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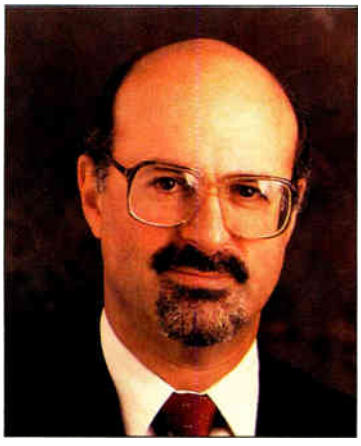
OCTOBER 1994

Rebuilding the infrastructure

Battery options ◆ Digital standards ◆ Infoway survival ◆ Atlantic Show

WHAT DOES THE NEXT GENERATION WANT FROM US, ANYHOW?

PCS spectrum auction results



By Jeffrey Krauss, polishing apples in the information supermarket and President of Telecommunications and Technology Policy of Rockville, Md.

The FCC has just completed the first spectrum auctions. Narrowband PCS (personal communications services) nationwide licenses brought from $37 million to $80 million each, and the bids totaled more than $600 million, an amount that was more than 10 times as much as estimated by government officials. But as my calculations show, these numbers are not too far away from the current selling prices of cellular systems and TV stations. Let's see what this portends for the wideband PCS auctions coming in a few months.

Narrowband PCS results

Narrowband PCS is an advanced paging and electronic messaging service. Unlike today's one-way paging services, it will provide both a detailed message on your pager, and the ability to send an acknowledgment or reply message. The FCC auctioned off three types of nationwide narrowband PCS channels: 50 kHz outbound channels paired with 50 kHz return channels; 50 kHz outbound channels paired with 15 kHz return channels; and 50 kHz unpaired channels that can be used for both outbound and return messages. The 50/50 channels went for $80 million; the 50/15 channels went for about $50 million; and the 50 kHz unpaired channels went for about $38 million.

In determining the value of the spectrum, it's convenient to talk about spectrum value "per pop," which means the value per person in the service area. Since the United States has a population of about 250 million people, the $80 million is 32 cents per pop for 100 kHz of spectrum. Let's use that value as a reference.

TV stations

That 32 cents per pop for 100 kHz would equate to a reference of $19.20 per pop for a 6 MHz channel. Let's try to compare that with recent TV station transactions. WLTZ(TV) of Columbus, Ga. was recently sold for $4.3 million; the Columbus area has a population of about 480,000, for a value of $9 per pop. But WLUK-TV of Green Bay, Wis. just sold for $38 million; it covers a population of about 1,000,000, for a value of $38 per pop.

Fox paid between $75 million and $80 million for WHBQ-TV, Memphis, Tenn., which covers about 1.6 million people (about $50 per pop). WTNH-TV of New Haven, Conn. sold for $120 million. The New Haven market is only about 1 million population ($120 per pop), but actually the station is counted as part of the Hartford-New Haven market (2.4 million population), so that comes out to $50 per pop. And WSMV-TV (Nashville, Tenn.) is being sold for $159 million; with 1.85 million population, that's $86 per pop.

If anything, the reference $19.20 per pop looks like a bargain, until you consider that these TV stations are ongoing businesses, with existing plant, customers and a marketplace identity. In contrast, the FCC auctioned bare PCS spectrum.

Cellular systems

A cellular telephone system uses 25 MHz of spectrum. The 32 cents per pop per 100 kHz reference translates to $80 per pop for a cellular system. How does this compare to actual cellular system sales? It turns out that cellular systems in large cities sell for much more than those in small cities.

According to one expert I talked with, cellular systems in the top 60 cities in the country would expect to bring $150 to $400 per pop. Systems in smaller urban markets might bring $50 to $150 per pop. And rural areas might bring $25 to $50 per pop. The reference of $80 per pop again looks like a bargain, at least for the large cities, but like the TV stations, these prices are for operating cellular systems, not bare spectrum.

Wideband PCS auctions

The Congressional Budget Office made a back-of-the-envelope calculation a year ago and estimated that the wideband PCS auctions might bring in $10 billion. They did not have the benefit of the narrowband PCS auction results. At 32 cents per pop per kHz, the total of 120 MHz should bring in $96 billion!

Now that number does not take into account the cost of buying out microwave operators who already populate the 1850 MHz to 1990 MHz band, but I estimate relocation costs to total only about $1.5 billion.

I would expect a regional license to be less valuable than a nationwide license, because it should be cheaper to operate a larger system than a smaller one. There should be economies of scale, and marketing a national brand should be easier. Since the wideband PCS licenses will be regional, not national, I'd guess at a big reduction, perhaps 50 percent, compared with national licenses. So perhaps the total will be $45 billion in revenues for the U.S. Treasury.

But even at this cut rate (16 cents per pop per 100 kHz), a wideband PCS license for the New York Major Trading Area (30 MHz of spectrum, population = 27 million) should bring in between $1 and $1.5 billion.

Auction a cable franchise?

What if a city decided to auction off a cable franchise? Would it bring in millions? Are you kidding? It already has! Remember franchising? Those were auctions. Between the institutional government networks, funding of community programming, and franchise fees, local governments have been far more successful in extracting money than the Federal Government. Now the Feds are catching up. CED

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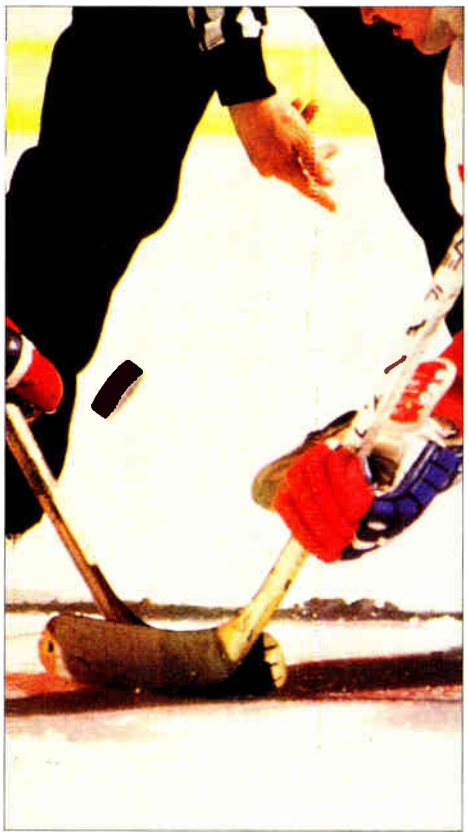

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By Roger Brown

Build it...and they will come. That seems to be the philosophy of cable operators as they frenetically build the high-tech platform that will make advanced services possible.

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The cable operating environment is a cruel one, especially for power supply batteries. This story describes the fundamental design and construction features of lead-acid batteries and compares the performance of available technology choices.

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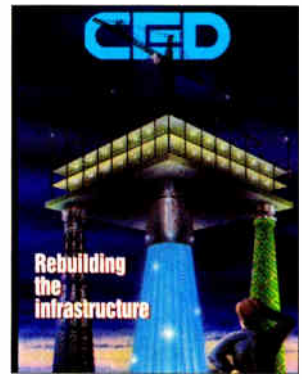
When OSHA knocks on your door, will you be ready for an inspection? The editor of Antec's *Cable Safety* newsletter details the ins and outs of new regulations and how cable companies can comply.



About the Cover

The cable infrastructure rebuild is a work-in-progress. Illustration by Bob Stewart.

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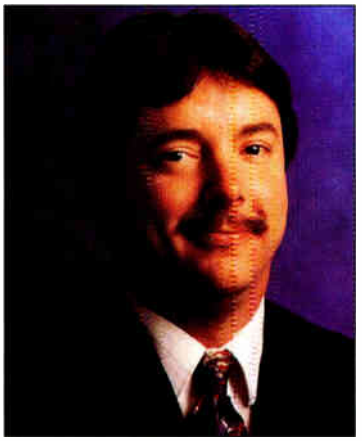

Suffering a few growing pains

While the telephone companies openly hype their ability to construct the national infoway, in reality, they may find the going a little rough. In fact, at least one of them is having problems just getting customers hooked up for phone service in a timely manner.

US West has been taking a lot of heat from the Colorado Office of Consumer Counsel and the Public Utilities Commission over an increase in consumer complaints about busy signals on its customer service lines and long delays to get service. Does this tune sound familiar?

Colorado is enjoying a robust economy and is being inundated by new residents from other states. US West says that's causing its order backlog to grow. But according to the consumer advocacy group, problems within US West began two years ago when the number of people waiting more than 30 days for phone service began to escalate dramatically, according to a story in "The Denver Post." Right now, there are about 2,700 people waiting for service, an increase from 2,400 in August 1993.

In response, the PUC is proposing a new set of rules that will redefine a wait order and force US West to provide service within five working days if wiring is already in place (90 days if not). But the most intriguing rules focus on the alternative methods US West must provide to those who are waiting for service.

The PUC wants US West to use one of seven alternatives, including: cellular, remote call forwarding, voice messaging, satellite service, radio service, PCS, microwave or party lines. There's a lot of legal wrangling over how much authority the PUC has and just when those waiting customers have to be served with one of the seven options.

Nevertheless, the point is clear: the RBOCs are under as much pressure to provide basic levels of service to their customers as the cable companies are, if not more. Despite a widespread perception that they're better than the cable companies at providing that service, it's equally clear that isn't always the case. Given all of the layoffs the RBOCs are announcing as they prepare themselves for a competitive future, I think that pressure can only intensify.

Now comes word that some local phone companies want to implement a new "call setup" charge because most of today's phone calls last less than one minute. With the popularity of voice mail, fax and other alternatives such as e-mail, 52 percent of residential phone conversations now last less than 60 seconds, up from just 22 percent in 1982.

The phone companies claim this costs them money because it's in the first minute when they incur their costs. Others say this is just "telecom tomfoolery," and a perfect example of how the phone company is able to wrestle money out of sympathetic PUCs.

If the latter is true, telcos had better learn a quick lesson and reduce their costs somehow. For if they want to deliver other services such as video in a competitive environment, they can't have it both ways. Giving people what they want when they want it is everyone's goal, but it's never easy.

Roger J. Brown

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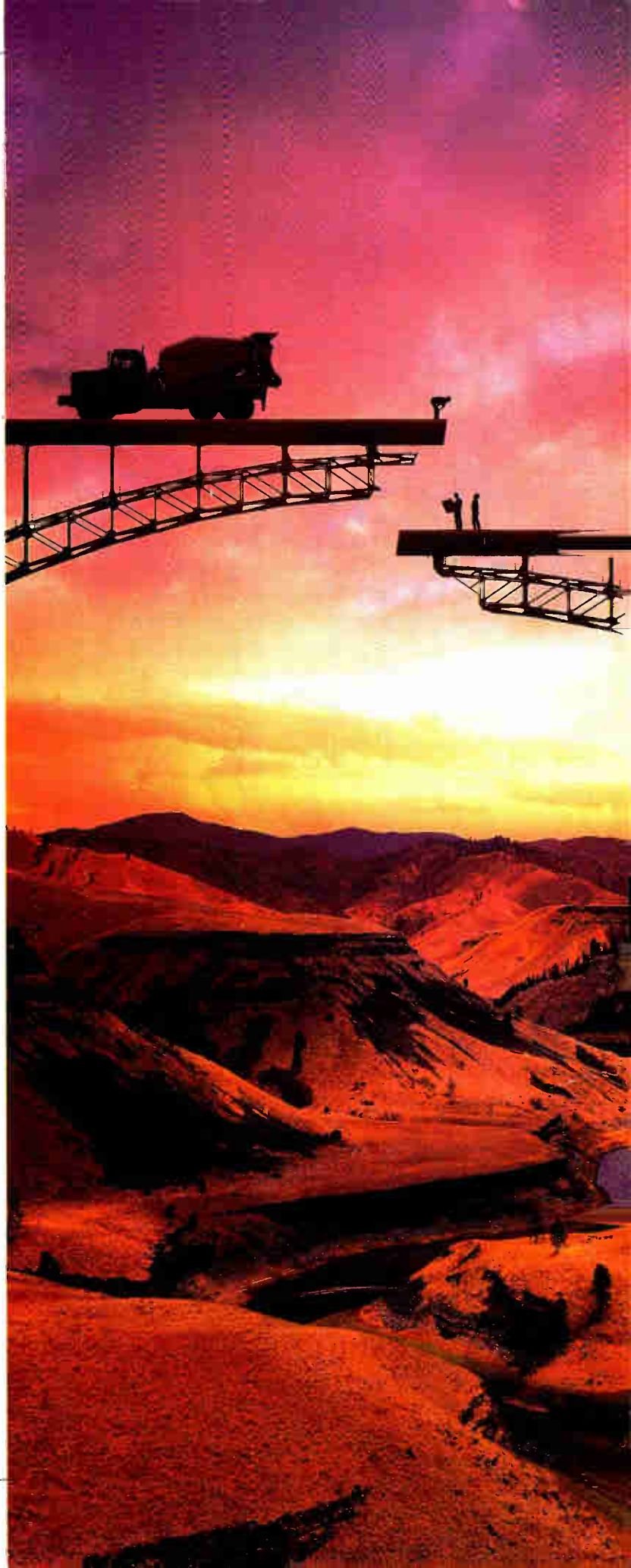

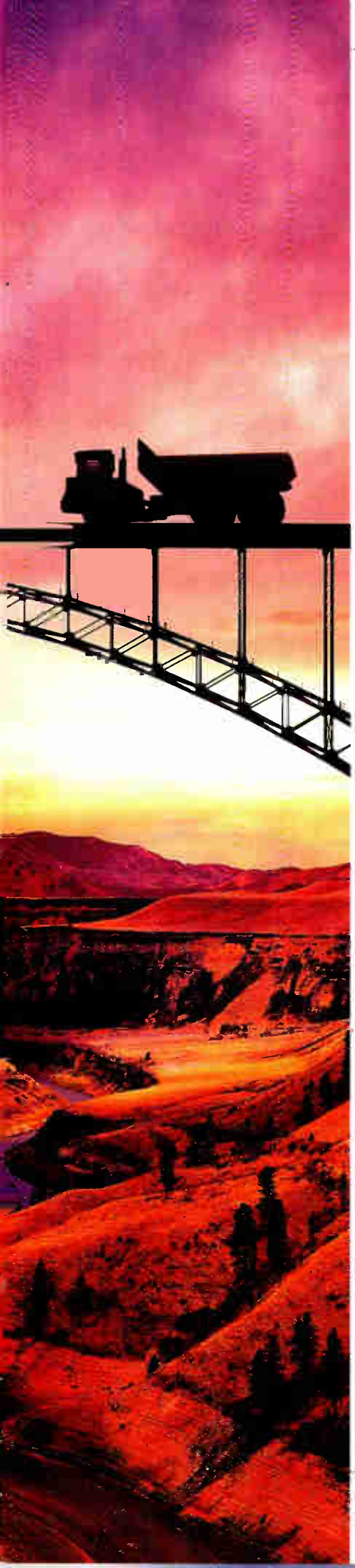

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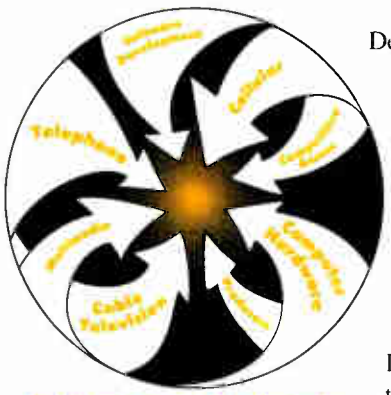

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- **Fast Lane or Frontage Road: The State of the Infrastructure**
- **Opportunities in Business Applications**
- **Serving Government and Education**
- **Policy Issues: Universal Access, Privacy and Intellectual Property Rights**
- **Divided Highway vs. Seamless Interconnection: Relationships and Regulations**
- **Consumer Applications: "What You Want, When You Want It"**
- **Information Super Toll Road: Revenue Issues**

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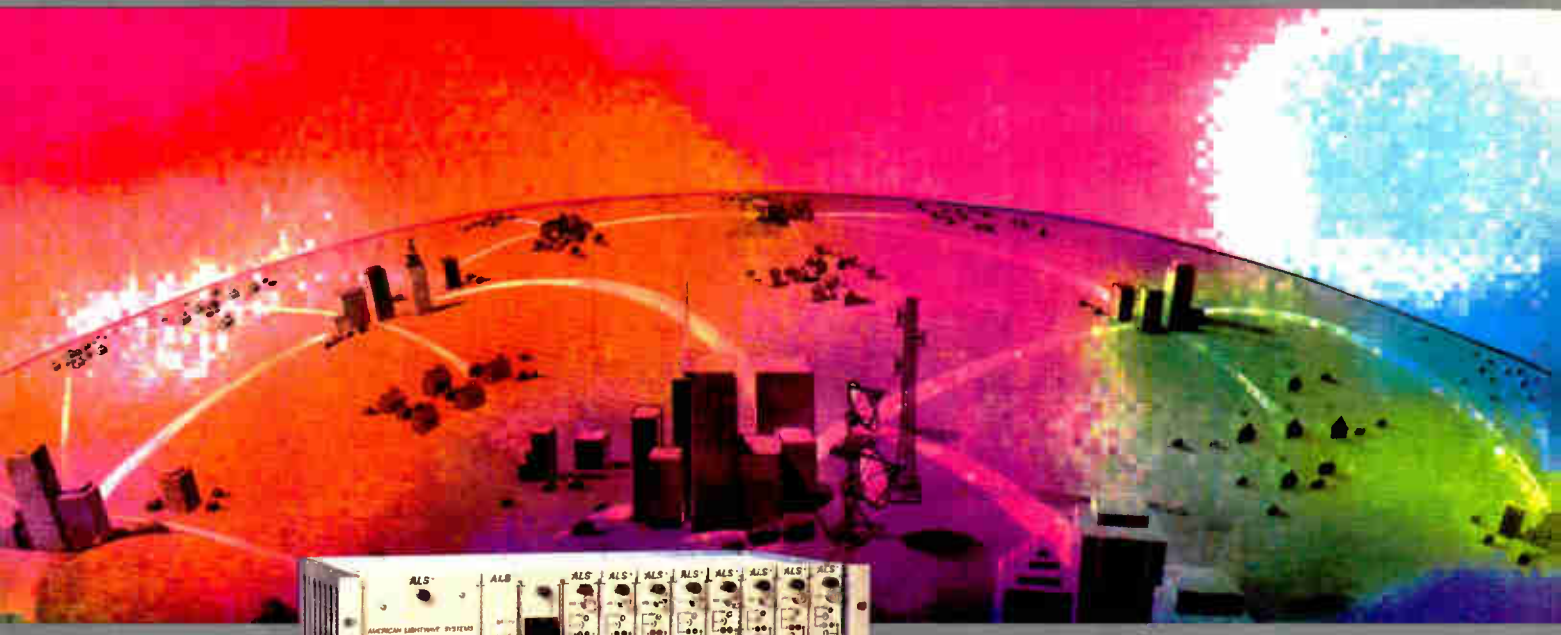

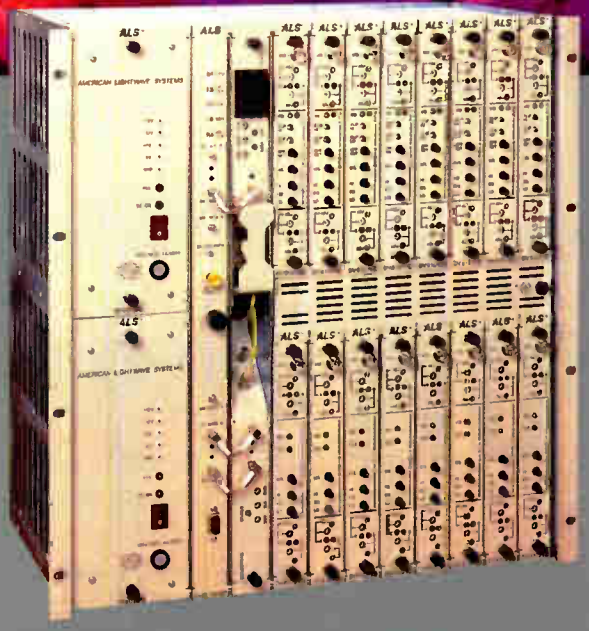

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A tool for the trade

The Power and Communication Contractors Association (PCCA), a non-profit trade association, will celebrate its 50th anniversary in 1995. PCCA includes among its member companies those which are involved in the construction of cable television, fiber optic and telephone systems, as well as those which construct electric power facilities. The association has three contractor subdivisions, represented by councils: the Power Contractors Council, the Telephone Contractors Council and the Cable Television Contractors Council (CTCC).

