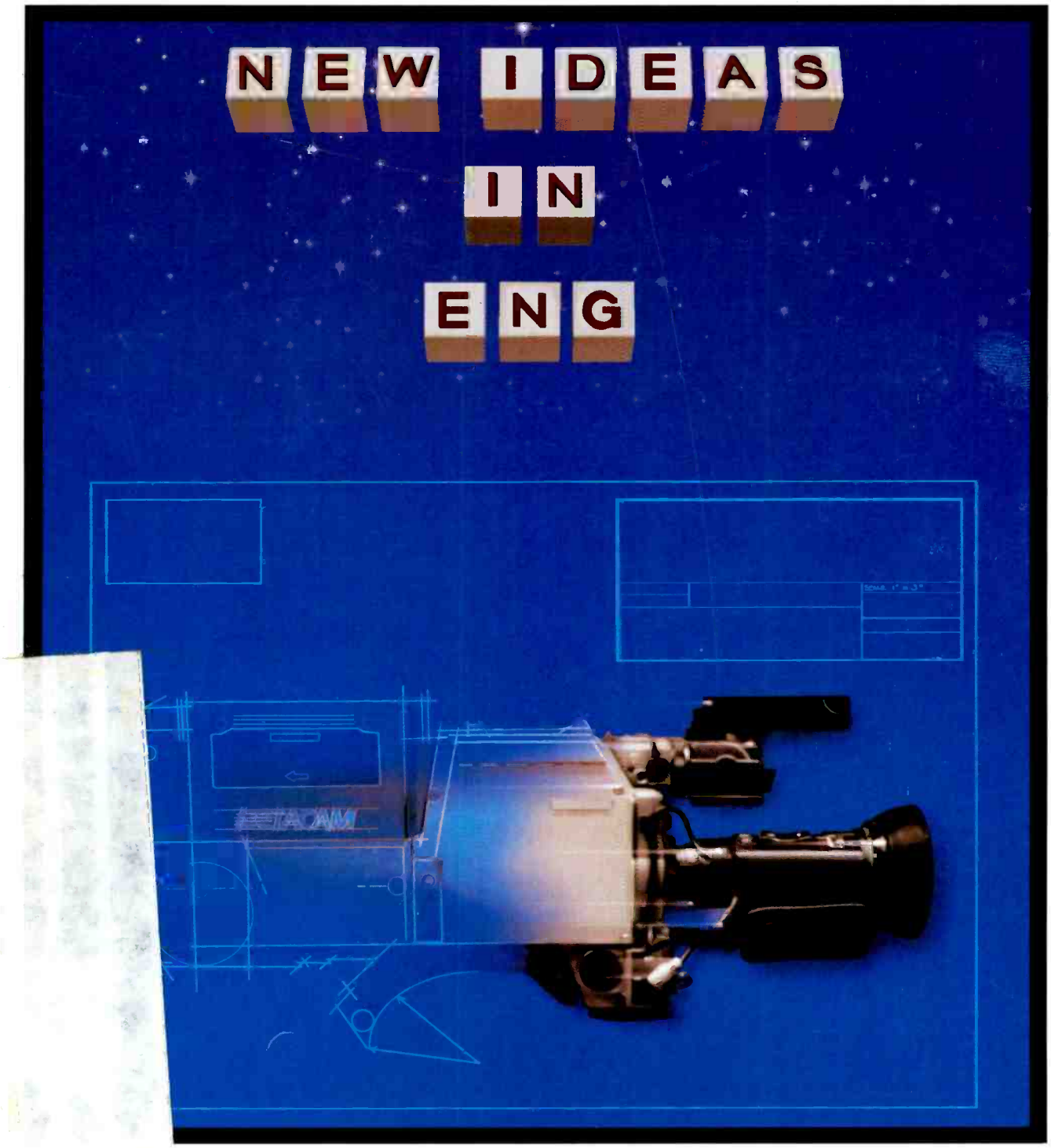
DECEMBER 1987 $3.00

# BM/E

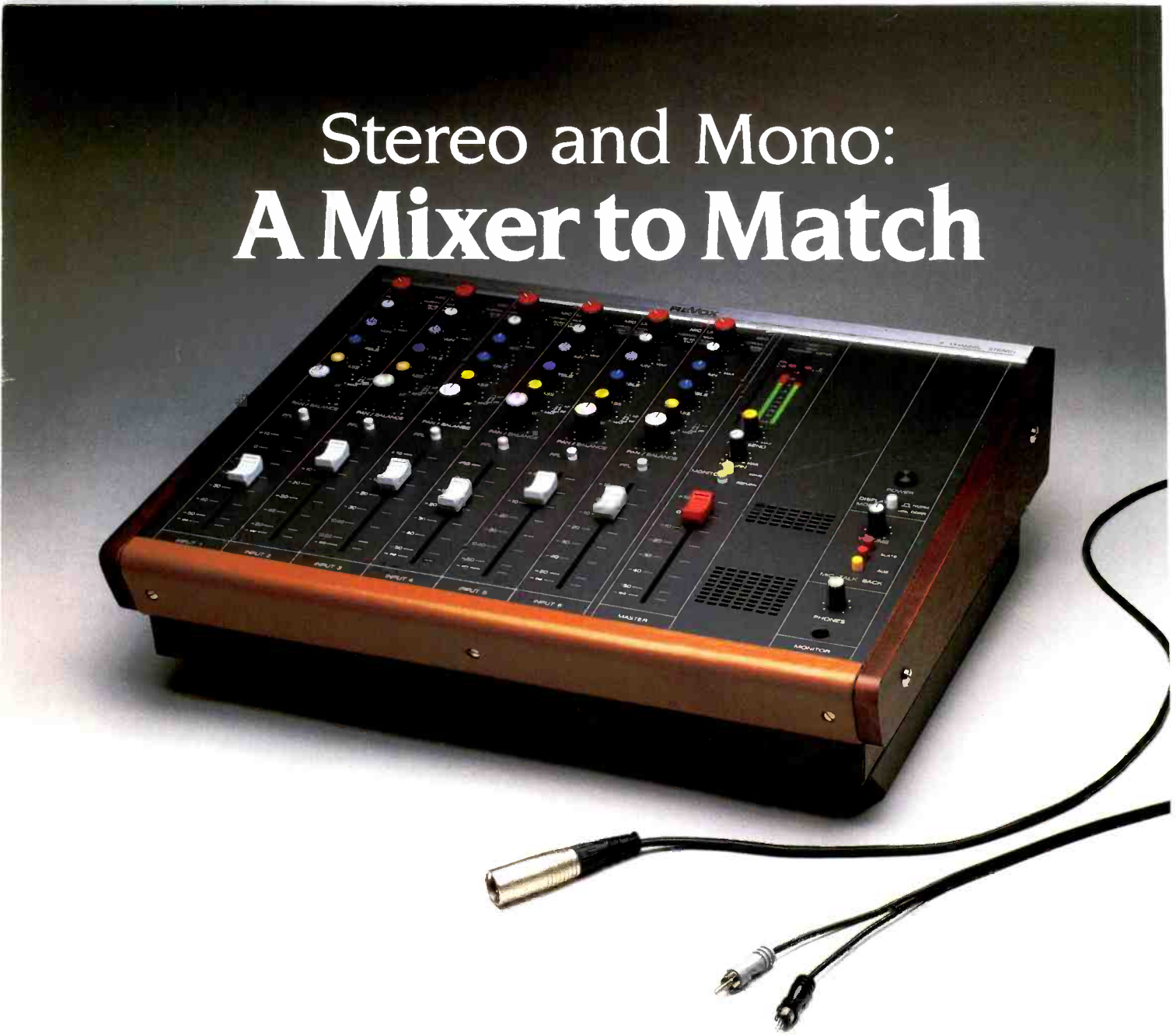
BROADCAST MANAGEMENT/ENGINEERING




**Also in this issue:**

■Cart Technology ■Satellite Facilities ■CCD Cameras
■Formats ■Lenses ■Engineering Wish List

# Stereo and Mono:
# A Mixer to Match



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Options include: a rack mount kit and an expansion unit with dBx Type II noise reduction processor, two phono preamps, test generator and fader start logic for all inputs and master.

Detail of connection panel at rear of console equipped with XLR and RCA connectors

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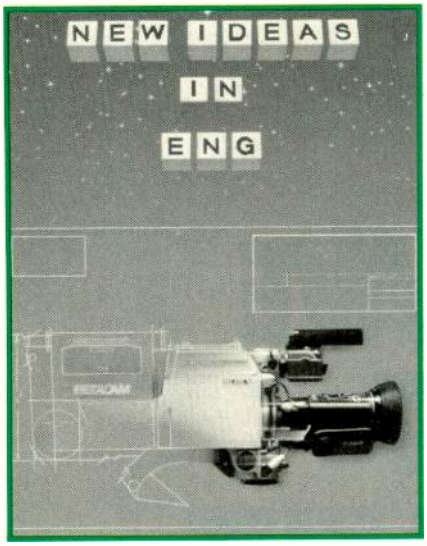


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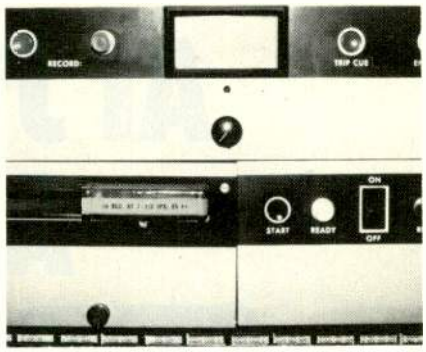

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## Features



## Departments



## Cover:

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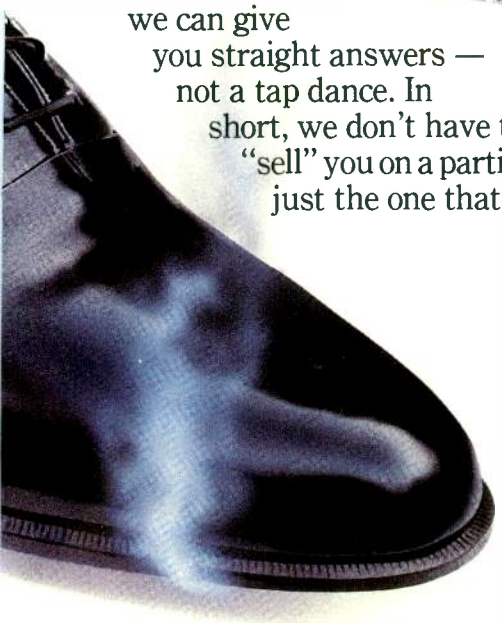

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# Traffic Report

***"The devastation that license trafficking has foisted upon the industry is there to see."***

In October, antitrafficking legislation came before both the House and the Senate. In the House it was sponsored by Representative Al Swift, a Washington Democrat, and it has come before the Telecommunications Subcommittee.

Many legislators seem divided on the issue, and the NAB itself has not taken a clear opposition to the proposed law. The NAB's response has been that it does not want to support such legislation as a standalone bill. The FCC, of course, hides behind deregulation.

It's understandable when senators and congressmen cannot come to a consensus due to political manipulation, constituent responsibilities, and general base covering. But an industry association such as the NAB has no valid reason for not committing to a clear position on an antitrafficking bill. It's either good for the industry or it's not, standalone or not. The FCC, of course, stands behind deregulation.

Obviously, the industry is in need of such legislation having undergone a ridiculous license-trading frenzy in the last few years, a frenzy that has left many station owners with a very heavy debt load to service. This means, of course, the owners cannot service the public interest as their license says they must do.

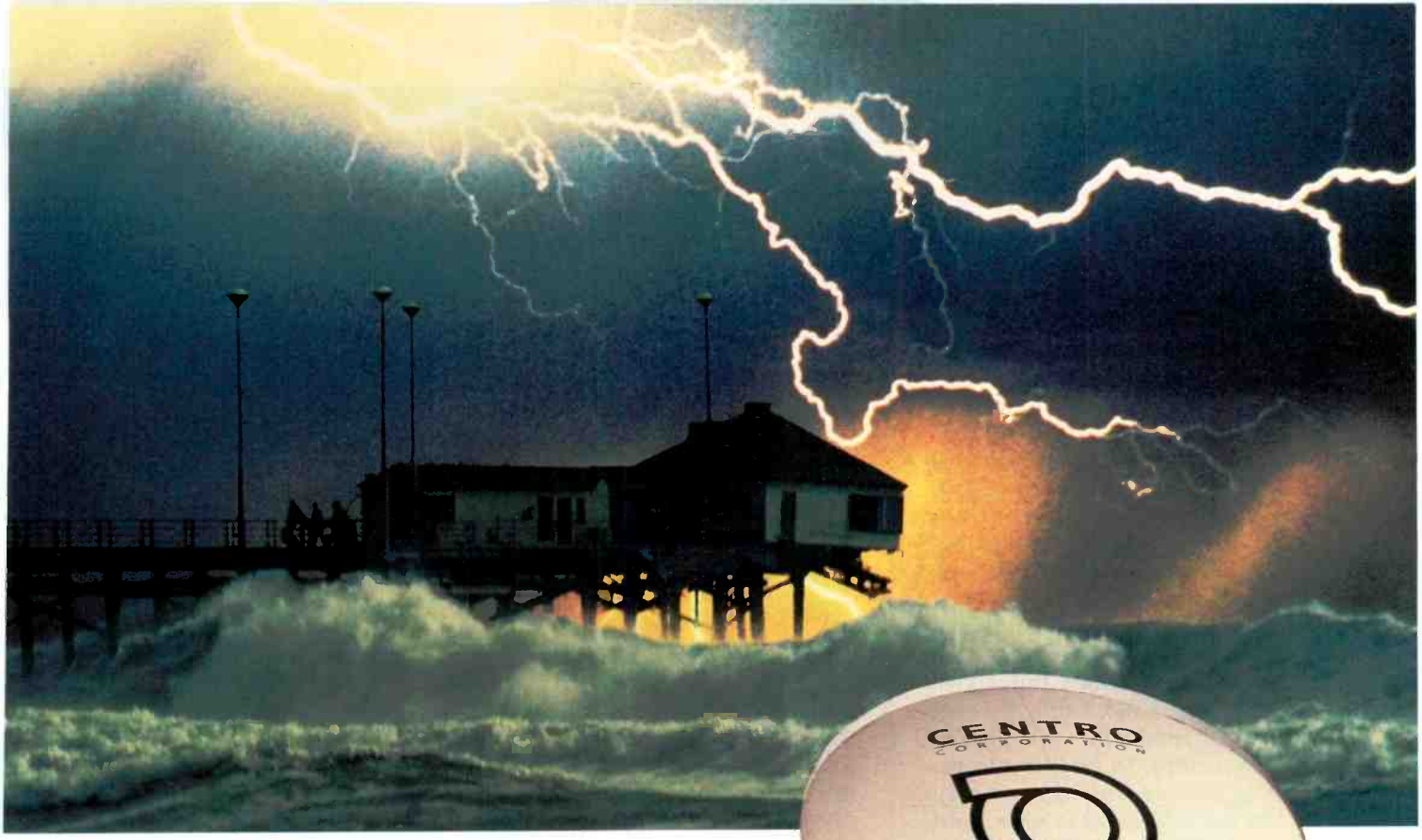
Nor can they purchase the new equipment that will keep them competitive in the long run. It also may prevent them from hiring upper levels of talent and even forces them into accepting sub-par programming packages due to lack of funds. All of this bodes ill for the industry.

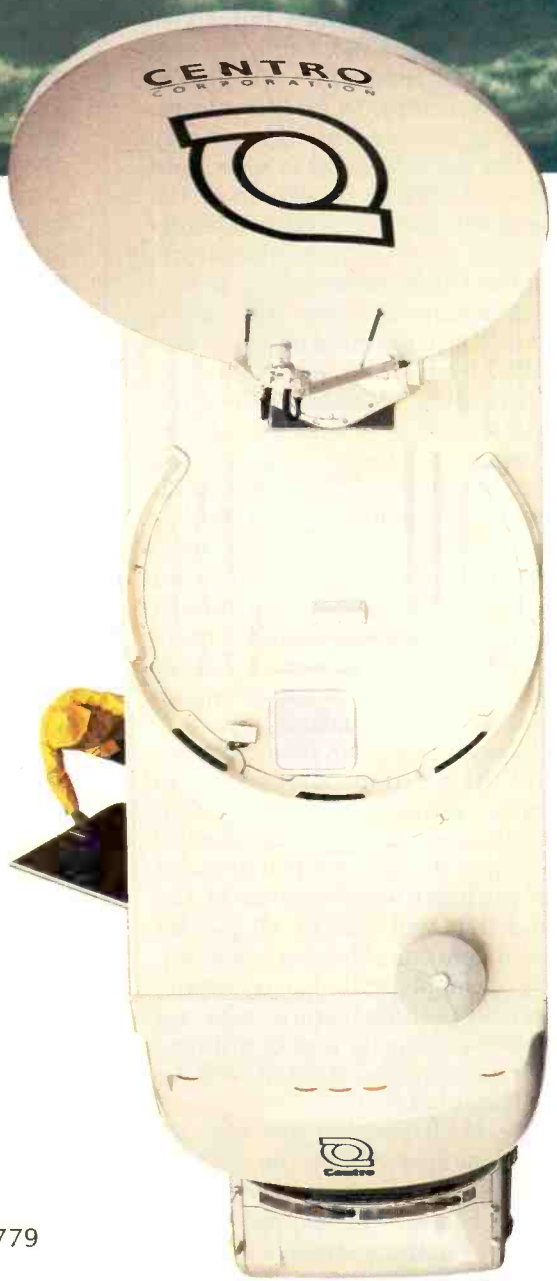
The devastation that license trafficking has foisted upon the industry is there to see if only we would open our eyes. Legislation that forces a three-year license holding period is a healthy measure (in as much as legislation can be) and should become law. The evidence is in. We are now living with the results of free license trading, and the industry is in a slump. There are many reasons, some excuses, but it is evident that license trading is a major contributing factor to broadcasting's very large debt.

Let's face the facts. The three-year rule is now a must. Pass the bill, and let's get on with the business of broadcasting.

Tim Wetmore

*Tim Wetmore*
*Editor*



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## FCC Urged to Regulate NRSC

In a petition filed with the FCC on November 6, the NAB urged the Commission to adopt the NRSC standard as a mandatory regulation. If passed, the regulation would require all AM broadcasters to convert to NRSC by January 1, 1990. The NRSC standard for AM preemphasis and deemphasis with an accompanying 10 kHz bandwidth is now being implemented by AM stations on a voluntary basis.

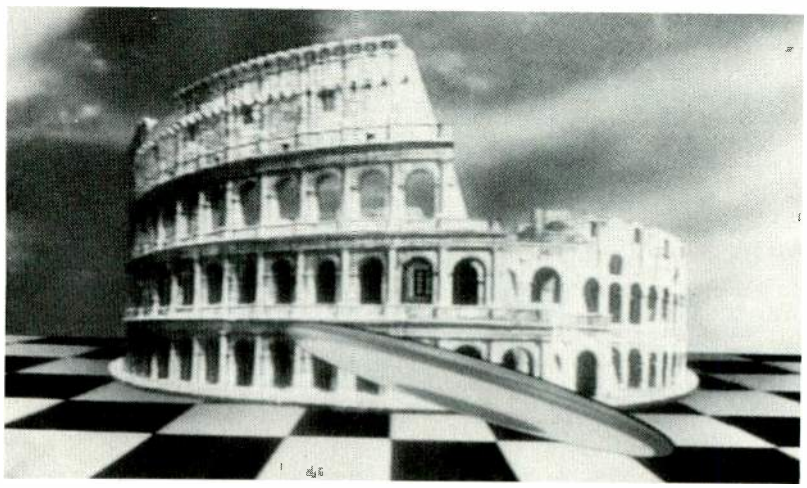
The standard was established in a cooperative effort by the NAB, the Electronics Industries Association (EIA), and several leading broadcast equipment manufacturers. In addition to restoring processing uniformity within the AM band to eliminate adjacent station interference, the standard also received the assurance of receiver manufacturers, via the EIA's involvement, to produce better-sounding AM radios upon implementation of the NRSC by U.S. broadcasters.

According to Michael Rau, the NAB's director of Spectrum Engineering and Regulatory Affairs, 422 AM stations have either already converted to the standard or promised to convert in the near future. However, Rau adds that there has been some "good-faith doubt" expressed by the radio manufacturers as to whether enough broadcasters will ultimately employ the standard.

In explaining the reasoning behind the petition, Rau says, "It's becoming increasingly clear that compliance with the standard is the right thing to do. It will make a significant improvement in the band that will benefit all parties in the long run. Making it mandatory to comply will also assure the receiver manufacturers, who are investing literally tens of millions of dollars in this, that it will be implemented."

The NAB petition has also received support from the NITA's assistant commerce secretary Alfred Sikes, who expressed his support for the initiative in a letter to FCC Chairman Dennis R. Patrick. In his letter, Sikes noted that the standard will enable the sound of AM radio to compare favorably with FM.

"I would not argue for unnecessary government intervention in this, or any other area," Sikes stated. "The deteriorating economic condition of AM broadcasting is largely due to the poor comparison of AM's sound quality with the FM service. The improvement is too important to be left to voluntary compliance by the AM industry."



**Let the games begin!** A cleaned-up Coliseum and gold discus evoke the grandeur of ancient Rome in this 2D image from New York's Caesar Video. The scene was one of several animated mosaic backgrounds supplied by the company for the opening of the NBC Sports presentation of the *Roma '87 World Championships of Track and Field*, which aired August 29 to September 6. Commissioned by NBC Sports producer John Gonzalez, the one-minute sequence featured multiple animated elements that move in and around painted images of the Coliseum. The combination 3D/2D computer graphics and animation was designed by Caesar's art director Anne St. Pierre on Quantel's digital workstation consisting of the Paintbox, Harry, and Encore digital effects generators. A 10-second 3D opener of the Coliseum was designed by Black Cat Productions and coordinated by Caesar animator Jeff Buckland.

The company's special effects editor Bob Roesler also built a nested zoom that moved through the Coliseum to an enormous stone portico with doors that opened to the first scene of each show. The doors actually opened to a negative black image that was used as a key source for the transition to live action.

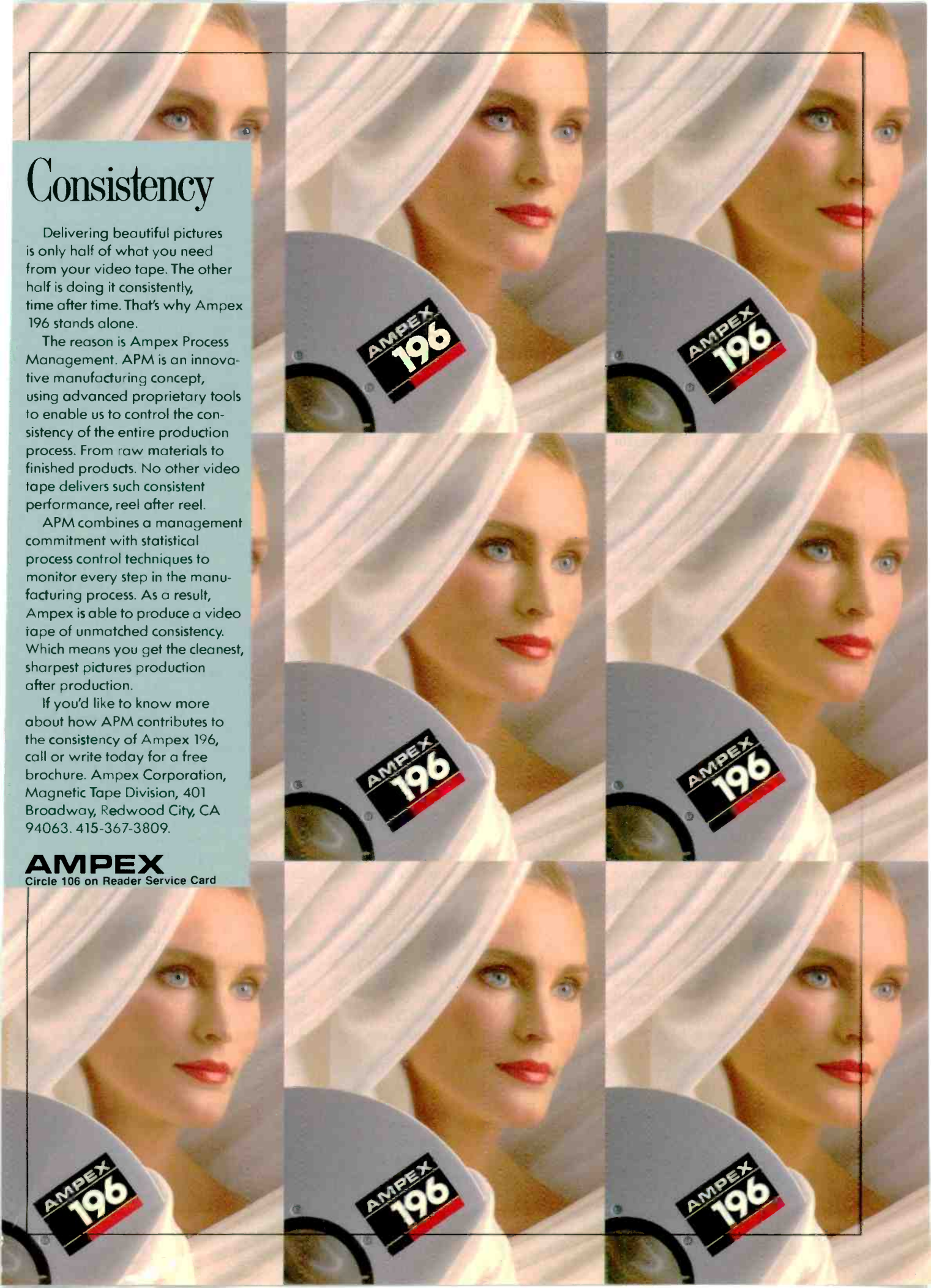
## Digital Audio Via Satellite Expected to Increase

The use of satellite-transmitted, digital audio is expected to have a major impact on network radio coverage of the 1988 Presidential campaign.

The technology, which provides studio-quality sound from any remote location, has already been successfully used for radio broadcasts from the Reagan-Gorbachev Summit in Reykjavik, Iceland, and the recent NATO Economic Summit in Venice, Italy.

"It just sounds so much better," notes Joe Maguire, vice president of engineering for the United Stations Radio Networks. "It sounds local."

The transmissions in both cases were handled by IDB Communications Group in Culver City, CA, which employed a 1.8-meter flyaway unit to uplink the audio for

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the Venice summit meeting. The audio was then downlinked by IDB in New York and distributed to the NBC, CBS, NPR, United Stations, AP, and Mutual radio networks.

According to Dennis Feely, IDB's senior vice president and director, digital audio can be uplinked from remote locations for the same cost as analog uplinks. "This will make a big impact on Campaign '88," he says. "Where in 1984 we were uplinking the network's campaign remotes in analog, this time we'll be able to do it in digital with the difference being far superior quality."

