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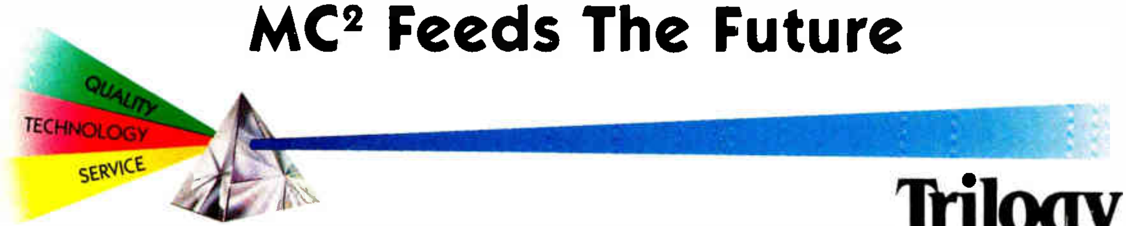

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Frequency allocation chart 41
By the CED staff

It's updated, it's out and it's better than ever. Next stop? Your office wall. Pull out and post the revised CATV frequency chart, packed with spectrum reassignments and fully channelized to 1 GHz.

Automated fleet management 46
By Michael Major

It seems cable operators are looking more favorably on automatic dispatch and fleet functions, if Rogers Engineering, TCI of Colorado and Cox/San Diego are any indication. The computerized systems promise improved technician efficiency at a reasonable cost. This article discusses how the systems work and who uses them.

Set-tops grow up 56
By Roger Brown, CED

Operators are looking at the new generation of digital set-top terminals as enabling devices for them to deliver interactive services in real time to viewers across the country. What issues are involved and what features are likely to be built into the next round of set-tops? Leading engineers and equipment manufacturers discuss those questions.

Sixth annual salary survey 30
By Leslie Ellis, CED

Do cable operators really have a technological leg-up on tomorrow's broadband, digital platform–or will governmental red tape in the guise of re-regulation stymie cable's lead? How do you measure up against your peers in cable engineering? Find out what cable's engineering community thinks of re-regulation, competition, management, salaries and myriad other issues in this year's salary survey.

Q&A with SCTE's Chairman 60
By Roger Brown, CED

What does Tom Elliot have in mind for the Society of Cable Television Engineers during his tenure at the helm? How does he plan to continue its success story and capture even more members? What's the SCTE's role in the global communications and standards-making processes? Find out in this question-and-answer interview.

Tech standards update 68
By the NCTA

Since the publication of the addendum to NCTA's Recommended Practices handbook last month, a few corrections and clarifications have been made to the document.

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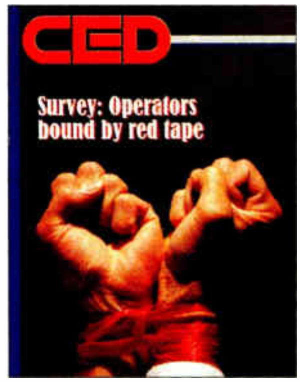

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With re-regulation, operators feel like their hands are tied

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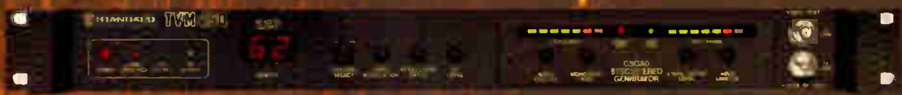

Vive la Révolution!

Hoping the Grand Alliance is just that

Throughout broadcasting circles, the recently announced "Grand Alliance" of advanced television proponents is being both hailed as the enabler of a North American high definition standard and nailed as the instrument by which broadcasters will be forced to spend millions on new technology that no one is even sure anyone wants.

The Grand Alliance represents an agreement between the remaining advanced television proponents to build, test and market a new television standard to American consumers. Revenue from the sale of new receivers and transmission equipment will be pooled and distributed equally among all players.

In general, those in the cable industry most closely watching the development of advanced television seem pleased with the arrangement, because it will conceivably speed up the implementation process (or at least eliminate some sources of litigation). Cable interests are eager to get an advanced TV system to market because premium services like HBO and Showtime will probably be among the first to transmit programming in the new format.

More good news for cable is the decision by the Grand Alliance to pursue a higher-order modulation scheme–something like 16 VSB or 256 QAM. This comes as good news because it shoe-horns two very good pictures in a single 6-MHz slot.

Already there is some controversy, however. CableLabs issued a press release endorsing the 16 VSB approach championed by AT&T/Zenith. That raised the ire of Tom Elliot, VP of engineering and technology at TCI, who said a 256 QAM approach should be tested and considered before anything is endorsed. Since then, CableLabs has tempered its "endorsement" of 16 VSB, saying it's "not singularly focused" on that approach.

There also has been–and continues to be–much speculation as to the stability of the entire Grand Alliance, because there are some fundamental technical disagreements between Alliance members. For example, one of the first press releases issued said there was fundamental agreement on scanning format, the shape of the pixels and modulation scheme.

But, according to insiders, disagreement over these issues still exists.

For example, not everyone, especially the computer industry, is happy that the Alliance chose to support both progressive and interlace scanning formats, arguing that the evolution to progressive scan will be held back by the preponderance of smaller receivers that won't be required to display progressive pictures.

On the other hand, broadcasters perceive that the computer industry waited until the last minute when it sent a letter to the FCC that called for progressive scan and square pixels. According to the letter, those elements were necessary if the new television standard is to be interoperable with computers and a national communications infrastructure.

The bottom line is that much is yet to be decided about advanced television. Let's hope the Charlotte field tests shed more light than shadow. Otherwise, the Grand Alliance may not be so grand.

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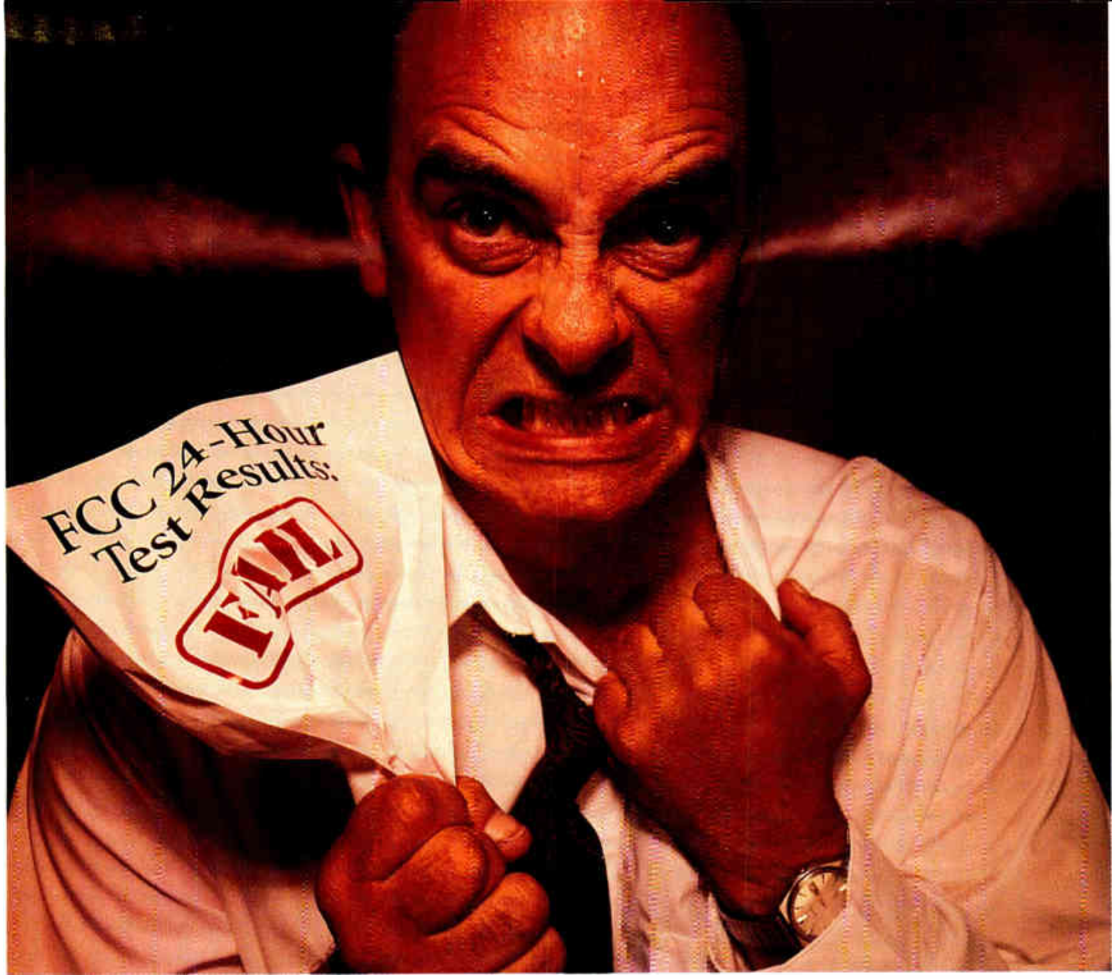
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Cable, telcos extend olive branch to developers of multimedia

Compiled by Roger Brown, CED

If society does indeed rush headlong into an interactive encounter with televisions and computers, at least two national infrastructures–cable and telephone–will be competing mightily to carry the lion's share of the promised interactive shopping, education and entertainment services.

Brian Roberts of Comcast and Richard Brown of Ameritech came head-to-head to Seybold's Digital World '93 conference in Los Angeles last month to woo developers of interactive multimedia services.

Brown used the event to rally support for Ameritech's Advanced Universal Access plan, which essentially calls for deregulation of Ameritech in exchange for the RBOC opening its network to any and all service providers.

Brown said Ameritech will have a ubiquitous, high-speed switched network capable of carrying digital, full-motion video. "Take a new look at what the telcos have to offer–today," implored Brown. Those offerings include national connectivity, a two-way network designed for interactivity, and (soon), a digital platform. "Clearly the telcos are an attractive alternative," Brown concluded.

Roberts countered Brown's assertions by pointing out that the cable infrastructure is already broadband and can be upgraded to digital and two-way on a "pay as you go" basis without making everyone pay for it. "If you want it (interactivity), we give it to you" in the form of a set-top terminal, Roberts said. "If you don't, we won't. We think the economics stack up real well."

Roberts also said cable operators are beginning to explore methods of interconnecting the thousands of cable systems already in existence to provide national connectivity. He recounted how Comcast originated and transported a PCS telephone call across the Atlantic Ocean without ever using an RBOC to do it.

"We don't believe in an electronic superhighway," he said. "It's superhighways–a network of networks" that will provide the connectivity needed to deliver multimedia to consumers.

Amplifying Roberts was Ed Horowitz of Viacom and Geoff Holmes of Time Warner, who provided status reports of the Castro Valley and Orlando test sites.

Holmes said Time Warner will deploy the Quantum architecture it used in Brooklyn-Queens in most of its cable systems over the next five years. In Orlando, Time Warner is adding an ATM switch and storage of the equivalent of 1,000 hours of full-motion video to prepare for the transaction age.

Holmes asked those in attendance to think of the future not as a time when 500 channels will be offered, but when a viewer will have his own dedicated channel that allows him to watch what he wants, when he wants it, with full VCR-type control (fast forward, rewind, pause, etc.).

Interestingly, Holmes and Horowitz differed on their long-term views of interactivity and multimedia. Horowitz's forecast is for a slow, conservative roll-out of these services, tempered mostly by high start-up costs.

For example, Horowitz said it costs about $100 million to start a new programming service. Furthermore, the new digital set-tops Viacom will deploy in Castro Valley are costing the MSO between $800 and $1,000 per unit. "Intelligent networks are expensive," said Horowitz. Consequently, he sees a slow roll-out of digital terminals: starting at 200,000 initially, growing to 1.5 million within a year and the addition of 4 million more per year until some 20 million units are in the field by 2000.

Holmes is much more bullish, expecting a "critical mass" of digital set-tops to be in the field within two to three years, because he believes when consumers are given the chance to control their television viewing, they'll leap at it.

Hewlett-Packard threw its hat into the interactivity ring, not as a developer of software, but as a developer of hardware. Robert Frankenberg, VP and general manager of H-P's Personal Information PRoducts Group, said his company wants to build a platform through which interactivity is viewed. He predicted a great competition between platforms before a winner is chosen by the market.

He said television, not computers, is what must "show through" any interactive product. "Everything in the market now is too close to the computer and too far from the consumer."

ICTV President Leo Hoarty also addressed the audience, consisting primarily of multimedia developers, and cautioned them about the "look" of interactive programming. He says pictures displayed over television must be different from computer pictures because the NTSC format is limited in its display capabilities. He then demonstrated ICTV's system, which always has "something moving" but consists of large picture elements so they can be seen from a distance. "It has to act like broadcast TV," said Hoarty.

Apple CEO John Sculley used the forum to debut and demonstrate "eztv," the company's electronic program guide. The system–which could be integrated in a set-top–provides on-screen channel numbers, allows viewers to browse through the program listings organized by several criteria and allows for single-button VCR recording. Up to 12 different programs can be displayed simultaneously.

Kaleida Labs, the joint venture company created by Apple and IBM, publicly demonstrated for the first time its ScriptX object-oriented computer software system that allows the same software to be used on both IBM and Apple platforms.

The software is currently being tested internally and will be rolling out in several months. Kaleida recently announced an alliance with Scientific-Atlanta to develop set-top terminals for the interactive age. That set-top will be compatible with and capitalize on the ScriptX system.

FCC conducts tests of EBS upgrades

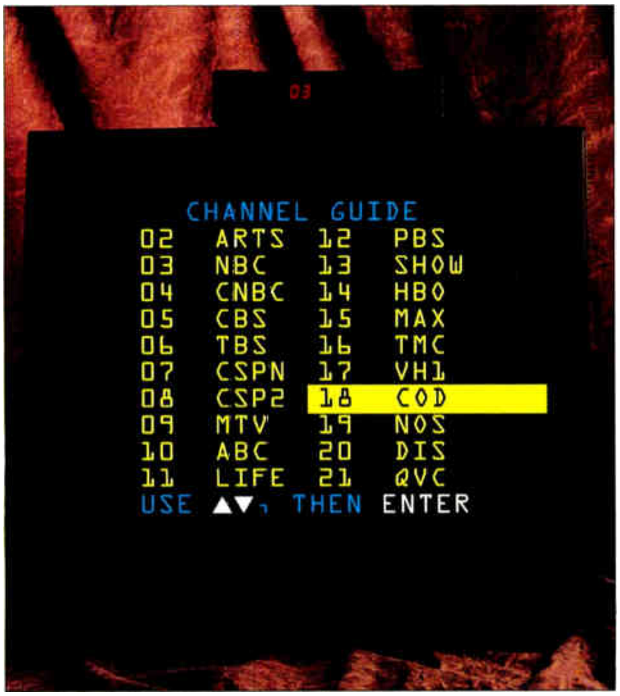
Federal Communications Commission representatives and several manufacturers of new emergency alerting devices gathered in Denver at the end of June to conduct a three-day test and demonstration of systems that could become available to the public because of an ongoing FCC notice of proposed rulemaking.

The FCC is presently sorting through a plan designed to overhaul its antiquated Emergency Broadcasting System to make it more efficient. Specifically, modernizations include increased speed and reliability, shortened alerting tones and the ability to address specific areas for alerting.

While EBS has always enjoyed strong support among television and radio broadcasters, the FCC now recognizes the important role of cable, paging systems, and satellite communications in the nation's communications structure; consequently it hopes to bring cable operators into the fold as active participants in the program.

Several proposed systems and technologies were tested in Denver and carried via broadcast, cable and satellite networks. No test results were announced, but participants called the test successful in nearly every facet. Additional tests will be conducted in the Baltimore, Md. area this month.

Time Warner Cable and TCI of Colorado represented the cable industry in the tests. Jones Intercable's Ken Wright, who chaired the SCTE EBS working group and gathered input from the industry for FCC comments he submitted, was an observer, as was Claude Baggett of



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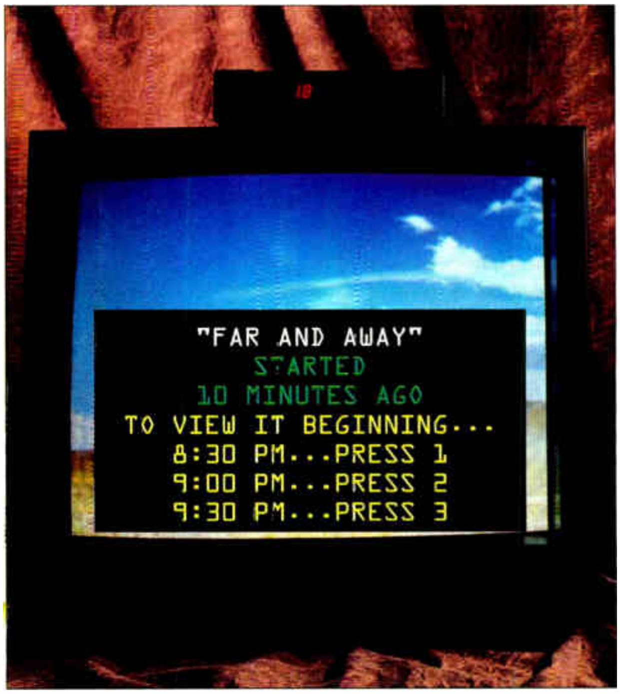

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While the various systems represented apparently worked, the key consideration for any system will be cost. In Wright's comments to the FCC, he said the cable industry alone would be forced to spend as much as $100 million depending upon what the FCC will ultimately require of the new national alerting system.

That message has not been lost with the hardware manufacturers. Discussions with representatives of several manufacturers, including Hollyanne, Dynatech and Information Age Systems, showed a keen awareness that any alerting system slated for cable must be affordable because of the number of channels cable operators distribute.

"Cable is a vulnerable media and it cannot be perceived as the main line of emergency communications," said Bruce Robertson of IAS.

CTANY demos network of networks

Four cable systems, three alternate access carriers, a program provider and long distance carrier joined together last month to demonstrate the ability of existing fiber optic and coaxial networks to provide teleconferencing capabilities between medical facilities and educational facilities.

The demonstration–believed to be the first of its kind–was undertaken to blunt arguments by New York Telephone for a major upgrade of its outside plant facilities. The demo was organized by the Cable Television Association of New York State (CTANY).

The ability to link medical and educational institutions to share resources over great distances is being touted by New York Telephone as a key reason for its upgrade, according to CTANY. This demo was meant to prove that alternative carriers can perform the same function, without subsidy from governments or ratepayers.

The presentation provided interactive links between hospitals in New York City and Syracuse and between high schools on Long Island and a school in Syracuse. This "network of networks" used 47 miles of coaxial cable and 349 miles of fiber optic cable.

The cable systems involved included Cablevision Systems Corp., Time Warner Cable, Paragon and NewChannels. Fiber links were provided by Home Box Office; alternate access providers Fibernet, NewChannels Hyperion and Teleport Communications Group; and AT&T long distance.

The medical demonstration connected doctors at St. Luke's Roosevelt Hospital in Manhattan and Crouse Irving Memorial Hospital in Syracuse. Physicians at both facilities were able to consult with their colleagues, including an on-line examination of a CAT scan.

The educational "distance learning" involved a music teacher at Calhoun High School in Bellmore, Long Island, who was teaching interactively to students in Valley Stream High School on Long Island and Nottingham High School in Syracuse. Participants in all three locations were able to hear and see each other interact.

"This demonstration clearly shows that by linking various telecommunications networks, the technology of tomorrow is available today," said Richard Alteri, president of CTANY. "The network of networks is a reality."

Corning, S-A file comments on rates

Two technology companies–Corning Inc. and Scientific-Atlanta–have jointly filed comments with the Federal Communications Commission requesting reconsideration of the FCC's cable rate regulations, fearing that cable operators' efforts to upgrade their networks will be stymied by the onerous benchmark/rate cap requirement.

Because of the regulations, "it's possible that cable TV operators may have little alternative but to cut back dramatically on what had been a rapidly growing investment in fiber optics and other advanced technologies," said Kathy Rauch, Corning's cable television market manager.

Corning and S-A argue that the FCC action puts cable operators in a "double bind" of having to accommodate broadcasters who elect to be carried while suffering from reduced revenues by as much as 10 percent to 15 percent.

Corning notes that the cable television market was the fastest growing segment in fiber deployment, having grown more than 100 percent in 1992. This compares with local exchange carrier growth of 30 percent and interexchange carrier growth of just 14 percent that same year.

To prove their point, Corning and S-A commissioned a financial impact study from the accounting firm Deloitte & Touche. That study examined the financial impact of re-regulation on three typical cable operators had the new rules taken effect in 1990.

The result was that the industry would have suffered a $552 million reduction in cash flow. Deloitte & Touche concluded that "it would have been extremely difficult and highly unlikely that these cable companies could have maintained the historical level of capital expenditures through additional financings."

The bottom line: cable operators wouldn't have been able to afford to install the amount of fiber optic cable it has, which would make it doubtful the industry would be able to offer some of the new services it's now touting.

