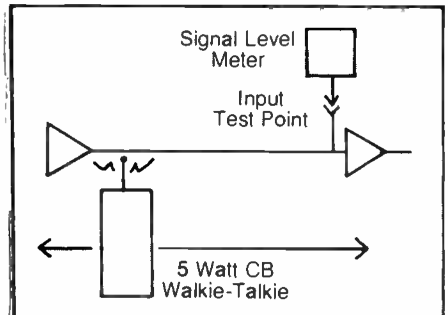
MHz should not cause interference to downstream signals.

If you experience this sort of interference, determine the probable area of CB signal penetration by analyzing service complaints, and then find the leak. The following method of leak location has yielded good results to date.

Using a signal level meter tuned to 27 MHz, and connected to the amplifier input test point (Figure 1), slowly proceed along the amplifier span intermittently keying with the test transmitter. Walkie-talkie's are being used for communications between personnel. The meter should peak sharply when the test transmitter passes under the leak. If you do not find the leak at first, be persistent.



EQUIPMENT SET-UP, FIGURE 1

Replace defective equipment with new RFI shielded equipment, utilizing RFI sleeve style connectors. Grounding of equipment housings works only occasionally because the standard 18 foot vertical ground is nearly a perfect half-wave stub at 27 MHz, transforming the low impedance of the ground, to a high impedance at the equipment housing.

If the CB transmitter radiates strong harmonic signals at 54 and 81 MHz, interference may be caused to low band channels even when proper trunk isolation exists. In these cases, *locate the CB operator and persuade him to fit a harmonic filter to his transmitter.* (Available from GC Electronics, Part number S2158GC.) *Threaten to call the FCC if he doesn't cooperate.*

CB Signals Penetrating Drops and Feeder Lines

This type of interference will appear on most television channels as the result of TV tuner overload, but will be localized to one feeder line or a few drops in the vicinity of an illegal CB operator.

The 27 MHz CB signal may be removed adequately in many cases by installing a filtered matching transformer in the drop. For example, the RMS CA-2600F has a high pass filter that offers up to 30 dB of rejection to 27 MHz signals. The filtered matching transformer will not block harmonics of 27 MHz effectively. Again, the best solution is to *convince the offending CB operator to fit a harmonic filter to his rig.*

CB Signals Penetrating The TV Set

These cases of interference are usually localized to one apartment building, neighborhood or trailor court. Disruption of most channels is caused by TV tuner overload.

If a filtered matching transformer does not remove the interference, modification of the TV set may be necessary. High pass filters that connect directly to the TV set tuner are widely available at low prices and can be installed by TV service representatives.

In some instances, two or more isolated cases of CB interference may give the appearance of a trunk ingress problem. The intermittent nature of the interference may compound the problem of identifying the type of interference.

If a careful analysis of service complaints gives no clue, first try issuing filtered matching transformers to subscribers who complain of interference. Instruct them to call back if the problem persists. If the filtered matching transformers have no corrective impact, the problem may well be a leak in the main trunk.

Mr. Delmer Ports
Vice President, Engineering
National Cable Television Assoc.
918 16th Street, N.W.
Washington, D.C. 20006

Dear Delmer:

I had a chance to read your article on CB interference in the April issue of "Communications/Engineering Digest," *and found it very interesting.*

I thought you might be interested in a copy of a memorandum on the same subject which was circulated within TeleCable. The leak detection scheme is quasi-illegal but it seems to work well. Also, the information on availability of hi-pass filters for TV sets might prove useful to some operators.

Very truly yours,

TELECABLE CORPORATION
N. E. Worth
Director of Engineering

TELECABLE Shares A Solution to CBI Interference

DATE: April 22, 1976

TO: All Chief Technicians, Bill Gillespie

FROM: N. E. Worth, Director of Engineering

SUBJ: CB INTERFERENCE

The recent increase in the number of Citizen's Band Radio Service Operators and the proliferation of illegal CB transmitters has caused a sizable RFI (radio frequency interference) problem to both off-air and cable reception of television pictures. The interference generally manifests itself as intermittent wiggling lines in the pictures and occasionally audible voice interference to the sound channel.

CB transmitters operate in the 26.96-27.23 MHz region of the radio frequency spectrum with single sideband emission and a maximum peak envelope power of 12 watts. However, CB transmitters equipped with illegal linear power amplifiers may emit several hundred watts of power with a strong harmonic content that tapers off with an increase in frequency. (See Table 1.)

2nd Harmonic	54 MHz
3rd Harmonic	81 MHz
4th Harmonic	108 MHz
5th Harmonic	135 MHz
6th Harmonic	162 MHz
7th Harmonic	189 MHz

Table 1

There are several ways in which CB transmission may impair reception of TV pictures or sound in a cable system. Listed below are causes, symptoms and cures for three common interference mechanisms.

CB Signals Penetrating The Main Trunk

A strong CB signal in the near vicinity of the trunk cable may penetrate the system and cause overload of trunk amplifiers, affecting most channels. In this case the interference will not be localized to one neighborhood but will be present all along the downstream trunk. For this type of interference to occur, there must be a leaky fitting, equipment enclosure or cable sheath break.

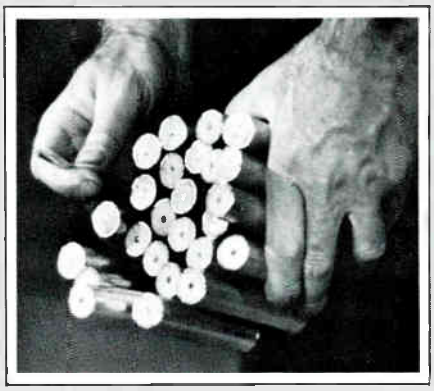
A CB transmitting antenna located 25 to 50 feet from the cable and radiating several hundred watts of power could produce an electric field intensity at the outside of the cable which would correspond to a signal level of up to +80 dBmV to +90 dBmV. However, an equipment housing with good connectors should have an isolation of at least 90 dB unless a leak exists. The penetrating signal entering the cable should be at most, 0 dBmV. An 0 dBmV signal at 27

How Teleprompter's Fiber Optics System Works

Last week Teleprompter mace history by bringing fiber optics out of the lab and into a working system. The actual operating run is 250 meters and is being used to transport HBO signals from the microwave receiver site to the headend in Manhattan, NYC.

The optical fiber being used represents a cooperative effort between Fiber Communication Co., who produce the fiber, and Belden, who package six fibers in one jacket. Fiber cables so packaged are the size of a piece of RG 59 drop cord, however. each fiber is capable of 1 GHz bandwidth. The loss of the fiber is 10 dB per kilometer. Comparing this to conventional coax, the six-fiber cable could replace 20 coax cables. In addition, the loss of the coax would be four times greater than the fibers.

The transmitters and receivers are not yet capable of using any significant portion of the bandwidth available, but rapid advances are being made almost daily. The present TPT system is using LED's made by Bell Northern that will work to 20 MHz. RCA has just announced devices that will work to 200 MHz, so wideband, multi-channel use of the fiber is just around the corner.



The six strand optical fiber cable can replace up to 20 conventional coax cables.

The TPT system, as it is working today is passing a 4.5 MHz video channel plus sound. The light transmitter electronics are made by Bell Northern and consist of a bias source for the LED, and an amplifier.

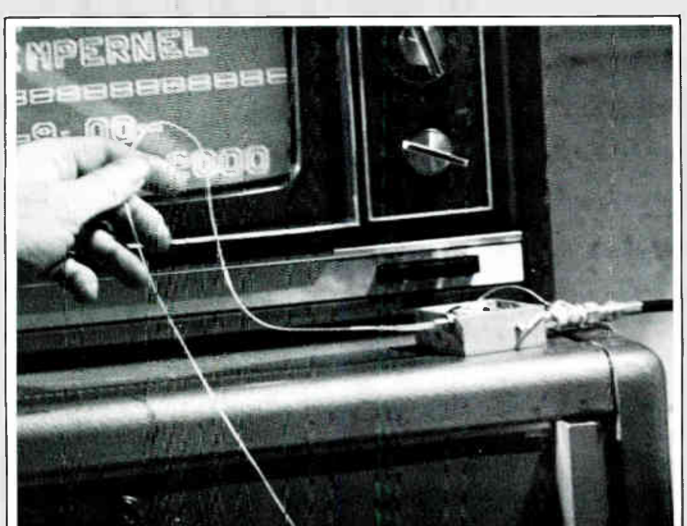
The receiver (pictured) uses a P.I.N. diode as the photo sensitive device and is built into a little box that includes the bias source and a video amplifier.

The system works single channel with a 57 dB signal-to-noise ratio. TPT plans to add T channels beginning with T-7 (5.75 to 11.75 MHz). The present electronics should be capable of passing up to four complete TV signals.

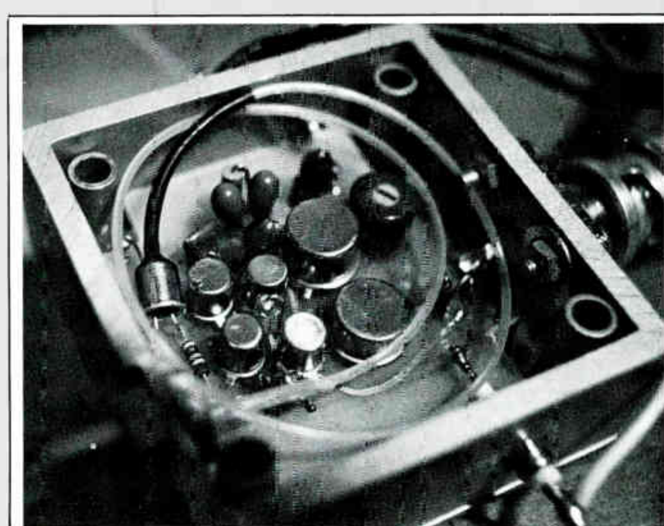
TPT projects that with design advances in the LED's and P.I.N. diodes, full-channel fiber optic cable is just around the corner. They also feel that the full bandwidth of the fiber cannot be explored until digital TV signals are used. Fortunately parallel advances in inexpensive digitizing techniques for TV pictures are also being made.

The promise and potential of fiber optic cable was best summarized by Bill Bresnan, president of Teleprompter Cable, when he said, "Fiber optics is a promising technology that has developed much faster than expected. The necessary components are now available to construct OF trunkline transmission systems. OF offers many advantages over conventional coax: bandwidth, low attenuation, no equalization, elimination of leakage and ingress, moisture resistance and others. When suppliers reach mature manufacturing potential, fiber optical systems will cost less to build than coax, and will be better.

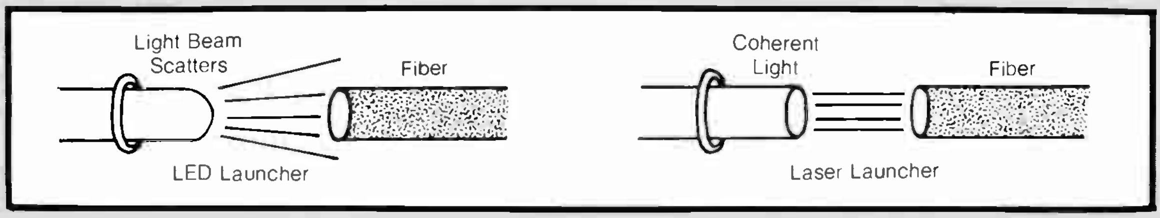
It is an important cable industry move to develop this technology and use it."□



A single fiber sheathed in a plastic tube is shown connected to the Bell Northern receiver in the Teleprompter installation.



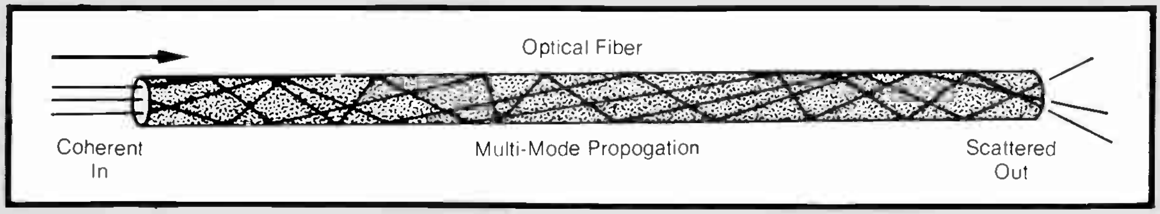
Inside the Bell Northern receiver, the P.I.N. diode can be seen connected to the end of the optical fiber with the video amplifier included in the same housing.



Efficiency of Launcher (Source)

Fiber

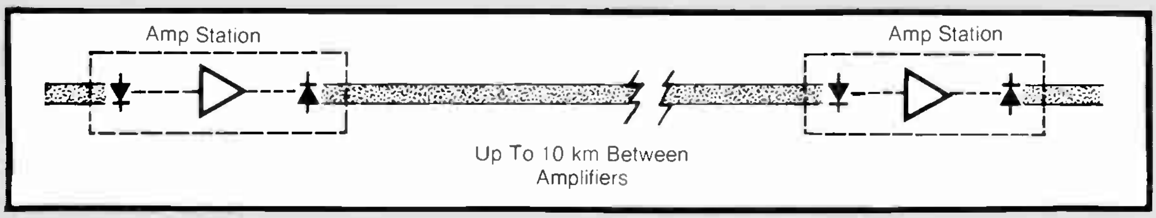
The actual fiber passes the light "signal" with three major constraints. Light will be attenuated in the fiber due to internal impurities, material scattering losses, and waveguide defects. As the light travels through the fiber, it will take many different paths, literally rattling around inside until it comes out the other end. Because of these different paths, a single pulse at the input may arrive as a series of pulses at the other end. This effect limits the maximum length and high frequency limits of the fiber. Newer graded index fibers, however, are capable of hundreds of megahertz of bandwidth and losses as low as 2 dB/kilometer.



Path of Light Through Fiber

Detector

The detector most commonly used is a P.I.N. Diode. This is a light sensitive diode capable of very high speeds. The P.I.N. requires about 50 volts of bias to be sensitive in high frequency ranges. Normally, an amplifier is also considered to be a part of the detector to make up for the optical fiber losses and bring the signal back up to a useable level.



Typical Cable System Using Fiber Optics

Cable Systems

Once the sources and detectors are capable of operating up to 250 MHz or more, building a cable system with optical fibers will be quite simple. Conventional amplifiers as we know them will be replaced with similar looking amps containing a detector at the input and a source at the output. The same 20 dB of amplification will be required. Equalization can be eliminated since the fiber passes all signals with constant attenuation across the frequency range. AGC stations can also be done away with since the fiber does not change with temperature.

Since the fiber loss is significantly less than coax; between 10 and 2 dB per kilometer, amplifier 20 dB spacing will be much greater. The same 40 cascaded amplifiers that today give you a maximum range of 15 km could cover as much as 400 km (using 2 dB per km fiber).

Optical fibers also have other advantages. The size of the cable is much smaller. The cable is not as fragile as coax. Problems from ingress and cable leakage will be non-existent.

Summary

Fiber optics is the sleeping giant. It is no longer a "blue sky" proposition. The technology is rapidly advancing and within the next year we will see wideband systems operating in the field.

