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Communications Engineering & Design/The M... f B... ...gy ... er 1984

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Cable video game future?

Scrambling/signal theft/ new TV standards

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Reader Service Number 2

CED™

October 1984

About the Cover

Imagination is the heart of multi-user video games and may have a future in cable, say Jerrold's Bill Freeza and John Gaby in this month's cover story. Artist Malcolm Farley uses his imagination to illustrate this concept on this month's cover.

DEPARTMENTS

 CED. (USPS 300-510) (ISSN 0191-5428) is published monthly plus periodic special editions by Titsch Communications Inc., 600 Grant St., Denver, CO 80203. © October 1984, Volume 10, Number 10. Subscription Price: 1 year, $26.00; 2 years, $43.00; 3 years, $63.00. OUTSIDE USA 1 yr. $64.00; 2 yrs. $89.00; MUST BE PREPAID IN US FUNDS ONLY! Second-class postage paid at Denver, CO. *CED* is published on behalf of all parties, including the Society of Cable Television Engineers (SCTE). POSTMASTER: Please send address changes to P.O. Box 5208 T.A., Denver, Colorado 80217. MEMBERS OF THE BPA.

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Reader Service Number 3

Frank Bias

Chances are when Frank Bias blows out the candles on his 65th birthday cake this Oct. 1, he won't be thinking about retiring. He'll be looking forward to grappling with the latest technical challenges confronting the cable engineering community.

Bias, who entered the communications field as a student engineer in the test department of General Electric more than 40 years ago, has seen cable mature from the mom & pop shops of yesteryear to the 40- and 50- channel megasystems of today.

He remembers the day when the industry was run by technicians who climbed poles to bring TV reception to areas that couldn't receive off-air programming. And he recalls the time when Californians lined up in the rain to obtain the converters that would bring them their first glimpses of pay-TV.

But perhaps his fondest memories are when, as VP of cable engineering for Viacom, he would put on his hard hat and go see what the crews were doing on the system.

Bias joined cable in 1969 as associate director of cable technology for CBS Television Network. Before then, he spent nearly 30 years in broadcasting, rising up through the ranks at GE. "It takes a lot of courage to change careers at 50. Frank won the respect of everybody in the industry for doing that," said Joe Van Loan, vice president of engineering for Viacom Cable.

A year later, when CBS divested itself of its cable interests, Bias elected to go with the cable side and became transmission systems manager for Tele-Vue Systems Inc., now known as Viacom. In 1971, he became director of engineering, and in 1974, vice president of engineering. Three years later, he transferred to New York, becoming vice president of engineering for the communications division of Viacom International. There, he was responsible for the design and operation of cable systems, serving 300 thousand subscribers, and for the company's MDS and television originating studio facilities. In 1979, he advanced to vice president, science and technology.

At Viacom, Van Loan says Bias is looked upon as much as a father as a superior. "He is sought after for his opinions, not just for technical advice," he added.

Despite his achievements, Bias, who self-effacingly describes himself as a "keeper of minutes, an emptier of ashtrays," has never sought the spotlight. "It has been said I'm more of an engineer's engineer," he claimed.

But his contributions to the industry have not gone unnoticed.

"When I think of Mr. Bias, I think of a rock who represents a cornerstone of engineering efforts in the cable industry, of someone who has attempted to bring a higher level of competence to the industry from an engineering standpoint," said Norman Weinhouse, Norman Weinhouse Associates.

"He is the Walter Cronkite, the dean of cable engineering," said Wendell Bailey, NCTA's vice president of science and technology.

During his two-year tenure as NCTA engineering committee chairman, "Bias infected the group with a zest for excellence and service to the industry that transformed the committee from a closeknit group of 10 to 15 people who met semi-regularly to 50 very active members who meet two days a week once every eight weeks," Bailey added.

And the positions which Bias takes on tricky technical policy issues almost invariably are adopted later by the rest of the industry, Bailey said.

Besides being a member of the NCTA engineering committee, Bias is a fellow of the IEEE, an active member of the Society of Motion Picture and Television Engineers, a member of the Society of Broadcast Engineers and a senior member of the SCTE, from which he was named "Member of the Year" in 1977. He also has been active on Electronic Industries Association's and U.S. National Committee of Broadcast Engineer's committees. In 1979, he received the NCTA's "Outstanding Engineering Achievement Award, Operations."

Perhaps, it is this commitment to cable engineering that keeps Bias from retiring. Especially at a time which he deems critical to the industry's future.

"I'm fascinated to see how cable's relationships with the telcos, DBS and VCRs develop. I'm going to keep working as long as I can.," he reaffirmed.

—Constance Warren

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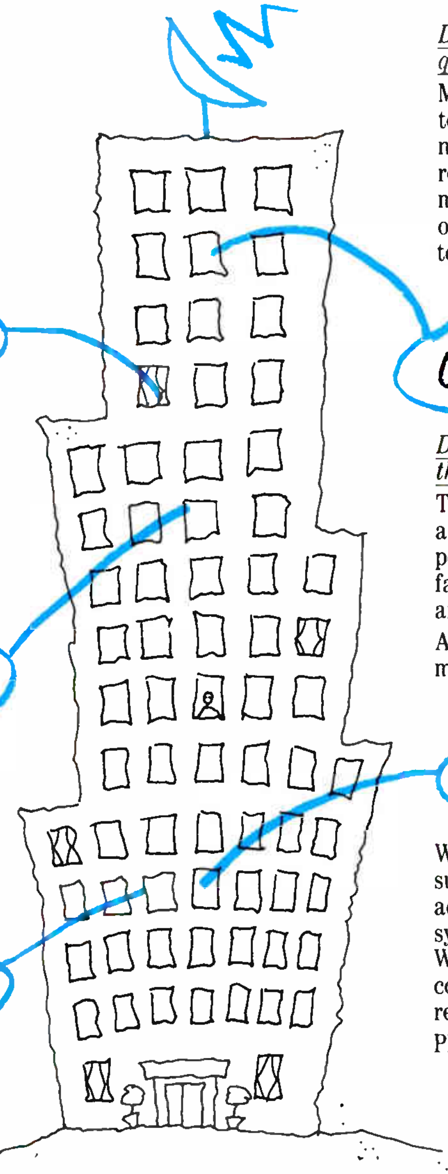

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Reader Service Number 5

Seminars

October

8-10: Iowa Technical Seminar, sponsored by the **Iowa Cable Association**, tutorial on modern cable television systems, Des Moines. Contact Jean Hamilton, (515) 245-7566.
8-11: Tennessee Cable Television Association Convention, Maxwell House Hotel, Nashville. Contact Dan Walker, (615) 256-7037.
9: Southern California Chapter of Women In Cable Meeting, Marina Marriott Hotel, Marina del Rey, Calif. Contact Jeanne Cardinal, (213) 410-7312.
9-10: Satellite Technology for Non-Technical Managers, New York City. Sponsored by **Phillips Publishing Inc.** Contact Conference reqistrar, (301) 986-0666.
9-11: Blonder-Tongue SMATV/MATV/CATV/TVRO seminar, Summit Hotel, Dallas. Contact Sharon Leight, (201) 679-4000.
10-12: Magnavox Mobile Training Seminar, Philadelphia. Contact Laurie Mancini, 800-448-5171.
10-12: Telcos & Videotex, Sheraton Harbor Island Hotel, San Diego. Contact **Online Communications**, (212) 279-8890.
12-14: SMATV/Private Cable Hands-On Workshop, Dallas. Contact **Burrull Communications Group**, (608) 873-4903.
14-16: The **West Virginia Cable Television Association**'s fall meeting, The Greenbriar, White Sulphur Springs, W. Va. Contact (304) 345-4710
16-17: Videotex conference sponsored by the **Yankee Group**, New York. Contact Lisa Caruso (617) 542-0100.
16-18: Mid-America Cable Show, Hilton Plaza Inn, Kansas City. Contact Rob Marshall, (913) 841-9241.
16-18: Jerrold Technical Seminar, Columbus, Ohio. Contact Kathy Stangl, (215) 674-4800.
17: SCTE's Denver Chapter will hold an all-day "Basic Cable" tutorial at Denver University's Driscoll Center. Contact Sally Kinsman, (303) 696-0380.
17: Delaware Valley Chapter of SCTE Meeting, George Washington Motor Lodge, Willow Grove, Pa. Contact Bruce Furman, (215) 657-4690 or John Kurpinski,(717) 323-8518.
17-19: Minnesota Cable Communications Association Convention, Amfac Hotel, Minneapolis. Contact Mike Martin, (612) 861-1166.
23-24: Videotex conference sponsored by the **Yankee Group**, Palo Alto, Calif. Contact Lisa Caruso, (617) 542-0100.
24-25: Blonder-Tongue SMATV/MATV/CATV/TYRO Technical Seminar, Rodeway Inn, Bloomington, Minn. Contact Eugene Foster, (612) 941-9800.

Looking ahead

Jan. 10-14, 1985: NATPE '85 Mo.
Jan. 30-Feb.1, 1985: Texas Cable Show, Convention Center, San Antonio,Texas
Feb. 5-6: Arizona Cable Television Association Annual Meeting, Phoenix Hilton Hotel. Contact Susan Bitter Smith, (602) 257-9338.
April 14-17, 1985: NAB, Convention Center, Las Vegas.
June 2-5: National Cable Television Association Annual Convention, Convention Center, Las Vegas.
Aug. 25-27, 1985: Eastern Cable Show. Congress World Center, Atlanta.
Sept. 18-20, 1985: Atlantic Show, Atlantic City.
Dec. 5-7, 1985: Western Cable Show, Convention Center, Anaheim, Calif.

Volume 10, No. 10

CED

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1 oz. P > 1 lb. C

Where P = Prevention and C = Cure

It took the NTSC about three years to agree on a format for broadcast television in the United States. That was more than 40 years ago.

Today, a similar flurry of standards work is underway, and the outcome will affect the cable, satellite, broadcast and consumer electronics industries for many years to come.

Since 1982, a joint NCTA/Electronics Industry Association Engineering Committee has been working on interface and compatibility standards for consumer devices hooked to cable systems.

The ATSC, composed of broadcast, cable and satellite industry representatives, has been at work for a little less than two years on transmission and display standards for all television applications. In addition to setting specifications for improved NTSC, the ATSC seeks accords on new 525-line formats like multiplexed analog component systems. The group also is working on HDTV standards.

Last June, the FCC advisory committee on technical standards for DBS service submitted its own conclusions on transmission, encryption and receiver protocols for DBS. And a technical committee recently established by the DBS Association will extend its predecessor's work, beginning with receiver standards. The group will concentrate on interference, antenna, receiver and satellite colocation issues, while the ATSC focuses on signal format.

Like the ATSC, the DBSA committee is conducting its work in a flexible, public, open manner. Chairman Harley Radin, vice president of Direct Broadcast Satellite and Co., is looking for a low-key, constructive effort resulting in voluntary standards for the industry.

Many of the group's recommendations, like those of the ATSC, joint NCTA/EIA and DBS advisory committees, will have a direct impact on the cable industry. Encryption standards, for example, will become operational issues for the industry as HBO and other programmers scramble their signals.

New transmission, interface, and ultimately, new display standards also will move from the realm of debate to the marketplace, in the process becoming issues of finance as well as of technology.

Standards are money—for operators, manufacturers and programmers alike. Most technical accords involve gains and losses—gains for suppliers and existing users of the specified technologies, and losses for those who must replace, modify or purchase proprietary systems.

As was the case when our 525-line NTSC television format was adopted, winners and losers may be spawned as a by-product of technical decisions made now. There can be few guarantees in such a process. But there can be little excuse for inaction when the opportunity for input exists.

The ATSC and DBSA technical committees, as well as NCTA/EIA committees, are forums for open debate and compromise. The cable industry can avoid rude shocks if constructive participation occurs now, as the issues are discussed, and before a concensus is reached.

Reader Service Number 7

1.75° spacing 'possible,' FCC says

NEW ORLEANS—Satellite spacing of two degrees may not be the stopping point, says FCC Satellite Radio Bureau Chief Ronald Lepkowski. "Although further reductions at C-band would be costly, it's a possiblility at Ku-band."

"Closer spacing would have to be examined, if only to determine whether it's technically feasible or not," he says. "I'm not advocating it, but it must be looked at as a technical issue."

Lepkowski's comments were made at an FCC workshop at the Satellite Communications Users Conference held here Aug. 28-30.

Currently sitting on a pile of applications from 21 companies for 85 orbital slots, the commission expects to develop rules for allocating spaces before the end of the year, he says. A lottery is being considered as one option, and FCC action is expected late this year or early next year, Lepkowski reports.

The commission also will be taking a look at what to do with non-conforming antennas in the two-degree environment, and an exception policy may be considered, he says. But he indicated there will be no reconsideration of the FCC's 29-25 log theta specifications for side lobe performance.

While defending the commission's choice of the new specs, he acknowledged that there may be some problems with smaller antennas. Still, he argued that "the pattern is feasible and meetable for most of the off-axis area, depending on the type of traffic carried."

Other conference speakers discussed the prospects for DBS, and one termed the outlook for European high-power DBS "not good."

HBO Vice President for Network Planning Robert Zitter insisted that the company will scramble all its satellite feeds in 1985, using the M/A-COM VideoCipher II system. Zitter said HBO would ship descramblers to its affiliates by the end of the year.

Discussing Scientific-Atlanta's B-MAC encryption system, John Lowry, chairman of S-A's Digital Video Systems subsidiary, focused on depth of scrambling. "We don't believe the system can be broken in audio, and estimate it would cost $50,000 per box to descramble video," he said.

Using the Data Encryption Standard algorithm, keys and codes are changed four times a second, Lowry said. The line translation scrambling system puts sync information in the VBI and eliminates the color and audio subcarriers.

M/A-COM's Mark Medress, vice president of Video Products, estimated that VideoCipher II would be in production in November. The line segment displacement scrambling system eliminates all sync information and inverts video. All addressing data and audio information are contained in the horizontal blanking interval, he said.

VideoCipher II also uses the DES algorithm.

David Beeching, director of marketing and sales for Oak Communications' Satellite Systems Division, predicted that two additional major programmers would follow HBO's lead and scramble their signals in 1985, with more jumping in the following year.

Oak's system uses analog video with audio embedded and transmitted in video. "To our knowledge audio has never been broken on our system," Beeching said.

General Instrument's Bill Lambert, vice president of the firm's Satellite System Division, gave a January 1985 production target for the Star-Lok system, which uses sync elimination and video inversion scrambling. Audio and control data are inserted in the VBI, and the system can be configured for IBM-PC control. Using the DES algorithm, key changes are made once every 25 hours.

Originally seen as a Ku-band DBS product, Star-Lok is adaptable for both cable and MDS use, Lambert said.

Also at the show was a new Ku-band RF terminal by Scientific-Atlanta Aimed at the common carrier market, the compact transceiver is designed for roof mounting and eliminates the need for a shelter, said Mike Hooper, marketing manager for business communication with S-A. The RFT-1200 is designed for voice and data applications.

