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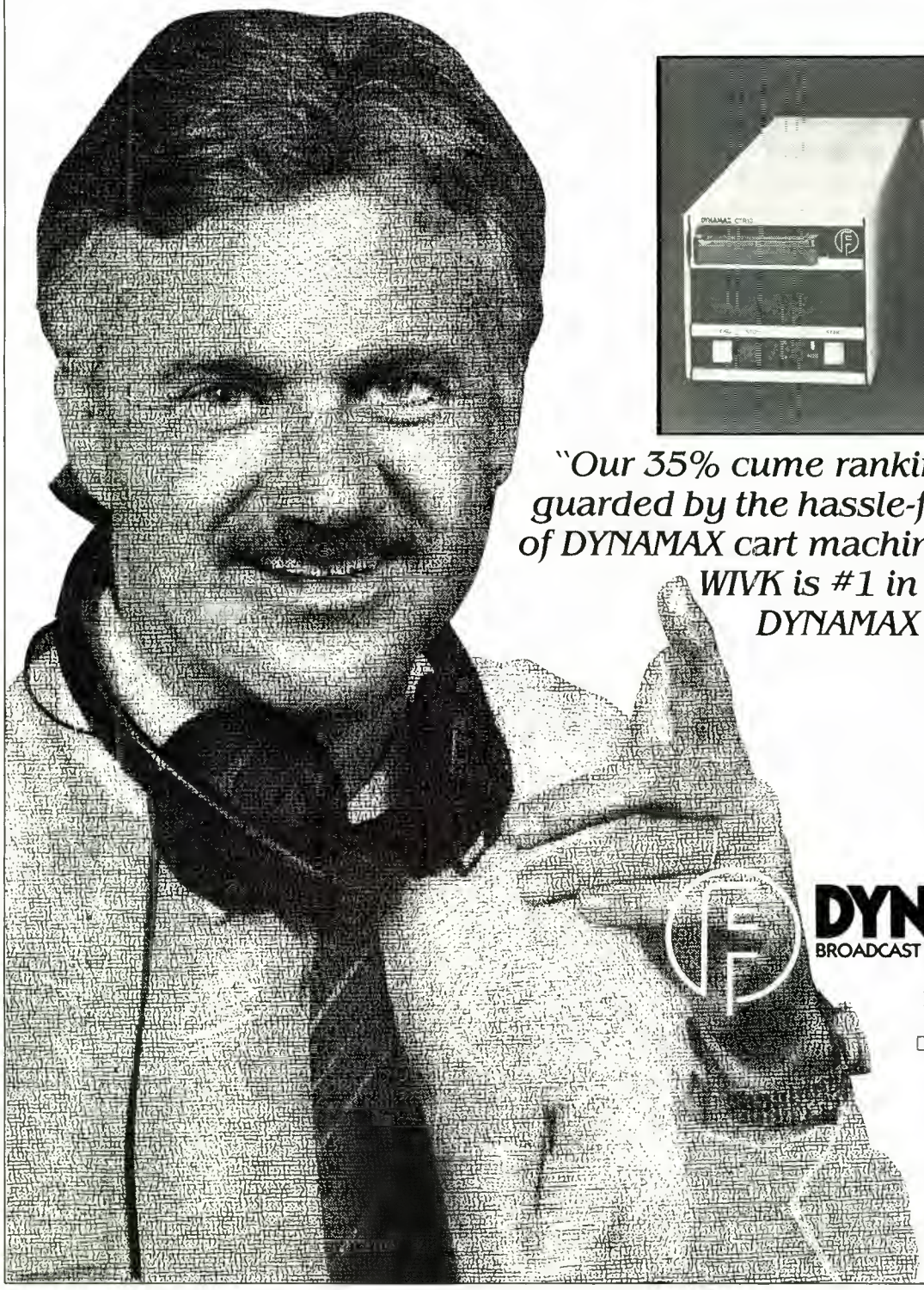

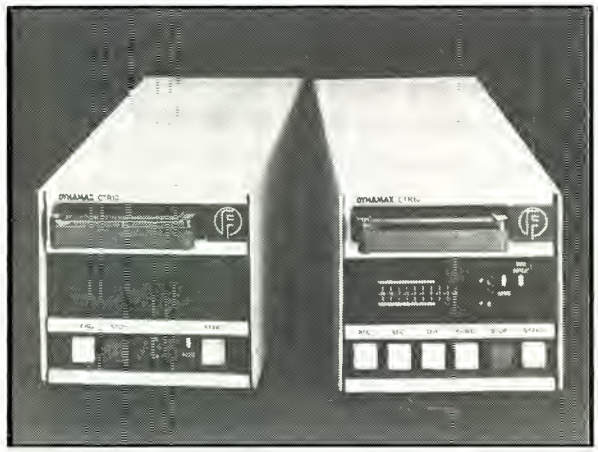

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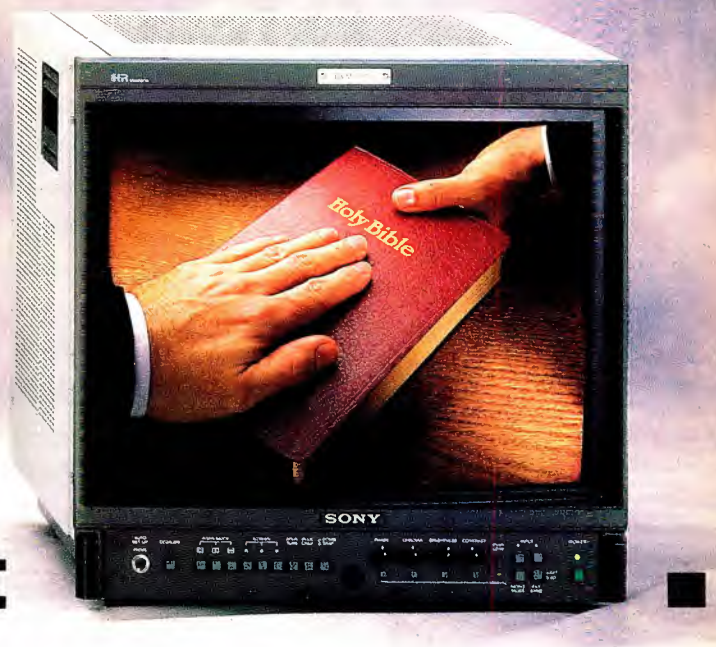

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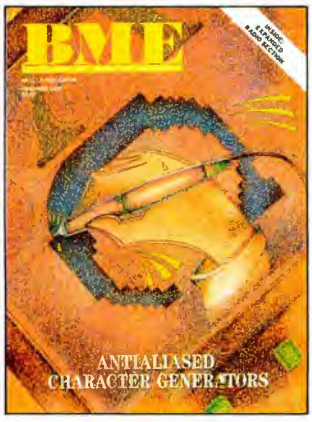

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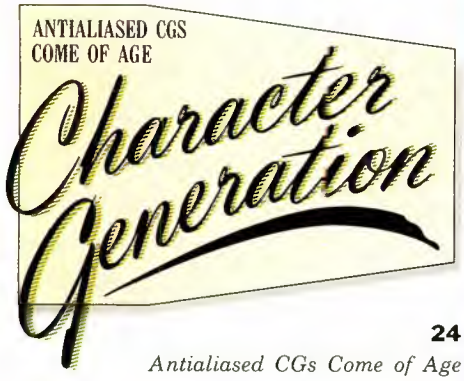
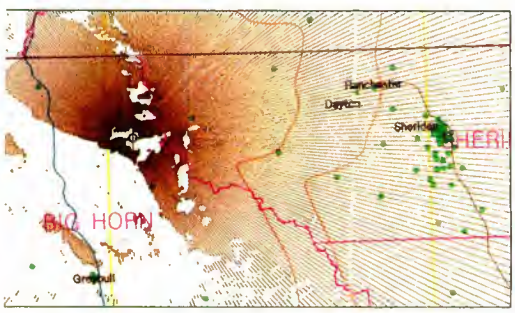


24 *Antialiased CGs Come of Age*

35 *Will Your STL Be Legal Next July?*



38 *Supplementing the Service Area*

BME
FOR TECHNICAL AND ENGINEERING MANAGEMENT

NOVEMBER 1989
VOL. 25, NO. 11

Features

24 Antialiased CGs Come of Age
Once too expensive and too slow for anything other than high-end post, the antialiased character generator has become a speedy, cost-effective alternative.

30 Pipeline Processing in Character Generation
A new approach to CG design, pipeline processing, permits the elimination of frame buffers.

35 Radio Engineering

35 Radio News
Will Your STL Be Legal Next July? . . . TFT Reciter Gets FCC Type Acceptance . . . EIA and NAB Launch Program to Promote High-Quality AM Sound . . . NAB Asks FCC to Dismiss Petition Seeking New Jersey FM Translator Upgrade

38 Supplementing the Service Area
Some broadcasters have looked at boosters as a sort of "cellular salvation." Yet even with a host of high-tech improvements, booster results can be disappointing if the system is not painstakingly engineered.

45 Digital Production and Control Take Off in the Great White North
A Canadian radio chain's leap to digital production lands it squarely on the side of the future.

51 Narrowband Digital Audio
Concerns about the RF spectrum inefficiency of digital audio systems are about to be made moot, as smart and transparent data compression schemes come on-line.

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BME (ISSN 0005-3201) is published monthly by NBB Acquisitions, Inc. BME is circulated without charge to those responsible for station operation and for specifying and authorizing the purchase of equipment used in broadcast facilities in the U.S. and Canada. These facilities include AM, FM and TV broadcast stations, CATV systems, ETV stations, networks and studios, audio and video recording studios, teleproduction facilities, consultants, etc. Subscription prices to others: $36.00 one year, $50.00 two years. Foreign: $50.00 one year, $75.00 two years. Air Mail rates on request. Copyright 1989 by NBB Acquisitions, Inc., New York City. Second class postage paid New York, NY, and additional mailing offices.

POSTMASTER: send address changes to BME, P.O. Box 6056, Duluth, MN 55806.

Columns & Departments

12 Viewpoint
The more elements of the HDTV picture that can be agreed on internationally, the greater the benefits for international program exchange and engineering cooperation.

14 Update
Sony Announces Serial Interface on All Future Digital Video Products . . . Peter Caranicas Named Director of Editorial Development for BME *. . . Dolby, Ampex and Others Receive Emmys . . . SMPTE Ad Hoc Group Submits Report on Digital Key Standard*

19 Tech Watch
Lasers On a Chip Shrink Computers

59 New Products
BME*'s expanded product coverage*

76 Compute
Use an Electronic Spreadsheet to Make Indirect Power Tables

78 Spectrum: The Regulatory Environment
Winds of Change at the FCC

81 Advertisers Index

82 Business Briefs
Comark places a 60 kW Klystrode transmitter in service in Chattanooga.

82 *New Age Sight & Sound's BOSS/2 System*

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VIEWPOINT

The more elements of the HDTV picture that can be agreed on internationally, the greater the benefits for international program exchange and engineering cooperation.

It is premature, of course, to predict the outcome of the HDTV transmission tests due to begin this spring, or the HDTV standards the FCC eventually will set for the U.S. Nevertheless, we'd like to venture a few thoughts on what might constitute an appropriate HDTV system for this country.

On the transmission side, we're loath to see the limitations of NTSC carried over into the next generation of television technology. Compatibility with present-day receivers clearly is an economic survival issue for today's television broadcasters. But any system that fails to overcome the major transmission difficulties that have plagued NTSC for decades is bound to be a failure in the marketplace and another blow to over-the-air "free TV." Rather than simply ensuring that an HDTV transmission system is no worse than NTSC in its transmission ruggedness, we urge the ATSC to insist on improving not only resolution, but also off-air reception to the millions of viewers who still depend on terrestrial transmission. If such improvement proves impossible with receiver-compatible systems, we further urge the ATSC to give serious consideration to a simulcasting system, such as that proposed by Zenith. Surveys show that U.S. TV viewers are excited by the prospect of better pictures. If broadcasters are hampered by less than the best possible transmission technology, they may lose those viewers forever.

The European community's adamant stance on the 50 Hz field rate has dimmed the chances for a true world HDTV standard, but we're heartened to see efforts continue toward a common image format for HDTV production. The more elements of the HDTV picture that can be agreed on internationally, the greater the benefits for international program exchange and engineering cooperation. The "best" HDTV system for the U.S. may be the one that most closely matches the systems used by our counterparts across the world.

This month, as a special service to our radio readers, *BME* offers a greatly expanded edition of our Radio Engineering section. The section leads off with a story on booster technology written by Mike Starling, senior engineer at National Public Radio and a new contributor to *BME*. Dan Daley, who contributed pieces on intercom systems and headphones for last month's special supplement, returns this month with a profile of Moffet Communications, the Canadian radio chain that recently switched entirely to digital production. *BME*'s audio editor, Skip Pizzi, rounds out the section with an exploration of narrowband digital audio transmission, a development bound to have a major impact on radio. We hope you find these articles on the state of the art in radio technology useful and informative. ■

Eva J. Blinder

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Editor

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UPDATE

Sony Announces Serial Interface on All Future Digital Video Products...Caranicas Named Director of Editorial Development for BME*...Dolby, Ampex, Others Receive Emmys...SMPTE Ad Hoc Group Submits Report on Digital Key Standard*

Sony Announces Serial Interface on All Future Digital Video Products

All future Sony digital video products complying to the 4:2:2 component signal format and 4fsc NTSC and PAL composite formats will be provided with serial digital input/output capability, according to Peter Dare, vice president, product management, Sony Communications Products Co. Dare said the new serial digital interface is capable of handling signals with up to 10 bits resolution for the video signal, combined with 20 bits resolution audio (four channels).

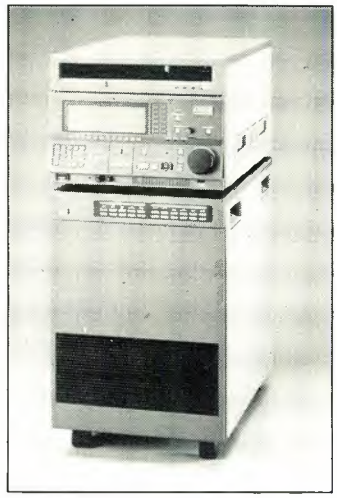
"It's critical that we offer a simple, practical means of providing digital input and output capabilities," Dare said, "as many customers want to integrate D-1 component and D-2 composite equipment in the same environment." He said some serial interfaces may be able to use existing coax cables for distribution and patching of signals. Sony is also offering conversion kits and adaptor boxes for both its own existing equipment and other manufacturers' digital video products.

According to Merrill Weiss, managing director of systems engineering at NBC and chairman of SMPTE's Committee on Television Technology, the Sony interface is being built to a standard now being considered by his group. "There is a document wending its way through the SMPTE process that defines the serial digital interface and Sony is building to that document, which will be approved shortly," Weiss explained.

"In a sense, by making the announcement now, Sony is anticipating final approval by SMPTE of this system," Weiss noted, adding, "I have to believe that, even if SMPTE were not going ahead, Sony would be."

Other digital video manufacturers may take a wait-and-see attitude on the new serial interface. Craig McCartney, senior product manager, digital effects at Ampex, told *BME*, "We certainly are waiting for some indication from the marketplace as to what if any serial digital interface people want us to put on equipment for them. Frankly, the most interesting has been the one based on the Sony chip set."

McCartney said Ampex has a sample of the Sony chip set but is not planning to make serial interface standard on all equipment at this time. He said the company is aware, however, of the need. "We know there is a perceived need among users for serial digital interface because of the problems of the parallel: the bulk of the cables, the maximum cable length is short, patch panels are massive and all of those other problems. It's not a good system to set up a routing system around," he pointed out.



Sony VTR: serial interface soon.

Weiss summed up what he sees as the industry's likely attitude toward the Sony announcement. "It's a logical next step. The parallel interface was a means to get started interfacing digital equipment. Now it's time for a practical interface; doing it on a single cable using an ordinary connector like a BNC is just the logical next step. It's like moving from UHF connectors to BNC connectors some years ago, only multiplied, because the parallel component connector was so cumbersome." ■

Caranicas Named *BME*'s Director of Editorial Development

Peter Caranicas has been named director of editorial development for *BME* and other new projects.

In announcing the appointment, Kevin J. Condon, senior vice president and group publisher of ACT III Publishing's Technical Group, said, "Peter is an experienced, talented professional who will be a great asset in developing the editorial direction of future acquisitions and start-up publications in the technical area of television and video."

"Just as important," Condon continued, "is the contribution Peter will make working with Eva

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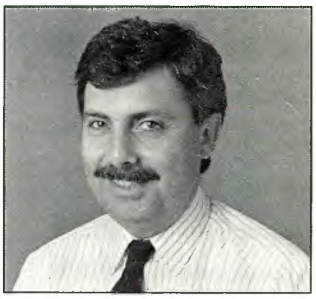
Blinder, the editor of *BME*, especially as we create a plan for the magazine's 25th year of publication and beyond."

Caranicas was most recently editorial director of View Communications, where he was responsible for the editorial development of *View*, *INTV Journal*, *World Screen News* and *Wrap*. Prior to joining View in 1987, Caranicas was editor of *Millimeter* magazine for four years. He has also served as editor of *View* magazine, founding editor of *Videography* and managing editor of the newsletter *Video Publisher*. ■



Peter Caranicas.

SMPTE Ad Hoc Group Submits Report on Digital Key Standard

The Society of Motion Picture and Television Engineers' Ad Hoc Group on Key and Depth has submitted a report on key signal standards, which will be published in the January issue of the SMPTE journal.

According to the group's chairman, William C. Miller, manager of TSE maintenance at ABC/Cap Cities, the group's charter "was to come up with a key signal standard by NAB '89 and to look into 4x4 and interchange of depth information between different devices—which turns out to be a very sticky wicket," he said. "We came up with a key signal standard that has now gone through all the necessary channels and will be published in January."

Miller said the group's report describes a key signal standard written in general enough terms to cover key signals in composite domain, component domain, digital and analog, and that it is applicable to any video standard. "It uses the T parameter—the minimum rise time that a particular television system is defined for (in NTSC, T is defined as 125 ns)," he explained. "The timing specs in the standard are expressed as T over some number; therefore you could use the standard for any HDTV system, just by plugging in the appropriate T parameter." Miller went on to say that the Ad Hoc Group coordinated with EBU, which has been working on key standards for digital component video.

"Essentially, we have said that a key signal from a particular video system should look like a video signal from that system," Miller summed up. "For example, if you're working in NTSC, it should have burst on it. The burst is needed for timing purposes."

SMPTE director of engineering Sy Becker says the Group's recommendations on key signal standards have been approved by both the Working Group on Studio Video Standards and the Standards Committee and will be published in the January issue of the society's journal. After publication, barring negative comments, the recommendations will go to the Executive Committee for standards approval and, if approved, will become an official document of SMPTE.

But the biggest problems seem to be in dealing with depth information interchange in digital formats. "We're looking for help on it," Miller admitted. "If there are any geniuses out there with some idea on how you can interchange depth information, we'd love to know it.

"There's a fairly naive way to do it: For each pixel, there should be an associated depth value and you should be able to spit that out on an adjacent data stream," Miller noted. "If you have a key signal output that's also coming out of an RP-125 signal stream, the key goes in the luminance holes, but the chrominance holes are empty; the depth information could go in there."

But Miller also said that that system breaks down when the objects being worked with include figures such as a sphere or a cube, because of the multiple planes involved. "The idea is to avoid having to do multiple generations to key those figures; that just wastes time. There may not be a solution," Miller said.

