BME

FOR TECHNICAL AND ENGINEERING MANAGEMENT

AN ACT III PUBLICATION

JULY 1969
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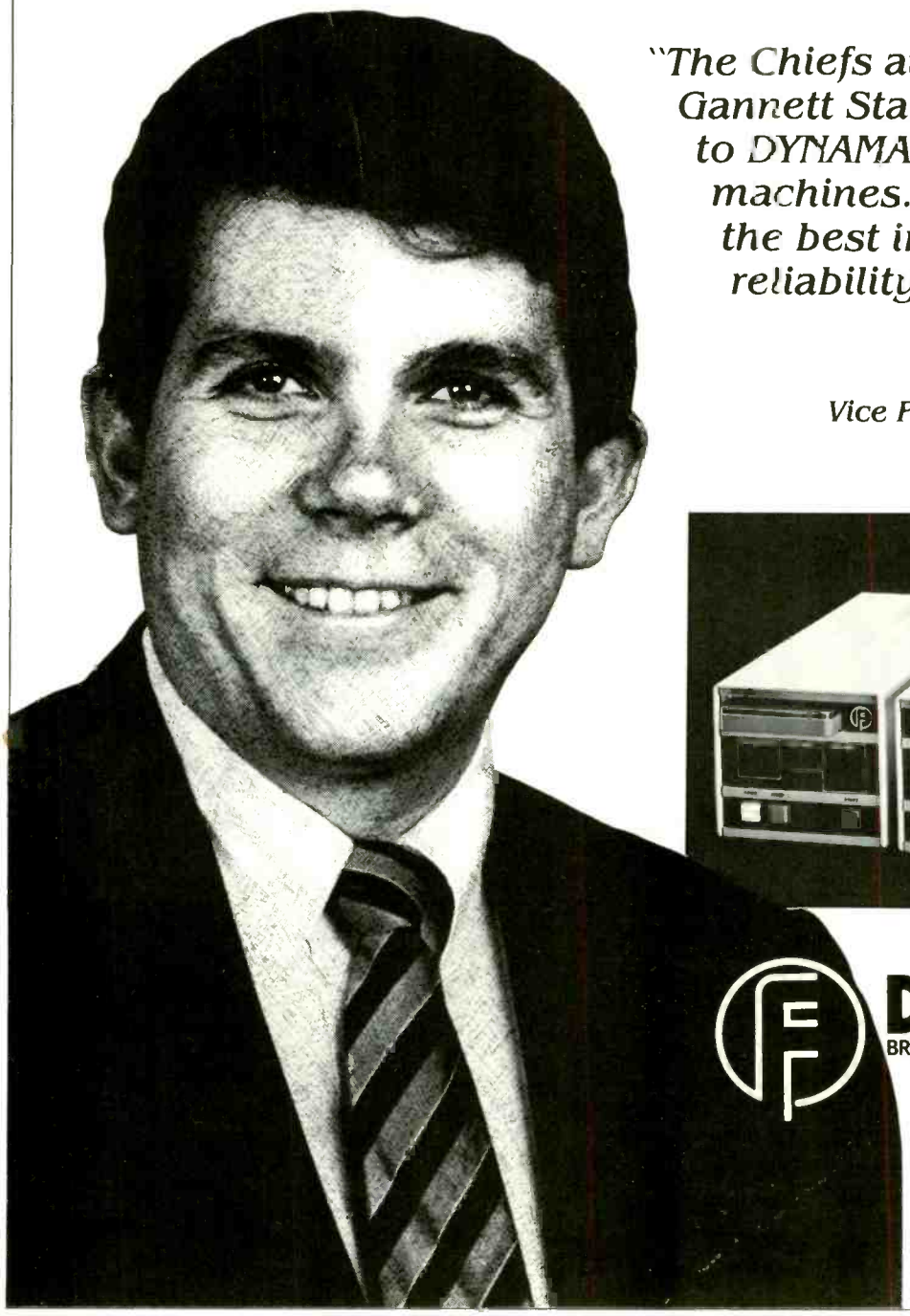

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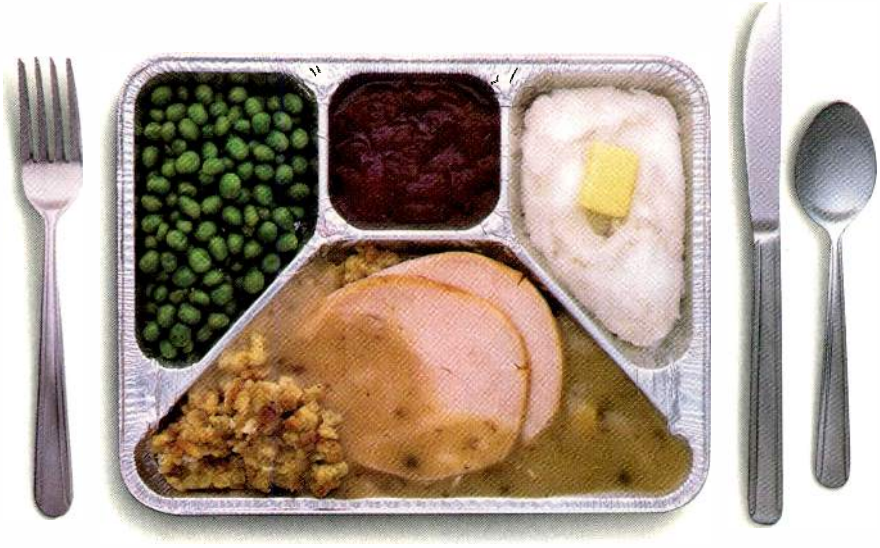

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One of these revolutio the world looks at TV w

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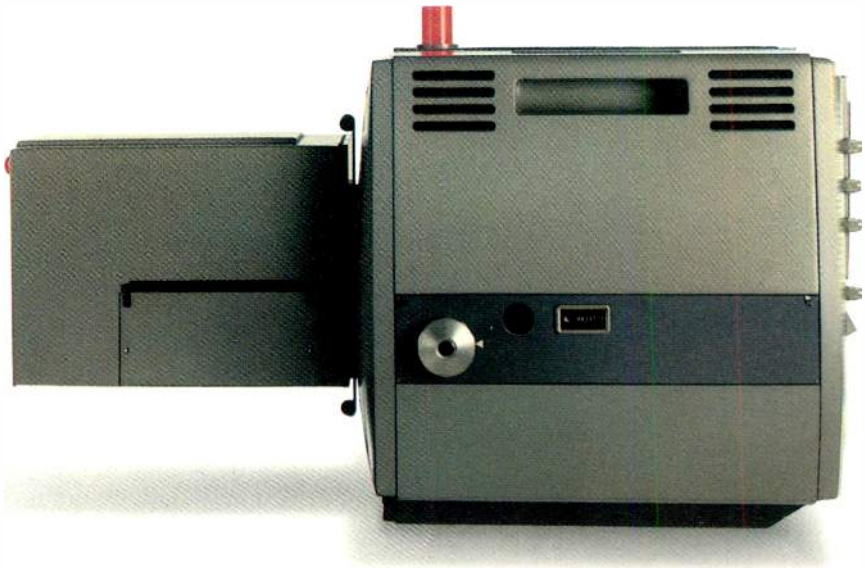

Plumbicon Tube Camera

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switchers, videotape recorders and graphics equipment are among the best-engineered, highest quality and most reliable in the world. Our work in High Definition and CCD products is pacing an industry which faces the most sweeping technological advances since its beginning.

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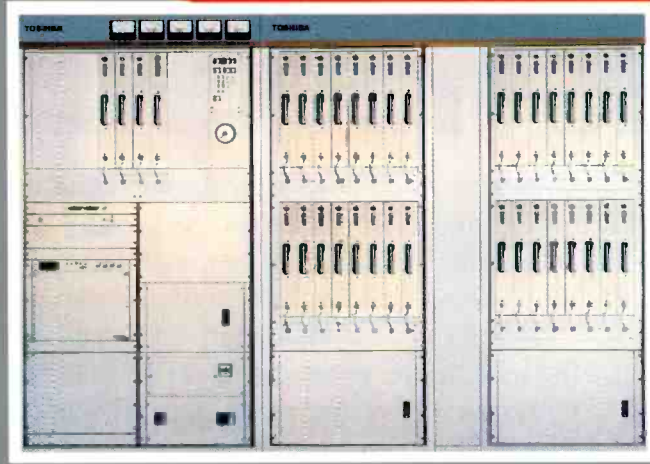

32KW 2000 Series VHF TRANSMITTER

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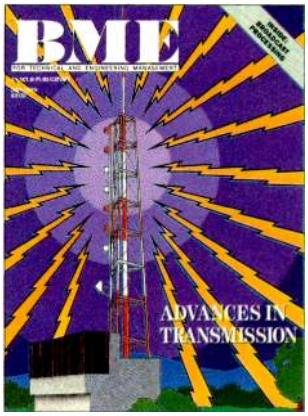

On the cover:
Cover illustration by Tom Cushwa. Black lineart created on the Macintosh II, with airbrush for color.

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BME
FOR TECHNICAL AND ENGINEERING MANAGEMENT

JULY 1989
VOL. 25, NO. 7

Features

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Columns & Departments

19 *Rupert Neve*

More and more people are lining up for the Panasonic SVHS Pro Series.

One look is all it takes. And you'll see why more and more people are lining up for the Panasonic® SVHS Pro Series. Because anyone in the market for a high-quality professional video production system, simply can't afford not to look at what the Pro Series can do for them.

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Panasonic
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VIEWPOINT

The recent spate of mergers and acquisitions bears close watching.

If the current of industry consolidation continues to its logical conclusion, life will be considerably easier for broadcast-industry journalists. We'll only have to go to three press conferences a year, and NAB will shrink to a manageable weekend task. For the rest of the industry, however, the recent spate of systems manufacturers buying each other—and, in some cases, buying their customers—may not suggest such a rosy future.

In a number of ways, the consolidation trend we're seeing is an inevitable part of the industry's maturation process. With its fiftieth birthday recently passed, television is no longer a spring chicken, and radio predates it by several decades. Spectrum availability limits the number of potential stations and hence the size of the industry; this, coupled with increased competition from newer distribution media such as cable and satellite television, is making television as tough a sell for industry manufacturers as radio ever was. New managements in both services are looking more closely than ever at the bottom line.

No wonder, then, that consolidation is such an attractive option to industry suppliers. But what of its effects on end users? Diversity of ownership is supposed to accomplish the same basic goal in any field: to provide competition, which in turn creates genuine marketplace choices. We're now seeing what may be the beginning of a trend toward diversified, vertically integrated mega-companies. Consolidation can have beneficial effects, allowing manufacturers to achieve economies of scale and giving companies the physical and economic means to pursue large-scale R&D. But it can limit choices, and may also squeeze out the smaller, entrepreneurial companies.

To cite a notable recent acquisition, the merger of Carlton and UEI has brought under one roof Quantel, Abekas, Solid State Logic, and the Technicolor film duplicating facility, along with graphics and production houses that include UK-based Cambridge Computer Graphics, New York-based Post Perfect, the Unitel chain, and Windsor Video. In such an alignment, the possibilities for abuse and restraint of trade are many. The effect could be chilling if Carlton-UEI's production houses are given an unfair (to others and sometimes to themselves) "first crack" at the latest new equipment in a market in which the replacement cycle is only three years.

We trust Carlton-UEI will behave honorably, as they have in the past, and continue to allow each of their owned companies to operate independently in an open marketplace. We hope other newly merged companies will follow their example. Large companies as well as small can bring needed innovation and diversity, and both contribute to a healthy broadcast environment. ■

Eva J. Blinder

Eva J. Blinder
Editor

How Good is Our 3rd Generation? Take a Look at Our 5th!

PERFORMANCE DATA (AG-7500A)

	1st Generation	3rd Generation		5th Generation
		w/o TBC	w/TBC-200	w/TBC-200
Horizontal Resolution (Color Mode)	400	370	360	350
S/N Ratio (dB)				
Luminance (Color Mode)	57.2	51.7	52.0	49.0
Chrominance (AM)	51.8	47.5	51.4	44.5
Chrominance (PM)	44.3	40.1	43.8	35.2

Data represents measurements by independent engineering evaluation. VCRs taken at random from inventory.

- Signal Source: Shibasoku TG-7/1
  Luminance: 50 IRE flat field w/burst
  Chroma: 50 IRE w/100 IRE p-p
  Resolution: Monoscope Shibasoku 58A-1
- Noise Meter:
  Y-S/N: Rohde & Schwarz UPSF2/UPSF2E2 200 kHz HPF, subcarrier trap on 4.2 MHz, LPF, weighted
  C-S/N: 100 Hz HPF 500 kHz LPF, unweighted

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Our TBC-200 time base corrector has a 16-line correction window, chroma plus/enhancement, chroma noise reduction and no-roll circuitry. To make multi-generation recordings even better.

The UTP-1 signal transcoder is more than ready to transcode virtually any component signal into any other component signal. Saving you an extra generation.

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Toggle switches allow selection of A-type, no processing, or SR.

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Dolby

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UPDATE

DARPA Funds ATV Display R&D ... Electric Sound from Fairlight Ashes ... Carlton Buys UEI: Industry Trend? ... Ultimatte Honors Production Houses NAB Nixes Proposed RF Ordinance ... Sony Opens U.S. R&D Facility

DARPA Funds ATV Display R&D

The Defense Advanced Research Projects Agency (DARPA) has named five companies that will receive funding to develop high definition television display technology, according to a report published at press time in the *New York Times*. In addition to its stated intention to provide a "shot in the arm" for America's languishing semiconductor and related high-technology industries, DARPA is interested in military applications for HDTV video and computer-screen technology.

Contractors selected to develop projection display technology include Newco Inc. of San Jose, CA; Raychem Corp. of Menlo Park, CA; Texas Instruments of Dallas; and Projectavision of New York. Photonics Technology, Inc. of Northwood, OH, will work on plasma flat-panel display technology which can produce HDTV images of different sizes on a screen or directly on a wall.

Amounts of various grants were not released, although DARPA is known to have earmarked "at least" $15 million for two HDTV development projects. The Pentagon unit is also working on plans to fund research into HDTV receiver technology.

Finally, no announcement has been made to date whether DARPA will fund Zenith Electronic Corp.'s widely publicized request to help develop its "flat tension mask" computer display technology for HDTV use.

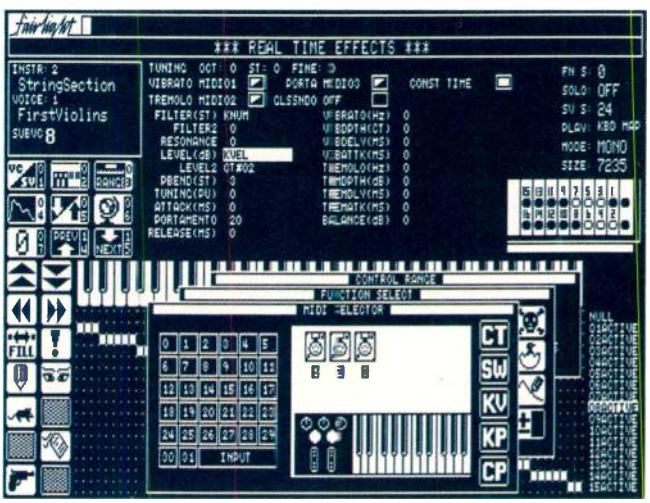
At the same time Italian company Euphon International srl of Torino has announced production of a 30-minute HDTV video. Made for Cine Fiat, the video was shown recently in Madrid on a 150-inch screen to launch Fiat's new Lancia Dedra car. The project took six weeks to produce plus 10 days of work in post-production including chromakey, motion control and an adapted Quantel Paintbox, according to Euphon. Euphon produced in the 1125/60 HDTV standard, which Italian broadcast network RAI uses as a production standard. NHK in Japan recently announced it will transmit 1125/60 HDTV programming one hour per day for tests.

In related news, Joel Chaseman, chairman of the Association of Maximum Service Telecasters (MST), recently testified before the House Committee on Science, Space and Technology's Subcommittee on International Scientific Cooperation. Congress should "focus on our free and universal local broadcast system as an integral part of the big HDTV picture" and work to develop a single broadcast transmission standard, Chaseman said. Further, Congress should help reserve UHF and VHF television bands for local-station HDTV. ■

Electric Sound From Fairlight Ashes

As reported in *BME* in April, original founders Kim Ryrie and Peter Vogel have purchased the assets of Australian-based Fairlight Instruments Pty and formed a new company headquartered in Sydney, Australia. Called Electric Sound and Picture, the new company acquired Fairlight's intellectual property, trademarks, designs, software, patents, company stock and "work in progress."

Fairlight collapsed suddenly last December following failure to obtain additional funding from the government-sponsored venture capital group backing the company. Following the Western Pacific financial group's withdrawal, the MIC funding program took the largest write-off in the history of Australian venture capital financing, sources said.



Fairlight Instruments' digital audio workstation display.

UPDATE

In the U.S., interim sales office functions will be undertaken by former user support executive Andrew Brent while Electric Sound seeks North American distribution. Brent has also set up a separate company to service existing Fairlight equipment and other professional digital products throughout the U.S., Canada and Mexico. Called the Digital Support Group, the company offers service contracts for Fairlight Series III equipment; service programs for Fairlight Series 2X and Series I and CVI video equipment will be available shortly. Nearly three-quarters of current Fairlight owners have bought contracts, Brent says. "The equipment isn't temperamental," said Brent, "but when you're down, you're down, and a lot of money is involved." Contact the Digital Support Group at (213) 460-4884. ■

SMA president Mike Morrissey (L) and vice president Dave Satin (R) accept award for Ultimatte compositing.

Ultimatte Honors Production Houses

Video compositing company Ultimatte kicked off its international achievement awards program with a ceremony at the NAB. Five production houses and one TV network snared honors for excellence using Ultimatte equipment.

New York FX house SMA Video was honored for its work compositing TV commercials. SMA chose camera angles to produce a seamless Ultimatte composite rather than employing ADO multilayering or visual devices, SMA vice president Dave Satin said of its award-winning spot for Toshiba. The effect was created at Manhattan Transfer using frame-by-frame negative-to-tape transfer via a Rank and Steadigate onto an Abekas A-62 DDR. The results were composited in post. ■

Carlton Buys UEI: Industry Trend?

Merger and acquisition marriages brokered by financial wizards are joining the trend toward integrated hardware systems recently spotted at the NAB. The latest players include U.K.-based television and video consortia Carlton Communications and UEI, which is itself currently taking over the New York-headquartered Unitel post-production chain. Carlton agreed in late May to acquire UEI for about $805 million.

Combined net worth of the two companies would be about $2 billion, industry sources say, giving it enormous vertically integrated clout in the TV facilities, manufacturing and post-production industries. The new firm will own both Quantel and Abekas, formerly direct competitors in the video effects and graphics industry, plus—through an acquisition by Carlton last year—the Technicolor video duplication and film processing facility. Carlton will also own UEI's Solid State Logic (SSL), a power in the audio and audio-for-video fields, and British graphic arts company Cambridge Computer Graphics, which it recently bought.

Implications for producers, directors and the production and post-production facilities market are extensive, although corporate spokespeople assert each company will operate independently. Reaction from the facilities market is positive, though wary. "The only way they'll succeed is to allow each operation to retain its own policies and identity," one industry vet told *BME*, citing Carlton's reputation for allowing Abekas to maintain a consistent pricing policy as one reason for the success of both ventures.

Carlton currently owns the Moving Picture Company, TVI and Carlton Television in London, Post Perfect in New York City and Complete Post in Los Angeles. UEI is expected to complete acquisition of the majority share of the Unitel chain as well as New York-based independent Windsor Video shortly.

In related merger and acquisition news, a new California company, Quad Eight Electronics, Inc., has purchased the assets, goodwill, engineering and manufacturing facilities of the Quad Eight audio mixing console operation of the Mitsubishi Pro Audio Group. Operation, support and development of Mitsubishi Pro Audio's digital equipment was recently taken over by Neve North America, a Siemens Group company headquartered in Bethel, CT.

Quad Eight will continue to manufacture its Westar console under the Virtuoso name plus its FilmStar film re-recording console, according to new president Bill Windsor. The company has assumed all warranty and non-warranty service obligations for Quad Eight/Westrex consoles in North America and the Far East.

In addition, music television production syndicators M&M Syndications of Voorhees, NJ has bought internationally regarded

Sigma Sound Studios of New York City. In addition to concentrating on core audio recording business, the studio will also develop audio-for-video capability, according to M&M president Michelle Pryne. M&M also owns New Jersey video facility Edit Masters.

