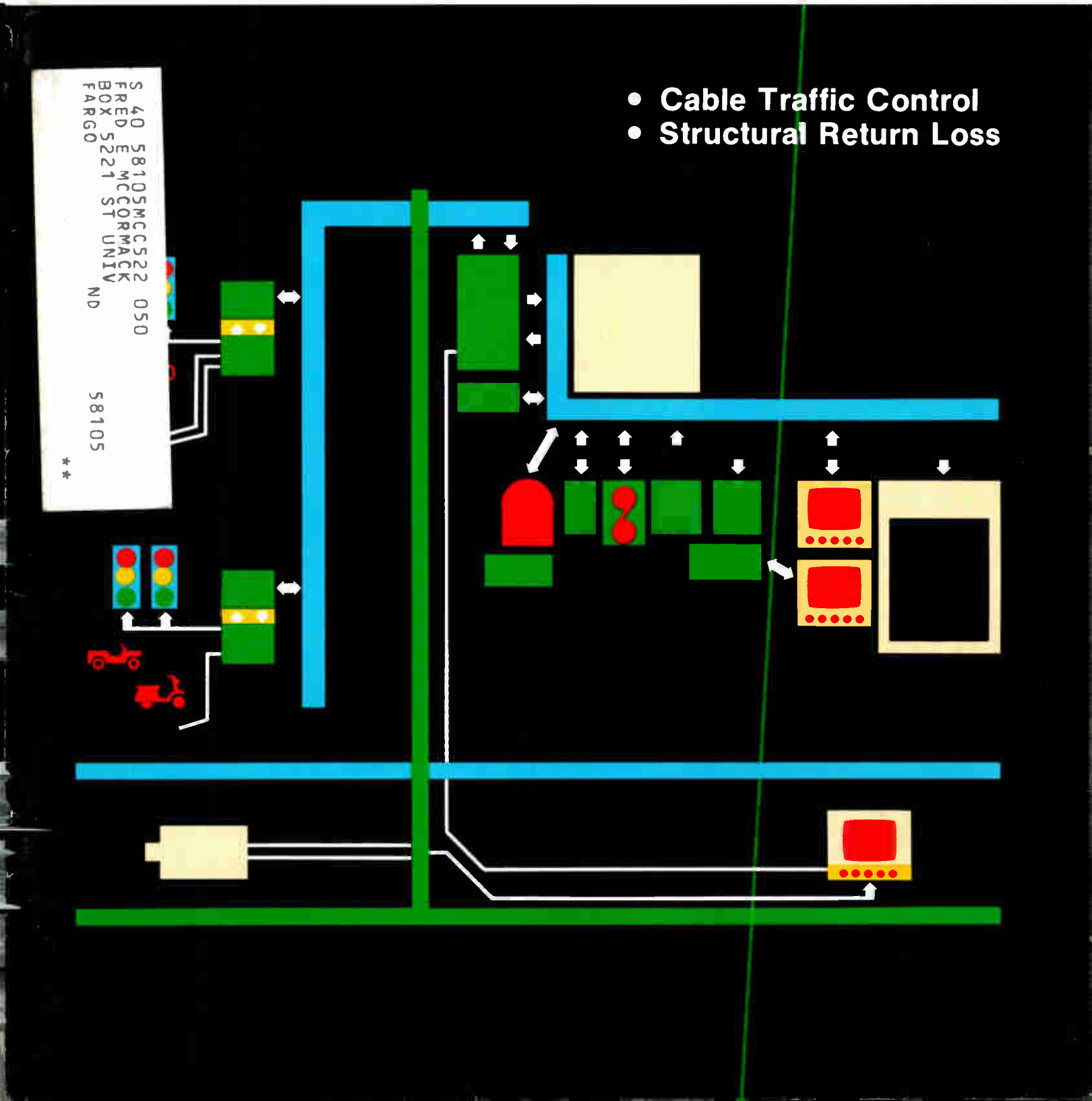
CED™

Communications Engineering Digest/The Magazine of Broadband Technology March 1981



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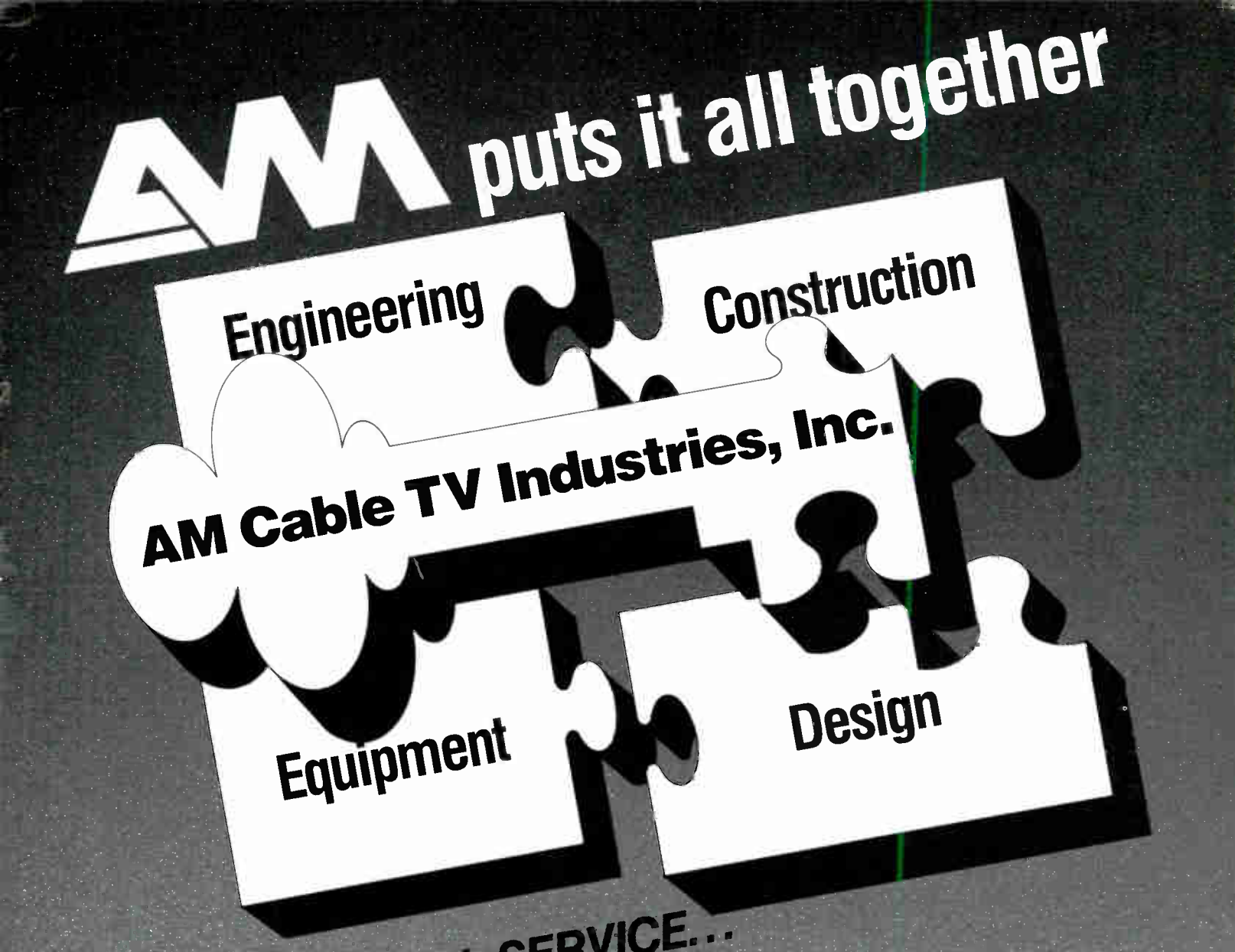

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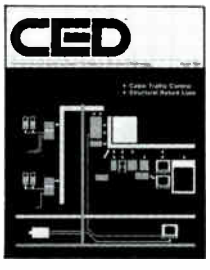

About the Cover
In the TeleCable traffic control system in Overland Park, Kansas, local intersection controllers receive impulses from the system detectors as vehicles pass over them. The controllers accumulate the data and send it to a central computer, located in City Hall. In the future, the city plans to install video scanners at major intersections.

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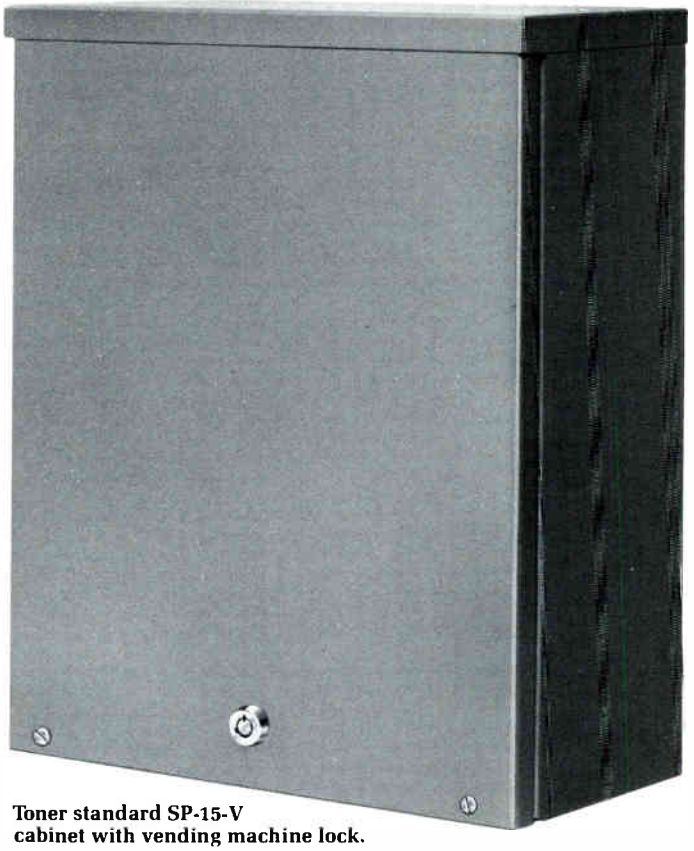

Toner standard SP-15-V cabinet with vending machine lock.

Just call 800-523-5947*
We have a good selection in stock.

Today, more than ever, it makes sense to protect your cable TV system —especially pay TV—from theft and illegal hook-ups. But, often, a good cabinet is hard to find.

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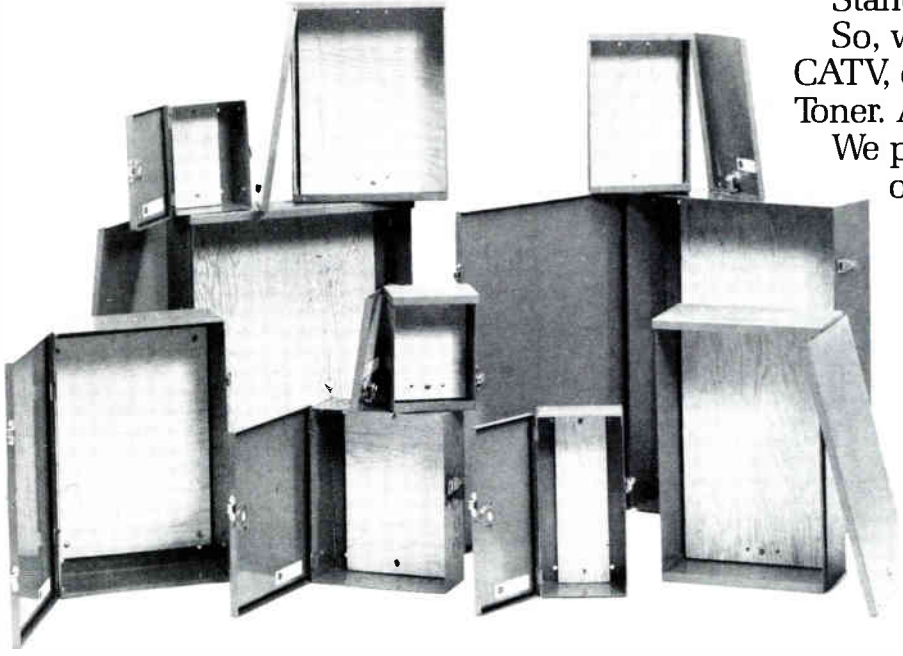

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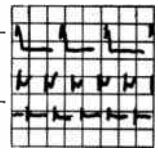

The Waiting Game

A backlog of requests from cable systems to use frequencies in the 108-136 MHz and 225-400 MHz bands has caused the Federal Communications Commission to amend its rules. Under previous rules, a system was required to give the commission at least 60 days notice before utilizing the frequencies. The purpose for the regulation was to enable the agency to review the request and make certain that cable usage of the frequencies would not interfere with air navigation and ground-to-air communication channels. However, the FCC received so many requests for authorization that it was unable to process them within the 60-day period. According to the FCC, several cable operators began using the frequencies without commission approval, causing a potential threat to navigation frequency use. At present about 140 cable systems are "on hold" until the FCC can approve the request. To date, there have been five documented cases of interference to navigation communications and the enforcement division of the cable bureau intends to crack down on any other possible offenders. The new rule eliminates the time limit for the FCC to authorize use of the critical frequencies. A spokesman at the bureau said that authorizations will probably take longer than 60 days, "perhaps substantially longer."

Terrestrial Tribulation

Home Box Office is generally associated with satellite-delivered pay television product, but a recent filing the company introduced at the Federal Communications Commission produced a strong reminder of the company's early days. HBO submitted its comments with regard to the commission's inquiry into establishing interim procedures for direct broadcast satellite (DBS) services. In the filing, the company requests that the commission should consider frequency assignments for DBS that "would minimally impact the terrestrial fixed service." **The reason HBO is concerned with the terrestrial services is because many of the network's affiliates in a four-state region still transmit the pay TV programming by microwave.** According to an HBO source, "more than 100 systems" in Pennsylvania, New Jersey, New York and Connecticut receive HBO by terrestrial means.

Telephone Line vs. Cable

The Times Mirror Company is planning a major trial of a hybrid videotext system in the Los Angeles area. Scheduled to start in the fourth quarter of 1981, the system will operate simultaneously over both telephone lines and two-way cable plant. Two hundred terminals will be installed in homes in Los Angeles and Orange Counties for the trial. Times Mirror has selected the Canadian Telidon videotext system and Telidon Videotext Systems, the manufacturing vehicle for the U.S. market, has been given an initial contract valued at more than $1 million. Since Times Mirror owns the **Los Angeles Times** and other publishing subsidiaries, much of the data used in the project is expected to come from these sources.

Pegging a New Appointment

Sources at the **Federal Communications Commission indicate that Marjorie S. (Peggy) Reed will be named as the new general counsel.** She will be filling the vacancy created when Robert Bruce stepped down to join the Washington law firm of Leva, Hawes, Symington, Martin and Oppenheimer. Reed was previously serving as legal assistant to Acting Chairman Robert E. Lee.

Videotex Olympics

Meanwhile, the international rush to capture the U.S. videotex market has been officially entered by two British firms representing **Prestel**, the United Kingdom's videotex offering. Logica, Inc., a British computing and communications company, **and British Telecom**, the telecommunications arm of the British Post Office, **have formed a joint venture known as British Videotex and Teletext.** BVT has been set up to market Prestel in the U.S., but it has a secondary goal of promoting British technology and standards as well. The Federal Communications Commission is studying the various international systems to adopt teletex standards and a British industry submission is reported to be "imminent."

Waste in Government Wording

The Federal Communications Commission has outdone itself with the appellation attached to its new advisory committee, which will assist with U.S. participation in the 1983 Regional Administrative Radio Conference. The committee will advise the FCC in specific technical areas including the cost implications of direct broadcast satellite (DBS) services; the feasibility of sharing frequencies between DBS and terrestrial services; and the allotment of orbital slots for DBS birds. However, the biggest problem the committee will face is designing its letterhead. The handle the committee has been stuck with is: the **Advisory Committee on Preparations for the International Telecommunication Union 1983 Region Two Broadcasting Satellite Service Planning Conference.** Phew.

Whatever Happened to Manners?

An unprecedented action by NBC has greatly upset the Senate Rules Committee members and the other broadcast networks. Last week, camera crews from the networks and other interested parties were allowed into the Senate chamber to experiment with lighting in the event that the body decides to allow its activities to be televised. Later, on the evening news, **NBC** commentator Roger Mudd **aired a segment taped by NBC's camera crews, ignoring a gentleman's agreement that no television footage from inside the Senate be broadcast without explicit permission.** Several members of the Rules Committee were outraged by this breach of etiquette. To make matters worse, during the open house, CBS fired up a bank of lights that had the two senators who showed up for the test squinting into the glare. These gaffes may make the Senate turn to less obtrusive sources for the proposed television set-up.

Seminars

MARCH

8-10: The **Ohio Cable Television Association** annual convention will he held at the Sheraton-Columbus Hotel, Columbus, Ohio. Contact the association at (614) 461-4014.

9-11: Arizona State University, Tempe, Arizona, is holding a three-day intensive course on "Fiber Optical Communications." Contact Dr. Joseph Palais, (602) 965-3757.

12-13: The **Louisiana Association of Cable Television Operators** will hold its annual convention at Toro Hills near Many, Louisiana. Contact Andrew Angelette, (504) 446-8444.

15-17: North Central Cable Television Association is meeting at the Holiday Inn in Fargo, North Dakota. Contact Paul Keating, (701) 662-8141.

16-17: The annual spring engineering conference of the **Society of Cable Television Engineers** is being held at the Opryland Hotel in Nashville, Tennessee. Contact the association at (202) 293-7841.

17-19: The **Oklahoma CATV Association** will hold its annual meeting at the Holiday Inn West, Oklahoma City, Oklahoma. For display information contact Jerry Stovall, (214) 328-4469. For convention information, contact the association at (405) 382-3179.

18-19: The **Georgia Cable Television Association** will hold its annual convention at the Sheraton-Atlanta Hotel, Atlanta, Georgia. Contact Marian Smith, (912) 354-7531.

23-24: The **Public Service Satellite Consortium** will conduct a hands-on workshop on "How to Teleconference Successfully" in Denver, Colorado. Contact the consortium at (303) 458-7273.

24: The Princeton University Department of Electrical Engineering and the New York, Princeton and Jersey Coast sections of the IEEE is holding its **1981 Communications Techniques Seminar** at Princeton University. The seminar will focus on the advances and opportunities for digital techniques, including packetized subscription television and the proposed Northeast lightwave corridor. Contact Cynthia A. Donovan, Room 2F512A, B.T.L., Holmdel, New Jersey 07733.

24-26: Information Gatekeepers, Inc., is holding FOC '81 East at the Hyatt Regency Cambridge in Boston, Massachusetts. The event will include a fiber optics trade show, three short courses on fiber optics and a technical program on short-to-medium-range fiber optics applications. Contact the firm at (617) 739-2022.

28-April 1: Illinois-Indiana Cable Television Association is having its annual convention at the Hyatt Regency Hotel in Indianapolis, Indiana.

APRIL

6-10: The Engineering Office of the **Community Antenna Television Association** is holding a technical training seminar on systems distribution problems, failures, measurements and tests at the Holiday Inn of Garland in Dallas, Texas. Contact Ralph Haimowitz, (305) 562-7847.

13-14: The **Society of Cable Television Engineers** will hold a seminar on "Digital Electronics and Cable TV" at Stouffer's Inn, Denver Airport, Denver, Colorado. Contact SCTE at (202) 293-7841.

13-15: The **International Association of Satellite Users** is holding its 1981 conference and trade show at the Washington Hilton Hotel, Washington, D.C. Contact the organization at (703) 893-2217.

23-24: Information Gatekeepers, Inc., is sponsoring

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"VIEWTEXT '81: International Viewdata Markets and Applications," at the Sheraton National Hotel in Arlington, Virginia. Contact Steve Weissman, (617) 739-2022.

22-24: Integrated Computer Systems, Inc., is holding a workshop on "Fiber Optics Communications Systems" in Los Angeles, California. Contact Ruth Dordick, (800) 421-8166; (213) 450-2060.

26-28: The **Virginia Cable Television Association** will hold its annual convention in Wintergreen, Virginia. Contact Lorraine Whitmore, (804) 320-2180.

MAY

4-8: The Engineering Office of the **Community Antenna Television Association** is holding a technical training seminar on systems distribution problems, failures, measurements and tests at the Paramount-Heathman Hotel in Portland, Oregon. Contact Ralph Haimowitz, (305) 562-7847.

11-12: The **Society of Cable Television Engineers** will hold a seminar on "System Test Requirements" and "Preventive Maintenance" at the Hilton Airport Inn, Kansas City, Missouri. Contact SCTE at (202) 293-7841.

13-15: Integrated Computer Systems, Inc., is holding a workshop on "Fiber Optics Communications Systems" in Washington, D.C. Contact Ruth Dordick, (800) 421-8166; (213) 450-2060.

20-22: Videotex '81, an international conference and exhibition, will be held at the Royal York Hotel (Toronto, Ontario) and the Canadian National Exhibition grounds.

29-June 1: The **National Cable Television Association** is holding its 1981 convention in Los Angeles, Convention Center. Contact Dan Dobsin, (202) 463-7905.

JUNE

1-5: The Engineering Office of the **Community Antenna Television Association** is holding a technical training seminar on systems distribution problems, failures, measurements and tests at the George Washington Motor Lodge-East in Philadelphia, Pennsylvania. Contact Ralph Haimowitz, (305) 562-7847.

14-16: Montana Cable Television Association will hold its annual meeting at the Sheraton Hotel in Billings, Montana. Contact Bob Briney, (406) 586-1837.

JULY

27, 28: The **Society of Cable Television Engineers** will hold a seminar on preventive maintenance in Orlando, Florida. Contact SCTE at (202) 293-7841.

AUGUST

20-22: The **Southern Cable Television Association** convention and trade show, the "Southern Show," will be held at the Georgia World Congress Center, Atlanta, Georgia. Contact the group at (404) 237-8228.

SEPTEMBER

14-15: The **Society of Cable Television Engineers** will hold a seminar on "Cable Plant Construction" and "System Test Requirements" at the Hyatt Airport Hotel, Los Angeles, California. Contact SCTE at (202) 293-7841.

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– Load %	± 2
Turn on time delay (sec.)	6
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Input transient protector	Standard circuit breaker Option-Thyrite arrestor
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Call or write today for a full information package. Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051, (408) 727-0700.

Avantek

Editorial

Stepping into Big Shoes

Help wanted. Expanding trade association is seeking an individual with the unusual blend of engineering, business and political expertise to serve as vice president of science and technology based in the nation's capital representing the interests of one of the most aggressive and developing business and consumer communications industries both within the United States and abroad. Salary may be commensurate with experience.

Any takers? The situation is this. For only the second time in more than a decade the National Cable Television Association is looking for someone to fill its engineering position. If you haven't heard by now, Christopher M. Weaver, who has served in that spot for the past 18 months, has resigned at the request of NCTA President Tom Wheeler (see story page 17). We don't normally take notice of comings and goings with regard to personnel matters beyond noting them for the record or bidding an occasional "hale and farewell" to those who have served well and are moving on to new challenges. However, the role of engineering vice president for NCTA is critical, not only for the further development of the association but for the industry at large. It cannot be taken too lightly.

