their high-end receivers to accommodate the device. But here is where the ball was dropped by the cable industry.

Cable hardware manufacturers were (and still are) reluctant to design and build a product without proven market demand. Cable operators can't buy the device if they haven't been built. It's the classic chicken-and-egg predicament.

This stand-off is holding the industry hostage—and time is running out. It costs TV set manufacturers money to put the plug on the back of the set. With high competition and low margins a fact of life for these guys, it won't be long before they decide to scrap the whole idea. (In fact, it's been said that unless MultiPort shows some sign of life by this fall, the plug will quite literally be pulled.)

If that happens, cable TV will rightfully be looked upon as the villain in the eyes of the public—again. What the industry needs is a few pioneers willing to bite the bullet, buy some decoders and match them up with TV sets. The issue is not a technical one, it's an operational one. Indications are, however, that non-engineers don't understand MultiPort's benefits. But engineering managers can use their influence to get the project out of the starting gate. Bringing the management team up to speed on what MultiPort has to offer is of paramount importance and could help cable market its way to 80 percent penetration levels. Engineers should talk to their colleagues immediately or prepare to pronounce the project, and perhaps some possible revenues, dead.

Roger J. Brown

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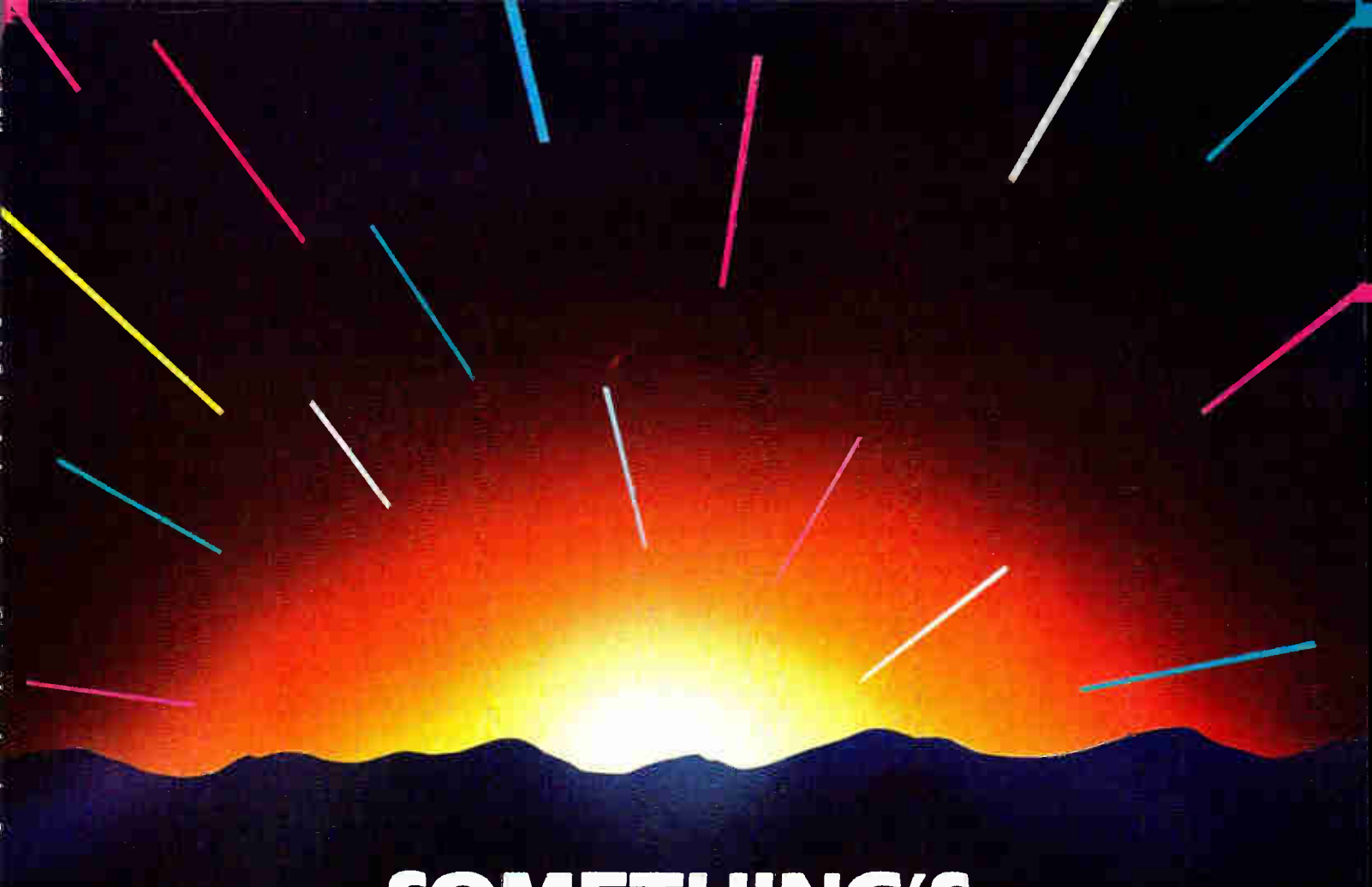

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Reader Service Number 5

SPOTLIGHT

Callahan charts cable's future

Ask any of the 13 million audio compact disc owners why they chose to buy the disc technology and they'll probably mention the word quality. Pure, beautiful sound, without noise. To Edward Callahan, vice president of research and development for United Cable Television Corp., and an avid owner of many compact discs, this digitized music represents what is possible for the electronics community, especially cable television.

Edward Callahan

Computer background

Callahan's enthusiasm for technology and cable began while working for IBM in its advanced systems development division. During the latter part of the '60s, Callahan, the engineer representing IBM, was involved in business studies with several MSOs looking at the future of interactive computer terminals into people's homes. When Monty Rifkin, then chairman of ATC, made a comment about needing someone in the cable industry with computer skills, it prompted Callahan to call Rifkin. Within a month, Callahan was the director of research for ATC.

Throughout the next 11 years with ATC, Callahan's eagerness for new technologies and the possibilities of interactive services kept him involved with engineering—even though the remainder of the industry was caught up in franchise wars. In 1981, when ATC became "too big" after the furious battles to stake territory, Callahan again made a phone call, this time to Gene and Richard Schneider of United Cable, to talk about job possibilities. Shortly thereafter, Callahan went to work for United as the vice president of research and development.

New technologies

Callahan's research group is responsible for approval of all amplifiers, satellites, converters, receivers and other equipment necessary to make up United's cable systems. Callahan also works with industry vendors on developing new products and bringing new technology into the marketplace. "We would come up with black box specifications," says Callahan, "and say, if only we had a device that did this, or this, then we could offer the following kinds of services to subscribers."

It is Callahan's constant contemplation of new products and how those devices will satisfy subscriber's needs that forces others working with him to look at the system as a whole. It is important to Callahan that both operations personnel and suppliers realize that "a cable system is,

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indeed a system. You don't just modify or change or go after one portion of the system," says Callahan. "You look at it all the way from the initial signal source to the furthest subscriber."

Staying busy

After some encouragement and Wendell Bailey's 1986 promise to make the NCTA Engineering Committee meeting a non-smoking session, Callahan agreed to become a member of the respected group. He has not missed a single meeting since and has a high regard for Bailey and the interchange that takes place. Through the engineering committee, Callahan also became involved with the SuperNTSC subcommittee to look at improved definition television. He also keeps up on industry issues by his involvement as a senior member of the SCTE.

But it doesn't stop there. Not only is Callahan on the board of directors for Cable Labs, he is also the chairman of a Cable Labs subcommittee on technologies for new business. The committee looks at new technologies and how it could impact the future of cable. "As new technologies in consumer electronics happen, as new technologies in cable transmission schemes develop, we'll be looking at some of the new business opportunities or potentials they offer," says Callahan. "If you look at the audio compact disc, it's been the most widely accepted technology in the shortest time period and I think we'll see more things like that happening."

Because of United's early involvement with fiber optics, Cable Labs also requested that Callahan participate in the strategic analysis of fiber optics for cable. As a technical advisor, Callahan is working on what the transition for cable system design might look like. And finally, Callahan is keeping up with HDTV as a member of the FCC HDTV implementation subcommittee, working party 2—transition scenarios.

Callahan's responsibility with the subcommittee is to come up with critical paths (timelines) as they relate to cable. The FCC will then, in its evaluation process, look at proposals, demonstrations and testing, evaluate the timelines and decide who can get to the marketplace sooner. "I signed up for the transition scenario," says Callahan, "because I thought it would be an interesting one. Especially knowing that cable would have a potential advantage for delivering HDTV pictures to the home."

Happiness is cable

Callahan definitely keeps active within the cable industry and the reason is quite simple. "I like it," he says. "I don't know when I've had more fun in my professional career. Computers, and the potential future of digital transmission and interactive services are things that really get my attention." Callahan sees his future role in cable as helping to get new technologies to the subscriber, and to improve the quality of cable distribution networks over time with continued or increased use of fiber in system designs.

Even his hobby, music, is symbolic of what Callahan thinks a subscriber should be receiving. "My boys, ages 7 and 12, are very much into technology and have their own disc player," says Callahan. "I want them to know that you can have good reproduction of music in the home." With Callahan's positive and enthusiastic outlook for cable, along with his desire for better technology, noisy signals may soon be as obsolete as scratchy records. ■

—Kathy Berlin

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Reader Service Number 8

Debunking some MultiPort myths

When I joined NCTA in 1981, one of my first duties was to get introduced to the NCTA Engineering Committee. I spent the bulk of that first meeting trying to understand the issues this group had been deliberating for some time. One issue that jumped out at me concerned compatibility and friendliness with consumer electronics. The more I listened, the more amazed I became that the deliberation had been going on for some time. At that meeting, a suggestion was made to form a joint committee with the Electronic Industries Association (the trade association that represents television set manufacturers) to look into issues of interest to both groups.

From this suggestion came the EIA/NCTA Joint Engineering Committee with Bob Rast, then of ATC, as its first chairman. The first item the committee tackled was the channel numbering plan used by the cable industry and the manufacturers of "cable-ready" television sets. In the end, Interim Standard 6 was produced, which carefully detailed the correct frequency and tolerances for all the cable channel numbers. This is a voluntary standard, but if you look around today you'll find that most converters and TV sets comply with IS-6.

By Wendell Bailey, Vice President Science and Technology, NCTA

Then came MultiPort

The next combined effort was toward an issue that came to be known as IS-15, a.k.a. MultiPort. Work on that standard has taken over five years. The technical result is very satisfying. The cooperation between the cable industry and the EIA's top engineers has been exemplary. Indeed, everything has clicked except the implementation of this device. That has been stalled by a variety of events that threaten to undo five years of good work.

I won't go into why this is good for everyone. I would, however, like to talk about some of the issues that get raised by people who don't understand what IS-15 is and who spread false information and negative thoughts about this project. Some people don't support MultiPort because they've already got a scrambling system and don't want to add a second one with the first. They also don't want to change out the boxes that go with their old system.

But the fact is, in order to implement IS-15 products, you won't have to change anything. You would simply buy an IS-15 box from the same vendor that sold you your current scrambling system. This box would be completely compatible with the existing encoder and software. If you have a customer with an IS-15 equipped television set, instead of putting a regular converter/descrambler in the home, you would supply an IS-15 device.

Another comment I frequently hear is that IS-15 will cut into remote control revenues. Consumers will be able to use the remote control that came with their television sets and won't rent them from cable, thus cutting into the rental income previously enjoyed. Basically, this is true, but there are several things to be said here.

The rules of the game

If you feel that supplying an IS-15 MultiPort to your customers will cut into your remote revenues, then don't plan to buy IS-15 devices. It's that simple. You don't have to play in this game if you don't want to. You should, however, understand the reason you're not playing has to do with your desire to have remote control revenue. If you don't want to play with IS-15 hardware, don't get in the way of the people who understand that being friendly to your customers may put more money on your bottom line than remote control revenue ever did.

There are other people who believe that whether you adopt MultiPort or not, remote control revenues are at risk. Consumers can buy or rent remote controls from sources other than cable operators. Shutting down the IR window of the converter device to thrwart the customer's desire to use their own remote control will eventually backfire as a business practice.

Other people have asked why we're doing this, since the average TV set lasts 15 years and it may be a long time before enough TV sets are equipped with the IS-15 MultiPort to make a difference. But when do we start if we don't start now? Saying that the task is daunting is not a sufficient reason to not begin the journey.

Surprise, surprise

When we got involved with this project, it was the Engineering Committee's feeling that the tough sell would be to the television set manufacturers. It was felt that the cable operators and equipment manufacturers would be in favor of doing this. Much to our surprise, the television set manufacturers stepped up to the bar and did what they had to do first, leaving cable to play catch-up.

The cable industry must decide whether or not this project is important. I suspect it is, given that MSO senior executives are placing such a high priority on "customer service." By this, they usually mean answering the phones and fixing the customer's problems when the customer calls.

But when you analyze the causes of customers' problems, you find that there is a variety of things that prompt customers to call. Certainly, billing problems and cable outages are on the list. The confusion over how to use their in-home electronic equipment is also on that list. And while I am unaware of any statistics about TV/VCR owners who don't take cable because of the mess of wire and plethora of remote controls that result from multiple pays, most people agree that the prospect upsets some potential subscribers.

How many? I don't know, but with the consumer electronics world doing everything in its power to make products friendly and easy to use, anyone who impedes the consumer's desire to avail themselves of those types of features stands to be singled out as the bad guy. ■

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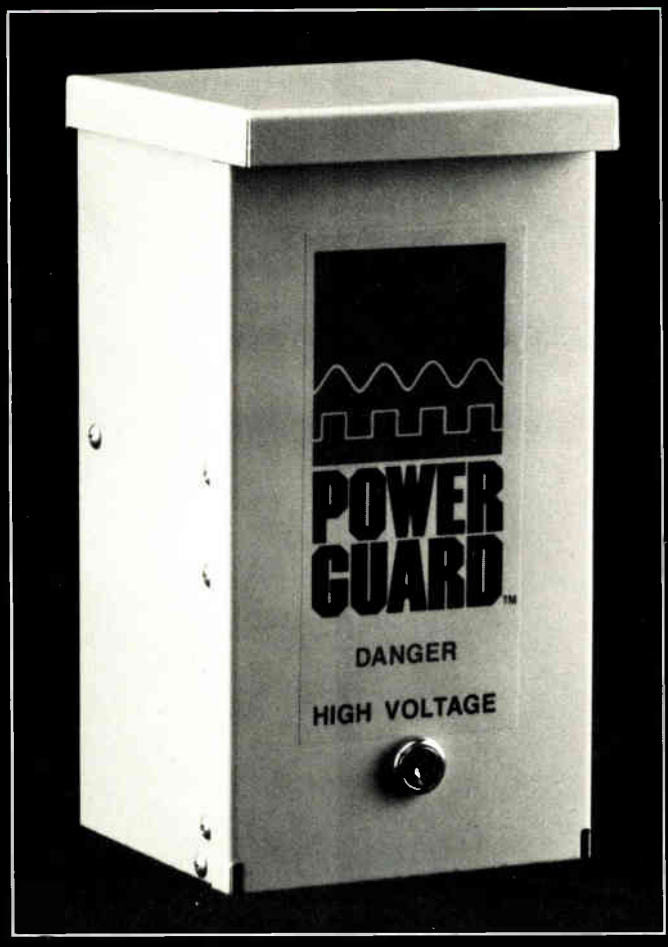

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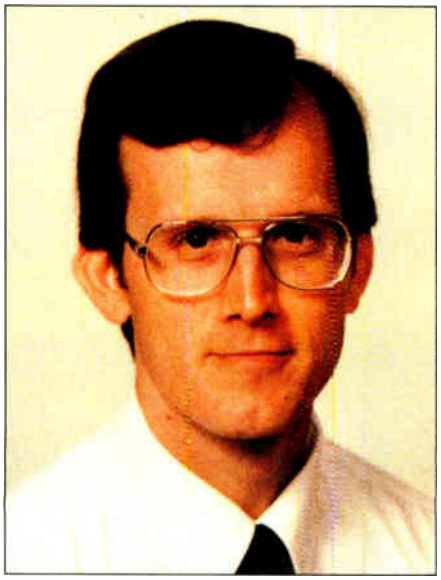


Noise weighting: CCIR vs. RS-250B

In an earlier column, I wrote of the confusing history surrounding the definition of video signal-to-noise ratio. Confusing, that is, in both the definition of "signal," and whether or not noise "weighting" was used in the measurement. I also indicated that there used to be a substantial difference (2.6 dB) in the weighting function between the old standard RS-250A, and the CCIR noise weighting network (which is also recommended by NTC Report #7). The revised EIA Standard RS-250B, on the other hand, recommends a noise weighting network which isn't that much different from the CCIR recommendation. What I didn't show in the earlier column however, was the actual difference between the two weighting networks.

What is noise weighting?

Noise weighting is a technique used in video S/N measurements which reduces the amplitude of the high frequency noise components of the video waveform prior to the RMS noise measurement. This is accomplished by the introduction of a weighting network prior to the RMS voltmeter in the measurement system. The purpose of the network is to simulate the eyes' apparent inability to perceive high frequency noise in a video signal.

Because the eye cannot see such high frequency video noise anyway, the weighting network simply removes these noise components so that they are not included in the measurement. Since we are removing higher frequency RMS noise voltage from the measurement, noise weighting has the affect of significantly increasing (improving) the measured value of S/N ratio.

As I mentioned previously, the difference between the CCIR noise weighting function and that given by RS-250B is not all that drastic, and is shown in Figure 1. The graph of each function was plotted from the equations shown using a piece of software known as MathCAD. The equations that define each function were taken directly from RS-250B and NTC-7, and are also shown in the diagram. Note that while each network produces about 13 dB of attenuation at 4 MHz, at 1 MHz the CCIR network produces only about 4.8 dB of attenuation compared to 6 dB for the EIA network.

Difference is predictable

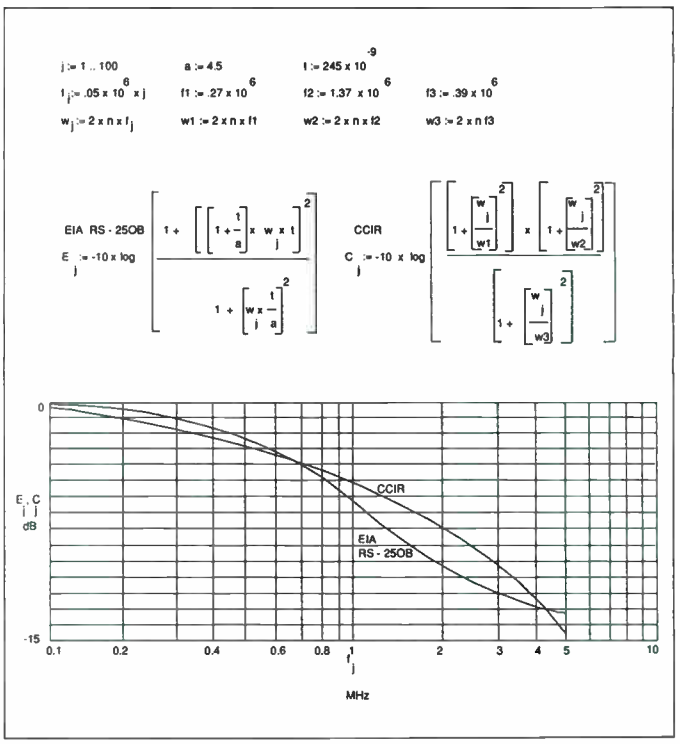
Below about 500 kHz, however, the CCIR network offers slightly more attenuation. As a crosscheck between mathematics and reality (after all, reality is where most of us live), the frequency response of an actual CCIR noise weighting network, currently manufactured by Tektronix, was examined on a network analyzer and found to fall precisely on the CCIR curve of Figure 1. So what?

If you then integrate each function over a 4.2 MHz bandwidth and calculate the difference (in dB) between the two resultants (MathCAD does this all very easily) the calculation will yield a predicted 0.6 dB difference in weighting between the two functions, with the EIA network yielding the most noise improvement (higher value of S/N ratio). For AM systems in a 4.2 MHz bandwidth, for example, the difference between the CCIR weighted and unweighted S/N ratio is about 6.2 dB, with the weighted figure being the higher (better) number. The RS-250B weighting function, on the other hand, provides a measured S/N ratio that is about 6.8 dB better than the unweighted case. Even though this information is available from various sources in the literature, it was nice to know that the mathematics holds true, and these values can be easily derived if necessary.

Choose what's best for you

The point here is that the CCIR and RS-250B weighting functions are, in fact, different, and in a 4.2 MHz bandwidth, will produce a discrepancy in measured S/N ratio of about 0.6 dB—so be careful if extreme accuracy is important to you.

On the other hand, you could argue that the accuracy of the entire S/N measurement process is such that consistently resolving to 0.6 dB accuracy is highly unlikely anyway. Take your pick. At least now you have the knowledge to identify the weighting network you are using and perhaps have a better understanding of the result of your measurement. ■



By Chris Bowick, Engineering Dept. Manager, Scientific-Atlanta

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Reader Service Number 10

State regulators study telco TV

Historically, cable television operators have been regulated at two levels. Local governments typically grant franchises, which include all sorts of regulatory requirements and obligations. But the federal government—in particular, the Federal Communications Commission—has also imposed a variety of requirements on cable operators, both to foster the growth of cable as a national medium of communications and to protect the viability of local broadcasting.

Lately, a third set of regulators have shown increasing interest in cable television. Until now, state public utility commissions (PUCs) have not played a significant role in regulating cable television. Their job is to regulate common carriers, including telephone companies. Cable operators have not been—and, under the Cable Act cannot be—regulated as common carriers in the provision of video programming. But the potential overlap of the cable and telephone businesses has brought the state PUCs into the picture.

New services bother PUCs

Part of the state regulators' concern stems from cable's potential provision of various non-video telecommunications services in competition with the local telephone companies. In several cases, state PUCs, at the behest of the telephone companies, have simply refused to allow cable systems to offer such competitive services. Other PUCs may be willing to allow cable operators to provide such services, but only subject to their own common carrier regulation.

Whether telecommunications services offered by cable operators are intrastate services subject to state regulation or are, instead, part of interstate communications subject to FCC regulation is not addressed by the Cable Act and remains unresolved.

But what has caused state regulators to become even more interested in cable is the potential ability of telephone companies to offer television service. Fiber optics and the prospect of integrated switched digital networks have regulators wondering whether, if telephone companies were to become providers of cable service, the states might be able to bring cable television under their own regulatory umbrella in a way that benefits both cable subscribers and telephone ratepayers.