Finally, IDB Communications Group of Los Angeles continues on its acquisition binge. The satellite transmission services company announced in June that it is buying CICI, Inc., the international services division of Contel ASC. Formerly a subsidiary of Communications Satellite Corp. (COMSAT), CICI provides international transmission services for the data/voice and television market. Cash price for the deal is approximately $21 million.

The acquisition makes IDB the single largest supplier of international television transmission and INTELSAT business services, according to IDB chief executive officer Jeffrey Sudikoff. A recent COMSAT study concluded IDB plus CICI will provide more international television and leased data services via IBS than any U.S. carrier including AT&T and MCI.

IDB recently purchased U.S. TV programming satellite transmission provider Hughes Television Network (HTN), amidst predictions of consolidation in the satellite services industry. Initially established to provide radio services, the company now owns and operates 14 earth stations in Staten Island, NY, and Los Angeles. ■

Harry Taxin

Sony Opens U.S. R&D Facility

Sony Corp. inaugurated a U.S. research and development outpost for high definition television on May 3, 1989 in San Jose, CA. The newly renamed Advanced Video Technology Center will conduct R&D in HDTV, leading to eventual manufacture in the U.S., according to Harry Taxin, president, Sony Techology and Engineering Operation. Other Sony R&D centers outside of Japan are in Australia and England.

In an interview after the inauguration ceremony, Taxin stressed Sony's commitment to its U.S. operation. Sony Corp. of America currently employs more than 7500 people in the U.S., and the current expansion is expected to create additional jobs.

The Advanced Video Technology Center (AVTC) is an expansion of the Sony Video Technology Center, founded in Palo Alto, CA, in 1977. The technology center moved to San Jose earlier this year to provide "a more synergistic relationship with engineering and to expand high definition research and development in the U.S.," according to Taxin. It was renamed the Advanced Video Technology Center to reflect Sony's commitment to making the San Jose facility a top R&D center. Taxin also stated that the center will see "stepped-up activity" now and will double the number of engineers employed there within two years, from 25 to 50. The AVTC will do R&D and develop product prototypes in the areas of graphics/special effects and editing as well as HDTV. Additional applications to meet medical, government, desktop publishing, and other business and industrial needs are foreseen.

Taxin added that the AVTC will provide technical support to a new Sony Southern California venture, the "Hollywood Workshop," scheduled to open in the Los Angeles area in the next few months. Organized by Sony's Advanced Systems Co., the workshop is designed to provide loaner and demonstration HDTV equipment to the 35 mm film production market in Hollywood.—*Christin Hardman* ■

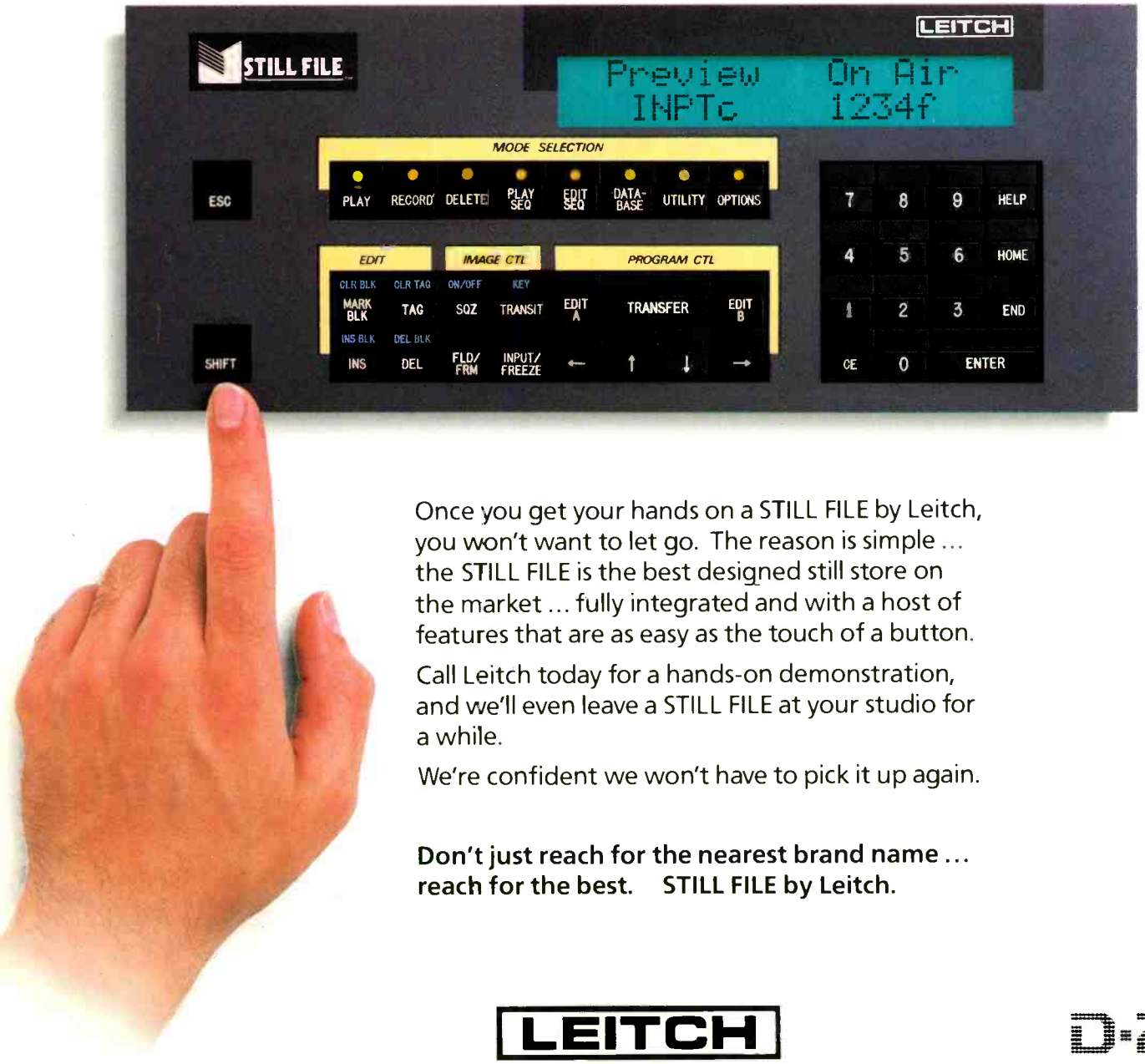
NAB Nixes Proposed RF Ordinance

In news just in, the NAB has asked the city of Seattle, WA, not to adopt a proposed RF radiation ordinance. The Seattle proposal mandates compliance at levels 10 times more stringent than the current American National Standards Institute (ANSI) standard.

"The Seattle proposal is another example of why the EPA should move on the NAB's request to adopt a federal guidance level for RF emission," said NAB regulatory review committee chairman Gary Grossman, explaining Seattle's proposed ordinance was unnecessary.

Broadcasters are already required to comply with FCC regulations based on RF exposure levels which ANSI has established as safe, the NAB said. The Seattle proposal is "inordinately restrictive" and not supported by scientific data, the Association explained, adding that it wouldn't benefit the public any more than existing FCC regulations already do. ■

ONE TOUCH... AND YOU'LL SHIFT TO LEITCH



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CROSSTALK
AN ENGINEERING MANAGEMENT JOURNAL

WLOW Creates 'Paperless' Station ... Rupert Neve Ponders Broadcast Consoles

WLOW Creates 'Paperless' Station

Everyone knows by now that combinations of station automation design and touchscreens can help create "paperless" stations—but WLOW-FM, Hilton Head, NC, has gone one step further. Commercial spot production is recorded as digital audio and integrated into the solid-state station system to do away with carts, and thus with tape.

WLOW-FM's main control room: touch here, please.

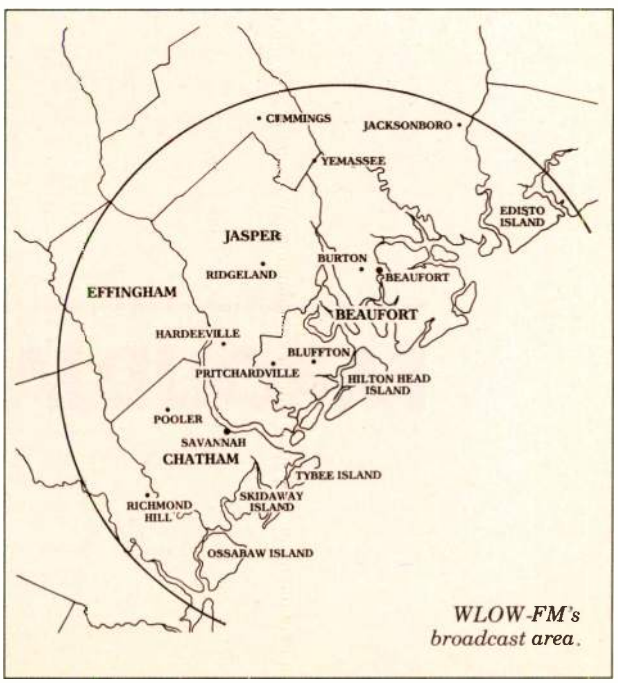
Well, practically. Music is custom-cut for WLOW and played on one of six Otari ARS-1000s, according to proud station consultant and designer Lee Simmons. But the station has expanded on its installation of Media Touch touchscreens to convert the tape output of the Otaris into a full-blown automation system. Operating the "auto" touchscreen function runs the Big Band MOR format station overnight and weekends. "The longest it took any announcer to catch on was one day," said Simmons. "This was easy for everyone."

WLOW's pioneering installation—up and running June 22, 1988—is unique in several ways. First, the station has scrapped the control room control board in favor of a 19-inch touchscreen. Next, the station is the only installation in the U.S. to date that has married a business system (CBSI), a touchscreen control system (Media Touch) and a solid-state sound system (Gentner Digasound), Simmons said.

Equipment for the mixed marriage includes an Acer 386 16 MHz 32-bit computer with a 40 MB hard disk acting as a file server. Novell netware is used on the station's LAN, which is fed from a hub with five Acer 710 input terminals. The total system's operation begins at the CBSI business system, which creates logs and downloads them to the Media Touch system. This function enables the station's traffic department to create and download a log in three minutes. The production department is then notified where to place commercials in the Digasound system, which records digital audio and stores it on a 380 MB hard disk. Eliminating carts, this capability reproduces 15 kHz digital audio in stereo or mono. Maximum search time is 40 seconds. WLOW puts all its production audio into this system, which is brought up to a screen by the Media Touch system as it is scheduled and directed to play by the CBSI system.

The system produces an extremely clean sound, according to Simmons. From the touchscreen, audio is routed to a special digital fader and then back into the switcher as a source. Steps of loudness can be adjusted by changing software. Further, all the audio is computer switched via Ramko data switchers; stereo is generated by switching on two mono sources with a frequency response of 5-438 kHz. A Moseley 600 STL drives a Broadcast Engineering transmitter which is carefully controlled to minimize crosstalk, distortion and separation. "People write letters saying how great the separation is, so we must be doing it right," Simmons says.

WLOW also likes the totally integrated touchscreen approach because it cuts down on maintenance. There are no pots to clean or wear out, and fading is controlled by moving a finger on a screen.



WLOW-FM's broadcast area.

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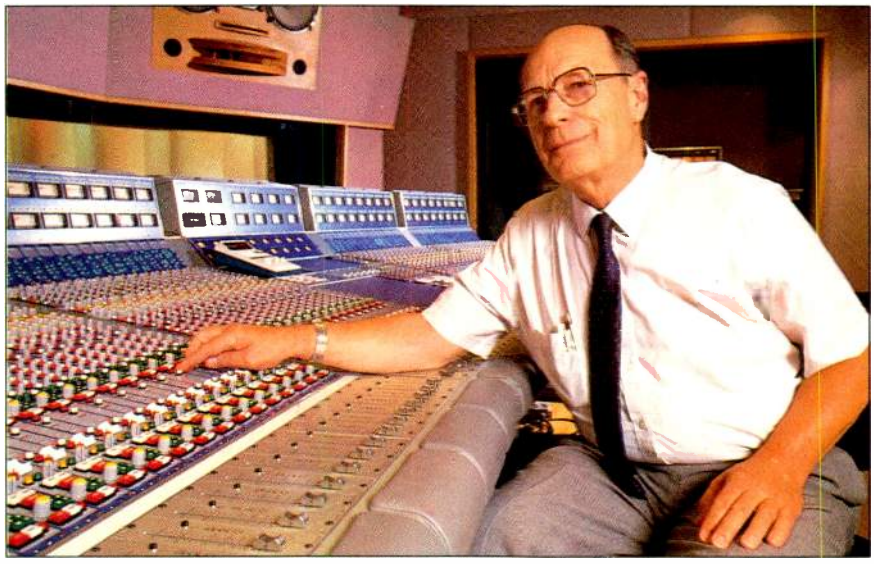
The WLOW system is also unique because both the audio sources for the main control room and every studio in the station are routed through the system. If a component fails or must be serviced, a special computer menu and command will change all the control audio and logic functions immediately. Simmons says the system can also note and log when a mic is turned on and when a particular source is played.

Backup is provided by a 14-inch touchscreen in WLOW's production studio. If the main system must be serviced, the station switches to backup, where a Wheatstone 16x32 console acts as a source for conventional station operation.

"We're excited about how this station works and we think it shows how stations will operate 10 years from now," Simmons said.



Audio engineering designer and consultant Rupert Neve listens to his Focusrite console at Electric Lady Studios, New York.

Rupert Neve Ponders Broadcast Consoles

The father of some of the best music consoles in the world tweaked his new design into such a state of perfection that his company, Focusrite Ltd., went out of business. "I just underestimated the costs of getting it right," Rupert Neve told *BME* during a recent visit to New York. Neve's visit was at the behest of a new company team to audition the Focusrite console recently installed at Electric Lady Studio. A former audio consultant for the British Broadcasting Corporation and currently a consultant for broadcast console maker Amek, Neve will be inducted into *Mix* Magazine's Hall of Fame at the 1989 TEC Award ceremony this fall.

"My job as an engineer is to make cost-effective design decisions," Neve stated. "I know that statement's a little ridiculous in light of what happened to Focusrite, but that is my goal." Keeping designs cost-effective is even more important when the client is a broadcaster, Neve added. Another priority then becomes defining the exact functions a broadcaster wants his console to deliver.

"Consoles for broadcasting and for music recording are two very different things," Neve explained. "In music recording you want to lay onto the master tape the sound that is most faithful to the image in the mind of the producer and not necessarily the sound that goes into the mic. Here the job of the engineer is to see into the minds of the artist and producer and help them do that."

Broadcasters look for tools to paint pictures in a different way. "They're concerned with manipulating equalizers and effects and moving from one 'scene' to another quickly," added Neve. "They're concerned with preserving integrity in the sound, but not to the 'ridiculous' needs found in music recording." Couple different goals—such as delivering news in a timely fashion or delivering ratings with a hit colorized movie—with broadcast audio's limited frequency response and stations frequently find the "Golden Ear" audiophile an unforgiving listener, Neve said.

That said, Neve feels the needs of the broadcast audio market can and should be better addressed. Although the UK broadcast market is hemmed in by technical standards committees, Neve feels this state of affairs must not limit engineering design. "We're slow to implement the latest techniques in the UK, but we're not slow with our ideas," Neve said. "We need to look at broadcast techniques and put ourselves in the perspective of the perceptive user." Engineers must also ask themselves at the design stage if broadcasters will be able to use a product they like, and if they will be able to pay for it. "The definition of an engineer is someone who can do for tuppence what any fool can do for sixpence," he joked.

Neve's current broadcast "hobbyhorse" is console design for countries not on the cutting edge of modern technology. He's currently working on a mixing desk for educational use that will be "top of the line" design but employ only equipment that meets specific needs in a Third World market. He's eager to hear from broadcasters working in less-developed countries. "Do you really need faders?" he asks. "Will your operators use them, or are they just switches?"

Readers who'd like to discuss Neve's Third World console design projects can contact him through Focusrite Audio Engineering, Unit 2, Bourne End Business Centre, Cores Road, Bourne End, Bucks, England SL8 5AS; (44) 628 819 456. ■

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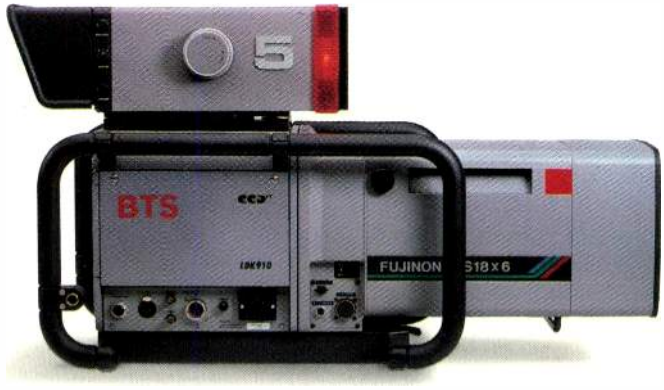

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LDK 91 CCD Portable Camera

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But of course, big ideas also come in small packages. The LDK 91, a lightweight, easy-to-handle ENG/EFP camera, is the LDK 910's portable companion. Singled out by *Broadcast Engineering* magazine as one of the ten "Pick Hits" of NAB '89, it has the same CCD sensor and the same top picture quality as the LDK 910.

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RISC Pays Off in Chip Design

By James A. Ackerley

As increasingly sophisticated applications put pressure on microprocessors to perform more calculations in less time, computer manufacturers are increasingly turning to a new category of microprocessor that promises great performance advantages. Reduced instruction set computing (RISC) processors promise speeds three to seven times faster than those achievable by complex instruction set computing (CISC) processors. According to their proponents, they will maintain this advantage no matter what is done to speed up the CISC processors. This is because the reduced size and increased speed of a RISC processor are the result of a simpler architecture, rather than of any improvement in chipmaking technology.

Computers accomplish such applications as word processing or data manipulation by doing many simple, repetitive tasks very rapidly. Some of the simple tasks are more complex than others, however. Some typical simple tasks or instructions include loading a word into a register, branching to an out-of-sequence instruction, or multiplying two numbers. An example of a more complex instruction would be multiplying two numbers and also storing the result. A computer can be designed so that the instructions it performs are very simple and few in number, or more complex and greater in number.

Originally, all computers used the more numerous, more complex instructions. In the early days, many programs were written in assembly language, in which one line of code is equal to one instruction. Complex instructions meant fewer lines of code and greater programmer productivity. Computer scientists soon discovered, however, that performing two or more tasks with the same instruction took longer than performing the same tasks with separate instructions. Also, programming in the high-level languages largely came to replace programming in the assembly languages and the high-level language compilers simply do not make use of many of the complex instructions. These developments have led in the last five years to the emergence of the RISC computer, which performs only a few simple instructions with greatly increased speed.

The popularity of RISC computers is growing rapidly. MIPS Computer Systems estimates that in 1989, RISC computers will account for approximately eight percent of the output of 32-bit desktop computers worldwide. By 1993, that percentage will rise to 40 percent, the company predicts.

RISC processors vary in implementation, but tend to have certain traits in common. Most RISC machines are based on single-cycle instruction execution. The instruction set is limited to primitive functions that can execute in a single or extremely few machine cycles. Also, in most RISC machines, the CPU registers are enlarged and the data processing instructions operate only on these registers. A separate set of instructions with a limited set of addressing modes is available for referencing memory. This scheme of simplified instructions speeds processing that can be slowed by multiword address operand fetches.

Internal view of SPARCstation 1.

RISC processors promise speeds three to seven times faster than those achievable by conventional processors.

A third trait of RISC machines is extremely close coupling with memo-

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ry. The increase in the effective instruction execution rate requires a higher bandwidth from the memory system. To provide this bandwidth, most RISC machines have implemented very sophisticated memory caching techniques.

Instructions in the I-cache and data in the D-cache can be accessed about four times faster than the same information in main memory. Since large blocks of memory can be transferred quickly, the caches are loaded with loops of instructions or data before processing begins. In about three out of four cases a read instruction can be executed at one of the caches rather than at memory.

Pipeline processing, though not exclusive to RISC machines, is typically employed. The idea originated in the design of supercomputers and simply entails doing several operations at the same time. Using the MIPS R3000 RISC microprocessor as an example, one cycle requires five steps. The first step, instruction fetch (IF), accesses the translation lookaside buffer (TLB) and calculates the instruction address required to read an instruction from the I-cache.