To facilitate the use of digital audio transmissions, IDB is establishing a digital network link between the major news studios and the company's teleport facilities in New York. Systems have already been installed in studios at CBS and ABC in New York and in the main studios of AP, Mutual, and Voice of America in Washington, DC.

"We hope to expand this network to one that will eventually enable all the radio networks to get to and from anywhere in the world in digital audio," adds Feely.

Although some maintain that the permanent installation of digital communications systems is an expensive alternative, Feely counters that "compared to the cost of the telephone circuits we're replacing—especially if you take quality into account—the digital audio system is far more economical in the long run."

Bob Donelly, director of satellite operations for the ABC Radio Network, sees other advantages as well. "We not only need high-fidelity sound, but we also need multichannel, duplex capabilities as well as auxiliary data capabilities," he says. "To do that effectively, we definitely think digital is the way to go."

## Video Switching Arrives in Capitol

A new video service called Capital Coverage has become operative in Washington, DC. The system of switchable fiber optic links will feed directly from such locations as the U.S. Department of State, the White House, the Capitol, and the Pentagon to provide broadcasters with live, unedited transmissions.

The new system is a joint venture between Washington International Teleport (WIT) and Bell Atlantic's Chesapeake and Potomac (C&P) Telephone. A 32 x 32 matrix video switch located at Chesapeake and Potomac's radio/television center in downtown Washington will serve as a processing center for WIT's teleport operations.

WIT will control the switch from its international satellite gateway in McLean, VA. A private data channel will control the processor, enabling WIT to remotely switch the video to its terrestrial microwave or fiber links strategically located throughout the District of Columbia, Maryland, and Virginia. WIT will provide uplink services to any C- or Ku-band domestic satellite in addition to direct international transmission.

## Vintage VTR Donated to Video Museum

One of the first videotape machines, an Ampex VR-1000, has been restored to full operation by the Palo Alto-based Merlin Engineering Works and donated to the American Museum of Moving Images in Astoria, NY.

The machine, replete with several racks of glowing vacuum tubes, was rebuilt to commemorate 30 years of video recording and was originally displayed at the 128th SMPTE convention in New York and the SMPTE Winter Conference in San Francisco earlier this year.

The large quadruplex VTR was one of the first production models built by Ampex and weighed nearly one ton. It was delivered to the University of Missouri in Columbia in early 1959 and continued to be used until 1984, when it was donated to the restoration project by David Dunkin, director of the school's Academic Support Center.

"The Columbia machine had most of its original components," says John Streets, president of Merlin and head of the VTR restoration project, "unlike many quad VTRs still in TV stations, which have been modified extensively over the years."

Streets adds that restoration of the VR-1000 took nearly a year, with all chassis and electronics sections stripped and rebuilt from the ground up. A Tektronix 525 and 526 monitor and vectorscope were donated by Steve Coulam of KDVT-TV in Denver to replace the missing original parts, while Bill Fitts of CMC Technology supplied a new rotary video head, rebuilt to the original Ampex VTR specifications.

The VR-1000 will be on permanent display at the American Museum of Moving Images' $10 million facility, which is scheduled to open in early 1988.

## Boston Receives a Lighthouse

Warren Happel, vice president of engineering at Cleveland's WEWS-TV, has announced that the Scripps Howard Lighthouse Award for outstanding achievement has been presented to Jim Boston, the station's maintenance engineer, in recognition of his design of a computer library of broadcast equipment instructions.

The library is the result of several years' worth of personal technical notes and existing instruction book information. Boston's user-friendly system is designed to be a speedy reference for the operation and maintenance of any piece of equipment at the station. The program will be useful for both new staff members and engineers using newly acquired broadcast equipment.

"Engineers are too often not noticed until something doesn't work," Happel says. "Speaking as an engineer, we take particular pride in the recognition of Jim's work, and his receiving the Lighthouse Award."

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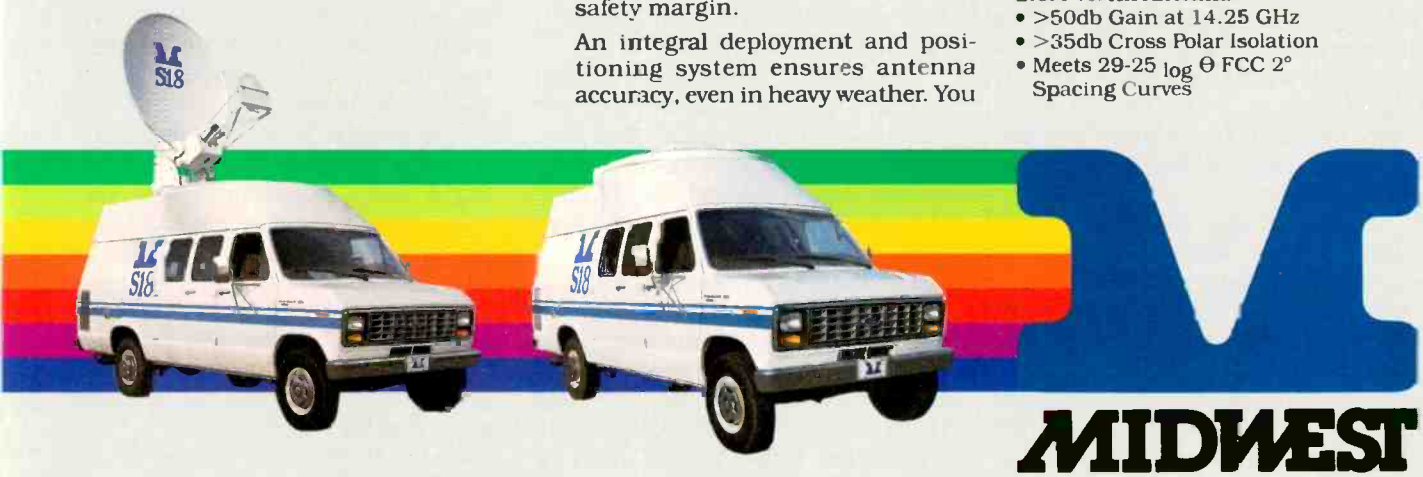


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The Lighthouse Award, which is named after the Scripps Howard logo, consists of a medallion and a cash prize.

## To Russia With Rock

The first package of American TV programs has been sold for broadcast in the Soviet Union according to a recent announcement by the New York-based Orbita Technologies Corp. and Belka International.

The package bought by Gosdelradio, the U.S.S.R. State Committee for Television and Radio Broadcasting, consists of *Rock and Roll: The Early Days*, *British Rock: The First Wave*, and *The Making of Sun City*, the anti-apartheid effort featuring performances by Bruce Springsteen, Bob Dylan, and others. The shows are scheduled to be broadcast later this year on one of the two Soviet national television networks.

Although this is the first sale of American TV programming to the Soviet Union, Orbita delivered a week's worth of Soviet TV—much of it broadcast live—to cable's Discovery Channel last February. The company is currently developing U.S. broadcast and videotape outlets for Soviet cartoons, children's shows, general interest programming, and news programs such as *Vremya: The Moscow Evening News*.

Orbita's subsidiary, Belka International, was created out of the company's unique working relationship with Gostelradio. It now functions as a liaison between U.S. broadcast companies and the appropriate Soviet political committees.

Over the past year Belka has served as an intermediary for a number of broadcast clients doing business with and in the Soviet Union. Its credits range from the recent weeklong filming of *Mr. Rogers' Neighborhood* in Moscow to ABC's "Congressbridge" series of programs featuring members of the U.S. Congress and the U.S.S.R.'s Supreme Soviet body in the Kremlin.

"Recent changes in Soviet law encourage ventures with Western companies and allow Soviet agencies and ministries to operate autonomously," says Marina Albee, Belka's president. "Taking advantage of these new Soviet laws is often difficult for those unfamiliar with the bureaucracy and language. Belka expedites, and often initiates, commercial projects between the two countries by guiding proposals to the right desk in Moscow."

Orbita's president Ken Shaffer adds that the company is in the process of negotiating the sale of many "classic" American TV programs to the U.S.S.R. Shaffer, who in 1984 designed the satellite tracking system that is now used at several U.S. universities to view domestic Soviet TV broadcasts, perceives television as a window.

"Windows work in two directions," he says. "Changes going on in the Soviet Union are more profound than we sense through our own nightly newscasts. With these technologies we see these changes happening right before our eyes. It's a new use of the medium."

## NARTE Sponsors Scholarship

The National Association of Radio and Telecommunications Engineers, Inc. (NARTE), has established an annual scholarship contest for up-and-coming talent in the engineering and telecommunications fields.

The contest encourages college students to articulate the value of radio, electronic, and telecommunications certification programs in general and the NARTE Certification & Endorsement Program in particular.

The contest is open to all students pursuing NARTE-related degrees who have completed their first year of a two-year technical/vocational school or their first three years of a four-year college. Applicants must be enrolled, or planning to enroll, in the second or final year of their post-secondary education.

The winning paper from each school is to be selected by the head of the technical training department. The winning author and his or her instructor will additionally have their NARTE certification fees waived for that year upon approval of their application. The national grand winner, selected by the NARTE board of directors, will receive a scholarship award of $1000—half of which will go to the student and half to the sponsoring institution.

The papers must be double spaced and at least 1500 words (but no more that 3000). Applications to submit papers must be received by February 10, 1988, although the organization hopes to receive most applications by December 31, 1987. Completed submissions must be postmarked no later than midnight, February 11, 1988. Applications can be obtained by writing to: NARTE Headquarters, Scholarship Contest, ATTN: Ray D. Thower, P.E. President, P.O. Box 15029, Salem, OR 97309.

## In Search of the Sexiest DJs

*Playgirl* magazine often features "10 best-looking" lists. But here's one that may be of interest to our readers: a search for the sexiest male radio personalities in America. The magazine's editor-in-chief, Nancie S. Martin, maintains that there are usually good-looking men behind those rich, disembodied voices, and she wants to prove it with the feature that is scheduled to appear in the May 1988 issue.

The contest is open to any man whose primary profession is hosting a radio music program. Entries should include an eight-by-ten-inch photo, a brief personal and professional resume, and an audio cassette of a typical air check. Final selections will be made by the editorial staff with photos of the winners taken in or near the DJs' home base.

Send entries by December 1, 1987 to: "The Sexiest DJs in America," c/o *Playgirl Magazine*, 801 Second Avenue, New York, NY 10017.

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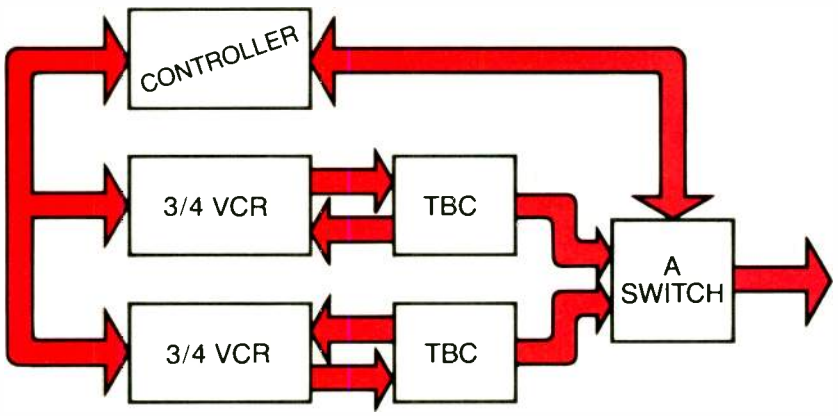
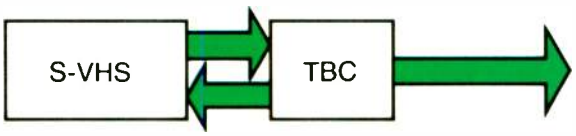



Panasonic Pro-Series S-VHS 2-hour playback system—requires no controller, only 1 TBC, only 1 VCR.

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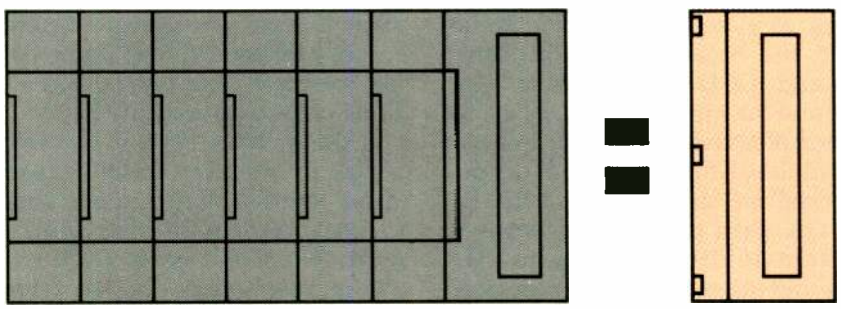

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Circle 110 on Reader Service Card

# CCD = ENG

*Choosing and maintaining equipment for an ENG crew can be one of the technical manager's most difficult assignments. When it comes to ENG cameras, the imaging device of choice appears to be the CCD, and manufacturers are advancing the technology to meet the demand.*

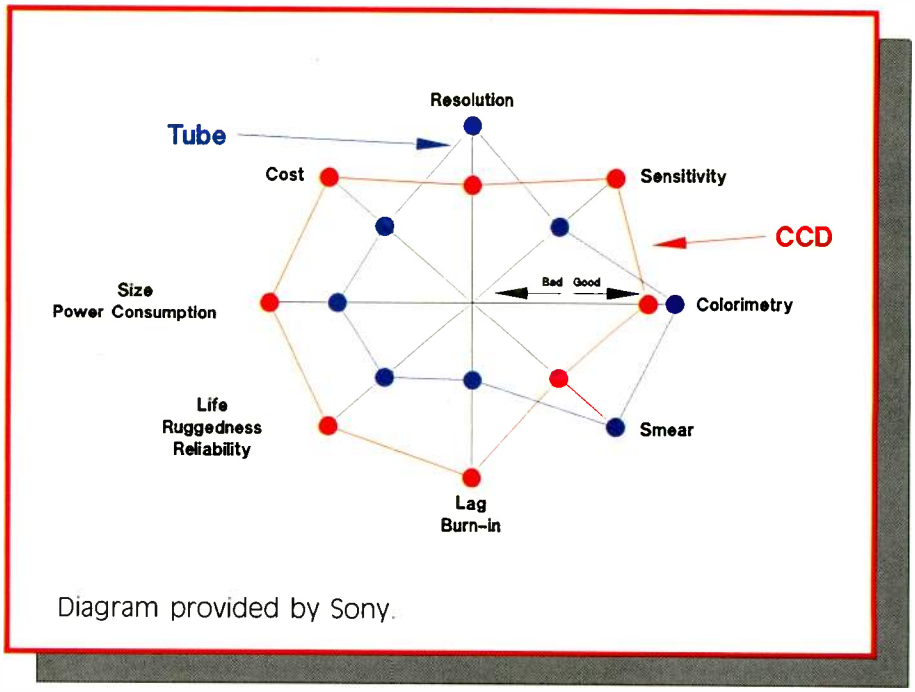


Diagram provided by Sony.

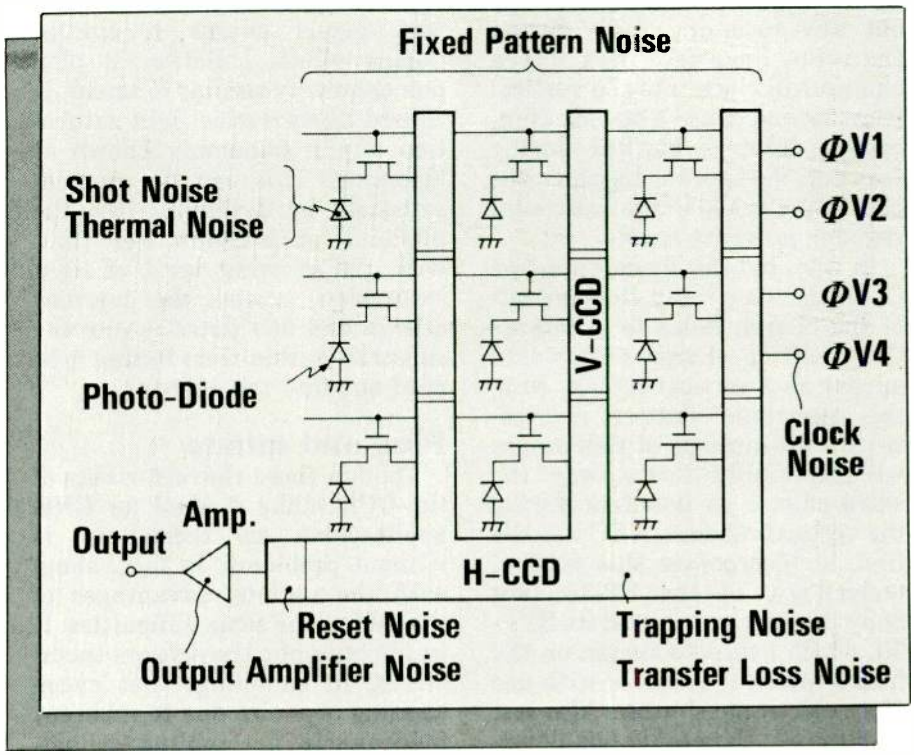
**By Tim Wetmore**

For the last few years the broadcast industry has been hearing about the coming of the charge-couple device (CCD) and, as is the case with most new technologies, the industry took a wait-and-see attitude to determine if it could be implemented into the broadcast environment. Though CCD imagers have been around for quite a while, color imaging of broadcast quality was not available. Then, in 1985, NEC delivered on the promise with its SP-3A. Still the industry was reluctant to drop its Ikegami HL-79s and other three-tube cameras, though operators were less reticent in complaining about them.

When NBC decided to convert some of its ENG camera operations to CCD with a multiunit purchase of the SP-3A, the die was cast. Indeed, prior to this announcement, many manufacturers, Sony and Panasonic among them, had already introduced ENG-quality CCD cameras as 1987 seemed to be the year of the chip. Now, as CCDs improve and the buying curve for solid-state imagers continues to rise, it seems evident that the charge-coupled device has come of age, representing perhaps the best choice in ENG camera possibilities.

If this is true, then it is worthwhile to find out what makes them work—what makes them the ideal camera for ENG applications. There has been much said about resolution, registration, signal-to-noise, and sensitivity on both sides of the prism block. Perhaps it would serve us well to examine the technical, engineering parameters of these sensors to sort out some of the signal from the noise about tube versus chip.

Much of the confusion surrounding CCD cameras comes from questions about what they will or won't do in a given situation. First of all, the charge-coupled device is an analog system, not a digital one. Secondly, in a practical applications sense, a CCD camera will "do" anything a tube camera will do. Many of those things it will do better and some, less well. For example, because of better aliasing and resolution characteristics, the tube camera performs better when shooting a fashion show or something where fine detail and intricate patterns will be the dominant visual image. Also, when very high production values are demanded, the higher resolution and better S/N ratio of the tube wins out. Of course, it's not often an ENG crew is called upon to shoot a fashion show or to produce a prime-time program.



CCD image sensor noise sources. Chart courtesy of NEC.

It is precisely the other characteristics of the CCD camera that make it so ideal as an ENG tool. First, let's dispel a myth. Some CCDs do have lag, but the top-of-the-line units offered by the major manufacturers are, for the most part, completely free of this problem. There are no burn-in problems with the CCD, and, since there are no yokes or power supplies—nor are there tubes—the CCD camera is much lighter. It also consumes much less power per operating minute than does a tube camera, two prime considerations for an ENG outfit.

Perhaps more importantly, motion shooting is better with a CCD camera, and it is impervious to magnetic, electrical, and physical vibration disturbances. Setup and maintenance are far easier with the solid-state camera. In addition, many operators feel that the chips provide a cleaner black than tubes, given that the black fades as the tube begins to age, whereas CCD cameras can balance black just as well as white.

This discussion relates, also, to the differences between the two technologies when it comes to static and dynamic resolution. Static resolution, in which tubes are superior, is determined when the camera and/or the subject is standing still. Dynamic resolution, however, is where tubes begin to show blur and lag difficulties as, typical of ENG subjects, motion is quite commonplace. One of the ways CCD designers solve motion problems is to incorporate an optical shutter, often electronic but not necessarily, to reduce exposure time and thus minimize the effect of lag and blur.

## Physics primer

To closely examine how these characteristics come into play, a look at the engineering design of the chip is appropriate. Solid-state sensors can take several forms, though the most popular in broadcast cameras has certainly become the CCD. While tubes use a photoconductive sensor, the solid-state chip uses a photodiode to collect the light. There are currently two basic types of CCD technology used in today's cameras: frame transfer, with separated optical and storage areas, in which the transfer takes place during the blanking interval; interline transfer, in which the optical and storage areas are interleaved on the optical surface.

There is also a third type of configuration, rapidly becoming the most sought after. It is a combination of the two technologies, referred to as frame-interline transfer. The advantage of the hybrid technology is that it allows the designer to avoid the use of a mechanical shutter, required with a frame transfer device in order to avoid vertical smear, while still benefiting from the assets of separate storage in the frame transfer device.

Preceding the development of the interline and frame transfer chips was the X/Y configuration, a sensor in which each pixel consisted of a photocell and an MOS switch. Some MOS transistor sensor technology has been used in the past (most notably Hitachi's SK-1, though Hitachi now offers two CCD models), but MOS types are less sensitive because of a higher noise ratio.

The basic operating principle of image sensors is gathering, storing, and transferring. To do this the sensors convert incoming light into a charge. The electric signal, proportional to the intensity of incoming light, is created by a photodiode converting incoming light into photoelectrons. The charge produced by this light is temporarily stored. This is accomplished by the capacitance of the depletion layer of the photodiode. The third stage is to transfer the charge to a charge-coupled shift register in preparation for output.

There are critical differences between the two fundamental technologies in the way in which the signal is read out. The interline chip transfers the charge into a vertical shift register, which shifts, line by line, into a horizontal register and from there to the output. The frame transfer device, on the other hand, has an upper portion that holds the photosen-

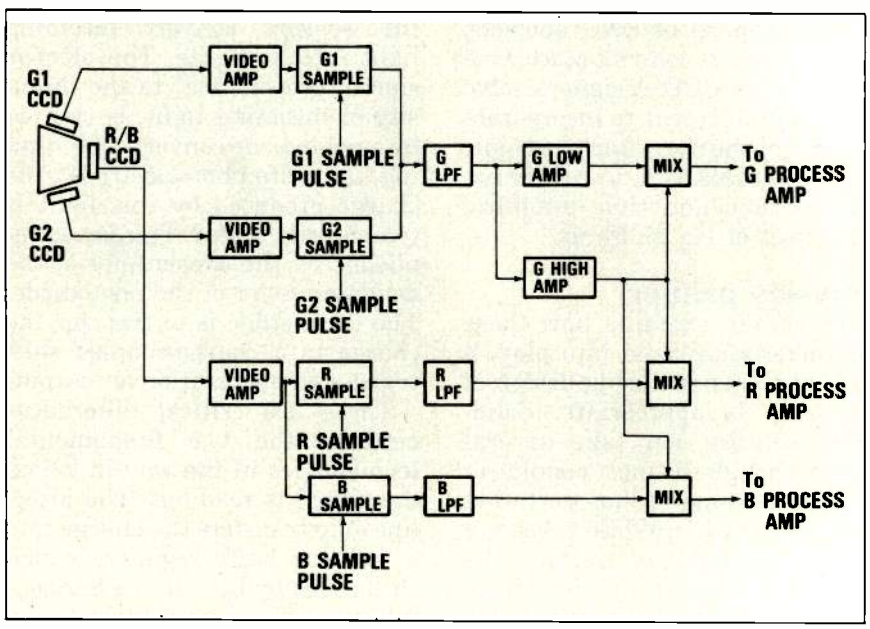
sitive imaging area with the lower part acting as the storage area. The photocell, in the upper portion, is also a readout element, and the charge is clocked out from the image area to the storage area very rapidly during frame blanking.

The physics of respective designs also cause performance differences. The frame transfer device, for example is more sensitive due to the greater surface exposure of the photodiode, whereas the interline device is only 35 percent exposed since it is interleaved with the vertical (readout) register. Thus, in any given area, the frame transfer chip can expose more pixels to light, thus giving greater resolution. To state the obvious for all charge-coupled devices, the more pixels located on the chip, the greater the resolution. This is the current design and manufacturing challenge: to fit more pixels onto the same ⅔-inch imaging area. This is why some people have been more attracted to the frame rather than the interline transfer (though Sony claims to have 10,000 interline transfer BVP-5s and DXC-3000s in the field).

The drawback on the frame technology, as already stated, is its requirement for a mechanical shutter to eliminate vertical smear. This is accomplished by the mechanical shutter blocking out any incoming light during transfer because that extra charge will clock into the vertical transfer and cause a streak. If incoming light is blocked during transfer, the speed with which the charge is clocked to the horizontal register prevents smear.

In the hybrid frame-interline CCD, the very rapid clocking out of the charge helps to eliminate the trickling charge that would appear as a vertical streak. Also, the electronic shutter incorporated into cameras of this design will electrically "throw away" the extra charge as it enters during the vertical readout. NEC was the first to incorporate this type of technology, in the SP-3A, but Sony has just announced its BVP-50, which bases its design on the frame-interline transfer with use of an electronic shutter. Also just announced, Panasonic has developed a frame-interline unit as represented by the AK-400. Ampex, too, recently unveiled its CVC 50 incorporating frame-interline transfer.

It should be noted that although the interline device, the other transfer technology being discussed, is supposed to be free of vertical smear, the reality is that charge leakage resulting from insufficient shielding of the transport pixels causes a similar flaring effect. Halation, a phenomenon very similar to smear, is caused by excessive light saturation and is commonly known as blooming. This can be compensated for by designing into the photocell an overflow well that, with the growing level of light saturation, accepts the overflow charge and dissipates it into the substrate rather than letting it be read out into the register.




Video system diagram of the SP-3A colorcamera, which uses two green channels. The figure also shows the mix of channels wherein the green determines resolution.

## Plus and minus

Though these characteristics of the CCD make it ideal for ENG applications, no technology is without problems. In fact, along with the various advantages of the CCD come some difficulties. It is, for example, the sensors themselves, in sampling, that cause aliasing or moire due to inherent inadequacies in sampling technology. The work being done on CCDs, in addition to fitting more pixels onto the chip, is targeted toward reducing some of the inherent weaknesses of the technology. Some of this is done in the research lab, while some of the efforts take place within the camera itself. It is here that spatial-offset technology comes into play.

Beyond the physics of the actual charge-coupled device, one of the challenges in putting the imaging sensor into practical use involves its installation into the camera itself. All CCDs get glued directly to the prism block. This is a task that must be executed with precision and care or the incredible advancements in solid-state physics will be wasted. In addition to improving luminance resolution and aliasing characteristics, registration and stability are absolutely dependent upon the accuracy of the chip mounting.