Many concerns

Therefore, at its winter meeting in Washington, D.C., the Communications Committee of the National Association of Regulatory Utility Commissioners (NARUC) considered a proposed resolution endorsing the FCC's conclusion that Congress should repeal the telephone company-cable television cross-ownership prohibition. I had an opportunity to visit with many of the state commissioners on the committee, and they seemed to be primarily concerned about two things.

First, they were concerned that the cross-ownership prohibition might prevent telephone companies from making full and efficient use of their facilities. Allowing telephone companies to provide television programming on their fiber systems might, in the view of some commissioners, allow the telcos to spread the huge cost of these transmission facilities, reducing the portion to be borne by the telephone ratepayer.

Second, the commissioners were disturbed by what they perceived as the lack of competition in the cable industry. The notion of cable as an "unregulated monopolist" was widely shared by the state regulators, who complained about exorbitant rates and poor customer service.

Luck on cable's side

Fortunately, the committee was willing to study the issue and listen to our views before voting on the resolution. At their meeting, a panel consisting of NCTA's Jim Mooney and Gene Kimmelman of the Consumer Federation of America (who oppose repealing the cross-ownership prohibition) and John Sodolski of the United States Telephone Association and Cynthia Pols of the National League of Cities (who favor it) discussed the pros and cons.

Mooney and Kimmelman pointed out that any efficiencies and any new competition that might result from the provision of television programming over telephone company facilities could be obtained if the telephone companies leased capacity on their facilities to other unaffiliated program providers (as they are currently allowed to do.)

Allowing the telcos to provide their own programming over their facilities would provide no additional benefits, but would create serious risks of anti-competitive cross-subsidization and discrimination by the telcos that would increase telephone rates.

Cable wins—for now

The panel discussion raised serious doubts in the minds of many commissioners as to whether repealing the cross-ownership prohibition was a good idea. They voted overwhelmingly to table the resolution and to study the issue further.

Their future consideration of the issue may focus more on how the states should regulate the provision of integrated broadband facilities by telcos to unaffiliated programmers than on whether telcos should also be allowed to provide their own programming. In this regard, the NARUC vote to table the cross-ownership resolution represents a victory for the cable industry.

But even if they were generally persuaded that telco television is not the answer to what they perceive as a lack of competition in the cable industry, the state regulators continue to be troubled by rate increase and poor customer service. If this perception persists, regulators will keep searching for solutions and may be more inclined to adopt a "solution" that, like repeal of the cross-ownership rule, ends up making not only cable operators, but also consumers, worse off. ■

By Michael Schooler, Deputy General Counsel, NCTA

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Reader Service Number 11

Examining the telco/cable bind

The purpose of the NCTA Engineering Committee is to examine the technical issues of concern to the cable television industry. It is presently chaired by Dr. Walter Ciciora of ATC and is composed of senior technical representatives from cable systems, programmers and manufacturers. The committee meets every second month to review and update the status of the various technical issues confronting the industry. When necessary, ad-hoc committees are set up to investigate new technologies of potential concern or benefit to the industry.

The February 8-9 meeting started with an update of FCC and Congressional action of interest to the industry, delivered by Wendell Bailey of NCTA:

1. **Telco-cable cross ownership.** The FCC is reviewing the present cross ownership rules to determine if they are still necessary. Commissioner (James) Quello has recently modified his position on the issue, so there may not be the necessary majority of commissioners in favor of eliminating the rules.

Cannot act alone

The FCC could not eliminate the rules on its own, but can recommend changes in the Cable Act to Congress. Presently, the rules are codified in the Cable Act and the telco modified final judgment (MFJ) does not allow cable ownership by telcos in their service area except under special situations. The FCC could, however, decide to modify the waiver requirements to allow easier access by the telcos and recommend to Congress that the rules be changed.

It is doubtful that Congress would change the Cable Act this soon after it was passed, however, there is pressure to remove jurisdiction for the MFJ from Judge Harold Green and give it to the FCC. If this occurred and waiver requirements were changed, then telcos could possibly get into the cable business in their local areas.

2. **Syndex**. The Commission is reviewing the comments filed on petitions for reconsideration of the syndex rules. It is expected that the rules will be allowed to go into effect but with some delay on the implementation date.

3. **Terminal devices**. The FCC has adopted output level and leakage specifications for terminal devices which will require more circuitry in heterodyne converters and have the potential for creating leakage in excess of Part 76 limits. The adopted regulations specify a maximum output level for converters but as manufacturers have no control over the input level to a converter and must certify its output level, AGC circuits will have to be added.

A second potential problem is the higher leakage limit allowed for converters compared with a cable system. If the converter leaks at a level higher than Part 76 allows, then it must be disconnected from the system by the cable operator. However, manufacturers are allowed to build and sell converters that leak at higher levels than Part 76 allows. Petitions for reconsideration have been filed.

4. **Technical deregulation**. Reply comments were filed in the technical deregulation proceeding. NCTA again recommended that the requirements that apply to Class 1 signals should apply to Class 2, 3 and 4 video signals. These regulations would then be made guidelines and franchising authorities could not impose more stringent requirements.

5. The American Mobile Satellite Consortium Inc. has filed an amended application requesting access to a portion of the CARS band for satellite uplinks. The cable industry is unaware of the applications and will investigate the status of the application.

6. Congressional interest in advanced television continues to increase. This has added to the number of meetings being held in Washington covering all aspects of advanced television.

7. A bill has been introduced in the Senate which would impose nondiscriminatory pricing for satellite services by eliminating volume discounts to large MSOs.

Under new business, a subcommittee was formed to investigate in-home wiring requirements to insure signal leakage and quality pictures are maintained in the home. The committee members were reminded that if the cable company creates or has its hands on a signal at any time, then it is responsible for leakage of that signal for all time.

Subcommittee reports

1 The SCTE Cable-Tec Expo is scheduled for June 15-18 in Orlando. The June Engineering Committee meeting will be held the day before the Engineering Conference.

2. The HDTV subcommittee has assisted in the preparation of a test procedure for advanced TV on cable and submitted a proposal for a MultiPort device for advanced TV receivers. Tests of the NHK MUSE HDTV transmission system were carried out on both the Media General and Jones systems in the Washington, D.C. area. These were successful and indicated that HDTV can be delivered over conventional, coax systems.

3. Stereo TV test procedures have been completed and circulated for comment. J.J. Gibson of Sarnoff Labs has reviewed the document and made a number of suggested changes.

4. The Recommended Practices book will be reissued as a second edition in the late spring. A number of new procedures will be included to cover coaxial cable testing and stereo television.

5. The EIA MultiPort working party has completed the additions and revisions to the specifications. It is now working its way through the EIA approval process and will be issued as a full standard in the next couple of months. The final version includes specs for PPV ordering through the TV set remote control.

Two decoder manufacturers expect to have production decoders available this quarter and one set manufacturer is working with cable companies in the San Francisco area by providing the names of customers who have purchased TVs with MultiPort installed.

6. The Consumer Electronics Bus was demonstrated at both the winter Consumer Electronics Show and the Homebuilders Show. Additional cable industry input is required in the development of the cable portion of the Bus spec.

7. Seminars explaining the requirements for continued use of the aeronautical band have been sponsored by NCTA. Two more seminars remain in the series and both are fully booked.

The dates for the next Engineering Committee meeting have been changed to April 26-27 in Washington, D.C. ■

By Brian James, Director of Engineering, NCTA

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Reader Service Number 12

HDTV proposals: where do we stand?

From consumer fascination to media hysteria, high definition television (HDTV) has become *the* buzzword to wrap up the '80s. The first demonstration of HDTV in Washington in 1987 by NHK (Japan Broadcasting Corp.), MST (Maximum Service Telecasters) and the NAB (National Association of Broadcasters) brought little indication that it was a blockbuster event. Now, two years later, there are 15 HDTV transmission proposals (13 video and two audio) vying for acceptance from the FCC.

Today, there is equipment being constructed, a laboratory to test equipment being built, and a process set up to select, by consensus, a single standard from the 15 proposals and recommend it to the FCC for adoption. Each system represents different approaches to the problem. And each system proponent believes it is the best solution.

Engineers in Glenview, Ill., test the Zenith "Spectrum Compatible" HDTV transmission system. Today's cable and broadcast transmission systems can cause interference, as shown in the bottom row of TVs being tested by Zenith's Wayne Luplow, left, director of electronic systems research and development, and Rich Citta, manager of electronic systems research and development.

Why HDTV?

HDTV is too different from the traditional NTSC (National Television Systems Committee) video format to fit within conventional delivery systems. So why all the fuss about a technology that has caused nothing but research and money? Aside from the obvious technical and economic advantages, HDTV provides a better viewing experience. And with the introduction of pre-recorded media, in the form of magnetic and optical tapes and disks, cable and broadcast will have to display an equivalent signal in order to compete.

Fortunately, the cable industry has an advantage over broadcasters because of the self-contained spectrum it operates in, along with the freedom to do with that spectrum whatever is appropriate. As Walt Ciciora, Vice President of Engineering and Technology for ATC, says, "the broadcasters are in a world of hurt." Spectrum is scarce and in order to deliver a true HDTV signal, more bandwidth is needed.

On the other hand, this dilemma directly affects the cable industry. Cable must not only look at proposals which are suitable for use via cable but proposals that are likely to be used by broadcasters for terrestrial delivery.

Progress being made

On paper, HDTV seems to be making headway as the various proponents battle their way through the maze of FCC advisory committees, planning subcommittees, systems subcommittees and working parties. Each proponent's system is being analyzed on its adherence to three key issues: NTSC compatibility, bandwidth usage and effective handling of motion in pictures.

According to Hugo Gaggioni, secretary of the FCC advisory subcommittee on systems analysis, only six or seven of the 15 proposed systems are credible—Sarnoff/NBC, NHK (MUSE), Philips, Zenith, the New York Institute of Technology, the Del Rey Group and Scientific-Atlanta.

(It is beyond the scope of this article to go into detailed descriptions of each of the proponent systems. For a brief comparison of each, see Figure 1.)

John Henderson, group head of television system technology research for the David Sarnoff Research Center, agrees with Gaggioni. "I would guess there are about five or six proponents that are serious, major proponents—and the two audio systems have interesting and good ideas. Some of the others are, quite frankly, doing things that violate physics," says Henderson.

All unique approaches

Each of the seven major proponents, for the most part, have a unique procedure. "We feel very good in that we have a systems approach to HDTV in terms of allowing terrestrial broadcast, cable TV, satellite and storage medium to compete on an equal basis," says Dr. Larry French, senior technical officer for Philips Consumer Electronics. "We don't think anybody, except the Japanese, have

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Reader Service Number 13

approached that problem." Perhaps not, but to Richard Iredale, president of the Del Rey Group, its Tri-Scan subsampling signal "is the common sense way to do it. If I was hit by a truck tomorrow, I still believe someone would pick up the technology and run with it," says Iredale.

Zenith Electronics Corp. has a different perspective. "We feel the answer in both cable and terrestrial is to be able to use currently unusable channels," says Wayne Luplow, executive director of electronics systems research and development for Zenith. "The real issue is, in terms of NTSC and particularly in terms of cable, can you get a high definition signal in a 6 MHz cable channel? We can do that, but Sarnoff, Philips and MUSE cannot."

Natural disagreement

Naturally, Sarnoff disagrees with what they can do. "Zenith has a single channel proposal for HDTV but in order to be compatible they have to maintain NTSC. So it takes a total of two channels," says Henderson. "With ACTV II, we also need two channels but what is unique about the Sarnoff proposal is we have this ACTV I interim option that can make a traumatic difference. We don't need the spectrum and we can build displays to match its (ACTV I) performance," he adds.

Allen Ecker, senior vice president of technical operations and chief technical officer for Scientific-Atlanta, views the issue differently. "You also have to look at the delivery signal. There are two key elements, whether the signal is optimized for frequency modulation or amplitude modulation," says Ecker. "Our B-MAC signal is optimized for FM—which fits nicely in a 22 to 24 MHz transponder—and results in a much more rugged signal."

Five different proponents, five different views. So where do we go from here? The first step of analyzing the proponent systems is almost completed. Next is to test them. And to test the proponents, somebody must build something. This is the significant step facing all the proponents at this time. Robert Hopkins, executive director with ATSC (Advanced Television Systems Committee) states that "if a proponent tests well, then and only then, can we consider them a contender."

The race is on

At the Consumer Electronics Show in January, Ben Crutchfield, chairman of the FCC testing party, stated that it won't be until the end of this year before testing begins and that testing will take one and a half to two years. However, testing has become a blending of several factors: equipment, funding and politics.

Equipment is a costly step. Dr. William Glenn, with the New York Institute of Technology, says that there are few, if any, American proponents that can compete with the testing procedures. According to Glenn, none of them can afford it. "The only proposed transmission systems that have a lot of financial backing are in the countries that have the TV receiver manufacturers," says Glenn. Greg DePriest, vice president for MST, says it simply: "If you don't have the money to construct hardware, there's nothing to test."

Regardless, there are others who

Figure 1

HDTV proponent comparison chart

System	Company	Channels	Bandwidth	Total number scan lines per frame	Horizontal resolution (Lines per picture width)	Vertical resolution	Aspect ratio
HD-NTSC	Del Rey Group	1	6 MHz	900 Progressive	700	700	14:9
ACTV I	David Sarnoff Research Center	1	6 MHz	1050 Interlaced	410	480	16:9
ACTV II	David Sarnoff Research Center	2	6 MHz Ea	1050 Interlaced	650	780	16:9
HDS-NA	Philips Consumer Electronics	1 1/2	9 MHz	1050 Interlaced	480	480	16:9
VISTA	William Glenn, NY Institute of Technology	1 1/2	7-9.5 MHz	1125 Interlaced	800	700	5:3
Spectrum Compatible	Zenith	2	6 MHz Ea	787 1/2 Progressive	1020	648	5:3
MUSE-6	NHK, Japan Broadcasting Corp.	1	6 MHz	1125 Interlaced	750	690	16:9
MUSE-9	NHK, Japan Broadcasting Corp.	1 1/2	9 MHz	1125 Interlaced	750	690	16:9
HD-BMAC	Scientific-Atlanta	2	6 MHz Ea	525 Progressive	945	480	16:9

A few, like Iredale, consider the MUSE technology excellent. "Of all the systems out there," says Iredale, "I like the MUSE system best—except for ours," he adds. "I think if they'd had their thinking caps on 10 years ago when they created MUSE, they would have created HD-NTSC (the Del Rey system)."

Others are irritated by the economic comparison of American versus Japanese/European. "We get into this habit of mixing and matching countries or continents with system proponents and in a sense, that's inescapable, and on the other hand, it's regrettable," says DePriest. "What we really should talk about is proponents and systems and the approaches inherent in those systems."

DePriest may have a point. At this time, the Japanese and Europeans are not looking at terrestrial broadcast or cable delivery mechanisms. They're looking at DBS (Direct Broadcast Satellite). NHK's response to MST and the NAB's criticism of non-compatibility resulted in the creation of the MUSE-6 and MUSE-9. However, the Japanese are now in a similiar position to their American counterparts—serving terrestrial broadcast needs.

Again we come back to testing. Each proponent is required to provide a complete system, including imagery and RF transmission. So far, the proponents have been working on pieces but not the whole system. Glenn has been working on image transmission but not on audio or RF propogation. Dolby has been working with audio, but not in imagery or RF transmission. And Zenith has been working with RF but not in audio or imagery. Although each proponent covers a different aspect of the total picture, they are all done separately. According to Glenn, the logical thing is for all of them to get together. "I think the best way to solve this would be for the FCC advisory committee to try and combine the efforts of the proponents rather than have us voluntarily try to combine them," says Glenn.

Moving along

Whether the FCC combines proponents or selects a singular approach, everyone is in the position of having to move forward. Several of the proponents, Philips, Glenn, and MUSE, have hardware and have been demonstrating it to the broadcasting and cable industries. According to Ecker, S-A's B-MAC proposal is 80 percent operational now. Their system, along with MUSE and Philips, are the only proponents with a satellite delivered signal. Sarnoff and Del Rey both have computer simulations of their proposals, with Sarnoff currently working on a prototype encoder for its ACTV I system. Zenith is hoping to have live pictures by the end of the year and NHK plans to have one-hour regular programs, via DBS transmission, by April of this year. And, as of presstime Philips was planning to actually show the total resolution, dual signal—for both their satellite and terrestrial signal combined, in March.

Patrick Wilson, director of public relations for Philips, expresses some annoyance that many of the misconceptions of their HDS-NA system comes from the things they've done with actual hardware. "We never said what we're showing is going to be the prettiest, best picture you've seen.

What you're seeing is actually how it will be done," says Wilson. "Once we know how to get us there, then we can improve the picture. The fact that we've done it on actual hardware, we think that's pretty impressive."

Implementation

With some hardware in place and systems gearing up for testing, it brings to mind a completion date. When will full HDTV be implemented? At this time, everyone seems in agreement that it could be another two to three years before a standard is set. Once a standard is selected, there will be a period of time before products are built to that standard. Initial products are expected to be high in cost, especially when considering past history with VCRs, compact disc players and personal computers. Because of this maturing of proponents and displays, contenders see an eight to 10 year period before HDTV is a significant factor in the commercial market.

According to Ciciora, something to consider during that period is the growth of cable. "By the time HDTV is here, cable should be, at least, at 80 percent penetration of TV households," says Ciciora. "This means that whatever technology is chosen for HDTV must work on cable because, at that point, anyone who is into video will likely be a cable subscriber," he adds.

A good thought for cable's future, but HDTV is hot on everyone's mind now. The trade publications have devoted an extraordinary amount of space to this new technology; telcos are spurring action by insisting that HDTV is not possible without fiber and the consumer magazines have added fuel by giving as much ink to HDTV as the trade publications. With this onslaught of information, even the most unassuming consumer is becoming aware of the possibilities of HDTV. But will it be 10 years before anyone sees it?

"It depends," says Ecker, "on whether we're going to have an evolutionary or revolutionary process to high definition. I think the key is whether you really move to the 16:9 aspect ratio or the 4:3. I think we will see an improvement in an evolution in quality of television keeping the 4:3 aspect ratio."

French agrees. "The consumer will see what we're talking about this year—IDTV (improved definition television) is the first step," he says. "The consumer is going to see the improved picture and then, it's natural, we'll go to wide screen and actually far more resolution," he says.

Sarnoff's two proposals are evidence of their contention that HDTV is an evolutionary process. "There's two things that have to come to pass before full HDTV is possible," says Henderson. "First of all, there must be spectrum in which to send it. Secondly, there must be a display capable of reproducing it. And those two things do not now exist and won't exist for at least a decade together," he states.

So there it sits. HDTV has its drawbacks to overcome before it becomes commercially significant. However, perhaps it should be looked at from DePriest's viewpoint. "We've come a long, long way, and we still have a long way to go," says DePriest. "But pointing out that there are some shortfalls doesn't, or shouldn't, subtract from the number of giant strides we have made." ■

—Kathy Berlin

New research brings promise to fiber to the home efforts

There were several advances in Fiber to the Home (FTTH) systems and technology at Optical Society of America's 12th Annual Optical Fiber Communications (OFC '89) Conference. sheer numbers of papers. The telephone industry research facility described a system capable of serving nearly 2,050 subscribers off one fiber/laser with 90 channels of video.

Scientists from Heinrich Hertz Institute (Berlin, Germany) described its system for providing an almost unlimited number of TV channels to a subscriber by utilizing a switched time domain (STDM) distribution system. The HHI researchers have evaluated the functionality of various transmission/distribution schemes (theirs and others), from the viewpoint of migration into HDTV in the near future.

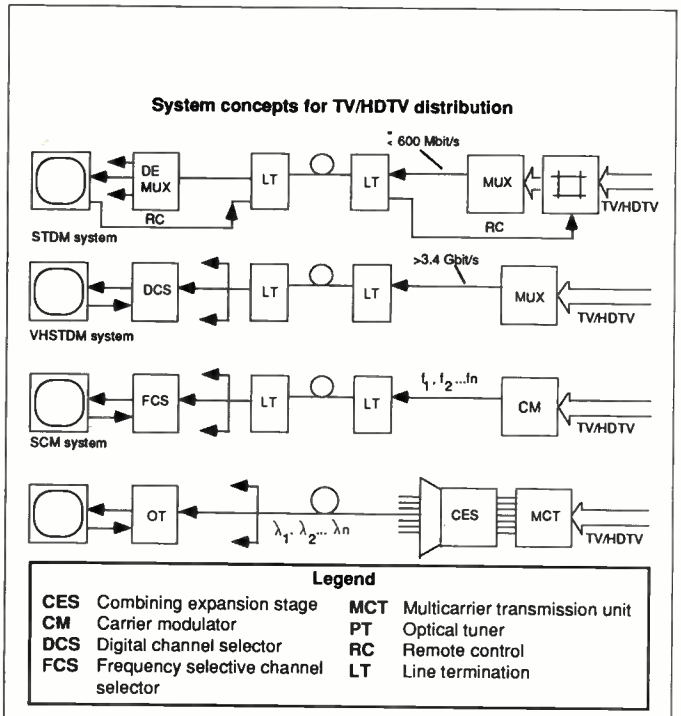

Figure 1

Systems defined

Based on the work done by the scientists from HHI, distribution systems have been categorized as frequency division (or domain) multiplexing (FDM), and time division multiplexing (TDM).

TDM has also been subcategorized into two speed ranges. Switched TDM (STDM) for FTTH systems operating up to 600 Mbt/s, and very high speed TDM (VHSTDM). VHSTDM is also an un-switched system.

TDM systems can be subdivided in relatively low bit-rate subscriber lines. Generally, they carry up to four video channels, utilizing a dedicated switched network. VHSTDM, conversely, delivers all transmitted channels to each subscriber simultaneously, similar to what is accomplished with conventional copper technology.

Likewise, VHSTDM can be utilized in trunking applications and is the most likely prospect for the proposed national CATV interconnect projects being studied here in the U.S.

The FDM systems are the immediate and main area of interest for the CATV companies, rather than the digital techniques. The telephone industry is researching FDM, but is investing in digital video technology.

FDM is subcategorized into SCM (subcarrier multiplexing), HDWDM (high density wavelength division multiplexing) and CMC (coherent multiple channel), which is in early research stages. With coherent transmission, either analog or digital baseband modulation can be utilized.

The HHI researchers said an STDM system is realistic with today's state-of-the-art devices. One advantage to this system is the fact that the number of channels to be offered to subscribers can be unlimited. However, the drawback is the switch.

VHSTDM removes the difficulties related to TV switching, but increases the optoelectronic and electronic component speed requirements. This can be translated to read "more cost, more potential for problems."