Those interested in contributing to the Ad Hoc Group's study of depth interchange should contact Miller at ABC/Cap Cities, 30 W. 67th St., New York, NY 10023. ■

National Academy Honors Seven With Technical Emmy Awards

In ceremonies at the Sheraton Centre Hotel in New York City, the National Academy of Television Arts and Sciences awarded the 1989 Emmy Awards for technical achievement. The seven recipients were Ray M. Dolby, for audio noise reduction systems for professional VTRs; Ampex Corp., for development and implementation of composite digital videotape recording; Sony, for development and implementation of composite digital videotape recording; Magni Systems, for development of a fully programmable television test signal synthesizer; RTS Systems, for development of two-wire intercom systems; TRW LSI Products, for analog/digital video conversion technology; and CBS, Inc., for development and realization of an intelligent master control system for television stations and networks. ■

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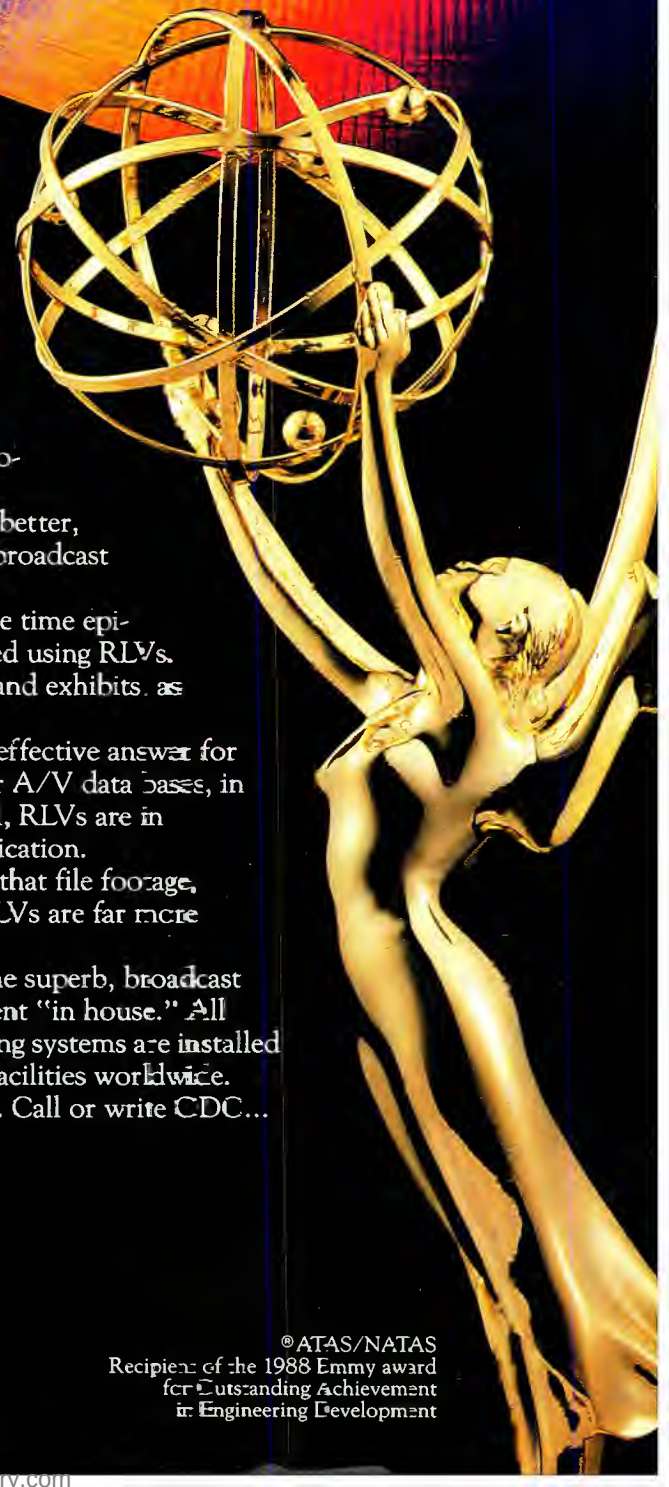

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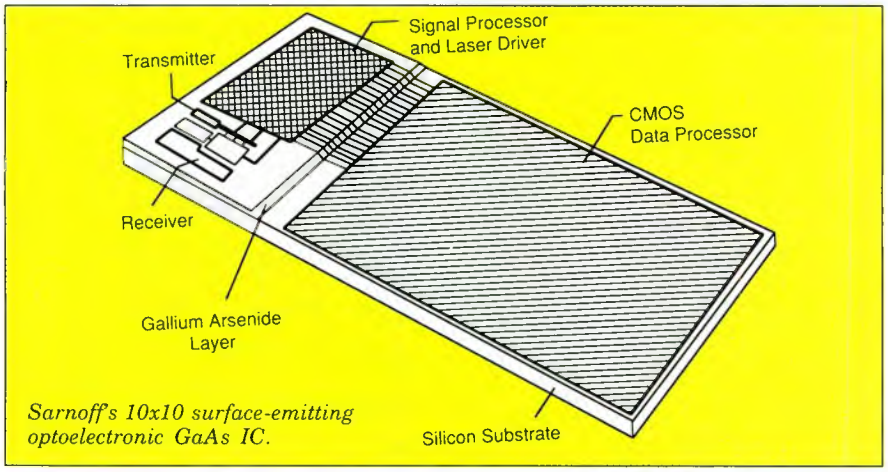
Lasers On a Chip Help Shrink Computers

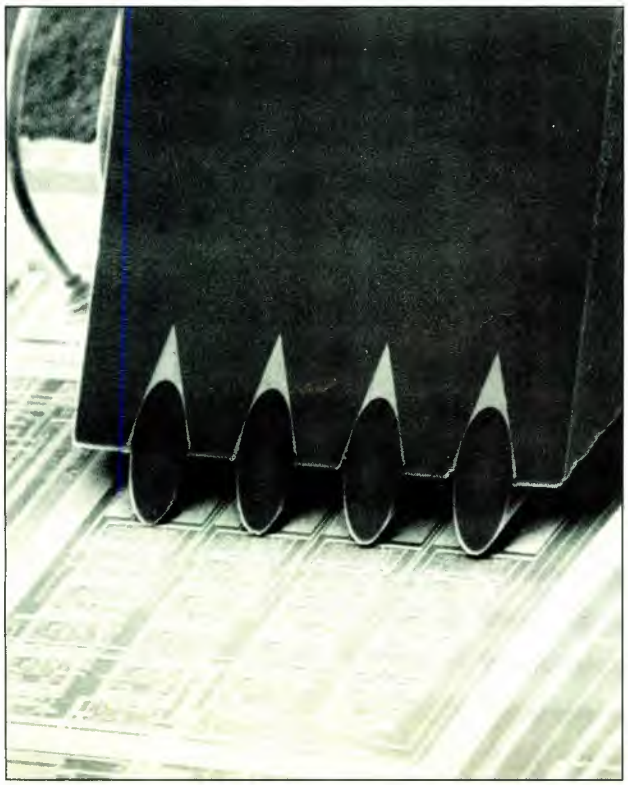
By Robert Rivlin

It is a maxim of the computer industry that everything must get smaller and smaller as it, at the same time, increases in complexity. Thus, the room-sized computers of a few years ago have now been reduced to models that today fit on desktops and into wristwatches.

Currently, computers are pushing the limits of just how many transistors and electronic circuits can be packed onto an integrated circuit microchip. As the packing density of the chips becomes greater, so also do the problems of crosstalk and heat buildup. Thus, despite the search for a superchip that will carry millions of circuits, scientists looking toward the more distant future are beginning to explore other pathways.



Sarnoff's 10x10 surface-emitting optoelectronic GaAs IC.



The transmitter section of IBM's experimental optoelectronic computer chipset, magnified several hundred times.

This is especially true when it comes to supercomputers. The Crays of today have shrunk to about the size of a large piece of furniture. Already requiring an extensive internal cooling system, these computers have gotten about as small as they practically can.

New research into optoelectronic devices, however, promises a bright future for smaller supercomputers. The coupling of the coherent light of a laser with fiberoptic transmission already is opening up the field of telecommunications, with phone circuits based on light capable of handling far more calls than those based on conventional wires. Scientists envision that tomorrow's computers also will be able to handle data using lasers and fiber rather than the wires and electronic circuits of today.

One important step toward that realization has been the recent laboratory demonstration of optoelectronic IC chips that can pack dozens, even hundreds, of lasers onto a single chip. One of the furthest along in this research is the David Sarnoff Research Center, which recently introduced a semiconductor diode laser 100 times brighter than the type of laser that emits light only from its edge—the type currently available to circuit designers. The new laser, called a Grating Surface Emitting Array (GEA), is a monolithic, two-dimensional diode laser structure in which a diffraction grating fashioned of silicon is layered over the laser-emitting gallium arsenide (GaAs) surface like a storm grating. The laser light is emitted from 100 points on the surface of the device.

"For the first time, lasers can be combined on a single chip using conventional integrated circuit fabrication technology," says Dr. Michael Ettenberg, director of the optoelectronics research lab at the Sarnoff Center. "As a result, the GEA maintains the ruggedness and simplicity of a diode laser while combining the

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power of many thousands of lasers packed as closely together as transistors on a computer chip."

In addition, the surface-emitting aspect of the new device makes possible for the first time integrated optical interconnections between semiconductor chips to enable chip-to-chip communication in excess of 10 gigabits per second. Sarnoff researchers believe this technology will handle the severe interconnect limitations currently confronting many computer and telecommunications systems.

"Advanced computing is facing an uphill battle against the electrical interconnect problem," says Ettenberg. "The GEA technology, together with the GaAs layers grown on silicon and the GaAs integrated circuits, represent the three component technologies necessary to achieve optical interconnects between VLSI chips."

Another group of companies with a keen interest in developing high-density laser chips—because of their potential use in fiberoptics telecommunications—are the various Bell organizations. A team of telecommunications scientists working on a joint development venture between Bellcore and AT&T Bell Labs (two completely independent research organizations) have now come up with what they believe to be the world's smallest surface-emitting laser array.

The team, consisting of three scientists from Bellcore and four from Bell Labs, has been able to fit two million of the lasers, each approximately one-tenth the size of a human hair, into an area the size of a fingernail. They expect eventually to pack 100 million lasers into the same amount of space.

Using molecular beam epitaxy, a laboratory method for forming extremely thin layers of semiconductor materials, 600 alternating layers of aluminum arsenide and gallium arsenide are deposited onto a substrate of GaAs. This 600-layer stack is then etched or carved into an array of microscopic cylinders or lasers using chemicals directed by a beam of atoms.

"This new laser requires 100 times less space than a conventional semiconductor laser used in similar applications today," Bellcore team member Axel Scherer claims. Using a lithographic technique that prints tiny dots only 0.005 inch thick, the team created laboratory prototypes of surface-emitting lasers sufficiently small and efficient to make feasible applications that were previously impossible.

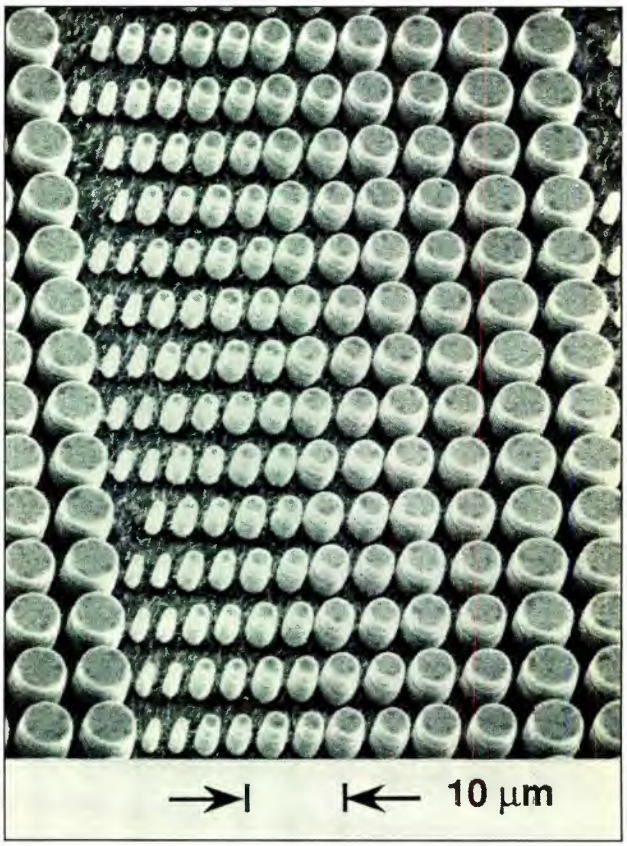
The lasers are expected to have applications for technologies such as sending light pulses simultaneously into a large number of thin fiberoptic cables, or for information transmittal between computer chips. The technology has already been transferred to scientists working on Bellcore's "learning chip," which performs functions 100,000 times faster than computer simulations, and can be "taught" rather than programmed.

Like the Sarnoff device, the new Bellcore/Bell Labs laser is surface-emitting, rather than the edge-emitting type now in common use and restricted to one laser per chip. Bellcore's Scherer predicts that the new process is likely to become "the way" to make surface-emitting lasers in the future because of its simplicity and versatility and because the lasers require very little electrical current—a mere 0.001 A—to function.

Not all companies are as convinced that the future lies in entirely optoelectronic devices. IBM, for instance, feels that a chip that contains both optical and electronic components will be far more useful in the near-term future, and scientists at the IBM Thomas J. Watson Research Center have developed just such a device.

The IBM researchers have demonstrated two experimental computer chips for transmitting and receiving data over fiberoptic lines at speeds of a billion bits per second. The quarter-inch, fingernail-sized receiver holds 50 times more components than ever previously assembled on a chip designed for such a purpose. The chip contains more than 8000 transistors with characteristic features as small as one micron, as well as a number of lasers made of the new GaAs material. IBM scientists have also recently introduced an experimental three-chip set containing all the necessary optical and electronic components for sending and receiving data over fiberoptic lines at a billion bits per second. ■

Rivlin is a freelance writer living in Katonah, NY. He was previously editor-in-chief of BME.



This hair-thin section of the Bellcore/Bell Labs chip contains more than one million working lasers per square centimeter.

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ANTIALIASED CGS COME OF AGE

Character Generation

Five years ago, a new generation of character generators started to appear on the market. The Aston was the first "antialiased" character generator offered to the television industry, followed shortly by Quantel Corp.'s Cypher and Chyron Corp.'s Scribe.

For many years, character generators were little more than electronic titling generators for titles, crawls and credit rolls. The character generator became much more valuable to the industry when font compose and logo compose features were incorporated. These features gave users the

ANTIALIASED CHARACTER GENERATOR FEATURES

	Channel Capacity	Dual Outputs	Inputs	Outputs	Hard Drive (MB)	Removable Hard Drive	Floppy Drive
Chyron SuperScribe	Single	No	Composite	Composite, RGB	30	No	Yes
Chyron Infinit	Single, Dual	Yes	Composite, RGB, CCIR 601	Composite, RGB, CCIR 601	50	No	Yes
Aston A4	Single, Dual	Yes	Composite, RGB, CCIR 601	RGB, CCIR 601	30/70	No	Yes
Ampex ALEX	Single, Dual	Yes	RGB, Key, CCIR 601	Composite, RGB, CCIR 601	100	No	Yes
Quantel Cypher	Single, Dual	Yes	RGB, CCIR 601	Composite, RGB, CCIR 601	180	Yes	No
Abekas A72	Single, Dual	Yes	RGB, Key, CCIR 601	Composite, RGB, CCIR 601	40	No	Yes
Dynatech Delta 1	Single, Dual	Yes	Composite, RGB, CCIR 601	Composite, RGB, CCIR 601	160	No	Yes
Quanta Orion	Single	No	Composite	RGB	42	No	Yes

All units profiled in this table offer GPI and serial port control; 256 levels of transparency; overlapping characters; and a font compose facility.

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By Joseph P. Mahedy

ability to color capture and store color logos, recalling them with fast access. The process, however, was very time-consuming and could tie up the system for hours or even days, depending on the complexity of the compose. Today, the character generator is an integral part of any television production, from live news and sporting events to complex post-production. The current generation of character generators has much greater speed and operational capabilities than its predecessors of a few years ago.

Antialiasing technology was developed originally for use in 3D computer animation systems. When an object is rotated diagonally without antialiasing, "stepping" appears on the diagonal edge of the object. Antialiasing algorithms blur the edges of diagonal lines slightly so they appear to be sharp and smooth, without objectionable "jaggies." Antialiasing eliminates stepping, but substantially raises the price of a system.

Interest in antialiased character generators has grown rapidly in recent years. Early antialiased character generators produced high-resolution, "typographic"-quality titles, but generally did not operate in real time and therefore were unsuited to on-air use. Today, most of these systems are fast enough to be used for most live events as well as in the post-production environment.

The new generation of antialiased character generators offers substantially more than just antialiased type. Great improvements in resolution and speed, with instantaneous sizing, rotation and skewing, are now standard features of many. These new character generators go far beyond titling, with several of the systems offering sophisticated capabilities such as 2D and 3D graphics, internal still stores, paint and animation complete with light sourcing.

Once too expensive and too slow for anything other than high-end post, the antialiased character generator has become a speedy, cost-effective alternative.

Antialias Levels	Instant Sizing	Standard Typefaces	Variable Speed Roll
256	Yes	8	Yes
256	Yes	15	Yes
256	Yes	5	Yes
256	Yes	15	Yes
256	Yes	15	Yes
256	Yes	15	Yes
256	Yes	12	No
16	No	5	No

Because the systems mentioned in this article share many capabilities, I will concentrate on the unique features of each.

The Chyron Scribe family of antialiased character generators has grown since its original introduction to include the Scribe, the SuperScribe and the Scribe Jr., along with the latest version, the Infinit. The Infinit, which will be on the market late this year, is a very high-end system that includes all the features of the SuperScribe plus full 3D animation, a paint system, framestore and a digital fx package. It should be noted that the entire Scribe family maintains message and font compatibility.

The primary difference between the three models is speed, with the SuperScribe being the fastest. Interactivity, on-line conversion and attribute manipulation can only be accomplished on the SuperScribe.

Craig Seaman, senior Scribe operator at Image Group in New York City, uses the SuperScribe daily. He believes the biggest advantage of the SuperScribe in post-production is its versatility in adjusting sizes of fonts and positioning. He adds that the system is very interactive from an operational perspective. Full pages of menus allow easy exploration, even without continual referral to the operations manual. In addition, user-labeled directories and the ability to search for messages facilitate finding and updating previous words.

The Scribe systems provide instant access of unlimited type styles and sizes to produce antialiased characters that appear sharp from 10 scan lines to full-screen in height. The resolution of the Scribe exceeds the resolution of a television camera. The font library exceeds 1500 master typefaces, eight of which come standard with the system. Additional typefaces may be purchased from Chyron for approximately $200 each. The master typefaces are stored on the 40 MB hard drive in the unit. Six selectable rolls and 10 selectable crawls are provided; specific timed rolls and crawls can be programmed.

Since the Scribe family is so software-intensive, the user can purchase optional software packages to enhance the system. The Advanced Font Utility I includes variable viewpoint

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ANTIALIASED CGS COME OF AGE

Character Generation

control of 3D displays; variable light-source shading; texture mapping, providing five standard textures of marble, woodgrain, brick, stone and cellophane; and metallic shading. The Advanced Font Utility II includes 3D texture mapping, which allows single-tone textures to be mapped onto three-dimensional characters. Also included are neon tube effects, inner and outer glows, chisel effects and bevels. Advanced font create utilities include dynamic read effects that permit DVE-type effects to flip and tumble characters.

Aston's latest version, the Aston 4, offers very high-resolution characters with an effective resolution of 10 ns. The unit comes standard with a 20 MB hard disk drive and a floppy disk drive, and can be upgraded with a 70 MB hard drive. The unit features great range in title creation. For example, fonts are available in sizes from 10 to 100 TV lines, and italics are variable from four to 30 degrees. Drop shadows have variable thickness in eight directions. The "Logo Master" feature provides the ability to create multicolored graphics from artwork.

The Aston 4 comes standard as a single-channel unit, but can be upgraded to two channels by purchasing a printed circuit card. The second channel can be operated independently of the first simply by adding a second keyboard. The standard unit also comes complete with two independent, high-resolution text planes, a graphics plane and a shaded background plane.

Five master typefaces come standard with the unit. Additional typefaces may be purchased from Aston at $250 each from a library of over 2000. Over 26 million colors are available for use as single or multicolored characters, shadows and backgrounds. Another Aston feature, Flexi-Roll, makes modifying rolls very easy. Rolls can be programmed to the exact length of time you require.

Eric Schermerhorn, Aston operator at National Video Industries in New York, comments, "When we first started shopping for character generators, Aston caught our attention because of the ease of operation and the price. We now own nine units, eight of them integrated into our edit suites and film transfer unit and one standalone unit for preprogramming text and camera-capture artwork. Aston engineering has been extremely helpful and quick to diagnose and rectify the rare problems."

He added, "Because our editors operate all the equipment in the room, user friendliness was very important." Schermerhorn says the Aston's menu-driven system allows quick access to any level of the A4's operation, and the help key provides quick and concise information on all functions and keystrokes.

"The ease of operation also applies to timing credit rolls," he notes. "The A4 allows us to fit a roll into a given time period without loss of quality."

Quantel's antialiased character generator, the Cypher, is designed to compose and present a wide variety of caption types. Fifteen typefaces are standard with the unit, and over 2000 additional typefaces are available at extra cost.

Among its other sophisticated features, the Cypher allows character words or lines of text to be manipulated in three-dimensional space and

This edit suite at National Video Industries incorporates the Aston A4.

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Character Generation

also offers realtime light sourcing. Background pictures can be stored on the unit's 40 MB hard drive. (The unit also has a 20 MB removable disk.) The Cypher links easily with other devices in the Quantel line, and is capable of downloading pictures from the Quantel Paintbox.

A little over a year ago, Abekas entered the character generator field with an antialiased model, the A72. The A72 comes standard with 15 master typefaces, and additional typefaces (from a library of over 1500) cost approximately $200 each. The high-resolution typefaces also have 256 levels of antialiasing, and may be sized instantly from 10 to 54 lines. Font compose and color scan are available. The user can choose from a palette of 16.7 million colors for independent character, drop shadow and background colors. In addition, the A72 allows speed-programmable rolls and crawls. The unit has a 100 MB Winchester drive and a 3.5-inch floppy drive. It is controllable from a GPI and a serial port.

One A72 user is Philip Scharf, director at WCAX-TV in Burlington, VT. He comments, "We purchased the A72 because the quality of the unit was extremely smooth. It also has the ability of instant modification of the font, for example, sizing, shadows and italics. Being able to input full-color artwork was an additional factor we were looking for."

WCAX uses the A72 for both live news shows and commercial production, and Scharf says it performs well in both situations. "Initially the A72 was a little slow for news, but Abekas worked with us and it now speeds right along," he adds. "The A72, being software-based, has made upgrades very fast and simple. We have hopes of more features being easily added to the machine.

Quanta Corp., known for years for inexpensive, basic CGs, recently entered the antialiased arena with two models, the Delta 1 and the Orion. The Delta 1 is the higher-end model, offering characters with up to 256 levels of antialiasing. Twelve typefaces (out of a library of over 3000) come standard with the unit.

The Delta 1 offers a host of high-end features, for example, the creation of multilayer effects with unlimited planes per page. Planes can be overlapped to any depth, so new characters at different sizes can be placed directly over existing characters. Texture mapping is available, and any color camera image can be used as a texture for a character, border or shadow. Graduated characters and backgrounds can be achieved. Shadows can be set at any angle from one to 64 pixels, while the slant range for italics is 90 degrees forward or back.

The "variable blur" feature makes a character border or shadow appear out of focus. Characters can be any size from 10 lines to full screen. The unit has 2560 fixed roll and crawl speeds. A realtime clock is available, along with "headliner" software that includes stretch and squeeze perspective and embossing. The Delta 1 incorporates a 160 MB hard drive and a 43 MB removable disk.

Quanta's Orion is a low-cost antialiased character generator with 16 levels of character antialiasing and 256 levels of transparency. Up to 250 fonts may be resident in the unit. The Orion can display over 1000 colors per page and features vertical wipes for transitions, with cuts and dissolves at any of 99 speeds. Slow reveal is available. The unit can camera-capture logos with seven levels of color entry or 16 levels of gray scale.

The most recent entrant into antialiased character generators is Ampex Corp., which announced its ALEX system a year ago. The basic ALEX system consists of a keyboard with a mouse and a signal system with a 3.5-inch floppy disk drive and 40 MB hard drive. ALEX's screen dialog system makes it very fast and simple to operate. The user has the ability to create and save custom fonts and to save custom user environments for specific applications.

ALEX's Dynamic Attribute Manipulation (DAM) feature offers several ways to resize or apply statics to fonts, as well as the ability to display aspect characters in the X-Y-Z axis. DAM also permits control of the display characteristics of shadows and borders. The integral drawing package permits the user to incorporate geometric shapes such as polygons or Bezier curves quickly into any scene or graphic. These can be combined to make logos or other elements. A detailed discussion of ALEX's internal architecture will be found in this issue starting on p. 30.