As we understand the facts to be and as is customary with senior staff positions, Wheeler informed the association's board of directors and members of the engineering committee that he had asked for and received Weaver's resignation because of what has been described as instances of insubordination. As explained to us, Weaver, contrary to the expressed intentions of Wheeler and senior staff members of the association, testified before a Congressional Panel with respect to the technical requirements of the "in House" communications network being upgraded throughout the halls and steam tunnels of Capitol Hill. As so often is said, "he testified in his own behalf." On the one hand, academic freedom could be cited and perhaps Weaver could justify his actions as his duty as a responsible scientist. To NCTA, however, it was grounds for dismissal. As Wheeler explained, "People in an organization at that level do not have the authority to unilaterally commit the association or themselves to testify... I told him I didn't want him testifying. The fact of the matter is that he was there because of his expertise in the area which comes at least in part from the fact that he was with the association. This is a political environment. He testified in a direct countermand of my instructions and I think it was a situation of gross insubordination."

Our purpose here is not to try and play the role of labor arbitrator, especially after the fact. What we do want to emphasize here is that these things do happen. After many years of observing and reporting about NCTA, we also wish to emphasize that even though the association does operate in a political environment, as it is supposed to do, one of the unique aspects about it during the last few years is that it has been able to fulfill its charter without compromising anyone's professional standards, engineering or legal. The events which led to Weaver's resignation would probably not have occurred if somehow both parties had not seen the end coming—a self-fulfilling prophecy, if you will.

At the moment, NCTA is going all out to identify candidates for the position and proceed with the selection process. The events of the recent past should not discourage any qualified candidates from applying for the job. Nor should it discourage anyone from making recommendations. Greater emphasis than ever will be placed upon technology in the association during the months and years ahead. The individual who assumes the responsibilities of science and technology will have the challenging and exciting opportunity to influence not only the direction of the association but also the breadth of communications services available to consumers.

Pat Gushman

CED

Volume 7, No. 3

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NCTA Issues Advisory On Aeronautical Frequency

WASHINGTON, D.C.—The Federal Communications Commission has initiated a program to inspect cable systems for violations of the FCC part 76.610 rules, effective immediately. Part 76.610 governs use of aeronautical frequencies 108-136 and 225-400 MHz. Field operation bureaus around the country are randomly checking systems to determine compliance with these rules (see **CED**, 2/81, p. 7).

Section 76.610 requires 60 days written notification to the FCC of intent to use any of the aeronautical frequencies in cable systems. This 60 days is a minimum. Once a system has written to the FCC, the system must await FCC approval prior to using those requested frequencies, regardless of response time. Systems which began using these frequencies on or before January 1, 1978, were permitted to continue to use the frequencies but were required to list that use on FCC Form 325, Schedule 2, in 1978. These systems must obtain FCC approval before operating additional channels in those bands. All systems are required to request FCC approval for and channel activation in these bands after January 1, 1978. Operators are further required to monitor regularly their systems for signal leakage, keep logs of such leaks and repair any leaks found.

FCC field inspectors will be inspecting cable television systems to determine answers to these questions:

1) What channels are currently being used on your systems?

2) When did you first use these aeronautical channels?

3) What carrier frequencies are being used?

4) What are the peak power levels in your system?

5) When was the FCC first notified of your use of aeronautical frequencies?

The inspectors will expect to see a copy of your FCC request for use of aeronautical frequencies, the required FCC Form 325, Schedule 2, which must be filed annually. They may also request to see a log containing other information required by Section 76.610. It is likely, however, that the inspector will want to check the system to corroborate the data in your records.

Results of these investigations will be forwarded to the Cable Television Bureau for review. The bureau will take appropriate action. Any system using channels in violation of 76.610 will be required to cease use of those channels immediately, and system operators who have been using aeronautical channels without prior FCC authorization will most likely be fined. The FCC has forfeiture authority to impose fines of up to $20,000 per violation. The systems that have filed the required notice (even if filed late) and have ceased to use the critical frequencies pending clearance are likely to avoid fines and have a prompt processing of their clearances and/or waiver requests. The only other alternative for the operator is to reduce power on the channel below 10^{-5} pending clearance.

(Reducing power below 10^{-5} is not a viable alternative. A system that reduces power below 10^{-5} as per 76.610 may violate part 76.605 subpart K of the rules.)

Although FCC investigators will primarily be checking to determine system compliance with the 76.610 requirements, they may also use the opportunity to check for compliance with other FCC rules. Depending on the results of these spot checks, the staff may initiate field tests for signal leakage on a significant scale. Accordingly, operators are reminded in particular of their obligations under Section 76.613 to locate and remove any cause of harmful signal leakage on their systems.

—National Cable Television Association

FCC Authorizes Test Of British Teletext System

CHICAGO, ILLINOIS—The Federal Communications Commission has authorized a one-year experimental teletext service over the broadcast facilities of Chicago station WFLD-TV, Channel 32, to test the economic and technical viability of the British teletext system, Polyglot C.

The commission also waived an FCC rule to allow the station to charge customers for Polyglot C service. Field Communications Corporation, licensee of WFLD, requested the experimental authority. The rule that was waived forbids a broadcast licensee to charge for a service provided through an experimental authorization.

The service as proposed will provide news, information and a limited amount of advertising to no more than 100 customers who will be provided with special receivers and decoders. The teletext information will be broadcast in the vertical-blanking interval.

The Chicago experiment is one of several approved by the FCC, but it is unique because it allows Field Communications to charge customers directly for the use of the service. As yet, other experimental operations have not done so. They do, however, intend to make a return on the placement of decoders used for descrambling the videotext signals.

Among the most widely publicized videotext experiments underway are those by CBS. The network has been granted authority to conduct an experiment using a small number of subscribers and the following stations: KNXT-TV, Channel 3, and PBS's KCET-TV, Channel 28, in Los Angeles; WETA-TV, Channel 26, in Washington, D.C.; and Oak's STV operations KBSC-TV in Corona, California, and WKID-TV in Fort Lauderdale, Florida.

Field Communications plans to conduct a three-month technical phase, and then place about half its receivers and decoders in private businesses and the rest in hospitals, shopping centers, recreational facilities, colleges and universities, transportation facilities and terminals and government buildings. Only four will be placed in private homes.

The second phase, lasting the rest of the year, will evaluate the technical operation on a broader basis and assess the public demand and economic viability of the service. It will provide information on the types of information most in demand, potential audiences, costs of distribution, management and providing information, acceptability of subscriber fees and demand for advertising.

According to Field Communications, the service charge will meet only a small portion of its investment and operating expenses and will test the marketability of the service. The fee is expected to be between $30 and $120 per month. Subscribers will be able to cancel on 30 days' notice.

Field Communications is also planning to test the Polyglot C service with two cable television systems in the Chicago area to evaluate the service's compatibility with cable.

Cable-Ready Televisions Create Industry Problems

WASHINGTON, D.C.—The lack of communications between the cable industry and manufacturers who are producing "cable-ready" television sets has prompted National Cable Television Association President Thomas Wheeler to contact the manufacturers in an attempt to alleviate the problems.

Wheeler informed the manufacturers in a letter that the latest set designs have

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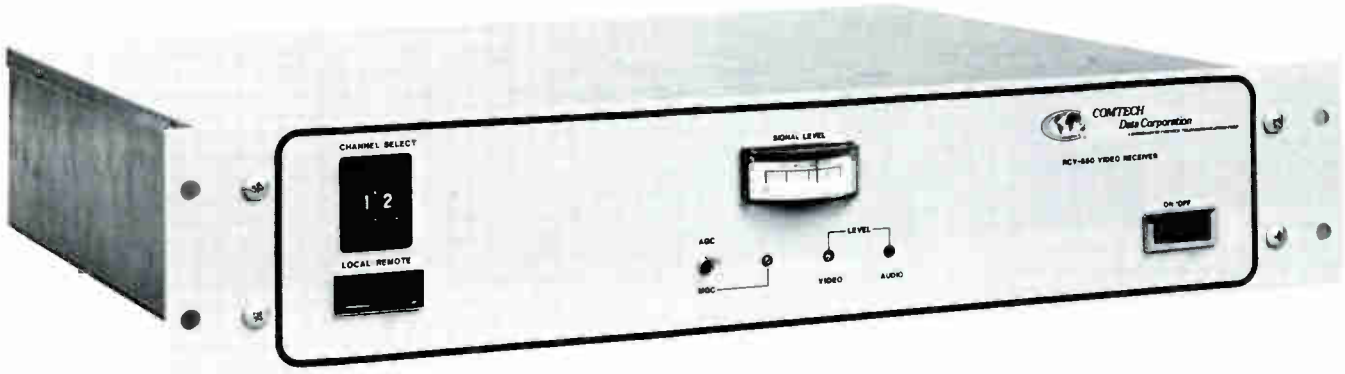

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been developed without input from the cable industry and are "not compatible with present day cable television technology." The sets are causing substantial public relations difficulties for the industry.

In the early 1970s, several manufacturers concluded that building a cable decoder into a television set would be an effective way to interface the cable and broadcast industries. This led to the development of the first cable-ready sets. The sets are supposed to eliminate the need for the subscribers to utilize set-top converters. However, the recent development of such sophisticated technologies as multiple tiering, addressability and signal scrambling have made these sets more of a problem than a benefit.

According to the NCTA, the new technologies can no longer be handled by a decoder that is built into a television set. The organization has cited several problems experienced by an unwitting consumer who buys such a set. For example, if a subscriber's system offers more than 20 channels, he must also purchase a converter from the cable system in order to receive the additional signals.

Another difficulty which occurs with surprising regularity, the NCTA reports, is that consumers are not being informed that they must also subscribe to the cable system in order to receive the cable programming.

A third problem involves the remote control devices that accompany many television sets. The devices are rendered useless to a subscriber who is tuning in additional channels with a converter supplied by the cable company. In addition, the consumers are not being told that they need an additional external demodulator in order to receive pay television over the cable system.

To make matters worse, the NCTA says, if the 400 MHz technology becomes a mainstay of cable systems, these cable-ready sets will quickly become anachronisms.

Although the cable system operators have nothing to do with the problem, they are often the recipient of the complaints, causing the public relations problems for the cable industry. "Poor communications" between the industry and the television manufacturers is cited as the reason these problems have developed.

"Our main concern is that, because of this lack of understanding, the consumer is not being adequately educated to the limitations of these sets and the extra equipment that he must also purchase in order to have full use and enjoyment of cable television," stated a recent NCTA newsletter.

"Obviously, if the consumer believes that he is buying a product which is capable of doing certain things and he later finds out that this is not so, it is only logical for him to direct his anger at the cable company which he feels is taking advantage of his ignorance," it continued. "Judging from the complaints that our members are getting, this is what is happening with alarming frequency."

Wheeler's correspondence to the cable-ready set manufacturers stated that the cable industry is "willing to advise and, wherever possible, supply necessary information about cable needs to television set manufacturers."

The NCTA has asked that anyone aware of specific ads that misrepresent the facts about cable television contact Jim Stilwell of the NCTA's Engineering Committee.

NCTA Hunts Candidates For Weaver's Vacated Post

WASHINGTON, D.C.—The search continues at the National Cable Television Association for someone to fill the position of vice president of science and technology. Thomas Wheeler, president of the organization, said he plans to hire a new executive "as quickly as possible."

"We just had a meeting with the engineering committee and they are working with three headhunters, so it's proceeding apace," Wheeler said. At press time, there were no specific candidates for the job.

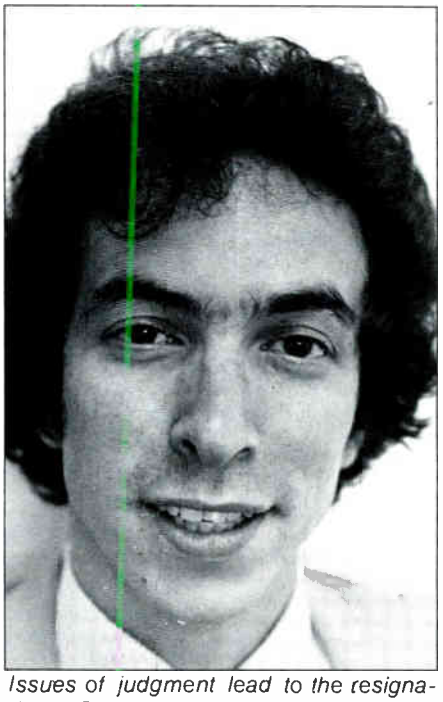
The position became vacant when Christopher Weaver was asked to resign as vice president in February. According to Wheeler, there had been "some ongoing difficulties" between Weaver and the NCTA.

"They were issues of judgment for the most part," Wheeler said.

Weaver was asked to resign after he testified without prior approval from any of his superiors at the NCTA at a House of Representatives committee hearing on an information system that the House was installing. According to Wheeler, Weaver did not check with Kathryn Creech, senior vice president of industry affairs, Bob Ross, senior vice president of government relations, or anyone else before making the decision to testify.

"People in an organization at that level do not have the authority to unilaterally commit the association or himself to testify," Wheeler said. "I found out about it [Weaver's plan to testify] at a staff meeting on the Monday before the testimony, which was scheduled for Wednesday. I told him I didn't want him testifying."

Weaver said that he wanted to testify as a private citizen, but he was presented on the witness list as a representative of the NCTA. He then went out and "apparently got the National Academy of Sciences to sponsor his testimony," Wheeler said.



Issues of judgment lead to the resignation of Christopher Weaver.

"The fact of the matter is that he was there because of his expertise in the area which comes at least in part from the fact that he was with the association," Wheeler said. "This is a political environment, not an academic environment. He testified on a direct countermand of my instructions and I think it was a situation of gross insubordination."

Weaver was previously embroiled in a controversy over the use of three-meter earth stations for receiving Westar III. His engineering committee came out with a recommendation that system operators avoid the use of the dishes, primarily because the Federal Communications Commission was considering reducing the satellite spacing to three degrees. The recommendation came under fire from representatives of Southern Satellite Systems, who were pushing a plan to install the three-meter dishes at cable systems across the country to access Westar III transmissions. The dish manufacturers also objected to the position.

Wheeler stated that the dish controversy was not the reason Weaver was asked to resign, but he said that the situation could have been handled better.

"The science of it was right," Wheeler said, "but the handling of it was wrong."

FCC Adheres to AM Stereo Plan

WASHINGTON, D.C.—The Federal Communications Commission has decided not to split its current AM stereo proceeding. At this time it will not consider the possibility of letting the market choose

among various mutually incompatible systems before it receives and analyzes the additional technical data it asked for last summer.

The action came as the commission denied review of the Broadcast Bureau's decision in December extending the periods for filing comments and replies. The effect was to continue with the proceeding as planned, primarily toward selection of one of the five proposed AM stereophonic systems if such action is justified by the information already received and additional data submitted during the comment period.

Systems were proposed by Motorola, Inc., Magnavox Consumer Electronics Company, Belar Electronics Laboratory, Inc., Harris Corporation and Kahn Communications, Inc. All were found to be at least minimally acceptable.

Kahn and Hazeltine Corporation asked for review, arguing that the marketplace issue should be resolved. They argued that the issue could be decided without an extension of time for comments and a decision to let the marketplace make the choice would eliminate the need for further technical information.

The FCC said that the primary purpose of its request for additional data was to facilitate its selection of a single system, although it did not foreclose the marketplace approach. A determination to leave the decision to the market, it said, would depend on its final evaluation of the systems and such factors as the likelihood that multi-system receivers will be practical. Both depend on the information requested, according to the FCC.

Last April, the FCC decided to select one system and tentatively chose the one offered by Magnavox. To quantify the data for the final selection, it asked for additional information when the selection process came under heavy criticism in July. It stressed then that technical incompatibilities among the systems would bear on the public's ability ever to receive AM stereo transmissions.

Union Develops Cable Apprenticeships

WASHINGTON, D.C.—The Communications Workers of America (CWA), an affiliate of the AF of L-CIO, has developed a three-year union apprenticeship program that will provide training in three segments of the communications industry. Under the plan, beginning employees in the cable television, interconnect and alarm system industries will receive 144 hours of training each year while working for their perspective company. The initial phase of the program is underway in New York, Los Angeles and San Francisco.

Although the percentage of cable employees who are affiliated with unions is small, there are a few pockets in the country where cable installers and related employees are union members. Such areas include San Francisco and parts of Los Angeles.

If a cable company signs a contract with the CWA for its system, its employees will be eligible for the apprenticeship program. During the first year, an employee would receive up to 100 hours of training on general topics such as color coding, circuit reading, basic first aid and a survey of electronics and outside wiring, according to Dutch Kleywegt, CWA apprenticeship specialist. The other 44 hours are specific to each industry. In the cable area, a first-year employee in the program would receive training in test equipment, protection in grounding and knowledge of cable equipment.

The 144 hours is taught in conjunction with a community college in the area. Generally, instruction is given over a two-semester period. A student can choose to take either three hours each week for 48 weeks, four hours a week for 36 weeks, or six hours a week for 24 weeks.

"We try to work into the contract that after an employee has been in the apprenticeship program for a year and has been on the job during that time, he gets a promotion if he passes the courses," said Kleywegt.

The second year offers training in mathematics, AC and DC currents and other specific electronic instruction.

"In the third year," said Kleywegt, "for cable there's 72 hours of instruction in system noise, a system overview of trunk lines, coaxial theory and color television design."

There is also 40 hours of training with solid state devices, including semiconductors, diodes, integrated circuits, digital electronics and transistors.

"We showed this plan to Telecommunications, Inc.," Kleywegt said. "They're the first cable television system to show any interest and they were very enthused with our curriculum."

Any employer who works out a contract with the union pays $0.10 per employee per instruction hour. The employee then agrees to take the instruction during his own time.

"But the employee is picking up his trade and the company, of course, is going to get a better employee," Kleywegt said.

The apprenticeship program was begun under the auspices of the Department of Labor which gave a grant of $270,000 on April 1, 1980. The grant expires March 31 of this year, and Kleywegt said CWA will be seeking another grant so the program can be expanded into the remaining nine districts that the CWA serves. Such possible extensions would make the program available in Chicago, Denver, Austin and St. Louis as well as other cities. Once the apprenticeship program gets fully underway, Kleywegt expects it to be self-sustaining.

According to Kleywegt, Teleprompter in San Francisco and Theta Cable in Los Angeles are also interested in the project. Negotiations with TCI are continuing.

"I've seen some language that they're [TCI] going to put into the contract that guarantees the employee the right to be promoted or the right to stay where he's at," Kleywegt said. "That's what we're interested in. If the guy hires on and wants to be a lineman the rest of his life, that's all right with us."

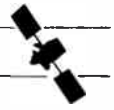
The purpose of the program is to provide employment, especially for minorities and women.

"That's why the Department of Labor wanted to grab hold of it," Kleywegt explained.

The CWA, with 620,000 members, is the ninth largest union that is affiliated with the AF of L-CIO. About 85 percent of its members come out of the Bell system. It also represents workers from interconnect companies, public employees and what the CWA terms the communications systems industries which include the cable and alarm businesses.

Once an employer signs an agreement with the CWA, the money paid for each employee goes into a national training fund which is supervised by a joint council of both company owners and union representatives.

Satellites



Comsat Contracts RSI To Build Torus Antenna

WASHINGTON, D.C.—Comsat and Radiation Systems, Inc., of Sterling, Virginia, have finalized an agreement authorizing RSI to manufacture and market the multiple-beam torus antenna developed by Comsat Laboratories. The contract gives RSI exclusive rights to build torus antennas ranging in size from three- to 8.5-meters and non-exclusive rights to other sizes.

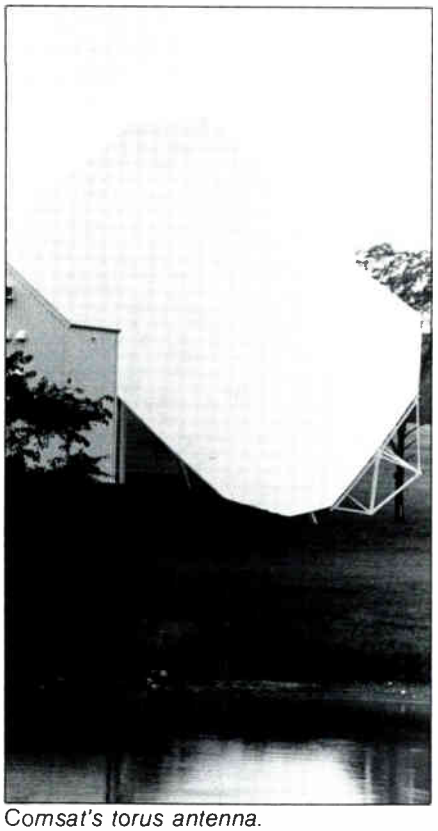
Comsat has been employing a torus antenna on an experimental basis at its Clarksburg, Maryland, laboratory since 1973. The first version developed was a 9.8-meter antenna that had an accompanying price of close to $200,000. It was made available to the public last fall along with the announcement that smaller torus antennas would be developed in the near future.

The torus antenna most suitable for use in cable systems is a 4.5-meter model

that will cost about $29,000. The price tag includes three receive-only feeds which will allow the reception of three satellite transmissions at once.

With the current four degree spacing of satellites in the geosynchronous arc, the 4.5-meter torus is capable of receiving signals from five satellites simultaneously. If the spacing is reduced to three degrees at a later date, the antenna will be able to access seven birds within a 24 degree orbital arc.

RSI will construct the 4.5-meter torus with eight contoured aluminum panels. The panels are then joined to a lightweight backup structure mounted on adjustable tubular legs. The manufacturer is recommending a concrete foundation of approximately 20-feet-by-20-feet for the antenna system.



Comsat's torus antenna.

RSI has primarily manufactured tactical military antennas for the United States and foreign governments for the last five years. Prior to that time, the company was a regular research and development contractor for the government. According to Michael Steinman, RSI vice president, 50 to 60 percent of the company's business is currently devoted to the tactical military antenna line. Other RSI products include air traffic control antennas and commercial satellite dishes.

The company built its first satellite earth station, a 32-meter model, in November 1978. Comsat has used RSI for several projects over the years and was approached to built the prototype 4.5-meter torus.

One advantage of the torus antenna over a conventional parabolic antenna is that the torus could be of particular value to a cable operator who would like to access several satellites but is prevented by the prohibitive cost of purchasing the land to house several earth stations, according to the company.

Steinman stated that the availability of the torus will depend on the response from the industry. He said the manufacturing capability exists to produce the torus in a matter of weeks. "But we have to sell the product first," he said.

SCTE News

SCTE Names Moderators For Panel Discussions At Nashville Conference

WASHINGTON, D.C.—The Society of Cable Television Engineers has announced the moderators for the panel sessions at its 1981 Spring Engineering Conference. Slated for March 16 and 17 at the Opryland Hotel in Nashville, Tennessee, the conference, entitled "Challenges for the '80s," will feature seven panel discussions.

