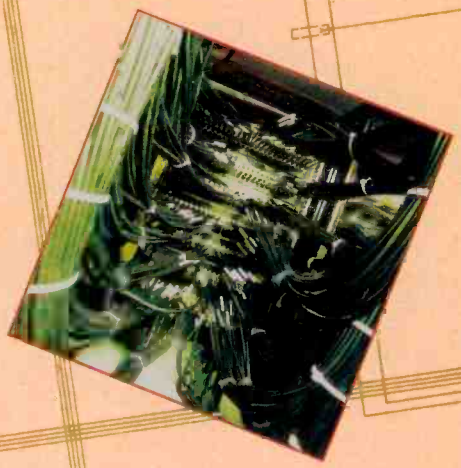
BME

FOR TECHNICAL AND ENGINEERING MANAGEMENT

AN ACT III PUBLICATION

DECEMBER 1989
$3.00

INSIDE: SURVIVING THE STORM



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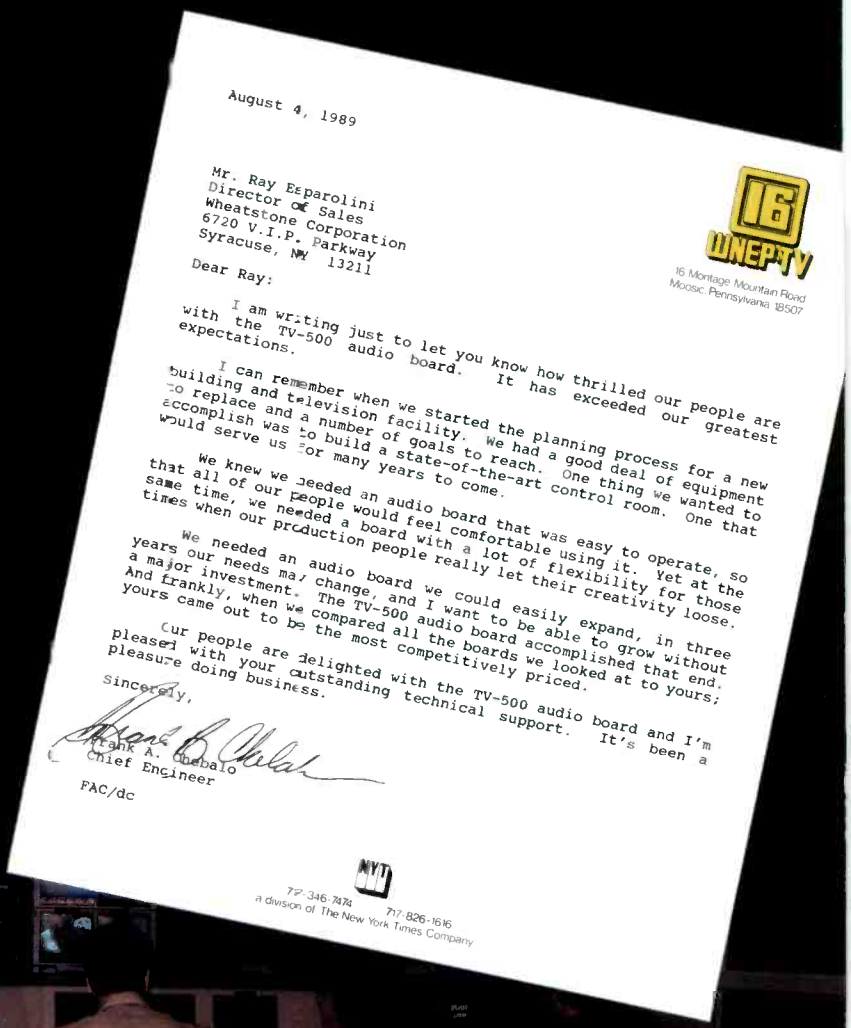

August 4, 1989

Mr. Ray Esparolini
Director of Sales
Wheatstone Corporation
6720 V.I.P. Parkway
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Dear Ray:

I am writing just to let you know how thrilled our people are with the TV-500 audio board. It has exceeded our greatest expectations.

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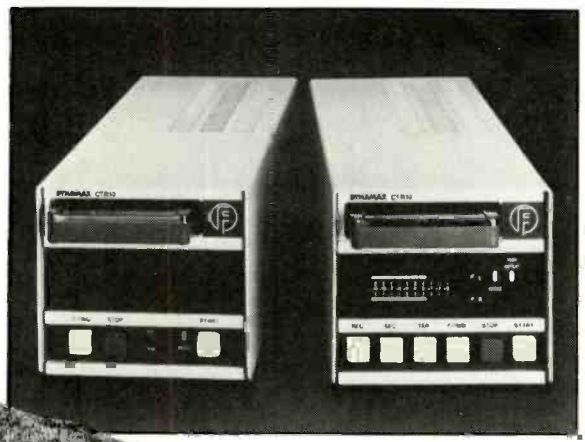

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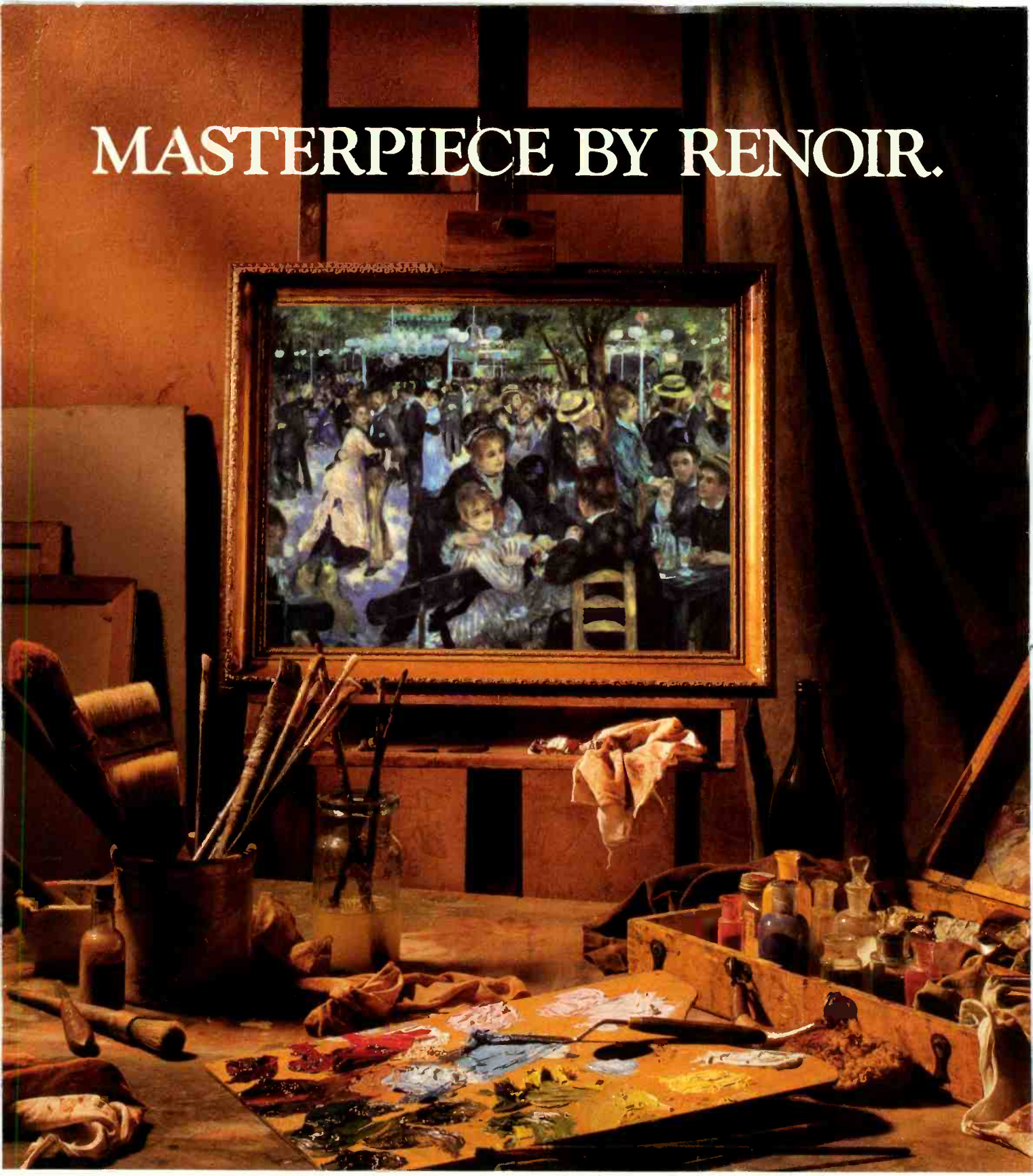

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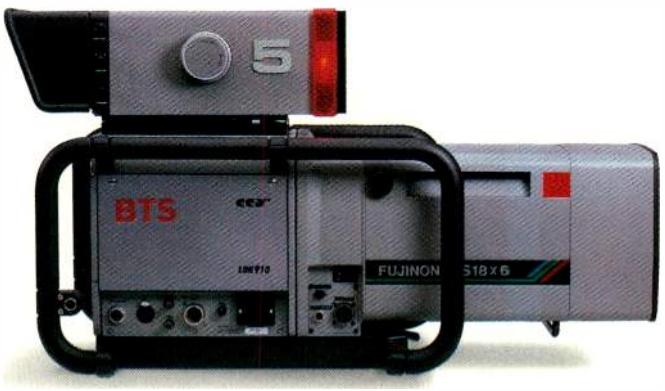

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But of course, big ideas also come in small packages. The LDK 91, a lightweight, easy-to-handle ENG/EFP camera, is the LDK 910's portable companion. Singled out by *Broadcast Engineering* magazine as one of the ten "Pick Hits" of NAB '89, it has the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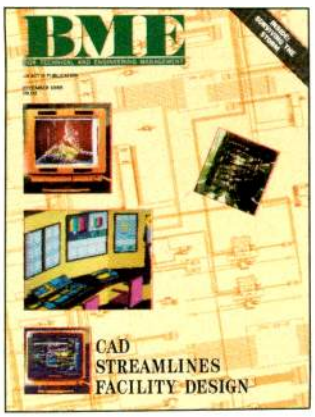

On the cover:
Cover design by Donald Krogman. Art furnished by Video Design Pro, Las Cruces, NM

40 *The 131st SMPTE*

32 *Surviving the Storm*

BME
FOR TECHNICAL AND ENGINEERING MANAGEMENT

DECEMBER 1989
VOL. 25, NO. 12

Features

PHASE TRAK 90™

The perfect cart machines for an imperfect world.

PHASE TRAK 90 PLAYBACK &
PHASE TRAK 90 RECORD/PLAYBACK

Do you really need a cart machine as good as Phase Trak 90? In a perfect world, perhaps not. After all, there'd be no tape skew or phase error in an ideal universe. So, you wouldn't need the continuous non-encoded phase correction circuitry* we developed for Phase Trak 90 cart machines. This BE-exclusive process is so effective, it actually cleans up stereo carts that sound dull on ordinary machines, while assuring consistently clear mono performance.

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On a fault-free planet, all audio formats would be created equal. Then you wouldn't need Phase Trak 90's superior cartridge guidance system, Phase Lok V head block and CD-quality sound, including our Dynafex® noise reduction system that audibly improves stereo signal-to-noise performance.

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* Patent Pending
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Columns & Departments

68 *Newstar goes to college.*

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VIEWPOINT

In 1990, BME will retarget its editorial content to serve the specific needs of our readers.

While many view the end of a year—especially the last year of a decade—as a time for reflection on the past, we at *BME* see it as an opportunity to move forward. With that in mind, I'd like to bring you, our readers, up to date on some significant news at *BME*.

First of all, I'm pleased to announce the recent formation of an Editorial Advisory Board. Its members will play an active role in helping to guide our editorial direction and focus, and in providing feedback, ideas and technical expertise. We'll be calling on them from time to time to participate in seminars and roundtables along with other industry chief engineers, and they will play an active role in judging the third annual Excellence in Engineering Awards, to be featured in our February 1990 issue. The members of our Editorial Advisory Board represent a geographically diverse cross section of leading chief engineers in television and teleproduction. We welcome their participation.

Secondly, it gives me great pleasure to introduce William A. Owens, who has joined us as technical editor. Bill brings with him more than 20 years of engineering experience and excellent writing ability, and we look forward to his contributions. This month's issue includes a feature article written by Bill, "Surviving the Storm," beginning on page 32. For more details about Bill and our Editorial Advisory Board, please see our Update pages.

More changes are in the works for 1990 as we prepare to serve our readers in a more targeted way. Our Radio Engineering section, created a year and a half ago at our readers' request, will become a separate publication in 1990. It will be devoted strictly to radio, with its own character and focus.

In addition, with the February 1990 issue, *BME* will be renamed *BME's Television Engineering* and will be written exclusively for engineers working in all areas of broadcast and non-broadcast television. We have exciting editorial calendars planned for both magazines for the coming year, and we look forward to your continued readership as we strive to tailor these publications to your specific needs. We welcome your comments and opinions. ■

Eva J. Blinder

Eva J. Blinder
Editor

UPDATE

NAB Calls on Congress to Regulate Cable...MST to FCC: Clean Up TV Interference...BME Names Technical Editor...BME Announces Editorial Advisory Panel...Faroudja Moves Ahead on ATV ...Leonard-Duran Bout to Air Via HDTV

MST to FCC: Clean Up TV Interference

The Association of Maximum Service Telecasters (MST) has petitioned the Federal Communications Commission to initiate an inquiry on television interference. The association asserts that the technical quality of local television broadcasting is being threatened by the encroachment of non-television signals into spectrum space previously dedicated to over-the-air television. MST further claims the FCC has been negligent in the protection of TV broadcasters, due to its relaxation of standards relating to non-television-generated interference with broadcast television stations.

In its petition, filed October 4, MST, a group of approximately 250 large- and small-market television stations encompassing commercial and public, network and independent, VHF and UHF stations, is asking the FCC to investigate several ways in which FCC policies may have had a negative impact upon stations.

According to the petition, the FCC has no clear definition of television interference, with the result that interference appears as less of a problem than it really is. The petition further asserts that the FCC "considers only the incremental effect of interference" when considering new spectrum users, without looking at the cumulative effect of all potential sources of interference which results.

In addition, MST believes the Commission "lacks a comprehensive and clearly articulated framework for making decisions" on potential interference, and has relied more upon market forces and consumer complaints than on clear technical standards.

One of the critical points the petition makes is the effect of FCC-authorized "sharing" of television channels by non-television services, including such land-mobile transmissions as police and fire services, cellular telephones, and wireless microphones used in ENG production.

Along the Gulf of Mexico, the recently implemented Automated Maritime Telecommunications Service (AMTS) is expected to create interference problems for stations on Channels 10 and 13. John Reece, chief engineer of WALA-TV, Ch. 10 in Mobile, AL, said he is "well aware of the potential problem," as his broadcast tower is only 30 miles from a proposed AMTS site. However, Reece has had no viewer complaints about interference directly traceable to the AMTS.

According to Wendell Nelson, chief engineer of WMBB-TV, Ch. 13, in Panama City, FL, his station fought implementation of the system, expecting that it could cause serious problems. The station has no way of measuring what problems have been caused, however, as its tower was demolished when a military jet rammed into it, WMBB is operating on a temporary tower.

The Commission has also permitted the use of broadcast television frequencies for field sensor security systems, and has permitted ultrasonic medical diagnostic machines and variously sized personal computers to emit low-power, spurious emmissions on broadcast television frequencies. The net effect of all this, according to the petition, is that broadcasters are faced with potential interference from a wide range of sources.

The NAB has announced its full support for the Association's efforts to have the FCC improve its regulation of existing and proposed uses of the spectrum which interfere with the essential public service that television provides. ■

BME Names Technical Editor

Act III Publishing has named William A. Owens to the position of technical editor for *BME* magazine. Owens, who will be based at Act III's New York headquarters, assumed the full-time editorial position in mid-November.

Before joining Act III, Owens was an engineering consultant to WHSE-TV, Ch. 68 in Newark, NJ. Prior to that, he spent two

years as director of operations and engineering at Meycom, Inc., of Naples, FL. Meycom is the licensee of WNPL-TV, Naples, and formerly operated WUXA-TV, Portsmouth, OH. Owens's experience includes over 20 years of engineering and operations work in the television industry.

"Bill brings to *BME* the precise combination of talents we were seeking," said *BME* editor Eva J. Blinder. "His comprehensive knowledge of television engineering and technology, combined with his strong writing skills, make him the ideal candidate for this position."

Owens resides in Little Falls, NJ. ■

Faroudja Moves Ahead on Advanced Television

Advanced television came one step closer to reality as Yves Faroudja, president of Faroudja Research Enterprises, announced that nine major companies with interests in broadcasting, engineering and cable television have agreed to provide funding for product development and field testing of the SuperNTSC enhanced TV system.

According to Faroudja, the goals of the project are the development of a system that will deliver to home viewers a higher-quality picture with improved sound, while also providing minimum disruption of existing distribution media, at a reasonable cost to the viewer.

Funding for the project will be provided by Capital Cities/ABC, Comcast Cable Communications, Continental Cablevision, General Instrument, Newhouse Broadcasting, Scientific Atlanta, Tele-Communications Inc., Viacom International, Inc. and Westinghouse Broadcasting.

The funding will support product development and testing for the SuperNTSC system, and will permit testing of the system in actual broadcast and cable environments. Twelve cable system sites will be utilized to demonstrate the quality of the SuperNTSC system, provide information on technical requirements for widespread introduction of the system, and gather market research on consumer demand.

The SuperNTSC system involves processing at both transmission and reception, operating on the standard 6 Mhz channel bandwidth, with no additional subcarrier required. The system includes image enhancement, noise reduction and line doubling (525 to 1050), and is said to provide image quality approaching 35 mm film. It is designed to be compatible with current broadcast, cable and satellite distribution, as well as existing cable head-end systems, since it provides a signal that is fully compatible with current NTSC transmission and reception equipment.

NAB Calls on Congress to Regulate Cable

In a letter to Sen. Daniel Inouye (D-HI), the chairman of the Senate Communications Subcommittee, the National Association of Broadcasters has called on Congress and the FCC to regulate cable television systems as common carriers, rather than under their current "privileged status" according to the 1984 Cable Act.

In the letter, NAB president and CEO Edward O. Fritts asked Inouye to take "a hard look at cable's present regulatory treatment" during the subcommittee's upcoming hearings on cable carriage issues. A similar request was made to Rep. Edward Markey (D-MA), chairman of the House Telecommunications Subcommittee.

Fritts cited American Television and Communications' decision to program a cable channel in Rochester, NY, as an independent station, in direct competition with the local broadcast stations in that market. He pointed out that this channel will not require an FCC license, nor will it be subject to the public-interest obligations that apply to broadcast stations under the terms of their licenses.

ATC, owned by Time/Warner, Inc., "even intends to give this channel 'call letters,' that are patterned after those used by television stations," Fritts' letter continued. He added that because of cable operators' near-complete discretion in programming and positioning of content, ATC can give its channel a favored position.

Fritts also noted that while broadcasters are forbidden by federal law from owning cable systems in their markets, nothing prevents a cable operator from creating a local station equivalent on its system. He warned that if ATC is successful in this action, "the cable industry may transfer these same practices into other markets."

Fritts summed up NAB's position by saying, "We see the specter of cable vertical integration growing to the point where it warps the entire relationship between our two industries." ■

In a related development, Philips Consumer Electronics has apparently reversed its position on Enhanced Definition Television. Speaking at an engineering conference in Washington, DC, company vice president Peter Bingham endorsed a two-step implementation of advanced television, with an initial move to NTSC-compatible EDTV, followed with a later move to "true" widescreen HDTV.

The company had previously maintained that direct implementation of HDTV transmission should be the next step taken by the industry. In his speech,

No jamming in Inner Mongolia.

Cassette jamming is one of the biggest problems production crews face. Unless they're shooting with Sony Videocassettes. No wonder the producers of a recent documentary shot in Inner Mongolia chose to tape with Sony BCT Series Betacam® cassettes.

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BCT Betacam cassettes, for instance, combine a high-impact ABS anti-static cassette shell with a base film that's been given Sony's ultrafine carbon-black back coating. All of which ensures more uniform tape transport and superior winding characteristics. Among other things, this kind of runability helps keep Mongolians out of a jam.

No matter which Sony Professional Videotape you're working with, there's one thing you know for sure. Its greatest ability is durability. Whether it's Betacam, U-matic,® 1" or Digital tape. So take on the world. With Sony Videotape. In Inner Mongolia or in your own studio you need a tape that's tough as Sony. After all, there's no better way to prevent unwanted jam sessions.

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UPDATE

Bingham effectively reversed that position, proposing industry cooperation to introduce ATV receivers with a minimun of delay, and announcing that Philips would be able to bring ATV receivers to the consumer market "very quickly."

The Philips proposal for a move to an intermediate ATV format prior to implementation of full-scale HDTV eliminates the major difference between Philips' position and that of the Sarnoff Research Center. Sarnoff calls for introduction of a NTSC-compatible ACTV-1, with improved detail and a wide picture on one television channel, followed by a later introduction of ACTV-2, a wide-bandwidth HDTV format requiring an additional spectrum. ■

BME Announces Editorial Advisory Panel

BME has announced the formation of an editorial advisory board of chief engineers at broadcast television stations and teleproduction facilities across the country. The advisory board will play a key role in setting the editorial direction of *BME* when the magazine becomes *BME*'s *Television Engineering* in February, 1990.

The board, which will meet periodically, will participate in *BME*-sponsored seminars and focus groups on industry technology and trends. Board members will advise *BME*'s editors on editorial direction and on technical issues. In addition, board members will assist in judging the annual Excellence in Engineering Awards. Award winners will be announced in the February issue.

The 13 members of the advisory board include: Jim Bartel, chief engineer, Post Effects, Chicago, IL; Richard Edwards, vice president/director of engineering, Guy Gannett Broadcasting Services, Miami, FL; Neil Feldman, president, Video Post & Transfer, Dallas, TX; Robert Frey, director of engineering, Pacific Video Resources, San Francisco, CA; Patrick Howley, president, Post Perfect, New York, NY; Stanley Kronquest, chief engineer, HSN Telemation, Seattle, WA; Joseph Mahedy, director of technical operations and chief engineer, Modern Telecommunications, Inc., New York, NY; Kenneth D. Miller, vice president, engineering, Capitol Video, Washington, DC; Robert Murch, vice president, engineering, WPIX-TV, New York, NY; William Napier, director of engineering, WBTV, Jefferson Pilot Communications, Charlotte, NC; Fred Steurer, vice president, engineering, Pulitzer Broadcasting Co., St. Louis, MO; Roy Trumbull, assistant chief engineer, KRON-TV, San Francisco, CA; and James Wagner, vice president, technical and engineering operations, Jacor Communications, Inc., Cincinnati, OH. ■

Leonard-Duran Bout to Air Via HDTV

As the struggle to choose a terrestrial HDTV standard continues, HDTV is encountering little conflict in another kind of contest. HDTV Sports, a joint venture of Platinum Sports Netork and Zbig Vision, is scheduled to present the December 7 boxing championship bout between Sugar Ray Leonard and Roberto Duran via live closed-circuit HDTV.

The live production is scheduled to originate at the Mirage Hotel in Las Vegas, and to be uplinked by Hughes Communications, using the MUSE-E transmission system. The satellite transmission will be downlinked in Miami, Minneapolis, Toronto and New York City.

According to HDTV Production's Stuart Samuels, executive producer for the December 7 broadcast, the production is being fielded in cooperation with International Broadcast Consortium and NHK Enterprises USA. The NHK-supplied equipment at the Las Vegas site will include three digital HDTV cameras, a Chyron HDTV Scribe and a Sony 9000 HDTV switcher. HDTV Sports is supplying commentators, technicians and producers. ■

BME *welcomes your comments and opinions. Write to us c/o Editor,* BME *Magazine, 401 Park Avenue South, New York, NY 10016. You may also contact us on MCI Mail at ID 326-8115 or on Compuserve at 71630,1236.*

New Generation of Microscopes 'Feels' Surface Features

By Robert Rivlin

Scanned probe microscopes can detect atomic-scale forces such as magnetism and temperature variations.

Ever since Dutch naturalist Anton von Leeuwenhoek invented the microscope in the late seventeenth century, scientists have been anxious to peer closer and closer at the world around us. Approximately 100 years ago, however, the German physicist Ernst Abbe described a fundamental limitation of any microscope using lenses. The Abbe effect, as it came to be known, states that diffraction will obscure details smaller than approximately one-half the wavelength of the reflected radiation. In today's science, where biologists study single molecules of protein, materials physicists need to examine tiny flaws in crystals and those laying out structures on microchips sometimes work with elements only atoms wide, the need is constant to see objects smaller than the wavelength of light.

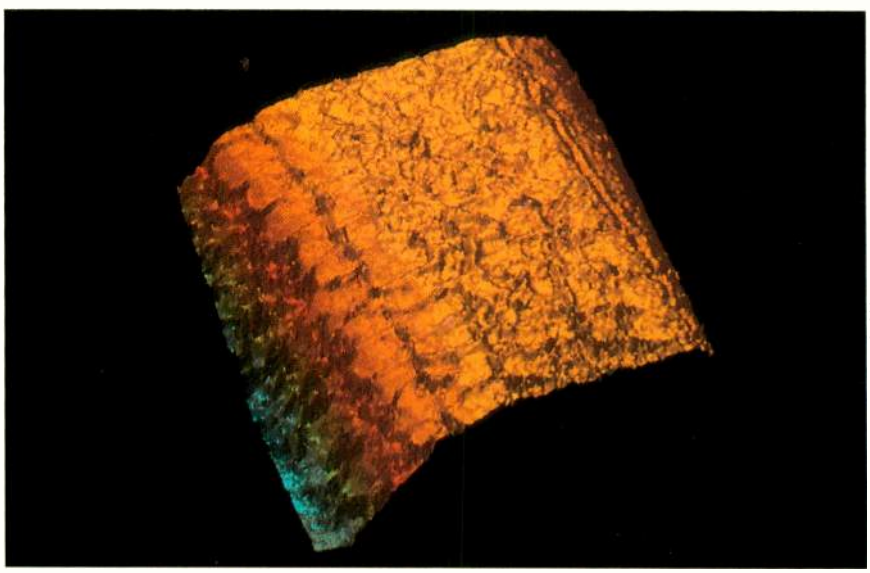
One solution has been the electron microscope. It has several limitations, however. Specimens for study must be encased in a conductive material and then submitted to a powerful beam of radiation, often destructive to the specimen itself.