Jottings

CableLabs and **Motorola** have agreed to cooperatively evaluate methods to effectively integrate cellular and PCS mobile systems with cable's broadband network. The project will focus on the definition of suitable network architectures for transmission of PCS baseband and RF signals. Later stages of the project will examine both theoretical analysis and field trials to optimize the performance of such a system configuration...If multimedia fails, it won't be because there wasn't any way to deliver it. **GTE** has launched a project to build 50 fiber optic rings in 12 states in preparation of the advent of multimedia services. The project is expected to cost more than $200 million and will provide a platform for future services. The networks will utilize Sonet equipment primarily provided by AT&T...Residents and businesses in Orlando will be able to utilize wireless personal communications when **Time Warner** completes construction of its Full Service Network there. The giant media and cable company chose to integrate **Qualcomm's** CDMA wireless system in Orlando by the end of 1993. The system marks the first time such PCS technology is being fully integrated into a cable television infrastructure...**Scientific-Atlanta** went to the computer industry for a new chief executive officer. James F. McDonald was elected by S-A's board to succeed Bill Johnson, who left the company several months ago. James Napier had been interim CEO. McDonald has held positions with Prime Computer Inc., Gould Inc. and IBM...**MCI Communications** introduced optical switching in its network to provide route protection and restoration capabilities. MCI has implemented the Aster Optical Switch in Memphis. The switch re-directs a lost signal to an alternate route in less than 20 milliseconds. It is also bit rate and wavelength independent, which will allow MCI to upgrade its network without obsoleting the switch...**USA Video Corp.** and **ADC Telecommunications** have agreed to develop an end-to-end video dialtone solution. The plan is to integrate ADC's Homeworx platform with USA Video's server and digital video receiver. Rochester Telephone is already scheduled to test the system in 100 homes later this year. The Homeworx platform is based on a passive optical network architecture and supports telephony and broadband services via a fiber-rich configuration. CED

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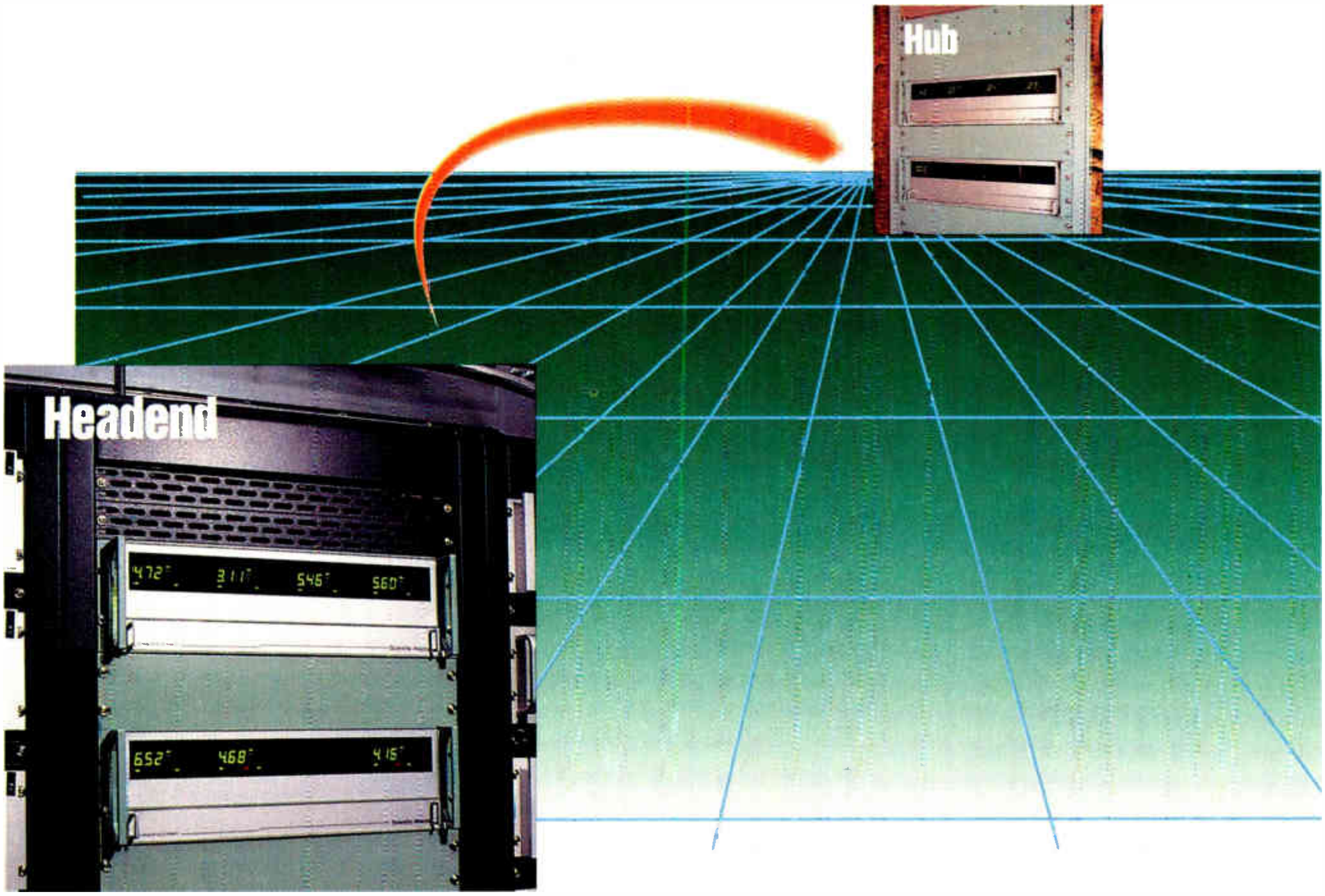

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Semon: A bridge over troubled waters

By Leslie Ellis

Some complain about learning by doing. "Baptism by fire," "sink or swim," they call it. Doug Semon thrives on it–and as director of engineering/new technology for Viacom Cable, he's most definitely swimming. In fact, a more naturally curious person is tough to imagine.

This is a guy who is so energetic and curious, he could easily and quite successfully make a career shift testing toys and bouncing around on pogo sticks as actor Tom Hanks does in the movie "Big." As a 41- going on 14-year-old, Semon possesses an infectious, childlike quality. He says he learns through hobbies; perhaps that explains why his list of free-time activities could well fill up the entire space of this page. Among the highlights? Driving diesel locomotives through northern California and cashing in frequent flyer miles not to take vacation, but to pilot a 757 jet simulator. He performs magic, he just took up mountain biking, and he tinkers, tinkers, tinkers.

It makes one wonder if perhaps by some fluke of the universe, there are more than 24 hours in a Doug Semon day.

Semon isn't all about tinkering and tomfoolery, however. Armed with these inherent personality strengths, Semon is leading cable's charge on compatibility issues, as co-chairman of the NCTA/EIA joint engineering committee. He's leading a parallel life at Viacom, as its "unofficial liaison" between the engineering and marketing departments. Simultaneously, he's deeply engrossed in the company's newsmaking, high-tech Castro Valley project.

Grower and cameraman

Semon's vocational background is clearly as diverse as his personality. He started in life as a 10-year-old "grower" in his grandparent's floral greenhouse. (A grower, as Semon explains it, is someone who hauls dirt, waters plants and picks weeds.) Some 10 years later, Semon nabbed his first cable job after getting fed up with a college job as a bartender at a yacht club outside Toledo, Ohio. As he describes it, he saw an advertisement in a campus building requesting a University of Toledo Educational TV cameraman. Although Semon knew virtually nothing about video cameras, he talked the director into hiring him. "I just went in early a few evenings and watched what everyone did. Then I faked it. I did fine," the gregarious Semon laughs.

Soon after, a co-worker at the station left to work for a start-up company called "Channel 100" which provided pay TV services. Semon soon followed, performing repairs on the set-top boxes which enabled the service. After earning his E.E. degree, the company hired him full-time and transferred him to Concord, Calif. By the time he was 30, Semon was general manager of the company.

In 1981, Semon saw an ad in the then-fledgling *Multichannel News* for a corporate staff engineer. He interviewed with Joe Van Loan, now a mentor of Semon's, and got the job.

These days, Semon's attention is focused on three areas: the completion of the company's Castro Valley origination facility, the blending of Viacom's engineering and marketing departments and the astronomically huge project of instigating harmony between the cable and consumer electronics industries.

"It's interesting that the latter two projects are very much related," Semon says. "Here at Viacom, I'm trying to cut through the hype and help the engineering and marketing departments–and the vendors–to understand what our customers really want. The same holds true at the joint engineering committee meetings.

Semon says he pays close attention to service call records and works hand-in-hand with Viacom's marketing department. "It's not just solving technical problems," Semon says. "It's more of applications engineering, with a human twist in there."

The compatibility conundrum

That human twist is an omnipresent consideration within the joint NCTA/EIA committee, as well. Semon was named co-chairman, succeeding industry guru Dr. Walt Ciciora, in 1991.

He says he accepted the appointment as a means by which to "give something back" to the industry. "I sincerely hope that when I retire many years from now, I can know I've contributed to something lasting to this whole problem."

Since his appointment, the temperature within that committee has risen–considerably. "Some federal laws were passed which are forcing us to find a solution to the customer interface," Semon says. "I like it a lot; at the same time, it's frustrating as hell."

Despite the frustrations of making a roomful of tenacious engineers agree on something that directly affects their respective businesses, Semon says the challenge is what keeps his interests piqued.

And how does this decided insider think the whole interface issue will shake out? "The solutions are very elusive for existing problems," Semon laments. "A comprehensive solution to watching one channel while recording another, picture-in-a-picture and timed recording is very, very difficult. There's an awful lot of equipment out there that's been built over the last 10 or 15 years." Because of that, a comprehensive solution to existing compatibility issues is largely a matter of time, Semon says. "As we move into digital transmission–assuming we can set some digital standards–these problems will ease."

Clearly, having a man like Semon leading cable's side of the compatibility equation can't hurt. A decidedly different kind of manager, Semon lends the kind of "get-down" mettle often needed in precarious situations. "There have been times when I've had to interrupt a quarrel in one of the meetings and say, 'Hey, listen. There was cable before there was cable-ready. Now sit down and be quiet.' "

However, that last bit of advice may be easier said than done for Semon himself. He admits that he has "never grown up;" he even owns up to having a short attention span. Perhaps that's why this 41-year-old ball of fire has never married: He has yet to find someone to keep up with him. CED

How to de-mystify new technology

By Wendell Bailey, VP of Science and Technology, NCTA

One topic of conversation that continues to arise when I sit around with my engineering friends and colleagues is the issue of new technologies and their impact on entry-level employees. These conversations frequently take place in comfortable chairs and dimly lit parlors, among the people I respect most and have the most envy for (because of their breadth and depth of knowledge in so many different and diverse disciplines). During these episodes, it's not uncommon for one or more of us to wax nostalgic about how we broke into the technical world ourselves.

I, for instance, distinctly remember building my first Morse Code sending and receiving set (wired) when I was about eight years old. I wrote (with a pencil) the Morse Code on the side of the wooden box and strung wire (which I obtained by unwinding an electromagnet) from the house to the garage. My mother and father promptly declared that I would be an engineer, and told their friends they had seen me build something that would communicate.

Three years later, I worked at getting my first amateur radio license. I distinctly remember studying all about "anodes" and "cathodes" and "getters"–and all those other wonderful things that glowed in the dark. By the time I finished my first two years of college, transistors surfaced. While I had a nodding acquaintance with how they worked, I wasn't quite sure exactly what some of the terms meant.

Well, the years have gone by, I've gotten a lot older and have consequently been exposed to a lot more technology than those early basement experiments. Somehow, I'm able to have conversations with colleagues of mine who are much more studied and erudite about the intricacies and esoteria of technology. Most of the time, I nod along and make the occasional comment–well enough that an outsider might assume that I understand all of this conversation.

Confession time. Much of the knowledge I've acquired through the years has come by simply listening to these people. Often I've learned by piecing together bits and pieces of information, like all engineers do. Other times I don't have a clue what they are talking about. At those times, I've found that nodding sagely and mumbling the intermittent "um" or "ah" yields an excellent appearance of learnedness and intelligence.

Technological precipice

Here we are, on what some would call the precipice of a new age–an age when television signals will be digital and compressed; when transmission up to a few meters from the house will be at light frequencies; when there will be multiple wavelengths of light delivered through a single fiber; when test equipment will be measuring bit error rates; when we'll be looking at constellations in order to determine the relative strength or robustness of a modulation scheme.

You have to begin to wonder whether or not we or the new technicians to this industry have properly prepared ourselves for this new era. What kind of training do we need? What new information do we need? How do we, as engineering managers, ensure that everyone can deal with this new world? Further, what is the danger that someone will be left behind?

There are those (I am not among them) who believe that this new, digital world will serve as the catalyst for a new class of people to come in and displace those who have served us so well all these many years. And these same people speculate that if you are under the age of, say, 21 or 22, you'll probably be able to keep up with these new technologies–but if you're up in your 30s or 40s, you'll be so wedded to the old analog technologies that you won't have a chance of learning or becoming proficient with digital compression, fiber optics and optoelectronics.

Same song, different era

I, however, and many of my friends see evidence to the contrary. How is this new age so different from past periods of technological change? I remember when I saw my first IC tester. At the time, I thought, "Now that's a hell of a thing, what exactly does that do?"

Somehow my rusty old brain managed to grasp the bits and pieces needed in previous times of change. To boot, I was in that 30-something age range–that period we refer to as the transition point between those who will make it and those who won't.

I'm also reminded that just five years ago, we were hard pressed in the cable television industry to find anyone who knew what an OTDR was. Lo and behold, these days most cable technicians not only know what and OTDR is and how to use one, but carry one in their trucks. All you have to do is look at the *NCTA Technical Papers* from the past few years to see that cable people have already come up with new techniques and new technologies in the fiber optic era. Note that these authors aren't necessarily the young people right out of school nor the old people ready to retire. Rather, it's a mixture of all of them.

The plain fact of the matter is that these technicians and engineers are people who, by their very nature, are eager to learn and equally eager to have know more skills. These people like technology, like to see where it's going and indeed, like to help it along.

These people will study in the morning, or on their lunch hours ,or at home at night. They'll pester colleagues, vendors or anybody they think might have the information they need. Because of this, my bet is that we don't have to worry a whole lot.

We do, however, have to pay attention to our obligation as technical leaders to provide this information and training. It is our responsibility to ensure that those people who want to learn get ample opportunities to do so, because these will be the people who continue to run our systems. Armed with knowledge, these technicians and engineers who run our systems can de-mystify and properly handle any new technology that comes along. CED

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Resonant circuits, filters, and traps, Part 2

By Chris Bowick, Group Vice President/ Technology, Jones Intercable

This month, we will continue our journey toward a complete understanding of filters and traps by examining another basic and fundamental concept called resonance. We will determine what causes resonance and how we can use it to our advantage. The information presented here, and in the next several columns will be adapted from my book *RF Circuit Design*[1], and various data supplied by the "trap" vendor community.

Many of you are probably familiar with the voltage division rule which states that whenever a shunt element of impedance Z_p is placed across the output of a signal source that has an internal resistance of R_s, the maximum output voltage is:

$$V_{out} = Z_p V_{in}/(R_s + Z_p)$$

Thus, the output voltage available from the circuit, V_{out}, will always be less than the signal supplied at the input to the circuit, V_{in}. If Z_p is a frequency-dependent impedance, such as a capacitive or inductive reactance, then V_{out} will also be frequency dependent and the ratio of V_{out} to V_{in}, which is the gain (or, in this case, loss) of the circuit, will also be frequency dependent. Let's take, for example, a 25 pico-farad (pf) capacitor as the shunt element and plot the function of V_{out}/V_{in} in dB vs. frequency, where we have:

$$V_{out}/V_{in} = 20 \log_{10} (X_C/(R_s + X_C))$$

where: V_{out}/V_{in} = the loss in dB, R_s = the source resistance in ohms, X_C = the reactance of the capacitor in ohms = $1/\omega C$, and $\omega = 2\pi f$.

The loss of this circuit increases as the frequency increases; thus, we have formed a simple low-pass filter. Also, the attenuation slope eventually settles down to the rate of 6 dB for every octave (doubling) increase in frequency. This is due to the single reactive element in the circuit.

If we now delete the capacitor from the circuit and insert a 0.05 micro-Henry (µH) inductor in its place, then:

$$V_{out}/V_{in} = 20 \log_{10} (X_L/(R_s + X_L))$$

where: V_{out}/V_{in} = the loss in dB, R_s = the source resistance in ohms, and X_L = the reactance of the inductor in ohms = ωL.

Here we have formed a simple high-pass filter with a final attenuation slope of 6 dB per octave.

Thus, through simple calculations involving the basic voltage division formula, we were able to plot the frequency response of two separate and opposite reactive components. But what happens if we place both the inductor and capacitor across the generator simultaneously? Actually, this case is no more difficult to analyze than the previous two circuits. In fact, at any frequency, we can simply apply the voltage division rule as before. The only difference is that we now have two reactive components to deal with instead of one, and these reactive components are in parallel. If we make the calculation for all frequencies of interest, we will obtain the plot shown in Figure 1. The mathematics behind this calculation, using the voltage division rule, is really very simple, and is as follows:

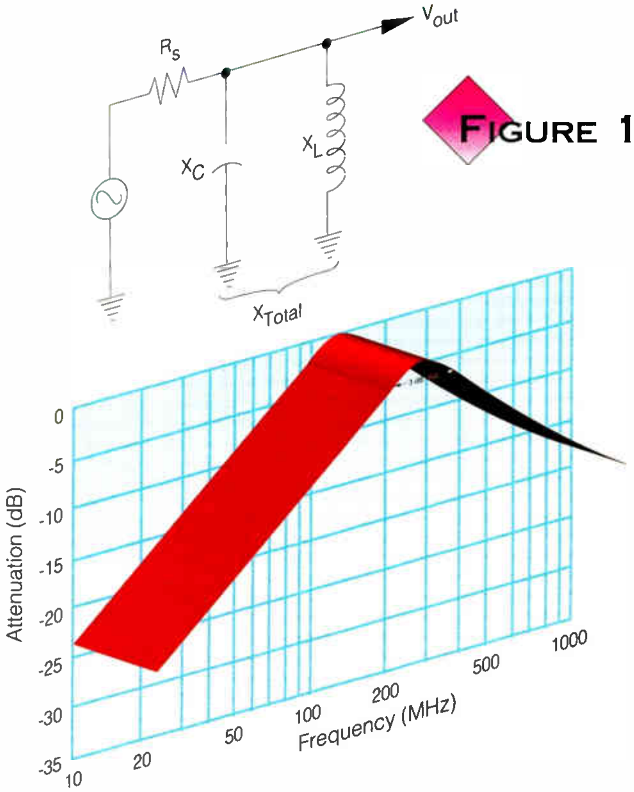

FIGURE 1

$$V_{out} = X_{total}(V_{in})/(R_s + X_{total})$$

and where

$$X_{total} = X_C X_L/(X_C + X_L)$$

If you substitute the second equation into the first, and combine terms, you will find that the loss (in dB) at any frequency may be calculated from the equation:

$$V_{out}/V_{in} = 20 \log_{10} (\omega L/(R_s - \omega^2 R_s LC + j\omega L))$$

Notice in the plot, that if we use a source resistance of only 50 ohms, and the inductor and capacitor values given above, we form a very simple low-Q (wide bandwidth) resonant circuit centered in frequency at about 142.35 MHz. At both 40 MHz, on the low side of resonance, and at 500 MHz, on the high side of resonance, for example, its attenuation is only down by about 12 dB–not a very exciting filter. As we continue to move away from resonance in either direction, the slope of the curve settles to about 6 dB per octave.

We can make good use of the characteristics of tuned and resonant circuits by placing various reactive elements such as inductors and capacitors in different configurations so that we can create the frequency response desired for our networks–lowpass, highpass, bandpass or bandstop. In order to simplify the above analysis, however, it was done with the assumption that the components utilized were perfect, or lossless.

In addition, the impedance of the source and the load will have a significant impact on the performance of any filter. For these reasons, in the coming months, we'll examine the effect of these phenomena on the Q of the tuned circuit, with the ultimate goal of improving our understanding of the inner- workings of filters and traps. CED

References

1. Bowick, Chris. *RF Circuit Design*, SAMS (a division of Macmillan Computer Publishing). Indiana, 1982-1991.

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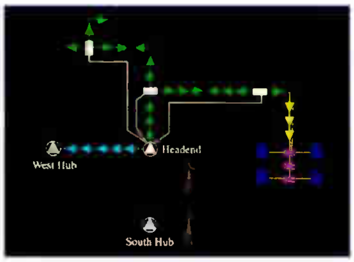
NOT ALL CABLE MANUFACTURERS



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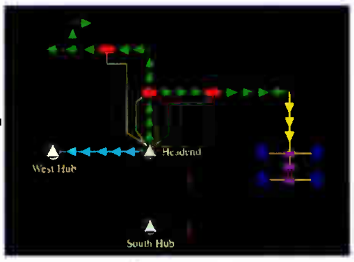

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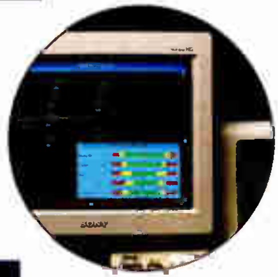

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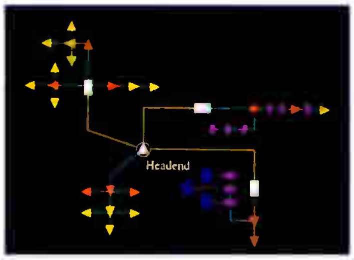

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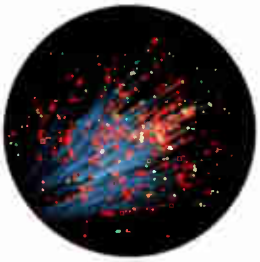

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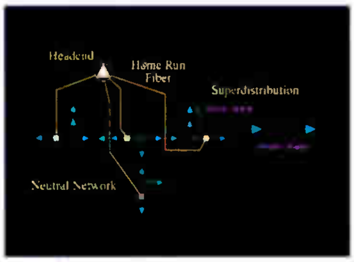

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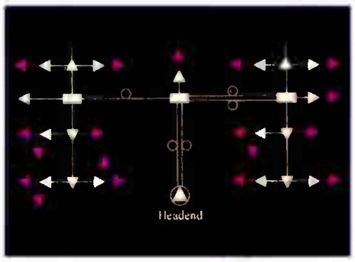

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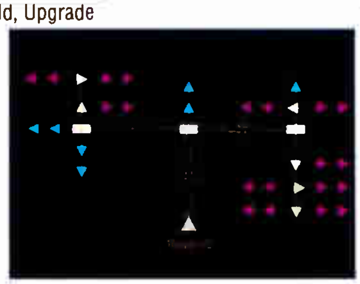
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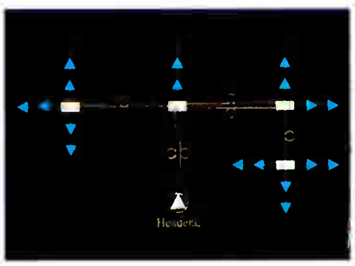

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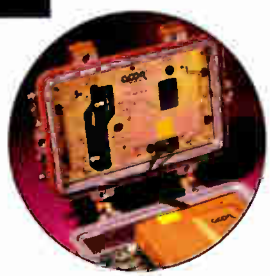

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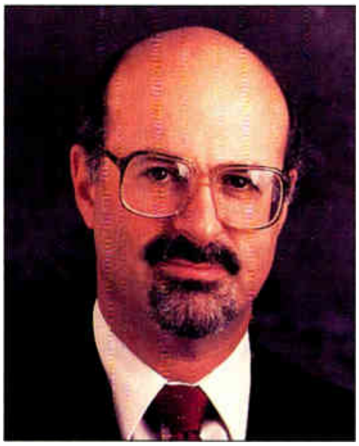

Rate regulation: Tricks of the trade

By Jeffrey Krauss, independent telecommunications policy consultant and President of Telecommunications and Technology Policy of Rockville, Md.

The FCC's 500-page decision on cable rate regulation provides cable operators with two choices: "benchmark" rates and cost-of-service rates. Benchmark rates are straightforward–you read the price per channel right off the FCC's chart. Cost-of-service rates are more complicated. They require detailed accounting procedures and studies to allocate costs that are shared among different services.

But telephone companies, which have been subject to cost-of-service rate regulation since the Communications Act was passed into law in 1934, have become masters at the game. They have developed tricks that take advantage of the system in order to charge rates that are higher than allowed.

Now, I could go ahead and make up examples of telephone company cheating on rate regulation. But why do that when the recent FCC decision on "expanded interconnection tariffs" and other FCC decisions can offer real examples.