The second step (RD) reads the instruction from the I-cache into the processor and also reads any required operands from CPU registers while decoding the instruction. The third step, arithmetic logic unit (ALU), performs the required operation on the instruction operands. The fourth step, memory (MEM), accesses either the D-cache or memory when the instruction is a load or a store and the fifth step, write back (WB), writes the ALU results back to the register file.

Each step requires an average of one CPU cycle. Since all five steps are executed at once, the instruction execution rate approaches one instruction per CPU cycle. Pipeline processing is possible because different CPU resources are utilized on a noninterfering basis.

One of the most exciting recent developments in RISC processing was the introduction, in February, of Intel Corp.'s i860 RISC processor. Its 64-bit architecture, previously associated only with supercomputers, promises to bring "desktop supercomputers" closer to reality. (Intel's 80386 microprocessor, in contrast, uses 32-bit architecture and the more standard CISC design.) Initially available in a 33 MHz model, the i860 will become available in a 40 MHz model by the end of the year, with a military version to follow. It is expected to be used in applications requiring high-speed multiprocessing and 3D graphics.

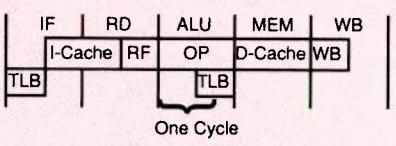
RISC processors are showing up in computers from a number of companies. MIPS Computer Systems makes several RISC computers and workstations, including the M/2000 computer, which runs at 20 MIPS and is supported by the R3000 RISC microprocessor and the R3010 RISC floating-point accelerator. The company licenses LSI Logic, Integrated Device Technology, Performance Semiconductor, Siemens and NEC to manufacture the R2000, R3000 and R3010.

Intergraph Corp., manufacturer of the RISC CLIPPER microprocessor, makes its own line of InterServe, InterAct and InterPro RISC computers and sells chips to other computer manufacturers.

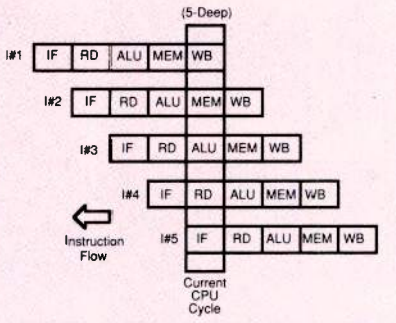
Sun Microsystems makes the SPARCstation 1, which runs at 12.5 MIPS, and the SPARCstation 300 and SPARCserver 300 series, which run at 16 MIPS. Motorola makes the RISC Delta series 8000 system which, using parallel processing, runs at between 17 and 60 MIPS.

Both Hewlett-Packard and IBM make their own RISC microprocessors and computers and neither sells its chips. H-P has a line of multiuser systems based on the H-P 10 MIPS precision architecture microprocessor and a second line supported by the Apollo microprocessor. Advanced Micro Devices has the AM29000 RISC microprocessor which runs at 17 MIPS and is targeted for the embedded processor market, which includes such products as laser printers and graphics cards. VLSI Technology's VL86CO20 RISC microprocessor runs at 10 MIPS and supports Acorn Computer's Archimedes computer.

Projections from MIPS Computer Systems forecast the introduction of emitter-coupled logic (ECL) RISC microprocessors and predict they will run at speeds as fast as 120 MIPS within the next two years. Is there a market for all this speed? The industry's answer is yes. A typical comment comes from James Farrell, technical communications manager for VLSI Technology, who says, "I feel that RISC computers will be 25 percent of all microprocessor-based systems by 1992." ■

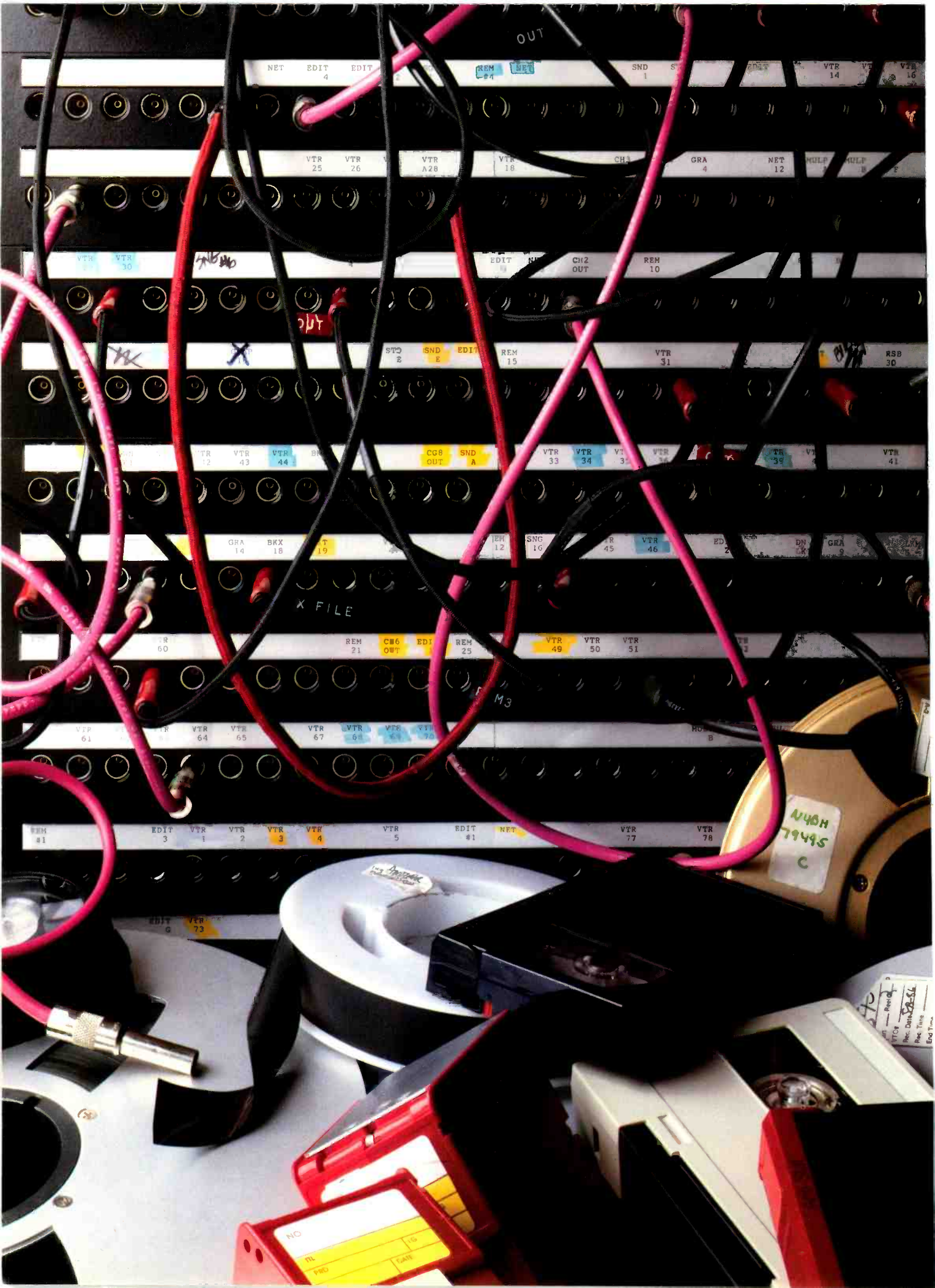


Instruction execution sequence for R3000 microprocessor. Courtesy of LSI Logic.



Instruction pipeline. Courtesy of LSI Logic.

Two or more tasks per instruction take longer than the same tasks with separate instructions.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ADVANCES IN UHF TRANSMITTER TUBES

The rising cost of power has made efficiency more important than ever in UHF transmitters.

BY DAVID A. WHITE

When television was in its early days, operating on low VHF frequencies, transmitters using high-level modulation techniques allowed the use of triode tubes operating class C. With the advent of low-level modulation and the expansion to high-band VHF and UHF, new devices were needed to achieve the linear amplification, higher gain, and higher power handling demanded by broadcasters. Now, in recent times, other requirements were added to conserve energy and keep operating costs low. These new demands have led to innovative answers from manufacturers of tube and solid-state power transmission devices, not only to operate them on higher frequencies and at higher powers, but with increased efficiency.

The klystron was invented in the 1930s at Stanford University by two brothers, Russell and Sigurd Varian. Since those days, output powers have increased from a 1 W power level to the 15 kW to 60 kW and higher levels commonly used now in UHF television. Several companies are producing klystrons today, providing a choice of suppliers. The klystron is rugged and reliable, with a typical tube life of several years. Though the life of these tubes can be long, their purchase price is generally quite high. External and integral cavity klystrons are enjoying great success, with the external units being more popular today because of their lower replacement cost. The external cavity klystron replacement price is inherently lower because it is not necessary to produce its cavities each time the tube is manufactured, as required with the integral type.

High on the list of advantages for the klystron is its high gain, with about 35 dB or more possible. The klystron's very long tube life, as long as 50,000 hours, relates to its massive size, which places lower stress on the tube as heat can be dissipated over its larger component parts. Because of its ability to handle power, the tube is well-suited for 15 kW to 60 kW high-power UHF television service. Typically for power greater than 60 kW and for reasons of redundancy, klystron amplifiers are placed in parallel, requiring complex RF transmitter output combining networks such as a "magic tee" or hybrid combiners with coaxial switch arrangements for bypassing emergencies. The klystron is a nonlinear device, which is correctable, and capable of operating at the highest UHF frequencies and powers. Another advantage is that there are multiple sources. The so-called "big three" klystron suppliers are Varian, Amperex (Valvo) and EEV.

A broadcast klystron's efficiencies are improved when operated in the visual-only mode. It is in this mode that the visual klystron can take advantage of the various pulsing and efficiency improvement techniques to improve its typical low efficiency. Prior to the energy crisis, high output power was more important than energy consumption. Klystrons are considered to operate Class A, but on a nonlinear curve that has dc

input power constant and the output power varying with modulation. As a result, much energy is wasted. Since the klystron is a nonlinear device, it requires an expensive modulator/exciter which has extensive predistortion capabilities. High initial cost and replacement prices for klystrons can range from $20,000 to $60,000, on average, depending on whether they are the external or integral cavity type. Klystrons are physically large and require special handling. Design requirements for transmitters using the klystron require large cabinetry, a carriage assembly with magnets and cavities for the external type or the bulky integral cavity type and magnet assembly, which need mechanical assistance for insertion of the tube. When klystrons are operated at lower power levels, they are typically operated in the multiplex mode. This mode does not permit the use of a pulsed klystron in visual service and a separate non-pulsed aural klystron.

Development of a tube that could offer the benefits of a klystron and the efficiency of a tetrode actually began in the 1930s at RCA. This project was taken on by Varian, which later finally developed the Klystrode tube. This tube was ultimately introduced in 1985 and more recently used in operating transmitters in Georgia and Tennessee. The Klystrode is a device that claims to have the best of both worlds: high klystron gain and high tetrode efficiency. Since only a handful of transmitters have been built, the present data may or may not pertain completely to other channels. One transmitter manufacturer is quoting multiplex use of the Klystrode, paralleling several tubes for higher power configurations, eliminating the need for an external diplexer system. Life expectation and reliability of the Klystrode will be proven with time. At present, the first high-power Klystrode transmitters are reportedly doing well. The tube manufacturer, Varian EIMAC, also anticipates future availability of 15 kW versions and 40 kW tubes.

Another new entry in high-power transmission is the multistage depressed collector (MSDC) klystron, which promises to provide additional improvements in output efficiency, similar to the Klystrode. This design attempts to extract energy efficiently from the electron beam by a graduated five-step collector with decreasing collector voltages, from full collector voltage down to zero, to produce an energy transfer that is not abrupt and wasteful but smooth and efficient. New transmitters are now being produced using the MSDC tube. Again, like the Klystrode, time will tell how well this tube will perform.

User demands for higher frequencies, higher power and increased efficiency have led to innovative answers from power tube manufacturers.

Early tetrodes used for UHF were only capable of small amounts of RF power. At the beginning of this decade, tetrode-equipped transmitters were reaching powers of up to 22 kW. That figure has now moved up to 35 kW achievable from a single tetrode. The tetrode is the third oldest member of the vacuum tube technology family. This four-element vacuum tube differs from its predecessors when used at high-power UHF frequencies in that it requires special construction of its cathode/heater, control grid, screen grid and anode. It is very important that the grid and cathode elements be

UHF Alternative: The MSDC Klystron

A recent development in UHF transmitting technology is the multistage depressed collector (MSDC) klystron, developed by Varian Associates. The MSDC klystron is identical to the external-cavity klystron up to the last interactive gap. At that point, the collector is changed to the MSDC design, which collects the used beam more efficiently with less waste heat. In addition to enhanced transmitter efficiency, this tube design offers several advantages, according to Varian Associates. The MSDC klystron achieves high gain, uses simple and well-understood tuning techniques, uses normal klystron beam voltages which permit air-cooled supplies, and has the ability to use highly developed precorrection and pulsing techniques, improving performance. It maintains the inherent ruggedness and long lifespan of the klystron.

A potential problem with any depressed collector design is regeneration due to electrons turned around in the collector and returned to the beam in the opposite direction. This has been addressed by designing the collector electrode geometry to avoid regions of reflecting electric field, and by coating the electrodes with an electron-absorbing material. According to Varian, test data indicate that regeneration is detectable but at least 20 dB below the signal level, and consequently does not disturb the klystron linearity. Other potential problems, including outgassing of the collector coating material, electrolysis at the coolant fittings and video currents on the collector electrodes, were also addressed with appropriate design modifications.

Figures published by Varian indicate a figure of merit of 140 percent for ACE-pulsed external-cavity MSDC klystrons with average picture modulation, compared to 60-75 percent for present-generation ACE-pulsed external-cavity klystrons. Power consumption is correspondingly lower, resulting in substantial predicted cost savings. ■

Because the efficiency of the klystron has always been among its worst points, methods have been sought to improve its performance.

closely spaced for high gain, yet not break down or flash over at operating potentials. These modern power tetrodes take advantage of a circular design which is concentric around a high emission heater/cathode. The control grid is held to a fraction of a millimeter away from the heater in order to achieve good gain. One manufacturer uses a new type of grid which is made of unwarpable graphite that is laser trimmed. Extremely pure pyrolitic graphite is used in a special high temperature process to form a one-piece grid casting. *[Editor's note: Pyrolitic graphite is also used in the Klystrode grid.]* A silver-plated copper anode is external to the tube for ease in cooling. Either forced air or a vapor cooling process called Hypervapotron provides excellent high-power cooling capability. Tube base designs may be either of two types. One is a plug-type base that inserts into the socket and is twisted into knife-type contacts. The other is a coaxial type base, which permits the use of a shorter socket assembly with less contact inductance. The body of the tube is made of new type ceramics that provide an ideal seal and tightness with good mechanical stability at high operating temperatures. The heater/cathode is thoriated tungsten that provides for long life, a higher emission per temperature degree and uniform electron emission.

The modern tetrode has many advantages over other methods that are presently available for low, medium, and some high-power UHF television transmission applications. This is especially true when initial cost and overall plant efficiency are of concern. The use of tetrodes for television RF power amplification for any transmitter power of 100 W and above, at UHF frequencies, is less expensive than all-solid-state transmitters presently available. Today's tetrode is a compact component that allows for simplicity of design to power levels of 35 kW visual service and up to 25 kW combined service. Operating class AB, a single-ended tetrode transmitter provides excellent overall plant efficiency and power savings compared to that of a klystron transmitter for UHF medium power levels. A

tetrode has lower high-voltage requirements than a klystron transmitter for the same power level. Most importantly, it is also less expensive at initial purchase than a multiplexed klystron or Klystrode transmitter for UHF medium power levels.

The tetrode is the third oldest member of the vacuum tube technology family.

Current tube designs with regard to cooling and element spacing limit the high-power range of UHF tetrodes. Highest gain is limited due to the tight spacing between grid and cathode. Previous data have shown that average life for a tetrode is lower than that of a klystron. However, new data also indicate that mean time between failure (MTBF) figures are on the increase. These MTBF numbers point out that 16,000 to 20,000 hours is a common lifespan for some tubes. There are fewer sources for supply of high-power tetrodes. Not all companies make a tube that will interchange socket-for-socket with those of other manufacturers. There is no doubt that the tetrode must take a back seat to the klystron where gain is concerned. Typical tetrode gain is around 15 dB, giving a clear 20 dB advantage to the klystron. The Klystrode appears to have about an 8 dB advantage over the tetrode.

Until now, UHF visual-service-only tetrode transmitters reached 22 kW and IF-diplexed UHF tetrodes were limited to 10 kW. Cavity development held back the development of new transmitters until Thomson Electron Tubes and Devices Corp. finished its development and performance tests. The Thomson TH-563 and cavity are the latest stage in the tetrode's steady improvement in higher power capability at UHF.

New higher-power amplifier designs now exist that offer exceptional operating cost savings advantages when compared to multiplexed klystrons operating between 10 kW and 30 kW. Acrodyne Industries recently delivered a 25 kW single-ended tetrode transmitter to a 24-hour station in Florida. This transmitter is low-level IF diplexed and available for operation on any U.S. assigned UHF television channel.

Various visual and aural power ratio capabilities show the IF diplexed tetrode transmitter to be the most

cost-effective means to achieve medium transmitter levels. When comparisons among klystrons, Klystrodes and other high-power RF devices are made, it is common to use a value called "figure of merit" in the analysis. Figure of merit for a multiplexed transmitter may be defined as the peak of sync power at 50 percent average picture level and 10 percent aural power divided by the average dc power input. Some transmitter manufacturers do not include the aural power if they are only calculating the visual klystron or visual Klystrode tube merit numbers.

$$\text{F.O.M} = \frac{\text{Psync@ 50\% APL \& 10\% Aural}}{\text{Average dc Power Input}}$$

How much power the entire transmitter consumes is a simple way of comparing the operating cost advantage of one transmitter to another. An Acrodyne TRU-10KVC 10 kW UHF transmitter can be used to show the values of "plant figure of merit":

	TRU-10KV	TRU-25KV
Psync w/10% aural	10 kW vis + 1 kW aural	25 kW vis + 2.5 kW aural
Plant Power Consumption 10% Aural, 50% APL	20.7 kW	46.3 kW
Plant Figure of Merit	0.53	0.59
Tube Figure of Merit	87%	97%

Finally, operating cost comparisons for various power levels of IF diplexed tetrode transmitters and multiplexed klystron transmitters should be reviewed carefully to determine which system really fits the needs of the user.

In summary, transmitters available today offer a wide variety of choices, though all are heading toward increased operating cost efficiency. For power levels where tetrode transmitters can operate, the tetrode is one of the most efficient single RF power tubes available, for the least dollars invested. Other very efficient options promise to be the Klystrode or MSDC klystron. types, but their high initial purchase price might offset In conclusion, tetrode transmitters are designed to have the greatest low-cost advantage for transmitter powers under 35 kW, solidifying the design's important position in the low/medium power UHF marketplace. ■

Note: Klystrode is a registered trademark of Varian Associates, Inc.

Editor's Note: Figure of merit is defined in this article to include aural power. Other manufacturers do not include aural power in calculating the figure of merit; they define figure of merit as peak RF power output divided by average dc power input at 50 percent APL.

White, currently sales director for Acrodyne Industries, has been an engineer, manager and instructor in the broadcast industry since 1967.

UHF Alternative: The Klystrode

UHF power tube technology has evolved along two parallel paths, one utilizing gridded tubes such as tetrodes, and the other using electron beam tubes such as klystrons. Each technology has unique limitations and advantages: Tetrodes have low gain and comparatively short life, but are small in size and efficient in operation. Electron beam devices like the klystron have low power efficiency, but high gain and long life.

The Klystrode tube was developed in an attempt to combine the advantages of both types. A Klystrode tube uses the cathode, gun and beam characteristic of a klystron, as well as the klystron's inductively coupled output structure. An RF-driven grid is used to bunch the electron stream; this bunched electron stream reduces the critical nature of element spacing and transient time, which allows for large, reliable structures. The use of pyrolytic graphite in the grid also enhances the grid's stability and life expectancy.

While the Klystrode has been in service for a relatively short time compared to klystrons and tetrodes, several Klystrode-equipped transmitters have been installed and reportedly are operating without problems. Comark Communications, which manufactures Klystrode-based UHF transmitters, has installed units ranging in power from 10 kW multiplexed, air-cooled, to 120 kW diplexed, water-cooled. Four units, comprising nine sockets, are presently in service; another nine sockets are expected to be in operation by this fall. WETA, Washington, DC, recently became the first major-market station to purchase a Klystrode-based transmitter; its 120 kW unit will be placed in service by next month.