A new generation of microscopes, invented during the past several years, may overcome these inherent limitations. The new microscopes use tiny probes, sometimes only a single atom across at their tips, to scan over the surface of a specimen to "feel out" atomic-scale features on the specimen's surface. They report the findings back to electronic imaging systems that provide images of the surface features. These scanned probe microscopes also can detect atomic-scale forces such as magnetism and temperature variations.

The "great-granddaddy" of the new generation of microscopes was invented by Gerd Binnig and Heinrich Rohrer of the IBM Zurich Research Laboratory in the early 1980s. (They received a Nobel Prize for their efforts in 1986.) The scanning tunneling microscope (STM) they invented relies on the ability to position a sample within a single nanometer beneath the tip of a probe. Piezoelectronics—ceramic materials that change size minutely when an electrical potential across the material is changed—are used to manipulate the sample in three dimensions.

In the STM, the aperture is a tiny tungsten probe whose tip is ground so fine that it may consist of only a single atom and measure just 0.2 nm in width. Piezoelectric controls move the tip to within a nanometer or two of the surface of the conducting specimen—close enough so the electron clouds of atoms at the tip and of the nearest atoms on the surface of the specimen overlap. When a small voltage is applied to the tip, electrons tunnel across the gap, creating a tiny tunneling current. The strength of the current is highly sensitive to the width of the gap and typically decreases by a factor of 10 each time the gap is widened by 0.1 nm, half the diameter of an atom. X and Y piezoelectric controls move the probe back and forth across the specimen surface in a raster pattern.

If the probe maintained a steady height, the tunneling current would fluctuate dramatically. Instead, the tip moves up and down to correspond with the topography. This is accomplished with a feedback mechanism (error detection/correction loop) that senses the changes in tunneling current and varies the voltage applied to



ART: IBM RESEARCH DIVISION

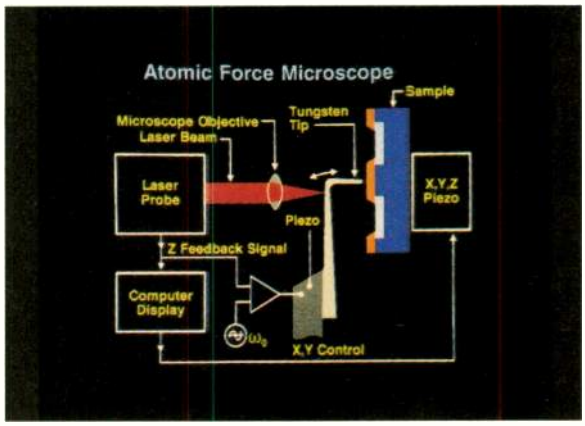
This is what silicon looks like when viewed by the atomic force microscope.

a third, z-axis piezoelectric, which moves the probe vertically to stabilize the current and maintain a consistent gap between the microscope's tip and the specimen surface. The variations in voltage applied to the Z piezoelectric are then translated into an image of surface relief. If all parts of the system are sufficiently highly tuned, the STM can reveal surface atoms as small as 2 nm in diameter.

The STM is limited, however, by the need to have the sample be conducting or semiconducting. Scientists have been working on other scanned probe microscopes that circumvent this limitation.

One of the most successful has proven to be the atomic force microscope (AFM). This device moves a minute tip made up of a fragment of diamond mounted on a thin strip of foil across the specimen surface in a raster pattern. In place of tunneling current, the AFM measures the force of repulsion in the electron clouds generated by the diamond and the specimen atoms. The foil acts as a spring to keep the tip pressed against the surface as it is moved up and down by the surface atoms, an arrangement somewhat like a phonograph. A tunneling current flowing between the foil and an STM tip mounted just above it measures the foil's deflection. A feedback mechanism responds to variations in the tunneling current by adjusting the voltage on a piezoelectric control that moves the sample up and down. The voltage variations on this piezoelectric mimic the sample's topography and are the basis for the image.

Unfortunately, the pressure exerted by the AFM's diamond tip—about one millionth of a gram—is enough to distort the surface over which it is scanned. Other groups of scientists have been working to formulate new types of microscopes that eliminate problems arising from both nonconducting specimens and destructive pressure from the scanning tip. One of the most advanced groups is the one working under Kumar Wickeramasinghe at the IBM Thomas J. Watson Research Center in Yorktown Heights, NY. Looking for new ways to monitor production quality in microelectronics manufacturing, Wickeramasinghe has come up with the laser force microscope (LFM), an instrument capable of measuring not only the tiny elements used on microcircuits with a resolution 10 times greater than the elements themselves, but also the very properies of magnetism and currents that flow in the circuits. The microscope is also useful for examining atoms of dopands—small amounts of material used in the creation of the silicon that forms the basis of microchips.



A diagram of the workings of the atomic force microscope.

According to Wickeramasinghe, the LFM is based on measuring the very weak attractive forces between the tip and the sample surface. As the tip moves to within 100 angstroms of the surface, it measures the shift in resonance frequency of a tiny cantilever to which the tip is attached.

"Essentially, the forces that are felt by the tip shift the resonance frequency," Wickeramasinghe explains. "So if you attach the tip to a little piezoelectric crystal that makes the tip vibrate near its own resonance, then as the sample approaches the tip, the resonance will shift. If you are driving the crystal tip at a fixed frequency, that shift will result in a change in the oscillation amplitude."

Changes in this oscillation amplitude are detected using a very sensitive laser interferometer. This information is then compared with a reference signal, which generates an error signal that is then fed back to the z-axis piezoelectric on the sample stage. This moves the sample toward or away from the tip in order to maintain the error signal at zero. By doing this, the tip can be scanned over a surface, maintaining a constant gap, while the signal that is applied to the Z piezoelectric is recorded and used to generate an image.

The microscope is used mainly to measure different physical properties such as charges on surfaces, electrostatic forces, magnetic forces and the like.

Another newly invented microscope, the scanning thermal microscope, scans for thermal properties of samples. This microscope's probe may be the world's smallest thermometer, measuring temperature variations of a ten-thousandth of a degree. The probe consists of a tungsten wire whose smallest point is 30 nm across. The wire is coated with a second metal that is separated from the tungsten by a layer of insulation everywhere except at the tip of the proble. The tungsten-nickel junction acts as a thermocouple, generating a voltage proportional to its temperature.

Wickeramasinghe's research is still moving forward. "Right now," he says, "the images provided by scanned probe microscopes do not tell you much about the surface composition of the sample. The present focus of my group's research efforts is to work with spectroscopy along with the images from the LFM in order to reveal the exact nature of the atoms found on the sample surface." ■

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

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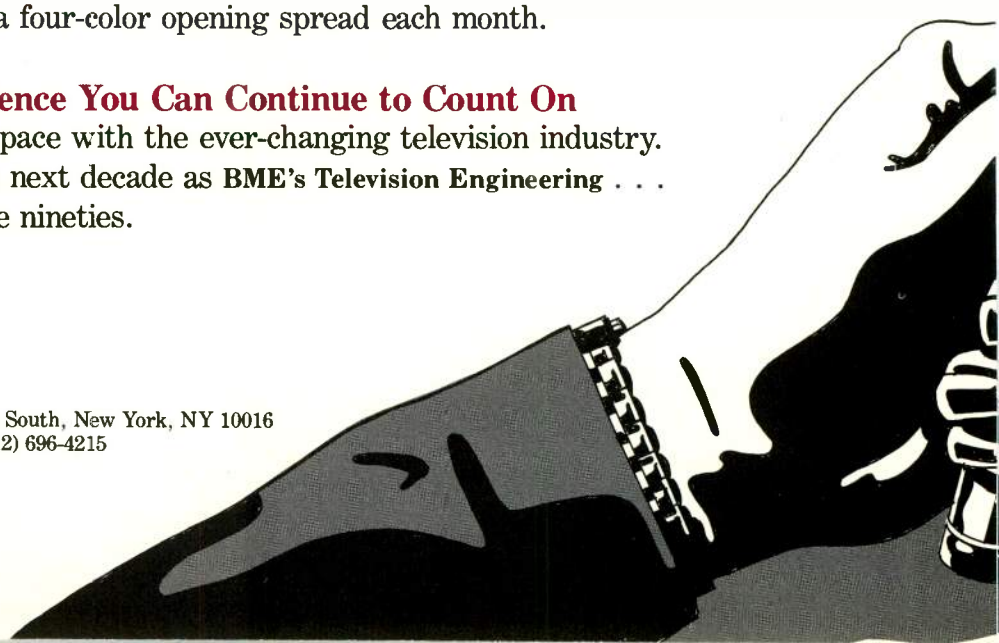

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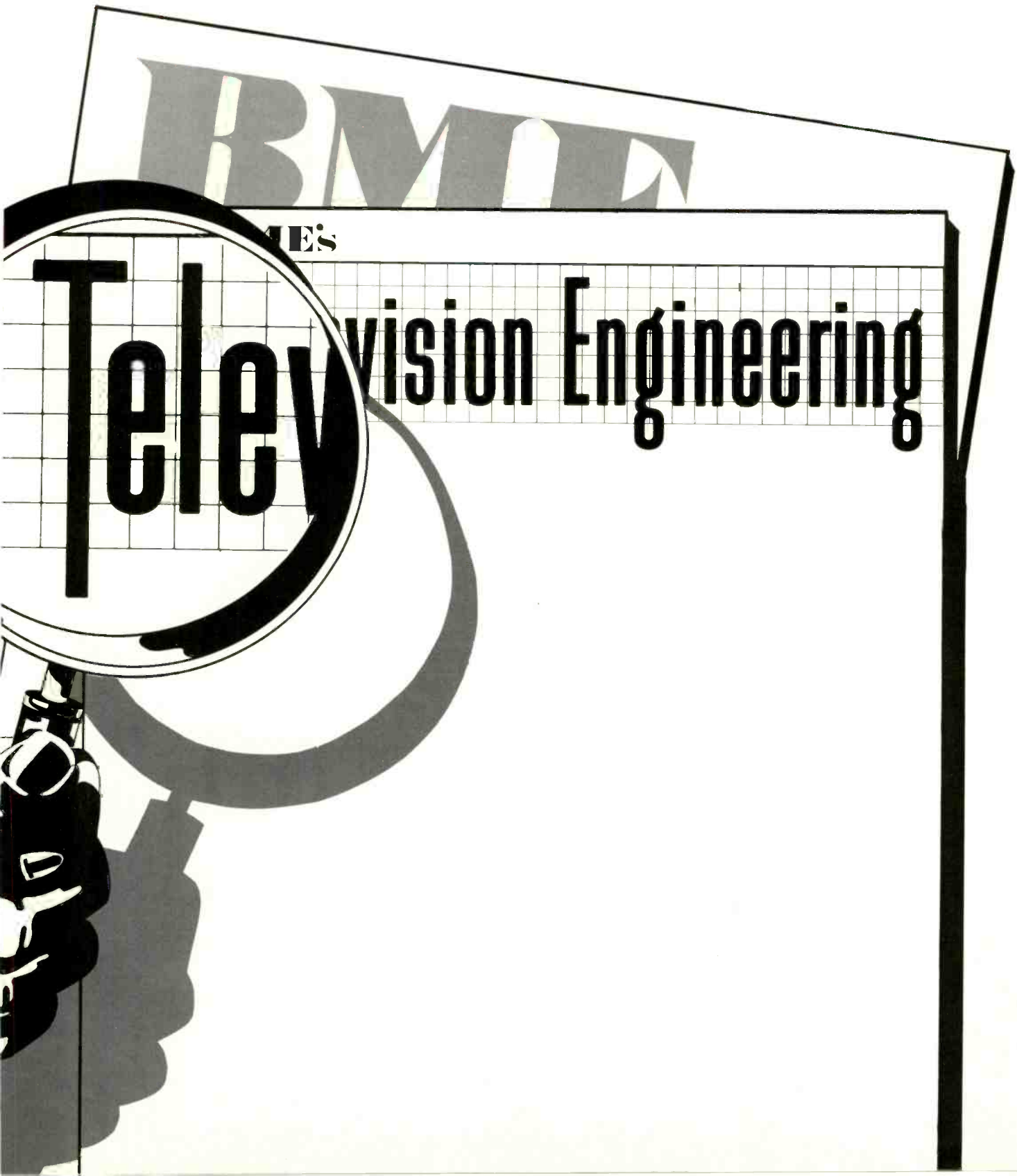
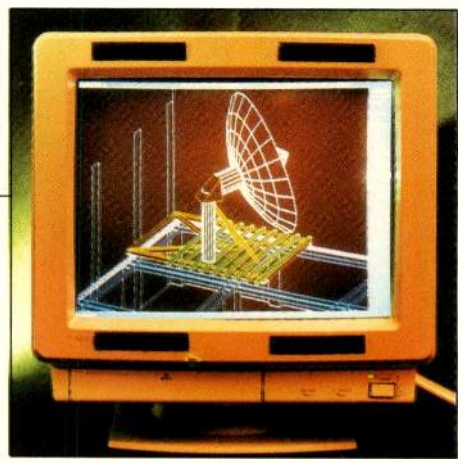


FACILITY CONSTRUCTION USING COMPUTER-AIDED DESIGN

Computer-aided design (CAD) is becoming the method of choice for designing a modern teleproduction facility.



In April of this year, The Image Group, a division of Modern Telecommunications, Inc. (MTI), accomplished an ambitious move of its Compugraph Designs computer graphics subdivision to brand-new quarters in New York City. The Image Group, a union of Compugraph Designs and Image Mix, now dwells under a common roof in a digitally integrated facility that reflects the benefit of an innovative computer-aided design (CAD) system. Designing this facility was the task facing the design team, for which I acted as draftsman, co-designer and foreman.

When Charles Heuer, director of engineering, project coordinator and co-designer, and I set out to design the new Compugraph Designs facility, we had a good idea what equipment we were to include, but few specific guidelines as to how all these devices would interface. Our interaction with MTI principals had given us a clear understanding of the requirements of the task. We were to design a digitally integrated plant to accommodate the union of Compugraph Designs and our other MTI post-production facility, Image Mix. These two subdivisions comprise The Image Group, which spans two floors in midtown Manhattan.

By choice, most of my previous design projects had been accomplished with traditional pencil and paper. I had worked with other computer systems that I found to be inadequate to my needs, primarily due to their inability to keep pace. Once I began working with computer-aided design, however, I found this relatively new system invaluable in aiding me in the process of designing this complex technical installation. The CAD system provides extensive preview tools to abstract, simplify and polish rough system implementation concepts. Properly utilized, CAD can provide all the requisite documentation in substantially less time, and with a great deal less error than I might have made with pencil and paper. The CAD system is effective at projecting costs and materials required for system construction, upgrade and refinement, which is invaluable in bidding proposals.

Before a single wire was pulled, I spent many months working with the CAD system to preview rack placement and layout, wiring, signal distribution, cooling and power requirements and most importantly, the human interface. Concurrently, I began to personalize our CAD system's collection of semi-integrated software packages: the Autodesk AutoCad Release 9, a Progress Runtime Database and a collection of Parts Libraries, Autocad menus, data extraction programs and Database Front End from Video

Design Pro. The hardware consisted of an SIA 20 MHz '386 machine with 5 MB of RAM, a very fast 85 MB Control Data Wren III hard disk drive and a high-resolution color display system with hardware-assisted realtime zoom from Verticom, Inc.

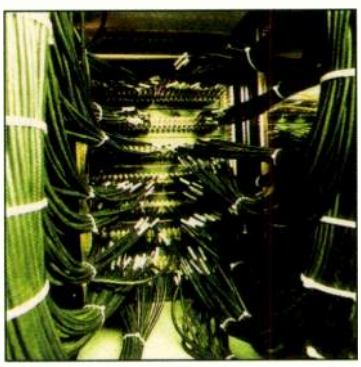
Everything was occurring simultaneously, of course, which is to be expected in any project of this stature. Material and equipment delivery dates and room placement and dimensions were changing on a daily basis. While CAD was helpful in notating these changes, it was our design team on whom I depended for day-to-day input and exchange of ideas. The design of anything as complex as a computer graphics facility depends upon the diverse talents of the design team. Our team consisted of Chuck Heuer and myself, along with extensive input from our Compugraph production team, including creative director Mike Saz and EFX editor Bill Mahler. We worked closely with architect Alan Garry and his team of contractors, electrical and airconditioning consultants, and with Blaise Scelsi, MTI engineering administrator. All of the work, from concept to implementation, was supervised by Philip J. Mancino, one of MTI's principals.

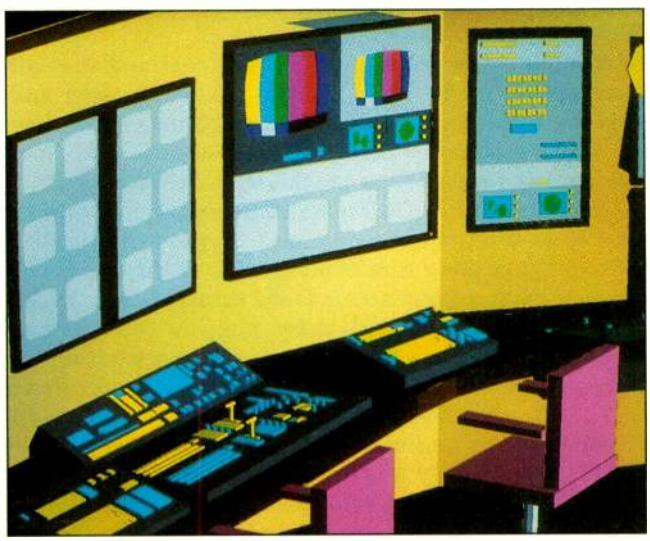
When construction finally began, we were prepared. The design team's input enabled me to devise a clear and precisely detailed set of schematics and mechanical drawings and a complete cable database, all implemented by the CAD system. Our eight-member professional wiring crew, consisting of Bernie Agbayani, Rod Catapano, Joe Chiolo, William Frias, Glenn Pogue, Wayne Reynolds, Corbett Santana and Bill Stierhout, went to work.

The basic process of design consists of drafting out groundplans, rack elevations and, most importantly, schematics. Video Design Pro hosts a vast library of electronic blocks and mechanicals easily inserted into a drawing. Unfortunately for us, at the time, these libraries were designed more for top-100 market television stations than for New York-market computer graphics facilities. This left a rather large drafting project on my shoulders, which worked out surprisingly well for our unusual, multilayered signal system, despite the unavailable pictorial elements. Next, exact cabling information was drafted right into the schematic view. Cable lengths were simple to calculate as all plans and elevations are to scale. The computer literally told me how long each wire was to be. Finally, cabling information was extracted directly from these drawings and placed into a database.

The database allowed me easily to control the 14 miles of cable that went into this project. The programs told me how much wire and how many connectors of each type should be ordered and how much it would cost. I was able to sort on any field and create lists of wiring schedules to be given directly to the crew. The lists were very detailed as to source and destination equipment, source and destination racks or rooms, type and length of wire and signal passing through each wire or set of wires comprising each loop. The programs enabled me to print labels with all of the above information appearing on every cable.

An important aspect of CAD is that data was 100 percent consistent among the schematics, elevations, runlists and labels. I could hand out work assignments to one crew to cut, label and bundle a group of cables, and another group would receive a list of cables to be flown. Others were given individual assignments and specifics





Opposite: CAD display of Television City earth station. Top left: Compugraph Designs wiring schematic. Bottom left: View from the Compugraph Designs patch bay. Right: Typical rendered CAD drawing from Video Design Pro.

By far the most important contribution of CAD is its ability to preview any aspect of a system long before the alligators start to appear.

FACILITY CONSTRUCTION USING COMPUTER-AIDED DESIGN

on dressing and connectorizing a particular rack of equipment with complete confidence of data consistency. Each of these work assignments was generated by database sorts. If a worker found a documentation error, it was easy to trace and correct. A CAD system of this type, in my opinion, reduces errors by at least an order of magnitude.

Another strength of CAD is signal tracing and calculating propagation. The computer was able, with great ease, to show me graphically how a string of devices was interconnected. Further, it would accurately print our signal attenuation and propagation delays in nanoseconds and degrees of subcarrier. I could even program it to flag cables that might not work because they were too long, such as CCIR 601 cables.

With CAD, data was consistent among the schematics, elevations, runlists and labels. If a worker found a documentation error, it was easy to trace and correct.

CAD systems generate excellent documentation. It has proven to be an easy job to familiarize new engineers with the entire system from a single manual. Troubleshooting is also a breeze with the system manual, or just by glancing at the labels on the cables. If one end of a wire is found, the other end is immediately known, along with the purpose of the cable.

By far, the most important contribution of the CAD system is its ability to preview any aspect of a system long before the alligators start to appear. Confidence in the system's ability enabled crews to load racks of equipment with minimal supervision, and with the assurance that the heat load would be evenly distributed, that equipment location would be convenient for servicing and that all operators would be able to reach all the buttons and displays. Incidentally, pictorial information generated by the CAD system is perfect for presentation to non-engineering personnel to provide essential feedback.

Additionally, the CAD system's preview capabilities allowed us to start a crew in our Television City facility cutting and labeling wire bundles a full month before our wiring crew was given access to the actual facility, which up to that time was still under physical construction. When we finally had access to the facility, we were able to fly over 75 percent of the system wiring in just under three days. It is important to point out that Compugraph Designs was still on-line at our MTI facility while the new Image Group facility was being built. Over 80 percent of the existing equipment complement was moved over to the new facility in three consecutive weekends without a single lost day of operation. The equipment was just brought over and plugged in.

CAD systems alleviate a lot of the mundane and repetitive chores and permit the designer to concentrate on the real task at hand: a machine environment easily used by people. It is important for a designer to understand not only the specific strengths and weaknesses of each member of the operational staff, but also how this affects the methods, style and techniques each person uses on a daily basis. The equipment environment must be flexible enough that any image that might be created can be created expediently, while still allowing ordinary processes to remain simple. Only when video designers are unencumbered by complex technical regimens can they produce their best work.

To implement an easily utilized machine environment, we immediately decided to use a routing system for all important signal distribution. Further, to maintain image quality and consistency, we made the upper level of routing adhere to the D-1 standard, CCIR 601. As most of our new equipment already adhered to that standard, it became a matter of properly dealing with the equipment that did not. The lower level of routing had to be NTSC, as most of our final work leaves the house in that format. Signals, of course, had to be up- or downconverted between these two standards. To minimize consistency problems, we implemented a master translator system so all signals being up- or downconverted to or from CCIR 601 would always pass through the same signal processing devices, virtually guaranteeing that all transformations would match. Since most image creation and manipulation occurs in the "perfect" world of CCIR 601, we basically streamlined the signal manipulation path, simplifying operations as well. We are proud to have one of the first Grass Valley Group Horizon DHX 601 routers on line.

Both our Horizon routers (NTSC and 601) are controlled by common control panels in multiple locations. The programming of each router control panel is highly specific to the work done at each location. These routers also allow us to tie easily into our existing Image Mix facility on the floor below. Integrating both of our one-inch/D-2 editing suites and both color correction suites at Image Mix with Compugraph Designs was a bit more complex than just running a few tie lines. A great deal of imagery created at Compugraph Designs is generated in our 3D graphics computers, paint systems and motion control animation stand, but occasionally a job comes into the house that demands nearly the full equipment complement of both floors. Obviously, the ease of switching serial and GPI control systems and control panel lines must be as efficient as routing digital and analog video. Keeping track of the myriad permutations is complicated enough without having to remember the intimate details of each wire, switching and monitoring system. The CAD system visually provides this necessary abstraction.

Many of the positive aspects of working with CAD have been enumerated in this article. But for those of us who work with any computer system, it is always frustrating

to deal with the inevitable limitations imposed by any system that tries to order the chaotic human mind. For example, I have found little use in generating a system schematic in four or more separate parts. One of the key elements to any information system is constant access to comparative data. Working with a pile of drawings or many drawing files only manages to confuse, not enlighten. But working with one huge drawing file, even on the most powerful of computers, means waiting for pictures to load, sometimes up to several minutes. And when it's time to print these drawings, the wait becomes even longer—usually overnight. A color electrostatic plotter that produces E-size drawings at 400 dpi in five minutes is definitely something to be considered, but only if there's an extra $50,000 or $60,000 in the budget. Pen plotters are not a good alternative unless the intent is to create huge wall murals. (Pen plotters cannot print small text well at all.) Most laser printers can handle only A-size drawings, usually without color. Users like myself tend to use fast, wide-carriage color dot matrix printers, which typically take all night to rasterize and print drawings of the complexity required by a project of this size.

Working with the CAD system, I found that it was never quite tailored to my particular application. When I began working on this project, I brought with me an eclectic background of experience in video electronics, operational engineering, systems design, drafting, data systems management, software programming and general PC hacking, which all seemed, if not necessary, quite helpful. In the last year, I have rewritten AutoCad menus and written 50 or more script and batch files, and many pages of AutoLisp routines, to try and automate some processes and overcome other limitations. Though it is not inherently complicated, CAD is not necessarily easy to use. What CAD is is a powerful visualization and organizational tool, the basics of which can be grasped in a few days. Achieving proficiency, however, can take months.