PCCA Executive Vice President Mike Strother is hearing from his cable contractor members that the number-one issue in dealing with operators is manpower, especially the availability of technical personnel, including linemen who can do everything from string wire to install repeaters. "We are experiencing a significant shortage across our industry," says Strother, "and in fact, I have been directed to do whatever the association can do to improve that situation."

Another issue confronting CTCC's members is the confusing status of standards. "From one six-month period to the next, the contractor may encounter at the same cable company totally different engineering design standards and application methods," adds Strother.

PCCA has several efforts in the works to tackle these contractor/operator issues. To address the standards question, several of PCCA's members are involved with SCTE committees, working to forge industry wide standards that both contractors and operators will adhere to. To help increase the pool of trained technical personnel, the association is in the process of putting together a directory of existing training programs as a resource for its members.

And finally, PCCA's board recently agreed on a means to facilitate contractor/operator communication. The association's members will soon be categorized in a database not only by the type of work they do, but also according to the areas of the country they work in, based on the 10 SCTE regions. Operators will then be able to conduct computer searches for contractor personnel via a number of different criteria. CED

John Jamar, executive vice president of Cable Constructors Inc., one of the primary contractors for the Roanoke project, explains that the relationship worked because the operator mapped out a concise schedule with specific period deadlines, and then relied heavily on CCI to oversee operations. "They basically said, 'I've got a really big whip, so you take the little whip that I normally crack, and go ahead and crack it like crazy," paraphrases Jamar, "so that I don't have to get the big one.' And that seemed to work really well."

Adequate leadtime

Before a project ever begins, there is one critical step an operator can take to help ensure that the project succeeds: provide the contractor with sufficient leadtime. The fact that contractors are facing severe shortages in trained crew members is voiced by Larry Linhart, president and CEO of Columbus, Ohio-based NaCom, and many others in the industry. While typically, cable operators have expected contractors to be ready for action in 30-45 days, with the current shortages, contractors like NaCom would prefer to have several months to rampup. The situation will probably get worse before it gets better, because a large number of skilled technical people bailed out of the industry the last time it experienced a downturn.

The labor shortage also means contractors should be careful about overcommitting their resources. The old adage of "under promise and over deliver" is critical now that contractors are not so confident they can deliver on a timetable that is consistent with past history.

Schenck concurs that experienced personnel, especially equipment operators and journeyman linemen and splicers, are becoming harder and harder to find. What's worse, there's even less raw talent to be trained these days, as opposed to years past.

This shortage of talent is partially due to the nature of the projects that operators are now involved in, according to Austin Shanfelter, president of SHANCO Corp. and group leader of PCCA's CTCC Steering Group (see sidebar, above). "The splicer is of all necessity. They are doing electronic changeout, electronic upgrade work now," says Shanfelter.

In response to the shortage, Shanfelter, as well as some of PCCA's operator members, have taken the initiative and started a training school: Telecommunications Training and Placement Group Inc., in upstate New York. The school offers an intense four-week program that teaches everything from map reading to climbing to installation and splicing.

Sophistication, equipment & standards

These days, operators are calling on contractors to upgrade systems into the realm of increasing complexity. Fiber is moving deeper into the neighborhood, systems are being designed at 550 and 750 MHz, and headends are being consolidated. While some operators are still skittish about a major investment in advanced services, others are already activating the return path in preparation for interactivity and data communications.

In one example, Cablevision Industries has been doubling the amount of fiber it installs every year since its initial installation of fiber in 1990, according to Van Loan. "The first fiber to the feeder project was in 1990," he notes, "and each year, we are increasing the amount of fiber we use in these projects."

Although rebuilds and upgrades are continuing at a rapid pace, contractors don't seem to be experiencing significant delays in getting equipment–yet. While Linhart notes that lead times are lengthening, "We've adjusted to that...nothing extremely inconvenient yet." But operators take note: he foresees the situation worsening in 1995.

For his part, Schenck is seeing some delays in coax and fiber cable and electronics delivery; however, it's difficult to determine whether these are caused by the vendor, or by the operator not ordering the equipment in time.

What happens when labor shortages, increasing system sophistication and equipment shortages collide? Delays will most likely result, unless both operators and contractors plan ahead. And although it's probably unavoidable because of the rapid pace of system rebuilds, the lack of consistent standards is becoming a major source of frustration. Though Shanfelter doesn't experience the problem firsthand, his fellow contractors tell him they see bid packages originating from the same company that are completely different, depending on whether they come from the East or the Midwest.

Making it work

Ultimately, operators and contractors have the same goal: to get the job done on time, with minimal glitches. To that end, Linhart sums it up nicely: "We should be teammates more, and opponents less." CED

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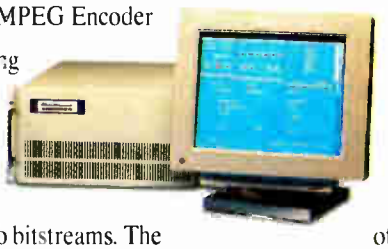

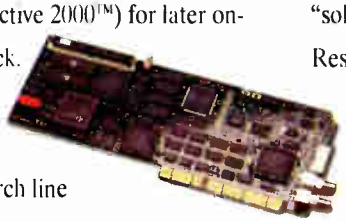

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Beyond MPEG 2 Defining a North American digital television system

By Graham Stubbs, Consultant to TV/COM International

Very large networks for the distribution of digital video compressed programming are now being deployed, or planned for deployment, in the United States and Canada. System operators will expect interoperability of equipment supplied by multiple vendors, and may eventually expect commonality of some functions with consumer electronics products. The networks being planned will include distribution of compressed programming from network to network and across the boundaries of networks of dissimilar media, e.g. satellite and cable. Plans also call for combining into a single network programs which may arrive via satellite, and other digitally compressed programs stored in a local file server.

The international MPEG 2 standard is expected by many to be the basis for interoperable systems and hardware. However, there is much more to a digital television system than those elements addressed by MPEG 2.

Via such networks, consumers will have access to an extraordinary variety of programs from many sources; a significant challenge in system design is to identify program materials in such a way as to make "navigation" easy and natural for the consumer.

In order to better understand what's involved in defining a comprehensive interoperable system, it's worthwhile to examine what a digital video compression (DVC) system consists of, what elements are already standardized, and what remains to be done to achieve interoperability.

A DVC system is sometimes described in terms of layers. The Compression Encoding Layer consists of the service components, i.e., digitized and compressed video and audio plus ancillary data formed into variable length packets. The transport layer consists of a multiplex of fixed length (188 byte) packets into which service components of multiple services have been inserted. At the scrambling layer, the payloads of secured packets are encrypted. The transmission layer is the modulated RF signal with appropriate error correction coding, etc.

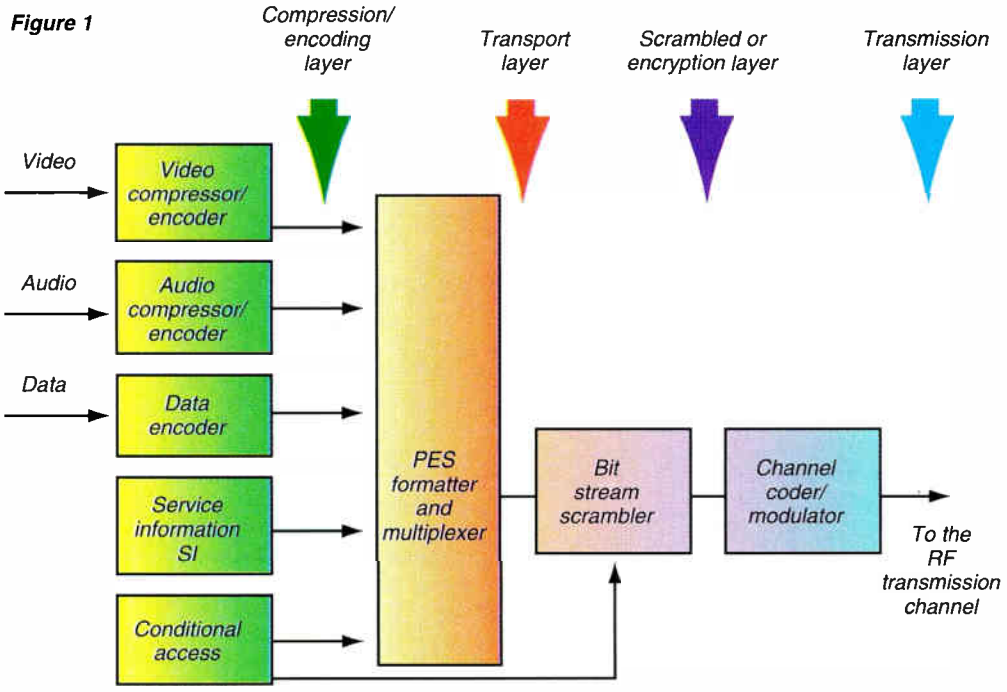
Of these elements, only the compression layer and transport layer are addressed directly by MPEG 2. (For North American applications, even the audio definitions of MPEG 2 are not necessarily applicable). Issues which have to be addressed outside of MPEG 2 are:

- ✔ Audio compression (Musicam or Dolby)
- ✔ Networking management and service information
- ✔ Conditional access
- ✔ Scrambling and conditional access
- ✔ Channel coding and modulation.

The audio issues (and standards) are fortunately already being addressed for HDTV application by the Grand Alliance in the United States.

Considerable work has been done on the four remaining topics by such bodies as the Canadian ABSOC and the European Digital Video Broadcasters (DVB) Group for Satellite and Cable applications. Some of this work is referred to in the text of this article. The objective of this article, however, is to help understand what is needed for satellite and cable operations in North America, and to what extent standards can help ensure a rapid and orderly deployment of systems which will benefit programmers, operators and subscribers.

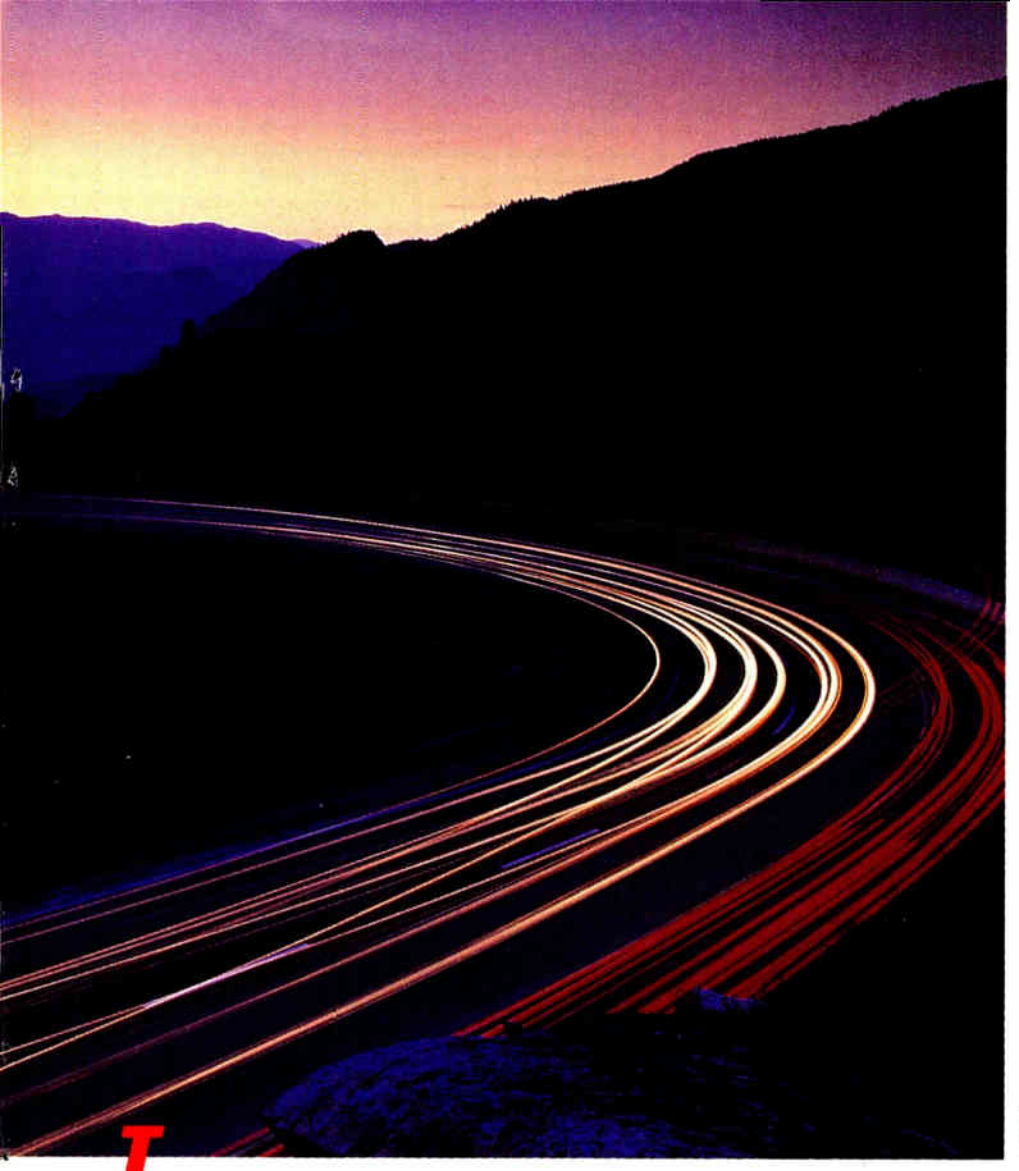
Figure 1



MPEG 2 video and transport

MPEG 2 video compression and transport standards have emerged as the common elements in DVC systems in North America and internationally. The ATV (HDTV) system being adopted in the United States has evolved to be based on MPEG 2 video and transport. The proprietary standard definition digital systems being prepared for use in the United States and Canada are intended to be capable of being MPEG 2 video and transport compliant. The European DVB system also includes these elements, as do most other systems being planned around the world. Numerous semiconductor vendors are preparing video compression, decoding chips and demultiplexing chips based on MPEG 2 standards.

However, even within MPEG 2, decisions and selections need to be made. The MPEG 2 standard is structured as a tool kit which pro-



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vides, for example, a number of choices of functionality and picture quality which can be determined by the system designer and operator. A controversial example of such a choice relates to picture quality, and the use of "B" frames and desired picture definition. The controversy revolves around the cost of memory to implement MPEG 2 "Main Level" Main Profile operation vs. Main Level "Simple Profile" operation.

What is needed is a set of rules for minimum functionality that all receiver-decoders in the network are expected to meet or exceed. Also needed are rules for operation of encoders so that transmissions can be correctly decoded by even the minimally configured decoder. To allow for upward compatibility with future enhanced versions of decoders, the decoders must be able to skip over data structures which are reserved or correspond to functions not implemented in the decoder. It has to be assumed that any legal data structure may at some time be transmitted, even if not used at first.

The European DVB dealt with these issues with an "Implementation Guidelines" document defining these rules of operation. The same issues need to be addressed in a North American system.

Preference for Dolby AC-3 audio

MPEG 2 specifications call for a European developed audio system known as Musicam. It is capable of delivering audio services including monaural and stereo, as well as surround sound and special services such as audio for the visually impaired.

In the United States and Canada, there is a preference for the Dolby-developed AC-3 system which delivers a similar range of high quality audio services. The preference has been accelerated by the adoption of Dolby AC-3 by the ATV Grand Alliance.

The details of how Dolby AC-3 digital audio packets are incorporated in the MPEG 2 compliant transport stream are still being worked out; suffice it to say that the Grand Alliance ATV system will fully specify carriage of AC-3. The Advanced Television Systems Committee (ATSC) which is charged with preparing standards documentation for the entire ATV system, is preparing a national standards document for AC-3 and will also document the inclusion of AC-3 audio data in the transport.

Navigating the multiplex

A major component of the MPEG 2 system specification, as applied to a multi-program network, is multiplexing a number of programs within a single transport stream. Each program consists of associated packetized elementary streams representing video, audio and private data. In order to allow an MPEG 2 decoder to extract, re-assemble and deliver a complete program to a television display, the programs and associated elementary streams need identifiers. MPEG 2 contains a set of program specific information (PSI) tables which are also multiplexed into the transport stream. The four MPEG 2 defined PSI tables are:

✔ Program Association Table (PAT). For each service in the multiplex, the PAT locates the corresponding Program Map Table. The PAT also gives the location of the Network Information Table. (Note: a service may consist of a series of programs delivered as part of a schedule, or even a single program). When a decoder first selects a particular transport stream, it extracts the PAT from the transport stream; from the PAT, the decoder can then select an individual program from the stream.

✔ Program Map Table (PMT). The PMT identifies the location of all the elementary stream packets which constitute each program within the stream, and the location of the Program Clock Reference (PCR) signals for the service. The PMT also provides standard MPEG 2 descriptors for each elementary stream from which the decoder can determine if it has the capacity to decode and display a particular program.

✔ Conditional Access Table (CAT). The location of entitlement management message (EMM) streams are identified in the CAT, as well as descriptors for the conditional access system (or systems).

✔ Network Information Table (NIT). MPEG 2 defines the location and syntax structure of the Network Information Table, but the contents are not defined by MPEG 2. The purpose of the NIT is to define physical parameters of the network and to enable the decoder to navigate within and among all the services of the network.

In order to illustrate the types of service information which facilitate location and selection of programs by a decoder, some of the work undertaken by the European DVB will be described.

The MPEG 2-defined PSI tables provide for management and navigation within the multiplex of a given transport stream, but support is limited in relation to multiple transport streams. For this reason, the European DVB has created detail for the empty Network Information Table, and has added six new service information tables. These tables include information which informs the decoder about the physical parameters and services carried in transport streams of the network other than the one to which it is presently tuned.