According to the company, a 60 kW peak visual, 6 kW average aural common amplification, water-cooled Klystrode-equipped transmitter requires only 60 kW average power from the ac line. This figure represents average consumption over the broadcast day for the entire transmitter; higher power is consumed at black picture and lower power at white picture.

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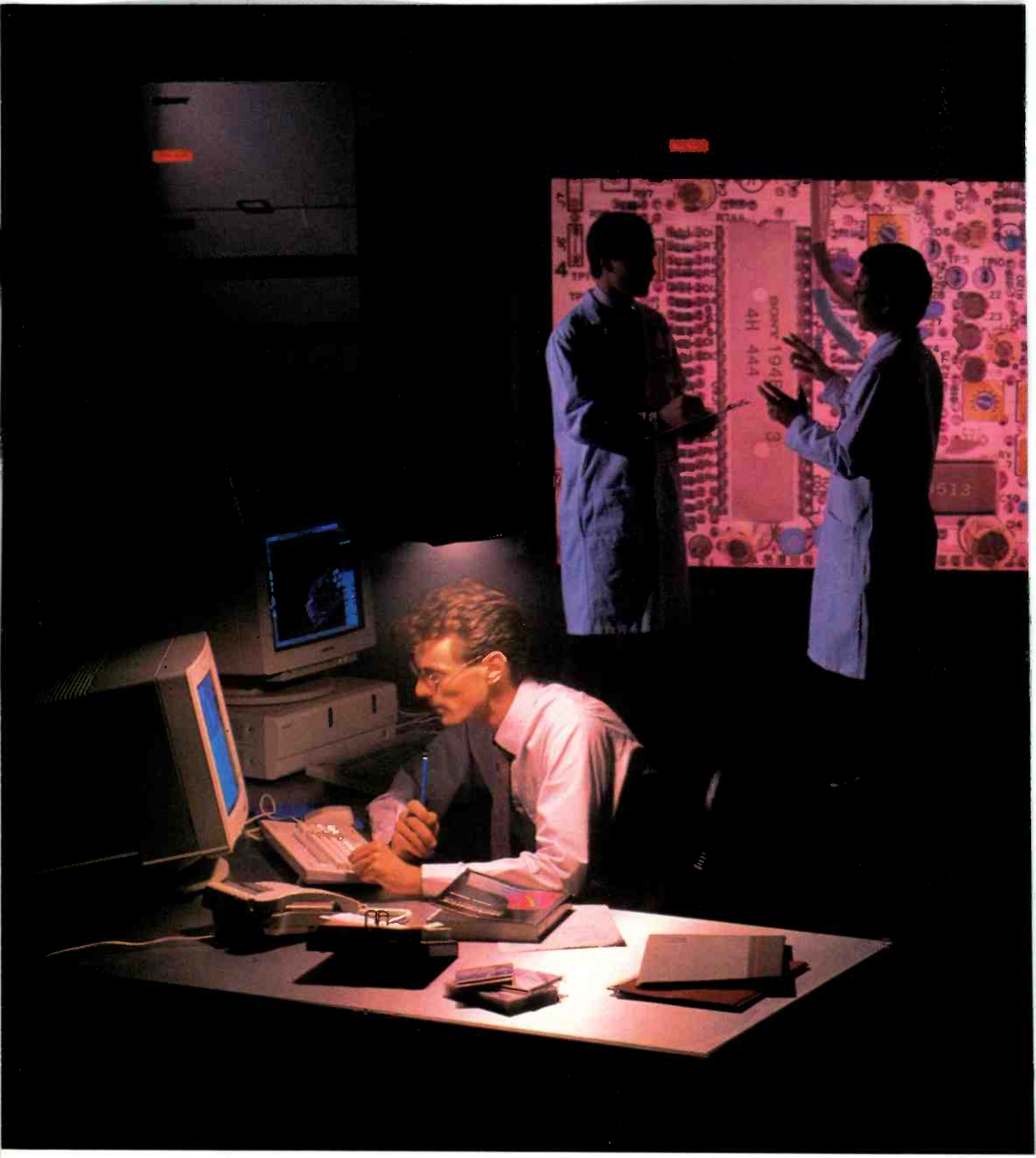

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—*Robert Strutzel, WGN-TV*

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—*Jim Martin, WOAY-TV*

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SECURITY DRIVES TECHNOLOGY ON CAPITOL HILL

BY SCOTT STANDIFORD AND PERRY WHITE

When security considerations drove the microwave trucks off Capitol Hill, broadcasters responded with an innovative fiberoptics system.

The Washington, DC headquarters of NBC News are located in the northwest area of the city on Nebraska Avenue. News material is collected here from locations throughout the metropolitan area for review and editing for possible inclusion in scheduled newscasts, specials and bulletins. Much of this material comes from locations we use on a regular basis. In this category would go Capitol Hill, the White House, the Pentagon and several other key government agencies which contain facilities for each of the major networks and several large group station owners. Each of these locations is linked to the various broadcast entities by microwave systems or leased lines.

Over the past 10 years, the various government agencies have become quite concerned about security. Within Capitol Hill, this took the form of restrictions, which became effective early in 1989, on the number of vehicles that could enter the plaza on the east front of the Capitol building. Thus was born the Capitol Hill Fiber Optics Project, a pool venture of around 20 broadcasters to connect the House and Senate Galleries along with seven other locations to each of the pool members. Interconnecting these locations was done with a combination of copper lines, both video and audio, and fiberoptics. Copper links, because of their lower cost of activation, were cheaper for runs less than 1000 feet. Beyond 1000 feet the pool elected to use multimode fiber. The advantages of fiber for the longer runs include:

Long-distance transmission capability without repeaters and without equalization. Our longest run to date has been 4800 feet. Our multimode equipment can go much further.

Higher bandwidth capacity; no equalization is required to components for long runs.

Lighter weight and smaller size mean lower cost for conduit installation.

No ground loops and immunity to RF/EMI, a major problem on Capitol Hill. The EMI problem is especially serious since roll calls on the Senate side of the Hill are signalled by subcarriers mixed in with the ac power system.

The primary advantages of activating copper are:

Lower cost of activation. An equalizing video distribution amplifier is roughly 10 percent of the cost of an optical transmitter and receiver.

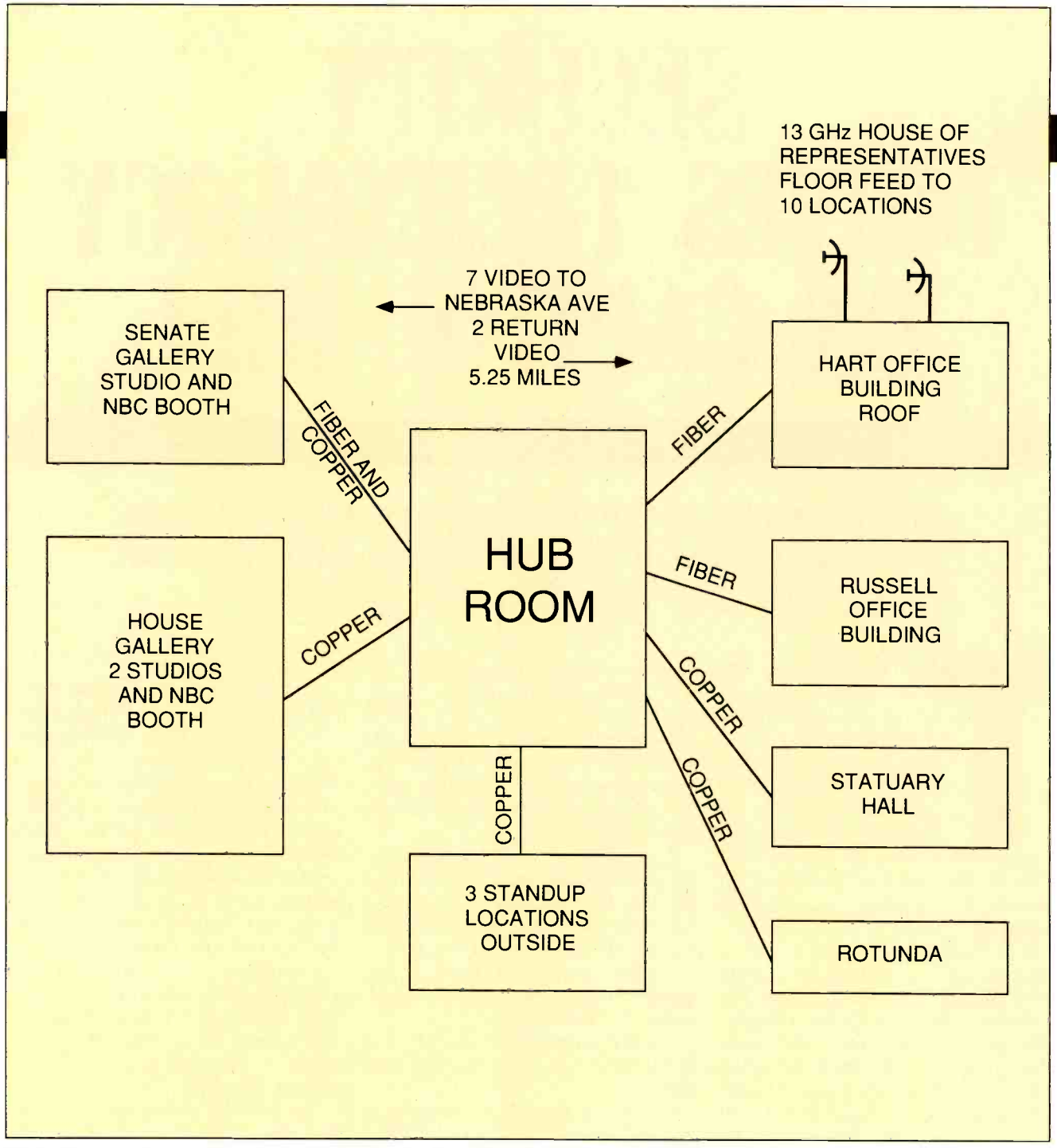
Lower cost and standardized connectors are used in audio and video distribution. Optical connectors cost more to apply to fiber, and they require costly tools and skilled operators to use them.

As a part of the Capitol Hill Fiber Optics Project, the 20 or so pool members arranged to have both the fiberoptic cable and copper pulled to all locations from a central "hub room" (actually, two small rooms adjacent to each other) located in the Capitol Building. At this location each pool member has equipment to switch incoming feeds to leased lines or a microwave transmitting point atop the Hart Senate Office Building.

Construction was supervised by a chairman chosen from the pool, with work performed primarily by an outside vendor. Costs were split by the members according to the number of circuits each required.

The original chairman of the project was Andy Haas of ABC. CNN took over one and a half years ago, and Al Friedman of CNN is the current chairman. Fiber was pulled by Universal Fiber of Salem, VA, and copper was pulled by Virginia Cable Co. of Alexandria.

The heart of the system is a Grass Valley Group model 20-10V/A 20x10 video and dual audio routing switcher, computer-controlled from Nebraska Avenue. This places incoming video and audio on the fiber links to the Hart roof microwave site. The switcher is physically small, which is very important since space in the hub rooms is at a premium.



Block diagram showing the networks' joint Capitol Hill Fiber Optics Project.

At the "hub room," each pool member has equipment to switch incoming feeds to leased lines or a microwave transmitting point atop the Hart Senate Office Building.

We were very careful in the selection of fiber transmitters and receivers since this is a relatively new technology. We chose the PCO 5000 rack-mounted fiberoptics transmitters and receivers from PCO, Inc., of Chatsworth, CA. An important factor in the decision was that the unit provides a better "link budget" over a given link than any other equipment examined. "Link budget," a term used in describing fiberoptics systems, is analogous to "fade margin" in microwave systems.

Both the Grass Valley switcher and the PCO fiber units have been in daily use since the first of this year with no failures.

A number of fiberoptics links (six or seven to date) have already been installed as part of the project. Several pairs link the hub room and the Hart Senate Office Building roof and one connects the hub room and the Russell Office Building. At present, there are seven microwave paths off the Hart roof, with dedicated fiber activated for each. Two more are

Security considerations forced pool members to devise new ways of broadcasting from Capitol Hill.

about to be installed in reverse direction for a total of nine links, and another link to the Russell Building rotunda is planned. Future plans include wiring the 30 Senate hearing rooms.

The last portion of the system to be installed will be the M/A-COM MA-18CC and MA-23CC microwave links on the Hart Senate Office Building roof.

NBC will utilize seven video channels feeding the Nebraska Avenue facility and two video channels in the opposite direction. The two channels will enable correspondents on the Hill to view the network during times when programs are not carried on the air locally.

Another portion of the project involves NBC providing an over-the-air feed of the proceedings of the House of Representatives to participating pool members on 13 GHz. ABC provides a similar service, also on 13 GHz, of the proceedings of the Senate.

A large part of the Capitol Hill Fiber Project is up and running for NBC. It is a great convenience to us to be able to go to a location to feed interviews and cover events with program transmission facilities in place. It has freed manpower to allow us to cover more news. We expect the system to grow in the future, allowing us to provide better coverage of what happens on Capitol Hill. ■

Scott Standiford is manager, technical operations, NBC News, Washington, DC. Perry White is supervisor of construction for NBC, Washington, DC.

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BY ROBERT RIVLIN

HARRY AS EDITOR: A PRACTICAL SOLUTION?

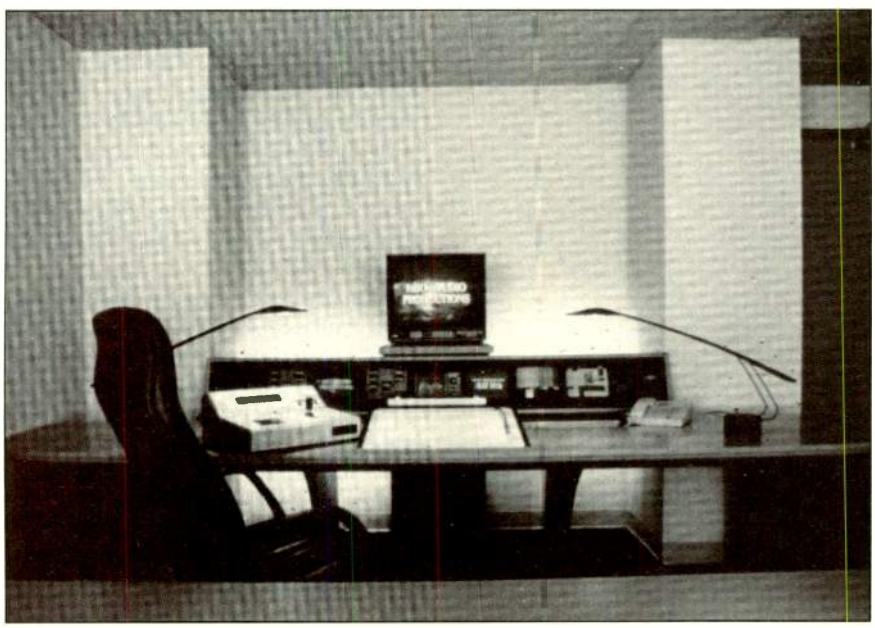
Some post-production facilities are finding that the Quantel Harry can be a versatile editing tool as well as a graphics compositor.

When one thinks of a computerized editing system, normally what comes to mind is a computer controller interfaced with VTRs and other pieces of equipment. For an increasing number of post-production facilities, however, the concept of computerized editor has been expanded to include the use of the Quantel Harry digital disk recorder—originally developed for applications such as multilayering work, digital keying and animation rotoscoping—for more conventional editing applications.

Currently, some 32 U.S. post-production companies and the NBC network own Harrys. By no means all of them are using the $425,000 machines for doing cuts-only editing, and in most cases the Harry is installed in its own graphics composition suite where digital production equipment also includes the Quantel Paintbox and some form of digital effects processor such as the Quantel Encore.

Harry holds 112 seconds of digitized 4:2:2 video on hard disks. Material can be entered either digitally, or through serial interface ports for VTRs such as Sony and Ampex one-inch, Sony and BTS D-1, and both Betacam and MII CAV machines—in which case Harry also acts as a digitizer.

Once material has been captured, the operator is offered random access to any frame within the 112 seconds, using a pen and tablet and on-screen menus for control. Harry has a unique display mode that shows in and out points as two strips of



The Harry console at HBO Studios in New York City.

HARRY AS EDITOR

The digital finishing suite has no edit decision list capability (yet), and so time code readouts must be relied on for finished program length.

frames—very similar to the effect of holding two strips of film up to the light. Frames can then be joined together, or shipped off to the Paintbox or Mirage for further processing.

The basic Harry unit also incorporates some production switcher capabilities such as dissolving and wiping and, of course, keying. What has made it possible to use Harry in a more conventional edit suite setup, however, is the SMPTE-introduced E-Motion II, consisting of a software upgrade for the E-Motion hardware/software feature found in earlier machines (a $20,000 addition installed by Quantel either in the factory or in the field). E-Motion I offered rudimentary machine control of three VTRs—essentially with the purpose of allowing the operator to select which portions of a tape to dump into Harry's memory, and then which portions of memory to write back onto the tape.

With E-Motion II, however, machine control has been considerably expanded. The operator can now use the Harry pen and tablet to control functions that include jog on all three machines—presumably two source decks and a record deck. This allows the precise selection of edit points. E-Motion II also reads time code so automatic edits can be performed.

The new Harry package also offers profile dissolves and profile stretch. The profile feature displays the dissolve or move as a sine wave on the monitor. The operator then uses the digitizing pen to adjust the parameters of the move, stretching and contracting the wave shape. When replayed, the effect follows the pattern of the sine wave constructed by the operator.

The new software also includes several features that will make Harry more like a production switcher found in a typical post-production suite. The interface with Encore HUD has been improved, allowing total control of the Encore effects from the Harry tablet. Equally significant is a new HiCon mode—the equivalent of a downstream keyer built right into the Harry. In the past, according to Rich Alcala, chief engineer at Encore Video in Los Angeles, the original Harry holdout matte generator coupled with the facility's external downstream keyer was "a bit of a pain to work with." The problem is that it requires perfectly converged foreground and background mattes before they are input into the Harry. If they don't match, then the external device has to be adjusted and the mattes reinput.

This is no problem for Encore, which uses its Paintbox for the creation of perfectly matched mattes. But the addition of the HiCon mode in the Harry will allow images to generate their own key mattes suitable for reinsertion into the image. Perhaps the most important new feature of all, in terms of increasing Harry's versatility as a tool for editing, is its ability to shuttle material directly from one VTR to another without necessarily going through Harry processing.

This is Quantel's answer as to how Harry can be used to edit long-form pieces. Set up with three D-1 VTRs, the editor assembles the master program material by building it up serially on the master deck. Program elements that do not require editing are simply laid down, while elements requiring editing are transferred into the Harry. The digital production suite has no edit decision list capability (yet), and so time code readouts must be relied on for finished program length. But it adds a considerable degree of versatility to what can be accomplished in the 4:2:2 environment.

Additional software upgrades, announced just before NAB 1989, increase Harry's utility for editing. Harry users can now perform a "brain dump" of the contents of Harry's disks to D-1 tape, with the directory contents stored on a 3.5-inch floppy disk, allowing a session to be suspended and picked up at a later time. A "selective dump" capability allows the user to build a working file of effects, which can be accessed as a form of edit decision list. And a new interface for IBM-compatible personal computers links with Harry over a serial communications port, allowing off-line edit decisions.

What are some of the facilities doing editing work with Harry? At

HARRY AS EDITOR

Encore Video, editor Helena Parker estimates that some 20 percent of its work is edited on the Harry—including show opens and commercials. The 15-second Coke spot seen during the Super Bowl was one of these.

Harry edit sessions always start with an off-line edit in which the client has chosen time code numbers, unless the edit is extremely simple and takes can be laid down one after the other. Parker uses Sony D-1 and BVH-2000s with the Harry, with special effects produced using an Abekas A52. "Harry is a great box," she says, while at the same time admitting to some problems with its handling of time code during edit sessions. "Harry won't 'go to' a frame count number," she explains. "This means you have to scroll through the material until you find the right place. Also, there's no trim capability."

Malcolm MacDougall, a producer and head of sales for New York City's Charlex, says that editing on the Harry is "like a dream come true." The facility has three edit suites and two Harry suites, which also contain Grass Valley Group Kaleidoscope digital effects interfaced through the massive Charlex routing switcher system (see *BME*, January 1988).