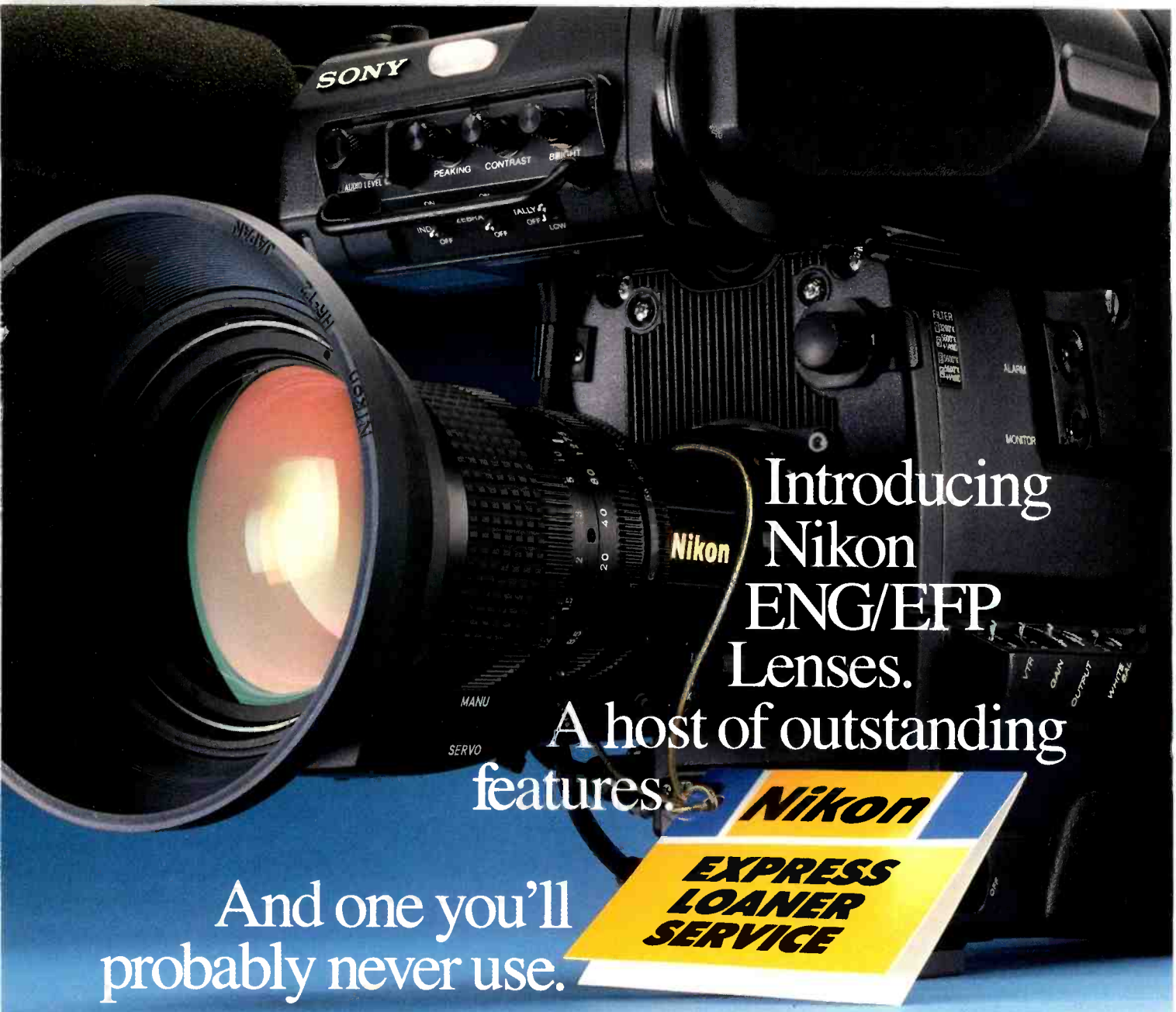
Completed and operational machine room at Image Mix.

CAD preview capabilities allowed us to start cutting wire bundles a month before our wiring crew was given access to the actual facility.

One and a half years have passed since we purchased the CAD system, and I have found much in the area of hardware and software has begun to change. The more sophisticated display systems available now make design faster, and prices for high-resolution plotters are dropping. Also, companies that market CAD systems for video facilities, such as Video Design Pro, have upgraded their products tremendously. Much more of the design process is now interactive and automated, eliminating some of the necessity for the customization I had to perform. Attributes are now directly assigned to devices and, as connecting wires are drawn, this database of attributes automatically annotates the drawing and updates the cable database. Once the cable database is generated, the computer can create new drawings from an alternate perspective, such as from the patch bay or room or subsystem. Libraries of components are much more extensive and detailed, and mechanical views of components are now 3D representations. Console preview is a much more realistic process, better suited for work with the architect or end user.

The Compugraph Designs facility project was successfully completed and is now operational, and much of the credit goes to the computer-aided design system. I've gone on to other projects and in each, CAD has been used. Phil Mancino and I worked together with the CAD system for a detailed rendering of the mounting system for a new satellite dish for our Television City facility. Most recently, I used the CAD system with John Martin, director of studio operations, in the design of our newest MTI facility in Stamford, CT. Now that the CAD system has proven itself invaluable, we are looking forward to maintaining leading-edge technology and continuing to utilize our own and the CAD system's innovative approach to design. ■

Verdone is staff design engineer for Modern Telecommunications, Inc., New York City.



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Digital Technology:

At the ITS, a distinguished panel explored the benefits and risks of digital video technology.

IS THE PICTURE COMPLETE?

D-1 may currently be too expensive for all but the most critical applications, but that scenario will soon change, according to the panelists at a discussion held at the recent convention of the International Teleproduction Society (ITS). Nevertheless, teleproduction engineers will face hard choices in digital video for some time to come. Issues of interface and transcoding, recording formats and the all-digital studio were among the topics raised at the panel, "Digital Technology: Is the Picture Complete?" The provocative comments are excerpted here.

Panelists included Ed Zirkowski, head of the Interactive Computing Systems Research Department at Bell Labs, Princeton, NJ; Phil Bennett, vice president, engineering, Abekas Video Systems; Peter Dare, vice president, product management for Sony Communication Products Co.; David Scammel, senior product manager for broadcast products, Quantel; Charles Clarke, president, Digital F/X; John Davis, president, Digital Services Corp.; Peter Symes, staff engineer, Grass Valley Group; and Jim Duca, director of technology planning for Ampex Corp.'s Video Systems Div. *BME* editor Eva J. Blinder moderated.

BME: What are the life expectancies of the formats we're using right now? Let's start with D-1. Is it viable for the long term in its present form?

Dare: I think what we have on the marketplace today is the first attempt at producing the D-1 VTR. It is certainly true that it is currently quite expensive. I believe that as time goes on, the costs related to D-1 will indeed decrease. We've all learned that the 4:2:2 format as it was defined had some shortcomings, insomuch that it didn't produce a key channel, which was so necessary in this particular industry. I think most manufacturers are looking at the 4:2:2 format and determining how we can meet the real demand in terms of 4:2:2:4. At a couple of trade shows, we have demonstrated 4X4 processing in cooperation with some other manufacturers, and if you thought 4:2:2 was expensive, you should try 4x4.

In terms of the VTR's operation, I think most people here recognize that the current equipment has limitations with respect to slow-motion capability and reverse motion and so forth. We have been able to conceptually demonstrate a machine operating at more or less the same speed range as a format-C type machine. I believe that in the foreseeable future that the costs related to a 4:2:2 implementation will decrease, and certainly the operational characteristics of the 4:2:2 machine will better emulate those of a format-C machine.

Scammel: I'm sure that Peter's comments would be very reassuring to all of those of you who have invested in 4:2:2 equipment. I'm not so sure how reassured those of you who invested in the D-2 concept will be. Many of you may have considered or may have purchased that equipment because it was a cheaper digital. And some of you may be a little confused by why we've suddenly got these two formats.

Bennett: One of the things we've got to do is keep in our minds very clearly the distinction between tape formats and video formats. We've looked at D-1; Peter addressed it as D-1 and David as 4:2:2. At the moment, those terms are almost coincident, but certainly not connected. We will no doubt see tape formats of the future which differ from D-1, but which are component digital recording formats. Until we go faster than 13.5 MHz or until we go more than 10 bits, all of the existing interface definitions will serve as well, and we may be dealing merely with, "What sort of tape have I got?" That admittedly is an area of concern for facilities, but it's much less dramatic than considering the distinction between analog and digital or between digital component and digital composite. We've already seen, with the machine proposed by

"The cost to implement a 4:2:2 suite in the future will be no more than 1.2 times the cost to do a 4fsc suite."—Dare

Panasonic, that we now have a totally different alternative tape format for composite digital, but one which conforms to the same video interface that is being used for what we all know as D-2.

"When you go from D-1 to D-2, you have to remap and it introduces new artifacts. It's not transparent just because it's digital."—Duca

Dare: Let me just comment on the 4fsc composite issue for a moment. If we're trying to say that one format will exist and one format will not exist, I don't believe we're taking a very practical view of the situation. I think that both formats will exist. In the case of the 4:2:2 component format, currently the costs of that format are quite high, whether it be signal processing or whether it be VTRs. I think within the foreseeable future that will change. I think in the case of 4fsc, or the D-2 format, it will find its uses in broadcast and program distribution. And just to raise an eyebrow or two in the audience perhaps, if indeed NBC is successful in promoting a compatible ACTV-E system, the 4fsc format has the capability of doing that. The 4:2:2 format does not ....I think both formats have a place in the marketplace, and I think when you come to discuss digital implementation of an edit suite, the cost to implement a 4:2:2 suite in the future will be no more than 1.2 times the cost to do a 4fsc suite.

Duca: The D-2 format was early intended to go into the analog composite world, which is not going to go away. And we don't confuse that with some inroads which have been made into using composite digital in production and for layering. But when we're in that layering domain, the highest quality is in the component digital domain.

To move all of the support products like special efx and character generators into the total 4fsc domain would be quite expensive, and using translation boxes is also quite expensive. On the one hand, we now have a lot of new effects devices which are component digital. There's no other way to make those devices. On the other hand, now that we have 4fsc recording media, some say, why shouldn't we convert everything to D-2 in the studios? I'm not sure that's the way we want to approach that.

Bennett: I'd like to differ slightly on possible scenarios for D-2. Clearly the reason people are buying D-2 machines for post-production is that it's just like a home VHS machine. Push the button and it plays. In principle, it's an ideal post-production machine. Now, what I would see driving the transition toward digital post-production equipment besides the VTR is going to be cost and ease of use. I think some of the places in which those D-2 machines are going to wind up are going to be fairly ugly, in terms of the particular uses to which they're being put. They're going to be used in a non-technical environment. There won't be an engineer to play with them. So I would say there would be a very strong demand for digital post-production equipment just because of the plug-and-play factor, rather than because of any real digital advantage or purely the reliability/ease-of-line-up issue. Clearly, those advantages apply in the D-1 environment as well. But the primary reason for going to an all-digital environment in D-1 is quality.

"It's not too long before there will be practical intermediate steps for 4:4:4:4."—Clarke

Symes: D-2 is the sort of equipment we've seen coming upon us over the years in many different guises. First of all there was analog, then various kinds of equipment started to appear that were digital inside, because either it was the only way to do it, or it was the most cost-effective way to do that particular thing. We started getting more and more of these digital black boxes within the analog studio. You can say that D-2 is another example of that. It's a better, more cost-effective way to do your recording function within an analog composite suite. However, Phil is absolutely right as well. We have come into this phase where digital is going to become the mainstream way of doing things . . . .I think not only for TV stations, but in post-production facilities, we're seeing more and more that facilities cannot afford to have people who are competent at the component level to troubleshoot [their digital equipment]. This is partly because the machines don't go wrong very often now, so everything the maintenance staff have learned, they've forgotten by the time they do go wrong. It's also partly because these people are incredibly difficult to find and incredibly expensive when you do find them. So there will be a general trend toward equipment which is easier to maintain.

"We're seeing more and more that facilities cannot afford to have people who are competent at the component level to troubleshoot [their digital equipment]."—Symes

BME: We've brought up 4:4:4:4 briefly. What are its advantages and disadvantages?

Clarke: We've built a whole line of products that maintain a 4:4:4:4 commonality within the system, but allow input and output to various more practical recording standards at the input and output of the system. So why be 4:4:4:4 inside? Well, it gives you the chance to have the highest-quality common-denominator format, if you wish to call it a format, to allow you the bandwidth advantage while you're working, keying, creating air brushes and creating graphic elements in 4:4:4:4. Also, by keeping the sampling rates and all the rest cleverly lining up with existing digital standards, it allows you to easily transcode in and out 4:2:2 and other formats.

Now, that brings up the question of how do you store 4:4:4:4? There are possibilities, although as Peter has pointed out, the economics of building a 4X4 machine are quite prohibitive at the present time. However, as the computer medium catches up, and optical techniques make it possible to record masters at those types of resolutions, it won't be too long before there will be practical intermediate steps for 4:4:4:4.

Davis: I disagree a little bit. The 4:2:2:4 standard probably yields very comparable results. You're going to have luma and chroma separation anyway, and if the chroma is half the bandwidth, it doesn't have to be sampled as fast. In fact, as long as you sample with adequate sampling frequency, in theory you can reproduce the original image with 4:2:2:4. So the question for a manufacturer is, do you raise costs by adding additional memory and so forth, or do you get the kind of results the user expects by using 4:2:2:4?

"As long as you sample with adequate sampling frequency, in theory you can reproduce the original image with 4:2:2:4."—Davis

Bennett: All these things have significant incremental cost. Everybody in post has been telling the manufacturers for a while that they really want a key along with the video. Obviously, that's not necessary for all requirements in post . . . .Lurking behind this discussion is the fact that right now what people are asking for is the key. What they're probably really going to want is something that encodes Z depth as well as key as computer graphics advances . . . . And if we're talking about 4:4:4:4 data rates, there should be a discussion as to whether we want to use that extra bandwidth for sharper chroma where we may or may not need it, or for something that might give us more usage of the Z information.

"There will be a very strong demand for digital post-production equipment just because of the plug-and-play factor, rather than because of any real digital advantage."—Bennett

Scammel: I believe there is great danger here of confusing all of you in terms of what equipment you purchase today. You buy a piece of D-2 equipment because it's cheaper now; it's easy to use. You're not going to necessarily equip a complete edit suite with D-2 or composite equipment because not all of that equipment is available today in complete digital format. And then what happens in a year's time when Peter has actually got his 1.2-times-the-price D-1 machine? You're stuck. You're not going to get the benefit then of moving into the D-1 or the 4:2:2 area until you actually remove all of that existing composite equipment . . . .I firmly believe that we have a 4:2:2 digital standard. It was very carefully worked out. There are problems with some areas of 4:2:2, and we've already heard some of them. But if you look hard enough, there are also solutions within the format. I think we've proved to you all that the standard works with eight bits with dynamic rounding. There's no need to suddenly start talking about having a 10-bit standard.

Clarke: We are only using 4:4:4:4 as an internal standard, and we are certainly not proposing to immediately replace 4:2:2 for recording. We showed in cooperation with Sony and Pacific Video Resources at NAB the ability to record a 4:4:4:4 image some time off in the distant future, where such a bandwidth was available for recording. As Peter Symes has mentioned, the key channel by far is the preferable next step, and we support that entirely as an extension to the 4:2:2 D-1 recorder. But the 4:2:2 is very good at the current economic standard.

Symes: I'd like to very briefly address the issue that was raised on eight or 10 bits. First of all, we do not propose 10 bits as opposed to dynamic rounding or something else. It is certainly necessary to have some intelligent rounding technique when you are going to reduce the number of bits. And in digital processing, you always have to reduce the number of bits. There are no alternatives. The reason we had proposed using and do use the 10-bit interface is because it gave us some additional headroom, and because we were able to do so at no cost to the user since that was the way the interface was defined.

Dare: The 4fsc format is a 10-bit interface only. I think the issue that we at Sony are trying to address is how you get the signals around your plant, not whether it's eight bits or 10 bits. Currently the format definitions all require the use of a 25-pin connec-

tor on the back of the equipment. And I believe that in terms of cost reduction, in terms of making a digital plant practical, that the serial interface must be the direction in which we go.

BME: That brings up the issue of transcoding between formats. How much do you lose, for example, when you output 4:2:2 from a 4x4 box?

Dare: I think the first thing you lose is $12,000. (Laughter.)

Bennett: I guess the one that people are particularly concerned about is the D-1/D-2, D-2/D-1. I guess most people would agree that D-1 to D-2 isn't a problem, but D-2 to D-1 is a problem, even if you spend $12,000. I don't think there's going to be any magic bullet for getting clean pictures out of D-2 into D-1.

Duca: Ampex does make one 4:4:4:4 device, the ALEX. The way I think of that is RGB . . . .When we go from RGB to color difference, and 4:2:2's a color-difference system, you have to remap, and it causes some artifacts. When you go from D-1 to D-2, you also have to remap, and it also introduces new artifacts. It's not transparent just because it's digital.

"Ray tracing you can't do practically today for a lot of applications, but it will become very inexpensive in the future and may approach real time."
—Zirkowski

BME: How are developments in personal computing affecting video?

Bennett: I think what's happening in the computer workstation business is probably much more relevant. Companies like Silicon Graphics and Sun are coming out with very powerful processors. I don't think they're going to be making effects devices and video switchers obsolete any time in the real near future. They are getting very much faster at rendering and texture mapping, which is starting to impact some of the special effects business. The control interfaces on them are getting much more sophisticated. And the end-user prices are quite reasonable. The problem with these computers is they do tend to grow obsolete every five minutes.

Zirkowski: We've been thinking

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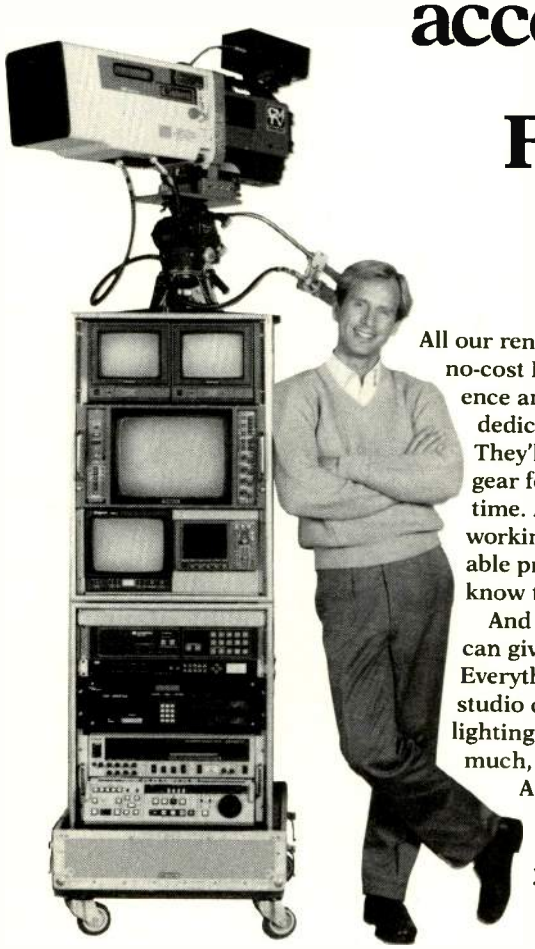

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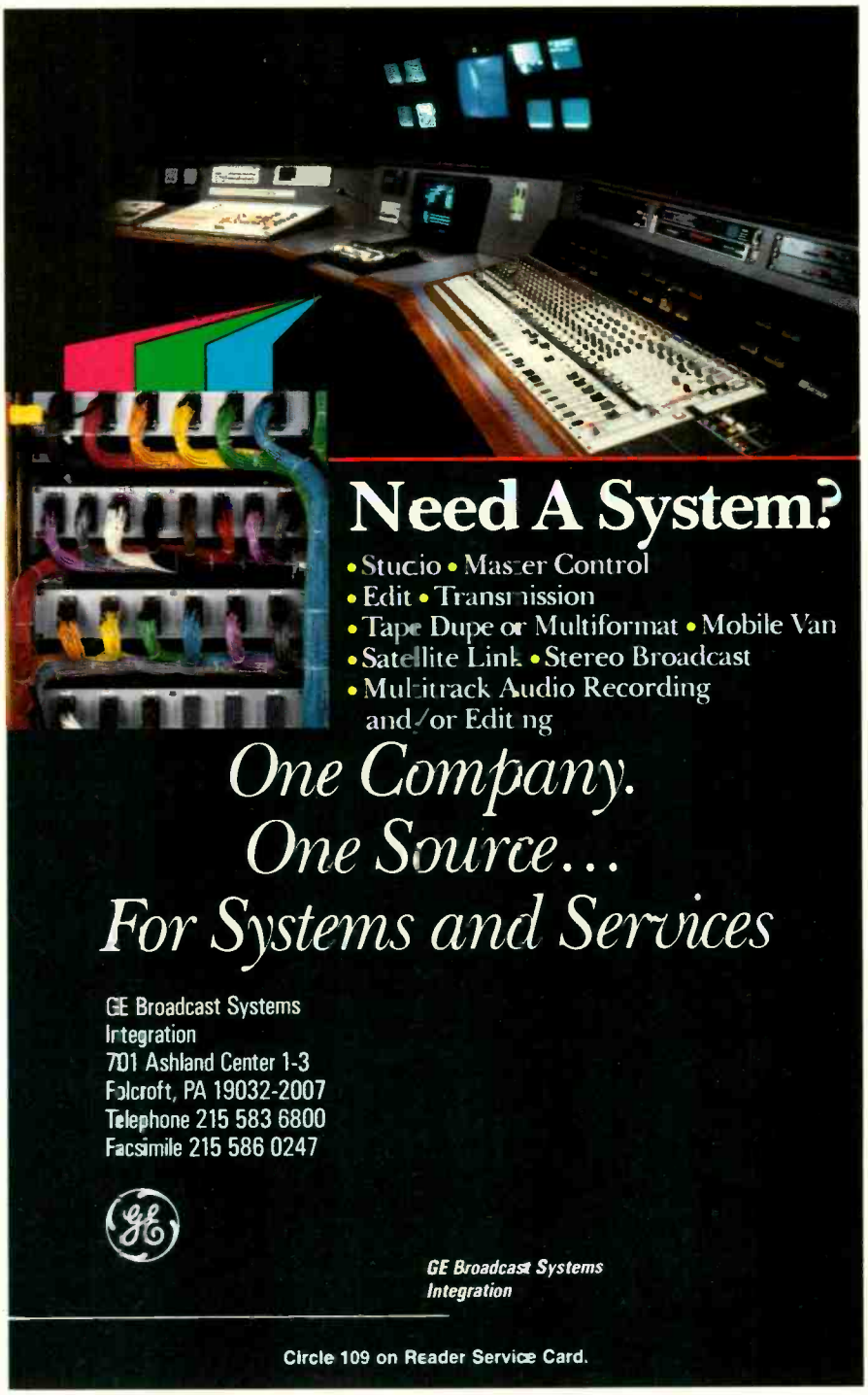
along another direction. Think of it this way: Instead of the abstraction being a bunch of boxes with cables, think about it as a bunch of software packages all running on the video equivalent of a DSP. This doesn't make manufacturers very happy, because basically what you produce is a video software industry where an effects system is now a shrink-wrapped package. We think that's more in the future because the economics work that way. Processing is expanding tremendously. We also think that there's going to be more integration between processing and storage. Going out and building a RAM recorder connected by cable to a processor is probably the way it's going to happen, long-term, in the next 10 years. We think what AKG has done with the RAM audio workstation shows a lot of what the future of video is.

Also, you're going to see, in terms of workstations, parallel processing. AT&T has this unit called the Pixel Machine, and they're putting out a device that uses DSPs. And if you think about DSPs, they're just very fast floating-point processors. They were originally designed to do Touch-Tone coding. It's a very expensive function. But DSP can do Touch-Tone decoding on hundreds of lines simultaneously. That functionality is very similar to what you're going to do for ray tracing and graphics and a lot of other things. Ray tracing you can't do practically today for a lot of applications, but it will become very inexpensive in the future. It may also approach real time; that is, 30 frames a second.

"There are problems with some areas of 4:2:2. But if you look hard enough, there are also solutions within the format."
—Scammel

Scammel: Just because the cost of a particular piece of hardware comes down, there's an awful lot of cost involved in the software to drive them. If you want a very simple, very easy-to-use control interface, that's not something that just gets dreamed up overnight and programmed into your PC. An awful lot of software effort and software man-hours go into that. So I think we need to be a little bit cautious about the fact that the processing power is getting faster and cheaper, because there is a point at which it becomes a trade-off against the actual time spent to program up the software. ■



SURVIVING THE STORM

When Hurricane Hugo targeted Charleston, TV stations prepared for the worst—and got it.

"We have on our hands a degree of physical destruction that is unprecedented in anyone's living memory." The speaker was Joseph P. Riley, the Mayor of Charleston, SC; the date was Friday, September 22, 1989. The occasion was a news conference following a tour of the city, the morning after the night Hurricane Hugo hit town. It was a wild night, a night of 135-mph winds, torrential rains, and a 12- to 17-foot wall of water surging through Charleston's harbor. Hugo had been the tenth-strongest hurricane ever to hit the United States, an "extremely dangerous Category 4 storm," according to the National Hurricane Center in Coral Gables, FL. By now we've all seen the images, the destruction and the pain. As this article is written, the cleanup is well underway, but the unwanted visitor will never be forgotten.

Arbitron ranks Charleston as the one hundred and ninth television market. The city's four stations serve the area from Beaufort in the south to Myrtle Beach in the north, and inland to Sumter. The Charleston stations were all targets of Hurricane Hugo, and each sustained damage as a result.

WCBD-TV's satellite dishes were bent out of shape by the storm.