Double recovery of costs

The most common trick in telephone cost studies is to include the same costs in two different parts of the analysis. For example, for these "expanded interconnection tariffs" the telcos must make available floor space in telco central offices for competitive access providers to lease. So "floor space" is a specific tariff element, and its direct costs include building costs, electric power, and other costs. But in reviewing the telco filings, the FCC discovered that floor space, electric power and these other charges are also included in general network operation expenses, which become part of the overhead loading factors that are applied to direct costs. So if they had not been caught, they would be recovering these costs twice.

United Tel was caught trying to double-recover labor costs. In calculating installation labor costs for DS-1 crossconnect and DS-3 crossconnect rates, United included the engineering and installation labor both as an annual expense associated with the location space, and as part of the depreciation expense for the equipment. BellSouth was caught trying to recover costs of space construction in both non-recurring and recurring charges. GTE tried a similar approach.

Bell Atlantic developed space occupancy charges based on local office space rental rates, and then added administrative costs for periodic review of each central office. But the FCC said the local rental rates include a typical landlord's overhead costs such as periodic review of the landlord's space, so adding in the administrative costs was double recovery. US West also used local office space rental rates, and then added on property taxes and operating costs, even though the FCC said that local rental rates probably include those factors already.

If you can't get away with double recovery, then try misallocation. In telephone company practice, this means taking a cost that is actually used for one service and charging it to another service. This is most commonly done to reduce the price of competitive services and shift the costs to monopoly services.

One example of misallocation of costs, dredged out of ancient history, is the AT&T allocation of microwave transmission costs for a new data transmission service in the mid-1970s. AT&T was competing with a startup company named Datran that later went bankrupt. AT&T had an extensive network of intercity microwave links that it used for long distance voice circuits. Each microwave radio channel had a low-frequency portion that was typically not used for voice circuits. AT&T devised a way to carry data circuits on this part of the microwave channel, and called it Data Under Voice. AT&T took the position that no microwave costs should be allocated to the new data service, because the microwave systems were installed to carry voice, and adding Data Under Voice did not decrease their voice capacity.

The FCC rejected this position. The FCC cited AT&T technical journals showing that this spectrum could be used for video and other services, and should therefore have an "opportunity cost" assigned to it in the ratemaking process.

In that same AT&T data services case, by the way, the FCC also caught AT&T overstating the growth of demand for the new data service. The result was a lower cost-per-circuit than would have resulted from a lower demand. If you take a fixed network cost and divide it by a larger number of circuits, you get a smaller cost-per-circuit. It's all simple arithmetic.

Cable operators may be more familiar with cost misallocation in connection with pole attachment rates. Telephone and electric companies allocate the cost of the pole among the cable, electric and telephone services it carries. The FCC Rules contain procedures for allocating the costs of poles. But sometimes the telephone companies get it wrong.

Getting caught

The examples above come from FCC decisions where the double recoveries and misallocations were caught in the course of rate investigations. In a rate investigation, FCC accountants and competitors' accountants spend weeks poring over the telephone company's rate development procedures. A rate investigation creates an enormous burden on FCC staff resources.

But if you get caught, then what? Is getting caught misallocating rental costs as serious as cable leakage, where you can get socked with a $20,000 fine?

No. In most cases, the FCC simply tells you to change your rates to the level that its accountants calculate. In really egregious cases, if you've been caught overcharging the public by millions of dollars, you may be required to refund the overcharges. But not always. In 1984, Comsat was caught earning excessive profits of nearly $50 million during the previous four years. But the FCC never ordered a refund.

So don't look at cost-of-service rate regulation as a terrible new regulatory burden. Look at it as an interesting opportunity. CED

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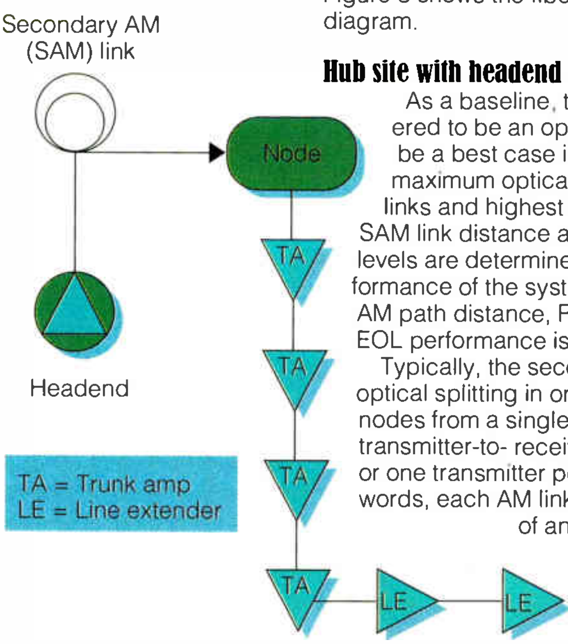
Digital video vs. AM supertrunking: Part 2

By Robert W. Harris
Sr. Applications Engineer-Fiber Optics
C-COR Electronics, Inc.

FIGURE 3
Fiber rich CATV system block diagram with no hub site(s)



A model can be developed which employs headend to hub supertrunking in a 550-MHz, fiber-rich architecture. Out of the headend and each hub site is an AM link (defined in this paper as the secondary AM link or SAM). The SAM link carries the full 50 MHz to 550 MHz AM-VSB signal format. Following the SAM link are four power doubling trunk amplifiers, a power doubling bridger and two power doubling line extenders. The serving area covered by each secondary AM node is 12.5 miles of RF plant. The EOL performance objective is 48 dB CNR, -53 dBc CTB and -58 dBc CSO. Figure 3 shows the fiber-rich CATV system block diagram.

Hub site with headend quality

As a baseline, the hub site is first considered to be an operational headend. This will be a best case initial starting point allowing maximum optical path losses on the SAM links and highest RF output levels. Next, the SAM link distance and RF amplifier operating levels are determined such that the EOL performance of the system is met. The secondary AM path distance, RF operating levels and EOL performance is given in Table 2.

Typically, the secondary AM link will use optical splitting in order to serve two or more nodes from a single transmitter. A common transmitter-to- receiver usage ratio (R) is 1:2.5 or one transmitter per 2.5 nodes. In other words, each AM link has 40 percent of the cost of an AM transmitter. From this, we can determine the secondary AM cost per system mile from an ideal starting point (a headend) using the equation,

$$SAM_{he} = [(T_c * R) + N_c] / N_m \qquad (1)$$

where:

SAM_{he} = secondary AM cost per system mile with headend quality hub site
T_c = cost of AM transmitter
N_c = cost of AM node
R = transmitter usage ratio
N_m=miles of RF plant served per node

Using today's pricing, we find the secondary AM fiber electronic cost to be about $575 per mile. Again, this cost is assuming that the hub is providing headend quality signals at the input of the secondary AM transmitters.

Hub site fed digitally

The output of a digital video fiber optic supertrunk yields a performance identical to that of a standard CATV headend. Again, the secondary AM link distance and RF amplifier operating levels are determined such that the EOL performance of the system is met. The secondary AM path distance, RF operating levels and EOL performance are given in Table 3. It is found that the same operating parameters as in the example above for the secondary AM path loss and RF output operating levels can be used.

Using equation 1 and again using today's pricing, we find the secondary AM fiber electronic cost to be about $575 per mile.

Hub site fed from LLAM supertrunk

The LLAM supertrunk provides near-headend quality. The CNR performance is about 58 dB through optical loss budgets of about 12 dB. However, even though lightly loading the transmitters with 9 to 13 channels, a finite and measurable level of composite distortions still exist.

With the hub site being fed from a LLAM supertrunk, the secondary AM link distance and RF amplifier operating levels are determined such that the EOL performance of the system is met. The secondary AM path distance, RF operating levels and EOL performance are given in Table 4.

Table 4 shows that the LLAM performance has affected the secondary AM node optical path distance as well as the operating levels of the RF plant. The secondary AM link distance was lowered by 2 dB and the RF operating levels of the bridger and line extenders was lowered by 2 dB. These two changes were necessary in order to meet the same EOL performance as achieved with a digital supertrunk to the hub site(s).

Cascade	Equipment description	Output level	CNR (dB)	CTB (dBc)	CSO (dBc)
1	Output of headend	N/A	60	-120	-120
1	Secondary AM fiber to Nodes, 80 channel loading, 10 dB optical path	37/32	52	-65	-62
4	27 dB spaced power-doubling TA	39/33	53	-62	-63
1	27 dB gain power-doubling BA	43/34	56	-69	-67
2	30 dB operational gain power-doubling LE	43/34	59	-66	-65.5
		EOL performance	48	-53	[illegible]

TABLE 2
Cascade performance out of the headend

Editor's Note:
Last month's article posed several questions, including the impact of LLAM supertrunks on AM secondary fiber, RF cascade performance and overall system cost. This month's second and final segment aims to answer these questions through several cable "models."

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FIGURE 4

Fiber rich CATV system block diagram with hub site(s)

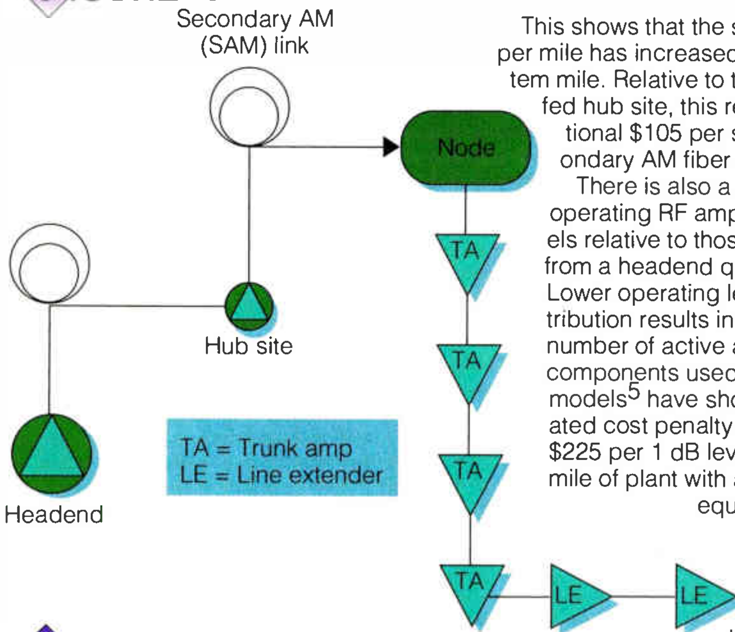
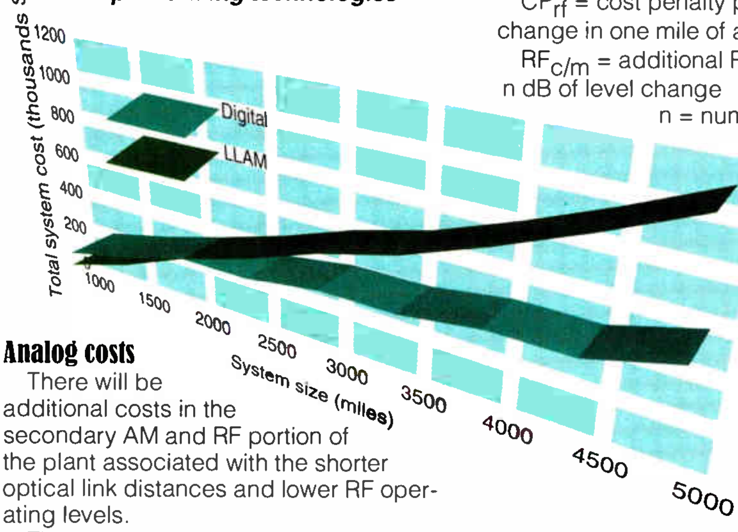


FIGURE 5

System cost comparison of supertrunking technologies



Analog costs

There will be additional costs in the secondary AM and RF portion of the plant associated with the shorter optical link distances and lower RF operating levels.

The secondary AM link can still use optical splitting in order to serve two or more nodes from a single transmitter. Each node still serves 12.5 miles of plant. However, there is now only 8 dB of fiber path loss to work with instead of 10 dB, a 20 percent reduction. This reduces our transmitter-to-receiver usage ratio (R) by 20 percent to 1:2.0 or one transmitter per two nodes. In other words, each AM link now supports 50 percent of the cost of an AM transmitter. From this, we can determine the LLAM fed secondary AM cost per mile. Using equation 1a we find,

$$SAM_{llam} = [T_c * R) + N_c] / N_m \qquad (1a)$$

where:

SAM_{llam} = secondary AM cost per mile with Lightly Loaded AM hub site.

This shows that the secondary AM cost per mile has increased to $680 per system mile. Relative to the headend quality fed hub site, this represents an additional $105 per system mile in secondary AM fiber electronic costs.

There is also a cost penalty for operating RF amplifiers at lower levels relative to those when served from a headend quality hub site. Lower operating levels in the RF distribution results in an increase in the number of active and passive RF components used. Sample design models[5] have shown that the associated cost penalty ranges from $75 to $225 per 1 dB level change per one mile of plant with active return. An equation is given to calculate the additional cost of operating RF amplifiers at lower levels.

$$CP_{rf} = RF_{c/m} * n \qquad (2)$$

where:

CP_{rf} = cost penalty per dB of RF level change in one mile of active plant

$RF_{c/m}$ = additional RF cost per mile per n dB of level change

n = number of dB level change from an optimum headend output.

Using the low end additional cost of $75 per 1 dB per system mile amount, we find that 2 dB lower RF operating levels results in an additional $150 per mile cost in the RF plant.

Supertrunk costs

This section investigates the total system cost impact on the secondary AM and RF electronic components as a result of employing a supertrunk. We will look at various system sizes and determine the cutoff point where any cost savings from the LLAM supertrunk are offset by additional expenses in the secondary AM and RF portion of the plant.

From the above discussions, we can formulate an equation (equation 3) which characterizes the total system cost penalty from using a LLAM supertrunk system. This model considers system size in miles and assumes that a certain number of hubs would be required for a given system size. The cost premium of the digital supertrunk is subtracted from the cost penalty associated with the LLAM supertrunk.

$$CP_{llam} = \{H/(H+1) * N_m[CP_{rf} + (SAM_{llam} - SAM_{he})]\} - D_{st} \qquad (3)$$

where,

CP_{llam} = total system cost penalty from using LLAM supertrunk

H= number of hub sites

CP_r = RF cost per mile associated with change in RF operating levels

SAM_{llam} = secondary AM cost penalty when using LLAM supertrunk

SAM_{he} = secondary AM cost when using digital supertrunk

N_m = total number of system miles

D_{st} = cost premium of digital supertrunk with H hub sites.

The following example illustrates the point. Assume a 3,000 mile plant with four hub sites. From Table 1, the cost premium for a digital supertrunk with four hub sites is $440,000. From equation 3 we get,

CP_{llam} = {4/(4+1) * 3000[$150 + ($680 - $575]} - $440,000

= $612,000 - $440,000 = $172,000.

In other words, the original cost savings of $440,000 from using a Lightly Loaded AM supertrunk is offset by $612,000 from additional costs in the secondary AM and RF distribution portions of the plant. This results in an additional $172,000 overall system cost. Table 5 and Figure 5 shows the total system cost savings or increase when implementing a LLAM supertrunk using a variety of system mileages.

It should be noted that any additional cost for the receive site building(s), if any, is not included in the total system cost. Additional cost savings may be realized from less expensive LLAM receive site buildings relative to the building size and cost requirements of a digital supertrunk receive site. Also, the digital network used in the example is a simple point-to-multipoint star configuration. It is assumed that a single bank of optical transmitters can be split to feed all the receive sites. More sophisticated digital networks with "self healing" and redundancy options and/or longer path losses requiring additional transmitter and/or repeaters will increase the cost of the digital network.

Advantages and disadvantages of LLAM

There are a number of advantages when using the LLAM supertrunking approach as outlined above. Through wave-division-multiplexing (WDM), only four fibers are required to transport 80 channels. There are no signal format

changes that need to take place (AM-VSB in, AM-VSB out). Scrambled signals are processed in the same way as non-scrambled signals. The rack space requirements are modest–about 20 inches in the headend and 20 inches in the receive site. The receive site equipment can be located within an outdoor pedestal that is environmentally controlled with a relatively small (< 2,000 BTUs) air conditioning unit.

A disadvantage of LLAM supertrunk appears in the form of added costs to the plant due to its slightly lower performance (near-headend quality) relative to uncompressed digital. For the given model above, this occurs in CATV systems larger than 2,000 miles. Also, for an 80 channel LLAM supertrunk, there can be as many as 12 RF bandpass filters. The use of these filters yields seven cross-over channels. Each cross-over channel will suffer a slight degradation relative to the non-crossover channels in carrier level and CNR performance.

Additionally, each AM link will require optimization for obtaining the proper RF output and signal performance from each frequency band. If optical automatic level control (ALC) is not employed within each transmitter and receiver, path loss and transmitter output power variations over

TABLE 3 *Cascade performance with digital supertrunk*

Cascade	Equipment description	Output level	CNR (dB)	CTB (dBc)	CSO (dBc)
1	Digital supertrunk to hub site(s)	N/A	60	-120	-120
1	Secondary AM fiber to nodes, 80 channel loading, 10 dB optical path	37/32	52	-65	-62
4	27 dB spaced power-doubling TA	39/33	53	-62	-63
1	27 dB gain power-doubling BA	43/34	56	-69	-67
2	30 dB operational gain power-doubling LE	43/34	59	-66	-65.5
		EOL performance	**48**	**-53**	**-58**

TABLE 4 *Cascade performance with LLAM supertrunk*

Cascade	Equipment description	Output level 550/54 MHz	CNR (dB)	CTB (dBc)	CSO (dBc)
1	LLAM supertrunk to hub site(s)	N/A	58	-70	-70.5
1	Secondary AM fiber to nodes, 80 channel loading, **8 dB optical path**	37/32	**54**	-65	-62
4	27 dB spaced power-doubling TA	39/33	53	-62	-63
1	27 dB gain power-doubling BA	**41/32**	54	-73	-69
2	30 dB operational gain power-doubling LE	**41/32**	57	-70	-67.5
		EOL performance	**48**	**-53**	**-58**

time may cause one or more of the RF frequency bands to vary in level relative to one another causing each group of frequency bands being "off" in level.

Advantages and disadvantages of digital

Uncompressed digital video networks provide an identical and consistent headend quality signal performance at each and every hub site regardless of path loss. Optimization of each digital path link is not required. The 30 dB optical loss budget allows for multiple splitting of the transmitter output so as to share the cost of the transmit equipment with multiple receive sites. WDM can be used to transport 80 uncompressed digital channels over three active fibers with a spare window available for future use.

Neither diplex filtering nor post-amplification is required and there are no crossover channels. The RF output levels and performance at each digital receive site will not vary over time due to changes in the optical path loss. Digital systems can be configured with patented[4] direct IF or RF outputs with carrier frequency variation less than ±5 Hz. At least one digital video equipment supplier can now transport all forms of RF scrambling. The technique used to accomplish RF scrambling is expected to allow transportation of digitally compressed video using 16 QAM and/or 64 QAM carriers.

TABLE 5 *Total system cost savings/increase when employing AM or digital supertrunk*

System miles	# of hubs (est.)	Cost of premium digital ($)	System cost penalty from LLAM ($)	Total system cost savings/increase from using LLAM ($)
1,000	1	205,000	127,500	-77,500
1,500	2	285,000	255,000	-30,000
2,000	3	365,000	382,500	17,500
2,500	3	365,000	478,125	113,125
3,000	4	440,000	612,000	172,000
3,500	4	440,000	714,000	274,000
4,000	5	520,000	850,000	330,000
4,500	5	520,000	956,000	436,000
5,000	6	595,000	1,092,700	497,700

As shown, the total system cost can actually be less when using a digital network as opposed to a LLAM supertrunk. This was due primarily to the slight performance degradation of AM resulting in increased secondary AM and RF distribution electronic costs.

A relatively simple and inexpensive digital network (point-to-multipoint) can be installed and later upgraded to a redundant self-healing ring network that provides the maximum level of protection from fiber path or component failures. With an installed digital network, a plat-

TABLE 6

Supertrunking comparison

30 Channel Supertrunk Feature	Digital	LLAM
Consistent signal performance at each hub site (no variation in performance due to different path losses or channel loading)	Yes	No
RF diplex filters required	No	up to 12
Number of cross-over channels	None	7
Potential for variation in RF output level due to fiber electronics	No	Yes
Requires RF scramblers at receive site(s)	No	No
Transports all forms of scrambling	Yes	Yes
RF scrambled channels transmitted per wavelength	16	variable
Modulators or IF/RF converters at receive site(s)	Yes	No
Post-amplifiers required at receive site(s)	No	Yes
CNR	60 dB	58 dB
CSO (worst case)	None	-70.5 dBc
CTB (worst case)	None	-71.0 dBc
Number of fibers required without WDM	5	8
1550 nm optical terminal available	Yes	Yes
Number of fibers required with WDM	3	4
Platform in place for interconnected hub sites and regional networking	Yes	Yes (with degraded performance)
Transports digitally compressed video carriers	Yes	Yes
Transparent optical repeating	Yes	No
Optical loss budget available	30 dB	<14 dB
Maximum point-to-point distance	100 km	<35 km

form is in place for future growth into regional networking.

Digital video networks do, however, require considerably more rack space and power consumption than an AM supertrunk approach. This is primarily because each channel is processed separately. Digital system inputs typically require baseband video and either baseband audio or 4.5 MHz audio subcarrier. Modulators or IF/RF upconverters are required at each hub site. Each digital receive site requires as many as two seven-foot racks and air conditioning of about 7,000 BTUs. Digital receive site equipment has been placed in underground vaults, former headend buildings, and outdoor buildings as small as 7 feet x 6 feet x 8 feet. Table 6 shows a comparison between LLAM and digital supertrunking.

Conclusion

This paper has examined two methods of fiber optic supertrunking for CATV applications: Lightly Loaded AM and uncompressed 8-bit digital video. LLAM supertrunking provides near-headend quality performance through less than 14 dB optical loss while digital video provides headend quality through 30 dB path losses. Both technologies can employ WDM to reduce active fiber count requirements.

The slightly lower performance of the AM supertrunk relative to digital supertrunking has been shown to directly add expense in the RF and secondary AM portions of the CATV system. The additional expense is reflected in the requirement to 1) operate the RF distribution at lower operating levels and 2) design lower path losses for the secondary AM links that serve the nodes. Both of these effects can offset the original savings from the lower cost AM supertrunk.

> **The design engineer must consider the overall system cost impact from each method of supertrunking**

When considering a supertrunking application in a CATV network, the design engineer must consider the overall system cost impact from each method of supertrunking. Factors include receive site building size, power consumption and cooling requirements, as well as any additional RF distribution and secondary AM costs. CED

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5. C-COR Electronics, Inc. System Design Group.

