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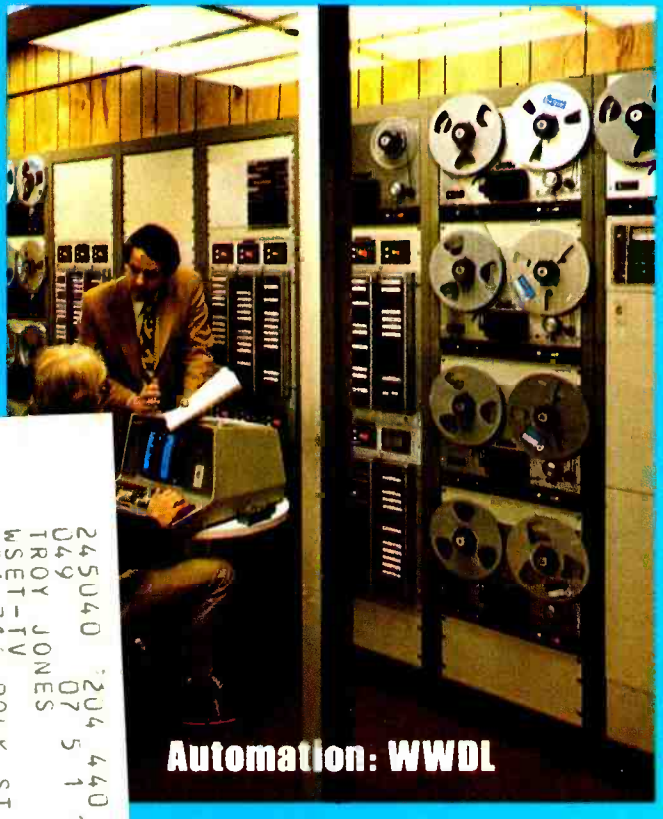

Automation: WWDL

DIGITAL BASICS

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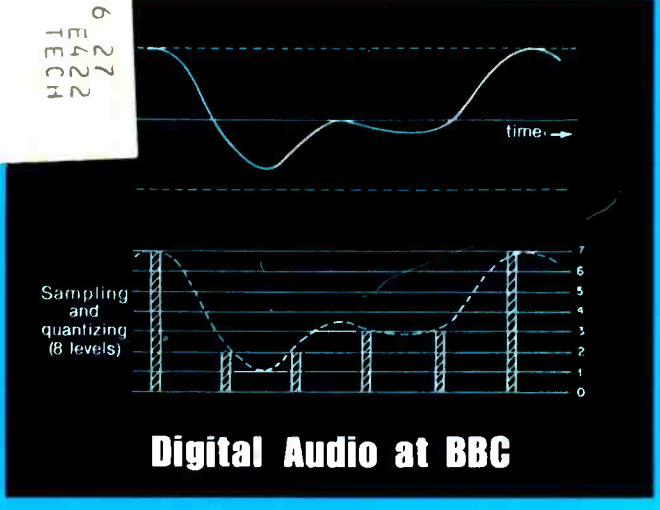
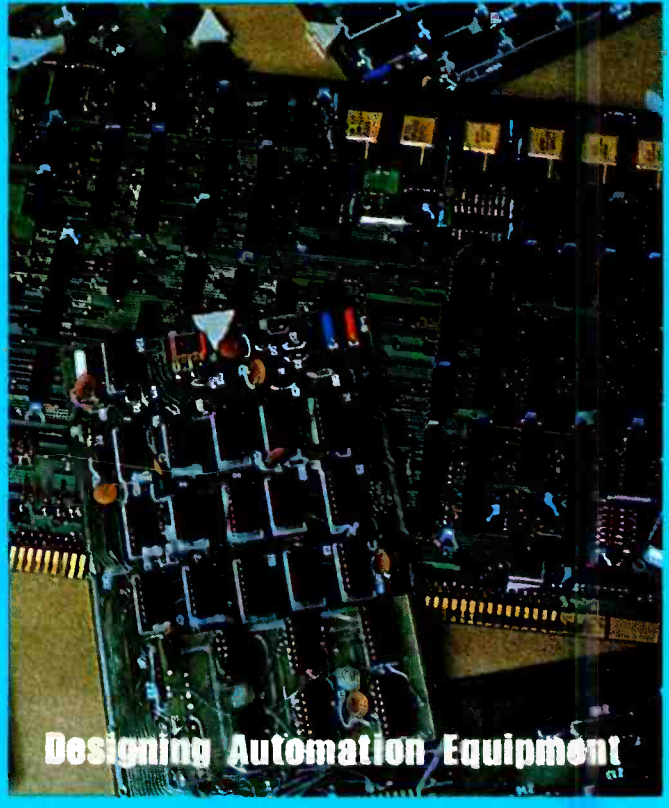