Indeed, CCD attachment is one of the toughest battles in CCD implementation and is handled differently by different manufacturers. Some do it themselves, others have optics companies do it according to a specifically designed process. NEC, with a 390-pixel

# WHAT HAS 5 VTR'S, 2 ROBOTS, 3 ROTARY LIBRARIES, 1,184 CASSETTES, A COMPUTER, THE ABILITY TO PLAY 15-SECOND SPOTS BACK TO BACK CONTINUOUSLY, IS AVAILABLE NOW,

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horizontal resolution, uses double green imagers and spatially offsets the two chips so they are interleaved by a half pixel, doubling the effective horizontal green sampling rate. This forces the use of multiplexing for the red and blue—incorporating a sampling filter—so the sampling is halved, resulting in a sampling ratio of 4 to 1 green to red or green to blue.

Larry Thorpe, Sony's director of studio product management, explains that "Sony's chip has 510 elements and uses a conventional RGB approach where the red, green, and blue chips are glued to different ports on the prism. The red and blue chips are carefully placed so that the pixels are aligned in space and there is no offset between the red and blue. The green, however, is offset horizontally by half a pixel. Thus, green pixels are interleaved by a half pixel with both red and blue. The luminance (black and white) information is a linear function of green plus red plus blue, resulting in the luminance aliasing being reduced to less than color aliasing."

Another pragmatic manufacturing obstacle relates to the universal goal of increasing resolution by increasing the number of pixels. This is a manufacturing problem because the technology is there to do it, but the precision of placing the increased pixel count into a ⅔-inch imaging area requires very exacting quality control and thus high cost. In fact, Kodak, NEC and others have shown experiments in CCD monochrome systems with something very close to HDTV resolution.

Yet, there remain design obstacles. When the number of pixels is increased, vertical streaking, noise, and shading problems can become more prevalent due to the overwhelming task of quality control on a higher order. Nevertheless, if history continues its course, the processes will catch up with the demands, prices will come down and, within a few years, a very high-resolution CCD product will be on the market.

As a final but no-less-important engineering consideration, noise in CCDs should be mentioned. The CCD is more complicated as a system than the photoconductive tube, therefore noise becomes an important consideration in the system. Generally, two types of noise can be loosely related to the CCD: random incoherent noise and coherent or static noise. Depending on design and camera implementation, either type of noise may be more obvious.

Random noise is a mixture of shot noise, thermal noise, and semiconductor noise—these are device dependent. Coherent noise can be a direct result of mechanisms within the device. Extremely high-speed digital clocking is required to drive CCDs, signal output levels are low, and camera front-end problems like complex ground loops and clock crosstalk are more difficult to handle than the equivalent systems in a tube camera.

A brief explanation, paraphrased from Sony's Larry Thorpe, follows regarding noise in the three stages of the CCD's function. It should be noted that these are generic characteristics, not confined to any individual manufacturer's product, but inherent in CCD technology.

In the CCD, input mechanism noise due to the random nature of photoelectron collection over a small interval of time is known as photon or shot noise. As is true with the pickup tube, this is proportional to active signal level. Thermal noise associated with the input resistance of the charge injection circuit is also a factor in this evaluation.

The second stage of CCD operation, the charge integration and transfer function, finds noise known as bulk-state noise associated with buried-channel CCDs. Here is also the important dark-current noise—a mechanism stemming from thermal generation of random-hole electron pairs in the bulk depletion region and the semiconductor insulator surface.

The final stage, the output, is subject to a capacitor-reset noise arising from the random variation of reset levels of the CCD readout switch that charges a capacitor. An additional noise source, unique to the solid-state sensing array, is fixed-pattern noise, which manifests itself as a fixed nonuniform spatial background in the reproduced image. This type of noise is a result of dark-current nonuniformity between pixels. Consequently, manufacturers strive to minimize and equalize the individual pixel dark currents, and the success here is one of the keys to the dynamic range of the CCD sensor.

## In the field

All the technical discussions about resolution, smear, and noise are, of course, important and necessary to evaluating the technology, but where it all counts is in operation. How does the cameraperson use the camera? Is it harder or easier to acquire the images the team set out to capture, and does this affect the quality of the pictures gathered?

The answers lie in three areas where CCDs are clearly superior: size, weight, power consumption. These add up to an easier, more efficient camera to operate and, thus, better pictures. The weight of the camera is very important for long or arduous shooting since fatigue will cause a camera operator to shoot less efficiently and be generally less responsive to events.

Even beyond the pragmatic analysis of how easy and efficient it is to use, setup and maintain, it is clear that the image quality of today's CCD camera is truly good. It is certainly of a high enough quality to satisfy ENG requirements, and, with the market anxiously awaiting each new CCD development, the manufacturers are exploring superior imaging devices that will soon put questions about CCD image quality to rest. The cameras will be light, efficient, durable, and produce beautiful pictures.

Some manufacturers are rumored to already have studio-quality prototypes ready. Meanwhile, the charge-coupled device appears to be the technology of choice for ENG. **BM/E**

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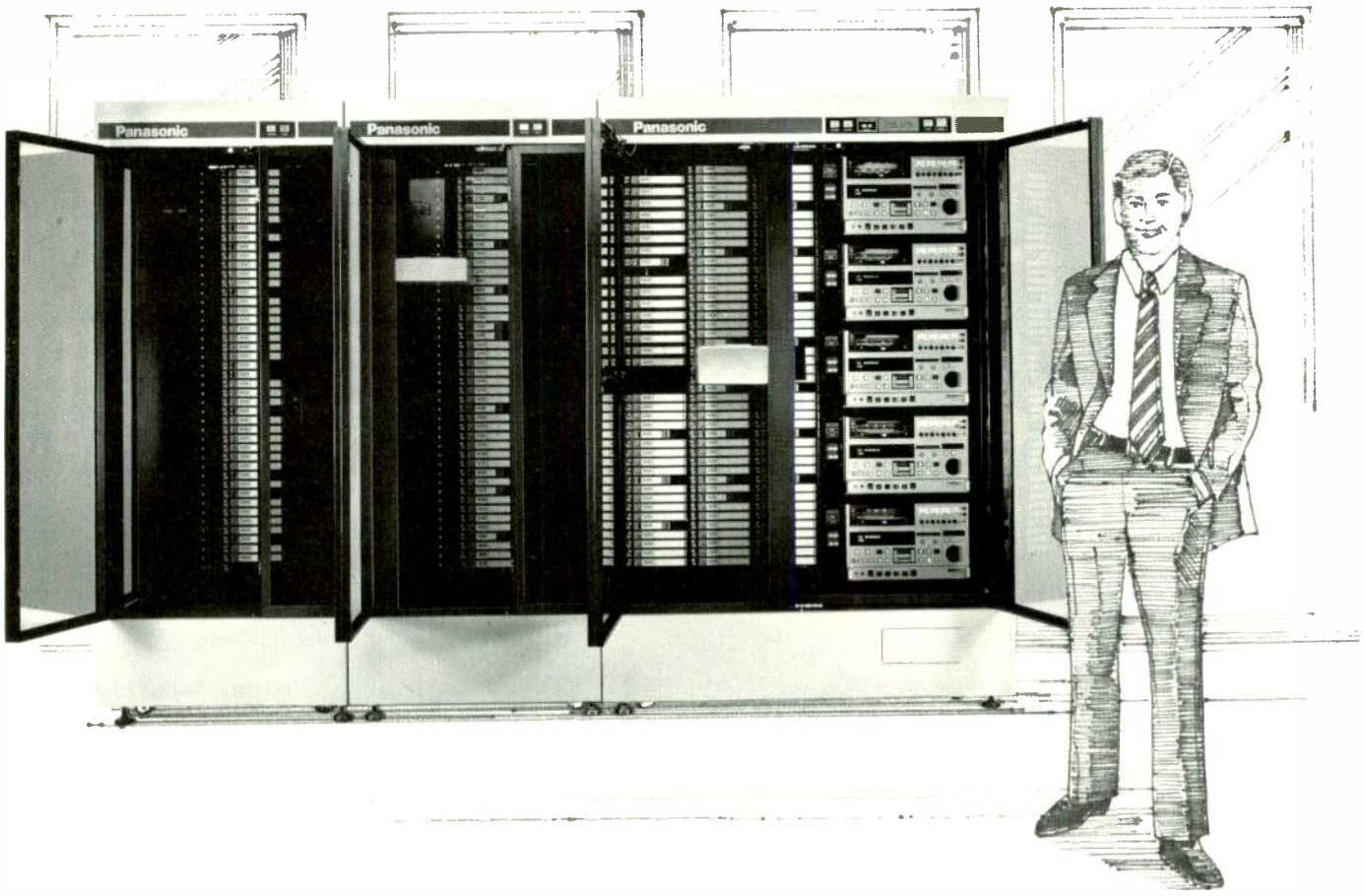


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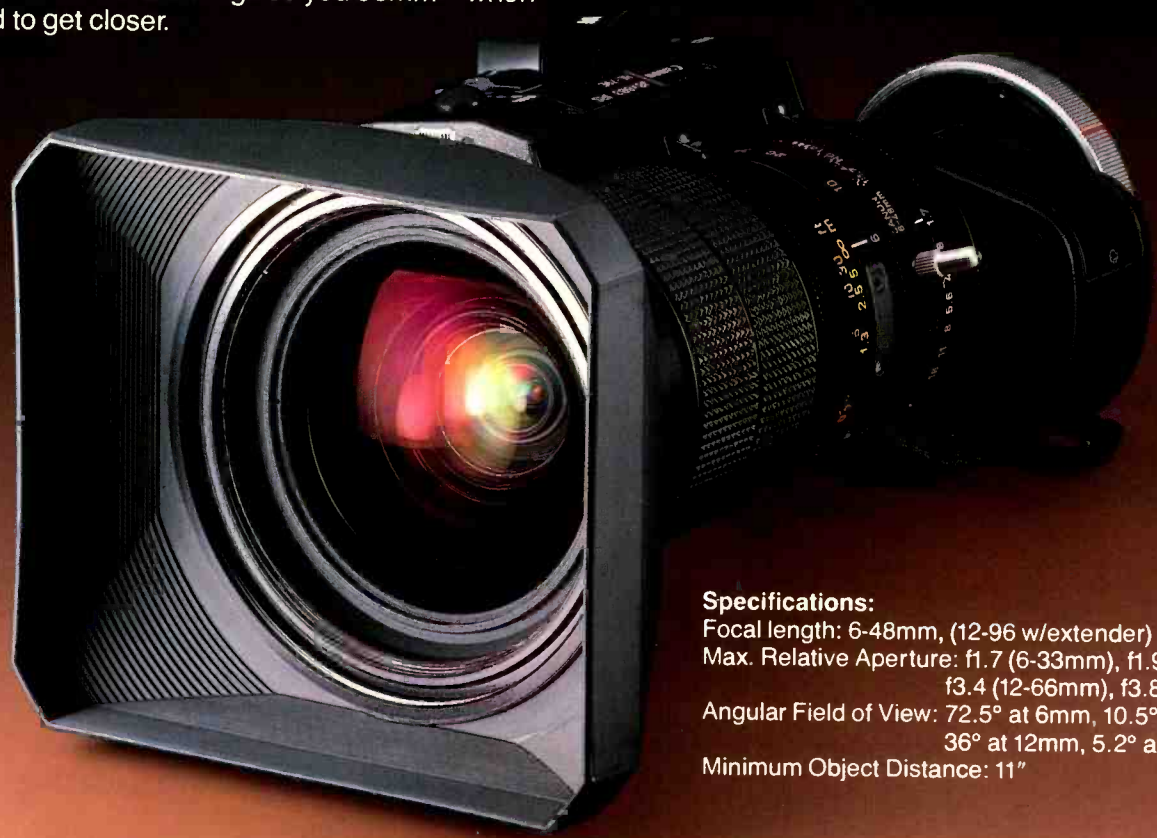

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# LENSES: MAINTAINING YOUR IMAGE

Time. That luxury that is so fleeting in an ENG environment is the one thing a camera operator can't afford to lose due to improperly maintained equipment. If the moment is lost, so is the news. That's why, in today's high-voltage news operation, maintaining the ENG/EFP zoom lens is of utmost importance, especially as cameras and pickup devices get better.

The operator can't afford to notice, suddenly, that the image quality has vanished by magic. If the camera is more than a year old, the chances are the zoom lens that's mounted to it is producing images of lesser quality than its original, peak performance. And it may have happened slowly if periodic checks were not part of a maintenance routine. After a year of use, all three basic components of the lens are probably impaired as a result of being exposed to the harsh life of newsgathering.

Often, the optics will get scratched or coated with fingerprints and dust, reducing both resolution and contrast. Also, the mechanics of the focus and zoom gearing will be filled with dirt particles, keeping them from effecting a smooth movement. The electronic controls, in addition, may have been subjected to moisture, causing a potential loss of both zoom and iris functions. With a working knowledge of the functioning of a zoom lens, it can be kept at peak operating efficiency regardless of the environment.

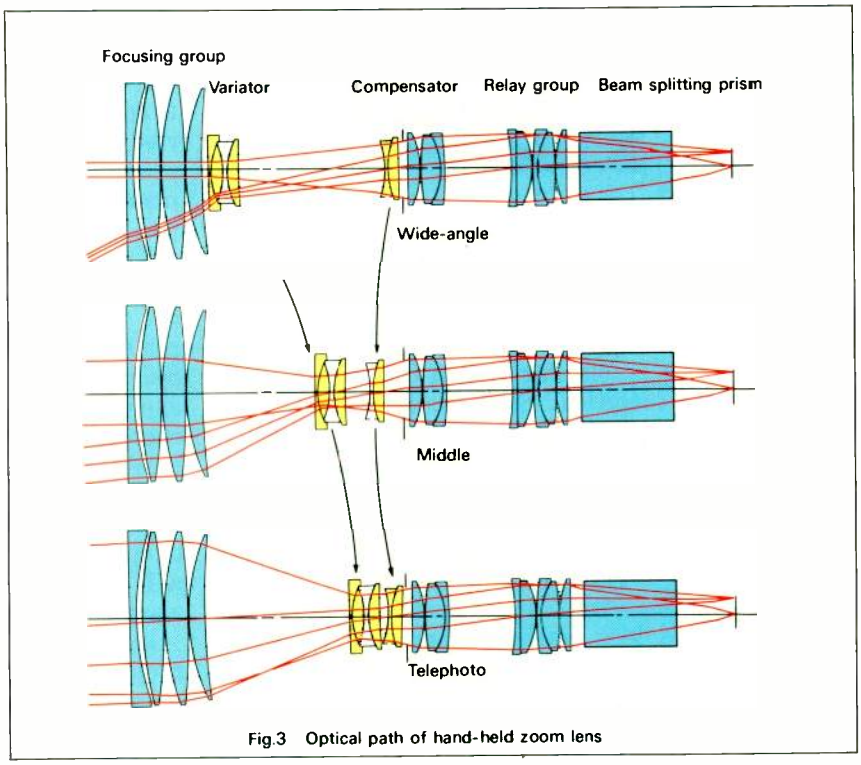


Fig.3 Optical path of hand-held zoom lens

Drawing showing optical groups and light path of typical ENG/EFP zoom lenses. Further information is available from Canon's TV optics book.

*In the rigorous ENG environment, great demands are made on all equipment. Lenses, as part of the original image capturing device, are among the most important and most delicate elements in the entire system. Maintaining the properly chosen zoom lens is one of the essentials of today's ENG engineering picture.*

## Basics first

Since, in many technical operating environments, many items can be named something different, it serves a purpose here to define the zoom lens and its critical elements. By definition, a zoom lens is "a precision electro/opti-

cal/mechanical system, which can change its field of view without noticeably changing its aperture or focus. This is made possible by the use of complex cams and followers controlling precisely designed and manufactured optical components."

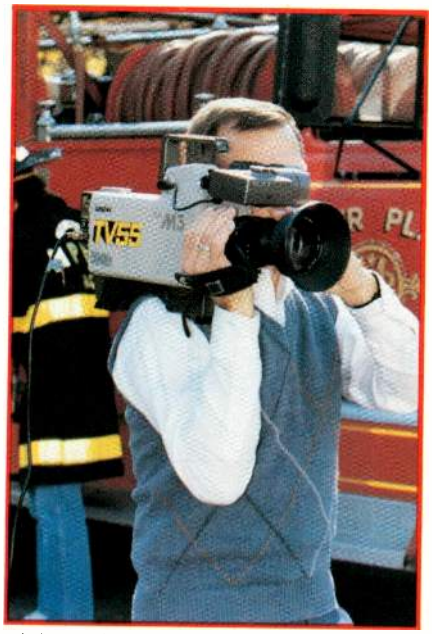
The zoom lens itself is made up of four optical groups. The first group is usually referred to as the focusing group, with its function being to gather the incoming light rays in order to bring them into focus. The second and third groups are the two internally moving sections. The section that moves to vary the image size is called the variator. The other moving section of the lens is the compensator, which moves in order to maintain focus and reduce the aberrations created by the variator changing the field of view. This fourth group of optics serves as the prime lens, i.e., to focus the image onto the pickup device (tube or CCD).

The zoom and aperture are controlled by servo motors attached to the lens. Gears transmit the torque delivered by the motors to smoothly change the zoom and aperture barrels to the position required by the camera operator. The motors, in turn, are controlled by zoom and iris circuit boards and switches.

## Maintenance second

To keep the lens in working order, it is essential that the lens be considered as a system. And there are many ways to ensure smooth operation. The simplest preventive maintenance procedure is to keep a clear filter and sunshade mounted on the lens at all times. The clear filter is the least-expensive insurance policy for protecting the expensive front element.

Tony Catalano, zoom lens technician at Canon Broadcast, has seen many lenses come into his service facility with scratched and broken front elements that could have been avoided with the inexpensive clear filter. "I have seen repairs in which the second elements have been destroyed, chipped, or fractured because the first element broke and impacted upon the second element."



This photo, taken by Jack Kanakaris, shows an ENG zoom lens in a typical environment: covering a fire scene.

Similarly, Ron Cotty of E.N.G. Optical Services in the Denver area, who was factory trained by most of the television lens manufacturers, also believes that a clear filter should always be kept on all ENG/EFP zoom lenses. "The few dollars spent," states Cotty, "for a clear filter can save a lens owner somewhere between two to three hundred dollars for a replacement front element."

Other maintenance tips recommended by Cotty are periodic tightening of all screws to keep the parts working well together and using a toothbrush or paintbrush to remove dirt rather than using compressed air. Cotty feels that compressed air may force dirt into the internal workings of the lens. Once this happens, the dirt compounds with the zoom lubricant and causes the focusing to be "raspy."

Further, electronic repairs should be approached with caution. Eric Rojack, field service engineer at Fujinon, emphasizes that "the zoom and iris servoes are electrically aligned to the zoom and iris gear ring travel. When removed and reinstalled, they must be electrically realigned." He also warns against attempting to lubricate a zoom lens with commercially available lubricants, which may cause more problems in the binding movement. The correct lubricants are specialized and not available through regular outlets.

Internal contamination, evident in a dirty lens that starts to bind, should be treated at a factory authorized service center. As a preventive measure, a zoom lens should be overhauled every year to year-and-a-half. The lubricants will dry out, even if the lens is left on a shelf under normal room temperature (in about two years), thus requiring cleaning, lubricating, and adjusting. The time period for overhaul and the behavior of a particular lens will depend upon the lens itself and the type of use to which it is subjected.

This brings up the question of environment. In temperatures all the way down to -20 degrees F, regular lubricant will suffice. Should a lens be required, however, to function in a colder environment, special lubricants must be obtained from the service facilities of the lens manufacturer. Once the lens has been modified to operate in very cold weather, it will not function normally in warmer temperatures.

Another common maintenance problem encountered in normal zoom lens use is that of moisture. Of course, encountering rain or snow is not unusual to an ENG crew, and operators will often notice that moisture has entered the lens. The first step is to wipe off the external moisture with a soft, dry cloth and then seal the lens in a plastic bag with silica gel or other desiccant to dry it.

Often, no internal leakage will be noticed after exposing a lens to rain or snow. In this situation it is best not to run the zoom at a high rate of speed because the zoom gear may spread the water collected in it to the iris and zoom amplifier boards.

The manufacturers, of course, realize the typical use of ENG lenses and have designed weatherized servo housings with funnels and drainage ports surrounding the zoom control and rocker

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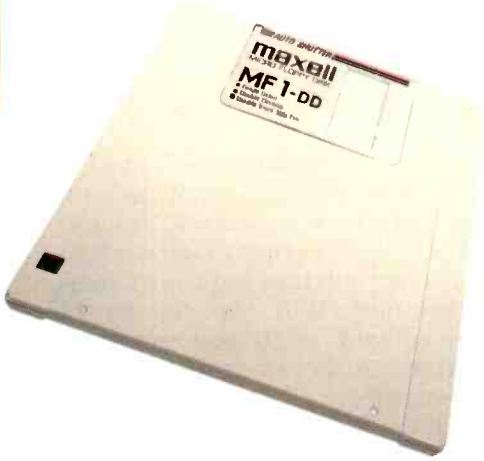
For example, suppose you've spent a fussy 55 minutes adjusting your cameras for absolute perfection in tight closeups, for a special on kids and pets.

But as soon as you start shooting, the on-camera narrator becomes very ill and you have to reschedule. This leaves you not feeling so well yourself. Because you know, in a day or two, you'll have to create that look again.

No problem -- with Hitachi's system. Setup and adjustment data from as many as six cameras and 32 scenes can be filed on a single floppy disk. You can automatically set up your cameras again anytime -- *exactly* the way they were. About two minutes is all it takes.

Other computerized camera systems can't do this. Only Hitachi has the software and the




built-in floppy disk drive that does it. On-board micro-computers in Hitachi's SK-970D and SK-97D cameras exchange data with the disk.

Think of the advantages. You can file and re-use camera adjustments that flatter the complexions of specific talent. You can match and keep on file the look of any continuing series.

The bottom line is -- you save time. You add to effective production time by cutting down setup time.

That's why a major network

**SU-97D**
**Auto Setup Control Panel**
- Built-in 3.5 inch floppy disk system
- Data Transfer between files
- Lens extender display
- Numeric keypad for file selection
- Camera number LED display

**Hitachi SK-97D**
- Zero method auto setup
- S/N 60dB
- Real time registration compensation
- 2/3" MS LOC DG Plumbicon tubes
- Triax Capability - 10,000 feet

bought 47 of the first SK-970D's and SK-97D's.

Call us for a demonstration. See our Zero Method automatic setup camera system with the built-in disk drive and many more Hitachi features that solve problems and save time. Call now.

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switch, and they have also incorporated plastic covers for the circuit boards.

Even with all this protection, some moisture is likely to infiltrate the servo housing and come into contact with the zoom and iris amplifier boards. Though the amount may be small, the moisture will evaporate leaving a sediment that will eventually short the ICs or transistors. Since this is a gradual deterioration, the process may not be noticed immediately, but will eventually force the lens onto the bench.

## Zoom techniques and maintenance

Since a zoom lens is essentially a variable focal-length lens, it is easiest to focus at the longest focal length. It must be understood that the longer the focal length, the less the depth of field or, put another way, the more sensitive it is to selective focus. Once the exact focusing distance has been established, then the focal length can be determined, by zooming back from the long focal length to the widest, stopping at the most suitable point.

In order to establish smooth zoom and focus movements, both the focus and zoom rings should be turned throughout their entire range, allowing the lubricant to be distributed evenly. This should be repeated several times, when starting to use the lens for the day, and especially when the lens has not been used for some time. When attempting to zoom manually, always make sure that the servo is disengaged. If the servo is engaged and the zoom barrel is turned, this could cause damage to both the motor and gears.

When an ENG crew has to ship a lens, a sturdy shipping case with the proper shock insulating material should be used. It is always best to remove the lens from the camera when shipping long distances. More important, a zoom lens should always be shipped with the focus set at infinity and the zoom set at the minimum focal length. Thus, the glass elements of the variator and the compensator sections will have the maximum separation, eliminating the possibility of them hitting and cracking due to a rough shock.

## The perfect lens

Choosing the correct lens for the job requires determining the parameters of potential use. Aperture, focal lengths, zoom range, close focusing capability, size, weight, and cost are some of the considerations to be taken into account. Other questions to be addressed are: What light conditions will the camera be likely to experience? What distances will the camera be working with most of the time? Will most shots be wide or tight from a distance, or both? Will subjects other than people be covered; will they require extreme close-ups? Will the camera be hand-held or tripod-mounted? Where in the world will the lens be used?

Schwem Technology's image stabilizing 60-300 mm zoom lens mounted on an ENG/EFP camera.

If the lens is to be used to cover subjects in low light level situations, a higher aperture is an obvious requirement. A camera equipped with a f/1.8 lens needs 75 percent more light to make an equal-quality picture to that of the same camera equipped with a f/1.4 lens. The ramping of the maximum aperture must also be considered in choosing a lens. Most zoom lenses made today do not have a constant aperture and therefore ramp down to a lesser aperture as the focal length is increased.

As an example, a 14 to 1 zoom has an aperture of f/1.7 at all focal lengths between 8 and 91 mm. The aperture then ramps down to become f/2.1 when it reaches the maximum focal length of 112 mm. Lens designers incorporate ramping maximum apertures as a means of keeping the size and weight of a zoom lens to a minimum while extending their range of application.