The "New Developments" panel will be moderated by Christopher Weaver, former vice president of science and technology for the National Cable Television Association; "Data on Cable," by John Lopinto, Home Box Office; and "Pioneer's Panel," by Tom Polis, conference chairman and vice president of engineering at Comcast Corporation. "Satellite Service Development" will be hosted by Ernie Olsen of Metrovision; "System Design Concepts for the '80s," by Richard Covell of GTE Sylvania CATV products; "Systems Monitoring and Testing," by Richard Hickman of Metrovision; and "Development in Earth Receiving Stations," by Hubert J. Schlafly, TransCommunications Corporation.

At the March 16 luncheon, the SCTE will present its Member of the Year Award along with the President's Award. Also, "a very special speaker" will address the members, **CED** was told.

At the traditional speaker's reception that evening an Irish theme will be adopted to celebrate St. Patrick's Day.

On March 17, the luncheon will center on the 1981 SCTE annual meeting and introduction and installation of the officers who will serve in 1981.

Registration fees for the conference after March 1 will be $300 for SCTE members and $400 for non-members. Telephone registrations will not be accepted for the conference and all registrations must be accompanied by payment. Contact the SCTE at (202) 293-7841.

Business Notes

★ **TOCOM, Inc.**, sold 15 two-way interactive Cablesecurity systems and three 55 Plus addressable converter systems last December, with deliveries scheduled during 1981. Sixty-one TOCOM Cablesecurity systems have been sold for use in cities throughout the United States and Canada and will be available to approximately 3,860,000 homes when the construction of the new cable systems is completed. The 55 Plus addressable converter systems were purchased by Storer Cable Communications for installation during 1981 in three new two-way interactive cable television systems.

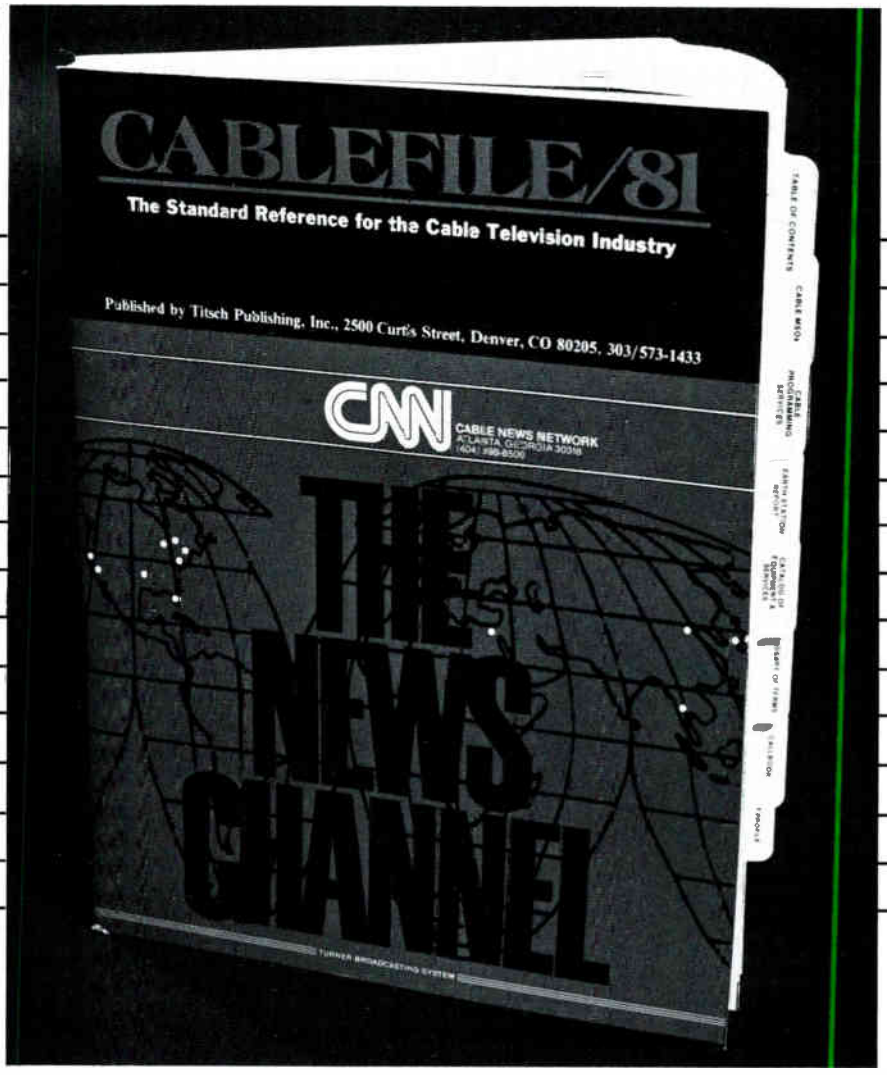
★ **Dow Jones & Company** has signed an agreement with The Western Union Telegraph Company for the purchase of partial ownership of a domestic communications satellite to be launched by Western Union in 1982. The company agreed to purchase two of the 24 transponders on Westar V. The agreement also provides for a backup transponder which will be transferred to Dow Jones upon failure of either of the two primary transponders.

★ **Digital Communications Corporation** (DCC), a M/A-COM company, has received an order for 74 additional MARISAT baseband controller units. DCC is supplying the controller units under subcontract to Scientific-Atlanta, Inc., to which it has delivered over 350 controllers since 1975. The DCC equipment is used in Scientific-Atlanta's satellite shipboard terminals for ship-to-shore voice and telex communications service through the MARISAT satellite operated by Comsat General.

★ **World Business Corporation** has acquired the assets of dba Cap-Inc. of South Pasadena, California. World will use the assets in its WBC Electro-Supply Division. dba Cap-Inc. is a full-line capacitor distributor.

★ **Satellite Television & Associated Resources, Inc.**, has acquired the capital stock of Media-point, Inc.,for approximately 148,000 shares of STAR's common stock. Media-point, Inc., operates an over-the-air MDS pay television service in Orange County, California, which has about 3,000 subscribers.

★ **Cable DeKalb** has reached a contractual construction agreement with AM Cable TV Industries, Inc., of Quakertown, Pennsylvania. The construction involves new cable system construction and a rebuild to expand channel carriage in some of the suburbs surrounding the city. The total Cable DeKalb project will pass over 110,000 homes in metropolitan and suburban Atlanta.



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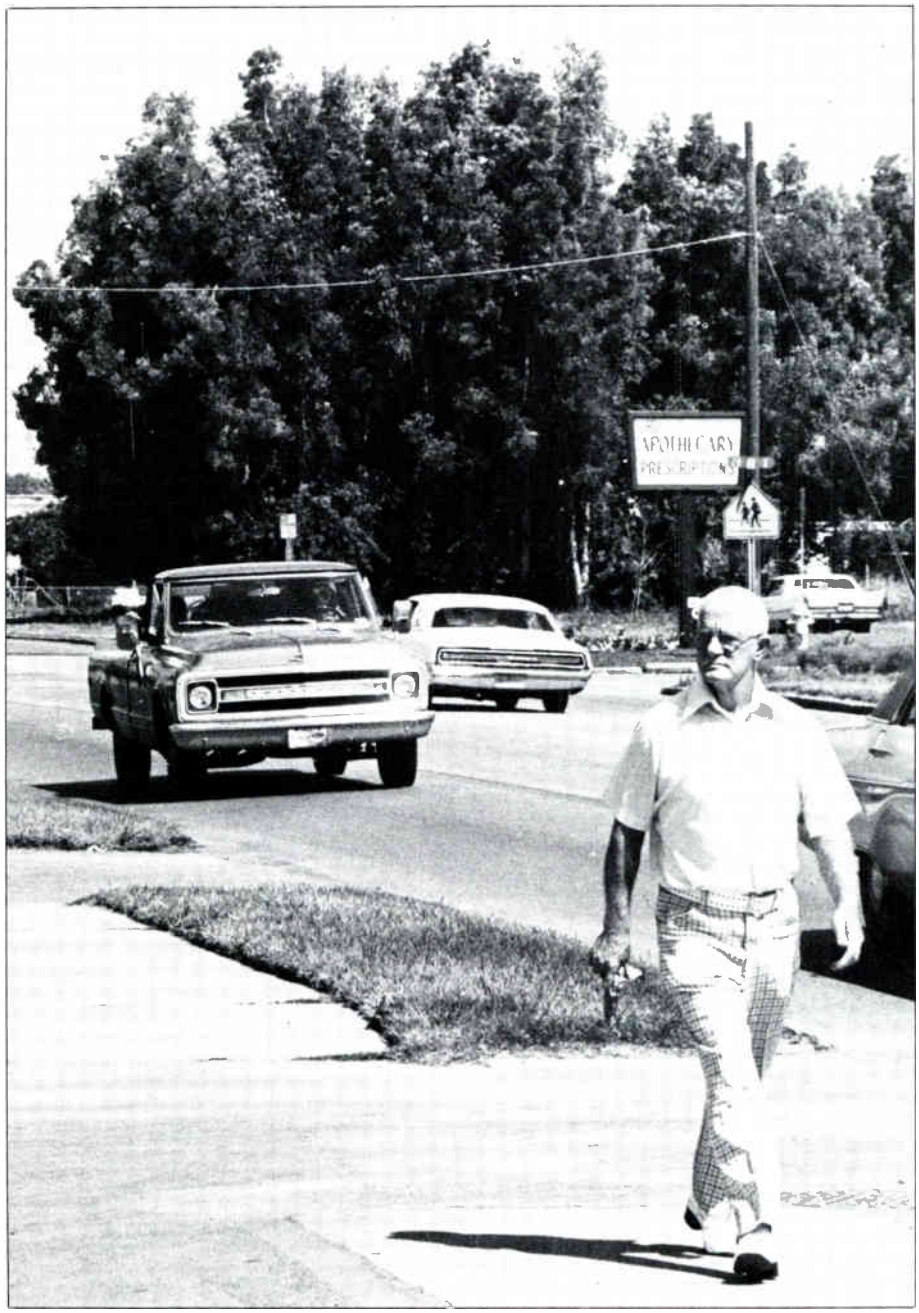
Cover Story

TeleCable Two-Way Eases Traffic Tangles



By **CED** *staff.*

In the early 1970s, the city manager and director of public works in Overland Park, Kansas, began a search to find a way of coordinating traffic signals in their city of 80,000. At the time, the majority of the approximately 40 signals in the city were leased from the Kansas City Power and Light Company. The signals were not interconnected or coordinated in any way, and the controllers were all old, electro-mechanical types.

In 1973, the city contracted with Stanford Research Institute (SRI) to perform a study and make a recommendation on a type of system which would provide more effective traffic movement in Overland Park.

In its report, SRI said:

1. The lack of coordination and responsiveness of traffic signals to change in traffic demand patterns was a significant problem in Overland Park;

2. Some of the major streets and intersections were potential traffic safety problems;

3. Higher standards of traffic signal maintenance and operation were required.

SRI also indicated certain advantages to a coordinated traffic signal system:

- Reduction in number and rate of traffic accidents;
- Reduction in vehicle travel times, stops and delays;
- Increased flexibility in signal-control strategies;
- Increased efficiency of capital improvement projects; and
- Increased availability of traffic-flow data for use in transportation and land-use planning.

After studying a variety of control methods ranging from a fixed time, time-of-day system up to a computerized system, SRI recommended that the city purchase the existing signals from

"The Stanford study recommended that the means of transmission be a cable television line as opposed to a telephone line."

KCP&L and procure a computer-controlled traffic signal system. SRI submitted the basic design for what was to become the Overland Park Traffic Control System (OPTCS).

Based on the results of the report, the city was able to obtain a commitment for federal funding, and in 1975 DeLeuw Cather and Company (DCC) was selected as the systems engineer for the project. DCC would be responsible for implementation planning, detailed system design, modification of existing software packages developed for the Federal Highway Administration (FHWA), development of new software to meet the OPTCS requirements, documentation, training and total system integration and operation.

The final system design as developed by DCC consisted of vehicle detection and intersection control equipment, communications equipment, computer center equipment and computer software.

While the study was underway, Overland Park was being wired for a two-way cable television system by TeleCable of Overland Park. The two-way capabilities of the system meshed smoothly with the city's desire for traffic control.

"The Stanford study recommended that the means of transmission be a cable television line as opposed to a telephone line," explained Jim Pirner, general manager of TeleCable of Overland Park. "There were several factors involved. I guess the rate of data is better using cable, the reliability of the data transmission is higher, I understand, and the economics of it are very favorable."

System Design

After the city spent several years working with computer experts, TeleCable began installing cable connections to 55 of the city's 84 intersections. Figure 1 shows the

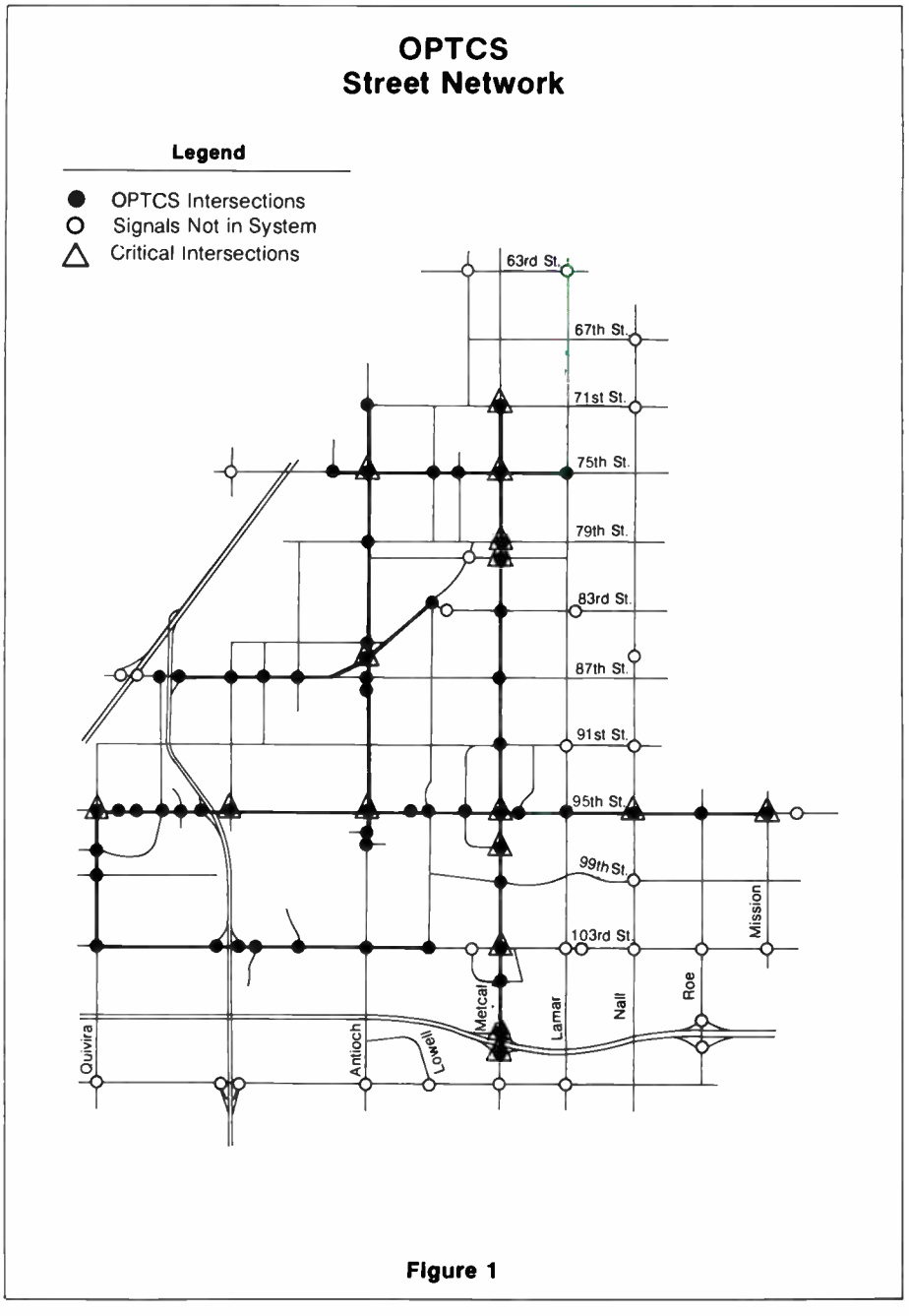


Figure 1

Overland Park street grid, noting OPTCS intersections, signals not in the system and critical intersections. In some cases, it was necessary to expand the plant to accommodate all the intersections, but Pirner said that wasn't much of a problem.

Figure 2 on page 29 shows the design of the OPTCS system. The frequency allocations used in the system are shown in Table 1.

At the intersections, vehicle-actuated traffic sensor loops are buried in the street at strategic locations. These system detectors, which are located 300 feet from the intersection to detect vehicles in normal traffic flow, collect data on traffic volume, speeds and congestion.

Local intersection controllers receive impulses from the system detectors as vehicles pass over them. The controllers accumulate the data and send it to a central computer, located in City Hall. Local intersection detectors also provide information to the controllers, but that data is not used by the central computer.

The local intersection controllers are model 170 microprocessor controllers built to specifications developed by the state of California. These controllers are actually microcomputers that must be programmed to function as traffic signal controllers. The basic traffic control program was provided by the state of California, and the systems engineer, DCC, was responsible for modifying the program to provide the communications capabilities required by OPTCS. All minimum green times and all yellow, red and pedestrian times are timed by the local controller, which uses information from the local detectors, located at or near the stop bar, to skip unnecessary movements and to extend the time for certain movements within limits set by the central computer. The local controller sends the green light status and information from the system detectors back to the central computer.

The central computer, located at the Traffic Engineering Department offices in Overland Park's City Hall, is a Systems

Table 1

Frequency Allocation

Outbound Data (From TeleCable Headend). To Be Transmitted in Mid-Frequency Band.
Data Includes:
- Command Data (Headend to Controllers 169.05 MHz)
- Controller Return Data (Headend to Computer, 168.65 MHz)

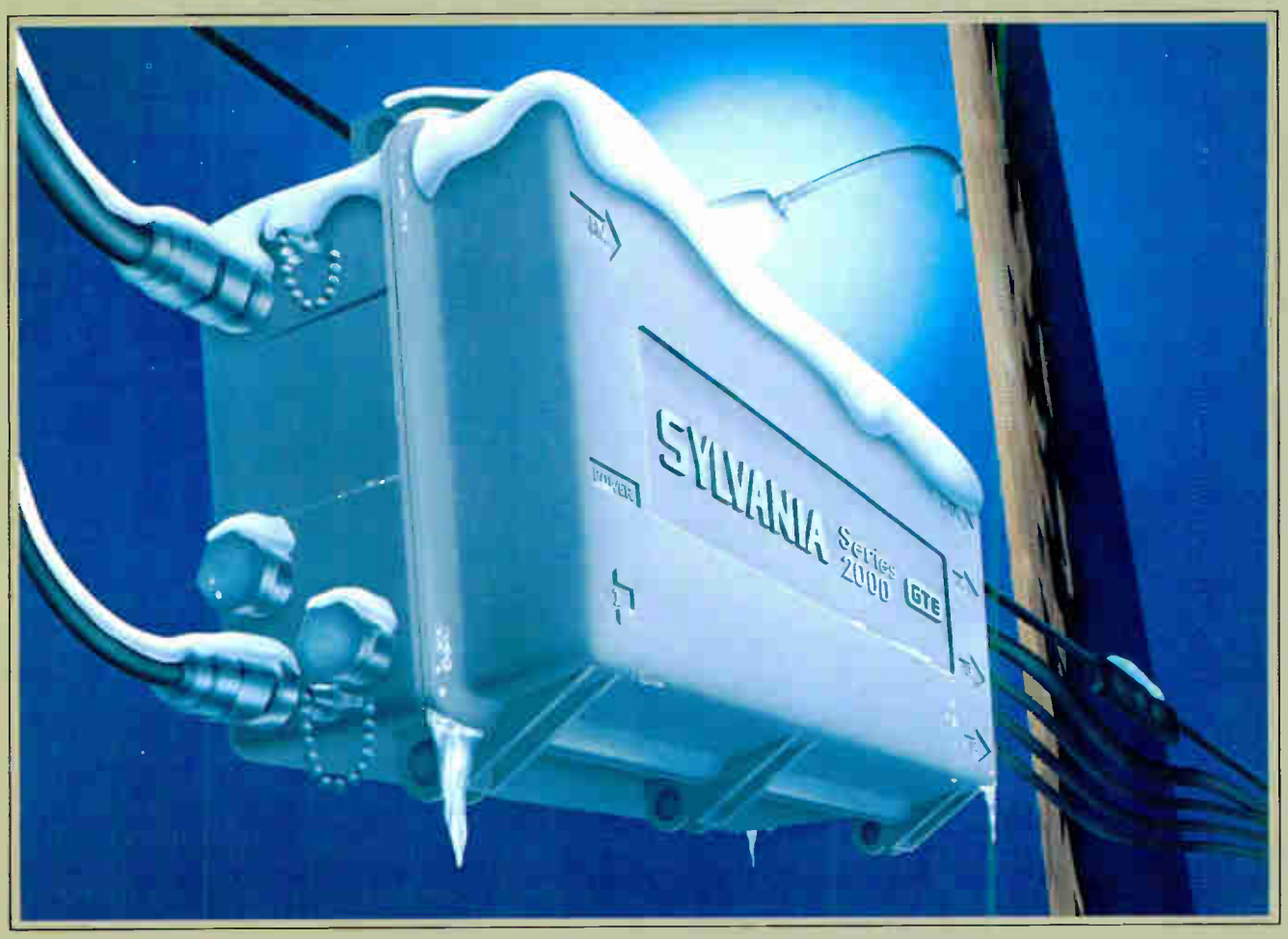
Inbound Data (To TeleCable Headend). To Be Transmitted in Low-Frequency Band.
Data Includes:
- Command Data (Computer to Headend, 12.8 MHz)
- Controller Return Data (Controllers to Headend, 12.4 MHz)

Low-Frequency Return Channel Data Will Be Transmitted Up in Frequency into Mid-Band Outbound Channel.

To Conserve on Channel Usage, All Upstream Data (Return Data) Will Be Contained In One of the Standard Return Channels.

Frequency Multiplexing Will Be Used To Provide Three Distinct Bands within This Standard Return Channel.
- One Band for Computer Command Data
- Second Two Bands for Controller Return Data

The Sylvania 400 MHz line. The signal must go through.