Digital Audio at BBC



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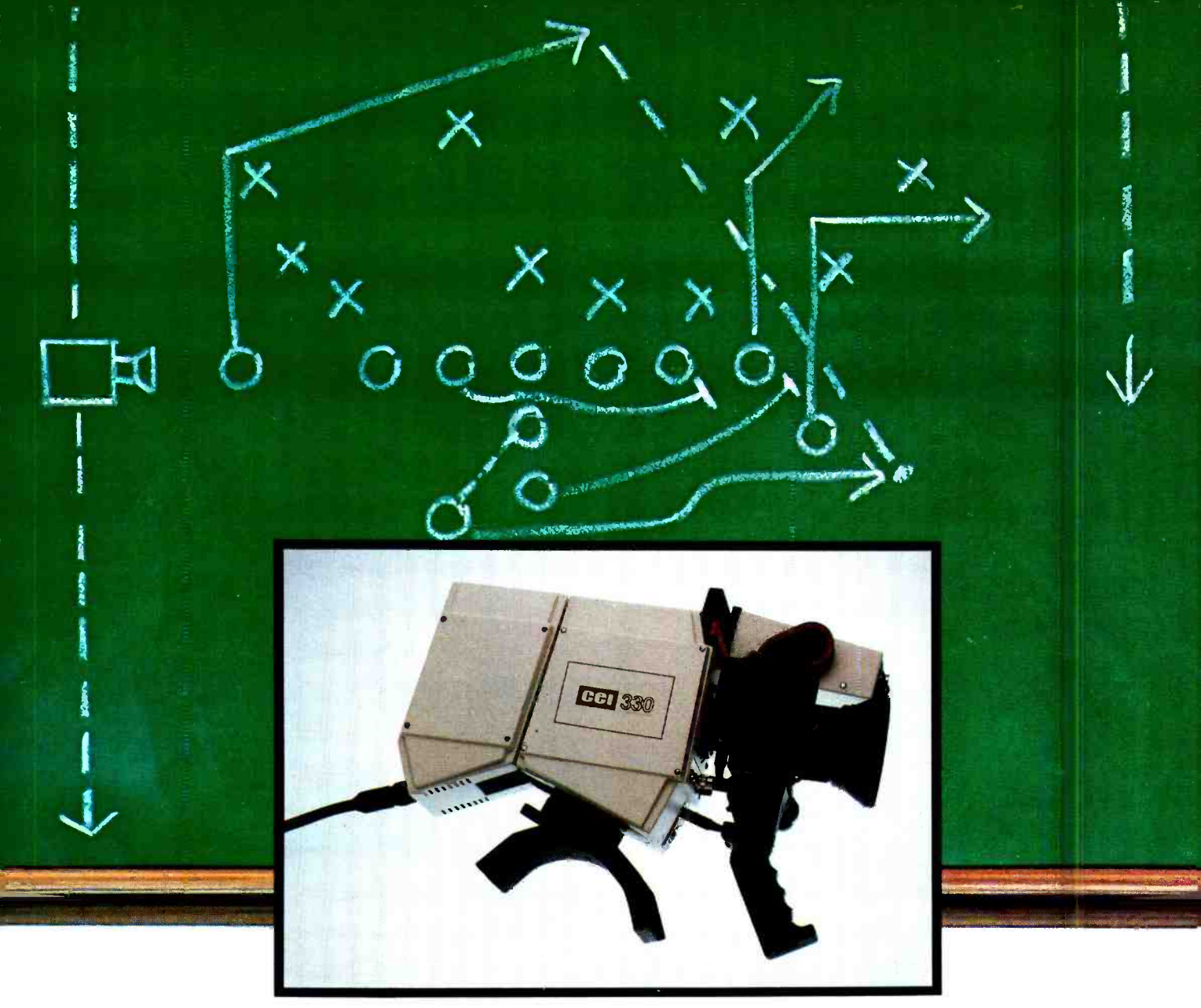