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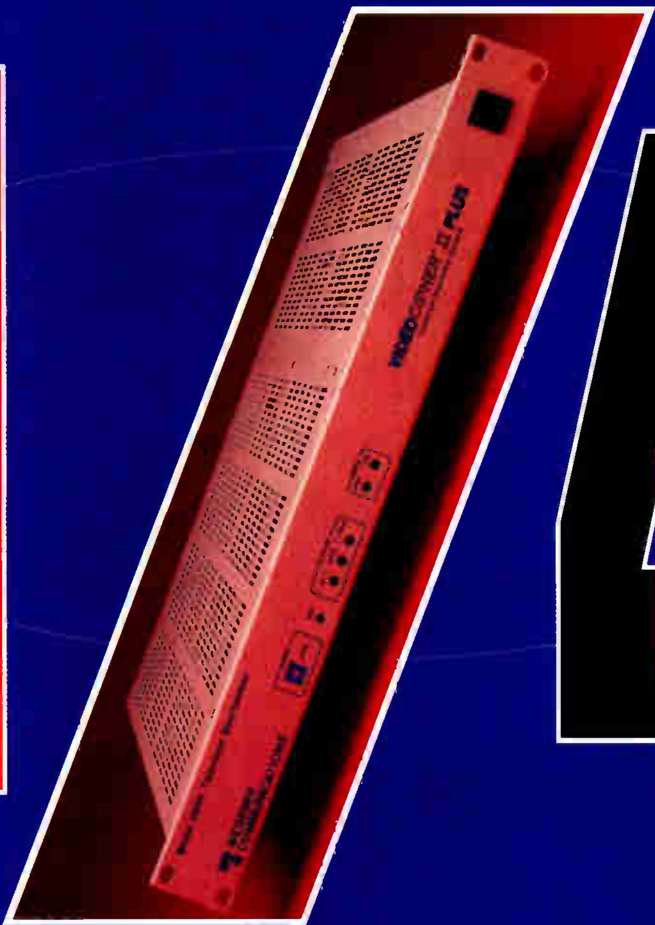

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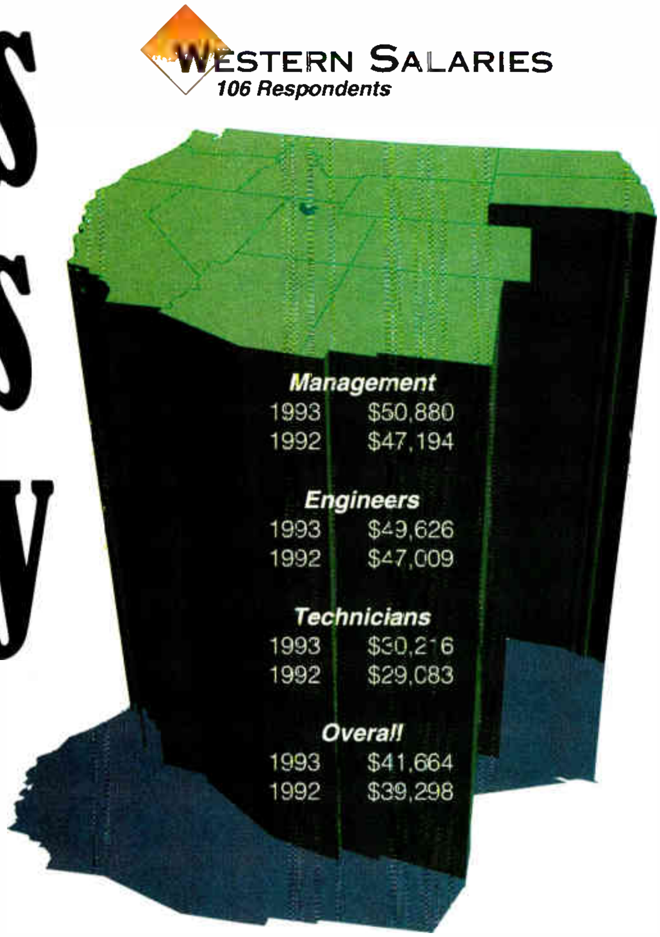
Operators say: Hands tied by red tape

Re-regulation stands to harm technology plans



By Leslie Ellis, CED

Imagine how cable operators must feel. They've finally gotten a clear vision of methods to upgrade their networks into two-way, interactive, broadband pipes capable of carrying voice, video and data to schools, businesses and residences. Yet, government regulation threatens to make the necessary upgrades impossible to afford. So close and yet, so far. It must be a nightmare.

It's real, according to those in the technical community. The effects of the 1992 Cable Act are yet to be felt, but cable operators fear the days ahead. DBS will finally launch early next year; the telcos promise to gain more experience as a provider of video, data and voice services.

If that wasn't enough, the pace of technological change could cast cable systems as communications also-rans if operators are forced to postpone system upgrades for an extended time.

It's a complicated future, even without the "help" the government has provided, according to those who responded to *CED*'s sixth annual salary and job satisfaction survey. The survey was mailed to 2,000 randomly-selected *CED* readers in May; 437 (21 percent) responded.

In order, the top three concerns mentioned this year are as follows:

1. The effects of re-regulation
2. Competition
3. Pace of technological change

However, most comments on the 437 surveys weave the top three concerns together. Usually, these worries read as a question: With the recent regulatory setback, cable operators will likely suffer budgetetary strains: with less money, how can the industry invest in the new technologies needed to remain competitive against the telcos and DBS providers?

A Florida technician sums up his regulatory woes this way: "If cable gets the jump on the infrastructure of tomorrow, good. If the Feds give inside treatment to Bell, it could get interesting."

"Governmental interference is at its worst," grouses an engineer from West Virginia. "The current regulations are almost a textbook example of socialism. Russia and Eastern Europe have rejected socialism, yet this country seems to becoming more socialistic every day."

Perhaps the most stinging commentary on the recent governmental actions against cable comes from this 29-year old engineering manager in Tennessee: "The federal government is well on its way to turning our business from an entrepreneurial, raging success story to a Bill Clinton/Al Gore bureaucratic, do-nothing quagmire. It's no fun."

Telco paranoia

With telcos like Southwestern Bell and U S West making headlines this year by dipping their toes a little deeper in broadband waters, it's no wonder competition finished a close second to re-regulation in this year's survey. Interestingly, the concerns ranged from anger to camaraderie. In years past, for example, the technical community fretted about telco intervention in the cable business; now many are actively networking with their telco brethren in hopes of future employment. "I'm looking for employment with a telephone company in my area," writes a Missouri technician. "As soon as their hiring freeze is over, I'm there."

Others worry whether or not their corporate management team has the wherewithal to effectively compete with the telcos. "Telcos have the big bucks to buy broadband engineers and build their own headends. If they all interlink, cable television is dead," theorizes a Virginia-based engineer.

One tech in the Virginia area thinks an ultimate marriage between cable and telco could ultimately prove beneficial to subscribers. "System operators are all the same: They think their greed and shortsightedness can be shielded by slick marketing campaigns and whining politicians. Maybe operators *should* be absorbed by their soulmates in the telephone business."

Tidal wave: Technology

The way this year's batch of surveys read, it's a wonder the technical community can even keep up. In fact, stress ranked high on the list of job-related gripes, usually because of an acute lack of time.

A young engineer (29) in Pennsylvania, for example, says his schedule is so harrowing and stressful, he's on medication "just to keep up."

Another technician says he uses morning commuting time to think through his day and plan priorities–but that invariably, by 10 a.m. his day's plan is out the window and he's off in a completely different direction.

Still other respondents say they've resorting to taking trade publications home to keep up with new technologies. "I love to read, but this is getting ridiculous," one engineering manager wrote. "No offense, but I like to settle down with a good book–not an explanation of digital compression."

Interestingly, though, the time and stress complaint seems to be the trade-off for working at a pace that doesn't allow repetition or boredom. The "I'm never bored" theme showed up on a majority of surveys; one engineering manager says he enjoys the overall satisfaction of knowing he can successfully juggle 45 things at a time.

Survey highlights

Highlights from this year's survey include:

✔ **Raises and bonuses are up.** Technical managers, engineers and technicians are all making more money than they did in 1992. Almost half of the respondents received a performance bonus in 1992; the average bonus came in at around $1,500.

✔ **The majority has been in cable a long, long time.** The majority of this year's respondents–a random sampling of *CED*'s readership base–have been in the cable television industry for over 15 years.

✔ **Business management training is needed.** Resoundingly, cable's engineering managers, engineers and technicians are not pleased with the management training they've received. This ties in

"Small ops are in Congress' way. I expect the FCC to send in the firing squads any day now."

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with another undercurrent in this year's survey: lack of respect. Apparently, the technical group is weary of being labeled "tech guys;" they want to be included in business decisions as well as technical decisions.

✔ **Staffing is up; layoffs are down.** More than half of this year's respondents (52 percent) say their companies have added technical personnel in the past year. Only 18 percent say their companies have reduced staff.

✔ **Bosses are paying for training and education.** More than 90 percent of those surveyed say their companies will pay for training and education; 75 percent of those same respondents say they've enrolled in educational courses within the past year.

✔ **Almost everybody plans to stay in cable.** A whopping 90 percent of those surveyed say cable is where they want to be, and that they plan to be in the industry three years from now. Several openly wonder, though, whether it will be called "the cable industry" in three years. "Cable industry–or communications industry?" one engineer writes.

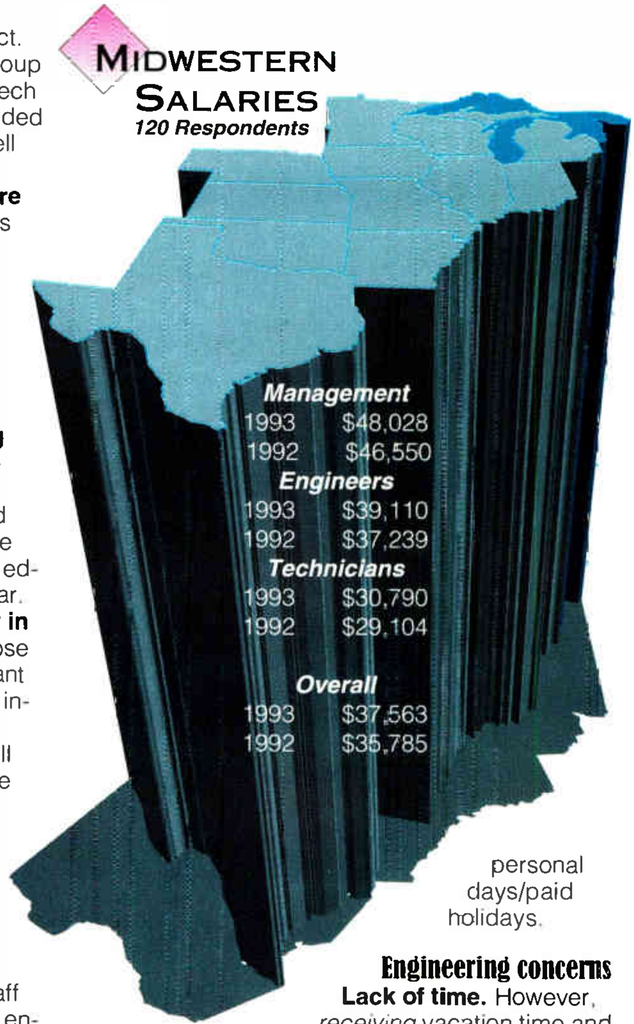
Profile of today's engineer

The average 1993 engineer (who, in this forum, is a chief engineer, system VP of engineering, staff engineer, district engineer or plant engineer) is just shy of 40 years old. He has worked in cable for more than 15 years. He's been with his current employer for three years or less. He comes from a large system with 80,000 subscribers or more and supervises about 14 technical staffers.

He loves technology and the rapid pace of the cable business. He wants upper management respect for the knowledge packed away in his head–as one engineer from Ohio puts it, he doesn't want to be pigeonholed as a "technical person," and not considered for general management opportunities. This isn't surprising, given the present cyclical move of technology toward the forefront of the cable business.

He's somewhat satisfied with compensation and advancement opportunities, and feels an above average level of job security.

Today's engineer earns an average of $49,891, plus an average bonus of about $1,750. The highest-paid respondent this year made $90,500 in 1992; the lowest paid made $21,000. He pays about $100 per month for medical and dental insurance–that's up $20 from last year. He gets 17 days of vacation, on average, plus about seven



personal days/paid holidays.

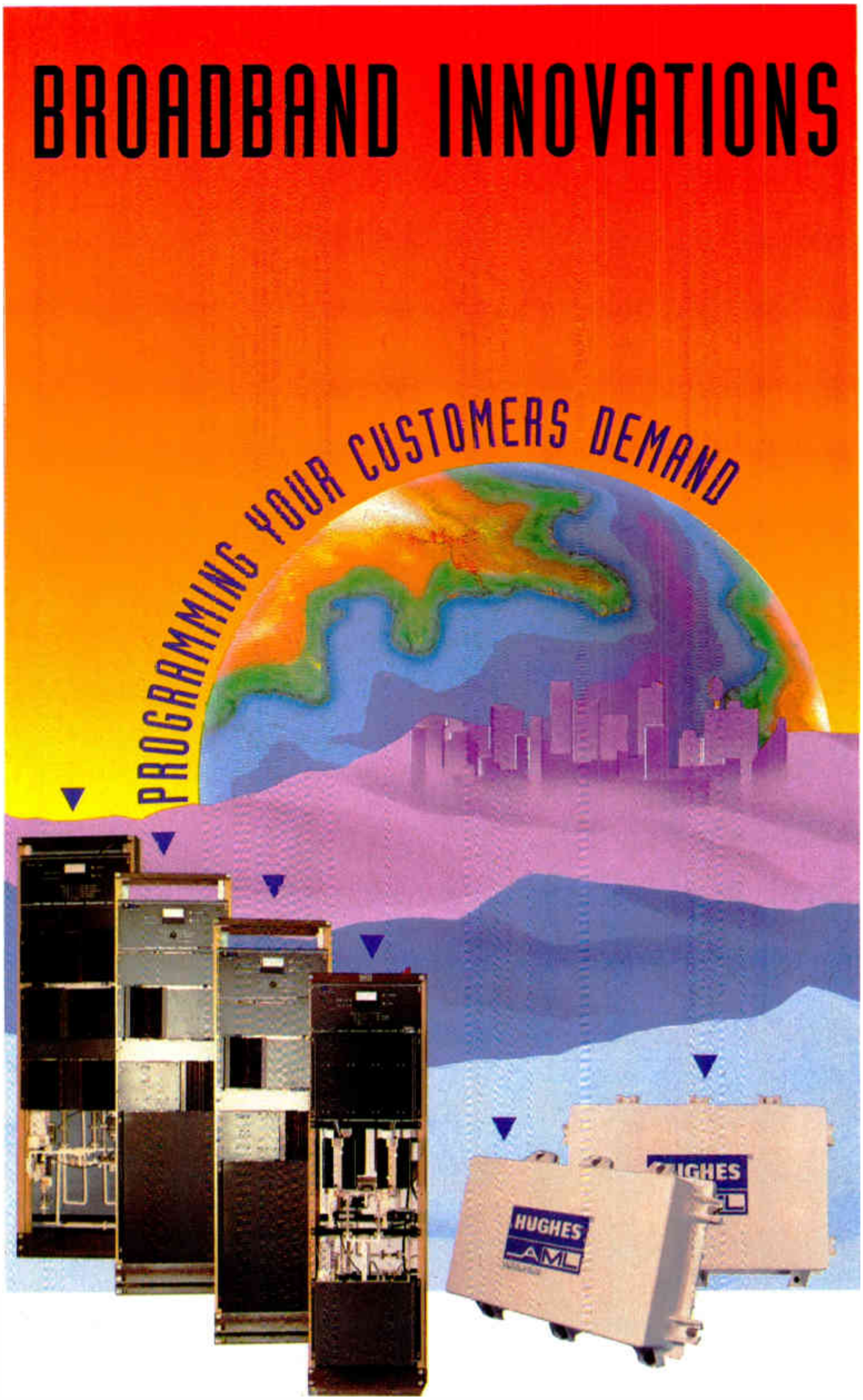
Engineering concerns

Lack of time. However, *receiving* vacation time and actually *using* it are two separate realities. As this year's engineers put it, they're too busy to even take vacation. "There's no rest in my job," comments an engineer in Colorado. "I have a lot of vacation saved up, but no time to take it."

One of the biggest time-eaters, the engineers say, is the never-ending stream of paperwork and reports which must be completed before a work day is considered "over." As one engineer puts it, his MSO is paperworking him to death. "The amount of paperwork I have to deal with is insane," says a New York-based engineer. "There's a significant lack of corporate support in this area."

Gripes with management. This year's surveys indicate that cable's engineers are increasingly dissatisfied with system-level and corporate management. A case in point is this bitter comment from an engineer in Maryland: "We are penny-wise and dollar stupid. Everything is 'how cheap can we do it now.' I sincerely believe that the CATV industry cannot function solely on what appears on the bottom of a ledger. Our company has lost its nerve."

That "bottom line" management style is a painful thorn to engineers, according to the comments on this year's survey forms. "We constantly hold back commitments to technology because



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of the lack of a perceived payback. If the industry doesn't invest soon, it'll be left in the cold–myself included," writes an engineer in Michigan.

Specifically, engineers seem to be unhappy about the communications flow between themselves and management. "We are in the communications business, and it seems that communications is what we lack," says an engineer in Pennsylvania.

Need for training. "Technical training is desperately needed," bemoans an engineer in California. Another engineer in the same state complains that good-quality technical people are hard to find with the funds available. " We lose many good techs because of the chickenfeed wages the MSOs are willing to pay."

Another engineer from Wisconsin says that the hiring situation is so bad there, no one even applies when he puts an ad in the paper for a technical position. "We wind up with poor help because our pay scale is poor. You get what you pay for," he writes.

Technician profile

This year's "average" technician–defined in the survey as an installer, technician or technical manager–is just over 37 years old. He makes about $30,700, on average, and an additional $330 or so in bonus money. The highest-paid tech this year brought home $60,000; the lowest paid received $8,000.

The average 1993 technician has been in the cable industry for more than 15 years; he's been at his current job and with his current employer for six to 10 of those 15 years. He comes from a large system, with 80,000 or more subscribers.

No. 1 rated concern, '88-'93

Managers

1993	Reregulation
1992	Keeping up with technological change
1991	Training
1990	Reregulation
1989	Competition
1988	Competition

Engineers

1993	Reregulation
1992	Keeping up with technological change
1991	Reregulation
1990	Reregulation
1989	Training
1988	Training

Technicians

1993	Competition
1992	Budget cuts/gripes with management
1991	Reregulation
1990	Reregulation
1989	Competition
1988	Compensation

Engineers

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Top five industry concerns
1. Effects of reregulation
2. Competition
3. Technicalogical change
4. Training
5. "Bottom line" management styles

Top five job gripes
1. Lack of time/ stress
2. Management gripes/no respect
3. Low pay
4. Lack of quality help
5. Poor communication

Top five job "pluses"
1. Never bored; pace; challenge
2. Being on the cutting edge of technology
3. Freedom to do job
4. Great co-workers
5. Like boss/management staff

He receives almost 18 vacation days per year, as well as eight personal/paid holidays. He pays just over $100 in medical/dental insurance premiums per month ($10 more per month than last year).

On average, technicians have high regard for the security of their job, but several comment openly about the long-term effects of headend consolidation and trunk amp reductions.

Technician concerns

The respondents in this year's survey paint a picture of a technician who is very articulate. He knows the high tech issues and has an exceptionally good grasp on the day-to-day technical operations of his system. His top-three concerns are competition, the effects of re-regulation and the quest to keep up with technological change. He spends a good deal of time speculating about the future.

"It appears to me that the industry has been so profit-oriented, it failed to posture itself for a secure future. Re-regulation, in my opinion, is the result of industrywide greed," theorizes one technician.

Another technician from the Pennsylvania area offers this worry about

"There's no rest in my job. I have vacation, but no time to take it."

the future of the cable business: "Is the cable industry and our system willing to finance the cost of technological advancement so we can effectively compete in the future telecommunications field–and not be confined to just delivering video?"

Pay scale. A common thread among the technicians is a general dissatisfaction with wages and benefits; in fact, that point rose to the surface as the number one job-related gripe. A tech from Missouri, for example, grumbles that he has "much too much month at the end of the money."

"I look at it this way," writes a technician in Florida. "Our rates go up 10 percent, my bills go up 7 percent, and I'm told I'm lucky my pay was raised by 3 percent. Does this make me happy? *Not.*"

Long hours/stress. Like the engineers, the technical group also suffers from stress-related maladies attributable to many long hours.

One technician from South Carolina says he works all day only to come home to more service calls. "I've worked here for 13 years. Subscribers now call me at home, instead of calling the office!"

Today's tech, while he likes what he does, feels he doesn't have the right

"Because of rate re-regulation, all our plans for new technology are on hold."

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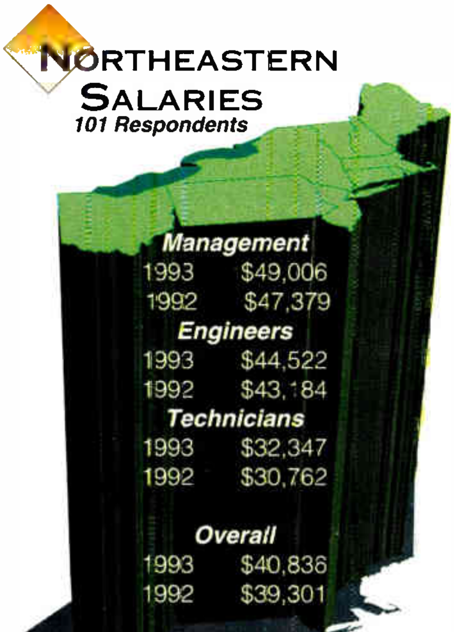

tools or staff to do the job right. He wants more recognition for his efforts. Several respondents complain that technicians, as a group, are not respected.

Training. Training is another issue widely commented upon by this year's technicians. In a nutshell, they feel as though technology keeps on moving, while training stagnates. "Training is a big issue with me–it's still sink or swim around here," writes one tech.

"With all the new technologies and advancement in the cable industry–fiber optics, digital compression, HDTV and consumer-friendly devices–we are not getting any training for it," one technician worries. Another technician says he's had fiber in his system for more than a year, but has yet to receive any training on the technology.

On the up side, the average technician likes the fact he can work away from the office without direct supervision. Typical comments from the technicians illustrate a guy who likes "not being cooped up all day," and very much likes "not having a supervisor breathing down my neck."

He enjoys being on the cutting edge of new technologies, and finds great satisfaction in meeting new people every day. He very much enjoys his co-workers. And then there's this off-color "plus" from a Louisiana-based tech: "I can spew enough techno-babble to amaze or confuse most laymen I meet."

Management profile

The portrait of the 1993 engineering manager–which includes plant managers, system managers, presidents and VPs of engineering–is a guy (although a handful of women responded in this category) who is the oldest of the three categories, at just over 41 years old. He pockets an average salary of $49,900, with an extra $3,100 in bonus money. The highest paid manager made $130,000 last year; the lowest paid made $20,000. He's pleased with his salary, for the most part.

Today's engineering manager supervises about 17 people. He's been in the industry for more than 15 years, and has been with his current employer between four and six years. He supervises a system with 80,000 subscribers or more. Last year, the average engineering manager took 16 vacation days and eight paid holidays/personal days. He pays the most per month for medical and dental insurance, at $116.