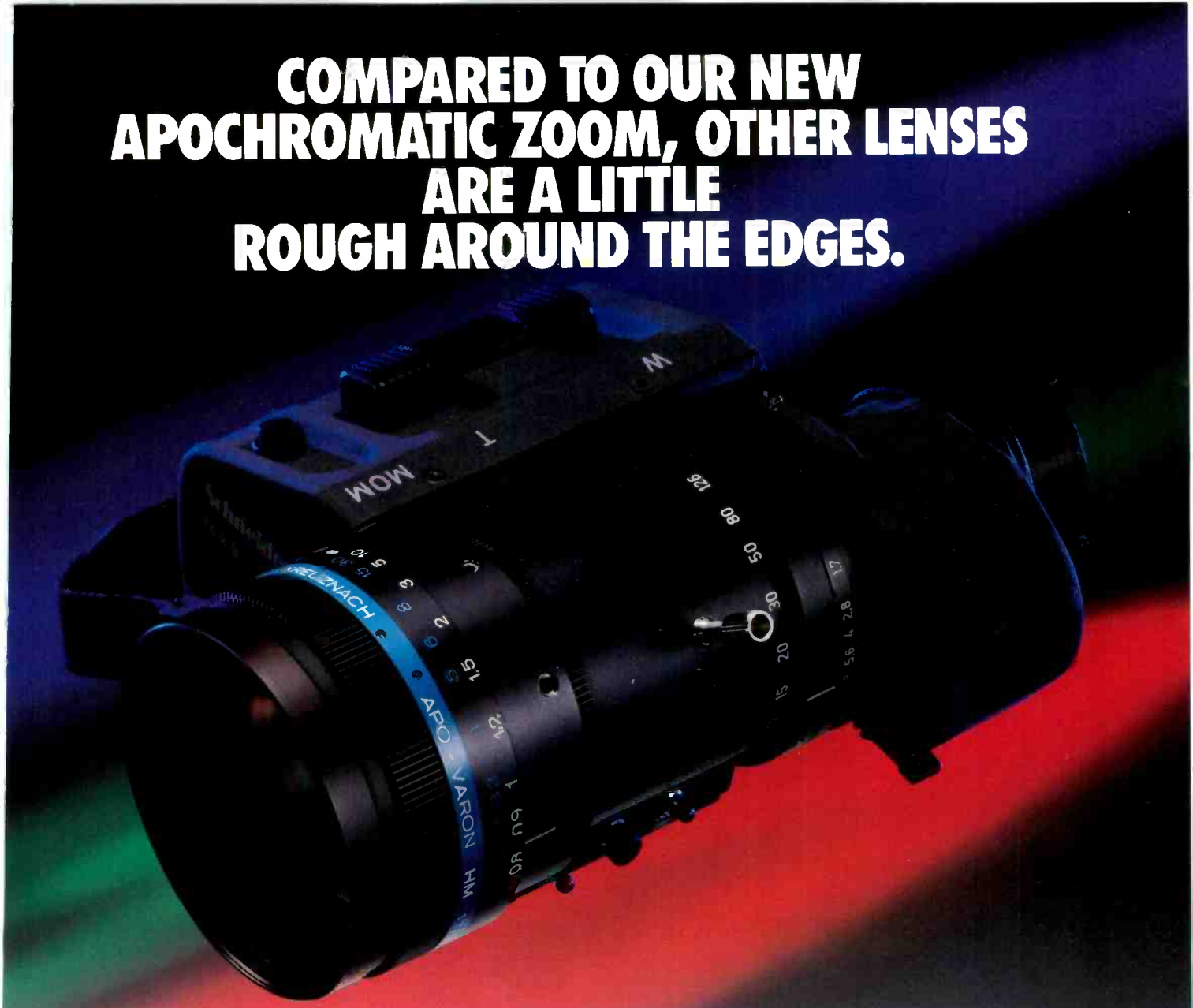
Cameras, too, affect lens choice. Most prism-type cameras now in production have prisms that will pass light at a maximum aperture of f/1.4 and, therefore, a lens with an aperture higher than f/1.4 will be of no benefit. The higher aperture lens brings along with it larger size, weight and cost. Besides, normal zoom lens focal lengths, ranging somewhere from nine to 153 mm, will cover the majority of subjects in most assignments.

Modern zoom lenses now offer everything from extreme wide-angle zooms from Canon and Fujinon that start with a wide 5.5 mm (77 degrees, 19-feet by 61-degrees, 55 feet) with an 8.5 to 1 zoom ratio all the way up to the longest range 50 to 1 that provides everything from wide angle to extreme telephoto (9.5-475 mm). In addition to its super long range, this zoom boasts an extreme f/1.4 aperture. Both Schneider and Angenieux provide quality lenses of this type.

The 5.5-47 mm wide-angle zoom is ideal for hand-held work or for maneuvering in very tight areas, while the 9.5-475 mm is best suited for sports and field production. The lack of longer focal lengths for greater magnification is a trade-off for the wide-angle zoom and the size (19 inches in length) and weight (35 pounds) are considerations for the long range 50 to 1.

Most normal zoom lenses permit focusing at all focal lengths at approximately 0.8 m (31.5 inches). Wide-angle zoom lenses will focus as close as 0.3 m (11.8 inches), while the long range zooms, on the other hand, focus to about 0.9 m (35.4 inches). It should be noted that while a macro function may allow focusing to the front of the glass of a zoom lens, it does not permit zooming or changing of focal lengths without refocusing the

# COMPARED TO OUR NEW APOCHROMATIC ZOOM, OTHER LENSES ARE A LITTLE ROUGH AROUND THE EDGES.




Chromatic aberrations. They can cause loss of picture detail. Color fringing. Poor color registration.

The introduction of broadcast CCD and high quality tube cameras means compromises like these are no longer acceptable in zoom lenses. To meet these new and demanding camera specifications, Schneider introduces the 14X APO-VARON HM ENG/EFP Zoom.

The 14X APO is a major leap forward in TV zoom technology. Its true apochromatic design focuses the image formed in the three primary color channels in precisely the same image plane.

The result is rather eye-catching. Both longitudinal and lateral chromatic aberrations are significantly reduced. MTF is increased, and picture quality is greatly enhanced.

Lightweight and compact with a sturdy weather-proof housing, the 14X APO is the type of rugged performer you'll value for other reasons, too.

It has a 2X extender, macro focus, and a unique servo iris control built into the zoom pistol grip. The 14X APO is available with positional servo focus. And the lens accepts a wide range of EFP accessories, including an aspheric attachment for superwide fixed focal length.

So if you're concerned about your image, do something about it. Get Schneider's new 14X APO-VARON Zoom.

For more information or a demo, contact: Schneider Corporation of America, 400 Crossways Park Drive, Woodbury, NY 11797, (516) 496-8500.

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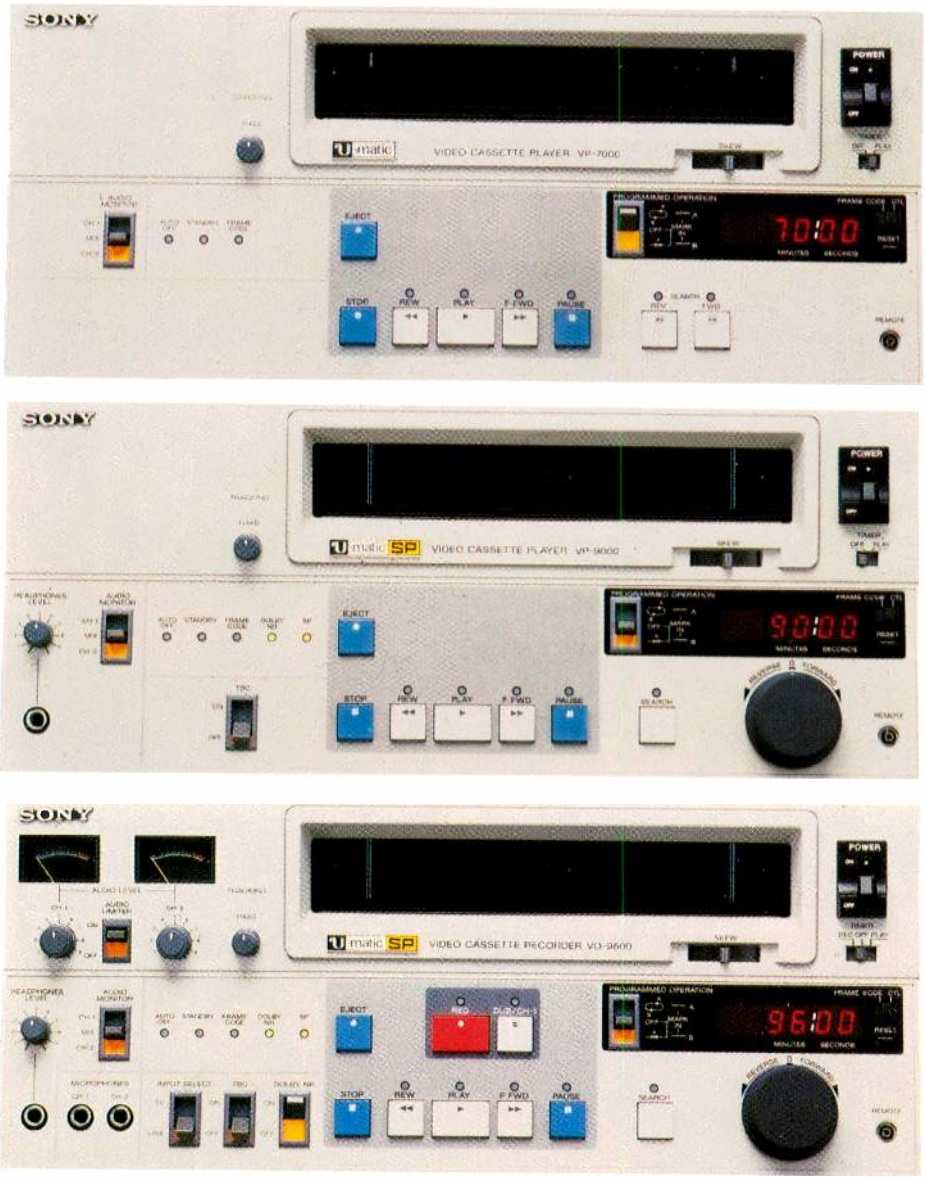
**Circle 115 on Reader Service Card**

# When it's time to move up from U-matic, move up to U-matic.




Some video experts would have you believe that the only way to upgrade your video equipment is to throw it out and start over.

At Sony, we see it differently. And you will too when you see the new TYPE VII and TYPE IX series of U-matic players and recorders.

Not only are they compatible with your existing U-matic equipment, they offer performance that until now you could only get at twice the price.

For starters, you get SP technology on the TYPE IX models, which means superior picture quality on both originals and copies. You also get a new form of absolute address called Frame Code. As well as a computer interface which lets you preset players and recorders to start and stop at certain times.

More impressive, however, is the price. We've designed these U-matics to fit into your budget as easily as they fit into your facility.

To learn more about TYPE VII and IX, or to attend a Sony video workshop, please write to Sony, P.O. Box 6185, Department U-4, Union, NJ 07083.

With U-matic, moving up to a new standard in video could be as simple as opening a box and plugging it in.

SONY

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macro mechanism lever. Magnification is limited with macro focusing as the closest focusing in the macro mode is only possible when the lens is in the wide-angle position.

In addition to how a lens is used, where it is used is also important. There are two separate questions to be addressed here. One is: what type of environment will the lens be exposed to? Extremes of humidity, temperature, blowing sand, and other hostile conditions affect the answer. Some lenses offer sealed servo housings that will resist high humidity (rain and snow, but not a dunking) and sand and dirt. These seals may also keep the internal lubricants from mixing with dirt particles.

The second question is where, geographically, the lens will be used. Critical here is whether or not a service facility for the type of lens exists in the part of the world where the lens will be used. All lenses require maintenance at periodic intervals so proximity to a service center becomes critical. A good professional service organization will not necessarily have the criterion that the lens manufacturer has a branch in a local city, but it does require technicians at the facility to be factory trained and have factory drawings and tools.

Further, a professional zoom lens technician will be familiar with all groups of the optics and mechanics, as well as the electronic parts and should have the expertise to make adjustments to the variator and compensator without having to return those parts to a factory branch. Besides having the proper spanner wrenches and other hand tools, the service facility will be equipped with both a collimator and a lens test projector. The collimator is an optical instrument for measuring focal lengths.

## New technologies

In the past few years there have been important advances in zoom lens technology. There has been, in addition to extreme wide-angle zooms and extreme long-range zooms, both a size and weight reduction. With the recent advent of CCD cameras, the lens designers have a new challenge. Since, in a CCD camera (see accompanying story, "CCD = ENG," p.00, this issue), the chips are affixed to the color-splitting prism directly, and since the red, blue, and green wavelengths have different focal points, the modern zoom lens must be corrected for longitudinal chromatic and lateral chromatic aberrations.

Presently, no lens is totally free of these chromatic aberrations, however, the new breed of zoom lenses is designed to minimize and control aberrations throughout the entire focal range. In addition, new lenses have a high-flat modulation transfer function (MTF) in order to match the performance of the CCD. A serious problem now exists in that there are different types of prisms in use, necessitating different types of lenses to match the particular prism being used in the camera.

For the near future, new lenses with higher apertures can be expected to match the new high-aperture f/1.2 prisms. Until recently there was no advantage to using a lens with that high an aperture. Yet, with the advent of the f/1.2 prism, several high-aperture f/1.2 lenses are already available. Having a very high aperture demands a large diameter, which translates to a rather large lens, perhaps too large for ENG and some EFP purposes. Just as the present normal zoom lenses have been reduced in size and weight, it seems clear that the high-aperture lens will follow the same path.

Specs for the new ultra wide-angle Fujinon zoom: 8.5-47 mm, f/1.7, and a minimum object distance of 0.3 m.

Another innovation in lens design from both Angenieux and Schneider is the recent introduction of continuous focusing from infinity to virtually the front glass in broadcast lenses. This close-focusing system uses a microprocessor to move internal lens elements into focus beyond the normal focusing capability of the front focusing group. This will certainly be an aid to the ENG/EFP field if it is made available in smaller portable lenses.

In other technological advances, Schwem has found acceptance for its image-stabilizing zoom lens. It is a 60 to 300 mm zoom that incorporates a built-in gyro that stabilizes the light path of the lens rather than the entire mass of the lens and camera and results in a much smaller, lighter package. Eliminated are the high-frequency vibrations found in aircraft, boats, autos, or even some hand-held work. Like all gyro systems, panning movements must be slow and planned since, once the pan is initiated, it will continue in that direction and requires practice in order to terminate it smoothly.

Whether a station chooses to buy into the newest technology or whether an ENG outfit is equipped with older lenses, the knowledge of the basic parameters of zoom optics will assist in imaging performance and maintenance of the lens. Often, the best source of information is the manufacturer of the lens in addition to other users. Also, there are many manuals available on the theoretical and practical aspects of optics. All these sources should be helpful in maintaining your image. **BME**

**About the Author:**
For more than 12 years, Bern Levy served as a director of photography for both NBC and United Technology Research Labs. Over the past 20 years, he was involved with technical marketing for Angenieux motion picture and television optics.

# The NBC Satellite Experience Part II

**By O.S. Paganuzzi**

*Technological advancement was the desired goal of implementing the NBC satellite system, but operational and financial justifications were always of first priority. To this end, system milestones were set in order to gauge progress and test the validity of projections.*

Perhaps the most dramatic move in the decision to go forward with the NBC Skypath project was the choice by the satellite task force to use the Ku-band distribution system. Steering the project along this path was done for a number of reasons. First, it was obvious that Telco costs would escalate due to the imminent divestiture of AT&T. Even if the costs remained at 1982 levels, however, many affiliates would have been dissatisfied with the performance and flexibility of the service then being provided.

A second factor behind the project was that, beyond rising costs for existing operations, our projections for expansion would cause even greater cost escalations. Among the elements in our expansion plans were stereo distribution, improved on-site newsgathering, and corporate communications. An added pressure to all of this was that implementation of the new features of the network would require extensive lead times.

## Satellite decision

Considering all of these relevant factors, alternate distribution methods were examined but only satellite distribution was determined to provide any practical

**Editor's note:** *Part I* (BM/E, *November 1987, p. 69) gave the reader a chronological report on the conception and development of the NBC Satellite Distribution System. This second installment offers a more detailed discussion of the components and systems used in the network.*

advantages. Even satellites, however, presented many shortcomings. The common consensus was that only C-band distribution, with tightly budgeted rain-fade margins, was practical and dependable. Yet our own investigations determined that even C-band systems presented their own unique set of problems that could make them unwieldy in the future.

Physical surveys of potential earth station sites near Manhattan reinforced concerns for the high costs resulting from C-band site sizes, environmental needs, structural demands, and signal-interference problems. As determined by the task force, the only reason for using C-band lay in the lower values of rain-fade margins. It appeared, however, that Ku-band, with proper design, would answer to all criteria even though it was evident that outside, expert opinions were necessary.

In response to the issuance of a request of information, Comsat General submitted a proposal for a Ku-band model projecting a signal availability of 99.99 percent. This bettered our existing 99.98; that .01 percent variation represents an outage of approximately 53 minutes on the network. The model specified antenna sizes, geographical locations, transmit/receive budgets, transponders, and it indicated, as well, that a Ku system was "doable" and proper for our approach.

The final concern was with the statistical probabilities employed by Comsat in their loss calculations. These were extrapolated from their own findings, but the figures were less than the predicted theoretical values. Bob Butler, chief engineer of the NBC satellite network, armed with data compiled by Dalsat (for NBC), not only verified the basis for the Comsat calculations, but proposed a rain cell theory that lent consistency to the variances. Based on the premise that only two basic storm systems exist (rainstorms topping at 14,000 feet and thunderstorms topping at 60,000 feet), the theory statistically implies that the area covered by heavy rainstorms is inversely proportional to their intensity, and considers this phenomenon relative to the angular elevation of the sight-line distance to the satellite through the rain cell. It also considers the self-compensating nature of Ku-band satellite locations versus the expected rainfall rate (shorter sight lines, higher rain rates in East and South U.S. versus longer paths, lower rain rate in West and North).

## Earth station location

Initially, every earth station site was individually surveyed by a team of Comsat, Harris, and NBC personnel, and a written document on the survey site was generated. Many local factors (look angle, terrain, building or ground constraints, aesthetics, station configuration) were considered in the survey and discussed with local representatives. From this, a final plan was formulated for each station by Harris, and local vendors were selected for construction. Each of the installations required a secure in-plant space allocation capable of accommodating a standard five-rack configuration no more than 50 feet from the antenna pad. Interestingly, most stations could supply this space; very few locations required the construction of an out-building to house the terminal racks.

Each of the earth station configurations is, of itself, a stand-alone system independent of, but located upon, the premises of existing broadcast facilities. The stations receive baseband audio and video signals as if distributed by any common carrier. However, to interact with the intelligence of the earth station, a source identification (SID) signal was enmeshed in our uplink transmis-

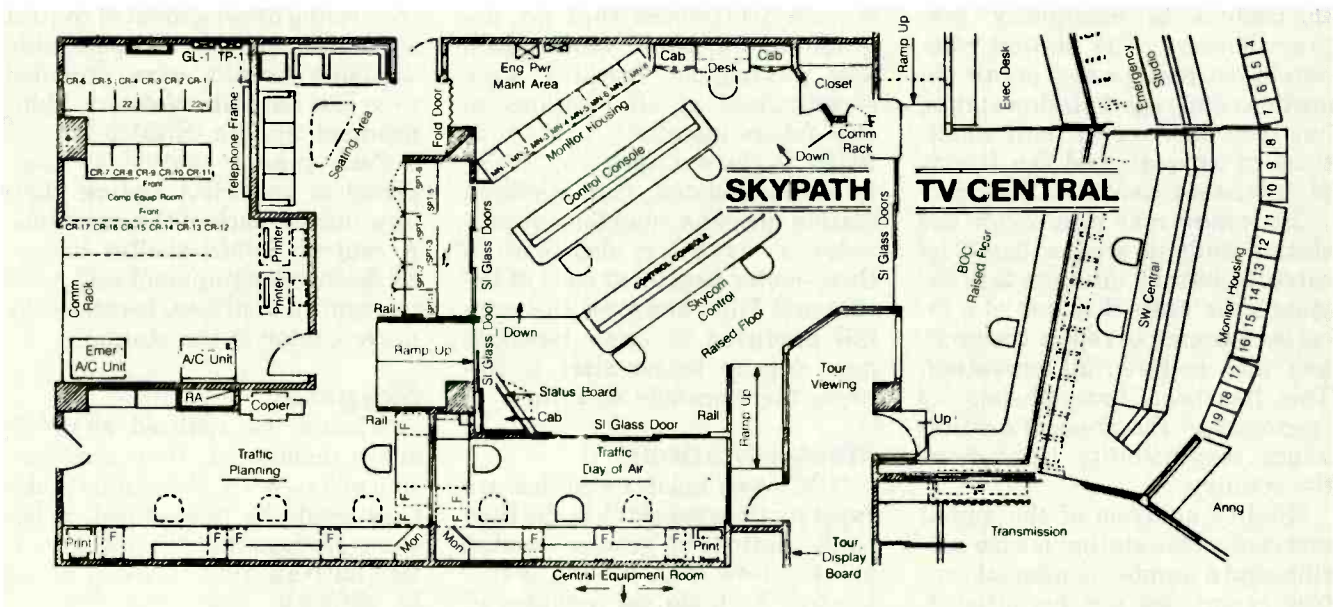
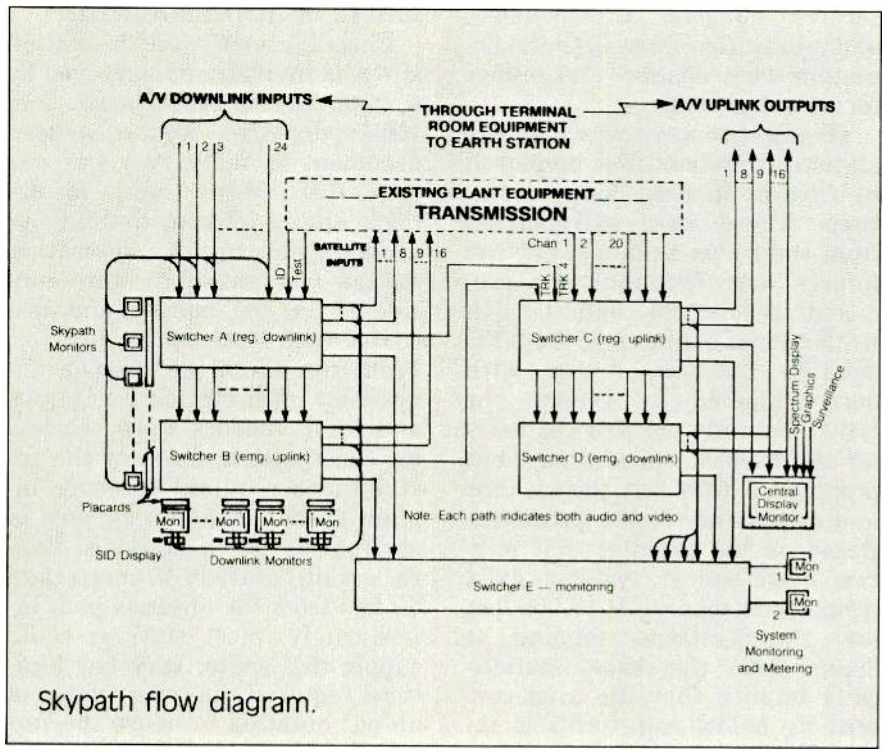



**Figure 1:** New York Skypath Control.



Skypath flow diagram.

sions for a "handshake" status-return burst from each of our stations to our master station.

This required that a small transmitter be located at every station (even ROs) to create a totally interactive computer-supervised system. The local computers will select redundant routes through the station in the event of a component failure. In addition, intelligent equipment can be made to independently switch themselves to emergency program sources. The station computers not only protect on-air operations and report station status, but they also report fault conditions to Skypath and the Harris Maintenance Center in Florida.

The center may interrogate the station fault in greater depth by satellite, but the ultimate task demands the radio dispatch of a local serviceman to repair the problem and restore full operation. This has been accomplished by "sectorizing" the areas of maintenance responsibility throughout the country.

Quality analysis of the signal received at the station is also possible and a number of manual control operations are permissible. As an example, a recent shift of main operations from SBS transponders to the RCA K2 bird took place, and the movement of all antennas was handled in a methodical, overnight manual process that took into account time zones, local conditions, approximate time operations, sign-offs, and potentially malfunctioning equipment.

In outfitting the RO locations, only three of the allotted five rack spaces were used, though each site was designed as a T/R unless it was determined that an upgrade would never occur. Still, any mechanical features were standardized at all locations so that future installations (such as PUPs at the antenna site) might be accommodated. Our standard station antenna complement provides a six-meter dish with a three-meter backup at each of the ROs and T/Rs; however, the rainfall predicted at some locations does require larger sizes to improve the rain-fade margin.

## Master stations

NBC's two master stations are exact replicas except that the Burbank station is ground located and the New York station is roof located. Each station provides 12 protected downlink outputs (24 incoming feeds) and eight protected uplink inputs (16 outgoing feeds). The feeds are divided into two independent groupings, each of which is fed from/to its own independent system with its own eight-meter antenna. Each of the two independent systems is again divided into a regular/emergency system, and appropriate computer protection schemes are provided to maintain automatically uninterrupted network programming.

The four I/O system groups are connected to the central transmission area in Radio City by four independent underground conduits. All video signal cables carry the 70 MHz intermediate frequency spectrum existing between the in/out sections of the up/down converters. Therefore, all audio and video signals for each feed coexist on one cable. Rather than use fiber optics, it was determined that more traditional plenum-type coax would be better suited for our interfacility links (IFL). This was based on manageable cable lengths, ten times cost savings, easier maintenance, and many other factors.

Similarly, the computer links were direct-wired (RS-422) and were run with the video trunks in the IFL conduits. All cables were run between terminal locations before connection to the equipment. However, because of the continuing development of control software, additional patchable computer trunks were provided from the Satellite Network Management System (SNMS) lab.

Each master station is comprised of two HPA uplink shelters, one for each of the antennas. A central SNMS shelter houses all downlink equipment and, with the control facilities, becomes the nerve center of the station.

## Skypath

When it was realized, as previously mentioned, that construction of a new TV Central in Radio City would be impractical, it became obvious that finding a location for New York Skypath would be difficult. One area was required, conveniently located and large enough to satisfy require-

ments such as expansion space for new equipment, proximity to TV Central and traffic, noise isolation, maintenance access, modern aesthetics, tour viewability, and short installation time.

In addressing the cost/aesthetics issue, a trend toward an industrial design concept was adopted, and extreme tonalities were favored (black, midnight blue, white, grey, brushed aluminum) with relief provided by wood tones. This was done to underline the high-tech atmosphere while providing a quiet, paced operations environment that would readily integrate into the different decor of TV Central.

Specifications for layouts, elevations, console designs, materials, colors, etc., were submitted to the various operations managers for review, commentary, and approval. After many versions, the final set of specifications was turned over to NBC Engineering early in 1986. Demolition and reconstruction of what had been the telecine area had begun in early 1986 since we knew this was to be turned over to Skypath, NBC having eliminated telecines and gone to film-to-tape transfer and electronic slide stores. Work on the new Skypath area itself did not begin until July. It was completed early in September.

In the control room, a wall of small monitors provides continuous monitoring of the 24-hour regular/emergency downlink feeds. Above every monitor in the wall a display placard is located that can be manually programmed by a small, hand-held terminal. This allows the operators to label each feed with names convenient to their operation. The placards also contain a set of LED indicators for each left/right audio channel associated with the monitor. The LEDs flash during overlevel or long-silence conditions. Thus the illumination of the fault LEDs will prompt the operator to initiate setup of the faulty signal on a metering bus. Of course, the absence of any fault light does not guarantee faultless audio performance, but it does provide some

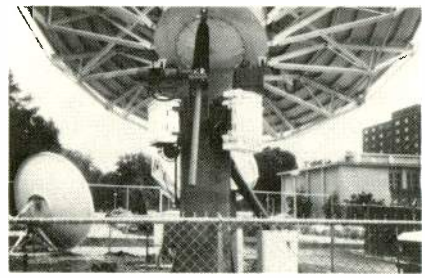
confidence when an operator has to monitor more than 80 audio sources!