Also showing a data system was Ancom, the Alcoa-NEC subsidiary. Hitching a modem to a DBS receiver, the company demonstrated its method for downloading data. *—Gary Kim*

FCC approves 18 GHz cable plan

WASHINGTON—On Aug. 8, the FCC voted to allow cable operators to use 72 contiguous 6 MHz channels in the 18 GHz (17.7-19.7 GHz) band, instead of the two non-contiguous 36-channel segments previously allocated for cable TV use.

The ruling resulted in the adoption of a consensus plan recently proposed by NCTA and four other 18 GHz band users, namely Harris, Hughes, M/A-COM and Ericsson. The plan called for the reassignment of cable operator frequencies into one contiguous band and of the other users' frequencies into non-contiguous channels.

While no cable equipment has yet been built for 18 GHz operation, NCTA's Director of Engineering William Riker said the previous frequency plan would have required two AML systems for two-band operation. With the new ruling, one AML system will suffice, he said.

The FCC opened up the 18 GHz band to cable operators in September 1983, when it allowed operational fix service users to share the CARS band with cable operators, broadcasters, common carriers and other communications services. Operational fixed service users had occupied the 12.2-12.7 GHz range, but were removed from those frequencies in the late 1970s when the FCC decided to reserve those channels for DBS.

"The commission moved the OFS to the 12.7-13.2 GHz band because it would cause minimal displacement," said FCC's Cable Bureau Supervisory Engineer John Wong. Operational fixed services wouldn't need to buy or swap equipment, just retune their transmitters, he added.

But cable operators objected, saying the extra load in the CARS band would create interference.

The FCC also gave OFS users more priority in the band, meaning their applications would be chosen over cable operators' filed the same date, Wong said.

The FCC addressed the cable operators' complaints by giving them two 36,6 MHz channel segments in the 18 GHz band.

But the NCTA petitioned the FCC earlier this year, arguing that the two band assignment was not cost-effective.

The consensus plan was formed later and presented to the FCC as the best possible solution to the cable operators and other 18 GHz users' concerns, Riker said.

But even with the new channel alignment, cable operators will have difficulty transmitting beyond an 8-mile range, Wong said.

Riker agreed, saying,"We would have preferred additional frequencies in the 12 GHz range."

—Constance Warren

Viacom safe from low power TV interference

PLEASANTON, Calif.—Viacom's Oroville, Calif., system may not need to worry about LPTV interference because the LPTV station may never be built. At least, not at its original site, says Del Heller, director of engineering for the MSO.

The California operator previously petitioned the FCC, objecting to Global Village Channel 2's construction permit because the station might interfere with its reception of a distant signal transmitted from the San Francisco Bay Area. The FCC denied the petition, claiming it was filed too late.

But the transmitter site specified in the original application is an AM radio tower located in a low area of the community, surrounded by hills. The site would restrict the station's coverage and keep it from reaching its full market potential, Heller said.

Also, the station could run into some interference problems caused by a nearby lumber processing facility. Electrical driers used to cure the lumber generate significant electrical interference in channels 2-5. This interference could severely degrade the LPTV signal, Heller said.

The LPTV station may loose its financial backing, as well. During conversations between the Viacom Oroville plant manager and Global Village, the LPTV station raised doubts about whether its principal financial backer, a Cambridge University offical, would continue to support the venture. The backer reportedly is concerned about the site selection and potential interference problems, Heller explained.

But even if Global Village moves ahead with construction, FCC regulations will protect the California cable system from LPTV interference. The second user of a frequency, in this case Global Village, must resolve any interference with a prior user. Viacom has to document the problem, however.

The FCC window for filing objections to LPTV construction permits is narrow, and operators must respond promptly.

"Sure, we'd like to see a 30-day window for lottery permits instead of the current 15 days," Heller said. But neither he nor other industry members expect the FCC to change the deadline.

Heller said Viacom missed the 15-day filing for Global Village because it hadn't been subscribing to a clipping service that lists all FCC-related LPTV activity. Even if it had, though, the operator would have only had one week in which to repond, because the clipping service doesn't arrive at Viacom's door until one week after the FCC action is taken.

In that week, the operator must determine expected interference levels, based on well-documented calculations, and respond to the action. This process usually takes two people two days, Heller said.

Viacom has its own staff—Heller and another employee—monitoring and coordinating LPTV efforts for each Viacom system. Cable systems also can subscribe to services such as Comsearch's CLIP—Cable TV/LPTV Interference Protection—which will do the monitoring and interference analysis for a fee.

Michael Morin, vice president, Mass Media Services for Comsearch, says that large carriers, such as Cox, and single headend systems alike are subscribing to the service. The service costs $50 a month for a small system.

Comsearch issues a report each time an FCC action is taken and at the end of the month. Interference analysis is based on the predication method used by the commission and takes into account the proposed LPTV station's power, coordinates and channel use; the average terrain separating the site from the headend; and the location of distant signal transmitters.

Morin says 25 headends have signed up for the service since its formal introduction at the National Cable Show last June. And he expects demand to grow. "With the FCC granting 40 to 50 permits a month, LPTV interference is becoming a serious threat. Two years ago, the service may have been ahead of its time, but now it's timely," he said.

Robert Bond, project manager for broadcast communications services, Compucon, disagrees. He cites company studies that show a lack of interest in LPTV monitoring services.

—Constance Warren

Cox bows out of MetroNet

DENVER—In early August, Cox Cable Communications told Chase Manhattan Bank officials it was withdrawing from the home banking and cable interactive service venture between itself, Chase, the Jerrold division of General Instrument and Sytek Corp., in which GI owns a controlling interest.

The decision, publicized early last month, was made 10 months after Cox and Jerrold announced their two-way interactive video entertainment/videotex agreement.

Despite Cox's withdrawal, Jerrold and Sytek will go ahead with the project, Jerrold Spokeswoman Patti Reali said. And Chase Manhattan "is continuing its relationship with Jerrold," a bank official said.

The agreement called for Cox and Chase to develop the interactive services, including home banking, and for Jerrold to develop the Communicom home addressable terminal. Jerrold and Sytek were working together on the MetroNet data transport network architecture and system protocols.

Referring to poor results from its San Diego market trials, Cox Official David Anderson said the company felt "it had been a pioneer long enough."

The San Diego project lost half of its subscribers whenever a fee for the interactive services was charged, Anderson reported. Fees ranged from $5.95 to $7.95 and a total of 1,000 subscribers participated in the project over a three-year period.

Anderson cited the lack of commercially available hardware as another reason for the operator's withdrawal.

While Cox believes interactive services are not commercially viable now, it will continue to monitor the field and has left its Enhanced Cable Services department, which used to head the videotex venture, intact, Anderson said. The operator also will continue its efforts in pay-per-view.

Jerrold is not so skeptical.

"The company is continuing to back the project. The Cox withdrawal only really affected our manufacturing schedule," said Bill Freeza, MetroNet program manager.

"Production will have to wait until there is a customer," he added. And market trial units, originally targeted for the fourth quarter of 1985 deployment, will be held back until Jerrold firms up its plans.

—Constance Warren

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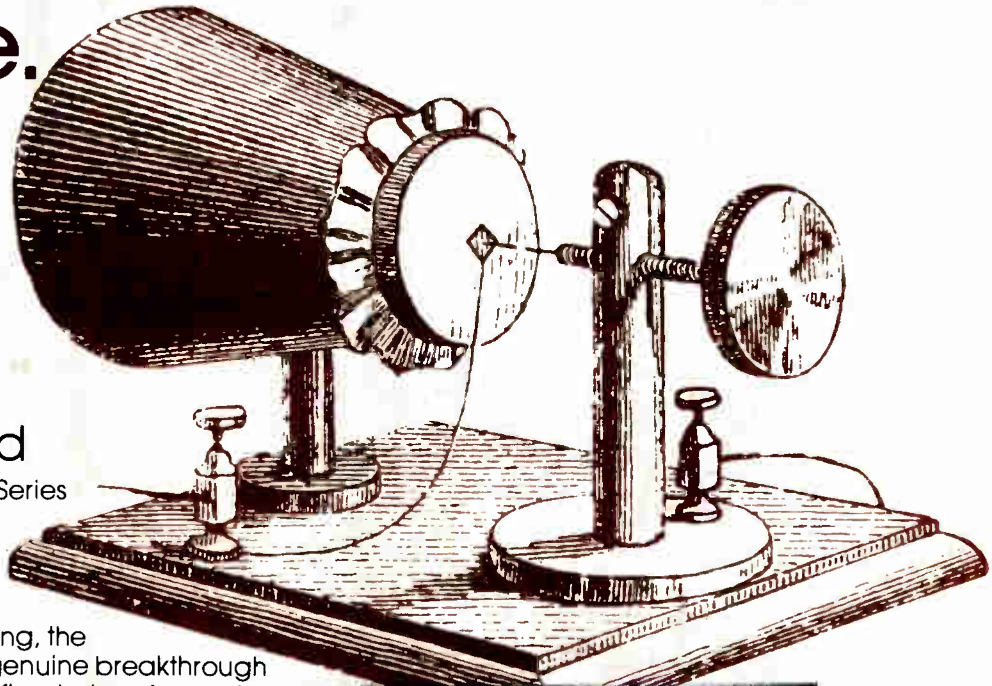

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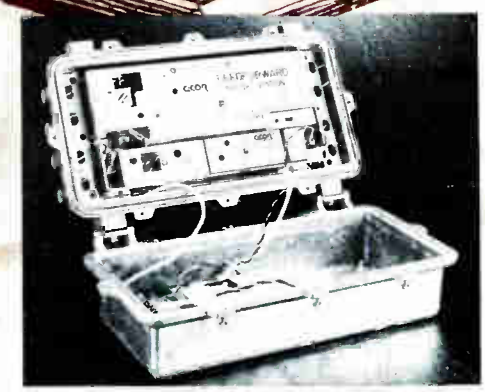

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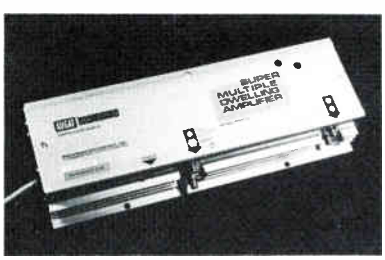

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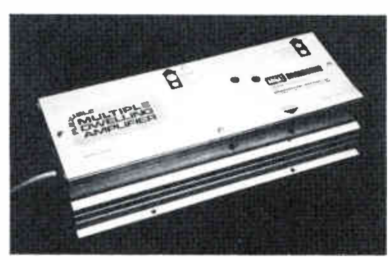

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Reader Service Number 11

AUGAT® BROADBAND

Quality and Innovation

ATSC explores new TV standards

By Gary Kim

NTSC: Frequency-multiplexed chrominance

NTSC uses a subcarrier at 3.58 MHz to encode color, producing hanging dots, dot crawl and luminance/ chrominance crosstalk when the signal is demodulated.

MAC: Time-multiplexed chrominance

MAC formats compress luminance and chrominance information, transmitting them serially. The result is a reduction in nonlinearities such as group envelope delay.

There hasn't been a group like the Advanced TV Systems Committee since the National Television System Committee established U.S. television displays and transmission standards. But if, or perhaps when, our current 525-line format is abandoned in favor of another, it will in large part be the work of the ATSC. Representing a consortium of associations and interests including broadcasters, the NCTA, EIA, IEEE, SMPTE, U.S. equipment manufacturers and satellite broadcasters, the ATSC was spun off about a year and a half ago from the Joint Committee for Intersociety Cooperation. The JCIC is a Washington, D.C.-based standards group including many ATSC members. "The ATSC is really the same as the NTSC committees were, although there aren't as many manufacturers as then and the regulatory climate is different—less regimented," says ATSC executive director Dick Green.

The group currently is organized into three major technology groups, each exploring different evolutionary paths for television in the United States.

The first group is looking at improved NTSC formats. Technology Group Two is looking at enhanced versions of NTSC such as multiplexed analog component systems. Group Three is working on standards for high-definition television systems with twice the resolution as NTSC, wider aspect and stereo sound.

Each technology group has various subcommittees working. The TI group, for example, has a task force examining transmitter, receiver, and camera improvements. In addition to new processing techniques such as prefiltering and predistortion, the "NTSC Zero Plus" task force is taking a look at digital frame stores, a step beyond digital processing. The TI group is planning on demonstrating its improved NTSC formats in November.

The T2 group proposed "strawman" specifications for improved 525-line MAC signals in July of this year, and experiments with the new standards are being conducted by such companies as CBS, Comsat, Scientific-Atlanta and Phillips, Green says. "The important thing is that the group has agreed on the key parameters for satellite distribution. The system is FM-transmission optimized, and among the significant parameters is line-alternating color to preserve bandwidth."

Green says this format isn't good for studio formats, where color on every line is still preferable. Chrominance, luminance and compression ratios also have been set, he adds.

The T3 group had developed its HDTV "straw man" early this year, and already has passed the standards along to the Consultative Committee for International Radio (CCIR), which reports to the International Telecommunication Union. The CCIR meets every four years, and recommended the existing standards for digital stereo, Green says.

"That was a heartening development for us, because it established an environment for a worldwide studio format for HDTV," he adds. The T3 group is working on a preliminary standard that has to be approved by the U.S. State Department, and Green expected to send those specifications in during September. The 1125-line system proposed uses a 60-field, component encoding, 5x3.33 aspect ratio format. "The big question is whether the 50-hertz countries, especially those in Europe, will agree," according to Green.

The Asian and European broadcast unions participate in ATSC meetings, and Green reports good cooperation with them, although he says it's too early to tell whether the Europeans will buy the 60 Hz standards. "The issue now is how much it will cost to convert from a 60 to a 50 Hz format," he says.

The Japanese have been working on HDTV for 14 to 15 years and have done more technical work than anybody, Green says. The ATSC's system is very similar to theirs. But Green said the current specifications are a proposal, not a recommendation yet.

With so many diverse interests represented, it might be supposed that the level of discord or disagreement is large. Green says it isn't. "Nobody's locked into a big investment on any particular system yet, so the general attitude is 'let's develop the best possible technical system,' instead of fitting the standards around an existing set of components."

It might also be supposed that the objectives of the groups are antagonistic. Again, Green says it isn't so. "There are applications for all three systems. Better NTSC is a good idea no matter what. And we also need a better FM transmission system. Studios really can use HDTV—perhaps an electronic equivalent to 35mm film."

In a sense, the three sets of standards can be seen as a progression: better NTSC first, improved NTSC in the medium term and HDTV as a long-term system.

If everything goes according to schedule, the CCIR will make a decision on the ATSC proposals in October 1985. Before that the U.S. State Department will have given its blessing, presumably in April 1985.

"We're well on our way to a world HDTV standard—at least we've got a good shot at it," Green says.

The renaissance of video games

Recent developments in broadband communications technology have made possible an entirely new form of interactive entertainment—the multi-user game. This article describes this new type of social encounter and explores the psychological aspects that differentiate multi-user games from traditional arcade type video games. The underlying network technology also is described—specifically, the MetroNet network being developed by General Instrument.

By William Freeza, program manager, and John Gaby, lead software engineer, MetroNet, Jerrold division, General Instrument Corp.