The main bulk of Charlex's work is on TV commercials, and Harry has done several commercials "that have never seen the light of analog tape," according to MacDougall. In these instances, the Harry was interfaced with Sony D-1 machines using material transferred directly to digital tape, edited on Harry, then bounced back to D-1 again as the master. "We try to decide on a job-by-job basis whether a piece is best done using Harry or one of the edit rooms," says MacDowell. "One of the disadvantages of using the Harry is that you have to wait for the effects—even simple wipes and dissolves—to be processed, unlike the edit room where you can see it previewed right away."

Although Harry has been used at Charlex for some longer-length corporate programs, MacDowell also sees Harry's 112-second storage as a limitation with program-length material. "You have to keep shuttling to the point on the VTR you want," he says, "and then transfer to Harry. But being able to visualize the edits and work with the pen and tablet is much more intuitive—much more like editing film, which is the background of many creative people in the industry."

HBO Studios in New York City is one of those facilities that uses its Harry for limited post-production applications such as graphics and optical editing, but not for meat-and-potatoes work. "It's a bit expensive to tie up a Harry for simple editing," observes Ralph Fumante, VP of operations for HBO Studios. Fumante notes that in major production areas such as New York, an increasing amount of work is being transferred directly to digital cassette using a Rank Cintel 4:2:2 machine. But where do producers go to edit this material? "Harry has its applications," Fumante says, "for editing titles and special effects and that kind of work." But without the E-Motion II package, Fumante is forced to transfer the digital program material to Harry memory before it can be worked on.

HBO's answer to finishing digital cassettes is a new Digital Finishing Suite currently under construction. It features D-1 machines, a Grass Valley Kadenza and Abekas A64 disk recorder. According to Fumante, this configuration not only offers random access to the digital material but is more cost-effective. Work done on one-inch will be transferred directly to D-1 and then accessed through the Kadenza with selected portions transferred to the A62 for further processing and effects.

In conclusion, it appears that although significant improvements for post-production are being offered by Quantel, most facilities still view the Harry primarily as a graphics composition device. With today's multimachine edit controllers as sophisticated as they are, most view the post-production suite as still quite adequate for handling routine editing tasks. ■

Rivlin is a free-lance writer living in Katonah, New York. He was previously editor-in-chief of BME.

The SMPTE-introduced E-Motion II has made it possible to use Harry in a more conventional edit suite setup.

RADIO ENGINEERING

NUMBER TEN SPECIAL SECTION JULY 1989

FCC Considers Upping Class A Power

The FCC is currently considering a proposal to increase power across-the-board for Class A FM stations. This follows the creation of the new Class C3 FM classification in April (See "Spectrum," p. 60.)

How would such a power increase help—or hinder—other FMers? The Commission is examining this proposal to determine that any authorized power increase—whether it's the proposed 6 kW across-the-board increase or another figure—won't create objectionable interference for other licensees.

The FCC's concern stems from Class B and Class C criticism of the initial proposal. Whether such criticism is valid is a separate issue, since the proponent of the across-the-board increase argues persuasively that the proposal would not reduce the level of signal protection currently afforded by the FCC's own rules. If that is in fact the case, Class B and Class C stations have nothing to fear.

But the spectre of possible interference has led to expressions of concern, and the Commission is sensitive to such expressions. In an apparent effort to satisfy all sides, one FCC representative pointed out at the NAB convention that the Commission is looking into granting some power increase relief to Class A licensees in combination with other rule changes that would ameliorate non-Class A stations. One alternative would be the elimination of different geographical zones, a move that would broaden the range of channel classification options available in areas where Class A stations feel the need for upgrading.

While the FCC's failure to grant an across-the-board power increase to date is disappointing to some, the proposal is still under active consideration. It's usually impossible to predict precisely when action in any particular rulemaking can be expected, but look for some activity on this front in the next nine to 12 months.

—Harry Cole ■

New Jersey Class A's Still Hoping

Following a recent meeting, the New Jersey Class A Broadcasters Association remains hopeful the FCC will act on its proposed across-the-board power increase for Class A FMers early this summer.

While a compromise solution such as a consolidation of geographical areas appears to be most likely, the Association strongly supports its original proposal.

"What we've asked for is what we want to get," said Robert McAllan, president of Press Broadcasting Co. and the Class A association which originally presented the proposal. "It's fair and it meets the needs of the entire broadcast industry. It's vital to take a broad look at this thing to make radio a dominant player in the greater media mix and in the ears of listeners."

The Class A association had lobbied for an across-the-board increase in power to 6000 W at 100 meters for all U.S. Class A stations. "Anything that doesn't give everybody something is counter to the goals we are trying to achieve," McAllan said. "The last thing we want to do is create a daytimer situation on the FM band." A counterproposal sponsored by the NAB would accommodate partial increases for a percentage of Class A stations.

Deemed "an easy rulemaking," the FCC's new Class C3 classification is claimed to improve matters only when stations are relatively far apart, according to McAllan. "It's better than nothing, but we're looking for help for everybody," he said.

Ironically, Press Broadcasting Co. recently sold its Class A FM station (WJLK-FM) and is negotiating to acquire a New Jersey Class B. "It's near a Class A that is nearly up to existing standards," said McAllan. "We're still supporting this proposal because we believe in it." ■

Radio '89—Y'All Come

New Orleans will play host to NAB's annual Radio Convention September 13 through 16. Special seminars for engineers include "Technical Aspects of Shortwave Broadcasting," which is available to attendees at no extra charge. A $50 fee will be charged for the AM Directional Antenna seminar and for the Digital Radio Station seminar. The NAB mailed registration forms to all members in June; contact the Association for more information. ■

CONTENTS

RADIO RETHINKS AUDIO PROCESSING

As audiences become more accustomed to CD audio quality, broadcasters may need to adjust their thinking about audio processing—and their equipment, too.

BY SKIP PIZZI

Discussions of audio processing among broadcast engineers are akin to debates on the nature of art among artists—often heated, always filled with subjectives, and assuredly interminable. Nevertheless, new elements, primarily due to the arrival of digital audio, have been added to recent deliberations on the subject. Fueling these recent exchanges is the increasing use of digital audio as on-air source material by broadcasters. Should all that dynamic range be sacrificed when it goes to the air? On the other hand, some counter, the dramatically lower noise floor of digital audio sources actually allows more compression with less audible artifacts caused by noise modulation. Probably of greatest concern is the very real issue of the audience's improving taste in audio quality. Has the penetration of the compact disc into American households created a new breed of consumer? Does the average listener now demand the quality previously reserved to the audiophile?

If one answers "Yes" to the above, or even, "Not yet, but soon," the obvious follow-up is, "So what do we do about it?" An extreme approach is to reduce airchain audio processing to protection limiting only, and encourage increased operator awareness of loudness and levels on the air. Others feel that this approach could prove a disservice to the audience in the digital age, since such source material's widened dynamic range can easily allow audio levels to fall below the ambient noise floor of the listener's environment. And it has been established that most radio listening takes place under conditions where ambient noise levels are relatively high.

A prudent course, then, might be to process carefully and with the utmost transparency and freedom from artifacts, using moderation in the amount of dynamic range reduction employed. This almost certainly calls for a flexible, multiband-type audio processor. Naturally, a radio station's format will dictate much regarding the actual amount of compression applied, but this philosophy always recommends a minimalist approach within each format's context.

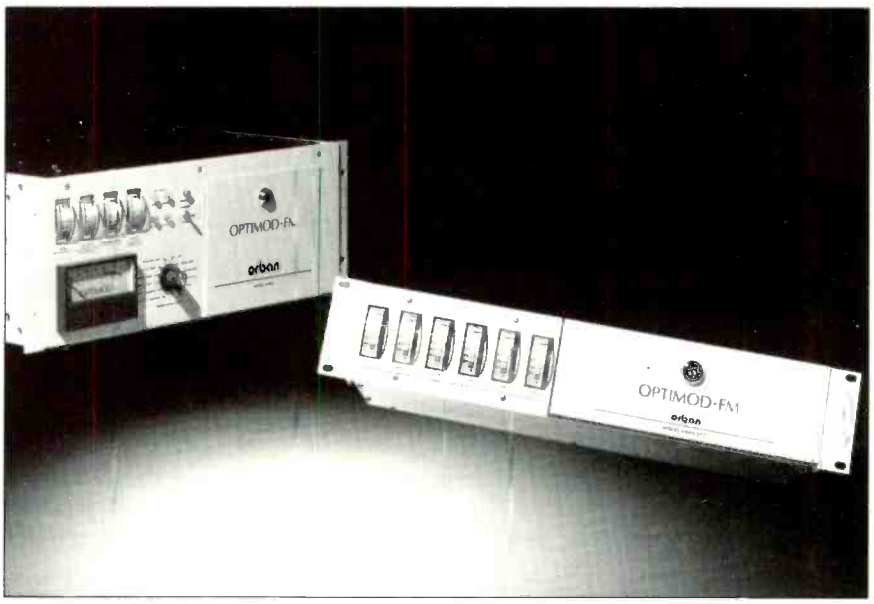
A further question concerns whether the audio processing should itself be performed in the analog or digital domain. Someday this will be a moot point, but until such time as the whole audio chain is digitized, a choice must be made on this issue—starting now, as the first digital broadcast audio processors are becoming available.

Perhaps not surprisingly, analog processing still has much to offer here. As in other areas of audio signal path (as opposed to storage media), analog systems are a tough act to follow, especially in terms of real-world cost-effectiveness. One area in which digital audio processing does excel is in its accuracy and consistency of operation: between units, among channels, and across time. This stability and uniformity of performance is important, but most would probably not rate it the highest priority for an audio processor. Some other processes are easier to accomplish in the digital domain than with analog technology, such as strict linear-phase filters; the FIR (Finite Impulse Response) filter design is a good example of this. Beyond this, opinions differ as to digital audio's suitability to broadcast audio processing.

Robert Orban, chief engineer of Orban Associates, feels that digital signal processing (DSP) still has a long way to go before it matches the cost-effectiveness of state-of-the-art analog systems. To outperform or even simply match a good analog audio processor would be prohibitive in terms of cost today, in his view. Orban voices a concern regarding the processing time required to pass through digital audio circuitry as well, noting that the real-time performance of analog systems may become an advantage that users never real-

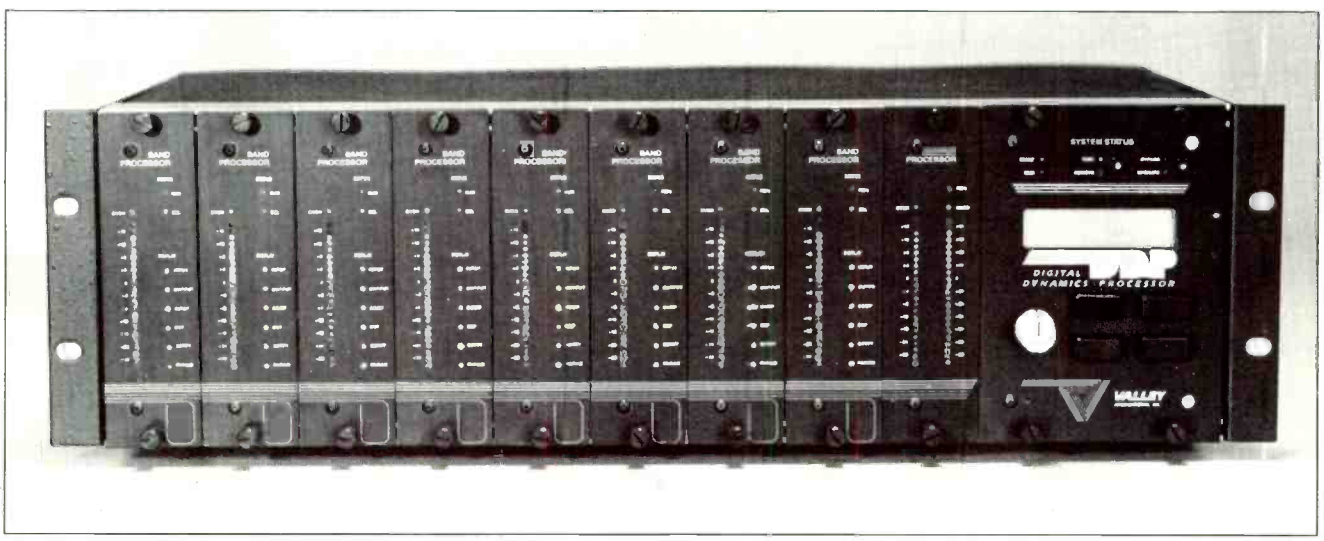
ized they were enjoying. Orban concedes, "Digital audio processing will eventually come to pass." He cautions, however, "It will not be the cure-all that some people are predicting. In fact, the sonic results will not be radically different from what we have today with high-quality analog systems."

Chuck Adams, engineering manager of Circuit Research Labs, adds that the generally smaller size and ease of serviceability further enhance the economy of analog systems. He feels a major component of the cost burden is not so much DSP but the analog-to-digital and digital-to-analog conversion circuitry. "If you're going to do a lot of compression," he stresses, "you need a really *good* A-to-D converter to keep the noise floor low enough at the front end, and those are still pretty expensive." But Adams sees this as a temporary problem and looks ahead to the not-so-distant future, perhaps, when the audio stages preceding and following the audio processor are also operating in the digital domain, so such conversions will be unnecessary. Meanwhile, Adams points out the advantages of digital control of analog processing circuitry, as some of the top recording studio consoles have implemented, allowing for multiple stored settings in a processor, and their instant recall.



The Orban Optimod-FM Models 8100A and 8100A-XT2, among the most popular today.

At Valley International, on the other hand, president Norman Baker feels that the time for fully digital broadcast audio processing is already here. "It's simply a logical extension of the use of digital audio source material on the air," says Baker. "Try as we may with analog, we cannot recreate the accuracy and precision of digital audio processing." Baker feels that this is responsible for the preservation of the true fidelity of digital recordings for broadcast that the listener now demands. "At first, it was just the freedom from pops and clicks that made digital attractive to the listener, but with the increasing sophistication of the audience, other things like the enhanced separation,



Valley International's DDP Digital Dynamics Processor, the first all-digital broadcast audio processing device.

dynamic range and overall clarity have become important to maintain."

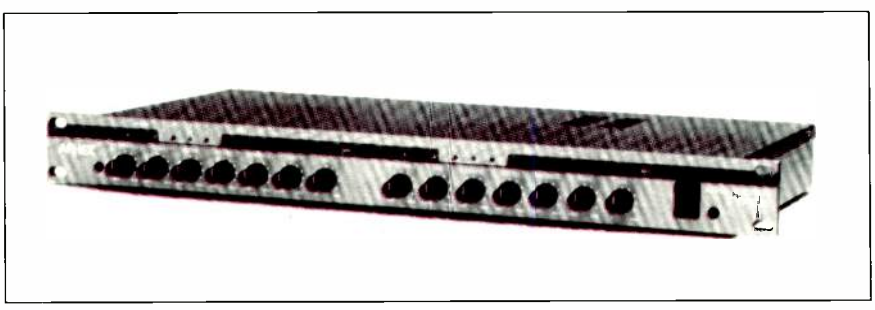
Such a philosophy is what brought Valley International to introduce the first digital broadcast audio processor, the DDP, utilizing 16-bit PCM techniques. Developing such a device hasn't been easy, though. Baker claims that Valley has spent two intense years in developing the product, which has only recently been released after testing on a wide variety of formats. "CHR was the toughest," cites Baker, "because most of those stations want to be really loud. But we were able to show that it was possible to get loud without a lot of artifacts or loss of separation, and still stay very clean." Nevertheless, should future software improvements become available, chip replacement in the field is all that's necessary, according to Baker.

Regarding the cost concern, Valley has packaged the DDP in a three-band, five-band or eight-band configuration (the first two models being field-upgradeable to higher band-splitting levels), and with digital inputs and outputs only. If required, a separate high-quality A/D-D/A converter section is available, using oversampling and Apogee filters on both ends, with sampling rates of up to 50 kHz. This, of course, brings up the issue of DI/O (digital input/output) formats. Currently, the DDP uses what Valley refers to as a "generic" DI/O, which they claim can be easily interfaced with the Sony SDIF-2 and -3, the Mitsubishi PD, or the JVC-900 formats, with an AES/EBU interface under development. Valley is also developing a digital stereo generator that the DDP can be directly interfaced to without conversion to analog.

The possibilities are a bit mind-boggling, and may redefine the very nature of the way audio processing is used by a station.

Further cost-effectiveness of this approach becomes evident, Baker continues, when one considers that a station may change formats radically without needing to change its audio processor. Block-formatted stations will reap an immediate benefit in this regard. Baker concludes by looking at a typical, highly processed station, which may have an AGC-type device, multiband limiters, an overall peak limiter, and even a stereo enhancer and an equalizer in line, all in separate boxes, and finds that a single digital audio processor makes both economic and technical sense. The ability to store and recall drastically different settings with instant and silent switchover adds another benefit beyond the capabilities of a conventional system. Processing could even change for each DJ, with personalized voice processing settings triggered by the announce mic key, thus eliminating the need for a separate mic processor and its associated audio path. The possibilities are a bit mind-boggling and may redefine the very nature of the way audio processing is used by a station. The Valley DDP accommodates both RS-232 and RS-422 protocols for this purpose, allowing computerized or clock control of such switching, as well as operation in conjunction with an automation system.

Marvin Caesar, presdient of Aphex, agrees that the audience has acquired increased awareness of audio quality, but feels that no matter what sort of audio processing technology is used, "FM radio is not going to compete with domestic digital audio sources on the basis of quality." Nor should it, says Caesar. "Total preservation of a CD's dynamic range is not desirable to the listener anyway, so audio processing will continue to be necessary, but with as little damage to the sound's overall fidelity." But he voices a concern with which others concur, that the 75-μs pre-emphasis curve is a major contributor to FM's problems and one that is no longer necessary, although he admits that doing away with it would be a troublesome process. Caesar's compromise approach is to try to increase the "realism" of programming to the listener by increasing "dimensionality and spaciousness," as he puts it. Cost-



The Aphex Aural Exciter Type III, the latest in a long line of enhancement products.

The 75-μs preemphasis curve is a major contributor to FM's problems, and one that is no longer necessary.

The CRL IPP-100 microphone processor, an example of a digitally controlled analog audio processor.

effective high-quality analog audio processing can help "cut through" the pre-emphasis problem, for which he suggests the use of transparent and transient-preserving processors along with the possible application of a specifically designed enhancement tool such as a broadcast "aural exciter" or similar black box that his firm and others produce. Meanwhile, Caesar sees a move toward more end-user processing, both single-ended (such as home DSP devices) and encode-decode (such as surround-sound). TV audio will become a major market for such products, Caesar predicts.

And what of the stereo enhancement devices that have been introduced of late? Several manufacturers have come up with black boxes intended to improve the stereo image's perceived width without adversely affecting mono compatibility. (These are not stereo synthesizers per se, in that they begin with stereo information and turn it into wider stereo, as opposed to changing mono into pseudostereo, as a synthesizer would.) Their effect is subtle, but their prices are not. To many, such devices are not worth the money but, nevertheless, another area for development in the broadcast audio processing world may have been identified, namely "stereo enhancement." The slow sales of these units may indicate a different trend. The broadcaster may be tiring of the proliferation of separate boxes for every processing element. Here is yet another opportunity for the comprehensive and integrated capabilities of DSP to be utilized.

Analog systems are a tough act to follow, especially in terms of real world cost-effectiveness.

The effect of audio processing on RF modulation parameters has also received increased scrutiny of late, for both AM and FM broadcasting. The NRSC recommendations for AM can be adversely affected by excessive processing, such that a station whose audio conforms with NRSC-1 pre-emphasis standard might have an emission characteristic that falls outside the RF mask defined by NRSC-2, due to excessive or misadjusted audio processing. A recent reexamination of the RF spectrum effects of composite clipping has shown it to be responsible for significant amounts of bandsplatter, and thus undesirable.

It's clear that much work is afoot in the audio processor field, in both the analog and digital domains, along with hybrids between them. Digital audio seems to have spawned the need for such improvements, but analog may have great promise in meeting the challenge of our current milieu. Whatever the hardware, the whole issue always comes back to the sound—yours and your competition's. Perhaps Norman Baker summarized it best with his characterization of audio processing: "It's an art—and it's harder than it looks." ■

Pizzi is BME's audio editor.