Management concerns

Gripes with management. Surprisingly, even the engineering managers have bones to pick with management–presumably, in this case, corporate management. For starters, they don't like spending valuable time settling personnel disputes. "Most of the time, I feel like a human resources manager and a babysitter

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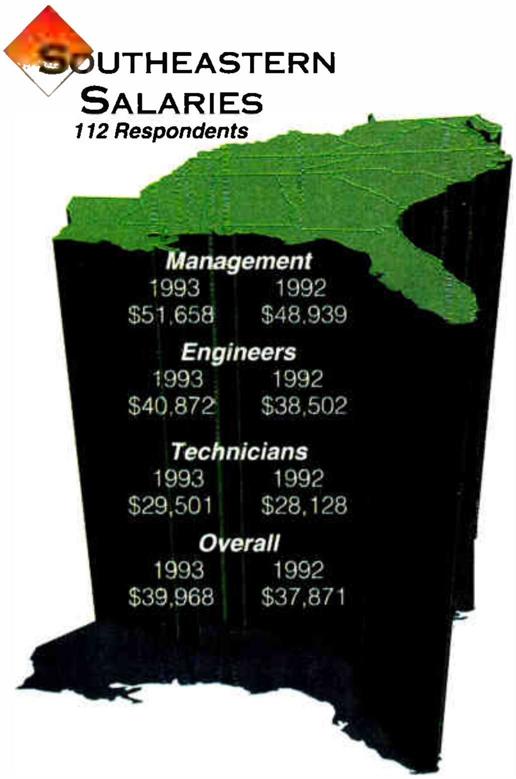


as opposed to a plant manager in a highly technical field," says a California-based manager.

Another management gripe is a lack of attention to customer service issues. "It's a miracle I haven't been tarred and feathered and run out of town," laments a manager in Arkansas about management's indifference to customer service. In fact, many of the engineering managers wrote heavily about cable's perceived image as "money hungry pigs," and how badly that needs to change.

"If the current negative perception of the cable industry isn't changed by improved customer service, we all might as well hang up our gaffs and go home," comments a plant manager in California. "Competitors will key in on these issues."

Still others complain about how top-heavy their management team is. "There are too many chiefs and not enough Indians–it slows down the action process and holds up positive change," comments a New York-based engineering manager.

One engineer from North Carolina has this idea for corporate management: "The big MSOs should consider cooperating on training and standardization efforts–they should get back to basics. Bigger is not always better...look at Sears."

Time/stress. Like their engineering and technical associates, today's engineering managers appear to be completely tapped out for time. As a result, they say, they're burning out. "There's too much work and too little time," scribbles a manager in Massachusetts. "Workload has increased while staff has not."

"I'm burned out," concurs a 52-year-old manager in Washington "In the last five months, three technical managers in this part of the state have left the industry because of stress and frustration."

Manpower/training. This year's engineering managers lump their concerns about staffing and training. The surveys indicate a common feeling among managers that qualified technical help is hard to find, and when it is found, there are training funds.

"In my 18-plus years in the industry, I've noticed that we always jump in with new technologies and new ideas–and then train our people," laments a manager in North Carolina. "We should train first, then build bigger and better."

Managers also seem bothered they can't offer their technical staffers better pay and benefits. "I'm with a small system," writes a manager in Pennsylvania. "I wish I could be able to pay my employees a better salary–I really do."

Praise for support staff. However, despite their complaints, engineering managers are exceptionally complimentary about their staff. They enjoy a sense of satisfaction when a customer calls in and praises an employee.

They like being able to make decisions that will ultimately affect the success or failure of the company.

In all, the managers, see cable as a rewarding industry in which to work. "Despite all the perceived negatives, it's still fun to come to work each day," writes a manager in North Carolina.

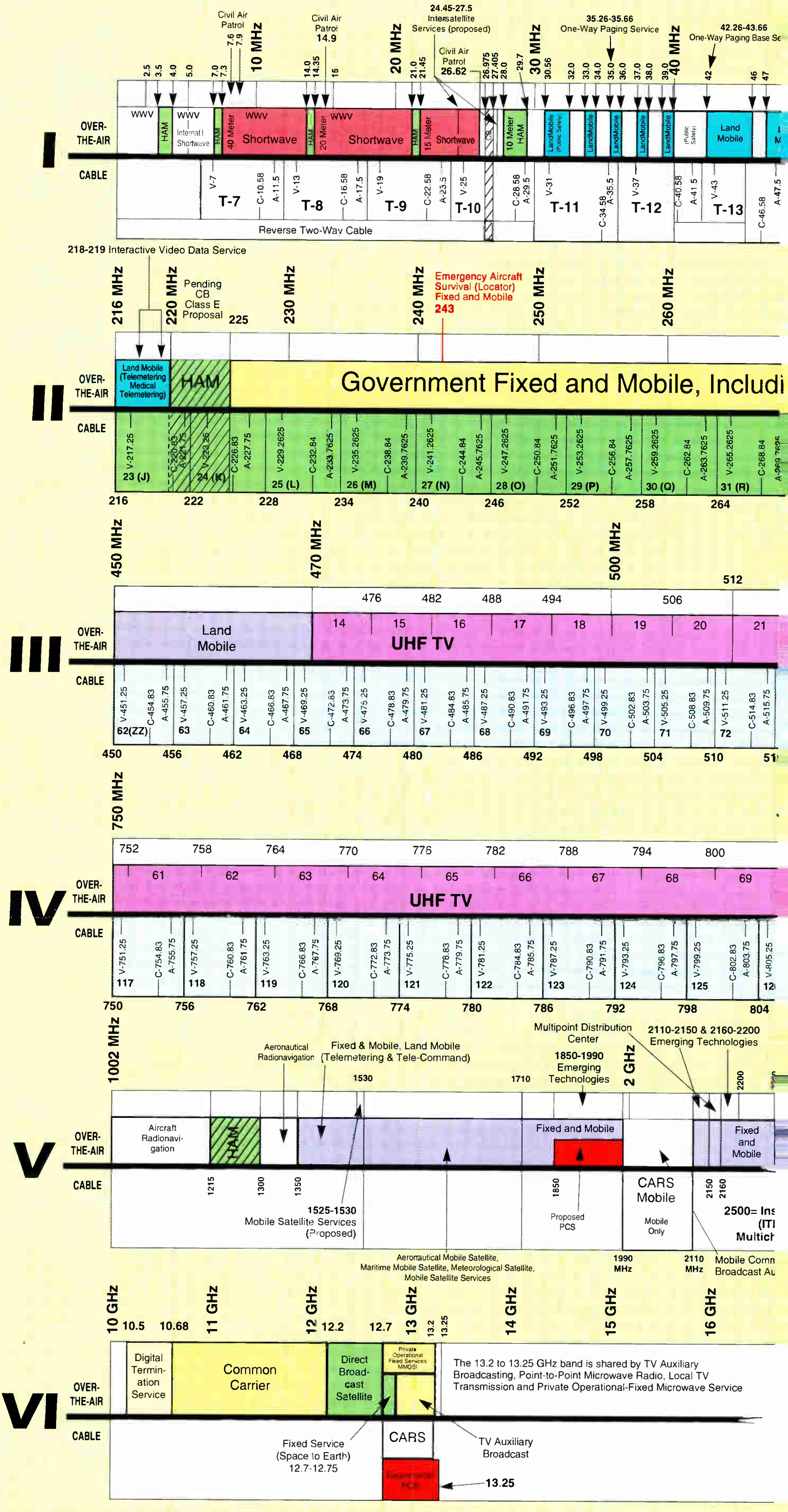
Final analysis

Complaints aside, however, it appears most within cable's technical and engineering ranks are largely satisfied. Indeed, their compliments are just as hearty as their criticisms. Certainly, if they weren't satisfied, they would have left the industry long ago. Instead, this year's survey illuminates the fact that all three groups–engineers, engineering managers and technicians–have been in the industry for 15 years or more.

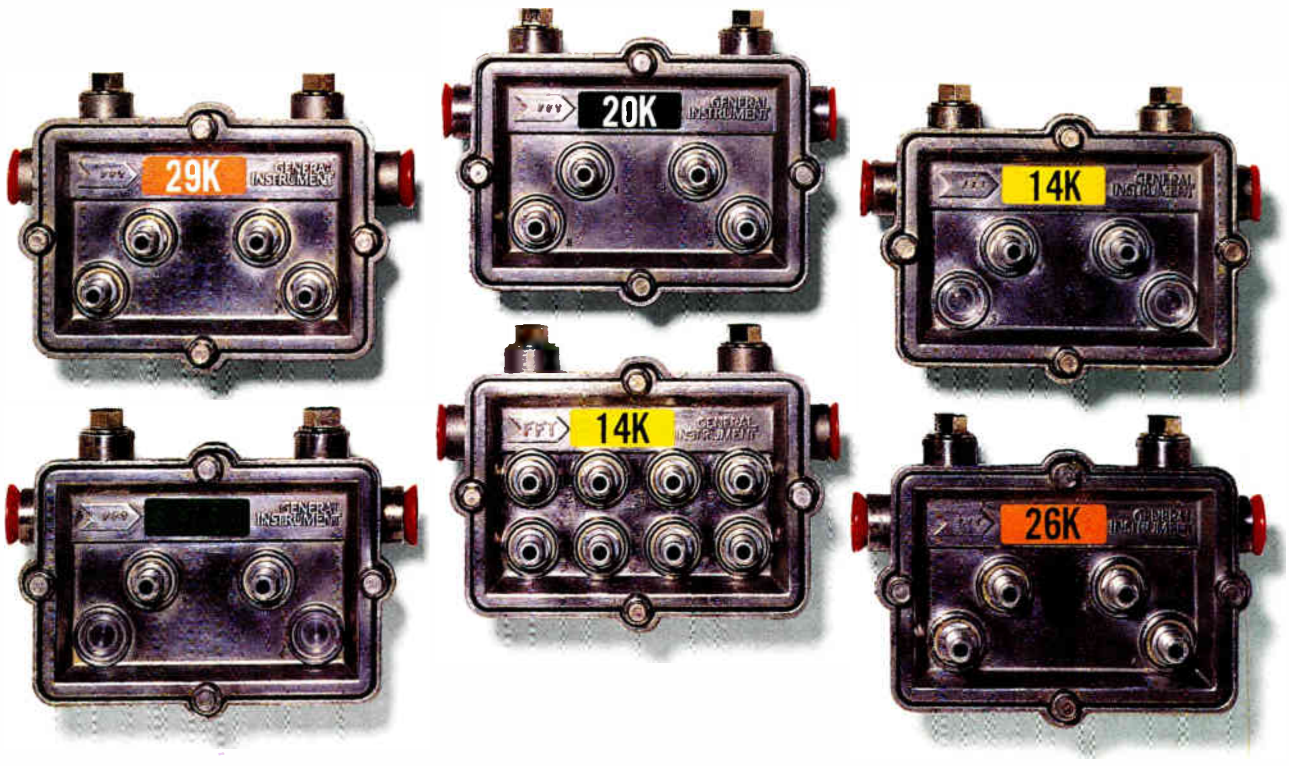
One has to wonder, though, about this comment from a Massachusetts-based technician: "The challenge for me is being able to pick out a line problem or an outage. It's almost as good as sex!"

Sorry, Massachusetts. Jury's still out on that one. . . and you most definitely need some time off! CED

CED 19



CATV channel designations reflect the Cable Television Channel Identification Plan recommended by a joint committee of the Electronic Industries Association and the National Cable Television Association. Former standard designations appear in parentheses. This chart shows channel assignments as designated by a draft revision of IS-6 (which extends the channel designations to 1 GHz). Operators should be aware that this revision has not been officially accepted by the joint committee and is subject to change. It should be noted that some manufacturers using phaselock IRC channel spacing avoid using Channels 5 and 6 as designated on this chart. Instead, they set the freq carriers are at 79.2625 MHz and 85.2625 MHz, res designate those channels with numbers other than Also note that CATV channel designated carrier bands 108 MHz to 137 MHz and 225 MHz to 400 M frequency offset and notification requirements in Se 76.617 of Part 76 of the Federal Communications C and Regulations. Positive offsets are displayed on t offsets are employed where HRC systems are usec



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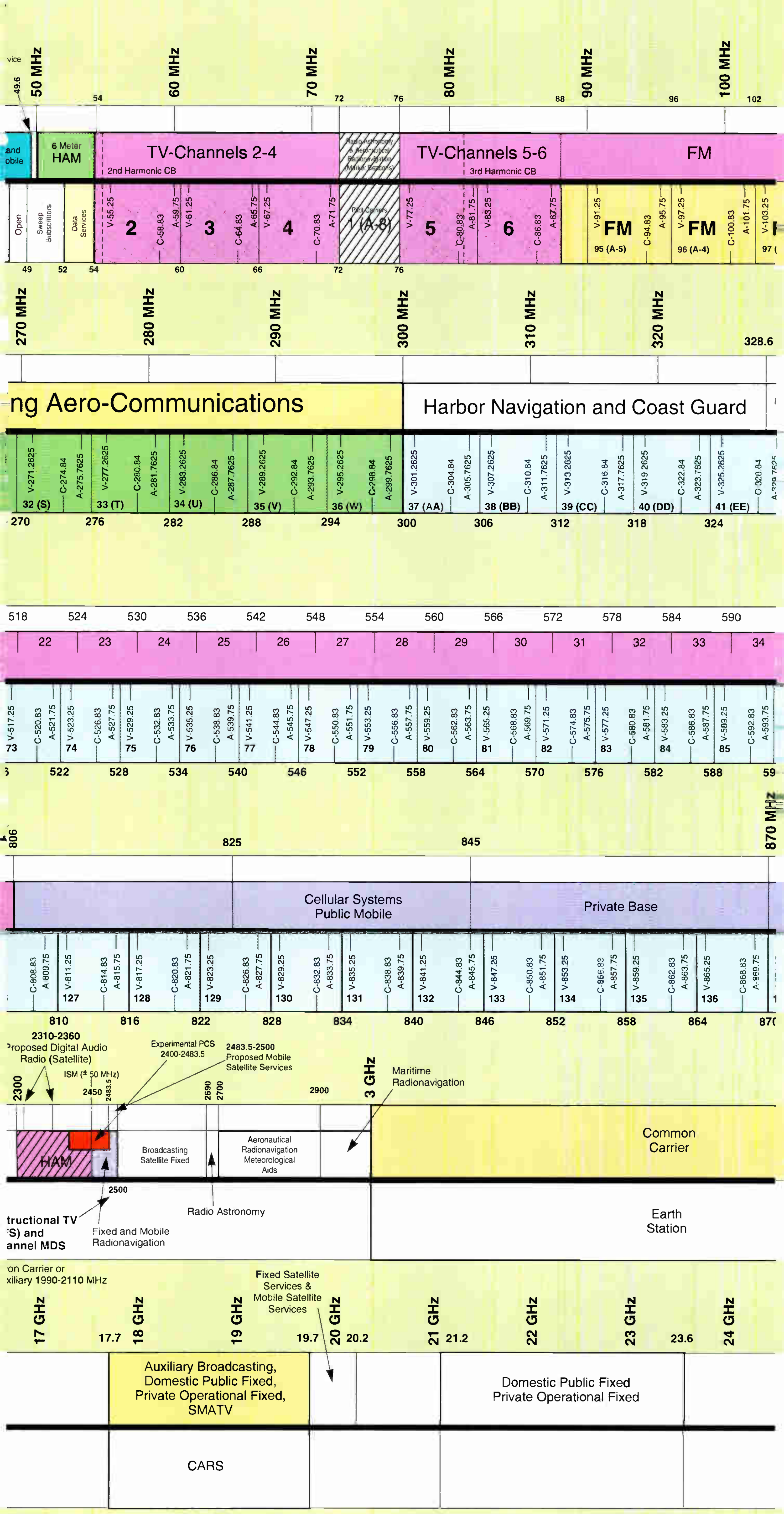


ıencies so the video ɔectively, and usually 5 or 6.
requencies in the Hz are subject to the ction 76.610 through ommission's Rules his chart, but different or if the CATV oper-

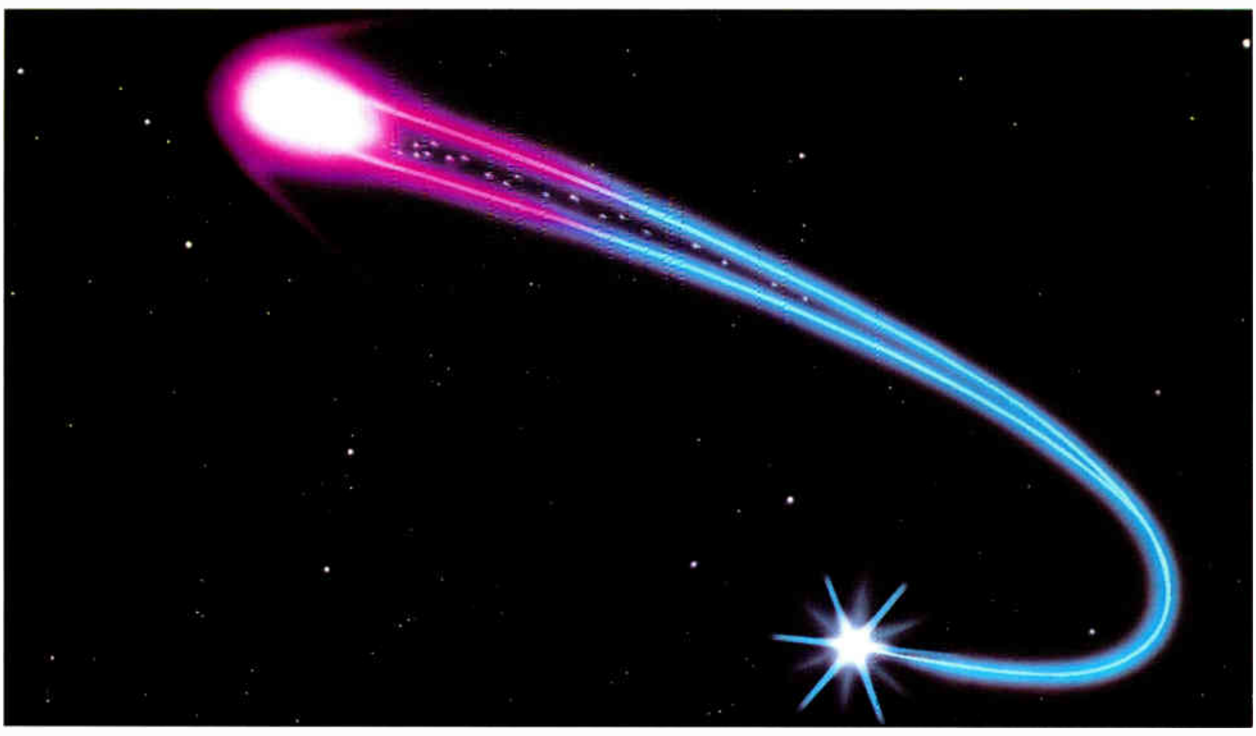
ator elects to use negative offsets (see Section 76.612).

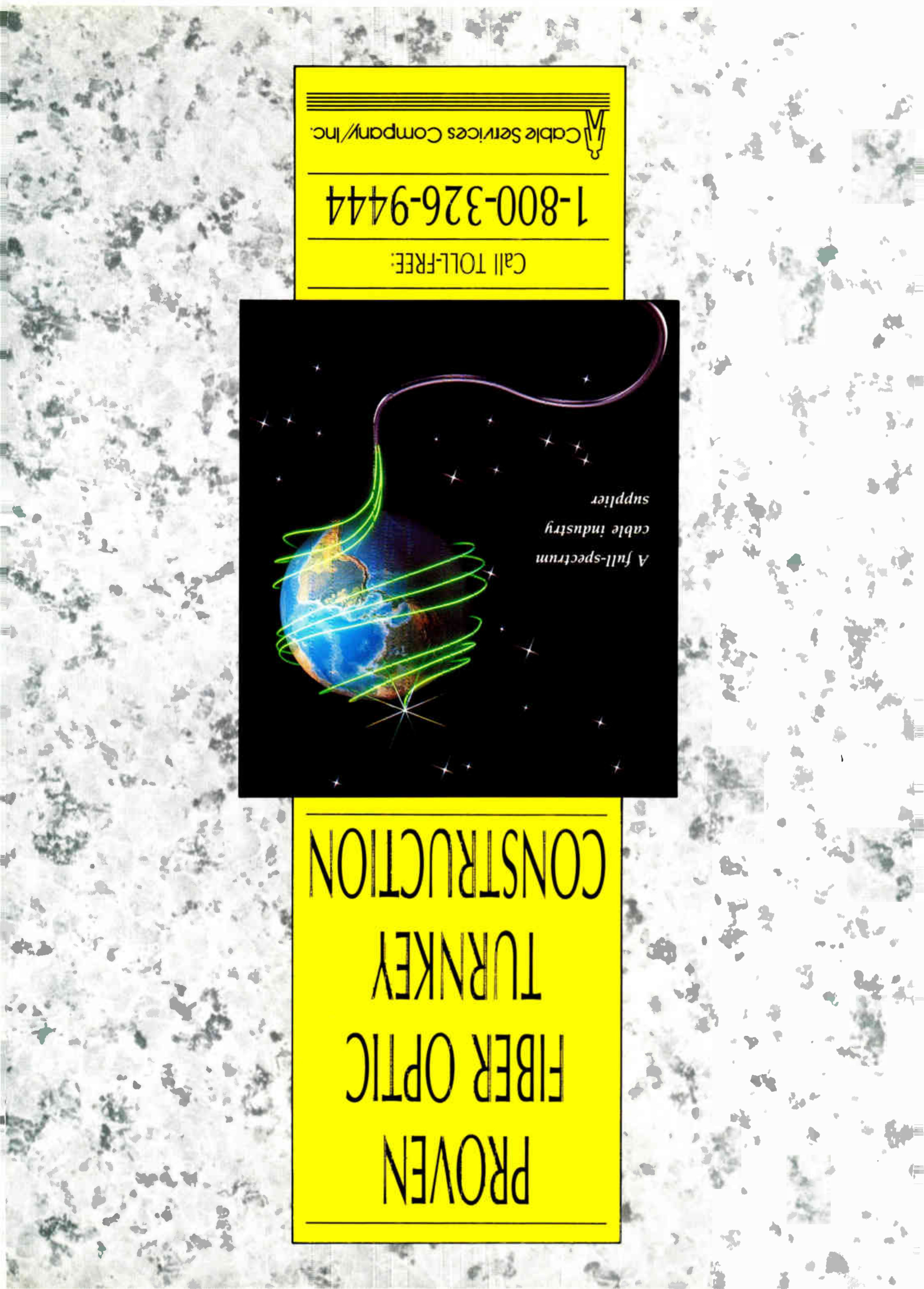
** Channels 88 and 89 are subject to interference from set-top converter IF frequencies.

† (Channel 145, local oscillator frequency) Use of this channel for priority programming is not recommended. It is used as the second local oscillator frequency for some television sets. The possibility exists that local oscillator leakage from the set may cause interference to another TV viewing this channel. The interference may be independent of the channel to which the subject TV (i.e., the one containing the double con-

version tuner) is tuned.