Steve Michelson Productions in San Francisco is a beta test site for the ALEX. Michelson comments, "We chose the ALEX because of its ability to integrate into our system, which includes other Ampex products such as the ACE, AVA and ADO. While the software is still evolving, we are pleased with the quality and performance of the system. We feel the system already has features that make it superior to other character generators in its class. Its speed, character layering, font creation and color palettes are exceptional." ■

The current generation of antialiased character generators has much greater speed and operational capabilities than its predecessors of just a few years ago.

Joe Mahedy is chief engineer and director of technical operations at Modern Telecommunications, Inc., New York City.

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PROCESSING PIPELINE

Character Generation

A new approach to CG design, pipeline processing, permits the elimination of frame buffers.

The popular design approach in graphic engines, the video display systems of a wide range of character generators, is the frame buffer. Unfortunately, frame buffer-based character generator systems must make some compromises in either color depth, image sharpness or complexity to accommodate motion. While still images are antialiased to achieve maximum sharpness along video object edge transitions, frame buffers cannot always respond quickly enough to maintain full antialiasing when these objects move, causing edges to take on some amount of blur or stepping. In response to these limitations, Ampex Corp.'s ALEX (Advanced LEXical system) character generator incorporates a unique "pipeline" approach designed to maintain antialiasing during any motion.

Using special-purpose hardware, the frame buffer allows for realtime or near-realtime manipulation of data within the buffer. Manipulation is limited to moving blocks of data, drawing vectors and filling blocks of memory with patterns.

As an equivalent of the image appearing on the screen, the buffer is structured as a matrix of rows and columns of memory. At the intersection of any row with any column is a memory cell, or pixel. Each pixel can be addressed individually, allowing control of what appears at each point in the picture. The matrix has a third dimension as well, typically consisting of 24 bits of memory per pixel arranged in groups of eight each for red, green and blue. By controlling the contents of the red, green and blue groups, more than 16.7 million different colors can be assigned to a pixel.

The frame buffer architecture offers a good deal of flexibility with its individually addressable pixel structure. In particular, it allows antialiasing of lines not exactly aligned with the row/column structure. Special algorithms determine which bits of adjacent pixels should be set to zeros and which to ones to produce the least jagged appearance of transitions in the image. Antialiasing makes it possible to display text in "print quality" from a variety of typefaces. Virtually all character generators on the market today use this approach.

However, frame buffer architectures begin to show deficiencies when called upon to display dynamic characteristics. This is because these dy-

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By James Wobermin

namic characteristics are based on how fast data can be written and moved within the buffer. Approximately 33 ns are required to update a complete nonmoving image in real-time video. If significant motion of symbols (that is, text characters, logos and other objects) occurs, the time for recalculation of an entire frame exceeds the 33 ns period. Therefore, to achieve motion, a compromise must be made, usually by dropping some or all antialiasing. Restrictions are also placed on the ability to overlap symbols dynamically in the frame buffer, again because of the speed at which calculations can be performed.

The architecture of the ALEX graphics engine takes an approach that avoids frame buffers by using a series of stages in a "pipeline" concept to regenerate the video output in each field. ALEX uses a 4:4:4:4 internal structure and incorporates a full eight-bit linear key channel. This pipeline design offers several advantages over the more ubiquitous frame buffer system.

Each pipeline stage processes only those parts of the symbol data needed in that step. Unused data are passed along with no wasted processing.

First, any symbol on the display may be moved, in real time and independently of any other symbol, because the display is regenerated for each and every field. Another unique feature of this architecture is that all other antialiasing characteristics (up to 256 levels) are included in the regeneration process at all times. These motions may occur along any arbitrary path defined by the user.

Second, when symbols overlap other symbols, the pipeline system provides for identifying boundaries, defining the overlapped regions and maintaining antialiasing. The colors and key signal within these boundaries may also be controlled independently from the original characters creating the overlap.

Finally, the architecture, despite its dynamic capabilities, comes with lower hardware and software costs than a comparable frame buffer-based system.

The ALEX pipeline structure contains five stages. (See Figure 1.) The system CPU provides the first stage, the vertical sorter, with high-level symbol descriptions of the objects to appear on the screen. These descriptions are loaded into the vertical sorter's symbol memory block, where they are organized in scan line order. The descriptions are routed to the boundary generator as a list of descriptions for each scan line of a field. If a symbol begins on line 10 and is 30 lines high, the data defining that symbol will be included on scan lines 10 through 39. During field one, even lines are generated. Odd lines will comprise data processed during field two.

The vertical sorter deals with those data necessary for defining the vertical position of a symbol, specifically symbol name, Y position and symbol height. The remainder of the data for each symbol, including X position, plane offset and color scheme address, is passed to the second pipeline stage, the boundary generator.

The vertical sorter deals with those data necessary for defining the vertical position of a symbol, specifically symbol name, Y position and symbol height.

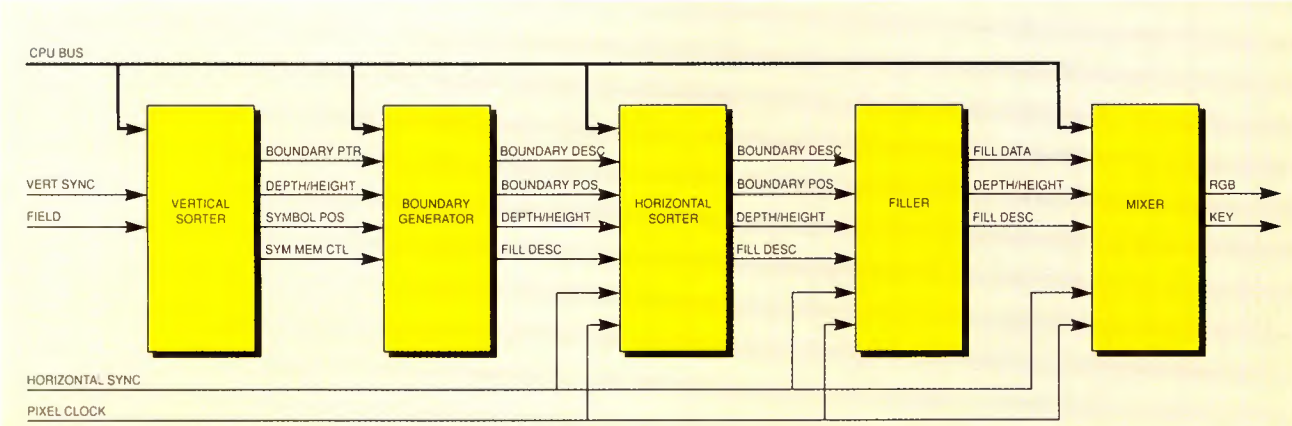

Figure 1. Block diagram of the ALEX graphics engine.

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PROCESSING PIPELINE

Character Generation

In the boundary generator are four memories. One of them, the symbol memory, is an extension of the vertical sorter symbol memory and is updated each field with new X location data, as well as the plane offset and color scheme address. The second memory is a line index memory, which contains pointers into an intersection list memory. Together, the two determine boundary data of each symbol for each scan line during a field, maintained as groups that describe boundary crossing data pairs that are on the same scan line of each symbol.

The boundary pair data from the boundary generator are organized by the third stage of the pipeline, the horizontal sorter, into pixel order. Once sorted through a series of interlinked memories, these boundary pairs provide information to modify any boundaries involved in conditions of overlap or hidden region contours. Following the sorting and modification processing, the boundary data are stored in a buffer for each field.

The fourth stage, the filler, is driven by video sync in order to produce each pixel of each field in realtime video. When coincidence is detected between line and pixel positions of descriptions stored in the buffer and in the filler, a boundary description is sent to the filler for processing. Based on the start area, increment area and pixel width values, the filler generates each boundary through a linear interpretation scheme. Two boundaries can be processed in parallel. If two boundaries are found to exist within a given pixel, then the plane data determines priority between the two boundaries.

The pipeline system identifies boundaries, defines overlapping regions, and maintains antialiasing when symbols overlap.

Two boundaries crossing one pixel implies that three separate colors can contribute to the color of that pixel. The filler stage calculates three mix coefficients and three fill descriptions for each pixel. The information is used by the last pipeline stage, the mixer, to produce RGB colors and a key value. Fill descriptions are actually pointers into the color palette with an index into a function RAM that produces R, G and B components and key values. The four values are combined in accordance with the mix coefficients.

Data in the color palette (16.7 million colors) contains a start color, a difference color and a key value. From these, the system may produce a color blend for any symbol. A number between 0 and 1 from the function RAM is multiplied by the difference color; that product is added to the start color for a given scan line of a contour in the symbol. The result from the mixer stage is an antialiased output into RGB and key channels.

One might expect that this complex approach could require as much time as a frame buffer system. Three factors speed data handling in ALEX. First, all of the internal communications of the system are accomplished through an Ethernet/"cheapernet" LAN. Second, in the pipeline, each stage processes only those parts of the

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symbol data needed in that step. Unused data are passed along with no wasted processing.

A third factor is the manner in which the symbol information is stored. A symbol consists of an outline or boundary description and a color scheme, rather than a bit-mapped image. The symbol boundary is a set of line segments defining the shape. Any symbol may have multiple boundaries, all of which must be closed.

Each has a contour number to specify a color scheme for defining how the interior of each contour (bounded area) is to be filled. Each symbol is contained within a bounding box Y scan lines high by X pixels wide (see Figure 2). The bounding box provides ready size information in creating scaled symbols. Before a symbol is placed in the pipeline, it is scaled by multiplying the bounding box dimensions by the scaling factor.

Each contour of a symbol is dissected into line segments of one scan line height. These segments are paired into left and right boundaries of each contour for each scan line. As shown in Figure 3, a boundary point may be right boundary for one contour and left boundary for another countour simultaneously.

With pipeline processing, any symbol on the display may be moved in real time and independently of any other symbol because the display is regenerated for each and every field.

The color scheme of a symbol has a set of fill attributes for each contour of the symbol. In the symbol illustrated in Figure 4, there are two contours, so there are two sets of fill attributes.

Fill attributes include three types of information. The first is an indication of RGB color. The second carries the key or transparency level of a component (a contour and its fill attributes) with the background. The third assigns one of 16 planes or layers onto which the component is placed. The system provides eight primary planes, each with a secondary shadow plane. The concept of planes allows for priority of symbols when they overlap on the screen, although overlapping of symbols may occur in the same plane. No data is lost during an overlap, which means that recalculation of antialiasing is not required.

Placement of symbols into the graphic engine or display is determined by specifying values for the location of the upper left corner of the symbol's bounding box in the graphic engine coordinate system. The origin of a bounding box will have both pixel and fractional pixel values for X as well as scan line and fractional scan line values for Y for more precise positioning. The operator accomplishes this procedure simply by pointing with the mouse or by moving the cursor with the arrow keys.

ALEX also includes a ninth plane that can be used for background video imported from external sources, such as a camera, VTR, paint system or shaded background. ALEX will expand with new capabilities as the engineers continue to work in the pipeline approach to dynamic character generation. For example, the basic architecture is extensible to provide the capability of texture mapping and shading symbol interiors. The pipeline architecture of ALEX permits this kind of future expansion, while offering high-quality motion with no degradation of the antialiased images. ■

James Wobermin is the engineering project leader for the ALEX character generator, Ampex Corp. Video Systems Division.

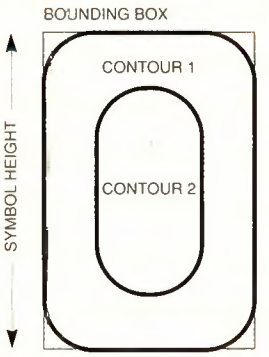

Figure 2. *Symbol bounding box with symbol height.*

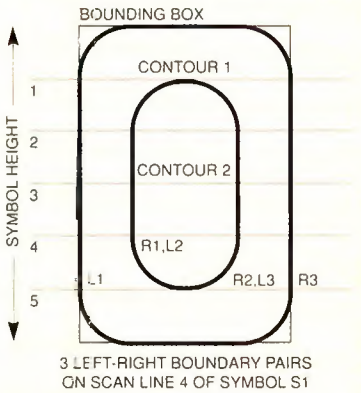

Figure 3. *Symbol bounding box with left/right pairs.*

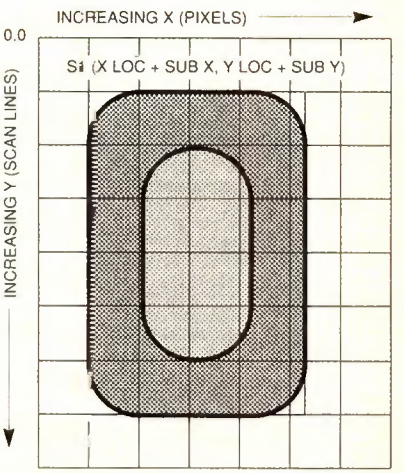

Figure 4. *Bounding box with fill attributes and symbol placement.*

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—Bryan King,
Chief Engineer, KLBJ AM-FM

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RADIO ENGINEERING

NUMBER FOURTEEN SPECIAL SECTION NOVEMBER 1989

Will Your STL Be Legal Next July?

Whether certain model aural STLs and ICRs operating in the 950 MHz band will be legal after July 1, 1990 is presently the subject of hot debate within the broadcast community. In case you missed it—and many, if not most, broadcasters did—Rule 74.550 will require all 950 MHz equipment to be type accepted, or at least type-notified, after July 1, 1990. The rule itself was adopted in late 1985 and will require tighter frequency tolerances and emission requirements than most pre-1985 equipment was designed to deliver.

Dr. R. Douglas Hogg.

What is unusual about this rule is that there are no grandfathering provisions. Thus, for equipment that does not meet the new specs, operation beyond July 1 will be illegal. Of the three major STL manufacturers—Marti, TFT, and Moseley—only Moseley has indicated a reluctance to go through type notification procedures with the FCC to keep operators with their older products legal. Note, however, that all of the manufacturers have some early vintage models that probably are incapable of meeting the new specifications without extensive modifications (pre-STL-8 Martis or the basic TFT 7700 no suffix, for example). For most other pre-1985 models, a field installation kit or trip to the factory (in some cases estimated to cost several hundred dollars) will be required to meet type-acceptance specifications.

At a press conference at last month's SBE Convention, TFT's Jesse Maxenchs distributed copies of a letter from James E. McNally, Jr., chief of the FCC's Engineering Policy Branch, in which McNally appeared to rule out an extension of the July 1, 1990 deadline. In the letter, McNally stated that standards for permissible frequencies and channel bandwidths, power output stability and emission limitations are clearly stated in the rules; frequency tolerance was added in a later oversight order. The letter added, "These requirements also apply to 'grandfathered' Part 74 stations operating in the 942–944 MHz band."

At the press conference, Dr. R. Douglas Hogg, president of Moseley Associates, stated, "Temperature and antenna range tests are required, but could be hard for licensees to perform. Manufacturers are best equipped to do this ... but the process of trying to upgrade a huge number of [STLs] would overwhelm everybody."

The manufacturers are currently evaluating what action to recommend to the owners of their individual products. An additional wrinkle is the report that the FCC Labs in Columbia, MD, are unable to locate the lists of the models for which the STL manufacturers have already supplied test data that demonstrate compliance with type-acceptance or notification requirements.

At presstime, Moseley announced that it is filing for type notification for the majority of its PCL-505 STLs, based on the FCC's enactment of a tolerance for frequency stability for 942–952 MHz STLs and ICRs. The company also said it is seeking clarification from the Commission as to the way in which FCC identifier labels will be issued for STLs already in service. Moseley said it is possible that such equipment may have to be sent to its facility, checked and updated if necessary, prior to issuance of the identifier label.

In the meantime, some broadcast organizations are preparing a petition that reportedly will request, at a minimum, grandfathering from 74.550 provisions in all markets where the new 950 MHz repacking provisions of the Rules are not triggered by excessive frequency congestion. Presumably, in such markets, operators will have greater resources to upgrade their equipment, as the channels become narrow-banded. ■

—M. Starling, E. Blinder

TFT Reciter Gets FCC Type Acceptance

TFT has introduced a synchronous FM broadcast system called the Reciter, which has received FCC type acceptance for commercial use.

The company says the system is a "two-in-one" unit that replaces the STL receiver and FM exciter at an FM transmitter site. TFT president Joe Wu calls it "the first major change in STL technology since the 1960s." By combining the functions of an STL receiver and an FM exciter with an intermediate frequency (IF) interface be-

CONTENTS

Radio News 35

Boosters & Translators 38

Moffat Goes Digital 45

Narrow Band Audio 51

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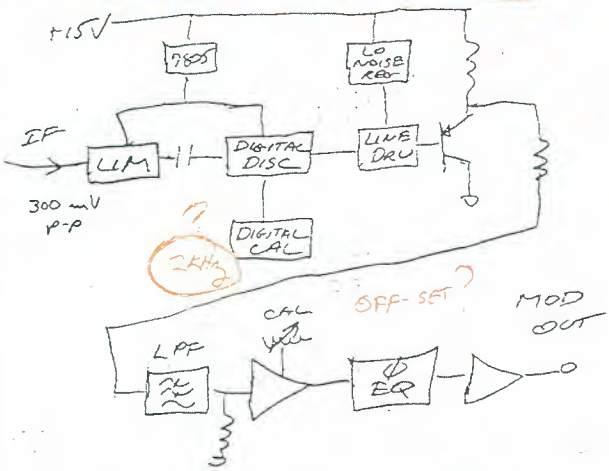

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TFT's Reciter is FCC type accepted.

tween them, the company says, the Reciter avoids bringing the signal down to baseband, eliminating demodulation and remodulation of the baseband signal. It has been air tested at three FM stations.

TFT also says the Reciter provides synchronization of phase, frequency and modulation level to an FM booster system, regardless of the number of sites. (See "Supplementing the Service Area," pg. 38.) ■

EIA and NAB Launch Program to Promote High-Quality AM Sound

The Electronic Industries Association's Consumer Electronics Group and the NAB have begun a joint program to promote high-quality AM sound using the NRSC standards in AM receivers. The goal of the program is to establish a certification mark or logo to be used on the faceplate of high-quality AM receivers. Under the program, any receiver manufacturer could use the trademark in promotion of receivers designed in accordance with the NRSC standards.

NAB will organize promotions for the mark in local AM radio markets and assist in developing tie-ins for retailers.

The program is subject to final approval of the EIA/CEG board of directors.

Stan Salek, NAB staff engineer, told *BME* that the final standard is still under development, with the latest modification due to be published in January. Commenting on receiver manufacturer interest in the program, he admitted, "Interest is either emphatic or non-existent, with more manufacturers expressing no interest right now." He pointed out that Denon is currently building a receiver that meets the specifications and could receive the certification when the program gets under way. ■

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NAB Asks FCC to Dismiss Petition Seeking New Jersey FM Translator Upgrade

The NAB has asked the FCC to dismiss a request to permit the licensee of an FM translator in Fort Lee, NJ, to originate programming. In its filing, the NAB said it is "ill-timed and unjustified" due to the Commission's ongoing review of FM translator policy and the agency's previous denial of an earlier and identical request from the licensee, Gerard Turro.

Turro maintains that his station "does not serve the public need" because it is barred from unlimited origination of programming, adding that Bergen County, NJ, has no authorized or allocated "commercial FM facility."

NAB disputes that claim, noting that the county is served by dozens of broadcast voices, including several licensed to cities in the county. In a reply to the NAB filing, Turro rejects that argument. His lawyer, Rainier K. Kraus of Koteen & Naftalin, Washington, DC, told *BME* there is no licensed FM station in Bergen County and the only AM station, WWDJ in Hackensack, NJ, programs paid religious material exclusively. Turro's reply goes on to say that "Bergen County's circumstances are demonstrably unique," arguing that a decision in his favor will not set a precedent for other FM translators.

The NAB charged Turro with attempting to avoid the FCC's FM allotment procedures and use the "back door" in order to put a new FM station on the air. The association pointed out that Turro had made a similar request to the FCC in 1986, shortly after the Fort Lee facility began operating. The FCC denied that request and it was upheld by an appellate court. The NAB said the FCC should only consider Turro's current request in the context of a future rulemaking addressing a wide range of FM translator-related issues.

Gary Grossman, NAB Regulatory Review Committee chairman, said, "With the Commission now considering possible changes in its FM translator rules this request is untenable. Also, it is not compatible with established FCC policy and should be dismissed."

Kraus said, "The people NAB has to convince of its argument are not only the FCC but also the political leaders of Bergen County and the governor of New Jersey, all of whom support Turro's request." ■

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SUPPLEMENTING THE SERVICE AREA

Some broadcasters have looked at boosters as a sort of "cellular salvation." Yet even with a host of high-tech improvements, booster results can be disappointing if the system is not painstakingly engineered.

Friday afternoon, 4:30 p.m.; steam pours out of the handset. It is disquieting enough if it is a listener, worse if it is the GM: "Explain to me how come I can see TV pictures of Neptune from four and a half billion miles, but I can't hear your transmitter just 12 miles away?"

Nearly 100 years after Marconi's first broadcast at Bologna, broadcast engineers are still living with the wonder of radio physics. Controlling propagation vagaries often seems as much an art as a science. Witness NAB's AM antenna project, the ongoing search for certainty in predicting FM directional performance, and broadcaster chagrin over the wild variations in radio, TV and aeronautical receiver performance (invariably blamed on the broadcasters, of course).

Yet make no mistake: Imperfectly as the medium has evolved, advances in booster technology—coupled with greater flexibility in the regulatory environment—have improved the results of coverage enhancement efforts. Major refinements in booster technology have been heralded as the solution for your coverage woes. Yet, field implementation is only now catching up with the innovative theories behind improved booster methodology.

Even the most ardent proponents of these new approaches confess a certain awe for Mother Nature's unpredictability and caution that there are no perfect solutions; every booster will come with a host of problems as well as benefits. The physics behind multitransmission point propagation indicate even the most innovative systems under development will be no panacea for some of our most common coverage woes: multipath, intermodulation zones, or supplementing coverage on flat terrain. In short, anywhere there is a residue of the primary signal, the resulting desired/undesired field ratios will often combine to destroy useful reception.

As TFT's Jesse Maxenchs puts it, "Every booster installation is as unique as a snowflake." Several consultants routinely utilize contour, shadowing, and census documentation that promise to illuminate exactly which underserved pockets warrant the greatest focus and what system design will minimize the "nuisance-interference" zones. These maps can also be a tremendous asset in illustrating to your decision makers the nature of the existing problems and how proposed solutions should improve your station's coverage area. In some instances, such detailed contour mapping has indicated surprising solutions to site selection and radiation pattern choices—solutions that may not have been considered with visceral impressions.