For all four stations, the week prior to Hugo's arrival was one of waiting and watching. Careful attention was paid to weather forecasts, with stations relying on their in-house weather staffs as well as Accu-Weather and NOAA for updates on Hugo's possible direction. All four broadcast from studios located within the Charleston area, with transmitting towers outside the city. The Ch. 24 Fox affiliate, WTAT-TV, and the Ch. 2 ABC affiliate, WCBD-TV, each broadcast from their own separate towers; WCIV-TV, the Ch. 4 NBC affiliate, and WCSC-TV, the Ch. 5 CBS affiliate, share a tower and a diplexed antenna. For all of the stations, serving the public,

By William A. Owens

WCIV-TV's staff evacuated under orders; the station was the first in the Charleston area to "pull the plug."

and protecting their people and property were the most important goals.

Preparations began well before the storm hit. WCBD-TV's chief engineer, Michael Opauski, advised, "Don't take anything for granted. Have a game plan well in advance, so you don't have to think about what you need to do when you need to be doing it." Good planning was essential to his station's weathering the storm. WCBD-TV, which is located near a major waterway, designed a game plan that included preparations to broadcast from the transmitter site. Makeshift control rooms and edit bays were set up, a portable satellite dish for receiving ABC network programming was rented, and several days' worth of syndicated programs were brought out to the transmitter site. Back at the studio, most equipment and office areas were protected with plastic drops.

WCIV-TV is located on what is mostly marshland, on the causeway linking Charleston and Sullivan's Island via the Ben Sawyer Bridge. Based on predictions from their weather staff, the station's management decided that evacuation would be necessary. According to Denise Simpson, the station's director of community affairs, "We had the warning, and we took it seriously from the beginning." Under the direction of chief engineer Carl Shaw, the station's technical center was stripped of its most essential gear, with support items relocated higher in the station's equipment racks. Any equipment that could be moved was loaded onto rented trucks and moved inland, along with the station's public and business files.

On the Charleston waterfront, WCSC-TV also made plans to evacuate to higher ground. Station management decided to scrap all regular programming during the storm and to broadcast live from the county's Emergency Command Headquarters. The station's satellite and ENG trucks would be located there and would be used as control and edit rooms. Rather than raise a microwave mast during the storm, the station's technicians installed a short post on the headquarters building, and mounted a spare transmitting antenna aimed at their transmitter site receiver. At the studio, broadcast and office equipment was loaded into rented trucks and moved to the station's own emergency command center, almost 20 miles inland at the

Holiday Inn in Summerville, SC.

For WTAT-TV, in contrast, preparations were minimal. Since it is located further inland than Charleston's other stations, the station appeared to be in little danger from water or the storm surge, and its concrete building was assumed to be secure.

With Hugo nearing Charleston, the area's television broadcasters were ready for the worst, and the worst was on its way. On Highway 703, WCIV-TV was the first to pull the plug. With the area under an evacuation order, the station signed off just after 4:00 p.m., secured the satellite dishes and cut power to the building. The few staff members remaining headed inland.

At 4:00 p.m., WCSC-TV cut over to its live coverage from the Emergency Command Headquarters. While that broadcast was underway, station staff secured the waterfront building and cut power to the building at 4:35 p.m. The station remained on the air until just after 6:00 p.m., when a lightning hit at the transmitter site caused the aiming motor of the microwave receiving antenna to turn itself due north, directly away from the incoming signal. Unable to move the receiver back to its proper position, the station was, for all its efforts, off the air. WCSC's chief engineer, Jack Becknell, Jr., considered an attempt to travel to the transmitter site to re-aim the receiver, but weather conditions at the time made the trip impossible.

Over at WTAT, it was a night of mostly normal broadcasting. Using its graphics equipment, the station carried weather updates and information from the Emergency Command Headquarters, relayed via a radio link. At approximately 10:30 p.m., however, the station experienced a series of power dumps at the transmitter site, and it was decided to shut down rather than risk damage to the transmitter. A few minutes later, all power to the transmitter building was lost.

Broadcasting from its transmitter building, WCBD had shut down the studio building after losing power at approximately 10:00 p.m. In anticipation of power problems, the station was running on its two generators, but stopped at 11:45 p.m. when the generators were swamped by water.

David Bird, chief engineer of WTAT, sums up the aftermath: "Everybody's in the same fix. Everybody's got damage, everybody's offered to help each other, but we're all short of help." From a business standpoint, WTAT was the worst hit in the market; its 1667-foot transmitting tower fell to Hugo's 135-mph winds. According to Bird, the tower was built in 1985, and while it met its specifications for wind resistance, it was no match for Hugo. The tower fell in the direction of the winds at approximately 12:15 a.m., as the leading edge of Hugo's eye was making landfall. Neighbors a quarter of a mile from the tower site reported that they felt the earth shake from the impact as the tower buried itself into the ground from the weight and force of the impact. Bird considers his station lucky that the tower fell in the direction it did, as damage to his transmitter building was minimal. The station was expecting to be back on the air from a 400-foot tower by the end of October, with a full-size replacement expected in about eight months.

The loss of WTAT's tower raises the issue of employee safety, particularly with WCSC's Becknell. "You do what you can to maintain an information source to the public," Becknell states, "but when it comes to the safety of your staff, you need to be ready to 'pull the plug and run.'" Becknell considered it most dangerous to attempt operating from the transmitter site during the storm, as WCBD did. "If anyone in operations says to hole up [at the transmitter] under the tower and operate . . . shoot them," he suggests, adding that conditions on the leading edge of a hurricane can produce tornado-like winds that could topple any tower. In that kind of situation, Becknell points out, "You may be digging whoever's there out from under a tower."

For Becknell's own station, WCSC-TV, damage was, as expected, extensive. Microwave dishes were bent out of shape, as were mounting masts. While the broadcast tower survived, there was damage from vibration of the outer anchor plates. Microwave equipment utilized at the station's relay site was damaged when the relay building was flooded with several feet of water. In the studio building, according to Becknell, "Half of the equipment worked, half didn't." The building had taken water when Hugo's winds lifted off a portion of the roof. The control rooms had almost an inch of water in them, and almost everything in the building was drip-

At WCIV, desks washed to the other side of the building.

ping wet, due either to the rains or the humidity. The station returned to the air late Friday morning, using its generator to power the transmitter and using its satellite truck, positioned at the transmitter site, as a control room.

You may remember the news pictures of the Ben Sawyer Bridge, twisted and impassible. A short distance away, WCIV-TV, sitting on marshland, had been swamped by water. "I did not think my desk would wash to the other side of the building," Simpson remembers. The building had taken four and a half to five feet of water, which ran through it like a river. The station returned to the air on Saturday, September 23, broadcasting from the transmitter site using a satellite truck on loan from parent Allbritton Communications as a control room. As the clean-up continued at the studio building, rented trailers served as offices, and a makeshift control room was pressed into service for on-air operations and news. For non-news production, the station rented the facilities of WTAT-TV. WCIV expected to return all operations to its own studio building by the end of October.

WCBD-TV returned to the air Friday morning, broadcasting from the transmitter site using a satellite truck from its sister station in Tampa, FL, as a control room and the revived generator for power. At the transmitter site itself, damage was evident, including some movement of the tower's concrete anchors. The station's transmission line was found to be broken at an elbow. Satellite and microwave dishes were damaged, with those on the tower actually pushed back into the tower due to the force of Hugo's winds. At the studio, a portion of the roof over the news area and edit bays was blown off, resulting in extensive water and wind damage. While most of the damage has been cleared up, the station continued to operate its transmitter on generator power through mid-October, and its news operation was using rented trailers while repairs were made to the building.

Three of the four Charleston stations are group-owned, and in the days following Hugo, help arrived in force. WCBD-TV's parent, Media General, sent manpower and equipment, a satellite truck and a helicopter. Allbritton Communications sent a satellite truck, technical equipment, manpower and food supplies for WCIV's staff. WTAT-TV is owned by Act III Broadcasting, which sent its corporate director of engineering to Charleston to inspect the damage and to aid in finding a replacement tower.

According to the chief engineers, equipment vendors have been quite supportive of their needs. WCSC-TV's Becknell found his vendors "super—drop-shipping rental or loaner gear, all of them have been outstanding," with some vendors personally driving replacement gear to the station. WTAT-TV's David Bird even found one manufacturer's rep arriving with a "cooler full of pop and a picnic basket full of food." His advice to those in a similar situation: "Don't be baited by vendors calling with low-ball prices. Stay with the ones you know, the ones who have given you service all along."

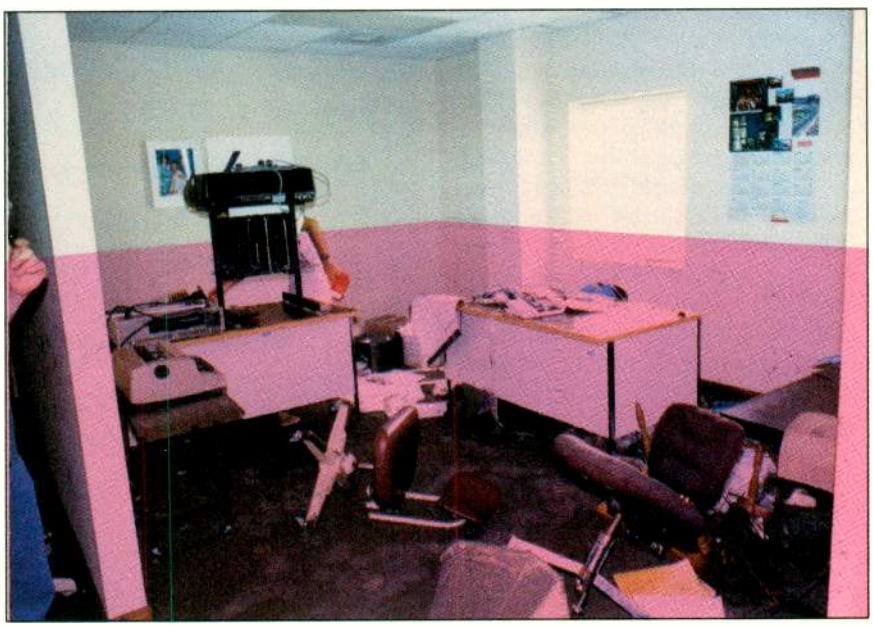
The most dangerous hurricane is a Category 5 storm, with winds in excess of 155 mph. Only two Category 5 storms have hit the U.S. in this century—a 1935 storm that caused 408 deaths in the Florida Keys, and Hurricane Camille, which caused 256 deaths in Louisiana and Mississippi in 1969. The most intense hurricane since 1899 has been Hurricane Gilbert, a Category 5 storm that struck Jamaica and Mexico last year.

Hurricane Hugo was a Category 4 storm; in theory, less dangerous. It was one of 14 Category 4 storms to hit the U.S. in this century, and more than likely not the last one. For television broadcasters facing the challenge of surviving this kind of storm, the best learning is from experience. For that experience, you need only listen to the Charleston broadcasters.

WTAT-TV's Bird: "Physically prepare your plant and your people. Store water, food and camping supplies." WCBD-TV's Opauski: "Have a game plan well in advance, tons of plastic covers, and fuel for your generators." WCIV-TV's Simpson: "Protect your files, get out what you can, decide what can be sacrificed." WCSC-TV's Becknell: "Plan ahead, provide your crews and facilities with batteries, radios, flashlights, food, water, fuel and chain saws. Lock down anything you don't want to move, and move everything you can to a base of operations you consider disaster-proof." Words of wisdom, from people who've been there. ■

Owens is BME*'s technical editor.*

Nearly five feet of water turned WCIV's offices into a veritable swimming pool, as shown by the red tinted area on the wall.



The 131st SMPTE CONVENTION

As expected, the 131st Technical Conference and Equipment Exhibit of the Society of Motion Picture and Television Engineers convened in Los Angeles last October 21–25. Unexpected, however, was the earthquake that struck the Bay Area, 400 miles to the north, a few days earlier. Unfortunately, that tragic event dominated conversations at SMPTE and overshadowed what turned out to be an exhibit lacking the richness of new products found in certain shows of years past.

Not that too many new products are needed, however. The biggest problem the industry has now is choosing from among the existing--or soon-to-be-made-available--products, formats and standards. HDTV, of course, presents a dizzying array of choices, and everyone fears that any pioneers in that realm will end up with arrows in their backs.

Digital recording is now associated with dilemmas undreamt of only a few years ago. For high-end users leaning to D-1, how will that 4:2:2 format fare in an emerging 4:4:4:4 post-production environment? For D-2 users, will this really be Type C's replacement? For the silent majority that still waits, will "D-3" become irresistibly compelling?

Advanced television was, as usual, a principal topic of discussion at SMPTE, both at the formal papers and in corridor talk.

Advanced television was, as usual, a principal topic of discussion at SMPTE, both at the formal papers and in corridor talk. Even before the show began, Eastman Kodak Co. turned heads with its announcement of a joint development, with Rank Cintel, of an HDTV telecine that would coax the continued use of film as a production medium for high-definition electronic images. The convention itself kicked off with a live, all-digital satellite HDTV transmission from Tokyo to Los Angeles.

There was action on the digital-

recording front as well, with the composite digital D-2 format continuing to make headway among broadcasters and facilities, and with BTS joining Sony, Ampex and Hitachi as a marketer of D-2 VTRs. Ampex confirmed rumors that it had experienced glitches in its D-2 line and said those problems are now fully resolved. Sony announced a major D-2 sale of VTRs and library systems to Viacom, which will use them at its Long Island facility and uplink for all four of its cable networks. Meanwhile, Panasonic continued to display engineering models of its half-inch composite digital videocassette system, informally known as D-3, as well as a prototype of a D-3 ENG camcorder.

Other much-bruited topics at the show were automated camera pedestals (with systems from TSM and A.F. Associates drawing good crowds), the role of 4:4:4:4 processing in digital systems of the future (the DF/X exhibit displayed the power of 4x4 in post), and certain other high-ticket digital items that are reliable showstoppers.

One of the latter was Abekas's A-84 digital switcher. Another was Grass Valley Group's Kadenza digital video production system. At SMPTE, Grass Valley introduced the KURL option for its Kaleidoscope digital effects system. KURL adds such manipulations as page turns and rolls, ripples, slits, size and position modulation, nonlinear transformation, and circular modifications to Kaleidoscope's considerable existing functions. In addition, KURL's enhanced light and modeling give the operator X, Y and Z control of either point or bar lights. By enhancing Kaleidoscope, KURL also adds to Kadenza's power.

The KURL option, which works with 5.0 software, replaces an existing board in the Kaleidoscope. Cost to the user is $13,500.

BME's show report this year focuses on those areas where the most technical progress was discernable over the year before: the expanding role of PCs in television equipment, advances in audio for video, and rapid evolution in post-production systems, graphics and effects.

PCs: Where the Action Is

An outsider attending SMPTE for the first time would have had the definite impression of being in the midst of a personal computer show, for everywhere there was evidence of the computer's increasing impact on broadcast and video equipment of all levels of sophistication and price. In fact, anyone who didn't already know that one needs to be computer literate to work in television broadcast or production these days would certainly have been made aware of that fact by the products at the show.

In the area of technical operations, several companies showed noteworthy items. ETI Systems, a new company exhibiting at SMPTE for the first time, introduced a PC-based switching system designed to automate test procedures. The product combines control software with hardware: a rack-mount controller, various switch modules, and control software. Another company, Video Design Pro, offered a CAD package designed for television and teleproduction. It also displayed a new documentation-maintenance software package called MasterDOC. Gefen Systems, a distributer of sound effects and music libraries, showed PC control of the Sony CD changer, a concept with potential uses both in audio and video production, as well as at radio stations. It's available in IBM or Mac versions.

PCs in post were everywhere. The former Calaway Engineering, now Quanta Editing Products, introduced the CE75, a three-machine editor at the low end of Quanta's line. Offering optional CMX- and GVG-compatible EDL, the CE75 is upgradeable all the way to the top-of-the-line CE200 and costs under $8000. Like many of the PC-based products, it uses a customized PC and is therefore available only as a hardware/software package.

Other post applications: M&R Data Services introduced its Symphony Series, a PC-based video editing system that is fully expandable and field-upgradeable. Avid Technology showed its Mac II-based video editing system (see below). Nesbitt Systems demonstrated its NSi Tape Library System, essentially a database application for PCs, designed to maintain and classify a library of thousands of videotapes. The system was originally developed for NBC.

Sharing a booth with Nesbitt, Video Logic Corp. offered Log Producer, which runs on an IBM-compatible laptop. It is designed to enable producers to keep accurate shot lists. While not an EDL management system, it does have a hardware interface that allows the user to control the VTR. Shot lists may be accessed by the Nesbitt Tape Library System.

Corvis Communications showed two software-only packages that run on 286 or 386 computers. The REEList EDL management software and EDL Disk R/x are a collection of EDL utility programs. For those without PCs, Corvis will supply a bundled hardware/software package for under $15,000 that includes a 286 with 640K RAM and 40 MB hard drive, 3.5-inch and 5.25-inch floppy drives, a keyboard and a "Multiboard" that provides a serial interface for eight-inch CMX drives and software security.

PC applications in graphics were evidenced by Aurora, which showed a new high-end paint system, the AU/260, based on a high-performance 33 MHz 386 computer. The system has a 660 MB hard disk (with optional configurations up to 2 gigabytes of storage), 4 MB of RAM, 60 MB streaming tape drive for backup, and a Weitek coprocessor for maximum

By enhancing the Kaleidoscope digital effects system, Grass Valley Group's new KURL option also adds manipulations to Kadenza's power.

performance.

Symbolics, well-known for high-end, workstation-based graphics systems, unveiled a desktop 3D animation system built around the Macintosh II platform. It includes a special microprocessor chip dubbed Ivory, designed by Symbolics, and the supporting hardware required to permit the the Mac to run the Symbolics software. The modification is called "MacIvory." The SMPTE demo of this product was its first. Cost: $59,000; very low for a Symbolics graphics system. Normally, they run on Silicon Graphics Iris workstations. Also shown was a Macintosh II-based 2D graphics system.

Amiga is another system making a play for the video industry. Studio Spectrum showed a very low-cost graphics system with titling, paint and animation capabilities called the Spectrum Video Graphics Workstation. It's based on a modified Amiga motherboard and has the capability of incorporating a Targa or Vista board for higher-quality video.

Everywhere there was evidence of the computer's increasing impact on broadcast and video equipment.

Truvision showed its latest Vista line video cards. These install into a PC to give it full video graphics capabilities. They're available in two basic configurations: ATVista, for AT-compatible PCs, and NuVista, for Macintosh II computers. Several variations of each are available. These products are the basis of several PC-based graphics systems; they overcome many of the inherent limitations of the PC in terms of display resolution and processing power.

In the area of desktop video, Julian Systems offered The Worx, a Macintosh II-based series of audio and video production systems that include video editing, audio editing, digital audio recording, and computer graphics (including paint, titling and animation). Pinnacle Systems showed its Macintosh II-based Video WorkShop, essentially a means of producing a storyboardlike display for preproduction planning and editing of video programs. Software for this system is licensed from Seehorn Technologies. And Magni Systems, known for high-quality T&M gear, showed the VGA Producer, a genlock board allowing PC-produced VGA graphics to be output onto videotape.

AUDIO: Now Hear This

SMPTE reinforced digital's growing role in the audio domain, an interesting counterpoint to the "Gee, we really did like analog after all" tone of the AES show in New York that preceeded SMPTE. In particular, there is the increasing presence of digital audio workstations, and more digital control of existing analog signal sources. The one unanimous sentiment in this regard was that there's an increasing demand for better audio in video and broadcast applications, and that digital is perceived as being able to deliver that quality. Even if all-digital systems are presently too expensive, many people feel such systems will dominate the field in the long-term. In the meantime, hybrids of digital and existing analog equipment are on-line.

Digital audio workstations (DAWs) are becoming more common in broadcast audio for ADR, Foley and editing. Players in this game include Lexicon's Opus, NED's PostPro, Studer Editech's Dyaxis, AMS's Audiofile, SSL's ScreenSound (a fully integrated Harry-based sound editing system), Soundmaster's Syncram system and Cinedco's Audiflex. Aside from the absence of tape noise, these tapeless systems also offer random access, which provides enhanced speed over sequentially loaded tape systems.

Lexicon presented its new Opus/e Digital Audio Editor for its Opus Random Access system. It's a standalone editor which can be upgraded to a full Opus system at a later point. The Opus system also displayed some enhancements at the show, including control grouping of multiple channels, multiple EQ grouping, user-definable groups, and punch in/out improvements.

The abilities of these systems to facilitate dialog editing, PSAs, and music and effects libraries for instant access is luring some of those who can afford these top-shelf, disc-based systems. For instance, the Opus system runs about $160,000, while the Opus/e editor is about $100,000. Studer Editech's Dyaxis goes for about a quarter of that price, according to company VP Gerald Kearby, who adds that the Dyaxis was developed with broadcast applications specifically in mind.

No one disputes the relative costliness of digital audio at this time; however, some systems—like the Dyaxis and Opus—are component-oriented, allowing entry-level users to get started without the costs associated with turnkey systems. Also, some systems use existing computers as systems operators. For instance, Dyaxis is Macintosh-oriented. Kearby says the Mac's digital audio-for-video advantage is clear. "The waveform base editing capabilities [of the Mac] make it ideal," he says. Mac is also the leader in pro audio, although—as in video—the Amiga is coming on strong.

The more digital establishes itself, the more prices will come down as R&D costs are amortized.

The Cinedco Audiflex is geared specifically for dialog editing. The four-channel system (expandable to eight) sells for $118,000. As with other DAWs, rerecording of dialog (or any

other source material) remains totally in the digital domain, with no generational loss along the way.

At AMS, Nigel Branwell said regional sales of the Audiofile have been "interesting," with the Northwest outstripping Los Angeles. As filmmakers begin to see the benefits of digital audio, he expects the L.A. area to become a bumper market.

Digital technology is entering the intercom marketplace as well, although the signal there will be analog for some time to come. As intercoms now have to deal with more sources simultaneously, as well as a wider variety of interfaces, digital control of the audio signal is gaining importance and usefulness.

McCurdy's CS9500 integrated communication system uses digital control technology in a 50 x 50 expandable matrix. Its high-speed microprocessor can cross-point access signals in less than 100 ms, regardless of system size, and the system can be interfaced with a PC for storage and retrieval of programs. McCurdy also offers new telephone and camera interfaces in this model.

Clear-Com's Matrix Plus is another digital system with fully digitized, two-way audio requiring only single-pair, station-to-matrix wiring. An internal memory downloads the most recent configuration upon power-up.

Consoles are also functioning digitally more and more. Sony's brand-new VSP-8000 is a digital audio mixer aimed at video editing suites. It can be serially controlled by a BVE-9000, and its digital audio input routing switcher is AES/EBU-compatible. Here, as in the digital applications for DAWs and intercoms, automation and disc storage of user information is increasingly common. Mixer settings can be stored on a 3.5-inch floppy, allowing digitally controlled equipment like this to recall mixes quickly and to be, in effect, customized for different users. The Orion Newsmaker Series consoles are another example of the hybrid of digital control of analog signals. An all-digital operator control head connects to analog rack-mounted electronics via a serial cable.

What's happening here is that a number of innovations—especially digital control of analog audio and console operations and parameter control automation—developed for pro audio are migrating to audio-for-video as the demand for greater audio quality increases. Digital is pricey, but it's not unreasonable to expect that, as with digital signal processing, the more digital establishes itself, the more prices will come down as R&D costs are amortized. The actual componentry in many instances is relatively inexpensive. And looking long-term, when the price of RAM chips finally begins to come down, that storage and retrieval technology may give hard discs a run for their money.

When the price of RAM chips finally begins to come down, that storage and retrieval technology may give hard discs a run for their money.

Once a technology becomes relatively widespread, versions of that technology become available in smaller formats. The decrease in bells and whistles on these versions, though, does not necessarily imply a lessening of power. The trend has been taking place in the pro-audio industry with the proliferation of home-based recording systems that allow small users to record sophisticated multitrack masters, increasingly in the cassette format. Interfaces are now available for video in these environments. Computer sequencer programs incorporate both SMPTE and MIDI (Musical Instrument Digital Interface) code capability, thus providing a digital foundation for the audio/video interface on an extremely cost-effective basis. Tascam's 688 MIDISTUDIO is an eight-track cassette multitrack deck and console unit that accepts MIDI Song Pointer (MSP) information. MSP is much more powerful than simple FSK synchronization, since it allows chase and lock capabilities with high-resolution error correction from anywhere in a song. Via the Tascam MIDIizer, the 688 can be locked up to other MTRs or VCRs with SMPTE.

This puts extremely powerful audio-for-video capabilities in the hands of a lot of potential users who might not have been there before. It raises some interesting questions, too; questions that the recording industry is already pondering: How will the proliferation of home-based facilities affect larger commercial facilities? It's possible that the growing number of cable and LPTV outlets will provide markets for smaller facilities, while the growing demand for high-quality audio will keep larger companies and the networks busy on the upper end of the scale.

The week after SMPTE, Dolby Labs announced the availability of its Dolby S noise-reduction technology, a consumer version of the company's professional Dolby SR. The announcement was to be made in Japan, since most consumer audio electronics are manufactured there. Dolby also demonstrated its new Model 500 digital audio encoder/decoder, which codes two audio channels at a data rate of 128 kb per second, one-sixth that of 16-bit linear PCM. This compression capability is an important step in data rate transmission and storage.