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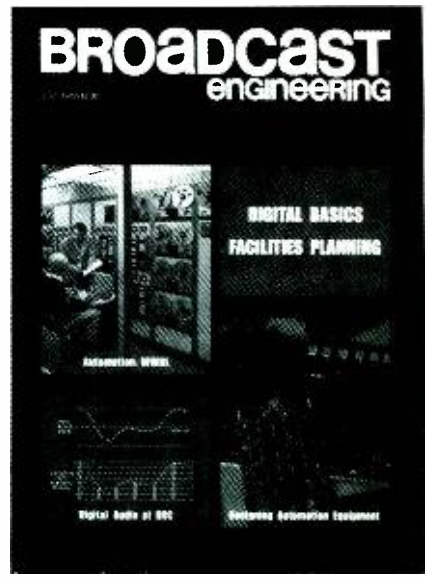
The journal of the broadcast-communications industry

July, 1979 ☐ Volume 21 ☐ No. 7

ARTICLES

DIGITAL & BROADCASTING

BUSINESS & TECHNICAL AUTOMATION



THE COVER

As indicated in the upper right corner, this month's cover marks the beginning of a series of articles on digital technology for broadcasting plus a special topic on planning facilities. The digital series will continue in future issues of ***BE*** and will involve several authors covering basics, applications and case studies.

In the upper left corner, WWDL's push into automation is illustrated and is backed up with a full article by Doug Lane beginning on page 56.

In the lower left corner, digital audio is sketched for BBC's progress in adapting digital to their operations. A descriptive article on the BBC digital audio status begins on page 48.

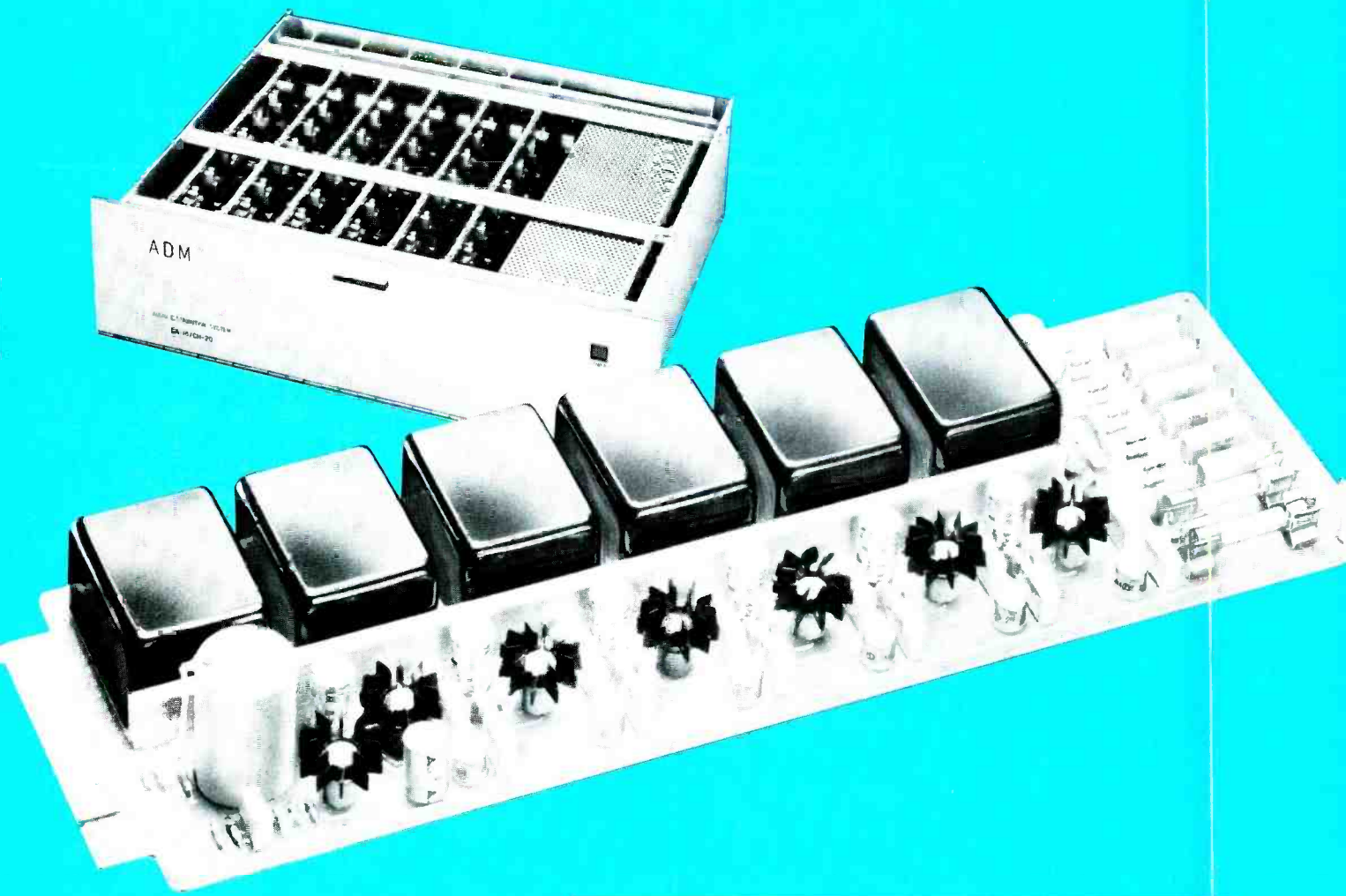
In the lower right corner, one step in the evolution of automation equipment for broadcasters is illustrated. An article discussing this development, written by Mike Pierce of Sono-Mag, begins on page 59.