†† (Channels 151-153, IF frequency) Use of tl gramming is not encouraged. They are used as quency in some television sets. When such a se in this part of the spectrum, then it may experien riers on these channels. If this occurs, the only s vide a bandstop filter tuned to these channels. S sity, remove several additional channels either s

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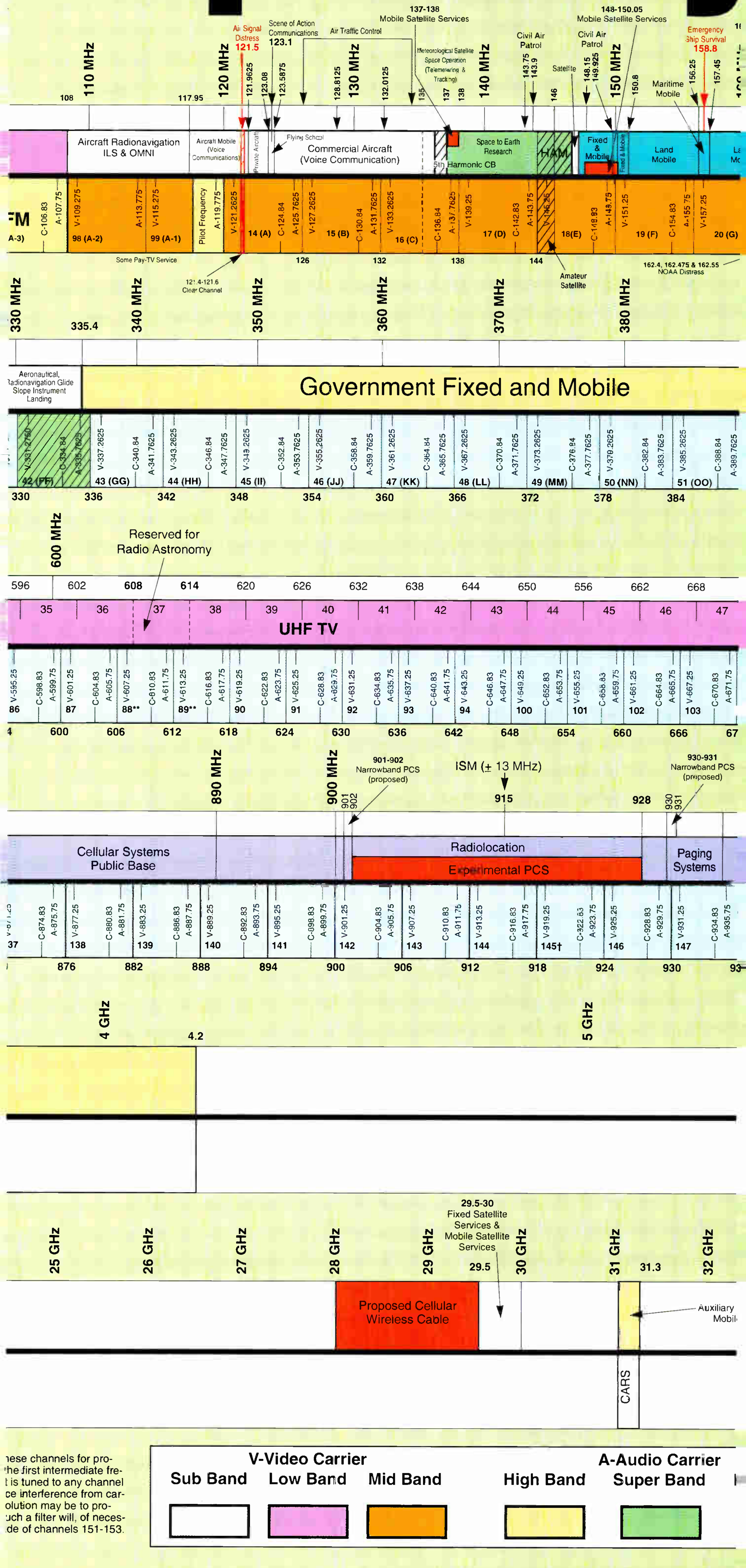

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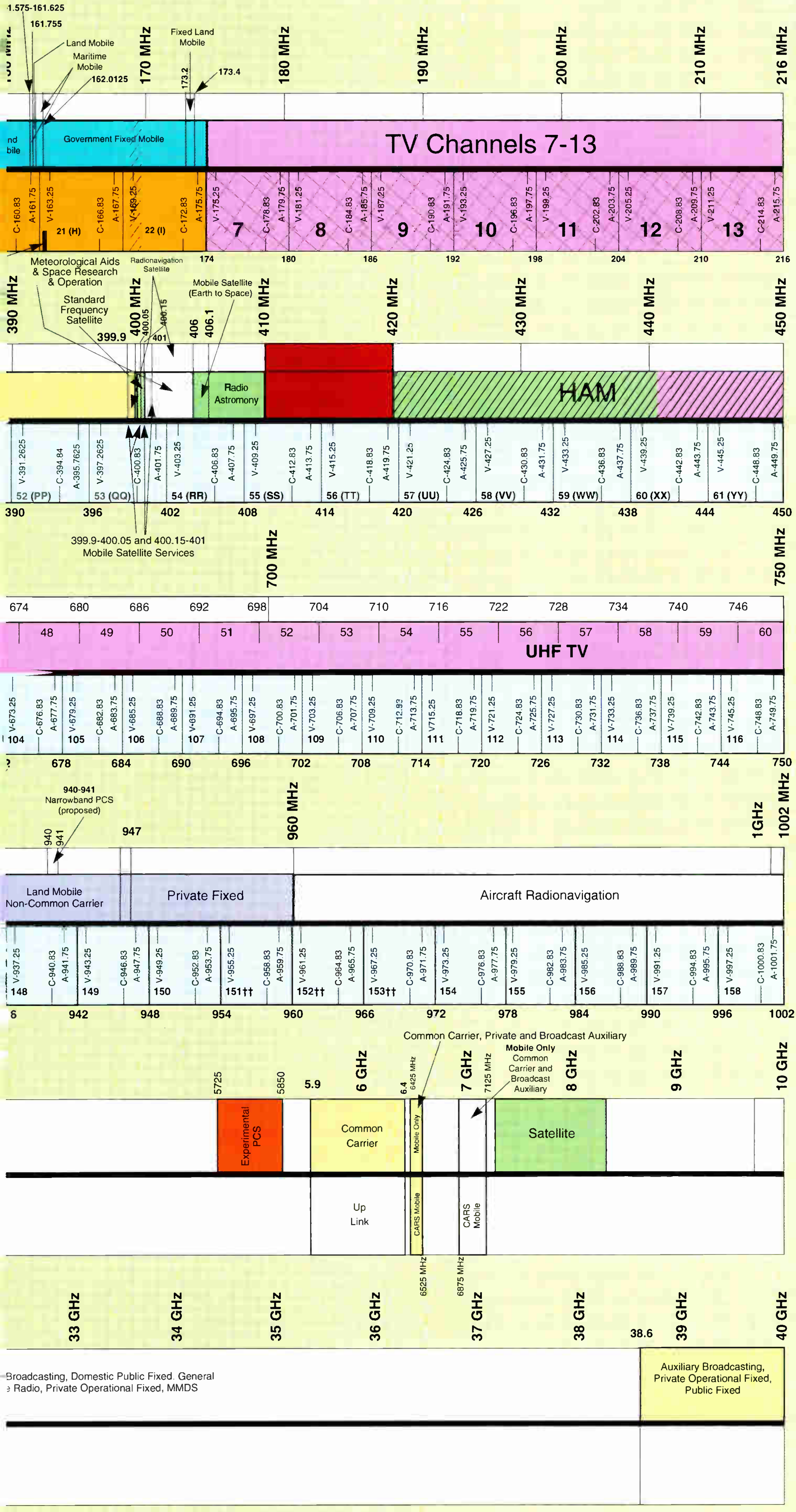
Chart



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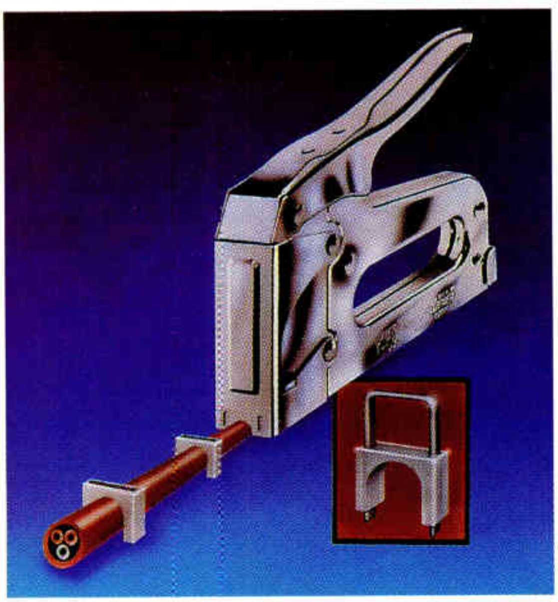

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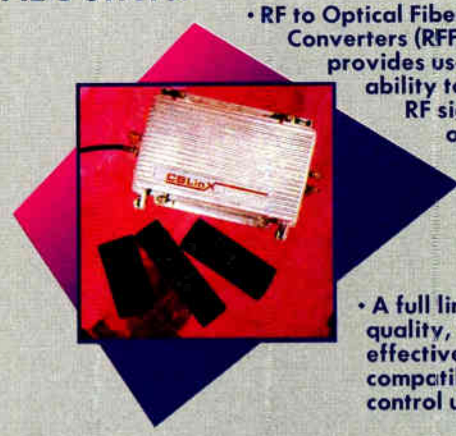

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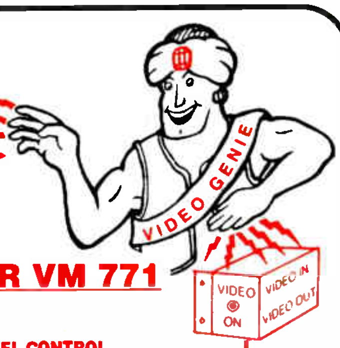

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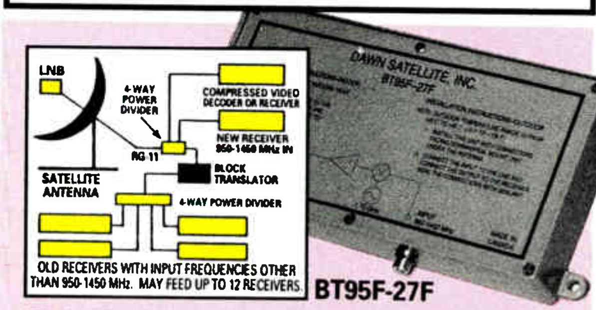

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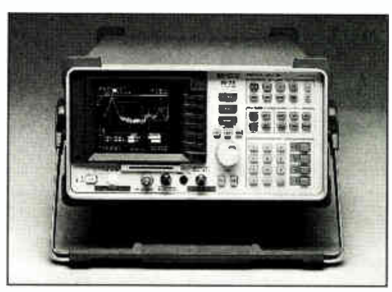

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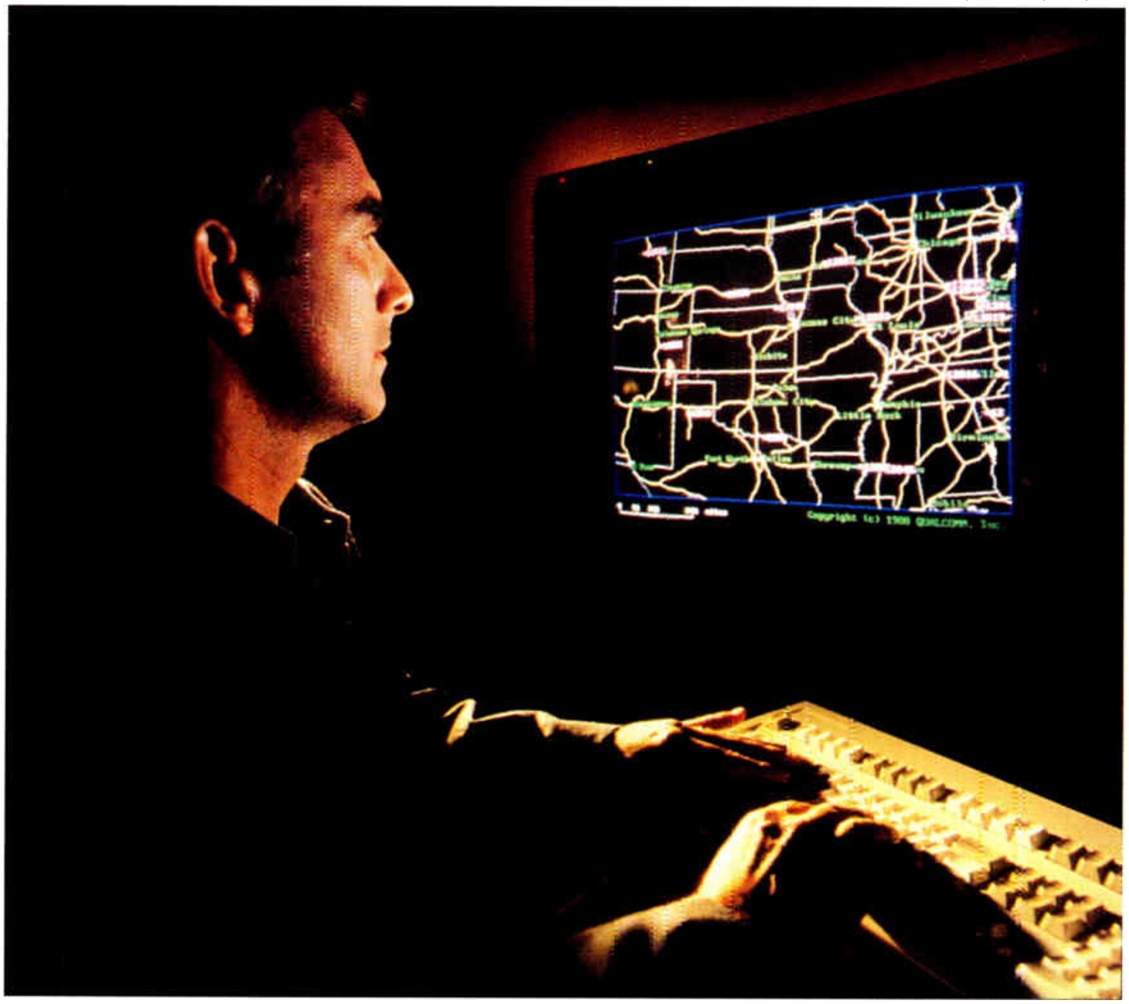

On-screen mapping lets users zero in on the exact location of any vehicle

Automating dispatch functions

Fleet management systems

By Michael J. Major

"If it moves, automate it!" has been the rallying cry of many proponents of high technology over the years. The latest expression of this philiosophy is the trend toward computerized cable television fleet management systems, with the intent of automating as many of the related functions as possible.

Where do these systems come from and why are they just now making their appearance in cable systems? How do these systems work? How much do they cost and what benefits do they bring?

The first cable TV company in North America to embrace the technology was not in the U.S. Instead, it was Toronto, Canada-based Rogers Cable TV Ltd. "We did a pilot study in 1989 with a small number of vehicles and it showed about a 10 percent to 15 percent improvement in efficiency," says John Anderson, vice president of project engineering at Rogers.

Incoming service calls pass directly into the main billing computer in the system designed and implemented by Mobile Data International (MDI), a company since acquired by Motorola. Data is then handed off from customer billing through the MDI system to the dispatcher's console. The console provides several screens of information related to fleet status, individual technician status and pending orders. Dispatching is done from the terminal directly to the trucks. "Voice is available, but it's rarely used," says Anderson. "Most everything is done electronically."

To keep the dispatcher apprised, field technicians key in the status of pending work, when it has been completed and if they are en route to the next job. In turn, they can request a call forward to make sure the next customer is home. In addition, they have access to other information, such as account histories.

"There are many more efficiencies and much more accurate information conveyed, as well as much less wait time trying to get on a two-way radio with a dispatcher," says Anderson. He adds that calls that come into local service centers after regular business hours are received in the central dispatching office in Vancouver for improved customer response time.

Rogers Cable TV has about 400 vehi-

cles on-line nationwide, at a cost of about $7,000 per vehicle. This is in contrast to the estimates of $10,000 to $13,000 it would cost of similarly outfit a vehicle in the U.S. One reason is that Rogers' system lacks some bells and whistles now in vogue. For instance, it does not incorporate Global Positioning System hardware, which tracks trucks via satellite in real-time to provide dispatchers with information about vehicle location. Nor do these vehicles provide graphic information about the fleet status.

Anderson says they really don't need the GPS feature because the dispatcher can get a rough fix on the location of the technician from the location of the last order or service call. And while graphics aren't critical, they are being considered in the next evolution, Automated Mapping and Facility Management (AFFM). AFFM will go way beyond automated dispatching to include a corporate database of the outside plant tied to the customer database. This will be incorporated into the integrated network management system that will monitor and control all fiber and coaxial cables.

Not easily quantifiable

How effective has Rogers been in fulfilling its 10 percent to 15 percent efficiency projections? "It's hard to nail down the numbers to see if we've achieved that goal, for the business has evolved rapidly," says Anderson. "We can't point to better service because we've added more customers and services such as pay-per-view and multiplexing.

TCI and Cox will both install fleet management systems in the near future.

Field management systems like this are just beginning to be implemented in the U.S. The first one to be up and running is Cox Cable Hampton Roads in Virginia Beach, Va. Cox is using a $600,000 system provided by Arrowsmith Technologies Inc. of Austin, Texas.

Projected to be up and running soon is TCI of Colorado and Cox Cable San Diego, both of which will install systems integrated by Advanced Telecommunications Solutions, a unit of Bull Information Systems. TCI plans to spend $3.1 million to bring automation to the Denver area, while Cox will spend $1.2 million in its sprawling San Diego system.

Buford Television, based in Tyler, Texas, recently looked to Qualcomm Inc.'s OmniTRACS two-way mobile satellite system to equip 70 tech vehicles across eight states. The system, which was originally developed for the over-the-road trucking industry, will be used by Buford to transmit work orders to field techs and track the location of its fleet in real-time.

"The majority of our subscribers are located in rural areas," says Kay Monigold, vice president of administration at Buford. "With this system we can see the location of each vehicle in our fleet and quickly assign the call to the most appropriate technician."

The OmniTRACS system includes a portable keyboard, a communications terminal and a dome that houses an antenna. Techs send and receive messages using the keyboard/display unit in the vehicle. The information is transmitted via satellite to Qualcomm's Network Management Center, where it is processed and forwarded by modem to Buford's headquarters–all in a matter of seconds. Vehicle location is said to be accurate to within 1,000 feet.

Why haven't these systems appeared in cable systems before now, and why are they coming to the fore with such apparent urgency?

One reason, says David Lieberman, ATS's director of marketing, is that though the individual components of the systems have previously been available, they are just now able to come together in a cohesive architecture that can be effectively customized for individual cable systems. Additional pressure is coming from new Federal Communications Commission regulations that require operators to respond to customer complaints within a 2- to 4-hour period, says Lieberman. Furthermore, he says, leading cable companies feel the need "to become proactive in video-on-demand, near video-on-demand and many other new services on the horizon."

Curt Bilby, Arrowsmith's COO, adds that the new era of cooperation between cable and telephone firms, highlighted by the recent partnership between Time Warner Cable and US West, means "the industry is getting ready to move in a manner of rapid change to get on the electronic highway–and not be left behind."

Dilby reports that, at Arrowsmith, the various technologies of open system architectures, distributed processing, digitized maps, mobile data communication and satellite positioning are coming together in its Integrated Cable Operation Management system, of which is Fleet-CON in a part.

PHOTO COURTESY ROGERS CABLE

A Rogers Cable service tech uses the MDI system

The Arrowsmith system works basically the same as the one at Rogers, with customer information downloaded to the dispatcher and real-time communications moving back and forth between the dispatcher and service personnel on the road. The main variations are the addition of GPS and the digitized map, which allows the dispatcher to see the customer locations on his screen and where the various service vehicles are in relation to each other.

Bilby maintains his system will increase technician productivity by 20 percent, and pay for itself in eight months.

Tim Ross, customer service manager, field operations, at Cox Cable Hampton Roads, reports that after the third month of demonstration and testing the Arrowsmith system, "We've seen real improvements in productivity and a reduction in time to complete jobs."

Ross says that in-truck terminals were in the company's financial plans five years before the FCC regulations came out. "Our need and desire to improve customer service is driving this," he says. "Every day we're feeling a greater demand to improve customer services."

One initial problem the company had, Ross says, "was the "Big Brother is watching over me' reaction from the technicians when they first saw the trucks." But that feeling soon passed. "As soon as they saw their productivity increase, their morale increased as well," says Ross.

ATS' Lieberman describes his company's Field Service Management System as consisting of four integrated components. The first is the geographic information system (GIS), which maps a company's service area and superimposes the land base and outside plant facilities required to provision services to the subscribers. Next comes computer aided dispatching, which integrates with

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the cable company's existing operations support system for service order entry and trouble ticket generation operations. GPS gives the company the ability to locate all vehicles in a work force. All vehicles equipped with GPS receivers/transmitters can be tracked in real-time. The mobile data terminal, a portable terminal/computer equipped with wireless communications (either RF or cellular) provides communication between the dispatchers and vehicle drivers, enabling the host computer to transmit new service or repair requests to service technicians while allowing them to transmit completion notifications back to the host computer.

Improved efficiencies

Lieberman maintains that because of the "improved efficiencies, more work can be done in the same period of time." He adds that because of algorithms built into the system, the latter can detect outages. Also, if a certain number of calls come in for the same reason, the computer registers that these are not due to the same cause, and so dispatches only the necessary truck, not the unnecessary extras. "We're now building an architecture into the system to incorporate status monitoring as well as leak detection," Lieberman says. "All of these components taken together will form a totally automated repair and service bureau."

John Suranyi, general manager of the south suburban systems of TCI Denver says his use of the ATS system is still in the implementation stage, but adds, "we sense that over a technician's 10-hour workday, we'll be able to trim off one hour of inefficiencies. In fact, the employees may not be required to even report to the office in the morning. They would be dispatched from their terminals and would be required to come to the office only for regular meetings or to pick up materials."

Suranyi says the system should help them streamline communications, better manage and evaluate the work on an immediate basis, and better coordinate the scheduling of appointments. "In future years, the uses may extend toward inventory management, asset management and status monitoring. It will certianly allow us to receive better information, and so make better decisions."

It all looks great on paper. The only question is, will all this automation work as anticipated and is it worth the expense?

To gain some perspective on this matter, take a step back in time to those prehistoric days when a two-way radio represented the height of high-tech. A technician came to work in the morning and picked up his assignments that would be arranged in a logical order, based on local geography.

The work orders would account for his main schedule, with emergency orders or unforseen problems–all communicated via two-way radio or telephone–filling in the holes.