Laser modulation bandwidth require-

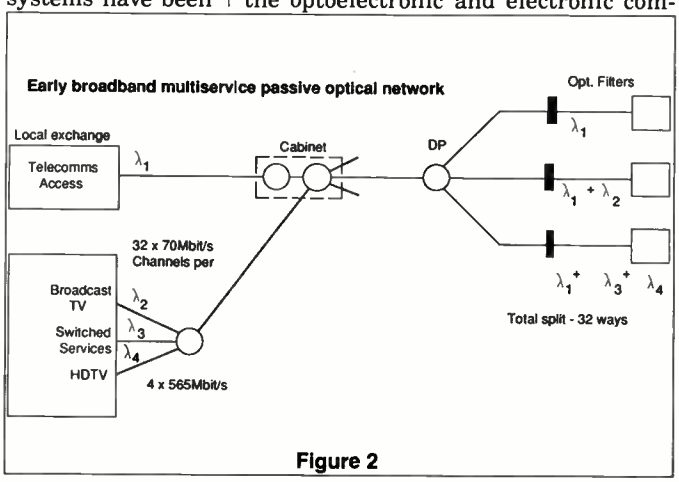

Figure 2

Optical switch technology appears to be rapidly maturing and is being included in design plans for FTTH systems. Extensive progress is being shown in the development of optoelectronic components for 100 percent digital modulation on FTTH systems, while work is also continuing on various near-term analog video transmission systems. This work is still in the research and development stages at both Bellcore and GTE Laboratories.

GTE Laboratories reported on two systems capable of transmitting 20, 60 and 120 video channels (and data) via star-coupler with the capability of servicing up to 32 subscribers off one single mode fiber.

But Bellcore dominated OFC '89 in

By Gary Moore, Consultant

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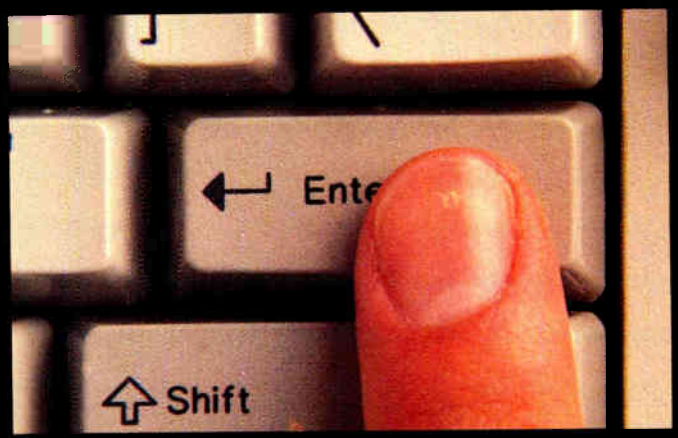

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MLM display showing sweep response. White is actual response; yellow is stored response.

MLM display showing the video, color and sound carriers of Channel 3 with upper adjacent channel picture carrier and lower adjacent sound and color carrier also shown.

MAGNAVOX

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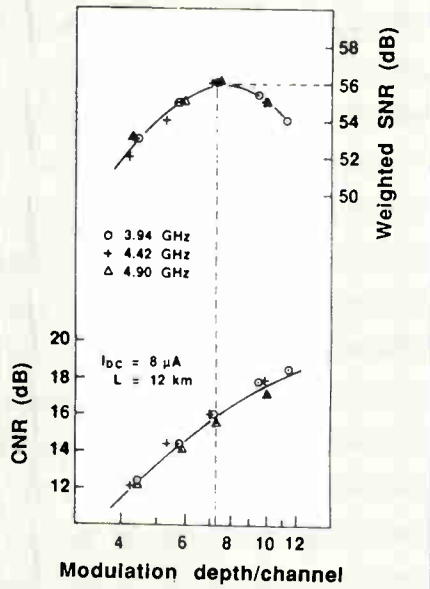
Reader Service Number 20



SNR and CNR vs modulation depth for 60 FM channels transmitted over 12 km with a received signal of - 20 dBm.

Figure 3

ments for 100 video channels (according to HHI) should be 8 GHz. The equivalent digital bandwidth required is estimated at 14 GHz, depending on the degree of compression utilized.

The advantage of the SCM analog system is the existence of microwave technology. The disadvantage is the ultrahigh speed requirements on optoelectric and electronic components.

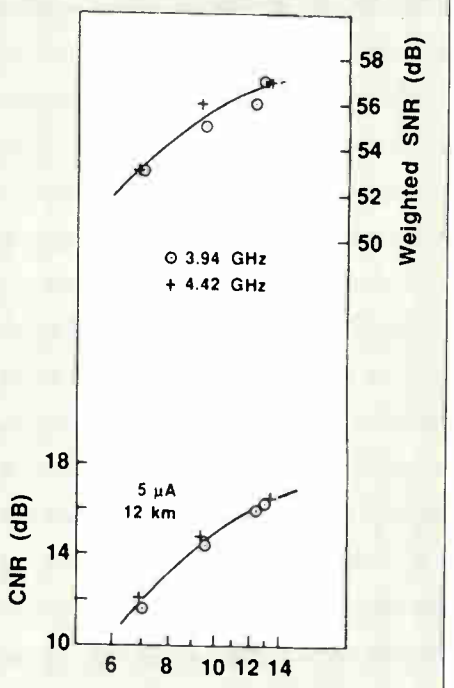
Analog limited

Only a limited number of analog channels are feasible (30 to 50) utilizing baseband modulation, according to the HHI research report.

HHI summarized its findings by saying SCM and STDM techniques could be implemented in the present or near-term, with VHSTDM, CMC and HDWDM in the "not exceptionally distant" future.

HHI further reported that the system characteristics of HDWDM were similar to CMC. The coherent optical heterodyne receiver is replaced by a tunable filter. However, the sensitivity is reduced due to the required direct detection of the optical signal.

For several years, Robert Olshansky has been leading R&D efforts at GTE in multichannel analog video for FTTH applications. The latest work from Olshansky and his colleagues describes a SCM (frequency modulated subcarrier) distribution system capable of



SNR and CNR vs modulation depth for 36 FM channels transmitted over 12 km with a received signal of - 22 dBm.

Figure 4

carrying up to 120 analog video channels.

The GTE research claims this to be an economical way of providing voice, data and multichannel video services to a maximum of 32 subscribers from a single (single mode) fiber.

The General Telephone and Electronics research proposes the use of PONs (passive optical networks) for the SCM signals. The PONs concept has recently been reported on by British Telecom Laboratories (BT), and follows by almost five years similar research done by Amphenol, even though the Amphenol work was primarily directed to digital transmission.

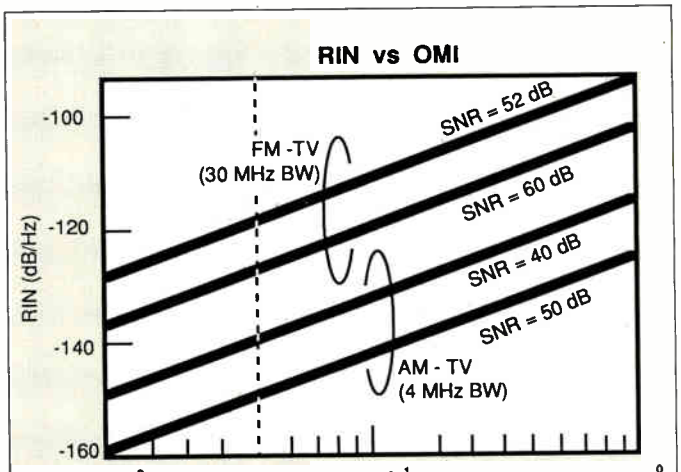


Figure 5

The BT research indicates the numerous optical transmission problems arising from analog transmission can be overcome by utilizing wavelength flattened passive optical splitters. Essentially, they are star-couplers specifically constructed to minimize optical interference at a specific wavelength.

The GTE presentation points out that PONs reduces the existing power budget problems that hamper SCN distribution to multiple subscribers. GTE points out, however, the number of splits is dependent on the uniformity of the optical splitters. A 1 x 32 split may not be achievable due to aberrations in splitter uniformity.

In addition to utilizing special splitters, GTE has also modified the modulation depth (increased it) and is driving the laser at a higher bias current. Typically, an optical signal is launched at 0 dB, and GTE calculates the receiver sensitivity at -14 dB. GTE claims to have achieved an additional 6 dB of received signal power by increasing the depth of modulation, plus an increase to +3 dB by operating the laser with a 5 mW bias and a 40 percent coupling efficiency or at 8 mW with a 25 percent coupling efficiency.

Double system = 120 channels

The GTE system requires two lasers, multiplexed, to achieve the 90 to 120 channels to the subscriber. Demultiplexing of the two laser signals is accomplished electronically—not optically—by equipment at the receiver.

Olshansky and the GTE research team summarize its system like this:

"The power budget for a subcarrier multiplexed passive optical network has been analyzed, and the feasibility of transmitting 60 FM video channels having a 56 dB SNR (signal-to-noise ratio) with a -20 dB received signal has been demonstrated. This SCM-PON represents a very low-cost approach to the distribution of video signals to 16 to 32 subscribers. It has the additional key feature of providing many paths for evolution from today's NTSC video technology to future technology, which will encompass both high definition TV as well as digital transmission."

GTE goes digital

In addition to the broadcast system described by Olshansky, et. al., GTE scientist Douglas Tang reported on a "telco-style" home run architecture switched SCM system built and tested by GTE.

This system provides the subscriber with 20 (107 Mbt) uncompressed digital video channels plus an additional 2.04 Mbt for voice and data at a total data rate of about 2.144 Gigabits.

As described, the 21 microwave subcarriers are multiplexed together and intensity modulate a 1300 nm laser attached to a fiber dedicated to feeding only one subscriber.

Subscriber premise equipment consists of an optical receiver (HF-PIN diode) and five double conversion microwave receivers for simultaneous reception of four video channels and the voice-data channels.

5 km range

The Tang system is calculated for a typical plant (link) distance of 5 km, with an additional power budget margin that would allow the link extension up to almost 10 km. A significant development in the system is the modulation scheme. Rather than use frequency-shift keyed microwave subcarrier multiplexing (FSK), Tang has chosen to utilize BPSK (biphase-shift keyed microwave SCM).

The GTE researcher cites his choice of BPSK for the following reasons:

- At any given bit error rate (BER), BPSK has the advantage of operating at an energy-per-bit-to-noise density ratio which is 3 dB less than FSK.
- External BPSK modulators can operate at data rates of several hundred Mbt, as compared to unequalized FSK of VCOs (microwave voltage controlled oscillator) which are limited to about 50 Mbt due to low pass effect of the tuning varactor.
- FSK requires a separate VCO for each subcarrier. A VCO has very poor frequency stability and is unsuitable for systems requiring stable channel frequencies, without external stabilization.

Analog Video Loop Distribution Using Two-Stage Cascade Optical Amplifiers

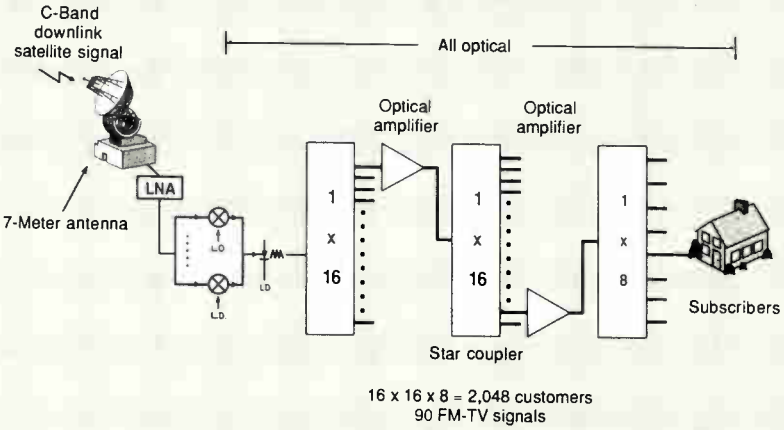


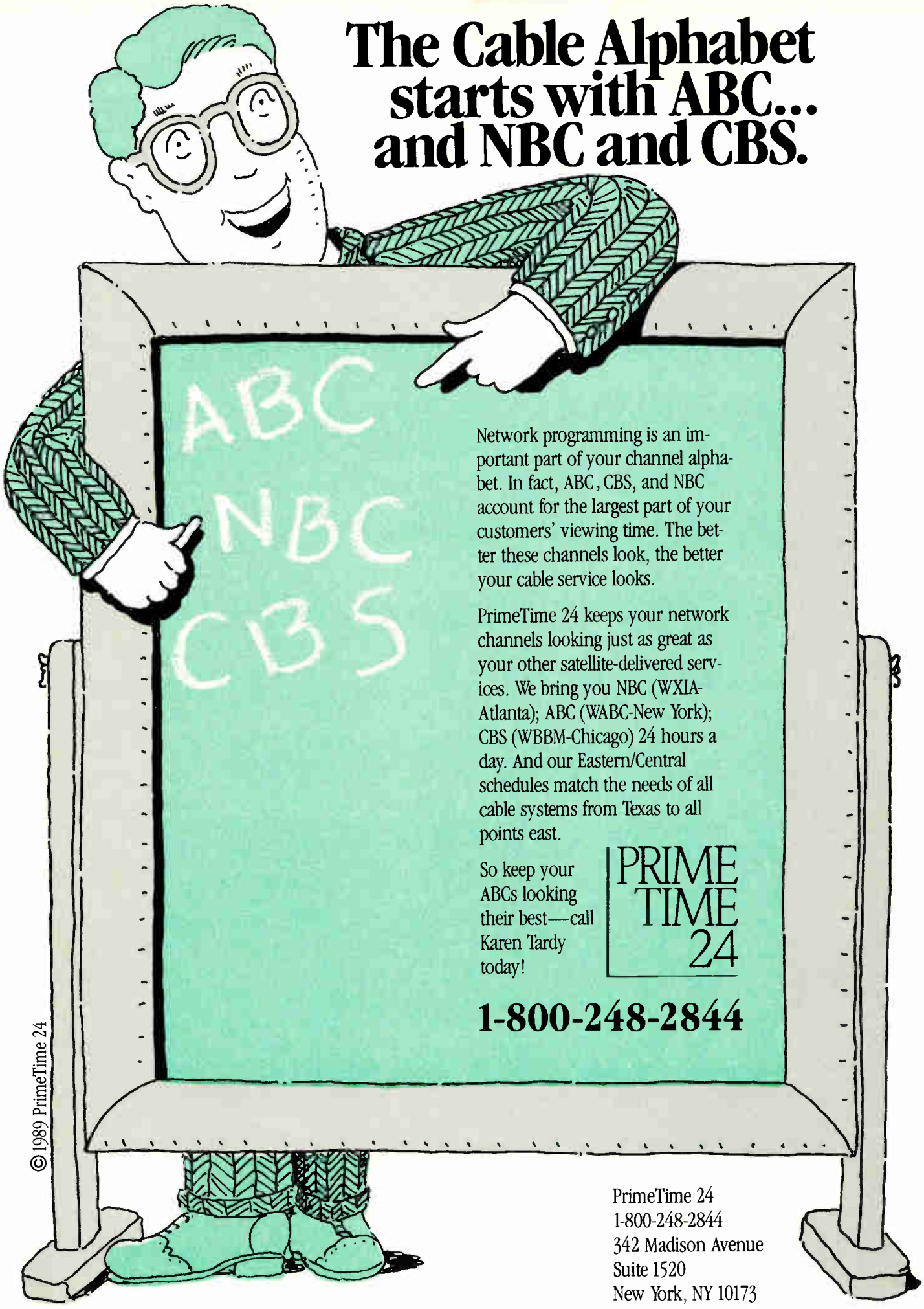
Figure 6

Tang utilizes a unique comb generator frequency synthesizer technique to achieve circuit simplicity and more reliable temperature stability. This reportedly produces a frequency stability to within 6 kHz at 6 GHz over a range of -30 to +70 degrees C. He also said the elimination of 20 VCOs for each transmitter increases the reliability of the system.

Tang summarizes his report:

"An operational wideband lightwave video distribution system using digital BPSK microwave subcarriers has been demonstrated. For a BER of 10^{-9}, an overall link loss of 12 dB can be accommodated when a laser with 1mW output power and a modulation depth of 5 percent per channel are used. Link losses of greater than 12 dB can be accommodated until limited by intermodulation effects."

The Cable Alphabet starts with ABC... and NBC and CBS.



Network programming is an important part of your channel alphabet. In fact, ABC, CBS, and NBC account for the largest part of your customers' viewing time. The better these channels look, the better your cable service looks.

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Reader Service Number 25

Bellcore

While the bulk of the telephone industry research effort to establish video FTTH transmission schemes is digital, research efforts in the analog field have been maintained.

Bellcore research scientist Winston Way described a research project for short term solutions to analog transmission problems. He pointed out the attractiveness of SCM (analog) systems is due to the short term economics and reported on techniques that will maintain the SNR at preferred levels while allowing the SCM system to distribute to over 2,000 subscribers.

Way and his research partners have achieved multiple drops with 90 video channels that seem to meet at least the SNR portions of the EIA-250B video specifications.

One of the many problems that has hindered analog SCM is the low receiver sensitivity, which prevented distribution to a significant number of subscribers.

The Bellcore research has apparently solved the signal strength problems by utilizing optical amplifiers in cascade and maintaining a respectable SNR. ■

SoBell outlines fiber strategy

The most significant development for the CATV industry at the Optical Society of America's (OSA) Optical Fiber Conference '89 was Southern Bell Telephone Company's description of its plans for the subscriber loop during the next four years.

Southern Bell has been this country's leader in the installation of fiber optics to the subscriber or living unit. For over two years it has had an experimental fiber optic CATV system in operation in the Hunter's Creek subdivision near Orlando, Fla.

Table 1

All fiber—mix & match

	%/Unit	COST Target 1st Cost	Monthly	REVENUES/month Willingness-to-pay	
Switch	7.9	$180	$ 6	Basic local phone svc.	$24
				Videotext	$10
				CATV transport —upstream billing	$ 6
Remote	26.3	$600	$15	Home security	$ 6
				Energy mgmt.	$ 4
Transmission	30.7	$700	$17	Meter reading	$ 1
Terminal Info center	35.1	$800	$21	Vertical Services Including: Common Channel Signaling, TouchStar, Voice Print, Prestige, Alternate Billing System, Store & Forward, Custom Calling, TouchTone 2-Way	(est) $ 8
		$2280	$59		$59

Perhaps our most important contribution to CATV powering is restoring meaning to the word reliability.

In the past fifteen years we've made some very significant contributions to the CATV industry. We've developed the most efficient standby power concepts. We've developed the powering technology that delivers the cable signal with unprecedented reliability. In fact, every major standby power innovation has come from Alpha, including complete status monitoring, automatic performance monitoring, uninterrupted power output, and more. But what makes us proudest is to hear people in the industry say we've brought respectability to the standby power business.

Standby power systems were introduced to make CATV signal delivery more reliable. Ironically, many of the standby systems were notoriously unreliable. They gave the entire industry a black eye.

We've worked very hard to design and build products that keep working under the most demanding environmental conditions. The fact that we're continuing to grow at an increasing pace while others have faded or disappeared shows that our concern for quality is right. And when our customers tell us we've restored confidence in standby power systems, that's the payoff.

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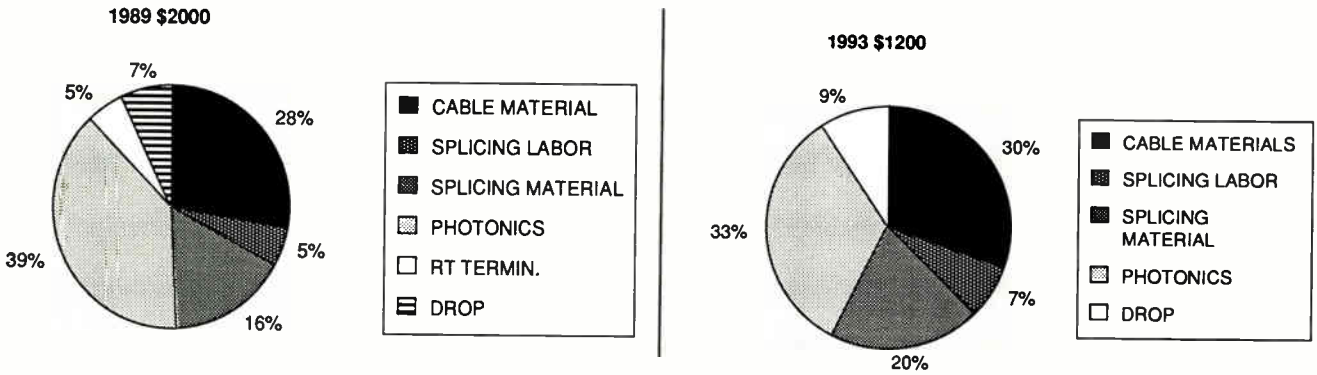
Reader Service Number 28

Table 2

Fiber '89 aggregate distribution facility components in plant costs

(For illustrative purposes)



Future strategy unveiled

Based on the Hunter's Creek experience, as well as other developments, Southern Bell publically announced how, why and when it was going to make more moves into fiber to the home (FTTH).

SoBell Vice President Richard K. Snelling, in a speech outlining his company's vision of "The Fiber City," detailed the telco's planning, estimated costs and revenues, and timetable for completing FTTH.

While he spoke of acquainting regulators with SoBell's HDTV video transmission capabilities, Snelling's speech stressed Southern Bell's (and the other telephone companies by inference) intention to provide entertainment video services to the subscriber. Southern Bell expects to have more than 1 million miles of fiber installed by 1993, the majority of that in the local subscriber loop.