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Charles C. Adams—"Analog and Digital Technology for Audio Processing", *43rd Annual Broadcast Engineering Conference Proceedings* (NAB 1989).

Charles C. Adams—"Proposal to the LNRSC-FM Subgroup, Composite Spectrum Occupancy Working Group on the Improvement of FM Quality", National Radio Systems Committee, c/o NAB Science & Technology, Washington, DC, 1989.

C. Adams, R. Orban, D. Werrbach—"Broadcast Audio Processing in the L1990's" (audio recording), *1989 Public Radio Conference,* InfoMedix, Garden Grove, CA. (Tape #B187-62)

Michael E. Morgan, Jason Dunaway, Rick McCollister—"A Digital Dynamics Processor for FM Broadcast", *43rd Annual Broadcast Engineering Conference Proceedings* (NAB 1989).

ANNOUNCING BME'S THIRD ANNUAL EXCELLENCE IN ENGINEERING AWARDS

NOMINATIONS ARE NOW BEING ACCEPTED

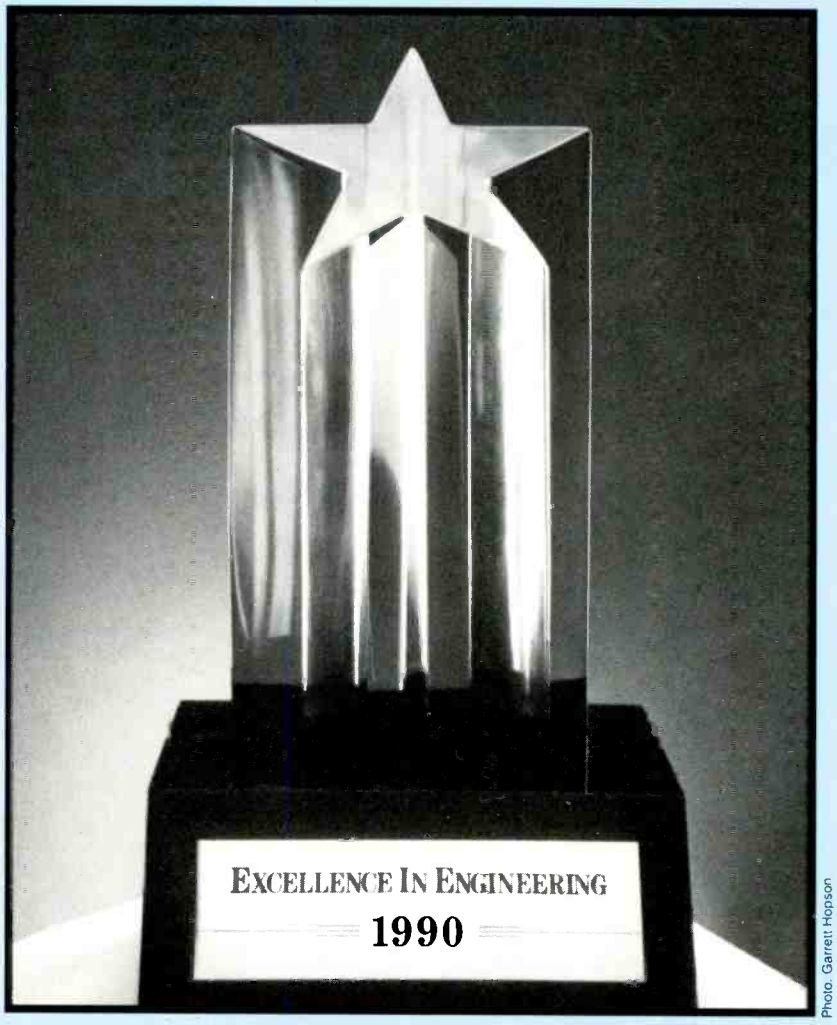


Photo: Garrett Hopson

For the third consecutive year, BME magazine will present the Excellence in Engineering Awards, recognizing those organizations and individuals who have made significant contributions to the art of broadcast and teleproduction engineering.

Honorees may include stations or facilities that have demonstrated innovation in design or operation; industry groups that have spearheaded technological progress; or researchers who have furthered the science of broadcasting.

To nominate an organization or individual, or for more information, contact Eva J. Blinder, Editor, BME magazine, 401 Park Avenue South, New York, NY 10016, (212) 545-5100.

BME

Nominations must be received no later than October 30, 1989.
Award winners will be announced in the February, 1990 issue.

TEST CDs COME OF AGE

New test CDs can help improve your whole facility's fidelity and capability.

BY SKIP PIZZI

Test CDs are nothing new; they've been with us since the introduction of the Compact Disc format. But a new twist has been added recently. Unlike previous test CDs that simply provided signals to check the operation of the CD player, several newly released CDs can turn your CD player into virtually any kind of audio signal generator, to be used to test the *rest* of an audio system. For the price of a test CD you can (within some limits) duplicate the functions of several thousand dollars' worth of sophisticated test equipment, and save time and trouble when performing the tests in the bargain.

Three recent CDs are noteworthy here: the "Studio Reference Disc" (SRD) from Prosonus, the "NAB Broadcast and Audio System Test CD" from the National Association of Broadcasters, and the "CodeDisc," also from Prosonus. Prices range from $40 to $80.

The Prosonus SRD contains 62 cuts of material designed for strictly audio (non-RF) measurements, but encompasses signals useful in both the electronic and acoustic domains. It is notable for its ecumenism, bringing into one place such diverse and useful systems as the C.A.V.E.A.T. recommendations, the LEDR and A.S.C. monitor tests, and TEF analysis. Its presentation is also superb, with elucidating liner notes by Mel Lambert, and a sultry announce voice reminiscent of Captain Kirk's computer on the *Enterprise* introducing each cut. The liner notes clearly list and explain the applications of each cut, and provide referrals for further information about the proprietary testing and measurement systems involved.

Included on the disc are the usual range of sine wave spot frequency tones (all digitally generated) at both reference level and 10 dB below, plus sine wave sweeps and bursts, pink and white noise (in bursts and at length), impulse clicks, polarity and channel ID checks, and various musical tuning references, including a full 88-note piano scale. Such pitch testing, previously meaningless with analog test recordings, is made possible by the absolute playback speed accuracy of the CD format. Moreover, uniformity between players and consistency over time and multiple uses make all of these test discs much more valuable than their analog counterparts.

The Prosonus Code Disc features an hour of continuous SMPTE time code.

The SRD also contains the full C.A.V.E.A.T. header recommended for use in audio-for-video. (See the March 1989 *BME* for a full description of this format.) The "Music Articulation Test Tape" (MATT) from Acoustic Sciences Corp. of Eugene, OR, is found on the disc as well, allowing for objective and subjective evaluation of a monitor system's capabilities in handling complex waveforms, along with the "Listening Environment Diagnostic Recordings" (LEDR) from EASI of Evanston, IL, which allows judgment of a monitor system's spatial accuracy of reproduction. Finally, the SRD also contains several time/energy/frequency (TEF) sweeps from Techron Industrial Products of Elkhart, IN, for use with their TEF System 12 Analyzer, a primary tool among today's acousticians in measuring the response of a room and/or its loudspeaker system. The availability of various TEF sweeps on this CD allows for a digital recording of their playback to be made at the location under test, so that analysis can be done off-site.

The NAB test disc takes a notably different approach, with the emphasis (not surprisingly) on electronic and RF performance. After a brief introductory segment, no announcer is heard, so identification of the cuts is by visual display only. This may be a help rather than a hindrance; if one uses a cut from the CD to trigger a measuring device or recording system, or loops a cut, having a voice slate at the head can cause problems.

The disc contains 99 cuts, the maximum allowed in the CD format, but

further delineates them by the use of 257 index markers. Starting with some basic but important CD player performance checks, the disc includes test signals for measurement of frequency response, harmonic and IM distortion (SMPTE and CCIR), dynamic range, phase shift (both absolute and relative L/R), flutter, crosstalk/separation, RF spectrum occupancy, and receiver protection ratios. In many cases, multiple forms of measurement of these parameters are available. The disc also contains signals used for calibrating FM systems (Bessel tones for FM and MTS main and subcarriers), THD analyzers, audio processing equipment, preemphasis and deemphasis circuits, PPM, VU and phase meters, and modulation monitor peak flashers. All the NRSC-AM test signals and an AM modulator linearity test signal (a very linear triangle wave) are on board as well, plus a number of other handy signals such as the FM stereo pilot, NTSC and PAL/SECAM horizontal sweeps, and the EBS and DTMF tones (the latter including supervisory tones not found on standard keypads).

A CD player will never replace a good multifunction generator on the bench or test-cart, but it can certainly increase the productivity of the maintenance personnel using it.

Again, most signals have been digitally generated, and excellent annotation is provided, with minor exceptions regarding the use of "out-of-phase" when referring to polarity reversal, and some confusion on absolute versus relative phase shift in the CD player checks. These aside, the NAB Science and Technology Department has presented the industry with a tremendously useful and economical tool, and they are to be roundly cheered and commended. The disc has been manufactured for NAB by Denon Digital Industries of Madison, GA.

Finally, Prosonus has also released the CodeDisc, featuring one hour of continuous SMPTE time code (30 fps,

non-drop), for use in nongenlocked synchronization applications when no time code generator is available. Such a disc might prove useful at a MIDI studio in which a sequencer must be synchronized with a multitrack tape, or for locking two multitrack recorders together.

We may be seeing the beginnings of a trend here. The conveniences and thrift of this approach are quite apparent already, so further introductions seem inevitable. Nevertheless, there are limits to applications of test CDs, especially in the frequency domain, where the high-frequency cutoff restricts the number of harmonics in square wave tests, for example. A CD player will never replace a good multifunction generator on the bench or test-cart, but it can certainly streamline the hardware requirements there, and increase the productivity of the maintenance personnel using it. The CD player chosen should have 99-cut and index capability, and easy looping, along with excellent (preferably dual) D-to-A conversion; balanced outputs are also desirable. And test CDs must be *meticulously cleaned* before use! It is much easier to perceive errors in pure tones than in program material; moreover, dropouts may cause major measurement errors that go aurally undetected, especially in short-duration burst-type tests.

These CDs will never make the Hot 100, but they could become broadcast engineering's greatest hits. ■

Pizzi is BME*'s audio editor.*

For Further Information:

- Prosonus
1616 Vista del Mar
Hollywood, CA 90028
(213) 463-6191

- NAB Science & Technology
1771 N Street, N.W.
Washington, DC 20036
(202) 429-5300

- See also:
Salek, Stanley, "The NAB Test CD - Use and Applications," *43rd Annual Broadcast Engineering Conference Proceedings* (NAB 1989).

Set Up Levels In An Audio Chain

By Ronald F. Balonis

Whenever equipment is connected together, an audio chain is formed, and the chain's weakest link affects how well the whole chain works. In an audio chain, the weak link can be the equipment, the interconnections, or the adjustment of each piece of equipment.

This month's Compute offering is a spreadsheet-like program that helps to set up levels in an audio chain. It allows trial-and-error planning of an audio chain to optimize equipment adjustments and interconnections.

In a well-designed, optimally adjusted audio chain, overall S/N and headroom are maximized and overall distortion minimized. While most interconnections and adjustments of equipment will work some way, the forgiving nature of today's state-of-the-art equipment is no excuse for not doing it the right way.

The basic procedure for optimizing the setup of levels in an audio chain is to apply several basic, but mutually exclusive, rules of thumb during planning. First, keep in mind that an audio chain is only as good as its weakest link. The equipment or device with the highest noise level affects the overall S/N most. The equipment or device with the lowest overload, or clipping, level determines a chain's overall headroom. Secondly, the lowest signal levels have the greatest effect on overall S/N. To maximize S/N, keep the minimum signal levels in the audio chain at least 10 dB greater than the chain's input level. Third, the highest signal levels have the greatest effect on headroom and distortion, so to maximize headroom and minimize distortion, set the operating levels (gains and losses) so that all of the equipment reaches overload or clipping at the same time.

An audio chain for a given equipment configuration, input and desired output is optimized by setting the levels at each link in the chain with device gain controls or by using passive audio attenuators/pads. See the AFPADS.BAS program in the July 1988 Compute to calculate them. Further, remember that each equipment maker has its own way of specifying performance.

For computational consistency, the program assumes these specification definitions: First, all levels are in dBm, that is decibels referenced to 1 mW across a resistive impedance of 600 ohms. "Input level" is just that, the input level to the audio chain. "Input noise" is the noise floor level of the input signal. Typically it will range from a -124 dBm to -120 dBm equivalent input noise (EIN) for a "good" preamplifier with a microphone as input to the input device up to the actual output noise of the driving source. "Gain" is the device gain (if an amplifier) or loss (if a pad or attenuator) in dB. "Clipping level," in dBm, is an arbitrary or actual level at which clipping

```
AFCHAIN.BAS          +++ Set Up Levels In An Audio Chain +++

No. of Devices  (2-8): 7
Input Level     (dBm): -56.0
Noise Level     (dBm): -124.0

Device#  - 1 --   - 2 --   - 3 --   - 4 --   - 5 --   - 6 --   - 7 --
Gain   :  58.0     0.0      10.0     -8.0     10.0     -10.0     10.0
Clip   :  27.0     12.0     22.0     14.0     24.0      14.0     24.0
SNR    :  124.0    124.0    65.0     124.0    72.0      124.0    67.0

Label  :  CONS     ATTEN    AGC      ATTEN    STL       ATTEN    LINITR

HROOM  :  25.0     10.0     10.0     10.0     10.0      10.0     10.0
OUTPUT:   2.0      2.0      12.0     4.0      14.0      4.0      14.0
NOISE  :  -66.0    -66.0    -42.8    -50.8    -40.0     -50.0    -38.3
DRANGE:   93.0     78.0     64.8     64.8     64.0      64.0     62.3

Change Device # <Q>uit:



AFCHAIN.BAS          +++ Set Up Levels In An Audio Chain +++

No. of Devices  (2-8): 7
Input Level     (dBm): -56.0
Noise Level     (dBm): -124.0

Device#  - 1 --   - 2 --   - 3 --   - 4 --   - 5 --   - 6 --   - 7 --
Gain   :  58.0     -10.0    10.0     -8.0     10.0     -10.0     10.0
Clip   :  27.0     12.0     22.0     14.0     24.0      14.0     24.0
SNR    :  124.0    124.0    65.0     124.0    72.0      124.0    67.0

Label  :  CONS     ATTEN    AGC      ATTEN    STL       ATTEN    LINITR

HROOM  :  25.0     20.0     20.0     20.0     20.0      20.0     20.0
OUTPUT:   2.0      -8.0     2.0      -6.0     4.0       -6.0     4.0
NOISE  :  -66.0    -76.0    -43.0    -51.0    -40.2     -50.2    -38.4
DRANGE:   93.0     88.0     65.0     65.0     64.2      64.2     62.4

Change Device # <Q>uit: 2     <G>AIN <C>LIP <S>NR <L>ABEL: G    To: -10
```

Figure 1. *Demo screens for AFCHAIN.BAS.*

```
0  'AFCHAIN.BAS ++ Set up AF Levels in an Audio Chain ++
5 'by Ronald F. Balonis  1/23/89
10 '
40 DIM GAIN(8),CLIP(8),SNR(8),OUTLEV(8),HDROOM(8),NOISE(8)
50 TLE$="+++ Set Up Levels In An Audio Chain +++"
100 CLS:PRINT "AFCHAIN.BAS           ";TLE$:PRINT
110 LINE INPUT "No. of Devices  (2-8): ";NDEVICE$
115  IF NDEVICE$="" THEN STOP ELSE NDEVICE=VAL(NDEVICE$)
120  IF NDEVICE>2 AND NDEVICE<9 THEN 130 ELSE RUN 0
125 '
130 LINE INPUT "Input Level     (dBm): ";INLEV$
135  IF INLEV$="" THEN RUN 0 ELSE INLEV=VAL(INLEV$)
140   IF INLEV<-124 OR INLEV>40 THEN RUN 0
145    LOCATE 4,23:PRINT USING" ####.#";INLEV
150 '
160 LINE INPUT "Noise Level     (dBm): ";INOISE$
170  IF INOISE$="" THEN INOISE=-124 ELSE INOISE=VAL(INOISE$)
175   IF INOISE<-124 OR INOISE>INLEV THEN RUN 0
180    LOCATE 5,23:PRINT USING" ####.#";INOISE:PRINT
195 '
200 PRINT"Device# ";:'----- Get Gain, Clip, SNR, & Labels
205 FOR I=1 TO NDEVICE
210  PRINT " -";I;"--  ";
215 NEXT I:PRINT
245 '
250 PRINT "Gain   :";:KR=CSRLIN
255 FOR I=1 TO NDEVICE
260  LOCATE KR,I*9:GAIN$=""
265  LINE INPUT " ";GAIN$:GAIN(I)=VAL(GAIN$)
270   IF GAIN(I)<-124 OR GAIN(I)>124 THEN 260
275    LOCATE KR,I*9:PRINT USING"|####.#| ";GAIN(I);
280 NEXT I:PRINT
285 '
300 PRINT "Clip   :";:KR=CSRLIN
305 FOR I=1 TO NDEVICE
310  LOCATE KR,I*9:CLIP$=""
315  LINE INPUT " ";CLIP$:CLIP(I)=VAL(CLIP$)
320   IF CLIP$="" THEN CLIP(I)=40:'DBM
325    IF CLIP(I)<-124 OR CLIP(I)>40 THEN 310
330     LOCATE KR,I*9:PRINT USING"|####.#|-";CLIP(I);
335 NEXT I:PRINT CHR$(8);" "
340 '
350 PRINT "SNR    :";:KR=CSRLIN
355 FOR I=1 TO NDEVICE
360  LOCATE KR,I*9:SNR$=""
365  LINE INPUT " ";SNR$:SNR(I)=VAL(SNR$)
370   IF SNR$="" THEN SNR(I)=124:'DB
375   IF SNR(I)<0 OR SNR(I)>124 THEN 360
380   LOCATE KR,I*9:PRINT USING"|####.#| ";SNR(I);
385 NEXT I:PRINT:GOSUB 900:'---------- Make a Line of -------
390 '
400 PRINT "Label  :";:KR=CSRLIN
405 FOR I=1 TO NDEVICE:LABEL$=""
410  LOCATE KR,I*9:LINE INPUT " ";LABEL$
415  LOCATE KR,I*9:PRINT USING" \      \ ";LABEL$;
420 NEXT I:PRINT:PRINT:GOSUB 900:'----- Make a Line of -------
430 '
500 LOCATE 15,1:'------------ Calculate Levels in the AF Chain
505 NOISE(0)=INOISE:OUTLEV(0)=INLEV
510 FOR I=1 TO NDEVICE
515  OUTLEV(I)=OUTLEV(I-1)+GAIN(I):N1=10^((NOISE(I-1)+GAIN(I))/20)
520  HDROOM(I)=CLIP(I)-OUTLEV(I):  N2=10^((CLIP(I)-SNR(I))/20)
525  NOISE (I)=20*LOG(SQR(N1*N1+N2*N2))/LOG(10)
530 NEXT I:'-----Then Display Them Line by Line
550 '
600 PRINT "HROOM :  ";:FOR I=1 TO NDEVICE
605                     PRINT USING"|####.#| ";HDROOM(I);
610                   NEXT I:PRINT
615 PRINT "OUTPUT:  ";:FOR I=1 TO NDEVICE
620                     PRINT USING"|####.#| ";OUTLEV(I);
625                   NEXT I:PRINT
630 PRINT "NOISE :  ";:FOR I=1 TO NDEVICE
635                     PRINT USING"|####.#| ";NOISE(I);
640                   NEXT I:PRINT
645 PRINT "DRANGE:  ";:FOR I=1 TO NDEVICE
650                     PRINT USING"|####.#| ";CLIP(I)-NOISE(I);
655                   NEXT I:PRINT:GOSUB 900:PRINT:'- Make -----
660 '
695 PRINT:KR=CSRLIN
700 LOCATE KR,1:PRINT SPACE$(79):LOCATE KR,1:N$="":X$="":CHNG$=""
705 LINE INPUT "Change Device # <Q>uit: ";N$:N=VAL(N$):'---- Device?
710  IF N$="Q" THEN RUN 0:'-------------------- Restart from the Top
715   IF N$<>"" THEN 800 ELSE LOCATE KR,1
720 '
725 LINE INPUT "Change Input <L>evel <N>oise: ";N$:'-- Change Input?
730  IF N$="" THEN 700
735   I=INSTR("LN",N$):IF I=0 THEN 700 ELSE LOCATE KR,33
740 '
745 LINE INPUT "  To: ";CHNG$:'---------------------- Change it To:
750  IF CHNG$="" THEN 700 ELSE CHNG=VAL(CHNG$)
755   ON I+1 GOTO 700,760,765
760    IF CHNG<-124 OR CHNG>40    THEN 700 ELSE INLEV =CHNG:GOTO 770
765    IF CHNG<-124 OR CHNG>INLEV THEN 700 ELSE INOISE=CHNG:GOTO 770
770     LOCATE I+3,23:PRINT USING" ####.#";CHNG:GOTO 500:'-To Recalc
775 '
800 IF N<1 OR N>NDEVICE THEN 700 ELSE LOCATE KR,28:' Change Device #
805  LINE INPUT "  <G>AIN <C>LIP <S>NR <L>ABEL: ";X$:'- Change What?
810   I=INSTR("GCSL",X$):IF I=0 THEN 700 ELSE LOCATE KR,61
815 '
820  LINE INPUT"  To: ";CHNG$:CHNG=VAL(CHNG$):'------  Change it To:
825   IF CHNG$="" THEN 700
830   IF I=4 THEN LOCATE 8+I,N*9 ELSE LOCATE 7+I,N*9
835    ON I GOTO 840,845,850,855
840     IF CHNG<-124 OR CHNG>124 THEN 700 ELSE GAIN(N)=CHNG:GOTO 860
845     IF CHNG<-124 OR CHNG>40  THEN 700 ELSE CLIP(N)=CHNG:GOTO 860
850     IF CHNG<0    OR CHNG>124 THEN 700 ELSE SNR (N)=CHNG:GOTO 860
855      PRINT USING" \      \ ";CHNG$;:GOTO 700:'---- Another?
860      PRINT USING"|####.#| ";CHNG;: GOTO 500:'---- To Recalculate
890 STOP:'---- Go no farther
900 PRINT SPACE$(7);:'----- Make a Line of ------- Here
905 FOR I=1 TO NDEVICE
910  PRINT "  ------ ";
915 NEXT I:PRINT:RETURN:'-------------------------- End of Program.
```

Figure 2. *AFCHAIN.BAS, a program to calculate room acoustics.*

begins in a device (use or assume the same for each device).