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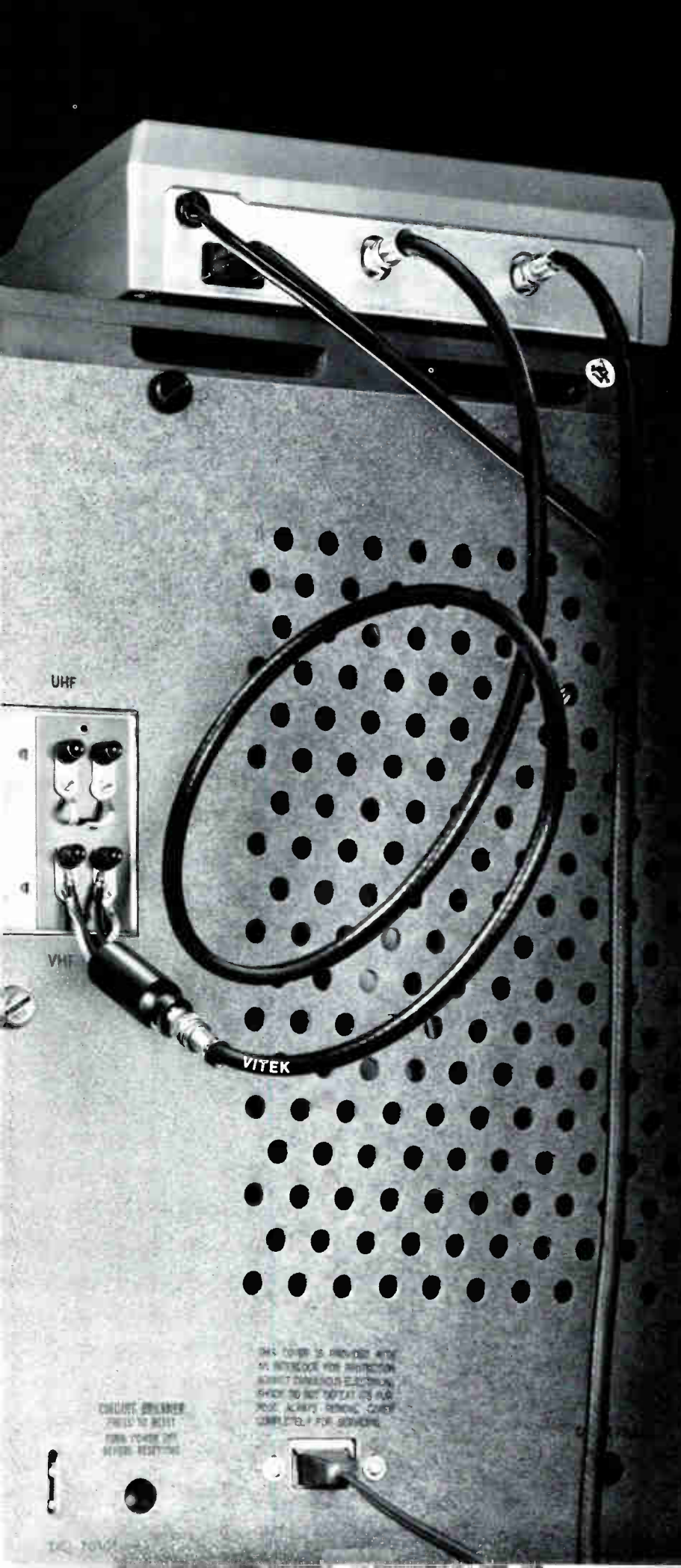

Do your set top converters cause TV overload?

VITEK Jumper Trap is the solution.

The jumper cable with the built-in video notch filter solves TV overload problems by reducing the level of the upper adjacent video carrier without affecting the signal-to-noise ratio of the desired output channel.

Often the output of set top converters exceeds the levels at which TV sets can operate without being overloaded. The overloading, which shows up as distortion, is caused by inadequate filtering of the upper adjacent video carrier at the converter output, or by misalignment of the TV set.

Up to now, the only solution was to use an attenuator pad, which lowers the levels of all signals, including the desired ones, and tends to degrade the desired channel's signal-to-noise-ratio.

The VITEK Jumper Trap is a combination jumper cable and video notch filter, which is installed between the set top converter and the subscriber's TV set, replacing the attenuator pad. It has the same physical appearance and characteristics as regular RG-59 cable but it utilizes the patented VITEK Cable Trap technique, used so successfully in Pay TV. It reduces *only* the interfering signal level, with absolutely no affect on the signal-to-noise-ratio of the desired channel.

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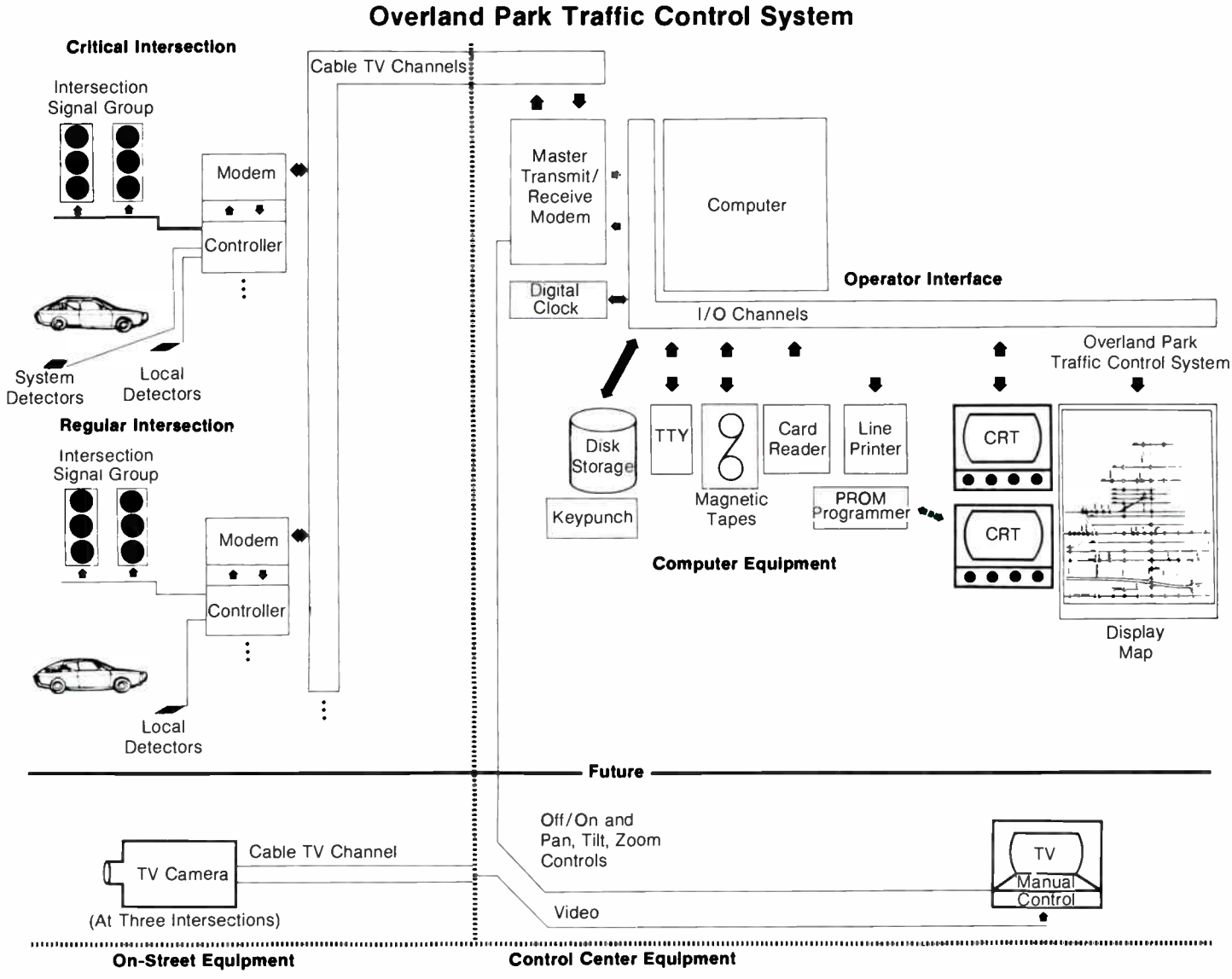

Figure 2

Engineering Laboratories model SEL 32/35. The terminal and display connected to the central computer include a keyboard/CRT, hard copy printer and a six-foot-by-six-foot street map with the status of each intersection indicated by light-emitting diodes.

Through the CRT, the operator is able to start up and shut down the system, display system reports, request map display modes and change traffic control modes.

The CRT is also used to display traffic-flow data and alarm messages. The hard copies of these reports may be produced on the line printer, which also prints out 15-minute and end-of-day status and performance reports.

The central computer is equipped with a master data modem which allows the computer to transmit and receive digital data over the cable system. The modem characteristics are shown in Table 2 on page 30. The master modem transmits its signals over the upstream path of the cable system to TeleCable's headend. There, the signal frequency is converted and the signal is transmitted over the downstream path of the system to the traffic intersections, as shown in Figure 3 on page 30. Each of the intersections is equipped with a slave modem which receives data from the master computer and in turn transmits data over the upstream path to the headend and then over the downstream to the master modem at City Hall. The master modem, operating at a data rate of 9,600 bits per second, polls each of the slave modems to exchange data once per second.

The software for OPTCS is based on the extended version of the Urban Traffic Control System (UTCS) software originally developed and implemented in Washington, D.C. UTCS was a research and demonstration project sponsored by the Federal Highway Administration to show the effectiveness of computerizing urban traffic signals. Since approximately 70 percent of the cost of the OPTCS project was federally funded, FHWA stipulated that UTCS software be used. The software was modified by DCC to work on the type of computer used to handle communications over cable television lines as required in Overland Park. The basic types of traffic control available with OPTCS, which can be selected for the entire system or any section, are:

- Manual selection of patterns by the operator;
- Selection of patterns on a time-of-day basis;
- First generation traffic-responsive selection of stored patterns based on traffic surveillance data collected and analyzed by the system;
- Critical Intersection Control (CIC), in which certain intersections are capable of having their timings changed on a cycle-by-cycle basis; and

• Second generation traffic-responsive development of new signal patterns by the computer based on traffic surveillance data collected and analyzed by the system.

The system is divided into four sections for traffic control purposes. There are 64 system detectors monitoring traffic flow conditions and 15 intersections are equipped for CIC.

The system, which operates from 6:30 a.m. to 8:00 p.m. weekdays, 10:00 a.m. to 10:00 p.m. Saturday and 11:00 a.m. to 6:00 p.m. Sunday, now operates in the second generation traffic-responsive mode exclusively, and CIC is normally in operation. The cycle lengths permitted when the system is under computer control range from 50 to 140 seconds and are based on current traffic volumes. A unique feature of OPTCS, however, is that at certain minor intersections, when the cycle length is 100 seconds or longer, those intersections will go a cycle length that is one-half that of the other signals in the section. This reduces delay for vehicles on the side street and have only a minor adverse effect on the progression on the major streets.

Debugging

Once the system was installed, Pirner said there were a great deal of technical difficulties to iron out.

"With any computer application there are hardware problems and the city had to debug them," he said. "They also had a predictable number of computer software problems to iron out. There were also some problems with the microprocessors at the intersections. They apparently had a very delicate range at which they could be tuned and not much of a tolerance for straying. The city learned that it had to bench check them before sending them out and set them within a certain threshold."

Not all of the problems were on the city's end of things, either.

"Our principal debugging was that the frequencies being used, below 20 MHz, are subject to ingress from squirrel-damaged cable and loose fittings and anything else that might cause loss of integrity in your cable plant that wouldn't necessarily impair pictures on the forward system, but they can sure play hell on the reverse," Pirner said.

"So we had a period of going through and cranking down fittings and changing out splices and making sure that we were tight from a physical integrity standpoint," he continued.

Table 2

Modem Characteristics

American Modems Model 741R

• Operating Mode	Full or Half Duplex, Asynchronous
• Data Rate	9,600 BPS
• Data Format	Asynchronous, Serial, Start-Stop Code
• Modulation	2 Level PSK, Suppressed Carrier
• Transmit Level	+35 dBm v Nominal
• Receive Level	-20 dBm V Nominal ±10 dB
• Carrier Mode	Switched or Constant
• RTS/CTS Delay	100 Microseconds
• Interface, Data	Conforms to EIA Standard RS-232C or CCITT Rec. V. 24
• Error Rate	1 x 10^{-8} at RF System C/N Ratio of 25 dB Measured in 96 KHz
• RF Interface Impedance	75 Ohms Unbalanced
• Carrier Frequencies	Downstream 168 to 174 MHz; Upstream 11.75 to 17.75 MHz
• Indicators	LEDS for DSR, Carrier Detect, RTS, Power On.
• Power	115 ± 10 percent VAC, 60 Hz, 6 Watts
• Environment	
Temperature	-31°F to 165°F*
Relative Humidity	0 to 95 Percent Non-Condensing

OPTCS Communication Data Flow

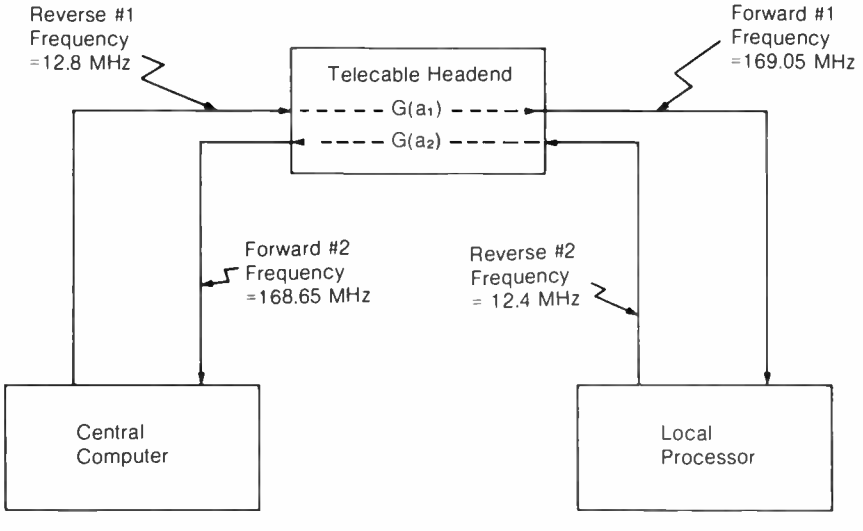

Figure 3

Quantifying Results

Reduction in travel time, fuel consumption and air pollution have come to be the standards by which the effectiveness of any transportation project is measured. By comparing the levels of these three indicators before and after the implementation of an improvement, the effectiveness of the improvement can be quantified. Although the subjective opinion of Overland Park transportation department personnel was that improvements had been made in traffic flow on the city's thoroughfare streets, everyone was anxious to discover what magnitude of improvements were actually being realized.

The primary tool used in the evaluation of OPTCS was the Travel Time, Speed and Delay (TSD) Study. In this study, a test car is driven in the traffic stream and data recorded includes the number and duration of stops and the total elapsed time between intersections and for the entire route. The routes studied for the OPTCS evaluation included five major thoroughfares on which 43 of the 55 intersections in the system are located. The number of trips made on each of the routes during both the a.m. and p.m. peak periods was varied in order to provide statistical significance.

The TSD study results showed that motorists experience eight percent less delay, eight percent less total travel time and 24 percent fewer stops since the installation of OPTCS. These improvements in traffic flow result in a direct savings of $500,000 per year to motorists in Overland Park in fuel alone, based on an annual reduction of 400,000 gallons at $1.25 per gallon, or 20,000 barrels of crude oil. Automobile emissions reduced annually will include 428 fewer tons of carbon monoxide, 28 fewer tons of hydrocarbons, and 24 fewer tons of nitrous oxide. Direct calculations also show 283 fewer hours of travel time

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"I know of no more economical way to start a pay channel than with TEST's Scramble Guard. Start with a positive scramble system and install decoders only for your premium subs, instead of trapping every non-pay drop. If you want, add negative traps *after* the cash starts coming in," Allen advises.

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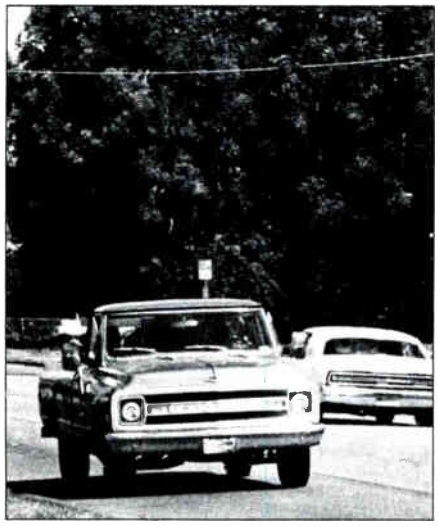

during a.m. and p.m. peak hours.

Other benefits that cannot be quantified at this time include:

- Accident reduction. Although a sufficient time period has not elapsed for a valid before/after analysis of accident data, it is a generally accepted traffic engineering theory that reducing stops will reduce accidents.
- Reduced traffic signal maintenance. The installation of model 170 microprocessor controllers has reduced the maintenance burden both in the required inventory of spare parts and in the number of signal repair call-outs.
- Increased information. Vehicle surveillance data from the system detectors will help traffic engineers and planners monitor changing traffic patterns.

Before and after studies have indicated that improvements have not been uniform throughout the system. Initial efforts will be made to make improvements in parts of the system where there has been either a degradation or minimal improvement thus far. These efforts will include "fine tuning" the existing control methods and possible use of other control strategies. Additional studies will be made on the effect of OPTCS on side streets with thought of developing new computer control strategies to minimize side street delay while maintaining good progression on thoroughfares. Other items to be considered for the future include expansion of the system to more intersections, video surveillance of selected intersections and emergency vehicle preemption as shown in Figure 2 on page 29.

Easy Maintenance

"From a technical operations standpoint, it's running perfectly," Pirner said.

Ralph A. Lewis, traffic operations engineer for Overland Park, agreed with that summation and added that the maintenance cost of the system has been going down steadily as well.

"The amount of time that we've had to devote to maintenance of the two-way once we got it up and running has been trivial," Pirner concurred. "We only charged the city for 37 man-hours of maintenance for the month of January."

The traffic control system in Overland Park is a prime example that two-way cable technology can be used for large scale applications of transmitting digital informtion. But Pirner had some words of warning for any company planning such a system.

"Any cable company that is venturing into a large scale two-way application, whether it's traffic control or home alarms, ought to realize that there will be a significant burden placed upon its field service people initially in terms of simple, physical, mechanical integrity," he said. "You can't buy the cheap splice and the cheap entrance fitting and so forth. You really have to pay attention to everywhere you have a connection, because if you don't, the ingress will ruin your two-way application very quickly. We're pleased to report that it can be done with a good continuing effort on the physical tightness of the plant."

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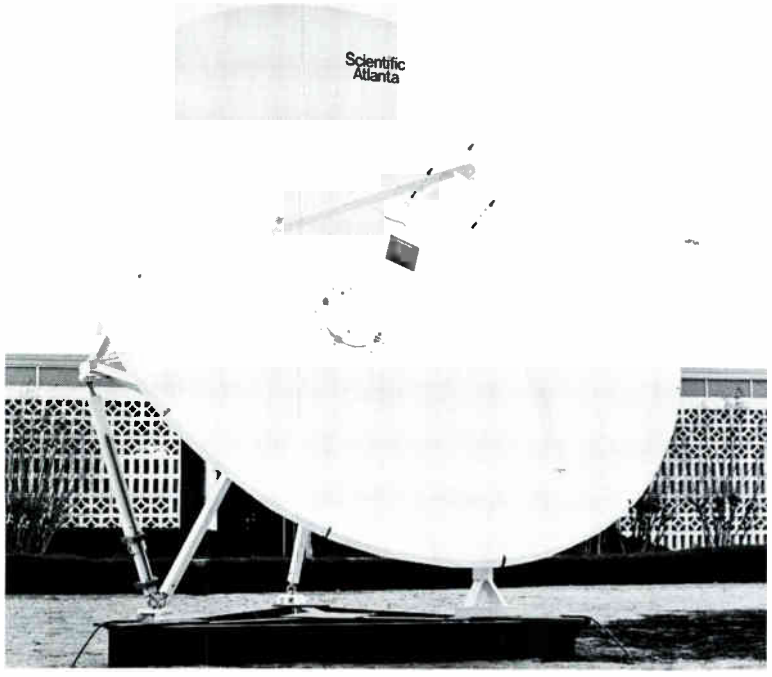

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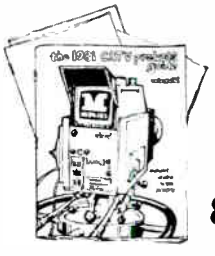

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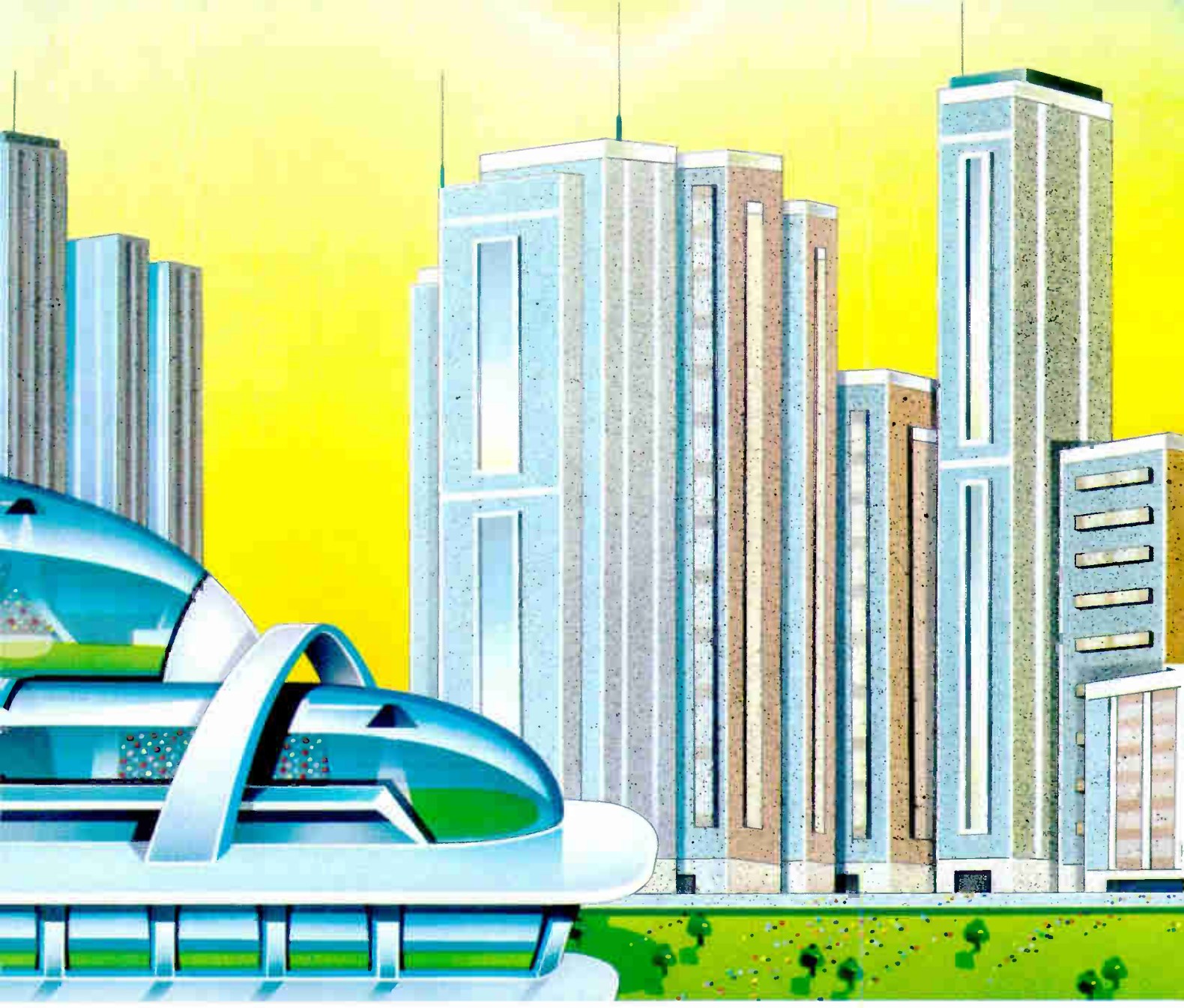

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The Ups and Downs Of Structural Return Loss

In this issue, Raleigh B. Stelle III, national and international sales manager for Texscan Corporation, continues his series of articles on the fine points of operating test equipment. Future articles will deal with system spectrum analysis and coaxial cable calculations.