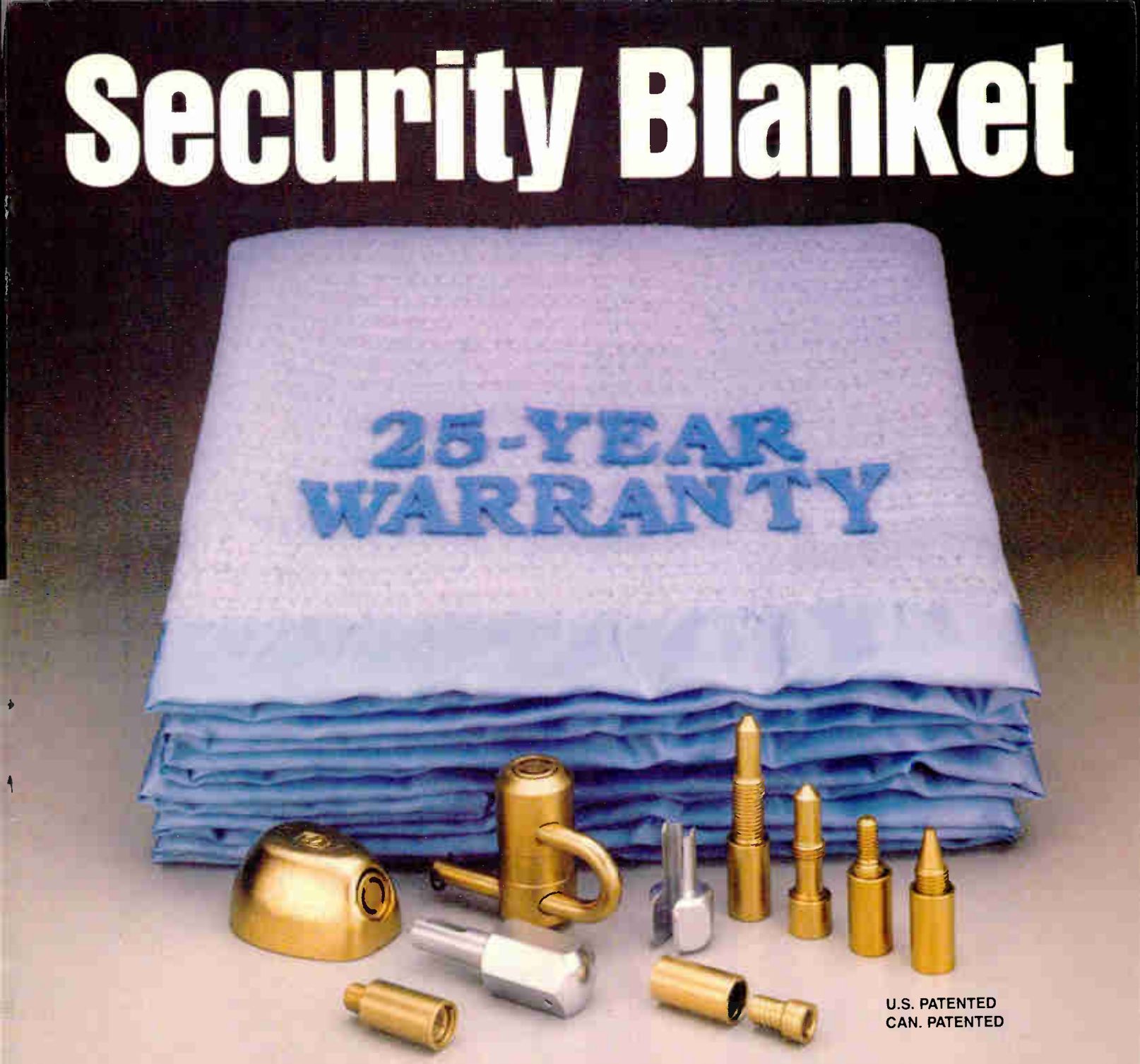
Copper being retired

In his Plenary session address, Snelling announced his company was beginning, this year, to retire copper cable "...on a mass basis." Snelling did not comment on the prevalent theory that "whoever gets fiber to the subscriber first will own that subscriber," but he admitted there is a race to provide FTTH.

"Who will build the fiber city? The natural assumption is that the telephone companies will build the fiber network and that is not necessarily true," he said. He pointed out that CATV companies are rapidly beginning to deploy combined fiber/coax systems using fiber analog architecture.

Southern Bell currently is favoring a single mode dedicated fiber utilizing a double star topology carrying multi-

Security Blanket



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Reader Service Number 30

Ask for the

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Equipment That Stays "Legal" Over Time.

Others may claim to conform to current FCC regulations, but over time, dependent on ambient temperature, their components age and drift. Our components stay legal because we use temperature-controlled oscillators, each with its own oven and FCC-required offsets in both positive and negative directions. So, frequent adjustments and maintenance are unnecessary and you can feel confident that your ISS equipment will stay stable over the long term.

Practical, Reliable Agility, Because You Really Do Need It.

We at ISS were the first to make agility practical, reliable and compact. Before we introduced our line of agile modulators and demodulators, agility was expensive, cumbersome and often inaccurate. Our decision to specialize in agility, coupled with the manufacturing experience we've developed over the years, has now made us the market leader.

Other companies have fought to catch up with ISS by saying they now offer agile components, but their components are in reality quick, knock-off products, manufactured by an outside source, to which they have attached their labels. One claims that agility is not necessary all the time so it is provided for you only when you need it. If this is true, why has a whole market sprung up devoted to selling "used" modulators?

Moon.

So when you're looking for agility, look to the leader the other leaders have been following– ISS Engineering. ISS' agile components were chosen by:

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- ❒ *Numerous federal agencies.*
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- ❒ *The Seoul Olympics.*
- ❒ *U.S. armed forces' shipboard operational and video services.*

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Reader Service Number 31

**Series II Plus*

plexed digital POTS (plain old telephone service) and data with video being carried as both narrow band and broadband analog as an interim modulation scheme.

A spokesperson for Southern Bell stressed that analog video was being viewed only as an interim solution, and the ultimate system design would be totally digital. "This (analog video) is a rather dramatic change in philosophy for me that I formed in the last six weeks primarily because of very rapid development of competing technology that cannot be overlooked," Snelling told the OFC audience.

Snelling revealed the cost for providing copper-based service to a new subdivision to be about $1,500 to $1,600 per subscriber, with that cost rising between 19 percent and 22 percent annually. With fiber, SoBell estimates it costs about $2,000 per subscriber today to provide ISDN services plus video to that same subdivision. In 1993, the company expects the cost to drop to $1,200 or less per subscriber.

Snelling advocated volume purchase contracts for a system as a means of reducing development costs. "Remember, we are deploying a system, not just hardware, and I include in that cost the in plant placing cost of the contractor on the cable material. From 1989 to 1993 the photonics costs decrease significantly.... Also, the remote terminal cost for 1989 disappears or is swallowed into the photonic cost in 1993," he explained.

The monthly cost of a full FTTH system, the "Fiber City" envisioned by SoBell, is about $2,500 per living unit in the network. Monthly revenues, including a 15 percent return on equity are about $59 per month, said Snelling. Interestingly, the revenues from CATV and HDTV are estimated to be less than $10 per month per subscriber.

HDTV is here—now

"...I am convinced we will (change out the world's TV sets to high definition sets) within the next five years...," predicted Snelling as he discussed the needs for the entertainment industry and the cable TV industry to unite with the telephone companies in a common technical standard.

He pointed out that the customer would be the one to suffer if the industries did not agree on a standard. He described the customers situation with references to the witches scene from Macbeth, "Bubble, bubble, toil and trouble...."

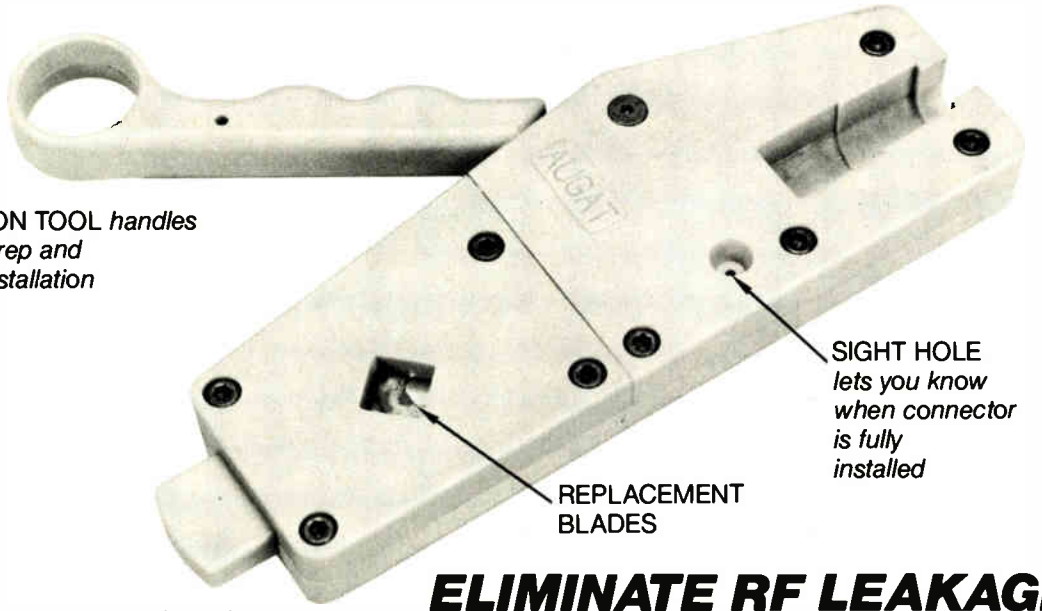
The standard Snelling referred to is a modified SONET. He described the standard as, "Basically, they (CCIT) mapped European, North American and Japanese standards into a 9 x 270 frame structure with 155 Mb/s channel delivery to the living unit and/or business location, and ultimately moving on to 600 Mb/s.

"This agreement established SONET as being further defined allowing synchronous streams which will give us the self-healing network characteristic. It also gave us the standard concept for asynchronous mode," Snelling said.

He hailed the new agreement as providing the stabilization that will allow and encourage manufacturers to introduce hardware that is compatible with world standards.

Snelling said he was excited over the broadband on demand capabilities of the new transmission standard, especially the ability to alternate the data bit stream from voice, data and video simultaneously with three high definition TV channels while maintaining a 55 to 60 dB signal-to-noise ratio. ■

—Gary Moore



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Snap-N-Seal's 360 degree compression on the cable jacket ensures a complete radial seal — virtually eliminating RF leakage. Snap-N-Seal™ has a triple seal for maximum protection against harsh environments. This adds up to increased life of drops and reduced maintenance costs.

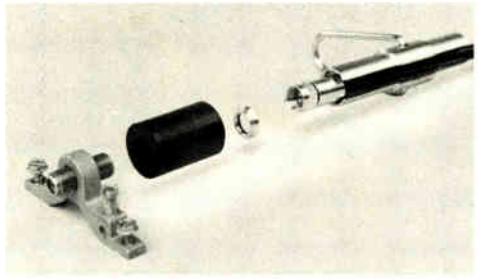
Snap-N-Seal™ is also a snap to install — no more crimping. LRC even offers a convenient all-in-one tool for installation.

Put a little snap in your "F" connector installations. Call or write Augat Communications Group, LRC Electronics, P.O. Box 111, Horseheads, NY 14845. 607-739-3844.

Also, ask about these LRC tools and options:

Open end installation wrench, featuring $\frac{1}{2}$" - $\frac{7}{16}$"

Weather cap to protect disconnected drops from environmental conditions allowing re-use of the connector.



Security shield and security shield tool

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Reader Service Number 34

Are ad sales levels taxing insertion equipment?

With local ad sale revenues surging ahead at an industry-wide growth pace of about 25 percent per year, it's reasonable to ask whether the cable TV system advertising agenda is outpacing the ability of ad insertion systems to meet demand.

Owing to the peculiarities of cable ad sale economics, with 30-second spots going for anywhere from $2 to $200, manufacturers have developed gear that is cost effective for operating in a piecemeal, multiple-channel environment, where no one channel can support anything approaching the sophistication and quality of the gear used at the typical broadcast station. And, at the same time, suppliers have sought to keep up with cable operator demand for ever more flexibility in a hot marketplace where it has become desirable to be selling ad avails on as many as a dozen or more channels.

Growing friction

"They want it all, and they want it cheap," is the way Bill Robertson, senior product manager at MSI Corp. sums up the demand for ad insertion gear. As a result, there appears to be growing friction among suppliers and customers alike as to what tradeoffs should be made in the effort to accomplish an ever more daunting task at reasonable costs.

Typical of some of the upheaval in the marketplace is the situation at Coaxial Cable Communications in Columbus, Ohio, where a 15- to 20-percent failure rate resulting from spots being dropped by one manufacturer's random access insertion system has forced the company to turn to another supplier. "We're staying with random access," says Bill Gillbert, vice president of advertising, "but we've got to have better performance."

Elsewhere, there is talk of suits against manufacturers for poor performance of such gear, and some operators are foreswearing random access altogether, preferring instead to work with sequential systems that provide an automated approach to compiling tapes. "You may make the best mousetrap," laments Eugene Bartlett, director of business development at Tele-Engineering Corp., "but sometimes it's hard to prove to the customer that he has to get rid of the mice this way."

By Fred Dawson

Series of complex tasks

Along with the demand for flexibility in ad placement have come such requirements as high-quality production and accurate verification, including video verification that spots ran cleanly as well as in their designated spots. Billing has become more complex a task as well. And with ever more ads running, the operator requires more automation in tape preparation, including dubbing and cueing, to avoid overwhelming staff costs.

But, the economics of the local ad sale being what they are, none of this has prevented operators from forging ahead with the offering of more and more channels to their ad-hungry clients. The development curve at United Artists Cablesystems' Wayne, N.J. system is typical of the trend. In 1980 the system got into the advertising business by offering avails on the Madison Square Garden Network and its local origination channel, which remains an important part of the system's program mix. By '83, the business was offering six channels to local advertisers, and two years later it was up to 12. Today it's at 15 channels, and according to Lenny Melamedas, director of studio operations, another channel is about to be added, and more are sure to come.

To keep pace, the system has gone through three generations of ad insertion gear, arriving at a current mix that includes Channelmatic's Ad Cart 2+2 for provision of random access ad insertion covering eight channels and the Spotmatic Jr. for sequential placement on the remaining channels.

There's no arguing that the move to more sophistication over an expanding array of channels has been costly, says Melamedas. With channels like CNN and MTV that offer two minutes of local avails per slot requiring four tape recorders per channel, the cost of adding a channel to the system's ad sale effort can run $18,000 or $20,000, he notes. Moreover, "maintenance is forever," with technicians needed to "clean and hand-hold the tape machines and to watch to see if you've taken a power hit"—tasks made all the more daunting because the system's headend is about 25 miles away from the studio operations center.

Immediate payback

But, even with technician salaries skyrocketing (the system just lost a maintenance engineer who went to work for Sony for $50,000), Melamedas has no trouble justifying the operations costs of the UA system sales effort. "The payback starts right away when you add gear," he says, "$100,000 is a month's billing for a couple of satellite channels."

Indeed, a recent analysis by Eugene Bartlett at Tele-Engineering of the costs for all the bells and whistles associated with full random access capability offers a clear picture of why the local ad effort is snowballing. Bartlett calculates that the equipment costs to meet commitments for 16 networks, using 24 half-inch VCRs, comes to about $160,000. Another $20,000 goes for adding space to accommodate the gear, and backup spares might cost about $20,000, bringing total equipment costs to $200,000. Figuring two ad salesmen ($25,000 each), two camera technicians ($18,000 each), an editor/operator technician ($25,000) and two clerk/computer operators ($15,000 each), Bartlett puts annual salary and benefits costs at $169,200. Rounding out the cost side are electric charges ($1,000 annually), tape supplies ($10,000) and maintenance ($7,000), bringing the annual cost total to $187,200.

For 16 networks, Bartlett calculates there are a total of 80 30-second spots per hour for the daytime and 88 spots per hour for the nighttime. For revenues, he projects that total sales will average 80 spots per hour for 10 hours per day at $2 per spot, which adds up to $1,600 in revenue per day. "It should be clear that it is possible to

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CSR-191
controls one VCR for random sequential spot selection.

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Advertising and engineering managers across the country demand the wide range of capabilities offered by ComSerter. Key benefits are random access spots, full stereo audio, direct spot search, automatic fail-safe modes, broadcast style switching, selectable end-of-break modes, video verification, advanced tape marking, simplified installation, automatic VCR timing adjustments, auxillary inputs, external processor loop, preview outputs, multi-tasking operating system and modular design as well as thorough training and support.
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Reader Service Number 35

raise $584,000 worth of gross revenue based on a mere $200,000 investment," he states. Factoring in the annual costs, this leaves a net revenue of $397,000.

The reliability question

But if, on paper, it looks like operators should be more than happy to dance to the siren tune of the local ad business, there's a contrapuntal dissonance wafting through the industry that is giving many people pause as they approach the dance floor. The sound they hear is what MSI's Bill Robinson refers to as the "whirring, clicking mechanical monsters" at the heart of the cable industry's ad sales effort. No matter how sophisticated the switching, verification, microprocessing and software elements of the ad insertion system might be, Robinson notes, the constant rolling and rewinding of the tape players is a mechanical hassle not easily overcome.

"The amount of work these machines can perform without breaking down is impressive," Robinson comments. "But, with what they go through in the cable TV environment, the manufacturers are probably going to have to upgrade the standard maintenance schedule. Over any given amount of time in use, there's probably a big difference between the environment where a machine sits in a board room and is run once a week and the ad insertion environment where gears are turning on and off without any cooling time between operations."

With such considerations in mind, another manufacturing executive, Charles Warchol, vice president of marketing at Falcone International Inc., comes up with VTR maintenance costs that are far in excess of the amounts shown in Bartlett's analysis. Citing a three-year manufacturer-provided maintenance cost budget of $2,400 per VTR, Warchol says, "When you realize that when a VTR fails it means the rest of the system is down, the sum of VTR operating costs is higher than the costs of the insertion gear."

Warner eschews random access

At Warner Cable, the concern over tape player reliability has led to a corporate decision not to pursue random access technology at this time, according to Nancy Rubin, director of ad sales. With 10 stand-alone ad sale operations company wide, ranging from a six-channel offering in Youngstown, Ohio to a 14-network sales effort in Houston, Warner assigned Rubin to take a hard look at the equipment alternatives in commercial insertion toward the end of last year. "I spent an extreme amount of time investigating what's out there," she says, "and after going through the process I was more convinced then ever that we should not be using random access at the present time."

Instead, Rubin says, the company is sticking with a sequential approach, using a sophisticated, automated tape compiler to prepare a reel for each network on a daily basis at each cable system. Working from a master reel of spots supplied by the advertisers, the machine, dubbed "Pegasus" by its supplier, A.F. Associates of Northvale, N.J., automatically copies spots in predesignated sequence onto the reels for each channel. "It can take five edit lists across five networks and compile automatically in sequence," Rubin says, adding that it takes the machine less then 60 seconds to do what a manual operator does in three to five minutes.

Rubin says this approach is a flexible alternative to random access, allowing the operator to sell spots for precise placement as many times a day as required by the client. The average system works from four to six master reels at any given time, she says.

The cutting edge

Another advocate of the sequential/automatic compiler approach is Gregory Davis, director of video operations at Oceanic Cablevision in Honolulu. As noted in a presentation at last year's NCTA Show (and later reprinted in the December issue of *CED*), the Oceanic system represents the true cutting edge when it comes to challenging tasks for commercial insertion equipment. With an active ad inventory averaging about 250 items at any one time, the system cannot operate random access on a four VTR/channel basis, since a 3/4-inch, 60-minute video tape can only carry 100 ads or so (at 30 seconds per spot).

"Having more spots than will fit onto a single 60-minute tape means having to continually change tapes or install additional VCRs," Davis notes. "Rather than changing tapes all day, we could triple the number of transports per network to allow all spots to be loaded at all times," which would work out to three VCRs to cover the full inventory one time through. Thus,

Continued on page 52

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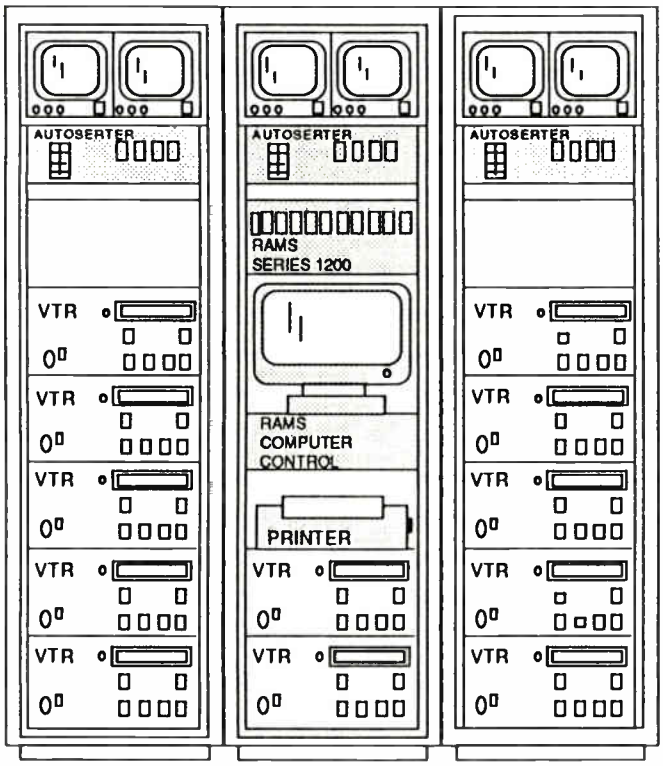

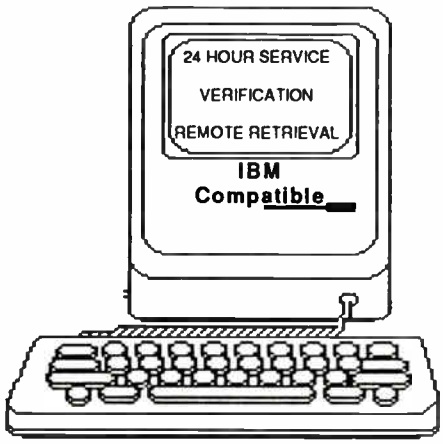

12 CHANNELS	1 VTR	4 VTR	Single VTR savings $	%
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Reader Service Number 37

Top-of-the-line commercial insertion gear from 7 manufacturers

Manufacturers have taken a wide-ranging approach to the automation of the commercial insertion process in cable television systems. Consequently, direct comparisons on a category-by-category basis are difficult. In this compilation of product information, we have focused on the top-of-the-line basic gear offered by each manufacturer for full random access or, if they have chosen not to offer random access, the most sophisticated gear offered for another methodology, such as pod random access or automatic compilation/sequential.

The prices quoted reflect costs for four channels, with or without VCRs, as noted, but can be less if fewer VCRs per channel are required. At additional costs, with additional tape recorders and other add-ons, systems can be expanded to many additional channels without adding to the controller hardware and software. All product information in this schedule is developed from material supplied by manufacturers.

Company	Product	Components and Costs
Ad Systems	AD Commander AC-400R	Automated Break Compiler $19,800 4-Channel Pod Random Insertion System $17,600 Traffic/Billing Computer & Software $7,800

Total Price	Max. No. of VCRs per Channel	Type VCRs
$45,200 (for 4 channels, including VCRs)	One, plus two for Break Compiler	Sony VP-7020

Product description

The combination of the Automatic Break Compiler and four-channel Pod Random Access Insertion System is designed to achieve random access capability with one VCR per channel in addition to the two VCRs required for the compiler. The compiler facilitates preparation of "on air"tapes used in the insertion package. The operator types into the computer a list defining the order and break length of the groups of spots, and the machine performs the compilation. For insertion, the operator enters the schedule for each satellite channel into the insertion system computer, which takes over the insertion process from there. The system records the activity on two floppy discs. The operator manually sorts data from the discs at the Automatic Compiler work station for preparation of an affidavit form for billing.