Suppose—just suppose—that tonight when you come home from work you can dial a number on your telephone and the drama that unfolds on your (TV) screen stars—you.

Thus began an extraordinary article written by Bob Lucky in 1979[1], which envisioned the evolution of person vs. person, computer mediated video games in which hundreds of players, each in the comfort and anonymity of their own home, could simultaneously participate in a new *interactive* entertainment medium called the *GameNet*. When Lucky's article was written, the technology was too expensive for commercial introduction and the circuit-switched, twisted pair telephone network could not support the kind of data traffic that would be generated. Now, thanks to five years of declining semiconductor prices and new broadband data communications architectures that utilize two-way cable TV systems, subscribers will soon be offered the vicarious *thrill of victory* and *agony of defeat*, along with more traditional forms of entertainment like HBO and ESPN.

Most significantly, these new entertainment products will directly address the issues that contributed to the fading popularity of today's videogames, hopefully ushering in an era of sustained growth in non-passive video entertainment.

Loosing 'kick'

In a way, Lucky foresaw the decline of the videogame industry long before it peaked when he observed that "there is something unsatisfactory about a machine as an opponent." Just like a drug to which a user becomes addicted, single-user videogames loose their "kick." The technology did for a time adapt, moving from *Pong* to *Pac-Man* to laser disc games like *Dragons Lair*, but it was quickly outpaced by the videogame junkies who became bored with the robot-like sameness of each new game. Downloading the same games over one-way cable or dial-and-dump telephone connections fails to address this "habituation" problem. Such approaches merely offer different delivery economics for a product that has been shown to have no staying power. Mattel, like other manufacturers, did attempt to bring in a human element with its two player *Intellivision*. The logistics of finding flesh and blood opponents of the appropriate caliber, however, proved too difficult, and the restriction to two players proved too limiting.

Network based multi-user games, in contrast, pit human ego against human ego, individually or cooperatively, without requiring players to get together. They capture the essence of role playing fantasy games like *Dungeons and Dragons* and add the real-time action of aircraft flight simulators. Literally hundreds of interacting players can come and go from a never-ending game scenario constructed as a microcosm of life —complete with heroes, villians, friendships, coordinated group action and serendipitous encounters. Most importantly, the system does all the hard work. It creates and maintains the setting for this social encounter, matches up allies and opponents and provides a learning environment for novice users who need an experienced guide to show them the ropes, providing an electronic dude ranch of sorts. The level of difficulty, as well as the mix between intellectual activity and reflex action required for any game, can be adjusted for the particular target market. A given game also can evolve as the player population matures, i.e. when the initial "kick" begins to wear off as determined by on-line usage statistics.

An earlier example of these concepts can be found by looking at the experiences of a computer-based education system called PLATO. Research began on PLATO at the University of Illinois as early as 1960. By the late 1970s, a system had evolved that could support as many as 600 simultaneous users in 18 states across the nation. While PLATO's primary use was for education, it had a number of unique and interesting characteristics, which made it suitable for other purposes as well. The system consisted of two mainframe computers connected to about 1200 terminals over lines supporting a data rate of 1200 bits per second. It was unique in two ways: all the terminals were the same and all used high resolution graphics. These characteristics, combined with a versatile interprocess communications facility and a relatively free environment, paved the way for the development of a number of highly sophisticated interactive computer games.

Naturally, the first games to evolve out of this environment were a series of sophisticated single-user games. Although the initial single-user games were very popular—so popular that access to all games was permanently restricted to only very unreasonable hours—they involved relatively straightforward interaction of the individual and the computer. The interactive multi-user games that came later quickly eclipsed them in popularity.

Successful pioneers

The first truly successful multi-user game was a space wars game called *Empire*. The game was based on both strategy and reflex and allowed up to thirty simultaneous players to combat for the domination of the universe. Rather than being a free for all, however, the players were divided into six teams and were forced to cooperate with other members of their team to achieve their goals. The game was an overwhelming success, notwithstanding the access restric-

We step into the exclusive "Prancing Pony" tavern where the mighty dwarf fighter Crush and his faithful sidekick Orange are making arrangements for one of their more harrowing adventures.

It seems that Crush had decided that he would like to make a sojourn to level five or maybe six of the dungeon (not an undertaking to be taken lightly), and he had posted a notice on the castle bulletin board to this effect. Crush's fame as a leader "extraordinaire"' soon lead to a veritable flood of applicants. In a short time the party had acquired Aryel and Big Daddy, both powerful priests; Volcker, a wizard of great power, two lower level fighters, and the secretive and powerful Samurai Kahn.

"The party is almost complete," muttered Crush. *"We need only a good thief to handle the traps, and we can be off."*

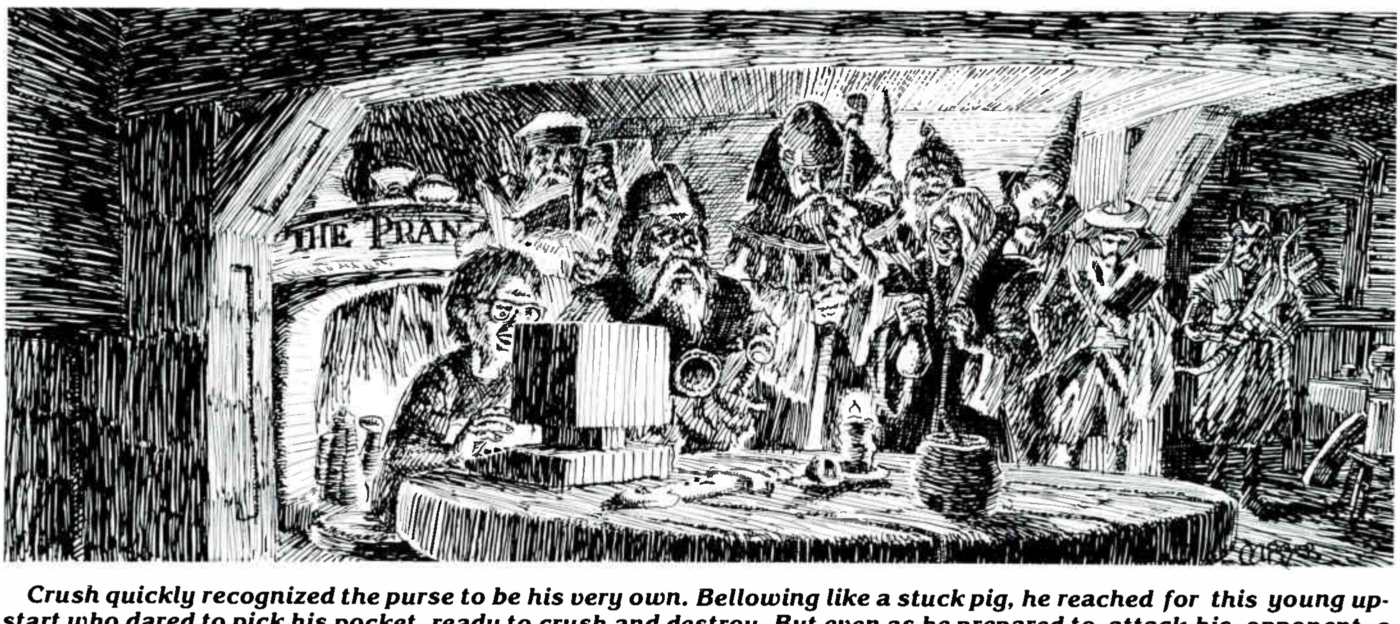
Bowman, one of the lesser fighters in the party, spoke up: *"Crush, I am concerned about the strength of our party. We only have one wizard and not enough fighters to cover our rear."*

"Look," replied Crush, *"when I venture that deep I like to travel lean and mean. No dead wood. Volcker is one of the best wizards in the business, and Kahn saved my life."*

Just then a short woman, seemingly hardly more than a child, entered the tavern and cast her eyes about. *"I am looking for a dwarf named Crush,"* she said. *"I am called Elenor, and am an excellent thief. I would like to join your party."*

At this point Crush almost choked, roaring with uncontrollable laughter. *"A hobbit thief?"* he managed at last. *"Now I've seen everything. Look, kid, why don't you run along before you get hurt. We are going on a serious trip and don't have time to babysit."*

"At least let me buy you a drink," Elenor asked, producing money from a fat purse.



Crush quickly recognized the purse to be his very own. Bellowing like a stuck pig, he reached for this young upstart who dared to pick his pocket, ready to crush and destroy. But even as he prepared to attack his opponent, a dagger appeared, as if by magic, in Elenor's hand, and Crush was stopped with the point poised at his throat.

A smile broke out on Crush's face. He laughed and said: "You're a good kid. Welcome aboard!"

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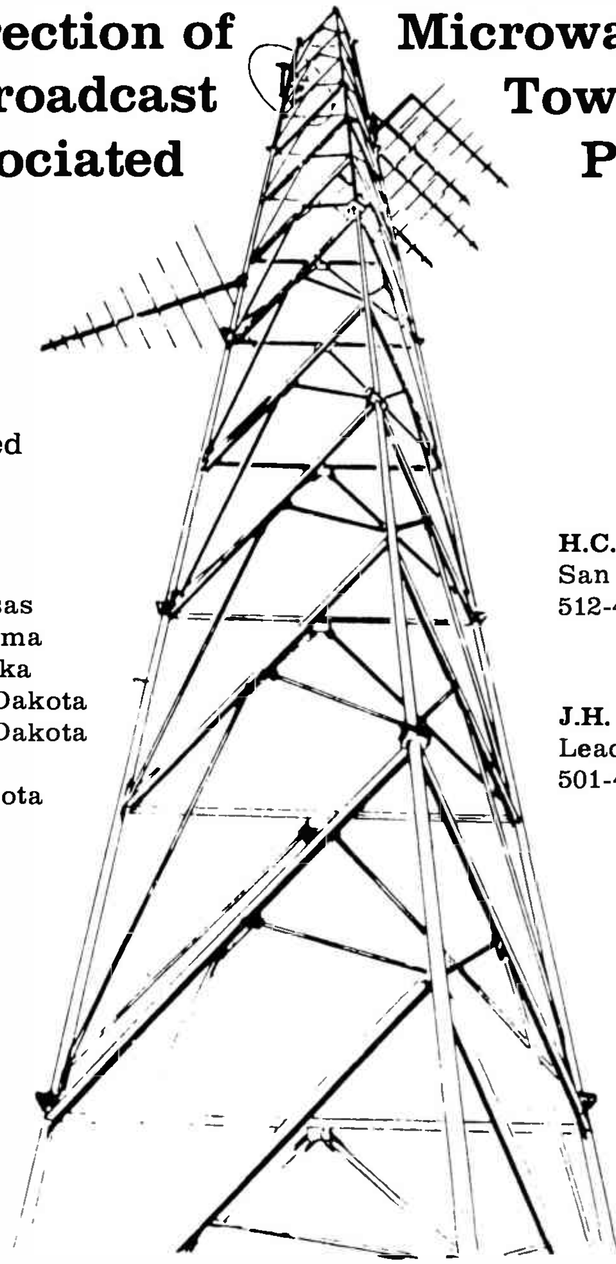

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Reader Service Number 12

tions. *Empire* logged an excess of 270 hours of usage a day and sustained this rate over a period of three years.

Oubliette was another successful multi-user game. The game's principle design goal was to provide a computer mediated version of the role playing fantasy game of *Dungeons and Dragons*. *Oubliette* was quite complex. The player took the role of an adventurer who joined with a band of other players to explore a vast dungeon filled with marvelous treasures and perilous dangers.

Cooperation amongst players was essential. Players met in "taverns" and formed parties.

To provide a "feel" for how the game was played, a dramatization of an episode typical of *Oubliette* is presented on page 21. The example illustrates the interplay of game action and player imagination, so important to the success of multi-user games.

It is important to note that even casual players of games like *Empire* and *Oubliette* tended to get caught up in the spirit of the game and began to strongly identify with various aspects of the fantasy. In *Oubliette*, the "fantasy" attachment became so pronounced that characters and the equipment they acquired were actually bought and sold for real money. There was even one case in which a "fully equipped" character was sold to another player for $100.

Although fancy graphics and real time action enhanced this fantasy attachment, they were only incidental to the multi-user interaction. This interaction is central to the psychological aspects that keep the players coming back for more.

The centralized architecture of the PLATO system provided a technical solution to some of the problems involved in writing and operating multi-user games, but it had several severe limitations precluding its use as a commercially viable delivery system for games. The most serious defect was the communications medium. The University of Illinois campus frequently used direct microwave connections. Off campus, however, telephone lines had to be used. Bandwidth restrictions limited the amount of information that could be exchanged with the terminal. This all but precluded distributing the "smarts" of the game by downloading the game itself to the terminals. It also limited what was possible in the area of real time animation since it was not possible to send sufficient information to the terminal rapidly enough for sophisticated effects.

A second problem came from the use of large mainframe computers, which ran the game programs. Although PLATO could boast up to 600 simultaneous users on their two mainframes, this was only true if people used educational programs, which generally required a lot of thinking and very little computer time. Games were very much more CPU intensive. The system could handle no more than 80 simultaneous game players, and then only if the games were well-written and allowed only minimal real-time action.

The 'MetroNet' fit

This is where MetroNet comes in, a broadband, distributed, packet-switched network under development by General Instrument and its Sytek affiliate for use in two-way CATV systems. MetroNet is designed to support a variety of interactive residential data services (commonly referred to as videotex) including bank-at-home, shop-at-home, electronic mail, pay-per-view movie purchases and other forms of electronic information retrieval. Utilizing between one and six regular TV channels, MetroNet divides the allocated spectrum into multiple 300 KHz wide, 128 kbps data channel pairs. Each channel pair can be shared by terminals on the system using a carrier sense multiple access with collision detection (CSMA/CD) protocol. Two-way connectivity between upstream and downstream data paths is achieved via a simple packet repeater in the headend.

The terminals that operate over MetroNet are entirely RAM (random access memory) base. This means that the operating system, communications protocols, and animation software can be downloaded over the cable, rather than burned into ROM (read only memory). This allows for the distribution of the "smarts" of the games, offloading the central computer to such an extent that a small and inexpensive minicomputer can handle many more players than a large mainframe could in a centralized architecture. An inexpensive, semi-custom video chip set also is being developed, which will allow the terminal to perform dynamic perspective scene generation in real time. The parameters describing a scene (for example a battlefield covered with buildings, mountains and enemy tanks) can be stored locally in the terminal, with images being generated and displayed on the TV screen from the ever-changing perspective of the player. Each player will seem as if he were driving along, looking out the front window of his tank. The "moves" of the other tanks, which are really other players on the network, are transmitted at periodic intervals over the 128 kbps data channels. The terminal software will interpolate positions between updates. This allows for a completely distributed implementation of a multi-user action game, solving the performance and economics problems encountered with PLATO and other systems like it.