Testing for structural return loss (SRL) is recognized as one of the more important tests required of new equipment and cables prior to installation. SRL tests can tell you how much, and at which frequencies, the cables or equipment lack in matching the impedance of each other. Mismatch of impedance in either can cause signals to be reflected from the mismatch back to the source, and then again forward to the load. At a minimum, impedance mismatch can cause lack of sharp detail in the pictures. At worst, it could cause severe ghosting.

This article, the second in **CED**'s test equipment series, explores some of the theory behind, and the practical applications of, structural return-loss testing.

First, consider a length of perfect, lossless transmission line (cable) of an impedance Z_o, a source with the impedance of Z_s, and a load impedance of Z_L. If $Z_s = Z_o = Z_L$, there is no mismatch and, therefore, no loss. This is shown in Figure 1. All of the energy provided by the source has been transferred to the load by the perfectly matched and lossless cable. In real life, this set of circumstances is not possible. If Z_o or Z_L are of any value other than Z_s, there will be reflections of at least a portion of the source signal.

In an extreme case where $Z_o = 0$ (short circuit), or ∞ (open circuit), all the forward or incident energy is reflected toward the

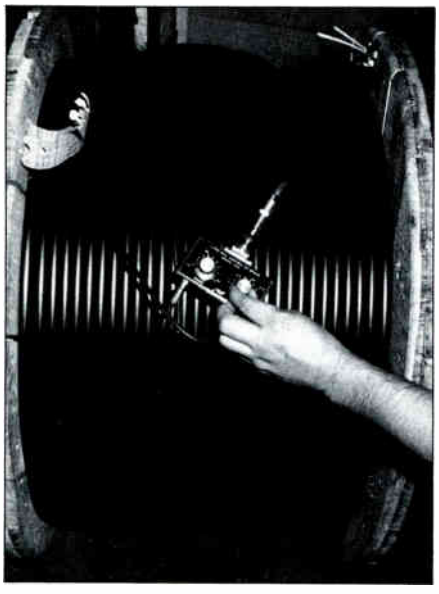


Photo courtesy of CCS Hatfield Wire & Cable

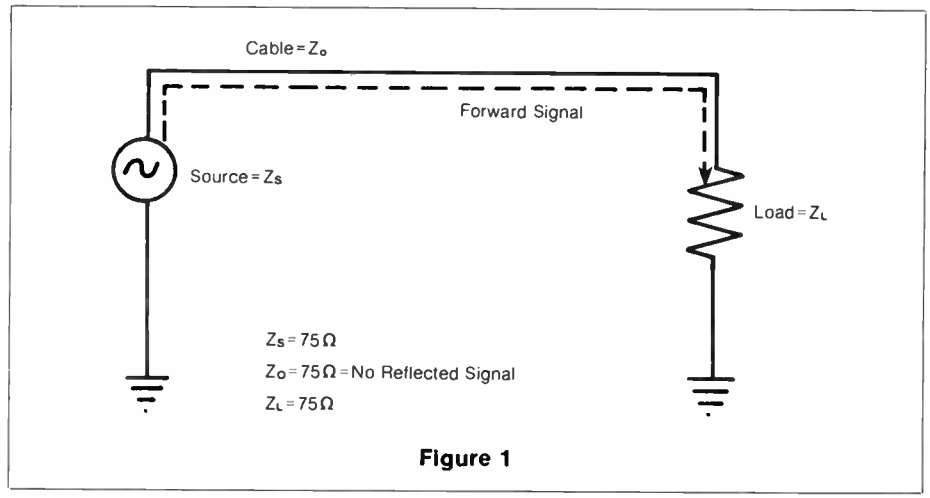


Figure 1

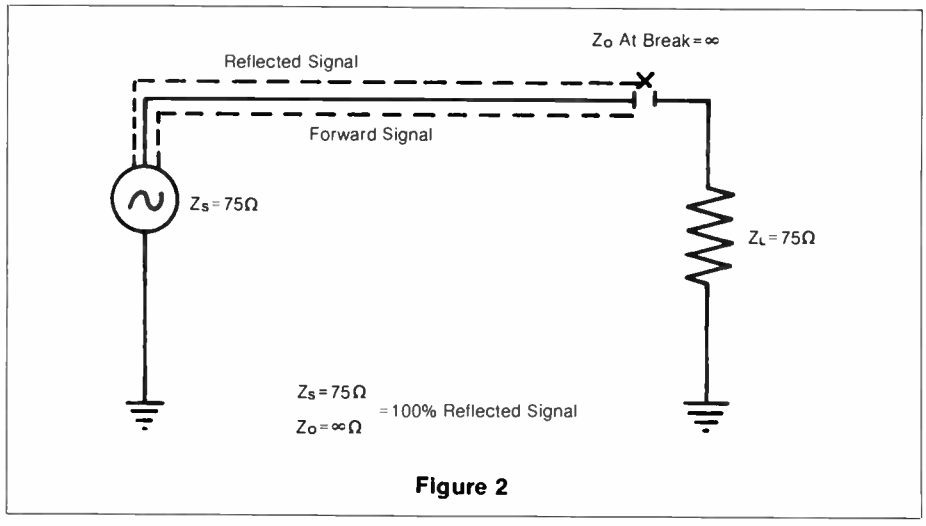


Figure 2

source, as shown in Figure 2 on page 36. The difference between the magnitude of the forward and reflected signals, in dB, is the return loss.

Coaxial cables have two important parameters which make them less than perfect. These parameters are impedance Z_o and attenuation A_o. The characteristic impedance of coaxial cable may be determined by three factors, as shown in Figure 3.

1) Diameter of the center (inner) conductor (d).
2) Diameter of the inside surface of the outer conductor (D).
3) Dielectric constant of the insulating materials between the two conductors (e).

Mathematically, the characteristic impedance of coaxial cables can be determined using the equation in Figure 4.

$$Z_o = \frac{138}{\sqrt{e}} \left(\log_{10} \frac{D}{d} \right)$$

Figure 4

Some typical values of dielectric constant (e) are:

Foamed polystyrene: 1.03
Teflon (PTFE): 2.1
Polyethylene: 2.26
Polystyrene: 2.56

The impedance of a piece of coaxial cable may be determined at any one point by knowing the D/d ratios and the dielectric constant. Notice the phrase "at any one point." This is meant to suggest that things may change at some point in the cable. The possibilities are endless.

Suppose, for example, that a bend or kink has occurred in the cable and the center conductor is no longer centered within the shield. The impedance formula is changed, as shown in Figure 5.

That formula got kind of hairy in a hurry, didn't it? There is not much chance that the cable impedance is still 75 ohms.

Or, suppose that a section of the outer conductor (shield) is missing entirely. In this case, the formula in Figure 6 applies.

Or, suppose that the cables became dented or crushed during shipment of during unloading or handling at the job site. There is no telling what the cable impedance would be if the cables looked like those shown in Figure 7.

Also, in any manufacturing process, it is virtually impossible to maintain a product to ±0.00 tolerance. A piece of the cable could be made with a section in the exaggerated configuration shown in Figure 8. The impedance will vary at each point in the cable where a change takes place. Even worse are those places where the discontinuities are periodic and repeat time after time at fixed intervals. Also, the diameter of the inner conductor could change with length due to excessive

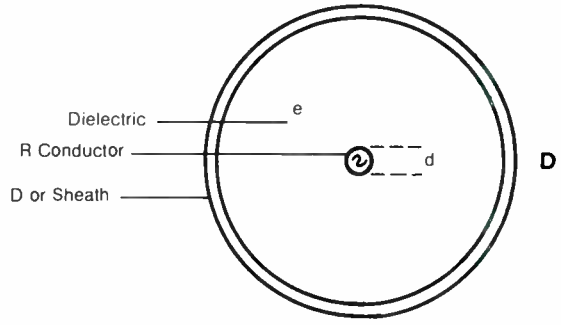


Figure 3

$$Z_o = \frac{60}{\sqrt{E}} \cosh^{-1} \left(\frac{1}{2} \left[\left(\frac{D}{d} + \frac{d}{D} \right) - \left(\frac{4C^2}{dD} \right) \right] \right)$$

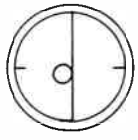


Figure 5

$Z'_o = Z_o + Z_o(0.03\,\theta^2)$
θ in radians.

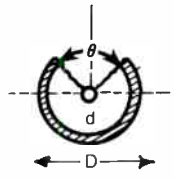


Figure 6

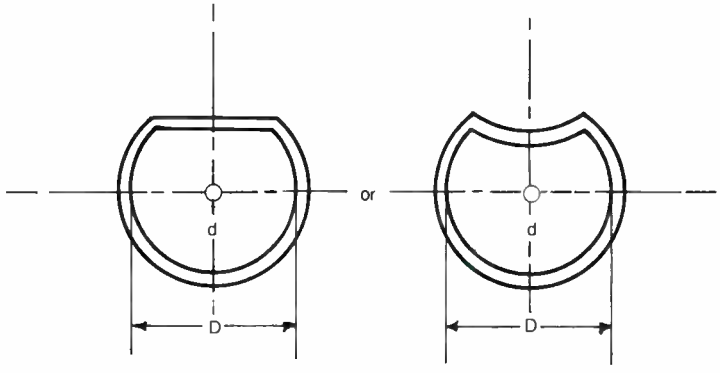
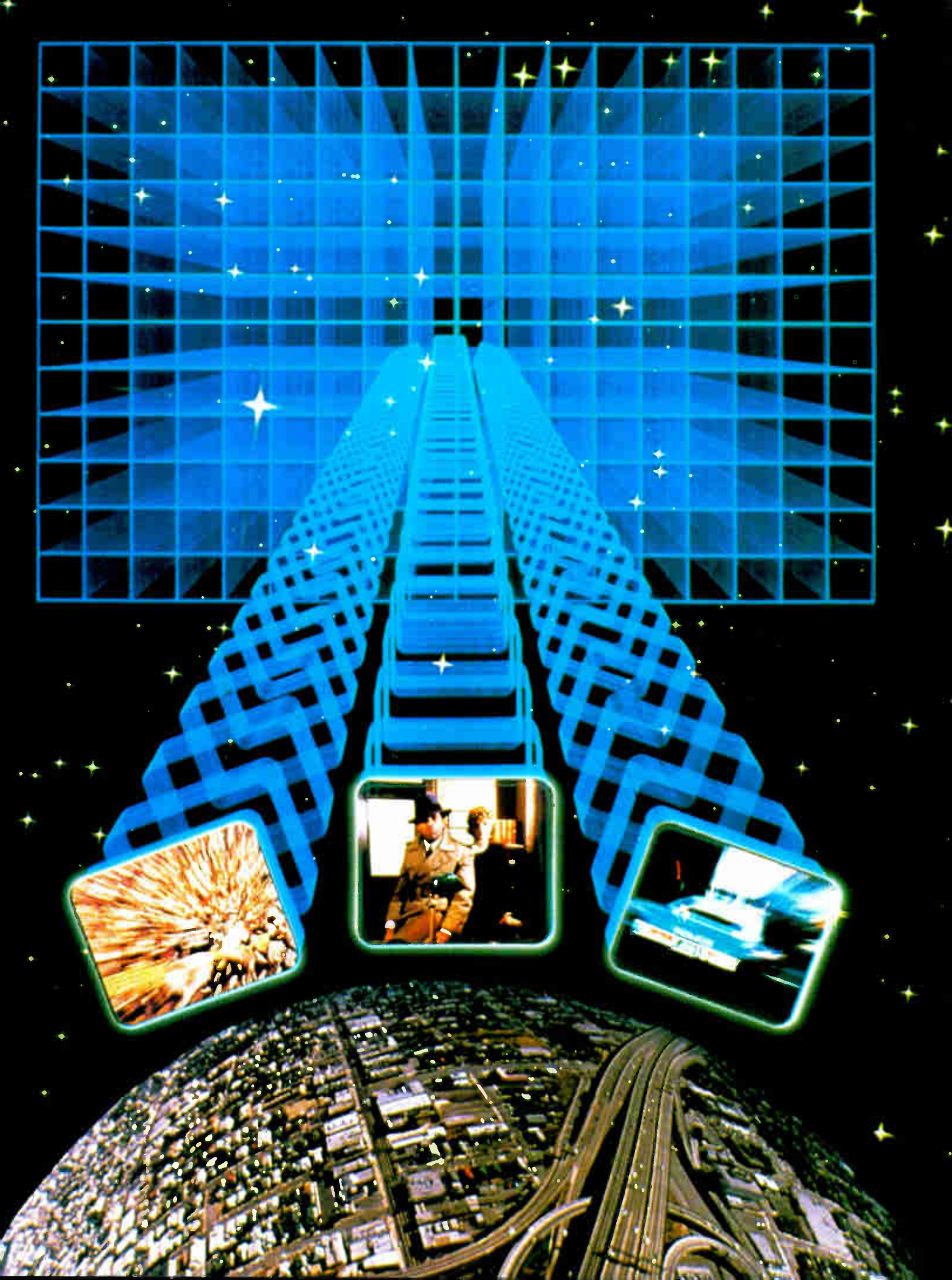


Figure 7

Figure 8



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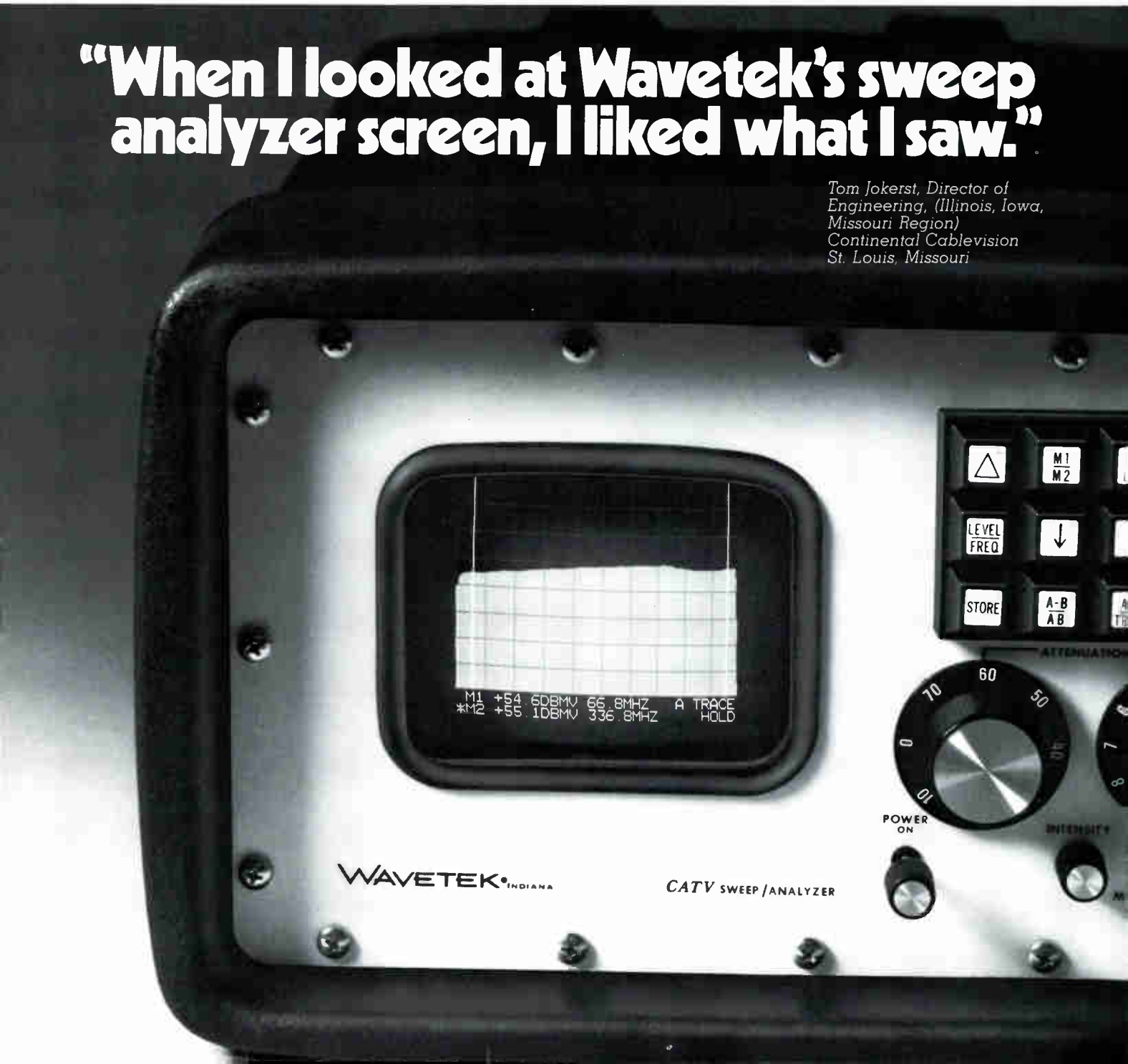

tension either in the field or during cable manufacture. The consistency and the composition of the dielectric material may also change during manufacture. The conclusion is clear: no cable is perfect. For this reason, the structural return-loss must be tested before any coaxial cable is buried or lashed to strand.

Consider for a moment what happens to an RF signal sent along a cable with poor impedance match. Each time the signal encounters an area such as those described above, a portion of the signal will be reflected back toward the source. But the reflected signal does not go back in phase with the incident (forward) signal. It will lead or lag the phase of the incident signal, depending on whether the impedance mismatch encountered is higher or lower than Z_o.

Reflections arising from a properly terminated transmission line which has some imperfections are called structural return-loss and are measured with respect to the source voltage in dB. Measurement of structural return-loss in cables is accomplished by using a reflection bridge with swept RF voltages. Reflection bridges are of two basic types, DC and RF. Both operate on the same principle as the well-known Wheatstone bridge. Figure 9 illustrates the basic circuit.

If all resistances are equal, the voltage from A to B will be 0. In cable television, the standard impedance for cables and devices is 75 ohms. The bridge must be designed to work at this impedance.

If one of the resistances (impedances) is different from the others, R_x for example, a voltage will be developed from A to B

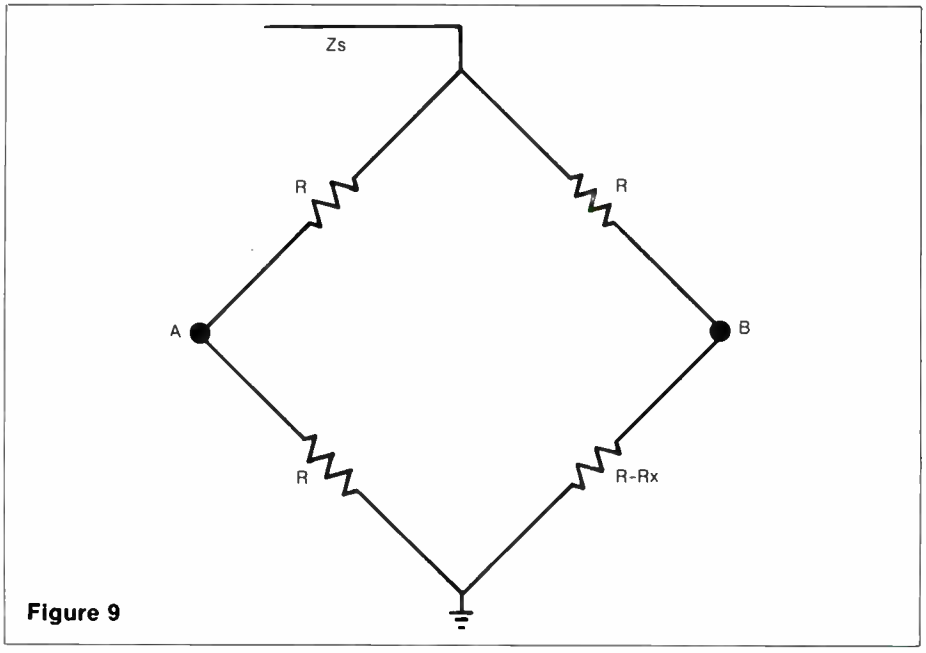

Figure 9

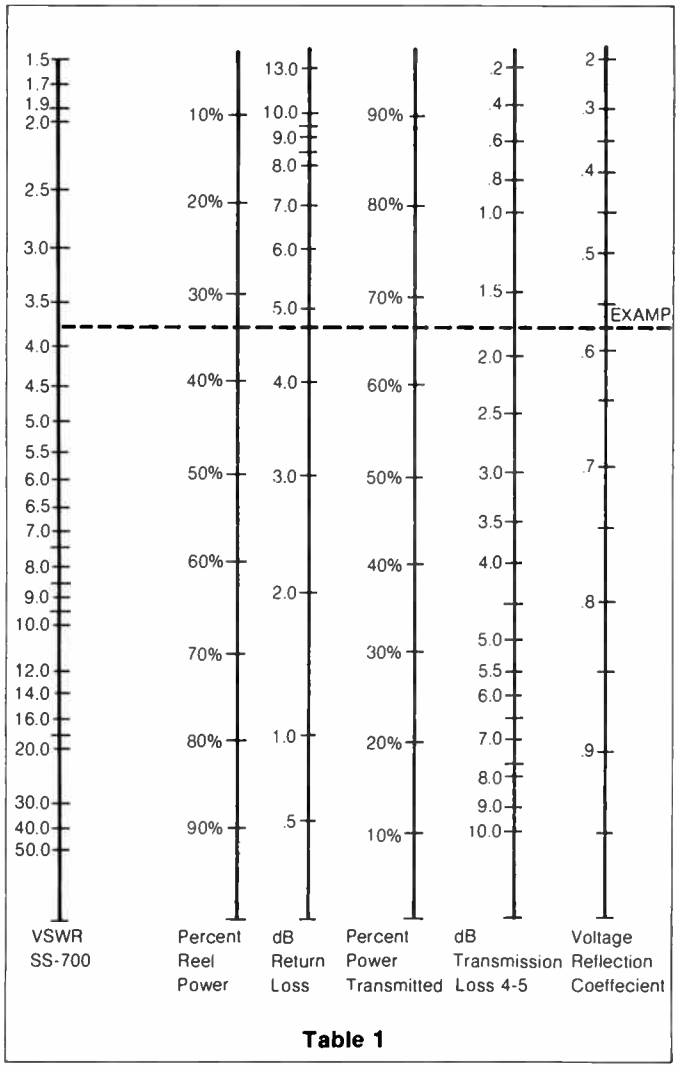

Table 1

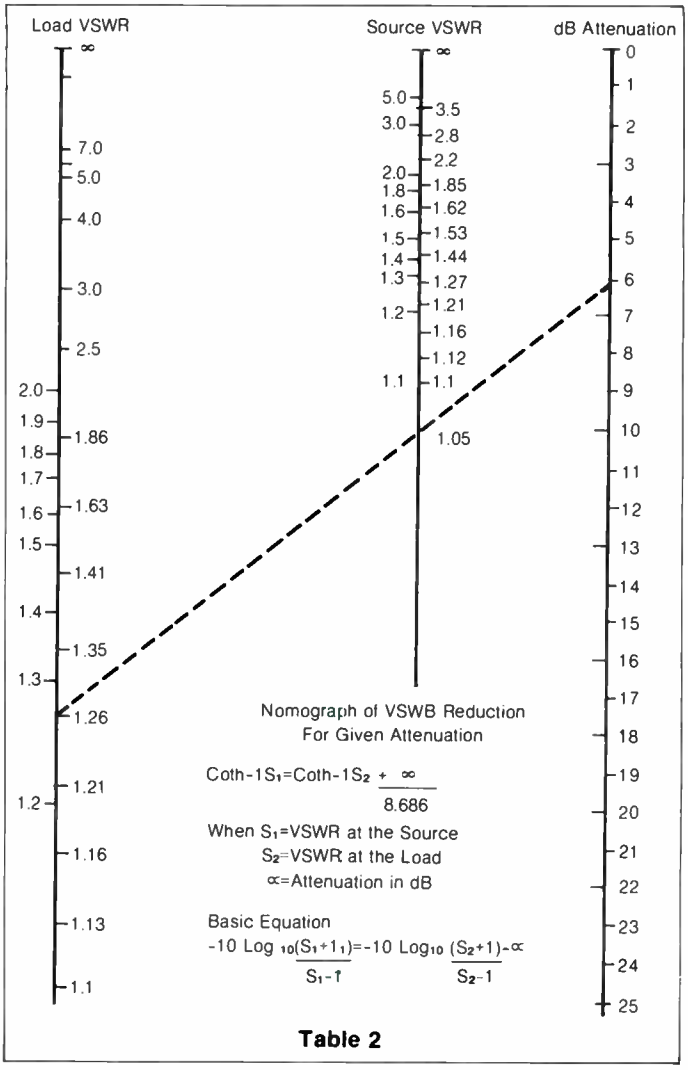

Table 2

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The unique printer, automatically prints time of power outages (time power went off and time power returns). Of course the PT-3000 has a built-in battery for power back-up to insure all control functions are activated during the power outage.