Although video feeds are monitorable directly on a screen, NBC has chosen to display only the active feed of a regular/emergency pair; although unseen, the backup feed does exist on an A/B relay entering the monitor. While this minimizes the number of feeds on display, it does not provide immediate knowledge of a possible failure in the nondisplayed feed.

For this function, SID units are used as alert devices. Below each of the larger monitors an SID display unit is located for viewing alternately each of the monitors and for displaying the (previously inserted) identification signal if all is well. If a protected pair is being monitored, the SID readout will not change, but a blinking LED will indicate continuing analysis. A fault in the undisplayed video signal will cause periodic disruptions of the SID display, immediately making an error evident to the operator.

Skypath, however, is not intended to be manually controlled, and the system will automatically compensate for most error conditions. Nevertheless, fault alerts provide the means for human tracking and understanding of trouble sources in the event that further follow-up or optimization is required.

The layout of Skypath (see Figure 1) was designed for efficiency and automation, requiring few control operators and providing each department with easy access to other, related departments. The Skypath computers are fed a prepackaged air routine, which is interpreted for the various switching and control functions necessary to accomplish the day's programming. This requires not only that local commands be originated, but that sky-switching commands be transmitted as well. Resulting operations can effectively surpass terrestrial capabilities. By means of nationwide sectionalization, commercial inserts can be more efficiently programmed, regional time zones economically serviced, and network transmission expanded (pretapings, news spots, local news originations, communications, etc.).



Dish setup and PUP unit at WIS-TV in Columbia, SC.

## Skycom

Located in Skypath control, Skycom is a transmission system that allows the NBC satellite system access to any accepted originator. It provides the flexibility for a news or special interest story to be transmitted for general or specific distribution. This includes live or taped material for later use while normal programming continues.

Skycom allocates the use of transponder space so that any properly equipped satellite news vehicle can establish communications with the Skycom Hub and request transponder access. When requested, Skycom, with traffic, will locate an available uplink time slot so the SNV can uplink on the system from its location. No other hookup facilities are required. The one-to-all capability allows receipt by the vehicle's own station and/or other properly equipped network locations.

Once programmed into the Skycom computer, the selected transponder is protected from double illumination by the computer. A queuing countdown provided by the computer will turn the appropriate uplink sources off and on. Each vehicle is equipped with a control package and terminal display that integrates Skycom control into the truck system and provides a continuously updated status report to the VDT. In addition to the uplink control, the system can tune the video and/or communications channels within the truck.

An "all-call" channel is used

initially to establish communications, but after assignment, a unique channel is assigned that will provide operations links as well (three additional duplex telephone circuits are provided for program integration use). Truck design criteria supplied by NBC make it possible for each of our recognized vehicles to perform their initial checkout (including polarization) in the receive mode prior to contacting Skycom.

As an additional "man-machine" assist, we have assigned a further function to the SID units located in Skypath. The same programmer used for placard labelling allows interrogation of the SID units beyond the level of source identifications. Thus, if a problem should arise with a Skycom origination, any NBC receiving location may conveniently look-up the vehicle's base station telephone number and personnel contact by "asking" the SID.

As presented, the system may seem perfect but, like all systems, it has had its problems. Due to commercial power problems throughout much of the country, spikes, dropouts, noise, etc., were consistently affecting our intelligent equipment. We even had an unexplained rebooting of our station computers.

Another thing originally overlooked caused a problem. Overemphasized audio sibilants on uplinks caused by extreme high-frequency equalization at the source mix began to occur. We found that each of our audio uplinks is itself a typical (pre-emphasized) FM broadcast system requiring dynamic limiting if the system is to tolerate the broad processing range used in audio productions. Thus, the need for FM limiters in each of the major uplink channels.

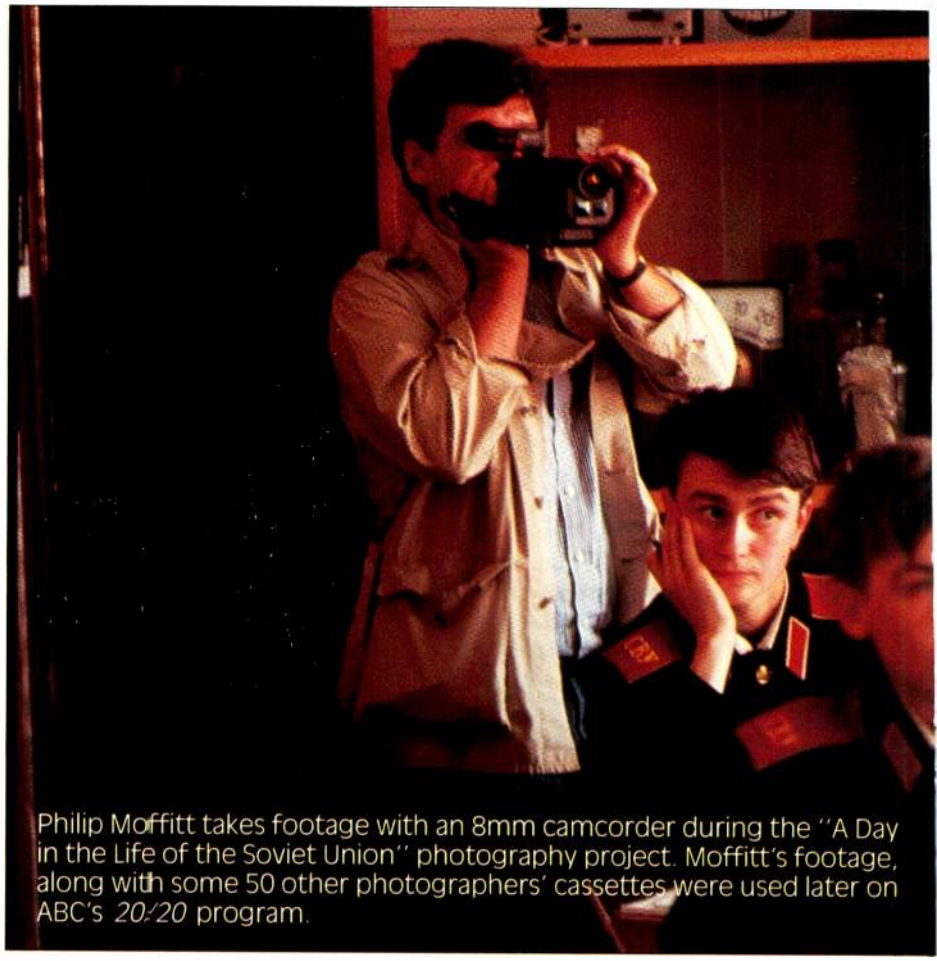
Regardless of such obstacles, the success of the NBC satellite network system has proved itself time and again, and we have seen that many of the goals and projections of the task force team have been achieved. More advances and changes will occur involving computers, transponders, uplinks—even the facility itself will continue to be updated. New technologies and improvements on existing ones will affect the planning of this and other systems. As fiber networks increase in cost effectiveness and other areas, and as Ku satellites become more familiar, dramatic changes are possible. **BM/E**

**About the author:**
Mr. Paganuzzi recently retired from NBC as engineering manager, satellite network. He received his MBA from Iona in 1970 and an AB in physics from Columbia University in 1949. He joined NBC in 1951 as maintenance engineer and moved to facilities design, setting many new standards for the industry.

# NEW FORMATS FOR NEWS

*Engineers find themselves faced with the challenge of integrating 8 mm, VHS, Super-VHS, and other consumer video formats with more standard material for news broadcasts.*

**By Robert Rivlin**



Philip Moffitt takes footage with an 8mm camcorder during the "A Day in the Life of the Soviet Union" photography project. Moffitt's footage, along with some 50 other photographers' cassettes were used later on ABC's *20/20* program.

Over 15 years ago, in 1971, Sony introduced the then-revolutionary U-matic format into the consumer video market. Designed as a replacement for home movies, and to counter consumer dislike of open-reel tape formats, U-matic was a consumer flop.

Just how ¾-inch U-matic got started as a professional recording format remains cloaked in the mysteries of time. The currently accepted legend is that one of the television networks had a demonstration unit that it was examining when a fire broke out across the street. Some bright-thinking engineer thought to send the recorder over with a portable camera and captured the event for the evening news.

Whatever its history, U-matic has become an almost universally accepted news format, with around one million units sold worldwide since 1971 (along with the mid-1970s introduction of the BVU series). The current installed base in the U.S. is estimated at over 250,000 units, at least a tenth of which are employed by broadcast news operations.

Now, for the first time in almost two decades, however, the burgeoning market for U-matic is beginning to slip away. An estimate from the Sheer and Chaskelson market research firm reported that the ¾-inch market may have declined over 65 percent last year, and that by 1989 "U-matic may be almost just a memory in broadcast news."

The replacement formats of choice have become MII and Betacam/Betacam SP. Somewhat surprising to marketers of both systems, it seems, the acceptance of the the half-inch component analog video formats has spread like

wildfire in news departments in recent years, far sooner than most had expected.

## U-matic improvements

Three-quarter inch is by no means a dead format yet. "If I had to convert our station from ¾-inch to component analog video (CAV) today, we'd end up spending over $1.5 million overnight," claims Warren Happel, VP of engineering for the Scripps-Howard stations and also acting director of engineering for the group's WEWS-TV facility in Cleveland. "Even though we know we're eventually going to convert, we're not ready yet to make that large a commitment. And, besides, we're not certain at this point whether to go with MII or Betacam."

Finding that he did need to replace some existing U-matic equipment, Happel turned to the new U-matic SP format almost 10 months ago. Used in conjunction with the station's standard U-matic decks, in news editing bays equipped with Sony BVE-9000 editors, the BVU-950 decks are also used to roll news material directly to air.

"We've never performed the measurements, but there's definitely a picture improvement between regular U-matic and U-matic SP," Happel notes.

# Format Comparison Chart

| | Consumer VHS | ¾-Inch U-matic | U-matic SP | S-VHS | Typical CAV | 8mm |
|---|---|---|---|---|---|---|
| Tape type, coercivity (oerstad), cost/min. | Oxide, 700, $.13 | Oxide, 700, $.30 | Oxide, 750, $.31 | Oxide, 900, $.20 | Met. part., 1200, $1 | Met. part., 1450 $.11 |
| Studio record time<br>Field record time | 120 min.<br>120 min. | 60 min.<br>20 min. | 60 min.<br>20 min. | 120 min.<br>120 min. | 90 min.<br>20 min. | to 2 hrs.<br>N/A |
| **Audio Characteristics**<br>Audio tracks<br>Audio S/N<br>Audio noise reduction | <br>2<br>40 dB<br>varies | <br>2<br>48 dB<br>none | <br>2<br>52 dB<br>Dolby C | <br>4<br>48 dB<br>Dolby B | <br>2 long., 2 FM<br>56 dB<br>Dolby C | <br>1 afm, 2 pcm<br>>60 dB<br>none |
| **Video Characteristics**<br>Y bandwidth[1]<br>Y S/N[2]<br>C S/N[3] | <br>1 MHz<br>N/A<br>45 dB | <br>3.25 MHz<br>49 dB<br>47 dB | <br>4.25 MHz<br>50 dB<br>48 dB | <br>1.6 MHz<br>N/A<br>47+ dB | <br>4.5 MHz<br>49 dB<br>50 dB | <br>N/A<br>44 dB<br>N/A |
| H lines res. | 249+ | 260+ | 340+ | 400+ | 450 | 230 |
| K factor (2T pulse)<br>Diff. gain<br>Diff. phase<br>Y/C delay | N/A<br>N/A<br>N/A<br>N/A | N/A<br>N/A<br>N/A<br>N/A | <3%<br><3%<br><3 deg.<br><25 ns | N/A<br>N/A<br>N/A<br>N/A | 2%<br>2%<br>2 deg<br>20 ns | N/A<br>N/A<br>N/A<br>N/A |

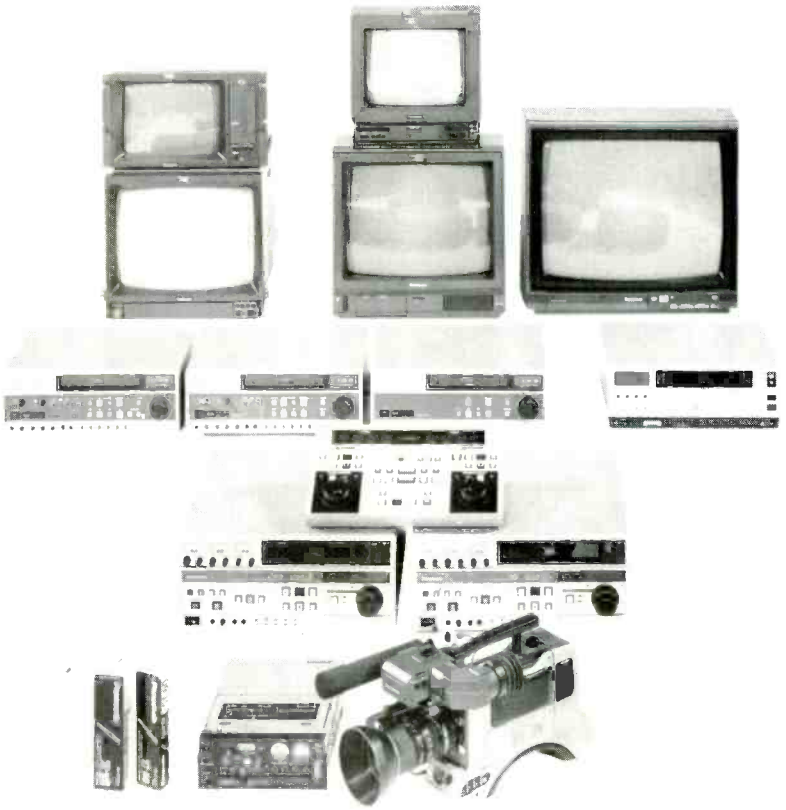
All specifications based on manufacturer's published figures

Notes:

[1]An indication of the total amount of luminance (Y) information that can be recorded by the system.

[2]Luminance and chrominance signal-to-noise rations based on recording an NTSC composite signal; component S/Ns are equal to, or better than, the composite values.

A subjective measurement horizontal lines of resolution as measured on a variety of different monitors. As a general rule, each MHz of bandwidth (see "Y bandwidth") equals 80 lines of H resolution.



Panasonic's ProView S-VHS system.

According to Sony specs, the U-SP format, which uses a newly formulated videotape, has a Y bandwidth of 2.8 MHz (compared with standard U-Matic's 1.6 MHz), has a S/N of 49 dB (compared with standard U-matic's 46 dB), and delivers 340 lines of resolution (as compared with standard U-Matic's 260). Even Happel admits, however, that U-Matic SP is simply an interim stage before he converts his stations entirely to CAV.

## Can it happen twice?

The impending scenario here is clear: CAV will become the news-acquisition format of choice in the 1990s. Nonetheless, there are a number of broadcasters who believe that some of the newer consumer formats, including Super-VHS and 8 mm, may find a place in broadcast news. Few in any market above 100 will openly admit the use of consumer formats on a regular basis. For specialized applications, however, such as airplane crashes, fires, and natural disasters, "found footage" gathered by people who happened to be on the scene with home video cameras can make an exciting complement to a station's regular coverage.

And why not? Signal specs for the newer formats are extremely good, delivering signal quality for at least the first generation that is superior to ¾-inch U-matic on almost every count (see accompanying Format Comparison chart). Given that viewers are not accustomed to particularly high-quality news footage because of the existing ¾-inch standard, pictures recorded with the newer formats can be integrated quite successfully with other news program sources.

"If you take an image shot with a high-quality, professional camera on S-VHS, I don't think you'd be able to tell the difference between that picture and one shot with a comparable-quality camera on ¾-inch," claims Ardell Hill, director of operations and engineering for WXFL-TV, Tampa, FL.

Hill has been experimenting with the use of the new Pinnacle V-1000 special effects unit signal

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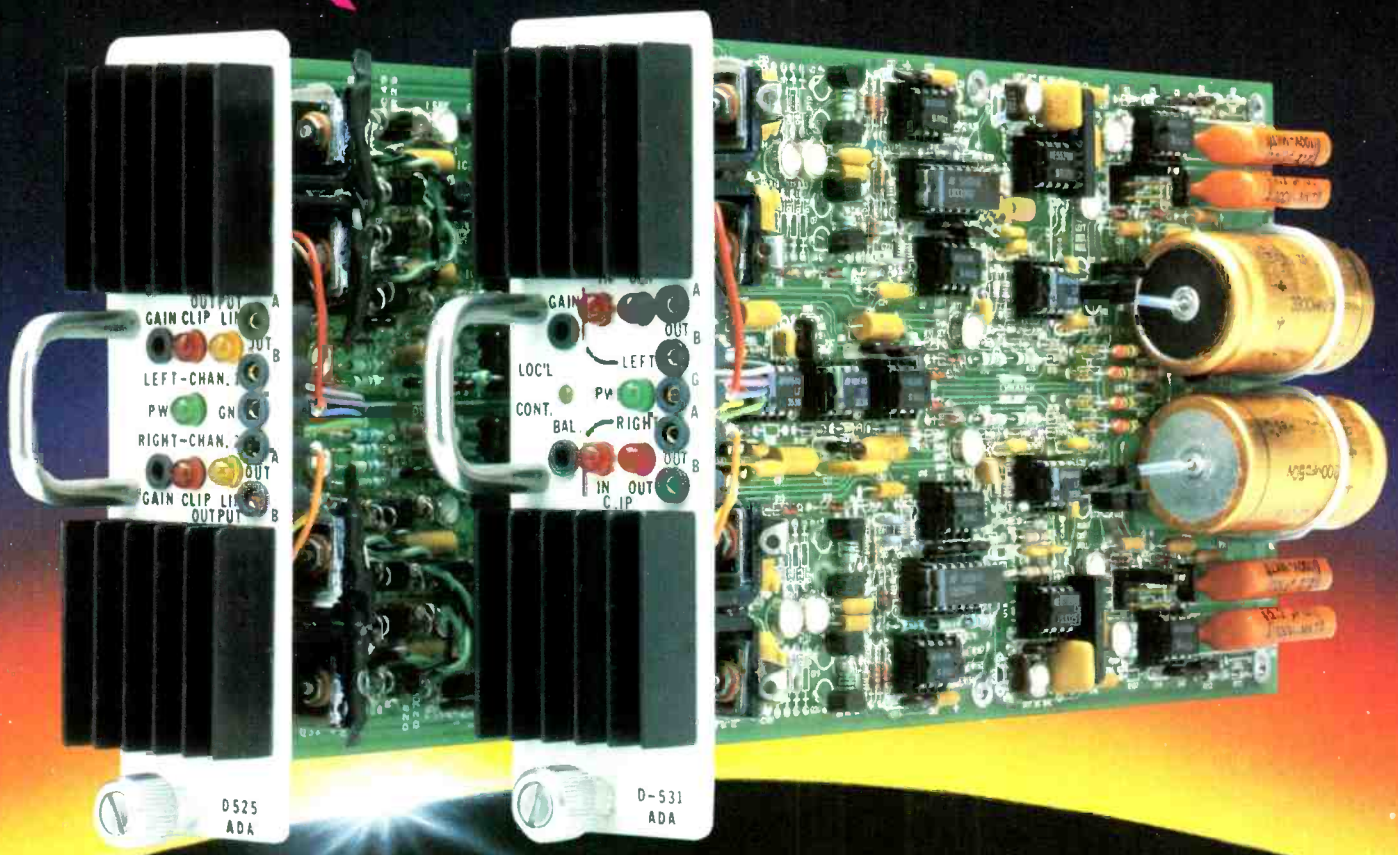


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processor, a low-cost device designed for news edit suite applications and makes it possible to take S-VHS's Y,C recording format as a source and integrate it with material recorded in virtually any currently available format.

"The Pinnacle unit is making it possible for us to put consumer video directly on the air," says Hill. "Not only can we take video from almost any source, but we can do things with it such as using the box's special effects to wipe the consumer video images in and out. It won't make fuzzy, noisy video clear. But it can take consumer video and make it legal to broadcast."

The general game plan at the station is to convert current ¾-inch operations to MII over the next few years (see "Business Briefs," *BM/E*, Nov. 1987, p.81). But Hill plans to install several VHS and S-VHS decks in the news department to handle what may eventually become a fairly steady stream of consumer videotapes. The station already promotes its News Hound program, where viewers who shoot something unusual are invited to contact the station directly.

"In addition, we all have friends and associates and contacts at local ad agencies and the like who have home video cameras or know someone else who does. We plan to put out the word that we can take in many different sources of news information," Hill explains. He also points to the increasing use of consumer-quality video recording by police and fire departments and other government and private agencies who use videotape for documentation. With the the station's format capabilities, that material could be put directly on air.

## Network experience

WXFL-TV is by no means alone in its use of consumer video formats to present otherwise-unavailable visuals or in its promotion to viewers of the fact that it is capable of accepting their home videos. Many local stations incorporate this type of footage acquisition. Now, however, even the

major networks are getting involved.

In a 1987 version of the "fire across the street" U-matic story mentioned above, a British physician attending a medical conference in the Soviet Union happened to be standing in Red Square when a daring young man, who had piloted his airplane through the Soviet defense system, landed amidst some rather startled tourists. The British doctor, who happened to be shooting home movies with his VHS camcorder, caught the whole thing.

"As soon as we heard about the story over the wires I telephoned our Moscow bureau to see if there was any footage available," recalls Jerry Lamprecht, VP of newsgathering for NBC. "They were already working on it."

NBC's Moscow bureau knew there was a conference in town, and informed the conference organizers that they would be interested in speaking with anyone who had been shooting footage in Red Square at the time of the landing. A few hours later the doctor called, bureau personnel viewed the tape, transferred it to ¾-inch, and then fed it back to New York via satellite. Forty-five seconds of consumer video footage, showing the plane swooping in low, landing, and the crowds gathered around as Mathias Rust emerged, were on network news within hours.

"People in the newsgathering business used to have a standing policy to check around for anyone who had been shooting still photographs when this kind of event happened," Lamprecht says. "Now we automatically ask 'Was anyone shooting video?' And the public is beginning to realize that if they do shoot something spectacular, there may be a market for it—not only locally, but on national news as well. We just have to hope they call us first before the other networks get involved."

Lamprecht recalls other examples of NBC's use of consumer video on air: A year ago, for instance, a sailor aboard an American ship happened to catch a naval attack in the Persian Gulf. A tourist in Japan caught the crash of a small plane into a hillside. A spectator at the recent Paris Air Show caught a midair disaster.

As a nonengineer, Lamprecht thinks the quality of the on-air video is fine. "We don't plan to use those kind of camcorders for special features work," he quips. "But when there's an emergency, or when we're going on a trek through Nepal, they definitely have their place."

## 20/20 foresight

ABC, too, has had experience with airing consumer video—although in the case of two recent

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segments of *20/20* the use of consumer 8mm was well thought out in advance.

The segments documented Collins Publishing's "A Day in the Life . . . " project in the Soviet Union. "Collins equipped 100 photographers, 50 from the U.S. and 50 from Russia, with still cameras, and sent them to 83 locations in the Soviet Union to shoot whatever they could in a single day. The resulting stills were edited and published as a book in October, 1987," recounts Tom Nagorski, associate producer for *20/20*.

"We wanted to document the event for segments of the show. But the Soviets would only allow us to bring in two additional crews besides our Moscow bureau. We would have been limited to covering the main shoots in Moscow, Leningrad, and Kiev, and would have missed the out-of-the-way places being visited by the other photographers."

The solution came from one of the event's corporate sponsors, Sony, who was able to provide each American photographer with an extremely compact 8 mm CCD camcorder that could be carried along with the photographer's other gear. Using footage shot by either the cameraperson or the guide who accompanied each photographer, ABC was able to document the entire event.

"We wrote memos to the photographers telling them what we planned and asked to borrow their tapes when they returned," Nagorski explains. "Almost all of them were willing to cooperate. We ended up with about 50 cassettes, ranging in length from 15 minutes to an hour."

The 8 mm originals were dubbed up to one-inch, with simultaneous copies made in ¾-inch. Nagorski and editor Mitch Udoff then edited on the ¾-inch copy, reconformed the cuts on a ¾-inch master, and reinserted the video from the field cassettes on the one-inch air product.

"The technical quality of the 8mm material, that formed at least 50 percent of our segment on the event, was extremely good," Udoff comments. "I venture to say the average viewer couldn't tell the difference between that material and the footage shot by our own field crews using BVU equipment. We were definitely surprised by how good the contrast and detail appeared, especially in well-lit scenes. And the color saturation was quite acceptable."

A replacement for professional ¾-inch or CAV? Not exactly. Home video formats don't really have the quality that it takes to make high-quality airable product, especially when edited down through multiple generations. But for occasional use in covering emergencies, or in unusual documentary situations, S-VHS, 8 mm, and other consumer formats still waiting in the wings will definitely find their way into the broadcast plant. **BM/E**

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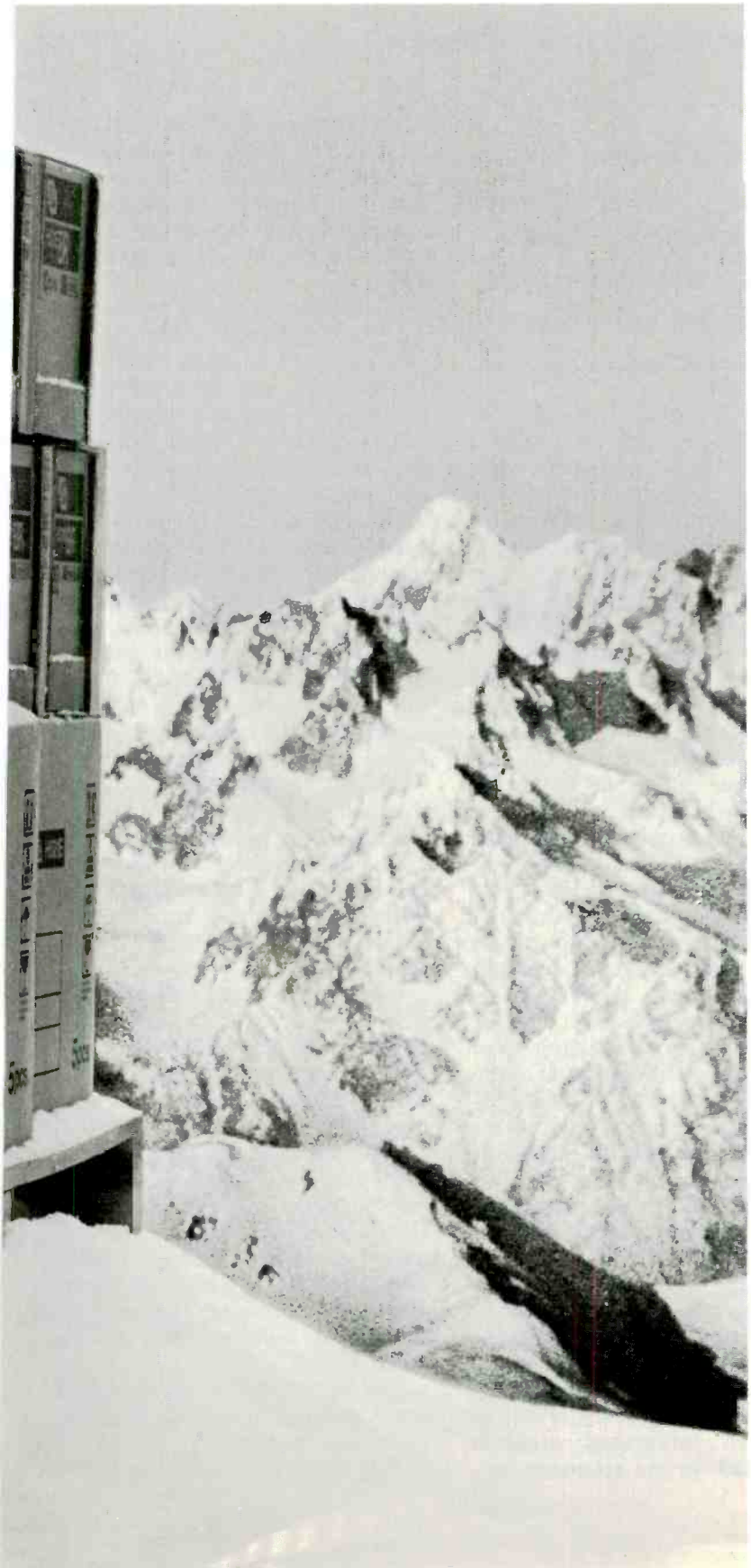

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# Gearing up for

**By Robert Rivlin and Eva J. Blinder**

It used to be that manufacturers would wait until NAB in the spring to introduce new products. More and more, however, manufacturers are using the SMPTE as a showcase for new systems and technologies. And nowhere is this more true than with graphics and effects gear.