Company	Product	Components and Costs
ARVIS	7000 Series	7200 Standard Insertion System 7550 Workstation

Total Price	Max. No. of VCRs per Channel	Type VCRs
N/A	1.5 (6 VCRs for 4 channels)	Sony VP-5000

Product description

The 7000 series offers scheduling, trafficking, insertion and billing, designed for unattended 24-hour-per-day operation for up to seven days, with capacity for up to 400 sales orders per week. Spots can be random accessed, so that no sequential podding is required and tapes do not have to be striped. The remote and workstation communicate in a self-diagnostic mode. If one tape player goes down, the others are automatically reconfigured to cover the schedule, and the system is protected from power failures to ensure no loss of data. The week's schedule is automatically adjusted for new order entry, maintenance or other downtime. Unsold avails are automatically used for PSAs or station promos. Trafficking is accomplished through one-time order entry and a choice of automatic scheduling or fixed position orders.

Company	Product	Components and Costs
Channelmatic	ADCART 2+2 RA-4422	Insertion hardware, VCRs, signal monitoring, racks, etc. $66,897 PC traffic and control $26,800

Total Price	Max. No. of VCRs per Channel	Type VCRs
$93,697 (for unit serving 4 channels, includes VCRs)	Four	Sony VP-5000

COMMERCIAL INSERTION

Product description

The ADCART system offers modular flexibility, starting with a basic configuration of as few as two channels and four VCRs (unit priced here serves four channels with full random access at four VCRs per channel) The system allows the operator to mix ROS gear with the random access system, as needs require. The system is expandable to as many as 100 network channels, with full random access of up to 100 30-second spots per 60-minute tape. The CTR allows for monitoring of as many as 12 networks on a single display screen, and the system offers stereo audio capability to advertisers. Spots can be previewed without any rewiring or system reconfiguration, based on a new proprietary tape encoding technique. The system features multiple spot cueing options, including DTMF tones, contact closure, programmable real time or operator initiated manual cue.

Company	Product	Components and Costs
Falcone	RAMS 1200	Autoserter insertion mainframe, handling four channels (system expandable to 12 channels., with 4 channels per Autoserter) "Trunkmaster", with system bus master card, microprocessor with 4 kilobits local memory and 8-bit port under control of cable system's master computer. "Intelligent Machine Controller", with 2 Kb local memory and 8-bit interface port, visual check-out consisting of LEDs Complete computer subsystem, including PC, monitor and printer

Total Price	Max. No. of VCRs per Channel	Type VCRs
$22,182 (Excludes VCRs)	One	3/4 inch

Product description

The RAMS 1200 system employs random pod access (two commercials per pod) as a way to achieve random access-like flexibility without requiring multiple VCRs per channel. It is a standalone system, with its own PC, allowing it to be run at the headend without interconnection to an office computer, and it comes with preformatted tapes. Customized ad insertion schedules can be set by hour, day, and network. The system provides on-line verification affidavits and features remote headend query, automatic check of VCR performance, full electronic switching, both audio and video, and independent gain control for audio and video. The system is mainframe expandable to 12 channels.

Company	Product	Components and Costs
MSI Corp.	ComSerter	CSR-294 (1 unit plus 4 VCRs provides full random access for two channels that offer 2-minute avails)—$6,894 CSR-192 (2 at $4,850 each) (Each unit plus 2 VCRs per unit provides full random access for one channel with one-minute avails)—$9,700 ComSert Software (To control ComSerter units)—$2,150 Traffic/billing software—$6,000 (Can go as high as $18,000 for multiple-location operations)

Total Price	Max. No. of VCRs per Channel	Type VCRs
$24,744 (Excludes costs of PC and 8 VCRs for 4-channel system)	Four	Sony SP 5000

Product description

The basic design concept embodied in the ComSerter line is "single channel integrity," which means that each satellite program controller can function independent of any other. Each ComSerter is a stand-alone unit containing its own power supply, microcomputer, memory, video and audio switcher and VCR(s). Any malfunction of one channel cannot affect another. The controllers control on-air switching of local spots scheduled for insertion on advertiser-supported satellite program channels. The units receive and store spot schedules from a "traffic" computer or keyboard terminal, detect satellite cues for local avail insertion, switch the VCR spots on air and store verified logs needed for affidavits, invoices and management reports. The CSR-294 controls four VCRs for random access selection during two-minute breaks, and, if desired, it can insert spots on two satellite channels at mutually exclusive break times. Through the modular, single channel unit design, the ComSerter line can accommodate any system size and level of sophistication, and the line is fully compatible with other MSI lines already in the field. Several ComSert software programs are available to enhance system operation, provide expanded reports or offer full traffic and billing. Program audio from both satellite and videotape services can be routed in full stereo.

Chart continued on page 54

for a network offering two minutes per local avail slot each hour, the loading of four 30-second spots through random access would require 12 VCRs per channel.

Moreover, Davis asserts, every new spot would have to be dubbed once for every playback VCR on every channel, meaning that, with over 200 active spots at any one time, the system would have to keep 63 tapes current, organized and available. Given that the system receives from five to 10 new commercials each work day, it would require anywhere from 10 to 30 man-hours daily to make all the dubs necessary to add the new commercials.

With its huge ad inventory, Oceanic is an extreme case right now, but it isn't hard to imagine that many systems will be in the same boat in the years ahead. But the question regarding random access that now occupies engineers is that of reliability. Rubin says the only potential downside to the sequential approach is the possibility that satellite-delivered cue tones might be missed, resulting in the playing of ads in the wrong slots through the remaining tape sequence. And Davis adds that the sequential approach closes off the flexibility of immediately adding spots, since tapes are compiled sequentially only once a day.

A random access supporter

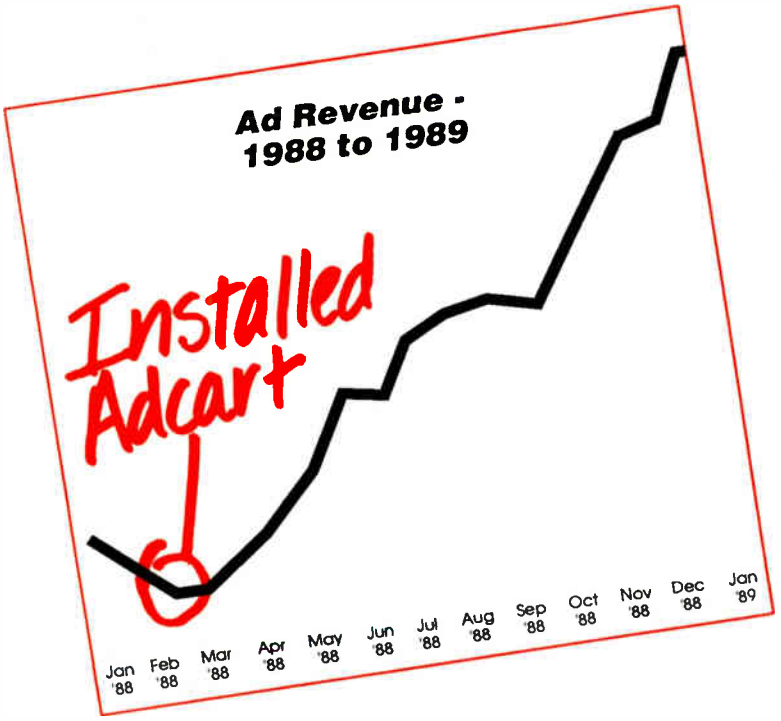
To Bill Gillbert of Coaxial Communications, which is the hub operator of the fiber-wired hard interconnect involving Telemedia and All-America Cable in Columbus, these drawbacks are serious enough to ensure he'll be staying with random access, despite the problems he's had with one vendor's gear. "We're going to be going to 10 channels in the future," he says, "and that's too many to risk the damage to the business that can come from a power outage or missed cue tones."

Lenny Melamedas at UA Cablesystems in Wayne, N.J. is another proponent of random access who believes the technology is reliable enough to build a business on, even at the 16-channel level his system is headed toward. Citing his experience with the eight-channel Channelmatic Ad Cart 2+2, Melamedas says, "We're very satisfied with the system's performance. We were one of the first customers for this system, so we had the startup hassles any initial customer is going to have with a new product. But they were not serious problems, and the system has been running smoothly since break-in. I'm not stretched so thin that I couldn't add to the maintenance crew if I had to. If I decided I needed two more maintenance days I could add them, but, the fact is, I don't."

Training is essential

Mike Watson, vice president of sales at Channelmatic, amplifies the point. "Yes, we get some feedback about the equipment being too complicated," he says. "But I think people have to look at this business like they do at other aspects of the cable industry, where things get ever more complicated as technology opens new revenue opportunities. We see engineering organizations making a commitment to training people in use of more sophisticated gear in some areas, but when it comes to commercial insertion, there's not the effort."

Eventually, the type of scenario



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COMMERCIAL INSERTION

Company	Product	Components and Costs
Tele-Engineering	Ad-Cue 2000	Network Interface Units,—one per channel—cost quoted is for 4 channels (1 x 4 configuration for single channel requiring four VCRs to achieve random access—also available in 2 x 4, 3 x 4 and 4 x 4 configurations. Unit can run up to seven VCRs per channel, permitting program as well as ad insertion.)—$36,000 VCR control and base software—$10,000 (for VCR, computer interface and Ad-Cue operation) Cable assemblies—$1,600 Tape Assembly Controller—$1,500 Load Sharing Switch, optional (can be added for six or more channel operation to reduce the number of VCRs or for providing avoidance path around failing VCRs or cable assemblies)—$6,400 IBM compatible XT or PS-2—$2,000 approx.

Total Price	Max. No. of VCRs per Channel	Type VCRs
	Four	Sony 3/4 inch or 1/2 inch VHS

Product description

The Ad-Cue 2000 system supports full spot random access, with 3/4 inch and 1/2 inch Super VHS format, stereo audio ad presentation, true HDTV video bandwidth, frame-by-frame digital pulse train in the vertical interval combined with solid state switching. The system supports any desirable network configuation with standard IBM compatible XT or PS-2 computers, combining centralized billing operation and direct down-loading of traffic schedules with data transmission checks on both transmit and receive. The use of the Load Sharing switch permits deployment of fewer tape players or can be used for backup to "soft" failures. The built-in automatic tape duplication system saves time and labor in spot reel copying. Video quality verification assures advertisers of clean video as well as verification that spots ran. The company offers an optional videodisk interface to allow operators to be ready for the arrival of videodisks.

Company	Product	Components and Costs
Telecommunication Products Corp.	Nexus Commercial Ad Inserter and ADministrator	Nexus Controller—full random access provided by one controller per channel—manufacturer does not publish prices ADministrator—software package providing one-location control over administering the video library, trafficking, verification, billing, etc. Tone Encoder (optional)

Total Price	Max. No. of VCRs per Channel	Type VCRs
N/A	Four	N/A

Product description

The Telecommunication Products random access system is designed to be software intensive, permitting direct, one-location control over every facet of the ad insertion and administration process, with full accounting built in. The Nexus controller not only handles multiple VCR inputs; it also integrates character generator input directly into the process, allowing operators to easily use unsold avails for classified advertising. The Nexus 1 was designed to be fail safe, so that, in the event of a programming source failure, such as VCR failure, the controller will automatically switch to the satellite source. Insertion can be accommodated on a run of schedule or fixed position basis.

affecting the commercial insertion operation at Oceanic could overtake systems everywhere, which could dampen the appeal of random access considerably. But, then again, technology has a way of staying ahead of the game to where such situations, once they become the norm, are provided solutions that don't involve the types of tradeoffs that operators like Gillbert and Melamedas are unwilling to make.

Already, the solution to ever more complexity in ad sales is visible in the form of optical disks. Manufacturers are looking at disk-based systems with an eye toward rolling them out just as soon as prices come down a little more. MSI's Bill Robinson says, "We're looking for price breaks in disk technology that will enable us to move away from our biggest headache, which is the tape machine." With the price for an optical mastering device now at about $160,000, he notes, the time may not be far off.

For operators now investing in random access technology, the possibility that optical disks may remove the drawbacks associated with VCRs could be decisive in justifying the costs and hassles of building a business on random access technology. With one disk equaling the playback versatility and capacity of four VCRs, notes Tele-Engineering's Bartlett, the costs are already getting close to evening out for the highest priced gear, such as his firm's Ad-Cue 2000. If that's the case, the random access-versus-sequential compiler debate could become moot long before many operators have crossed the threshold into advanced commercial insertion. ■

Fred Dawson is director of editorial development at CableVision *magazine.*

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Reader Service Number 40

HDTV in the headend

With all the talk of HDTV these days, not much has been said about specific equipment requirements for the cable system. Here we take a look at what the cable headend might look like after HDTV. What kind of new equipment will be needed? How much bandwidth? Will there be any impact on existing service? These are all questions which come to mind.

You might well ask how one can anticipate the requirements for new headend equipment, with so many different systems being considered. There are some key issues which help to narrow the possibilities and provide a reasonable picture of what might happen.

The key assumptions

A look at the FCC Interim Decision and Further Notice of Inquiry yields four key decisions:

- The terrestrial broadcast channels will remain at 6 MHz spacing,
- There will be no added terrestrial broadcast spectrum assignments,
- All terrestrial broadcasts will be compatible with existing NTSC receivers,
- Media other than terrestrial (i.e. cable, satellite, recorded) are free to act independent of these constraints.

While the decision does not stipulate a single terrestrial standard, this is a quite reasonable conclusion.

With these facts as guides, we can begin to see how different types of systems will affect the headend. The systems can be placed in three categories:

- Single channel NTSC compatible,
- Dual channel (NTSC compatible channel + augmentation channel),
- Simulcast (NTSC channel + HDTV channel).

Bandwidth usage increases from 6 megahertz (MHz) for the single channel compatible to at least 9 MHz for dual channel and 12 MHz for simulcast systems. All three categories require some new equipment.

Equipment changes

Let's look at what equipment changes are required to carry the NTSC signal, which is a part of all three categories. First, consider the single channel compatible category. By definition, a single channel compatible signal can pass through standard NTSC processing equipment because you can receive it on a standard NTSC receiver. The NTSC receiver, however, uses only the NTSC portion of the signal. Successful processing of full HDTV may require better control of filter response (flatness, group delay, selectivity) since single channel systems typically interlace additional information on subcarriers or by other means. Interference effects will likewise be different from NTSC. The compatible signal may be more sensitive to interference at certain frequencies. The modulator for these systems may or may not be significantly different from a standard NTSC version depending on system details.

Because of spectrum limitations, a successful broadcast stand-alone HDTV or augmentation channel must be placed in channels adjacent to existing NTSC channels.

In dual channel systems, one channel is generally standard NTSC. This channel should be fully compatible with existing NTSC equipment. Signal quality requirements will be high with a commensurate effect on equipment performance requirements. Some systems modify this channel and could require some changes akin to those in the single channel case.

Simulcast systems employ a completely standard NTSC channel and a completely new HDTV channel. There are no constraints placed on the NTSC channel since the information for the HDTV signal is independent of the NTSC signal.

The 'new' channels

We now turn our attention to the new channels; the augmentation channel and stand-alone HDTV channel. The stand-alone channels proposed will require the modulator and all processing equipment to be of new design. This is likely to be true of any stand-alone channel since it must be very different from NTSC to produce HDTV resolution within 6 MHz and fit in channels which are presently taboo. The augmentation channel will very probably require a special modulator and processing equipment as well. As in the single channel case above, interference effects will be different. The carrier could even be located at spacing different from NTSC channels. In most, if not all dual channel systems, the channel width is 3 MHz for augmentation (which does place carriers at non-standard spacing).

Spectral distribution in these new channels, and even the single compatible channel, will be quite different from NTSC. As pointed out above, this can cause a change in interference sensitivity, and requirements on channel flatness, group delay and selectivity. Adjacent channel protection requirements would also be different. NTSC signals have statistically dense concentrations of energy at some frequencies and correspondingly sparse concentrations, or holes, at others. Filters which take advantage of these concentrations (e.g. use notches at adjacent sound and color) may not be sufficient with the spectral distribution presented by a new augmentation or stand-alone channel. This could force changes to some processing equipment on existing channels located adjacent to the new signal.

Co-channel must be low

Because of spectrum limitations, a successful broadcast stand-alone HDTV or augmentation channel must be placed in channels adjacent to existing NTSC channels. They will also produce and be subject to co-channel interference with other NTSC channels. For these reasons such channels must be rugged and require less adjacent channel pro-

By Gerald H. Robinson, Principal Engineer, Scientific Atlanta

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tection for the NTSC channel. They also must produce low co-channel interference. They should likewise find few interference problems in a cable system. A notable exception could be CTB (composite triple beat) since the carrier may not be at the standard spacing or because of use of the spectrum near the carrier.

We now see that in all cases the major equipment changes should be limited to one channel for each of the three categories. There may be implications for some existing channels but this does not appear probable. Bandwidth requirements will be 6-, 9-, or 12-MHz in one or two channels depending on the system type.

Let's look at some of the specific design requirements which will be imposed by various format parameters. For example, some systems employ a sync which does not extend beyond the voltage swing of the video in either the augmentation or stand-alone channel. The reference level may not be sync level. For these systems, sync, clamp and AGC circuits will be very different from those used today. Quadrature modulation of the main carrier is sometimes employed. This requires carrier recovery and synchronous detection. Phase noise performance in systems with quadrature modulation is of more concern.

Other considerations

Also, questions arise about sound buzz in single channel systems which use quadrature modulation. Nonlinear processing is used by some to improve noise. This requires very good mod/demod linearity and precise modulation depth and may impose more stringent limits on channel flatness. Two separate baseband video inputs are used in at least one system. Each of these carries portions of video. Sound is generally carried digitally in addition to the normal sound carrier. Portions of the video may also be carried digitally. It is easy to see that the usual simple relationship between the picture and individual "lines" of video no longer exist in many cases. There will be strong motivation not to process these signals at baseband once they are modulated.

All of the concerns above relate to signals which are at baseband or already modulated onto a carrier in the format to be carried on the cable. Many signals will be delivered by satellite. The satellite format will be different from the terrestrial format in most cases. This is simply because what fits well in the narrow channel AM format for terrestrial does not suit the wide channel FM format of satellite. Most proponents have suggested a Multiplexed Analog Component (MAC) format for satellite delivery of their signal. Some degree of transcoding will be required between the satellite and terrestrial format.

Receivers will be different

In a thoughtfully designed system this should be fairly simple. The degree to which receivers must change will vary greatly depending on format details. Certainly the comments about sync above will apply to AFC circuits. IF filters may change as well as other circuits which may be designed around the NTSC. Baseband bandwidth will be broader but receivers presently operable with the existing MAC format

may be satisfactory or nearly so.

We have discussed the possible effects of the terrestrial format on headend equipment. This format almost certainly must be carried. A central question is whether or not a cable specific format will also be used. This format could be optimized for cable and could even use more bandwidth, if desired, to improve performance. Cable is certainly not restricted to carrying only the terrestrial standard, but why would cable choose to do otherwise? After all, why make it more complicated?

To answer this question one must first look at how cable relates to other media. Cable often competes more directly with recorded media than broadcast. This is particularly true with films, one of the larger early sources of high definition material. Present developments in tape and optical disc make it very probable that high quality pre-recorded sources of HDTV will reach the home early. Cable will need to deliver quality that compares well with these sources.

Cable-specific format

The need for higher quality, coupled with the fundamental differences between terrestrial and cable (cable has different multi-path constraints, more flexibility of spectrum and channelization), suggest that a separate cable specific format may be developed. This format would have the same basic parameters (scan rate, etc.) as the terrestrial standard to permit easy interface with receivers which can be expected to have component baseband input. When the competitive environment is considered, dual standards would seem a definite possibility. It would be premature to try to analyze the requirements of a cable specific format on headend equipment here since none have been proposed and tradeoffs abound.

An important issue has been left out of our discussion. This is scrambling. Any cable specific system would presumably include security methods, but what about the terrestrial format? The NTSC compatible channels of all three types of systems should permit the use of existing scrambling techniques (assuming the vertical and horizontal interval, etc. are left alone). But a word of caution is needed. The scrambling artifacts produced when this channel is used to produce full HDTV may not be acceptable. For example, shifts in DC level may appear more severe or have unexpected results. This should be one of the first tests to which proposed systems are submitted when testing cable compatibility.

Of course, if the NTSC portion is scrambled, the HDTV signal could not be received (except for the stand-alone case). It seems likely that two levels of service might be offered to the customer at different cost, depending on his receiving equipment. Then the augmentation channel must also be secured to prevent all customers ordering "NTSC only" service. Of course, a stand-alone channel must be secured but methods are not yet defined. If a separate cable format which includes security is employed for premium services and all terrestrial signals are a part of basic service, the issue goes away. It is difficult to analyze the problem more specifically with present information but it is certainly one deserving attention as a terrestrial standard is sought. ■

A new technique for small system trunking

Although originally presented as part of the 1977 National Cable Television Association Technical Papers, this article by John Hastings of C-COR Electronics continues to have applications today. The paper has been updated to reflect today's costs and specifications.—Ed.

There is a requirement for the cable television industry to provide service to areas outside the basic body of the system. In many cases, small systems are actually comprised of many small systems interconnected by what is commonly called supertrunk, express trunk or simply dead trunk runs. This report will not eliminate these situations but will attempt to describe a new technique for providing high performance, low cost cable service to sparsely populated areas.

Two of the limiting factors that have prevented cable operators from providing service to remote (rural) sections of their franchise areas have been economics and performance.