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- *Fourteen [illegible] program commands, example: LIST command prints [illegible] of displayed channels in chronological order.*
- *Automatically prints time of power outages (time power off and time power returns).*
- *Audio beep can be used as a local alarm clock for a reminder of real time appointments, etc.*
- *Alphanumeric keyboard and printer, allows use to add comments to printouts for logs and messages.*
- *Keyboard override capability allows user to easily change any of the eight outputs.*
- *Display mode indicates the current status of all outputs and real time.*
- *The PT-3000 has been designed so that future add-on features can be field installed, as they become available.*

Write or call for information about this great new product from Tomco.

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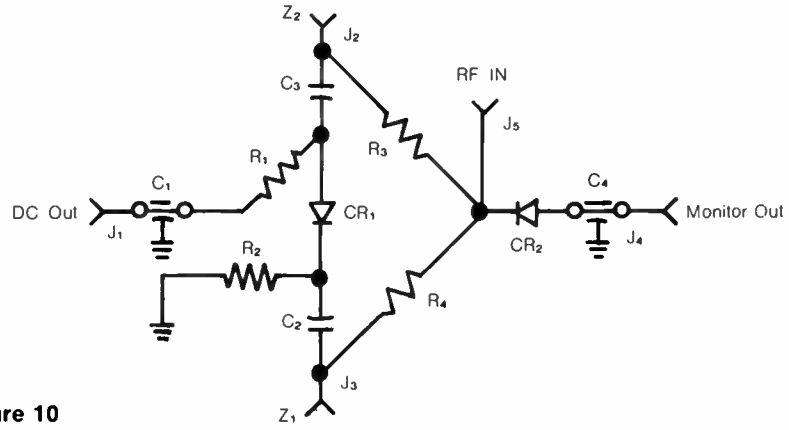

Figure 10

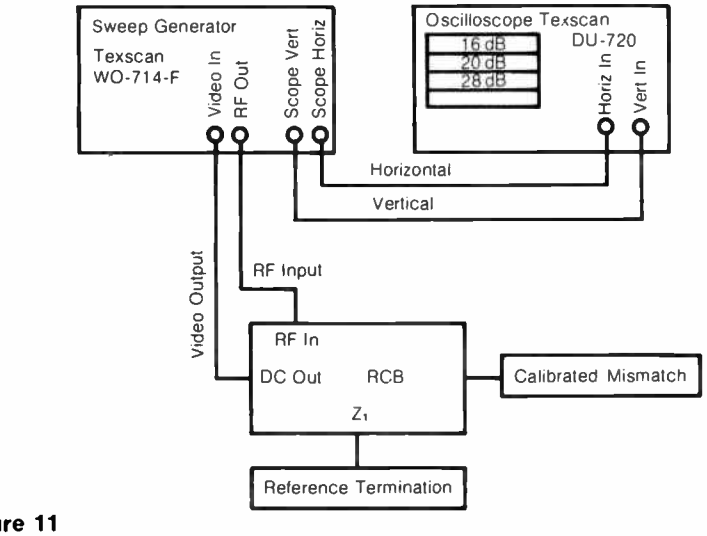

Figure 11

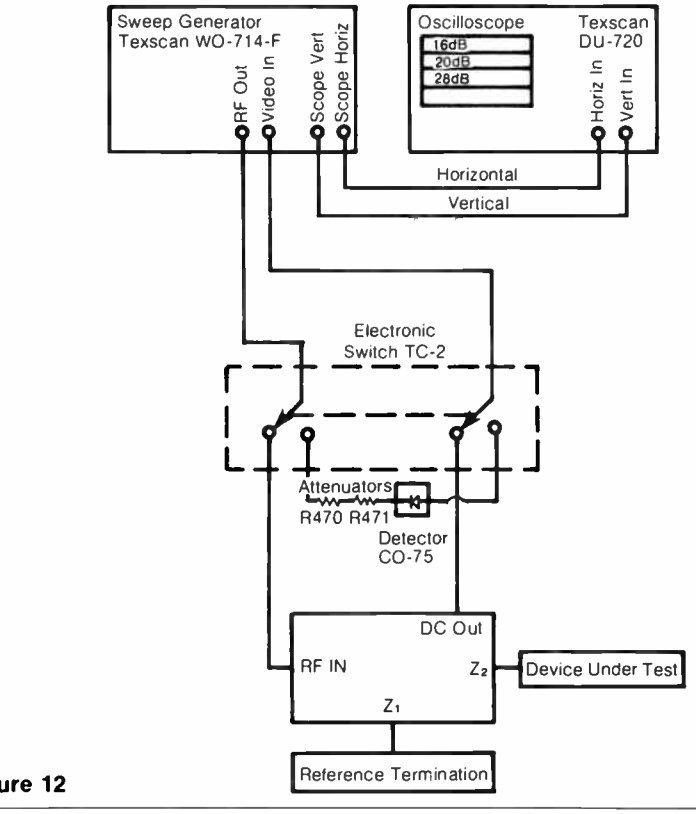

Figure 12

which is proportional to the value of R_x. In order to measure RF from A to B, a diode and RF decoupling return network is connected across A and B. A schematic of one make of return-loss bridge, Texscan's model RCB-3/75, showing all components of the DC type bridge, is shown in Figure 10.

The reference termination is connected at Z_1 (75 ohms) and the unknown impedance (cable, amplifier, tap, etc.) at the Z_2 port. When the swept RF voltage is applied at RF IN, a detected DC voltage which is proportional to Z_2 appears at J1, DC OUT.

Figures 11 and 12 are two test setups utilizing the DC bridge. The first is a manually calibrated system, the second uses variable attenuators for calibration.

The technique for calibration is to apply various calibrated mismatches to the Z_2 port and note the DC offset on the oscilloscope. The position of the mismatch (16 dB, 20 dB, 28 dB, etc.) is usually noted in china marker or grease pencil on the oscilloscope graticule. A

$$SRL = 20 \log_{10} \frac{V\ REFLECTED}{V\ REFERENCE}$$

V REFLECTED / V REFERENCE	SRL dB	VSWR
1.12	1	17.40
1.26	2	8.72
1.413	3	5.85
1.585	4	4.42
1.778	5	3.57
1.995	6	3.00
2.239	7	2.62
2.512	8	2.32
2.818	9	2.10
3.162	10	1.92
3.584	11	1.78
3.981	12	1.67
4.467	13	1.58
5.012	14	1.50
5.623	15	1.43
6.310	16	1.38
7.079	17	1.33
7.943	18	1.29
8.931	19	1.25
10.00	20	1.22
11.22	21	1.20
12.59	22	1.17
14.13	23	1.15
15.85	24	1.13
17.78	25	1.12
19.95	26	1.11
22.39	27	1.09
25.12	28	1.08
28.18	29	1.07
31.62	30	1.06
35.48	31	1.058
39.81	32	1.051
44.67	33	1.046
50.12	34	1.041
56.23	35	1.036
63.10	36	1.032
70.79	37	1.029
79.43	38	1.026

Table 3

word of caution: any change in the oscilloscope vertical gain or position, or scope drift, will give erroneous readings and require recalibration.

The only calibration required for this setup is to short-circuit Z_2 and adjust the variable attenuators until the two traces on the oscilloscope correspond. Note the attenuator values, they should be near 6 dB. Connect the unknown to Z_2 and adjust the variable attenuator to cause the highest return-loss peak to just touch the reference line. Note the attenuator reading and subtract the "zero" value. This gives return loss without regard for oscilloscope settings.

A problem will be encountered when trying to sweep cables of great length. Remember, a cable has attenuation and problem areas which are greater than 16 to 18 dB that will not be visible. The signal was attenuated by 16 or 18 dB in getting to the fault or discontinuity and will lose the same amount getting back to the bridge. Signal levels will be pretty small after losing 32 to 38 dB on the round trip.

To help clarify the process, the article will provide one more measurement technique related to transmission lines and a few tables and nomographs for reference.

It is possible to determine the distance to an open or a short on a piece of coaxial cable of 10 dB attenuation or so in the following manner:

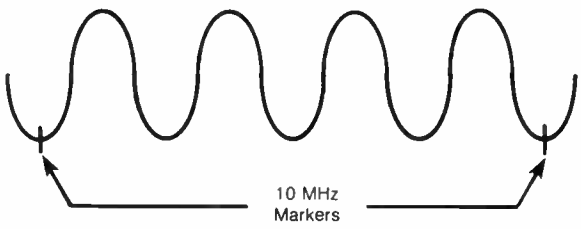

Figure 13

1) Set up the test set for return-loss measurement, but do not terminate the far end of the cable.

2) Adjust the sweep width to display approximately ten cycles of return-loss amplitude peaks. Increase the number of cycles for longer cables, as required, or use another harmonic marker to obtain the desired display.

3) Depress the 10 MHz harmonic marker switch to obtain the approximate display shown in Figure 13. Use the formula in Figure 14 to determine the distance to the fault.

In the formula,

L = Cable length in feet

N = Number of cycles between markers

V = Velocity of propagation factor (velocity in cable / velocity in air)

F_m = Marker interval in MHz (10 MHz)

Case 1. If the cable is continuous to the end, the display will appear to reverse as a short circuit is applied and removed on the far end of the cable.

Case 2. If shorting the far end of the cable produces no display change, an ohmmeter at the near end will measure high impedance if the line is open.

$$L=\frac{492NV}{F_M}$$ Cable with Foam Dielectric

$$L=\frac{492\times4\times0.81}{10}=160 \text{ Feet}$$

Figure 14

Case 3. If the ohmmeter indicated a low impedance, the cable is shorted.

These are values of VSWR (voltage standing wave ratio), return loss, etc. Read the chart in Table 1 on page 41 horizontally. For example, a 3.8:1 VSWR = 4.8 dB return loss and 32 percent of the power transmitted is reflected. The transmission loss will be 1.75 dB, etc. See Table 2 on page 41.

The nomograph in Table 2 is useful for determining match characteristics of remote devices such as amplifiers and antennas. To use the nomograph, it is necessary to know the interconnecting cable attenuation. If the VSWR is measured at the source end and a line connecting the measured (return loss) and cable attenuation is extended to the left column, the load VSWR (return loss) can be read directly. In the example a 6 dB cable and load measures 1.05 VSWR (32 dB) and the load VSWR is 1.26 (19 dB). This assumes a cable with no extraneous losses and $Z_O = Z_S$.

Table 3 on page 43 is a cross reference for VSWR and return loss and is derived from the basic equations for VSWR, shown in Figure 15.

In the following example, $Z_O = 75$ ohms, $Z_L = 50$ ohms

$$\xi = \frac{75-50}{75+50} = \frac{25}{125} = .2$$

$$S = \frac{1+.2}{1-.2} = 1.5{:}1 \text{ VSWR}$$

and

$$\xi \text{ dB} = -20 \log 10^{1}/.2 = -20 \log 10^{.5} = -20(.699) = 13.98 \text{ dB} = \text{Return Loss}$$

Return loss at the point of transmission line to load transfer is 14 dB. To determine the return loss at that point when measurement is made at the source, it is necessary to add twice the amount of cable attenuation ($2A_O$) between source and load.

ξdB = $-20\log_{10}1$ = Return Loss in dB

ξ = Reflection Coefficient

S = VSWR

$$\xi = \frac{Z_L - Z_O}{Z_L + Z_O}$$

$$S = \frac{1+\xi}{1-\xi}$$

Figure 15

Raleigh B. Stelle III has been with Texscan for nine years, two years in his present capacity. He is working with Ralph Haimowitz on the newly formed Engineering Committee of the Community Antenna Television Association to develop technical seminars for cable television engineers.

Out Of Sync

"Out of Sync" is a service provided by ***Communications Engineering Digest*** *to our subscribers. We will help you locate answers to all technical questions submitted. On urgent problems, or problems lacking in essential detail,* ***CED*** *may respond to you by phone prior to publication.*

Names and locations will not be published without written authorization. Send your questions, and possible solutions, to "Out of Sync," ***Communications Engineering Digest****, Titsch Publishing, Inc., P.O. Box 5400-TA, Denver, Colorado 80217.*

Q. We are making plans to upgrade a cable system built in 1967 in which aluminum sheath cable, single-ended amplifiers and pressure taps were used. Our plans include replacing the pressure taps with in-line multitaps. Can you provide us with an effective method of removing pressure taps and closing the cable in order to assure its integrity?

A. The best method that I know for removing pressure taps and still preventing moisture ingress and signal leakage is to not remove the pressure tap block at all. Remove only the tap insert (stinger). Use a disconnect plug, such as the Magnavox DPT-1076 or equivalent, with the threads liberally coated with a sealant to seal the tap block hole. Tighten the plug firmly with an open end wrench.

Use extreme care in handling the cable and tap block during insert removal and sealing. The aluminum cable sheath is easily broken during the process. I also recommend sealing block sides to the cable with RTV or other sealant (not silicone lubricant) whenever possible.

If you are unable to locate a source of the disconnect plugs, I am told that an F-81 connector, properly sealed, will work just as well. Disconnect plugs are normally less expensive and are easier to seal.

Q. We have a problem in our system and have been unable to locate the exact cause. In balancing our trunk lines, there are places where amplifier input signal levels are near perfect. On the outputs of the amp, signal levels are no longer linear. Some channels are higher than normal and some are lower. We have replaced the amp modules a number of times but this does not help. It may change the levels slightly, but does not eliminate the problem. When we sweep the replaced module on the bench, the output is exactly right. Do you have any suggestions?

A. Only one. The description given points to a fairly common cause, an impedance mismatch somewhere in the output cables. It is likely to be between the output of the amp where the problem is noticed and the next amp in the cascade. A TDR will usually show up any mismatch problems in the cable and give the location of the fault. If a TDR is not available, try taking apart all the splices and passive devices in this line. Look for loose connections and water or corrosion.

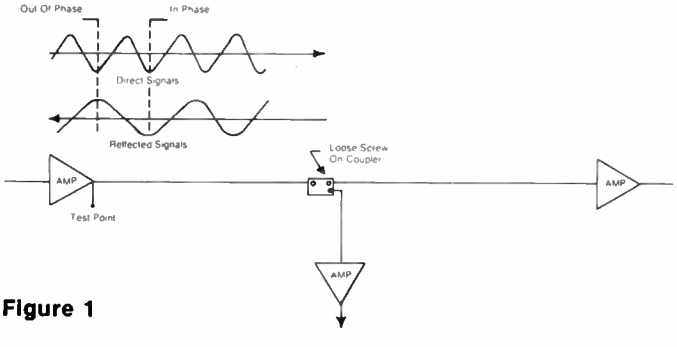

Figure 1

The problem is usually a combining of direct signals out of the amplifier and reflected signals from the mismatch. Arriving signals from the mismatch may be in phase, out of phase, or any combination between. Out of phase signals can reduce the direct signal levels and in phase signals may give the appearance of an increased signal level. See Figure 1.

Another suggestion. To save some time and trouble, try installing a line terminator at the output of the amp before taking the line apart. If the problem is mismatch, the terminator should bring the levels back to normal.

Q. I read with interest the articles on MDS in October *CED*. It appears to me that the greatest threat that MDS has is from STV, which has appeared in many cities. This was not mentioned in the two articles. I also did not understand why cable operators could not use the master antenna system in complexes, the same way MDS does. Why use external cables when the buildings are already wired up?

A. In answer to your first question, it is doubtful if a subscription television operation will ever have more than one transmitter within a given city. On the other hand, multipoint distribution may soon be able to transmit on many channels within the same area. Multiple pay MDS channels would definitely have a greater detrimental effect on a local cable operation than one STV signal.

On your second question, there are several reasons why many cable operators hesitate to use existing master antenna system cables. For one, the FCC has ruled that all cables connected to a system become an integral part of that system and are therefore subject to the same FCC requirements and specifications as the rest of the system. Since the cable operator had no control over the types or quality of the cables and devices used, signal leakage and minimum signal level requirements may not be met. The cable operator also had no control over the design of the internal wiring. Many contractors, in order to be able to offer attractive bid prices to building owners, have cut corners on equipment quality and have also designed the system in a "loop-thru" configuration. Loop-thru systems are like a series string of lights. When you turn off one toward the start of the run, all others are off from that point toward the end of the run. Almost all operator control is lost.

Most modern cable television multiple dwelling unit design is a home-run type of design. This means that each apartment or dwelling unit is served by a separate cable from a central point or service box. Each dwelling unit can then be totally controlled by the cable operator. The service can be connected, disconnected, have pay TV service connected or disconnected, or any other change. All this can be done without disturbing service to the other apartments or having to gain entry into the apartment in question.

Even though it is much more expensive initially to wire the multiple dwelling units yourself, the savings in time, headaches, and labor costs, as well as being able to sell a subscriber exactly the service desired, can easily cover costs. With home-run wiring, you can bill each apartment separately instead of the less profitable "bulk billing."

Intermod

Installing A School

A project that I have been dreaming about for the last ten years, pushing for the last three years, and working on almost full time for the last two years is now nearing completion. Actually, it would be more realistic to say that it is rapidly approaching its beginning.

For many years, I have felt that an acute need exists for much more technical training in the cable television field than is readily available. Most commercial schools which offer cable television training are either too long (22 months average) or too expensive, or both. Many younger would-be techs could not afford the time or the money. Home study courses helped, but only after you were actually hired.

What was really needed, I felt, was for the really big cable companies to train their own people. This would allow them to hire inexperienced people and train them properly with the same types of equipment they would eventually be using. There were a number of valid objections to such a project, with the main one being the cost.

With the help and encouragement of many people, approval was given by American Television and Communications Corporation for me to conduct two pilot programs for installers. Each class would last for two weeks and would train about 15 new installers in each class. Such a program would allow us to evaluate each student's progress and see if we really could train a novice to make installs effectively after just two weeks of training. We could also determine the actual cost of this type training. The final results of the pilot program surprised even me, its greatest supporter.

Of the first class, all of the trainees were able to go back to their systems and immediately start making actual installs with little or no additional training. Their production, as judged by their immediate supervisors, was at least 70 percent of that of an installer with two or more years of field experience. In quality, the work of the new installers was judged to be superior to that of many job-trained installers.

For the second class of the pilot program, we decided to include some of our experienced installation supervisors as a control group. After some initial awkwardness, we determined that even these people could benefit from the type training we were offering. They could finally learn "why" things were to be done in a certain way. They universally agreed that the training was beneficial to them.

The pilot program was completed over a year ago. Some of the graduates were almost immediately moved upward to positions as technicians or supervisors. Now, virtually all of the graduates are in technical positions or are supervisors. This made believers of almost everyone.

ATC made plans to establish a full-time training center based on the information gathered during the pilot program. Construction of the training center was started last fall and construction is expected to be completed by the end of April 1981. The first classes are scheduled to commence in May. We expect to train more than 500 technical employees each year at this facility. Levels of training to be offered range from beginning installer up through specialized courses for our engineers.

The building will house three large classrooms, an electronics laboratory with a full set of modern test equipment for each test bench position, a full headend and earth station, a well equipped lunchroom/lounge, offices for three instructors and all the other requirements of this type school.

An outside cable system containing amplifiers of all types, distribution system, underground plant and a pole farm for climbing instruction are next to the school building. For installer training, a 12-foot-by-24-foot building was constructed. Each side of this building has a different type siding: asbestos shingles, wood lap, cement block and aluminum siding. It also has an attic and a basement. The interior and exterior walls are designed for easy replacement as required.

I have written two of five training manuals that will be used in the school. A chief instructor is about ready to start teaching. Two other instructors and a secretary will soon be on board to complete the instructional staff.

So, as I stated, the project is just about complete for me. For hundreds of installers and technicians, it will just be the beginning.