Are you getting daily reminders from management or production asking opinions about the latest trends in this rapidly changing field? Market surveys show that despite a cooling off throughout broadcast and teleproduction/post-production facilities when it comes to buying items such as VTRs, there is still a constant need for new graphics gear. So the next time you're asked your opinion, here's what to tell them!

One of the hottest trends, particularly in broadcast, is the development of graphics systems based around personal computers. And, more and more, there is a trend towards integrated workstations that combine different software modules for applications such as painting, 3D, and digital effects into a single box that can be simply and inexpensively installed in an editing room.

Among the low-cost and mid-range systems, one of the most popular is proving to be the Pinnacle Systems 3000 Series, an integrated graphics workstation approach combining digital special effects, still store with graphics composition, paint, and 3D modeling and animation.

A number of other companies are now beginning to take a modular, workstation-like approach to graphics and effects, making use of general purpose computer hardware and then adding a layer of graphics applications programs to control it.

*SMPTE proved that manufacturers of graphics and effects products don't wait around for NAB rollouts any more.*

One of the most exciting new products taking this approach is the DF/X 200, a component digital (the equivalent of 4:4:4:4 processing with a wide variety of composite and component output formats) workstation offering real-time 3D special effects, high-resolution character generation, and 2D painting and graphics in a single box. The 200 is the first product from Digital F/X, under the presidency of Chuck Clarke (formerly of Grass Valley Group).

A unique value of the integrated workstation approach is that the same windows-oriented approach is taken to the user interface for all three functions. The device accepts virtually any control mechanism available— from joystick and trackball through digitizing tablet. Each applications package also has its own set of special features, ranging from word processor-like controls of the character generator pages to extensive airbrushing capabilities and hardware antialiasing with the paint program.

Prices for the open architecture, modular system range between $100,000 to $125,000.

A prime concern being expressed by those putting together graphics systems is how to interface pieces of equipment so that a single image can be worked on by several different pieces of equipment. An integrated graphics workstation is one approach. Another is the use of a local area network (LAN) to tie the system together. But far the most practical thus far, however, is the use of equipment that conforms to the CCIR 601 digital component standard.

Even some equipment that is not yet 4:2:2 compatible can be used in a 601 network, however. Thanks to a new two-card hardware set being prototyped by Abekas (Action Video is one of its Beta sites), Quantel Paintbox can now put out a CCIR 601 signal that can be directly imported into a device such as one of the Abekas component digital disk recorders.

Abekas has also been hard at work on its brand-new A72 component digital character generator. One of the chief features of the software-based system is that the attributes of its typehouse-quality fonts can be instantly redefined. Font attributes that can be changed in this way include size, drop shadow, border, and italics. The A72 includes full-color scan-in, and has a color palette of 15 million colors that can be displayed on a single page simultaneously.

Its Scribe system selling well, Chyron has set its sights on HDTV with the premiere of an HDTV version of the high-quality text generator. Shown in prototype, the "HyperScribe" features antialiased text and an HDTV Logo Compose Tablet for digitizing original art to 1125-line HDTV resolution. A unit was expected to be installed at a Beta site within 60 days after the show, and Chyron promises that production models will be deliverable after NAB '88.

The NTSC Scribe also boasted some enhancements at SMPTE, including the new Advanced Font Utility II software package. Glow,

# Graphics


neon, and beveling effects are among the new features of AFU II, along with character borders in multiple color layers and mapping of text or graphics onto solid models. A new external interface for Scribe allows the device to take information directly from such sources as automated sports and election reporting systems.

Dubner, too, is in the midst of redefining the character generator into a full-fledged graphics tool. Introduced at SMPTE was the first go-round of the Graphics Factory, a 4:2:2-based system that will eventually incorporate dual-channel character generator, dual-channel painting, and 3D modeling and animation. The SMPTE product, priced at $54,000, was the dual-channel character generator. By NAB it is expected that both paint and 3D will be available as plug-in cards with software modules.

Symbolics, which showed its 3D animation system to broadcasters for the first time at NAB '87, at SMPTE introduced a new VTR controller software package and announced the imminent introduction of its own VTC-1 Video Tape Controller.

The new software, known as S-Record, operates in conjunction with the Lyon Lamb Mini-Vas animation controller to control VTRs and disk recorders for unattended animation rendering. It allows the Symbolics operator to control the video devices directly from the Symbolics machine console. A menu-driven interface allows automatic device control; alternatively, the user can build complex shot lists for automatic output.

Another major development from Symbolics was a new HDTV graphics system with full 2D and 3D animation and paint capabilities. According to the company, the system is the first to support HDTV output of 3D animation. The first sale of the HDTV animation system was also announced at SMPTE. The New York City HDTV production facility 1125 Productions, was scheduled to take delivery of the first Symbolics HDTV 3D system before the end of 1987.

A number of new graphics product introductions at SMPTE were not exactly new products so much as existing products being marketed through new business arrangements.

This characterizes the Specter system from 3M, a product formerly sold exclusively by its developer, NeoVisuals. Specter is a package of high-end 3D modeling and animation routines that is hardware independent and can be run on any Silicon Graphics or Sun Microsystems workstations. As one would expect, the system incorporates a wide variety of modeling and animation techniques, with simple user interface to set the lighting, position the "camera," describe the motion paths,

Animated sequence celebrating the 50th anniversary of the Golden Gate Bridge. Produced for KPIX-TV by the San Francisco Production Group on its Cubicomp Vertigo system.

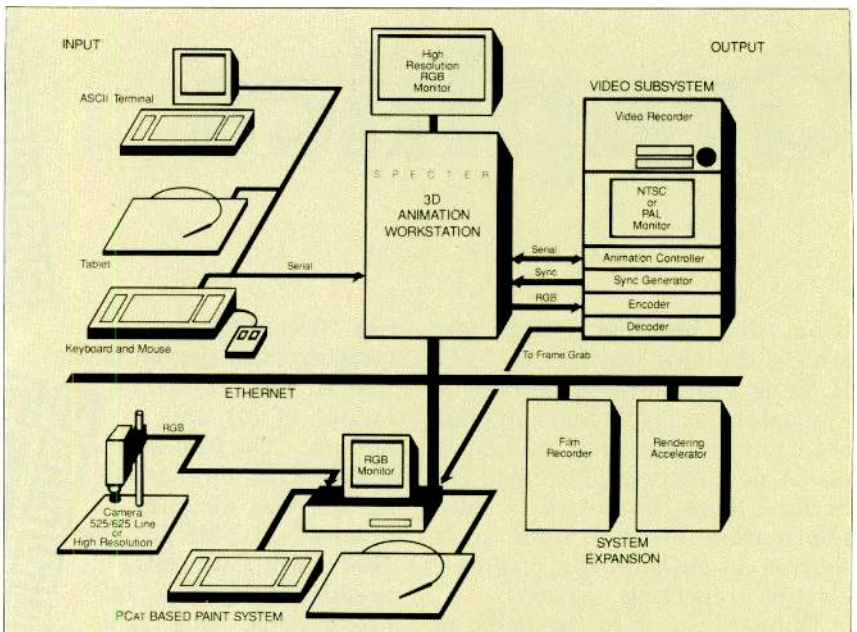
etc. More significantly, perhaps, Specter allows the user to set the level of antialiasing so that a quick check of scenes is possible without having to go into full-scale rendering.

Cubicomp's big SMPTE news was further progress in its acquisition of Vertigo Systems. All sales and support services for Vertigo's line of 3D graphics systems has now been taken over by Cubicomp, and new sales offices for Vertigo systems have been opened in Boca Raton, FL, New York, and Los Angeles. Cubicomp is now actively marketing Vertigo's V2000 3D computer graphics system, and Vertigo's sales and support staff have been formally transferred to Cubicomp.

Cubicomp is at working on a Cubicomp-to-Vertigo file translator, which would convert models developed on the Cubicomp PictureMaker system to Vertigo format. According to Cubicomp, the file translator is intended to allow current PictureMaker users seeking to upgrade to the more powerful Vertigo. It seems likely, however, that it could also enable the PictureMaker system to act as an economical off-line workstation for Vertigo users.

Several new developments in the PictureMaker line were also demonstrated at the show. Cubicomp's new Render Acceleration Compute Engine, or RACE, is a $19,500 plug-in circuit board with eight MIPS (million instructions per second) of processing power. According to the company, RACE can increase PictureMaker speed by a factor of 15. Cubicomp's latest system software, Version 2.0, is required for RACE operation.

Three new PictureMaker systems also made their debuts. The PictureMaker/60 and PictureMaker/50 are both based on the 80386 microprocessor and include a proprietary 24-bit frame buffer. The top-of-the-line PictureMaker/60 sells for $57,500; the PictureMaker/50 is $46,500. Both are available now and feature Cubicomp's new True Color Paint software package (the 60 also includes the True Color Animation package). The third new system is the PictureMaker/10, designed expressly for the creation of business presentations, charts, and graphs.




Block diagram of the 3M Specter system showing the well-thought-out video interface.

Microtime's new Graphics Systems division is now the home of the Ani-Maker and Image-Maker 3D graphics and animation systems, formerly from ITI. Both systems integrate 32-bit, full-color 2D paint capabilities with real-time RGB frame grab, 3D modeling and animation, internal VTR control, and font generation. The Image-Maker also includes an off-line rendering station. The processing platform for both systems is an IBM-compatible 80386-based computer; 80286-based systems are available at lower cost.

Aurora's two newest graphics systems, the AU/220 and AU/280, are now being delivered, and both had enhancements and expanded capabilities at SMPTE.

For the 280, software enhancements include color cycle animation capability; a preview function for the 3D modeling program; timeline-based animation editing; selective real-time 3D animation capabilities; automatic storyboarding; flexible tiling and texture fill; and picture browse capability. The system now provides color cycle, multi-plane, and traditional cel animation in one integrated package.

On the hardware side, the 280 now boasts a 340-megabyte hard disk as standard equipment.

New features for the AU/220 include optional real-time frame grab and compatibility with the PAL and SECAM television standards. The 32-bit, full-color 220 offers antialiasing and optional cel animation and 3D modeling.

On the low end of its line, Aurora announced a new AccuWeather interface for its AU/75 IBM AT-compatible graphics system. The interface is part of Aurora's optional Weather Package, which connects the 75 via modem to a variety of whether and sports data services.

Quanta Corp. expanded the high end of its line with the new Artista graphics system, which combines paint, 3D modeling, and animation capabilities. The $69,995 Artista, slated to begin deliveries this month features a flash digitizer for full-color camera capture; a variety of user-definable brush types; a pop-up color palette with on-screen mixing; and horizontal, vertical, up/down slope, and automatic tile backgrounds. Also standard are five multicolored or antialiased fonts with either 3D edges or drop shadows; stencil cutting; and extensive

cut-and-paste capabilities.

The Artista's 3D capabilities include hierarchical structuring and real-time preview. The rack-mountable unit features two 5 ¼-inch floppy disk drives, a 190-megabyte hard disk, and a 32-megabyte streaming tape backup unit.

Quanta also showed Quantapaint 32, a new standalone 32-bit paint system with 14 drawing tools, electronic brushes ranging in size from one to 50 pixels, and effects such as mosaic, tile, duplicate, posterization, shadow, slide, and three-point perspective draw. The system, scheduled for delivery this month, lists for $29,995.

New capabilities and a lower price for the ArtStar 3D Plus led the announcements at ColorGraphics Systems' SMPTE booth this year. The system, aggressively priced at $99,000, features a new digital mixer hardware option and new Auto-Trace software.

The DVM-100, as the digital mixer option is called, adds a variety of sophisticated animation features, such as true dissolves between two 24-bit, full-color images, including high-quality glows, fades, and dissolves, and real-time moving of full-color cutouts. The option also allows animation of full-color layers; transparent, color-cycled "movie" capability; and "undo" editing capability in the ArtStar paint program.

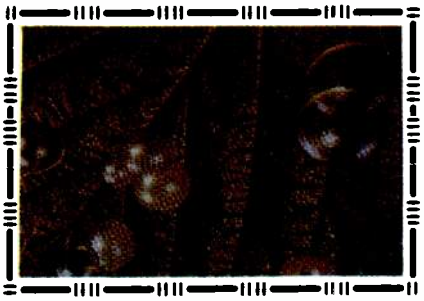
The new software feature, Auto-Trace, is designed for quickly and efficiently converting flat art into 3D images. Images may be drawn by an artist or input with a camera

Ampex showed its ESS-5 still store system as a product at SMPTE, interfaced with the company's graphics systems.

Other news from Ampex was the introduction of an 18-input version of its AVC Vista series production switcher, designed especially for smaller broadcast facilities, off-line editing suites, mobile units and corporate/industrial facilities. (A 10-input version was introduced at NAB '87.) The switcher features a graphics-oriented display and uncluttered control panel, streamlining and simplifying user access to its complex functions. A fully integrated digital effects loop, known as Digi-Loop, allows ADO effects to be easily inserted into the video path of various switcher effects without tying up backgound inputs or auxiliary switching.

DSC premiered several new effects for its Eclipse digital effects system, which premiered last year. The additions include new modes for "twist" and "curved" effects, and new "page turn" and "page scroll" options. Eclipse's curved effects option created plenty of excitement last year, and the new modes enhance the system's already impressive capabilities.

Among the other features Eclipse offers as standard are programmable effects, picture placement, picture cropping, automatic cube builder, linear and curved picture twist (both in the curved effects option), rotation, perspective with rotation, smooth trajectories, and many more.



Frame from "The Hidden Power of Plants" produced for WGBH-TV's Nova series on a Microtime Image-Maker system—a PC-based product.

Rendering speed continues to be a pivotal issue in deciding between one graphics system and another. In the broadcast environment it is being realized that despite the wonderful-looking images produced by computer animation, 3D will never become a reality in day-to-day news graphics until 3D achieves a significant improvement in how quickly frames can be generated. And at post-production houses doing graphics, where billable time is fixed by competitive market conditions, profitability of the graphics operation often depends on how many frames can be cranked out per hour.

Among the companies addressing this issue directly is BTS, which has introduced the Pixelerator—a rendering engine that is hooked up to the FGS-4599 as part of a local-area network. With a single Pixelerator CPU, the system cam perform as much as 30 times faster than the basic FGS—computing at 65 million instructions per second (MIPS) or 10 million floating-point computations (megaflops) per second. By adding multiple Pixelerators together, incrementally greater processing speeds are achieved while the system automatically delegates pixels and screen areas to processors depending on their work load.

Quantel Paintbox users will be glad to note that Quantel continues to aggressively develop new software capabilities. Version 4.06, released at SMPTE, adds several new features, including restore brush, allowing a second picture to be selectively revealed under the current picture (either for effect, or to quickly restore the original image); smear, allowing a stencil to be moved across the image smearing the stencil as it goes; a smudge brush; the ability to control the rate of flow from the airbrush through the pre-select menu; and a rubber stamping capability in the stencil mode.

As a final note, complementing its line of 4:2:2 digital teleproduction equipment, which includes the Enhanced MKIIIC Digiscan 4:2:2 telecine, Rank Cintel introduced the new ADS-80 digital slide scanner. The ADS-80 was shown in conjunction with the Logic Gallery 2000 still management system, which incorporates Rank's Slide File still store and Art File graphics facility. Rank also showed its MatchBox digital still store, which adds an absolute color matching facility to the MKIIIC Digiscan digital telecine. **BM/E**

*For more information about graphics and effects equipment directly from the manufacturers, circle number 199 on the Reader Service Card.*

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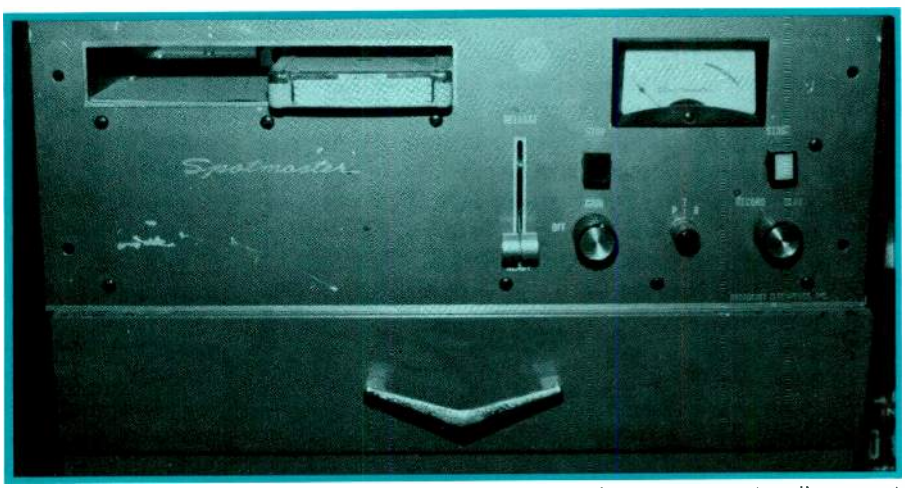
**Circle 132 on Reader Service Card**

# Industry Roundtable: Future Trends In Cart Machine Technology

**Edited by Steven Schwartz**

*Nowhere is the contrast between advancing technology and practical daily use of equipment more evident than in the workhorse of the radio station: the cart machine. To address this important dilemma, we present a panel discussion.*




Like the Classic 1957 Chevy, Broadcast Electronic's Spotmaster lives on!

Radio broadcasters have maintained a love/hate relationship with the audio cartridge machine for nearly 30 years. On one hand, there's the unparalleled convenience of being able to record, play back, and instantly cue up program material on individual tape cartridges. On the other, cart decks are notoriously maintenance intensive, a drawback that has plagued the medium since its inception.

Although the cart machine continues to be a mainstay at radio stations the world over, the success of the compact disk has heralded numerous digital alternatives to this established but trouble-prone approach to audio reproduction. In recent months the analog cart has been challenged by an assortment of audio storage and retrieval devices—everything from hard disk-based systems to R-DAT to EPROMs to videotape to digital data carts.

The future of the cartridge machine was a hot topic of discussion at this year's Radio '87 convention in Anaheim, CA. With the further encroachment of digital applications in audio recording and reproduction for radio, representatives from four major cart machine manufacturers joined in an NAB panel discussion on the future of analog cart technology. Moderated by audio consultant Jim Loupas of James Loupas Associates in Houston, the panel consisted of: Jack Williams, president of Pacific Recorders and Engineering; Art Constantine, vice president of marketing, Fidelipac; Tim Bealor, manager of audio products at Broadcast Electronics; and Tom Becker, sales representative from ITC/3M.

## Dolby SR & PR&E

*Pacific Recorders & Engineering demonstrated the first application of Dolby's Spectral Recording*

*(SR) system with an analog cartridge machine at the NAB show in Dallas last March. The demonstration, which involved the company's top-of-line Tomcart deck and outboard Dolby SR cards, reportedly achieved a dynamic range of 92 dB. The company has since been licensed by Dolby to develop SR racks that will be compatible with all commercially available tape cart systems.*

**Jack Williams:** Dolby Spectral Recording, or SR, is a new professional studio mastering system that yields recordings with exceptional purity of sound. Spectral Recording provides two technical advances in any form of analog tape recording. First, there's a substantial extension of headroom, which allows the use of a uniformly high maximum recording level on all audio frequencies. Second, is the elimination of the influence of noise and nonlinearity on the reproduced sound. Our system delivers this performance through being adaptive to the signal spectrum and by consistent application of a philosophy called the *principle of least treatment.*

The design of Dolby Spectral Recording has been carried out with close attention to the properties of human hearing—especially the need to prevent any audible artifacts in signal processing. At the lowest signal levels, or in the absence of a signal, Spectral Recording applies a fixed-gain-versus-frequency characteristic that reduces noise and other low-level disturbances by as much as 25 decibels. Only when the level of part of the signal spectrum increases significantly does the circuit adaptively change its own spectral reproduction characteristics. When this happens, our system changes gain only if frequency changes are needed, and only by the required amount.

All recording and communications systems have definite dynamic range limits. However, a simple measurement of maximum level and noise does not reliably indicate how recordings made with such a system will sound. Such a test says nothing about noise that appears only in the presence of signals, such as modulation noise, or about system behavior when the signal is at the overload level. Because SR increases recording headroom considerably, there is less risk of under- or over-recording. The working space is increased and there is greater freedom for creative effort and production.

An audio program changes constantly in level and frequency content. The gain settings that would give the best recording at the middle frequencies may cause low and high frequencies to overload. Lowering the recording level to prevent this reduces the audible signal-to-noise ratio. It follows that much of the capacity of the recording system is unused. Dolby Spectral Recording makes use of this capacity.

One way to define the ideal sound reproduction is to show the limits of human hearing as a window, as we did for the conventional audio recording in this slide (see Figure 1). The top of the slide corresponds to 120 dB, a continuous sound pressure level that is unbearably loud. The black boundary at the bottom of the window is the threshold of hearing. Sounds at this level are just audible to a listener with sensitive hearing. A recording system with a window [such as the one shown here] could be played back without audible noise or overload, even if the highest levels were literally at deafening levels.

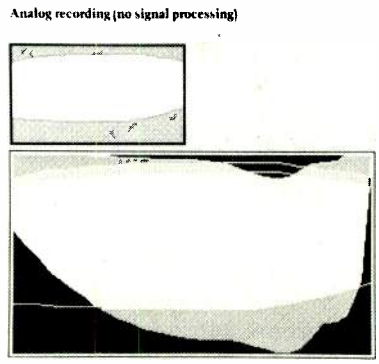



**Figure 1:** Human hearing thresholds.

We can compare the static performance of different recording systems by superimposing their windows on this auditory window. Sliding the analog window up and down corresponds to playing the tape back at higher or lower levels. Any limitation that would be audible will appear as an obstruction that reduces the size of the opening in this auditory window. It is important to remember that this method of comparison does not show dynamic audible effects, such as modulation noise of analog systems; nor does it show low-level nonlinearities or the effects of d.c. asymmetry, all of which occur in varying degrees in most digital recording systems. These effects all close the corresponding windows from the bottom when a signal is present.

The analog reference levels used in these comparisons are 250 nanowebers per meter and the digital reference level is 10 dB below the absolute clipping level; the recordings were done to present the audio at an acoustic playback level of 110 dB. Now, when those recorded signals are present, the only low-level defect in analog recording that can be heard or measured is tape hiss. However, in the presence of signal, the analog tape recording window closes further as other artifacts are added to the signal layer by layer—which, of course, is part of the reason that multiple generations of analog recordings deteriorate so rapidly.

Of course, several components of noise and nonlinearity can appear in the presence of a signal (see Figure 2). A signal is shown as a vertical bar A and is at a level that would cause three percent harmonic distortion in the tape medium. These harmonics are represented by the group of bars labeled B. Modulation noise, which appears only when the signal is present, is spread over a wide range of the spectrum and is represented by the area labeled C. The bottom layer of noise [labeled D] is tape hiss, which is caused by the statistical fluctuation of magnetic domain orientation.

Unassisted analog tape recording shows characteristic limitations in available headroom at low and high frequencies and a

substantial level of noise at mid-frequencies. A typical digital recording provides performance that is better than conventional analog tape in several obvious ways. The main drawbacks are the hard clipping barrier and the disadvantageous spectral distribution of noise. Although the measured dynamic range of a digital recording system may exceed 90 dB, the noise level is not uniform with frequency. The noise level is extremely low at low frequencies—much lower than analog tape, which is already more than adequate in the auditory window of low frequencies. However, digital system noise crosses the auditory threshold precisely in the spectral region where the ear is most sensitive. The usable improvement in noise level, especially in the presence of a signal, is not as great as theory predicts. Because the noise generated in the digital system is not random, and is therefore especially noticeable to the ear, it is normally masked by the addition of dither noise, which elevates the final noise level.

The Dolby Spectral Recording system contains an anti-saturation system that is designed specifically to deal with high levels and the low- and high-frequency ends of the signal to further extend headroom. Another feature of Dolby SR is its spectral skewing, which reduces the level of the incoming signal at the extremely low- and high-frequency ends of the spectrum. Spectral skewing desensitizes the control system of the Dolby SR unit to minor aberrations and tape-to-head contact and azimuth alignment, which might cause errors and fluctuations in the high-frequency response and head bumps and other low-frequency response variations.

## Applied technology at BE

*Broadcast Electronics recently introduced two products of note: the DV2, a digital, solid-state recorder/reproducer, and the Phase Trak 90 analog cartridge deck, which features a unique nonencoding phase-correction system that checks the phase relationship during playback for all carts—regardless of the system on which they were recorded.*

**Bealor:** For the 1987 NAB convention, one of the major trade publications in our industry did a survey of the people responsible for equipment purchases at AM and FM stations and AM/FM combinations. Two of the many questions that were asked in the survey are as follows. Number one: "What type of equipment have you budgeted for purchase in the upcoming year?" And the second question: "What type of new technology will you be looking for in the next year?" The top five answers to each of these questions were listed in the survey, and the third most common answer to the first question was cartridge machines. The second most common answer to the second question was some technology to replace cartridge machines.