Cost vs. quality

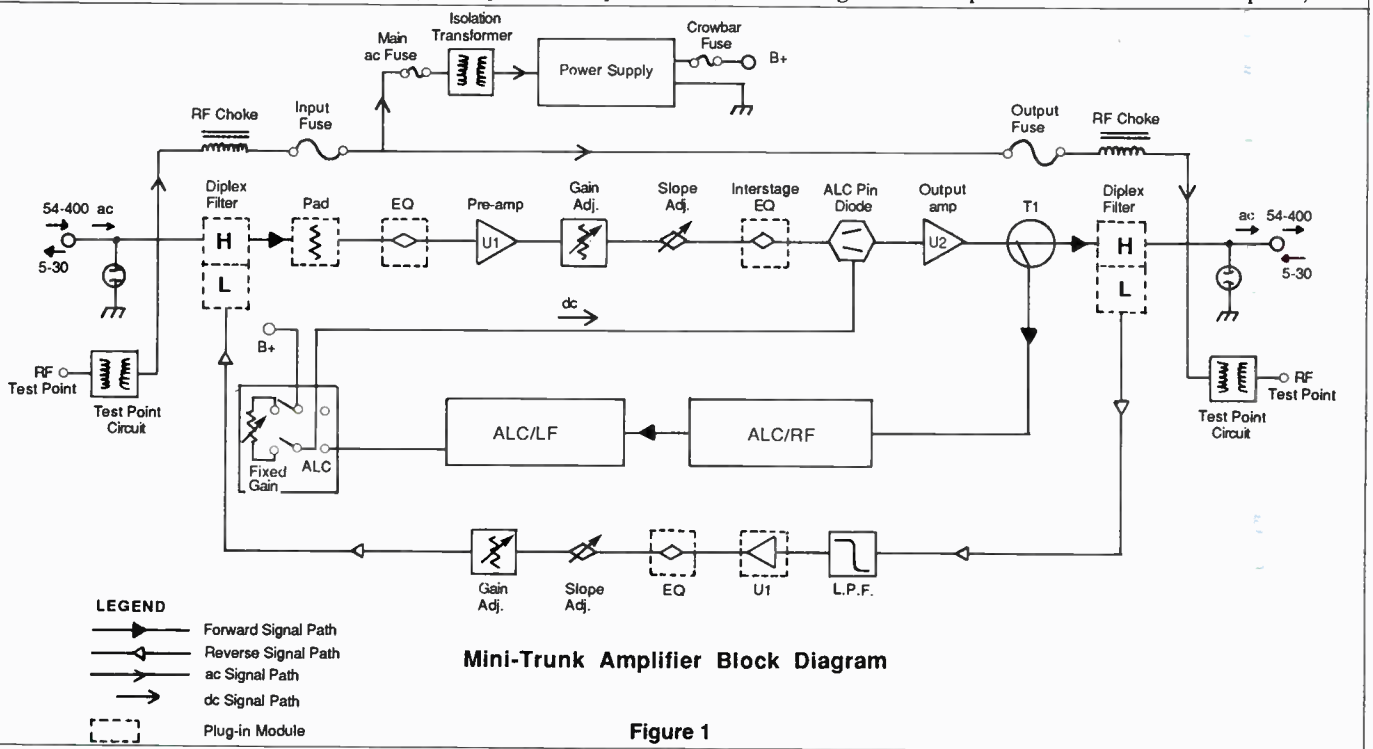
In many cases, desired performance to these remote areas could be provided, but the cost of doing so is prohibitive. Microwave links could provide the performance desired if there was a subscriber base to warrant the expense. Supertrunks, consisting of large diameter, low loss cable, offer land route alternatives to provide pictures of quality to these areas when using sophisticated high quality amplifiers.

Unfortunately, in providing a quality product to these remote areas, performance is sometimes easier to overcome than the prohibitive costs of installing such system extensions. A means to serve remote extensions without compromising performance, while at the same time being economically feasible, should be of interest to many operators and certainly could be considered a new technique.

The 'mini-trunk'

The term "mini-trunk" has carried the stigma, in the minds of many cable operators, of something cheap and inferior. This may be the greatest obstacle to generating interest in a mini-trunk amplifier. In this discussion of mini-trunks and their applications, costs should be thought of as inexpensive or reasonable in price, but the system described here is definitely not cheap or inferior.

When C-COR Electronics developed a series of mini-trunk amplifiers in 1977, they were actually distribution amplifiers with trunk quality hybrids. In those early amplifiers, the level control function was accomplished by installing pairs of thermal equalizers in the amplifiers, with one thermal equalizer being installed between two hybrid circuits and the other installed at the input to the first amplification stage. These amplifiers filled a needed



Mini-Trunk Amplifier Block Diagram

Figure 1

By John A. Hastings, National Market Manager, C-COR Electronics

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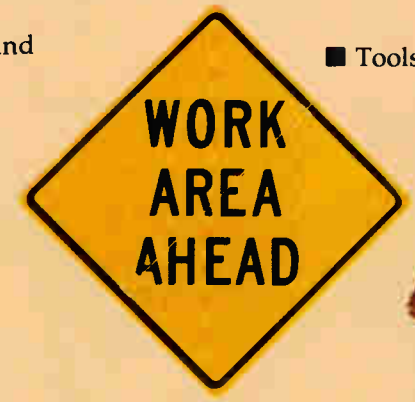

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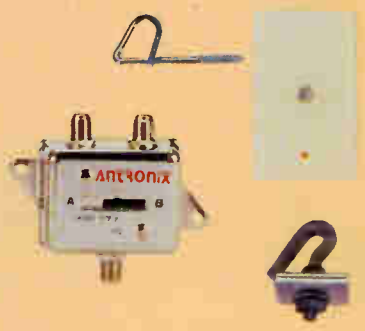
■ Housedrops



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DESCRIPTION: Bigham Cable offers aerial construction, underground construction, splicing and balancing for the CATV industry.

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FAX (614) 222-0581
280 Cozzins St.
Columbus, OH 43215
PERSONNEL: E. Jack Davis, President; Bill Holehouse, Vice President of Sales; 'Zack' Zekri, Sr. Account Executive; Stan Smith, Sr. Account Executive; Pete Tippett, Sr. Account Executive
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2113 Marydale Avenue
Williamsport, PA 17701-1498
PERSONNEL: John B. Roskowski, President; Harry A. Wahl, Vice President-Turnkey Sales; George Ferguson, Vice President Sales; John M. Roskowski, Vice President Construction; Robert Brantlinger, Director/Marketing
DESCRIPTION: Complete fiber optic, coax, or LAN, turnkey construction and supply company. Services include aerial and underground construction, splicing, house drop installation and headend installation. Also supplier of all major manufacturers and in house design, repair and engineering facilities.

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Cochran . . . . . .(619) 328-6778
Communications Construction
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Cathedral City, CA 92234
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WATS(National) . . .(800) 334-5287
31505 Grand River
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PERSONNEL: Michael W. Refalo, President; Michael E. Bisco, Vice President
DESCRIPTION: Turnkey construction of CATV, LAN and Fiber Optic systems. Including aerial, design, engineering, mapping, splicing, sweep and underground.

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COMMUNICATIONS AND UTILITY GROUP

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Cable Works 1-800-336-2205
2290 NW 2nd Avenue
Suite 9
Boca Raton, FL 33431
PERSONNEL: Steven M. Dyer, President; William P. Grieser, Sales Manager
DESCRIPTION: Florida Cable Works is a full service construction and installation contractor operating throughout the southeast. We offer aerial and underground new build, rebuild and installation services from planning and mapping through final testing and activation. In addition,

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Construction, Inc.
WATS(State) . . . . .(800) 841-4361
Highway 280 West
P.O. Box 760
Reidsville, GA 30453
PERSONNEL: Roger Kennedy Jr., President; Robert West, Vice President; Bob Skelton, Vice President; Frank Walker, Marketing Manager
REGIONAL OFFICES: Florida, (813) 439-3621.
DESCRIPTION: Aerial and underground line construction of CATV, LANs, telecommunications and fiber optic systems. Strand mapping, design, splicing, upgrades, rebuild, new extensions of system, balance, sweep and proof system. Sixteen years of experience.

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PERSONNEL: Anthony Brong, President
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WATS(National) . . .(800) 433-1129
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PERSONNEL: Joseph McCool, Chief Executive Officer; Robert M. Abbott, President; Earle Davis, Vice President/ Marketing
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REGIONAL OFFICES: 120 Floral Avenue, New Providence, NJ 07974 (201) 665-0133 Tony Cassara, Manager; 2124 Priest Bridge Drive, Crofton, MD 21114 (301) 721-6230 Michael Moffitt, Manager; 27543 Schoolcraft Road, Livonia, MI 48150 (313) 425-5700 Phil Knight, Manager; 6325 North Orange Blossom Trail, Orlando, FL 32810 (407) 297-4166 Glen Cosgrove, Manager; 743A Dogwood Park, Richland Hills, TX 76118 (817) 284-9287 James Bilodeau, Manager; 3125 Firestone Boulevard, South Gate, CA 90280 (213) 569-7997 Chet Gravett, Manager.
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DESCRIPTION: Aerial and underground cable TV construction; turnkey.

	Mini-Trunk MT-560	Standard T-500	Mini-Trunk MT-563	Standard T-503	Mini-Trunk MT-573	Standard T-523
Full Gain (minimum), dB	26	26	26	26	36	36
Bandpass, MHz	54-220	54-220	54-300	54-300	54-300	54-300
Flatness, ± dB	.2	.2	.2	.2	.2	.2
Typical Operating Conditions Channels, Number of	21	21	35	35	35	35
Spacing, Operational (1), dB	22 @ 220 MHz	22 @ 220 MHz	22 @ 300 MHz	22 @ 300 MHz	32 @ 300 MHz	32 @ 300 MHz
Operating Levels (4), dBmV	Ch 13/Ch 2	Ch 13/Ch 2	Ch W/Ch 2	Ch W/Ch 2	Ch W/Ch 2	Ch W/Ch 2
Input	10/10	10/10	10/10	10/10	7/7	7/7
Output	32/26	32/26	32/25	32/25	39/27	39/27
Distortion Charac. @ Typical Operating Levels (8) Cross Mod, (XM) (5), dB	−97	−97	−91	−91	−79	−77
Second Order (2IM) (6) dB	−86	−86	−85	−85	−76	−77
CW Comp Beat (CB) (8) dB	−97	−97	−91	−91	−78	−78
Noise Figure (3), dB	9	9	9	9	9	7
Factory Alignment Cable Loss, dB	11 @ 220 MHz	11 @ 220 MHz	11 @ 300 MHz	11 @ 300 MHz	21 @ 300 MHz	21 @ 300 MHz
Flat Loss, dB	12	12	12	12	12	12
Return Loss, Input and Output, dB	16	16	16	16	16	16
Gain Adjust Range, dB	0-6	0-6	0-6	0-6	0-8	0-8
Slope Adjust Range @ Ch 2, dB (pivot at 200 MHz)	−3.5	−3.5	−3.5	−3.5	−3.5	−3.5

Figure 2. Amplifier Specifications

requirement within the industry and many were installed in systems, and are still operating today.

Since the introduction of those early high quality mini-trunk amps, improvements have been made. The thermal level control circuits have made way to automatic level control circuits. A directional coupler has been added to the amplifier housing to provide a passive distribution output port. Through the evolution of improved performance hybrids, the current series of mini-trunk has benefited.

To provide some typical pricing comparisons for a 20-amplifier cascade, the following information is provided:

	Typical Price
Trunk Station T-50X w/ALC (32 dB spacing)	$810.00
Mini-trunk MT-57X w/ALC (32 dB spacing)	$495.00
20 amplifier cascade of full sized trunk stations	$16,200.00
20 amplifier cascade consisting of 20 mini-trunk stations.	$9,900.00

Using the unit pricing for the amplifier cascade, the mini-trunk amplifier cascade results in substantial savings over a similar cascade consisting of all

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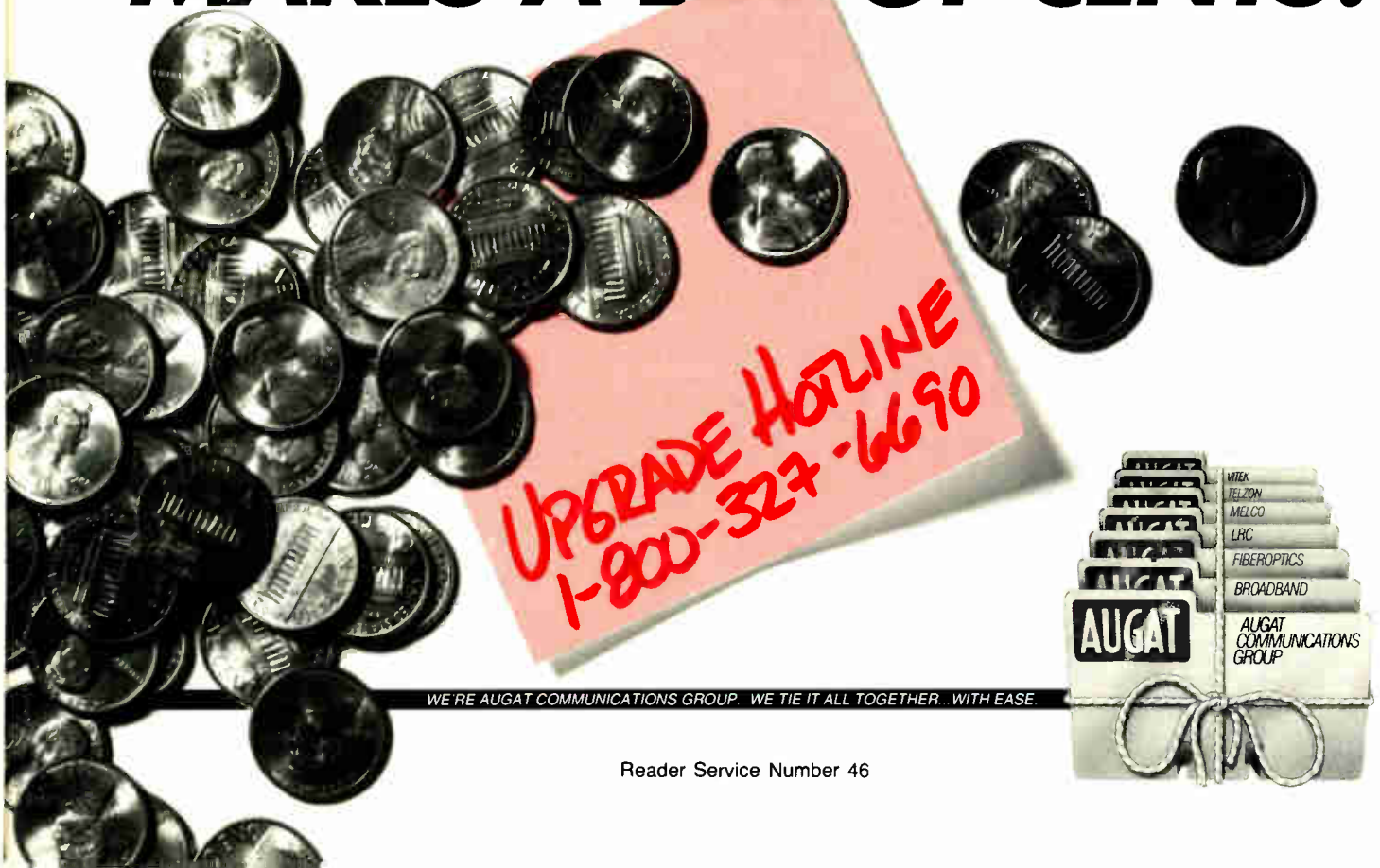

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	CNR at Highest Channel	X-M	2IM	CWCB Beat
22 dB Spacing, 54-220 MHz 21 Channels				
20 Mini-trunk Cascade	+47.0 dB	−71.0 dB	−73.0 dB	−71.0 dB
Distribution	+57.9 dB	−59.0 dB	−67.0 dB	−60.5 dB
System	+46.4 dB	−57.0 dB	−67.5 dB	−58.2 dB
20 Standard Trunk Cascade	+47.0 dB	−71.0 dB	+73.0 dB	−71.0 dB
Distribution	+57.9 dB	−59.0 dB	−67.0 dB	−60.5 dB
System	+46.4 dB	−57.0 dB	−67.5 dB	−58.2 dB
22 dB Spacing, 54-300 MHz 35 Channels				
20 Mini-trunk Cascade	+47.0 dB	−65.0 dB	−72.0 dB	−65.0 dB
Distribution	+55.9 dB	−59.0 dB	−67.0 dB	−57.0 dB
System	+46.5 dB	−55.5 dB	−65.8 dB	−54.1 dB
20 Standard Trunk Cascade	+47.0 dB	−65.0 dB	−72.0 dB	−65.0 dB
Distribution	+55.9 dB	−59.0 dB	−67.0 dB	−57.0 dB
System	+46.5 dB	−55.5 dB	−65.8 dB	−54.1 dB
32 dB Spacing 54-220 MHz 21 Channels				
15 Mini-trunk Cascade	+45.0 dB	−62.0 dB	−65.0 dB	+61.0 dB
Distribution	+57.9 dB	−59.0 dB	−67.0 dB	+60.5 dB
System	+44.7 dB	−54.3 dB	−62.8 dB	−54.7 dB
15 Standard Trunk Cascade	+47.0 dB	−58.0 dB	−66.0 dB	+59.0 dB
Distribution	+57.9 dB	+59.0 dB	−67.0 dB	+60.5 dB
System	+46.6 dB	−52.5 dB	+63.5 dB	+53.2 dB
32 dB Spacing, 54-300 MHz 35 Channels				
15 Mini-trunk Cascade	+45.0 dB	−56.0 dB	−64.0 dB	−55.0 dB
Distribution	+55.9 dB	−59.0 dB	−67.0 dB	−57.0 dB
System	+44.6 dB	−51.3 dB	−62.2 dB	−50.0 dB
15 Standard Trunk Cascade	+47.0 dB	−54.0 dB	−65.0 dB	−55.0 dB
Distribution	+55.9 dB	−59.0 dB	−67.0 dB	−57.0 dB
System	+46.5 dB	−50.8 dB	−62.9 dB	−50.0 dB

Figure 3. System Performance

standard full stations. Naturally, the amount of distribution required along the cascade will result in variations in the total price.

Figure 1 illustrates a block diagram of the mini-trunk amplifier. The mini-trunk station is made up of two basic modules: the RF chassis and the switching regulator power supply. All circuitry is contained within the housing with the RF chassis in the base of the housing and the power supply in the cover plate. The housing contains the necessary cable entry ports, test points and heat fins. The RF chassis contains the forward RF amplifier, the ALC circuitry and the reverse amplifier (optional).

At the input and output of the forward RF amplifier are diplex filters. These separate and combine the forward and reverse paths.

If the reverse path is not used, a buss wire is factory installed in place of the diplex filters and also the reverse amplifier location.

Two hybrids

The forward RF amplifier uses two hybrids to provide the required gain for

the mini-trunk. The gain and slope response of the amplifier are adjusted by installing fixed attenuator pads and fixed equalizers in the Pad and Eq locations in the amplifier and by adjusting the gain and slope controls located at the output of the input hybrid.

The Pad and Eq plug-in areas are located at the input of the input hybrid. Pads and equalizers installed here will provide a course adjustment of the amplifier output. Output levels are fine adjusted by using the gain and slope controls. These are referred to as interstage controls since these controls are located "between" the hybrid amplifiers.

The forward RF amplifier also contains a pin diode circuit and an interstage equalizer. The pin diode circuit receives a DC voltage from the ALC/LF amplifier and adjusts the gain of the amplifier within a 3 dB window. In mini-trunk amplifiers using high pilot ALC systems, the pin diode also adjusts the slope response of the amplifier, adjusting the gain at the high frequency versus the gain at the low frequency in about a two-to-one ratio. Mini-trunks using a low pilot ALC system changes the gain of the amplifier equally at all frequencies.

The interstage equalizer provides built-in cable equalization for the amplifier.

Comparing some specs

Figure 2 lists the individual specifications for conventional full-size trunk station amplifiers compared to the equivalent version of the mini-trunk amplifier. Note that they are very comparable.

The 22 dB spaced mini-trunk has system application for extended cascades which have channel loading up to 35 channels. The 32 dB spaced mini-trunk is generally recommended for shorter cascades. The decision on which mini-trunk station to be used must ultimately be decided by the individual user as is the case with any amplifier selection process. Bandwidth, channel loading, distance to be traversed and performance desired at the system extremes must be considered. There will be situations in which either of the mini-trunks could be used. Where such a situation exists, many could choose to use the 32 dB spaced unit on the basis that fewer amplifiers increases system reliability. The amplifier selection, however, must be based on realistic requirements, considering both present and anticipated future needs.

Figure 3 lists some typical system performance numbers using cascades of mini-trunk and standard trunk stations. Distribution performance has been included to show system performances. The distribution performance has been calculated on the basis of using the trunk cascade, plus one distribution (bridger) amplifier and two extenders in cascade. Trunk cascades are included in Figure 3 for comparative performance information. The comparison shows that either standard or mini-trunk stations can be used with negligible differences.

> The 32 dB spaced mini-trunk is generally recommended for shorter cascades.

Flexible approaches

While the goals for cable systems are fairly rigid in some instances, there is flexibility in the ways to approach those goals. Generally, performance within a system should not be greatly compromised since the object of providing service to remote areas is to gain subscribers and the subscribers will judge for themselves whether cable television is worth paying for. The approaches to getting to the subscriber areas are variable, at least with respect to amplifiers to be utilized and costs involved in purchasing those amplifiers.

Every reader might not agree with the approach discussed here, but an approach which is economical, provides excellent performance and is an option worth considering has been suggested. Other utilization considerations might be to use the mini-trunk within the main body of the system where relatively short secondary trunk runs eminate from the primary trunks. The tapped trunk approach lends itself to the use of the mini-trunk in both function and economies. The uses of mini-trunks are as varied as the imaginations of the operators. Perhaps the initial foremost consideration is that it could save cable operators real dollars. In this day, that alone makes the system discussed here well worth consideration. ■

Rebuild market having profound effect on suppliers

Record quarters. Record years. It seems that virtually everyone connected to the hardware side of the CATV industry is riding the crest of the construction market that shows no signs of slowing down. Equipment manufacturers report record sales levels while order backlogs continue to grow; new distribution companies form as quickly as others are bought out; and MSOs keep the good times rolling by finding more residential pockets to wire.

"Niche" players gaining strength

With the industry firmly ensconced in the middle of a rebuild cycle fueled by demand for more bandwidth capacity and better quality signals, system operators are sometimes squeezed by product "shortages" (instances where product is being produced but not fast enough to meet immediate demand). It's a market where many of the smaller, "niche" equipment manufacturers are making an impact. Suppliers like Triple Crown, Lindsay, C-COR Electronics and Nexus Engineering are experiencing renewed growth because MSOs have high levels of unmet demand for products.

Iowa Mold Tooling Cable reel loaders

The manufacturers' good fortunes are fueled by more than the U.S. market, however. Rural wiring in Canada and hot growth finally occurring in Europe is pushing sales to astronomical levels.

Doubled sales levels

For example, Lindsay Specialty Products has doubled its sales each of the past two years, according to Dave Atman, director of marketing-electronics. Even though the 33-year-old amplifier company, based in Lindsay, Ontario is well-known north of the border, it's just beginning to make inroads deep into the States.

"The U.S. is our smallest market," says Atman. Lindsay hasn't done well in the past because it's been unable to produce and stock enough equipment to keep up with the demand from U.S. operators, Atman says. "We do much better in newbuilds" because many upgrades are simple electronic module changeouts—and operators use modules from the company that originally sold them the amplifier, says Atman. But he hasn't given up, yet. Last November, Lindsay opened a sales office in Atlanta in order to capture some of the spillover from smaller operators who can't round up product from traditional suppliers.

Increased capacity

With the advent of fiber optic backbones and demand for more bandwidth, Atman believes operators will be attracted to Lindsay because it offers "fiber-ready" products like 650 MHz active drop amplifiers, 700 MHz passives, etc. Soon, the company will introduce higher-bandwidth line extenders, followed by 800 MHz to 1 GHz actives within the next two years, Atman says. "We're the smallest (supplier), but we're on top of things," he adds.