Glenn Chambers

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Canada Injects Millions Into Videotext Program

OTTAWA, ONTARIO—The Canadian government is injecting $27.5 million into its Telidon program to improve both the technical and marketing facets of the videotext system. In addition, the system will be the focal point of a major international data base project by Teleglobe Canada, the country's international telecommunications carrier. The latter project, scheduled to begin in mid-1981, is designed to provide data services via terminals distributed throughout the world.

The Telidon videotext system was developed by the Canadian Department of Communications and has been bid in several cable systems in the U.S. by Canadian cable firms. Since its inception, the Canadian government has committed $12.6 million to the program. The new funding will commit $17.2 million in the next year, and $10.3 million the following year.

Communications Minister Francis Fox announced the additional funding, predicting that there will be "more than 12,000 Telidon terminals in use within a year." He stated that the reason for the renewed commitment was that "our competitors are making heavy financial commitments to their technologies and their marketing efforts...

"This new commitment by the Canadian government and the commitments that will be forthcoming from Canadian industry should signal to all that Telidon is the videotext system to watch," Fox said.

The federal funding will be used for the manufacture of about 6,000 Telidon terminals that will be loaned to industrial concerns or used to conduct market trials. Product research and development and market development have also been earmarked as priorities for the Telidon system. Fox stated that the infusion of funds into these areas will eventually reduce the price and extend the capabilities.

Industry consultants in Canada have estimated that from one to four million videotext terminals could be installed in the country during the 1980s. The price figure attached to this videotext explosion could approach $1 billion.

Additional uses of the $27.5 million funding will include: up front support for "important national and international Telidon systems, including a national broadcast teletext service in English and French" and support for initiatives to permit disadvantaged groups "to exploit the Telidon potential as a communications medium," Fox said.

"The federal government and Canadian industry believe the electronic information industry has the potential of becoming a major sector of the Canadian economy," the minister said.

At the same time, the country is committing $4.1 million to the Teleglobe Canada project which will promote the use of Telidon in other countries. Currently, the system is being employed by the Venezuelan government for an information service with terminals placed in public locations throughout Caracas. American use of the system includes a project by the Alternate Media Center at New York University and one by public television station WETA in Washington, D.C. In the latter project, the data system is used in the Smithsonian Institute, the Washington public library and several government agencies.

The terminals and software for the three-year project will be supplied by Infomart, a Toronto-based electronics publisher. Infomart's contract is for $1.1 million.

The Telidon system was recently ratified as one of three world standards for videotext by the International Consultative Committee on Telegraphs and Telephones, a United Nations agency that is responsible for setting international telecommunications standards.

French Newspaper Joins Antiope Marketing Venture

WASHINGTON, D.C.—Antiope Videotex Systems, Inc., the marketing arm in the U.S. for French videotex and teletext technologies, has formed a joint telecommunications venture with **Les Echos**, France's largest daily financial newspaper.

The joint venture will market Didon Antiope and Teletel (Telematique Product) technology for the production, exchange and transmission of all types of information and services. **Les Echos** will be the majority stockholder in the venture.

The firm will conduct business with companies throughout North America, especially with data banks and information providers, cable television systems and common carriers. European data banks and information providers will be utilized, as well as American.

Antiope Videotex Systems, Inc., is the American subsidiary of SOFRATEV, a private company which has foreign marketing rights for the Antiope system.

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Expanding cable TV company is seeking a chief technician to supervise installation and operation of new cable builds. Applicants should be experienced in all phases of cable TV operation; knowledge of microwave installation construction and engineering; of CATV laws rules and regulations required. Second-class FCC license helpful. Must have 2 to 3 years field experience. Competitive salary with exc. fringe benefits plan. Send resume and salary history to:

Personnel Director
Norcom Video, Inc.
901 Kilbourn Avenue
Tomah, WI 54660
or call 608/372/8199
equal opportunity employer

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TeleCable Corporation, a leading operator of CATV systems, has an opening for an AAS or BSEE with 2 years of RF design experience to head up laboratory testing, product evaluation and field implementation of all new terminal products including addressable converters, descramblers, home information terminals and home security terminals. The position offers an excellent salary plus benefits with a growing company in an ideal climate.

If you are looking for more project responsibility, and your experience fits our requirements, please give us a call.

Nick Worth
TeleCable Corporation
P.O. Box 720
Norfolk, VA 23501
804/446-2576

SYSTEM TECHNICIAN

Excellent opportunity in South Florida, position opening for experienced system technician capable of maintaining a 35-channel, state-of-the-art, fully operational, dual cable, two-way system. Salary commensurate with experience. Equal opportunity employer. Send resume to:

Personnel Director
Selkirk Cable TV
644 South Andrews Avenue
Ft. Lauderdale, FL 33301

CHIEF TECHNICIAN

Exciting and challenging future for the right person, join us in the Atlanta area. Need chief technician with 5 years experience. Must be self starter, able to train and supervise technical staff, trouble shoot system from headend to the last amp. Design and map layout for small extensions. Responsible for maintaining 325-mile system with 54 channels and two way security service. MSO, excellent benefits including company-provided vehicle. Send resume to:

Wayne Lee
Cable TV Company, Ltd.
Chamblee, Georgia 30341

We are an equal opportunity employer.

Business Directory

Business Directory

MetroVision, Inc.

TECHNICIANS

Experience required in system turn-on, balancing, maintenance, and repair. An Associates Degree in Electronics or equivalent military or vocational education is desired. An FCC license is a plus.

Positions are available in Illinois, Michigan, and Wisconsin.

Contact: Dick Amell
MetroVision, Inc.
211 Perimeter Center Pkway
Suite 930
Atlanta, GA 30346
(404) 394-8837

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Payable in advance. Check or money order only.
When placing an ad, indicate the exact category desired: Help Wanted, Position Wanted, Professional Services, Business Directory, etc. If this information is omitted, we will determine the appropriate category according to the copy.

Deadline is three weeks prior to cover date. Orders will be accepted by written confirmation or taken over the phone. Replies with Blind Box numbers should be addressed to (Box Number) c/o CableVision Magazine, P.O. Box 5400 T.A., Denver, Colorado 80217. Rates: $40.00 per column inch. Minimum order one inch. For further information or to place your classified advertisement, contact Suzanne Sparrow at 303/573-1433.

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CONVERTERS FOR SALE

Have 4,000 plus (brand new) Oak RT-35 (three) triple-tapped Converters for sale. Price/a low, low $55.95, FOB Baltimore, contact Jim Wright, 301/252-1015.

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April 17, 1981-Show Issue

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May 15, 1981-Show Wrap-Up Issue

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Ad Index

New Products

Test Equipment

Tektronix, Inc., Develops Storage RF Spectrum Analyzer

Tektronix, Inc., has introduced its model 7L14 spectrum analyzer. The unit features a built-in limiter which protects the first mixer. The limiter does not degrade the distortion (harmonic and intermod) measurement capabilities of the 7L14. As a result, signal levels up to one watt can be connected to the input for any setting of the RF attenuator without damage to the first mixer.

The limiter has a built-in DC block which, in addition to preventing damage from a DC level on the signal, will protect the mixer from large (up to 50 V) line frequency (50/60 Hz) signals which may be present along with the wanted signal.

The 7L14 provides frequency coverage from 10 KHz to 1800 MHz. Other features include: 70 dB on screen dynamic range, spurious free; minus 130 dBm sensitivity, with 30 Hz resolution; CRT readout of control settings, four-to-one shape factor resolution filters; tracking generator and counter options; and a display mainframe compatible with more than 25 different 7000 series plug-ins: including amplifiers, timebases, logic analyzers, counters, A/D converters, and readout units. The 7L14 is physically and electrically compatible with all Tektronix 7000 series mainframes.

For information, contact Tektronix, Inc., Marketing Communications Department, D.S. 76/260, P.O. Box 1700, Beaverton, Oregon 97075; (800) 547-1512 or (503) 644-9051.

The model 7L14 spectrum analyzer from Tektronix, Inc.

Keithley Instruments Develops Low Cost 4½-Digit Multimeter

Keithley Instruments, Inc., has developed the model 176 multimeter that offers 4½-digit-precision at a cost of a 3½-digit instrument. The unit has 0.05 percent DC accuracy and AC frequency response to 20 KHz on the lower ranges. The model's 200 VAC and 1,000 VAC ranges are specified to five KHz and one KHz, respectively.

Other specifications include: 4½-digit LCD display with full-range and function annunciators; 100 uV to 1,000 V AC and DC; one uA to two A AC and DC; 0.1 ohm to 20 M ohm. The unit is fully protected from overload and has 1,000-hour battery life with standard alkaline cells. A battery eliminator is optional.

The model 176 is designed to take rugged use. All electrical components except fuse and battery are soldered to a single pc board and mounted in tough, shock-resistant case. Extensive vibration stress-testing assures that the model 176 will tolerate all the shock and abuse normally associated with harsh applications.

For information, contact Keithley Instruments, Inc., 28775 Aurora Road, Cleveland, Ohio 44139; (216) 248-0400.

Line Equipment

Gardiner Increases Gain Of Its Low-Noise Amplifiers

Gardiner Communications Corporation has increased the gain of all its low-noise amplifiers to 60 dB at no increase in price. Increased use of satellite signals has made it necessary to split signals more ways. In marginal areas, the increased insertion loss caused by eight-way power dividers can degrade picture quality. The added LNA gain overcomes this loss. Other applications include longer heliax runs or smaller heliax. For information, contact Gardiner Communications Corporation, 1980 South Post Oak Road, Suite 2040, Houston, Texas 77056; (713) 961-7348.

The model GCC-2120 low-noise amplifier from Gardiner Communications Corporation.

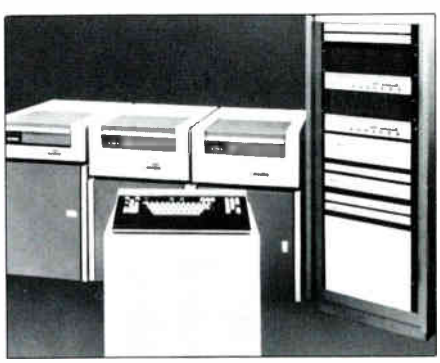
Video

Harris Video Systems Markets Video Still-Store System

A digital video still-store system that allows an operator to create, store and manipulate up to 5,840 stills on line has been introduced by **Harris Video Systems**.

Called IRIS, the new system creates digital video stills using inputs from VTRs, cameras, network feed, telecines, character generators, reflective artwork and other video inputs. The system can be used by up to three separate users simultaneously. All users have on-line access to the 5,840 individually catalogued broadcast quality images. Additionally, since the disc packs are removable, off-line still storage is limited only by the physical space available.

The IRIS system features automatic sequencing with a maximum throughput rate of one still every ½-second. IRIS also features comprehensive and flexible list and file management, the ability to generate and manipulate a list of stills on-line and the ability to copy stills and entire lists in one pack and store them in another. Slides can be pre-titled, which allows an operator to title a still for later use, freeing up on-line character generators at critical production periods. For information, contact **Harris Video Systems**, 1255 East Arques Avenue, Sunnyvale, California 94086; (408) 737-2100.



The IRIS digital video still-store system from Harris Video Systems.

Convergence Corporation Offers ¾-Inch VTR Interfaces

Convergence Corporation has added two new videotape recorder (VTR) interface options to its line of videotape editing products. The first of the two new interface options now being shipped is CCA-90/CR-8200 for use with JVC ¾-inch VTR models CR-8200, CR-6600, and CP-5500. The second interface option is

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INTRODUCING . . . . .

WISI MULTI-CHANNEL AM MICROWAVE LINKS

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UNTIL NOW

WISI AM MICROWAVE LINKS are used throughout Europe, and exclusively in Switzerland to transport television broadcasts from neighboring countries to CATV systems throughout the country. The performance of WISI AM LINKS is virtually unmatched by any other manufacturer of AM MICROWAVE SYSTEMS. WISI AM MICROWAVE LINKS were developed in Europe, by the Wilhelm Sihn Jr. KG., to pass the toughest technical requirements. These same high quality WISI AM MICROWAVE SYSTEMS have since become available in the United States.

Being aware of your desire to give your customers a high quality product while keeping your cost per subscriber at a minimum, WISI AM MICROWAVE LINKS were designed with efficiency in mind . . .

- ★ Dual conversion techniques are employed in both the transmitters and receivers.
- ★ 54 Channel Capability.
- ★ Pilot Controlled AFC/AGC.
- ★ Antenna mounted downconvertors eliminate wave guide losses at the receive site.

After the installation of your new WISI AM MICROWAVE SYSTEM our Applications Engineering Department remains at your disposal for any assistance you might need for operation and expansion.

WISI "THE BETTER CHOICE"

NATIONAL SALES AND SERVICE CENTER 800-531-7242, (In Texas) 512-349-8601

NOVA ENGINEERING, INC., 310 Breesport, P.O. Box 32943, San Antonio, Texas 78216

CCA-90/NV-9600 for use with Panasonic/National ¾-inch VTR models NV-9600, NV-9240, and broadcast model AU-700. Both new interfaces are designed to work with the Convergence ECS-90 editing system. The additions provide ECS-90 owners a wider selection of VTRs. For information, contact Convergence Corporation, 1641 McGaw, Irvine, California 92714; (714) 549-3146.

Miscellaneous

Vanner Introduces 1,000-Watt Inverter

Vanner, Inc., is manufacturing a highly regulated 1,000 watt inverter 12 or 24 V DC to 120 V AC for mobile production and ENG vehicles. Pulse-width modulation, with less than 14 percent harmonic distortion, and RMS regulation to less than two percent make the Vanner-Verter model 20-100X ideal for sensitive applications.

The typical in-field systems powered from the unit can include a ¾-inch cassette recorder, sync and color-bar generator, transmitter and receiver, audio mixer, color monitor and scope.

Two models are currently available. The ENG 20-100X for 12 V DC operation provides 1,000 watts continuously with 1,500 watt surge capabilities. Model 24-150X for 24 V DC helicopter use develops 1,500 watts and surges to 2,200. A built-in automatic shore-power transfer switch is available on both models.

For information, contact Vanner, Inc., 2136 Eakin Road, Columbus, Ohio 43223; (614) 272-6263.

The model 20-100X from Vanner, Inc.

Teltone Develops Telephone Interface Device

Teltone Corporation has developed a dual-tone multifrequency (DTMF) digital receiver and/or rotary dial pulse counter. Called the Teltone® M-927, it will accept all 16 DTMF or Touch-Tone® digits from a telephone, radio or other source. The unit can be used to interface telephones to data processing equipment and to control and monitor equipment.

The M-927 is contained in a 40-pin package and requires no external components except a single 3.579 MHz television color-burst crystal. The logic output can drive a transistor, low-power Schottky TTL, MOS or CMOS device. When coupled with a CMOS driver, the M-927 can operate a digital display.

Pin selectable logic outputs include: binary, two of eight (two of seven), one of 12, or blank. Strobe, three convenient clock frequencies, signal presence and DTMF/dial pulse mode indications give the M-927 the versatility and control to function in a wide range of applications.

For information, contact Teltone Corporation. 10801 - 120th Avenue, N.E., Kirkland, Washington 98033; (206) 827-9626.

Electron Fusion Devices Develops Solder-Paste Dispensing System

A system that automatically and uniformly dispenses a non-separating solder paste from disposable syringes in high volume production applications is available from **Electron Fusion Devices, Inc.**

The EFD solder paste system dispenses controlled amounts of paste as small as microdots repeatedly and faster than possible with conventional flux-cored wire solders. Packaged in clean 35 gm/10 cc disposable syringes, the paste is a non-separating homogeneous blend of solder particles surrounded by flux to ensure proper wetting and solder joint reliability. The unit features the model

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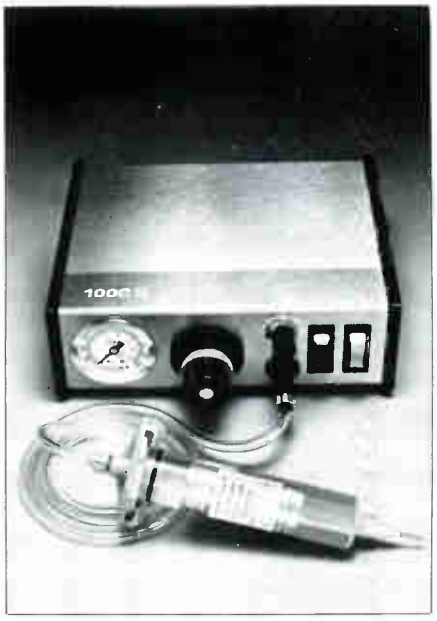
1000D electropneumatic dispenser and a choice of solder pastes including 60/40 tin-lead, 63/37 tin-lead eutectic, 62/26/2 tin-lead-silver and 96/4 tin-silver.

For information, contact Electronic Fusion Devices, Inc., 977 Waterman Avenue, East Providence, Rhode Island 02914; (401) 434-1680.



The automatic solder-paste dispensing system from Electron Fusion Devices, Inc.

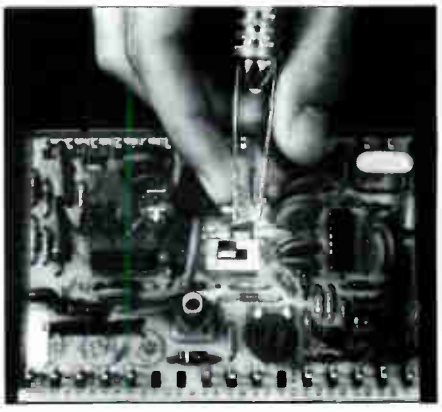
Progressive Electronics Markets Cable and Pipe Locator

Progressive Electronics, Inc., is marketing its model 508 cable and pipe locator. The unit is small and lightweight. It uses the "null method" with PEI's RF locator. The unit eliminates noise to adjacent circuits and uses ordinary 9 volt batteries. A long ground rod is not required. Transmitter output is protected against 240 volts. For information, contact Progressive Electronics, Inc., 432 South Extension, Mesa, Arizona 85202; (800) 528-8224.

The model 508 cable and pipe locator from Progressive Electronics.

Desco Industries Expands Lighted Tweezer Line

Desco Industries has added three battery-powered lighted tweezers to its line of electronic assembly aids. These tweezers all have stainless steel blades and are powered by a single AAA battery. The lamp directs light to the working point. A low-cost plastic case model is available for field tool cases. The tool is designed for working in poorly lighted field situations. Two stainless steel case models are available, one with a straight tip and one with an angle tip. For information, contact Desco Industries, Inc., 351 F Oak Place, Brea, California 92621; (714) 990-3005.



The Desco lighted tweezer is designed for working in poorly lighted field situations.

HS200 HS300 HS400
2, 3 & 4 WAY HYBRID SPLITTERS

The new HS200, HS300 and HS400 Hybrid Splitters are built in the most unique housing on the market today! The quad mounted housing gives real flexibility to allow for strand or eve mounting, flush wall mounting, or horizontal mounting when drops are coming up from the floor or in cabinets when all the ports are needed to face down for real ease of installation.

The housing is a strong die cast for outdoor use and further protected from the weather elements with our new super black chromate finish. Each port is machine threaded to insure a perfect "F" connector fit and then weather sealed.

- Unique *quad* mounted housing
- Sealed die cast housing
- Super black chromate finish
- Machine threaded ports
- Meets all FCC signal leakage rules
- Built, tested and quality assured to work over the full CATV range
- New 400 MHz Bandwidth with low Insertion loss
- 20 units to a master pack

INTERCEPT

We are serious about our passives...that's why we treat them like our actives.

Specifications

HS200

Bandwidth	5-300 MHz
Insertion loss	3.5db max.
Isolation	30db min.
Input match	20db min.
Output return loss	24db min.
Impedance	75 ohms
Connector Type	F61

HS300

Bandwidth	5-300 MHz
Insertion loss	3.5db max.
–at the port indicated	
Insertion loss	7.0db max.
–at two ports indicated	
Isolation	30db min.
Input match	20db min.
Output return loss	24db min.
Impedance	75 ohms
Connector Type	F61

HS400

Bandwidth	5-300 MHz
Insertion loss	7db max.
Isolation	30db min.
Input match	20db min.
Output return loss	24db min.
Impedance	75 ohms
Connector Type	F61

Intercept Corporation, 140 Delawanna Ave., Clifton, New Jersey 07014 Telephone 201-471-2212

People News

★ **Harold Null** has been promoted from Eastern region vice president for engineering to vice president, engineering, for the entire **Storer Cable Communications Division**. He will move to Cable Communications headquarters in Miami in the near future.

Null has been in the cable television industry since its beginning. A native of Tupelo, Mississippi, he began his career in 1955 as an installer-serviceman for Jerrold Electronics in Tupelo. In 1958 he transferred into broadcasting as a technician for station WTWV-TV and its Microwave Service Company in Tupelo. In 1960 he returned to cable television by rejoining the Jerrold Systems, now owned by Comcast Corporation. He served as construction supervisor and systems manager in Tupelo, West Point, and Okolna, Mississippi, and chief engineer in the Sarasota, Florida, system.

When Storer purchased the Sarasota system in 1970, Null was appointed director of engineering. He was named Eastern region engineering vice president in 1977. He has been involved in planning and construction of dozens of new systems in Kentucky, New Jersey, Maryland and Virginia.

Null is a senior member and past president (1979) of the Society of Cable Television Engineers; chairman 1980, SCTE; member of the advisory board for **Communications Engineering Digest**; and member of the Tower Club Southern Cable Television Association.

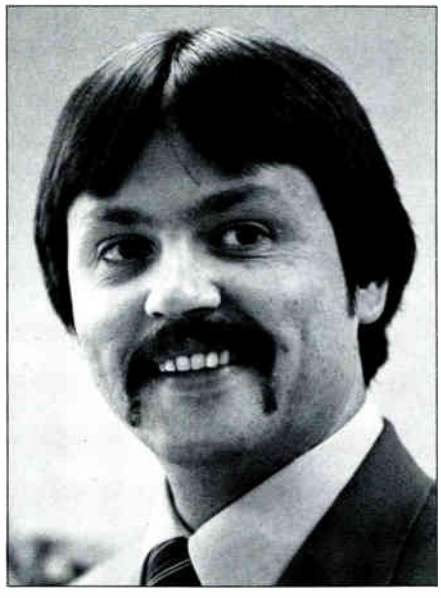
★ **Thomas M. Keenze** has been promoted from manager of engineering to vice president of engineering operations at **United Video, Inc.** Keenze, who joined United Video in 1974, is responsible for the company's 8,000 channel miles of microwave facilities, satellite communications, and research and development activities. Keenze's technological innovations at United Video include full stero FM sound and synthesized stereo for cable systems via satellite.

Thomas M. Keenze

★ **Allen Summers**, manager of **Mickelson Media, Inc.**'s Los Alamos, New Mexico, cable system, has been named corporate engineer effective April 1, 1981. In this newly created position, Summers will be responsible for the evaluation of new products and procedures, maintenance of company-wide technical standards, design and supervision of construction, and assistance with franchising and acquisition efforts.