The Network Information Table, as filled in by the DVB, contains information about services and physical networks. The Services List describes the types of services carried (TV, teletext, radio, etc.) and service ID.

The Satellite Network describes the physical satellite network and its parameters, including: frequency, orbital position, polarization, FEC outer code, symbol rate, FEC

Figure 2: *Satellite channel coding and modulation*

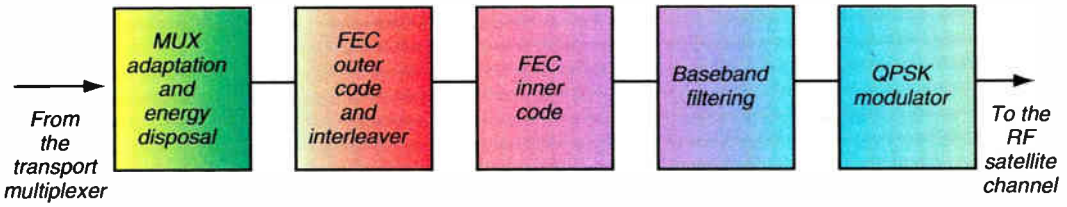
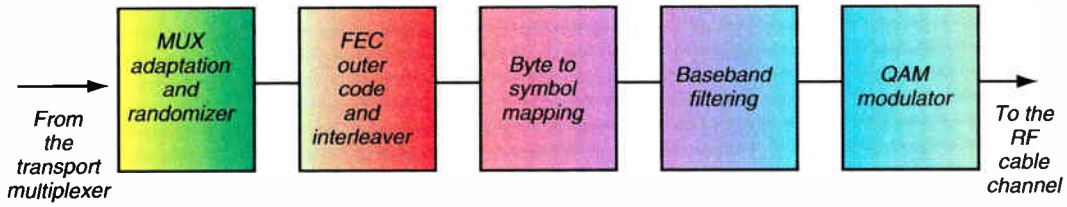


Figure 3: *Cable channel coding and modulation*



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identifiers could be added for differing bit-stream scramblers.

A possible solution to the access standards issue might therefore be to combine the NRSS interface with SI identifiers for multiple scramblers and access systems–thus avoiding the need to select a single scrambling or conditional access standard.

Channel coding and modulation

Selection of the modulation format for digital television transmission systems applied to cable continues to be a controversial topic. The Grand Alliance, after testing and evaluating both QAM and VSB, selected 8 VSB for terrestrial broadcast use. The FCC's advisory committee recommended 16 VSB, enabling cable transmission of two ATV signals simultaneously. However, preparation for the cable roll-out of proprietary equipment employing 64 QAM is also occurring.

The question, however, is not just whether to use QAM or VSB; neither of these terms fully defines the technical steps necessary to prepare a signal for transmission. And although there is general agreement that QPSK is the modulation of choice for satellite, considerable detail is required to specify the implementation of QPSK exactly. Along with modulation format come several additional signal processing functions. Figures 2 and 3 show, respectively, the channel coding and modulation functions applied to satellite transmission and cable transmission.

Satellite services

Satellite services are generally power limited, and ruggedness against noise and interference are important characteristics. Concatenation of convolutional (Viterbi) and Reed-Solomon codes are typically used to deal with interference or noise induced transmission errors. The five signal processing steps are:

✔ Multiplex adaptation and randomization for energy dispersal. When randomization is used, a polynomial for the Pseudo Random Binary Sequence (PRBS) generator must be specified. Additionally, sync bytes of some transport packets may be inverted to provide an initialization signal for the descrambler. (Descrambler is used in this instance to mean removal of energy dispersal randomization).

✔ Reed-Solomon outer coding, interleaving and framing. The DVB SI tables provide a descriptor to define the specific (e.g. RS (208,188 T=8) coding in use. Convolutional interleaving provides for overlapping of error protected packets, and the interleaving depth and other parameters must be specified.

✔ Convolutional (Viterbi) inner coding. The level of error correction may be selected according to service requirements or data rate. Typically, a system may allow code rates of 1/2, 2/3, 3/4, 5/6 or 7/8.

✔ Baseband shaping (filtering). Filtering is typically square root raised cosine. The roll-off factor is a design parameter which must be specified.

✔ QPSK modulator. Typically, the modulation is gray-coded QPSK with absolute mapping, i.e., no differential coding.

From the above, it is clear that two designers could select quite different parameters for all of these functions. To ensure interoperability, some combination of standardized parameters and adaptive operation of system elements is essential. These issues are best dealt with by standardization.

Cable services

Cable services operate in an environment where bandwidth is at a premium, but the transmission system is relatively free of noise and not power limited; hence, the error correction requirements are less than for satellite. The sequence of signal processing is similar to that for satellite:

✔ Multiplex adaptation and randomizer. Here the function is similar to that used for satellite transmission, but the purpose is more to ensure frequent transitions for synchronization.
✔ Reed-Solomon coder, interleaving and framing. The purpose and implementation are the same as for satellite transmission.
✔ Byte to symbol mapping. Because of the complexity of the modulation process, an exact mapping of bytes into symbols must be performed. As an illustration of the complexity of the modulation format to be defined, a constellation diagram for 64 QAM is shown in Figure 4. Fully defining VSB is similarly complex. The rules for mapping bytes into symbols also address differential coding.
✔ Baseband shaping (filtering). Here again, the square-root raised cosine filter is typically used; the roll off factor must be specified.
✔ Modulation. The question of QAM versus VSB is still unresolved.

Again, in cable transmission–as in satellite–there is much more to specifying an interoperable system than just calling for 64 QAM or 8 VSB.

Any one of the details may differ in one designer's implementation versus another. The only way to be sure that digital modems operate together properly is by specifying all the details.

Coming back to the choice between QAM and VSB, it may perhaps be appropriate to make sure that QAM and VSB are separately well specified and standardized while the debate over their relative merits continues.

The path to standards

From the above discussion, it's clear that there is much more to defining a digital television system than calling for MPEG 2 and resolution of the controversies surrounding VSB/QAM and conditional access. The proprietary systems presently in operation or under development should have addressed these additional issues; however, the service information, conditional access channel coding and modulation schemes used are not public at this time.

In the interest of equipment interoperability and ease of moving programs across network boundaries, it is important that these issues be opened to a standardization or industry review process. As an example, the existence of openly defined system information tables would encourage the development of display and navigation features while preserving interoperability. Some useful work has been done in Europe for applications that have similarities to digital satellite and cable networks in North America. There is certainly no mystery to what issues and parameters need to be specified.

However, for North America, an open standards process with participation by programmers, operators, network equipment manufacturers, consumer electronics manufacturers and others is essential. CED

Acknowledgments

Thanks to Fred Markhauser of Telesat Canada, for sharing with me his draft of Service Information Table recommendations prepared for ABSOC.

Additional reading

1. DVB Draft–Implementation Guidelines for the use of MPEG 2 Systems, Video and Audio in Satellite and Cable Broadcasting Applications in Europe (June 1994).

2. DVB Draft–Specification for Service Information in Digital Video Broadcasting Systems (May 9, 1994).

3. ETSI draft specifications: Framing structure, channel coding and modulation for 11/12 GHz Satellite Services; and framing structure, channel coding and modulation for Cable Systems (June 1994).

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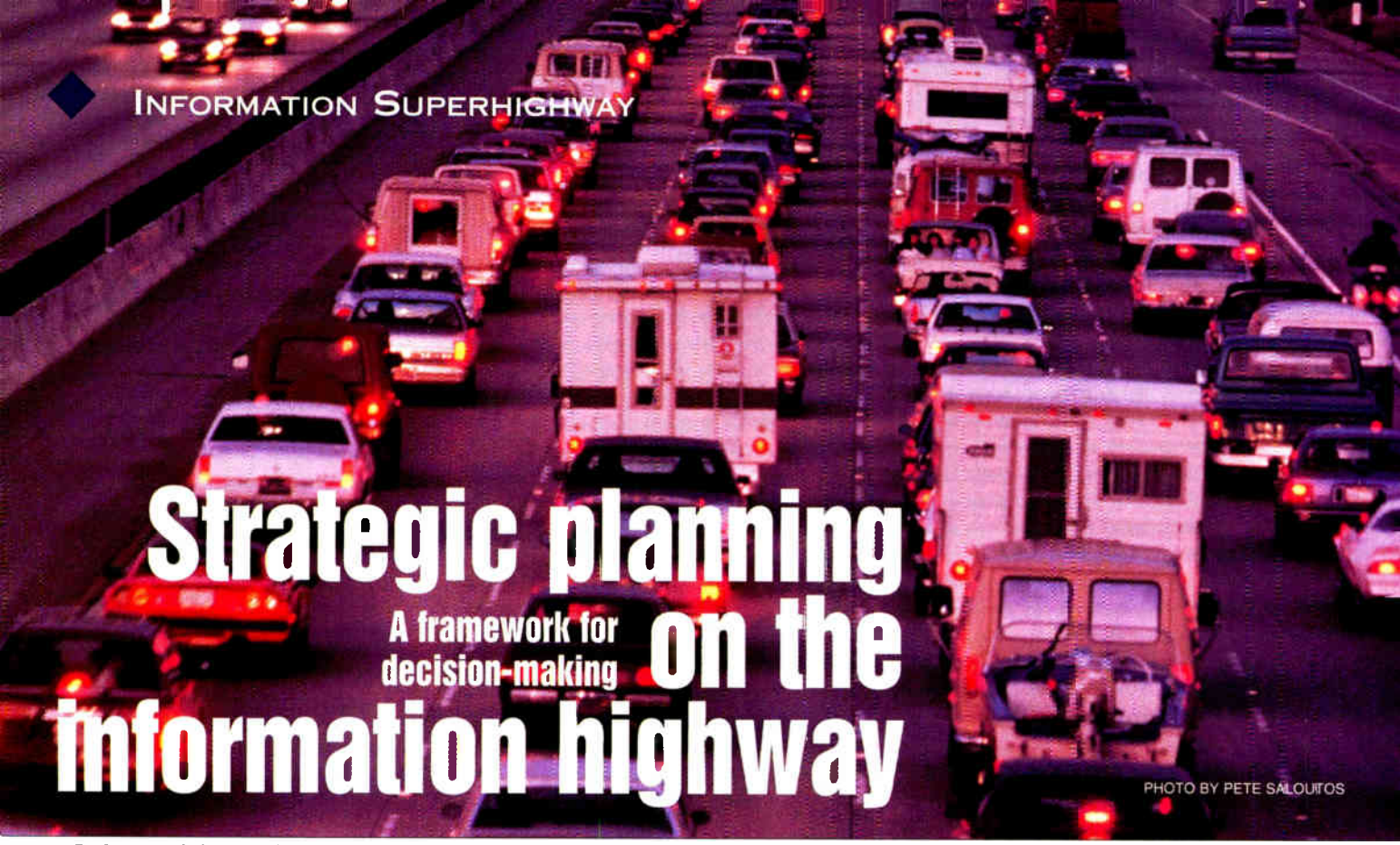


Strategic planning on the information highway

A framework for decision-making

PHOTO BY PETE SALOUTOS

By Larry Yokell, President, Convergence Industry Associates

The information superhighway. Digital convergence. The Internet. So many players, so many interests. What's real? What's possible? What's fantasy? Sometimes it seems that the viewpoints are as diverse as the American people themselves.

Vice President Al Gore dreams of an information superhighway that can "save lives, create jobs and give every American young and old, the chance for the best education available to anyone, anywhere." However, one recent poll indicates that many Americans do not yet share the Vice President's vision. Louis Harris and Associates found that 66 percent of the American public had not seen, read or heard anything about the information superhighway. Even among the 34 percent who are aware of it, fewer than half said they understood what it is.

Meanwhile, the status of the information superhighway (whatever this term means to you) changes daily. Companies announce mergers, acquisitions and initial public offerings one day, and then cancel them the next. New technologies become overnight sensations. New technologies run into snags and delays. One survey says that users are willing to pay hundreds of dollars per month for new services, while the next says they aren't. Throw in several hundred regulators, judges and politicians, and you've got enough human confusion and turmoil to delight the ever-growing ranks of "chaos theory" proponents.

Popularized in the blockbuster book and movie *Jurassic Park*, chaos theory grew out of attempts to create computer models of weather in the 1960s. In a nutshell, it states that there are hidden regularities within the complex variety of a system's behavior, even if that system appears on the surface to be quite random, unpredictable and chaotic.

All of this leads to one crucial question: how does a cable operator, vendor or programmer survive and even prosper in the chaotic environment of the information superhighway? Or stated another way, how can the "hidden regularities" be determined and then employed for optimal advantage?

Framing this kind of question is a lot easier than answering it. At first blush, it seems logical that part of the answer is to perform dispassionate strategic assessments and then, based upon the results, implement appropriate management decisions.

But corporations are only human. They are led, shaped and cared for by people with a wide range of agendas, ambitions, emotions, backgrounds, talents and foibles. Rarely are high-level executives willing to be swayed or make a strategic decision solely on the basis of a ream of cold-blooded data and statistics, no matter how compelling. They must feel it in their guts.

Best of both worlds

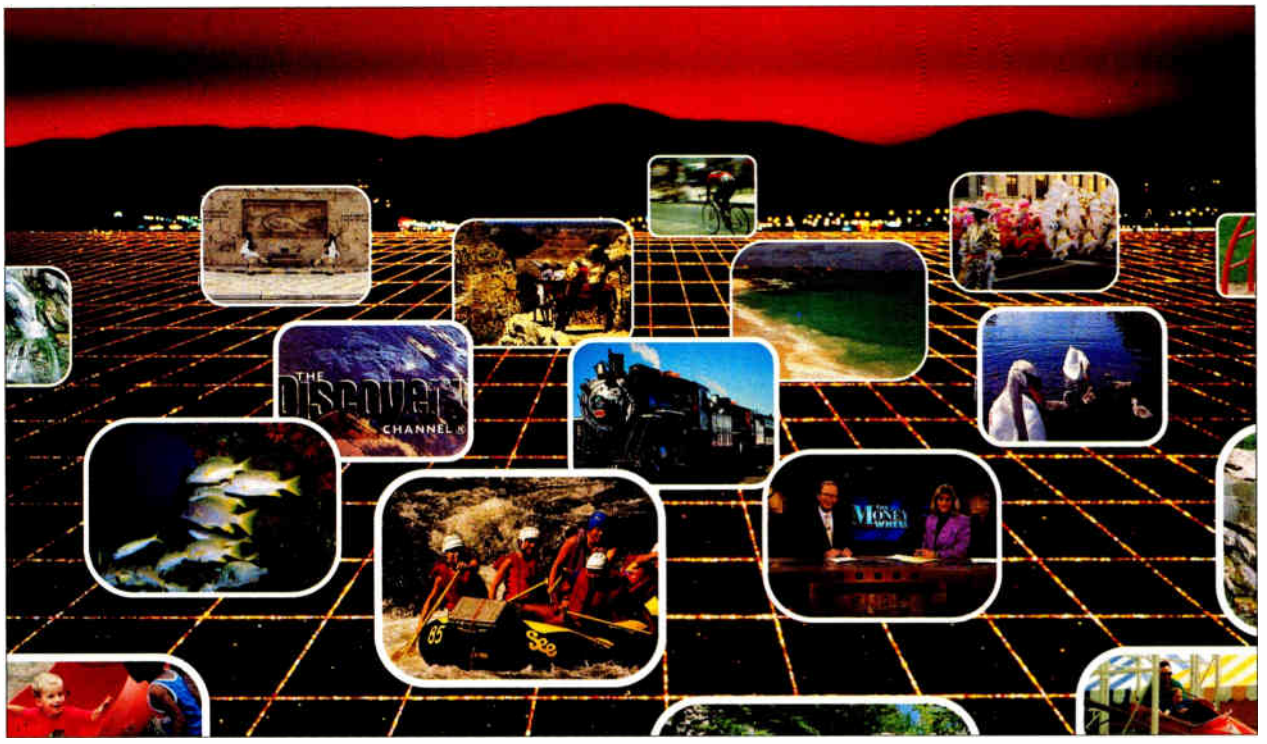
It seems clear that a good strategic planning process consists of marrying two essential elements—data analysis and human intuition. Therefore, let's propose a simple and flexible strategic planning framework that information superhighway executives can use to make high-quality decisions. This framework includes nine essential checkpoints. At each checkpoint, executives can apply the appropriate mixture of data analysis and human intuition.

The checkpoints are as follows:

Corporate vision—As redundant and hackneyed as this statement may be, all good strategic plans start with a well-developed vision for where the company wants to go. Those with excellent vision tend to prosper, while those with poor vision often fall by the wayside.

Visionaries such as John Malone, Bill Gates and Bill McGowen have spawned multi-billion dollar empires. In contrast, IBM's myopia helped to topple it from global supremacy in the computer business.

In the process of creating the corporate vision statement, executives should ask themselves several questions. What do we want the company to be when it grows up? Are we shaping the vision in a proactive and expansive environment where new business opportunities are available, or in one that is reactive and defensive of the core business? Can we achieve the vision through incremental, evolutionary processes or are more revolutionary approaches required? Is the timing right for our vision? Can we achieve our vision with internal resources alone, or do we need strategic partners? Are critical audiences, such as



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Business plan—Once the vision statement is set, the next checkpoint in the strategic planning process is to generate a Proforma business plan. Although their specific contents will vary dramatically, all business plans should include some discussion of the products or services the company plans to offer; the projected markets for these products and services; the projected financials (e.g., income statement, cash flow and balance sheet); implementation plan overviews for critical items (e.g., research and development, production, sales and marketing and customer service); the management team; and existing and future competitors.

Many companies expend massive quantities of time, effort and personnel resources preparing voluminous business plans. While these documents tend to be impressive by their sheer weight alone, they are often a tip off that the company doesn't know where it is heading and is experiencing the dreaded "analysis paralysis." A simpler plan is preferable.

Think of the business plan as a marketing document aimed at the investment community. If you can communicate the gist of it in a crisp, clear presentation lasting less than an hour, chances are good that they'll be interested in learning more and maybe even investing.

Financial climate—Last year, the stock market was red hot for all sorts of companies associated with the information superhighway. The IPOs for firms such as 3DO, Metropolitan Fiber Systems and BroadBand Technologies skyrocketed. The stocks of many established firms also did extremely well. Telco/cable merger and acquisition rumors were flying everywhere. And the mere mention of phrases such as video on demand, interactive TV or digital compression was enough to get a foot in the door at Wall Street.

This year things are quite different. Wall Street and the investment community have come back to earth. A number of major deals have failed, the potential profitability for various information superhighway applications seems less certain, and the economic implementation of critical technologies appears farther into the future than once believed. In addition, many supposedly cash-rich strategic partners turned out to have less funds to invest than was first presumed.

In the financial world, timing and perception are everything. Companies must continuously assess the financial climate to determine the amount and mixture of internally-generated, private investment, and public debt and equity funding that will be available to support operations.