Closer to home, C-COR Electronics is seeing a resurgence in product demand all across its product line, according to John Hastings, CATV national marketing manager. Operators are replacing old 300 MHz and 330 MHz equipment with 450 MHz gear and there's even "movement in the 550 (MHz) area," especially from operators rebuilding in larger markets.

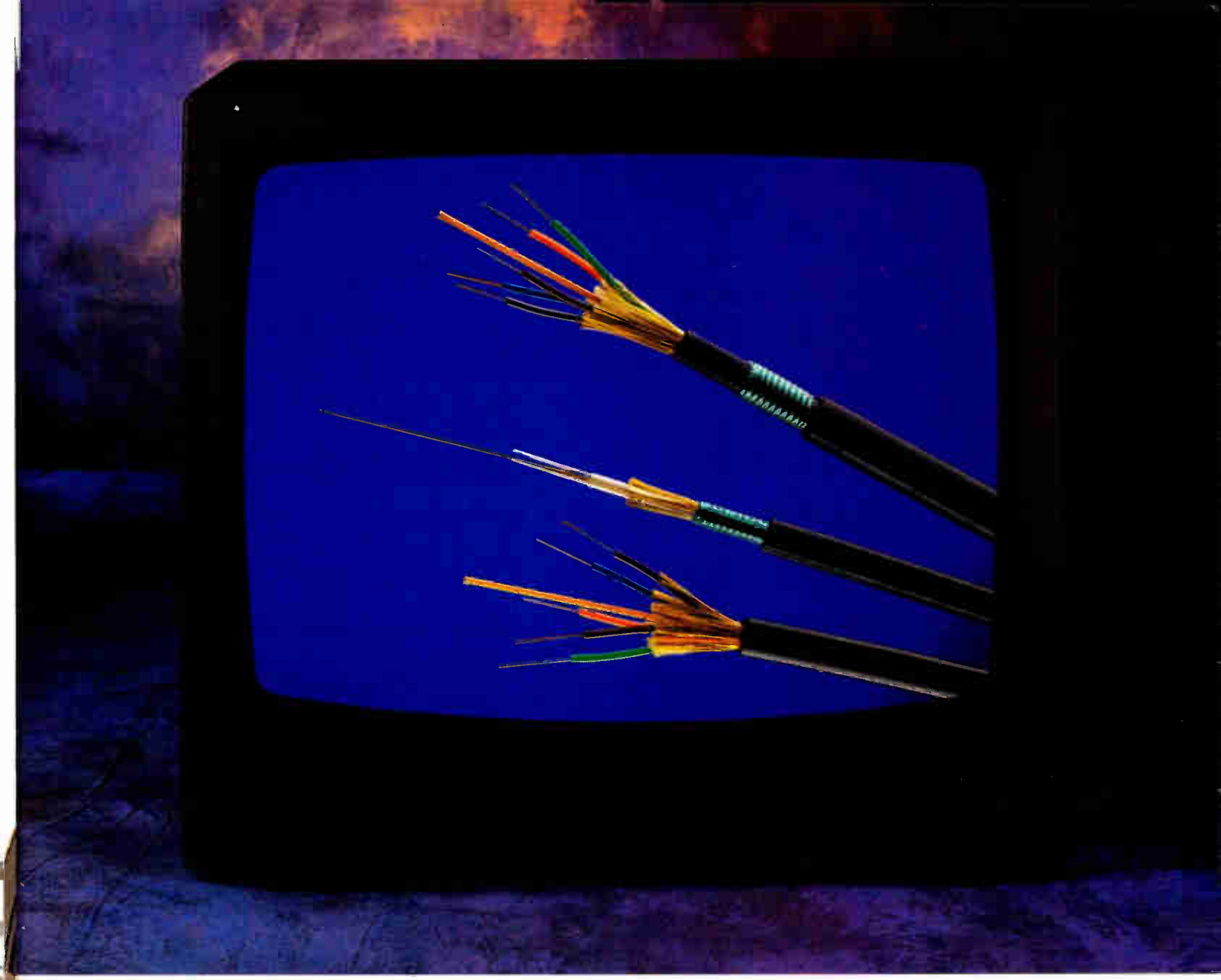
Strong year ahead

"We're anticipating a strong 1989 and it looks strong—at least on paper—for the next year," says Hastings. "Of course, there are a number of things that can change operators' minds...."

Through its C-COR Europe company, C-COR is keeping abreast of what's occuring overseas, but Hastings says the market remains tiny, especially when compared to the U.S. Hastings says the European market will probably be "booming" in a few years, but right now there's "more talk than action."

What about fiber? C-COR is "spending some R&D money" on products relating to fiber (the company expects to debut its fiber-to-coax amplifier at this year's National Show and will reportedly show an AM delivery system) but, says Hastings, the company would rather enter into a joint agreement with an existing fiber product manufacturer to avoid reinventing the wheel. In fact, discussions concerning such a relationship were still going on as of press time.

Instead, C-COR's growing R&D budget is targeting new, higher bandwidth electronics that can accommo-



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date the increased channel loads made possible by fiber delivery schemes. Hastings says C-COR will probably show hardware (mainline passives and splitters) capable of passing 800 MHz or 900 MHz at the Show in Dallas.

Not all that easy

Pushing the electronics to those levels isn't a huge engineering challenge, but it isn't easy, either, says Hastings. "It's certainly doable, but the key will be the hybrids," he says. He does expect to have to make changes to the amplifier housings, though. "We all found that when you went out to 550 MHz, you didn't just take existing product—you had to do some new design."

Triple Crown is making inroads in the U.S. on the coattails of hotel pay-per-view, says Brian Ward, director of marketing. With many MSOs going after the hotel and resort markets for PPV revenue, Triple Crown is benefiting "tremendously," he says.

MSOs getting smarter

But more importantly, the market is getting more knowledgeable, says Ward. When it comes to active electronics, MSOs are expressing more interest in good specifications, not just price. "It seems people are more conscious of specs" because of quality issues and the impending leakage control guidelines mandated by the FCC.

For example, operators want to know about input losses, interstage controls like variable slope controls and how signals are handled internally whereas up until recently price was the key issue. "Engineering departments are getting smarter and increasing their knowledge," says Ward. "Now they know what they want."

> When it comes to active electronics, MSOs are expressing more interest in good specifications, not just price.

Both Triple Crown and Lindsay point to rural builds in the U.S. and Canada as their new-found bread and butter accounts. As the value of each subscriber has increased, it has become affordable to deliver cable service to outlying areas. In fact, hundreds of small communities were wired in Canada by Cancom, a satellite programming service provider. Although the cable operations arm of the company was later broken up into several separate operating units to avoid conflict of interest concerns, the fact remains that small systems are paying off handsomely for the operators. The U.S. operator, known as K-1 (because it's based in Kansas) is making a living wiring areas with as few as 100 homes.

Nexus gaining ground

Small, rural systems are being drawn to Nexus Engineering's Series 100 headend, too, according to Leonard Zapalowski, Nexus' director of CATV marketing and sales. Selling on reliability, Nexus is attractive to operators of small systems because reliability means less maintenance and repair, therefore less cost to the operator. "The reliability argument is what we've been committed to and it's paying off for us," says Zapalowski.

Nexus recently introduced the VideoCipher Mainframe Board, which allows six VideoCiphers to be built into a single rack space. "We're finding that people *are* still building systems and this headend allows people to cable areas where they couldn't cable before," Zapalowski says.

Why? Because the cost is so low. For example, Nexus' 30-channel headend, which will process 20 scrambled channels and 10 off-airs, sells for about $32,000—a fact which is winning over a lot of system operators, says Zapalowski.

But how long will the build and rebuild "window" remain open? Zapalowski sees opportunity for the next several years, but cautions that political and/or economical changes could slam the window shut prematurely. If interest rates rise, for example, highly-leveraged U.S. cable system operators could be forced to put off a significant number of construction projects until conditions improve.

> Boring holes under centuries-old cobblestone streets or wiring landmarks is a touchy situation that hasn't been completely addressed yet.

Overseas 'window' bright

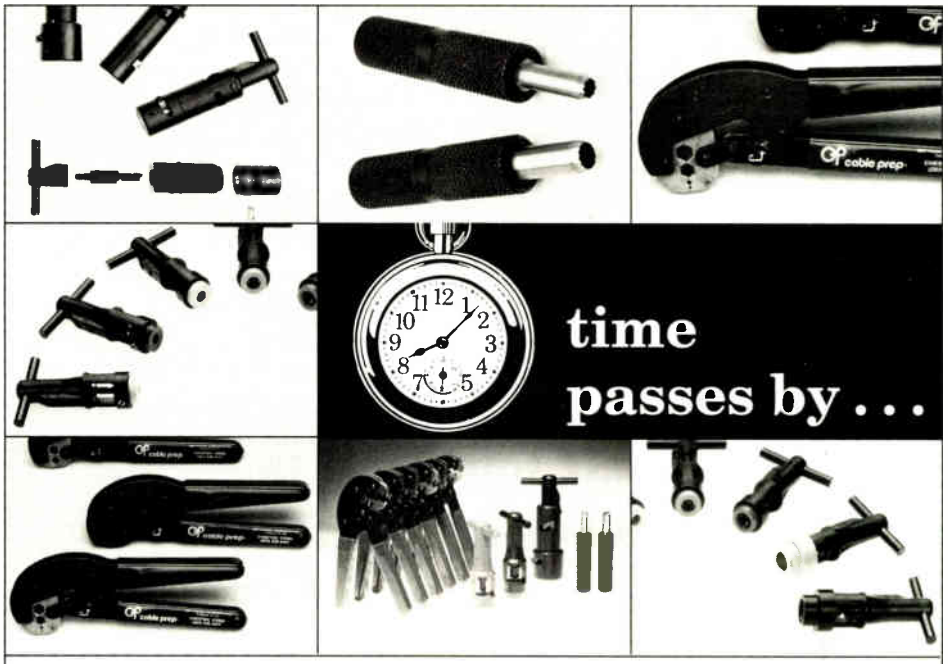
Regardless of what happens in North America, opportunities abound in Europe and the Pacific Rim. In fact, Lindsay and Triple Crown have already made significant inroads in those two markets.

Belgium, for example, is rebuilding its Brussels system and Switzerland's Geneva system is using Lindsay product "from trunks to taps," says Atman. Germany, Austria, Luxembourg and England all have significant contracts to let and are being courted, also.

In Europe, "the sky's the limit," says Ward. "It's just beginning to happen now, but the rate of expansion is the big unknown." Why? Because boring holes under centuries-old cobblestone streets or wiring landmarks is a touchy situation that hasn't been completely addressed yet.

Not in several years, at least, has the industry had so many things to look forward to. With rebuilds being driven by the need for more channels and better picture quality; rural system builds spurred by the high prices per-sub systems command today; and the prospect of newbuild activity heating up overseas; cable television equipment suppliers have a lot to be thankful for. ■

—Roger Brown



Earth station antenna theory and maintenance

BACK TO BASICS

Earth station antennas are a fundamental part of virtually every cable system. Unfortunately, their existence is often taken for granted, except when trouble occurs or a replacement is needed. In this "Back to Basics" look at this primary piece of equipment, Steve Havey with Scientific-Atlanta examines the principal parts of the earth station antenna and presents steps for routine maintenance.

While non-existent less than 15 years ago, today, television receive-only (TVRO) earth station systems are in use in practically every cable system in North America, providing the wide variety of basic, pay and specialized programming on which the cable industry has come to depend.

The heart of any TVRO system, or at least the most visible part of it, is the earth station antenna. These range in size from 10 meters in diameter, used primarily in the earlier systems installed in 1976-77, down to 2.8 meters, with 4.5 to 5-meter antennas used in the majority of systems.

It is the purpose of the earth station antenna to collect the extremely weak (typically -162 dBw) signals from the desired satellite and concentrate them sufficiently enough to produce a usable signal level. The ability of the antenna to increase the signal is typically expressed as gain in dB referenced to an isotropic source (dBi.) More recently, manufacturers have published efficiency numbers for their antennas. While 60 to 65 percent is typical for most antennas, others may achieve 70 to 72 percent. Care should be exercised here, however, as an antenna's efficiency in terms of gain is sometimes increased at the expense of sidelobe performance, a tradeoff the cable operator can ill afford in view of 3-degree to 2-degree satellite spacing.

While the design, construction techniques and composition of earth station antennas vary widely among manufacturers, each is composed of three basic components: reflector, feed and mount.

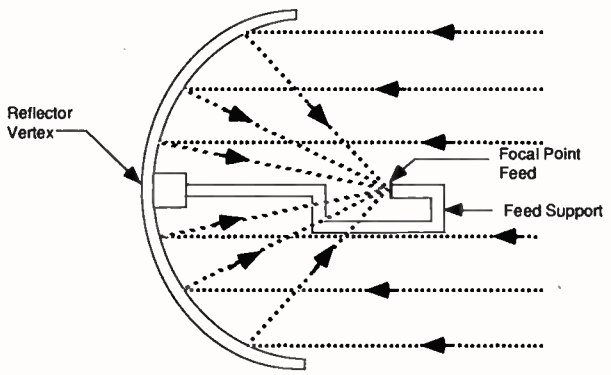
Reflector

The reflector is the "dish" part of the antenna. Usually constructed of either fiberglass, aluminum or steel, the reflector is curved so that the desired signals are reflected to the *focal point* of the antenna regardless of where they strike the reflector's surface. (See Figures 1 and 2.) Because the satellite signals will pass straight through non-metallic surfaces, antennas made of fiberglass must have a metallic coating or mesh embedded in their surface.

For single-beam antennas (those that are designed to receive signals from one satellite), the dimensions of the reflector's curve are derived from a parabola, thus the often used name "parabolic dish." Multi-beam antennas have a curve based either solely on a sphere or, as is most often the case, a curve which is parabolic in the vertical plane and spherical in the horizontal plane. It is the spherical curve which allows the multi-beam antenna to achieve uniform performance from all of its feeds even though, individually, they are not on a par with single-beam reflectors.

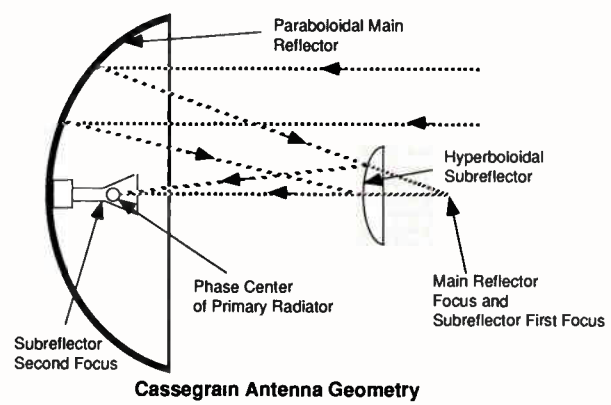
Multiple feeds have also been placed on single-beam reflectors, but unlike true multibeam antennas, the feeds do not produce uniform performance. The feeds mounted outboard of the center feed have distorted sidelobes and reduced gain compared to the center feed. The degradation of sidelobes and reduction in gain increases the farther these additional feeds are located from the true focal point. While up to five feeds have been installed on some antennas, two to three is the usual number, and it is questionable as to whether they will work with 2-degree satellite spacing.

Of primary importance in any reflector is its *surface tolerance*, or how closely it matches its design dimensions. The surface tolerance is critical in order to achieve not only the maximum gain (signal increase) from the antenna, but also to maintain the lowest sidelobe levels possible. It is the



Prime Focus Antenna Geometry

Figure 1



Cassegrain Antenna Geometry

Figure 2

By Steve Havey, Headend Earth Station Products Marketing Manager, Scientific-Atlanta

level of these sidelobes, or undesired gain in directions away from the desired satellite, that will determine whether or not the antenna will adequately perform with 3-degree or 2-degree satellite spacing. For the C-band frequencies (3.7 GHz to 4.2 GHz) currently used in cable TVROs, a surface tolerance of 0.060 inches or better is recommended. For Ku-band operation, the recommendation is 0.030 inches.

Feed

The feed is located at the focal point of the antenna and collects the signals that have been focused by the reflector. Because satellite signals are transmitted in both horizontal and vertical polarizations, an orithomode transducer (OMT) is usually attached to the feed. It is the OMT which separates the horizontal and vertical signals and delivers each to its respective low noise amplifier (LNA) or low noise block converter (LNB.)

There are two basic types of feed in use today, cassegrain and prime focus. The cassegrain feed provides more gain than a prime-focus feed and was the predominant feed design used in the early TVRO antennas. Figure 2 illustrates how, with a cassegrain feed, the satellite signals are reflected first from the main reflector to the sub-reflector and then to the feed horn mounted in the center of the reflector. Because of the open area in their large feed horns, cassegrain systems require pressurization to prevent condensation of moisture, which adds to overall system cost.

The prime-focus feed, compared to the cassegrain, provides approximately 0.5 dB less gain. This slight disadvantage is more than offset by the fact that prime-focus feeds cost less and do not require pressurization. Most important of all is the fact that sidelobe levels are typically 6 dB lower than a cassegrain feed allowing better performance with 2-degree satellite spacing. Figure 2 illustrates an antenna utilizing a prime-focus feed while Figures 3 and 4 show a comparison of cassegrain and prime-focus patterns from a 5-meter antenna. Some manufacturers offer retrofit kits to convert earlier cassegrain feed systems to a prime-focus feed.

Mount

The antenna mount physically supports the reflector and feed assemblies and provides the mechanical travel required to point the antenna to the desired satellites. Usually constructed of galvanized steel, the mount is generally bolted to a concrete foundation installed in the ground near the cable system's headend building. While earlier mount designs, due to limited travel, required that this concrete foundation be oriented in a certain direction or centerline, most designs today incorporate continuous (360-degree) azimuth travel and thereby eliminate the need for foundation orientation.

The most common mount in use by the cable industry employs elevation-over-azimuth (EL/AZ) geometry. With this type of mount, two separate adjustments, azimuth (side-to-side) and elevation (up/down) are required to point the antenna or to move it from one satellite to another. Polar mounts, which require only one adjustment to move from one satellite to another, are more difficult to install initially and usually require special orientation of the foundation. For that reason, they are seldom used in cable applications where frequent movement of the antenna from one satellite to another is not required.

There are two basic types of feed in use today, cassegrain and prime focus.

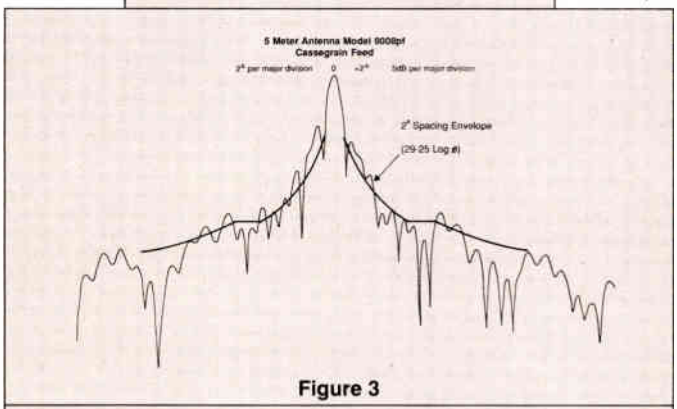


Figure 3

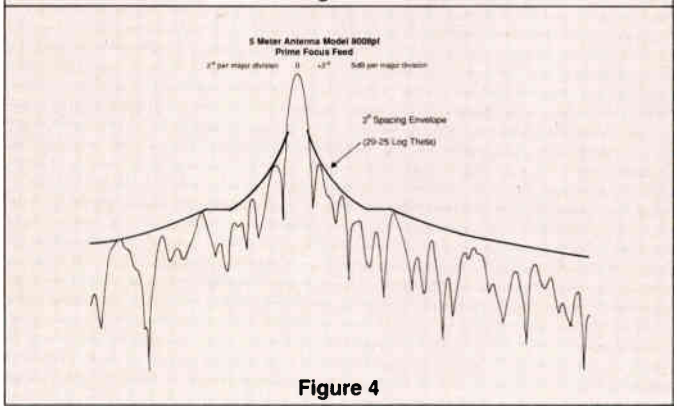


Figure 4

Routine maintenance

As with any other piece of equipment, routine maintenance should be performed on earth station antennas to ensure both their electrical and mechanical performance. Examples of items that should be checked on a periodic basis include:

Electrical.

- Checking all connectors on LNAs and LNBs for looseness, moisture and corrosion.
- Regular drying of desiccant crystals in the feed pressurization system. (If so equipped.)
- Check antenna pointing for maximum signal level. Some movement of the antenna may occur over time because of movement in the adjusting mechanism, settling of the foundation, etc.
- Check the feed polarization for maximum isolation between the vertical and horizontal signals.
- Make sure the feed opening is free of obstructions, including insect nests.

Mechanical

- Check to make sure all hardware is tight and free from corrosion, rust, etc. Treat and paint as necessary.
- Examine all structural members for signs of fatigue, cracks, etc.
- The reflector should be checked for visible damage such as dents, cracks and in the case of fiberglass antennas, delamination of the fiberglass or sagging of the reflector. Any of these signs indicate a possible change in the reflector's shape that could affect gain and sidelobe performance.

For specific recommendations you should always consult the product manual for your specific antenna or contact the respective manufacturer. ■

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5. CH ENG, MW, 45K	CH TCH, SE, 24K	LN TCH, E, 12/HR
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EOE

CORPORATE DESIGN—DRAFTER

Individual will perform aerial and underground cable television plan design and drafting for large cable television MSO at the company's corporate office. Will be responsible for design accuracy, bill-of-material generation and miscellaneous drafting projects as required. Will also be responsible for the maintenance of Corporate-wide maps.

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WHAT'S AHEAD

SCTE

April 10 *The Florida Chapter, South Florida Group* will host a technical seminar on HDTV. Call Dan Bernasconi, (305) 238-7960 for location and time.

April 13 *Chesapeake Chapter* will address "Satellite Communications" in a technical seminar at the Holiday Inn in Columbia, Md. Call Tom Gorman, (301) 252-1012 for details.

April 19 *The Rocky Mountain Chapter* will present a technical seminar on "Fiber Optic Communications." Call Rikki Lee, (303) 792-0023 for info.

April 20 *The Central California Meeting Group* will hold a technical seminar on "System Testing and Spectrum Analysis" presented by Tektronix. Call Andrew Valles, (209) 453-7791 for location and time.

April 25 *Satellite Tele-Seminar Program* will air "The Future of the CATV Business (Part II)" plus "Frontline: Senior Cable Engineers (Part I)" with Wendell Bailey of NCTA, Vito Brugliera of Zenith, Tom Elliot of TCI, Dave Large of Raynet and Joe Van Loan, consultant. Videotaped at Cable-Tec Expo '88 in San Francisco, the program will air from noon to 1 p.m. Eastern time on Satcom F3R, transponder 7.