Summers, 33, came to MMI in 1974 with the purchase of the Taos, New Mexico, cable system. While at Taos, Summers erected the first small-aperature satellite receive station in New Mexico. In 1979, Summers was instrumental in securing the Los Alamos franchise for MMI and, in return, was given the assignment of constructing the 130-mile system. Los Alamos was the first system in New Mexico to offer four tiers of service, including dual pay.

★ **D. Lee Erickson** of Prospect Heights, Illinois, has been named engineering administrator of the cable television division for **Centel Communications**. Erickson will be responsible for providing engineering support to Centel's cable television operations. Erickson most recently was chief engineer for New Trier Cable TV in Wilmette, Illinois. Prior to that, he was system engineer for Liberty TV Cable, Inc., Novato, California, where he was responsible for engineering of the firm's 200-mile system near the San Francisco Bay area and the design and construction of all system expansion and upgrading. Erickson holds a B.S. degree in electrical engineering from the University of California/Berkeley.



D. Lee Erickson

★ **Magnavox CATV Systems, Inc.**, has named **George F. Erhardt** as manager of project engineering. In this capacity, Erhardt will have project responsibility for MAPICS within the manufacturing department and limited run within manufacturing engineering.

George F. Erhardt

Before joining Magnavox CATV, Erhardt served 17 years with various divisions of North American Philips Corporation. He held the position of director of data processing and systems with Herman H. Smith Division, manager of manufacturing engineering with Philips Broadcasting Equipment Division, and electronics engineer with Avion Electronics Division.

Erhardt holds degrees from Hewlett Packard Education Center (automatic test equipment programming), IBM Education Center (programming and engineering), University of Pennsylvania (industrial electronics) and Farleigh-Dickinson University (electronics engineering). He is a member of the Institute of Electrical and Electronics Engineers.

He, his wife Carol and their two children now reside in Manlius, New York.

★ **Signetics Corporation** has named **Robert L. (Bob) Luce** as director, MOS technology development. Luce, whose 21-year career as a research engineer spans high-technology developments from germanium transistors to microprocessors, served as manager of microprocessor development prior to his new assignment. A native of Rochester, Pennsylvania, Luce was graduated from LaSalle College in Philadelphia in 1955 with a B.S. degree in chemical physics. He did graduate work toward a Ph.D. at Penn State before entering the electronics field as a project engineer on germanium high-performance transistors for Philco Corporation in 1959.

★ **John Merrill** has been named as systems engineer at **Entertainment and Sports Programming Network**. Merrill, who began his career as an electronic technician at the Phillips Broadcasting Company, later moved to CBS Laboratories as an engineering aide. He joined NBC in 1968 where he was an engineering supervisor before joining ESPN. Merrill, who has a background in electronic design modifications, will be involved in solving problems relating to equipment design. He will be located in the network's headquarters in Bristol, Connecticut.

Joseph J. Venzlowsky

★ **Joseph J. Venzlowsky**, process center manager, shells, has been promoted to director of manufacturing for **ITT Cannon Electric**, Santa Ana, California. A veteran of 30 years with this division of International Telephone and Telegraph Corporation, Venzlowsky began as a chip separator for Diamond Instrument Company, Salem, Massachusetts, which later was acquired by ITT Cannon. Promoted to production control supervisor in 1955, Venzlowsky was subsequently promoted to manufacturing superintendent for the Salem plant and assistant to the director, manufacturing of the Los Angeles plant.

★ **Terry Ryan** has been appointed manager of engineering for **Communications Construction Group, Inc.** Ryan, formerly the manager of MATV systems for Womatco Home Theatre, STV Subscription Services in New York City, will be responsible for cable television engineering, systems operations and the converter-repair department.

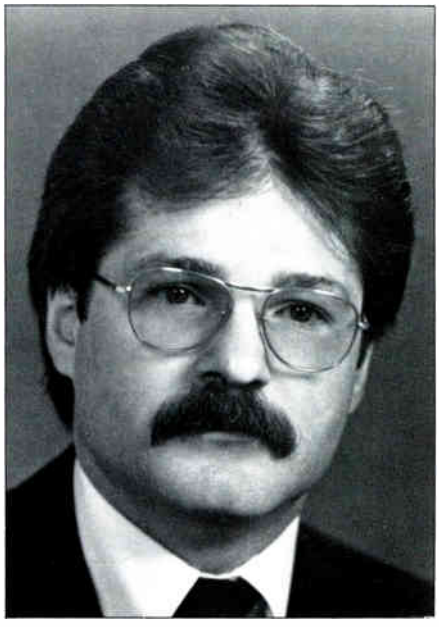
★ **Thomas V. Huet**, who joined Nelson L. Goldberg's Total Communication Systems in 1977, has been named vice president of production and engineering for **Action TV**. Goldberg, whose new regional pay television service will debut in March, announced that Huet will oversee operations of Video Voyager I, the first of several studio-on-wheels units that will be utilized principally for remote broadcast of area sporting events. Huet, a native of Tarentum, Pennsylvania, is a graduate of Penn State. He and his wife, Cheryl, reside in Tarentum.

★ **Fernseh, Inc.**, has named a new president and two new product managers.

William H. Butler will assume the duties of president previously assigned to W. Paul Warnock, who will leave Fernseh, Inc., to pursue other business interests. Prior to his most recent experience as a business management/marketing strategy consultant to electronics firms, Butler served as president of Kasper Instruments, a wholly-owned Cutler-Hammer (now Eaton Corporation) subsidiary which produces electronic component manufacturing equipment. Butler's previous positions include president of CEI, a manufacturer of broadcast television equipment, and general manager of CMX Systems, at that time a joint venture of CBS, Inc., and Memorex Corporation. Butler, who will be relocating to Salt Lake City, holds BSEE and MBA degrees from Stanford University.

Howard McClure, director of product management of Fernseh, Inc., has announced the appointment of **Douglas Harrison** as product manager for digital products. Harrison will be responsible for development and improvement of all digital products including the Compositor I™ graphics system and TDF-2 digital noise filter. Prior to joining Fernseh, Inc., Harrison was employed by Sperry Univac for 11 years where he held various engineering and management positions, most recently as program manager, new products. He holds a BSEE from the University of Utah.

Fernseh, Inc., also named **Edward C. Hippe** as product manager, responsible for the development and improvement of the TCF-3000 Telecine camera system and the company's line of precision color monitors. Hippe has held managerial positions at WLS-TV in Chicago, Illinois, WMAL-TV in Washington, D.C., Warner Cable, Guam Cable Television and most recently as director of engineering at Hubbard Broadcasting, Inc. Hippe is an active member of SMPTE, SBE, The Institute of Electrical and Electronic Engineers and Tau Beta Pi. He holds a Master of Science Degree from the University of Pennsylvania.



Steven Westall

★ **William T. Hanley** has been appointed manufacturing manager for optical fiber and cable of **Times Fiber Communications, Inc.**, a subsidiary of Insilco Corporation. Hanley will be responsible for all production inventory control at TFC. Hanley's previous experience was with the Corning Glass Works, where he spent 14 years in various engineering and production positions. Most recently he was production superintendent at Corning's Greenville, Ohio plant.

Times Fiber has also named **Steven Westall** manager, new business development. Westall will be responsible for assessing technology based opportunities for the Wallingford, Connecticut, firm.

★ **William R. Gangl** has been appointed product manager, modular connecting systems, for **3M's TelComm Products Division**. Previously product supervisor for the division's preconnectorized telephone cable systems, Gangl now has sales responsibility for all modular connecting systems, including MS² brand modular system splicing, MS² preconnectorized cables, MS² pre-term and MS² interface systems. Gangl joined 3M in 1972, from Northwestern Bell Telephone Company.

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WITH INTEGRATED DOWN CONVERTER

by CONIFER®

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This anodized reflector antenna with factory preassembled crystal controlled down converter results in excellent match and a substantial savings in installation labor.

The antenna is available with our standard down converter (MDPA) or with our new high gain, low noise converter (MDPA—LN). See specifications below. You also have a choice of vertical or horizontal polarization.

Microceptor is small and compact...about the size of this page... has low wind resistance and is unobtrusive on the home.

BASIC SPECIFICATIONS		
	MDPA	MDPA-LN
Antenna Gain	15dBi	15dBi
Antenna VSWR	1.1:1 max.	1.1:1 max.
Converter Gain	22.5dB typical	32dB typical
Converter Noise Fig.	4.2dB typical	2.5dB typical

THE ORIGINAL PARACEPTOR™*

America's most copied MDS antenna. Available with 18dBi gain or 21dBi gain. Preassembled and weatherproofed. Unique design has greater signal capture area.

CONIFER'S DOWN CONVERTER

Crystal controlled and designed for use with Paraceptor or other MDS antennas. Proven reliable in tens of thousands of installations. 100% tested. Competitively priced. Choice of standard or high gain, low noise models.

*Patents Pending

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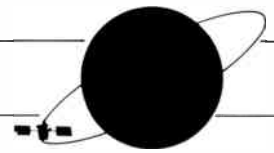
In Orbit



Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
CBN		24 hrs	None	F1,#8
CNN		24 hrs.	None	F1, #14
C-SPAN	Weekdays	12:00 p.m./6:30 p.m.	195°/1#	F1,#9
ESPN		24 hrs	None	F1,#7
Front Row		2:30 p.m./2:30 a.m.	481°/#	F1, #12 (E,C) F1, #10 (P,M)
HBO			Program	F1,#24
	March 1	3:30 p.m. 1:37 a.m.	729°/#	F1,#22
	March 2	5:30 p.m. 2:30 a.m.	Scramble	F1,#23
	March 3	5:00 p.m. 3:14 a.m.	835°/#	F1,#20
	March 4	6:00 p.m. 2:15 a.m.	Duplication	
	March 5	5:00 p.m. 2:55 a.m.	940°/#	
	March 6	5:00 p.m. 4:12 a.m.	Take-2 E	
	March 7	3:30 p.m. 3:56 a.m.	592°/#	
	March 8	2:00 p.m. 2:28 a.m.	Take 2 W	
	March 9	5:30 p.m. 2:10 a.m.	681°/#	
	March 10	5:30 p.m. 1:56 a.m.		
	March 11	5:30 p.m. 2:14 a.m.		
	March 12	5:30 p.m. 2:17 a.m.		
	March 13	5:00 p.m. 4:58 a.m.		
	March 14	3:30 p.m. 4:00 a.m.		
	March 15	3:00 p.m. 3:27 a.m.		
	March 16	5:30 p.m. 2:45 a.m.		
	March 17	5:00 p.m. 2:15 a.m.		
	March 18	5:30 p.m. 3:30 a.m.		
	March 19	5:00 p.m. 2:31 a.m.		
	March 20	5:30 p.m. 3:30 a.m.		
	March 21	2:30 p.m. 2:42 a.m.		
	March 22	3:30 p.m. 2:16 a.m.		
	March 23	5:30 p.m. 3:12 a.m.		
	March 24	5:00 p.m. 2:46 a.m.		
	March 25	6:00 p.m. 3:22 a.m.		
	March 26	6:00 p.m. 3:00 a.m.		
	March 27	5:30 p.m. 4:26 a.m.		
	March 28	3:00 p.m. 3:43 a.m.		
	March 29	3:00 p.m. 2:30 a.m.		
	March 30	5:00 p.m. 2:46 a.m.		
	March 31	5:00 p.m. 2:09 a.m.		
HTN		8:00 p.m./10(11:00) p.m.	517°/#	F1,#21
KFIX		2-4 hrs./day	None	F1,#1
KTVU			None	F1,#1
	Weekdays	7:00 a.m./1:00 a.m.		
	Weekends	7:00 a.m./4:00 a.m.		
Modern Talking Pictures			243°/#	F1,#22
	Weekdays	12:00 p.m./5:00 p.m.		
	Weekends	7:00 a.m./12:00 p.m.		
The Movie Channel		24 hrs.	None	F1,#5 (E,C) F1,#11 (M,P)
Newstime		24 hrs.	276°/#	F1,#6
PTL		24 hrs.	None	F1,#2
Reuters	Weekdays	4:00 a.m./7:00 p.m.	None	F1,#18

Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
Showtime			Program	F1,#12 (E,C)
	March 1	8:00 a.m. 2:00 a.m.	576°/#	F1,#10 (M,P)
	March 2	3:30 p.m. 2:50 a.m.	Scramble	
	March 3	3:30 p.m. 3:25 a.m.	679°/#	
	March 4	3:30 p.m. 3:37 a.m.	Off-line	
	March 5	3:30 p.m. 2:45 a.m.	753°/#	
	March 6	3:30 p.m. 7:56 a.m.	Access	
	March 7	8:00 a.m. 7:45 a.m.	843°/#	
	March 8	8:30 a.m. 2:24 a.m.		
	March 9	3:30 p.m. 3:15 a.m.		
	March 10	3:30 p.m. 3:03 a.m.		
	March 11	3:30 p.m. 3:21 a.m.		
	March 12	3:30 p.m. 2:45 a.m.		
	March 13	3:30 p.m. 6:30 a.m.		
	March 14	7:00 a.m. 7:30 a.m.		
	March 15	8:00 a.m. 2:45 a.m.		
	March 16	3:00 p.m. 2:52 a.m.		
	March 17	3:30 p.m. 2:45 a.m.		
	March 18	3:30 p.m. 3:00 a.m.		
	March 19	3:30 p.m. 2:26 a.m.		
	March 20	3:30 p.m. 8:00 a.m.		
	March 21	8:00 a.m. 7:08 a.m.		
	March 22	3:30 p.m. 2:30 a.m.		
	March 23	3:30 p.m. 2:55 a.m.		
	March 24	3:30 p.m. 2:35 a.m.		
	March 25	3:30 p.m. 3:26 a.m.		
	March 26	3:30 p.m. 3:26 a.m.		
	March 27	3:30 p.m. 6:30 a.m.		
	March 28	7:00 a.m. 5:26 a.m.		
	March 29	3:30 p.m. 2:52 a.m.		
	March 30	3:30 p.m. 3:50 a.m.		
	March 31	3:30 p.m. 3:26 a.m.		
SIN		24 hrs	None	Westar III, #8
Trinity (KTBN)		24 hrs	None	F1,#13
USA Network				F1,#9

Off-times are listed below. For on-times, see notes below.

March 1	2:00 a.m.	March 17	3:00 a.m.
March 2	3:00 a.m.	March 18	1:30 a.m.
March 3	3:00 a.m.	March 19	1:30 a.m.
March 4	1:30 a.m.	March 20	1:00 a.m.
March 5	1:30 a.m.	March 21	12:30 a.m.
March 6	2:00 a.m.	March 22	3:00 a.m.
March 7	3:00 a.m.	March 23	1:30 a.m.
March 8	3:00 a.m.	March 24	1:00 a.m.
March 9	2:00 a.m.	March 25	3:30 a.m.
March 10	3:00 a.m.	March 26	1:30 a.m.
March 11	3:30 a.m.	March 27	2:30 a.m.
March 12	1:30 a.m.	March 28	2:30 a.m.
March 13	1:00 a.m.	March 29	2:00 a.m.
March 14	2:00 a.m.	March 30	2:00 a.m.
March 15	3:00 a.m.	March 31	2:00 a.m.
March 16	1:30 a.m.		

USA Network. On-time is 7:30 p.m. except on the following days: March 1: 7:00 p.m.; March 7: 5:00 p.m.; March 8: 4:00 p.m.; March 14: 5:00 p.m.; March 15: 3:00 p.m.; March 21: 5:00 p.m.; March 22: 7:00 p.m.; March 28: 5:00 p.m.; March 29: 2:00 p.m.

Calliope. Saturdays: 10:00 a.m. to 1:00 p.m. Weekdays: 6:30 p.m. to 7:30 p.m.

The English Channel. Sundays: March 1, 11:30 p.m. to 1:30 a.m.; March 8, 10:30 p.m. to 12:30 a.m.; March 15: 10:00 p.m. to 12:00 a.m.; March 22, 10:30 p.m. to 12:30 a.m.; March 29, 9:30 p.m. to 11:30 p.m. Tuesdays: 11:00 p.m. to 1:00 a.m., except on the following dates: March 17, 10:30 p.m. to 12:30 a.m.; March 24, 10:00 p.m. to 12:00 a.m.; and March 31, 10:00 p.m. to 12:00 a.m. Saturdays: 1:00 p.m. to 5:00 p.m.

WGN	Mon.-Thurs. Weekends	5:42 a.m./3(3:30) a.m. Ends 3:00 a.m. on Sun	None	F1,#3
WOR		24 hrs.	None	F1,#17

E = eastern M= mountain
C = central P = pacific

All program times are listed for the eastern time zone, unless otherwise noted.

The Eagle 500 MHz Tap True Performance...

Under The Toughest Conditions.

Designing innovative products that perform beyond the competition is fast becoming tradition at Eagle. Innovation in our tap starts on the inside with true performance to 500 and beyond. Our tap's insertion loss is lowest in the industry and R.F.I. far exceeds F.C.C. specifications. You'll also find our [illegible] seizure screw is [illegible] to prevent pull out or other damage to electronic components. Plus, the Eagle Tap is easily adjustable for either aerial or pedestal mounting.

Outside, the Eagle 500 MHz tap is built tough to protect against the harshest elements. Our exterior hardware has a sandbonded finish and our die cast housing is available with either a clear iridite coating or E finish with our exclusive brass F-connectors for severe conditions like salt spray, industrial pollution or other highly corrosive elements.

COMPARE FEATURES

- **True performance to 500 MHz and beyond**
- **R.F.I. far exceeds F.C.C. specifications**
- **Lowest insertion loss in the industry**
- **Highest quality corrosion resistant aluminum alloy**
- **Moisture seal gasket**
- **Easily adjusted for aerial or pedestal mounting**
- **Sealed F-ports available in either machine threaded aluminum alloy or brass**
- **Modular design**
- **Available with either clear iridite or E coating**
- **Sand bonded finish hardware**
- **Ports are numbered for easy system audit**

The Eagle 500 MHz tap, built for true performance under the toughest conditions ... inside and out.

COMPARE EAGLE'S ELECTRICAL SPECIFICATIONS WITH THOSE OF OTHER MANUFACTURERS

VALUE	8	11	14	17	20	23	26	29	32	35
MODEL	EC4-408	EC4-411	EC4-414	EC4-417	EC4-420	EC4-423	EC4-426	EC4-429	EC4-432	EC4-435
COLOR CODE	orange	gold	white	black	green	purple	yellow	red	silver	blue
TAP LOSS										
INSERTION LOSS										
5 MHz		2.2	1.2	.5	.4	.3	.2	.2	.2	.2
300 MHz		2.7	1.4	.7	.5	.4	.3	.3	.3	.3
400 MHz		3.1	1.6	.8	.6	.5	.3	.3	.3	.3
450 MHz		3.2	1.7	.9	.7	.6	.4	.4	.4	.4
500 MHz		4.5	2.0	1.1	1.0	.9	.7	.7	.7	.7
ISOLATION - out to tap										
5 MHz		30	32	34	40	43	46	49	52	55
300 MHz		30	32	34	38	41	44	47	50	53
400 MHz		28	30	32	35	38	41	44	47	50
450 MHz		25	27	29	32	35	38	41	44	47
Tap to Tap 5-400 MHz 30DB Min.										
RETURN LOSS - In Out Tap 5-400 MHz 20DB Min.										

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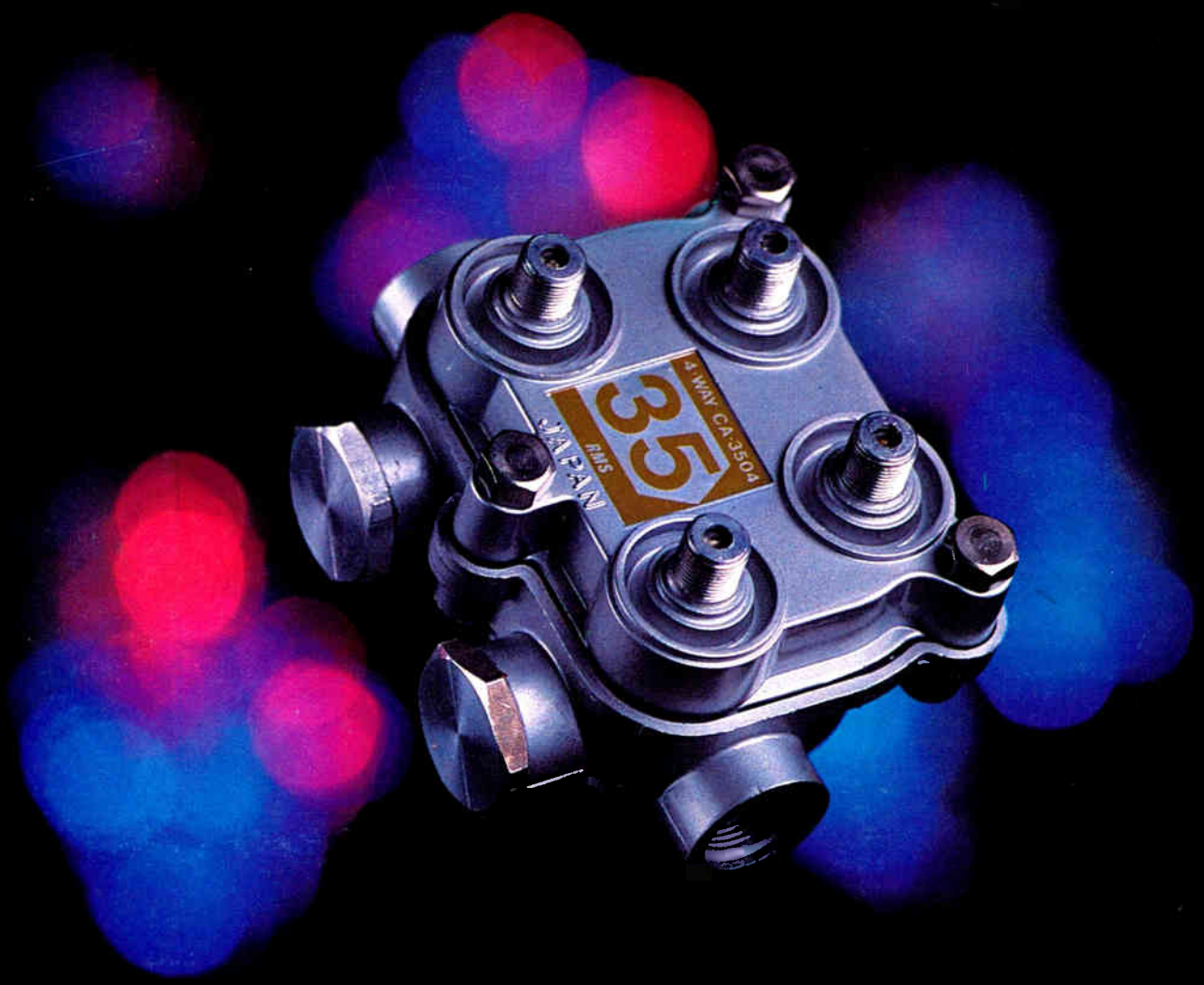

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