POST-PRODUCTION: Digital Conquers All

Two random-access digital editing systems, already seen at NAB, also drew crowds at SMPTE. One of them, Avid Technology Inc.'s Avid/1 Media Composer, is equipped with a Macintosh II user interface. The system's chief appeal is its ability to digitize video and audio and store them, together with time code, on fast disc drives. Once there, the editor has instant access to any part of the source footage for assembling, rearranging, trimming, etc., and can view the results instantly. While the video

is compressed in order to provide ample storage capacity, it is captured at a full 30 fps, allowing to-the-frame editing. Once the edit is complete, the system can build a master directly from the source tapes, or output an EDL on floppy for on-line. The system is now available for volume delivery to satisfy "pent-up demand," according to Avid. Its base price is $56,000. The other digital nonlinear editor is the Emc² from Editing Machines Corp., which also manipulates images and sounds (not tape decks or videodiscs), enabling the editor to use pictures (not time-code numbers). The system's optical drive stores up to four hours of time-coded video and audio as low-resolution video and time-coded audio. Price: $29,950 with the four-hour capacity. Additional four-hour modules are available for $7950 each, with a maximum of six per system.

Two random-access digital editing systems, already seen at NAB, also drew crowds at SMPTE exhibits.

One of the real pioneers in the field of random-access editing, Montage, showed the new portable version of its Picture Processor. Designed as a "workstation on casters," it is a self-contained modular system that can be operated in its own shipping cases. It delivers the long-form editing capabilities of a standard Montage System II and is meant for electronic editing on location. The five pieces weigh 2600 lbs. and can be set up in a half hour, according to Montage.

Another random-access pioneer, Cinedco, showed its Ediflex system alongside new Audiflex. While Cinedco extended its video expertise into audio, Amtel Systems Inc. did the reverse, extending its expertise in audio editors into the video realm by unveiling its E-Pix random access editor, which it calls a Hybrid Editing System. The E-Pix integrates videotape with recordable videodisc technology: tape provides the source medium, while disc transports act as a "virtual" recorder, allowing random access to the edited material and providing the system's nonlinear and realtime preview capabilities. Still another approach to editing could be witnessed at the Quantel booth, where the company was promoting its "Harry the Editor" concept, whereby the Harry system is used for fast, efficient editing of complex material that requires considerable effects work.

The Harry system is used for fast, efficient editing of complex material that requires considerable effects work.

Quanta Editing Products, a member of the Dynatech group of companies, showed the new CE25 and CE75 edit controllers. The CE25 is a two-VTR, cuts-only device, while the CE75 (see above) can also do A/B functions with three VTRs.

A video post system shown by Vistek Electronics Ltd. is essentially a D-1 switcher. Called the Vision V5001 Digital Video Mixer, it debuted earlier this year in Europe, and is intended for post use in situations where transparent operation for multiple passes is essential. The device's internal operation conforms fully to CCIR Rec. 601 (4:2:2). Originally designed by the BBC, it is now manufactured by Vistek, which has been licensed by the broadcaster. Prices start at $60,000.

Sony Corp. introduced the BVE-910 edit controller, which combines in one package the BVE-900 and its BKE-900K enhancement kit. Key features include 10 programmable macro keys that can memorize 20 keystrokes each, and a 998-event EDL memory. Sony also upgraded software for its BVE-9000 high-end editor with the BZE-9001/02 package. It expands system capabilities so that up to 12 video players and two recorders, or a combination of up to eight recorders and six players, can be assigned and actively controlled as well as displayed on the main menu monitor.

At the Ampex booth, visitors could view the new 3.0 version software for ACE Editors at work. It includes expanded file input/output control, comments keyboard, swapping source and record VTRs, spare VTR port, sync roll, manual modes, and new interfaces. A new MIF serial/parallel interface box will control Sony-type 5t VTRs and several parallel audio transports. For its ESS 5 Still Store, Ampex has unveiled a new networking system that allows users to record and browse through stills on any other ESS 5 or optical disc on the network.

Also in the still-store area, Asaca revealed its ADS-300, which uses erasable optical discs. One double-sided removable disc cartridge can store up to 1600 frames of color still image data. Horizontal and vertical roll of user-defined playlists are possible. Functions include random access, insert, overwrite, record, delete, skip/back and trim/position. Price: $59,000.

Adrienne Electronics Corp. showed new boxes: the AEC-BOX-1, an LTC reader box with RS232 and RS422 outputs; the AEC-BOX-14, a VITC-to-LTC translator box; and the AEC-BOX-19, an Ampex/Sony Type C VTR serial protocol converter box. The latter is priced at $600. From ADX Systems Inc. came a new audio synchronizer, the ADX-25 TurboLock. The unit controls rack machines from a single keyboard and converts any time code to any other. Made in Australia, it costs $6900.

Evertz Microsystems Ltd. showed the relatively new E2 (Evertz Emulator II), described as an intelligent

VCR transport interface "that graduates VHS, S-VHS or U-matic machines to the professional editing environment by communicating with the edit controller or computer, and providing transport control at all speeds."

It basically provides serial control of parallel machines for a cost as low as $1395. Skotel Corp., the maker of time-code products, showed new low-cost, half-rack designs for readers and generators.

A slightly bigger-ticket item was shown by Rank Cintel: the $485,000 URSA telecine. Seen for the first time at SMPTE, URSA is CRT-based with digital flying-spot scanning and full digital color channels.

Rank Cintel was also involved in SMPTE's most show-stopping announcement when on the eve of the event, it unveiled, jointly with Eastman Kodak, a new agreement on a high-definition telecine. Under its terms, Rank will develop, manufacture and market a new CCD telecine using proprietary components and technology developed by Kodak. The device is intended to assure film's future as an image-capturing medium in a high-definition television future.

GRAPHICS AND EFFECTS:
New Systems, More Power

Grass Valley-owned Dubner Computer Systems showed what it calls its "all-in-one" system, the Graphics Factory, which sports two 4:2:2:4 digital display channels. The GF-30 is the system's most basic dual-channel character generator configuration; the GF-40 adds full-color paint; the newest version, GF-50, also features 3-D modeling and rendering.

In the graphics area, Ampex showed a new keyframe-based animation package for the Alex character generator. It allows users to define individual paths or trajectories on the screen to which characters can be assigned; it also allows color cycling of any character or group of characters individually through the system's entire 16.7-million-color spectrum. In addition, the Ampex ADO 100 low-cost digital effects system made its SMPTE debut.

Electrohome Electronics, which announced its entry into the digital effects systems market at NAB, showed its JAZZ system, targeted at ENG and post applications. It sells for

A video post system shown by Vistek Electronics Ltd., the Vision V5001 Digital Video Mixer, is essentially a D-1 switcher.

$15,000, and includes video-workstation capabilities with 3-D, machine-control and graphics functions.

Other digital video effects systems shown included the Pictoris from Alta Group. The $10,900 device is a video compressor with variable crop, variable position, and special effects.

Meanwhile, new advances in graphics also came from ColorGraphics Systems (part of the far-flung Dynatech Group), which showed 2-D and 3-D modeling and animation packages for the DP4:2:2 paint and animation system. The new device uses 4:4:4:4 internal processing. Also from ColorGraphics: an updated Liveline weather graphics presentation system.

From a new company, Electronic Graphics Inc., came the Pastiche Graphics System, already seen in Europe, but new at SMPTE. The high-end system is designed specifically for artists and graphic designers in the post-production and broadcast markets. It features 2-D paint/animation, with realtime rotation and corner-pinning of cutouts. It also offers an optional 3-D modeling/animation package.

Also in graphics, Symbolics Inc. showed its MacIvory system, characterized by a company official as a "high-end device shoe-horned down to workstation size."

Enhanced capabilities for the Vidifont family of character/graphics systems were announced by BTS Inc. Among them: two new types of fonts which use high-quality, anti-aliased typography. These employ an exclusive "light-trapping" technique that provides edge-smoothing without using a linear keyer, resulting in high-quality reproduction irrespective of whether the standard insert keyer is used upstream or downstream.

The entire Chyron Group was at SMPTE in full force. Chyron Corp. showed its Scribe iNFiNiT! graphics and animation system, a recent addition to its Scribe family—consisting of Superscribe, Scribe, Scribe Jr. and Scribe for High Definition. iNFiNiT! offers character and graphics capabilities, as well as effects within a channel, effects between channels, still store, paint, and 3-D animation.

Aurora Systems, a company of the Chyron group, chose SMPTE as the venue in which to introduce the AU/260.

DSC, another Chyron Group member, announced full production, following beta testing, of its DiSC digital disc recording system, which offers 212-second recording capability, along with the collage compositing system for building multi-layered effects and sequences. The composite digital DiSC provides direct access to D-2 inputs and outputs. ■

Rank Cintel will develop, manufacture and market a new CCD telecine using proprietary components and technology developed by Eastman Kodak.

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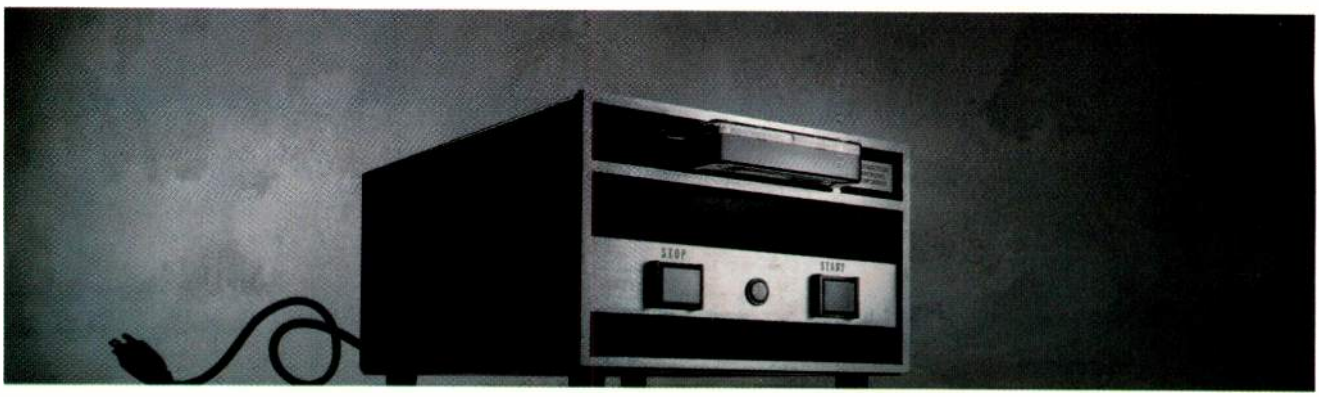

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RADIO ENGINEERING

NUMBER FIFTEEN SPECIAL SECTION DECEMBER 1989

Michigan Stations Evaluate New EBS Test Format

Broadcasters in the Lansing, MI, area are testing a new EBS tone format, designed to reduce the length of time that stations broadcast the EBS attention signal. The test, authorized by the FCC, is intended to demonstrate the viability of technical changes planned to eliminate the "tune-out" effect, where many listeners change channels or turn off stations broadcasting an EBS test.

The new test was prompted by a request from the National Association of Broadcasters for changes in the current EBS requirements, including changes in the attention signal, test script and monitoring requirements.

According to the NAB, the current EBS transmission of an initial 20-second tone burst annoys many listeners and viewers who then tune in to another station, or turn off the radio or television. Since the purpose of the tone burst is to attract the attention of the audience, the length of the burst is self-defeating.

Kelly Williams, NAB staff engineer, said, "The NAB is looking to permit stations to customize the test message to fit their market requirements. We believe that allowing broadcasters to shorten the test tone and customize the test message can serve the public more effectively, while still meeting the requirements for which the test was created."

The NAB proposes adoption of the tone format being tested in Michigan, which is essentially a 10-second, on-air burst, to be followed by a test script specifically created to inform the public of available local emergency services. The public would then receive information which would be useful in an actual emergency.

The Michigan test is being carried out in the Lansing and Central Michigan Operational Area, where Larry Estlack, chief engineer of WSYM-TV, is chairman of both the area and the project. He also serves as chairman for the Michigan State EBS.

The need for a shorter attention signal became apparent in a survey of local broadcasters, Estlack said. The survey covered both radio and television stations, and all of the area's broadcasters are participating in the test. Estlack reported that the stations believe the market has become more competitive.

"Program directors didn't want any reason for listeners to hit the button," he said.

Technically, the proposed changes are simple, according to Estlack. His station's TFT 760 took about 15 minutes to alter. Estlack also pointed out that some new receivers are being produced with user-programmable timing circuits. He estimated that it should be easy for station engineers to modify existing equipment and adopt the new standards, if the standards are implemented by the FCC.

One of the stations participating in the test is WJIM-AM, a 1 kW full-timer in Lansing, where chief engineer Ted Frantz reported that everything was "working real fine." According to Frantz, his TFT EBS receiver was easily modified to operate with the shorter burst time, and he reported no problem with false trips.

The Michigan test will continue through April 1990, when a final report will be presented to the FCC. Initial reports collected by Estlack indicated that no major problems exist, even with monitoring points in Detroit and Grand Rapids. ■

Broadcasters Lobby for License Reform, Technical Quality

Calling radio "a vibrant part of American life," three radio broadcasters testified in Congress on October 26. Appearing on behalf of the NAB, Ronald Davenport, CEO and president of Sheridan Broadcasting Network in Pittsburgh, PA; John Dille III, president of Federated Media, Inc. in Elkhart, IN; and Art Suberbielle, president and general manager of KANE-AM in New Iberia, LA, testified before the House Telecommunications and Finance Subcommittee, lobbying for two pro-broadcaster bills now before the House.

The two bills, H.R. 1136 and H.R. 2714, are considered critical reforms for broadcasters.

License renewal is the subject of H.R. 1136. The bill codifes the FCC's "abuse of process" rulings, making them permanent. The intent is to eliminate the practice of "greenmail" payoffs to challengers, by banning compensation except for legitimate expenses. In addition, the bill would base license renewals on the actual performance of the licensee.

Back in the early 1960s, the All-Channel Receiver Bill required all television receivers sold in the U.S. to receive both VHF and UHF transmissions. The purpose of H.R. 2714 is to do essentially the same for AM stereo by requiring that all FM stereos sold in the U.S. be capable of receiving AM stereo as well. ■

CONTENTS

TELEPHONE AUDIO INTERFACING

Telephony and broadcasting have been close cousins from the beginning, yet putting telephone audio on the air is never easy.

Getting audio from the dialup telephone network into a broadcast airchain has always been a challenge. Actually, that statement should read "Getting audio *to and from* the dialup network . . . ," and therein lies much of the problem. We tend to accept the dialup system as a fact of life as long as it remains a self-contained, immediately accessible communications instrument. Just pick up the phone and dial (or "touch"), and it works—well, most of the time. But when we have to plug it into another system of communications, we quickly realize its complexity, its unique elegance, and its incompatibility.

Whenever we replace the acoustic coupling to our ear and mouth—which the telephone handset normally provides—with electrical connections to studio equipment, problems will arise. Besides the obvious issue of audio quality limits on the dialup network, there are differences in level/impedance, high-voltage dc and out-of-band noise to contend with, plus issues of line seizing, hybrid losses and mix-minus backfeeding. Today's PBX systems add a final layer of complexity.

For starters, though, the simplest interconnection style is a one-way path, either to or from the telephone. The device used for this purpose is called a coupler. The old Western Electric terminology for this part was "QKT," and couplers are still referred to in this way by some. A coupler is a simple, passive matching unit that hooks up directly to the phone line and provides an audio connection, usually on a quarter-inch unbalanced jack. The coupler blocks dc and provides proper impedance and level for the studio environment. Conventional couplers do not seize the line, meaning that a telephone instrument must be off-hook on that line. That telephone's mouthpiece microphone output would then be mixed into the audio, so such phones are often equipped with push-to-talk switches on their handsets. Some recent coupler designs avoid this difficulty by offering an on-board switchable line-seizing option. Applications for couplers include receiving audio phone-feeds or sending audio via phone to other facilities or callers. Some couplers include an auto-answer feature with a timed contact closure to start a cart machine or the like, for use on listener call-in lines.

Couplers, although simple and inexpensive, are not appropriate for use in a proper telephone *interviewing* format, such as a newsgathering operation or call-in show might implement. For this application, a full, two-way telephone interface is required. The interface provides a full electrical substitute for a standard telephone instrument, in a bidirectional fashion. Audio input and output are provided, generally at +4 dBm balanced, along with a telephone line connection. These units always provide line-seizing when activated, and therefore act to the phone line just as a telephone instrument would, their only difference from standard telephones being the replacement of the acoustical transducers on the handset with audio connections.

Remember that a telephone instrument (or interface) is connected to the telco exchange's switch on a single pair of wires. This pair carries both incoming and outgoing audio, so transmission and reception is accomplished on the same circuit. This is referred to in telco parlance as a "two-wire" path. But audio signals to and from the handset transducers to the telephone instrument's electronics are carried on two separate circuits, one from the microphone for transmit, and one to the earpiece for receive. This signal condition is called "four-wire," and thus the telephone instrument (or interface) provides the function of "two-wire to four-wire conversion," by which the transmit and receive signals are properly separated on the user side, and properly combined on the telco side.

There are two general ways of accomplishing this. One is to use the simple gating method employed by

BY SKIP PIZZI

speakerphones. In fact, prior to deregulation of the telephone industry, many station engineers took standard Western Electric speakerphones and modified them for broadcast use by padding the speaker output down to line level and bringing it to a patch bay or console input. Although technically illegal at the time, this was a common practice prior to the 1980s. Some stations still use modified speakerphone hardware today. The major drawback of this approach is its requirement that only one end of the line is heard at any time (with the studio side taking precedence). When studio talent speaks, the caller cannot be heard. Phone line noise is also gated in and out, often making it more noticeable than if it were continuously present. In some models, gating release times are a bit slow, so callers' first words after studio talent stops talking may be upcut.

The second (and generally preferred) style of interface involves the "hybrid" circuit, a balanced bridge that attempts to null transmit audio out of the receive path, such that the studio audio input (i.e. talent voice) to the telephone interface can be heard by the caller, but does not appear at the output of the interface. In this system, both ends of a phone conversation are always audible, and no line-noise gating is heard.

The ability for the interface to perform this function in this way (which is just what a regular telephone instrument does) is limited by the hybrid's ability to null; this in turn is dependent on the impedance of the phone line in use, since it appears as the load on one side of the hybrid. But because the actual load impedance of each phone line is different, the nulling performance of a standard, fixed hybrid will vary with the line in use. Such a hybrid has to have its balancing impedance set somewhere in the middle of the range of possibilities, so practically every case is a compromise. The measure of a hybrid's performance in this regard is called "trans-hybrid loss," also referred to as "sidetone suppression"; this is a telephone interface's primary parameter of operation.

On a regular telephone, some amount of sidetone (the leakage of transmit audio back into receive) is desireable, allowing the user of the telephone to hear his or her own voice to some degree in the earpiece. In fact, the instrument purposefully performs some of this injection of sidetone. A telephone *interface's* performance in this area must be far superior to this, however, in order to isolate the receive audio, and thus minimize the amount of "telephonic" coloration given to the studio talent's voice. Short of this, an operator would have to ride gain on the telephone audio output, bringing it down every time talent spoke, and bringing it back up again whenever the caller responded.

Trans-hybrid loss on standard hybrid interfaces rarely exceeds 10-12 dB. And because impedance varies with frequency across a line, this trans-hybrid loss will not remain constant across the spectrum of the phone line's passband.

To improve beyond this level of performance requires a relatively recent innovation known as the "adaptive hybrid." Here, the interface measures the impedance of the phone line in use immediately after seizing it, and adjusts the balancing load to match. In this way, trans-hybrid loss is optimized for each call, and loss figures of up to 40 dB are possible. These "smart" systems are of course much more costly, but for the heavy telephone audio user they are worthwhile. Their price is roughly equivalent to that of a good cartridge recorder or basic reel-to-reel recorder, and if they are used for a significant portion of airtime each day (as in a talk-radio format), this would seem to be a reasonable expense. For the occasional user, though, they may be a bit pricey. Adaptive hybrids exist in both analog (Studer) and digital (Telos, Gentner) forms, the difference being the domain in which the actual nulling process takes place. Audio ins and outs are conventional analog in either case.

Another feature found on some interfaces is variable gating, allowing speakerphone-like action (hard gating) at one extreme, to full-duplex

Gentner's Digital Hybrid II, the latest, top-of-the-line interface.

hybrid operation at the other (no gating), with partial "dimming" of the caller level in between. Other designs include some measure of audio processing built-in; still other designs offer a variety of remote control options.

An important element in the successful operation of a telephone interface is the makeup of the audio backfeed that the studio supplies to the interface's transmit input. It is imperative that this backfeed *not* contain any of the interface's own output signal, thus avoiding feedback (especially on older designs with lower trans-hybrid loss) and eliminating the possibility of echo to the caller on satellite-delivered calls. To accomplish this, a "mix-minus" backfeed must be created on a console's auxiliary or "audition" bus, by assigning all console inputs—except the one used by the telephone interface—to that bus, then using it to feed the interface's input. This ensures that the studio-originating signals will be isolated and sent out to the caller, but that the caller's own voice will not return to him/her; the hybrid does the rest, isolating the caller's voice from the backfeed signal as best it can, and delivering it to the mixing console. The ideal facility will have a mix-minus backfeed normalled, or easily activated, without requiring cumbersome patching and/or assignments for each instance of use.

Once audio signals are properly extracted from the telephone, intelligibility may be enhanced by audio processing. Noise—often unnoticed through the band-limited telephone earpiece, but audible through a wideband interface—may be reduced on the line through the use of static or dynamic filters. Most noise results from long-distance transmission, but some can be generated locally in digital PBX switching systems, some of which considerably degrade quality by adding wideband noise and discrete tones; these tones may come and go sporadically during a call. Many digital switches also produce aliases or images that are typically low-pass filtered by the handset's earpiece, but which again can be heard through an audio interface. Appropriate filtering should be permanently installed with any telephone interface used in these systems. Alternatively, a few non-PBX lines may be used strictly for on-air. In this case, however, the agility and convenience of the PBX's call-routing to any interface extensions in studios is lost, and audio-feed calls must be placed or received on specific lines, with different hardware and phone numbers. For some, this is a worthwhile tradeoff, but for others (such as major news operations, where reporters' calls from overseas must quickly be transferred from editors to recording facilities) it is too high a price, and the audio quality of the PBX must be dealt with by engineering personnel. Some PBXs degrade audio less than others, at least in terms of spurious in-band products; get a demo or references before buying.

On the horizon may be the use of convolutional filtering, currently the sole province of high-tech telephone surveillance and security operations such as the FBI and CIA.

Variable noise filtering, adjustable for each call, is another useful feature. Gated systems, such as those formerly made by Burwen, or the currently available CRL Dynafex DX-1 and Symetrix 511A, may be helpful. Again, however, digital PBXs may get in the way, since the gating action of these systems may make quantization noise more subjectively apparent. Flexible fixed filtering such as that found on the soon-to-be-discontinued UREI 565T filter set is highly recommended. On the horizon with the advent of digital signal processing (DSP) chips may be the use of convolutional filtering, currently the sole province of high-tech telephone surveillance and security operations such as the FBI and CIA. These systems compare static to dynamic elements of the signal in the frequency domain, and within a user-adjustable time window, remove those elements that do not change (tones and noise), leaving those elements that do (signal). They are typically employed in processing aircraft "black-box" recordings, for example, and if new DSP-based technology makes them cost-effective, they will be of great value to telephone processing for broadcast.

After filtering, some adjustable equalization for enhanced intelligibility is a must. A simple, octave-band graphic equalizer is a good choice, although more complex graphic or parametric designs may also be useful. Speed of setup is an important criterion here, though; simplicity is preferable. Every call and caller will have a different sound, of course, but some general rules can be inferred, due mainly to the response differences between a reasonably flat audio interface and the somewhat tailored response of the telephone earpiece.

Subtractive equalization is preferred (*i.e.*, cutting spectral areas having excessive level, rather than boosting those that are deficient). This is especially true given the large amounts of adjustment that are often required in telephone processing, thus preserving headroom at unity gain in the equalizer and any downstream devices. The best place to start is about −6 dB at 300 to 400 Hz; often another −2 or −3 dB at 700 to

800 Hz is helpful. Finish off with small, narrow boosts at both ends, say +3 at 2.5 kHz, and +2 at 200 Hz. If a preceding filter hasn't done it already, roll off everything above 4 kHz to reduce noise. Some compression following the EQ is also helpful, especially in matching the apparent loudness of the reduced-bandwidth audio from a phone line with wideband studio sources, such as talk-show hosts or music. A simple, single-band compressor is all that is required. Beware of excessive compression raising or gating the noise floor of the phone line, however.

When installing a telephone interface system, allow for easy insertion of these processing devices between the interface output and console input, or via console insert points. Processing hardware should be placed where operators can reach all controls without moving from the optimum monitoring and board-operating position. Also consider the easy interface of single- or multiline frequency extension hardware (see "Improved R-ENG Using Dial-up Lines," *BME*, March 1989). And for serious talk-radio applications, a call-screening area is a must, with computer terminal control and display to hosts of queued callers. Easy and reliable multiline interfacing is required here, typically with 10 or 12 lines switched into *two* interfaces, each feeding separate console inputs and operated in A/B fashion on the air.