Dataworld, Broadcast Data Services and SoftWright are among the suppliers of these maps. Once the main transmitter is plotted with appropriate shadow or population density overlays, additional "what if" plots can be produced to illustrate signal coverage for various transmission sites, powers, and antenna systems.

If it is decided to supplement existing coverage with a booster, the transmitting site and antenna pattern are absolutely critical, and more important to a successful installation than the power variable. When it comes to antenna design, Martin Hadfield, of Hadfield and Dawson, Seattle, says, "The ideal vertical plane radiation pattern should have its minima at the horizon, with the main lobe at a relatively steep angle. Likewise, the horizontal plane pattern should have the main lobe directed into the area of interest, and nulls placed toward the most critical overlap areas."

In 1987, the Commission adopted new rules for the implementation of boosters at the same time that they froze commercial FM translator applications. The pivotal change was elimination of the "direct off-air reception" requirement—a drawback that, due to RF feedback, was virtually impossible to implement absent major terrain shielding between the booster receiver and transmitter. Ab-

BY MIKE STARLING

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sent a mountain, cliff, or huge building to isolate the received and transmitted signals boosted by typically over 100 dB, boosters simply did not work.

Any method of input signal delivery is now permitted: cable, microwave, satellite, phone lines, or paper cups with string (as John Huntley at KCRW says, "Inexpensive, but very bandwidth limited"). These indirect signal-delivery approaches have solved the input swamping problem and provided the impetus to tackle the remaining obstacle to effective booster operation: minimizing the "nuisance zones."

In addition to the relaxation in signal delivery, MM 87-13 also authorized boosters to operate at up to 20 percent of the maximum effective radiated power (ERP) for the class of the primary station. This 20 percent figure was chosen on the assumption that a station might need a booster to fill in as much as 25 percent of the primary service area. Thus, the 20 percent of maximum class power achieves a 1 mV/m contour roughly half that of the full-facility primary station.

Several restrictions apply, however. The booster may not transmit beyond the predicted 1 mV/m contour if the station is a Class A or C facility, the .7 mV/m contour if the primary is a Class B1 station, or the .5 mV/m if a Class B outlet. Moreover, for stations within 199 miles of the Canadian or Mexican borders, no booster can exceed 50 W ERP. Unfortunately, many of the early high-power boosters caused more interference than they solved and, according to FCC Auxiliary Services Chief Alan Schneider, some were subsequently turned off. Eric Lane of TFT quips, "I know of several that should be turned off." Of the scores of inquiries Lane has fielded about boosters, most callers were under varying degrees of misconceptions about the utility and limitations of boosters.

According to Ed Anthony, senior design engineer, Broadcast Electronics, who authored the 1988 paper that first detailed the range of factors for synchronizing boosters, "Boosters always create interference. The object is to make it occur where nobody is listening."

New efforts seek to minimize even the nominal zones of interference resulting from a carefully deployed booster by so closely matching the received signals from the booster and primary that field listeners will not notice audible artifacts. At present, there are three principal areas of ongoing development: frequency, modulation, and arrival time synchronization.

Frequency Synchronization. In the nuisance zones, an undesired carrier is presented to the receiver in addition to the desired signal. (For purposes of illustration, it does not matter whether the booster or the primary is the desired signal). In this instance, the undesired carrier will both amplitude and phase modulate the desired carrier.

As expected, the frequency of the resulting heterodyne will be equivalent to the difference in the two carrier frequencies. As the two carriers approach "zero beat," deviation and amplitude of the heterodyne disappear. It is important to note that the modulation index (both AM and FM) when an FM receiver is presented with two below-capture signals will never be more than one. This may prove to be a significant limitation on the extent to which field transparency of "full synchronization" is

Arrival Time Delays for Selected Baseband Frequencies (based on RF propagation at 5.307 usec/mile)

Frequency (kHz)	Wavelength (miles)	Distance from parity to cancellation node coherence (usec)	Delay to achieve phase
1	168.0	84	445.78
3	62.0	31	164.52
10	18.6	9.3	46.78
19	9.8	4.9	25.99
38	4.9	2.45	12.99
53	3.5	1.75	9.31
57	3.3	1.63	8.66
67	2.8	1.39	7.37
92	2.0	1.01	5.31

Solid Gold Then, Solid Gold Now

It must be recognized that, by the indiscriminate use of an FM Broadcast booster, an FM station can actually degrade its own service. This occurs when signals from the primary station and the booster arrive at a receiver with relatively equal amplitudes, but different phases, because of unequal path lengths. Due consideration must be given to the engineering aspects of the booster installation to insure that degraded areas are kept at a minimum. This objective can be aided by the judicious choice of a transmitter location to take advantage of terrain shielding, and the selection of a suitable transmitting antenna with the proper directional qualities to provide radiation toward those areas where service is desired and away from areas where interference would occur.—*FCC Docket 17159, which authorized boosters and translators, 1970.*

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achieved. As John Kean of Moffet, Larson, and Johnson points out, "The capture effect works best with high modulation indices, and can be as low as 1 dB for monophonic signals."

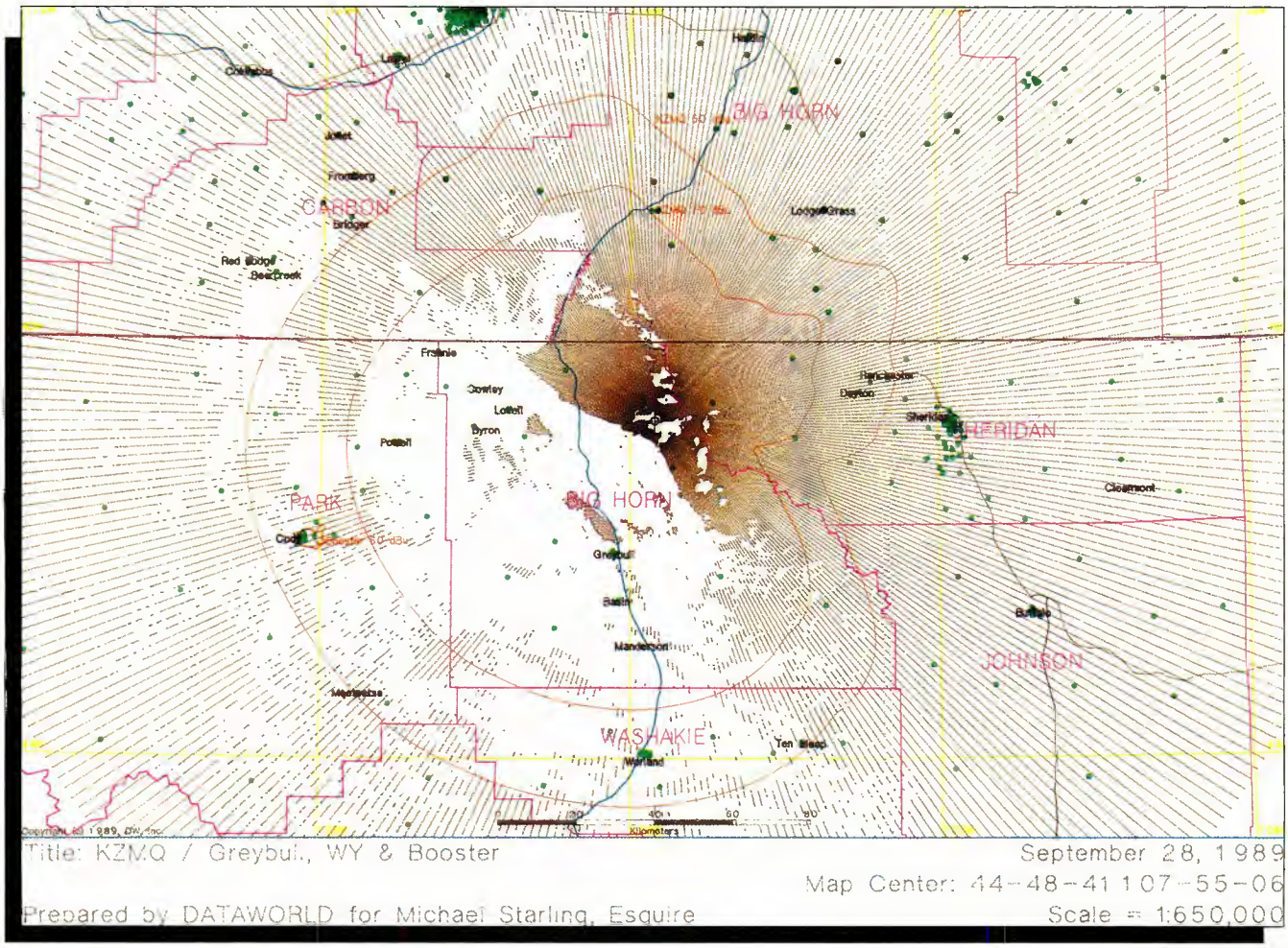
The resulting signal will be determined by the field ratios and phase of the two carriers presented to the demodulator. As Kean explains, "When an FM demodulator is presented a larger vector (the desired signal) and a smaller vector (the undesired signal) pointing in some independent direction at any given instant, the smaller vector's rotation around the tip of the larger vector creates distortion which increases rapidly as the amplitude of the smaller vector increases."

Modulation Synchronization. Omega Engineering International and Broadcast Electronics employ discrete reference plots to lock primary and booster carrier frequencies. The forthcoming TFT booster system will lock to a high-precision stereo pilot.

In 1988, Broadcast Electronics' Ed Anthony noted the modulation interference phenomena that result from detection of two carriers modulated by the same sine wave, both with nonidentical deviation (modulating percentages). Any disparities in the peak deviation will result in detection of an alias sweep signal whose upper frequency will equal the difference in peak carrier deviation per modulation cycle. According to Anthony, the resulting interference sounds similar to white noise and is most pronounced on modulation peaks, since this is the point of maximum divergence in the modulated carriers.

Recent studies by Martin Hadfield (of Hadfield and Dawson, Seattle)and Lane have quantified the resultant effect as a rapid 30 dB deterioration in SINAD for even a one percent difference in modulation peaks. Given the serious degradation such artifacts create, synchronization of peak modulation between booster and primary exciters warrants extremely careful calibration using bessel null functions. (See the NAB Engineering Handbook, Seventh Edition at Section 3.3-67.)

Whether such precarious dynamic



Case study by Dataworld of booster system at Cody, WY for KZMQ, Greybull, WY. Radial lines are terrain shadows.

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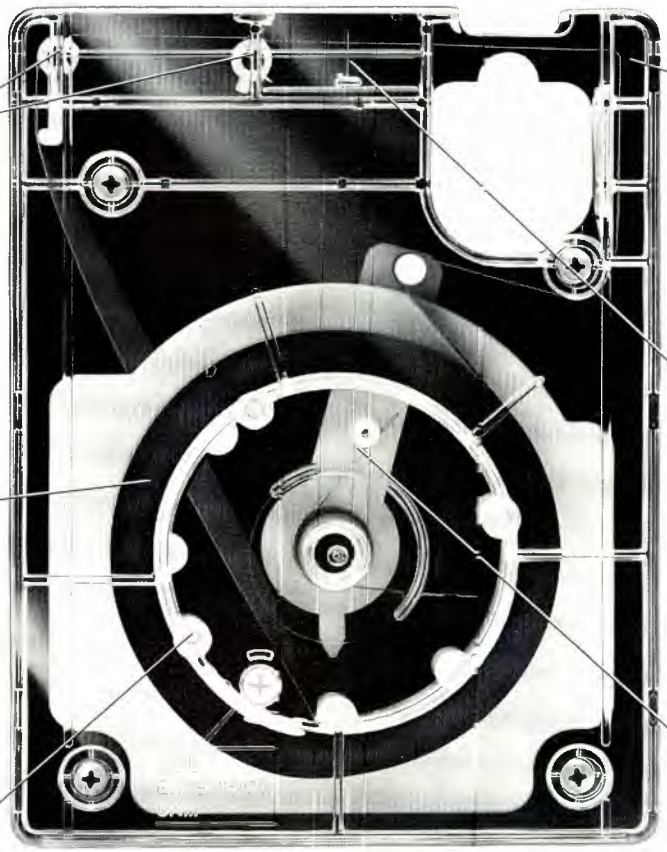

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matching is maintainable between two separate transmitter sites will be determined in trials currently planned for the next several months. Lane and Hadfield indicate that use of the recently type accepted TFT Reciter at both the primary and booster transmitter sites should facilitate precise modulating deviation tracking.

The TFT Reciter utilizes an IF interface that will circumvent baseband demodulation at the transmitter site, and replace conventional STL receivers and exciters in current transmission systems. This process promises to achieve several dB of improvement in transmitted S/N and stereo separation. This feature should also interest stations adversely affected by the loss of transmitted S/N as the narrowband 950 MHz provisions take effect in major markets. In a CD world, backward steps in system performance will be a penalty avoided by all who can afford the investment. (See the related story on Rule 74.550 on page 35.)

Receiver Arrival Phase. In addition to insufficient carrier ratios to achieve receiver capture, arrival time delays will cause the resulting demodulated waveform to be distorted. TFT is planning to include a thumbwheel-selectable speed-of-light digital delay line in their forthcoming Reciter booster to match arrival phase along the line where long-path and the digitally delayed path lengths are equal.

Although field tests have not yet been performed, based on lab experiments, Lane expects to be able to reduce the required capture ratio from a typical 20 dB to anywhere from 3 to 12 dB. Lane's subjective lab tests indicate that noticeable signal impairment will begin to occur within 10 microseconds of the point of coherent arrival. Since RF travels at roughly 5.31 microseconds per mile, this represents nearly a two-mile distance in which frequency, modulation and arrival time lock should result in a significant reduction of desired to undesired signal ratios required to achieve capture. According to Lane, as the time delay increases beyond 10 microseconds, the audible effect is analogous to mono-summed phase errors on an improperly aligned tape machine.

However, the audio baseband is typically only part of an FM signal. As Table 1 illustrates, complete cancellation of subcarrier frequencies will occur at distances significantly closer to a given parity point. According to Anthony, "This is immediately

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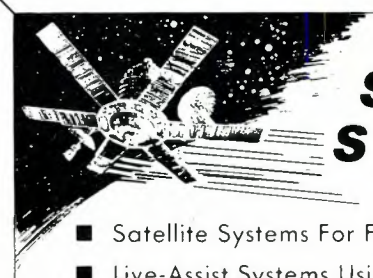

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alarming, especially for composite FM stereo and subcarrier performance."

In the overall context of booster performance, Lane seemingly agrees. "There are still disastrous zones of interference," he notes. "Even with a fully synchronized booster, it will only help with roughly 30 to 60 percent of the problem. There will continue to be extensive areas of major interference. Even with the improvements, we can't ever make it perfect."

An additional host of problems may be present in bringing the "digital delay" boosters to market. According to the project's design engineer, Charlie Hu, some spurs are present in the prototype A/D-D/A conversion and the system has yet to be tested with subcarriers. Also, stations using subcarriers for remote control telemetry will be forced to find alternate means of telemetry delivery since the premise of TFT's reciter precludes a return to baseband.

Absent near faraday-type shielding from intervening terrain, limiting power and coverage will also diminish the areas of the nuisance zones. The Commission may have unwittingly encouraged some broadcasters to invest in very expensive multipath generators with the authorization for high-power boosters. Hadfield cautions, "It helps to take a 'cellular' approach. That is, keep the antennas low, serve smaller pockets and allow the properties of signal transmission to help by limiting the reach of the booster contours."

On this theme, you can't get much more "cellular" than one consulting engineer's plan to use the Part 15 rule revisions to deploy very low power boosters around concentrated population areas such as apartment developments and trailer parks. Perhaps Larry Will's conclusion about a booster recently installed for the New Jersey TV Network may prove analogous to FM boosters. Will stated, "I'll be changing the booster into a translator as soon as the rules permit."

According to the FCC's Schneider, booster activity in 1988 picked up "really phenomenally." Yet, even with this dramatic increase in applications, there are today only about 75 boosters actually operating, compared to nearly 1700 translator stations. Even with the rise in booster interest, significant strides will have to be made in minimizing the nuisance zones before boosters cascade into every market. For now, the jury is still out on how well practice will conform to the theories of synchronization. ■

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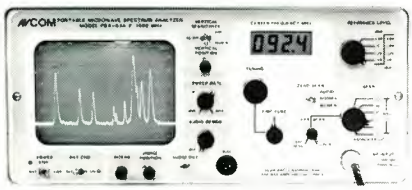

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DIGITAL PRODUCTION TAKES OFF IN THE GREAT WHITE NORTH

A Canadian radio chain's leap to digital production lands it squarely on the side of the future.

With eight stations in five cities, Winnipeg-based Moffat Communications' decision to switch to an all-digital program production and control format is a significant move in an industry where analog tape and cart technology have reigned for so long and where budgets have lagged behind television's in terms of embracing the digital audio revolution.

Moffat's five markets—CKLG/CFOX-FM in Vancouver, CHFM and CISS in Calgary, CITI and CKY in Winnipeg, CHED in Edmunton and CHAM in Hamilton—are now using a tapeless recording and editing system for all of their radio production work. Programming and traffic are being affected by digital also, with spots and promos loaded into a central hard drive that can be programmed and revised in real time digitally by either on-air staff or programming personnel, as well as having full digital backup.

The core of the new production approach is New England Digital's PostPro, an eight-track digital recorder incorporating the company's Direct-to-Disk technology. With all of Moffat's stations—AM and FM—broadcasting in stereo, the station's producers began requesting larger multitrack tape recorders. The PostPro was purchased to replace the analog four-track decks that have been the mainstay of radio production. The systems allow the stations' production staffs to assemble and edit program material faster and with greater accuracy, and all edits are nondestructive—no tape ends up on the floor since there is no tape to begin with.

"This puts us far ahead, versatility-wise," said George Buzunis, Moffat's chief engineer. "It gives us a leg up into the future," an entree into a digital domain he said the company had been planning for some time.

Buzunis compared the digital PostPros with updated analog systems, including eight- and 12-track units, before committing to digital. These would have had lower unit costs; however, when the need to renovate the production facilities to accommodate the larger analog units and their necessary consoles was taken into account, the average $165,000 (Canadian) unit price of the PostPro systems became competitive, since the digital units were literally rolled right in to the existing facilites and hooked up with no physical plant changes required.

CKY, Winnipeg, like Moffat's other stations, is using a tapeless production system.

By DAN DALEY

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This cart system at CKY has been virtually eliminated by the digital system.

So, despite the five digital recorders' pricetag, Buzunis maintains they are a cost-effective acquisition. He backs this up by saying that the digital systems have streamlined the production process considerably, adding a new level of versatility to radio production that has been appreciated by both the staff and clients. The speed that random-access disks offer also means production can be more profitable, since stations generally do not charge for production services.

The PostPro uses a variable sampling rate which in turn determines the amount of total memory available. Moffat's engineers have been using a 50 kHz rate, which provides 27 minutes of continuous space on all eight tracks.

Buzunis said that the change to digital production was fairly seamless. Originally, it was expected that both analog and digital systems would work simultaneously during the transition period to all digital. But after one week with New England Digital's training staff at the station locations, Buzunis found, "My producer had thrown the four-track deck out of the studio. I had figured it would be there for at least a month. They say they can't go back to tape now."

The inclusion of the Digital Audio Mass Storage system (DAMS) added another $150,000 to the chain's capital upgrade budget. The hard disk system, manufactured by Southern Broadcasting of Australia, and marketed here by Media Touch of Salem, NH, can digitally store up to 540 minutes of programming, sufficient to hold over 1000 30-second spots. This system will virtually eliminate carts at the stations, enabling on-air people to call up desired program at the push of a button.

"This digital system puts us far ahead, versatility-wise. It gives us a leg up into the future."
—George Buzunis, Moffat chief engineer

This storage and retrieval system will be controlled by one of two digitally automated systems now undergoing tests at Moffat. The chain's home-devised Computer Assisted Broadcast System (CABS) is in place at CHED in Edmonton. Its performance will be compared with that of a Media Touch OpLog (Operational Program Log) system installed at CHAM in Hamilton. That $200,000 piece of equipment includes multiple CD players, hard disk audio storage capability and an interface ability with station business software programs. If the Media Touch system is selected, Buzunis said the chain is prepared to order four more for the remaining locations in early 1990.

The interface protocol between the DAMS and the two control systems is fairly simple—an RS-232 interface. The interface between the PostPro and the DAMS storage system, however, undergoes an analog conversion, according to Paul Guttmann, senior engineer with Media Touch. This is to accommodate the Dolby A/D-PCM data compression, which gives the DAMS an effective 2:1 increase in storage space over straight 16-bit PCM mode.

"When the system was first developed, larger hard drives were more expensive," said Guttmann. "This data compression using the Dolby DP85 technology overcomes that." The signal is reconverted to analog through another Dolby unit before it is aired. "The DAMS is a standalone computer, and you can think of it as a standard cart machine, only instead of tapes it uses digital storage," explained Guttmann. "You assign an event location and make the transfer."

Dave Russell, hardware engineer for New England Digital, commented that the PostPro is capable of both analog and digital output, with the digital outs supporting all major digi-

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A cost-effective acquisition, the digital systems have streamlined the production process considerably.

tal formats—AES/EBU, F/PDIF, SVIF, SDIF as well as Mitsubishi, via a Universal Digital In/Out (UDIO), which outputs up to two tracks at a time digitally. "NED is digital I/0-ready for when the industry catches up," he said.

The use of the analog outputs in this application is necessary to

Another view of the studio at CKY.

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achieve the desired data compression, he added, noting that any degradation is negligible in a broadcast application.

Buzunis expects a few minor bugs in the beginning, such as adjusting to the lack of the five-second warning before the program begins that carts used to provide. But otherwise he anticipates the transition will continue to go smoothly.

Further digital transformations at Moffat will likely include multiplexed broadcasts on UHF channels, according to Buzunis.

The only major aspect of technology not currently under digital scrutiny is the STL; the approximately 22-mile link, currently operating at 1.7 GHz for AM and 950 MHz for FM, will be sufficient for the foreseeable future, Buzunis feels.

Further digital transformations at Moffat Communications will likely include multiplexed broadcasts on UHF channels. Buzunis has been following reports of experiments in Europe where up to 16 stations have been multiplexed on a single UHF channel.