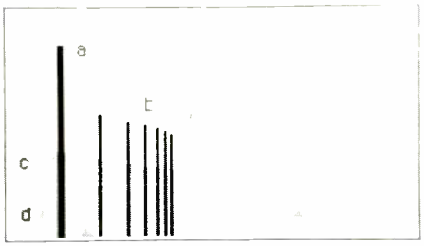



**Figure 2:** Disturbances produced by the pressures of a signal.

Consequently, this creates a bit of a paradox—both for users and for us, the manufacturers. It seems that a large number of the people responsible for what equipment is used in our industry want to replace the cart machine as we know it today. However, these same people are aware that, to date, there is nothing that will replace the cart machine. So, they will buy more cart machines. Now, we as manufacturers are faced with the same dilemma. Do we concentrate all our efforts on developing a good, reliable product that we know people will buy—if for no other reason but out of necessity? Or, do we change direction completely and pioneer a technology that will effectively do away with the cartridge? There is a good deal of merit in both approaches.

We at Broadcast Electronics feel that the best solution is to resolve the inherent problems as best we can in cart machines. And then, where technology and the application coincide, replace the cartridge machine—primarily in some of its more mundane jobs. To this end, we have brought out two new products. The first of these is the DV2, a solid-state record/playback unit, which in some cases as I've stated earlier, would replace a cart machine in some applications. The second product is the Phase Trak 90 cartridge machine.

The cart machine system has always had an inherent problem with short-term phase stability. And what we have tried to do is incorporate something called automatic nonencoding continuous electronic phase correction. In English, that means the PT90 will continuously correct stereo phasing of any cartridge recorded on any machine while it's being played back. Now, with the increased use of music on carts, a relatively new problem has shown up. That is, increased cartridge drag. Because of longer cartridges and new tape formulations, we as machine manufacturers have had to ensure that our machines will pull a five- or seven-minute cartridge loaded with a hot tape that maybe—and I emphasize *maybe*—has been played one or two times more than its useful life. Or, possibly—and I know that this seldom, if ever, happens—a cart that has been misused or dropped or kicked.

At any rate, pulling requirements for all of our products have increased. What we have tried to do is take some of the traditional portions of the pulling chain and improve them as best we could. Solenoids have been improved, designed to be more efficient [with an increase in] pulling power by as much as 100 percent. Also, the old bicycle chain that was used for years has been replaced. Ahead of the solenoid a stainless steel cable has been placed that not only couples the solenoid to the pressure roller shaft, but decreases the

amount of induced flux out into the head area. We've also made some improvements in the head assembly.

Now, the third problem we have is inherent in the cart system itself. One of the biggest headaches of cartridge machines in the past is serviceability. Cart machines have always been a maintenance-intensive piece of equipment because of the electro-mechanical design. What we've done is to try to make the units the most serviceable we can by making them the most modular we can. We've tried to make all of the rear panel boards plug-in to the extent that we've included the rear panel itself as part of the plug-in units. Both the power supply and the head block assembly are standalone units that can be removed with two screws. The front panel can also be removed as a standalone assembly. As a matter of fact, the machine can be disassembled into its basic 13 or 14 modulars in about 10 or 12 minutes. And, more importantly, reassembled into workable condition in about the same amount of time.

I guess what I'm trying to say by telling you all about this machine is that we at Broadcast Electronics feel that, in certain applications and with the technological advancements that have been made, that the traditional cart machine will be around for a long time. Now, however, we also feel that in some other applications, appropriate technology is available now to replace the cart machine. Broadcasters traditionally use an old Spotmaster or a WP Series or some other cart machine that happens to be on the shelf plugged in to the concert line, tied up to delay network news, or to play IDs or jingles. It's for these kind of jobs that we feel appropriate technology is available now in something similar to the DV2. This is a solid-state, RAM-based unit. It will hold about six-and-a-half minutes of memory and up to 99 different cuts with sequential or random-access playback. Today, this seems to be, to us, the most economical and practical use of available technology in replacement of cartridge machines.

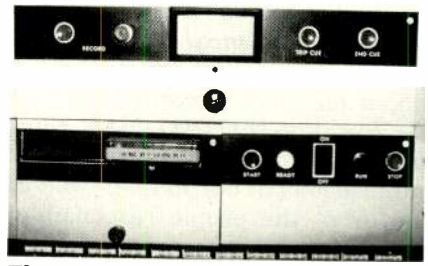


**Figure 3:** A look back: RCA/Jampro's old cart machine in rack-mount form.

We realize that users' wants and needs are continually pushing us, the manufacturers, toward cart machine replacement. However, the lack of a clear-cut direction for the technology of that replacement dictates that the existing medium, the cart machine, be as good as possible. And we at Broadcast Electronics are working to ensure that both of these needs are filled.

## Fidelipac asks: CDs or not CDs?

*Fidelipac introduced its first new cart in several years at this past NAB show. The back-lubricated Dynamax Cobalt tape cartridge is reported to offer a 2 db improvement in headroom between 8 and 12 kHz. More recently, the company was chosen by Voice of America to supply all cart machines for the $6.6-million renovation of 19 studios at VOA's headquarters in Washington, D.C.*

**Art Constantine:** One of the things that we have found disturbing is the insistence by the media that if you haven't converted to digital, you aren't keeping up with the times. We have [seen] all kinds of ads for processing equipment with headlines that say, "All digital by the end of the year. This is our goal." And we've seen ads for companies like Century 21 [that] carry the headline, "The fastest format improvement ever. One hundred percent of your music from Century 21 CDs."

How many people play CDs on the air? We wanted to find out. So, we called each of the 18 stations listed in the Century 21 ad who are quoted as playing CDs on the air. Do you know what we found? We found that of the 18 stations on the list, one had incorrect call letters. The station doesn't exist, but that's okay. Four of the stations said they played CDs directly on the air. But 13 said that although they were telling their listeners that the sounds they were hearing were coming direct from CDs, in fact, they were carting their CDs. That's a fairly heavy indictment against the CD as a live on-air device. And we asked those people who said they are carting CDs, why bother? Why live with the obvious signal-to-noise degradation, the obvious wow and flutter, the obvious hassles that you have.

They answered, "Actually, we're finding that carts are a lot easier to handle." These are quotes. "We're finding that cartridges protect our CDs from damage." "We find that we can control what cuts are aired by carting only those CD cuts that we want to play at our station." "We're finding that there's a tremendous level variance between compact disks, and we correct that by carting the CD." "We like the fact that we can program secondary and even tertiary cue tones on our carts and do semi-automated and automated on-air operations."

When we surveyed people's ideas about cartridge machines, we found that an inordinate number of people had the idea that a cartridge machine kind of looked like the Broadcast Electronics Spotmaster. Some people think of cart machines as this gadget made by Jampro in Philadelphia and marketed under the name of RCA (see Figure 3). These are vintage 1959 machines. Frankly, they are all well dedicated to doing the job they did those many years ago—along with this variety of endless loop tape cartridges (see Figure 4).

But that's not where we are today. As we've already pointed out, there are more modern machines and more modern carts. Fidelipac has moved out of the old model 350 adjustable corner post cart

you see on the left. In fact, [we've] even discontinued Hot Tape to move on to more modern products. We still make Master Cart, the Master Cart on the right is vintage 1977, and there is a new version available today. We've actually produced equipment that allows stations to convert from their old carts, their old record levels, and even discrete stereo into new, high-output, low-noise tapes [with] higher record levels and matrix stereo, if they wish.

So, to quote from a short article in a magazine that impressed me, one manufacturer had made an interesting statement that we completely endorse. He said, "I don't think technology is really driving the business. I think it's the performance of product that is driving all of this. People are simply going to use what's best for their application. So far as our vantage point is concerned, it's going to be oriented toward either giving somebody a much more powerful tool to do what they're doing now, or giving them a more efficient way of doing it. But we're not interested in technology for the sake of technology. And we don't think anyone else is either."

When new products are needed and the needs of broadcasters go beyond the equipment that is available today, and available from stock today, we'll start looking for better things to do.

## ITC/3M's digital dare

*This past NAB saw the introduction of ITC/3M's HCDA 3000, a digital cart deck designed in a traditional style using digital data carts rather than tape. The system is now being field tested and is expected to be marketed in early 1988.*

**Tom Becker:** As my esteemed colleagues here have mentioned, tape cartridge machines have been around quite a while—since the late 1950s or so. And, since their introduction, cart machines were quite well designed, and are quite well designed, to meet the needs of radio. As radio has changed over the years, so have cart machines. When better quality was demanded—and still is—manufacturers have provided. When phase stability became a concern, as it has been and still is, manufacturers provided.

You can stand back from broadcasting and look and think that a lot of things in radio have been changing lately. In the coming years, radio stations are going to be challenged even more, or at least that's our opinion at ITC. The challenge is going to be more than just the competitor down the block. Radio is going to be challenged by CDs in the home, by the R-DAT type of consumer digital products that are coming on the market, and even hi-fi stereo video. These are just a few of the real competitors that have rapidly surfaced within the last five years. And so, going after the marketshare for each radio station becomes more of a concern than just beating the processing of the guy down the street. They also have to be able to compete somewhat with what is available to the consumer.

With the belief that high-quality, reliable source equipment for the radio industry is a necessity and a requirement, ITC believes that, first off, analog is going to be around for several years—ten, 15, maybe longer. We also believe that a clean, consistent analog audio quality is best obtained by taking a system approach. That is, each station trying to stick with one particular tape cartridge, the same cartridge machine, and perhaps getting it all under the umbrella of just one manufacturer so that you've got quality control.

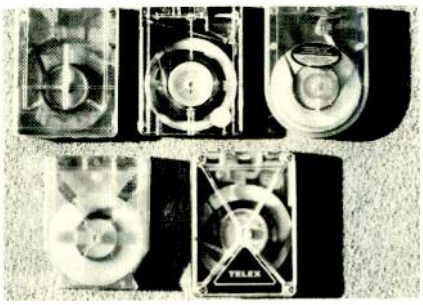


**Figure 4:** A collection of carts. The endless loop cartridge as it appeared over the years.

Different markets, of course, have different needs. Different audiences also require different technical needs, which require different levels of audio quality. Therefore, we also essentially believe that digital audio is the wave of the future. And there are several reasons for that. First of all, we're looking at no generation loss in dubbing; no degradation in sound over the life of the cartridge or over the life of the recording. We're not saying that this is an end-all solution. We are saying that we have decided to take the step forward and put our research forward, and come out with a product that we feel [will provide stations with the advanced, improved audio quality they] feel they need.

You would imagine that a cart manufacturer who has been in the business for as many years as ITC would come up with perhaps a tape approach. And the reason we've gone with a tape approach is that we believe that this is the most economical, the most feasible, and, perhaps, the easiest process of doing digital audio that still enables radio stations to not have to go in and retrain or change its staff or the way that they do things. And that's essentially what we've done. The HCDA 3000 provides radio personnel and programming with a digital audio format in a very proven cartridge format. If this is a good introduction, I guess only time will tell. Analog tape cartridges will continue to thrive and digital is perhaps the next step. I guess we're putting our eggs in the basket.

We decided to introduce the HCDA 3000 at the 1987 NAB in Dallas, and in doing so, we've become the first established [cartridge machine] manufacturer to really put forth a [digital] cart-based format. The real test is time: To see which of the manufacturers present here, and those that are not present, are really able to read the trends in this industry—which is not always easy—and determine what the marketplace wants and what they feel they need, and what will actually do the job for you. **BM/E**

# AN ENGINEERING WISH LIST

**Edited by Mark DuPré**

Holiday time is upon us—a time when everyone begins compiling wish lists. Yes, even engineering management. In this regard, we asked engineers from radio and television stations and independent teleproduction facilities what they'd like to find in their holiday stockings this year—what piece of equipment they would like to lay their hands on that either doesn't exist yet or currently exists as two or more separate pieces of gear.

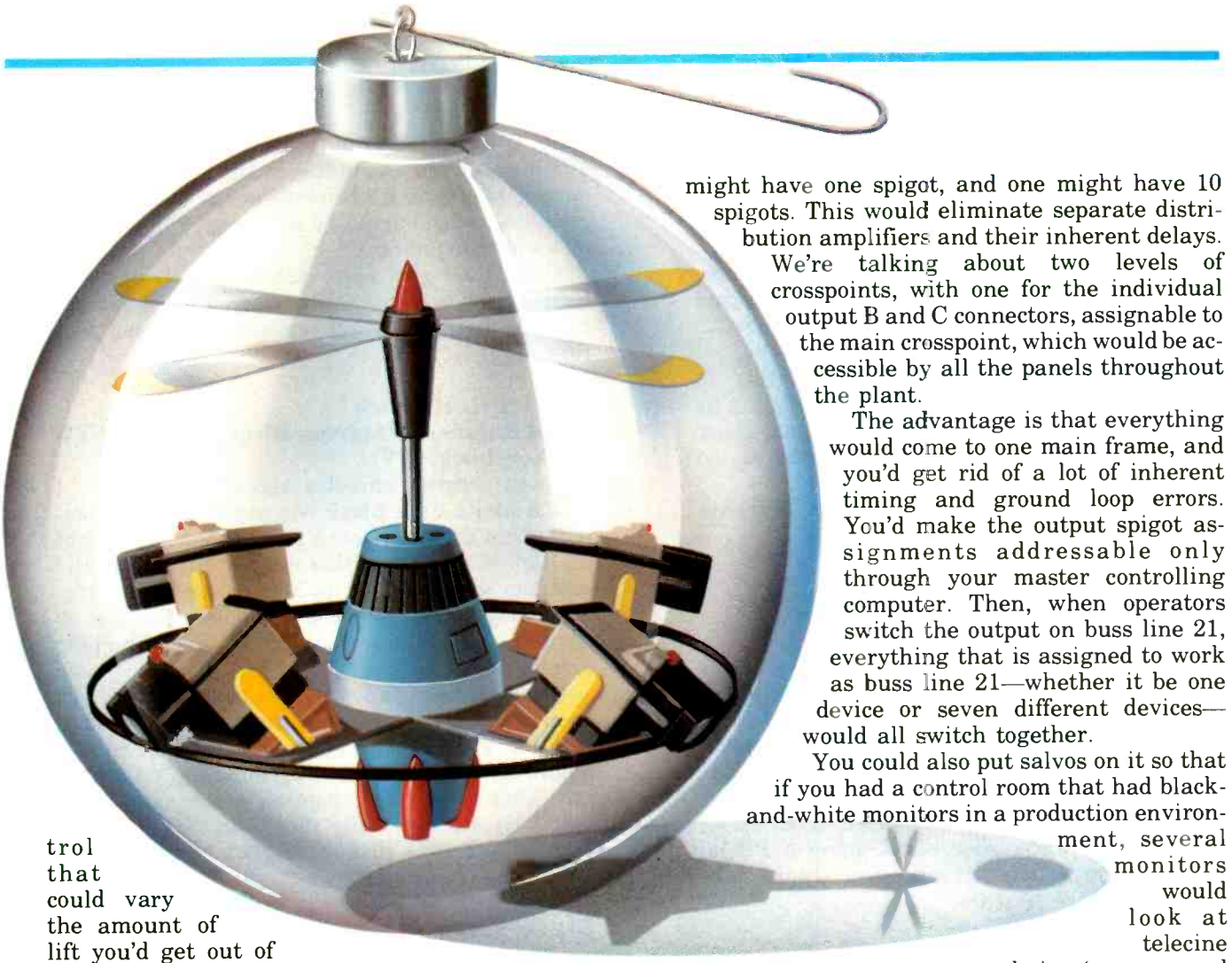
Some in the technical and engineering management community are pointed, direct, and absolutely sure of what they want (manufacturers, prick up your ears). Others look towards a more fantastic future, in which mind controls and antigravity devices are possible. In no case, however, did the opportunity to wish meet with silence or a blank stare.

**Charles Benner, Jr.**
**Chief Engineer, WUSL-FM**
**Philadelphia, PA**

I'd like something that would take care of automatically accepting traffic reports. My idea is that there would be a unit to tie into the reporter's phone line and provide a signal to start a reel-to-reel deck back at the studio. It would have to be easy to use at the source end—push a button, wait for a light, and then start the report. Back at the studio end, the reel-to-reel would start recording, leaving a pulse or code in the beginning so that when the report is done, the tape rewinds back to that cue. Once it's installed, you'd only have to set up by synchronizing the two units. Finally, there would need to be some type of indicator or sound that would alert the on-air talent that the material is cued up and ready to go.

**Leland Ohlhausen**
**Chief Engineer, KTAB-TV**
**Abilene, TX**

I'd like an antigravity machine, something about the size of a bathroom scale, that you could slide underneath equipment. You'd have a remote con-



trol that could vary the amount of lift you'd get out of it. There wouldn't have to be propulsion or anything—it would just have to lift things up. When you need to move heavy equipment around, you could just slide this magic platform underneath and float the equipment up or down. Or, when you have to inspect the tower, you could just get up on it yourself and float up and down.

We have a beam transformer that we're looking at moving. It weighs about 8000 pounds. I could fly this device under it, turn the knob, pick it up, and move it around wherever we wanted.

**Lou Toepel**
**Chief Engineer, Action Video**
**Hollywood, CA**

I'd like to see some type of electronic audio/video patch panel distribution system, a multilevel routing switcher. Right now, when you have a routing switcher, the output busses have two spigots each, and you end up taking one of those spigots out and DA-ing it so you can feed the monitor and a VTR and three or four other devices simultaneously. With other outputs, you might only use one of the output spigots and the other one goes unused.

What I'd like to see is a switcher with 64 inputs and 200 assignable output spigots that can be assigned to look at any output crosspoint. One output crosspoint might have six spigots, one output might have one spigot, and one might have 10 spigots. This would eliminate separate distribution amplifiers and their inherent delays.

We're talking about two levels of crosspoints, with one for the individual output B and C connectors, assignable to the main crosspoint, which would be accessible by all the panels throughout the plant.

The advantage is that everything would come to one main frame, and you'd get rid of a lot of inherent timing and ground loop errors. You'd make the output spigot assignments addressable only through your master controlling computer. Then, when operators switch the output on buss line 21, everything that is assigned to work as buss line 21—whether it be one device or seven different devices—would all switch together.

You could also put salvos on it so that if you had a control room that had black-and-white monitors in a production environment, several monitors would look at telecine chains (as compared to VTRs or still stores). But when you're doing news you would want the same black-and-white monitors to look at other devices. That would be a salvo assignment on the output level selection, rather than on the crosspoint upper level selection, which would be an operator function of selecting the input.

**Andy Butler**
**Director of Engineering, WQHT-FM**
**New York, NY**

As an all-sports station, we need to be able to place a reporter in the field and have him go on the air or feed to us over a cellular telephone using a broadcast-quality mic. The quality of cellular is very good, better on average by a considerable amount than a standard dial-up phone. But there's no input for a cassette or mic, and the handset on a cellular phone is clumsy and hard to handle, so it's not comfortable for on-air use.

I'd like somebody to build a portable cellular phone with at least 3 or 3.5 watts of output power that includes a built-in direct mic input through a standard mic connector, a line level unbalanced input that mixes with the mic, and a standard ¼-inch stereo headphone jack—all integrated into one package. It would be nice if it had individual level controls for the mic, the cassette, and the headphones, too.

**Bill Tullis**
**Audio Director**
**Turner Broadcast System, Inc.**
**Atlanta, GA**
I'd like to have some mental equipment controls. That way, you wouldn't have to sit there and fumble for buttons. You'd just have to sit there and think it. Put on your old headset and go for it.

I'd also like to see some affordable digital multitrack machines—something similar to what's available in the analog range. As far as wishes that people can easily understand, those are the only two things. Everything else is too complex.

Oh, yes, a third thing: I'd like to see "Murphy" banished to Iran.

**Donald S. Browne**
**VP/Technical Operations**
**ABS Broadcast Group**
**Arlington, VA**
At the beginning of every video game you see in an arcade there is a promo that runs about 30 seconds. Using some form of PROM, It demonstrates how the game is played, and presents the leading scores in the game.

What I'd like to have is an electronic device for playing back prerecorded spots using a PROM just like the arcade games. You would take the microchip containing the spot and insert it in a socket instead of inserting an audio cart or video cassette. To start, you would just push a single button and it would play instantaneously. If you want to do special effects, hit the button again, and it immediately starts up again so you get a fast repeat of a video segment.

This would give us a videotape cartridge machine that has no moving parts and is not susceptible to dirt, wrinkling tapes, or anything like that.

**Charles R. Helmick**
**Chief Engineer/Program Director, WTAP-TV**
**Parkersburg, WV**
As both program director and chief engineer, I would like a little black box to tie into the computer that could give me a readout the next day of all the little problems that don't fit into either the category of equipment failure or operator error. You always hear that the equipment did this or that, but you know that it had to be operator error.

We have discrepancy reports that are filled out each morning, or each evening after a shift, that detail any problems that arose during the shift—engineering problems, programming problems, any kind of problem: logging errors, why they didn't have a tape, why they didn't have a commercial, etc. The little black box would be real helpful to narrow it down.

**Frank Fotti**
**Engineering Supervisor**
**Malrite Communications**
**Secaucus, NJ**
A nice Santa Claus wish list item would be a true digital domain audio processor for FM radio, with digital control of the audio path as well as stereo generation, limiting, and clipping control. Controlling the audio in a discrete manner would give better control and better sound to a radio station. I hope to see something like this within the next three to five years.

**Ben Gamboa**
**Manager ENG and Studio, CFTO-TV**
**Scarborough, OT**
At the top of my wish list is a delegation switcher that would assign the CCU, with remote control, to the different control rooms throughout the facility. There are

other things I'd like to see. We recently sent a Betacam-equipped cameraperson to Thailand. He had no way of viewing the picture he had just taken—short of hauling along a BVW-25, which would have added too much weight. However, if he used MII, it wouldn't have been a problem. Maybe someone could come up with a black box that you could attach to the Betacam that will give you that facility.

Also, most teleprompters use a mirror in front of the lens, and it deteriorates the performance of the lens. Why doesn't someone come out with some LED four-line displays that could be put right on top of the lens instead? This type of setup wouldn't degrade lens performance.

**Bill Croghan**
**Chief Engineer,**
**KCEE-AM/KWFM-FM**
**Tucson, AZ**

I'd like a Swiss army knife combination with a straight blade, a Phillips head, a ¼-inch nut driver, and a mini-straight blade. I always find myself going back to the shop for one of those four tools, and I think they account for about 90 percent of the tools I have in my hand during the typical working day.

One other minor item I could think of would be an impedance bridge with a built-in synthesizer and detector. Let's put them all in one instrument. It would make it a whole lot easier to take common-point and field measurements—instead of having to haul out a separate bridge, synthesizer, and detector.

**David Smith**
**Chief Engineer, WTAF-TV**
**Philadelphia, PA**

I want a purely electronic commercial playback machine. It would have to be some sort of nontape storage device—optical disk or something else—where you can plug in commercials, and they could be archived into the system. You wouldn't have to move little boxes of tape around, and you wouldn't have to worry about little mechanical arms pulling things in and out. Interestingly enough, everything else I've ever dreamed about already exists.

**Harry Simons**
**Chief Engineer,**
**WAEB-FM**
**Lehigh Valley, PA**

What I'd really like to see are high-fidelity AM receivers. But if I had to wish for a piece of broadcast equipment, it would be a test-and-measurement device that would have a signal generator, audio analyzer, and scope built right into it. If all that equipment were in one unit it would save a lot of lugging, a lot of room, a lot of time, and a lot of hookup wires.

**Ray Bohnert**
**Chief Engineer, WIGM-AM/FM**
**Medford, WI**

We put our heads together and we all agree that a high-powered remote microphone would be very handy. You could go to a game, auditorium, or parade, and just pull out your mic and start talking—even if you were several miles from the studio. You can't always get through a crowd carrying a big amplifier, and you don't always have enough room to put up an antenna. It ought to be that you could just pull up, pull out your microphone, and talk.

Some of us also want to make things easier for the announcer. But we already have something like that. It's called automation.

**Richard Solberg**
**Engineering Operations Manager,**
**WLIW-TV**
**Plainview, NY**

I'd like to see brain-controlled editing systems. That is, a thought-pattern-processor control system, as opposed to manual or even computer-operated systems. I also think in terms of whimsical things such as computerized maintenance decks that fix things. Or a computerized secretary that never goes on coffee breaks, never calls in sick, always answers on the first ring, knows where everything is, never socializes at work, and can guide me through my job without my involvement.

**Jim Stagnitto**
**Director of Engineering,**
**WNSR-FM**
**New York, NY**

The piece of equipment I'd like to lay my hands on would be a fiber optic link STL. You could have your stereo generator at the studio and hook it up to a fiber optic link, a little black box that would do everything so you wouldn't have to go to PCM or anything like that. You'd be able to send a composite signal down the fiber and pick it up at the other end and put yourself on the air.

In crowded situations, such as we have here in New York, you probably couldn't get another STL frequency if you wanted to. So, this would eliminate the need to try to get a microwave frequency. You'd probably have the same bandwidth, quality, and capability with fiber optic that you have with microwave—plus, you'd be free from the tyranny of dealing with land lines. You'd be able to set up your stereo generator and transmit the complete composite from your studio site all the way to your transmitter.

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**Monty McAnally**
**President & Chief Engineer,**
**WEKC-AM**
**Williamsburg, KY**
There are a lot of things that can be upgraded in the radio station—cart machines, for example. There has got to be a better way of reproducing commercials than with the basic cart machine we use today—a digital effort of some type would be the most realistic.

I would also like to see a meter—a people meter, if you will—or some type of audience measuring device for radio. There has got to be a way to sample what people are listening to without the use of diaries or telephone interviews. It's vital information we all need.

**Ivan McKinnon**
**Assistant Chief Engineer,**
**WAGM-TV**
**Presque Isle, ME**
As a TV station, we need to go through all of our equipment to see that we're not putting out phase delays or chrominance or luminance delays. I'd like to have a visual idea of what I'm looking at when I'm adjusting, as well as an audio system to listen to how the audio is sounding. The thing that I would like to see is test equipment that covers the signals that you would use for both audio and video. In other words, a TV set along with a spectrum analyzer, a scope, and a volt meter—all in one neat little package.

**Gene Thomas**
**Station Engineer, KWFC-FM**
**Springfield, MO**
One thing that would really be of interest to me for sound reinforcement would be an audio console with a built-in spectrum analyzer. Instead of having to carry around a lot of extra gear, I would be able to just set up a mixer, analyze or check the frequency response of the room, and adjust my settings accordingly. I expect to see it eventually. There are a lot of advances along those lines of incorporating more and more gear together, especially with the digital technology coming out these days.

**Dick Martinez**
**Engineering and Program Operations**
**ABC Radio Network**
**New York, NY**
I guess there are two things that we're really looking at. Right now, we're very interested in random access digital storage. We're looking at something that has to be highly reliable, with zero down time, which basically excludes anything that's presently available. It almost cries for a solid-state storage device.