Regulatory environment—In many other industries, regulatory issues would be much further down in the strategic planning checklist. However, in the information superhighway business, regulation and politics rule. The courts, the FCC, the Clinton Administration, the Congress, the states, the municipalities and numerous interest groups are all trying to shape public policy to suit their own special desires. These volatile circumstances mean that multi-billion dollar winners and losers could literally be legislated or regulated into existence (e.g., the PCS licensing auctions).

It's not enough that companies simply track the ebb and flow of the regulatory environment and then passively adjust to the outcomes as best they can. A proactive strategy must be developed. What are our regulatory objectives? How can we best achieve them?

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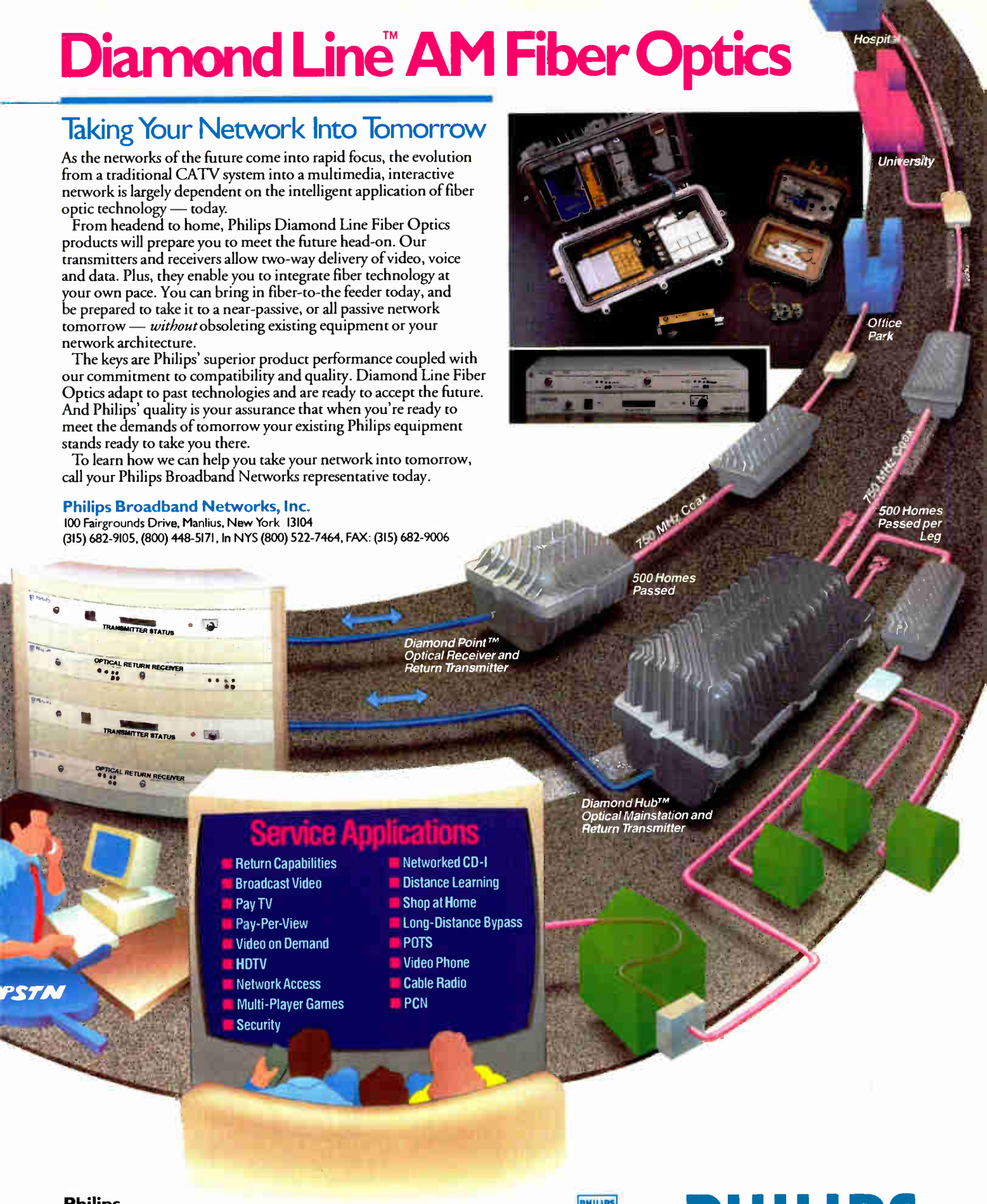

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Circle Reader Service No. 30

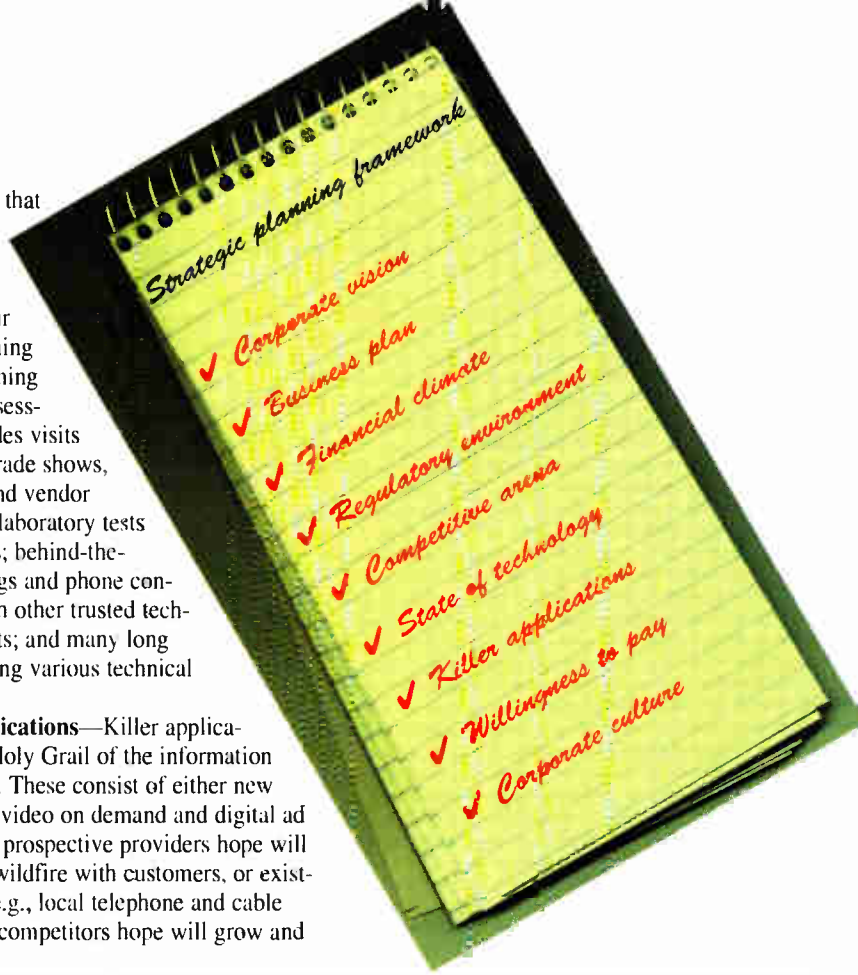
gies, new economics and a new regulatory climate are enabling information superhighway players to poach with impunity on each other's formerly separate territories. For example, the list of potential competitors in the local telephone market includes: local exchange carriers (LECs), competitive access providers (CAPs), interexchange carriers (IXCs), cable operators, low earth orbital (LEO) satellite providers, personal communications services (PCS) providers, cellular operators, specialized mobile radio (SMR) operators and electric utilities.

It is imperative for companies to assess their competitors continuously. What are their strengths and weaknesses? How can their weaknesses best be exploited, and how can their strengths best be avoided or mitigated?

State of the technology—It seems like technological advances on the information superhighway occur everyday. The trick is to distill facts from fantasy and then apply the new technology profitably. In some cases, the technology can be migrated incrementally into a company's arsenal of strategic weapons, while in other cases, "forklift upgrades" require a leap of faith.

This means that companies must spend a considerable amount of their strategic planning efforts performing technology assessment. It includes visits to numerous trade shows, conferences and vendor headquarters; laboratory tests and field trials; behind-the-scenes meetings and phone conversations with other trusted technology analysts; and many long hours examining various technical documents.

Killer applications—Killer applications are the Holy Grail of the information superhighway. These consist of either new services (e.g., video on demand and digital ad insertion) that prospective providers hope will catch on like wildfire with customers, or existing services (e.g., local telephone and cable TV) that new competitors hope will grow and



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diversify their businesses.

Clearly, the emerging markets for killer applications are confusing at best, and murky and ill-defined at worst. Some experts claim that in the future there will be no killer applications. Instead, the application world will become even more fragmented, and there will be an explosion of niche applications.

Therefore, companies need to perform or obtain the best market research available and skillfully apply it to their unique situations. All of this is a risky business since market research is at best a highly-sophisticated educated guess of probable human behavior and buying patterns. In determining what's a killer application and what's not, companies should look to past successes (e.g., cable TV and cellular) and failures (e.g., videotex) for guidance, while being flexible enough to recognize the possibilities that new application paradigms will appeal to the next generation of customers.

Customer willingness to pay—Many strategic analysts would lump this in with the killer application item described above. However, so many information superhighway companies miss the boat on this one that it's worth separate mention. In the final analysis, companies are completely dependent upon the willingness of customers to shell out money for their products and services.

How much money are customers currently paying for all forms of entertainment, information and communications services and products? Are they willing to pay more for new products and services, or will they simply shift their spending from one category to another? How much of their incomes are really disposable? How does a luxury become a necessity, and vice versa?

Corporate culture—Every industry spawns a certain type of culture, and every company within that industry seems to have its own unique cultural offshoot. In the information superhighway business, understanding the corporate cultures of your own company, strategic partners and competitors alike is extremely important. Failure to do so can wreak all sorts of havoc. For example, in the aborted Bell Atlantic/TCI merger, a blue chip, play-it-safe, quarterly dividend culture clashed with a growth company, go-for-it, cash flow culture.

Conclusions

To become successful strategic players, information superhighway companies need to foster an open and relaxed intellectual atmosphere where interdisciplinary brainstorming is the norm. In an environment fraught with intimidation and retaliation, stifling "group think" is bound to take over. Everyone will be right—right up until the day the company goes out of business.

Once a strategic plan has been crafted, it always makes sense to have a disinterested third party review it and serve as a "sanity check."

Furthermore, planners should overtly distinguish between those strategies that are based upon human intuition versus those that are based upon data analysis. Each strategy should then have a confidence level (e.g., 10 for high, 1 for low) assigned to it before it is presented to other senior executives for approval. Finally, planners must recognize that the strategic planning process is a never-ending journey, and that the shelf life of a successful strategy may vary from days or weeks to months or years. CED

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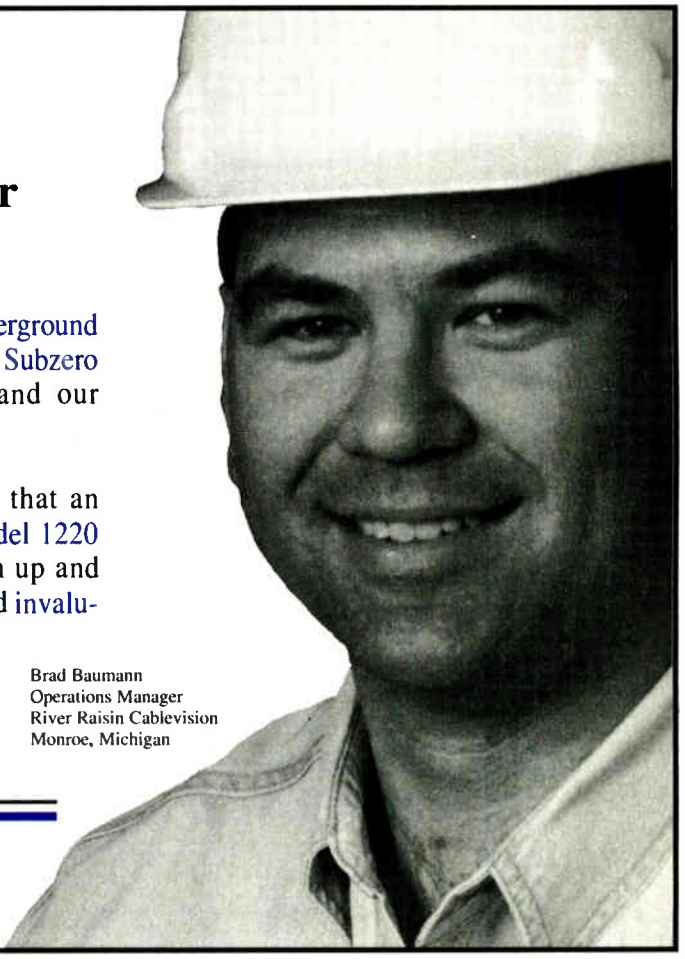

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New technology confuses PCS market

Decision crucial to business plan

By Fred Dawson

The state of confusion over air interface multiplexing schemes for personal communications services is worse than ever, thanks to pell-mell technical advances on all fronts.

With sudden, new momentum behind it, Europe's GSM digital cellular interface standard has moved to U.S. shores with vendor support for an adaptation to stateside PCS known as "DCS-1900." This follows Motorola's tailoring of GSM to the needs of enhanced specialized mobile radio (ESMR) carriers in the United States under the trade name "MIRS" (Motorola Integrated Radio Systems).

At the same time, a higher bit rate for voice signals, along with other improvements, is adding market appeal to CDMA (code division multiple access) as an interface for cellular and PCS alike. And, to a growing number of holders of cellular spectrum who believe timing is critical to success in digital wireless, IS-54, the U.S. time division multiple access cellular standard, has hit performance targets that are sufficient to make a business of going digital right now.

"I don't think anybody knows enough about this animal to come up with a hardcore plan of action," says John Dolan, PCS project manager for Cablevision Systems Corp. He notes that choosing an air interface for PCS is crucial to building a business plan, because the standard chosen will determine virtually everything about the service, from network design to number of users per microcell to the types of features and services that can be offered.

As Dolan suggests, the all-or-nothing nature of investing in PCS, as opposed to adding a digital tier in cellular, doesn't allow players the luxury of building a service around business niches. "PCS will be a consumer oriented business, or it won't be a business," he says. "You can't afford to spend for spectrum and build an infrastructure if you're only going to get significant usage on every third or fourth cell."

For those planning to participate in the FCC's spectrum auction, slated to get underway for voice-grade slots in early winter, knowing the business parameters as shaped by the choice of air interface schemes is fundamental to structuring a bid. This is why much of the wireless industry has yet to settle on final bidding strategies so close to auction time.

Like many other decision-makers in wireless communications contacted for this article, executives spoke only on background, given their companies' sensitivities to any disclosures of bidding strategies. "It's really important to keep everybody guessing," says a cable manager.

After months of testing various approaches, one executive's read is positive on what he sees as the two leading contenders for a PCS interface standard: CDMA and DCS-1900, which, as a GSM system, is derived from TDMA techniques but is distinct in operation and feature parameters from IS-54.

Pros and cons of CDMA

The two modulation systems represent very different paths into the PCS business, with primary distinctions in how frequency is partitioned, and therefore, in how the network is designed, and somewhat less clear distinctions regarding the service capabilities attending each system.

In its cellular mode, CDMA maximizes frequency use by breaking up the bit stream of each call, spreading it across 10 1.25-MHz channels at a rate of 38 voice calls per channel. Comparing cellular CDMA to TDMA, Tom Crawford, director of marketing at Qualcomm's CDMA technology business unit, says CDMA supports six and two-thirds times as many voice calls per microcell (380 vs. 57 over a 12.5 MHz cellular allocation to digital). About the same ratio holds for CDMA to DCS-1900.

Adding to CDMA's appeal, sound quality will be significantly better than either mode is today when second-generation gear devoted to true PCS rolls out in

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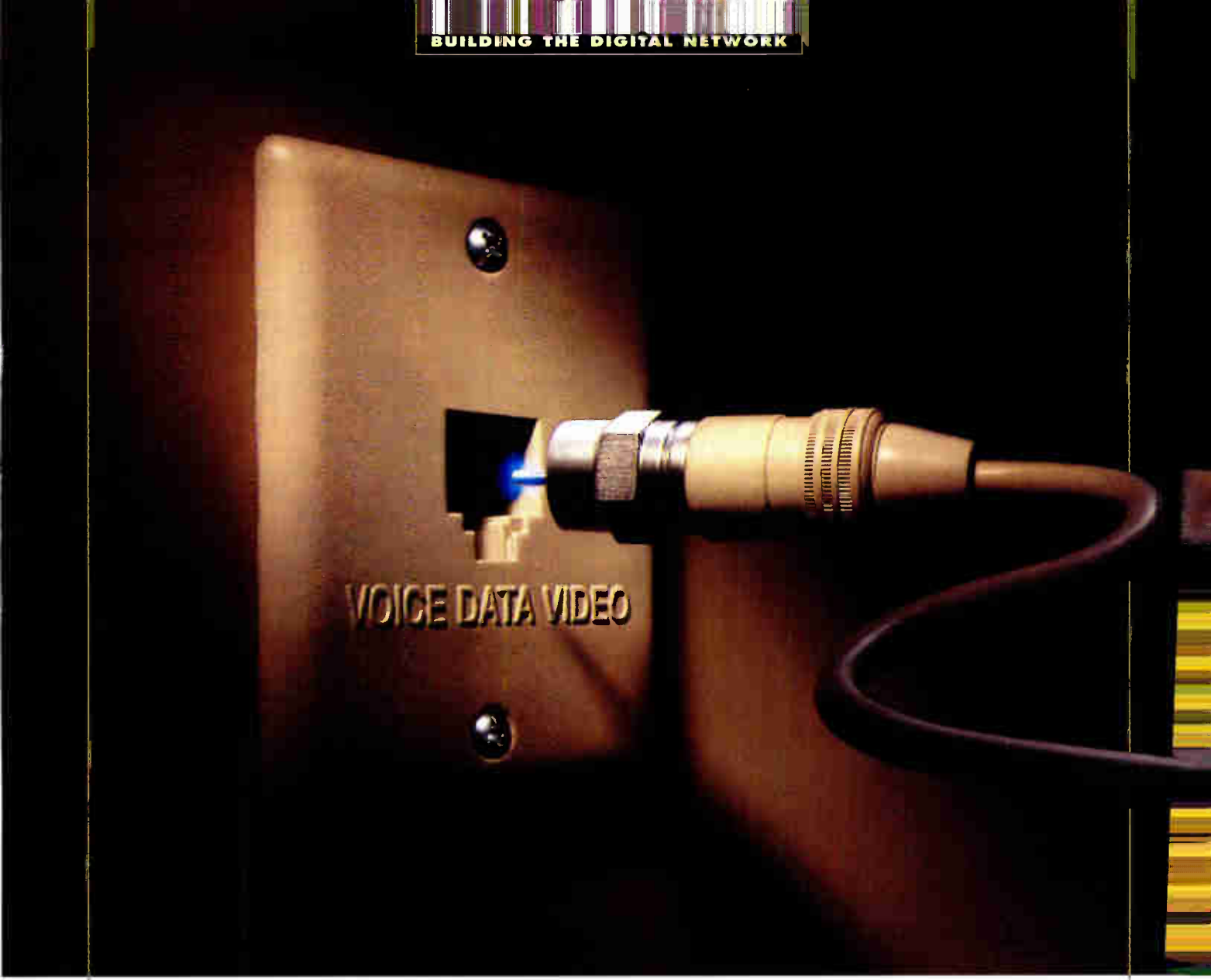

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Digital SMR did not have the fuzziness or fading of digital and analog cellular.

quencies in the 800 and 900 MHz bands, is a variation on GSM, it differs in significant ways, Garber notes, starting with the fact that MIRS supports up to six users per 25 kHz voice channel as compared to three for TDMA and GSM. This puts it roughly on a par in each market with existing cellular carriers, factoring in the improvements they gain from partial dedication of spectrum to digital.