Fiber Optics-How It Works

By Cliff Schrock
Technical Editor

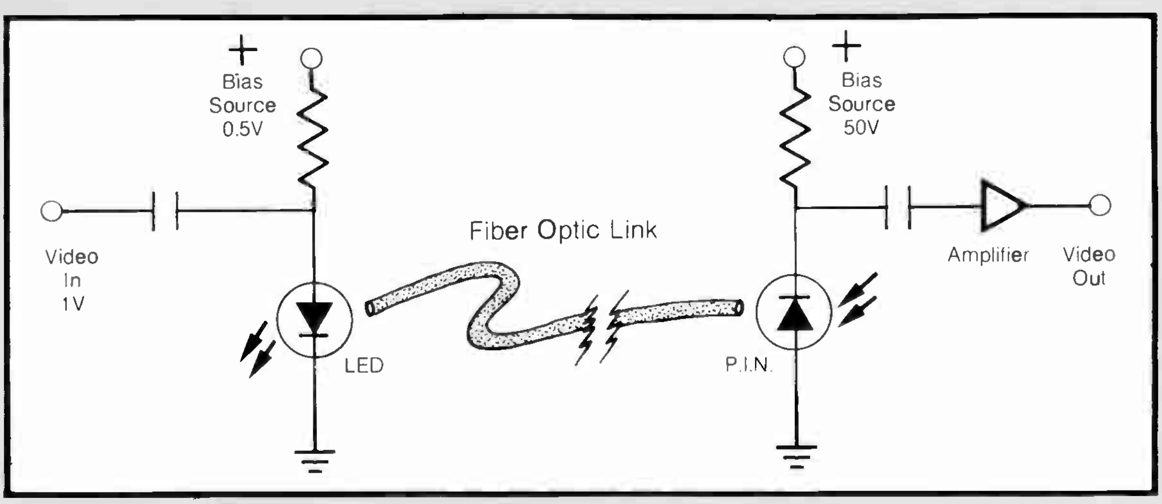
The neat thing about technology today is the way we keep turning Jules Verne stories into reality. I mean, . . . I have a rough time with coax, and television (where are the little men?) and now this guy (Bresnan of Teleprompter) walks up to me with a piece of blond hair that he says is "glass," and says he's going to put a TV picture down this "hair." Actually, he could put 33 TV pictures (200 MHz worth) down it today and thousands tomorrow when they start making better Light Emitting Diodes. And I'm standing there with my mouth open thinkin' "Yep . . . uh huh . . . here we go again!"

Concept

Fiber optics is conceptually simple. You take a light (source), "squirt" it down a glass pipe (optical fiber), and detect it at the other end with a photo-cell type device (detector). If the light source is modulated with voice or a TV signal, the signal will pass through the system and come out through the detector.

Present technology has fiber optic systems operating to 20 MHz, although experimental devices are operating up to 200 MHz. The light fibers are improving almost daily. Two years ago 20 dB of loss (light attenuation) per kilometer was pretty good, now you can buy 2 dB per kilometer fibers.

While there is black magic involved in the production of the fiber, the sources, and the detectors, there is nothing complex about the concept of fiber optics.



Simplified Fiber Optic System

Source

The light source is typically a LED (like those little red lights in your digital watch or calculator) or the source can be a solid state LASER. Don't let the word LASER excite you since the ones we're talking about for fiber optics don't look much different from a LED. To modulate either the LED or LASER, the devices have to be biased until they light (typically ½ volt for the LED), then the signal is coupled to the device to cause the intensity to flicker with the modulation.

A difficult problem of today is coupling the light source into the cable. The LED produces a directional light, but much light still will miss the cable. The solid state LASER's are excellent since they produce coherent light that can be aimed directly and launched into the light fiber.

Therefore,

$G_{(1)33'} = 54$ dB

$G_{(2)51'} = 57$ dB

$G_{(3)100'} = 62.3$ dB

$G_{(4)33'} = 54$ dB

and $G(\theta_i)$ = transmit gain, off beam, for unwanted earth stations

$= 32 - 25 \log \theta_i$

where $\theta_{1,2} = 3°$

where $\theta_{3,4} = 6°$

P_i = polarization discrimination factor for the i^{th} satellite system with reference to the wanted satellite system. (This is a representation of the co-polarization and cross-polarization signals. The cross-polarization factor for a satellite system, being interfered with by an RCA or ATT system, will be adopted as 7 dB and will apply for both uplink and downlink calculations.)

Therefore:

$$(C/I)_U = 83 - \left[(83 - 54 + 32 - 25 \log 3) \boxplus (83 - 57 + 32 - 25 \log 3) \boxplus (90.6 - 62.3 + 32 - 25 \log 6 - 7) \boxplus (85 - 54 + 32 - 25 \log 6 - 7)\right]$$

$= 32$

and $(C/I)_D$ = wanted satellite power radiated in direction of wanted earth station - unwanted satellite power radiated in direction of wanted earth station.

Therefore, wanted satellite radiated power.

$$C_D = EIRP_{SAT} - L_{FSD} + G_{ES}$$

and unwanted satellite radiated power

$$I_D = \sum_{i=5}^{8} \left[EIRP_{SAT_i} - L_{FSD_i} + G_{ES}(\theta_i) + P_i\right]$$

Since the downlink free space path loss is the same for wanted and unwanted signals, it may be dropped from the equation. Therefore:

$$(C/I)_D = EIRP_{SAT} + G_{ES} - \sum_{i=5}^{8} \left[EIRP_{SAT_i} + G_{ES}(\theta_i) + P_i\right]$$

where

$EIRP_{SAT}$ = 33 dBW

G_{ES} = 43.5 dB for 4.5 meter dish

and

$EIRP_{SAT_i}$ = EIRP of unwanted satellites

= 33 dBW for all satellites

$G_{ES}(\theta_i)$ = gain of 4.5 meter antenna at θ_i angles off axis

$$(C/I)_D = 33 + 43.5 - \left[(33 + 32 - 25 \log 3) \boxplus (33 + 32 - 25 \log 3) \boxplus (33 + 32 - 25 \log 6 - 7) \boxplus (33 + 32 - 25 \log 6 - 7)\right]$$

$= 20.3$

and

$(C/I)_{SE} = (C/I)_U \boxplus (C/I)_D$

$= 32 \boxplus 20.3$

$= 20.1$

Now we must consider the internal effects of cross-transponder interference due to frequency allocations, carriers near transponder edges, and other conditions within the satellite. Assuming a typical model for a non-reuse satellite:

$(C/I)_{SI} = 35$

We must also consider the effects of other external signals, such as terrestrial links and local propagation. Let us assume an average location where:

$(C/I)_{OE} = 23$

Therefore:

$C/N_{total} = C/N_{TU} \boxplus C/N_{TD} \boxplus (C/I)_{SE} \boxplus (C/I)_{SI} \boxplus (C/I)_{OE}$

$= 30 \boxplus 13.1 \boxplus 20.1 \boxplus 35 \boxplus 23$

$= 11.9.$

This is approximately 2 dB above threshold and is considered an acceptable operating condition.

Now Sp-p/Nrms for the video signal, including the effect of the audio subcarrier, may be calculated for this model

$$S_{p-p}/N_{rms} = C/N_{total} + 20 \log \frac{\Delta f_V}{f_{VM}}$$

$$= 10 \log \frac{B}{f_{VM}} + 10 \log 6 + EW$$

$$= 11.9 + 20 \log \frac{10.5}{4.2} + 10 \log \frac{36}{4.2} + 7.78 + 13$$

$= 50$ dB

and S/N (audio, unweighted)

$$= (C/T) + 10 \log \frac{3}{4}\left[\frac{X^2 \Delta f_{SC}^2}{f_A^3 f_{SC}^2}\right] - K + EA$$

where $C/T = C/N + K + 10 \log B = -141.1$ dBW/°K

Therefore:

S/N (audio) unweighted

$$= -141.1 + 10 \log \frac{3}{4}\left[\frac{(6 \times 10^5)^2 (7.5 \times 10^4)^2}{(1.5 \times 10^4)^3 (6.8 \times 10^6)^2}\right] + 228.6 + 13.2$$

$= 50.6$ dB.

The effect of rain attenuation was not considered in the above analysis since it varies with the location of the earth station. For example, a 4 GHz receiving earth station in the southeastern U.S. with 30° antenna elevation, requiring acceptable operation 99.9% of the time per year, will have a rain attenuation of 0.32 dB (CCIR report 208-2, 1970). The 4.5 meter TVRO station used in the interference model has adequate system margin for operation in this worst-case area in the U.S.

* $\boxplus$ represents a power addition.

Editors note:

There are basically two main arguments that can be leveled against the use of the small earth station terminal. The first is acceptable signal to noise ratio, and the second is side lobe suppression or the ability for the receive antenna to separate the intended signal from an adjacent satellite (carrier to interference ratio).

The use of low noise preamplifiers and other receiver techniques have proven that the signal to noise ratio problem can be overcome. The author of this paper Jack Golin provides a discussion of the interference problem of small earth station antennas and proves that the small antenna will also provide satisfactory interference rejection.

Multiple Satellite Interference Analysis

For 4.5 Meter TVRO Earth Station

By Jack Golin
ITT Space Communications
Ramsey, New Jersey

The hypothetical model used in this analysis is for five satellites, spaced 3° apart, in orbit over Conus, and their associated ground stations. Interference with the performance of a 4.5 meter TVRO earth station receiving TV from an HS-333 type satellite, within the model, will be analyzed. The interfering systems are an HS-333 satellite at +3° operating with a 51 foot earth station, an HS-333 satellite at -3° operating with a 33 foot earth station, an ATT (reuse) satellite at -6° operating with a 100 foot earth station, and an RCA (reuse) satellite at +6° operating with a 33 foot earth station (see figure).

Link Calculation for 4.5 Meter TVRO Earth Station

HS-333 Satellite Parameters

EIRP at saturation (beam edge)	33 dBW
G/T_{SAT} at beam edge	-6 dB/°K
Flux density for saturation at beam edge (Ψ)	-80 dBW/m^2

Earth Station Parameters (4.5 m Antenna at 30° elevation)

G_A	43.5 dB	T_{LNA}	90°K
T_A	25°K	G/T_{ES}	22.8 dB

Link Parameters

Downlink free space path loss (L_{FSD})	196.2 dB
Downlink atmospheric attenuation (L_{AD})	0.1 dB
Satellite transmit advantage (P_{AD})	0.6 dB
Effective area of isotropic antenna (A_i)	-37 dB (m^2)

TV Parameters

Peak video deviation (Δf_V)	10.5 MHz
Top video baseband frequency (f_{VM})	4.2 MHz
Video emphasis and weighting improvement (525 line) (EW)	13 dB
Subcarrier frequency (f_{SC})	6.8 MHz
Peak subcarrier deviation (Δf_{SC})	75 kHz
Deviation of carrier by subcarrier (χ)	0.6 MHz
Top audio baseband frequency (f_A)	15 kHz
Audio emphasis improvement (E_A)	13.2 dB
Boltzmann's constant (K)	-228.6 dBW/°K/Hz

C/N Thermal

The 4.5 meter TVRO system uses a full satellite transponder to receive video and audio subcarrier signals. A 36 MHz noise bandwidth will be used for this calculation.

C/N Thermal, Uplink:

$$C/N_{TU} = \Psi + A_i + G/T_{SAT} - K - 10\log B$$
$$= -80 - 37 - 6 + 228.6 - 75.6$$
$$= 30$$

C/N Thermal, Downlink:

$$C/N_{TD} = EIRP_{SAT} + P_{AD} - L_{FSC} - L_{AD} + G/T_{ES} - K - 10\log B$$
$$= 33 + 0.6 - 196.2 - 0.1 + 22.8 + 228.6 - 75.6$$
$$= 13.1$$

Carrier to Intermodulation

Since there is only one carrier transmitted, there is no intermodulation produced in the satellite transponder.

We must now consider the effect on C/N due to the interference caused by the surrounding satellite systems (C/ISE) is expressed as:

$$^*C/I_{SE} = (C/I)_U \boxplus (C/I)_D.$$

$(C/I)_U$ = wanted power illuminating the wanted satellite minus unwanted power illuminating wanted satellite (assuming similar atmospheric conditions for all ground stations)

Therefore, wanted uplink power

$$C_U = \Psi + A_i + G_{SAT}$$
$$= EIRP_{ES} - L_{FSU} + G_{SAT}$$

and the unwanted uplink power

$$I_U = \sum_{i=1}^{4}\left[EIRP_i - G_i + G(\Theta_i) - L_{FSU_i} + G_{SAT_i} + P_i\right]$$

Since the uplink free space loss and satellite gain are the same for the wanted and unwanted signals, they may be dropped from the equations. Thus,

$$(C/I)_U = EIRP_{ES} - \sum_{i=1}^{4}\left[EIRP_i - G_i + G(\theta_i) + P_i\right]$$

Where $EIRP_{ES}$ = 83 dBW

$EIRP_i$ = EIRP of unwanted transmitting earth station

Therefore,

$EIRP_{(1,2)ES}$ = 83 dBW

$EIRP_{(3)ES}$ = 90.6 dBW

$EIRP_{(4)ES}$ = 85 dBW

and G_i = transmit gain, on axis, for unwanted earth station

NOLOGY CONFERENCE

of the people attending the meeting, the information provided was fascinating with regard to the importance of rain drops in the field of satellite communications. (Knowing about, and really understanding the importance of rainfall, separates the men from the boys with regard to the homemade versus professionally manufactured, large versus small antenna controversy.) Seasons and solar cycles; diurnal variation of electron content at spring equinox; and OGUCHIS RESULT, which is pronounced like the famous shoe, were discussed. It is obvious that S/A knows what it's talking about in ground station technology and nires some brilliant talents.

One interesting solution to the problem of cable operators losing something like two minutes a year in satellite transmission—once in spring and once in fall (when the earth, the "bird" and the sun are lined up exactly in front of each other) was suggested by Hub Schlafly. Start a pool for subscribers to guess the exact time of day when the event will happen and present the winning subscriber with some valuable prize.

Sidney Topol, president of S/A, spoke at the luncheon and provided a history of the company's commitment and involvement to the communications industry and specifically to cable television. Topol outlined the beginnings of S/A and introduced Glenn Robinson, Chairman of the Board of S/A, one of the six Georgia Tech professors who started the firm.

When the sessions resumed, *Structural Design* was addressed by Fred Fonda, Manager, Structural Engineering. Jim Cook, Manager of the Antenna & Microwave Product Line, SATCOM Division, presented a paper on *Adjacent Channel Interference and Cross Polarization Discrimination.* co-polarization and cross-polarization were defined, FDM-FM carrier power spectrum, and equations on polarization at various typical sites were discussed.

E. M. Bennett, Consulting Structural Engineer with Bennett and Pless, Inc., spoke on the subject of ground station foundations. Items that are the responsibility of the ground station owner versus those that are the responsibility of the contractor were detailed. Costs and design implications were thoroughly reviewed. Then, Richard Barnes, S/A's Supervisor of Field Engineering followed through with a talk on the actual physical installation of the ground station. Foundation, towers, antenna, feed system and electronic interference were covered through the use of slides showing the crews performing the installation task.

Jim Hart took over at this point and the conference turned to receiver technology. Hart is a Staff Engineer in the Cable Communications Division of S/A, author of several papers on receivers and holds extensive credentials in the field. He described what makes up a receive earth terminal, system noise temperature calculations, system G/T, important FM characteristics, receiver carrier-to-noise calculations and video signal-to-noise ratios, audio performance requirements and antenna pointing. This second day ended with a cocktail reception and complete with Ted Turner providing the banquet address and updates of the evening's Atlanta Braves baseball game. Turner was his usual lively self and the dinner was excellent.

Winding Down and Back to Earth

The last day of the program started off with Heinz Wegener, Manager of GCE Engineering, SATCOM Division of S/A presenting a paper on *Video Receiver Performance and Design Considerations.* Purposes of the receiver, important and no-so-important specifications were outlined, as were tradeoffs made in the design of video receivers. Thomas Williams, a Senior Engineer in the SATCOM Division, described Scientific-Atlanta's Video Protection Switch in detail for the audience and Richard Barnes and Jim Cox completed the program with a presentation of recommended spare modules and components, periodic electronic testing requirements for GCE and test equipment recommendations.