Who's more efficient?

The assumption behind these new automated systems is that machines are more efficient than humans. It's true machines can perform narrowly defined tasks much more efficiently than humans, but they don't have the flexibility to effectively take on several tasks in which different judgment levels are required.

It's been found that machines, including computers, are most helpful when they are used as tools. On the other hand, grandiose systems such as computer integrated manufacturing, electronic data interchange or business to business communications and virtually all total office automation systems have not only cost large sums of money, but resulted in little or no increases in measurable productivity.

Is all this automated dispatching equipment really necessary? Will it lead to both better customer service and improved bottom line? Wait and see. CED

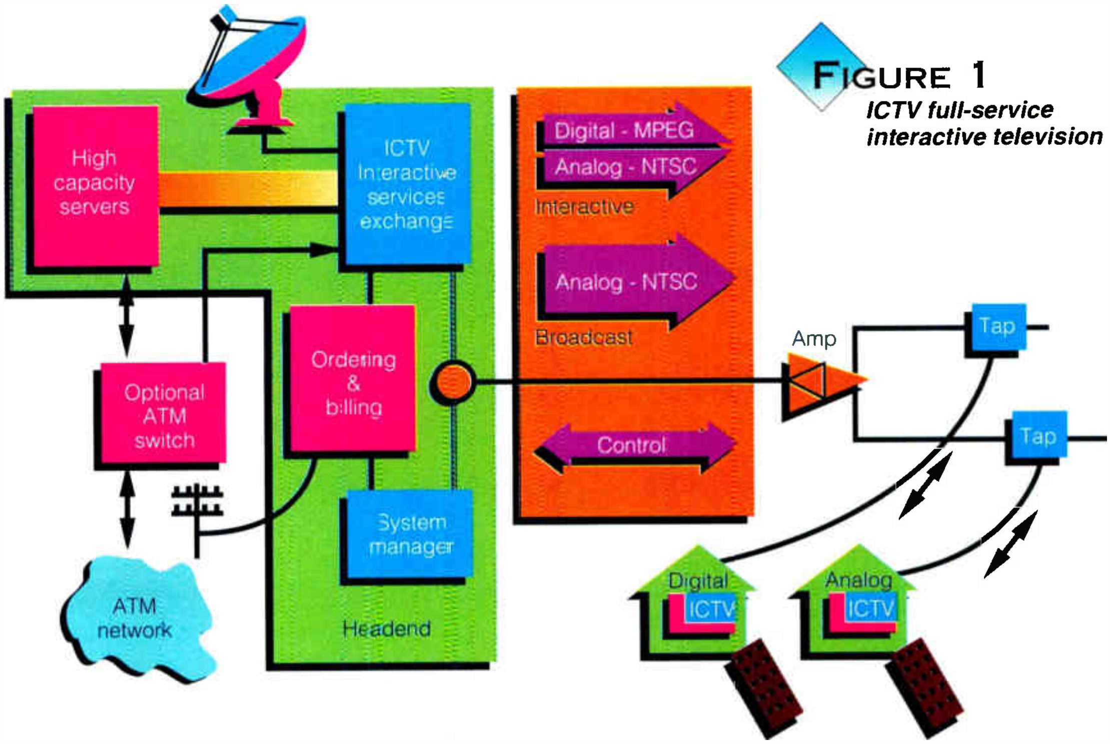

FIGURE 1
ICTV full-service interactive television

News analysis

What's driving interactive multimedia?

By Gary Kim

Necessity, as much as opportunity, is driving the computer, consumer electronics, cable TV and telephone industries headlong into a world of interactive, multimedia everything, aimed squarely at the home environment and consumer.

Consider where several major industries now stand–all at a crossroads of sorts. The consumer electronics industry has nearly exhausted the sales potential of every hot consumer innovation of the past 20 years. That's despite the fact that the U.S. market still represents about $40 billion in annual sales.

But price competition always is fierce when product lines mature, markets are saturated, and opportunities for true differentiation are scant. That appears to be very much the case now for product lines including: color televisions, videocassette recorders, audiocassette recorders, stereo receivers and tape decks, even camcorders and compact disc players. There is, in short, no "hot" new item to pull masses of consumers into stores.

Taking a beating

Consumer electronics profit margins, as a direct result, are taking one heck of a beating. Things aren't any better in the personal computer industry, where it seems nobody's making much money aside from Microsoft Corp. and Intel Corp.

Defining precisely what the markets are isn't so easy. But as a crude description, it's the hope of a whole new era of consumer electronics, harnessing the microprocessor to create new services and products for the mass market. The objective: allow customer access to any type of video, image, text, audio, voice or document communications at any time, from anywhere, to anywhere. OK, it's more a concept than a market. But that's not stopping anybody from chasing it.

Whatever the carrot of multimedia and personal digital electronics, the stick of severe price competition and mature product lines is whipping industry players without mercy. Having exhausted the potential of 1980s product lines, executives in both the consumer electronics and computer industries need no additional motivation to seek, and stimulate, mass consumer demand for hot new products. And make no mistake: interactive, multimedia, personal and digital are the four hottest adjectives personnel in each industry now

Something really new and different is needed to ignite another round of financial growth.

can utter.

At the same time, take a look at the cable TV industry. It's nearing 70 percent basic penetration, premium services are under pressure, rate re-regulation is back, and competition is barreling straight at it, on a collision course. No less than the consumer electronics and PC industries, cable needs something new to ignite a long growth spree.

In the telephone industry things aren't much better, either. Access line growth is in the low single digits, with no prospects of change. To make more money, usage of the network and its capabilities has to increase. Hence the drive to broadband, visual and more-intelligent services. If the total number of access lines can't be increased, then telcos must increase consumption of services by stimulating an appetite for new applications.

The long and short of it is that a number of large, important industries have simultaneously arrived at a significant fork in the road. All need something really new and different to ignite another round of financial growth.

The new fusion

Recent evidence for such a view comes from the summer Consumer Electronics Show and the National Cable Television Association convention, both held early in June. Though held a few thousand miles apart, both were remarkably close as harbingers of the new age of interactive, multimedia everything, integrated with new methods of network delivery.

Vince Carriero, Cablevision Systems Corp. management information systems vice president, for example, pointed out that CSC now is using asynchronous transfer mode (ATM) to switch traffic for its competitive access and medical applications customers at Stonybrook University and Brookhaven Laboratories. ATM also may play a key role for video storage facilities of the future, said Tom Staniec, NewChannels Corp. engineering vice president.

Time Warner Cable Senior Vice President, Management Information Systems Ed McCarthy reiterated his firm's position that the "Full Service Network" would embody a transaction-based, retail model completely unlike anything available today. "We cannot use our existing customer service rep model," McCarthy argued. Instead, the customer must have the ability to fulfill his or her own order, in real time, and have the sense that they are "driving the transaction," McCarthy said.

At NCTA, meanwhile, loaned executives from both Tele-Communications Inc. and Time-Warner Cable gushed about the prospects for the Sega Channel, the joint venture between the cable giants and Sega Entertainment Inc. The Sega Channel, expected to launch sometime this fall on a limited basis, will allow cable delivery of some 30 to 50 videogames a month to standard Genesis gameplayers outfitted with a special cable-supplied cartridge. As was the hope during the early 1980s, videogames may be the Trojan Horse to populate large numbers of homes with powerful 16-bit and 32-bit processors. Those friendly computing devices also could serve as digital terminals for other applications as well. The twin videogame giants also dominated the floor at CES.

Also at CES, AT&T revealed it would license 3DO technology and offer a telecommunications-capable version of the 3DO "Interactive Multiplayer," the multi-purpose entertainment appliance expected to ship in October. Presumably, that deal would allow developers to add new voice and data capabilities to the video and audio features of the unit, creating new opportunities for multi-player games conceptually similar to those that would be enabled by the AT&T-supplied Sega telecommunications unit. The foray

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❷ **Please check the category that best describes your firm's primary business.** (please check only one)

- ☐ 1a. Independent Cable TV System
- ☐ 1b. MSO (two or more Cable TV Systems)
- ☐ 2. Cable TV Contractor
- ☐ 3. Cable TV Program Network
- ☐ 4. SMATV or DBS Operator
- ☐ 5. MDS, STV, or LPTV Operator
- ☐ 6a. Microwave Company
- ☐ 6b. Local Telephone Co.
- ☐ 6c. Regional Bell Operating Co.
- ☐ 6d. Long Distance Telephone Co.
- ☐ 6e. Cellular Telephone Co.
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- ☐ 8. Cable TV Component Mfg.
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- ☐ 10. Financial Institution, Broker or Consultant
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- ☐ 12. Program Producer, Distributor, Syndicator
- ☐ 13. Advertising agency
- ☐ 14. Educational TV Station, School or Library
- ☐ 15. Telecommunications Consulting Firm
- ☐ 16. Local Area Network End-User
- ☐ 17. Local Area Network Equipment/ Services Supplier
- ☐ 20. Satellite Communications Services/ Common Carrier Firm
- ☐ 21. Telephone Equipment Mfg/Distributor
- ☐ 18. Others Allied to the field ________ (please specify)

❸ **Are you a member of SCTE?** ☐ Yes ☐ No.

❹ **In the performance of your job, check the product categories you authorize, specify or purchase.** (check all that apply)

- ☐ a. Subscriber Equipment
- ☐ b. Fiber Optic Equipment
- ☐ c. Test Equipment
- ☐ d. Distribution Eqmt
- ☐ e. Headend Equipment
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- ☐ g. Other ________

❺ **What is the approximate dollar value of the annual budget you are responsible for?**

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- ☐ c. 250,000 - 500,000
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191	192	193	194	195	196	197	198	199	200

means AT&T will be supporting both a popular 16-bit platform (the Genesis player) as well as a promising 32-bit machine (The 3DO unit).

What next? A cable decoder interface to 3DO, possibly. And why not. Jerrold Communications already is planning to put Intel 386 microprocessors (32-bit micros) and Microsoft Corp. software into its decoders.

Separately, Scientific-Atlanta, Kaleida Labs Inc. and Motorola Inc. have announced they will develop interactive, multimedia software using the Kaleida-developed "ScriptX" object-oriented programming language and operating system.

Video servers

At NCTA, the video-on-demand system concepts shown also suggested the degree to which cable technologists will be scrambling even faster to master the intricacies of client-server computing architectures and other arcana once the province of information systems professionals alone.

"I think I'm probably doing the same thing everybody else is," said Staniec. "I'm trying to figure out what they're (video server vendors) doing. If people don't understand it, it looks like CATV (technologists) now need to start subscribing to PC magazines." Among the items expected to occupy much attention are video server systems used to store and retrieve compressed digital video.

ICTV, the interactive system provider, demonstrated its hardware and software platform, based on the IBM ES/9000 client-server computing architecture and digital video servers. ICTV showed a system that can manage 3,000 to 5,000 simultaneous movie streams, store 10,000 to 20,000 movies, and serve 3,000 to 5,000 users. "Any person can access a copy, control it independently, with immediate response time," said Barry Willner, IBM Research project manager for large scale multimedia systems. To economically cope with varied levels of customer demand, the ICTV system uses a hierarchy of storage media and retrieval methods, said Willner.

Movies in strongest demand might be stored in semiconductor (active) memory. Disk storage might be used for other material in less-frequent demand. Some material, of archival nature, might even be stored on tape. "But the first three minutes would be stored on disk, allowing instantaneous access while the tape is queued up," said Willner. So the most popular movies might be stored in semiconductor memory, to allow the most-rapid access and retrieval. The next 50 to 100 most-popular titles might be stored on disk. Other infrequently-requested movies in the library would be kept on tape, with the first two to five minutes of each kept on disk. The system uses 200 independent 200-megabit-per-second channels to shunt video around.

The Silicon Graphics video server also shown at NCTA, "stores 32 hours worth of uncompressed video and supports up to 1,500 interactive video channels," said company officials.

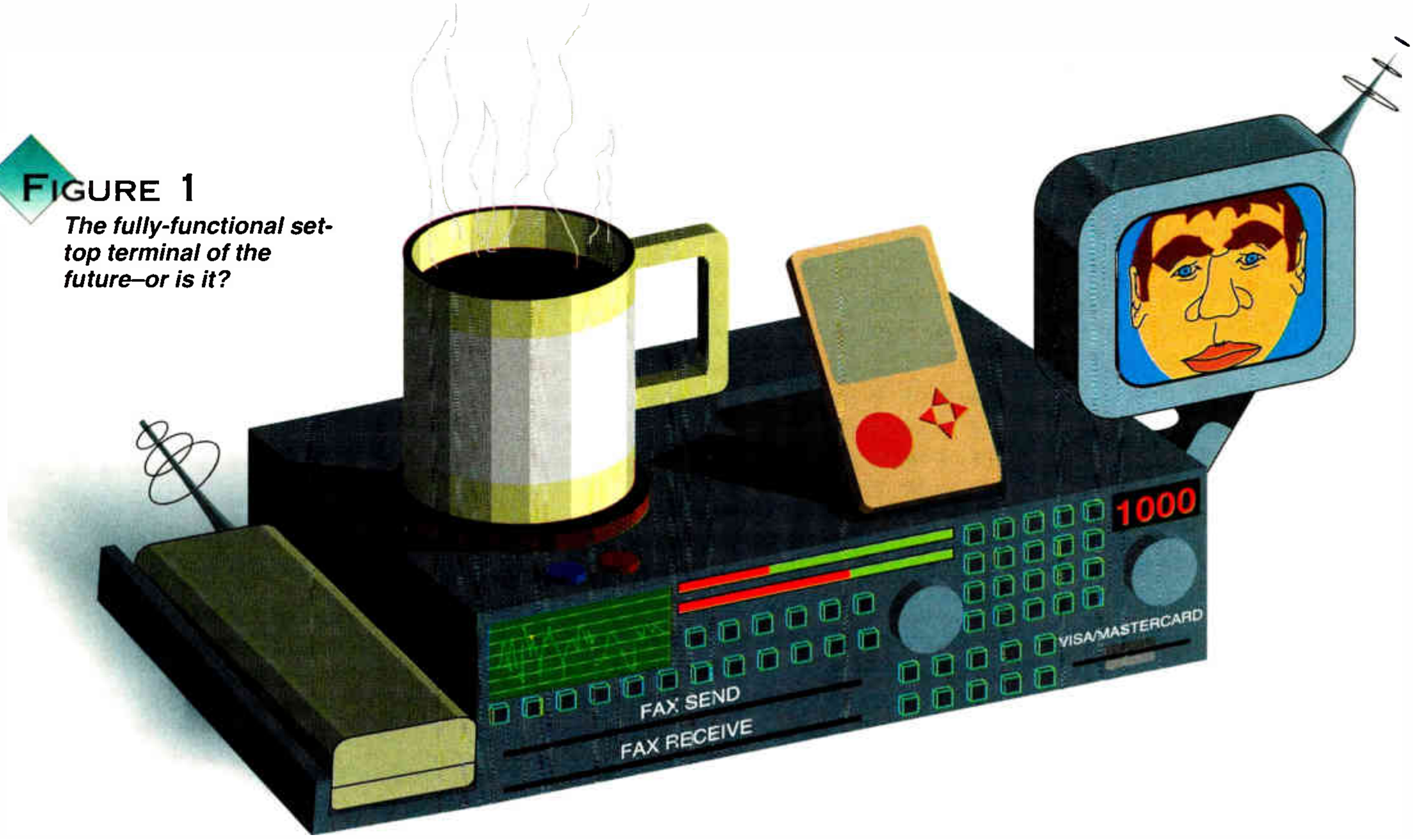
Its "Challenge XL" server, shown in San Francisco, features two to 36 processors, 16 gigabytes worth of memory and one to four output channels, each capable of supporting 320 megabyte-per-second file transfers. Internal disk storage ranges up to 32 Gbytes, while up to 960 Gbytes can be stored on external disks.

AT&T's video server will be "available next year," according to AT&T Manager, New Video Businesses John Connelly. Viacom Cable plans to use the AT&T video server for its video-on-demand trials in Castro Valley, Calif.

At the same time, cablers are going to start encountering Unix-based, distributed, relational databases such as Oracle, Sybase and Informix systems that have been mainstays of telecommunications industry databases in the past. CED

FIGURE 1

The fully-functional set-top terminal of the future–or is it?



Set-tops: Gateways to interactivity

More flavors coming

By Roger Brown, CED

Remember when Tele-Communications Inc. refused to buy descrambling set-top convertors because they were inherently unfriendly to TVs and VCRs? Now John Malone wants one in every home, school and business. He's already ordered 1 million new digital set-tops for roll-out in the middle of next year and he told the audience at the NCTA convention in June that this new device will be the "enabler" of two-way interactivity between the headend and the viewer.

The difference is, of course, that set-tops are growing up. Initially, they were designed to simply convert a range of frequencies the television could not receive into a frequency it could receive. But now, as computer memory and microprocessors have come way down the cost curve, every major cable operator plans to utilize the subscriber terminal as a method to enable a range of new services. The upshot is that cable operators will have a greater selection of set-tops from which to choose and they'll definitely be paying more for them.

Already, the way set-tops are designed and built is changing. Operators like TCI and Time Warner are asking set-top manufacturers to integrate capabilities created by non-traditional partners. Consequently, Toshiba, Kaleida, Silicon Graphics, Intel and Microsoft, among others, are helping develop the next generation cable box.

It doesn't stop there. TCI is reportedly working with a Silicon Valley start-up company to develop what's been dubbed a "Cray on a tray," or the equivalent of a supercomputer in a set-top device.

How they'll roll out

Initially, the new terminals will be used by operators to roll out a movie service that can be ordered "on-demand" by subscribers (as in the case of Time Warner's Full Service Network in Orlando) or offered at specific staggered starting times. A digital box is necessary to decode the movies that are digitally compressed for transmission via satellite to operators.

What gets operators excited, however, is the additional functionality that can be built on top of the digital platform. General Instrument and Scientific-Atlanta, working with Intel and Microsoft and Motorola and Kaleida Labs, respectively, have developed a laundry list of optional items that can be added or deleted according to operators' demands.

But clearly, these new set-tops will be powerful. According to Dan Moloney, director of product management at Jerrold-General Instrument, DigiCable boxes will house an Intel 386 processor which has been "optimized" to run at 486 speeds.

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This optimization involves some additional circuitry that allows some functions to be performed "outside" the processor, thereby speeding it up.

Scientific-Atlanta's 8600X

In actuality, GI is developing two different devices for TCI. S-A, by virtue of winning the contract to supply boxes to Time Warner for the Orlando project, is designing three new terminals, according to Gary Trimm, president of Scientific-Atlanta's Subscriber Technology Division.

TCI, which initially talked of initially specifying three boxes, now is talking of doing two, according to Bill Nash, who heads TCI's digital compression task force. The low-end device, which will carry a price tag of about $225, according to Hal Krisbergh, president of Jerrold, will still be a "very capable box," he said, with an electronic program guide and access to video games and data services.

The high-end box, which is expected to cost $300 or more, will offer dual-mode reception of General Instrument's DigiCipher II compression system as well as the emerging MPEG-2 standard. Nash said TCI intends to utilize MPEG specs for low data rate programs like movies (1.2 megabits per second) and DigiCipher for live video or sports broadcasts.

The world's most advanced set-top

S-A, which was reportedly close to signing a licensing agreement to build DigiCable boxes, also is building probably the most advanced set-top terminal designed to date for Time Warner. That device will operate at between 50 and 80 MIPS (millions of instructions per second) and is driven by Silicon Graphics' RISC 4000 processor. Trimm says the device will cost significantly more than the high-end box sought by TCI, but expects the cost to drop to the $500 range by 1996 or 1997. To prove his point, Trimm said the new analog box S-A is delivering this summer has a processor similar to the one used in XT-type computers a few years ago, and the whole box costs $125.

Indeed, manufacturers are preparing for a future that will force them to build more flavors of set-tops than ever before. In addition to the new lineup of digital terminals, there will continue to be analog boxes for the foreseeable future, required by operators who haven't rolled out digital services or within digital systems for subscribers who don't need a digital device.

"We certainly expect to build more versions of our set-tops," says Trimm. For example, he already expects to provide devices that interface with 3DO, Kaleida, Windows and other applications.

Moloney says the potential is there to have to design multiple subscriber devices. "We're clearly moving toward an environment where mass customization will become predominant," he says. "Our goal is to figure out how to do that without having 50 different models."

The memory trade-off

Another key to not obsoleting new digital terminals faster than operators can amortize them is to build in enough functionality in the factory to accommodate services planned for the next couple of years. But how can a manufacturer anticipate services that will require infrared blasters, vertical blanking interval receivers, smart cards, game interfaces and other peripherals?

The answer is random access memory. S-A and Jerrold designers are struggling over which functions to "burn in" during production vs. how much free memory can be afforded by operators. Another answer is downloadable software.

"Every (interactive service offering) requires hardware support," notes Trimm. To accommodate anticipated and unanticipated needs, S-A is developing an expandable memory bus and, uniquely, will offer user-installable "cards" to increase memory. Downloadable software with flash memory is also planned. "I've got a lobby full of people every day who want to put things in our convertors."

Moloney is taking a similar approach. Jerrold anticipates that some functions–such as on-screen menus and an electronic program guide to help viewers navigate through the available programming–will be mandatory, while others will become necessary as the market dictates. Otherwise, viewers may have to wait while some applications are loaded into the set-top.

Jerrold's digital set-top

Modularity

As cable moves into the digital age, some argue that now would be a good time to unbundle everything and pursue a modular approach. Dave Fellows of Continental Cable laments the fact there isn't a standard plug-in slot that could be utilized by different service providers to deliver new services to cable subscribers.

Fellows says there is no organized movement in this direction because operators are focusing their efforts on the input to the box, sorting through the wisdom of MPEG, DigiCipher II and 64 QAM. "If that gets nailed down, then I think my fellow operators will realize there's another de facto standard we'd like set."

Others say that's a noble goal, but fraught with additional baggage that tends to drive costs higher.

"It looks good on paper," says Vito Brugliera, VP of marketing and product planning at Zenith Cable Products. "But you need an interface standard to make it work. Without that, you don't get the volumes needed to reduce costs."

Tom Elliot TCI VP of engineering and technology agrees. "The modularity idea is terrific, but right away it introduces some cost issues. If most people are going to use (a particular feature) you're probably better off to build it in."

Pioneer and Zenith

What about Pioneer and Zenith, the other two major manufacturers of set-tops? According to executives at those companies, they too will offer a digital set-top by next year.

"There will be one (Zenith digital box), definitely within a year," says Brugliera. Will it support the MPEG standard or some other de facto standard? "I think they're converging," says Brugliera. Which is going to be a subset of the which is the question. We're part of that process."

Pioneer plans to develop an external device to decompress digital signals and display them on an analog device, says Paul Dempsey, VP of marketing and technology at Pioneer New Media Technologies. An integrated analog unit, based on MPEG standards, will come sometime later, says Dempsey. Will Pioneer license the DigiCipher technology? That's hard to say. Dempsey admits to having spoken with GI once, but downplayed the importance of the discussion.