Telephone audio isn't going to go away anytime soon. Implementing the helpful hardware discussed here will make its aural optimization as efficient and routine as possible. ■

Pizzi is BME*'s audio editor.*

For More Information

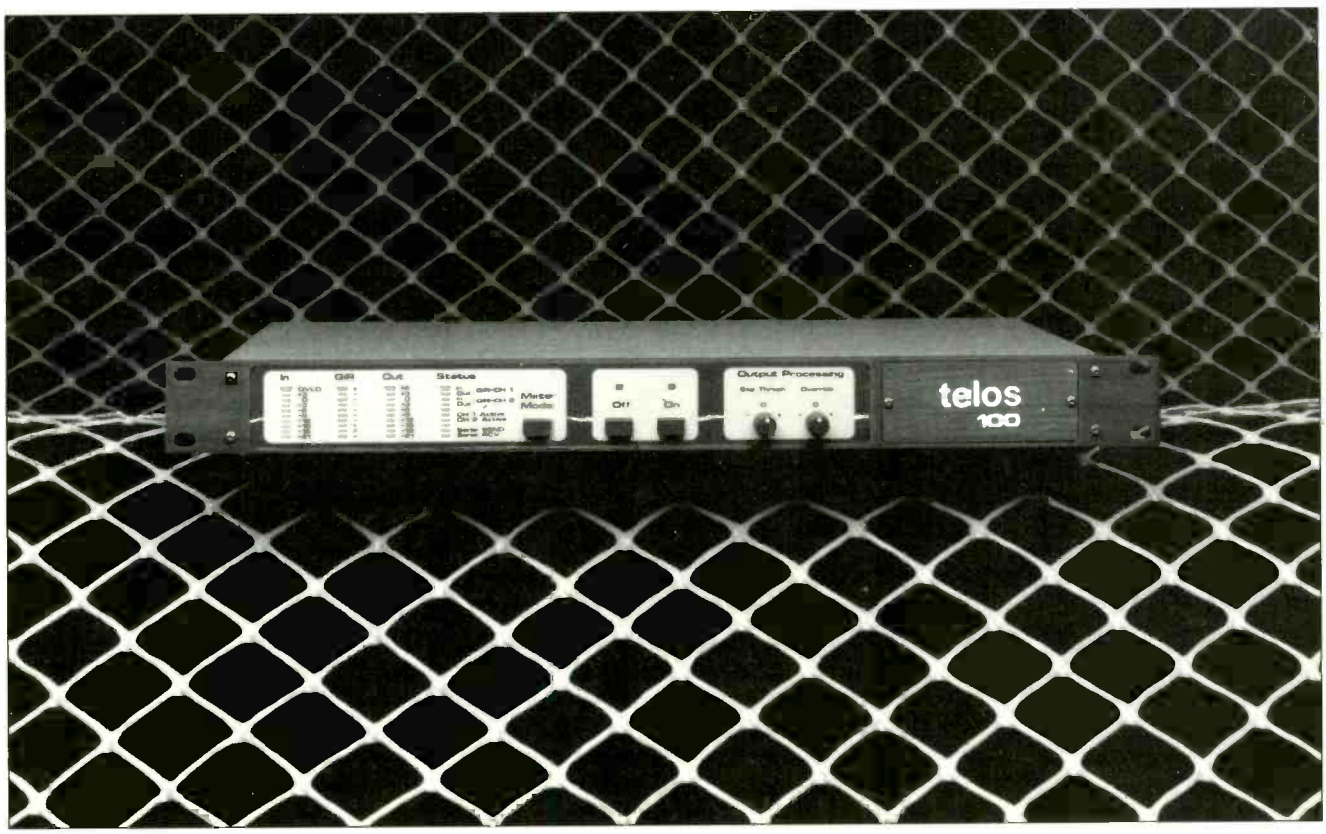
For more information on telephone interfacing (and there's plenty to be had), consult the following:

NAB Engineering Handbook, 7th Edition (Supplemented), Chapter 6.4.

"Understanding Mix Minus," *Mix*, September 1987.

"Processing Audio Feeds from Remote Sources," 46th Broadcast Engineering Conference Proceedings (NAB 1988), pp. 171-175.

Telephone Q&A—1989 Edition, Telos Systems. (An extremely informative and comprehensive pamphlet available from the manufacturer at 1729 Superior Avenue, Cleveland, OH 44114, (216) 241-7225. Highly recommended.)



The Telos 100 Digital Hybrid. Adapters are available for multiline interfacing.

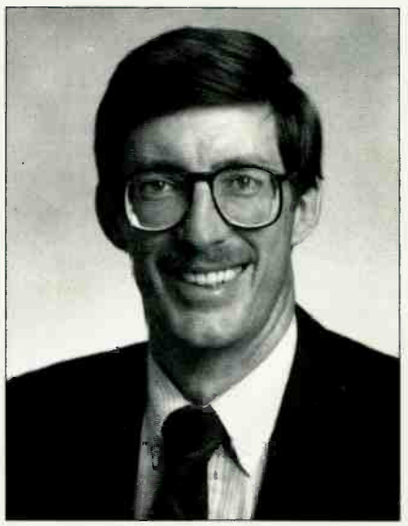
RADIO '89 HIGHLIGHTS DIGITAL

Radio '89 illustrated that digital audio is no longer just a leading-edge frill.

There were a few interesting *analog* developments at NAB's Radio '89, which drew radio broadcasters to New Orleans last September. Target Tuning, the folks who brought you the credit-card-sized, permanently-tuned-to-your-station "promotional radio" in AM and FM stereo, showed a new SCA version. Inovonics showed that FMX may still have some legs with an impressive new encoder boasting 20 dB better separation, lower distortion, improved metering and provision for up to three SCAs. Cellular phones continue to be applied in new and integrated fashions for on-air and communications uses.

But for the rest, digital audio fairly stole the show. The AKG DSE7000 workstation continued to win friends and influence people with its unique RAM-based and user-friendly approach. It's fast and flexible, and spot-type production is not disadvantaged by its relatively low on-line storage capacity. Its $30–40K starting cost is also relatively attractive in the serious workstation marketplace, and its IBM AT-style basis is familiar territory to many radio stations. An important future feature, on-board DSP (digital signal processing), will not be implemented until Release 2.0, expected sometime in 1990. It may be worth waiting for, especially since this version should include higher storage capacities and cost-effectiveness, replacing the current 1 MB RAM chips with 4 MB units (thereby increasing maximum RAM storage of the device to 68 track-minutes). Field-replaceable upgrades to 16 MB-chip RAM boards should be possible in 1991 or '92, quadrupling storage yet again.

Meanwhile, interest in hard-disk storage for broadcast is continuing to grow. This is a logical outgrowth of recent automation systems, in which PC-based controllers operated conventional playback hardware. Now, with hard-disk cost-effectiveness, capacity, access time, and reliability being what they are, it makes sense to put the audio itself into the computer, too, moving away from the hybridized digital-control/analog-storage systems. As before, these systems present themselves with a wide variety of operating schemes, from live-assist to full-walkaway. Sophisticated digital compression systems are beginning to show up, thus increasing capacity and cost-effectiveness. User-friendly control interfaces are another important design feature, and it's obvious that much work has been done by designers in this area. Touchscreen, trackball, mouse and QWERTY-keyboard control are all in evidence across the several systems.



Steve Lyman, senior technical officer of CBC's strategic engineering department.

Among vendors, Media Touch Systems had perhaps the largest showing in this area, with its OmniPLAY touchscreen controller interfacing with either conventional playback gear or its own DAMS (Digital Audio Mass Storage) hard-disk system. The latter uses the ADM (Adaptive Delta Modulation) coding system from Dolby Laboratories, and also can be used as a manually operated, stand-alone storage system. Computerized routing and logging systems are also offered, providing a radio station with many options toward total digital integration, in either a phased-in or "overnight" transition. Other new entrants in this field included Digispot and DHK/MacroMedia Design's Audisk system, each with its own interesting wrinkles. The future seems bright for this technology's growth.

DAT seems to be settling into a "comfort zone." As at previous shows, it was being used by many programming and other vendors on the floor (only more so), but without a lot of hype and hoopla about the format

BY SKIP PIZZI

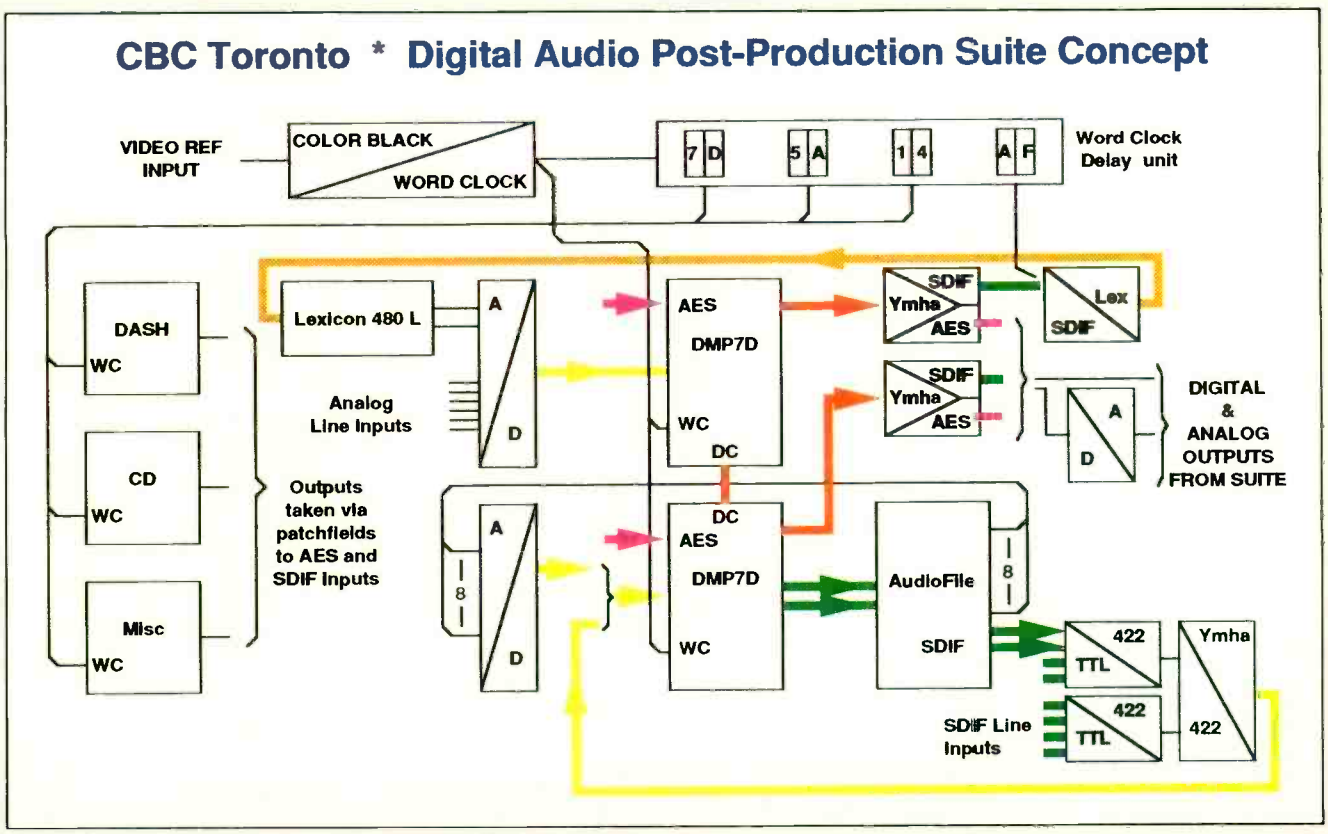
itself. It seemed to be taken for granted as just another tool, appropriate to the needs for a presentation. Meanwhile, CDs, having already reached this no-longer-a-novelty condition, continued to seem *de rigueur* in the appropriate places. Since small runs of custom CDs have lately become more cost-effective, several programmers are offering their material on CD. But recordable optical technologies (both write-once and erasable) have not yet made their appearance.

Speaking of the digital future, NAB Science and Technology held its Second Digital Radio Station Seminar at the show, receiving a reception from its attendees of equal warmth to last year's premiere. Among the highlights were a tutorial on CD-player maintenance from Laura Tyson of Denon America and a featured speech from Steve Lyman, senior technical officer of the Canadian Broadcasting Corp., Montreal. Lyman gave the attendees another bit of future shock with a look at a *true* digital radio studio that the CBC is constructing in its impressive new Toronto facility.

At the Digital Radio Station Seminar, Steve Lyman gave attendees a bit of future shock with a look at a true digital radio studio CBC is constructing at its Toronto facility.

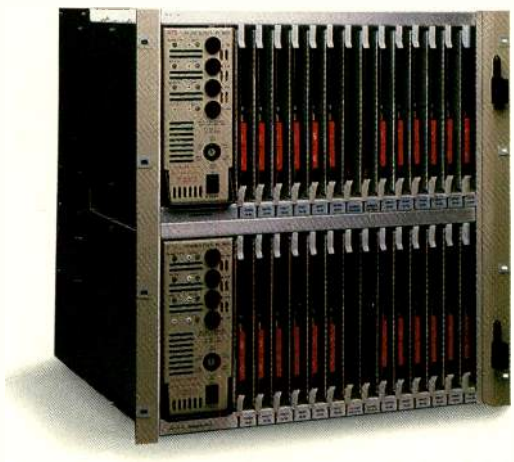
Some stations are already calling their facilities "totally digital," when what they mean is only that they are using all-digital source material. Lyman's presentation made it quite clear that the distinction is more than semantic. Digitally interfacing this studio with others in the plant was a problem, due to the long lengths of old cable involved. Most interesting, however, was a variable word-clock delay the CBC had to build to get different pieces of hardware to properly interface digitally—over and above the format converters and adapters required. CBC's goal is to have a facility capable of handling incoming digital source material from a wide variety of formats, and capable of post-producing it for broadcast completely in the digital domain. On-line testing of the facility is taking place now, and Lyman expects the studio to be officially completed in early 1990. ■

Pizzi is BME*'s audio editor.*



Basic block diagram of CBC's Toronto all-digital studio.

This switcher handles standard bandwidth like it's going out of style.



TVS/TAS-3000 Distribution Switcher

The new TVS/TAS-3000 video/audio distribution switcher from BTS handles standard bandwidth switching in stride. But the fact is, standard bandwidth may not be the standard much longer. And that's why the TVS/TAS-3000 is not your standard switcher.

With the advent of wide bandwidth video, you'll need a switcher that can handle the new higher bandwidth signals. The 3000 will. It provides a video bandwidth of more than 50 MHz, measured with a full-amplitude sine wave or video signal. Which makes it upwardly compatible with HDTV or computer graphics—no matter what the standard.

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All BTS switchers undergo 100% computerized factory testing and are protected with a 5-year warranty. In the unlikely event you do have a problem, simply return the board for a free replacement.

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New Products

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

Anton/Bauer Intros NP 13 Plus Battery

The 13.2 high-voltage design of Anton/Bauer's NP 13 Plus battery is designed to eliminate capacity loss, cold temperature and "memory" problems. The battery features 24 watt-hours of power and can be charged with many late-model OEM chargers.

Reader Service #200

Electrohome Jazz Video Effects System Features 14.3 MHz Sampling Rate

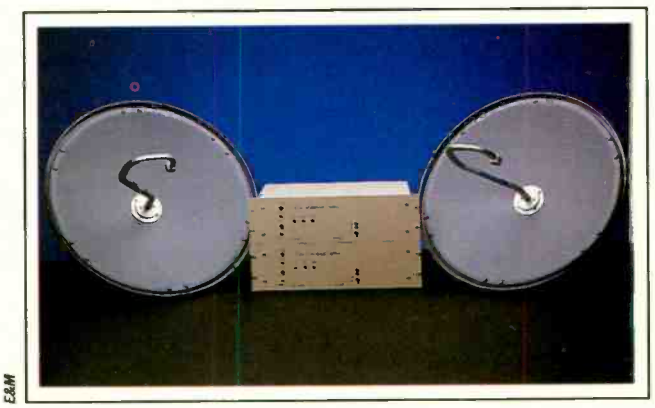
Electrohome's Jazz digital video effects system features broadcast-quality video with a 14.3 MHz sampling rate. Other features include 4:2:2 component internal processing, composite and S-VHS inputs and outputs and manual or programmable A/B video switching. Standard effects include rotation, flips and tumbles, shrink and zoom, over expansion, drop shadows and picture splits.

Reader Service #201

E&M Development Bidirectional Microwave Systems Available in Three Formats

E&M Development has introduced bidirectional microwave systems in three formats: studio-to-transmitter, wideband studio-to-transmitter and full duplex video and audio teleconferencing. The first offers simplex broadcast video with duplex audio order channel. The second is compatible with HDTV.

Reader Service #202

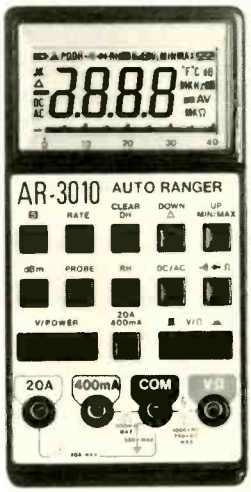


E&M

ARI Premiers Programmable Multimeters

American Reliance's AR-3010 and AR-3100 programmable autoranging multimeters feature fast-display mode; AutoData-hold mode; relative measurement mode; min-max memories; logic monitor modes and range hold. Basic measurement ranges are dc voltage; ac and dBm; dc current; ac current; continuity; diode junction; and resistance.

Reader Service #203



ARI

Covid 100 MHz RGB Distribution Systems Include Distribution Amps, Switchers

Covid has introduced a line of 100 MHz RGB distribution systems. Its 900 Series distribution amplifiers connect one RGB/computer video source to any number of monitors/projectors. The 950 Series switchers route signals from any combination of RGB or composite video sources to one projector or monitor. Switchers are available in four, eight, 12, 16, 20 and 24-input models; DAs are available with four or eight outputs. List prices range from $969 to $3950.

Reader Service #204

3M Premiers Digital Videocassettes

3M has introduced two digital videocassettes, the DCS D-2 composite digital and the DCN 4:2:2 component digital. The DCS D-2 features 1500-oersted small metal particle tape and meets SMPTE D-2 specs. It is designed for use in commercial playback and field acquisition. The DCN 4:2:2 features 850-oersted small oxide particle tape and meets SMPTE D-1 specs. It is designed for graphics storage and editing applications.
Reader Service #205

Maxell Unveils Betacam Tapes

Maxell's B-10BQ, B-20BQ and B-30BQ tapes have been specifically designed for use with Betacam systems. The company says the tapes feature low noise and high output and that the conductive backcoating and antistatic cassette shells resist dust and reduce dropouts.
Reader Service #206

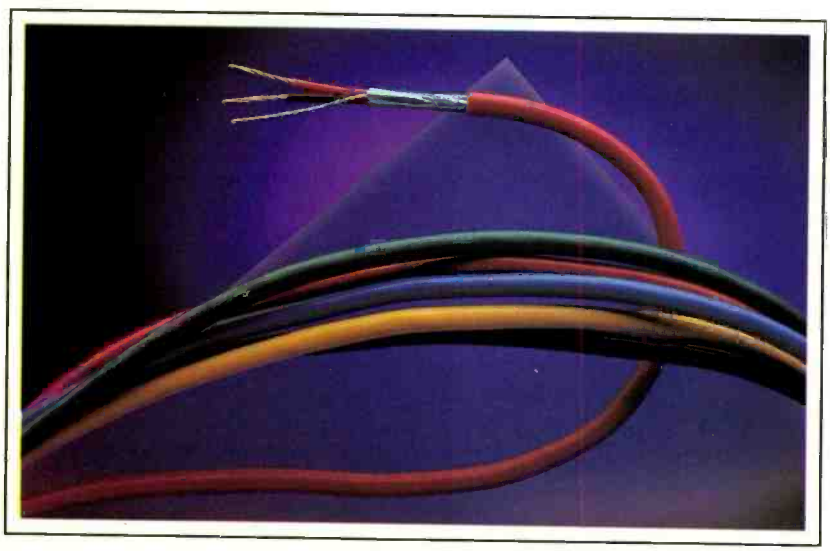
BT&D

BT&D's Optical Filter Is Continuously Tunable From 1250-1600 nm

BT&D's OFC1100 optical filter is continuously tunable over the wavelength range from 1250 nm to 1600 nm. Spectral performance data is supplied at two points in the tuning range—nominally 1300 nm and 1550 nm. Bandwidth is nominally 12 nm. Fiber-to-fiber loss is 4 dB typical.
Reader Service #208

Belden Announces Mini-Audio Interconnect Cable

Belden Wire and Cable offers a miniature twisted pair audio interconnect cable in multiple colors for internal and external, TV and radio studio equipment wiring and sound system installations. The 1266A cable is NEC CM rated and has passed UL 1581 Vertical Tray Flame Test for commercial building installations within walls. Available from stock in 1000-foot put-ups.
Reader Service #207


BELDEN

Great American Unveils Fog Machine

Great American Market's fog machine contains a two-quart inboard tank and can also be serviced from an external supply. The handheld controller is equipped with a 30-foot cord, extendible to 250 feet. Black industrial grade hose, four inches in diameter, is available in 10-, 15- and 25-foot lengths. List price is $1195.
Reader Service #209

3M Premiers Library Box

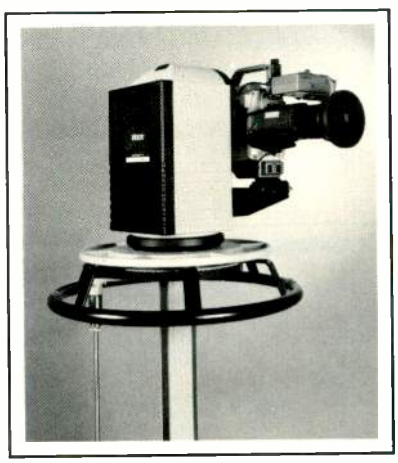
3M's TapeCare library box is available in nine-inch and 10½-inch sizes designed to store the company's 480XST and 479 one-inch videotape. The box features a blow-molded, impact-resistant, double-wall plastic construction. A special hub support system eliminates cinches by letting the reel rotate freely in the case, minimizing tape damage.
Reader Service #210

Knox Intros Imagr I Graphics Generator

Knox Video's IMAGR I graphics generator includes a 27 μsec bitmap, 16 million colors, font/logo compose and a set of graphic effects. The professional version includes encoders for NTSC and Y/C operation and an optional downstream mixer/keyer; the broadcast version includes encoders for NTSC or component video. List prices start at $6300.
Reader Service #211

Listec Video Premiers A-5000 Prompter System

Listec Video's A-5000 prompter system integrates with newsroom computers and includes an interface for remote camera control that provides automatic shot sequencing from original prompter text. The system also provides hard copy with studio instructions. Options include color backgrounds and international characters.
Reader Service #212



VINTEN

LTM

LTM Announces Cinepar 2500

LTM's Cinepar 2500 uses a 2500 W single-ended lamp mounted in the optical axis of a parabolic reflector, providing a very intense light at narrow beam position. The device comes with a set of lenses to focus from very narrow to super wide beam and operates off the LTM MKIII Alimarc 2500 W 120 V/60 Hz compact ballast. It features retractable T-handle.
Reader Service #215

Vinten Presents MH55 Integrated Head

Vinten's integrated MH55 camera head can carry a payload of up to 55 pounds. The head itself is integrated with its servo drive electronics, allowing the cable to the head to be a lightweight data cable. Features include silent operation, rapid shot-to-shot movements of 90 degrees/s and high precision shot repeatability.
Reader Service #216

Ventronic Intros Multiplexing Device

Ventronic's MCLM-100 is a fully integrated multiplexing device that transmits and receives video, audio, data (RS-232 and RS-422/tri-state 485) and 16 relay channels over a single duplex fiberoptic cable. The system consists of a rack-mounted controller unit that can support up to five individual duplex links and NEMA 12-approved weatherproof remote site controllers. Systems can be configured to monitor any number of remote sites for performance up to 8000 meters.
Reader Service #213

Bird Announces Water Column Loads

Bird Electronics has introduced three new water column load models for UHF television, 470-820 MHz, each tuned to optimize VSWR over the appropriate 6 MHz band prior to delivery. Three power levels are available. Each load excepts up to 80 psig coolant pressure.
Reader Service #217

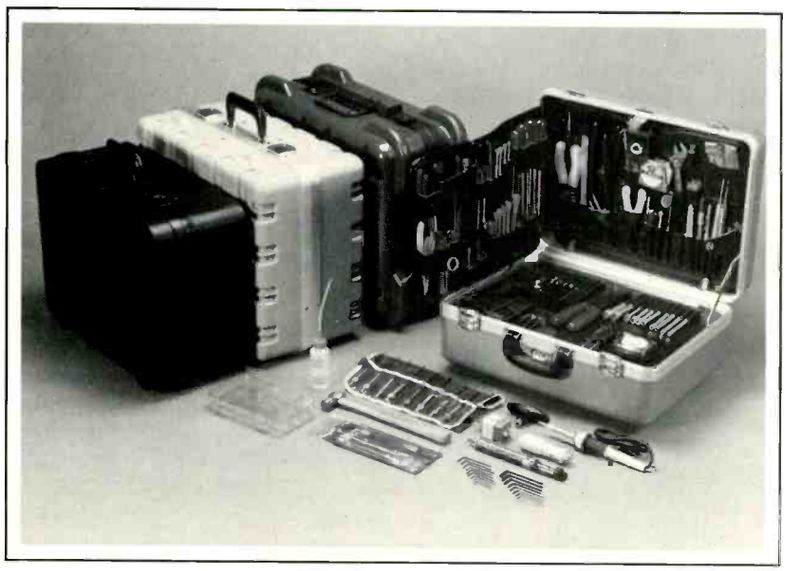
4 Designs' "Son of FX" Puts Rackmountable Equipment in a Mobile Workstation

4 Designs' Son of FX rack is designed to organize recording, computer and rackmountable equipment in a mobile workstation. The unit features two adjustable shelves for multitrack recorders, mixing consoles, and MIDI sequencers. It also features 10 units of rack space for mounting outboard effects, power amps, cassette decks or MIDI controllers. The unit measures 39 inches high by 21 inches wide by 16 inches deep.
Reader Service #218

4 DESIGNS

Jensen Adds Options to JTK-87 Professional Field Engineer's Kit

Jensen Tools now offers its JTK-87 professional field engineer's kit in more than 23 case styles and sizes and with a range of options and custom modifications available. All have two removable pallets; the deep model cases feature a gate-swing style for access to tools stored in the bottom of the case.
Reader Service #219



JENSEN

Andrew Intros LPTV Antennas

Andrew's ALPine series of LPTV antennas feature standard EIA 50 ohm flanges as input connections and side mount to tower or other supporting structure. Full-length radomes are provided to protect against rain, snow and ice. All mounting hardware is galvanized or stainless steel.
Reader Service #222