Totally, the program was excellent. It was chaired throughout by Levergood and held to schedule. From the response and remarks of those who attended, it is obvious that the industry needs more of this type of program and supplier-operator cooperation to provide a continuing update of cable television technology. Scientific-Atlanta deserves the thanks of the entire industry for providing a most complete learning experience.

Scientific-Atlanta Hosts Ma

19

EARTH STATION TECH

Judith Baer
Associate Publisher

More than 100 current and future users of TVRO earth stations met in Atlanta July 14-16 as the guests of Scientific-Atlanta during their Earth Station Technology Conference. Papers were presented on topics ranging from basic construction requirements to the very advanced engineering sciences including Faraday Considerations and Depolarization Effects Due to Rain. The program was coordinated for the company by Jay Levergood, division manager, Cable Communications Division, and Howard Crispin, vice-president, Corporate Marketing, with the assistance of Patricia Rooney.

Levergood opened the conference on Wednesday welcoming the participants. Crispin added a welcome from S/A's corporate staff. The meeting room was set-up with a complete set pf pre-published papers scheduled for presentation through the three-day meeting.

Opening Day

Howard Klippel, National Sales Manager for S/A, opened the technical portion of the program with an overview of communication satellite technology. Klippel provided a history of satellite industry growth and reviewed satellites currently in place and planned for the future and predicted locations for future satellites. Footprints, Effective Isotrophic Radiated Power (EIRP) and FCC U.S. domestic satellite maintenance requirements were covered in depth. Klippel noted in his paper that ". . . original systems of the Intelsat network were very costly, and the antennas and electronics tended to be supplied by a few large companies. Satellite communications is now well into a second phase, which involved a large number of small, much lower cost earth stations. The volume of sales is now such that standard earth-station designs are engineered, and systems are bought as catalog items."

Hubert J. Schlafly, Chairman of TransCommunications Corp., a consulting firm on satellite communications spoke on *Effects of Government Regulation on CATV and Pay TV.* Schlafly briefly explained the FCC's structure and charge of responsibility noting that rapid changes in technology often involve conflicting interpretations of policy, rules and practices between various bureaus of the Commission. "Nowhere is such conflict and confusion better demonstrated than in the domestic communications satellite area of regulation" according to Schlafly. However, he urged that users and applicants for TVRO earth stations have patience and continue to work with the FCC in changing regulatory requirements and demonstrated that such cooperation has already brought substantial change in favor of industry.

Bob Mason, Sales Manager, Earth Stations, Cable Communications Division of S/A outlined processing procedures for earth station applications with information about FCC permit and licensing requirements. Ken Leddick, S/A Marketing Manager in the Satellite Communications Division, Dan Yost of Compucon and Harry Stemple of SAFE led a panel discussion on *Frequency Coordination.* Leddick closed the first day with an overview of material that had been presented and S/A moved on to host a meeting of NCTA/CSAE, Satellite Sub-Committee No. 2 on Entertainment Uses chaired by Polly Dunn, Columbus TV Cable.

A Full Day of Learning

Thursday opened with Marvin Shoemake, Senior Engineer of S/A's Antenna & Microwave Product Line speaking on *Path Considerations and Effects to Received Signal Levels at the Ground Station.* Shoemake defined terminology and graphically described how satellite signals travel to the ground station, explaining the varied effects of free space and atmospheric attenuation, effects of rainfall in various parts of the nation and antenna noise temperature considerations. He continued with a presentation on two basic reflector feeder systems and design considerations for antennas.

Sharad V. Parekh, Senior Antenna Engineer at S/A, a Ph.D in Microwave Engineering and author of seven papers on the technology presented the paper on *Depolarization Effects Due to Rain and Faraday Rotation in the Frequency Reuse System.* While Parekh's paper might have been somewhat above the heads of many directly rotating the feed from behind the dish.) Virtually all satellite communication terminals in service therefore use cassegrain antenna systems. The only negative aspect of using the cassegranian antenna system is cost—$4,000 versus $500 for the prime focus feed plus the cost of additional waveguide and support structure.

A prime focus feed, on the other hand, is a simple horn aperture with limited ability to control shape or the primary reflector illumination. Prime focus feed also requires a long run of waveguide that adds loss and increases system noise temperature. This problem becomes more acute at higher frequencies (i.e., 6 GHz transmit band) and with lower noise amplifiers as they become available at more competitive prices.

Antenna Pointing and Surface Accuracy

Operation at 4 GHz with a 11 meter dish requires a pointing accuracy with wind loading of ±0.1° (wind gusting to 70 kph) and a surface accuracy of 2mm RMS to result in a net operational loss of 1.0 dB. The same antenna, if operated at 6 GHz (Domsat transmit band) would result in losses of 2.5 dB and would be unusable; i.e., losses of 7 dB at 12 GHz (future Domsat band). A small additional expense for structure and field alignment of the panels, produces an antenna with less than 1mm RMS surface tolerance and 0.05° pointing accuracy with wind load assuring operational performance at 4 GHz (0.25 dB loss), 6 GHz (0.6 dB loss) and 12 GHz (2.0 dB loss).

Antenna Coverage and Mechanical Design

Possible orbital locations of domestic satellites are from 70° to 135° west longitude. The amount of antenna movement required to cover this orbital arc varies depending upon earth station location. Pedestal configuration chosen for this system is designed to cover the full orbital arc without any structure modification and with the capability to motor drives if desired. By being able to switch between satellites in a short time frame (typically less than a minute) this antenna mount system offers the following capabilities:

- Programming from multiple satellites;
- limited sun outage protection;
- special event reception from different satellites; and
- changeover to a different satellite because of failure or system configuration.

Figure 3 is a drawing of the unique antenna configuration developed to fulfill these requirements. The design features a wheel and track azimuth positioning system with coverage limited only by the amount of foundation supplied. The elevation drive system is a jack-screw arrangement offering 60° of elevation motion. Readouts are provided at the azimuth bearing and by a turns-counter on the elevation drive gear box. Turnbuckles provide fine-azimuth adjustment and tiedown for high winds. Elevation adjustment is accomplished with a handcrank.

Tests

The antenna system described has been thoroughly tested at both 6 and 4 GHz and technically qualified as a candidate antenna for the Public Broadcasting System and is currently installed in the PBS prototype terminal. Testing performed on the antenna includes:

- 4 and 6 GHz elevation and azimuth patterns (360° azimuth, 0-60° elevation)
- Gain at 3 frequencies
- Noise temperature at 3 frequencies, 10° to 60°
- Cross polarization performance to ±1°
- VSWR (Receive and Transmit) over full band

System Electronics

Electronics supplied with this earth terminal include a Microdyne Model 1100 TVR/(VT) receiver. This unit offers remote or local switchable 24 channel capability and superior threshold and video performance. The switching capability allows immediate addition of remote control channel-select without receiver modification.

The low noise amplifiers are chosen from a series of units supplied by Amplica. The standard unit has a 2.6 dB noise figure, but is available with noise figures as low as 1.4 dB. These units have an excellent field history and are being supplied for the Alaska bush terminals in large quantity.☐

SPECIFICATIONS

The complete CATV earth terminal described has the following characteristics:

Antenna RF Subsystem	
Frequency Range	3.7 to 4.2 GHz 12 to 24 transponder coverage
Antenna Diameter	11 meters
Antenna First Sidelobe Performance	-15 dB nominal
Antenna Sidelobe Performance	G = 32-25 Log 0 1.0° to 48° -10 dBi 48° to 180°
Antenna Gain	51.4 dB minimum
Cross Polarization	40 dB minimum
G/T @ 20° Antenna Elevation (with LNR Temperature of 263°K)	27.4 dB @ GHz
Video	
Video S/N Weighted	54.5 dB
Video Baseband	20 Hz to 4.2 MHz ±0.5 dB
Composite Video Baseband	DC to 8.5 MHz ±1.0 dB
Differential Gain	±.2 dB 10% to 90% APL
Differential Phase	±1° 10% to 90% APL
Clamping	50 dB to Energy Dispersal
Antenna Mechanical	
Operating Winds	120 kph
Survival Winds	200 kph
Elevation Angle Coverage	10° - 70°
Azimuth Angle Coverage	180°
Net Weight	6,000 kg
Shipping Weight	7,275 kg

INSTALLATION AND PROOF OF PERFORMANCE TESTS

Tests include: G/T
Signal-to-Noise
Near in patterns
Positioning and alignment
Functional operation
Frequency agility

The design used reduces edge illumination of the subreflector to 18 dB thereby eliminating the spillover sidelobe problem and doing so reduces the optimally illuminated area of the 11 meter dish. The result is an 11 meter antenna with 51.4 dB gain, higher than any available 10 meter antenna system, but 0.7 dB lower than the higher efficiency antenna.

G/T up to 29.5 dB is achievable with this antenna for the following reasons:

- Low antenna temperature inherent with cassegrain feed configuration;
- short waveguide runs; and
- availability of low noise transistor amplifiers.

The standard G/T offered by this system is 27.4 dB. This G/T and potential higher values with lower noise amplifiers are important for future data services or dual transponder video applications with TVRO terminals.

Cassegranian Versus Prime Focus Feed

Selection of a cassegranian feed system was based upon the ability to use a secondary reflector to control primary reflector illumination for gain and noise temperature performance with compliant sidelobe characteristics. (The cassegranian system allows polarization adjustment much more conveniently by

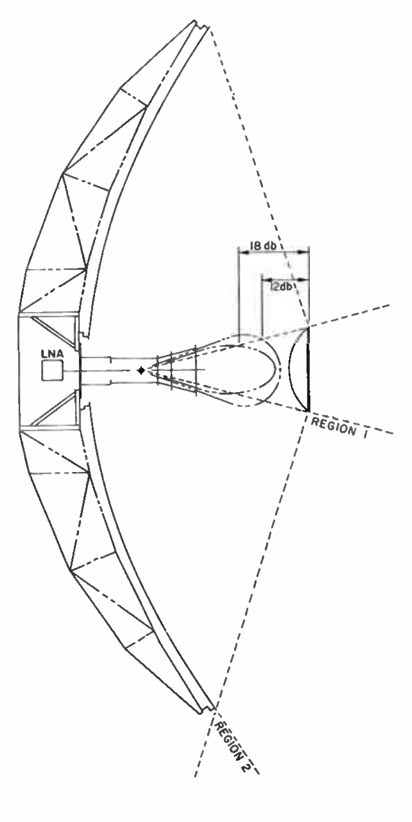


Figure 1

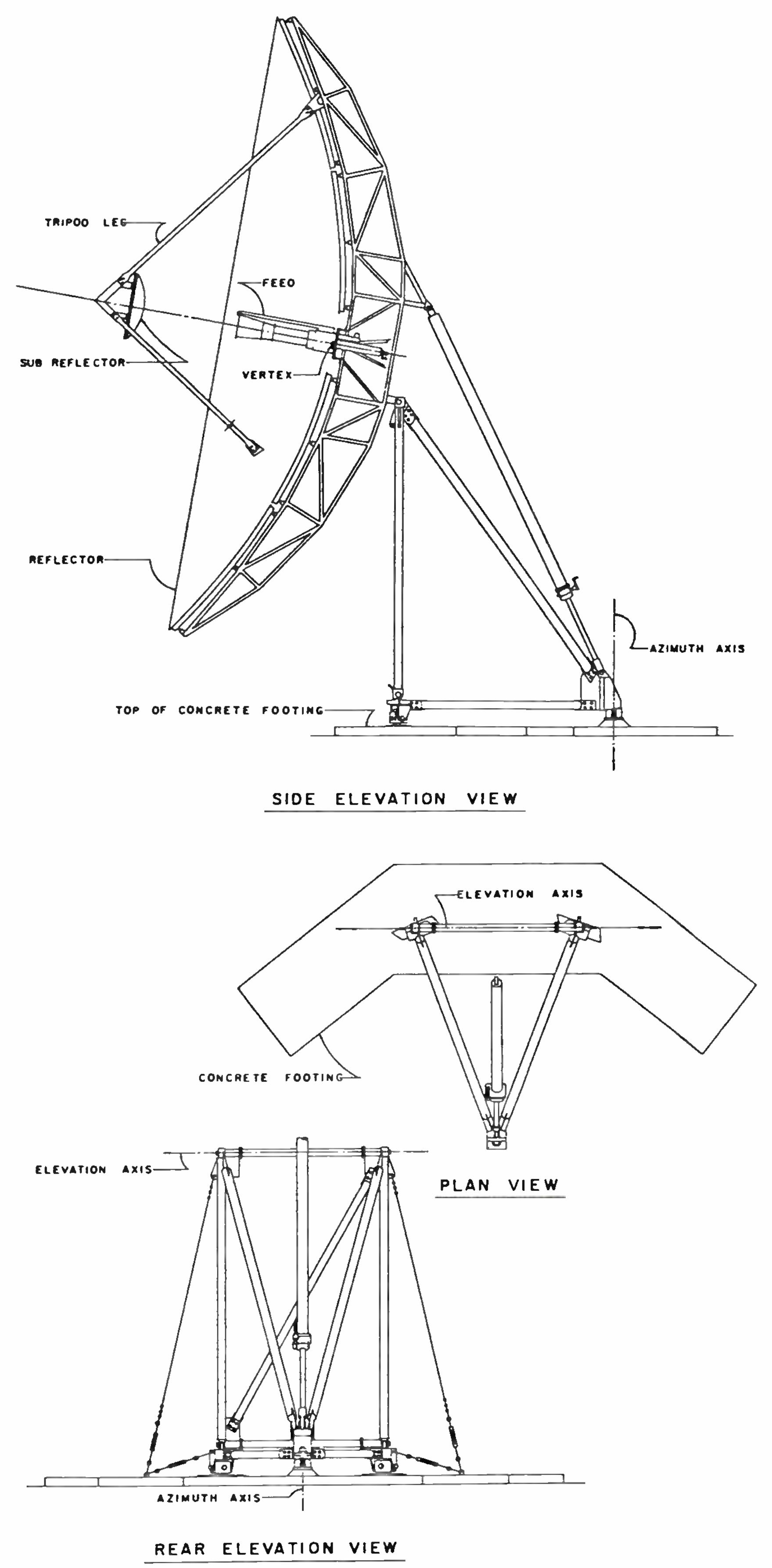


Figure 2

design criteria of a pbs earth station

David Hershberg, consultant and Don Branum, president
Radio Mechanical Structures Inc., Kilgore, TX

While the immediate need of the CATV industry for earth stations is TV reception, the earth terminal described below was designed with future needs also in mind. Before an operator spends capital dollars for an earth terminal, a thorough examination of communication satellite technological advances should be made and considered. Chances are that during the lifetime of any earth terminal operation an opportunity for transmitting or receiving other forms of signals and data will present itself. Acceptance of this premise becomes of fundamental importance for the operator to choose his earth station antenna wisely.

Introduction

Design and development of the terminal described was completed after an intense effort to produce a high quality antenna system at a competitive price. System requirements established for the antenna go far beyond those required to receive high quality television from a domestic satellite and are keyed to expansion to other services, complete orbital coverage and eventual use at higher frequencies. The system developed does indeed meet these requirements. It is, however, offered at a price that is still competitive.