The ready solution

With rollout of ESMR and cellular TDMA intensifying the time pressures on PCS, many players are beginning to look at DCS-1900, the U.S. PCS adaptation of GSM, as the most promising approach to hitting the ground running in the digital wireless shootout. The most outspoken advocate of this approach so far is MCI.

Last fall, MCI said it was teaming in technology development for wireless with Northern Telecom and LM Ericsson to ensure that equipment adapted from GSM for the U.S. PCS market would be interoperable and serve all the requirements of the new microcellular service. Now Ericsson has announced its first line of DCS-1900 gear, the CMS 40, which it says will be in production by the middle of next year.

As the first PCS system to offer an integrated network management system from the beginning, the CMS 40 will permit management of all network elements from a single platform, says Bo Hedfors, CEO of Ericsson Network Systems. Moreover, he notes that the system allows base stations to be installed and commissioned within one hour and can support expanded functionalities such as microcell and picocell structures and improved speech quality coders.

Siemens Stromberg-Carlson is also planning to offer a U.S. PCS system built on GSM, says Paul Carroll, director of market planning and analysis, though it remains unclear whether Siemens will conform to DCS-1900 in all particulars."The GSM approach offers carriers a tried and proven, feature-rich solution to offering new wireless services," he says.

With further refinements resulting from development of the DCS-1900 standard, the European route into U.S. PCS is drawing ever more attention, says the cable manager quoted earlier. "Our tests show it's fully compatible with delivery over cable networks," he adds.

"It's ironic," the manager notes. "GSM was created in Europe to overcome the splintering of the cellular market into all those separate national formats, but in the U.S. its presence may be taking us in the opposite direction, from a compatible cellular system toward a highly splintered environment for PCS." CED

Find what you're looking for in CED's 1994 Editorial Index.

Watch for it in December CED.

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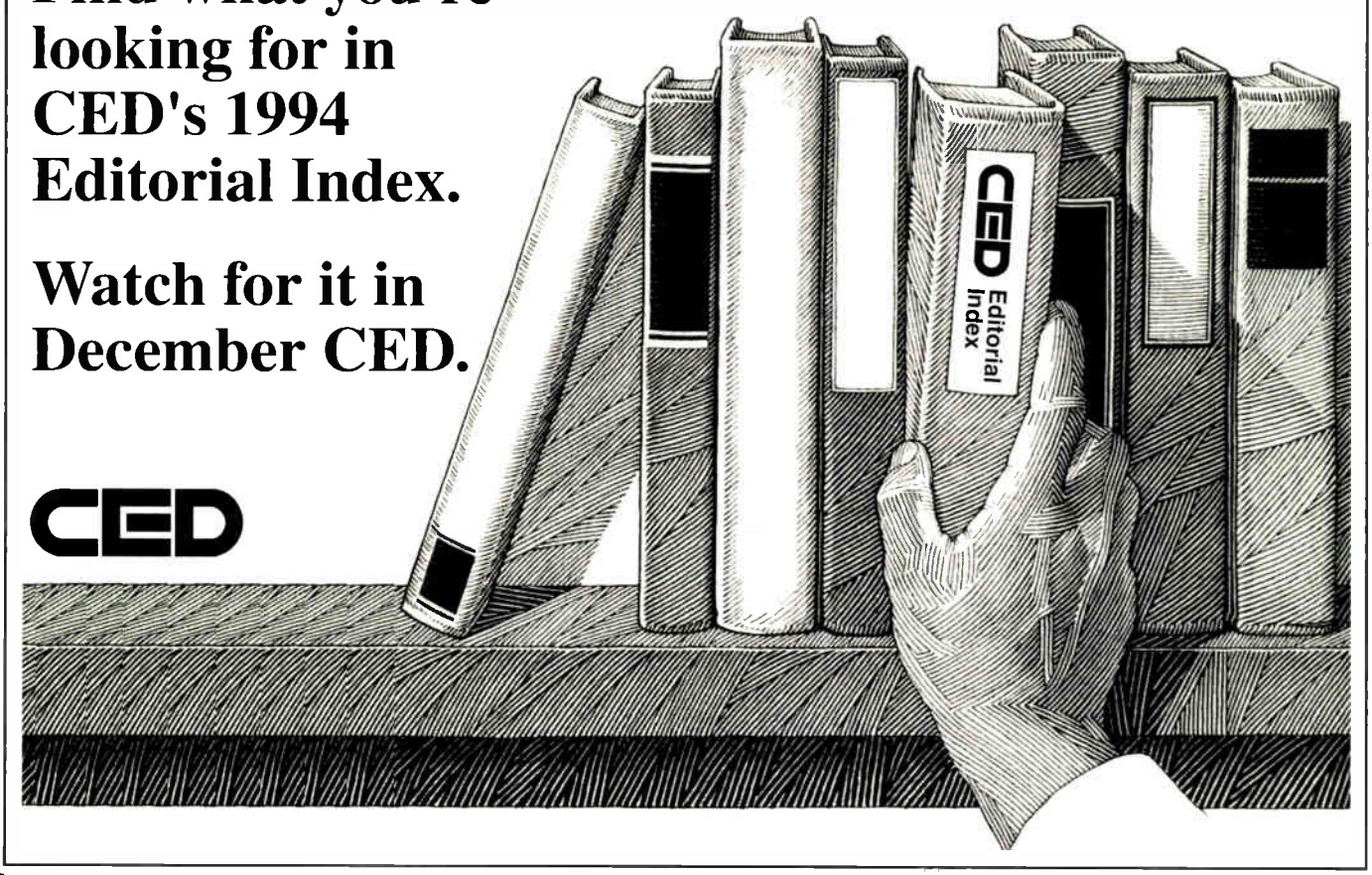

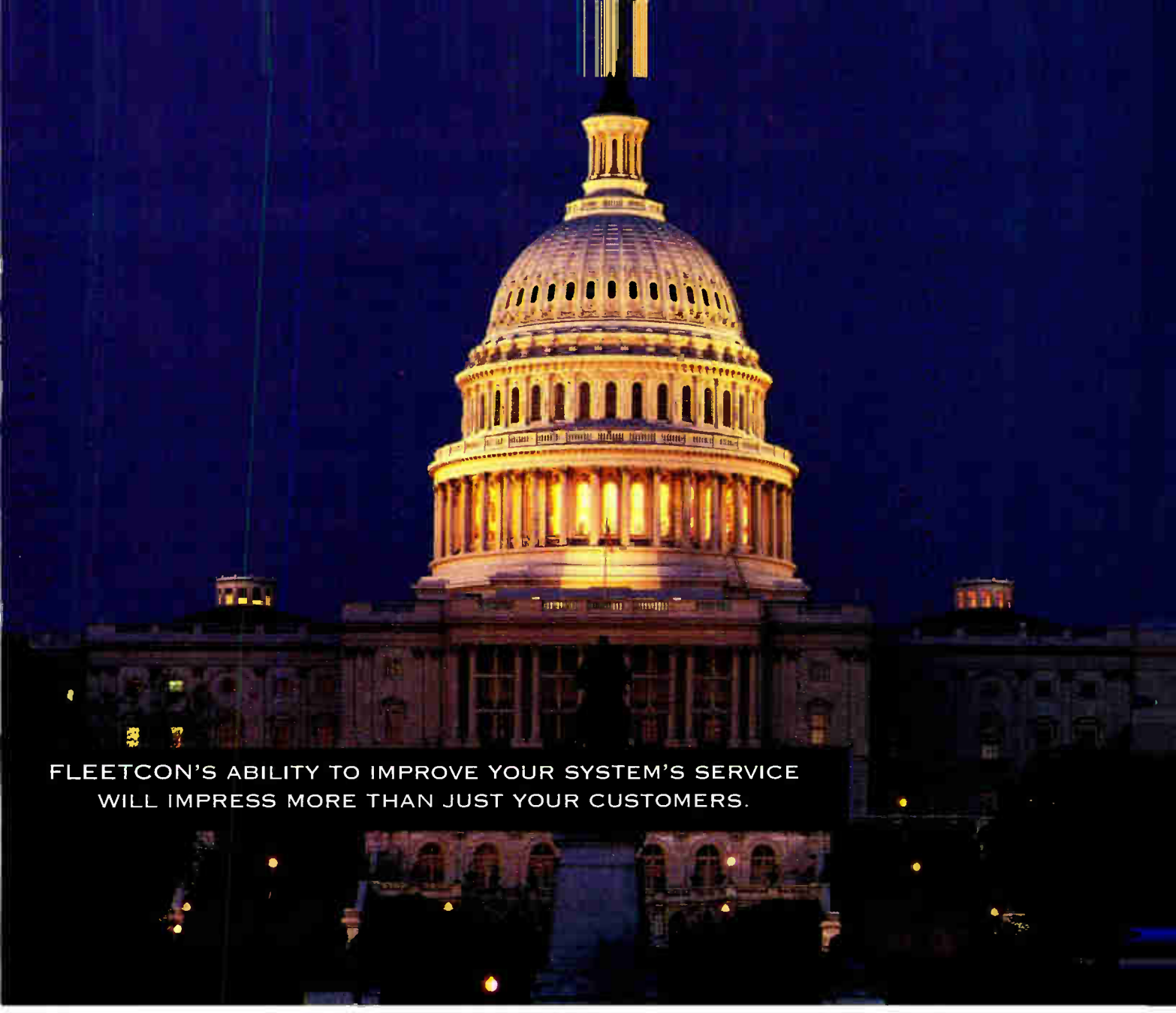

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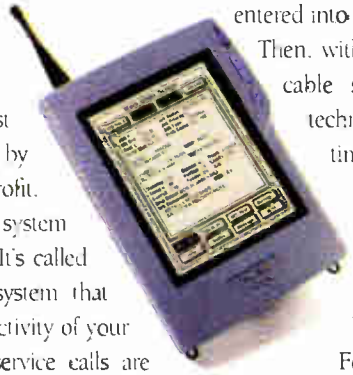

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to up-to-date Material Safety Data Sheets (MSDSs) that detail a product's ingredients, use and procedures for dealing with emergencies. For many chemicals, solvents, etc., most manufacturers make these MSDSs available; however, you may need to write to the manufacturer of glass cleaner to obtain an MSDS since "over-the-counter" products, as well as pharmaceuticals, also need completed MSDSs. Keep MSDSs readily available to employees and have them on hand in case of an OSHA visit. Fiscal '93 records indicate that 2,000 companies were fined for MSDS violations.

PPE

In July, a new rule on personal protection equipment (PPE) will, according to OSHA, improve safety protection for 11.7 million workers. Previous standards for head, face, eye and foot protection were adopted from American National Standards Institute (ANSI) consensus standards that are now more than 25 years old.

The final rule provides guidance for the selection and use of PPE, including a new section on hand protection. Employers will have to perform an assessment of the workplace to determine if hazards are present that would necessitate PPE. In most cases, appropriate PPE will have to meet new ANSI standards. Training employees on PPE is also mandatory (though that sub-part has been stayed until October 4). Train personnel when and what equipment is necessary; how to wear, remove and adjust PPE; the limitations of an individual item; and its proper care, maintenance, useful life and disposal.

For electrical protection equipment, for example, testing of PPE has changed. Most equipment must be tested before first issuing PPE to an employee. The device must then be retested every six months. In addition to documenting employee PPE training and use, maintain files on testing results of the equipment. For further information on PPE, review the April 6, 1994 issue of the Federal Register or obtain a revised copy of OSHA's free booklet, "Personal Protection Equipment" (OSHA 3077 1994, Revised).

Confined spaces vs. Telecom 268

When OSHA issued a new standard on confined spaces–which it estimates will prevent 54 fatalities and more than 5,000 serious injuries each year–many in the cable industry threw up their hands. Doesn't another set of OSHA regulations, Telecommunications Standard 29 CFR 1910.268, document the procedures for dealing with confined spaces?

According to OSHA, the confined space standard aims to protect workers in general industry from toxic, explosive or asphyxiating atmospheres by focusing on "permit-required" entry procedures that pose immediate health or safety risks to employees. Employers must identify confined environments as permit-required spaces, prevent unauthorized entry and protect authorized workers from on-site hazards, especially those who try to save a co-worker and become a casualty themselves. Experts say some 60 percent of the confined space fatalities are among "rescuers."

The National Institute for Occupational Safety and Health defines a confined space as "a space which by design has limited openings for entry and exit; unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy." This definition could include attics and crawl spaces, a particularly thorny area for cable systems

because many field technicians work in these spaces.

When the controversy between the "general industry" confined space standard and Telecom 268 came up, *Cable Safety*, an ANTEC-produced quarterly newsletter that provides user-friendly safety information to cable personnel, contacted five regional OSHA compliance officers. Each one urged cable companies to fully understand and implement the precautionary measures outlined in both standards. Since individual standards overlap in certain areas, the compliance officers say the confined spaces standard may provide greater protection in areas not documented within the telecom standard.

So how does one comply? First, identify areas that may represent a confined space and train workers on the hazards those sites may hold and how to effectively prevent accidents. Organize schedules so that employees who must work in confined spaces can be accompanied by an associate, and provide those employees with the proper testing and protection equipment.

Confined space PPE includes gas monitoring equipment that provides visual and audible alarms if a dangerous gas concentration exists. Air-purifying respirators remove contaminants before workers inhale them, while air-supplying respirators provide an independent source of breathing air.

A body harness apparatus attached by cable to a tripod also helps in compliance. These devices provide workers outside the confined space with the means to lift out an associate who may be overcome by toxic gases.

Bloodborne pathogens

Technically, compliance with the new bloodborne pathogens standard is not mandatory for cable television personnel, but training about the mandate is recommended.

The bloodborne pathogens standard (29 CFR Part 1910.1030) became effective July 6, 1992 and is designed to protect workers who may be exposed to bodily fluids and blood that may carry the HIV and hepatitis-B viruses. People who work in the health-care and public safety occupations are the primary focus of the standard.

Cuts and scrapes are, however, common within the cable industry, and OSHA is determining who is actually required to comply on a "case-by-case" basis. Even though cable is not the target of the regulation, specialized training in bloodborne pathogens certainly may be warranted. A person can avoid the

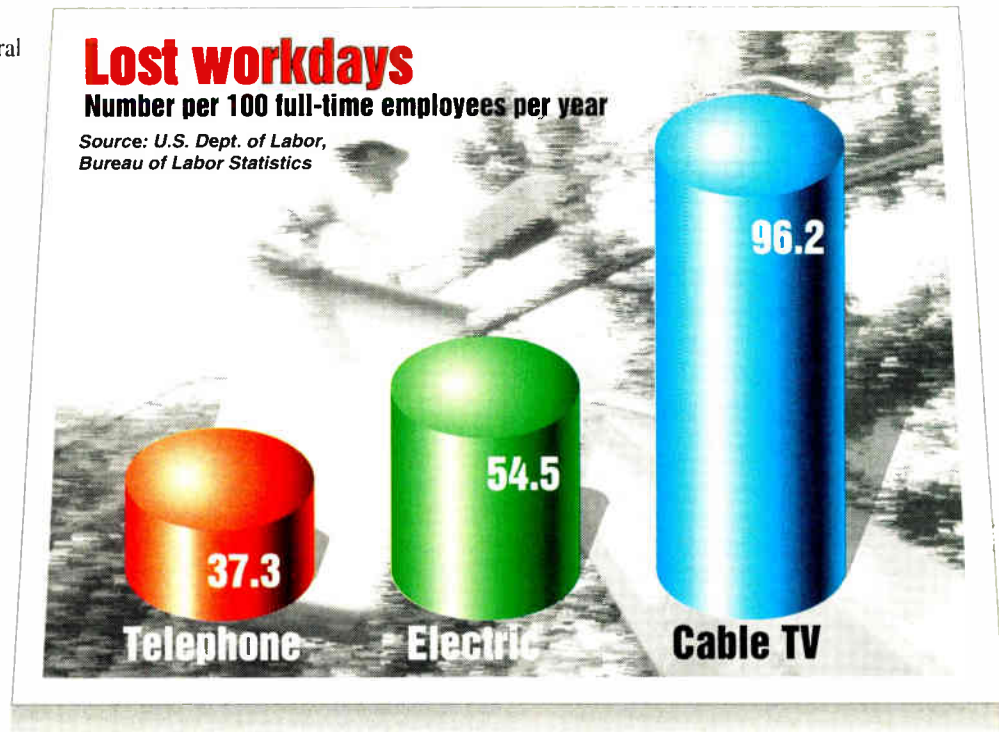

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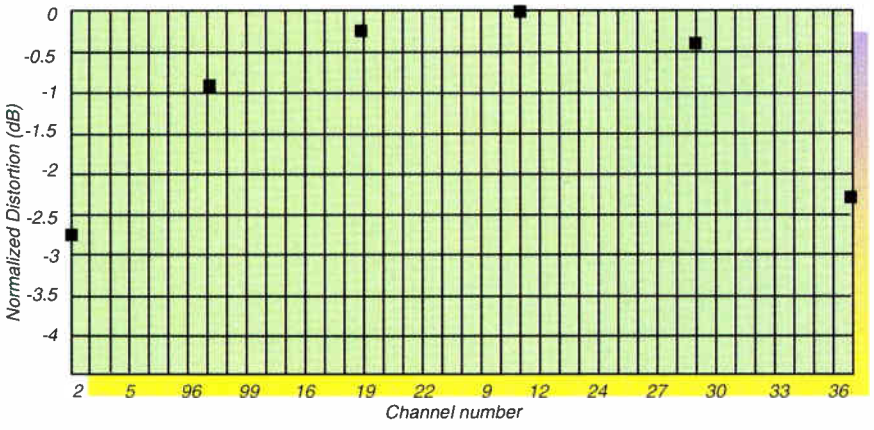
Figure 3: Typical normalized system distortion vs. channel



of the necessity of eliminating service interruptions, the approach of the NCTA engineering committee was to provide methods of measurement which will minimize, and if possible, eliminate these interruptions. It is highly recommended that every effort be made to become comfortable with a procedure for this test which will not require signals to be taken off the air.

Three measurement methods are discussed in the NCTA Recommended Practices. Method 1 is the traditional process which requires removing the video modulation for CSO and the visual carrier for CTB. This is the most accurate method but requires a service interruption for both measurements.

Method 2 is an alternate method which uses a CW carrier and measures the AM modulation component on the carrier. This AM component corresponds to the CTB which is at the carrier frequency. The advantage of this method is that it does not require removing the carrier at the headend, but it still requires the removal of video modulation on the channel under test.