Summit Full-Range Equalizer Provides Four Passive Overlapping Bands

Summit Audio's EQF-100 full-range vacuum tube equalizer provides four passive overlapping bands of seven frequencies each, plus high and low filter sections. The highest and lowest bands are peaking or shelving. Vacuum tubes are used for gain makeup, with 990 opamps in the output stage. The device features a 105 dB dynamic range and variable boost or cut up to 16 dB.
Reader Service #223

Lisand Unveils Tripod Adapter Plate

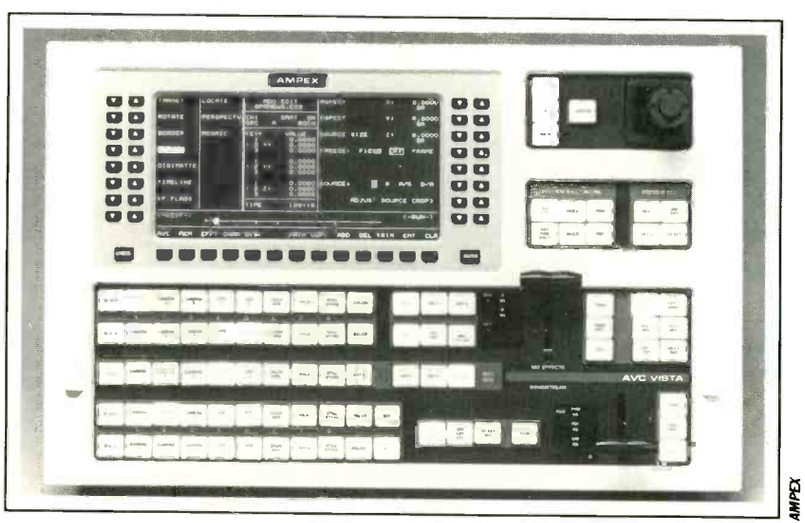
Peter Lisand's Model TAI-7995 universal tripod adapter plate can be used for the entire line of Ikegami cameras. Its features include a positive locking system, the ability to move the camera forward and backward to obtain center of gravity, and two treaded inserts.
Reader Service #220

Kinemetrics Offers Nanosecond Timing

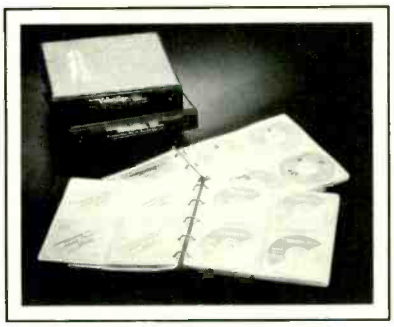
Kinemetrics/Truetime has introduced the Model GPS-DC, designed to provide extremely precise time, traceable to within ±200 nanoseconds. The unit is synchronized by signals from the satellites of the Navstar Global Positioning System and can determine the geodetic location of its antenna within 25 meters spherical error probability. List price is $12,500.
Reader Service #221

Ampex Offers New Features for Switcher Family

Ampex has introduced new enhancements and options for Ampex AVC switchers, including complete integration of the ADO 100 digital effects system with the AVC Vista switcher; a rackmountable disk drive for off-line storage of switcher and ADO effects; a key switching matrix for the AVC Century switcher; and an upgrade kit for the AVC Standard switcher.
Reader Service #224



AMPEX



VALENTINO

Valentino Puts Libraries in CD Binders

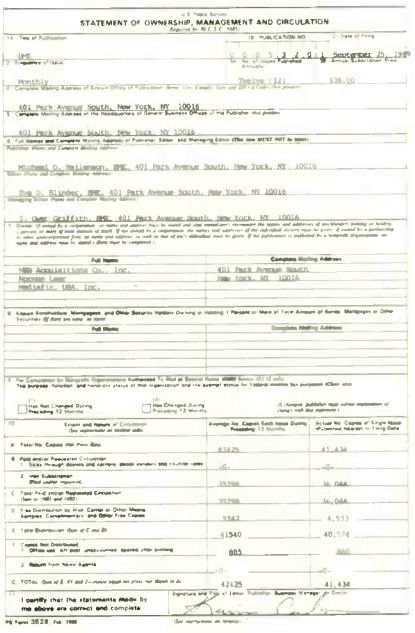
Valentino, Inc. has released both its production music and sound effects libraries in a compact disc binder system. The system holds the more than 40 CDs of the music library and the more than 30 CDs of the efx library in a paging format within ring binders. The binders are available at no extra charge when purchasing either library.

Reader Service #225

Wavetek Adds Software to CLM 1000

Wavetek now offers Telecommunications Products Corp.'s CLIDE software with Wavetek's CLM 1000 leakage field strength meter. CLIDE is a cable leakage management software program to aid CATV technicians in controlling RF leakage. The software can also be purchased separately.

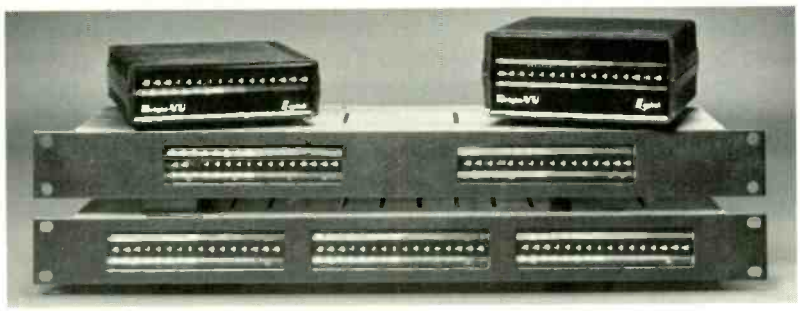
Reader Service #228



STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

IT'S AIR TIME!

DO YOU KNOW WHERE YOUR AUDIO IS ?



Bright-VU LED Audio Level Displays

Sometimes, a VU meter just doesn't tell you enough. For instance, if you're watching input levels to a tape or STL, a standard VU meter can't move fast enough to show sharp audio peaks which can saturate your tape or distort your sound.

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Circle 112 on Reader Service Card

ISS

ISS Satellite Receiver Includes C/Ku-Band Selection

ISS Engineering's GL-5020 commercial IRD satellite receiver has been approved by General Instrument Corp. The unit offers front-panel access to the VideoCipher II address code and allows easy removal of the VideoCipher for reconfiguration. Standard features include C/Ku-band selection, 600 ohm balanced stereo output, transponder or direct frequency input, digital subcarrier tuning selection and 100 kHz tuning resolution.

Reader Service #229

Advanced Videotech's Tech Talk Features Voice Scrambler

Advanced Videotech's Tech Talk is a 5 W, four-channel two-way unit that measures 5¼ by 2½ by 1¾ inches. It incorporates a voice scrambler that automatically inverts the signal between users.

Reader Service #233

Willow Offers VGA-TV Card With Genlock

Willow Peripherals has introduced its VGA-TV GE/O card. The device is switchable between eight and 16 bits and works with video resolutions as high as 1024 × 768. The card also features full-feature genlocking and a writable key register. Other features include the choices of colorkill and noninterlace mode output in NTSC.

Reader Service #234

THAT Corp. Offers Noise Reduction Circuit Cards

THAT Corp. has introduced reduced-cost dbx 321-Series noise reduction circuit cards. The 321CS is a 3:1 ratio wideband compressor utilizing 20 dB of preemphasis. The 321ES is a complementary 1:3 ratio expander for decoding the signal after reception. They are 100 percent compatible with existing dbx 321 models. List prices for samples are $150 each for either card.

Reader Service #230

Crosspoint Latch Presents Picture Mover

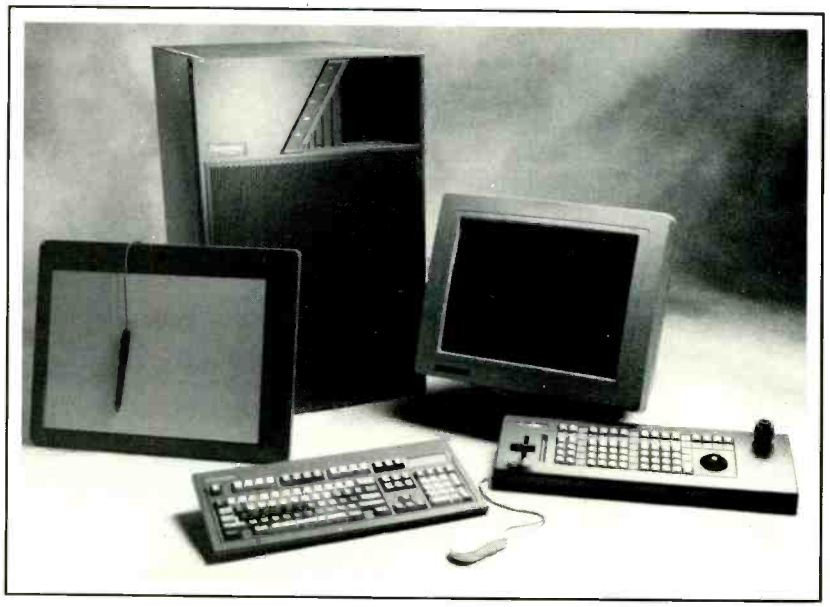
Crosspoint Latch's Model 6063, the Picture Mover, when installed with any of the company's switchers, will permit the operator to create a pull-off, pull-on, push-off or push-on. The effects may be created using any manufacturer's TBC with no modification required. The device is one rack unit high and features a standard GPI input with five transition rates. List price is $1995.

Reader Service #231

Digital F/X Unveils Composium Suite

The Composium digital edit suite from Digital F/X allows the user to control all editing functions from a single control station. The workstation processes signal in 4:4:4:4 resolution, based on CCIR 601, but enhanced by double-sampled R-Y and B-Y along with a full-bandwidth key or alpha channel. The system includes the Image Translator, a component video processor capable of realtime 3D image translation, rotation, perspective, defocus and scaling operations, as well as rendering, paint and compositing.

Reader Service #232



DIGITAL F/X

Gentner's Digital Hybrid II Allows Fully Interactive Conversation

Gentner's Digital Hybrid II incorporates a 16-bit Motorola digital signal processor with isolation designed to allow fully interactive conversation without hollow-sounding audio or system feedback. Switching between mix-minus and mic preamp is accomplished with the press of a button. List price is $1795.

Reader Service #235

GENTNER

Thomson TH 558 Tetrode Delivers Output of 600 kW in LW and MW

Thomson Tubes Electroniques has introduced the TH 558 tetrode, which delivers output powers of 600 kW in long wave and medium wave and 500 kW in shortwave. The tube's Pyrobloc grids provide stability, reliability and long working life, according to the company, as well as permitting use in PDM and PULSAM techniques. The Hypervapotron cooling system allows safe anode dissipation of up to 500 kW.

Reader Service #236

Peerless Premiers Mini-Yoke Bracket Designed for Nine- to 13-Inch Monitors

Peerless has introduced its mini-yoke mounting bracket designed for nine- to 13-inch monitors. Its width range is nine inches to 15 inches; height range is 9¼ inches to 13⅜ inches. Four versions are available, designed for use with structural ceilings, finished ceilings, suspended ceilings and one with a wall support arm.

Reader Service #237

Pomona Announces Multimeter Test Leads

Pomona Electronics is offering multimeter test leads as replacement kits. The banana plug/jack connectors mate with most Beckman, Amprobe, Simpson, Fluke, Triplett and B&K multimeters. Each kit consists of two leads, one red, one black. The test probe is a nickel-plated solid brass miniature tip in a nylon barrel.

Reader Service #238

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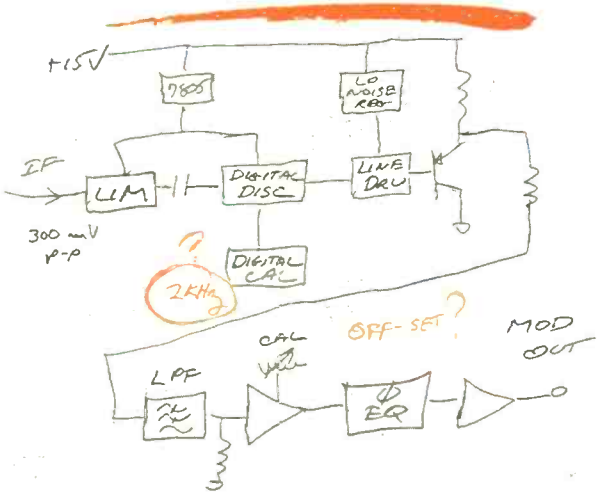

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NEW PRODUCTS

Schneider Premiers CCD Lenses

Schneider Corp. has introduced a line of high performance lenses for ⅔-inch and ½-inch CCD cameras. The lenses have been color-corrected for near infrared as well as the visible spectrum, allowing the user increased sensitivity of as much as two F-stops under incandescent light sources. The lenses include Cinegons with focal lengths from 4.7 mm to 12 mm; Xenoplans, with focal lengths from 17 mm to 35 mm; and a Tele-Xenar 70 mm lens.
Reader Service #239

Fuji Premiers Professional-Use S-VHS Cassette

Fuji's H471S S-VHS videocassette is designed to produce no more than three dropouts per minute even under adverse conditions. Other features include four-layer tape construction with polyester base film and specially formulated backcoating to reduce friction and ensure stable tape transport. Cassettes are available in 30-, 60-, and 120-minute lengths.
Reader Service #240

Sennheiser Introduces Handheld Mic

Sennheiser's MD 518 handheld dynamic microphone features a frequency response of 50-16,000 Hz, cardioid pattern, maximum cancellation of –17 dB at 180 degrees, a nominal impedance of 200 ohms and load impedance of 1000 ohms. The mic weighs 6.5 ounces.
Reader Service #242

SENNHEISER

LiteFX Announces Flicker Generator

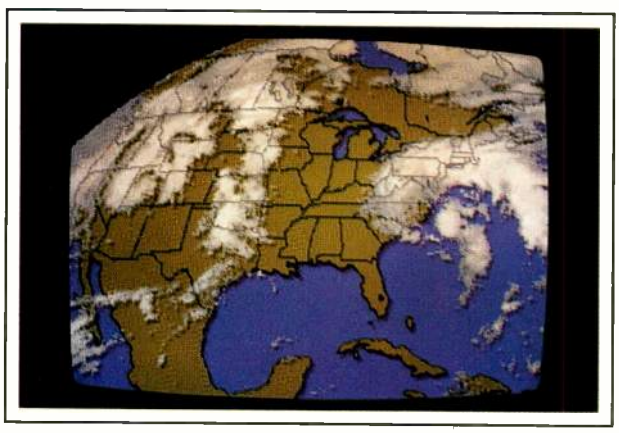
The LiteFX flicker generator features four channel control groups with independent flicker rate, dimming level and flicker amount controls for each. Dim controls and master fade control are operative in all modes. A chase mode features independent speed control and channel status indicators.
Reader Service #243

HP Intros 34 GHz Oscilloscope

Hewlett-Packard has introduced the HP 54123T four-channel, 34 GHz digitizing oscilloscope with built-in time-domain reflectometer. Other features include digital feedback sampling, built-in statistical analysis and histograms and optional triggering to 18 GHz. List price of the 54123T is $34,800.
Reader Service #244

Accu-Weather Updates Amiga Graphics System

Accu-Weather has announced enhancements to its Amiga Graphics Weather System. The enhancements include 9600 baud communications; scripted graphic downloading; enhanced communication with the company's Front Door Unit; full-screen display of graphics; fast-frame loops of satellites; and elimination of disk hang-ups and random error problems.
Reader Service #241



ACCU-WEATHER

The standards converter with the smoothest moving image of any system.

OKI's Digital Television Standards Converter Model LT2000 achieves *True Motion Continuity*. Next Generation Technology has produced the "Motion Vector System" (MVS™), making possible the first portable standards converter to eliminate motion discontinuity, or jerkiness, that occurs with high-speed camera panning and fast-action video program material. Other standards converters, using the now antiquated 2-and 4-field interpolation systems, fail to reduce motion discontinuity, and as a result are unacceptable for the professional market.

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*IGM is a development of Kokusai Denshin Denwa Co., Ltd.

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Computer-Aided STL System Design

By Ronald F. Balonis

Computer-aided design, or CAD, generally is thought of as an electronic replacement for a T-square and drafting board or for a sketchpad, a pencil and an eraser. It has come to mean a special kind of computer program. But many "not so special" programs running on "not so special" computers function like CAD systems, too. This month's Compute program lets you to do computer-aided design of an STL/microwave system. The program, STLBME.BAS, lets you design the system interactively within either equipment or path limitations and constraints. Reliable STL/microwave systems that work all the time don't just happen.

First, let's review the essentials of STL system design. The main mode of transmission at microwave frequencies (above 300 MHz) is the direct space wave. For the space wave, the effective distance between the transmit and receive antennas is limited to a line-of-sight, or optical, path. Therefore, for a reliable STL system, it is essential to avoid obstacles and to consider the effects of refraction and reflection caused by the weather, the atmosphere and the path clearance.

Under ideal conditions, the path loss for an STL system should approach the free space transmission loss. The ideal seldom exists on earth, however, and several factors affect the signal's propagation along a path and can cause it to fade. Rain, for example, tends to increase the path loss by an amount that increases as a function of both frequency and rate of rainfall (low at 300 MHz, high at 23 GHz). The atmosphere's dielectric constant changes with temperature, pressure and humidity and that causes changes in the atmospheric refraction of the wave so that it takes a path that follows a changeable earth curvature (K). The path clearance also affects the path loss in unpredictable ways, since the antenna receives reflected waves that have varying phases from the transmit antenna. All reflected waves cause fading, but those that fall within the first 0.6 fresnel clearance zone have the greatest effect. The STL path must clear path obstacles by at least this distance.

A reliable STL/microwave system is achieved by designing in enough excess system gain so that the receive signal always stays above the noise level—a "fade margin." The value of fade margin for a given reliability depends to some extent on the system's frequency (losses increase with frequency), on its equipment (high-power transmitters, high-gain antennas, low-loss coax and sensitive receivers improve it), the path's length (loss increases with distance) and its physical location (high is better than low). Based on broadcast experience for 950 MHz and given a 0.6 fresnel zone, the fade margin goal should be 20–25 dB for short paths and 15 dB for 5–15 mile paths. For higher frequencies such as 23 GHz, it should increase to 30–40 dB.

Here's how the program operates: After lines 100 to 135 print the input Data header on the screen, it then loops between lines 150 and 550. Lines 150 to 275 calculate and recalculate the STL system parameters for the input data. Lines 300 to 514 form a daisy chain of IFs to input data, based on the data type selection input in line 305.

Line 152 calculates path loss and 153 prints it on the screen at location. 154 calculates fade margin, which is printed by line 155. Line 156 calculates the 0.6 fresnel zone and 158 prints it.

The program code from line 160 to 188 makes the tabular flat earth path profile on the screen. Line 166 calculates, for 10

```
STLBME.BAS      +++ Computer Aided Design For STL/Microwave Systems +++

-- TX -->                      Freq.  GHz:  0.950          --> RX --
Ant.  dB:   16.0               Path km/mi:    5.8/  3.6    Ant.  dB:   16.0
Line  dB:   -6.0               LOSS    dB:  107.3          Line  dB:   -4.0
TX dBm/W:   41.5/ 14.0         Fade M. dB:   23.2          RX dB/uv:  -67.0/ 100.0

TX Elev. ---> (.6 fresnel = 12.8/ 42.1 m/ft CLEAR K=1 Elevation) ---> RX Elev.
-------------------------------------------------------------------------------
| 182.9| 174.0| 170.4| 167.8| 166.0| 164.8| 164.2| 164.2| 164.9| 166.7| 173.7|
| 600.0| 571.0| 558.9| 550.6| 544.7| 540.7| 538.7| 538.6| 540.9| 547.0| 570.0|
===============================================================================
|   0.0|   0.6|   1.2|   1.7|   2.3|   2.9|   3.5|   4.1|   4.6|   5.2|   5.8|
|   0.0|   0.4|   0.7|   1.1|   1.4|   1.8|   2.2|   2.5|   2.9|   3.2|   3.6|
-------------------------------------------------------------------------------
|  0%  |  10%  |  20%  |  30%  |  40%  |  50%  |  60%  |  70%  |  80%  |  90%  | 100% |
-------------------------------------------------------------------------------
      ------> ------> ------> DISTANCE (km/mi/%) ------> ------> ------>

DATA = <F>req. <P>ath <T>x <R>x <Q>uit:
```

Figure 1. *Demo screen for STLBME.BAS.*

```
0  'STLBME.BAS  ++ COMPUTER AIDED DESIGN FOR STL SYSTEMS ++
5 ' BY Ronald F. Balonis  August 25, 1989
10 '
20 '
30 KM=1.60934:FT=.3048:UV=224000!:CLR$=SPACE$(14):'--- CLEAR DATA LINE
50 TLE$="+++ Computer Aided Design For STL/Microwave Systems +++"
100 CLS:PRINT "STLBME.BAS      ";TLE$:PRINT
105 PRINT "-- TX -->";SPACE$(18);"Freq.  GHz:";SPACE$(18);"--> RX --"
110 PRINT "Ant.  dB:";SPACE$(18);"Path km/mi:";SPACE$(18);"Ant.  dB:"
115 PRINT "Line  dB:";SPACE$(18);"LOSS    dB:";SPACE$(18);"Line  dB:"
120 PRINT "TX dBm/W:";SPACE$(18);"Fade M. dB:";SPACE$(18);"RX dB/uv:"
125 PRINT
130 PRINT "TX Elev. ---> (.6 fresnel =           ";
135 PRINT "m/ft CLEAR K=1 Elevation) ---> RX Elev."
140 '
150 IF FRQ=0 OR PATH=0 THEN 160;'------- Need FRQ & PATH to calculate
152  LOSS=96.6+20*LOG(FRQ)/LOG(10)+20*LOG(PATH)/LOG(10)
153   LOCATE 5,40:PRINT USING"####.#";LOSS
154  FMRG=(TANT+RANT+TX)+(TLINE+RLINE+(-LOSS))-RX:' FM=GAIN-LOSS-RSENS
155   LOCATE 6,40:PRINT USING"####.#";FMRG
156  FZ  =.6 * 72.1*SQR(((PATH/2)^2)/(FRQ*PATH))
158   LOCATE 8,28:PRINT USING"###.#/###.#";FZ*FT;FZ;  D=PATH
160 FOR I=1 TO 11:'------------ Make a tabular FLAT EARTH PATH PROFILE
162  J=I*7-7+1:K=(I-1)/10:CLR=0
164  IF FRQ=0 OR PATH=0 THEN 170:'--- skip on 0
166   EB=.667*(D*K)*(D-D*K): FZ=.6*72.1*SQR(((D*K)*(D-D*K))/(FRQ*D))
168   CLR=(TELV+((RELV<=TELV)-(RELV>TELV))*ABS(TELV-RELV)*K)-FZ-EB
170  LOCATE  9,J:PRINT       "--------"
172  LOCATE 10,J:PRINT USING"|####.#|";CLR*FT
174  LOCATE 11,J:PRINT USING"|####.#|";CLR
176  LOCATE 12,J:PRINT       "========"
178  LOCATE 13,J:PRINT USING"|####.#|";PATH*K*KM
180  LOCATE 14,J:PRINT USING"|####.#|";PATH*K
182  LOCATE 15,J:PRINT       "--------"
184  LOCATE 16,J:PRINT USING"| ####% |";K*100
186  LOCATE 17,J:PRINT       "--------"
188 NEXT I
200 '
270 PRINT"       ------> ------> ------> DISTANCE";
275 PRINT" (km/mi/%) ------> ------> ------>"
280 PRINT:KR=CSRLIN
290 '----------------- The DATA INPUT structure is a daisy chain of IFs
300 LOCATE KR,1:PRINT SPACE$(78):LOCATE KR,1:DTYPE$="":TYPE$=""
305 PRINT "DATA = <F>req, <P>ath <T>x <R>x <Q>uit; ";:LINE INPUT DTYPE$
310 IF DTYPE$<>"F" THEN 320:'--------- NOT Freq
312  LOCATE 3,40: PRINT CLR$:LOCATE 3,40:LINE INPUT FRQ$
314   IF FRQ$<>"" THEN FRQ=VAL(FRQ$)
316   IF FRQ<.45 OR FRQ>23! THEN FRQ=0:'----Freq between .45 & 23 GHz
317    LOCATE 3,40:PRINT USING"##.###";FRQ
318 '
320 LOCATE KR,1:PRINT SPACE$(78):LOCATE KR,1
322 IF DTYPE$<>"P" THEN 340:'--------- NOT Path
324  PRINT "Path in <K>M or <M>I : ";:LINE INPUT UNIT$
326  IF UNIT$<>"K" AND UNIT$<>"M" THEN 450
328  IF UNIT$="K" THEN K=KM ELSE K=1
330   LOCATE 4,40: PRINT CLR$:LOCATE 4,40:LINE INPUT PATH$
332    IF PATH$<>"" THEN PATH=ABS(VAL(PATH$))*K
334    IF PATH >100 THEN PATH=0
336     LOCATE 4, 40:PRINT USING" ###.#/###.#";PATH*KM;PATH
340  IF DTYPE$<>"T" THEN 450:'-------- NOT TX
342   PRINT "TX <A>nt <L>ine <P>wr <E>lev. : ";:LINE INPUT TYPE$
344    LOCATE KR,1:PRINT SPACE$(78):LOCATE KR,1
346   IF TYPE$<>"A" THEN 360:'-------- NOT TX Ant GAIN
348    LOCATE 4,11: PRINT CLR$:LOCATE 4,11: LINE INPUT TANT$
350     IF TANT$<>"" THEN TANT=VAL(TANT$)
352     IF TANT>50 OR TANT<0 THEN TANT=0:'---------- TX Ant Gain < 50 db
354      LOCATE 4,11:PRINT USING"####.#";TANT
360   IF TYPE$<>"L" THEN 370:'-------- NOT TX Line LOSS
362    LOCATE 5,11: PRINT CLR$:LOCATE 5,11: LINE INPUT TLINE$
364     IF TLINE$<>"" THEN TLINE=VAL(TLINE$)
366     IF TLINE>0 OR TLINE<-50 THEN TLINE=0:'------ TX Line LOSS < 50 db
368      LOCATE 5,11:PRINT USING"####.#";TLINE
370   IF TYPE$<>"P" THEN 400:'-------- NOT TX Power
372    PRINT "TX POWER IN <D>BM OR <W>ATTS : ";:LINE INPUT TPWR$
374     IF TPWR$<>"D" AND TPWR$<>"W" THEN 450
376      LOCATE 6,11: PRINT CLR$:LOCATE 6,11: LINE INPUT TX$
378      IF TX$<>"" THEN TX=VAL(TX$)
380      IF TPWR$="W" THEN TX=10*LOG(TX*1000)/LOG(10)
382       LOCATE 6,11:PRINT USING"####.#/###.#";TX;EXP(TX/10*LOG(10))/1000
400   IF TYPE$<>"E" THEN 450:'------- NOT TX Elevation
402    PRINT "TX ANT Elev. in <F>EET or <M>ETERS : ";:LINE INPUT UNIT$
404    IF UNIT$<>"F" AND UNIT$<>"M" THEN 450
406    IF UNIT$="F" THEN UNIT$="FT":K=1 ELSE UNIT$="M":K=FT
408     LOCATE KR,1:PRINT SPACE$(78):LOCATE KR,1
410     PRINT "TX ANT Elev. (";UNIT$;") : ";: LINE INPUT TELV$
412     IF TELV$<>"" THEN TELV=ABS(VAL(TELV$))/K
414     IF TELV > 5000 THEN TELV=0
430 '
450  IF DTYPE$<>"R" THEN 550:'------- NOT RX
452   PRINT "RX <A>nt <L>ine <S>ens. <E>lev. : ";:LINE INPUT TYPE$
454    LOCATE KR,1:PRINT SPACE$(78):LOCATE KR,1
456   IF TYPE$<>"A" THEN 470:'------- NOT RX Ant Gain
458    LOCATE 4,67:PRINT CLR$:LOCATE 4,67:LINE INPUT RANT$
460     IF RANT$ <>"" THEN RANT=VAL(RANT$)
462     IF RANT>50 OR RANT<0 THEN RANT=0:'---------- RX Ant GAIN < 50 db
464      LOCATE 4,67:PRINT USING"####.#";RANT
470   IF TYPE$<>"L" THEN 480:'------- NOT RX Line LOSS
472    LOCATE 5,67:PRINT CLR$:LOCATE 5,67: LINE INPUT RLINE$
474     IF RLINE$<>"" THEN RLINE=VAL(RLINE$)
476     IF RLINE<-50 OR RLINE>0 THEN RLINE=0:'------ RX Line LOSS < 50 db
478      LOCATE 5,67:PRINT USING"####.#";RLINE
480   IF TYPE$<>"S" THEN 500:'-------- NOT Sensitivity
482    PRINT "RX Sens. in <D>BM or <U>V : ";:LINE INPUT RSEN$
484     IF RSEN$<>"D" AND RSEN$<>"U" THEN 500
486      LOCATE 6,67:PRINT CLR$:LOCATE 6,67: LINE INPUT RX$
488      IF RX$ <> "" THEN RX=VAL(RX$)
490      IF RSEN$="U" THEN RX=20*LOG(RX/UV)/LOG(10)
492       LOCATE 6,67:PRINT USING"####.#/####.#";RX;EXP(RX/20*LOG(10))*UV
500   IF TYPE$<>"E" THEN 550:'-------- NOT RX Elevation
502    PRINT "RX ANT Elev. in <F>EET or <M>ETERS : ";:LINE INPUT UNIT$
504    IF UNIT$<>"F" AND UNIT$<>"M" THEN 550
506    IF UNIT$="F" THEN UNIT$="FT":K=1 ELSE UNIT$="M":K=FT
508     LOCATE KR,1:PRINT SPACE$(78):LOCATE KR,1
510     PRINT "RX ANT Elev. (";UNIT$;") : ";: LINE INPUT RELV$
512     IF RELV$<>"" THEN RELV=ABS(VAL(RELV$))/K
514     IF RELV > 5000 THEN RELV=0:'------------ Elevation < 5000 ft
530 '
550  IF DTYPE$="Q" THEN STOP ELSE 150:'-- LOOP OR END OF PROGRAM ------
```