Antenna Size

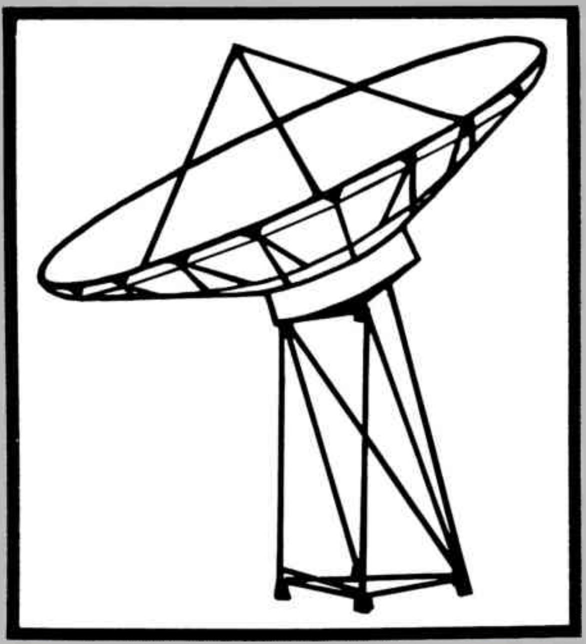
An eleven meter antenna was selected to meet system requirements for two reasons:

- This size offers a high margin G/T needed for a multiple use earth station.
- The extra diameter can be used to provide a shroud to reduce sidelobes to a point that FCC requirements are met without averaging.

The Eleven meter reflector used in the antenna has been used for the past three years in a highly efficiently shaped version for the Intelsat and Domsat transmit/receive communications market. In this configuration, efficiencies of 75% are obtainable yielding gains of 52.1 dB at 4 GHz. To achieve high antenna efficiencies it is necessary to achieve as close to uniform illumination across the main reflector as possible.

Highest efficiencies are obtained with illumination of 10 to 14 dB at the dish edges. These illumination values are not consistent, however, with low sidelobe levels. Referring to Figure 1, (a cassegranian antenna configuration), the critical areas are spillover past the subreflector (region 1) and spillover past the main reflector (region 2). (The prime focus feed also has a problem in region 2.)

Earth Stations:



A lot has been published about earth station technology over the past year. How it works, how to do it like the big boys, and the underground movement for smaller and less expensive earth stations all have taken up a lot of space in industry press. So much space in fact, that we open large envelopes with technical papers submitted for publication with a great deal of apprehension. However, the following two articles and the report on Scientific-Atlanta's conference held during July, represent a somewhat different approach to the same old subject. One represents the ultimate in conservative engineering and design—the other article takes the subject to the extreme opposite. The third reports industry's attempt to keep up.

Whether the brand of leadership required for this investment will emerge, only time will tell. It has happened before. You will recall that David Sarnoff dragged his network through ten years and an investment of $100 million in keeping color television alive, until it took off in 1964. Since then, everyone in the business has been in his debt. I think the lesson of that history will not be lost on future entrepreneurs. Nor will the fact that another major network was started with money from the cigar business.

Pressure to produce a major improvement in television service must, of course, also come from the viewers. As we have noted, the average viewer is now well satisfied with television, because he has no way of knowing how much better it could be. But he does go to the movies. He can be impressed by a suitably mounted publicity campaign that what he sees projected in the theatre is much better than what he can see at home. In the future, wide screen, picture-on-the-wall, television displays will be a reality. Then the viewer will find—because he must sit closer to the picture in relation to its size—that the lack of detail in the 525-line format is obtrusively evident. Under such conditions, the 1,000-line 35mm television format should sell itself in one demonstration at the neighborhood dealer.

What about the price the home viewer will have to pay for a 1,000-line receiver? It will be more costly than the present sets, no doubt, but not so much more as might be imagined. To keep the cost down, every advantage of bandwidth reduction must be taken, that is, we must improve the efficiency of television transmission.

To show how much is in store along that road, let me describe briefly the system of scanning known as "Sampledot," devised by an aerospace engineer, Robert Stone, of the General Electric Company. This system uses the standard 525-line NTSC color signal format, and achieves a bandwidth reduction of about 4-to-1. At its present stage of development, the system has shortcomings that disqualify it for broadcast use. But the obstacles to be overcome are far fewer than those faced in the development of the compatible color system. In my opinion, the Sampledot system, or one based on similar principles, would yield promptly to concerted industry-wide attack, just as compatible color yielded to the onslaughts of the NTSC.

For the following description of Sampledot, I am indebted to an old friend of all of us, Raymond Wilmotte, who has written an outstanding survey of future possibilities in his report "Technological Boundaries of Television," prepared at the request of the Office of the Chief Engineer of the FCC. I recommend Ray's three-volume, 185-page treatise to every engineer engaged in television development. It carries the identification FCC/OCE CE 74-01, and is dated December 1974.

In Sampledot scanning, the raster is divided into a number of small segments (96 of them in the version we are describing), from which individual picture elements are selected at a slow rate, the process being repeated from segment to segment in a pseudo-random sequence, such that all the picture elements of the scene are scanned in just over one-half second. The scanning pattern is of the uniform and repetitive type, identical to the NTSC standards, so the field rate is 60 per second. But the frame rate is just under two frames per second (actually 1.875 frames per second). This low rate compares with a frame rate of 30 per second in the NTSC system, and this implies a theoretical bandwidth compression of 16-to-1. In practice, the compression thus far achieved is only about 4-to-1, but this provides a fully scanned NTSC image, in a bandwidth of less than one megahertz. Moreover, the horizontal resolution, integrated over 32 fields, is—hold your hats, boys—670 lines, compared with about 300 lines in the NTSC system as received on a good receiver in a good location.

Seems too good to be true! Well, the system has two drawbacks that, at the moment, prevent its application to broadcast service. First, the selection of picture elements, while pseudo random, is not completely random, so a background pattern is discernible in the images at normal viewing distances. Second, if the scene contains many rapidly moving objects (as for example when the camera is panning), structural breakdown (akin to "break-up" of moving objects that so adversely affected the sequential color system) is seen to appear. Neither of these effects seems to be a basic impediment to future progress along the lines thus far so trenchantly explored by Engineer Stone.

The implementation of Sampledot is remarkably simple: two pseudo-random sequence generators, one at the transmitter and one in each receiver, control the scanning sequence. As presently embodied, these circuits are mounted on a 4-inch circuit board. If the recent history of the hand-held electronic calculator is any evidence, the circuits can be built into a large-scale integrated circuit at a price that will alarm the stockholders of the manufacturers producing them.

Let me repeat the salient figures of this achievement in bandwidth conservation: a standard scanning pattern, with 670-line horizontal resolution, and a transmission bandwidth of 0.9 megahertz! Taking the Kell factor at 0.7, the 670-line horizontal resolution can be matched with 670-line vertical resolution only if the scanning pattern has 957 lines. So we are within easy reach of the 1,000-line picture, and we aren't even using the 4-megahertz bandwidth, yet!

I don't intend to minimize the problems of background pattern and structure of moving objects that are present in the present embodiment of Sampledot. But, as I first wrote in 1940, "television engineering is a science of compromise" which means in current jargon that television engineers are experts at the trade-off game. By adopting different numbers and sizes of the areas from which the picture elements are randomly selected, and by the use of improved pseudo-random techniques, it seems reasonable to suppose that the Sampledot technique can meet broadcast standards in a 1,000-line system, if not in the 4-megahertz video bandwidth we now have, then certainly in the 10-megahertz bandwidth I have postulated here for a 1,000-line system (that is, using a 12-megahertz channel).

So, my conclusion is that a major forward step in the television service is within our grasp. It will take the organizing talent of a Doc Baker and the pride and drive of a General Sarnoff, perhaps, to put the development of such a system into motion and to bring it to public reality. On such men, as always, will the future depend.

Meanwhile, we have jobs to do, within the scope of the present system, to see to it that more people enjoy the service at its best. I have regretfully come to the conclusion that there is no adequate, broadly applicable answer to the multipath problem (which I believe is the most enduring of all the problems we face in broadcasting) other than distribution by cable. If this be true, **the present conflict between the purveyors of programs over the air and those who want access to them for the cable audience has only one answer: we must replace the conflict with open-handed, mutually advantageous cooperation.**

So far as receiver design is concerned, the present depressed market cries for a major improvement in product design, and the signs of its coming are there.

I hope that the compromise adopted in picture tubes to favor brightness at the expense of accurate, saturated color rendition, will yield to another trade-off that will bring television color rendition back to where it was years ago—closer incidentally to the color rendition enjoyed by the public in color photography. I hope for, and expect, a good technical result in the video-disk development, and eventually (following the evidence of the LP record wars) a standardized product. But above all, I look in our industry and our profession to a brave new world that uses new technology to offer a new, better service.□

today—television broadcasting—would be hard put to accommodate to it.

My scenario for the future of television includes a replay of the British and French experience in changing television standards—a feat those nations could accomplish because they could offer to keep the old standards on the air until the old receivers wore out. That route was feasible because the program choice, that is, the number of channels in use, is far smaller than in our country, and hence two channels can be used for each program, carrying transmissions on the old and new standards as long as the old standards are needed.

The standards changeovers in Europe involved major changes in channel width and arrangement, in the number of lines scanned, the method of sound modulation—pretty much the whole works. The driving force was the need to have all television receivers in Europe operate on one set of standards, commonly known as the 625-line "Gerber" standards, named after the Swiss expert who led the early movement to adopt them universally in Europe.

Can we hope to follow the same path in a changeover of standards in the United States? My opinion is: Yes, we can. First let me say that the 1,000-line system of the future will not require four times the present video bandwidth. Practical techniques of bandwidth compression, as we shall see, are already in existence that would reduce the required bandwidth by at least a factor of two. So we can plan in terms of a 12-MHz channel, that is, twice the width of our present channel.

Where can we find 12-MHz channels for duplicate transmissions, while the 525-line system is being phased out? I think we can write off any possibility of using the VHF spectrum, because no extra spectrum space whatever exists in that region. On the 12 VHF channels, there are now operating just over 600 stations, and shoe-horning in another one, in an area of sufficient population to support the service, is next to impossible. But the UHF spectrum is another breed of cat. On the 70 UHF channels there are now operating only some 350 stations, so the number of unused UHF channel assignments is vast—about 900 unused slots by the latest estimate.

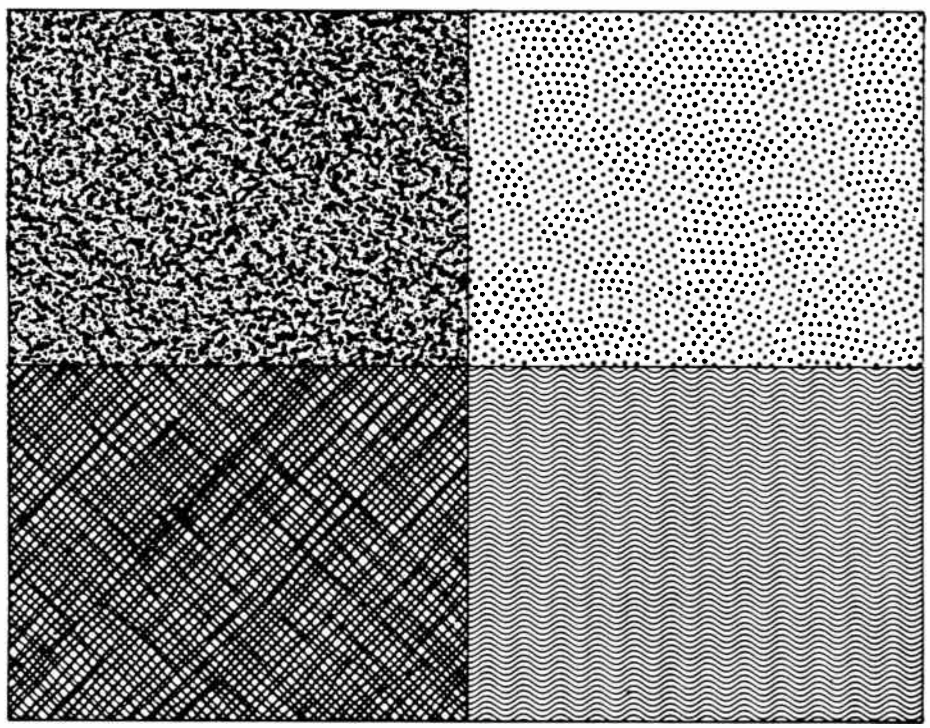
This vast waste of reserved spectrum space has received diligent attention from the FCC for years. One result is that the UHF tuners available in today's receivers are as easy to use as the VHF ones. Another is the FCC's insistence that every TV set sold in the USA should have UHF reception facilities, a largely unused investment by the public amounting presently to about $3 billion. The sole drawback, not to be underestimated, is the restricted coverage of UHF stations compared with VHF ones. Despite large efforts to increase the radiated power and to improve the noise performance of tuners, UHF cannot compete with VHF, given the same program, or so the history to date reads to me.

But UHF can and does (where used) cover the principal markets from which the vast majority of the broadcasters' income is derived. If a new and superior quality of service were available on UHF channels, we can confidently predict a scramble to get in the act, not only by the existing UHF broadcasters, but also by powerful entrepreneurs who would see the chance to get into the action by forming and ably programming a fourth network.

My forty years in the television business have convinced me that such a major change will be resisted strongly by the entrenched establishment—the VHF broadcasters. They would hardly welcome the expense of a new UHF transmitter, new cameras and sync chains, a radically different approach to program operations, and so on. Moreover, and most importantly, they would not wish to offer the advertising sponsors any doubt about the efficacy and indispensability of the present broadcasting medium. Any implied agreement that the service they now sell could be improved, and was in fact, being challenged by another system, would be unsettling in the extreme. **Given the ovine nature of the advertising fraternity, this line of thought could delay implementation of any standards conversion for years—if not forever.**

There is, however, an alternative route on which the driving forces of those providing television service are already arrayed to compete bitterly for the audience: that is, cable TV vs. on-the-air broadcasting. The FCC, using a brand of wisdom I am too old to understand, has required that every major cable system provide a spectrum equal to no less than 20 6-MHz channels—on the theory that sooner or later they will be occupied by special-interest programming, in addition to the fare intended for the mass audience. My view, old-fashioned as I admit it is, is that there is no way that many of these channels can be filled with special-interest programming, and paid for by special-interest audiences, over the long pull.

Today, there are about ten million homes served by cable, with most of the programming derived from the networks. If cable TV became the chosen instrument to bring 35mm television into the home (the spectrum space is ready and waiting for it), that figure would rapidly escalate and the attitude of the open-air broadcasters would change—in a hurry.



I do not wish to imply, in presenting these prospects, that mere technical feasibility will carry the day. The biggest stumbling block is the program source, with its production and talent costs. Initially, of course, existing 35mm movie theatre film would serve to demonstrate the system, and to keep it supplied with programs at least for a time. But if the 1,000-line system is to be competitive with the 525-line system an important investment must be made by the 1,000-line program sources to produce current program material for initially small audiences.

ology—
It?
It Be?

er
eon—

s Engineers, Inc.
ner Electronics

compatible and incompatible color systems, now a quarter century behind us, offers ample testimony to the economic clout exercised by the public investment in receivers.

In the light of that traumatic experience, we are well advised to concede that future progress in television broadcasting can be most easily made within the confines of the present system, that is, without requiring any change in the television channel arrangement nor in the system of scanning. That is a major concession, because the present system of repetitive, uniform scanning is woefully inefficient. It fills our precious spectrum with information that the eye of the viewer does not need and cannot in fact perceive.

Uniform scanning provides equal detail throughout the screen, corner-to-corner and edge-to-edge, whereas most of the time the eye is fastened on the center of interest, not on the corners. Much more drastic in its effect is the practice of sending each frame as though it were completely different from those preceding and following it. Thus, the television system is occupied, better than 90% of the time, sending over and over again what has already been transmitted.