While the single-user videogame industry is undoubtedly in decline, it is important to realize that video games are not just another hula hoop fad. *Atari* and *Mattel* may not have hit the mother lode, but anyone who has been or has known a videogame junkie has to believe that there is something basic buried in the human psyche waiting to be tapped by a more sophisticated form of this entertainment. The thrills and stimulation involved in personally confronting risks and challenges, the camraderie that occurs when groups with a common purpose are under pressure, and the opportunity to achieve recognition from one's peers through heroic (or villianous) deeds are separated from the disincentives that accompany such activities in real life. One's failures in the fantasy world remain anonymous and can quickly and safely be forgotten. Personalities can be changed or discarded at will, with no external repercussions. Prejudicial barriers, so apparent in the real world, do not bar individuals from experiencing the satisfaction inherent in attaining and and maintaining leadership positions.

Interactive video entertainment is destined to become weaved into our lives, just like the passive entertainment media have in the past. Piggybacked onto emerging videotex information and transactional services, these multi-user games address the very shortcomings that caused the earlier games industry to run out of gas. Satisfying the entertainment needs of the first computer literate generation is going to take more than finding another way to deliver movies. After all, CATV, DBS, LPTV, SMATV, broadcast television and VCRs all ultimately peddle the same product. What multi-user games are really trying to do is to harness the imagination and, until someone can figure out a way to control dreams, what could be more entertaining and/or profitable?

1) R. W. Lucky, "GameNet," IEEE Communications Magazine, November 1979.
2) PLATO is a service mark of Control Data Corp.
3) Oubliette is a trademark of Bear Systems.

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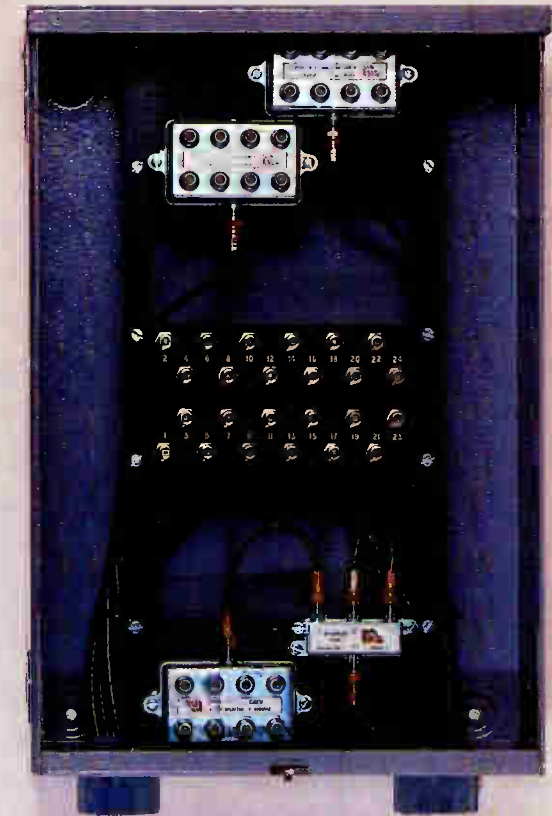

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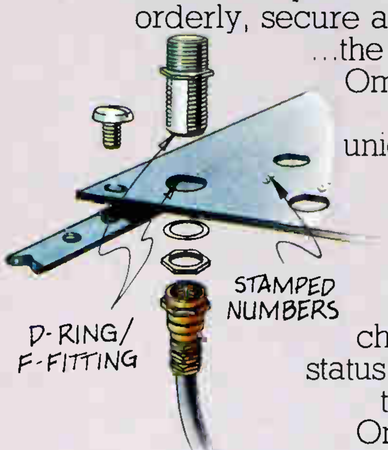

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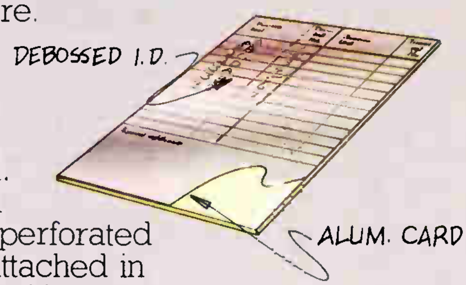

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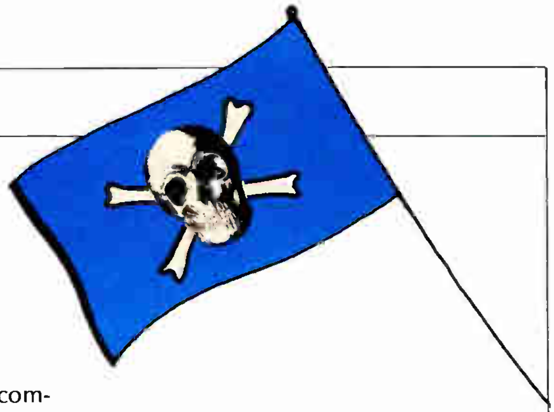
Reader Service Number 15

Practical pointers on signal theft



By Sam Towne, Manager, Addressable devices and quality control, Gill Cable

The technological advances that have made possible the cable industry's expanded channel capacities, tiered premium services, descramblers, addressable and pay-per-view functions also have created new theft of service problems. You can't just rely on audits of illegal connections to control theft of service problems. You also must confront converter tampering, inventory controls, descrambler recovery, theft of equipment, investigations, prosecutions and civil suits.

Theft of service is a complex problem. And all too often the impact of theft is underestimated and the subject is relegated to the "we ought to get around to that someday" category. By the time the subject comes up again, it is usually in the context of the extensive impact on system revenue due to unchecked theft of service.

As a result of my own involvement in combatting theft of service and discussions with many others, it has become apparent to me that nearly every successful anti-theft of service program has the same basic elements.

Clearly the most important element of a successful effort to curtail theft of service (and theft of equipment) is a wholehearted commitment from system management.

Nearly as critical is the selection of personnel to coordinate and implement the program. Depending on the size of your system and the extent of your theft of service problem, it is advisable to limit the number of people involved at this level. Situations may evolve that require secrecy, so discretion must be one of the attributes considered in selecting the people to spearhead the program.

Use a task force

I suggest a task force approach with five specific areas of responsibility.

- Internal: Examine inventory controls, company policies and procedures, make necessary recommendations and coordinate implementation.
- External: Conduct research to identify specific kinds of theft of service and the extent of each type; recommend and implement action plan.
- Community: Responsible for contacts with local law enforcement, community relations, press and publicity.
- Recovery: Establish and coordinate recovery of descramblers from disconnected and delinquent accounts.
- Legal Remedies: Consult with legal counsel, coordinate support effort for civil and criminal prosecution, appear as witness where necessary.

This does not necessarily mean that you need a minimum of five people as some of these functions can be combined. The important element is that responsibilities be clearly defined.

The objectives of this task force are to analyze the nature, extent and impact of current theft of service problems; recommend a course of action; and implement a coordinated plan approved by management. The group also should review policies and procedures and make recommendations on preventative measures. The ultimate objective is, of course, to convert the majority of those now stealing service to paying subscribers.

The task

The first priority is to define the characteristics and extent of each type of theft within your system. What is broadly termed "theft of service" can be more appropriately separated into four different categories.

- Illegal connections external to the residence (which would include removing premium service negative traps).
- Tampering with cable company equipment within the residence, including descramblers, converters, etc.
- Theft of equipment from the cable company or from subscribers either by cable company employees or non-employees, including subscribers who fail to return rented descramblers.
- Unauthorized sale of descramblers, positive traps, etc. not owned by the cable company.

The objective is to gather as much factual information as possible. The immediate benefit of this research is that you can concentrate your initial efforts on the most correctable problems. This approach may seem to be obvious and simplistic, but I've talked to many people in the cable industry who were frustrated trying to control a theft of service problem they had never taken the time to analyze.

In the case of illegal connections, if you currently have an audit team, do not accept their numbers at face value until you have done a sample audit to confirm them. One of the important questions to consider is whether subscribers are connecting themselves or being connected by others in the business of making illegal hookups for profit. Another important question is what percentage of disconnects are missed, leaving the drop activated, and creating an unauthorized connection to be caught by a later audit. Once you have the answers to these questions, you may want to take a good look at policies and procedures in this area.

Probably the best way to get some data on decoder tampering is to conduct an exchange program. Select a suitable sample of subscribers that have decoders and send representatives out to exchange them for other units. By testing the units recovered in this manner, you can determine the extent of subscriber tampering. This is most effective if you target subscribers who have only the lowest priced pay service. If you find a significant percentage of tampered units in this group, you will also want to sample other single service groups.

Another source of information about subscriber tampering and unauthorized sale of descramblers comes from tips phoned in by honest subscribers. We have operated a secret witness tip program for approximately three years and received hundreds of verified tips, including several that resulted in arrest and conviction of thieves. We offer a reward for information that is verified and results in recovery of our equipment and/or arrest and convictions.

Don't overlook information available from your own employees. Make sure they know who to contact with any information they may have and encour-

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GENERAL INSTRUMENT

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TOCOM, Inc. A Subsidiary of General Instrument Corporation age them to report any suspicious situations.

Watch inventory

Although you may not have any internal theft problem, don't neglect to study your company's inventory control system for descramblers. One of the program objectives is prevention, and the inventory controls are a vulnerable area.

There are several functions that should be examined for potential improvement.

- ■ Shipping and receiving documentation and reconciliation.
- ■ Warehouse security and access control.
- ■ Issue and return controls and reconciliation.
- ■ Return of units picked up from disconnecting subscribers.

Inventory control of descramblers is a difficult area to cover. One method that has worked well for us is flow charting of all processes in handling of descramblers, assigning each a location and status code, and inputing each change of status or location into a computer equipment inventory data base. For example, device serial number 1234 is issued (status) to installer number 456 (location) and when it is installed in a home, the account number of that subscriber becomes the new location code.

We use a locker system for issuing devices to installers and the unused devices are returned to the locker at the end of the day. The inventory is reconciled the next morning against the completed work orders and additional units are issued.

One of the more unpleasant aspects of theft of service is that occasionally cable company employees become involved. The vast majority of employees are honest, and they will most likely let you know if they suspect that some thefts are occurring. If you have reason to believe employees are stealing descramblers, the first step is to determine where and how the units are being sold. Are they selling to individual subscribers or to a middleman?

One common thread that seems to be prevalent in employee thefts is narcotics or alcohol abuse.

Recover converters

Descramblers are a common theft item in residential burglaries. You should have someone in contact with the police burglary investigation unit who can obtain assistance in identifying recovered descramblers and ensure they are to returned to your company or the proper subscriber. This is also an excellent way to establish a good working rapport with the local police agency. Your subscriber agreement should cover the policies and responsibilities of the subscriber in the event the descrambler is stolen or destroyed.

More descramblers are lost by subscribers failing to return them than are stolen. In many states, including California, failure to return rented or leased personal property is defined as theft, provided that there is a signed rental agreement and certain steps are taken to attempt recovery. Check with legal counsel concerning similar laws in your state.

The most successful way we found to alleviate this problem was to create a descrambler recovery team within our marketing department. The team coordinates closely with credit and team collections to reach delinquent accounts before a non-pay disconnect is scheduled. They go out to the residence and offer the subscriber the option of paying the delinquent balance and staying on service or surrendering the decoder.

This way, the system retains a lot of subscribers who would have been disconnected and recovers a lot of equipment that would have been difficult to retrieve after disconnect. They also respond to voluntary disconnects where the equipment was not recovered in the normal procedure.

These specialists are compensated on a commission basis and required to pursue every account assigned to them until it is resolved in some way. This approach has been helpful in identifying "skips" so skip tracing can be expedited without undue delay. Because the success of this approach hinges heavily on timing, an account tracking system that gives clear visibility of problem accounts with equipment assigned is essential.

Use the law

The unauthorized sale of decoders is now illegal in many states and some cities have enacted laws pertaining to cable piracy. The detection of this type of activity is not too difficult, so the main question is how to proceed. You must seek legal advice to gain an understanding of the applicable laws and what the preferred course of action will be.

There are several important steps which should be considered. The subscriber agreement I mentioned is very helpful, and I strongly recommend that you give it serious consideration. It will be the basis for any action you may wish to take to exchange or recover equipment or to collect damages. It also becomes a policy statement advising subscribers that you regard certain actions as very serious and not to be taken lightly, such as the responsibility to care for and return equipment.

Know as much as you can about your subscriber. Get identification and place of employment if possible when they rent descramblers. Some people will sign up for service with no intention of paying for it and repeat the process again using different names as long as they can get away with it.

Several cable companies have had excellent success with an amnesty program. Individuals can avoid prosecution by turning in their unauthorized descrambler with no questions asked. This amnesty offer is publicized through an intensive advertising campaign.

Sweep the system

Whatever course of action you take, there remains the task of obtaining reliable evidence. While this is not too difficult in the case of illegal connections, it becomes a formidable task in the case of tampering or use of unauthorized decoders. A technique that has been successful in the latter case is the use of a swept return loss bridge to observe the characteristic "signature" of a specific descrambler.

Use a portable sweep analyzer to sweep the subscriber drop while observing the reflected energy on a scope. Various devices will exhibit reflected waveforms that are consistently recognizable. This approach is only applicable if the device being used reflects a reliably identifiable "signature." Another approach is to monitor the drop with a spectrum analyzer and measure any radiated frequencies that may be a product of oscillators and mixers within the decoder that would further identify a specific type of device.

Use of this kind of electronic detection requires an extensive amount of research by your engineering staff to determine the reliability of the technique in your particular application. Not every device is as clearly identifiable as others, so you must have absolutely reliable results to consider this approach.

Theft of service is a new reality of the cable business. You can adjust to it, budget to deal with it, and control it or you can vacillate and incur the losses. I hope I've given you some useful ideas. The purpose of all this is to convince those now stealing service to become paying subscribers.

Communications Engineering & Design

TECH II

CED's feature supplement and Product Profile

October 1984

- **RF and baseband scrambling: pros and cons**
- **Product profile: character generators**
- **Parental control: the key to your TV**

Mycro–Vision's 'Max'

RF and baseband scrambling: pros and cons

By Vasudev Bhaskaran, senior research scientist, corporate R&D, and Mircho Davidov, director of corporate R&D, Oak Industries Inc.

Presently, CATV systems offer 35 to 64 or more channels of programming. Depending on the type of programming, there is typically a mix of scrambled and unscrambled channels, with the primary intent of scrambling being to deny access to the unauthorized viewer. (In this paper "scrambling" implies manipulation of an analog signal to render it unintelligible, whereas, "encryption" implies manipulation of a digital signal to achieve the same result.) As addressability becomes increasingly prevalent and two-way services become a reality, two trends in CATV video transmission may emerge:

- Video signals will be transmitted unscrambled and the HTU (home terminal unit) will be controlled to deny access to unauthorized channels. Such an approach will be best suited for an off-premise decoder and could be cost-effective in a MDU (multiple-dwelling-unit) environment. However, it may be susceptible to spoofing (fooling the upstream channel) and other forms of piracy.
- Video signals will be scrambled and access to a channel will be provided by means of a descrambler in the HTU. Such a scheme would be cost-effective in a SDU (single-dwelling-unit).