"Signal-to-noise ratio" (S/N) is the decibel difference between the noise floor and the above clipping level of a device. It is also a measure of dynamic range. "Headroom" is the decibel difference between the nominal (average) output level and the peak Clipping Level. Some headroom is necessary so that complex audio waveforms can pass through the system without clipping and without significant distortion. Headrooms in the range of 10-20 dB are necessary and desirable.

While the coded program looks complex and complicated, it is not really. Basically, it consists of three program modules. The first, after some program initializations extending from line 100 to 430, inputs the data in a line-by-line sequence and builds the spreadsheet form at the same time. The coding of each data module is similar—data input as a string, converted to numeric, tested for real-world limits, then displayed. The program input data limits are two to eight devices: input level 124 to 40; input noise -124 to input level; gain -124 to 124; clip -124 to 40; and S/N 0 to 124.

The second program module extends from line 500 to 660. It calculates the levels for each device in the audio chain—output level, headroom, noise, and dynamic range. The third program module extends from line 700 to 860 and implements the trial-and-error (what-if) part of the program. The program code prompts for the value to change, inputs and changes it, then recalculates the levels in the audio chain.

The two demo screens illustrate using AFCHAIN.BAS for planning the adjustment of a hypothetical, but typical, broadcast audio chain, with 10 dBs of headroom in the upper one and 20 dBs of headroom in the lower. For the equipment of this audio chain, the tradeoff is between headroom and S/N. The upper one has a better noise level with a marginal amount of headroom. The lower one has very good headroom with a marginal noise level.

Balonis is chief engineer at WILK, Wilkes-Barre, PA. His Compute programs are available for download on A/V Sync (404) 320-6202.

C3: A Class Act from the FCC

By Harry Cole

An observation of industry veterans is that every year around April, the FCC normally takes an action that improves the lives of broadcasters. Perhaps only coincidentally, these changes tend to be released shortly before the annual convention of the National Association of Broadcasters. Serendipitous or no, the phenomenon also occurred this year: In mid-April the Commission established a new classification of FM station, Class C3.

Before Docket 80-90 became effective five years ago, there were only three classes of commercial FM channels: A, B and C. Class A channels were allotted throughout the country. They featured maximum antenna height (HAAT) of 300 feet (later metrified to 100 meters, or 328 feet) and maximum effective radiated power (ERP) of 3 kW. Class B channels were restricted to certain geographic zones (including most of the Northeastern quadrant of the U.S. and all but the northernmost portion of California). They featured maximum HAAT of 500 feet (later metrified to 150 meters, or 492 feet) and maximum ERP of 50 kW. Class C channels were restricted to the zones from which Class B channels were precluded, with maximum HAAT of 2000 feet (metrified to 600 meters or 1968 feet) and ERP of 100 kW. Life was simple.

Then along came Docket No. 80-90, in which the Commission ruled that the relatively crude channel classification system led to inefficient spectrum utilization. This was because channels were allotted on the assumption that users would operate with maximum facilities. In practice, a licensee would often specify less than the maximum, generally because a transmitter site permitting maximum HAAT was unavailable. As a result, numerous interstitial areas developed which were not receiving service.

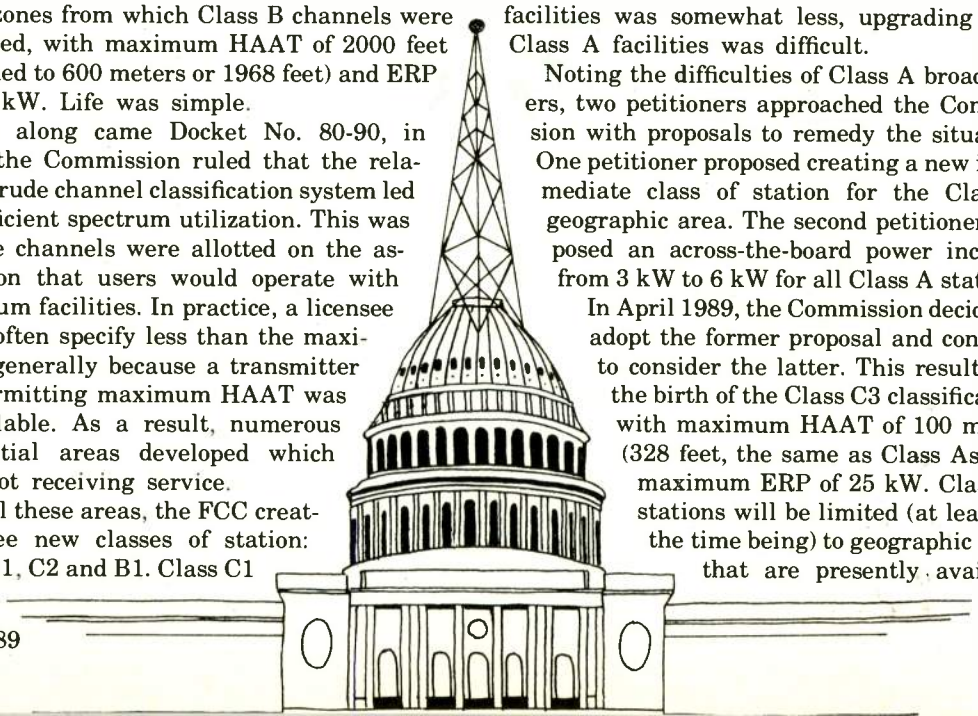
To fill these areas, the FCC created three new classes of station: Class C1, C2 and B1. Class C1 stations feature maximum HAAT of 299 meters (981 feet) and maximum ERP of 100 kW. Class C2's maximum HAAT is 150 meters (492 feet), with maximum ERP of 50 kW. The maximums for Class B1 are 100 meters (328 feet) and 25 kW. Class C1 and C2 channels are restricted to the areas where Class C channels have historically been permitted, and Class B1 channels are restricted to all other areas.

All these changes appear to have created more opportunities to upgrade existing stations realistically. Even with the creation of the three new channel classifications, a substantial disparity nevertheless remained between the maximum Class A facilities (3 kW, 100 meters) and the next higher classification (Class C2, with 50 kW/150 meters) in the Class C geographic zones. As a result, the upgrade possibilities in those zones tended to be few and far between. Indeed, even in the Class B geographic zones where the disparity between Class A and Class B1 facilities was somewhat less, upgrading from Class A facilities was difficult.

Cole is a partner in Bechtel, Borsari, Cole & Paxson, a Washington, DC-based law firm.

Noting the difficulties of Class A broadcasters, two petitioners approached the Commission with proposals to remedy the situation. One petitioner proposed creating a new intermediate class of station for the Class C geographic area. The second petitioner proposed an across-the-board power increase from 3 kW to 6 kW for all Class A stations.

In April 1989, the Commission decided to adopt the former proposal and continue to consider the latter. This resulted in the birth of the Class C3 classification, with maximum HAAT of 100 meters (328 feet, the same as Class As) and maximum ERP of 25 kW. Class C3 stations will be limited (at least for the time being) to geographic areas that are presently available



for Class C stations. As for the across-the-board power increase proposal, the comments submitted to the FCC in response to the initial proposal reflected a lot of disagreement about the propriety of such an increase and also about the means of implementing it. Presumably some of that resistance came from stations with higher classifications, who feared that higher-powered Class A stations might create interference somewhere within their present service areas. Faced with this resistance, the Commission chose to act only on the Class C3 proposal.

Back in the old days—five years ago—there were only three classes of commercial FM channel.

The availability of a new class of FM channel may affect existing stations in several ways. First and most obvious, any existing Class A station in the Class C geographic areas can consider the possibility of upgrading. In fact, the Commission itself had already identified some 150 existing Class A authorizations which could be upgraded. (A list of the FCC-identified stations has been published by the Commission and can be obtained from your communications counsel.) Since Class C3 stations have the same maximum HAAT as Class A stations, a station could conceivably upgrade its facilities simply by installing a more powerful transmitter. Thus, Class A licensees may find an opportunity to improve their signals with little difficulty.

One side effect of the Class C3 action that may not be so obvious relates to existing Class C2 stations. In order to ensure that Class C2 stations presently providing less than the minimum prescribed service don't now receive excessive protection, the Commission will require that such stations upgrade themselves to the appropriate minimum facilities. Affected Class C2 stations will have two years to improve their facilities to full Class C2 status or be downgraded to Class C3.

To make life simple, the FCC will issue a public notice identifying stations subjected to reclassification so they can take appropriate and timely action. Practically speaking, it should be fairly easy to avoid downgrading: in virtually all instances, only a minor increase in power—from 25 kW to 25.1 kW, for instance—will be required. Note, however, that applications for facilities changes necessary to avoid downgrading are subject to a special processing procedure. This procedure affords each applicant only one 30-day opportunity after the deadline to correct any deficiencies in the application.

In other words, assume you file a timely application for upgrading. Assume, too, that the FCC doesn't get around to processing your application until after the upgrading deadline. Also assume that the FCC finds some deficiency in your application. The Commission will then notify you of the deficiency and you will have 30 days in which to correct that deficiency *and* any others which may also appear in the application. If your application still contains problems after that 30-day period, it will be returned and your channel allotment will be reclassified. To get back to Class C2 status, you'll have to start back at square one by filing a petition for rulemaking. So take great care preparing an upgrade application.

If you are a Class A station subject to U.S. border agreements with Canada or Mexico, bear in mind that Class C3 allotments within 320 km of the Canadian border will be treated as Class B1 allotments. Class C3 allotments within 320 km of the Mexican border will be considered Class B allotments.

The effective date for adopting the Class C3 classification was June 1, 1989. Although there has been no indication this date has been changed as of this writing, you never the less may wish to consult with your communications counsel to be sure.

Finally, while the new Class C3 classification may help a significant number of Class A licensees in the Class C zones, how will the proposed across-the-board power increase affect everybody else? Here the Commission continues to look at the proposal with an eye toward taking additional steps to ensure any authorized power increase won't create objectionable interference for other licensees. (For more information on the proposed Class A power upgrade, see Radio News on p. 49 in this issue.) ■

EQUIPMENT

Cablewave Intros New Antenna Series ... Prime Image Intros Fourth HR600+ TBC ... Leader Intros Waveform Monitor/Vectorscope ... Tektronix Presents Microwave Spectrum Analyzer

Cablewave Intros New Antenna Series

A new series of two-, four-, and six-foot 23 GHz antennas designed for use as microwave links has been introduced by Cablewave Systems. The antennas are available in two styles—high-performance shrouded and standard parabolic configuration. The antennas utilize spun aluminum reflectors, center-fed waveguide feeds and galvanized steel tower mounts for attaching to standard 4½-inch pipe. Azimuth fine adjustment is ±5 degrees. Elevation adjustment is -5 to +50 degrees for two- and four-foot antennas and ±5 degrees for six-foot antennas. All meet EIA standards RS-195B and RS-222C.
Reader Service #206

Prime Image Intros Fourth HR600+ TBC

The fourth time base corrector in Prime Image's HR600+ series, model 811, features 600 horizontal lines of resolution, clean transcoding among all popular component and composite formats, eight-bit sample (chroma and luma), 3.58 feedback, drop-out compensation, luma noise reduction, full-frame synchronizer, hot-switch input between nonsynchronizer sources, freeze (frame, field 1 and field 2), strobe (field or frame, variable rate), selectable chroma noise reduction/enhancement, posterization, mosaic and sepia effects. List price is $9750.
Reader Service #207

Leader Intros Waveform Monitor/Vectorscope

Leader Instruments' Model 5872 combination waveform monitor/vectorscope includes all the features of the company's top-of-the-line Model 5870 except SCH phase measurement and full line selection. The unit also features sweep rates of 1 H, 2 H, 1 V, 2 V and 1 H MAG, 2 H MAG, 1 V MAG and 2 V MAG. A 5x vertical gain magnifier contributes to high-resolution differential phase and gain measurements in the R-Y mode. List price is $3795.
Reader Service #216

Tektronix Presents Microwave Spectrum Analyzer

Tektronix' new 2782 microwave spectrum analyzer features a coaxial frequency range of 100 Hz to 33 GHz with fundamental mixing to 28 GHz; full-range sweep from 100 Hz to 33 GHz; resolution bandwidths from 3 Hz to 10 MHz; and 100 dB display dynamic range. Other features include simultaneous digital and analog waveform displays and a color display system using a liquid-crystal, color-shutter display. List price is $65,000.
Reader Service #212

Amtel Presents New Editing System

Amtel Systems has announced the EPix nonlinear, hybrid editing system, engineered to use both tape and disc technology. As edits are selected from source videotapes, they are recorded on videodiscs where real-time previews and nonlinear editing are performed. EPix is designed for use in editing all types of productions, such as commercials, television series, and feature films. Features include fast startup, no mandatory logging functions, no tape duplication or disc mastering, auto-assembly of screening copies from tape or disc, built-in sync and audio/video switching, built-in list management and film conform capabilities and edit decision lists output in virtually any industry format.
Reader Service #200

TSI Unveils Syscon 200 A/V Control System

The Syscon 200 audio/visual control system from TSI features a modular design and can accommodate up to 75 functions per unit, depending on the control application, and up to 48 switches per panel. Other features include an input/output board that provides connections for remote control panels; machine control connectors labeled for each machine; prewired plugs for each machine; and push-on connectors supplied with the remote panels.
Reader Service #218

Siecor Test System Simplifies Return Loss Measurement

The time and effort to measure return loss is halved with a new option available with Siecor

Corp.'s CME 1000 attenuation test equipment, according to the manufacturer. Using the CME 1000's return loss option condenses the measurements into three steps, minimizing variables. Existing units can be upgraded. Single mode systems or cables at 1300 nm or 1550 nm can be measured to within ±1 dB accuracy, says Siecor. The unit meets EIA requirements of FOTP-107 and Bellcore technical reference TR-TSY-000326.
Reader Service #205

CRL Premiers Stereo Processor

CRL Systems has introduced its Tri-Band AM stereo matrix processor. The unit features state-of-the-art circuitry coupled with precise implementation of NRSC standards. List price is $2295. Also available from CRL are the PMC-450 Tri-Band peak modulation controller, $1695, and the IPP-100 programmable microphone processor, $1295.
Reader Service #217

IPM Offers Smaller Uninterruptible Power Systems

A smaller series of uninterruptible power systems is an addition to International Power Machines' Endless Power line of transistorized UPS. The SP Series includes modules of 18.75 kVA (Model SP18) and 30 kVA (Model SP30), enclosed in a contemporary cabinet. The battery pack may be connected to the UPS in a single unit or separated from it, depending on user requirements. In the event of a power outage,

the battery pack supplies power for 15 minutes or more, depending on the amount of power being used. The SP series is ETL-listed and is available for 60 Hz operation with input and output voltages of 208 and 480 V ac. Options include a digital monitoring panel with audible alarms.
Reader Service #202

Covid Announces S-Video Interface

The 123 S-Video Interface from Covid, Inc., is designed to provide a direct connection between S-video TVs and many computers, including the IBM PS/2 models 25 and 30. The 123 features separate Y and C signals, RGB analog and digital inputs, one composite and two S-video outputs. Any or all of the outputs may be used simultaneously. A change of input cable permits connection to PCs with CGA and most VGA cards. Optional software permits the 123 to support IBM PS/2 models 30-286, 50, 60, 70 and 80.
Reader Service #203

Wavetek RF Intros Signal Generator/Deviation Meter

Wavetek RF Products has introduced the Model 2407 signal generator/deviation meter, designed to increase productivity in ATE and field service applications. The synthesized signal generator covers a frequency range of 0.01 to 550 MHz and offers an IEEE-488 interface as a standard feature. RF output range is +13 to -127 dBm with an accuracy of ±1.5 dBm. Output power is -127 dBm to +13 dBm with resolution of 0.1 dB and full-band flatness of ±1.0 dB. Autocalibration includes the ability to initiate calibration over the IEEE-488 control bus for automatic correction and service. Access to internal error correction data is provided through the bus to track aging and to allow scheduled maintenance. Internal modular construction allows quick repairs. List price is $4595.
Reader Service #204

Kinemetrics Offers TC Reader/Tester

Kinemetrics/TrueTime's Model 9721 time code reader/tester is described as the first commercially available instrument to perform unsupervised bit-by-bit verifica-

tion of the full range of IRIG time codes. The unit can pinpoint the type of time code failure, as well as its position in time. In addition to accepting IRIG A, B, D, E, G and H time codes in either level shift or modulated format, the Model 9721 can accept parallel BCD inputs for verification.
Reader Service #213

Rapid Systems Announces Waveform Synthesizer

The R4000 arbitrary waveform synthesizer and function generator from Rapid Systems is designed to turn any PC into a turnkey 10 MHz system that outputs sine, square, triangle, ramp, pulse, DC or white noise waveforms. Other features include continuous, sweep and burst modes; user-definable interface software; 16,000-point waveform memory; mouse interface; and programmable amplitude to 10 V p-p.
Reader Service #214

Ellason Weather Radar Presents Model E250

Ellason's E250 color weather radar features five operator-selected ranges: 10, 25, 50, 100 or 200 nautical miles; variable antenna tilt angles from 0 to 20 degrees up; and three operator-selected gain positions: maximum, preset and minimum. Other features include an AT style computer cabinet; RGB output with 640 x 480 pixel resolution; 14-inch multiscanning monitor; Sperry RTA-1003-FCC type accepted part 90 antenna; automatic operation; and two map overlays.
Reader Service #208