An efficient television system would transmit only the changes that occur from frame to frame, and then only that amount of change that the eye can perceive. No one, after years of effort, knows how to do this in a practical sense, that is, in a receiver simple and reliable enough for home use. But the waste is there and we engineers should not ignore it.

The numbers that describe the overproduction of information in television are little short of scandalous. The American color television channel nominally devotes 4.2 megahertz of the channel to picture information, which is equivalent to a maximum rate of information transmission of over 8 million bits per second. But physiologists and psychologists have repeatedly confirmed that the maximum rate at which the human brain can consciously react to information clues is not greater than 50 bits per second, that is, only one bit for each 160,000 bits of capacity provided in the channel. Another way of viewing the matter is to say that if the television system could confine its attention to the changes in the picture to which the viewer can react, the job could be done on a channel width of a few hundred hertz at most.

This draconian mismatch between the information television needs to provide and the information it actually does provide has long been recognized by communications specialists, and it has proved an attractive target for invention—but thus far without notable success. The exception is the magnificent tour de force accomplished in compatible color television in adding the signals for hue and saturation while preserving, intact and unharmed, the existing black-and-white system and its channel arrangement. But color has done nothing to mitigate the principle disease, the wholesale overproduction of visual information in the scanning process.

This overproduction is, of course, not all bad. It irks the spectrum manager and the communications purist, but it does make for a receiver simpler and more reliable than would likely be the case if a more efficient use of bandwidth were in use. But uniform repetitive scanning imposes limits on the program operations of the system that we may forget are there. To get seven VHF stations to L.A. and New York (the basic premise of the choice of the 6-MHz channel in the mid-1930's) we long ago settled for a system of 525-line pictures, each composed of about 150,000 picture elements (half-tone dots).

That choice in turn makes it unproductive for the viewer to sit closer to his receiver than at a distance equal to about five times the picture height, which position, or one further removed, he finds comfortable in his home surroundings.

But consider the effect of the 525-line format on the production of programs in the studio or at the playing field. A director versed in 35-mm film production for projection in theatres, has new tricks to learn when his product is destined for television. He cannot use as wide a field of view for television production as he can for theatre projection, by a factor of better than two to one. So for television, he learns to use a new family of lenses, and to compose his scenes in a manner that has come to be known as "cozy" but whose proper adjective is "confining."

When the zoom lens came to television, it was welcomed as manna from heaven. Now the routine is: Give the audience a brief view of the whole scene, if you must, but let it be brief. Then switch or zoom to the center of interest. Otherwise, the viewer will be uncomfortable, because he cannot see clearly enough what he wants to see. Granted, zooming to the quarterback is a fine way to miss the pass receiver altogether, but with several independent close-up cameras, all video recorded, the missed play can be video-replayed.

No doubt about it, the confines of the 525-line picture have been coped with, and the viewer is satisfied by an adroit director. But the viewer doesn't know what he's missing. The director knows—and he has long since resigned himself to close-ups, zooms and other devices.

This confinement, which derives fundamentally from the inefficiency of television transmission, is the enduring penalty we pay for being forced to adopt the 525-line standard. At its best, this system can just equal 16-mm home movies on the studio monitor and is closer to 8-mm movies in the home.

What would it take to recast television in a 35-mm format so the director can go back, when it suits him, to the wide-angle lens? The answer is about 1,000 lines in the picture and in present practice about four times the video bandwidth, the removal of 60% of the VHF channels, substantial reduction in coverage due to the additional noise accompanying the increased bandwidth, double the power in the horizontal scanning circuits of every receiver, and a host of other insurmountable barriers. At this point, I could end my speech with the conclusion that no big improvement in television service is possible. But I am encouraged to stay on my feet because, in my opinion, **the technical and economic barriers are not insurmountable, although the most durably successful and entrenched business in America**

From 1934 until 1963, Mr. Fink's career was totally devoted to electronics and electrical engineering, in industry, government, and journalism. His activities and contributions are too well known to require repeating them here. From January 1963, Mr. Fink served as General Manager of the IEEE until 1975 when he retired to become Executive Consultant to the Institute. In 1974 he was appointed for life to be Director Emeritus of IEEE.

The opinions expressed in this address are solely those of the writer, and are not intended to represent those of IEEE or any other organization with which he is associated.

Television Techno[logy] How Good Is [It?] How Good Can [It Be?]

Address, IEEE Consum[er] Electronics Award Lunche[on] December 8, 1975

Donald G. Fink, Executive Consultant, The IEEE, Inc.

Reprinted by permission, from IEEE Transactions on Consu[mer Electronics] February 1976, Volume 22, Number 1.

Let me answer the first question: How good is television technology today? with my considered judgment: Television today meets its challenges with technical excellence unmatched in any other medium of mass communication. The statistics of its use by the public and the handsome returns earned by those who provide the service permit no other conclusion. But that conclusion does not imply that the television service is uniformly excellent, nor that it is an adroit exploitation of our spectrum resources. Television, as enjoyed by the majority of viewers, is far below its present potential, and its waste of the spectrum is one of the most enduring—and seemingly inescapable—failures of modern engineering.

At its best, the service rendered today by color television broadcasting is so good that, considering the obstacles it overcomes, it can only be termed a miracle. At its best! That means good program material, lovingly produced and directed within the limits of the medium, signals carefully and accurately conveyed from camera lens and microphone to the transmitting antenna, received in a location sensibly free of noise, multipath and other interference, reproduced on a well designed and adequately maintained receiver, properly adjusted to the user's taste. Given all those favorable conditions, the result is very good! But this is a formidable set of requirements to be met in making optimum use of the service. Most of the time, in most homes, the result falls short of excellent.

At its worst, television is a terrible parody. Within the broadcaster's domain, sloppy production and direction, with camera and other equipment out of adjustment, obtrude themselves on all viewers. Fortunately, such lapses are now rare in network operations, but a signal embodying none of these faults is at the mercy of the receiver, the viewer, and the conditions of reception.

Your speaker, as well as many engineers in this audience, has had ample opportunity to measure the dismal multipath conditions in a major city, and to go into the homes of typical viewers who, blaming external causes, have complained of poor reception. Often we find that the receiving antenna is disconnected, the receiver badly in need of restorative medicine, and/or its owner completely unversed in the art of adjusting his receiver to make the mpt of the available signal.

Such experiences have impressed on me the massive tolerance of most viewers to substandard reception. Like all subjective human responses, this tolerance has a logarithmic measure—that is, for example, each tenfold increase in multipath signal amplitude is perceived as having an equal effect in worsening picture quality. So our industry and our profession are the beneficiaries of a complacent ultimate consumer, who will spend hours (the national average of television use now exceeds six hours per day!) looking at a picture so bad that, **if he knew what he was missing, he would turn the set off** and find amusement elsewhere.

All—not some but all—of the sins and omissions of poor television reception today have technical answers, and we will review them in answering our second question, "How good can television technology be?" **For now, let me argue that the extension of cable television is the route by which we can conquer noise and multipath,** and that the self-adjusting receiver—aided by control signals broadcast between scanning fields— is the way to force good receiver adjustment on the viewer. Ultimately, coding of television signals to match their information content to the needs of the viewer's eye—and thus to remove bandwidth and channel limitations—may be coming.

We must concede, however, that changing the channel standards of television broadcasting will not come easily or soon, although the route is open as we shall see. The contest between

Advance registrations should be made as soon as possible as last year's session attracted over 130 technical personnel from 11 states. For further information on program and registration costs contact Bob Levy at the New York State Commission, (518) 474-4992.

RCA Builds Multi-Channel Headend System

A central headend and Northeast hub turnkey installation utilizing RCA Community Television System's CTM10 Color Television Modulators and HSP1 Heterodyne Signal Processors were recently completed for G.E. Cablevision to service the Grand Rapids, Michigan, area. The multi-channel system contains 31 RCA Processors and 25 of RCA's new CTM10 Modulators which were developed as companion units to the HSP1's.

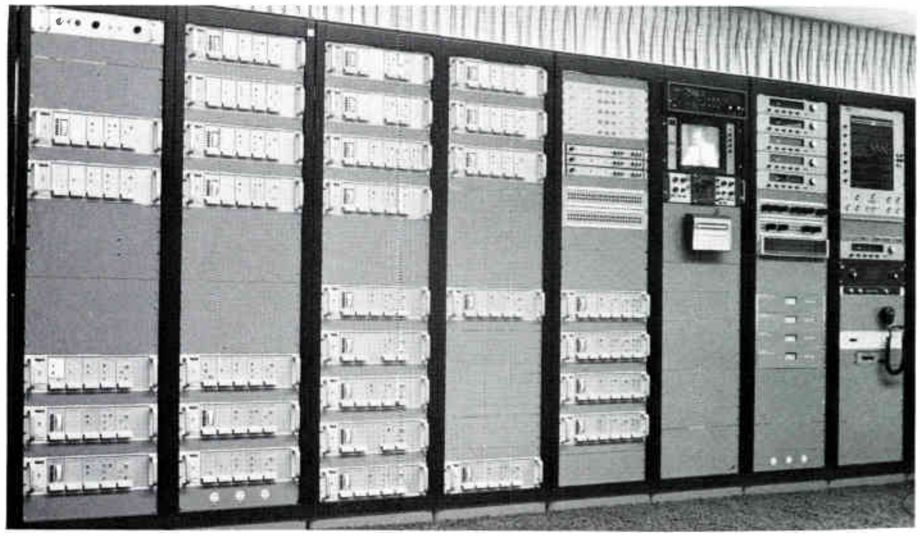
The central headend for the Grand Rapids system provides five trunk and distribution feeds; initially 26 channels will be occupied but the system is expandable to 30 channels. The central headend connects to the new Northeast hub and to an existing hub installation at Wyoming, Michigan, via an intertie cable system.

The headend designed by RCA features an active RF combining system, provision for standby power and an audio alert system. RF combining inputs are provided to accommodate 40 headend units plus pilot frequencies and FM processing equipment. Separate isolated outputs are provided to feed intertie signals to the Northeast and Wyoming hubs.

Standby power is provided at the headend and hub installations by means of batteries and chargers specifically designed for communication equipment. Additionally, the off-air processors are equipped for DC power operation which minimizes standby power requirements.

The audio alert system is designed to operate remotely via the phone system or from control at the central headend. The self-contained IF switching feature in each RCA Modulator and Processor causes the alert signal to appear on each channel leaving the central headend.

RCA conducted on-site installation and proof-of-performance testing of the headend system in July. The system is scheduled for full operation in August of this year.☐



testimony delivered to Congress from across the nation. The members of the Subcommittee were able to question Williams by means of telephone hook-ups. The project was a complete and total success technically and the audience was both intrigued and impressed with the picture quality and the display of cable technology.

Howard Hubbard, AFC and George Bell, Microdyne, working on ground station installation set-up for House Subcommittee Hearings July 20, 1976. This was the first transcontinental two-way, live testimony presented to Congress.

IEEE Call for Papers on New Cable Television Transactions

The Cable AdCom of the Broadcast, Cable and Consumer Electronics Society of the Institute of Electrical and Electronics Engineers has issued a Call for Papers for the new *IEEE Transactions on Cable Television.*

The Cable *Transactions* will debut in October and will be published quarterly thereafter. This marks the first time that engineering and technical aspects of broadband/cable television will be recognized as an engineering discipline separate from those of broadcast or consumer electronics. *IEEE Transactions* carry a distribution to libraries and other retention centers for research. More than 1,200 such facilities will receive these new *Transactions on Cable Television* automatically. Total circulation of the publication is estimated to exceed 2,500 for each issue.

Papers are invited on new technology, new technical developments, or tutorial papers which are of interest and instructive to engineers and technicians engaged in the various aspects of broadband/cable television, satellite and community antenna service.

Members of the cable television industry will receive an invitation to reserve a free copy of the first issue of these new *Transactions.* Reservations for the premiere issue must be made before August 15, 1976. Reservations may be directed to the Editor of the *Transactions* at the address below.

Abstracts for publication of papers should not exceed 200 words in length. Detailed instructions for publications will be provided upon receipt of the Abstract. All Abstracts and requests for further information should be directed to Editor, *IEEE Transactions on Cable Television,* P.O. Box 2665, Arlington, VA 22202.

Utica NY Goes Total Security for Pay-TV . . .

Central NY Cable TV, operator of the CATV System in Utica and 16 surrounding communities, has embarked upon a system of "Total Security" for its Home Box Office pay-cable service being offered June First. According to Bob Sereday, chief engineer, an exhaustive study of systems and procedures now being used by existing pay-cable systems and a thorough evaluation of hardware available was conducted starting last October. With the number of subscribers and the geography of the Utica area, traps were too costly to install and remove and could easily be defeated. All descrambler systems were thoroughly evaluated for cost, method of operation, how easily defeated and manufacturers' warranties.

The Blonder Tongue audio video descrambler system was chosen for the following:

Total security, both audio and video are scrambled. No problems with the language of the R movies in our subscribers' households. Undefeatable, we brought in outside television engineers to try to defeat the system, none succeeded. Optional parental key lock available.

Blonder Tongue warrants the descramblers for one year from date of installation in the subscriber's home, net 90 days from date of shipment. Service after the warranty period is on a fixed price basis. Complete control of each serialized unit from factory to installer/subscriber.

Frank Gruenewald, general manager; Bill Griffith, stock clerk, and Bob Sereday, chief engineer, Central NY Cable TV with the first 500 of 5,000 Blonder Tongue audio video descrambler being locked up in the special security room built for total security.

Toner Cable Equipment, Inc. of Horsham, Pennsylvania, is supplying the units. Units are received and stored in a specially constructed vault. Installers are issued units each day with their work orders. All stock control is by serial numbers. Each unit has a label on the back (label being sent by Blonder Tongue).

SCTA Southern Meeting

WHAT'S NEW WITH A TECHNICAL VIEW is theme for the Southern Cable Television Association engineering and technical sessions to be held during the SCTA meeting September 12-14 in Atlanta, GA. The programs will be staged in a classroom atmosphere with plenty of time for questions and answers.

Topics to be covered include Earth Station Technology, Satellite Receiver Technology, FCC Measurements, Methods of Measurements and Reliability. Speakers scheduled are Carl Van Hecke from Andrew Corp.; David Large from Avantek; James Palmer, C-COR; Robert Powers, FCC, and Michael Balbes from Microdyne. Scientific-Atlanta will take part in the program which will be hosted by Richard Hickman of Cox Cable and winner of the 1976 NCTA Technical Achievement Award. The program is being coordinated by John Weeks and Judith Baer.

Registration fee for the entire technical program is $15 for the two-day program. Housing has been arranged at a well priced facility nearby to the Fairmont Colony Square Hotel where the meeting will be held. Registration information is available from Otto Miller, (205) 758-2157.

NY State and SCTE to Cohost Meeting

The New York State Commission on Cable Television in cooperation with the Upstate Chapter of the Society of Cable Television Engineers will hold another Northeast Cable Television Technical Seminar on Tuesday and Wednesday, September 21 and 22, 1976 at State University College at Oswego, New York.

The Seminar will cover such topics as signal reception and antenna phasing, CARS band microwave techniques, MATV system interconnect, digital uses of cable, utility requirements and CATV studio design. One afternoon will be devoted entirely to a "hands-on" spectrum analyzer test workshop. This will be followed by an exhibit of test vans owned by various New York State cable operators.

Bob Bilodeau, president of the SCTE will be dinner speaker at the Tuesday night session. Dinner will be followed by the showing of two cable TV technical films.