Method 3 eliminates the need to disrupt an active channel by measuring the distortion in an unused portion of the band and extrapolating this reading to the portion of the frequency band with the worst performance. The accuracy of this approach is dependent upon the accuracy of the system distortion characterization. It is less accurate than other methods, but when used with cushion for error, serves as an acceptable method for guaranteeing compliance.

In all three methods, the NCTA Recommended Practices provides a step-by-step approach which will not be repeated here. Instead, this article will address a few additional items. A new method (Method 4) will be presented which has recently been introduced in several new pieces of automated test equipment. For more information on the details of the procedures, please refer to the NCTA Recommended Practices.

Method 1

See Figure 1 to view the distortion test equipment set-up. Then take the following steps:

1) Measure the peak level of the visual carrier level

2) Remove the video modulation for CTB or remove the visual carrier for CSO

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3) Measure the average value of the distortion products.

This approach will always get the most accurate and repeatable results because the masking signals in the band of interest are eliminated. Unfortunately, it also requires that somebody or something at the headend disables the modulation, and/or carrier, for the duration of the measurement after the carrier reference is stored. Because of the video averaging and slow sweep speed required with the 30 kHz IF bandwidth, this measurement can take up to two or three minutes.

Method 2

See Figure 2 to view the alternate test equipment set-up for third-order distortion. Then take the following steps:

1) Record the voltage of the carrier reference level in VDC

2) Record the level of the CTB imposed on the carrier in VAC

3) The distortion magnitude is:

$$CTB = 20 * LOG \left[\frac{VOLTS_{AC}}{VOLTS_{DC}} \right] + 0.5 \text{ dBc} \qquad (1)$$

The biggest advantage of this method is that communication is no longer needed with the headend to turn the carrier off for CTB if a channel is available for a CW carrier. It still requires an inactive channel, and in addition, hum and cross modulation will appear as AM components, and are indistinguishable from the CTB.

Method 3

Method 3 is a three-step process. The first step is to characterize the distortion of the system channel by channel. The second step is to measure the distortion at a frequency in an unused portion of the band. The third step is to extrapolate this measurement to the worst case channel in the system by using the characteristic generated in the first step.

The system characterization is the key to the accuracy of this method. Either Method 1, 2 or 4 may be used to make this initial set of measurements. The characterization requires interruption of service, but only needs to be done once unless the system configuration changes. This must be done for each portion of the system with unique channel loading, system tilts, AML or fiber links, amplifier spacing, etc. The characterization will stay relatively constant until major changes such as hardware layout or signal level changes occur in the system.

Figure 3 is a typical plot of the beat distribution and will not vary significantly from system to system. The plot is normalized to the worst case distortion by subtracting the worst case value from all others. One plot needs to be generated for CSO, and another for CTB.

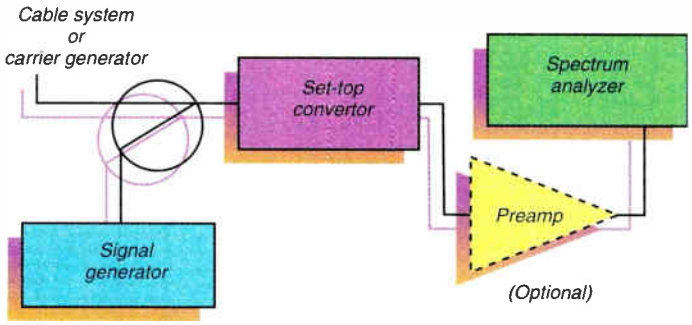
Using Method 1, 2 or 4, the distortion is measured at an unused portion of the band. If a CW carrier is required, it may be inserted 6 MHz above the highest visual carrier or at a 6 MHz increment in an unused portion of the band. If the system is well behaved and flat, an adjacent visual carrier may be used as the visual carrier reference. If this approach is used, the result must be adjusted for the difference in system gain and tilt between the frequency of the measured carrier and the frequency of the distortion.

The distortion measured in Step 2 (a negative number) is adjusted by the correction factor from Figure 3 to represent the worst case system distortion. For example, if the distortion measured at channel 37 in Step 2 is -58.3 dBc, the worst case distortion at channel 11 would be:

$$CTB = [-58.3 + 2.2] = -56.1 \text{ dBc} \qquad (2)$$

The trade-off of accuracy in this method is offset by the ability to constantly monitor the performance without service interruptions. In order to maintain good engineering practices, the predicted error in this approach must be added to the FCC requirement. For instance, if you suspect this may contain 3 dB of error, then the -51 dBc specification you normally test to becomes -54 dBc to guarantee compliance. If your system is operating close to the limit, then this approach will not have enough accuracy to keep you in a safe zone.

Figure 4: Set-top convertor distortion - test equipment setup



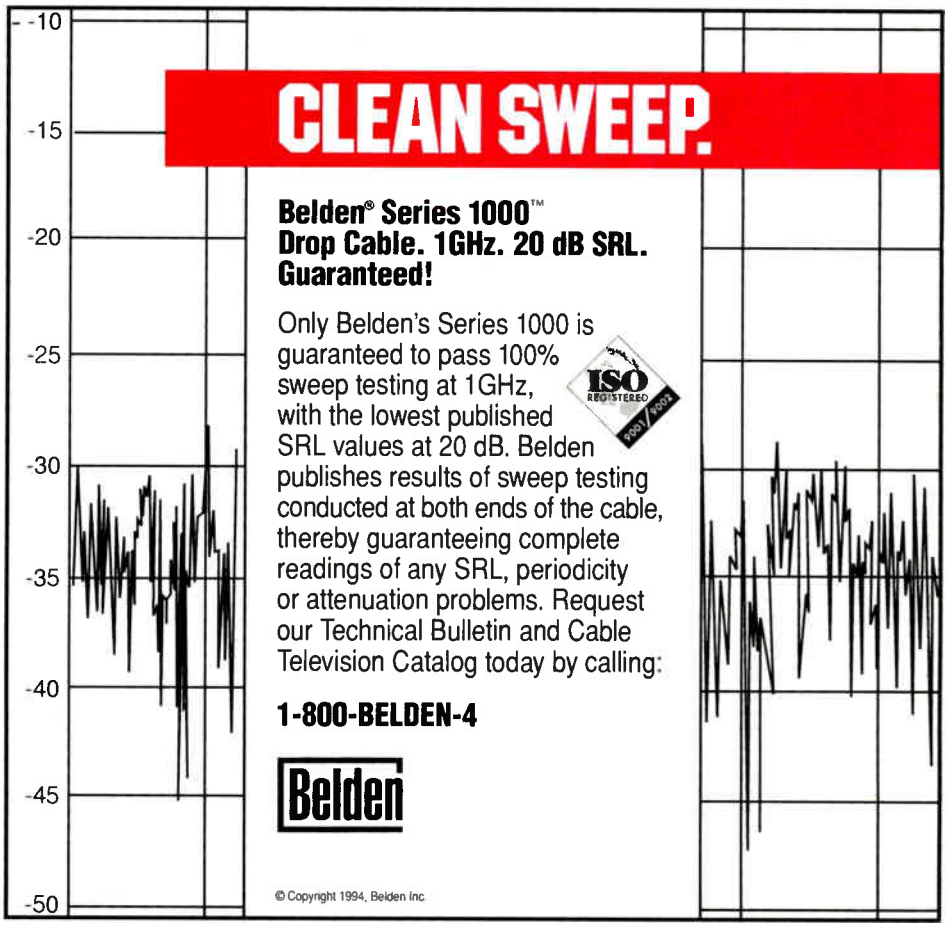


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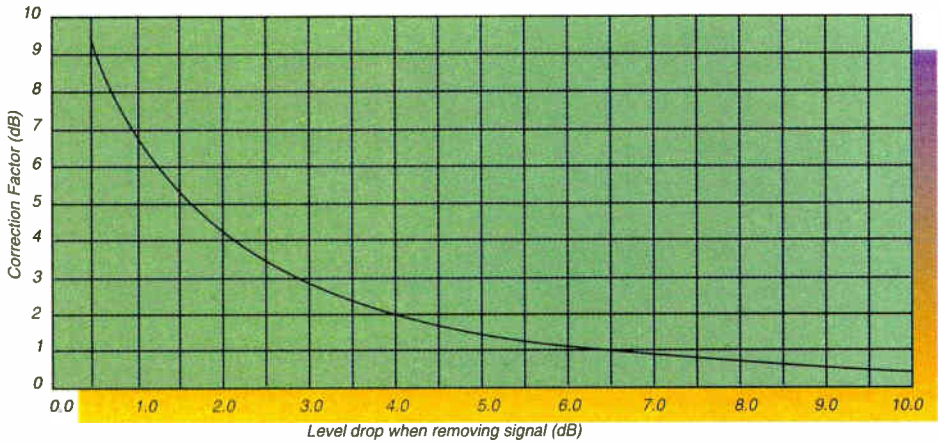
Figure 5: Beat-near-noise correction



Method 4

Method 4 uses a gated video measurement, which recently became available in some automated test equipment. It allows the measurement of second order components without interruption of service by measuring the distortion during quiet lines in the vertical blanking interval (VBI). It is typically an automated measurement which requires a non-scrambled channel, but the hardware set-up is the same.

The advantage of this method is that CSO on all unscrambled channels can be monitored automatically without service interruptions. On channels 5 and 6 in a standard channel plan, the CTB component is offset from the visual carrier, allowing CTB to be monitored on these two channels without turning off the carrier.

Measuring the convertor distortion performance by itself is perhaps the most difficult part of meeting the FCC requirements. Fortunately, the performance of the convertor is typically much better than the system itself and has little contribution to the overall system's distortion performance. The first step is to know whether the convertors are volume control (baseband) or non-volume control (RF) convertors.

In the case of baseband convertors, because of the signal processing on the demodulated video, there is no standard measurement method to recommend. The safest approach is to use specifications provided by the manufacturer. The specifications should be generated using conditions similar to the system operating conditions seen at the subscriber's drop, both in signal level and channel loading. If measurements are required, stick very close to the manufacturer's recommended procedure.

For RF convertors, any procedure used for measuring these should have the approval of the convertor manufacturer, because there are a wide variety of units available. The procedure outlined by the NCTA replaces the normal visual carrier with a carrier offset 250 kHz to 500 kHz below. This keeps the AGC of the convertor operating at a normal level and allows the CTB product to be measured next to the substitute visual carrier. Because of the dynamic range of this measurement (typically >70 dBc), a preamp is necessary between the convertor output and the analyzer input.

Using the set-up in Figure 4 and the visual carrier offset by 250 to 500 kHz, the measurement procedure is the same as Method 1 described in the NCTA procedure.

Calculating set-top distortion

Once the system distortion has been measured at the system test point by any of the methods described, and the performance of the convertors has been established, the two numbers need to be combined to arrive at the FCC requirement. The easiest way to do this is mathematically with Equation 5. You can see from the example that a typical convertor will have less than a 1 dB contribution to the overall performance.

Convertor distortion: $DIST_{CONV} = -75$ dBc (3)

System distortion: $DIST_{SYS} = -56$ dBc (4)

Combined distortion: $DIST_{SUB} =$

$$20 * \text{LOG}\left[10^{\frac{DIST_{CONV}}{20}} + 10^{\frac{DIST_{SYS}}{20}}\right] = -55.1 \text{ dBc} \quad (5)$$

Figure 5 provides a graphical approach for combining two distortion values.

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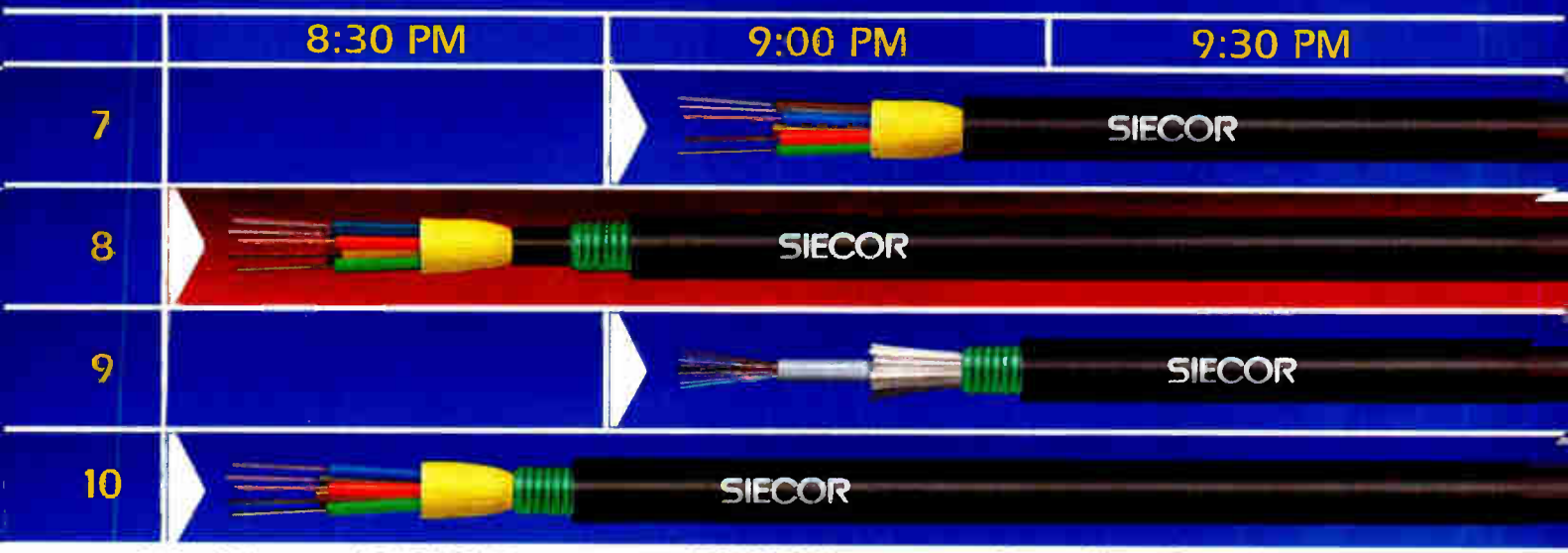

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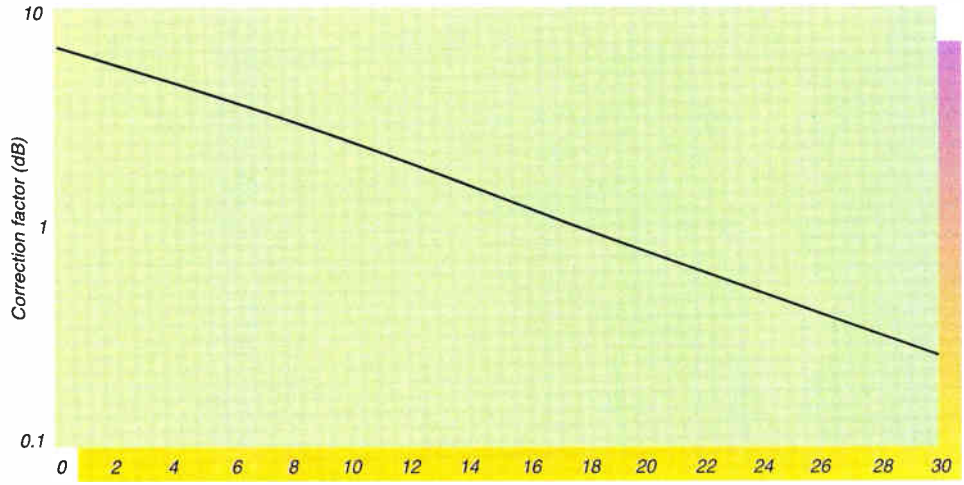
Figure 6: Combining two distortion values



Potential errors

One common error occurs when trying to measure the distortion products near the noise floor of the analyzer. If additional attenuation cannot be removed to provide higher signal level to the analyzer, then a correction factor should be used to adjust the measurement. The easiest way to determine this correction factor is to remove the signal from the input to the analyzer and note the change in level at the beat frequency. Figure 6 plots the correction factor versus this change in level.

Another common error is driving the input of the preamp or analyzer into overload. If this is the case, the system distortion will be masked by the preamp or analyzer distortion. The way to check for this is by increasing the attenuation at the input to the preamp or analyzer by 10 dB and verifying that the distortion changes by only 10 dB. If the distortion products drop by more than 10 dB, you need to start with a lower signal level, or use a bandpass filter at the input to limit the input power.

If a bandpass filter is used to limit the input power, make sure the passband of the filter is flat across the band of use, from the visual carrier to the frequency of the distortion. This can be tricky when using a tunable filter and automatic test equipment. Prior to selecting the automatic measurement mode, adjust the filter by using the noise floor of the analyzer to determine the filter's location.

Test equipment errors

In order to get accurate results in any of the methods discussed above, the errors contributed by the test equipment need to be understood. Because this is a high dynamic range measurement, the most important specification is the log scale fidelity or log scale linearity. This will usually be specified as x.x dB / 10 dB or a maximum error of x.x dB. One step that is often overlooked is the addition of this error to the measurement limit requirements.

For instance, if the maximum error of the analyzer is 1.5 dB, then the FCC target specification becomes -52.5 dBc instead of -51 dBc. If the attenuator is changed between the measurement of the visual carrier and the measurement of the distortion, then the attenuator accuracy also needs to be considered. This can add another 1.0 dB or more of uncertainty, depending on the quality of the test equipment.

Because of this, it is important to understand the accuracy of the instrumentation. It is conceivable that the potential error could be 3 dB or 4 dB with a lower cost piece of test equipment. It also means that if a higher dynamic range analyzer is used (one that can make the measurement without changing the attenuator), you can eliminate the attenuator uncertainty and lower your target specification.

To verify the accuracy of test equipment (and minimize the uncertainty of the measurement) it's a good idea to verify the log scale fidelity of the analyzer with a precision attenuator. A good attenuator will allow the analyzer's performance to be checked. Remember, this is a comparison measurement between a high level and low level signal, so absolute accuracy is not the concern for this particular test. What is important is that when you step the attenuator 60 dB, the signal on the display changes 60 dB. Log scale fidelity is a performance criteria that will change with operating temperature, so this should be verified across the operating temperature range.

Hopefully, this brief synopsis will make the semi-annual proof tests a little easier.