Figure 2. *STLBME.BAS, a program to design an STL system.*

percent path increments, the earth bulge (at k = 1) and the 0.6 fresnel zone. Line 168 then calculates the elevation of the clear STL path for each distance increment. Lines 170 through 186 print these results on the screen.

The program calculates only with valid values of Frequency (in GHz) and Path length (in miles or kilometers), so input them first. You can get path distance for the system by reading it directly from a topographic map or by using the coordinates and calculating it with September's Compute program, DISTBRG.BAS.

Next, for both the transmit and receive sites, input the following data: antenna gain (0 to 50 dB, from the manufacturer's specifications); line loss (0 to −50 dB—use manufacturer's data or August's Compute program, COAXATTN.BAS; if there are any connector or other losses, add them to the line loss); transmitter power in watts or dBm and receiver sensitivity in dBu or μV; get these from the equipment manufacturer's specs.

Finally, input the transmit and receive antenna elevations. Use the total mean elevation above sea level.

With all the system data, the program calculates the fade margin and the flat earth path profile tabulation for 10 percent increments of distance from transmit site to receive site. This is the clear elevation for a line-of-sight path compensated for both the 0.6 fresnel zone and earth bulge. Use the table to check the clearance along the path either visually or on a topographic map.

The design of STL/microwave systems is an esoteric topic for the nonexpert. GTE has published a very readable handbook: CH700, "Engineering Considerations for Microwave Communications System," available from GTE, Publications Manager, Dept. 431.1—Tube Station C-1, 400 N. Wolf Rd., Northlake, IL 60164.

Balonis is CE 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.

A Few Items of Interest (To The FCC)

By Harry F. Cole

As the year end approaches, we find ourselves with no developments that warrant an entire column. Accordingly, we offer the following grab-bag of odds and ends for you to ponder over the holidays.

Tape Delays/Monitor Tapes. As we have noted in previous columns, the FCC appears to be retrenching on its deregulation program in a number of areas, restoring rules, policies and regulations that had been eliminated (or substantially reduced) during the heyday of deregulation mania in the mid- to late 1980s. Most prominent on the list of items now the subject of increased Commission concern is the matter of indecency and/or obscenity on the air.

The question of obscenity and/or indecency is primarily a programming as opposed to an engineering matter, of course. You may find yourself dragged into the fray, however, if the programming department determines that it would be appropriate to install a tape delay mechanism in the studio to provide additional control over the material that goes out over the air (especially if the station's programming includes telephone interviews with listeners). A second, related mechanism might be the installation of a monitor, or logger, tape system designed to tape everything that goes out over the air.

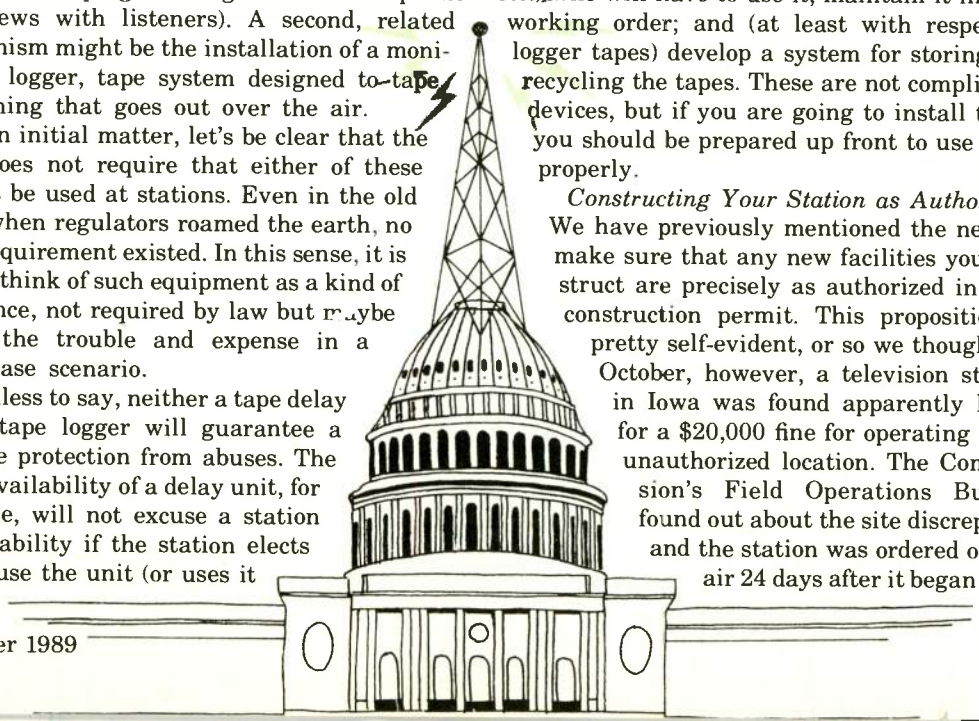
As an initial matter, let's be clear that the FCC does not require that either of these devices be used at stations. Even in the old days, when regulators roamed the earth, no such requirement existed. In this sense, it is best to think of such equipment as a kind of insurance, not required by law but maybe worth the trouble and expense in a worst-case scenario.

Needless to say, neither a tape delay nor a tape logger will guarantee a licensee protection from abuses. The mere availability of a delay unit, for example, will not excuse a station from liability if the station elects not to use the unit (or uses it ineffectively) so that obscenity or indecency ends up being transmitted. Indeed, the availability of such technical devices might cause problems in and of themselves. For example, installation of a tape delay might be construed as an admission by the licensee that it is aware of some potential problems with its program content; that awareness might lead to the conclusion (say, by the FCC or a court) that the licensee, being aware of a potential problem, should be extra-vigilant to prevent abuses. Alternatively, a licensee that installs and operates a 24-hour logger tape might find itself with concrete evidence of the broadcast of inappropriate material (*e.g.*, obscenity, indecency, slander or copyright infringement) that otherwise might not exist.

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

Of course, if the licensee does elect to put such devices in place, it will likely fall on you, the engineer, to: install it properly; explain its functioning to the staff (*e.g.*, announcers, producers, etc.) who will have to use it; maintain it in good working order; and (at least with respect to logger tapes) develop a system for storing and recycling the tapes. These are not complicated devices, but if you are going to install them, you should be prepared up front to use them properly.

Constructing Your Station as Authorized. We have previously mentioned the need to make sure that any new facilities you construct are precisely as authorized in your construction permit. This proposition is pretty self-evident, or so we thought. In October, however, a television station in Iowa was found apparently liable for a $20,000 fine for operating at an unauthorized location. The Commission's Field Operations Bureau found out about the site discrepancy and the station was ordered off the air 24 days after it began oper-



ation from the unauthorized site, resulting in an effective fine of almost $1000 a day. That is certainly a good reason to double- and triple-check your construction specs.

Of course, the size of the fine may also be a reflection of the size of the discrepancy; the antenna tower of the station in question was built more than 25 miles from its authorized site. We don't know how the licensee attempted to explain this impressive variance. The moral of this story: Measure twice, construct once.

STAs—A Thing of the Past? Once upon a time, an operating station (or a permittee trying to put its station on the air) could avail itself of a relatively easy means of getting authority to operate with facilities somewhat different from those specified in the station's instrument of authorization. You just filed a request for a "special temporary authorization," or STA, explaining what facilities you needed and why. The request could be in the form of a letter, could be signed by the licensee's counsel, and generally was treated as a high-priority item by the processing staff.

Recent reports from the Commission, however, suggest that the STA approach is no longer held in particularly high regard, at least in some offices. In fact, the FM processing staff appears generally inclined to ignore, or even reject, STA requests unless they involve situations that are truly emergencies. If you lose your tower in a hurricane, or if a squirrel shorts out your transmitter, the staff probably will be pleased to help you out with an STA. They are drawing the line, however, at proposals that appear to be efforts to avoid the growing backlog of pending applications for facilities changes.

A number of enterprising applicants, frustrated at their lack of progress in the processing line, have attempted to leapfrog the roadblock by requesting STAs that would permit them to operate with the facilities proposed in still-to-be-processed applications. If successful, the licensee gets, in effect, something equivalent to a tentative grant of its application, without having to wait for that application to reach the front of the processing line.

Unfortunately for those trying that gambit in the FM area lately, the staff is simply too swamped with applications to want to worry about your STA request. It is projected that an application for a new FM station filed today might not be designated for hearing for three to four years. Because of this state of affairs, the FM processing staff apparently believes that it cannot afford to allocate personnel and resources to individual requests that effectively circumvent the normal order of the processing line.

This policy of the FM branch has been largely unpublicized. While it is a policy that certainly makes some sense, we wonder whether it is the best response to the situation. If the backlog is so great that applicants are forced to seek alternatives, perhaps some fundamental adjustments to the application processing system are called for. We understand that the Federal Communications Bar Association is working with the staff in the hope of coming up with some steps that might alleviate the problem. We wish them luck. In the meantime, if you think you need an STA (especially for an FM station), be sure you make the most convincing case possible.

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AM Improvement. If you think the new Commission is ignoring the continuing problem of the decline in AM listenership, think again. In November, the Commission scheduled a very rare *en banc* hearing to consider a wide variety of topics relating to that problem, including the various outstanding rulemaking proceedings looking toward revision of a number of AM technical assignment standards.

En banc hearings such as this—where the Commissioners themselves are the primary audience to whom interested parties direct their remarks in person—obviously reflect the agency's serious concern about the AM industry. Nevertheless, it is far from clear that any results may be expected in the near term.

Remember, none of the Commissioners is an engineer, much less one of the elite (and arguably vanishing) breed of AM engineers. As a result, the ultimate usefulness of such an *en banc* hearing is questionable; the time might better be spent in an all-day, roll-up-your-sleeves session involving interested technicians and FCC engineering staff well versed in the rules. But to the extent that this hearing signals the FCC's continuing serious concern about the AM industry, it should come as a welcome sign. If you have any questions about any of these matters, contact your communications counsel. ■

BUSINESS BRIEFS

Two Charleston, SC-area radio broadcasters whose transmitters were lost in Hurricane Hugo have received replacement transmitters from **Broadcast Electronics. WDXZ-FM**, Mt. Pleasant, has taken delivery of a 10 kW transmitter; the new unit for **WKQB-FM**, St. George, is a 35 kW model . . . The **Alta Group** has delivered its one hundredth Pictoris video compression system to **Edityme**, a multiformat post facility in Las Vegas . . . **BTS** has sold a DCR-100 D-1 VCR to **Griffith and Tekushan, Inc.**, a New York City-based videographics facility. This is the first DCR-100 BTS has delivered to a New York production house . . . **Shook Electronics USA** has delivered a 48-foot production trailer to **John Crowe Productions**, Houston. The unit utilizes **BTS** LDK-6 studio cameras, a **Grass Valley Group** 1680 production switcher and an **Abekas** digital effects system/still store . . . **NBC News** has purchased four **Odetics** news control terminals for use in its New York network news facility; the devices will give NBC's technical directors last-second control over the selection and play of videotape during newscasts . . . **Rank Cintel** has sold an HDTV telecine to **Club Theatre Network.** The 1125/60 flying spot telecine will be used to transfer first-run movies to be shown in 14 HDTV theaters in the Southeastern U.S. next year . . . **WaveFrame Corp.** has delivered two digital audio production systems to **Real to Reel Studios**, Dallas, a commercial production studio . . . **Nova Systems, Inc.** began delivery of its Nova 900S super TBC September 1 . . . **Film Craft Video**, Farmington Hills, MI, has acquired a **Quantel** Paintbox V-Series, the first V-Series model in the Detroit market . . . Louisiana's first **Neve** V Series console has been installed at **Studio in the Country**, Bogulusa . . . **Comark Communications** has sold a 60 kW Klystrode-equipped transmitter to **WFWA-TV**, a PBS affiliate in Fort Wayne, IN . . . **Trio Video**, Chicago, has purchased nine **Sony** cameras and four Sony one-inch machines . . . Radamec EPO robotic camera controls by **A.F. Associates** have been installed at CNN in Atlanta.

Digital F/X has opened a New York City sales and service facility . . . Steven Bonica, formerly VP of engineering at NBC, has been appointed to the new position of VP, audio and video planning, at **Panasonic Communications & Systems Co.**..Mark C. Gray has been named president of the new **Sony Peripheral Systems Co.**..Paul Mitchel, a founding employee of **Charlex, Inc.**, has left to form **Paul Mitchel Systems, Inc.**, specializing in designing and installing management information systems for post-production facilities . . . The **Winsted Corp.** now offers a minimum five-day shipment on its 35-inch and 70-inch rack cabinets, or, Winsted says, it will pay the freight charges.

Ampex Magnetic Tape Div., newly restructured as **Ampex Recording Media Corp.**, celebrated its thirtieth anniversary in October. The company was founded in 1959 when Ampex purchased Orr Industries Co . . . The **International Teleproduction Society** awarded a special Humanitarian Achievement Award to **ABC Television** for its work in the field of closed captioning. ■

L. Sanders Smith, president of Dynatech Newstar (right), and R. Dean Mills, dean of the School of Journalism at the University of Missouri, have good reason to smile. Dynatech Newstar has presented the journalism school with two Newstar systems valued at more than $200,000. The systems will be installed at the school's radio and television stations early next year.

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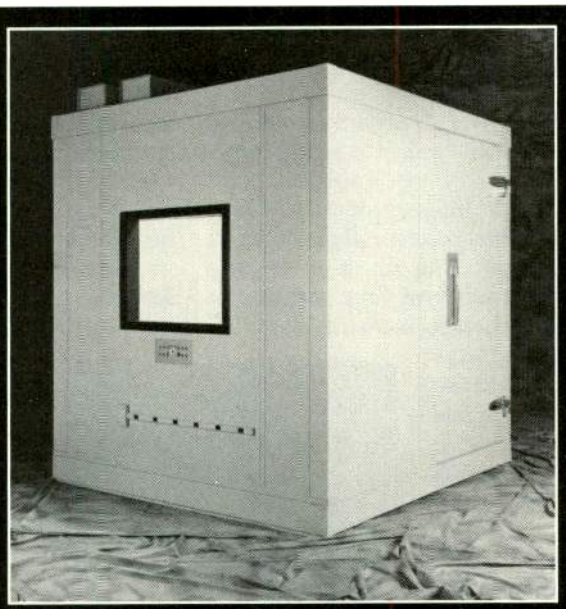

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Circle 115 on Reader Service Card.

Digital Video: Use It Right and It's Affordable

By Patrick Howley

Much has been said about digital in the last year. "It's too expensive," say those who are shocked by the $160,000 price tag of a D-1 VTR. "It's not good enough," complain those who feel limited by the eight-bit, composite D-2 format. "We don't need another format; I haven't paid for my one-inch VTRs yet," say skeptics everywhere. Let's take another look at digital post-production, with emphasis on economics versus quality.

The two popular digital formats, D-1 and D-2, offer many advantages compared to one-inch Type C: They are cassette-based, have four channels of compact-disc quality audio, and make transparent digital clone copies. Both formats, however, use expensive videotape that costs over twice as much as one-inch.

D-1 is component digital; it gives the highest-quality recordings possible today; it is the interchange format for a growing family of 4:2:2 devices; and it is an international standard allowing 525/60 or 625/50 record and playback. It also has disadvantages: The machine is very expensive; it lacks output proc amp controls; it has poor machine ballistics, including variable speed; it is relatively large and consumes a lot of power.

D-2 is compact in size and consumes less power; it is relatively cheap; it handles well under editor control, including variable speed; it makes an excellent playback deck in a cart machine; and it hooks up to a TBC remote system. D-2 also drops easily into an existing analog edit suite as a high-quality replacement for one-inch. Compared to one-inch, D-2 has better S/N, looks sharper, has fewer velocity errors and no moire. D-2's main disadvantage is the stretching of eight bits across the video signal, which results in quantizing errors, most noticeably in shallow ramp-type signals.

Let's look at a method of post-producing and broadcasting a typical 30-second commercial, taking advantage of each digital format, but using them in the most economical way possible.

The 35 mm negative is transferred by digital telecine directly to D-1, and simultaneously to D-2 by using a digital D-1-to-D-2 converter. Sound elements are transferred directly to D-2, or relayed later to the D-2 master. The D-1 material is loaded into a 4:2:2 graphics/compositing suite for retouch or graphics building. When finished, the scenes are output to D-2 through a digital D-1-to-D-2 converter.

The spot is then edited in a conventional edit suite equipped with D-2 VTRs instead of one-inch. Opticals and titles are added. After any revisions, a duplication digital clone is made, from which digital copies are made for distribution to the D-2 cart machines at the broadcast stations.

Following the above scenario, the video and audio signals that leave the cart machine at the broadcast station are identical to the edited master that the client approved in the edit session. This approach is both economical and high-quality. Signals are digital where they have to be, and post-production techniques are similar to those in standard one-inch editing.

With the price of a D-2 VTR decreasing below the cost of a one-inch machine, a D-2 broadcast cart machine is becoming affordable. Thus digital recording—used economically—will provide a higher-quality signal for viewers, without an increase in cost to the client. ■

Pat Howley is president of Post Perfect, New York, and a member of BME*'s Editorial Advisory Board.*

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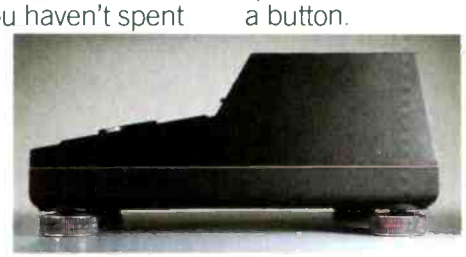

You see, the SL-P1300 is ergonomically designed to give you greater control over playback than you've ever had before.

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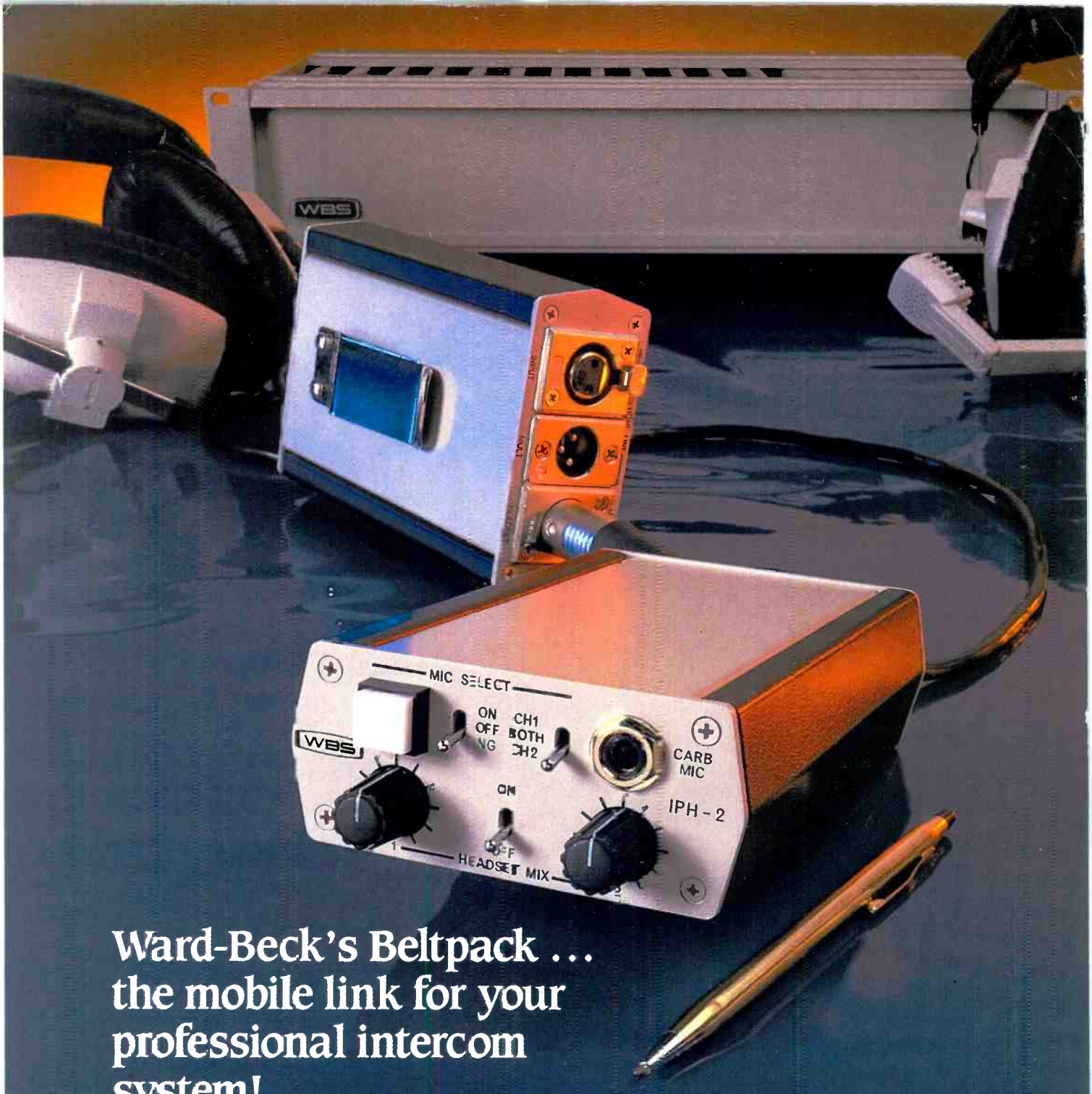

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