Another First! And It Worked . . .

Seven day work weeks are not uncommon to cable operators nor to the people supporting the industry. July 18 proved again, that when cable people want to do something, there is plenty of support around to help, even if it takes a day away from families on a near perfect picnic weather Sunday.

George Bell and Chuck Siperko of Microdyne, Howard Hubbard of Antennas for Communication, Kip Farmer and Harry Halpert from Western Union and various "kibbitzers" met at 1 p.m. on that Sunday at the front entrance to the Rayburn Office Building in Washington, D.C. complete with trucks, trailers and antennas, plus thousands of dollars worth of test equipment. Bob Johnson of NCTA observed as the group went to work setting up a satellite receive capability for cable hearings on July 10. The plan was successful and transmission from Santa Monica, California, to Wasnington, D.C. provided a showcase of industry technology and the capability of important distant signals.

Don Williams of Cox Cable's Mission Cable system in San Diego was the star of the showcase as he delivered his

Chuck Siperko, Microdyne, adjusting AFC's 3.2 meter horn conical antenna for transcontinental testimony delivered to Congress, July 20.

testimony to the U.S. House of Representatives Subcommittee on Communications. Williams' testimony was fed from Theta Cable in Santa Monica to Lookout Mountain above the L.A. basin in the Hollywood Hills. From Lookout Mountain it went to Perris (out around Riverside, CA) to WU's Steele Valley facility. At that point it left for WESTAR I, 22,300 miles above the equator at 99°.

Reception in Washington came through a 10' conical horned reflector antenna from AFC in Ocala, Florida. That receive-only portable antenna is the same model used through the Bell System long haul networks according to Howard Hubbard of AFC. A 48° Low Noise Amplifier had been supplied by Airborne Industries Laboratories in Long Island, NY and the receiver was a Microdyne Satellite/TV Receiver, Model 110-TVR. Compucon of Dallas, Texas, had provided the frequency coordination for the project. NCTA had promoted and coordinated the concept seeing it through to success as four monitors came alive in the hearing room.

This was the first two-way, live

Everything New from a Technical View!!!

The Southern Cable Television Association invites you to attend its Annual Convention in Atlanta, Georgia on September 12-14, 1976. Special Registration Rates have been arranged for Engineers and Technicians registering for the meeting if their company management is also attending. Included in the package is attendance at the SCTA Buffet, Sunday evening, September 12, all the technical sessions and admittance to the Exhibit area.

You are also invited to attend the Atlanta-Houston baseball game on Tuesday night, September 14 as a guest of SCTA.

Technical Program Highlights:

Measurements, Methods & Techniques: David Large, Avantek
CATV Earth Station Technology: Carl Van Hecke, Andrew Corporation
Satellite Receiver Technology: Michael Balbes, Microdyne Corporation
Reliability And Your Pocketbook: James Palmer, C-COR Electronics
Update: FCC Standards & Measurements: Robert Powers, FCC Cable Television Bureau
Demonstration: Optical Systems Channel 100/AFC
10′ Conical Horn Antenna

For Registration

Contact Otto Miller
205-758-2157
P.O. Box 465
Tuscaloosa, Alabama 35401

*15.00 fee is applicable if accompanied by management registration to the SCTA 16th Annual Convention. Housing can be arranged through Otto Miller, Executive Secretary, SCTA.

There will be Table-top displays of hardware. Luncheon meeting tickets may be purchased as desired. The entire package listed above, INCLUDING the SESSIONS, INCLUDING the DEMONSTRATION, INCLUDING the BALL GAME, and INCLUDING a BUFFET is available for $15.00 per person.*

wrap up

NCTA has developed **subcommittees** of the **Engineering Advisory Committee** in order to strengthen EAC and provide additional support for Delmer Ports, vice-president of Engineering. One such series of committees is the **Satellite Committee. John Calvetti, Oceanic Cablevision,** serves as **Chairman** of the overall committee; **Polly Dunn, Columbus TV Cable,** serves as chairman of the **Entertainment Carriage Subcommittee; Glenn Kriegel, Jones Intercable,** is chairman of the **Business and Auxiliary Services Subcommittee; Liaison with Public Service Operations** is headed by **John Saeman, Daniels Properties,** and; the **Standards Subcommittee** is chaired by **Kenneth Gunter** of **UA-Columbia.** Overall, more than thirty industry members are serving in various subcommittee assignments. Polly Dunn's **Entertainment Carriage Subcommittee held** a **meeting** on **July 14** in Atlanta, GA. Speaking of Atlanta, **Scientific-Atlanta** has announced that approximately **135,000 square feet** will be **added** to its main **facility** in the city's suburbs. Occupancy is scheduled for early 1977. Cost is estimated at $3 million for plant, laboratory and office space. **Sidney Topol, president of S/A,** says that company's **sales volume** is **forecast** at **$45 million** for **FY** end **June 30, 1976.**

Magnavox CATV Division starts a major **marketing** venture in **Europe** on August 1. **N. V. Philips Gloeilampenfabrieken, Eindhoven,** the **Netherlands** joins with the company in the effort. N. V. **Phillips** will **market** the complete line of **Magnavox CATV** equipment and services throughout Europe, including engineering and systems design services. **Thomas J. Polis,** international sales manager for the Magnavox CATV Division, has been busy **speaking around the world.** He addressed the **July** meeting of the **Camera National de la Industria de Television por Cable** in **Acapulco.** The subject was addressable taps. Earlier during **June,** Polis addressed **European** cable operators at the **International Meeting** on **Cable TV Distribution** in Liege, **Belgium.** The topic of that talk was status monitoring.

Daniel Mezzalingua, president of the Magnavox CATV Division, (seated left) and Kees Wansdronk, managing director of Philips Cable TV division, expect great things from their joint European marketing venture. Thomas Polis, international sales manager, (standing left) and John Broekman, Philips CATV sales manager, look on.

James R. Palmer, president of **C-COR Electronics,** recently gave a presentation on "Pay Television in the United States" before the **Alliance Internationale de la Distribution par fil** at their semi-annual meeting in Knokke, **Belgium.** The group is an international organization of cable system operators with only one company member from each country. Most European countries are represented, as are two South American countries. Both the NCTA and the Canadian Cable Television Association are corresponding members.

KTVK-TV, Channel 3 in **Phoenix, AZ** has **purchased** a **$208,000 package** from **TeleMation, Inc.** including a dual Compositor I Titling/Graphics Generator and Television Election Display (TED) System. The purchase is that state's first automated election reporting system and will be operational on October 1. **Dictaphone Corp.'s Scully/Metrotech Division** in Mountain View, CA has been **renamed** the **Audio/Electronics Division.** E. L. Tabat, president and chief executive officer, said the new designation more fully defines the scope of the division's manufacturing and research operations. The Scully trademark will continue to appear on the broadcast and studio recording equipment and the Metrotech trademark will appear on broadcast recorders and reproducers. W. R. Krehbiel is president of the newly named division. **Microwave Filter Co., Inc.** manufacturer of CATV traps and filters, has **acquired Unadilla Radiation Products** of Unadilla, NY. Unadilla manufactures baluns for Amateur Radio. The purchase will immediately realize a $70,000 increase in yearly sales and introduce a compatible market for MFC's filters, according to Emily Bostick, vice-president of marketing.

Martin Moran joins **Toner Cable Equipment** in Horsham, PA as **National Sales Manager, CATV Division.** Moran has more than 15 years of marketing experience in the CATV industry and according to Bob Toner, president of the company, the addition of Moran enables them to expand their services to the industry. **Frank Drendel** has **announced** completion of an **agreement** with Superior Continental Corp. for the **purchase** of **Comm/Scope Co.,** its coaxial cable manufacturing division. Terms of the acquisition are subject to a more definite agreement to be reached August 15 and the approval of the directors of the companies. Drendel is president of **Hutton-Drendel Associates** and formerly president of Comm/Scope and has most recently served as director of marketing and sales for Superior.

The **National Technical Information Service,** a part of the U. S. Department of Commerce structure, lists **Volume I** of the **Cable Television Technical Advisory Report** to the FCC as **No. 4** on its **best seller** list. Further down in sales, three of the technical volumes rank 14 through 16 of volumes announced for the FCC.

In the **"Theft of Service"** file, the **first criminal complaint** against "pirates" in **California** was filed on July 2 against the **Vornado Corp.,** owners of the **Two Guys Department Stores,** in San Diego by John W. Witt, City Attorney for San Diego. The San Diego Bureau of Investigation discovered evidence alleging that Two Guys' **salesmen** were **illegally intercepting** and **demonstrating Channel 100** pay-cable programs without paying for the service. **Florida** has passed **legislation** that becomes **effective October 1, 1976,** that will give Florida cable operators the most potent poaching and tampering law in the nation. The penalty for **criminal violation** of the new law is **misdemeanor** in the first degree (a $1,000 fine and/or one year imprisonment). There is also a separate **civil penalty** providing a penalty **payable** to the **system** of **$1,000** or **triple** the amount of **actual loss** or **damage,** whichever is greater. That liability continues even though the criminal conviction might be suspended. The law provides further protection by making it difficult for someone to plead ignorance and says that anyone assisting or causing another to receive service illegally is also equally liable for charges. In **Danville, VA** a **resident** was recently **fined $175** for **illegally connecting** his television set to the **Danville Cablevision Co.'s** distribution system. That fine is the largest penalty ever imposed for theft of cable service in the State of Virginia; however, the top fine allowed under the State statute governing such occurences is $500.

Staff members of the **Cable Television Information Center** have **asked** the **Federal Communications Commission** to **reconsider Access** and **Capacity Rules** under Docket 20508. CTIC filed a Petition for Reconsideration on June 21, terming the FCC's provisions as "unsound." CTIC urges the FCC to adopt a policy leaving the determination of delivered channel capacity to negotiations between cable operators and franchising authorities; calls for a requirement that large systems (over 3,500) provide at least one composite access channel, subject to a waiver based on the operator showing financial hardship and that medium sized systems (1,000-3,000) with adequate capacity be required to make one composite access channel available with modulation equipment necessary to permit transmission of the signal.

Home Box Office is buying rights for future pay-television exhibitions of 20 **Columbia** feature films, under a non-exclusive licensing agreement. Also, along with the agreement entered into between **TeleMation Program Services** and **HBO, Time, Inc.,** HBO's parent company, is **making** a **multi-million dollar investment** in production of **Columbia Pictures'** theatrical features. The investment will involve Columbia's productions over the next 12 to 18 months. Other news from **HBO** includes the appointment of **Seth J. Kittay** as **Regional Manager** for Metropolitan New York, with responsibility for HBO's relations with cable systems serving Manhattan and Long Island. Systems in that area combine approximately 25% of HBO's national subscribership. Kittay will also be responsible for HBO affiliates in Northern New Jersey and Westchester County and Long Island, NY.

Optical Systems president **Alan Greenstadt,** has **announced** the appointment of **George Andrews** as **assistant** to the **president.** Andrews will be involved in all areas of corporate development with emphasis on financial analysis. Optical Systems' **Channel 100** also **participated** recently in the **Florida Cable Television Association** meeting by delivering a **demonstration** of the company's **satellite transmission** capabilities via Western Union's WESTAR satellite. The 20 minute live transmission was part of three days of testing which marked Channel 100's start of its satellite transmission.

NCTA has announced the appointment of **James T. McCorkle** as **associate director** of **government relations.** McCorkle was legislative assistant to the Assistant General Counsel for Legislation, U.S. Department of Commerce. Also joining NCTA is **Vivian Goodier** as **assistant director** of **Government Relations.** Goodier was assistant to the president of the Grocery Manufacturers of America. More **committees** have been named for **NCTA:** OSHA committee appointments include **Marvin Dilbeck,** vice-president of Times Mirror Company, as **chairman. Associates** Committee Chairman, **Richard Jackson** of Jackson **Communications** has announced the following to serve as members of the committee: **I. A. Faye, AEL; W. H. Lambert, Jerrold; R. A. Hansen, CableData; G. M. Acker, Aberdeen Co.; H. Pruzan, Anixter-Pruzan; S. Sussman, Cerro; F. Drendel, Comm/Scope; H. Duszak, RCA CTS; R. Schneider, Times Wire; R. Titsch, Titsch Publishing; J. Palmer, C-COR; C. E. Maki, Theta-Com; T. Olsen, Tomco; J. Baer, Communications/Engineering Services.**

CCTA

canadian column

Kenneth Hancock, Director Engineering

Pay Television In Canada

Madame Sauve's speech on June 2 was the first sign of success with this campaign. The first sign of the change-of-heart in the Canadian government came fairly early on in the policy speech with the following statement: "The new service which I have found most exciting, because of its potential to improve programming and real program choice, is pay television. I am firmly convinced that the introduction of this new service will be a watershed in the development of broadcasting, with major structural implications for the entire system. The establishment of pay television service on a large scale is inevitable."

It soon became obvious, however, that the Minister was not extending a carte blanche to our industry. Perhaps some further quotations from the speech are in order at this time. "Pay television, if left uncontrolled, could damage conventional broadcasting in several ways. It could lead to siphoning—that is, the draining from conventional television, of those programs which are most attractive for pay television service, such as feature motion pictures and sports."

The Minister went on to establish three objectives for pay television in Canada. These are as follows. **First:** It must provide a range of programming which does not duplicate that now offered by broadcasters and must do so without siphoning programs from the broadcasting system. **Second.** It must endure the production of high-quality Canadian programs that Canadians will watch. **Third.** It must ensure that programs are produced in Canada for international sale.

These objectives were followed by the outlining of three basic options for the participants of pay-TV networks. The first option of individual licensees was stated to be undesirable. The second option of a consortium of cable and broadcasting operators while being given more favor was felt to suffer from the disadvantage of being subject to the vested interests of both participating parties. The final option, establishment of a pay television distributor or network owned and operated independently from existing off-air broadcasters or cable interests, was the one that the Minister found most attractive and on which she requested the views of all those interested.

The final major comment in the Minister's speech was that "no matter which option is chosen, the pay television network will also act as a distributor and will be responsible for the sale of Canadian programs to, and purchase of, foreign programs from non-Canadian program distributors. All licenses for home delivery would be granted subject to the condition that programs be obtained from the network."

The Minister called for submissions outlining proposals for a pay-TV network in Canada to be submitted by the 1st of September.

It is hoped that the go-ahead on pay-TV would be given by the end of this year.

The reaction of Canadian industry was rapid. Directly after the speech, while the Convention was still on, the CCTA Directors agreed unanimously with the principle of the formation of a corporate body through which all CCTA members could, at their discretion, channel their efforts at pay television, particularly those efforts that would relate to the September 1 presentation to CRTC. This agreement resulted in the incorporation of Pay Television Network Limited (PTN) who will present a "document for action" to the CRTC on behalf of all the Canadian companies that chose to participate.

During July and August CCTA is holding special seminars explaining the concept of PTN to Canadian cable television licensees.

The Canadian off-air broadcasters were not far behind. By mid-July, CTV, one of the major Canadian off-air networks, announced that it would also be setting up a pay-TV network. It was indicated that this broadcaster's network would be 60% owned by the 14 affiliates of CTV, with the other 40% of the equity being available to other broadcasters. The objective of this company would be to set up a production fund to support Canadian program production.

The next few months will be extremely active and interesting ones for Canada in the pay-TV field, and at this time we can only guess what the final decision of the government of Canada will be on this matter.

CableVision

The professional biweekly, out front in Cable TV.

CableVision's Financial Report

The in-depth semi-monthly newsletter of cable finance.

Communications/Engineering Digest

The monthly standard of broadband technical information.