"On those prototypes," he explained, "multipass effects are virtually nil. The amount of error correction they can put into it is excellent." Apparently the move could have beneficial bureaucratic implications as well; the spectrum efficiency that UHF multiplexing affords could endear stations to the regulatory agencies, Buzunis feels.

"The FCC and the DOC [Canada's Department of Communications] love that sort of thing," he comments. "By the year 2000, there could be a lot of stations broadcasting with that system if the manufacturers hustle. They certainly have a lot of incentive: Imagine selling the world a whole new set of receivers." ■

Dan Daley is a New York City-based freelance writer specializing in audio technology.

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NARROWBAND DIGITAL AUDIO

Major steps toward bringing CD quality digital audio to the RF domain have been made, as bandwidth requirements decrease.

As digital audio continues its inexorable penetration of the consumer marketplace via recorded media and playback hardware, concerns mount among FM broadcasters over audience erosion and devolution to a "mid-fi" format. The example of AM radio's losses to the higher-quality FM is fresh in broadcasters' minds, and most of today's FM is just not measuring up to the digital audio qualities upscale listeners now regard as routine. Can digital audio do for broadcast what it did for the record industry and put it back at the top of the audio "food chain"?

The concept of broadcasting digital audio signals is nothing new. But wideband, high-fidelity stereo audio such as that found in the CD format requires extremely high data rates, on the order of 1.5 Mb/s (16-bit quantization x 44.1 kHz sampling rate x 2 audio channels = 1.411 Mb/s). Using standard frequency modulation (*i.e.*, data transmission efficiency of no better than 1 bit/sec/Hz of occupied bandwidth) means that channel widths approaching 2 MHz for digital stereo audio signals are required. This spectrum inefficiency—relative to traditional analog audio transmission—has done little to ingratiate digital audio to the RF domain.

Nevertheless, some point-to-point digital audio transmissions have been made by broadcasters for STL and RPU uses (see *BME*, September 1988). In most cases, these systems require even wider bandwidths (typically 6 MHz) due to their output formatting of digital audio signals as monochrome video signals.

More recent products in this arena have utilized the T-1 transmission standard, developed in the telecommunications industry for wideband digital signal distribution. This format's 1.544 Mb/s data rate places it in the right area for such an application, but the T-1 system is primarily intended for multiple voice-grade channels (24 per carrier, bidirectional), so there has been more emphasis on lower data rates to keep the channel/carrier rate high. As a result, most of the telco T-1 hardware and service offerings for wideband audio have been of a 12-bit, 32 kHz variety or lower. Nevertheless, some new products in this field do provide 48 or 44.1 kHz, 16-bit quality stereo, with correspondingly higher occupation of the carrier, leaving little room on it for much else. Besides telco T-1 paths,

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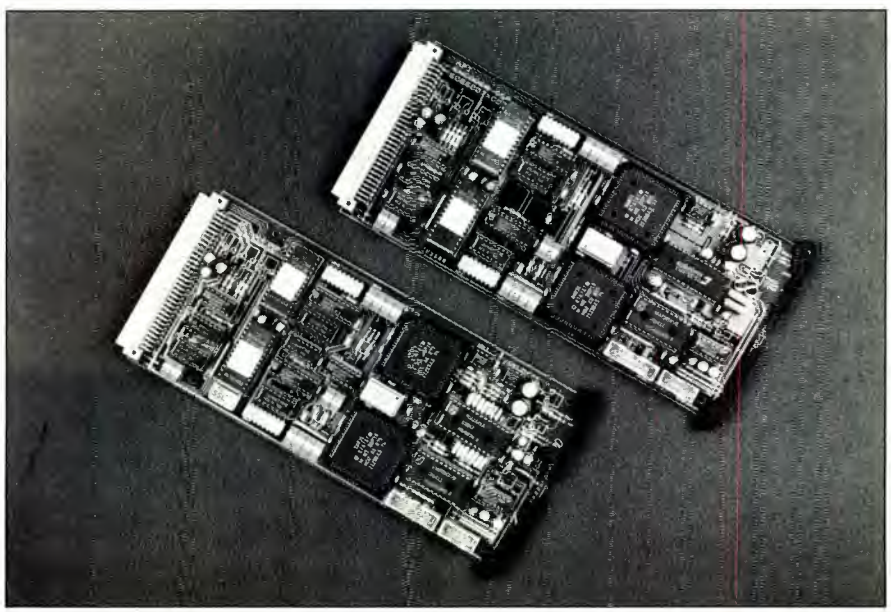

BY SKIP PIZZI

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RF transmission of such links for STL is possible on wideband video subcarriers, direct or T-1 fiberoptic paths, or 18 and 23 GHz microwave channels. Hardware for such systems is now available from Graham-Patten Systems (the VAMP series) and QEI (the CATLink), but occupied bandwidth is still 1 MHz or more for a single pair.

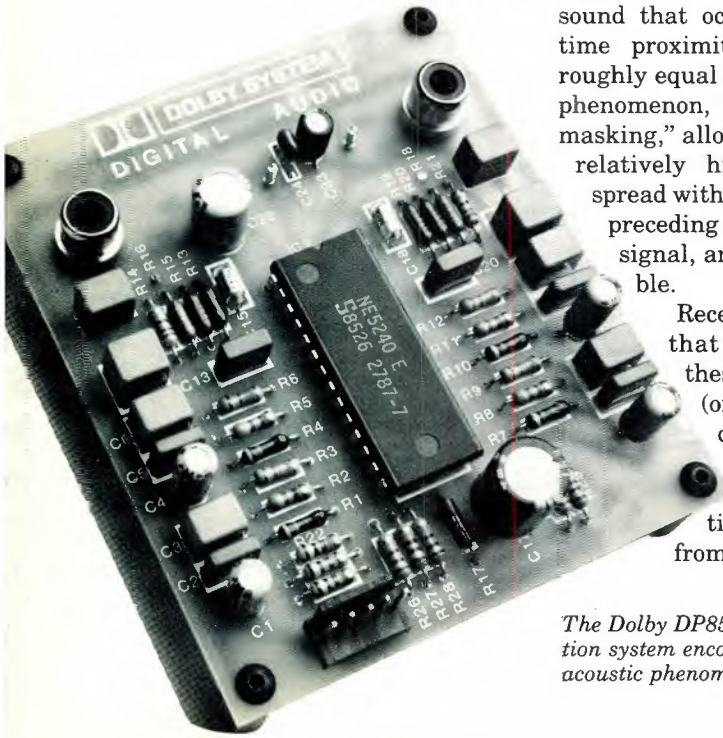
The laws of physics governing such data rates and their transmission are clear and unequivocal on these points, and that might be the end of the story if the end-user of such transmissions were a computer rather than a human listener. Research in psychoacoustics (the study of the human hearing sense) has provided information that tempers the above-mentioned limits to a great extent, and liberates the designers of digital audio systems to use far higher efficiencies by reducing data rates.

To understand the workings of these reductions, some basic concepts of psychoacoustics must be discussed—most notably, the so-called critical band theory and the subject of temporal masking. Both refer to the perceptual threshold of the hearing sense for one signal (noise) in the presence of another (audio), and their study allows a designer to understand what he or she can "get away with" when creating a data compression scheme along these lines.

Critical band theory tells us that the ear works very much like a 24-band realtime analyzer.

Critical band theory tells us that the ear works very much like a 24-band realtime analyzer, and that the perception of noise in each of the bands is subject to a high degree of masking by signals in that band. Thus, a data compression system that analyzes the presence and level of signals in each of these bands against their masking thresholds can decide what bands could have their resolution reduced without listeners detecting the increased quantization noise that would result. Temporal masking tells us that the ear is insensitive to a sound that occurs within a certain time proximity to another sound roughly equal in level or louder. This phenomenon, also known as "pre-masking," allows error signals—even relatively high-level ones—to be spread within a given time window preceding the onset of a desired signal, and thus remain inaudible.

Recent work has shown that systems employing these masking techniques (often referred to as "perceptual coding") can reduce data rates by dropping the resolution of the audio data from 16 bits/sample down to as few as 1.45 bits/sample, with little or no *audible* alteration of the audio signals. Quantization noise is certainly added to the signal, but these systems shape the noise in time and frequency such that it is masked by the original signal. Now, data rates of under 200 kb/s are conceivable for a digital stereo signal. This obviously puts the application of digital audio in a new light for the broadcaster, allowing a move to digital modulation techniques without a corresponding penalty in occupied bandwidth.



The Dolby DP85 Adaptive Delta Modulation system encoder, based on psychoacoustic phenomena.

In order for these "bit-rate reduction" systems to operate practically, however, several specific criteria must be satisfied besides pure audio quality retention. First, the complexity of the algorithms for such data compression must be minimized; the several systems already developed in this genre vary widely in this respect. For broadcast use, low-cost receiver hardware is critical to any system's success. Next, robustness of the signal must be considered. The error probability of a transmission path is often much higher than any type of current recording media, so error correction schemes and coding algorithms must take this into account. Finally, the coding delay that these systems introduce due to their often rather long buffers (100 ms or more) may present a problem for broadcast synchronization, realtime off-air monitoring, and the like.

Most systems share a common trait: Original analog audio signals are sampled and quantized by a high-quality digital system (usually 16-bit, 32 kHz PCM), then processed through the data compression algorithm to provide the final, reduced-bit-rate output. This output is in turn expanded back to 16 bit after reception, and finally converted back to an analog audio signal for reproduction.

Early methods used variations on the standard PCM process, such as floating point PCM, block companding, or adaptive differential PCM. All of these systems reduce data overhead by modifying the fixed quantiza-

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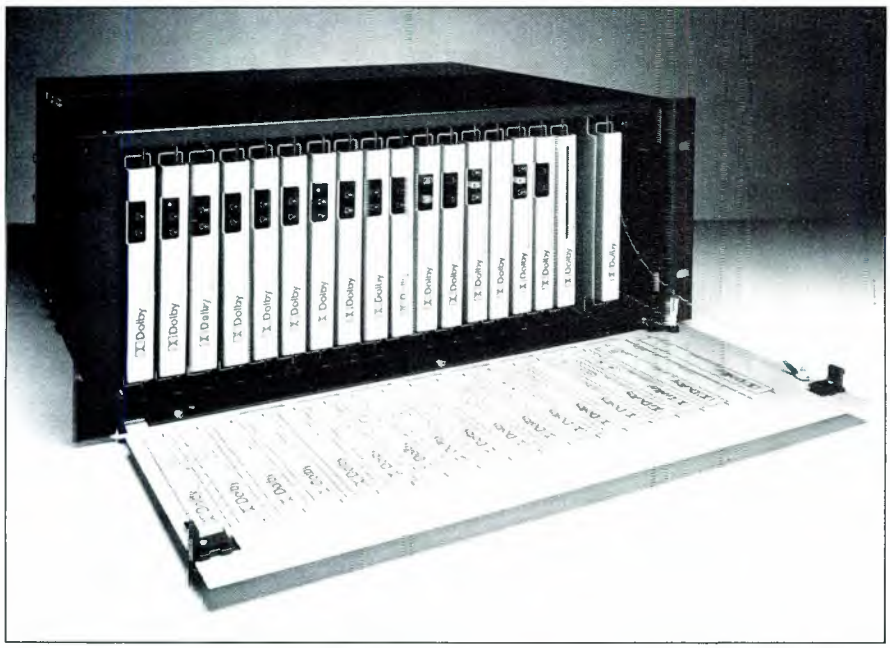

The Dolby ADM decoder, designed for low data-rate transmission and low cost.

tion levels of true PCM and adapting the dynamic range of the system to the needs of the moment. The first applies the companding instantaneously, allowing the quantization levels to vary by a small amount constantly; this sort of system is in widespread use by telephone companies, and typically provides a bit reduction of 16 to 14 or 14 to 11. The other two of these systems reassess the amplitude range of the signal over a given block of data (typically every 32 samples), redefining quantization levels in this "near-instantaneous" (NI) fashion, based on the maximum level encountered in the block. Standard PCM using this system (as in the BBC's NICAM system) can provide a bit reduction of 14 to 10. Differential PCM was added to this approach by the Japanese (the NI DPCM system), allowing reduction from 15 to 8 bits. Actual data output rates here range from around 700 kb/s to 1 Mb/s for stereo audio.

Next came the Adaptive Delta Modulation system (ADM) from Dolby Labs, the first to base its algorithm on serious psychoacoustic phenomena. Unlike those before it, and most since, this system does *not* start with a 16-bit PCM quantization step first. Delta modulation is a one-bit system that carries information about which way the sampled waveform is changing at that instant—up or down. There are no discretely coded level addresses as in PCM. Dolby's version of DM builds on this and was designed as a method of low data-rate transmission with high audio quality and low decoder cost.

Starting with a 204 kHz sampling rate, Dolby ADM varies from standard delta-modulation by adapting the step-size of the DM data from simply up/down to a variable step size, and adds variable analog pre/de-emphasis (under digital control) to the audio. Both the step size and emphasis schemes are based on noise-masking, and step-size is also optimized for low distortion. In addition to the delta-modulation audio data, the ADM datastream contains the step-size data and emphasis control data as well. Dolby ADM is already in use for television audio in an Australian B-MAC DBS system, and is also implemented in the Super-NTSC proposal for domestic ATV. It provides high-quality stereo audio with a data rate of 512 kb/s. The datastream is relatively insensitive to bit errors, since in a DM system, all bits are equal; there are no most- or least-significant bits (MSBs or LSBs).

With subband coders, audio is first split into many bands, generally imitating the ear's critical bands.

More recently, frequency domain converters have been developed, again strongly based on critical band theory. Three basic types of converters are in current use: Subband Coders (SBC), Adaptive Transform Coders (ATC) and Optimum Coders in the Frequency Domain (OCF). These systems have been able to achieve the most effective data companding to date, and show the most promise for the future of this technology.

With subband coders, audio is first split into many bands, generally imitating the ear's critical bands. Within these bands, quantization levels are assigned as the signal energy in each band warrants, such that critical band masking will assure no noise is audible. In early systems, this assignment was a fixed process; current systems use a soft function, with the adaptive bit allocation per band. (This technique was actually originated in the early 1970s at M.I.T., but seemingly forgotten until recently.) Solid State Logic recently introduced a subband ADPCM coding system called APT-X 100. The coder is available on the AT&T DSP16 digital signal processing chip, and is now also being delivered in card-level devices (including A/D and D/A converters) as well as full hardware form with power supply and clocking; the latter is a 1 RU, XLR in/out device. The APT-X 100 system provides high

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audio quality at a data rate of 4 bits/sample/channel (256 kb/s for stereo). SSL is currently pursuing a 2 bit/sample system that may be included on the AT&T DSP16A chip. Meanwhile, Dolby Labs has prototyped what it calls its Model 500 subband coder, with a slightly higher data rate than SSL's. The company hints that some product may be unveiled late this year or early next. Decoders are relatively equal in complexity to encoders in these systems, and processing delay is relatively low.

The other two forms of frequency domain converters apply transform functions to the signal. This process may be thought of as taking 16-bit standard PCM ("time domain", *i.e.*, quantized in amplitude vs. time) data, and every so often shooting a snapshot (transform "window") of the instantaneous "frequency response" (*i.e.*, spectrum) of the signal. The coefficients of the transform in each of the critical bands are then assessed, quantized and coded in various ways to produce a low data rate output. Due to the processing involved, delay through the system is longer, ranging up to 100 ms. Generally, processing delay is directly proportional to the amount of data compression accomplished here.

Stereo data rates for ATC systems range from 300–500 kb/sec (3.5 to 5 bits/sample/channel), although lower rates are predicted to be possible. The data rates in OCF systems are the most promising yet, with high quality already possible at 2 bits/sample. Quite acceptable fidelity has been demonstrated at 1.45 bits/sample with such a system, allowing monophonic transmission at 64 kb/s (the data rate used in ISDN paths, which will undoubtedly figure in future transmission strategies). The OCF format also allows decoder circuitry to be far less involved than that of the encoder.

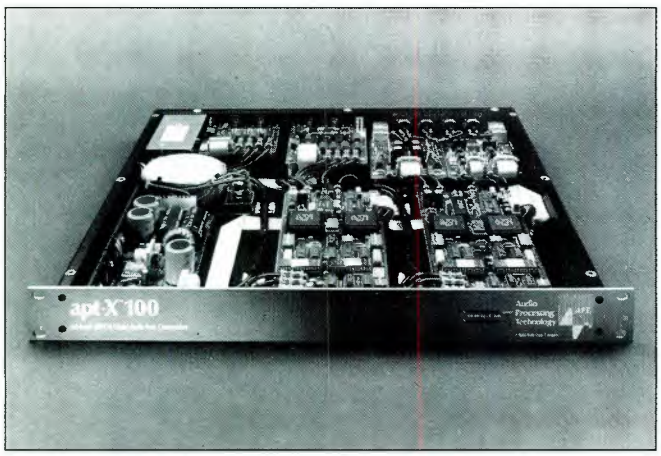
All of these systems are referred to in the the jargon of digital broadcasting as "source codes." The format in which a source code is actually broadcast is called its "channel code." While the source coding is primarily designed to provide a robust and spectrum-efficient audio signal, the channel coding furnishes a datastream format suitable for the RF domain, well-prepared for the adversity a signal might encounter there. An additional consideration is the form of modulation used and the further efficiencies that it can offer, since some of the more exotic types (QPSK, high-order QAM, etc.) allow practical encoding of five or more bits/sec/Hz, which compares quite favorably to standard FM's practical limit of 1 bit/sec/Hz mentioned earlier. (Digital technologies may make these forms of modulation more practical, reliable and cost-effective as well—see "The NCMO Breakthrough", *BME*, December 1988.)

Another recent innovation from California-based Genesys Technologies may also hold some promise. A clever and efficient direct source code algorithm (no intermediate PCM step) that is a hybrid of ADM and binary coding is combined with a unique channel coding system called "waveform modulation." The latter puts a "bump" in the sinusoidal waveform of a carrier wave, somewhere in the linear portion of the waveform between the peak and the trough. Depending on the exact location of the bump, a discrete data value is recovered, corresponding to an address in the hybrid source coding scheme. A claimed efficiency of 6 bit/sec/Hz is currently possible, with 10 bit/sec/Hz as a future goal. At the current rate, this beats even 64QAM, and at a fraction of the complexity. The channel coding is well-suited for use on another signal's carrier, making it possible for new signals to be added to existing formats without loss of compatibility. For this reason, Genesys is being looked at by developers of HDTV and other video applications. Psychoacoustic and psychovisual elements are incorporated into the Genesys data compression systems, but the approach is so radical that many still view it with some skepticism. Others hold high hopes for this on-shore developer.

Genesys is being looked at by developers of HDTV and other video applications.

Meanwhile, digital channel coding and modulation forms are being explored extensively in Europe, and one system employing Orthogonal Frequency-Division Multiplexing and Coding (COFDM) has been designed and tested favorably there by the French broadcast authority CCETT, in conjunction with the German IRT and the European Broadcast Union (EBU). It will be tested in Canada in Spring 1990. ■

Pizzi is BME*'s audio editor.*



The APT-X 100 includes both encoder and decoder sections.

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New Products

BME's expanded coverage of the latest developments in new broadcast equipment.

Intelco Presents BER Analyzer

Intelcc's Model 620 is an ESF-compatible printing BER analyzer. The unit features a full-pattern generator and error rate receiver, built-in printer, realtime clock, and automatic loopback confirmation and validation. The unit comes with an internal rechargeable battery.
Reader Service #200

Alta Adds External Disk Drive to Centaurus

Alta Group has introduced ESD, an external disk system that expands the storage capacity of its Centaurus dual-channel still store system. The option offers both fixed and removable storage media in nine combinations. Prices range from $4000 to $14,250, depending on the type and amount of storage.
Reader Service #201

Microwave Filter Intros Triplexer

Microwave Filter's custom triplexer 7258 connects three separate FM transmitters to the same transmitter without transmitter interaction. The unit is custom-tuned to any three specified frequencies from 88 to 108 MHz. Channel loss is 0.5 dB maximum and channel isolation is 30 dB minimum. Power handling is 100 W per channel with type N connectors. Price varies with specifications.
Reader Service #202

B&K-Precision Presents Sweep/Function Generator

B&K-Precision has introduced its Model 3026 sweep/function generator, a 0.5 Hz to 5 MHz signal source with integral frequency counter. Features include internal or external AM modulation, variable dc offset internal or external gated burst operation and three calibrated steps plus variable attenuators.
Reader Service #203

Allied Premiers Self-Contained Dub Center

Allied Broadcast's Associate Producer is a dedicated self-contained dubbing center contained in an overbridge device. Included is a standard kiosk to house needed equipment, a mixer manufactured by Henry Engineering for Allied and the user's choice of cart machine, compact disk and turntable.
Reader Service #204

ALLIED

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Fuji Presents Hi-8 Metal Tape

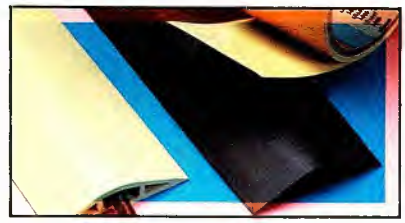
Fuji has introduced its Hi-8 MP metal videotape for highband 8 mm systems. The tape's signal falls within the FM range of 5.7 to 7.7 MHz, and when used with highband systems produces a horizontal resolution of more than 400 lines.

Reader Service #205

Azonic Intros Acoustical Materials

Azonic, Inc. has introduced a range of acoustical materials, including Pyramid, AZ2000, AZ3000, AZ4000 and AZMAX-6 and AZMAX-7. All patterns are available in four colors: charcoal, brown, blue and beige.

Reader Service #206



PANDUIT

Panduit Unveils Vinyl Floor Guards

Panduit's expanded line of vinyl floor guard for routing wire and cable is supplied in six-foot and 50-foot rolls and is easily cut to length. Three standard colors include safety yellow, electrical ivory and dark brown. Other features include double-faced tape for holding guard to concrete, tile or carpet.

Reader Service #209

ATRONIX

Atronix Unveils Molded RGB Cables

Atronix molded RGB cables are miniaturized coax custom-engineered to user specs, with conductors extruded in their actual colors and a range of available connector configurations such as BNCs, male and female F-series connectors and high-density 15-position D-Sub connectors for VGA applications.

Reader Service #207

Frezzolini Premiers MC2 Battery Charger

Frezzolini's MC2 and MC2 DC battery chargers feature a two-wire system, with no sensors required in the battery. The units fast charge four nickel-cadmium batteries sequentially or slow charge four batteries simultaneously. List price is $1595.