In a CATV system, there will be a mix of MDUs and SDUs. Furthermore, in the future, there will be a wide variety of information sources offered such as teletext, home banking, etc. Hence, it may be cost-effective to incorporate a descrambler in each HTU to prevent unauthorized reception of revenue generating video programming.

There are several ways in which a video signal can be scrambled. Although the scrambling techniques vary significantly, the following attributes can be considered fundamental in any scrambling technique:

- **Depth of Scrambling** The technique must assure that programming material offers no entertainment value to the unauthorized viewer. In some instances, the nature of programming material may be such that the scrambled picture should not provide any observable details, which would offend the unauthorized viewer.
- **Security** The technique must a) be time-varying so that real-time descrambling is not (inexpensively) possible; or, b) require very expensive or absolutely unavailable descrambling hardware.
- **Non-Degrading** The results of descrambling must not exhibit component or circuit-sensitive residuals, nor be discernable in the descrambled picture.
- **System Complexity** The HTU may encompass several functions besides the descrambler and, since the overall cost of the HTU should be low, descrambler hardware must be fairly simple.
- **Multiple Scrambling** As the type of programming CATV systems offer changes, there may be a need to overlay the previous simple scrambling technique (which gives good depth of scrambling) with a hard to defeat technique (which gives good security).
- **Bandwidth Expansion** Scrambled signal bandwidth should be such that video, audio and synchronization signals can be transmitted in a 6 MHz bandwidth.

Scrambling techniques that meet one or all of these attributes can be implemented at RF or baseband. The first generation of video scramblers was implemented at RF since such schemes resulted in a simple descrambler that did not require any demod-remod configurations. Most RF schemes implemented to-date possess weak security and marginal scrambling depth.

Baseband techniques evolved later and are prevalent now. Such schemes offer flexibility in that they can be applied to a satellite, STV or CATV environment easily. Baseband schemes can be implemented using digital or analog scrambling. When digital video signal processing becomes cost-effective, digital implementation of baseband scramblers may become prevalent.

At Oak, several RF and baseband scrambling techniques have been simulated on a computer.

Computer simulation procedure

The simulation procedure consists of the following steps:

- A frame of monochrome video is digitized by a DeAnza image-array processor. Display area of digitized frame is 512 scanlines and 512 picture elements per scanline with each picture element represented as an eight bit quantity. The digitized image can be displayed on a DeAnza monitor. This image is input to the VAX 11/780.
- The algorithm describing the scrambling technique is implemented on the VAX. All filtering operations and various transmitter, transmission link and descrambler functions are also modeled here.
- Scrambled image and descrambled image can be viewed on the DeAnza display monitor.

Simulations were performed for a still-frame of monochrome video. A test frame used in all the simulations is shown in Fig. 1. For NTSC color signals, perceived scrambling depth would be more than that depicted in the simulation results reported in this paper since even a slight modification in the video signal alters the color properties in the perceived image and tends to be annoying to the viewer.

RF scrambling

Conventional RF scramblers accomplish video and/or audio scrambling by jamming the video signal using a tone or inverting video signal or suppressing sync in the video signal.

Tone Jammer Interfering carrier is placed near the video carrier, thus causing a beat pattern in the receiver, which masks the actual video signal. Scrambling depth depends on the level of the interference carrier and the frequency at which it is located. One possible tone jamming frequency is 2.25 MHz above the picture carrier. Due to the manner in which the audio signal is recovered in the receiver, jamming tone at 2.25 MHz yields a beat at 4.5 MHz, which in turn jams the audio signal also. For effective descrambling, a trap is needed to attenuate the interfering carrier. Trap attenuation must be around 40 to 60 dB to avoid any residual effects in descrambled video. The trap also will attenuate useful luminance energy. Scrambling depth on video is marginal. Video signal security is very weak since the scheme is not time-varying and traps can be built inexpensively. In a cable system,

Fig. 1 Scrambler Input

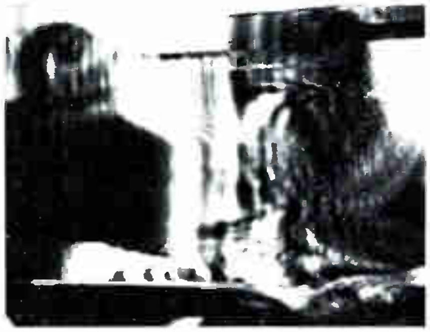

Fig. 2a Fixed Nonlinear Filter

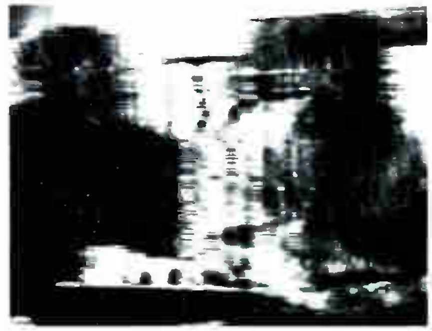

Fig. 2b Time-varying Nonlinear Filter

Fig. 3 Video Jitter

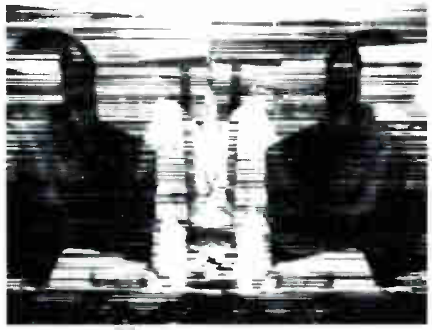

Fig. 4a Random Line Reversals

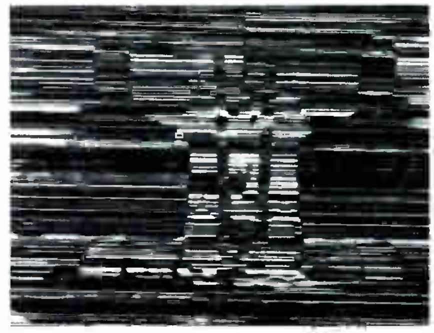

Fig. 4b Random Line Reversals, Random Line Transformations

Fig. 5a 16 Line Permutations

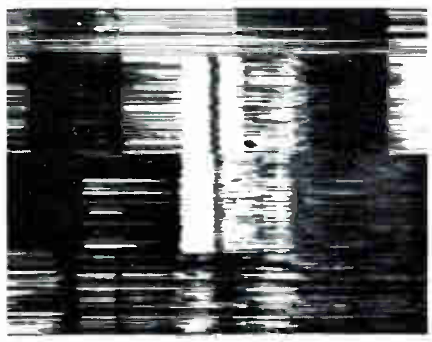

Fig. 5b 128 Line Permutations

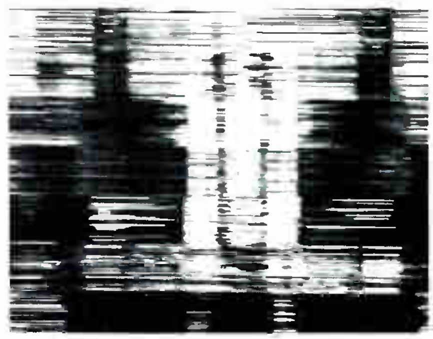

Fig. 5c 64 Line Permutations, Random Line Reversals

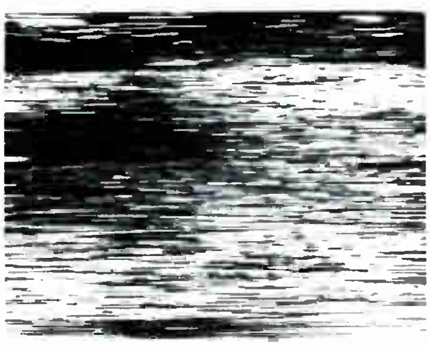

Fig. 6a Line Dicing

Fig. 6b Line Dicing Descrambler Output.VBS Filter Effects, Multipath (10dB, 500nsecs)

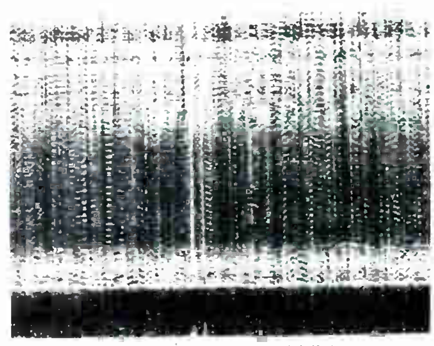

Fig. 7 Encrypted Video

introduction of a tone-jamming carrier for each scrambled channel will increase the number of beats in the system and, depending on the receiver front-end, may cause degradations in the nonscrambled channels also.

Video Inversion Scrambling is achieved by subtracting from the signal a constant RF carrier at the same frequency and phase as the actual RF carrier. This will result in the active video signal being treated as a sync signal in the receiver, thus yielding a jagged sync bar in the middle of the displayed picture. Video scrambling depth is marginal. Audio is not scrambled in this method. Descrambling operation is complex since RF carrier must be recovered with correct amplitude, phase and frequency. Errors in recovered carrier phase will appear as color distortions and errors in recovered carrier amplitude will cause luminance distortions. In a multipath environment it will be nearly impossible to reconstruct the carrier accurately—thus, luminance and color distortions are inevitable in a multipath environment. A PLL system may be needed to regenerate the RF carrier and, depending on the number of scrambled channels, the PLL system may turn out to be fairly complex.

The scheme possesses weak security since the subtraction of RF carrier is not done in a time-varying manner. Time-varying scrambling can be realized by subtracting from actual carrier an RF carrier with the same frequency, amplitude and a phase varying on a line-by-line or scene-change basis. Information pertaining to phase can be sent as low level modulation on the aural carrier. If phase is varied on a line-by-line basis, the inaccuracies in reconstructed RF carrier at receiver will cause annoying flicker in displayed image.

Sync Suppression Sync suppression scramblers can be realized in one of two ways:

- Sine-Wave Scrambler: The video signal is exponentially modulated by a low-frequency sine wave. For descrambling purposes, information regarding this sine wave is transmitted as AM on the aural carrier. The phase and amplitude of the low frequency sine wave are chosen so as to cause sync suppression. The receiver false locks on active video, thus yielding a jagged sync bar in the middle of the picture. By varying the frequency of the sine wave, time-varying scrambling is achieved.
- Square-wave or Gated Sync Scrambler: In this method, during the blanking interval, modulated signal

is attenuated by at least 6 dB, causing sync and color-burst to be below active video, thus yielding a scrambled signal similar to that obtained with the sine wave sync suppression scheme. In the descrambler, a gain of 6 dB is switched in during the horizontal blanking interval. The time instants at which the gain is switched in is transmitted by modulating the aural carrier.

- Depth of scrambling is identical for sine wave and square wave sync suppression schemes. Audio is not scrambled in either method. Sine wave scheme possess better signal security due to the time-varying manner in which the scrambling frequency can be chosen. With the advent of digital TV chip sets in RV receivers, it is possible to defeat square wave sync suppressors since such chip sets work on standard and non-standard sync signals (provided color-burst and standard vertical blanking interval synchronization signals are available). A sine wave scheme cannot be defeated by merely reinserting sync; modulation on video must be removed. Otherwise luminance and chrominance distortions will result in the descrambled signal.

Descrambler complexity is more for the sine wave scheme since in the receiver, circuitry is needed to accurately recover amplitude, phase and frequency of the modulating signal. In the square wave scheme, since the descrambling signal is a square wave, such signals can be generated accurately and easily by digital methods.

Descrambler residual effects may degrade video in the sine wave scheme. Since the AM signal on the aural carrier is used for descrambling, interference from in-channel chroma subcarrier, strong upper adjacent channel video carrier can cause constant luminance residuals in descrambled video if the descrambling loop bandwidth is not too tight. Furthermore, in the sine wave scheme any noise in the descrambling signal is transferred onto the video during the demodulation process. In the square wave scheme, since active video is never manipulated during the scrambling process, there is no noise transfer in the descrambling process. Any inaccuracy in sync regeneration causes side-by-side motion of displayed picture signal.

At Oak, two other RF schemes have been investigated.

Frequency Inversion Inversion of video frequency spectrum leads to a scrambled signal. Frequency inversion schemes can accomplish video and audio scrambling jointly. Furthermore, such a scheme can co-exist with the conventional RF schemes described previously.

Non-Linear Filtering Video signals can be scrambled by performing a non-linear filtering operation on the IF signal. An example of the computer simulated scrambled signal obtained with a specific non-linear filter is shown in Fig. 2a. Comparing this result with the scrambler input (Fig. 1), the scrambling depth appears to be inadequate. However, in a NTSC color signal, perceived scrambling depth would be much more. Descrambling is achieved by using the inverse non-linear filter. This filter can be implemented as a passive device and such a descrambler can be very inexpensive.

If fixed non-linear filtering is used, the scheme can be defeated fairly easily. A computer simulated result for a time-varying scrambler employing two non-linear filters randomly chosen is shown in Fig. 2b; good scrambling depth is obtained with this method. A PN sequence can be set for random filter selection and this sequence in encrypted form can be transmitted to the receiver, thus ensuring excellent video signal security.

Residual effects on descrambled signal can be minimized if a nearly exact inverse of the transmitter non-linear filter can be realized. Based on the extent of non-linearity required, this is feasible with today's technology.

In this scheme, audio is not scrambled. A sync suppression scheme can be added to further enhance scrambling depth.

Baseband scrambling

Baseband schemes possess analog and/or digital (or CCD based) implementations. Presently, most baseband techniques are implemented using analog systems; while good scrambling depth and security can be obtained, a greater variety of scrambling techniques can be implemented using digital systems. Several baseband scramblers have been studied via computer simulations; a brief description and simulation results are included here.

<u>Video Inversion/Sync Suppression</u> Such a scheme is used in Oak's Sigma and Orion products and also in various other commercially available scramblers. In Sigma, sync is suppressed, digital audio is inserted in sync interval and video is inverted randomly on a scene change basis. Even though a non-standard signal is transmitted in Sigma, it is not easily defeated in an ITT digital TV chip set based receiver since both vertical as well as horizontal sync signals are eliminated (not suppressed) and nonstandard signals are used in VBI. In Sigma, extremely high security obtained by digitizing and encrypting digital audio, coupled with the video scrambling scheme would thwart unauthorized viewers from deriving any entertainment value from the received signal. Due to the high performance of the HTU, such an approach will be very attractive for a CATV system.

Instead of suppressing sync, sync could be randomly inserted within each video line. This will yield a jagged bar in the middle of the picture. Since sync insertion introduces discontinuities in the video line, bandlimiting the signal will cause distortions in descrambled video.

<u>Video Jitter</u> Start time of active video of each scanline is randomly jittered. This has the effect of breaking vertical correlation in a picture. Larger values of jitter yield increased scrambling depth. Large values of jitter can be obtained by modifying blanking interval signals. Computer simulated results obtained for the video jitter scrambler with a random jitter are shown in Fig. 3. This scheme offers good scrambling depth; additional scrambling depth can be obtained using non-standard sync. The start time of jittered video is obtained from a PN sequence, and this sequence is sent to HTU in encrypted form for high video security. Simulations have indicated that inaccuracies in line start-time regeneration at the descrambler can be controlled so that negligible perceptual degradations result in the descrambled signal. For unauthorized descrambling, the receiver must estimate the amount of time-jitter. This can be done by estimating interline correlations and then advancing or delaying the received signal until the correlation is maximized. However, such computations cannot be performed inexpensively in real-time.