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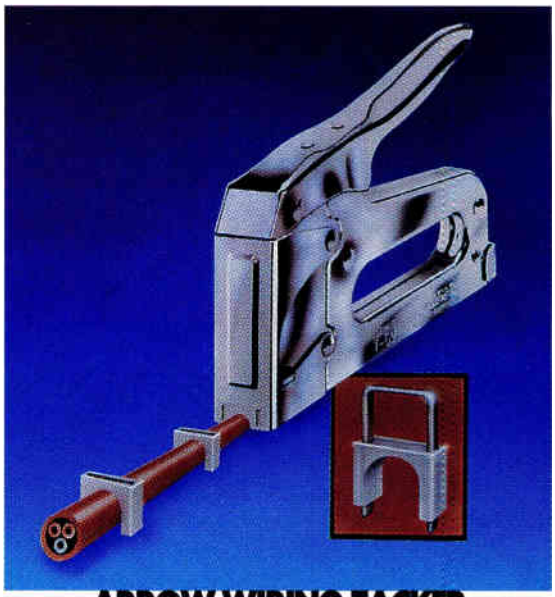

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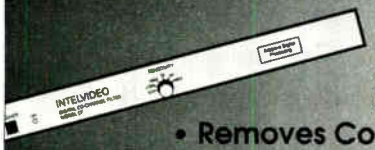

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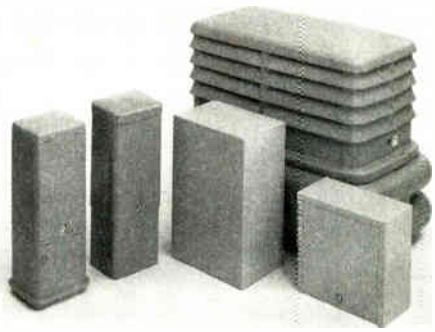

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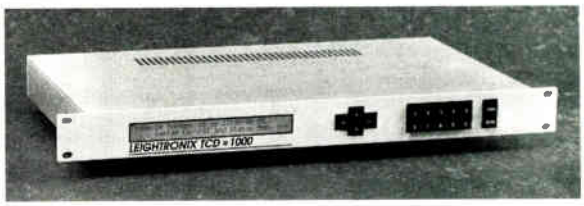

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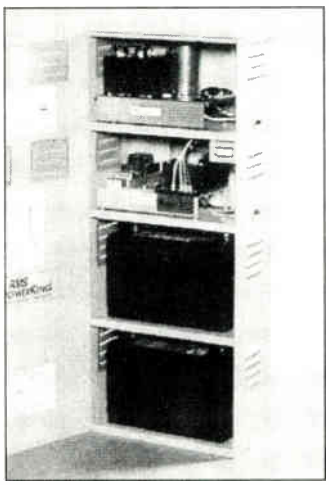

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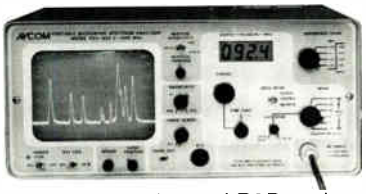

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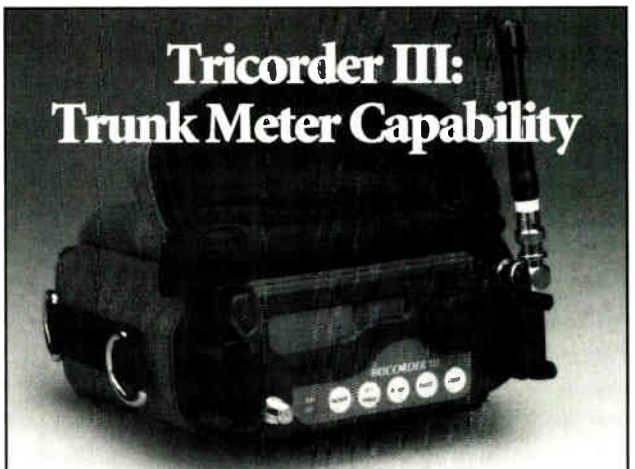

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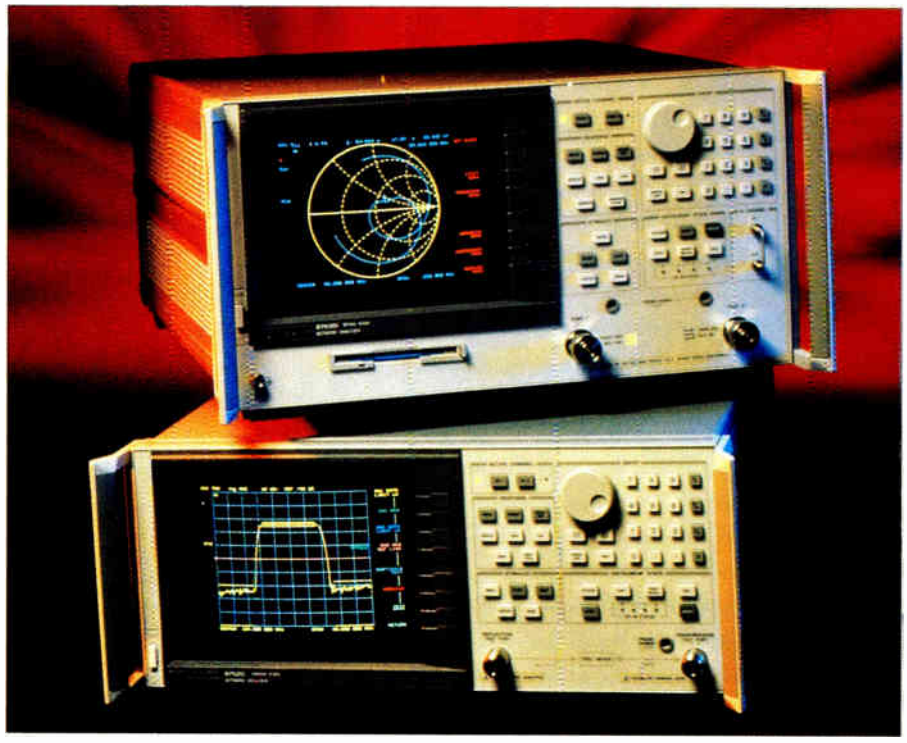
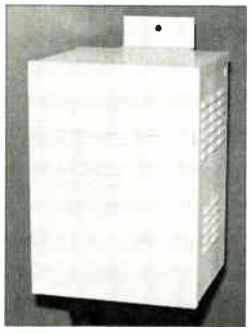


Network analyzers

Power supply enclosure

ROSWELL, Ga.-Performance Cable TV Products is announcing a series of power supply enclosures for both aerial and ground mounting. The pole-mounted cabinets are built of heavy gauge aluminum, while the pedestal units are high security steel, built to discourage illegal entry. The aluminum and steel units are identical and may be used interchangeably, depending upon the circumstances. The aerial enclosures are shipped with pole mounting brackets. The brackets also fit the steel version and may be ordered as an option, if needed.



Power supply enclosures

The cabinets come complete with wiring harness and hardware and are simple to install; power modules are located in the upper half of the enclosure, while the batteries are in the lower compartment. Because generous ventilating louvers provide optimum cooling, the power supply modules normally do not require fans.

The company has also announced the Surge/Gard, a snap action, auto reset circuit breaker which fits into power inserter fuse clips. The product is available in 15 or 20 ampere versions and serves as protection from random nuisance fuse related outages by resetting typically in 60 seconds. Also helps prevent circuit burnouts often associated with clamping types of surge suppressors.

Circle Reader Service number 62

FM receiver

TORRANCE, Calif.–A new low-noise receiver, designed specifically for FM applications, has been developed by Cable AML Inc. The IRXFM-200 is a block downconverter from the 12.7-13.2 band to the 950-1450 MHz band. This output was chosen to make the receiver compatible with the standard FM equipment commonly used in cable systems. The receiver features a crystal-referenced phase locked local oscillator for maximum frequency stability and low phase noise, and a composite microwave Automatic Gain Control (AGC) circuit providing more than 30 dB dynamic range. The IRXFM-200 is designed for rack mounting in an indoor environment for convenience and ease of access to components.

Circle Reader Service number 63

Time domain reflectometer

LINCOLN, Neb.–Riser-Bond Instruments has introduced the Model 1220 time domain reflectometer, cable fault locator, which quickly locates and identifies cable faults and conditions in all types of metallic cable. The Model 1220 features Riser-Bond's

Model 1220 time domain reflectometer

HP 8753D and 8752C analyzers

PALO ALTO, Calif.–Hewlett-Packard Co. has announced performance and productivity improvements to its high-performance network analyzers. The enhanced analyzers–HP 8753D and 8752C–are targeted for designers and manufacturers of RF components for wireless communications, television, cable TV, videotape and consumer electronics products. The HP 8753D has a fully integrated S-parameter test set that provides better performance and stability for longer-lasting calibrations, exceptional reliability and improved resistance to ESD. The HP 8752C, with its integrated transmission/reflection (single-bridge) test set, provides much of the performance of the HP 8753D at a substantially reduced price, according to the company.

Circle Reader Service number 60

Super-Store waveform storage, which provides 1,500 times more storage and comparison information of the waveform than competitive TDR storage techniques. The entire cable, both on and off screen, is stored for maximum versatility and resolution. Four waveform storage bins are standard on the Model 1220, with the option of 16 total bins. A high sensitivity and multiple pulse widths package, formerly available as an option, is now standard.

Also new from the company is the aforementioned Super-Store waveform data storage, a standard feature on Riser-Bond Instruments' Models 1220, 1205 and 1205T time domain reflectometer, cable fault locators. Super-Store provides storage of the entire cable under test and all waveform information.

Circle Reader Service number 64

High-speed converters

SUNNYVALE, Calif.–Philips Semiconductors has introduced a family of new 8-bit high-speed A/D converters that provide wide input bandwidth and low power consumption. The TDA8718, TDF8704 and TDA8714 are ideal for use in applications that require A/D conversion, such as multimedia, automotive and communications equipment applications. The TDA8718 digitizes at up to 600 Msamples/second, has one watt power dissipation and a usable input bandwidth of 150 MHz. The TDA8714 is a high-speed TTL converter, designed for professional applications such as video, radar, medical imaging and instrumentation. The TDF8704 is designed for standalone operation and contains an internal voltage-reference. It has the -40 degree C to +85 degree C operating temperature range necessary for automotive and industrial applications.

Philips Semiconductors has also announced the availability of an evaluation board for its video-to-PCI bus interface chip. The DPC 7116 SD is the first implementation of Philips' SAA7116, a YUV video bus to PCI bus interface chip which permits instantaneous live video DMA transfer from any video source directly onto the graphics, communication, CPU or hard disk memory in the system.

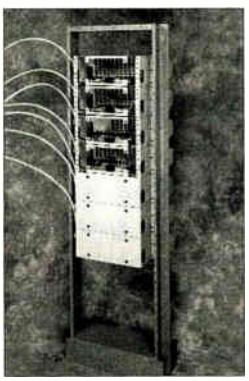
The evaluation board is a PCI card with a Philips TV Tuner to capture cable and TV signals. The tuner signal or other NTSC/PAL video (and S video) signal is captured and digitized by the Philips digital video (digitizing, decoding and scaling) chipset.

Circle Reader Service number 65

Fiber management

ATLANTA-GC Technologies Inc. is offering its telephone, CATV and LAN customers fully pre-terminated and tested fiber management systems to help simplify the fiber interconnection process, decrease labor installation costs and improve the reliability of their fiber optic networks.

Up to 144 preterminated fibers can be accommodated per shelf or cabinet, and up to seven, 10 1/2 inch cabinets can be installed in a typical seven-foot rack frame, for a total capacity of 1,008 fibers per system. GCT can provide systems with flame retardant ribbon riser or 900 micron cable, all industry standard connectors and any customer-specified cable stub length.



Pre-terminated and tested fiber management systems

Using GCT's family of fiber termination cabinets, patch panels and Premium-Performance cable assemblies, the user can customize a fiber management system to meet specific application requirements.

Circle Reader Service number 66

Optical receiver

WEST TRENTON, N.J.–EPITAXX Optoelectronic Devices Inc. recently introduced the ERM507 FJ-Series, a 2.5 Gbits/second Sonet/SDH PIN-Transimpedance Optical Receiver Module. The ERM507FJ-S incorporates a 25 µm active diameter InGaAs PIN photodiode with a 2.5 Gbits/second FET transimpedance amplifier. The dual inline butterfly package is pigtailed with a 9/125 µm single-mode, jacketed fiber. The module is of benefit for digital fiber optic receivers operating to 2.5 Gbits/second, for analog receivers to 1.7 GHz and for bursty data applications to 2.5 Gbits/second.

Circle Reader Service number 67

Cable ties

MEMPHIS, Tenn.–Thomas & Betts has expanded its offering of the Ty-Fast one-piece cable tie to include 11 sizes. UL listed for wire bundles ranging from 1/16 of an inch to four inches in diameter, the Ty-Fast cable tie is designed to meet the needs of the OEM. The one-piece cable tie is designed to ease application in wire harness fabrication and wire bundling installations, such as panels and switchgear. The cable tie features a two-sided grip at the tail end of the tie. The textured grip holds the tail securely in the tie's head during installation, and affords the installer an easy grip while tightening the tie. Ty-Fast cable ties are available in natural nylon 6/6 and are offered in 11 lengths, from 3.6 inches to 14.75 inches.

Circle Reader Service number 68

Video update

KENT, Wash.–The Light Brigade Inc. has released a new video, "Couplers, Switches & Isolators." The video provides current information on the types, variations, issues and applications in which these products are used. The video can also be used as a training tool for manufacturers, designers, instructors and technical sales organizations. It's available in NTSC, PAL and SECAM formats and is one in a series of eight.

Circle Reader Service number 69

OCTOBER

2-7 Optical Society of America (OSA) Annual Meeting and Exhibit/Interdisciplinary Laser Science Conference. Location: Anatole Hotel, Dallas. Call (202) 416-1480.

4-5 ¡Programacion '94!, a conference on satellite programming in Latin America, will be hosted by Kagan World Media at The Biltmore Hotel in Miami. Presentations will be given in both English and Spanish. Fee is $895. Call (408) 624-1536 to register.

4-5 Cable TV Measurement Seminar. Sponsored by Tektronix. Location: Raleigh, N.C. Call Kathy Richards, (503) 627-1555. (Please note: locations for this date and other Tektronix seminars listed here have changed since the initial announcement at CableTec Expo).

5-6 Cable TV Measurement Seminar. Sponsored by Tektronix. Location: Chicago. Call Kathy Richards, (503) 627-1555.

6-7 Cable TV Measurement Seminar. Sponsored by Tektronix. Location: Minneapolis. Call Kathy Richards, (503) 627-1555.

10-11 The Asynchronous Transfer Mode (ATM): Foundation for Broadband Networks. Presented by the International Institute for Learning Inc. Location: MSU Management Education Center, Troy, Mich. Call (800) 325-1533 or (212) 758-0103.

13 SCTE Satellite Tele-Seminar Program. "An Overview of the Society's BCT/E Certification Program, Part 2." To be transmitted on Galaxy 1R, Transponder 14, 2:30-3:30 p.m. EDT. Call SCTE National Headquarters (610) 363-6888.

17-19 SCTE Technology for Technicians II Seminar. Hands-on Technical Training Program for Broadband Industry Technicians and System Engineers. Location: Columbia, S.C. Call SCTE National Headquarters (610) 363-6888.

18-19 Reinventing the "Last Mile"–How Far, How Fast? Presented by Telecommunications Reports and TELCO Competition Report. A conference on new local loop technologies and applications. Location: Hotel Washington, Washington, D.C. Call (800) 822-MEET, or (202) 842-3022 for information or to register.

18-19 Multimedia: The Route to Tomorrow ComForum. Presented by the International Engineering Consortium. Location: Red Lion Hotel, Denver. Call ComForum (312) 938-3500.

18-19 Cable TV Measurement Seminar. Sponsored by Tektronix. Location: Boston. Call Kathy Richards, (503) 627-1555.

19-20 Cable TV Measurement Seminar. Sponsored by Tektronix. Location: New York. Call Kathy Richards, (503) 627-1555.

20 SCTE OSHA/Safety Seminar. Training seminar for system managers and safety coordinators on maintaining records and developing safety training programs. Location: Nashville, Tenn. Call SCTE National Headquarters (610) 363-6888.

20-21 Broadband: Making It Happen ComForum. Presented by the International Engineering Consortium. Location: Red Lion Hotel, Denver. Call ComForum (312) 938-3500.

24-25 Wireless Telecommunications Real Estate and Permit Acquisition for the '90s. Produced by the University of California Berkeley Extension. Location: The Oxford Hotel, Denver. Call (510) 642-6117 for more information.

24-26 Fiber Optic Installation and System Design. Seminar sponsored by The Light Brigade, tailored for those seeking a full understanding of fiber optics, from engineering to implementation. Location: Anchorage, Alaska. Call (206) 251-1240.

Trade Shows

October

4-6 Atlantic Cable Show. "Directions to the Information Superhighway." Technical sessions provided by SCTE. BCT/E and Installer Certification exams to be administered. Location: Atlantic City Convention Center, Atlantic City, N.J. Call (609) 848-1000.

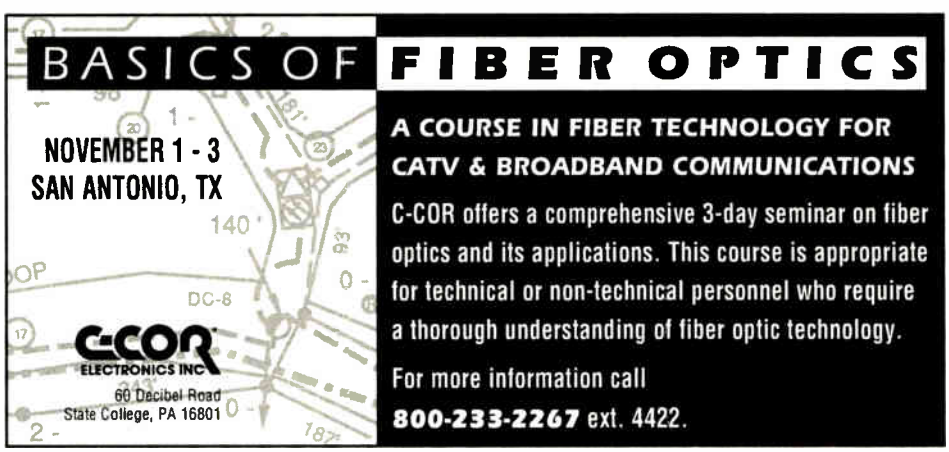
24-26 European Cable Communications '94. Location: London. Call (011) 44-71-222-2900.

31 CAPER/Jornadas '94. Location: Buenos Aires, Argentina. Call (011) 54-1-383-5399.

November

15-17 RF Expo East. Sponsored by RF Design magazine. Location: Disney's Contemporary Resort, Orlando, Fla. Call Argus Trade Shows (800) 828-0420.

30-December 2 Western Show. Location: Anaheim, Calif. Call (301) 468-3210.



Circle Reader Service No. 47

The issue: Signal theft

One of the biggest operational headaches cable operators have to deal with is signal theft. The National Cable Television Association has estimated that the cable industry loses about $5 billion every year to unauthorized viewers of cable signals–a whopping 20 percent piracy rate. What about your system?