Reader Service #208

Radiall Intros Fiberoptic Contacts

Radiall's Termini series of ceramic fiberoptic contacts is designed to fit its ARINC 404 and ARINC 600 connectors, as well as EPX-Rack & Panel and MIL-C 30999 circular connectors. The connectors are rated for a temperature range of -55 to 125 degrees C. They accept 125 and 140 micron fibers and feature a coupling attenuation of less than 1 dB.

Reader Service #210

AKG Announces DSE 7000 Audio Workstation

AKG's DSE 7000 is a RAM-based digital audio workstation incorporating the equivalent of an eight-track recorder, editing system and 10-input mixer. Digital audio is in 16-bit linear PGM format, with a 20 kHz bandwidth at 44.1/48 kHz sampling rate. Other features include 4.4 minutes of RAM memory and a conventional computer keyboard for other software functions. Delivery begins in late 1989 or early 1990.

Reader Service #211

Colorado Video Intros Video Contrast Enhancer

Colorado Video's Model 605 Contrast Enhancer is designed to improve contrast with gray scale expansion, compensate for unbalanced lighting with shading correction and invert video signals for viewing negative images. The unit connects between a video source and a monitor, tape recorder or digitizer.

Reader Service #212

Matthey Electronics Unveils Audio Filters

Matthey Electronics' customer definable audio filters are designed as antialiasing filters in digital audio applications. Each device is a compact multilayer PCB. The filters are available in a variety of cut-off frequencies, from 7 kHz to 20 kHz.

Reader Service #213

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FERROGRAPH

Ferrograph Intros Recorder/Reproducer

Ferrograph's new Model 9500 16-bit digital recorder/reproducer features a removable hard shell 5¼-inch cartridge and S/N ratio of 88 dB. Storage capacities range from 3.3 minutes of stereo at 44.1 kHz sampling to 36 minutes of mono at 32 kHz sampling. The unit is distributed by Gotham Audio.
Reader Service #214

Nalpak Premiers HDTV Test Chart

Nalpak's Accu-Chart incorporates eight camera test functions for checking and adjusting all standard and HDTV color TV cameras. The functions include gray level response, registration color rendition, frequency response, focus, shading and flare compensation. Both 3:4 and 9:6 formats are included.
Reader Service #215

Fluke Extends Range of Timer/Counters

John Fluke Mfg. has extended the frequency range of its PM 6652C and PM 6645C timer/counters from 1.5 GHz to 2.3 GHz with its PM 9619 high-frequency input option. The company says the option is easily installed in existing units by the customer; guaranteed frequency range with the option installed is 2.1 GHz, though 2.3 GHz is typical. List price is $895.
Reader Service #216

Magni Intros Signal Creator

Magni Systems' Signal Creator is a test signal generator for user-selected configurations of multiple formats and standards. Signals are stored on a wallet-sized memory card, each of which can accommodate as many as 100 different signals, depending on complexity. The company says the unit can be configured for virtually any combination of NTSC, PAL, 525- and 625-line component analog video, and 525- and 625-line digital video.
Reader Service #217

MAGNI

Anritsu Offers Optical Spectrum Analyzer

Anritsu's Model MS9601A optical spectrum analyzer delivers resolution of 100 MHz with level accuracy of ±2 dB (0.2 to 5 nm resolution). Measurement range is −65 dBm to +10 dBm (−50 dBm to +10 dBm at high resolution) and the unit measures wavelengths of 1.2 to 1.7 μm at ordinary resolution and 1.28 to 1.58 μm at high resolution, with sweep time of 0.3 s and wavelength accuracy of ± 1 nm. List price is $120,000.
Reader Service #218

BPI/Porta-Pattern Premiers Resolution Charts

BPI/Porta-Pattern's 001-50 and 001-51 resolution charts are designed for the requirements of CCD devices. Each is available in 9 × 12 field size, illuminator transparencies and 18 × 24 Dura Chart size.
Reader Service #219

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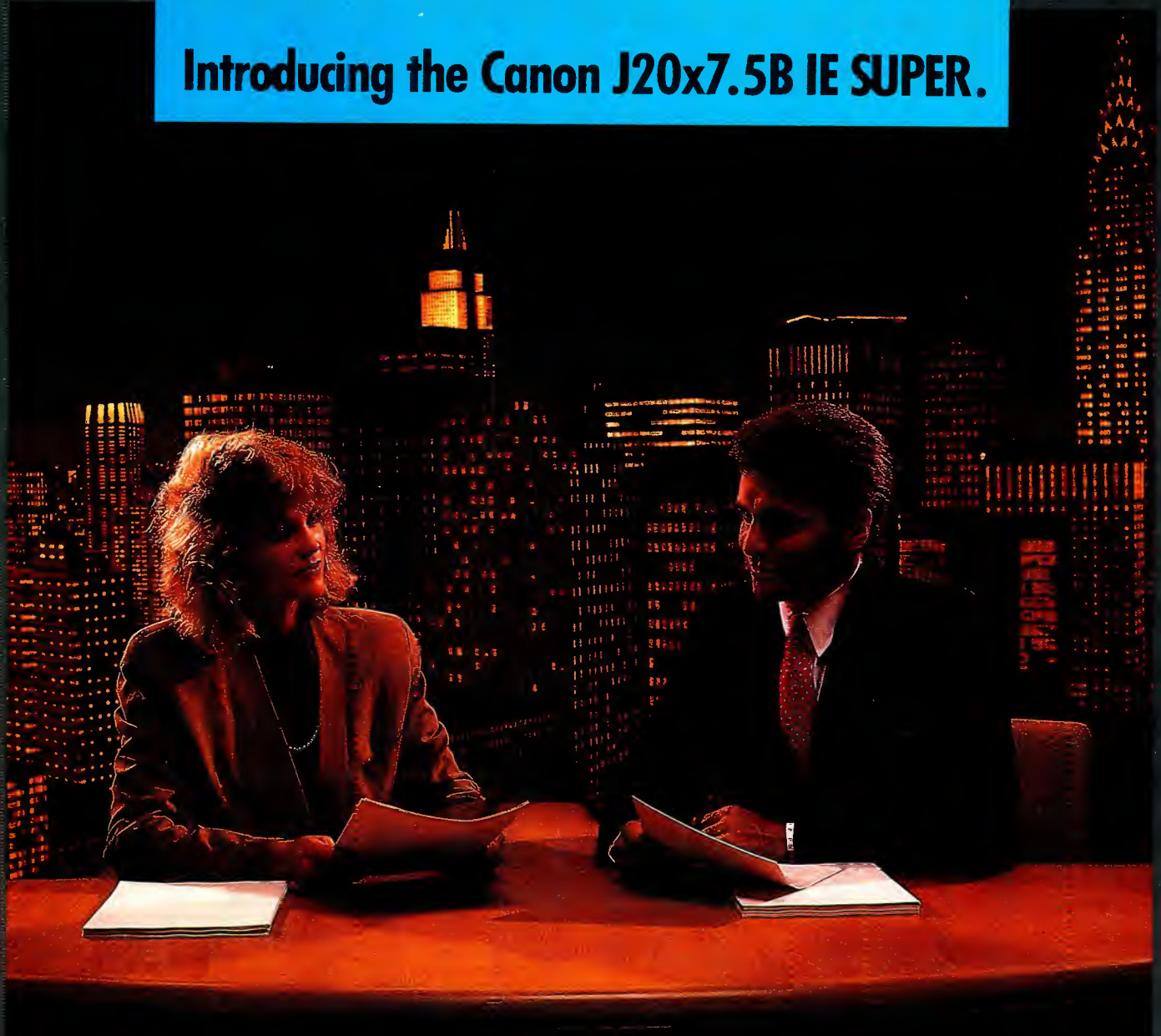
Introducing the Canon J20x7.5B IE SUPER.



Without a doubt, the new Canon J20x SUPER is the finest of the new generation of CCD lenses designed specifically for CCD cameras. Offering the kind of versatility to make it a star performer in any size studio.

The J20x SUPER boasts an incredibly high and flat M.T.F. to provide greater contrast and excellent resolution, especially at the corners.

And as in all Canon CCD lenses, we've reduced both lateral and longitudinal chromatic aberration to virtually zero for each color channel. Bright and sharp, even at the longest focal lengths.

Plus, the J20x SUPER's internal focusing design reduces chromatic aberration during focusing, provides a higher M.T.F. at each channel (even at M.O.D.) and results in less distortion at wide angle settings.

This incredible lens even focuses as close as 3¾ inches in macro!

Simply stated, the new Canon J20x7.5B IE will perform flawlessly in a wide range of studio and field applications. But then again, you wouldn't expect anything less from a Canon broadcast lens.

Focal length: 7.5-150mm
(15-300mm w/2x extender)
Max. Relative Aperture:
1:1.5 through 118mm
1:1.9 at 150mm

See us at SMPTE Booth #1326

Canon

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AMPEX

Ampex Announces M-GEN Setup for D-2 VTR

Ampex has introduced multigeneration software for its VPR-300 composite digital D-2 studio VTR. The M-GEN software permits users to preview the effects of various video settings for up to 20 generations and correct the minute setup errors that are created by various analog systems.

Reader Service #220

Rapid Systems Unveils Processing Peripheral

Rapid Systems' R490 waveform processing peripheral for PCs features a 512K data buffer and 500 kHz sample rate. The device can be used to capture 10 seconds of audio signals or 25 minutes of analog physiological data. It has four input channels, 250 kHz bandwidth, digital triggering and up to 4096 FFT spectrum analysis display. List price is $1995.

Reader Service #221

Silverwood Presents Library Management Program

Silverwood/MCS has introduced its MasterTrack library management program for tape/film facilities and producers. The program uses three related databases to keep track of customers, customer's reels and elements on each reel. The program operates on IBM and compatible PCs. List price is $2495 for the single-user version.

Reader Service #222

Microwave Filter Announces 15 kW Filter

Microwave Filter's Model 6516 is a 15 kW FM lowpass filter for suppressing transmitter harmonics. Features include 50 ohm impedance, 0.2 dB maximum loss (0.1 dB typical) and VSWR of 1.15 maximum to 105 MHz, 1.29 max to 108 MHz. Harmonic suppression is a minimum 40 dB (45 dB typical) at the second harmonic, 60 dB minimum at the third, fourth and fifth harmonics.

Reader Service #223

Hoodman Offers Viewfinder Hood

Hoodman's HVF37 Eclipse viewfinder hood seals out all glare-causing light, says the company. It is made of nylon, Velcro and fiberglass rods and folds flat. The hood weighs less than one pound. List price is $39.95.

Reader Service #224

VAL Announces Graphics Card

Video Associates Labs has introduced its MicroKey/Mark 10 EGA text and graphics overlay card. A plug-in modular board, the device requires only one slot. Other features include a fade module, RGB module and RGB and fade module. List price is $1395.

Reader Service #225

Tri-Tech Presents Remote Broadcast Studio

Tri-Tech has introduced its Cellcast remote broadcast studio, combining the functions of an 832 cellular telephone with a four-channel microphone/headphone mixing console. The unit weighs 15 pounds.

Reader Service #226

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YAMAHA

Yamaha Unveils Multitrack Mixer/Recorder

Yamaha's MT3X combination mixer/recorder is a six-input mixer with a built-in four-track cassette transport. Each input has two aux sends, L/R pan control and two-band equalizer. The unit also features individual 12-segment IED meters for each of the four recorder tracks and two 19-segment LED meters for the master stereo busses. List price is $995.

Reader Service #227

Boonton Premiers Pulse Modulator

Boonton's PM-1 pulse modulator converts any microwave signal source into a pulse-modulated source. The device covers a frequency range of 2 to 18 GHz and features rise and fall times less than 10 ns and on/off ratio greater than 80 dB. It accepts a video source of 0.5 V or greater into 50 ohms. List price is $2995.

Reader Service #228

Zaxcom Intros EDL Storage Interface

Zaxcom Video's HCP400 control panel and edit decision list storage interface operates with all of the company's current TBC control systems and will control up to 64 TBCs or D-2 VTRs. It will also interface to a videotape editor to save video parameters to the edit decision list.

Reader Service #229

Adams-Smith Unveils Zeta-Three Software

Adams-Smith's new software for its Zeta-Three audio-video-MIDI synchronizer and Zeta-Remote autolocator/controller permits users to learn tempos from audio click tracks; store three tempo maps in nonvolatile memory; upload and download tempo maps through MIDI ports; and control all Zeta functions via the MIDI port. The software is available to all current owners at a nominal charge.

Reader Service #230

Modulation Sciences Announces ModMinder

Modulation Sciences' FM ModMinder is designed to let broadcasters increase average modulation, use less processing and still stay within FCC limits. The company says the device works by registering only the events that the FCC defines as overmodulation, allowing users to boost modulation by as much as 3 dB.

Reader Service #232

Aztek Announces Computer Graphics System

Aztek's Spectrum System is a professional-quality computer graphics system that features video input for image capture, live video loop-through with graphic image overlay and direct industry standard RS-170A NTSC output to tape. Image manipulation techniques include image replication, cut-and-paste, airbrush masks, posterization, embossing and tiling.

Reader Service #233

AZTEK

TEAM Unveils Programmable Video Generator

TEAM Systems' Astro VG-814 video generator can be programmed to simulate any existing HDTV standard and can be used to create a series of standardized tests with different picture content, color balance and average picture levels. The unit produces RGB output using virtually any resolution, aspect ratio, frame rate or bandwidth. Scan can be noninterlaced or interlaced with sync/video or separate sync and video. A programmable RS-232C interface enables computer support for storage of test patterns and programs. List price is $5650.

Reader Service #231

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HME

HME Presents Interface Unit

HM Electronics' RW760 interface unit allows the company's 700 series intercom products to connect to two-wire, noncompatible three-wire, four-wire or telephone intercom systems. The unit includes a modular phone plug and ac adapter.

Reader Service #234

O'Connor Presents 10-30 Fluid Head

O'Connor Engineering's Ultimate 10-30 fluid head is designed to support camera packages weighing from 10 to more than 30 lbs. and features fully adjustable counterbalancing, adjustable and repeatable pan-and-tilt drag controls and A90 degree tilt.

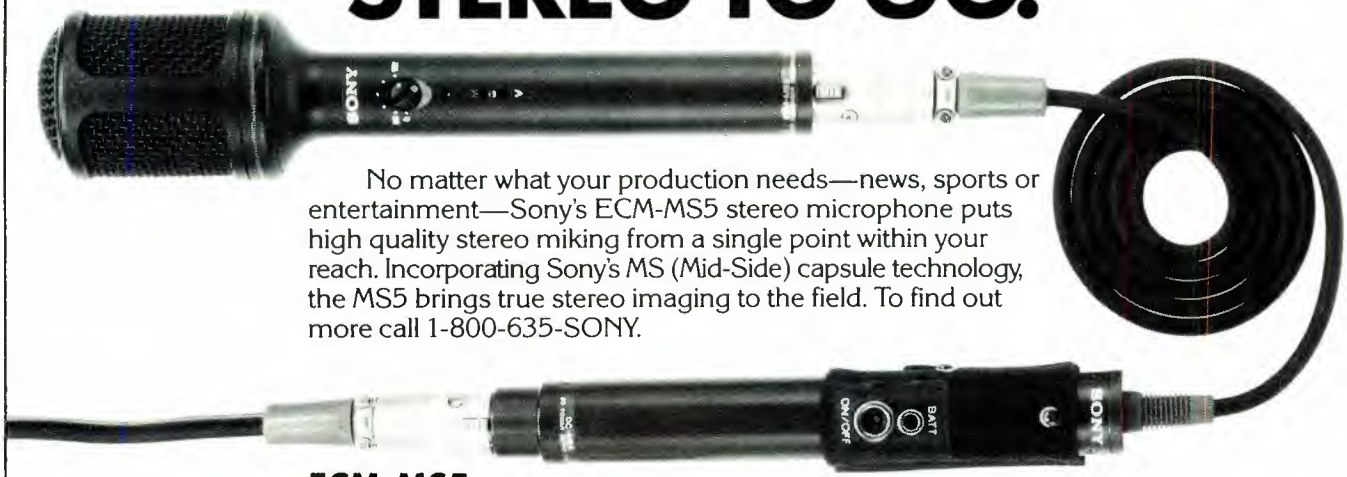
Reader Service #235

Connolly Offers Edit Control Interface

Connolly Systems has introduced the MEI-10 interface, which provides full edit control of an Ampex VPR-2 or 2B from a Sony BVE series editor. An eight-character/seven-segment front-panel display provides time code, user bits and tape timer information. The unit occupies two rack units and is suitable for PAL operation.

Reader Service #236

STEREO TO GO.



No matter what your production needs—news, sports or entertainment—Sony's ECM-MS5 stereo microphone puts high quality stereo miking from a single point within your reach. Incorporating Sony's MS (Mid-Side) capsule technology, the MS5 brings true stereo imaging to the field. To find out more call 1-800-635-SONY.

ECM-MS5

- Three matched condenser capsule floated by a one-piece rubber shock mount
- Light weight: 7.6 oz.
- Total Mono compatibility
- Accepts 12-48V external power
- Optional accessories include: Windscreen (AD-72), Handgrip (GP-5) and DC-MS5 power supply

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PROFESSIONAL AUDIO

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Pivotelli Intros Mounting Support

Pivotelli USA's Single Pivotelli is a wall-mounted L-shaped support available in sizes that permit mounted cabinets to extend 9, 12 or 18 inches from the wall. It is available in a range of models accommodating cabinet widths from 7½ to 47 inches and equipment weighing up to 176 pounds.

Reader Service #237

NED Offers Sound Library on Optical Disc

New England Digital's optical disc sound library, previously accessible only by the company's Synclavier system, can now be used with its Direct-to-Disk and PostPro series of digital multitrack recorder/editors. Each disk holds more than six hours of sounds, digitally recorded at CD-standard 44.1 kHz. The disk's WORM ability lets users record, store and organize their own sound files.

Reader Service #238

BELDEN

Belden Adds High Flex Cable to Brilliance Line

Belden has added a highly flexible 75 ohm video cable to its Brilliance product line. Belden 8281F features 22 AWG (7 × 29) bare copper conductor insulated with polyethylene. The cable is jacketed with low-profile matte finish PVC and is available in 500- and 1000-foot lengths, at list prices of $468.75 and $937.50, respectively.

Reader Service #240

Leader Offers 20 MHz Oscilloscope

Leader Instruments has introduced its Model 1021 20 MHz oscilloscope. The device features a 1 mV sensitivity, allowing very low level signals to be observed on its 8 × 10 cm rectangular CRT. Other features include variable trigger holdoff, TV-V and TV-H sync separators, LF-reject, HF-reject and line triggering. List price is $550.

Reader Service #239

LEADER

AMS Releases New Software for AudioFile

AMS has added TimeFlex, a time compression and expansion facility, to the software for its AudioFile system. The feature permits users to compress or expand the length of recordings to fit into prescribed time slots, without changing pitch. It is available free to all Version 8 AudioFile users.

Reader Service #241

Winsted Announces Tape Storage System

Winsted's TapeStor system features a high-impact plastic tape case that hooks securely to an extruded aluminum rail that mounts to any wall surface. Matching ID labels on tape and case provide accurate identification. Two sizes are available: Model 69005 for Beta; Model 69010 for MII or VHS.

Reader Service #242

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Caveat Emptor.

The Superscribe is the most widely used CG in the professional video industry. Bar none. End of story. Here's why...

• Unlimited roll • Unlimited crawl • Unlimited character overlap • Unlimited character sizing • Logo compose • External computer interface • Newsroom computer systems interface • Printer port • Support for floppy disc, Winchester disc and Iomega disc in all sizes • Networking • Multi-tasking operating system • Perfect antialiasing, regardless of size • Perfect bevels, chiseling, neon, glow, 3D, border, drop shadow, offset edging • Chartist graph maker • Less than one second disc access and message recall • Subtitling • Fonts by wire • Transform™ advanced animation • Compatibility between four different systems • Extensive software diagnostics • On-line font conversion • On-line logo conversions • Variable speed flash • Real-time clock • Event timer • Automatic logging and date stamp of system errors • 16.7 million colors • Bitstream™ font library • Linear keyer • Fade • CCIR 601 interface • NTSC, PAL and PAL-M versions • RGB outputs • RS232, RS422 and SCSI interfaces • Auto font load • Auto font change • Perfect character kerning • Extensive FIL utilities • 10 user-programmable function keys • Dynamic read effects • Row swap • Computer terminal interface • Auxiliary entry • Shaded backgrounds • Textured characters • Flexible tabs • Adjustable safe title • Preview channel • Expandable font memory • Camera capture • Unlimited character placement • Ruggedized chassis • Buffered reads • Variable slow reveals • Support for most world languages • Message directories • Auto operator setup • Metallic characters • Font data utilities • Toolbox™ clipart font • Variable transparency • Diagonal typing • Character rotate • GPI interface • Operator prompt screen • Character/word/row shift • Insert/delete controls • Pickup font/color • Power-on diagnostics • Industry standard VME BUS • UL approved • FCC approved

Only Chyron has more than 1200 anti-aliased character and graphic systems in use worldwide. They are Scribes.

So as you're bombarded by the claims of the "nouveau digital imitators," remember, they're just playing catch up ball. They have to say they're better even if they're not. Caveat emptor. Call us: **516-845-2020**
516-845-2022

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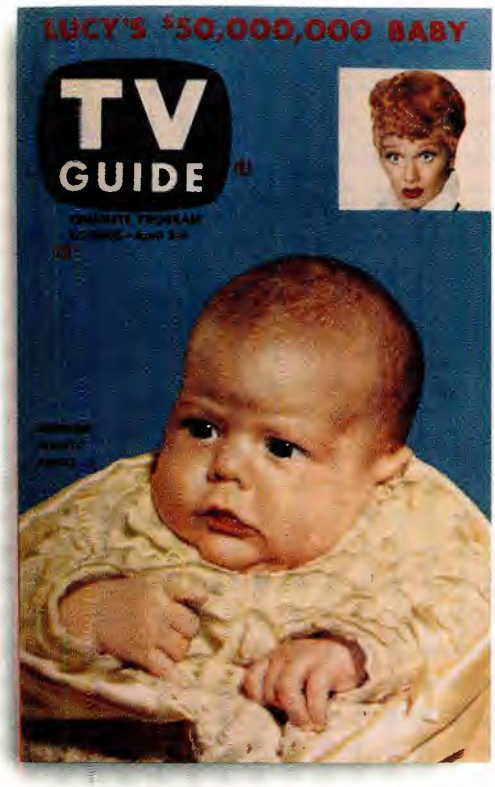

TV Program Scanner

One of these revolutio the world looks at TV w

BTS did not invent *TV GUIDE*.® Walter Annenberg of Triangle Publications did.