CableVision's Tech Review

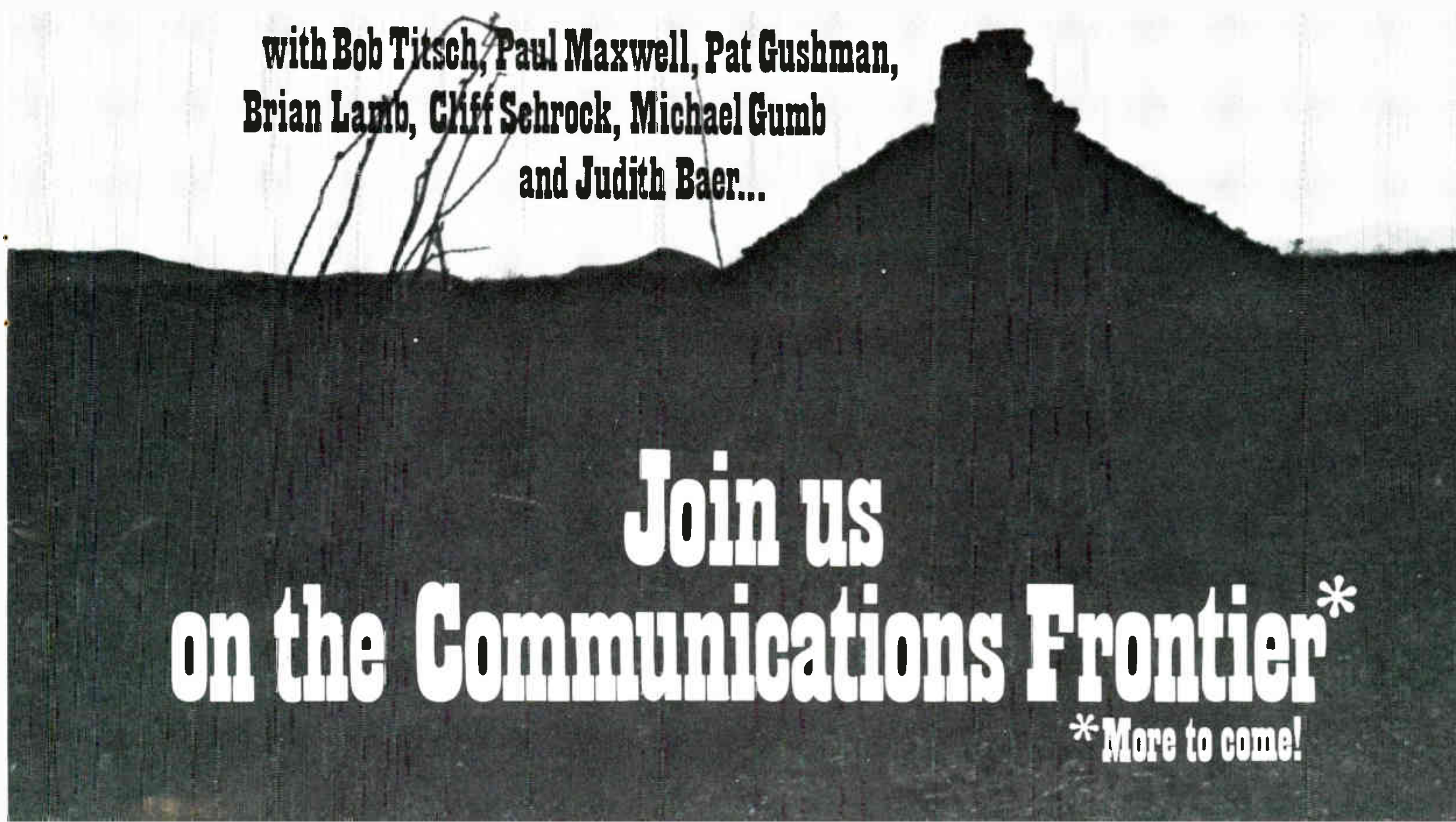
The special C/ED quarterly of "what's new" in Cable TV.

CableVideo

The public affairs video service from Titsch Publishing.

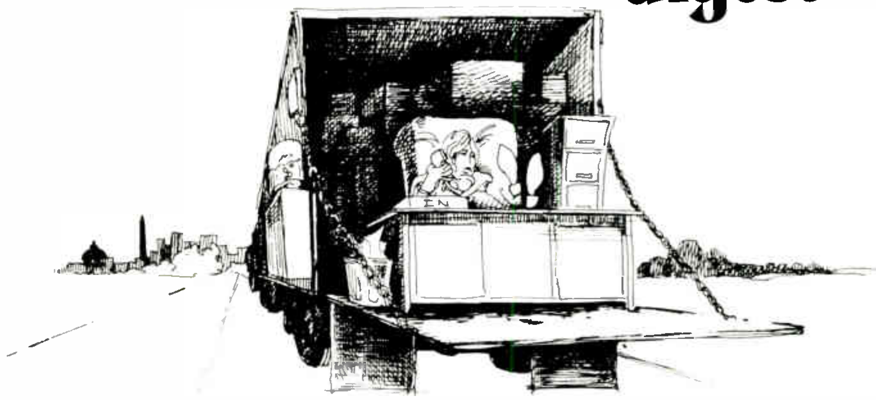
The CableVision Game

The first in a series of "specials" that are fun.



communications/engineering digest

reporting the technologies of broadband communications



AD INDEX

TECH REVIEW

C/ED

New Parameter II Low-loss Coaxial Cable Locks Out Moisture

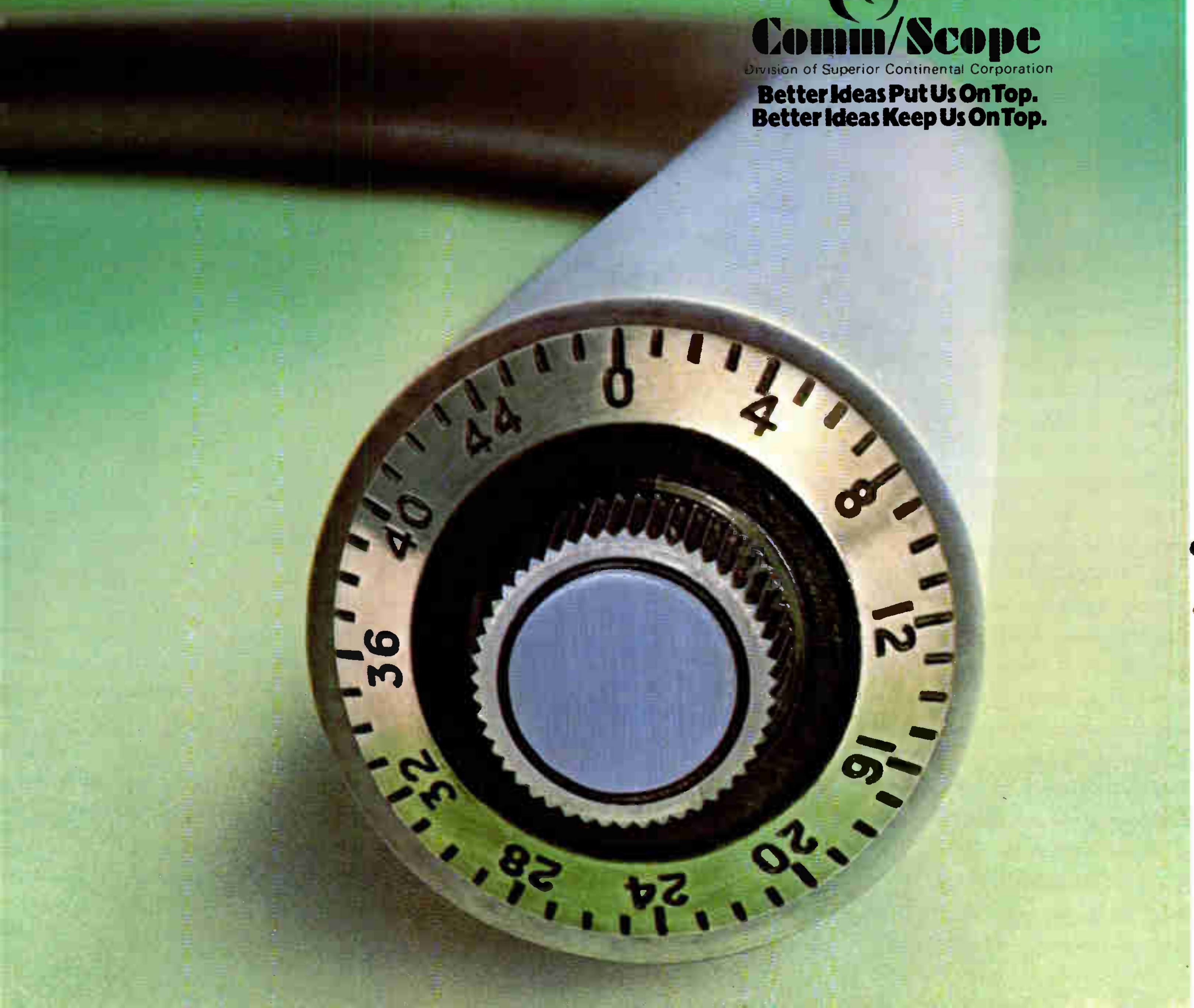
Moisture can be a problem with many types of low-loss cable. But not with new Parameter II low-loss cable. Thanks to our exclusive expanded polyethylene dielectric.

You see, some dielectric materials have poor bonding characteristics. But Comm/Scope's expanded polyethylene dielectric maintains the superior bonding properties of conventional polyethylene. To give Parameter II a lock-tight bond. And prevent moisture from affecting the center conductor.

Parameter II low-loss cable comes with a five-year written guarantee. For more information write today: Comm/Scope Company, P.O. Box 2406, Hickory, North Carolina 28601. Telephone (704) 328-5271.

Low-loss Parameter II. Locks Out Moisture.

Comm/Scope
Division of Superior Continental Corporation
Better Ideas Put Us On Top.
Better Ideas Keep Us On Top.



Technical News at a Glance

. . . the cablevision industry successfully showcased technology when first transcontinental two-way, live Congressional testimony was delivered from Santa Monica, California, to Washington, D.C. July 20 for House Communications Subcommittee hearings,on a 3.2 meter horn antenna.

. . . industry leader Teleprompter beat the world to the punch by introducing experimental optical fiber project in their Manhattan system. HBO signals travel 250 meters. The project is working smoothly according to participants.

. . . Scientific-Atlanta hosted over 100 current and future users of TVRO earth stations at 3-day Earth Station Technology Conference in Atlanta during July.

. . . James Hobson has been officially approved by the U.S. Civil Service Commission as Chief, Cable Television Bureau at FCC. Hobson has served as acting chief since departure of David Kinley for ATC, Denver.

. . . more than 35 cablevision suppliers will display wares at CATA CCOS-76 in Wagoner, Oklahoma, August 9-11.

. . . SCTA 16th Annual Convention hosts 3 days of management and tech sessions September 12-14 in Atlanta. Reduced tech registration fee of $15 includes sessions, buffet, exhibit area, demos and night out with Atlanta Braves.

. . . IEEE continues Call for Papers on cablevision technology. Initial IEEE Transactions on Cable Television *will appear in October and then quarterly. Over 1,000 reservations for first issue were received within first 20 days of offer to industry.*

. . . SCTE is counting ballots for election of 1976-78 officers. More than 20 names were nominated for four top national positions.

. . . NCTA's Engineering Advisory Committee held Engineering Standards Subcommittee meeting in Washington during July and completed draft of system measurement parameters. Next category will be headend parameters.

. . . FCC annual reports will be produced with trunk and headend information in metric system next time around. New DAD system is estimated to save industry considerable man/years of reporting as operators verify, update, sign and return info to Commission.

. . . Prodelin, manufacturer of 4.5 meter fiberglass earth station antennas, claim by actual measurement to have 29 dB carrier-to-interference (C/I) ratio. Not bad considering most 10 meter dishes are only 30 to 31 dB. Well, so much for FCC argument of large antennas for C to I suppression!!

Fiber Optics

A Treat or A Threat?

Delmer C. Ports
V.P. Engineering
NCTA

Generations of Glamour

Just as microwave technology was the center of attention in the 40's, and, as transistors erupted in the 50's; then satellite communications in the 60's, now fiber optics has emerged as the glamour technology of the 1970's.

Fiber optic communications is no longer a novelty in the research laboratories. It is a very positive form of communications and will fulfill some important parts of communication needs of the future. The principal developments up to now have been contributed by the major common carrier laboratories, military research organizations and large glass manufacturing corporations.

The basic characteristics are now fairly well identified; and the present development work is concentrating on improved techniques, refinements in performance and reduction to practice. Through prediction and analysis, it is now feasible to associate potential designs and tradeoffs with various applications.

There has been the inevitable blue-skying, but overindulgence in science fiction has always been a precursor of sound engineering, economics and marketing judgement.

Key Characteristics

Fiber optic communications offer a number of very desirable characteristics that add up to a unique potential. Broadband by present standards, small size, a potential for high reliability, highly resistant to interference, unlimited transmission range, potential for lower cost when within the scope of optimum applications, uniform attenuation over the useful frequency range, and insensitivity to temperature are some of the advantages.

What is Being Done Now

In the U.S. fiber optic links are being installed in military aircraft and naval ships for data and video. These are all short-range applications, but the superior performance being obtained is very significant. The major common carriers in the telephone industries are experimenting actively. AT&T is installing a 144-strand fiber optics trunk system between stations in Atlanta for a full-scale, comprehensive test. Teleprompter Manhattan Cable has installed a short-range trunk line for field testing.

In the United Kingdom, Rediffusion has installed an underground fiber obtics transmission line and is operating it for feasibility tests.

In Japan, a new planned community is being "wired" using fiber optics. When completed, this will be a full-scale test. France is also quite active in various developmental phases in fiber optic applications.

What Does It Offer Cable TV?

Beneath all the glamour and blue sky, it now is apparent that this new development will offer some advantages that are beyond the scope of conventional coaxial cable technology. Two recent studies—Dr. Tom Straus, et al[1] and George Kepsoshilin[2]—have identified the types of applications where fiber optics may have a competitive advantage. The first analysis shows that, for relatively modest channel capacity and medium distance ranges, it will be competitive with the more conventional installations for express or super trunks. The second analysis indicates that it will be competitive only for very high data rates and extended distances.

Why should these differences appear? One cannot be certain but possibly it is the difference between the traffic each investigator assumed. The first study assumed TV (analogue signals) while the other assumed high-speed digital data. Also, there is the possibility that the assumptions for the analyses were different (although both were generally conservative) and these subtle differences may have had an effect on the relative economics of the systems. Future refinement and service demands can also be expected to affect the conclusions of such studies.

There is a possibility of full linearity for transmission on these transmission lines and some researchers are quite optimistic. With this, it would be possible to put television signals directly on fiber optics distribution systems. At the present time, however, it appears more likely that television will be distributed in digital form, particularly when extended trunk runs are involved. Digital-to-analogue converters would then be required at sub-hub or local distribution points.

Predictions of Attractive Applications

With the foreseeable characteristics now before us, it is reasonable to predict that fiber optics will be attractive for the following uses: major trunk runs, express trunks, extensions to rural communities and shared use with other services.

The potential advantages include the following: For a given cost, there should be more capacity for multi-purpose applications. There should be negligible signal deterioration to local distribution points. There should be a potential cost saving under the limited applications described above. It should be relatively interference-free, and it is not expected to be a source of interference to others.