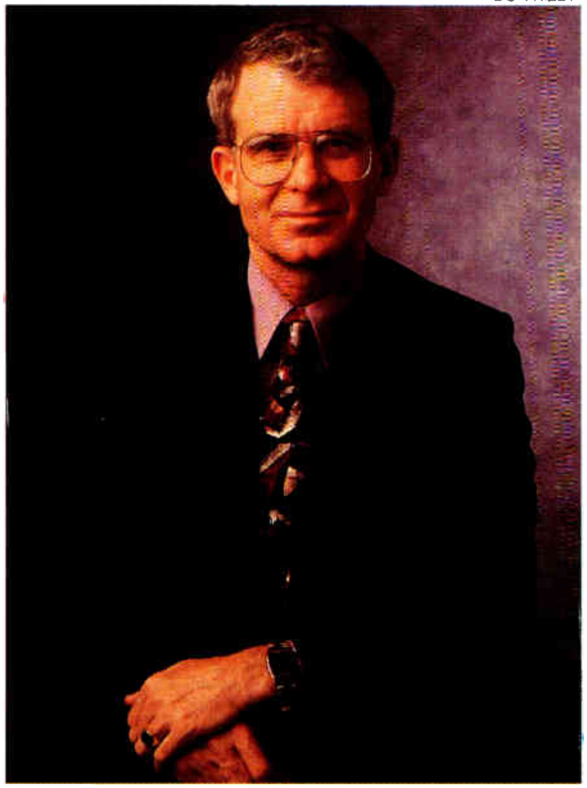
Remote controls

One thing that operators and viewers have to look forward to is simpler remote controls. Because set-tops will have extensive on-screen menuing, there is no need to assign a button on a remote control to every function. But will a remote simply become a wireless mouse? Probably not, according to the manufacturers.

"Remotes will get simpler, but not everyone is a mouse person," says Brugliera, drawing his comments from an extensive background in the consumer electronics industry.

Moloney says remotes are bound to become simpler, but buttons for mute, volume and channel up and down will likely stay. Channel numbers may disappear as viewers become more accustomed to selecting channels by name. CED

DON RILEY



One on one with Tom Elliot

A candid conversation

By Roger Brown, CED

Tom Elliot of TCI was recently elected chairman of the SCTE. This is the edited text of a recent discussion with him.

Q: What was your motivation for becoming SCTE Chairman?

A: I've been committed to SCTE for some time and I feel pretty strongly about the SCTE, its place in the industry and in history.

With all the things going on in our industry and the broadband community internationally, I feel the SCTE needs to be pretty aggressive and forward thinking on how it captures these opportunities. I think the SCTE intends to become the pre-eminent tech society in the broadband community and we need to understand what that means.

A lot of opportunities are positioned right where we are. Training is clearly an area that will be a big opportunity for SCTE and I think the standards area will emerge as a fairly significant issue for the industry and a good opportunity for us.

It's out of a sense of commitment to this industry but also the SCTE that I thought I'd see if I could help.

Q: What is the importance of SCTE in today's changing environment?

A: To people in the technology business, this an exciting time and it gets more exciting day by day. It seems we're witnessing an exponentially increasing rate of technological change in the world. Consequently, a technology-oriented group should be very well positioned to benefit the industry it's involved with.

Anyone can join SCTE. We're an open society and a perfect one to set standards and do training. So I think the SCTE is well positioned to be a big part of this exploding environment we see.

Q: What specific challenges does the SCTE face over the next few years?

A: Most of us who have helped the SCTE move ahead, including the journalists, the vendors and the operators, have always felt our single biggest challenge is to figure out how to sell our story. I think we have done, as shown by the growth of SCTE, quite well at selling that story to our peer groups.

But what we are still struggling with is finding ways to sell this story to the rest of the disciplines in this business. Certainly to management first and foremost but also to the marketing entity, and other disciplines not in the technology chain. We need to understand what their perceptions are of how we can help and fill those needs. If we do a good job of getting in touch with those communities and understand what we can do for them, it will be much easier to sell to them.

Q: Does SCTE have any specific projects underway to do that?

A: We're not underway with any specific projects. First of all, we need to ascertain accurately what the issues are, how to attack and then develop a appropriate program. This year the Board of Directors has on a policy basis asked the staff to spend a lot more time at that and has committed some funds to that. I would also like to solicit input from anybody on that subject.

Q: But haven't non-technical people often avoided technology discussions?

A: I think that's definitely true, for several reasons. It's like the grade school "fear of math" analogy. A lot of people are inately good at math but they're afraid of it, so they never try it. That upfront fear prevents them from going ahead. Also, when you ask a technologist the time, they tell you how to build a watch. You didn't want to know that much. So we damage our own cause. But technologists love this stuff so much that when someone asks us about it we probably tell them what we want to talk about rather than answering the question.

On the other hand, this is cyclic. A few years ago, there were a lot of folks who felt they could go through their career and pretty much stay away from having to understand technology because they didn't feel it would impact them. Now I think that mood is changing a lot. And we can benefit from that.

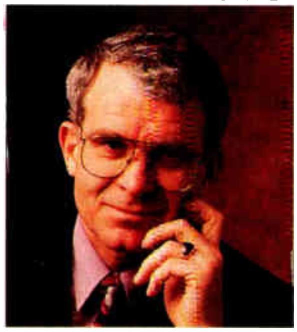
Q: Do you have any specific changes you'd like to make?

A: I don't think so. First of all a year goes by pretty fast. But we need to constantly ask ourselves, "are we doing the right things?" SCTE today is getting to be something we're all quite proud of–well over 10,000 members with a seven-figure budget. I would like to ask, "are the things we're doing now appropriate given where we're trying to go?" That's a tough question. We have to do that every place throughout the SCTE: the way the staff and the board work together; the way the committees work; the way the volunteers are able to help. I'd like to encourage people to constructively critique what's happening and make sure we're doing our best to continue to be successful.

Q: How important is the whole standards process and interindustry cooperation?

A: I think its fundamental. I think a lot of it should be done in an area where we have a voice so we don't just get run over. You've got to remember we're still a pretty small business, comparatively speaking. Many times we get involved with companies that are many times bigger than

DON RILEY



this whole industry. That doesn't mean we ought not be participating in other things–the MPEG process, CCIR process, CCITT process–but when you step in that environment, you have to remember you're in a minority.

There's no question that many of the new services we're looking at are by nature national services and consequently they've got to become interoperable. You've got have some recommended practices or standards so people can afford to make investments.

We need a common ground to meet on to agree on the interfaces and standards, then we can afford to make investments. It's an enabling issue that really cannot be overemphasized. Standards are fundamental enablers so the business community can afford to make investments.

Q: How will cable people have to adapt in a digital, transaction-oriented future and how does the SCTE contribute to that? What advice do you have for a person reading this ?

A: The technology world is on the forefront of a lot of the things we talk about. You hear economists, educators and people who study these trends say they think a young person entering the workforce for the first time will have to change careers five times on average. That means the traditional view of how we prepared for our working life and professional career is probably already obsolete and will become more obsolete as we move forward in time.

Specifically, the educational process will be directly part of the career process and vice versa. You'll see the whole career path change and the concept that you'll continually need to keep yourself current and upgrading your knowledge is going to become the way life is done , particularly in the technical business.

There has to be ways to integrate these two and I think we've tried to recognize that. The whole concept of recertification is that you have to stay current. The training committee is exploring the idea of a career path approach. Currently, the process is organized by subject and people learn everything about a subject and are tested on it. That process may not be entirely in sync with the way people would normally progress through their career.

Q: That's quite a challenge to keep the curriculum up to date.

A: It's a real challenge. I think the answer is in the question; you have to use technology. We've got to find ways to apply this processor-based, memory-driven technology so the process is dynamic. Someday in the future the whole process could be technology based–when you sit down at the screen to take the test, you enter your name and the machine generates the test dynamically. With an electronic-driven process, you can update the test very quickly. This is speculative but in the general sense the answer is quite clear–the technology is largely what is changing and it's also the solution. CED

disciplinary actions.

To minimize these concerns, it is important to clearly and consistently communicate the intent of the field observation program–describing its intent and the actions which can be expected following an observation.

Inviting worker participation and requesting input to improve work practices or help prevent unsafe behaviors should be encouraged, since workers are often the best source of information about the jobs they perform and the changes needed to improve them.

Of course, it is equally important that management consider and/or act on these suggestions by providing feedback to the worker.

To help gain worker support, Continental Insurance recommends advising the worker a few days in advance and setting a specific day to complete the observation. This method should put the worker at ease by explaining the purpose and the observation process, and giving the individual the opportunity to express any specific personal concerns.

According to Steve Bell, operations manager for Triax's Missouri, Tennessee and Arkansas region, "Our workers were initially concerned when we first introduced the field observation program; however once we explained our intent, responded to their concerns and began to consistently implement the program, these concerns were minimized."

Train the supervisors

Supervisors or lead technicians designated to complete these observations need to be trained in the program as well. Key to the program's success is reinforcement that it is not a fault-finding program but that action will need to be taken to correct unsafe behaviors.

Consequences control behavior, says Thomas Krause, Ph.D., president of Behavioral Science Technology Inc. If unsafe behaviors–including dangerous work shortcuts, using defective equipment or tools, not observing safe work practices, failure to wear personal protective equipment, etc.–are not addressed directly with the worker, these types of behavior will likely continue. Similarly, any positive behaviors observed should be encouraged. Quite simply, positive reinforcement enhances continuation of the desired behavior.

Once the observation has been completed and the results discussed, it is important to follow through on any commitments made. If the worker requests training or information on a particular aspect of the job, it must be provided. If equipment is defective, it should be repaired or replaced immediately. Behaviors which require change should be summarized and the workers provided with the guidance, training and education needed to effect these changes. Most importantly, the worker must agree that the observed, unsafe behaviors need to change and commit to change them. A simple handshake is often effective in obtaining this commitment.

A follow-up visit should be scheduled within 60 days to evaluate the progress being made. Again, positive behaviors should be rewarded and immediate direction given to modify unsafe behavior.

The use of an observation checklist (see Figure 1) or other similar form will prove most useful in measuring the effectiveness of safety efforts, as well as ensuring that observations are consistently performed among management ranks. The data obtained from these forms can be collected, tabulated and compared against baseline data to measure behavior improvements in key areas.

This data will also provide "real world" feedback on the extent to which workers adhere to the safety program, as well as measure specific behavior improvement efforts (wearing safety equipment, using defensive driving techniques, etc.).

Field observation provides management with the opportunity to identify, modify and measure worker behavior before an accident occurs. Through this approach, management will be able to act pro-actively to conditions, thus helping prevent losses and, in conjunction with workers and supervisors, contributing to the development and reinforcement of the safety culture of the organization. CED

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Continental Insurance is a major insurance writer for the cable TV industry.

Satellite antenna tracking system

ROCKLIN, Calif.–**Superior Satellite Engineers** has announced its TRAXX-10FGS satellite tracking system for use with fixed satellite antennas. The TRAXX-10FHS enables accurate tracking of non-geostationary satellites with an antenna which otherwise has no capability for motorized operation.

The rack-mounted device is a programmable microcontroller unit which controls a "feedhorn scan" unit by sampling the AGC from the internal beacon receiver. The feedhorn adjusts in both axes to maintain efficiency within 1 dB of peak signal strength, company officials say. The device is intended for use where a satellite antenna must access a single, non-geostationary satellite. It will retrofit to "virtually any" existing parabolic reflector, company officials say.

Circle Reader Service No. 41

Small C-band antennas

BURLINGTON, Iowa–New from Winegard Co. are two smaller satellite antennas as part of the company's QuadStar line. Both

HP's 8146A OTDR has two new modules developed for customers who asked for reduced cost.

New from H-P: OTDR modules

SANTA CLARA, Calif.–**Hewlett-Packard** has introduced two new plug-in modules for its HP 8146A all-haul optical time-domain reflectometer (OTDR) that reduce fiber optic link characterization costs. The new modules–HP 81462SL (for the 1300 nm window) and the HP 81465SL (1300/1550nm)–provide full OTDR capability at a price up to 30 percent less than top-of-the-line modules, HP officials say.

The modules were developed in response to the telecommunication industry's drive to reduce costs during the installation and maintenance of fiber-in-the-loop, fiber-to-the-curb, cable television and long-haul links.

Both the HP 81462SL and HP

81465SL modules feature dynamic ranges of 28 dB and 25 dB (respectively), with a short dead zone for measuring close to the beginning of a link.

Reflective faults can be detected within three meters, and nonreflective faults within 30 meters, company officials say.

HP's 8146A OTDR characterizes fiber links within seconds, via a single keystroke. Link analysis is repeatable; an event table on the unit shows the location of splices, connectors and faults together with the fiber attenuation between events.

Marks can be set automatically or adjusted manually; ghost detection is automatic. Up to five waveforms can be saved within the unit's internal memory. Or, up to 141 waveforms can be saved on an optional built-in floppy disk drive.

A memory-card reader for MS-DOS compatible cards up to 2 MB is also available.

The HP 81462SL module is priced at $10,500 and the HP 81465SL is priced at $16,800.

Circle Reader Service No. 40

antennas were designed for the high-power C-band satellites now in orbit. The 6'3" QD-0360 and the 5'3" QD-0535 antennas include a 0.35 F/D ratio for a narrower beam width (important for satellites spaced within two degrees of each other). The panels are made of rolled, expanded mesh that is smooth and flat with small openings.

Circle Reader Service No. 42

Low-cost "Weather Star"

ATLANTA–The **Weather Channel** has announced a new, low cost version of its addressable "Weather Star" receiving system. Officials with The Weather Channel say that the network has signed an agreement with Wegener Communications to manufacture the receiver, with shipments expected to begin next year.

"For some time, we have been looking for ways to make the Weather Star available to small systems," says Becky Ruthven, VP of affiliate sales and marketing for The Weather Channel. "After extensive R&D, we've developed a solution in terms of product features and cost. Many 0 small systems that want to launch The Weather Channel have not been able to afford the Weather Star; that's about to change."

The Weather Star is part of the propriety patented satellite communications system developed by the Weather Channel for telecasting local, system-specific weather forecasts to cable viewers every five minutes.

The new, low-cost model called the Weather Star Jr. will render forecasts in videotext (instead of the color graphics, animation, local weather radar and other visual effects available with the larger Weather Star 4000). As a result, the scaled-down model will be "significantly less expensive" than the Weather Star 4000, company officials say.

Circle Reader Service No. 43

Digital Multimeter

SAN DIEGO, Calif.–New from **Wavetek Corp.** is its autoranging, four-digit Model 2010 digital multimeter, which features the company's Fault Finder for detecting opens, shorts and intermittents.

It also features a 2 MHz frequency counter, 2000 µF capacitance meter, autoranging relative min/max averaging modes and resistance resolution to 0.01 ohms. Intermittents and other input variations are detected via an audible alert.

The unit is priced at $239. Included in that price: a three-year warranty, 9-volt battery, test leads, and more.

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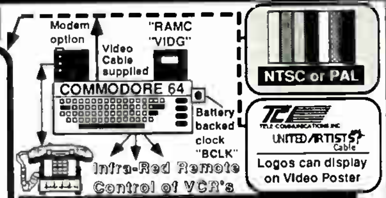

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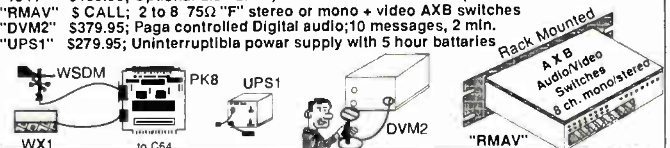

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Questions hung like fog in San Francisco

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

When the FCC adopted the NTSC color TV standards in 1953, RCA distributed nearly 10,000 of its first production model color TV receiver, the CT100, with a retail price of $1,000 (more than $5,600 in 1993 dollars). By 1964, the retail price had plunged to about $450 ($2,200 in today's dollars). Not only was the price still too high, however, but until 1965, even NBC broadcast only part of its program schedule in color while ABC, CBS and the other set manufacturers quietly sat on their hands waiting "until there is enough audience or sponsor demand."

And an engineer in every house?

Furthermore, the early color sets were complex. Ralph Cordiner of General Electric was quoted as saying: "If you have a color set, you've almost got to have an engineer living in the house." George C. Davis, a leading and widely respected consulting engineer, once remarked that color TV was by far the most sophisticated piece of equipment ever to be placed in ordinary households. The public was not adept at simultaneously optimizing the controls for color, hue, brightness, contrast, horizontal/vertical hold, nor even fine tuning. Purple faces and flat-topped heads, often buried in colored snow, were accepted by many as the norm. Worst of all, the adjustments kept drifting. Small wonder that in 10 years, fewer than a million color TV sets had been sold.

Since those primeval times, prices have tumbled to about $500 retail ($90 in 1954 dollars). Complex adjustments have been automated and stabilized. Picture quality close to the NTSC ideal is now commonplace. In fact, picture resolution on a modern 27-inch (or smaller) NTSC TV set is almost indistinguishable from HDTV with comparable picture height. Now, thanks to the magic of transistors and microprocessors, color TV is even more complex and sophisticated, yet with better quality and more reliability, at lower cost than ever before.

Even radio receivers, before television, were complex electronic devices. They used a bunch of vacuum tubes, the more the better according to the advertising. But when they failed, you could pull out all the tubes, test them at the drug store, and restore the defective radio merely by replacing the tubes that tested weak or bad. If the tuning went awry, a repair shop could realign it for much less than the cost of a new one. Now, with all of the complicated circuitry buried deeply in integrated circuit chips, the only cure for a failed radio is euthanasia.

Set-top computers

However, as Al Jolson once said of talking pictures (1927): "You ain't heard nothing yet." The enormous computer power poised to enter our homes by the turn of the century dwarfs anything presently available. Hundreds of thousands, maybe millions of microscopic transistors and diodes will be packed away in tiny chips hiding in set-top boxes, or "point of entry terminals (POET)" to implement the profusion of tantalizing services we didn't even know we wanted.

Two questions hung like a gathering fog over the exhibit floor at the Moscone Convention Center in June in San Francisco, enshrouding the glorious view of tomorrow's technology with disquieting apprehension. Will the unprecedented complexity of the man-machine interface be any more congenial to the user than present-day VCRs, which tend to be beyond the ability (or patience) of most people to use for any purpose except playing movie cassettes?

Moreover, will the vaunted interactive and transactional services find a mass market with high penetration rates and consumer friendly prices, or will it have to prosper in small specialty markets, priced for low penetration? In other words, who will pay for the high tech services, and how much will they pay?

A warning and a promise

Color TV experience offers both a warning and a promise. New technology will only be widely accepted when the price and operational simplicity match the perceived benefits. As these mutually interlinked criteria begin to coalesce into a critical mass, prices will plunge, devices will be made easier to operate, and public demand could snowball.

However, the risk is ever present that new technology may be offered before the public can manage it. Modern VCRs, for example, offer a wide range of useful functions. But most adults have to call on the kids just to reset the clock, let alone program delayed recording sessions. Too much new technology, offered to create public demand rather than to satisfy acknowledged needs, may lead to public indigestion. It takes time for the public to recognize the value of new technology. The learning curve is apt to stretch way out if the operations required are unfamiliar, and motivation is weak.

> **New technology will only be widely accepted when the price and operational simplicity match perceived benefits.**

A patient investment strategy is likely to be an important key to survival. CED

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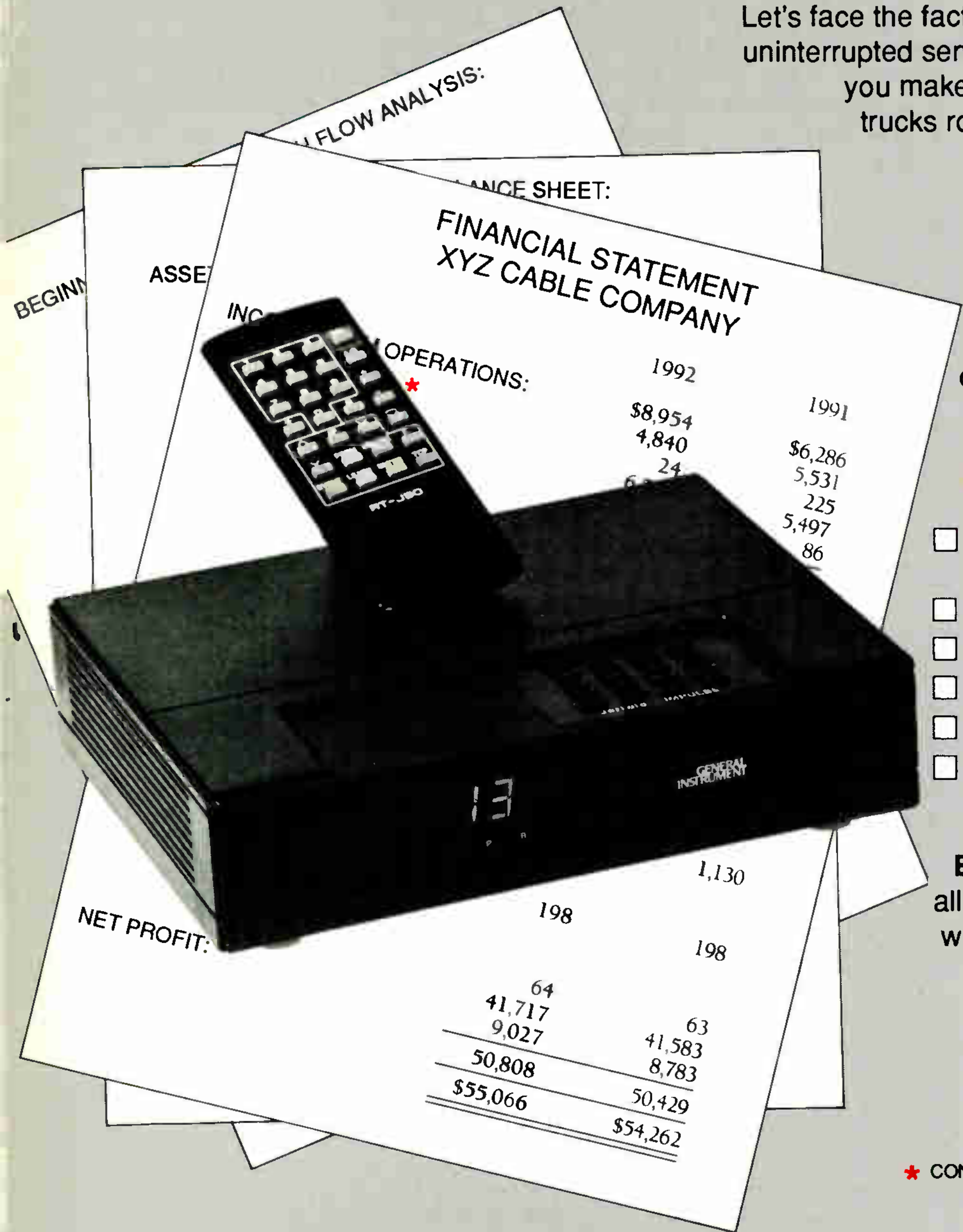

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