But you'd be surprised at how many of the most revolutionary ideas in the history of video did come from BTS. In fact, because we look at things differently, the whole world looks at things differently.

We introduced the first 3-D computer animation system. The first software-based character generator. The Plumbicon camera tube. The B format for videotape recording. The modular routing switcher. And of course, the first CCD film scanner, for which we won one of our three Emmies.

BTS has been a technological innovator in the video industry for six decades. Our cameras,

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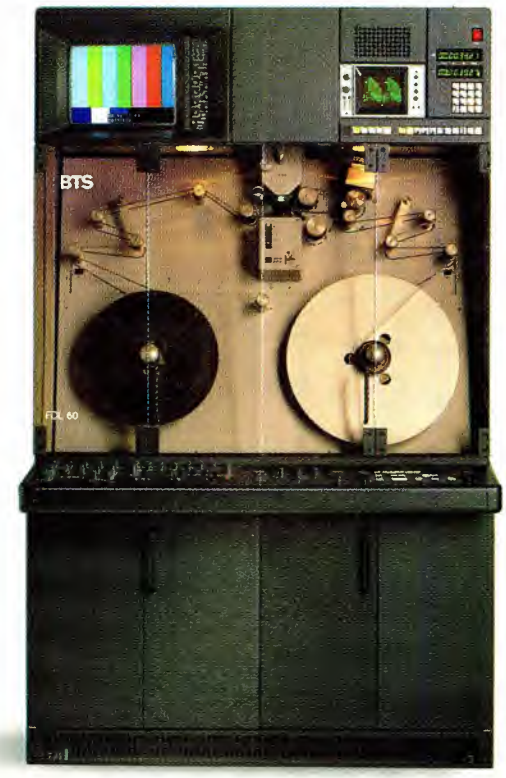

CCD Film Scanner

nary changes in the way as not invented by BTS.

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.

And we're as dedicated to better product service and support as we are to better products.

So although BTS may not yet be a household word, here's a word to the wise. In the years ahead, BTS will continue to be more forward thinking, more responsive and more innovative in our approach to video technology than anyone else.

Including Walter Annenberg.

BTS
The name behind what's ahead.™

BTS is Broadcast Television Systems, a joint company of Bosch and Philips. For more information, please call **1-800-562-1136** or write BTS, P.O. Box 30816, Salt Lake City, UT 84130-0816.

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Onan Offers Generator

Onan Corp.'s Hydrastar generator is designed for vehicles with hydraulic systems. The unit provides up to 5 kW of ac power for mobile applications. Its integral direct drive motor and generator eliminate flexible coupling to provide precision alignment and extended service life, according to the company.

Reader Service #243

B&K Intros Hand-held Digital Temperature Meters

Each of B&K-Precision's three hand-held digital temperature meters features a 3½-digit LCD display and standard 9 V battery power source. Models 920 (dual-input) and 910 span −58 degrees to +1999 degrees F. Model 900 spans −58 degrees to +302 degrees F. List prices are $55 for the 900, $80 for the 910 and $110 for the 920.

Reader Service #244

MAXELL

Maxell Offers New Lengths for One-Inch Tape

Maxell Corp. has introduced longer lengths for its one-inch P551 videotape. The new lengths—C-5, C-120 and C-180—include P551's bridge-type binder, Epitaxial magnetic particles and high-precision reels.

Reader Service #246

Panasonic Premiers S-VHS Videocassette Player

Panasonic's AG-7110 S-VHS Hi-Fi videocassette player features more than 400 lines of horizontal resolution. Other features include SMPTE time code playback, 14-step shuttle dial, five-digit LED realtime counter and 34-pin multifunction remote control terminal.

Reader Service #245

PANASONIC

Vinten Presents Tracking Bar

Vinten Broadcast's Pro-Touch Multiglider, a fully counterbalanced tracking bar, is two meters long and sits on top of its own tripod. The unit is fitted with a 100 mm leveling bowl designed to work with the company's Vision pan/tilt heads. Two models are available, one for ENG cameras, one for EFP cameras.

Reader Service #247

Anton/Bauer Premiers Fast Charger

Anton/Bauer's four-position fast charger is designed to work with the company's NP Plus and other slide-in type batteries. The LSNP features full microprocessor control of all functions, including three independent charge termination systems for capacity maximization and safety. Three charge modes are available: fast, balancing and lifesaver—designed to keep batteries 100 percent charged indefinitely.

Reader Service #248

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Digidesign Offers Free Updates to Sound Tools

Digidesign has announced the release of Sound Designer II Version 1.1, an update to the audio editing portion of its Sound Tools digital recording and editing system. The new software is free to registered users of the system and includes stereo time compression and expansion; faster SMPTE chase and lock; enhanced sample rate conversion; and SCSI support for the Akai S1000.

Reader Service #249

Knox Offers S-VHS CG

Knox Video's K40S is the component version of its K40 Microfont character generator. The unit features full bandwidth signal processing for Y/C inputs and outputs and uses Y/C DIN connectors for S-VHS compatibility. The K40S is switchable between composite and Y/C operation. List price is $2795.

Reader Service #250

For-A Premiers Multi Video Processor

For-A's MVP-2100 multi video processor is designed to convert noninterlaced RGB signals from a PC or other equipment into NTSC standard composite as well as component RGB signals. Features include selectable flicker elimination; built-in color encoder; composite or S-VHS Y/C358 background video; built-in background color generator; built-in sync generator; and two-page memory.

Reader Service #251

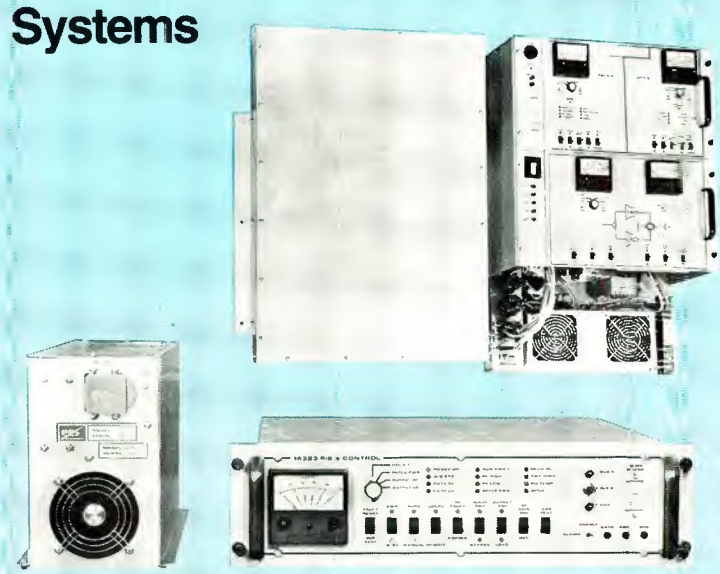
Thomson Premiers 50 kW Tetrode

Thomson Tubes' 50 kW TH 563 tetrode for UHF transmitters uses Pyrobloc grids and Hypervapotron cooling, both techniques developed by the manufacturer. The cavities are designed to provide optimal performance while ensuring extremely compact transmitter design.

Reader Service #252

GLOBAL SUPPORT FOR GLOBAL COMMUNICATIONS

Ku-Band Special Application TWT Amplifier Systems



Tested, tried and proven by communications experts worldwide, MCL's Ku-Band Special Application TWT Amplifier Systems meet—and exceed—industry requirements for reliable performance under all conditions. Advanced technical design and superior mechanical layout allow MCL equipment to operate effectively even in the most extreme cases: interference (EMI-radiation/RFI-susceptibility), electrical (power source), mechanical stress, environmental (temperature/humidity), general maintenance and transportable applications.

MCL offers a wide range of Ku-Band Special Application TWT Amplifier Systems designed specifically for the transportable satellite communications (video, voice and data) market. For those who require hub-mounting or portable equipment, MCL has deliverable switch-mode power supplies and a new range of special configuration 1:1 redundant and VPC TWT Amplifiers utilizing these power supplies. Output powers range up to 500 Watts for a phase combined unit.

MCL is the leading manufacturer of high-quality, competitively priced amplifiers, all of which are noted and proven for *unsurpassed performance.*

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TAS Intros Modem Test System

Telecom Analysis Systems has introduced its TAS 1002GX automatic modem test system. The device simulates a telephone network and associated impairments, allowing users to determine how a modem performs under any line conditions. It is driven by TASKIT menu-driven software.

Reader Service #253

Kenwood Unveils R-DAT Error-Rate Counter

Kenwood's DR-5755 R-DAT error-rate counter measures C1/C2 block error rates on inputs of PCM equalized NRZI signals from an R-DAT deck. It can measure error-rates on Track A/B or total error from both tracks, and can be used in a go/no go mode based on random error-rate values. List price is $3995.

Reader Service #254

Weather Central Offers Mac Compatibility

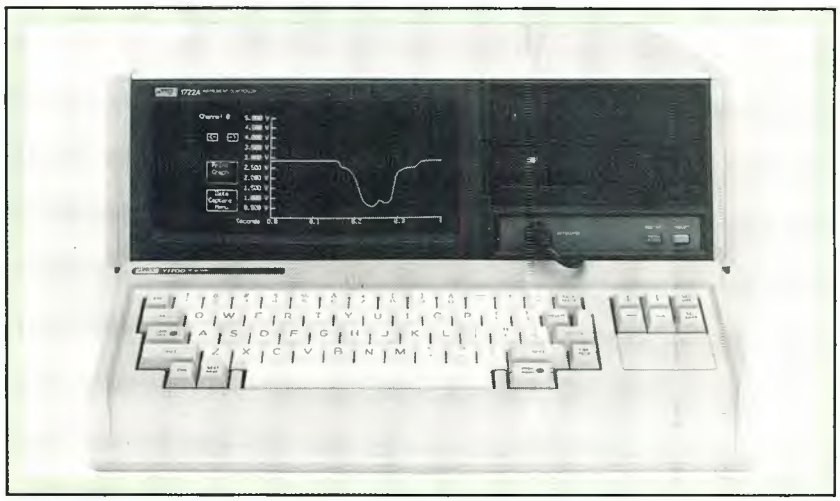
Weather Central's eight-bit and 24-bit weather graphics services are now available for Apple Macintosh computers. The software permits users to automatically dial, acquire and sequence weather graphics for on-air use. Other enhancements include improved antialiasing, auto sequencing and realtime cel animations.

Reader Service #255

Sony Unveils Video Scanner

Sony's Still Image Systems Division has introduced a flatbed color video scanner for computer graphics, video production and image archiving functions. The UY-T55 scans color flat art in as little as six seconds, producing a 24-bit color image at 500 TV lines horizontal resolution. The image can be enhanced and sized using the unit's on-board image manipulation features. Analog RGB, composite NTSC and S video outputs are featured. List price is $6495.

Reader Service 256



FLUKE

Fluke Premiers Hard Disk Option for Controllers

An internal hard disk option for Fluke's 1722A instrument controller and 1752A data acquisition system doubles the previous memory storage capabilities of both to 40 MB and provides increased transfer speeds, the company says. The option, 17XX-440, functions at ambient temperatures to 40 degrees C and at 99 percent humidity and features self-parking heads. The option may be installed in existing units at Fluke service centers. List price is $1995.

Reader Service #257

HEWLETT-PACKARD

HP Offers PC-Based Spectrum/Network Analyzers

Hewlett-Packard's PC-based spectrum/network analyzers, the 12.8 kHz HP 3566A and 102.4 kHz HP 3567A, both offer built-in time and frequency domain measurements that can be expanded to 16 simultaneous data-acquisition input channels. Measurement features include multichannel power spectrums, waterfall displays, frequency-response functions, auto/cross correlation, transient-time capture, ⅓ octave with A-weighting, stimulus-response testing and order tracking. List price for the 3566A is $22,000; for the 3567A is $18,000.

Reader Service #258

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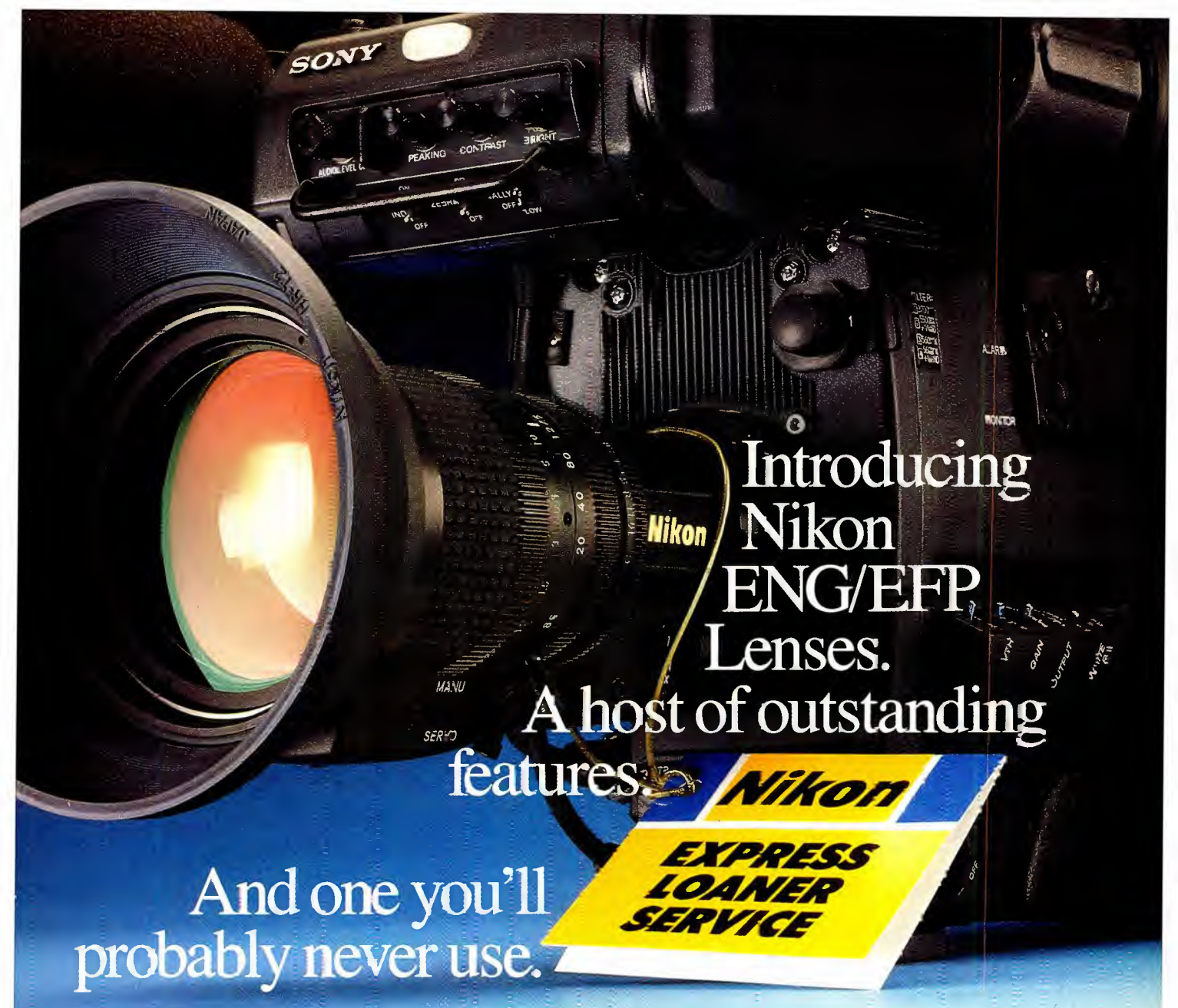

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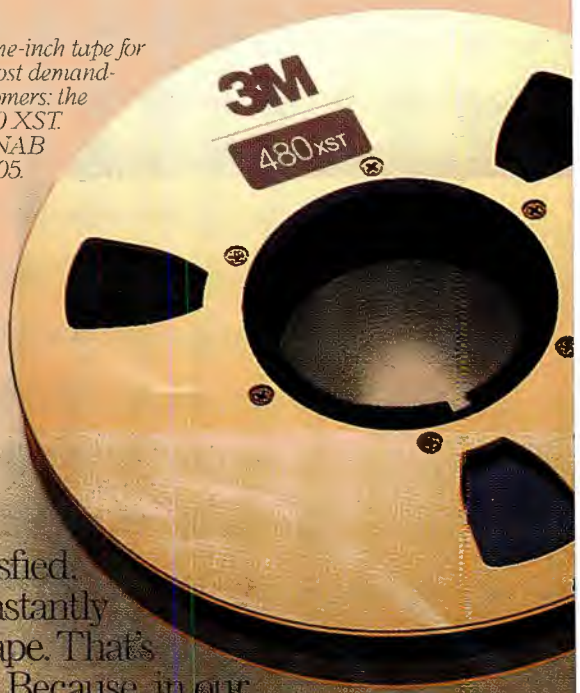

The people who use our tape are not easily satisfied. In fact, our best customers are never satisfied. They constantly demand more from themselves. And more from their tape. That's why they demand 3M tape. And why you should try it. Because, in our products and service, 3M is committed to one goal: We won't be satisfied until you are.

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SENNHEISER

Sennheiser Presents HD 25 Headphone

Sennheiser's HD 25 studio monitoring headphone uses dynamic drivers in a closed supraural design with an adjustable split headband and single-side audio cable. One cuff can be rotated off the ear and onto the user's temple. Frequency response is 30–16,000 Hz and nominal impedance is 70 ohms.
Reader Service #259

Advanced Videotech Offers Two-Way Radios

Advanced Videotech's Series 2000 is a 5 W, six-channel, two-way radio. Features include low-battery indicator, six-inch "rubber duck" antenna, belt-clip and crystals for one channel. Also available are the AudioTronix VHF and UHF hand-held two-way radios, which feature six channels with operating frequencies installed.
Reader Service #263

Frezzolini Presents Frezzi-Pag SC2

Frezzolini's Frezzi-Pag battery management system includes features such as auto mains select, auto cell balancing, a self-test program and fail-safe shutdown. Input supply is 90-140 V and 180-280 V; output is 4 A 22 V maximum.
Reader Service #264

E&M Development Intros Bi-Directional Microwave

E&M Development has introduced three bi-directional microwave systems: studio-to-transmitter, wide-band studio-to-transmitter and full duplex video and audio teleconferencing.
Reader Service #260

Leader Presents Sweep Generator

Leader Instruments' Model 430 video sweep and multiburst generator features a sweep signal that repeats at the field rate and sweeps from 100 kHz to 10 MHz. For multiburst operation, the unit provides a 100 percent white reference pulse at the beginning of each visible line, followed by equal amplitude bursts of 0.5, 1.25, 2, 3, 3.58 and 7 MHz. List price is $1755.
Reader Service #261

Bird Announces Absorption Wattmeters

Bird Electronic Corp. has introduced a line of high-power absorption wattmeters with power ratings from 1.5 to 10 kW and calibrated frequency ranges of 54 to 890 MHz. The units are available with 3⅛-inch EIA flanged and unflanged connectors; all models except the 10 kW are available with both convection cooling and blower forced-air cooling.
Reader Service #262

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When working with multiple formats, ALTA's Celeris provides a simple interface between **U-Matic dub** mode (Y688) and **S-VHS** (Y/C3.58), while maintaining the highest video resolution and color purity. With built in digital vertical & horizontal luma-chroma delay correction and a two year warranty, **Celeris** is a great value for only **$1,850.**

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Use an Electronic Spreadsheet To Make Indirect Power Tables

By Ronald F. Balonis

Electronic spreadsheet programs were originally conceived, and are still generally perceived, as computer tools for managers or financial analysts. However, an electronic spreadsheet program is also a useful computer tool for broadcast engineers.

Simply, an electronic spreadsheet is an interactive program that emulates the form and the format of a paper spreadsheet. An electronic spreadsheet is arranged as a grid of columns and rows with the intersection of a column (designated by a letter) and a row (designated by a number) defining a cell. The size of an electronic spreadsheet and the number of commands and functions it allows depend on the amount of memory and the program. But at a basic, generic level, they all allow you to use the cursor control keys to move a highlighted cell cursor around the spreadsheet; to edit text, data or a formula into each cell, and then to recalculate it instantly; and to format the cells for width and for display format. Although most spreadsheet programs operate alike with many things in common, they do have operational differences. For actual operational details or procedures, the reference manual for the particular spreadsheet program in use is the only source.

This month's Compute program is a relatively simple one for use on an electronic spreadsheet program. It's designed mostly to illustrate the utility and usefulness of electronic spreadsheets for the broadcast engineer. The spreadsheet program, PWRTABLE.WKS, generates an indirect output power table for AM, FM, or TV transmitters. The program is presented as a generic keystroke listing to make it compatible with the widest range of spreadsheet programs. The "program" consists only of the list of cells and the text, data or formula to type into them.

This spreadsheet application uses a rather simple "brute-force" algorithm that depends on the power of the spreadsheet program for its elegant simplicity. It emulates the time-consuming method you might use to make an indirect power table by hand. The Indirect Power Table title goes into the top row of cells, C1 to E1. The Voltage (input DATA) goes in cell A4 and its increment in B4. The Current (input DATA) is entered in cell C4 and its increment in D4, and the Efficiency (input DATA) in cell E4. The formulas in the rest of the cells then use these "input data" cells to make the table.

The formulas in the *row* of cells B6 to G6 calculate and display the horizontal voltage increment line—each cell's formula adds the voltage increment to the cell to its left. The formulas in the *column* of cells A8 to A20 calculate and display the current increment vertically—each cell's formula adds the current increment to the one above it. In the power matrix, cells B8 to G20 (bounded by the voltage row and the current column), the formula in each cell multiplies the column voltage by the row current by the efficiency in cell E4 to calculate and display the corresponding values of indirect power.