Instead of jittering the video, random video fields can be delayed. Descrambling is achieved by delaying the fields that were not delayed in the scrambler. Even though extremely simple hardware can be used for descrambling, this scheme is unacceptable due to inadequate scrambling depth.

<u>Time-Reversal</u> Active video of each line is transmitted as is or in a time-reversed manner; sync and color-burst are sent as is since unauthorized descrambling would be simple if these signals were also time-reversed. A PN sequence can be used to randomize the time-reversal process; for descrambling, the PN sequence in encrypted form is transmitted, thus ensuring a high level of security. A computer simulated result for this scrambler is shown in Fig. 4a.

Good scrambling depth on the video can be obtained with such a scheme. Video security is acceptable for CATV transmissions. The scrambling technique can be defeated using correlation techniques. This requires several lines of storage and high speed logic (an expensive solution).

The scrambler and descrambler are implemented using A/D and two lines of storage. This scheme, in combination with a secure audio scheme such as Sigma's, is capable of offering a high performance HTU. The residual effects introduced by the descrambler are negligible (line time distortion effects only) except when the PN sequence is received with errors. The digital PN sequence can be error-protected to overcome this problem.

Sync suppression can be included to enhance scrambling depth. Furthermore, since the signals are digitized, linear transformations on the digital signal can be performed to further increase the scrambling depth. In Fig. 4b, we show video scrambler output wherein video lines are randomly linear transformed and randomly time-reversed. This two-level scrambling process offers excellent signal security even though the linear transformation method by itself is insecure. (An analysis of signal security of the linear transformation scrambler is described in [1]: This analysis indicates that simple operations can be performed to accurately descramble the video without knowledge of the PN sequence.) In Fig. 4b, linear transformation is applied to randomly selected lines; if the inverse transformation process in the receiver is not exact, annoying flicker will be perceived in the descrambled image. To avoid this flicker, it is preferable to apply the linear transformation randomly on the basis of scene change.

Permutation of video lines A set of video lines is randomly permuted and the reordered lines are transmitted. At the receiver, lines are first stored and then reordered. Permutation of the lines is accomplished by a PN sequence which also must be available at the receiver for correct descrambling. In Fig. 5a, we show video scrambler output when a set of 16 lines is permuted and in Fig. 5b, scrambler output with 128 line permutation is shown.

Excellent scrambling depth can be achieved with a 128 line store in transmitter and receiver. Due to storage requirements, the HTU would be fairly expensive. Storage requirements can be halved with no decrease in perceived scrambling depth by randomly time reversing some of the permuted video lines. Simulation result for a 64 line permutation scheme with random line reversals is shown in Fig. 5c. Excellent signal security is also achieved since (1) unauthorized descrambling would be expensive, and (2) the PN sequence used in the headend for line permutations is encrypted and transmitted to the HTU.

Since sync and color burst are not modified, secure audio transmission as per Sigma scheme can be easily incorporated.

Line Dicing In this scheme, the active video portion of each line is split into two fragments and these fragments are interchanged prior to transmission. Length of each fragment is randomly changed on a line-by-line basis and this information is sent to the HTU. [Computer simulated result for such a scrambler is shown in Fig. 6a.] This scheme offers excellent scrambling depth and security. The descrambler can be implemented using digital systems or CCDs.

Since video line is fragmented and interchanged, abrupt discontinuities may be introduced in each scrambled video line causing an increase in the bandwidth of the scrambled signal. Bandlimiting the scrambled signal introduces distortions at the discontinuities, causing segment distortions in the descrambled video. In the presence of multipath, similar distortions will arise. In Fig. 6b, the descrambler output is shown; in this simulation, the line diced signal was filtered by an idealized VSB filter and then transmitted over a link which possessed a multipath of 10 dB, 500Nsecs. (Ten dB is the attenuation of the reflected signal relative to the direct signal and 500Nsecs is the delay in the reflected signal relative to the direct signal.) Multipath and VSB filtering causes significant segment distortions. The VSB filtering effect can be minimized by stretching a few samples between segment boundaries; however, multipath impairments can still be significant.

In unscrambled video signal transmission in CATV systems, a 5 percent line tilt causes no visible effects, whereas with a line diced signal even a 1 percent tilt will cause visible low frequency noise (less than 0.5 percent line tilt is required for no visible noise effects).

Due to degradations caused by VSB filtering, multipath and line-tilt, line-dice scrambling may not be viable in a CATV system.

MAC A, B or C Several MAC formats have been proposed for video and audio transmissions over a satellite link. MAC formats, by the manner in which they are created, yield a scrambled signal; the scrambling depth can be enhanced by using any one of the baseband techniques we have described in this paper. In its present form, the MAC signal is not directly applicable to CATV transmissions since baseband bandwidths are in the neighborhood of 6 MHz. Furthermore, with VSB-AM modulation, there is greater potential for cross-talk within the luminance and chrominance channels (assuming imperfect detection in the receiver).

Video scrambling methods

Various attributes of the video scramblers discussed in this paper are summarized in Table 1. For a CATV system, the scrambling method will be selected based on the peformance and whether the type of programming warrants extremely high scrambling depth or moderate scrambling depth that could be realized at a lower cost.

Future trends in video scrambling

It would be attractive to use a video scrambling method that would work well in satellite, STV and CATV environments, so that widespread dissemination of the signals is possible without any intermediate decode/re-encode processing; clearly, a baseband scrambling method would be preferred. With the development of low-cost, high-speed digital signal processors, baseband scramblers would be implemented in the digital domain.

Looking further into the future, fully digital video transmissions will be accomplished in CATV systems. Here, digitized video would be encrypted prior to transmission. When a DES-like encryption algorithm is applied to the digitized video signals of Fig. 1, a computer simulated encrypted signal results as is shown in Fig. 7. Encryption offers unsurpassed scrambling depth and security. In a CATV environment, most of the proposed new services (e.g. teletext, home banking, digital audio, etc.) are essentially digital information. These sources can be time-division multiplexed with digital video. The HTU architecture will now resemble a small, but powerful, computer capable of performing a myriad of functions such as decryption, error-correction, noise-reduction, etc.

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Table 1
Summary of Selected Video Scrambling Methods

Scrambling technique	Scrambling depth	Video security	Residual effects in descrambled video	Descrambler hardware complexity	Cost
RF Methods					
Tone jammer	marginal scrambles audio also	inadequate	useful luminance energy lost	low. 1 trap per scrambled channel	low
Video inversion	marginal	inadequate	luminance and chrominance distortions due to imperfect carrier recovery	complex	high
Sinewave sync suppression	adequate	adequate	noise transfer from descrambling signal to video	low	low
Squarewave sync suppression	adequate	inadequate (sync easily restored)	video jitter due to inaccurate timing	low	low
Frequency inversion	good. scrambles audio also	good	scrambled picture due to inaccurate timing	moderate	moderate
Nonlinear filter	good	good	distortions due to filter mismatch	low	low
Baseband methods					
Video inversion/sync suppression	adequate	adequate	distortions due to inaccurate DC restoration	moderate	moderate
Video jitter	good	excellent	jittered video due to inaccurate timing	moderate	high
Line reversals	good	adequate	negligible	low	moderate
Line permutations	excellent	excellent	negligible	high	high
Line dicing	excellent	excellent	significant segment distortions in CATV links due to VSB filtering and multipath	high	high
MAC A,B or C	good - in conjunction with other scrambling methods	good	not presently applicable to to 6 MHz CATV links	not known	not known

References
D. Rayhaudhuri and L. Schiff, "Unauthorized Descrambling of a Random Line Inversion Scrambled TV Signal," IEEE Trans. Commun., vol. COM-31, pp. 816-821, June 1983.

HOW TO TAKE THE RECALL OUT OF THE INSTALL

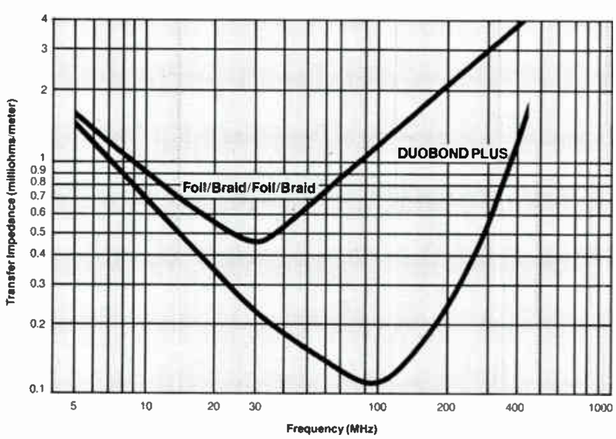
Belden's drop cable with DUOBOND PLUS™ shield helps you prevent costly call-backs. It's also the most shield-effective drop cable in the CATV industry.

Easier termination for maximum shielding integrity.

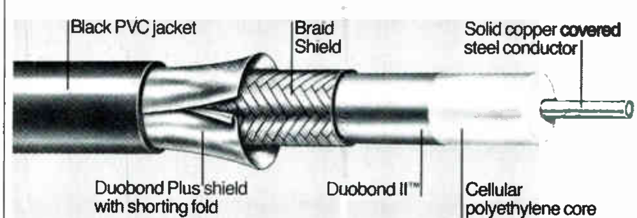
The DUOBOND PLUS shield features a foil/braid/foil construction with a shorting fold in the outermost foil which provides superior shielding effectiveness to typical 4-layer shield constructions. The transfer impedance graph demonstrates this effectiveness.

The added benefit is easier termination. This means less chance for error, resulting in greater shielding integrity and reliability. It also means fewer call-backs, lower operating expenses and more satisfied subscribers.

Cables with the DUOBOND PLUS shield require only half the steps for termination than 4-shield cables. Because it's less bulky, more flexible and its outer foil is bonded to the jacket, stripping and connectorizing are much simpler tasks. You can minimize your connector inventory to one size connector and one crimp tool.



Belden's unique shield protection.



The inner foil of the DUOBOND PLUS shield is bonded *directly* to the core. Foil pushback and signal leakage problems are eliminated. Protection from shielding degradation is eliminated during installation–where most shielding problems occur.

The unique shorting fold in the outer foil of the DUOBOND PLUS shield provides metal-to-metal contact for improved isolation. Traditional overlapping foils fail to reduce slot radiation as effectively.

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Drop cables with the DUOBOND PLUS shield are available in RG59, RG6 and RG11 constructions—messengered, non-messengered, dual and flooded versions. All cables are 100% sweep tested from 5 to 450 MHz with a minimum return loss of 23db for RG59 and 26db for RG6.

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Reader Service Number 38

COOPER INDUSTRIES **BELDEN**

Product Profile

Character generators

Manufacturer/ Model	No. of Type Styles	Character Resolution in Nanoseconds	Characters Per Line, Max.	Lines Per Page, Max.	Proportional Spacing	Italics	Flash	Auto Line Centering	Auto Page Centering
Beston									
Marquee CG-800	1	140	32	16	No	No	Yes	Yes	No
Cable Graphic Sciences									
System 1500	8	n/a	40	Variable	No	No	Yes	Yes	Yes
Chyron									
VP-2	6 from 45	35	62	24	Yes	Yes	Yes	Yes	Yes
Chyron IV	6 from 45	27	62	24	Yes	Yes	Yes	Yes	Yes
Dubner									
CBG-1	180	50	100	30	Yes	Yes	Yes	Yes	Yes
FOR-A									
VTW-210	1	52	32	8	No	No	Yes	Yes	No
VTW-400	2	50	26	8	Yes	Yes	Yes	Yes	Yes
Knox Video									
K-60	1	7x9 dot matrix	32	16	No	No	Yes	No	No
K-100	1	57	Variable	Variable	Yes	Yes	Yes	Yes	No
Laird									
7200	21	35	Variable	Variable	Yes	Yes	Yes	Yes	n/a
MCI/Quantel									
Cypher	6	n/a	Variable	Variable	Yes	Yes	Yes	Yes	Yes
MPB Technologies									
Vista 80	4	35-40	Variable	Variable	Yes	n/a	Yes	Yes	Yes
Vista 90	7 from 14	35	140	64	Yes	Yes	Yes	Yes	Yes
Mycrotek									
Max	2	70	32	8	Yes	No	Yes	Yes	Yes
Supra	10	40	32	8	Yes	No	Yes	Yes	Yes
Portac									
KBD-2	1	n/a	32	8	No	No	Yes	Yes	No
SRP Electronics									
45/7	1	n/a	22	18	No	No	No	Yes	No
Teledac									
T-1300	1	n/a	28	15	No	No	Yes	Yes	Yes
Telpar									
CTI-180	2	70	32	16	Yes	No	Yes	Yes	Yes
Texscan									
CDD-45	1, 8 op.	70	40	26	Yes	No	Yes	Yes	Yes
SpectraGen 4	1, 2 op.	35	40	26	Yes	No	Yes	Yes	Yes
Thompson-CSF									
Vidifont V	8	48	Variable	Variable	Yes	Yes	Yes	Yes	Yes
3-M									
D-1000	1	70	22	20	Yes	No	Yes	Yes	No
D-5000	4, 8 op.	35	80	16	Yes	Yes	Yes	Yes	Yes
Video Data Systems									
CG-1000	1	70	22	10	No	No	Yes	Yes	Yes
Vidstar	2, 8 op.	30	Variable	Variable	Yes	Yes	n/a	Yes	Yes

Researched and compiled by Lesley Dyson-Camino

Background Colors	Character Colors	Horizontal Crawl/Speeds	Vertical Roll/Speeds	Channels Controlled by Basic System	Wire/Weather Station Interface	Keyer	Resident Storage	Graphics
4	1	Yes/3	No	2	Optional	Optional	1K	No
128	128	Yes/1	No	1	Optional	No	70 pg.	5 graphic fonts, animation, library
512 512	512 512	n/a Yes/5	Yes/4 Yes/5	1 program, 1 preview 1	No Optional	Yes No	400,000 char. 2,400 lines	Palette animation 3/D animation
512	512	Yes/9	Yes/9	1 program, 1 preview	Optional	Yes	20 MB	Full graphics/ animation
1, 8 op. 64	1, 8 op. 64	Yes/4 Yes/4	Yes/4 Yes/4	1 program, 1 preview 1 program, 1 preview	Yes Yes	No Yes	4 pg. 8 pg.	No No
1, 8 op. 512	1, 8 op. 512	No Yes/multi	No Yes/multi	1 program, 1 preview 1 program, 1 preview	n/a Yes	Yes Yes	4 pg. 64 pg.	No No
32	32	Yes/9	Yes/9	1	n/a	Yes	10 pg.	Animation
Infinite	Infinite	Yes/multi	Yes/multi	1 program, preview	n/a	Yes	n/a	3/D animation
8 62	8 62	Yes/4 Yes/5	Yes/4 Yes/20	1 program, 1 preview 1 program, 1 preview	n/a Optional	No Yes	40-2000 pg. 1 pg.	Character graphics Yes
8 12	8 12	Yes/3 Yes/3	Yes/3 Yes/3	2 BNC connectors 2	Yes Yes	No Yes	120 pg. 240 pg.	2 graphics fonts Graphics font, custom logos
6	2	Yes/multi	Yes/multi	1	No	No	12 pg.	No
8	8	No	No	1	No	No	45 pg.	No
5	1	Whip	No	1	Yes	No	40 pg.	Limited
8	8	Option/1	Option/10	1	Yes	No	16 pg.	Optional characters
32 32	32 32	Yes/3 Yes/3	Yes/3 Yes/3	1 1 program, 1 preview	Yes Yes	Yes Yes	150 pg. 150 pg.	32 character graphics/ animation (both)
4000	4000	Yes/7	Yes/7	2	Yes	Yes	440 pg.	Full graphics/animation
8 512	8 512	Yes/2 Yes/9	Yes/2 Yes/9	1 program, 1 preview 1 program, 1 preview	No Yes	Yes Yes	36 pg. 50 pg.	32 char. graphics/ logos/separator (both)
512 512	512 512	Yes/9 No	Yes/9 No	1 program, 1 preview 1	No No	Yes Yes	36 pg. 2 pg.	26 graphic symbols Precision position/ 3-D/graphic windows

Parental control: the key to your TV

By Gary Kim

Until the advent of addressibility, key lock devices were the only way to provide parental control of adult programming. The indoor traps used in conjunction with the key locks typically are available in single-, double- or triple-channel configurations. Some versions trap video only, or video plus audio on two channels and video-only on the third.