We're talking about a fairly large system, somewhere in the order of 800 to 1000 minutes of high-quality, random-access storage. The reason for that is we have a large commercial news actuality and short-form programming storage requirement, and we're looking to get rid of all the tape handling, maintenance, and tampering of tapes and tape machines. Generally, the cartridge machine is what we're talking about, and in most environments, you won't find that requirement. But here it makes a lot of sense because of the size of what we're doing. To have a central storage area would tie in beautifully with our automation system, which presently runs our entire studio plant. It would be a unique situation, but it would work for us.

We've also sort of pioneered a very large scale, totally integrated automated plant. This plant is totally involved in computer automation to one degree or another, and we find that you really have to do everything custom in the way of software. So, my second wish would be for some industry standard for automation protocol—much like the standard General Motors is trying to set for factory floor automation. I know that there has been an attempt to provide something, but I think it's primarily directed at the TV side of the house. I have yet to see any attempt made to develop a protocol that would handle a plant. It's hard to tell, and I wouldn't want to second guess up-coming technology, but I would hope that the future is leading in this direction.

**Dean Winkler**
**VP/Director of Creative Services,**
**Post Perfect**
**New York, NY**
My first wish would be for something that simply taps the pleasure center of the brain so that you turned it on and you didn't care about anything else in the world. Now, failing that, on a more possible level, I would like to see an NTSC tape recorder—be it digital or analog—that had no noise, no quantizing error, and no errors of any kind. What I want is just a fully 100 percent transparent recorder/reproducer so that when layering and doing all those other things that we do right now, there's no noise and no errors from the generations, without having to stay inside a disk recorder like an A-62 or a Harry, which have a lot of other limitations.

So, if I can't have my first choice, which is my real number one wish, the second one will have to do. **BM/E**

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**About the Author:**
Mark DuPré is a freelance writer and the editor of *Image World* magazine, published by the Rochester (NY) Institute of Technology.

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# Paying the Piper

By Harry Cole, Bechtel & Cole, FCC Counsel

One of the ironic traditions associated with the usual year-end holidays and related festivities is that of making resolutions for the new year. Perhaps it arises from a recognition of the need to sober up (in whatever way may be appropriate) and attempt to improve one's behavior in the upcoming year. In the spirit of that tradition, we hereby offer a discussion of inspections, fines, and forfeitures—topics likely to send a distinctly unseasonal chill up many a broadcaster's spine.

First, as we have discussed previously in this column, the days of limited enforcement of the FCC's rules are gone. Several years ago, probably as a matter of necessity in the face of significant cut-backs in the Commission's budget, the enforcement program was reduced sharply. Few, if any, station inspections were conducted, and the number of fines and forfeitures issued for apparent rule violations dwindled. This did not mean, of course, that the rules were not being violated; more likely it just meant that, as a matter of resource allocation, the Commission felt that other matters on its agenda warranted the dedication of personnel and funds more than the ferretting out of licensees operating out of compliance with current FCC regulations.

Then, as the Commission's deregulatory program got rolling, it became possible to refocus attention on the operational end of things. Such a refocusing was particularly appropriate in view of the fact that much of the FCC's rhetoric in support of deregulation had been directed to the Commission's perception of its role as that of a traffic cop of the airwaves, making sure that a few necessary rules were obeyed. In any event, the Commission authorized its Field Operations Bureau (FOB) to hand out fines directly (rather than refer apparent violations to the Mass Media Bureau in Washington for follow-up action), and the Commission also apparently gave the FOB the green light to go out and inspect to its heart's content. The result was an upsurge in fines, as we have previously reported.

Unfortunately, other than FCC press releases there do not appear to be any generally available means of determining what types of violations are being cited by the FOB and how much in the way of fines each violation is costing. To help remedy this, we offer the following summary of a selection of forfeitures that have been handed out by the Commission throughout 1987.

In actions apparently arising under the main studio rules prior to their recent revision, two stations were hit with significant fines for violations related to the location of their studios. An AM/FM combination in the Washington, DC, area was fined $10,000 for failing to maintain a studio in is community of license and related violations. Meanwhile, an FM station in Tacoma, WA, was fined $5,000 for relocating its main studio without providing the FCC the requisite notification.

Even though the main studio rules have recently been relaxed substantially in certain respects (primarily relating the geographical area in which main studios may be established), they still impose significant restrictions on where a licensee can locate its main studio, what it can and must broadcast from that studio, and when and how it must notify the FCC of any changes in main studio location. And, since the Commission has attempted to make its main studio rules easier for broadcasters, it may now be inclined to enforce them more strictly. Again, it really should not be too difficult to assure compliance with these rules.

## Technical violations

The FOB's usual area of expertise is technical. That is, when an inspector pays a station a visit, he or she is most often interested in assuring that the station's technical operation is consistent with the rules. Thus, it is not surprising to find the following forfeitures relating to such matters:

- A $4,100 fine issued to an AM station on the Northern California coast for a variety of technical deficiencies, including an inoperative fail safe device, inoperative EBS equipment, broken antenna current ammeter, lack of antenna resistance and equipment performance measurements, and incorrect remote meter and control location;
- A $2,800 fine to an AM station in a small community in Eastern North Carolina for failing to maintain EBS equipment and failing to conduct weekly EBS tests, failing to have necessary control and monitoring equipment at the remote control point, over-power operation, and failing to provide full instructions to transmitter operators concerning their duties;
- A $2,700 fine to an AM station in the greater Los Angeles are for similar EBS- and remote control-related violations;
- A $2,000 fine to a TV station in Pittsburgh for failing to secure renewal of its STL and for failing

Continued on page 74

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**129th SMPTE Show Report—'87 Winter Conference Review**

## FEB

**NEW IDEAS IN AUTOMATION**
Covering studio, newsroom & routing/master control.

**Teleproduction Facility Engineering Update**

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## MAR

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BM/E's Survival Guide to Las Vegas gives the ultimate in advertising exposure. The only publication that gives NAB attendees a balanced mix of business and pleasure.

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3-D modeling and animation, paint systems, and integrated workstations.

**Engineering Tips for Better Field Recording, Digital Audio Report.**

**BDA/BPME Preview**

## JUN

**NAB SHOW-IN-PRINT**
BM/E's June issue—the broadcast industry's authority for post-show coverage, providing a complete overview of the products and events at the convention. Analysis of the impact of technical sessions as they relate to exhibited hardware.

**ITS Preview**

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**Oki Electric Industry Co., Ltd.**
Tokyo, Japan
**Circle 135 on Reader Service Card**

## Leader's Latest Oscilloscope

Leader Instruments Corp. has introduced the new 60 MHz CRT-readout LBO-2060 cursor-equipped oscilloscope. The unit is designed to allow users to observe waveforms, setting conditions, and measured values on a single display, and also displays salient settings conditions like CH-1 and CH-2 sensitivity, main and delayed sweep time, and triggering controls, thus reducing setup time in the field.

On-screen cursors eliminate graticule signal alignment and box-counting for voltage, time, and frequency operations. The two-channel dual time base LBO-2060 oscilloscope retails for $1490.

***Circle #200 on Reader Service Card***

## Knox K20 Shows Character

The K20 character generator from Knox Video is a full-color, high-res device that features upper- and lowercase fonts, an internal genlocking sync generator, and a downstream keyer.

The K20's other features include 16 pages of nonvolatile memory, intermixable eight-color palette, and four-speed roll capability. List price is $1395.

***Circle #201 on Reader Service Card***

## Rhode & Schwarz 20 kW Tetrode Bows

The new 20 kW TV tetrode transmitter NT 425 from Rohde & Schwarz is designed for use within a basic audio/video transmission network in the 470 to 860 MHz range. Capable of multichannel sound operation according to IRT dual-carrier methods, the unit rounds off R & S's line of UHF TV transmitters.

Features include a central control unit; valve, cavity resonator, and transformer monitoring; 48 analog signal capacity; and an integrated data acquisition system.

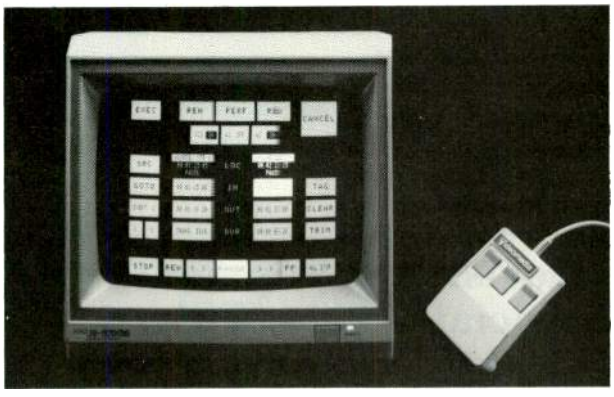
***Circle #202 on Reader Service Card***

## Gentner Custom Telephone Remote Packages

Gentner Engineering Co., has introduced a series of specially-packaged cases for telephone remote broadcasts. All the equipment needed for the remote, and the equipment for the studio end as well, are bundled in one travel-approved case.

Standard equipment includes a dial-up phone line, frequency extension equipment, and Aphex enhancement, noise reduction, and sharp filtering equipment. Nine models have been developed to meet nearly any application and budget—custom packages are also available. List prices start at $2995.

***Circle #203 on Reader Service Card***



## Videomedia's Mickey Editing System

A new low-cost, optomechanical mouse-based editing system has been debuted by Videomedia. The Mickey videotape editing system boasts compatibility with all common half-, ¾-, and one-inch videotape formats. System features of the package include distributed intelligent interface, 50-event memory, printer output, and user-programmable functions.

Two models of the system are available: Mickey I, which runs frame accurate cuts-only, and the expanded-feature Mickey II, which handles A/B roll editing. Editing features include a built-in video mixer, automatic two-channel audio-follow-video mixer, automatch and autoextend functions, and "one-mousestroke" edit list cleaning.

List price for Mickey I, $3500; Mickey II, $4500.

***Circle #204 on Reader Service Card***

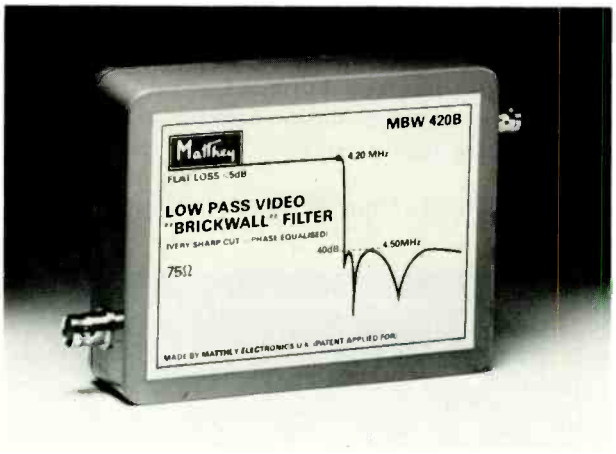
## Winsted Wheels In New Tape Truck

The Model U5042 programming tape truck, new from Winsted, is a durable easily moveable unit that can transport hundreds of videotapes at one

time. The truck is equipped with eight aluminum hanger bars that can accommodate Winsted TapeCubes, half- and ¾-inch shelves, and hanger cases for Sony, Ampex, and 3M tapes.

In addition a standup work surface is provided on the cart. Four-inch dual-wheel casters provide smooth transport.

***Circle #205 on Reader Service Card***

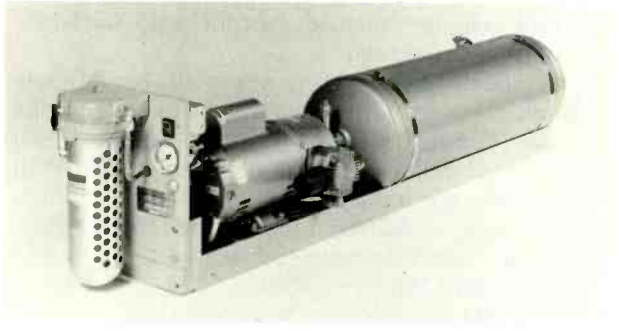



## Television Equipment Associates Hits With "Brickwall" Filters

Designed to eliminate spillover of inadequately separated video/hi-fi audio signals, the Brickwall Series of filters is available from Television Equipment Associates. The MBW420 model passes all video at 4.2 MHz while at 40 dB down on 4.48 MHz, and the MBW680 similarly manipulates signals in the 6.8 MHz range.

The Brickwalls prevent vision and audio defects due to close subcarriers on an unfiltered signal.

***Circle #206 on Reader Service Card***

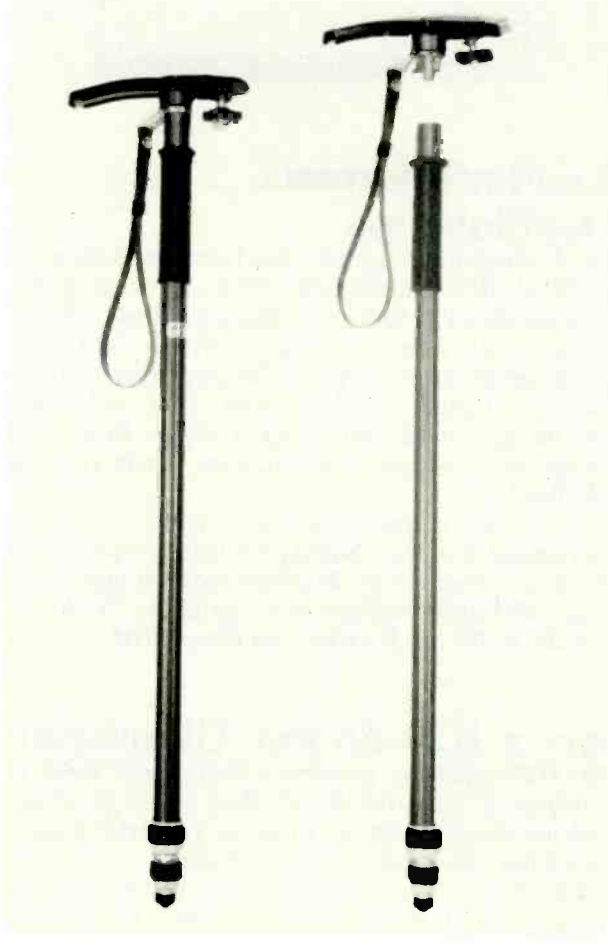


## Dry Air Module from Dielectric

A nitrogen replacement module designed as a low-cost supply of dry air for broadcast facility compressed air lines has been developed by Dielectric Communications. The module can replace nitrogen tanks in existing dry air systems, and eliminates the problems associated with pressurized gas storage as well.

The device consists of a compressor, storage tank, and a dessicant dryer of indicating gel that is capable of drying up 4400 cubic feet of air before any replacement gels are necessary.

***Circle #207 on Reader Service Card***



## Gitzo Monopods Take a Hike

In a unique design innovation, Gitzo has manufactured all its monopods with removable camera platforms. In the platform's place, a soft handle can be installed so the monopod can be used as a walking stick.

The hand-assembled pods extend smoothly, locking firmly into place on waterproof resin washers. The annodized extensions remain a full two inches in the next-larger tube section, providing firm support and rock stability. The Gitzo line of monopods is composed of 20 models of varying size, grip design, and camera platform to cover any need.

***Circle #208 on Reader Service Card***

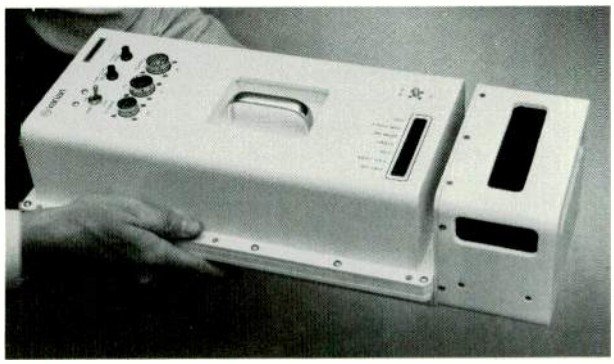

## SPC Surge Protectors from MCG

MCG recently introduced the SPC series of AC power line protectors designed to protect sensitive broadcast equipment systems employing dense microcircuitry from the adverse effects of lightning, transients, power spikes, and power surges.

Installation methodology requires the placement of an SPC in the main service panel of the AC power line. Reaction time is one nanosecond and a total of 12000 joules/phase can be absorbed for 120 VAC to 480 VAC single-phase panels.

Featuring triple redundancy, the SPC products ensure equipment safety even in the event of catastrophic transient irregularities
Prices start at $1475.

***Circle #209 on Reader Service Card***



## Varian Intros Compact TWT Amp

The VStar Satcom Amplifier, new from Varian, is a compact traveling wave tube (TWT) power amp designed for use in thin-route, small earth terminal applications—including VSATs, SNGs operations, and remote communications systems.

Combining greater power output, ruggedness, and small size, the unit provides 50 watts of output at 14 to 14.5 GHz. Gain is 49 dB at rated output; small signal gain is 53 dB. The 15-pound device retails for under $15,000.

***Circle #210 on Reader Service Card***

## Stereo Sentry from Sine Systems

A new early warning monitoring unit, designed in response to industry feedback, is now offered by Sine Systems. The Stereo Sentry will give instantaneous report on any one of eight specific audio conditions. Hooked into a station's air monitor bus, the unit can watchdog the entire plant, from microphone to antenna.

Features include balanced XLR inputs and an optional remote alarm panel. List price is $1399; the remote alarm option is $239.

***Circle #211 on Reader Service Card***


## 3M Rolls Out S-VHS Cassettes

3M has introduced a new line of professional-quality S-VHS videocassettes, which feature separate Y (luminance) and C (chrominance) capability to achieve a horizontal resolution of more than 400 lines.

The tape's advanced features are a direct result of a two-year research program at 3M to develop a "next-generation" oxide videotape formulation. Reported benefits of the S-VHS format include superior resolution and higher coercivity than standard VHS videotape.

***Circle #212 on Reader Service Card***

to operate that STL on its assigned frequency;
- A $2,000 fine to an AM station in a small community in Northeastern South Carolina for failing to file a license application (FCC Form 302) to cover changes in its facilities within 10 days of making the modifications;
- A $1,200 fine to an AM station in Puerto Rico for failing to maintain required logs and for failing to have at least one licensed operator on duty at all times of operation;
- A $1,750 fine to a TV station in Eastern North Carolina for failing to maintain its tower and for spurious emissions.

Meanwhile, we take this opportunity to offer a couple of tips on what to do if and when the inspectors do arrive at your station. First, it is advisable that all employees be instructed to alert appropriate management of the arrival of inspectors. For example, it should be standard operating procedure to notify the general manager and the chief engineer or, in their absence, other specified management officials. A knowledgeable station official should accompany the inspector throughout the inspection, to provide information, documents, and so forth.

Of course, FCC inspectors should be treated courteously and cooperatively. But it is important to recognize that the purpose of an inspection is simply to gather facts, not to make an on-the-spot determination as to whether a fine should be assessed. Thus, you should probably avoid arguing the merits of any apparent violation with the inspector—you will, after all, have plenty of opportunity to do that down the line. By the same token, you should not feel compelled to concede that every observation the inspector makes confirms one or another violation—remember, if you concede a violation in the inspector's presence, it will probably be more difficult (but not necessarily impossible) for you to argue otherwise later on.

After the inspection, the inspector will review his or her notes and, if appropriate, send to the licensee a notice of apparent violation or a notice of forfeiture. The licensee can respond to such a notice either by conceding the violation and paying the fine, or by submitting a detailed response explaining why the fine should be reduced or eliminated. And even if that response is rejected, the licensee may appeal the fine to the full Commission and, ultimately, to the courts.

If you have any questions about any of these matters, and especially if an FCC inspector visits your station and issues you a fine, you should consult with your communications counsel. **BM/E**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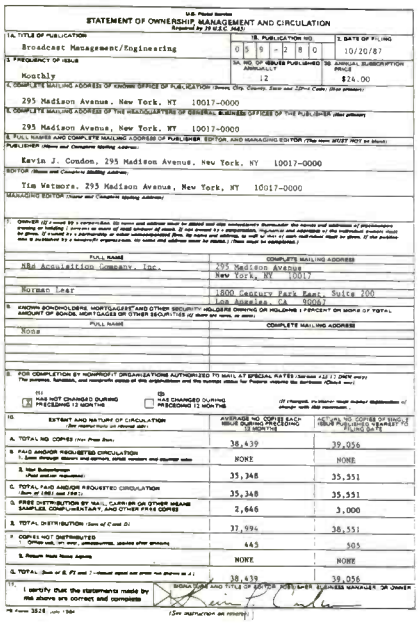

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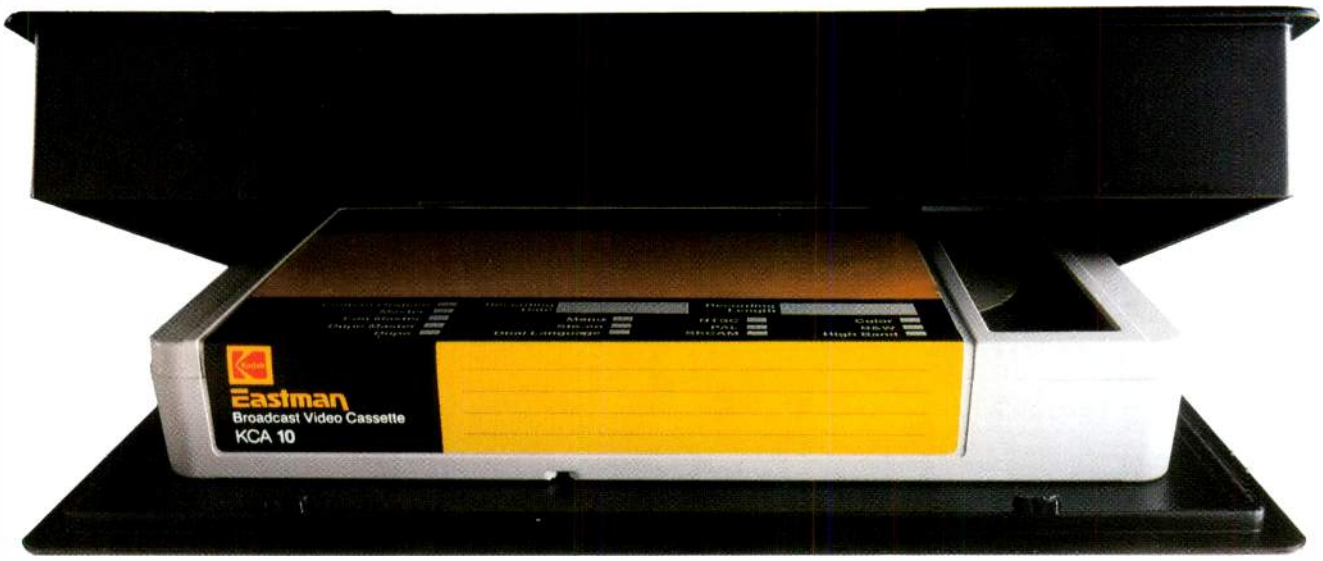


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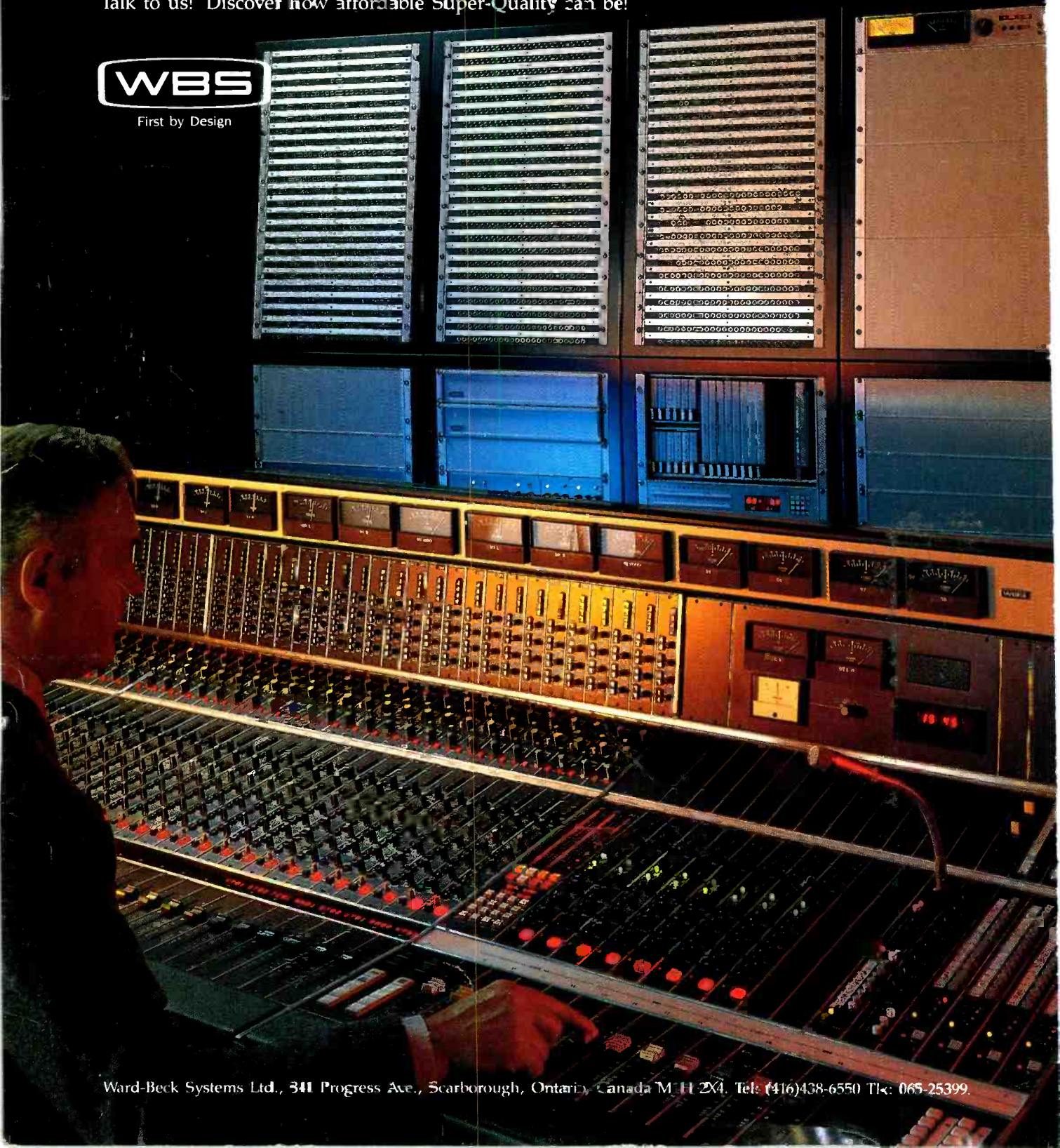

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