What It Will Not Do

It is very unlikely it will replace conventional coaxial cable for the actual house-to-house connections (at least for a long time). It will not obsolete conventional TV sets and related video equipment. It will not automatically open a door for the cable industry to new businesses not now available to it. It will not subject cable to serious competitive pressures beyond those already threatened (at least for a number of years). It will be a valuable asset to the cable industry for use in specific applications, but it will be neither a total panacea nor do we need to panic over the possible threat of it as a replacement or an immediate competitor for conventional coaxial cable systems.

Straus, Dr. T. M., Dr. F. L. Thiel, Dr. M. Barnoski, "Applications of Optical Fiber to CATV Systems." 24th Annual NCTA Convention Official Transscript, 1975, pp. 135-144.

Hewlett-Packard internal memorandum.

scte comments

Bob Bilodeau, President

Abundance in CATV?

We have heard the phrase "abundance" used in connection with cable television for the past decade to describe cable's abundant channel capacity growth possibilities, services, etc. There is one other area where abundance seems to fit. The area of technical literature.

CATV system technicians must feel like the fellow who chanced upon acres of lush strawberries with a one quart pail in his hand. The present day technician endures an abundance of technical literature like no other time in the past. The list includes TVC, recently reunited with NCTI (Cable Tech), CATJ, *CableVision, Communications/Engineering Digest* (of course), various annual and non-regular technical publications of NCTA, the FCC (CTAC) your own SCTE (e.g., First Annual Reliability Conference), technical literature written around specific equipment from manufacturers, Ken Simmons' Handbook, periodicals from the telecommunications industry, broadcasting, microwave, etc. This latter group includes Microwave Journal, TeleCommunications, Microwaves, Communications News, ad pulpium. Let's not forget the reference works by ITT, such as Data for Radio Engineers and the GTE Lenkert, Engineering Considerations for Microwave Communications Systems. Of course, I have omitted the multitude of publications in the video, data processing and fibre-optics fields, which all add to the list of suggested reading.

I personally subscribe to, read, or have read the above.

While I am not an Evelyn Wood's graduate, I don't read slowly either. However, by the time I have finished the cycle for the monthlies, it begins again. I feel compelled to continue for fear I should miss something and in fact, supplement this with attendance at various technical seminars. There I'm reminded of my obligation to the FCC utterances that deal with technical matters. The technical person of responsibility must be familiar with the current rules of the road for cable and microwave maintenance and operation.

Well, I pictured a very busy body. The reading and absorption process seem to preclude any time left over for normal assignments. Such is the nature of the technician's responsibility. After all, it's tough to fit a field of strawberries into a one quart pail!

In a traditional archival format soon to appear, will be the new publication of the IEEE Broadcast, Cable, and Consumer Electronics Society—*Transactions on Cable Television.* Cable engineers will want to receive this in addition to the volume of material now crossing their desks.

The cost conscious might wonder how the industry can support all of this print in support of a video medium. It's been difficult at times. Perhaps the TVC/NCTI combine brings strength to both; we hope so. Recently, two leading journals, *Communications/Engineering Digest* and *CableVision* have combined forces but unlike the TVC/NCTI merger, the two publications will continue in their respective images.

I support these very natural movements of assimilation in our industry. They have been successful, cost effective devices by cable operators themselves, over the years.

In addition, I commend *CableVision* for its stroke of genius in attracting the considerable talents of Cliff Schrock. If I could now find more quart pails, I will be better able to enjoy the fruits of their labor. Since Kudo's are in order, Judy Baer, the Ming Dynasty and the Titsch/Maxwell family deserve front page.

I will continue to read all that fits into my schedule. My hope is that what prints, fits.

Bob Bilodeau

opinion/editorial

Judith Baer, Associate Publisher

What do I think? I think it's a perfectly marvelous idea. What am I talking about? I'm talking about COMMUNICATIONS/ENGINEERING DIGEST being published by Titsch Publishing, Inc., the people who bring you *CableVision*. What other changes does such a relationship conjure up in my mind? What will happen to *C/ED?* Who's doing what to whom?

Simple: I like the idea of working with a talented group of people such as Bob Titsch has put together in Washington, D.C., Denver, and Portland, Oregon. I like the idea of being able to bring those talents to the technical and engineering side of the broadband/cable television industry. Ultimately, the point has always been, and will continue to be, to promote the engineers and technicians in the industry *TO* the industry and to promote the technology of the industry in general. The relationships that have developed and the lines of communication that have opened up during the past months of publishing *C/ED* convince me that this is an industry that does not have its head in the sand when it comes to technology. Just look at what we've accomplished in the field of domestic satellite communications in less than one year in the business, and look at our recent introduction of optical fibers for cable television transmission. This industry is not only willing, but obviously able, to make use of such advanced technologies.

As an industry, we've got the Institute of Electrical and Electronics Engineers behind us through the publication of the new IEEE *Transactions on Cable Television*. We've obviously got the interest of the industry through the Society of Cable Television Engineers and its increasing membership. Other industries know we're here and that we know what we're talking about. We're being included more often in the future planning sessions of government agencies and educational institutions such as the National Academy of Engineers and the Metropolitan Telecommunications Council. We've been here all along, but we've not had a proper showcase for our talents.

C/ED was designed to showcase cable television industry talents. The marriage (one of the few times I'd use that word) of *C/ED* and TPI just enhances the showcase and certainly insures its future growth. The added staff (seventeen professionals around the country), allows *C/ED* to be many more places than we've every been before. The facilities, the know-how, the enthusiasm and the heart all make a good package.

I am complimented by the arrangement. I am pleased with the possibilities for the future. I have no doubt that you'll notice changes in formats, but basically the book will stay the same. *C/ED* will be published monthly; *CableVision* will stay on its biweekly schedule. The two magazines remain two different publications. *C/ED* will continue to open lines of communication and present a varied number of views. It will be, no doubt about it—the best there is. *CableVision's* Tech Review will become a quarterly feature that will showcase new hardware as *C/ED* showcases engineering expertise and talent.

It will be the most complete. It will be the best. That is a promise. I would settle for nothing less.

Robet Titsch/*Publisher*
Judith Baer/*Associate Publisher*
Paul Maxwell/*Editor-in-Chief*
Cliff Schrock/*Editor*
Steve Riley/*Art Director*
Liz Petrus/*Assistant Art Director*
Sandra Treece/*Managing Editor*
Mike Borer/*Business Manager*
Lynn Cox/*Traffic-Circulation*
Bonnie Schmidt/*Production Chief*
Susan Cagle/*Composition*

volume 2, no. 8

communications/engineering digest

COVER: A section of fiber optic cable being used in the Teleprompter system is shown. Six strands are fitted into small diameter plastic tubing, then sheathed into a cable no larger than a standard drop cable.

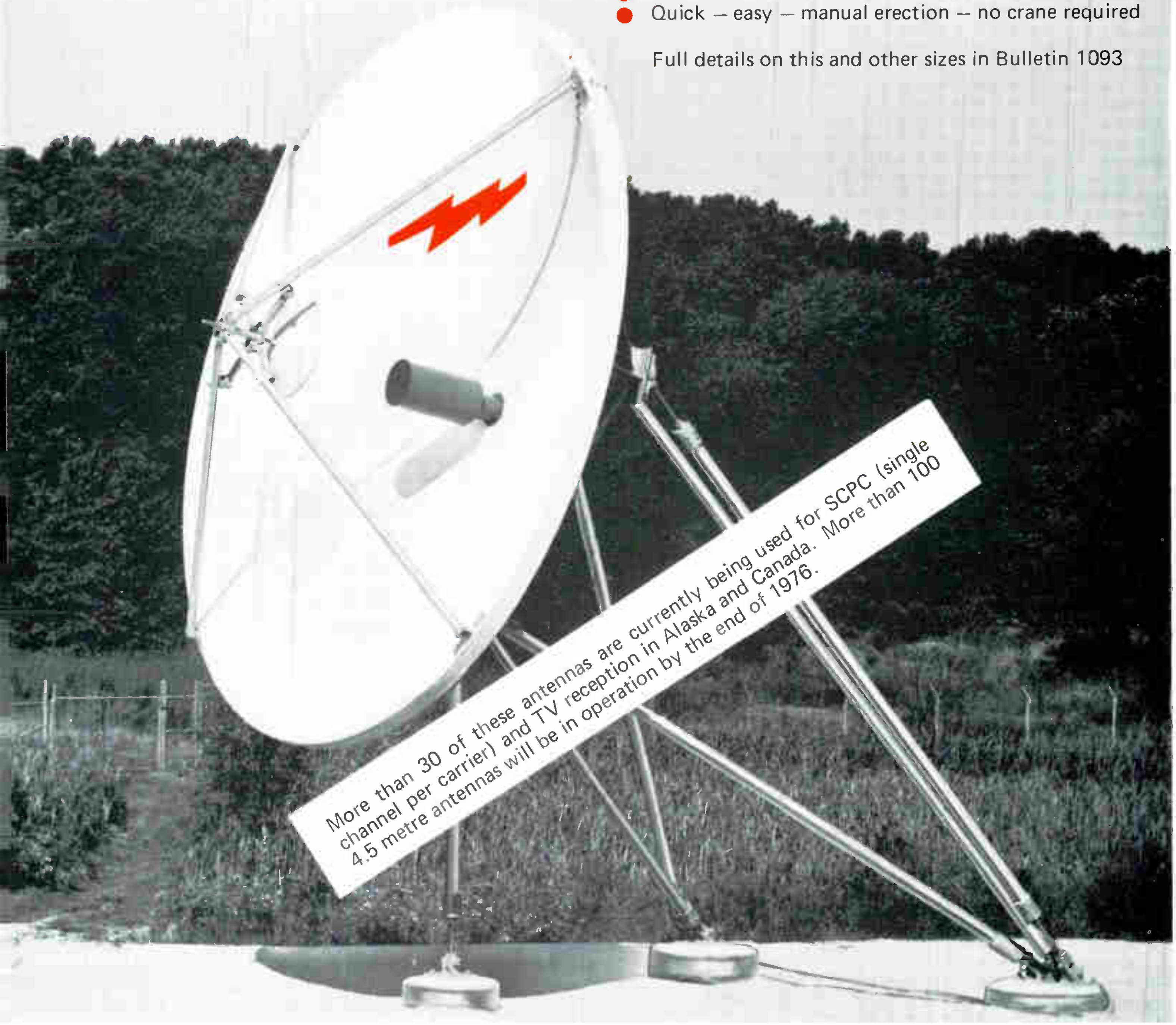
communications/engineering digest is published monthly for the Society of Cable Television Engineers by Titsch Publishing Incorporated © August, 1976. Subscription cost is $12 per year U.S. and possessions, $15 Canada and Mexico, $17 foreign. $1 single copy. Application to mail at controlled circulation rates is pending at Denver, Colorado.

32-25 log θ

AVAILABLE NOW . . PROVEN IN SERVICE
4.5 METRE EARTH STATION ANTENNA

- Measured patterns meet CCIR/FCC (32 – 25 log θ) requirements
- Receive only and 4/6 GHz receive/transmit versions available
- New patented high efficiency feed
- Universal mount
- Quick – easy – manual erection – no crane required

Full details on this and other sizes in Bulletin 1093

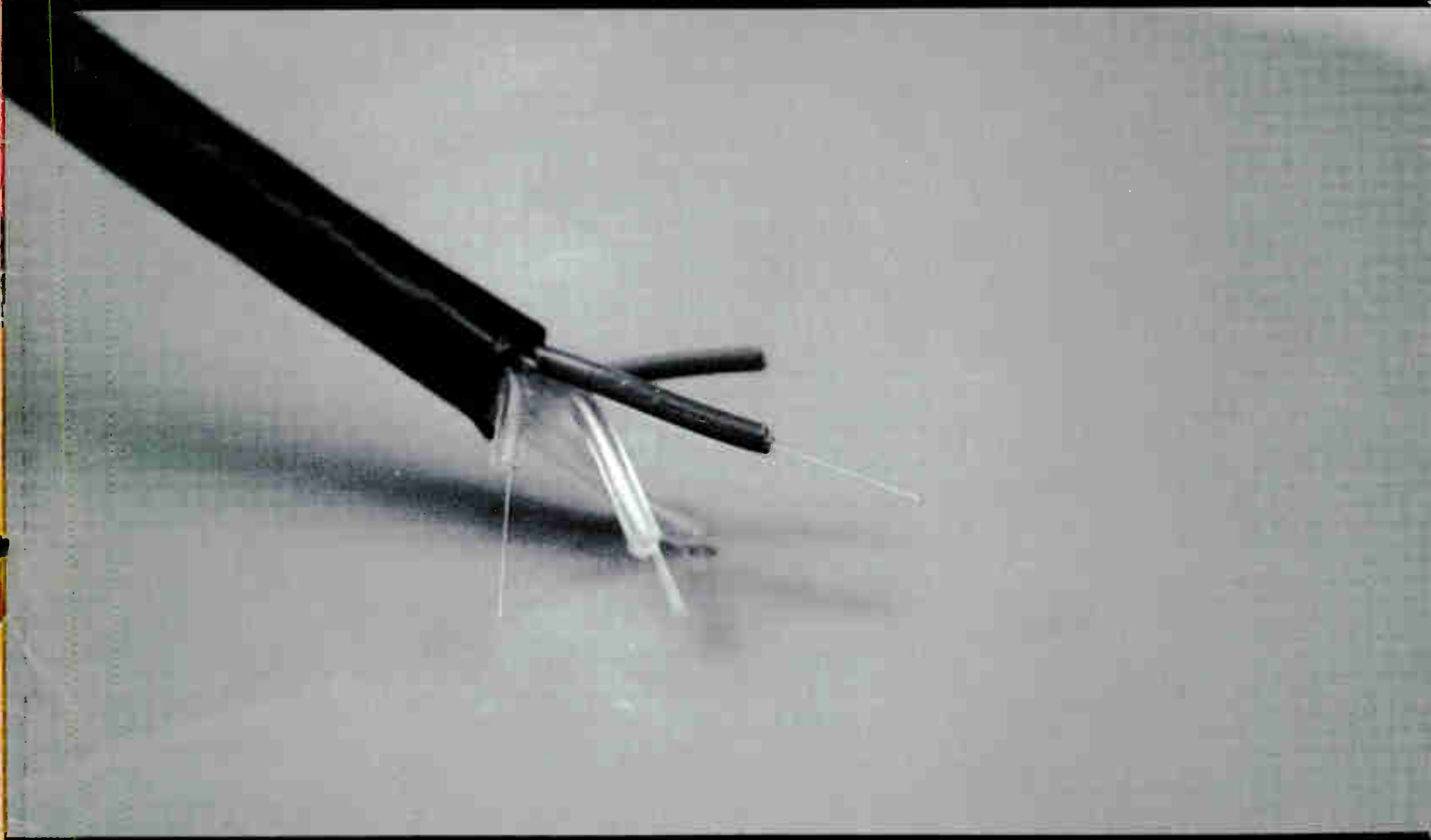


ANDREW

ANDREW CORPORATION, 10500 W. 153rd St., Orland Park, IL, U.S.A. 60462 Telephone: (312) 349-3300
ANDREW ANTENNA COMPANY LTD., 606 Beech St., Whitby, Ontario, Canada L1N 5S2 Tel: (416) 668-3348
ANDREW ANTENNAS, Lochgelly, Fife, Great Britain KY5 9HG Telephone: (0592) 780561
ANDREW ANTENNAS, 171 Henty St., Reservoir, Victoria, Australia 3073 Telephone: (03) 460-1544
ANDREW ANTENAS LIMITADA, Caixa Postal 600, 18100 Sorocaba, São Paulo, Brasil Tel: Sorocaba 2-8900

communications/engineering digest

reporting the technologies of broadband communications



volume 2, no. 8