EEG Enterprises, for example, distributes a line of single-, double- and triple-channel key lock trap systems handling everything from channel 2 through the hyperband. The multichannel traps will work on frequencies not adjacent to each other. A two-channel, two-key device also is available, allowing independent control of two channels. The video-only devices are available at about $14 each for single-channel, $24 for two-channel and $31 for triple-channel locks.

Video carrier attenuation is about 50 dB, says Bill Jorden, EEG vice president. As with all present indoor traps, there is some attenuation of the lower adjacent channel, varying with frequency. Sound and video traps also can interfere with the upper adjacent channel.

Augat LRC had considered bringing out a key-lock trap, but decided against it. The company does have a pole-mounted trap for low-, mid-, high- and superbands. The units can handle one or as many as five non-contiguous channels. Single-channel units run about $6.75 each and dual-channel devices, about $9.90 each. Attenuation is about 50 dB.

Keystone Electronics distributes video and audio, video-only and audio-only systems. For two-channel systems, depending on frequency, both video and audio probably can be trapped, the company says. The three-channel mid-band unit traps video and audio on one channel, and video-only on the other two. The superband unit only traps video. The video and audio unit sells for $18; the video-only unit, for $14. Non-adjacent channels can be trapped, and intercarrier attenuation ranges from 45-50 dB. Lower-band adjacents aren't affected much, but mid-band audio is, the company says. Upper adjacent degradation is "nominal." The company uses equipment from Illinois Lock, which makes key switches, and Eagle Comtronics, which produces traps.

But newer technology is on the way. Microwave Filter Co. plans to add a new product to its existing key-lock line in about six months. To be priced at about $15, the new four-to-six-channel trap is designed to meet the demands of tiered programming. The company's present traps attenuate video 70 dB, but the new system may hold at about 40 dB. "A 70 dB notch destroys the lower adjacent—a 40 dB doesn't," says Glyn Bostick of MFC. The new narrow-notch design is intended to make the picture unviewable while preserving the lower adjacent, and "flies in the face of old trapping rules of thumb," he says.

Key lock traps offer a relatively low-cost way to add the parental control feature to existing converter systems.

Operators considering addressability have some additional options to the key lock trap options on the Jerrold Starcom series, Hamlin MLD-1200A, Oak TCM-1 and Zenith Z-Tac set-top converters. For example, many set-top addressable systems also offer electronic locking of channels.

Typically, the subscriber is issued a parental control code that enables or denies all programming above a specified rating (G, PG, R, for example), or allows the subscriber to lock specific channels at will.

Some systems, like the Jerrold Starcom, Telease MAAST, and Zenith Z-Tac, have the ability to lock whole tiers.

Other systems, like the Tocom Impulse, Eclipse and 5503A, allow coding of 16 rating levels.

On the World Video Library TM-1 system, control is available on pay channels, while on the Pioneer BA-2000 and 3000 series, the Magnavox Magna 6400 addressable, Scientific-Atlanta series 8500 and Regency Electronics Roman line, all channels are controllable.

Some systems, for example Oak's Sigma, use baseband techniques like random video inversion, while others, such as Kanematsu-Gosho's Sprucer II, use sync suppression.

Off-premise systems present a mixed picture. Some, like Texscan's TRACS system, use a "positive" approach, allowing parents to program as many as 10 channels their children may watch.

Other, such as Times Fiber's Mini-Hub line, use the "negative" approach of specifying channels children may not watch. While the Mini-Hub prevents signals, whether jammed or scrambled, from entering the home, the Pico OTAS system uses a key lock to trap controlled channels.

Not all off-premise systems can provide parental control. The Ortech and Blonder-Tongue Guardsman systems are in this category. The AM Cable Tier Guard System doesn't have parental control capability now, but will when the keypad feature is added.

The planned ATC/Toshiba system will electronically lock channels, while the Pioneer off-premise system will probably use a key lock, as will Jerrold's Intranet. Lockable scrambled channels can be configured as 25 or 50 percent of total channels on Intranet.

Set-top addressable converter systems

Hamlin International Corp.
13610 First Ave., South
Seattle, Wash. 98168
(206) 246-9330

Jerrold Division/General Instrument
2200 Byberry Road
Hatboro, Pa. 19040
(215) 674-4800

Kanematsu-Gosho (USA) Inc.
One World Trade Center
New York, N.Y. 10048
(212) 524-8353

Magnavox CATV Systems, Inc.
100 Fairgrounds Drive
Manlius, N.Y. 13104
(315) 682-9105

Oak Communications Inc.
16935 W. Bernardo Drive
Rancho Bernardo, Calif. 92127
(619) 485-9880

Octagon-Scientific/Regency Electronics
476 E. Brighton Ave.
Syracuse, N.Y. 13210
(315) 476-0660

Pioneer Communications of America
2200 Dividend Drive
Columbus, Ohio 43228
(614) 876-0771

Scientific-Atlanta Inc.
4311 Communications Drive
P.O. Box 10527

Reader Service Number 30

Atlanta, Ga. 30093
(404) 441-4000

Telease
1875 Century Park East, Suite 930
Los Angeles, Calif. 90067
(213) 552-1055

Texscan Corp.
3102 North 29 Ave.
P.O. Box 27548
Phoenix, Ariz. 85061
(602) 252-5021

TOCOM Division
General Instrument Corp.
P.O. Box 47066
Dallas, Texas 75247
(214) 438-7691

World Video Library Inc.
2747 Airport Freeway
Fort Worth, Texas 76111
(817) 831-3811

Zenith Electronics
1000 Milwaukee Ave.
Glenview, Ill. 60025
(312) 391-8187

Off-premise addressable systems

AM Cable TV Industries Inc.
P.O. Box 505
Quakertown, Pa. 18951
(215) 536-1354

Blonder-Tongue Laboratories
One Jake Brown Road
Old Bridge, N.J. 08857
(201) 679-4000

Jerrold Division, General Instrument
see page 44.

PICO Products Inc.
103 Commerce Blvd.
Liverpool, N.Y. 13088
(315) 451-7700

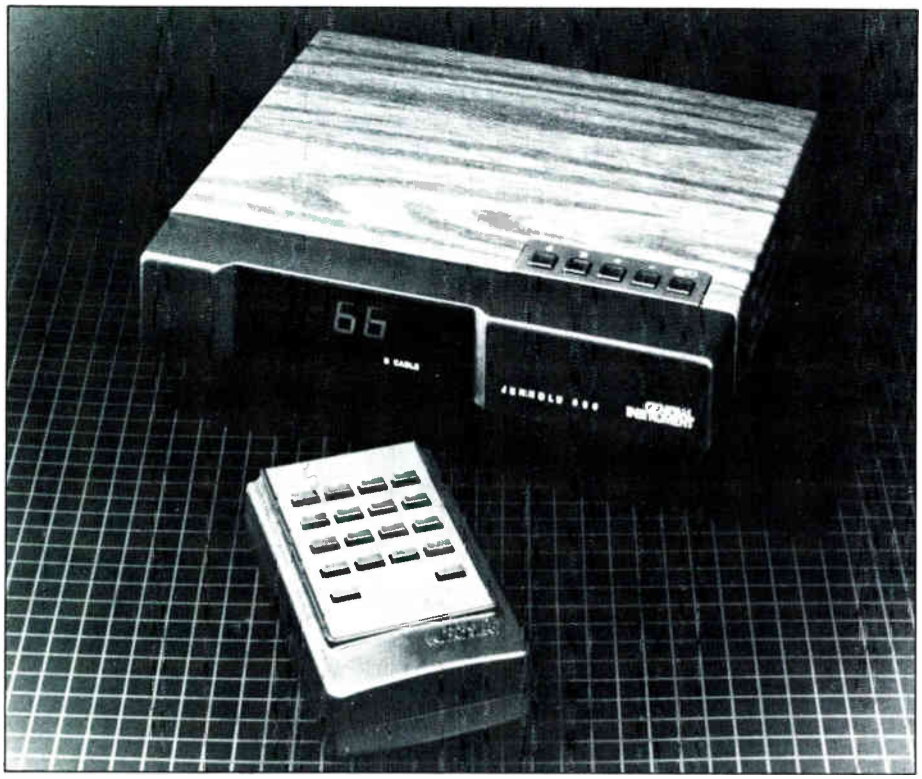
Pioneer Communications of America
see page 44.

Texscan Corp.
El Paso CATV Division
10841 Pellecano Drive
El Paso, Texas 79935

Times Fiber Communications
358 Hall Ave.
P.O. Box 384
Wallingford, Conn. 06492
(203) 265-8500

Ortech
297 Talmadge Rd.
Edison, N.J. 08817
(201) 287-2992

ATC/Toshiba
(303) 799-1200



Jerrold Starcom 450

Key-lock trap systems

EEG Enterprises
1 Rome Street
Farmingdale, N.Y. 11735
(516) 293-7472

Illinois Lock
301 West Hintz Rd.
Wheeling, Ill. 60090
(312) 537-1800

Keystone Electronics Corp.
232-246 E. Second St.
Plainfield, N.J. 07060
(201) 753-4400

Microwave Filter Co.
6743 Kinne St.
East Syracuse, N.Y. 13057
(800) 448-1666

Vitek Electronics Inc.
Four Gladys Ct.
Edison, N.J. 08817
(201) 287-3200

The August *CED* product profile listed Magnavox's 6400 non-addressable converter instead of the 6400 addressable version. The correct specs are: input frequency/channels, 50-450 MHz, 64 channels; -6–+15 dBmV input level; noise figure: 13 dB; gain: 0-6 dB; data carrier: FSK modulated, 108.3 MHz frequency; scrambling method: encoded, time-varying horizontal sync suppression; composite triple beat, second order distortion and cross modulation all are -60 dB; output frequency stability: ±40 kHz; and return loss: input: 6 dB min., output: 12dB. System features include parental control, favorite channel feature, last channel recall, remote control and novram for preserving user information during power outages.

Telease's MAAST converter also was not included in the August product profile. Specs for that system are RF input frequency: 54-440 MHz VHF, 470-890 MHz UHF; input return loss: 12 dB VHF, 10 dB UHF; noise figure: 6 dB for low-, high-, mid- and superband; 8 dB hyperband; and 8 dB UHF; adjacent carrier rejection: 48 dB upper and lower visual; image rejection: 60 dB VHF, 50 dB UHF; IF rejection: 60 dB VHF, 70 dB UHF; data transmission rate: 2.5 mbs; and scrambling method: sync removal, blanking interval moved to grey level, video inversion and quadrature modulated audio with suppressed carrier and pseudo random time multiplexing between audio channels. System features include 200 or more tiers of service, IR remote control, up to five channels of audio with each TV channel, impulse-pay-per-view, volume control, as many as 10 rating categories for parental control, electronic billing and credit limit and 7-day programming.

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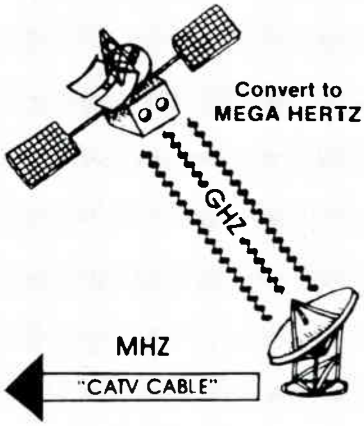

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Advertisers' Index

Headend

Modulation Associates releases demodulator

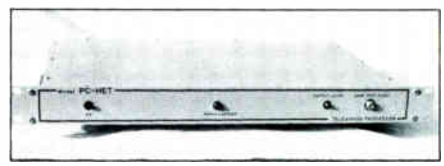
The SR-13, developed by Modulation Associates, is a fully synthesized, frequency-agile satellite video subcarrier demodulator system designed for use in program audio, multiplexed voice and/or data transmission via satellite. The SR-13 features linear detection and low noise characteristics. It can be a standalone unit or configured as a complete satellite subcarrier system by adding a Ku- or C-band microwave downconverter and video disciminator. Optional audio low pass filters and a companding unit allow end-to-end compatibility with most subcarrier formats being uplinked.

For more information, contact Linda Hayes, marketing communications director, Modulation Associates, 897 Independence Avenue, Mountain View, Calif. 94043, (415) 962-8000.

Cadco releases off-air signal processor

The PC-HET has been developed by Cadco Inc. as a companion to the PC-PRO modulator. It is self-contained and features a SAW filtered +45 dBmV output with 60 dBmV adjacent channel rejection. All spur products are 60 dB or more down from full output. The PC-HET accepts the input of single VHF or UHF standard television channels and output on any standard low-, mid-, high- or superband channel. All operating controls are front panel mounted, as is a -20 dB test point for ease of adjustment. The PC-HET costs $495.

For more information, contact Cadco Inc., 2706 National Circle, Garland, Texas 75041, (214) 271-3651.



PC-HET from Cadco

Earth Station

'Sidewinder,' newest feedhorn from Chaparral

The Sidewinder is the latest addition to Chaparral Communications' feedhorn line. Incorporating ferrite technology, the Sidewinder uses variable voltages at +15 to -15 VDC and offers both skew compensation and total redundancy between ports. The Sidewinder operates in all weather and temperature conditions, while delivering low loss. The company also offers the manually controlled Twister II. This unit features a standalone controller, a rocker switch for polarity change and a thumbwheel for skew adjustment. The Twister can also be ordered without any factory controls.

For more information, contact Chaparral Communications, 2360 Bering Drive, San Jose, Calif. 95131, (408) 262-2536.