Alias/2 Animation System From BTS

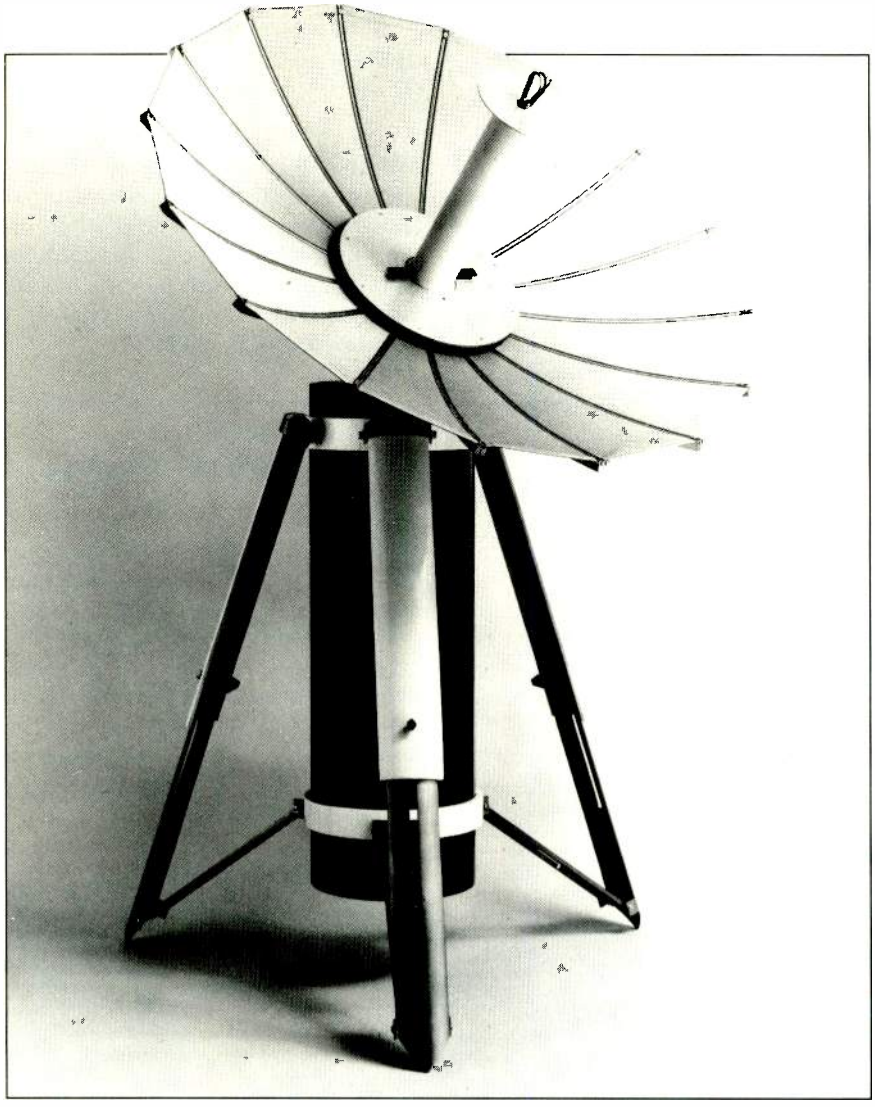
The combined capabilities of the new Alias/2 software package and its Pixelerator render engine create a state-of-the-art 3D modeling and animation system, says the manufacturer. Alias/2 is designed by Alias Research, Inc., and runs on the Silicon Graphics 4D Series workstations and directs the BTS Pixelerator in rendering animations. Some key options include trimmed surfaces modeling, CAD data compatibility, animation object metamorphosis and natural phenomena rendering.
Reader Service #208

Sola Power Systems Provide Total Isolation

Sola's Electronic 57 Series of uninterruptible power systems features a built-in shielded-primary isolation transformer. The transformer is located upstream of the UPS bypass switch so that, even when operating in bypass mode, the system's load is protected against spikes, surges and line noise. Output transformers are multitapped to allow user-selected combinations of load receptacles with outputs of 120, 208 and 240 V ac (single phase).
Reader Service #209

PSC Introduces Communications Module

Professional Sound Corp. has introduced the SX-F2 communications module for its Sonomax mixing panels. The SX-F2 talkback system features Slate Mic with subtone, PL Mic for talkback to boom, two remote roll switches and Boom Monitor stereo channel select. The unit can be installed in Sonomax models SX-S6, SX-S8 and SX-S10.
Reader Service #210



Comtech Intros INMARSAT Antenna System

Comtech Antenna, in conjunction with Seavey Engineering, has introduced its INMARSAT antenna system. The Model AS33-15 C/U is a 33-inch diameter collapsible antenna designed for L-band transmit/receive applications. Engineered for airline transport, the antenna weighs just 40 pounds with its case.
Reader Service #222

Benchmark Releases Preamp/Program Amp

Part of the System 1000 modular distribution and processing package, Benchmark's MDA-102 dual microphone preamp/program amp is a plug-in module. The unit features two channels of amplification with four outputs per channel, 1 dB noise figure, 200 kHz bandwidth and variable gain from -2 to +73 dB. Additionally, the preamp has three types of power built in, +12 V, +48 V phantom and +12 V AB/T power.
Reader Service #215

Debut for ABS MicroCart 200

American Broadcast Systems MicroCart 200 provides automated VTR control for stations wishing to configure a spot and program playback system using existing transports, TBC, monitoring and cabinetry. The system uses FSK cueing and is available as a single- or dual-channel system, with features such as two-second preroll, stereo audio and exclusive remote "Break" button. Complete system includes DCP-1000 computer, multiple terminals, switcher, sync distribution, transport interfaces, remote control panel, playlist, label and logging printers and cable harnesses to control eight VTRs.
Reader Service #201

Fluke Unveils GPIB Interface Card

John Fluke Mfg. has come out with the Philips PM 2202 GPIB interface card, designed to permit an IBM PS/2 computer to act as a controller for GPIB/IEEE-488 instrumentation and measurement systems. Standard features with the card include a set of software routines and drivers to simplify GPIB programming that can be included in applications written in BASICA/GWBASIC, Microsoft C and Microsoft Pascal. List price is $695.
Reader Service #211

Avcom Introduces Portable Spectrum Analyzer

Model PSA-65A, Avcom's portable spectrum analyzer, covers frequencies through 1000 MHz in one sweep with a sensitivity greater than -90 dBm at narrow spans. Options include frequency extenders enabling the unit to be used at Satcom and higher frequencies, audio demod for monitoring, log periodic antennas and carrying case. List price is $2675.
Reader Service #219

Technology Resources Presents TripodTray

TripodTray from Technology Resources Group is a three-pound tray designed to mount directly to any tripod with a ¾- to 2½-inch neck. The device holds up to 20 pounds of extra equipment, including

a TV monitor, VTR, power pack, lights, mixer, storyboards, tapes, scripts or headphones. TripodTray extends to 10 by 14 inches and includes cable grouping ports and wire coiling and hanging notches. List price is $89.95.
Reader Service #220

Editech 1000 Rematches TBC Settings

The Editech 1000 is an integrated hardware/software system that automatically stores and recalls time base corrector values on an edit-by-edit basis, permitting precise automatic rematching of TBC values to previously recorded video, says the company. The basic configuration consists of a PC interface board; two TBC interface boards; a system control panel; a TBC interface board enclosure; a program disk; and a 512K RAM minimum IBM-compatible PC (not included). List price for the basic system is under $5750.
Reader Service #221

Lemo Unveils Improved Video Triax Connectors

Lemo USA has announced improvements in the design of its video triax connectors. All receptacles have been modified with a special groove and multilam contact arrangement to ensure good continuity of signal through shell to shell conductivity. The plugs also now feature triple-wall construction. The latching mechanism has been improved by upgrading the spring material for the inner sleeve. List price for plugs is $118.15; in-line receptacles, $76.13; panel-mount receptacles, $34.83.
Reader Service #223

Intelco Announces Fiberoptic Test Sets

Intelco's 190 Series fiberoptic test sets allow users to select a complete testing system suited to their needs. Each set includes a hand-held optical meter and matching stable optical source, packaged in a foam-lined case. Sets have been designed for both single- and multimode fibers, as well as for short-, hybrid- and long-distance networks. Optical sources are available in a variety of wavelengths, with a choice of laser or LED source modules.
Reader Service #225

BUSINESS BRIEFS

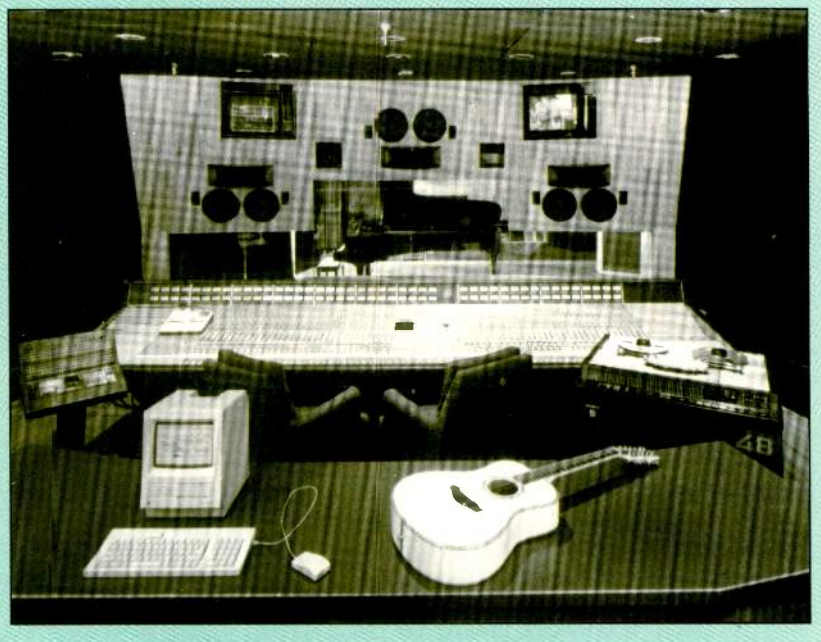
Varian Associates, Palo Alto, CA, and **Thorn EMI Electronics, Ltd.**, U.K., have dissolved their British joint venture known as **Thorn EMI-Varian, Ltd.** As a result, a product line formerly sited in the U.K. is being shifted to Varian's Microwave Power Tube division in California. The transferred products involve tubes for UHF broadcasting . . . **Ampex Corp.**, Redwood City, CA, has incorporated its magnetic tape division as a wholly owned subsidiary, **Ampex Recording Media Corp.** . . **Amoco Technology Co.**, a subsidiary of **Amoco Corp.**, has acquired a minority interest in **Meret, Inc.**, Santa Monica, CA. Meret supplies a variety of analog and digital transmission products and is preparing to unveil an HDTV fiberoptic system capable of 50 MHz RGB bidirectional transmission over 10 miles of single fiber, the product of a joint venture with **Rebo Research**, New York . . . **Video Rentals Inc.** and **A/T Scharff Rentals** have merged into a new company called **VRI Scharff Rentals**, located in Northvale, NJ. The company is headed by president Bill Ebell.

Panasonic Broadcast Systems Co., Secaucus, NJ, has sold cameras and studio VTRs to **KHQ**, channel 6, in Spokane, WA. "We completely reworked the news department around the purchase of the Panasonic equipment," said chief engineer Bill Isbell. Isbell bought a wide array of equipment, including seven AK-400 three-CCD color cameras and AU-400 camcorders; four AU-500 portable VTRs; five AU-650 studio VTRs; one AU-660PE high-performance studio VTR; and one AU-620 studio player.

Brabury Porta-Pattern, formerly located in Los Angeles, has moved its entire operation to the Kansas City area. The new address is 15755 South Highway 169, Olathe, KS 66062; telephone (913) 780-4822.

Berk-Tek, New Holland, PA, has promoted John Gibson to the new position of vice president, engineering and quality assurance. Formerly director of engineering and quality assurance, Gibson will direct the company's product development, manufacturing engineering and quality assurance functions . . . **Comark Communications, Inc.**, Colmar, PA, has named James L. DeStefano vice president, international sales; it has also appointed Raymond C. Kiesel vice president, advanced development and Stuart M. Kravitz, vice president, domestic sales . . . **Ampex Corp.** has named James Carro vice president, U.S. sales and service; Curtis Chan has been appointed senior product manager for new business development . . . Bill Kelly has joined **Editel/NY** as vice president, program sales, after 11 years as vice president, sales and marketing, with National Video Center.

The ITS Second Annual Forum is scheduled for September 16-19 at the Century Plaza Hotel in Los Angeles. Events set for the meeting include a comprehensive marketing institute program; hearings on HDTV production formats; breakfast roundtables; and seminars. ■



The Los Angeles Record Plant, part of the Chrysalis Group, has installed a new Solid State Logic SL 4000 G Series console. The new unit is an SL 4072 with 64 channels, G Series studio computer and Total Recall. Located in Studio 2 of the recording complex, the SSL console is used for record dates, as well as scoring television and motion pictures. "This is our fifth SSL console," said Chris Stone, president of Record Plant. "It replaces a previous E Series console that had been in service for seven years, longer than any other console in the studio's history."

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Circle 118 on Reader Service Card.

Don't Sell Your Signal Short

By Roy Trumbull

Earlier this century, the city fathers of San Jose, CA, engaged in an intense debate regarding the proper way to illuminate the city streets. One advocate, whom I'll call Brown, favored a central tower to provide a single light source. The opposition, call them the Smith faction, called for individual lamp poles on each block.

Brown praised the simplicity of his system and its cost-effectiveness. He had only to point to the sun to cite divine precedence. The Smith group countered that light distribution would be unequal, and citizens at a distance would be in the shadow of nearby buildings. The light on the tall tower was defeated, but the idea didn't go away. The modern-day Browns are engaged in over-the-air broadcasting, whereas the Smiths may be found in cable TV.

In AM radio, the central transmission point idea was effective. But television suffered from terrain obstacles and shadows. Cable came into being, in part, simply to provide a signal to places the light bulb didn't reach.

Today, the transmission side of broadcasting has stagnated while cable has grown into a giant. The existence of "free TV" comes down to two things: the right to occupy a given channel, and required carriage by the local cable systems. What would happen to your economic prospects if your place on the cable systems were taken by another station? How much of your present audience are you reaching over the air?

It is a real education to follow up on viewer complaints and find out how many neighborhoods are receiving strong interference from power line sparking. A poorly maintained three-phase high tension line can wipe out the entire low band. With HDTV, you may find only those within 20 miles of your transmitter site can receive an unimpaired signal.

Even cable households will have trouble. Many imported TV receivers permit leakage. A station's signal can have a black bar in it from the mix of the cable with the off-air signal. We must develop a leakage spec for receivers and convince Consumers Union to check leakage when it rates television receivers.

We need to do some fence-mending if we want to keep our audience share. More time needs to be spent in vigilant investigation of viewer-reported interference problems. The areas in trouble at any given time may add up to a significant percentage of total audience.

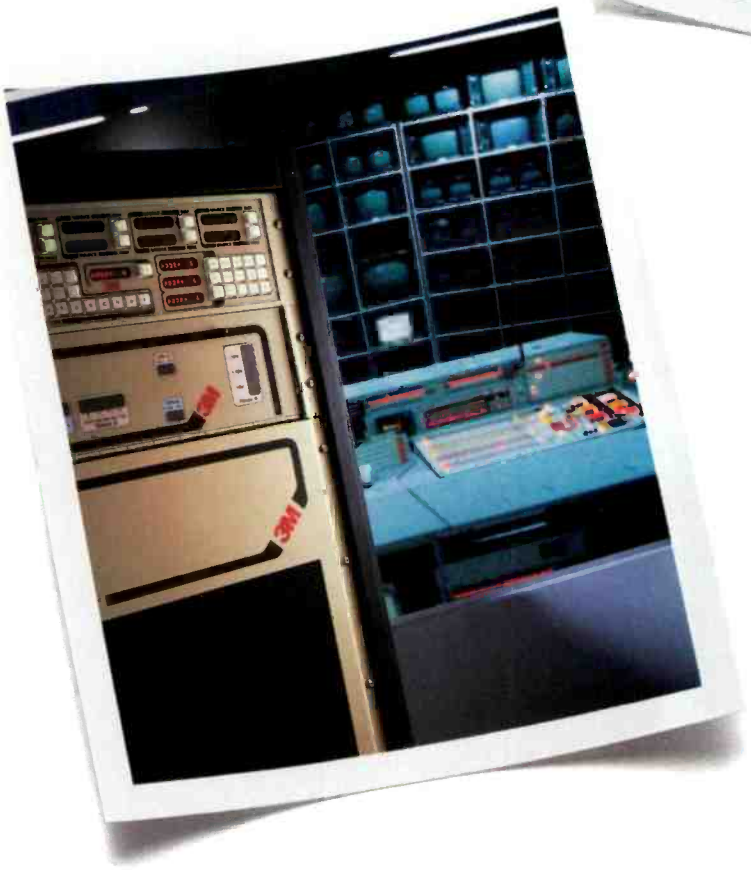
Stations in smaller markets have made good use of translators to serve their audience. Some PBS stations, for example, use many translators. Recently the FCC permitted TV on-channel boosters, but so far interest has been limited.

For the future, one can certainly paint dark pictures by speculating about the eventual outcome of combinations involving the networks, the telephone operating companies, and cable. It's important now to do your best to deliver a good signal and develop those audience pockets considered uneconomic by cable.

While national programming does have an impact, the viewers will still turn to you to find out what those three squad cars were doing at Mabel's earlier in the evening. Give them a good picture. ■

Roy Trumbull is assistant chief engineer of KRON-TV, San Francisco.

Directing Traffic In The Heart Of NYC.



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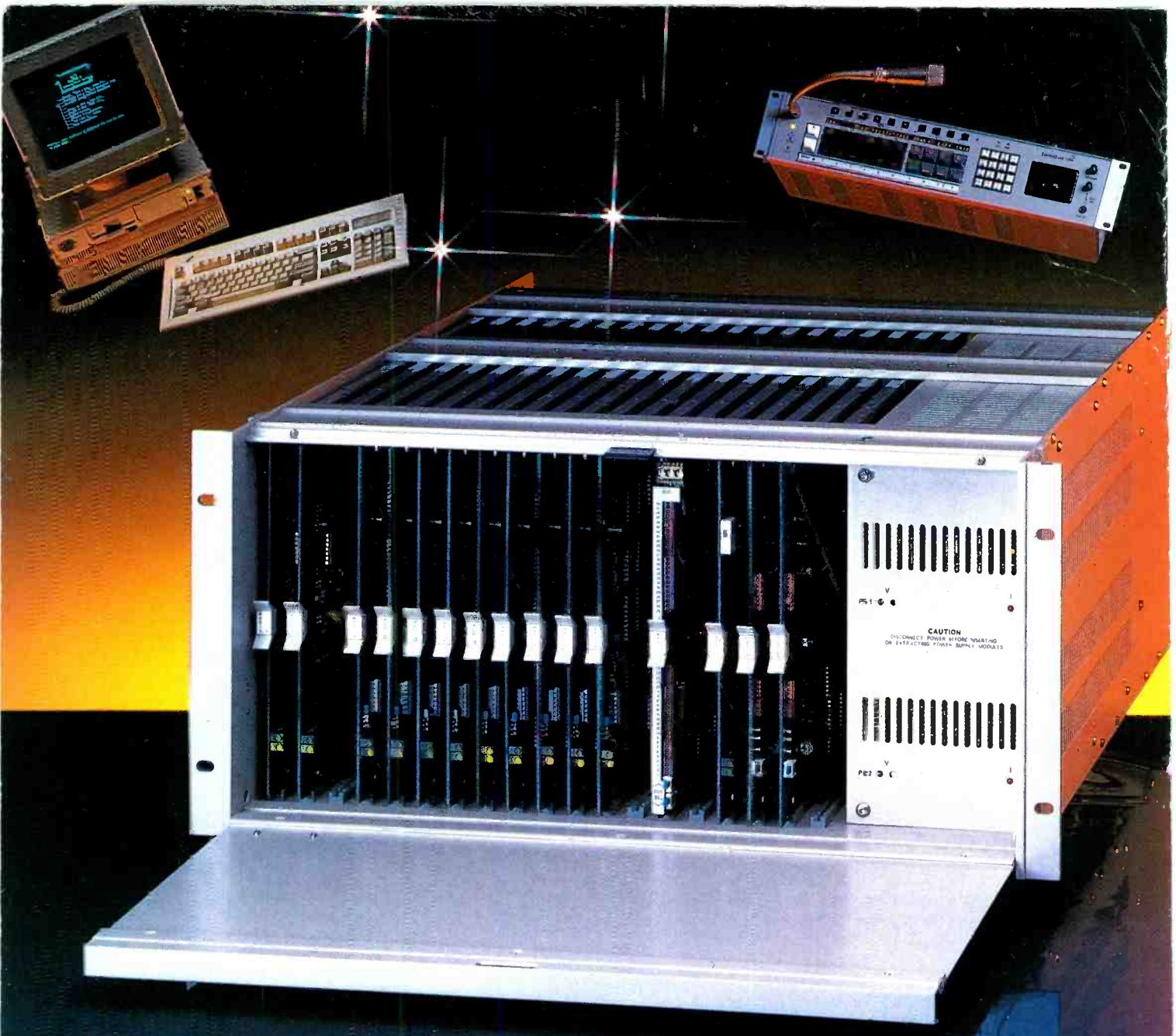

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