The questions:

1. What is your system's current penetration rate for basic subscription services?

❑ Below 35% ❑ 35%-55% ❑ 56%-75% ❑ Over 75%

2. What would you guess is the current level of basic service theft in your system?

❑ Less than 5% ❑ 5%-15% ❑ 16%-25% ❑ Over 25%

3. What is your system's current penetration rate for premium services (of all basic subs)?

❑ Less than 50% ❑ 50%-75% ❑ 76%-100% ❑ Over 100%

4. What would you guess is the current level of premium service theft among basic subscribers in your system?

❑ Less than 5% ❑ 5%-15% ❑ 16%-25% ❑ Over 25%

5. How much revenue does your system expect to lose to signal theft during 1994?

❑ Less than $20,000 ❑ $20K-$35K

❑ $36K-$50K ❑ Over $50,000

6. What recent steps has your system taken to reduce signal theft?

❑ None ❑ Regular audits ❑ Offer amnesty

❑ Started security program ❑ Other

7. How concerned is your system's management about local signal theft?

❑ Very concerned ❑ Somewhat concerned ❑ Not concerned

8. Has your system filed charges against anyone for service theft over the past year or so?

❑ Yes ❑ No ❑ Don't know

9. What hardware do you have in place to battle piracy?

❑ Scrambling ❑ Traps ❑ Locking pedestals

❑ Set-top descramblers ❑ None

10. Has your system ever used, or considered using, the "electronic bullet" method of detecting pirates?

❑ Yes ❑ No ❑ Don't know

11. Has your system ever set up a "sting" operation to detect pirates or expose an employee who is illegally hooking up homeowners to cable?

❑ Yes ❑ No ❑ Don't know

12. Has your system taken specific steps to ensure that your own installers aren't involved in piracy?

❑ Yes ❑ No ❑ Don't know

Your comments:

FAX US

303-393-6654

Make a copy of this page and fax it back to us at the number above or mail it to CED, 600 South Cherry Street, Suite 400, Denver, Colo. 80222.

We will tally the results and print them in a future issue. Your suggestions for future questions are always welcome.

We also want some written comments from you on this subject. Names won't be published if you request your name to be withheld, but please fill out the name and job information to ensure that only one response per person is tabulated.

Your name and title

System name:

Your MSO:

Location:

Your job function:

RESULTS

The issue: In-home wiring

As the digital era dawns in cable systems next year, one major focus area will be the miles of coaxial cable already installed in the house. Will the wiring be able to pass digital signals without breaking them up? If signals are split to high-speed computer modems and perhaps other devices, will there be enough signal level left to provide good pictures? This survey asked how you feel about the subject.

The results:

A majority of operators who responded to this survey report using better drop materials on a daily basis, which is a change in mindset from just a few years ago. Consequently, two out of three respondents expressed confidence that their systems will deliver digital signals to the home, even though one in five isn't sure.

Most say they favor a program that would allow the typical homeowner to purchase drop components from a retail outlet and give him responsibility for the inside wiring, and most companies have policies in place that would allow that to happen. (Technically, there are ramifications because the cable operator is responsible for system leakage all the way to the TV.)

Nevertheless, every person who responded said their systems charge a fee to wire additional outlets, which may drive most "do it yourselfers" to wire their own homes, often with components considered to be substandard.

There are many who believe that as low-quality components proliferate in the home, it will have a detrimental effect on the delivery of digital signals, which will result in additional service calls.

1. Does your system routinely install high quality components in the drop portion of the system?

Yes	No	Don't know
89%	**11%**	

2. If so, is that a change in attitude compared to a few years ago?

Yes	No	Don't know
56%	**44%**	

3. Some predict a high-quality drop system will be needed to deliver digital signals to the home. Do you think your system can deliver a 16 VSB or 256 QAM digital signal between the tap and the TV in a majority of the homes?

Yes	No	Don't know
67%	**11%**	**22%**

4. Does your system consider the drop to be a "system" that should rarely be broken open?

Yes	No	Don't know
44%	**44%**	**11%**

5. Does your system encourage homeowners to wire their own homes by making high-quality components available to them?

Yes	No	Don't know
44%	**56%**	

6. Does your system wire new homes with coaxial cable for free, or do you charge the homeowner and/or builder for that service?

Free	We charge	Don't know
22%	**78%**	

7. Does your system charge homeowners a fee to wire their homes for additional outlets?

Yes	No	Don't know
100%		

8. Does your system suffer from excessive direct pickup interference?

Yes	No	Don't know
11%	**89%**	

9. Would you favor making high-quality coaxial cable, splitters and connectors generally available to the public through retail outlets?

Yes	No	Don't know
78%	**22%**	

10. Would you favor a program where the cable company would be responsible for only the outside plant, much like the telephone company approach to maintenance?

Yes	No	Don't know
67%	**33%**	

11. Is your system interested in providing subscribers with high-speed access to data networks such as Prodigy or the Internet?

Yes	No	Don't know
56%		**44%**

Your comments:

"Any system planning to deliver digital signals better have well-trained in-house installers. Contract installers don't cut it."

– Todd Leser, Multivision Cable, Sonoma, Calif.

"Contractors do not understand the problems caused by low-quality wire and poor workmanship in pre-wired homes."

– John Sisk, TCI, Cantonment, Fla.

"Most subscribers do not know how to install connectors and don't have the proper tools."

– Bruce Witte, Country Cable, Ramona, Calif.

People on the move

Hiroaki Horima has been elected president of **Sumitomo Electric Lightwave Corp.** Horima joined parent company Sumitomo Electric Industries in April 1972 and was initially assigned to the Cable Engineering Section of the Communications Division,

Hiroaki Horima

where he was one of the pioneers in the development of CATV coaxial cable systems, multi-pair PEF-insulated junction cables and low loss unbalanced type communications cables. In January 1993, he was assigned as general manager to the Fiber Optics Administration & Planning Department of the Fiber Optics Division. In addition to his business achievements, Horima was awarded the OHM Prize in 1991 for the development of long-span and non-metallic, self-supporting optical cable.

Augat Inc. has announced that **Marcel Joseph** will retire from the position of president and CEO, effective December 31, 1994. Joseph will continue as chairman of the board.

William Fenoglio, formerly president and CEO of Barnes Group Inc., has been elected president, COO and a director. He will become president and CEO effective January 1, 1995.

Concurrently, **L. Ronald Hoover**, vice president and general manager of the Interconnection Products Division, has been named vice president Business and Technology Development, reporting to the CEO. Hoover will be responsible for defining advance technology programs, acquisitions and corporate business strategies.

Kenneth Walker, vice president business development, assumes the vice president/general manager-Interconnection Products position. Walker previously served as Augat's vice president-International Marketing and Sales.

In ceremonies during the Eastern Show, **Alex B. Best** of **Cox Cable Communications** was honored for his distinguished service to the cable industry in the South, as SCTA awarded him the Morris Dunn Award. The award is named in honor of one of cable's early pioneers. Best is senior vice president of engineering with Cox and joined the company in 1986 as vice president of engineering.

During the Eastern Show, SCTA also awarded **Frank Hamilton** with the Polly Dunn Award. The award is given for unusual and outstanding contribution to the cable television industry. Currently, Hamilton is responsible for all domestic sales through the Times Fiber Communications distributor network.

C-COR Electronics Inc. has appointed **William Provett Jr.** as vice president-operations and manufacturing. In this position, Provett will report to Daniel Finch, president and COO, and will be responsible for all manufacturing and operations activities in the company's State College and Tipton, Pa. facilities. Provett has been the general manager at C-COR's Fremont, Calif. digital fiber optics operation since April 1994.

In a related announcement, **Les Chitester** has been named as general manager-Fremont Operations, replacing Provett. In this position, Chitester will have full responsibility for managing C-COR's California digital fiber optic design and manufacturing operations. His most recent position was that of business unit manager for GSS/Array Technology.

Finally, **Robert Hoffman** has been appointed vice president-engineering. In this position, Hoffman will report to Finch and will be responsible for all engineering operations in the company's State College and Tipton, Pa. facilities. Prior to joining C-COR, he served as the vice president of engineering for Cincinnati Microwave Inc.

Jerry Johnson has been appointed as vice president of system development with **U.S. Computer Services**. Before joining the company, Johnson had served as a consultant on USCS' international convergence product, Intelecable. His new responsibilities will range from the design of application architecture and establishment of the development environment to database administration and the development of graphical user interface (GUI).

Mark McKeen

Mark McKeen has been named as vice president of engineering at **The Weather Channel**, which he joined in 1991 as director of engineering.

The network also announced that **Joe Conboy** has been named vice president of production for The Weather Channel. He had been director of production at the network since 1988.

Continental Cablevision has announced changes in its Singapore and Saint Paul operations. Under the terms of a joint venture, Continental Cablevision is responsible for the construction and operation of the Singapore cable television project. **Randall Coleman**, vice president and district manager of the MSO's Saint Paul operation, will be moving to Singapore to head the new venture. Coleman has spent the past 12 years with Continental. Assuming the new responsibilities in Saint Paul will be **Fran Zeuli**, formerly the marketing director of the Saint Paul and Northern Dakota County systems. Zeuli is a 10-year veteran with Continental.

Jim Clark has been promoted to vice president of sales for **Conifer Corp.**, a manufacturer of wireless cable MMDS reception products. Clark joined Conifer in 1979 and was previously sales manager. The Wireless Cable Association International Inc. recognized Clark with the President's Award in 1990 and 1992 for his outstanding contribution to the development of the wireless cable industry.

Kerry Cozad

Andrew Corp. has announced three promotions and a new appointment. **Kerry Cozad** has been promoted to product line manager, Broadcast Antenna Products. Cozad will be responsible for new product development and marketing of Andrew products worldwide, with emphasis on the wireless cable/interactive television markets.

Wally Mamak

Wally Mamak has been promoted to operations manager, Broadcast Antenna Products. He will manage manufacturing, purchasing and production planning and will retain responsibility for mechanical/structural engineering and the newly-created project office that manages development of products for customer orders.

John Tomczak has been promoted to accounts manager in the Broadcast Systems Business Unit, responsible for technical sales liaison on major broadcast and earth station antenna systems projects.

And in a new appointment, **Eric Krause** has joined Andrew as a Broadcast Systems Accounts manager. In this position, Krause will be responsible for the sale of Andrew products and services to Broadcast OEM/distribution accounts. CED

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C64	$179.95	Refurbished computer, with power supply (1 year warranty all products)
Modem	$ 89.95	1200 baud Hayes modem for remote page transfer
BCLK	$ 69.95	Battery clock (with RAM) restores time & date if power fails
PK8	$179.95	Controls 8 relays + DVM2; "WX1 & WSDM "+ IR inputs
WX1	$189.95	Temp.+Humidity ; WX1B $249.95 inc. barometric pres.
WSDM	$279.95	Anamometor Wind speed and direction; (Req. PK8)
RAIN	$249.95	Rain gauge daily, yearly total s in .01" increments
1541	$189.95	Disk drive; unlimited back up for RAMX
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Responsibilities include supporting large network services provider's entry into video market.

Strong interpersonal and communications skills and consultative selling skills; Bachelor/ Masters degree; work base in Washington, DC area.

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Recycling consumer electronics products

By Archer S. Taylor, Director and Senior Engineering Consultant, Malarkey-Taylor Associates

Have you ever wondered what happens to old TV sets, VCRs, stereos, radios, calculators, computers and even refrigerators? Obviously, some of them are stored out of sight in the attic, or a closet, especially if they are inoperative. Old TV sets may be moved to the bedroom, or passed on to the kids in college, or sold.

Electronic trash

Nearly 95 million households in the United States somehow account for about 250 million TV sets. It is estimated that 76 million households also have 105 million VCRs. Imports and manufacturer sales to dealers add about 25 million TV sets and 30 million VCRs annually, while only one million or so new TV households are being established. We do not know how many TVs and VCRs are sent to Mt. Trashmore each year. Obviously, you cannot keep on adding 25 million TV sets to 95 million households year after year.

As a matter of fact, a recent study conducted by Statistical Research Inc. (SRI) for the new Committee on Nationwide Television Audience Measurement (CONTAM) shows only a slight increase since 1981 in the percentage of TV households with two or three TV sets.

However, the number of households with four or more has increased from about five percent to 14 percent of TV households. Only 2 million or 3 million of the 25 million TV sets sold in 1994 apparently went into newly established households or became the fourth or fifth or sixth set in older households. Thus, it appears that 20 million or more TV sets must have been discarded to make room for new ones.

And then there are transistor radios, too cheap to be repaired. And clock radios. And 78-, 33- or 45-rpm record players/changers, cassette stereos and CD stereos. Already, computers, cellular phones and pagers are rapidly becoming obsolete, ready for the trash pile. And what about obsolete test equipment, cable TV amplifiers, VHF radios, Loran, GPS and on and on and on? Something has to give.

Recycling TVs and VCRs

The August 1994 issue of the *IEEE Spectrum* presents a provocative report by Dr. Patricia S. Dillon entitled "Salvageability by Design." Dillon is a research associate at the Gordon Institute at Tufts University. Her "Special Report on the Environment" describes responses to German and Dutch legislation mandating that electronics and appliance manufacturers recover and recycle products that are no longer useful.

Recycling of paper, glass, aluminum, steel and plastics has only recently been seriously addressed in the United States. Gradually enhancing the efficiency of refrigerators and other consumers of electrical energy has been legislated, although rather haltingly. Widespread recycling of electronic products is a disturbing concept that has not yet surfaced in the United States. Nevertheless, the volume of waste is monstrous. Dillon reports that, "This year, Germany alone will generate 1.5 million tons of electronic scrap, with consumer goods accounting for about two-thirds of it." The 25 million TV sets and 30 million VCRs sold annually in the United States to an already saturated public may well generate a million tons of scrap. This doesn't even take into account refrigerators, PCs, transistor radios and stereos.

Product memory

"In industrialized nations," Dillon says, "there is growing recognition that only through fundamental changes in product design can waste prevention and recycling be successful." A high tech "green port" scheme is being developed by a group of leading European firms in response to the German and Dutch legislation. Each product would be equipped with an electronic memory providing information to facilitate reuse and recycling at the end of its useful life. Recyclers could access information about the materials used, location of hazardous components and disassembly instructions.

Opposition

As you might expect, opposition has appeared in Europe. Who pays? Dutch and German industry estimate product price increases of between five percent and eight percent. Obviously, as Dillon says: "Consumers will ultimately pay." But there are many questions. If recycling costs are to be paid up front, at retail, how does the industry predict costs on long-life products lasting 10 or 20 years? Or should industry provide collection services to take back retired equipment for recycling? Responsibility is being placed on manufacturers to reduce the environmental impact of their products and provide for their ultimate disposal when no longer needed. The product "take-back" provisions in particular are causing great anguish in the German and Dutch electronics industries.

As far as I know, only Germany and The Netherlands have actually adopted legislation. But Japan, Austria, Italy, Switzerland and France are pursuing the "producer responsibility" principle. Disposal of obsolete electronic equipment and domestic appliances may not be as intractable a problem as disposing of radioactive waste that has a 10,000 year half-life. But it's a safe bet that the problem will not go away.

Maybe while they are at it, they will also outlaw plastic blister packs that force you to buy 10 pieces when you only need one. Maybe they will also set up standards so you can open the peanut package without using a knife, or your teeth! CED

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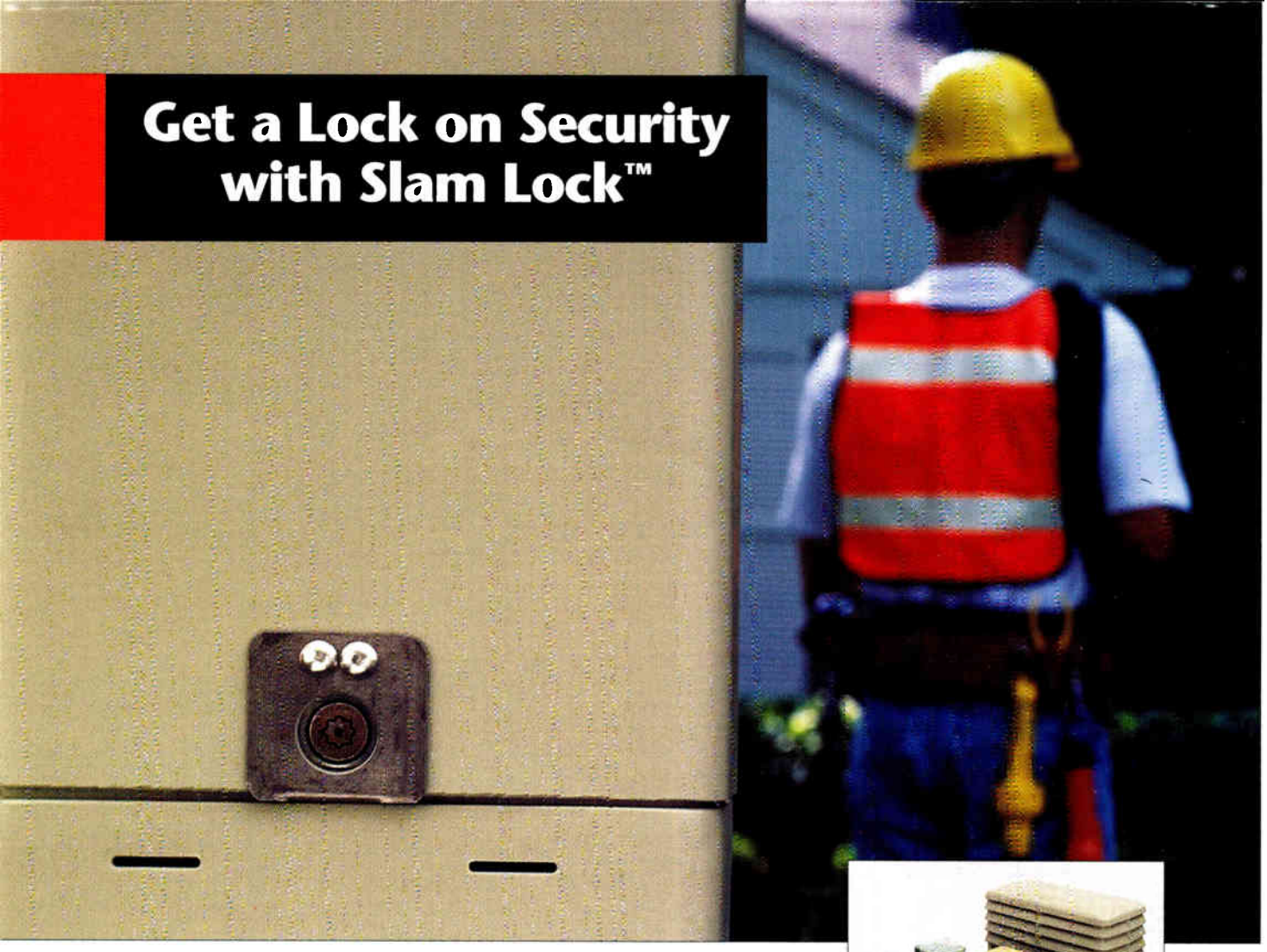

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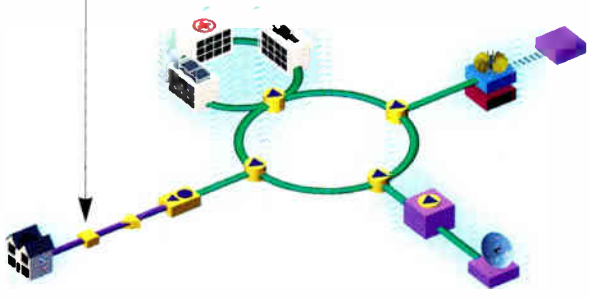

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