Uniden satellite TVRO system

Uniden Corp. of America has released a complete line of C-Band TVRO equipment consisting of the UST 1000

TVRO equipment from Uniden

and 3000 receivers, a low-noise amplifier, an 11 foot antenna, an 8 foot antenna and a feedhorn. The UST 1000 receiver features detente tuning with a lighted channel indicator and automatic polarity selection, a signal strength meter, tunable audio and a channel 3/4 modulator. The UST 3000 receiver contains the same features as the UST 1000, plus a digital LED display channel selector, built-in satellite/TV selector and indicator, and fixed and variable audio tuning. The UST 410 low noise amplifier features a weather-sealed housing, an internal voltage regulator, and built-in lightning protection circuitry. The UST Unirotor, a mechanical feed system, includes a robotics motor system, in-line design and an adjustable scaler. The UST 111 is a 24-panel 11 foot aluminum mesh antenna featuring extruded supports. The UST 108 is an 8 foot single-piece antenna made of hydroformed aluminum.

For more information, contact the Satellite Technology Group, Uniden Corp. of America, 15161 Triton Lane, Huntington Beach, Calif. 92649, (714) 898-0558.

Winegard receivers

Winegard Co. has introduced three new home satellite TV receivers. The model SC-7037S features infrared remote control, a built-in antenna positioner control and a power supply. Model SC-7037 also offers infrared remote. The model SC-7037E is a basic unit without a built-in actuator or remote control. All three receivers feature rapid scan control, a polarity format switch, a signal-strength LED bar graph, skew control, audio fine tuning, a crystal-controlled channel 3/4 modulator and video invert switching. An IF gain control provides balancing for cable loss if needed, and a downconverter switch allows the installer to interchange downconverters for easy servicing. Internal bypass circuitry on the SC-7037S and SC-7037 provides automatic switching from satellite to outdoor TV antenna, VCR, and cable when the receiver is turned off. Prices for the three models range from $776.55 to $1,235.80.

For more information, contact Winegard Co., 3000 Kirkwood Street, Burlington, Iowa 52601, (319) 753-0121.

Distribution

Anixter distributes new Raychem products

Four new Raychem products were unveiled by Anixter Communications at the Eastern Cable TV Show. The ThermoShield Cable Repair System repairs outer conductor cracks and restores outer conductor integrity by providing high RF shielding, a waterproof seal, mechanical strength and low electrical resistance. The LTEC 175 is a low temperature, heat shrinkable conduit-to-cable cap that accommodates all types of coaxial cable. The HotWrap Corrosion Protection System provides corrosion protection where tubing is unsuitable. It is re-enterable and replaceable without interrupting service. The ThermoCrimp Pin Connector can be removed from the equipment without disturbing the connections to the center and outer conductor.

For more information, contact Anixter Bros. Inc., 4711 Golf Road, One Concourse Plaza, Skokie, Ill. 60076, (312) 677-2600.

Belden cables

Belden Electronic Wire and Cable has introduced several new cable products. The 9864 dual RG-11/U type CATV drop cable features a Duobond Plus shield with 77 percent braid coverage and low-loss foam polyethylene insulation. It is 100 percent sweep-tested from 5-450 MHz. The 9L320XX is a transmission line cable laminated on .025 inch centers for the internal wiring of computer equipment using high-speed digital circuitry. Belden's new 9GP10XX peelable ground plane cable does not require special equipment to separate the mesh from the insulation.

For more information, contact Jeff Later, Belden Electronic Wire and Cable, 2000 South Batavia Ave., Geneva, Ill., 60134, (317) 983-5200.

People

Donald Haight joined Modulation Associates as president and chief executive officer. Haight formerly worked for Ampex Corp. as general manager of the audio/camera group and director of marketing for video systems.

J. Mahall

Augat Inc. has promoted **Jeff Mahall** to national sales manager, Interconnection Systems division, and **George Bauserman** to vice president and general manager of RDI/Reed Devices Inc. Mahall is responsible for group management and development of the national sales force for Interconnection Systems. Bauserman is in charge of all operations at RDI.

Tele-Engineering Corp. has restructured its management team, naming four heads of company daily activities. **Victor Colantonio**, director of marketing, will be responsible for expanding engineering services and product development. **Wendell Giggey** fills the newly created post of director of operations, in charge of project implementation. Giggey heads the program management team and the design/engineering staff. **Walter Pries** was designated director of system development and will provide technical support for all aspects of the firm's operation. **William Edmunds** was appointed director of administration.

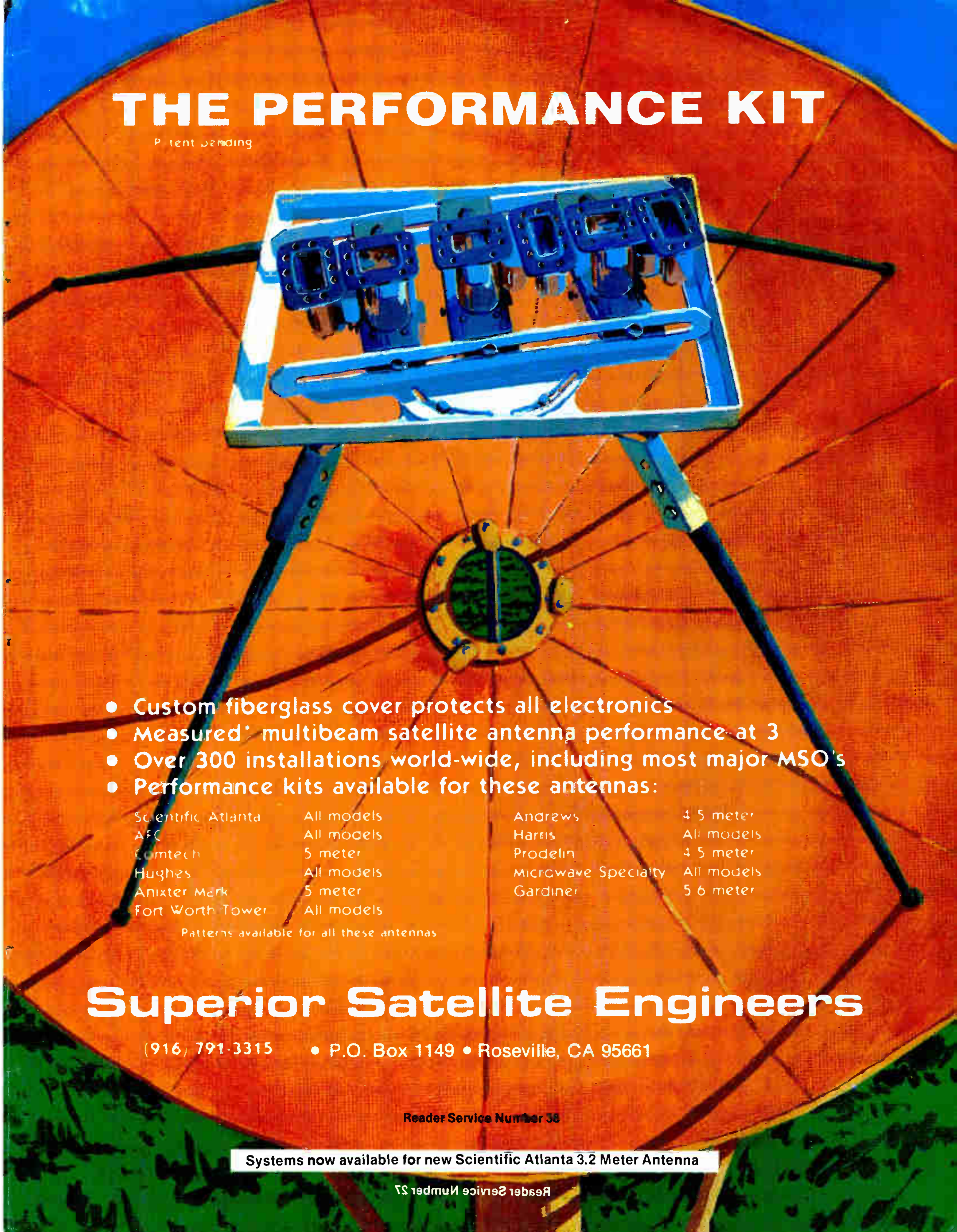
Gregory Casto has been named vice president, systems and services, by Magnicom systems. Casto joins Magnicom from the Chemical Division of Borden Inc., where he spent ten years in information systems management. In his new position, Casto will oversee Magnicom's computer operations support, customer service and product development. Magnicom also welcomed **Robert Hoffman** as marketing representative for Washington, Oregon, California and Nevada. Hoffman will market Magnicom's MARC/10 computer business system.

Walter Braun was named vice president, systems engineering and program management for RCA American Communications Inc. He joined RCA in 1972 as a systems engineer for the Global Communications division and was the July 1981 recipient of RCA's David Sarnoff Award for outstanding technical achievement.

Uniden Corp. of America announces the addition of four new associates to the Satellite Technology Group. **Gary Rhodes** and **Gayle Todd** were appointed district sales managers. **Phil Scott** fills the position of satellite customer service supervisor and **Bill Stark** joins Uniden as marketing coordinator.

James Jackson has been elected to the board of directors of Cableguard Inc., an independent cable security monitoring company. Jackson is senior vice president of the Systems Products division for CIGNA's Affiliated Business Group.

Henny Tejeda was named field equal employment opportunity administrator for AM Cable TV Industries Inc.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Signal	Day	Start/ Stop	Alert Tone	Trans-ponder

Westar V

Signal	Day	Start/ Stop	Alert Tone	Trans-ponder
Pro Am Sports System	Daily	varies	None	7X
SelecTV		24 hrs.	None	3D
Sportsvue		varies	None	4X
University Network		24 hrs.	None	1X

Comstar D-4

Signal	Day	Start/ Stop	Alert Tone	Trans-ponder
Country Music Network		24 hrs.	468*/#	9H
ON TV		24 hrs.	None	(W) 4H
SelecTV		24 hrs.	840*/#	(E)7V

Galaxy 1

Signal	Day	Start/ Stop	Alert Tone	Trans-ponder
BET	Daily	8 p.m./2 a.m.	406*/#	17
Business Times	Mon.-Fri.	6 a.m./9 a.m.	None	9
CBN		24 hrs.	414*/# 715*/#	11
Cinemax	Daily	24 hrs.	None	19
CNN		24 hrs.	024*/# 017*/#	7
CNN Headline News		24 hrs.	635*/# 541*/#	8
C-SPAN (back up)		24 hrs.	None	13
The Disney Channel	Daily	6 a.m./1 a.m.	617*/# 834*/# (E)	(E,C) 4 (M,P) 24
Galavision	Weekdays Weekends	4 p.m./4 a.m. 11 a.m./4 a.m.	None	20
HBO		24 hrs.	None	(E) 23
Home Team Sports		24 hrs.	None	12
The Movie Channel		24 hrs.	None	(W) 14 (E) 10
The Nashville Network	Daily	9 a.m./3 a.m.	866*/# 674*/#	2
Showtime		24 hrs.	None	5
SIN		24 hrs.	819*/#	6
WOR-TV		24 hrs.	None	15

Satcom 3R

Signal	Day	Start/ Stop	Alert Tone	Trans-ponder
AP News Cable		24 hrs.	None	6
Arts & Entertainment	Daily	8 p.m./4 a.m.	637*/#	1
Cable Jazz Network		24 hrs.	None	8
CBN		24 hrs.	414*/# (E,C,M) 715*/# (P)	8
Cinemax		24 hrs.	None	(E,C) 20 (M,P) 23
CNN		24 hrs.	024*/#	14
CNN Headline News		24 hrs.	635*/#	15
C-SPAN		24 hrs.	None	19
Dow Jones Cable News		24 hrs.	None	6
Electronic Program Guide		24 hrs.	None	3
ESPN		24 hrs.	048*/#	7
Eternal Word Television Network	Daily	8 p.m./12 a.m.	762*/#	18
FNN	Weekdays	6 a.m./7 p.m.	975*/# 738*/#	4
Genesis Storytime		24 hrs.	None	8
HBO		24 hrs.	729*/#	(E,C) 24 (M,P) 13
HTN		4 p.m./4 a.m.	207*/#	16
KeyFax National Teletext Magazine		24 hrs.	None	6
The Learning Channel	Daily	6 a.m./4 p.m.	192*/#	16
Lifetime		24 hrs.	361*/#	17
Lifestyle		24 hrs.	None	3
Love Sounds		24 hrs.	None	8
Moody Bible		24 hrs.	None	3
Modern Satellite Network	Weekdays	10 a.m./1 p.m.	243*/# 421*/#	22
The Movie Channel		24 hrs.	None	(E) 5
MTV: Music Television		24 hrs.	None	11
National Jewish Network	Sunday	1 p.m./4 p.m.	None	18
Nice and Easy		24 hrs.	None	8
Nickelodeon	Daily	7 a.m./8 p.m.	311*/# (E,M,C) 519*/# (P)	1
PEN	Monday	4 a.m./6 a.m.	None	16
PTL		24hrs.	None	2
Reuters News View		24 hrs.	None	6

Contact programmer's technical department for more information on transponder, use and alert tone.

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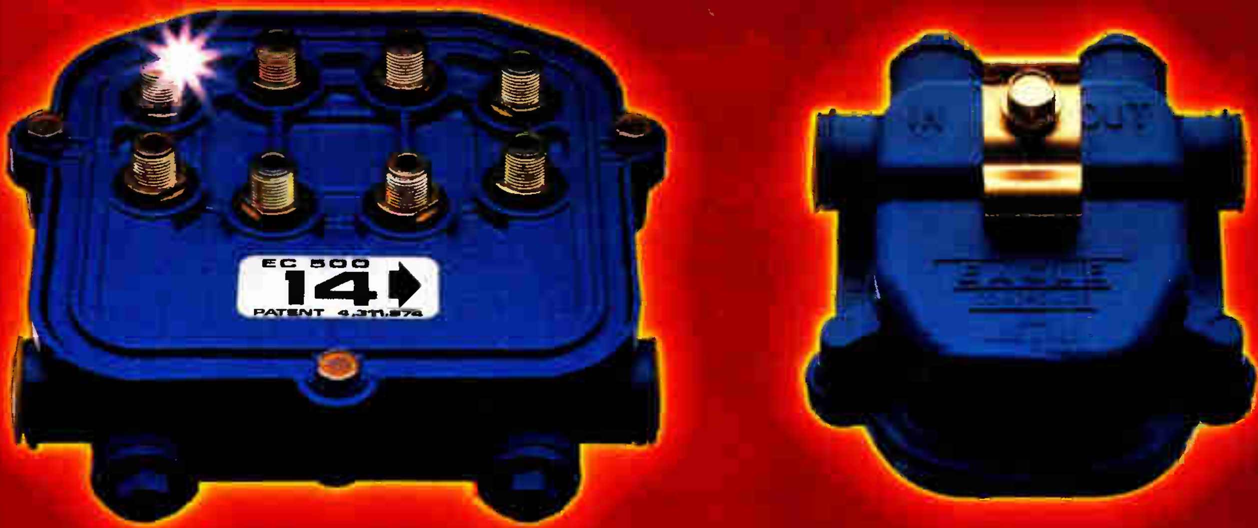

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