The demo screen shows an indirect power chart for a typical but fictitious FM transmitter. The program PWRTABLE.WKS creates a 6x13 screen size indirect

	A	B	C	D	E	F	G
1			INDIRECT POWER CHART FOR: WAAA-FM				
2							
3	Voltage	Incr.	Amperes	Incr.	% Eff.		
4	5000.00	25.00	1.00	0.02	0.87		
5							
6	Plate Volts	5000.00	5025.00	5050.00	5075.00	5100.00	5125.00
7	Amps.						
8	1.00	4350.00	4371.75	4393.50	4415.25	4437.00	4458.75
9	1.02	4437.00	4459.18	4481.37	4503.55	4525.74	4547.92
10	1.04	4524.00	4546.62	4569.24	4591.86	4614.48	4637.10
11	1.06	4611.00	4634.05	4657.11	4680.16	4703.22	4726.27
12	1.08	4698.00	4721.49	4744.98	4768.47	4791.96	4815.45
13	1.10	4785.00	4808.92	4832.85	4856.77	4880.70	4726.27
14	1.12	4872.00	4896.36	4920.72	4945.08	4969.44	4993.80
15	1.14	4959.00	4983.79	5008.59	5033.38	5058.18	5082.97
16	1.16	5046.00	5071.23	5096.46	5121.69	5146.92	5172.15
17	1.18	5133.00	5158.66	5184.33	5209.99	5235.66	5261.32
18	1.20	5220.00	5246.10	5272.20	5298.30	5324.40	5350.50
19	1.22	5307.00	5333.53	5360.07	5386.60	5413.14	5439.67
20	1.24	5394.00	5420.97	5447.94	5474.91	5501.88	5528.85

Figure 1. *Demo screen for PWRTABLE.WKS.*

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power output table that can be customized to the transmitter's plate voltage and current, with increments corresponding to its meters. Spreadsheet programs are data-driven models of the problem they are designed to solve; for this one, the "input data" cells are the title row (C1 to E1), the Voltage (A4) and its increment (B4), the Current (C4) and its increment (D4), and the Efficiency (E4). To generate a new, custom Indirect Power Table, just change them and recalculate for a new Indirect Power Chart. Then use either the spreadsheet's print function or the computer's print screen function to make a copy of it.

Since spreadsheet programs differ in some operational details, the program is just a keystroke listing of the data to enter into the cells. In the PWRTABLE.WKS listing, the left-hand column represents the cell into which to enter the right-hand text, data or formula. The default cell width format for this table/program is 11 with two decimal digits. Refer to your spreadsheet program's operation manual for the actual keystroke procedures for data entry into a cell and for setting the cell width to this value. Generally, it is just a matter of moving the cursor to the cell and then typing in the appropriate information, or selecting a function from the command line.

Spreadsheet programs have many other engineering applications and can be a handy tool for a broadcast engineer. Here are a few suggestions for other uses: tabulations and analysis of radial data in ND/DA Proofs; DA Loop and Base current deviation/ratio tables; calculation of ND/DA Effective Field—the RMS value of the inverse fields; compiling AF proof of performances; direct and indirect operating power tables; and mileage expense reports.

Spreadsheet programs come in many levels of power and utility, ranging from the simple and useful, with a couple of dozen commands and functions, to the awesomely complex, with a mindboggling array of functions, commands, and features. Spreadsheets are very powerful programs and because of that inherent complexity, regardless of what some say, it's not easy to master them—it takes time and persistence from everyone who has systems to model or problems to solve. Like any computer or computer program, its real power and utility is ultimately defined by you. ■

Balonis is chief engineer of WILK, Wilkes-Barre, PA. His Compute programs are available for download on A/V Sync, Atlanta, (404) 320-6202 and on Broadcasters Computer Database, Houston, (713) 937-9097.

PWRTABLE.WKS --- Keystroke listing

Cell	Formula	Cell	Formula
C1	"INDIRECT PO	A13	+A12+D4
D1	"WER CHART F	B13	+B6*A13*E4
E1	"OR: WAAA-FM	C13	+C6*A13*E4
A3	" Voltage	D13	+D6*A13*E4
B3	" Incr.	E13	+E6*A13*E4
C3	" Amperes	F13	+F6*A13*E4
D3	" Incr.	G13	+G6*A13*E4
E3	" % Eff.	A14	+A13+D4
A4	5000	B14	+B6*A14*E4
B4	25	C14	+C6*A14*E4
C4	1	D14	+D6*A14*E4
D4	.02	E14	+E6*A14*E4
E4	.87	F14	+F6*A14*E4
A6	"Plate Volts	G14	+G6*A14*E4
B6	+A4	A15	+A14+D4
C6	+B6+B4	B15	+B6*A15*E4
D6	+C6+B4	C15	+C6*A15*E4
E6	+D6+B4	D15	+D6*A15*E4
F6	+E6+B4	E15	+E6*A15*E4
G6	+F6+B4	F15	+F6*A15*E4
A7	" Amps.	G15	+G6*A15*E4
A8	+C4	A16	+A15+D4
B8	+B6*A8*E4	B16	+B6*A16*E4
C8	+C6*A8*E4	C16	+C6*A16*E4
D8	+D6*A8*E4	D16	+D6*A16*E4
E8	+E6*A8*E4	E16	+E6*A16*E4
F8	+F6*A8*E4	F16	+F6*A16*E4
G8	+G6*A8*E4	G16	+G6*A16*E4
A9	+A8+D4	A17	+A16+D4
B9	+B6*A9*E4	B17	+B6*A17*E4
C9	+C6*A9*E4	C17	+C6*A17*E4
D9	+D6*A9*E4	D17	+D6*A17*E4
E9	+E6*A9*E4	E17	+E6*A17*E4
F9	+F6*A9*E4	F17	+F6*A17*E4
G9	+G6*A9*E4	G17	+G6*A17*E4
A10	+A9+D4	A18	+A17+D4
B10	+B6*A10*E4	B18	+B6*A18*E4
C10	+C6*A10*E4	C18	+C6*A18*E4
D10	+D6*A10*E4	D18	+D6*A18*E4
E10	+E6*A10*E4	E18	+E6*A18*E4
F10	+F6*A10*E4	F18	+F6*A18*E4
G10	+G6*A10*E4	G18	+G6*A18*E4
A11	+A10+D4	A19	+A18+D4
B11	+B6*A11*E4	B19	+B6*A19*E4
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F11	+F6*A11*E4	F19	+F6*A19*E4
G11	+G6*A11*E4	G19	+G6*A19*E4
A12	+A11+D4	A20	+A19+D4
B12	+B6*A12*E4	B20	+B6*A20*E4
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D12	+D6*A12*E4	D20	+D6*A20*E4
E12	+E6*A12*E4	E20	+E6*A20*E4
F12	+F6*A12*E4	F20	+F6*A20*E4
G12	+G6*A12*E4	G20	+G6*A20*E4

Figure 2. *Key-in program listing for PWRTABLE.WKS.*

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Winds of Change At the FCC

By Harry F. Cole

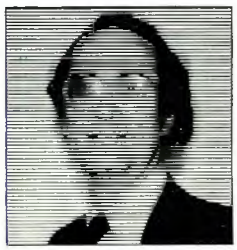
There are those who believe that the regulatory tendency in broadcasting is like a pendulum, sometimes swinging in the direction of more regulation, sometimes in the direction of less. With the arrival of three new FCC commissioners, who constitute a new majority appointed by a new administration, that pendulumlike quality is becoming all the more apparent. As a result, it is reasonable to assume that the decade of the 1990s may begin with a marked shift in direction for the broadcast industry's relations with the FCC. How far that shift ultimately will extend is hard to predict at this point; by contrast, it is easy to see that a shift has begun.

As you are doubtless aware, the resignation of Commissioner Patricia Dennis in mid-October gave President Bush the opportunity to appoint four of the five Commissioners, Commissioner Quello being the sole survivor from the Reagan FCC (and the Carter, Ford and Nixon Commissions, at that). Even before the arrival of this new Commission, it was clear that the "nonregulation" or deregulation policies that had been the hallmark of most of the Reagan years might be under reconsideration.

In recent years, a number of broadcast licensees have encountered significant difficulties in securing renewal of their licenses, largely because of concerns about their performance in the area of equal employment opportunity. The Commission has launched a serious offensive against the broadcast of "indecent" programming, a term once thought to include only the "seven dirty words." FCC application forms have become more detailed and lengthy.

All of these factors seemed to contradict the free-wheeling, "marketplace *über alles*" spirit of the Reagan days. In the early 1980s, the Commission tried to cast itself as nothing more than a spectrum traffic cop, responsible for the proper utilization of the radio band. If it did not have to do with the limited metes and bounds of frequency regulation, the FCC did not think it should have to worry about it. Instead, in the Commission's view, the marketplace could take care of any problems that might arise.

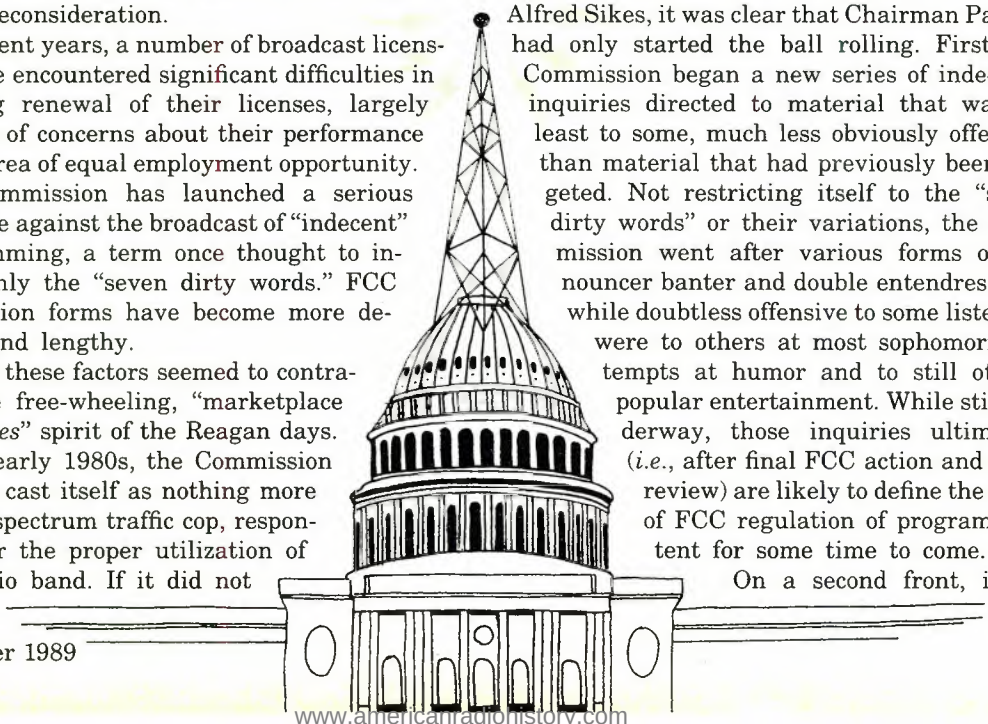
That idealized view, however, ran smack into certain political realities. For example, the marketplace may not be able to prevent discriminatory hiring practices. Similarly, experience has demonstrated that, far from driving out "indecency" (at least as the FCC seems to define that term), the marketplace encourages it to a significant degree. Since discrimination and broadcast indecency are not politically acceptable, some adjustment to the purely marketplace model had to be made. And sure enough, the FCC under former chairman Dennis Patrick initiated a significant number of EEO inquiries and launched a vendetta against "indecency."



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

Almost from the first days of the new Commission, headed by chairman Alfred Sikes, it was clear that Chairman Patrick had only started the ball rolling. First, the Commission began a new series of indecency inquiries directed to material that was, at least to some, much less obviously offensive than material that had previously been targeted. Not restricting itself to the "seven dirty words" or their variations, the Commission went after various forms of announcer banter and double entendres that, while doubtless offensive to some listeners, were to others at most sophomoric attempts at humor and to still others, popular entertainment. While still underway, those inquiries ultimately (*i.e.*, after final FCC action and court review) are likely to define the scope of FCC regulation of program content for some time to come.

On a second front, in an



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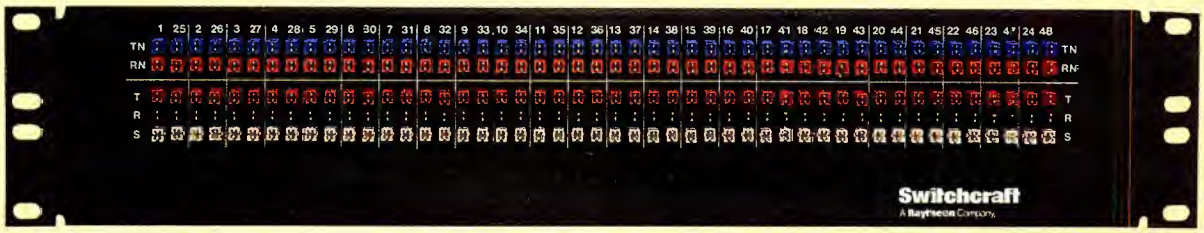

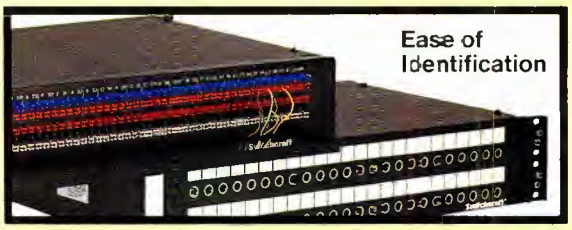

The APP Series audio patch panel speaks broadcast engineers' language with features that make it easy to install, wire, and maintain. No other patch panel offers the level of flexibility and simplicity available in Switchcraft's APP Series.

Insulation Displacement Connectors (IDC's) Make Termination Easy.

Color-coded IDC's insure accurate termination identification. One simple tool eliminates the need for wire stripping and soldering and makes connections quick and easy.

A Variety Of Wiring Options Expand Your Applications Possibilities.

The APP Series gives engineers the ability to terminate two wires at one IDC, so a signal can be transmitted to two locations. The unit can also accommodate 22 or 24 gauge wire, either solid or stranded.

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apparent bow to the now-prevalent nationwide anti-drug sentiment, the Commission announced in September that it would consider, as part of its licensing procedures, whether a conviction for drug-related activity might make an applicant for a new or renewal license unqualified to be a licensee. While this might appear to be a logical and common-sense step, it is completely inconsistent with the notion that the FCC should be interested *only* in spectrum-related matters. Indeed, several years ago the Commission had specifically announced that it would not consider, as part of the licensing process, an applicant's criminal convictions unless those convictions were shown to be broadcast-related or otherwise predictive of the applicant's likely conduct as a broadcaster. The theory was that the Commission should not be an arbiter of criminal right and wrong.

How far the FCC's regulatory pendulum will swing this time around is, of course, a matter of speculation.

While that theory is all well and good, it ignores the fact that the FCC hands out extremely valuable Federal licenses that permit licensees to have a significant impact on the population at large. By refusing to consider an applicant's criminal past (involving, *e.g.*, drug convictions) as part of that licensing process, the Commission placed itself in the position of possibly giving a license to a convicted drug dealer rather than to a noncriminal. Under the "FCC as spectrum traffic cop" approach, such a result theoretically would not be a problem; in the real world, where drugs are a major problem and where the government is looking for every possible means of fighting that problem, such a result was a big problem. Acting to stake out the moral high ground, the Sikes Commission voted unanimously to view drug-related convictions as a possibly disqualifying demerit in the licensing process.

Other changes may be in the wind. The Commission is in the process of reviewing its comparative renewal policies, with the hope of coming up with a new way of comparing, in some rational fashion, incumbent renewal applicants against challenging new applicants. Even though the question has been before the Commission for more than 25 years, the FCC's way of dealing with comparative renewal challenges remains largely unsatisfactory. While the Reagan Commission was generally averse to programming-related inquiries (whether or not in the comparative renewal context), the Bush Commission under Chairman Sikes may be more pragmatic. Absent some change in the Communications Act by Congress, the Commission will have to continue to permit comparative renewal challenges, and will therefore require some policy for resolving such challenges. The obvious place to begin is with the incumbent renewal applicant's past performance, meaning, in part, programming.

The full outlines of the Sikes Commission's regulatory agenda have not yet taken shape. In addition to the nontechnical matters mentioned above, there may be a greater emphasis on compliance with technical requirements. It is unlikely that the headlong rush to create a maximum number of broadcast stations throughout the country will abate. Saving the AM industry remains a priority. And maintenance of a strong nationwide television service will certainly demand attention. Because of these considerations, it remains important for the Commission to adopt and enforce strict technical requirements to assure a minimum of interference.

How far the regulatory pendulum will swing this time around is, of course, a matter of speculation. In this connection, though, one beneficial aspect of the newly arrived regime is its willingness to preserve and promote the best and the brightest staff members in an effort to assure quality performance. Rather than bringing in new people who, through inexperience, might be inclined to repeat the mistakes of the past, Chairman Sikes appears to favor drawing on the talent pool presently in place. Perhaps the best example of this is the appointment of Roy Stewart as the new chief of the Mass Media Bureau.

Stewart is an attorney who has risen through the Bureau's ranks over a 20-or-so-year career. He has been in charge of processing assignments and transfers (in the old Broadcast Bureau) and, most recently, served as chief of the Video Services Division. He has been involved with the development and implementation of many, if not most, of the Commission's broadcast policies and is familiar with both the practical and regulatory sides of the industry. At a time when the pendulum appears to be swinging back to increased regulation, an individual with Stewart's background may prove an effective brake. ■

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ADVERTISERS INDEX

Manufacturer	Page No.	Circle No.
Abekas	29	112
Ace Communications	81	135
Alta Group, Inc.	75	133
Ampex	22-23	
Auditronics, Inc.	44	121
Avcom	43	119
Belar Electronics	36	114
Broadcast Audio	48	123
Broadcast Automation	42	118
Broadcast Electronics, Inc.	8	104
BTS, Inc.	Cvr.III	101
BTS, Inc.	6	103
BTS, Inc.	68-69	129
Canon USA	62	126
Chyron	67	128
Computer Assisted Technologies-JDM	42	117
Ditech	43	120
Dolby	47	122
Fidelipac Corp.	3	102
GLW Enterprises	37	115
Hitachi	20	109
JDM	42	117
MCL, Inc.	71	130
Nikon, Inc.	73	131
Optical Disc Corp.	18	108
Panasonic Industrial Co.	10-11	105
Panasonic Industrial Co.	13	106
Polyline Corp.	81	136
Quanta	27	111
Radio Systems	49	124
Sony Broadcast Products Co.	4-5	
Sony Communications	65	127
Switchcraft	79	134
Technics	50	125
3M Broadcast Division	34	113
3M Broadcast Division	41	116
3M Magnetic Media Division	74	132
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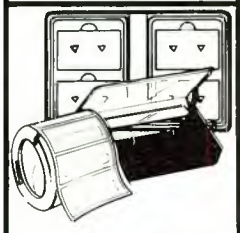

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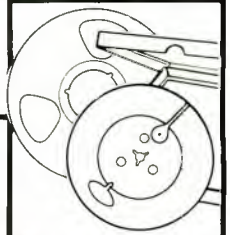

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BUSINESS BRIEFS

Comark Communications, Colmar, PA, has placed a 60 kW Klystrode-equipped transmitter into full-time broadcast service at WTCI, channel 45, in Chattanooga, TN . . . InnerVision Productions, St. Louis, has taken delivery of an **AMS AudioFile** digital audio recording/editing system . . . The Family Channel is reportedly the first national TV network to purchase a **Digital F/X Composium** edit suite for on-air promotional spots . . . Cornerstone Recorders, Chatsworth, CA, has installed a **Neve VR console** . . . Selkirk Communications, Fort Lauderdale, FL, and New River Recording Studios have joined their facilities through Synclink, formed by a dedicated coax cable and **Sony** digital audio processors . . . **Intraplex, Inc.**, Littleton, MA, says its T-1 digital multiplexer is being used in the first full-time digital link between the U.S. and the Soviet Union, established by **IDB Communications Group** . . . Viewpoint Computer Animation, Needham, MA, has added a second production suite, including a **Quantel V-Series Paintbox**.

The International Teleproduction Society has presented a Special Monitor Award for Excellence in Engineering Achievement to **Accom** for its Digital Image Enhancer 125 and to **Sony** for its DVR-1000 component digital VTR. The awards were announced at the recent ITS Convention in Los Angeles.

Scientific-Atlanta, Inc., Atlanta, has reported earnings of $36.3 million for the fiscal year ended June 30, 1989, an increase of 22 percent over FY 1988. Fiscal 1989 sales were $546.8 million, an increase of eight percent . . . **Gentner Electronics Corp.**, Salt Lake City, has reported revenues of $5.1 million for fiscal 1989, an increase of 53 percent. Net income was $445,930, a 64 percent increase over FY 1988.

Harris Corp., Quincy, IL, has named Harvey Baker vice president of manufacturing for its Broadcast Division . . . **Varian Associates**, Palo Alto, CA, has appointed Al Wilunowski vice president of its Microwave Tube Operations . . . **Solid State Logic**, Oxford, England, has appointed Colin Pringle to its board of directors as marketing director . . . **Broadcast Television Systems**, Salt Lake City, has named Roger Harvey Southeast regional sales manager. BTS also appointed Tom Deyo Midwest regional sales manager . . . **Barco Industries**, Los Gatos, CA, has appointed James F. Faith Western regional product support manager . . . **Arriflex Corp.**, New York, has named Rick Berry as product manager for the ARRI Grip line of lighting equipment . . . **Canon U.S.A.**, Jericho, NY, has named Joseph R. Patton as Western regional sales rep for the Optics Division. Canon has also appointed Thomas Bender to be BCTV sales manager for the Optics Division's Western regional office.

IDB Communications Group, Culver City, CA, has signed a five-year agreement with Cable News Network to provide full-time video transmission services from CNN's New York bureau to its headquarters in Atlanta . . . **Hughes Network Systems, Inc.** has announced a contract with CBS to provide a point-to-multipoint satellite network linking CBS-owned AM stations and the network's Radio Stations News Service. ■

The staff of New Age Sight & Sound, Atlanta, proudly surveys one of the production facility's most recent acquisitions: the BOSS/2 system from Alpha Audio Automation. Bill Allgood, left, president and production director, called the BOSS/2 "very cost-effective. Our clients feel that we are saving them time and money using the BOSS/2 because even though rates have increased, projects are now completed twice as fast." Pictured with Allgood are (l. to r.) Joe Wasser, engineer, Jason Bonnette, engineer, and Mitch Dorf, studio manager.

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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.

Together, these fully compatible CCD cameras will make your old ideas about picture quality go right down the tubes. For complete information and technical specifications on the new LDK 910 and LDK 91, call BTS at **1 800-562-1136, ext. 13.**

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