May 3 *The North Country Chapter* will hold a seminar on "BCT/E Certification Category V, Data Networking and Architecture" at the Sheraton Midway Hotel, St. Paul, Minn. Call Douglas Ceballos, (612) 522-5200, ext. 705 for details.

May 7 *Central Illinois Chapter* will host a technical seminar on "CLI/FCC Requirements and Signal Leakage Programs and Devices." Call Tony Lasher, (217) 784-5518 for info.

May 9 *The Chattahoochee Chapter* will present a technical seminar. Call Jack Connolly, (912) 741-5068 for details.

May 10 *North County Chapter* will meet for a technical seminar at the Sheraton Midway Hotel in St. Paul, Minn. The topic is BCT/E Category III, "Transportation Systems" with Dane Walker of Hughes Microwave. Call Douglas Ceballos, (612) 522-5200, ext. 705 for info.

May 10 *Mount Rainier Meeting Group* will hold a technical seminar on "Fiber Optics." Call Sally Kinsman for details.

May 12 *Rocky Mountain Chapter* will host a technical seminar on "Distribution Troubleshooting," "CLI and Signal Leakage" and "Magnavox Mobile Training Van" with Eric Himes of Magnavox and Ron Wolfe of ATC. Call Rikki Lee, (303) 792-0023 for details.

May 13 *Cactus Chapter* will present a technical seminar. Call Harold Mackey Jr., (602) 866-0072, ext 282 for info.

C-COR ELECTRONICS INC

C-COR Electronics "state of the art" seminars are three-day events designed to instruct relatively new technicians in basic theory, installation and maintenance of cable TV systems. Attendance is limited to a maximum of three persons from one system. The fee is $195.

April 25-27 *C-COR Electronics Seminar* will be held in Columbus, Ohio. Call Teresa Harshbarger, (800) 233-2267, ext. 326 to register or for additional info.

May 23-25 *C-COR Electronics Seminar* will be held in San Francisco, Calif. Call Teresa Harshbarger, (800) 233-2267, ext. 326 to register or for details.

MAGNAVOX CATV SYSTEMS CO.

The Magnavox CATV Systems mobile training center is a fully-equipped laboratory on wheels for cable training. The three-day seminars combine instruction in theory and practical hands-on training, using gear and test equipment common throughout the industry. The fee is $300.

April 11-13 *Magnavox Mobile Training* will be held in Bellingham, Wash. Call Amy Costello Haube, (800) 448-5171 (in N.Y. state, (800) 522-7464) for additional info.

April 18-20 *Magnavox Mobile Training* will be held in Portland, Ore. Call Amy Costello Haube, (800) 522-7464) to register, or for additional info.

April 24-26 *Magnavox Mobile Training* will be held in San Francisco, Calif. Call Amy Costello Haube, (800) 448-5171 for additional info.

Etc.

Scientific-Atlanta is offering one-day technical seminars at the following locations: **April 10** *Headend/Earth Station Systems Training* to be held at the Airport Hilton Inn, Philadelphia, Pa.

April 11 *Distribution Systems Training* to be held at the Airport Hilton Inn, Philadelphia, Pa.

April 27 *Headend/Earth Station Systems Training* to be held at the Hilton at Peachtree Corners, Atlanta, Ga.

April 28 *Distribution Systems Training* to be held at the Airport Hilton at Peachtree Corners, Atlanta, Ga.

May 10 *Headend/Earth Station Systems Training* to be held at the Chicago Marriott Oakbrook, Oakbrook, Ill.

May 11 *Distribution Systems Training* to be held at the Chicago Marriott Oakbrook, Oakbrook, Ill. For all S-A seminars, call Dan Pruitt, (800) 722-2009, for details and registration.

April 12-13 *Jerrold*, in conjunction with *CTAM*, will sponsor "Cable Insights '89—Taking the Mystery out of Cable TV Technology" at the Hyatt Regency Tech Center, Denver, Colo. Call Helen Werkheisor, (205) 674-4800 for details and registration.

Eagle debuts its version of off-premise addressability

There isn't exactly a groundswell of activity yet, but yet another manufacturer has jumped on the off-premise addressability bandwagon.

Eagle Comtronics showed off it's new addressable trap enclosure designed to be installed on the side of the home during the Texas Cable Show in February. The device is unique in that it incorporates a hard-wired store-and-forward device that allows system operators to offer impulse pay-per-view.

The housing is similar in size and construction as the boxes used by TCI and offered by Midwest CATV. The unit can accommodate negative, positive and multi-channel traps, according to Eagle's Chester Syp. In addition to addressability, the unit features a non-volatile memory, parental control and the optional impulse accessory box.

Syp said prototype devices are presently being tested in two different systems and delivery was to begin in early April. The device is expected to be priced competitively with traditional addressable converter/descramblers (not including traps) while the headend filter control module is expected to cost about $4,000.

In other Texas Show news, **Midwest CATV** announced it now stocks two new products. **Antronix**'s new patented CAM-Port, designed to automatically grip any size center conductor with the proper contact pressure without creating insertion wear on the contact, will be available in Antronix multi-taps beginning in April.

Also, **Power Guard**'s compact 15-amp power supply is being stocked by Midwest. The FR 6015-0 offers 87 percent efficiency, a two-year warranty and is the smallest 15-amp supply available to the industry, according to Midwest CATV Vice President Chris Sophinos.

Speaking of news from distributors, the parent company of **TV Cable Supply**, TVC Inc., acquired Horizon Cable Supply. The deal will merge both entities into a single nationwide distributor.

Other news found on the convention floor in San Antonio included a new fiber optic cable developed by **AT&T** and offered by **Anixter Cable TV**. A new rodent/lightning protected Lightguide Express Entry cable is designed to provide CATV system operators with lightning protection up to 105 KA and rodent protection that won't deteriorate in high-sulfate soils. The new cable is currently available with up to 48 fibers and priced about 30 percent higher that the original LXE configuration. A 96-fiber cable will be available soon, according to Anixter officials. For details, call Anixter's fiber hotline, (800) 342-3763.

Also, Anixter officially announced that it's research and development lab and national accounts center has moved to Denver. By joining Cable Labs in deciding to relocate to the "cable capital," Anixter's facility will be able to take advantage of "synergies" that will naturally exist, said Gaylord Hart, manager of product application development at Anixter. The lab will initially focus on fiber optics and other emerging technologies, including increased bandwidth passive distribution equipment. The national accounts center will be headed by Gene Robinson.

Riser-Bond Instruments got into the act by showing off its new Model 1210 time domain reflectometer. The "Cadillac" version of R-B's cable fault locator line features simultaneous readout in feet and meters, a waveform/data printer, auto distance calculation and supertwist LCD display with backlight, all housed in a rugged case. The unit can test coaxial, twisted pair or any metallic paired cable. The TDR is priced at $4,395. Call (402) 694-5201 for info.

FCC Field Engineer Clark Poole conducts a mock inspection of system signal leakage records with Session Moderator Les Read. Photo by Bill Riker.

Riser Bond's time domain reflectometer

HDTV research gets boost

Zenith Electronics Corp., in cooperation with **AT&T** is working on a $24 million research and development program to develop an HDTV processor/receiver, integrated circuitry and prototype hardware for evaluation and demonstration of Zenith's spectrum compatible HDTV proposed transmission system. The two companies are seeking $13 million in co-funding from DARPA, the U.S. Defense Advanced Research Projects Agency.

For the processor/receiver, AT&T Microelectronics will design and produce the integrated circuits while AT&T Bell Laboratories will apply its system-design technology to key elements of the project. Zenith will provide television systems and circuit experience technology along with management of the R&D program. The research will begin immediately. For more information call (312) 391-8181.

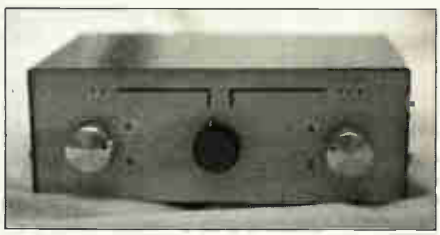
Corning Glass Works unveiled its new fiber-optic wavelength division

Continued on page 81

"Bird's nest" bothers Porter

Nine months in the cable industry seems like a relatively short period of time. However, it was long enough for Wayne Porter, installer technician with Adelphia Cable in the metro-Pittsburgh area to recognize a problem and develop a solution. Frustrated by messy hook-ups of VCRs and television sets in Adelphia's dual cable system, Porter decided to ignore the conventional way of doing things and designed the DCS Tape and View Unit.

The DCS unit allows dual cable subscribers to tape one program while viewing another on the opposite cable—without the confusing and jumbled

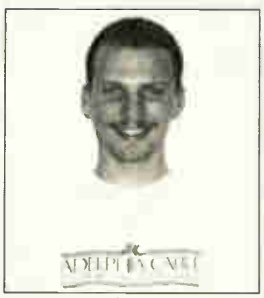


DCS tape and view unit

mess that normally accompanies VCR switchers and similar devices. The box incorporates similar technology as switchers, but hides it within the 6-inch by 8-inch design. The front panel is a two knob selection, which simplifies the operation for subscribers. Porter also designed the DCS Tape and View Unit II, which is compatible with Scientific-Atlanta converters, and the SCS Tape and View Unit for single cable systems.

Getting started

The idea for the DCS unit evolved while Porter and another installer were doing a downgrade at a subscriber's house. Using Adelphia's current VCR kit, which consists of three A/B switches and two two-way splitters, Porter felt the whole process was a mess and the subscriber had no idea how to operate it. "The back of the set looked like a bird's nest," says Porter. "It was really confusing." According to Porter, a typical installation of the VCR/TV hookup takes 30 minutes for wiring and an additional 15 to 30 minutes to explain to the subscriber how it works. "Sometimes, we have to put tape on the A/B switches so the subscriber knows what they have," adds Porter.



Wayne Porter

Refusing to believe something couldn't be done, Porter went home, scaled down the entire process, put it into a compartment and designed the front of the box to be self-explanatory. He then demonstrated the box for his supervisor, Adelphia's technical trainer, Gary Allridge, who tested the box to see if it worked. "I knew it worked," laughed Porter. Excited by the concept, Allridge called in chief technicians and district managers to see a demonstration by Porter. The general consensus was that he should publicize information about the box.

So what happens now? "I'm sitting back and waiting," says Porter. "I think if it can be manufactured on a large scale, it would save cable companies thousands of dollars." Porter states that the savings would come through decreased installation time and satisfied customers. "A lot of customers were turned off when they saw the mess," he says. "They would make you take it back out, saying they would never learn how to use it."

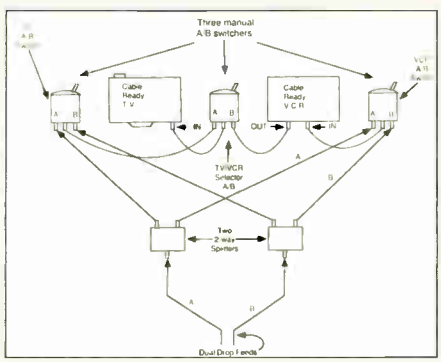
Inside workings

The DCS tape and view unit consists of two input ports, A and B (located in the rear of the unit), for dual cable systems. It then splits each feed with two, two-way splitters, through coaxial cable to one of two A/B switches, one for the VCR and one for the television set (located in the front of the unit). These two switches select the desired A or B cable for either the VCR or TV. A third A/B switch (located in front of the unit), is not used for switching from A to B, but for switching from VCR to TV. Jumpers within the unit, from the VCR/TV selector and the VCR A/B switch, are fed to the rear of the unit into three output ports. One port goes out to the TV conventional antenna "in" port, one to the VCR antenna "out" port and the third to the VCR conventional antenna "in" port.

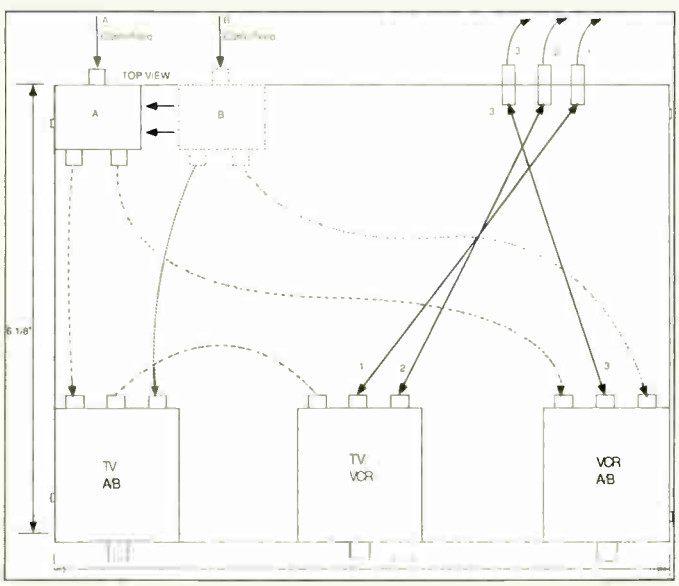
Both of the other units, the DCS tape and view II and SCS single cable system, employ similiar technology within the units. The units provide an easier, attractive method to tape one cable show while viewing another on a different channel. "I basically simplified it," says Porter. "Everything is worked from the front of the box. It's like a TV or VCR."

Meanwhile, Porter is forging ahead with his cable career. He completed the NCTI (National Cable Television Institute) installer technician course in a month and is busy working on the service technician course. If his first nine months are any indication of what Porter can do, watch out cable, we may be hearing more from this unique individual. ■

—Kathy Berlin



Conventional hookup



Inside the DCS tape and view unit

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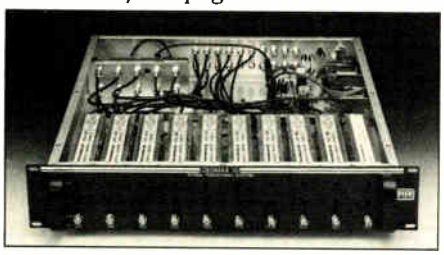

Pico Macom's Geomax-10

demultiplexer at the Optical Fiber Conference in Houston in February. The Photocor™ coupler, model MGM 1513, is designed to receive and demultiplex dual-wavelength light signals directly to the optical receivers. The MGM 1513 has typical insertion losses of 0.9 dB and 1.0 dB at nominal wavelengths of 1310 nm and 1550 nm, when used in single-mode systems using injection-laser-diode light sources. Crosstalk isolation is greater than 35 dB for either wavelength. Call (607) 974-7181 for details.

Available from **Siecor Corp.** is a new option to measure return loss. The CME 1000 return loss option, available for the CME 1000 optical attenuation test equipment, allows for measurements via three steps. New and existing CME 1000 units may be equipped with this feature. The option tests the reflection of systems for laser instability errors occuring because of reflection from connectors, mechanical splices and other interfaces. The portable unit can measure single mode cables or cables at 1300 nm or 1550 nm to within ±1 dB accuracy. For information call (704) 327-5000.

Converting UHF to VHF

A new module for the Geomax-10 off-air processing system has been introduced by **Pico Macom Inc.**. The Geomax-10 now features a converter module which converts any UHF channel to VHF (excluding prohibited channel conversions.) The UHF to VHF converter modules are available in three versions: the Model GUV-L for lowband applications, GUV-M for midband applications and GUV-H for highband applications. With this addition, the Geomax-10 contains all of the components of a pre-racked headend in one case. For information call (800) 421-6511. In California, call (818) 897-0028.

Channel Master has added a steel polar mount to its line of "T-Lock" Plus mesh or perforated antennas and the UPS 10 mesh satellite antennas. The pre-assembled steel polar mount features four ground pole locking bolts, a North/South alignment feature, a latitude setting adjustment with scale showing latitude degrees, continuous scaled declination adjustment with positive lockdown and a mount ground connector. For details call (919) 934-9711.

A new broadband AML® transmitter has been introduced by **Hughes Aircraft Company**'s microwave communications products. Designated the Model IBBT-116, this indoor transmitter uses the latest FET amplifiers to achieve 8 dB increased output capability. For more information call (213) 517-6233.

Norsat International Inc. has introduced a new member to its family of low noise products, the Gold Series of C-band LNBs. The 5200 Series incorporate a compact design and HEMT (high electron mobile transistor) technology. The 5200 Series Gold LNB is available in 55 degrees and 40 degrees noise temperatures. For information call (604) 597-6200.

Breaking ground

Allied has introduced a line of eight

boom-mounted jaw attachments for crushing and breaking concrete. The Concrete Cruncher™ is a two-jaw design which uses only one hydraulic cylinder and one mounting bushing in the center of the attachment. It can be installed on any backhoe or hydraulic excavator boom. Models range in size from 10 inch jaw openings to 57 inches with crushing forces from 24,300 pounds to 418,900 pounds. Call (216) 248-2600 for details.

A hydrostatic, track-drive trencher which features multiple power options and a choice of different track widths has been introduced by **Vermeer Manufacturing Co.** The T-450 Trencher can be equipped with 80, 110 or 118 horsepower diesel-powered engines, each specifically matched to their respective drive components.

The trencher assembly is available with 4-, 5- and 6-foot boom options and can vary trench widths from 8 to 25 inches at infinitely-variable digging speeds. For more information call (515) 628-3141.

Also available for trenching applications is the Turf-Serf by **E-Z Trench.** Designed to do three jobs in one application, the Turf Serf opens the trench, places the cable and backfills the trench. Priced at less than $1,000, the Turf-Serf is capable of installing 100 feet of cable, pipe or tubing within approximately 10 minutes. For details call (803) 756-6444.

Lindsay Specialty Products Ltd. has introduced a new drop amplifier. The LDA-10 provides 10 dB of gain over 650 MHz with a flatness response of ±1 dB and a guaranteed 4.5 dB noise figure. It has a U.L. approved 120 VAC converter. For additional information call (404) 633-2867.

A new signal generator/deviation meter from **Wavetek** was recently introduced. The Model 2407 is designed to increase productivity in ATE and field service applications. The synthesized signal generator covers a frequency range of 0.01 to 550 MHz and offers an IEEE 488 interface. For details call (800) 851-1202.

Available from **Microwave Filter Company Inc.** is the model 6297 bandpass filter. The filter isolates data channels at the headend. Passband is 100 MHz to 120 MHz and loss is 2 dB maximum. Rejection at 95.25 MHz is 30 dB minimum and 50 dB minimum at 133.25 MHz. Return loss is 15 dB minimum. Call (800) 448-1666 for more information.

Moving up

Ron Pignatello has been appointed to vice president of sales and marketing for **Diamond Communications.** Pignatello was previously national sales manager in charge of distributor sales.

Midwest CATV, a division of Midwest Corp., has expanded its Southern regional offices with the promotion of **Scott Wells** as sales manager. Wells, who comes from Midwest's Virginia Beach office, will be working with Elijah Midkiff overseeing both the South and Southwest regions for Midwest.

Anixter Cable TV has appointed **Wendell Woody** to the position of fiber optic applications manager. Prior to joining Anixter, Woody was national director of sales for Catel.

Nexus Display Systems Corp. has added **Richard Masson** and **Tony Lippert** to its research and development team. As the product development supervisor, Masson designs and supervises the manufacture of hardware for new products. Lippert, product support specialist, is responsible for assembling, testing and providing support for systems. ■

—Kathy Berlin and Roger Brown

Ad Index

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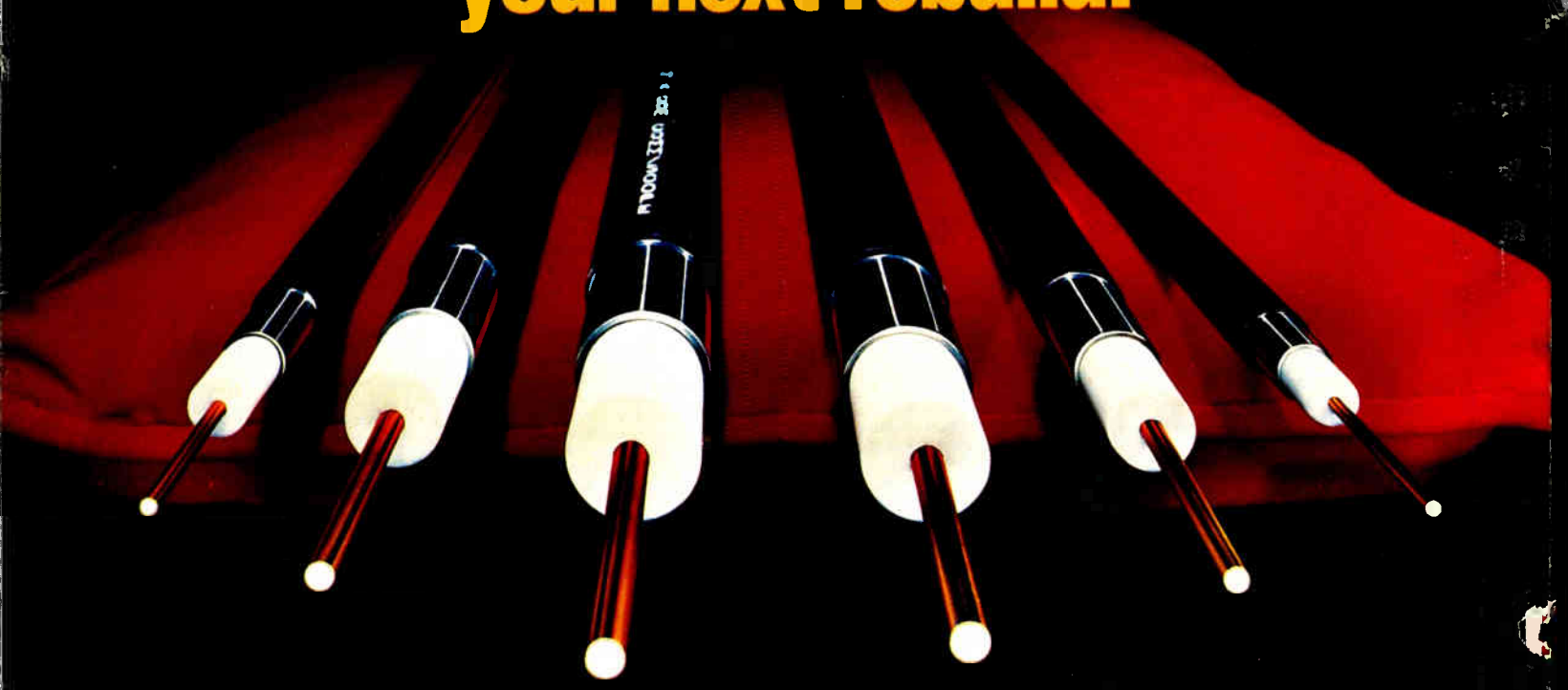

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