SPECIAL PREVIEW

The 19th annual Broadcast Financial Management convention will take place September 16-19 at New York's Waldorf-Astoria. For more information, turn to page 29.

NEXT MONTH

*More on digital basics & applications
*Pre-NRBA program review
*RENG links



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DEBATING THE 9kHz QUESTION

By Charles E. Wright, general manager, WBYS/AM-FM, Canton, IL

One of the hottest topics making the rounds in AM broadcasting today is the proposal for 9 kHz separation of channels rather than the present 10 kHz. For at least a quarter of a century, daytime stations have been trying to find a way to serve their listeners at night. The 9 kHz plan has been advanced by J. R. Livesay, chairman of the Daytime Broadcasters Association (DBA), who also owns three daytimers, as a possible solution to the crowded spectrum problem.

At NAB/Dallas '79 (March), Livesay gave a slide presentation showing how 14 new fulltime channels could be created by using the 9 kHz spacing. The AM band would be expanded from 530 to 1610 kHz. His table of assignments showed the frequencies where the present clear channel stations would operate. The 14 new channels could accommodate most of the 2300 daytime stations with a 1 kW operation. According to the plan, no station would have to move more than 4 kHz from its present assignment. This, according to the DBA chairman, would provide fulltime local radio service to 46 million people. Livesay said the present system discriminates against these people.

In his presentation, Livesay cited US Department of Commerce Engineers and Scientists who have indicated there will be no serious problems in changing to the 9 kHz plan in the US. The 9 kHz separation is now used in the other regions of the world, he emphasized. The DBA chairman said, "God may have control of the radio wave propogation characteristics, but God did not allocate and classify the AM broadcast band. Any community which can economically support an AM radio station should not be denied the opportunity to have a fulltime local broadcast facility."

A panelist taking an opposing view of the DBA plan was Jay Wright, retired vice president of the King Broadcasting Company and a member of the board of directors of the Association of Broadcast Engineering Standards. This group has members from all classes of radio stations. Wright built his case in opposition to the 9 kHz plan on engineering standards which he detailed. He said the daytime stations were the result of the "nature of physics" of radio and these characteristics cannot be altered. Wright said he favored the NAB

The radio engineering workshop at NAB/Dallas '79 which dealt with the 9 kHz question drew some sparks between opposing factions. Charles Wright (far left) of WBYS Radio was the session moderator. Panelists (from left) were Harold Kassens, A. D. Ring & Associates; J. R. Livesay, Daytime Broadcasters Association; Jay Wright, Association of Broadcast Engineering Standards; and Roger Jeffers, Community Broadcasters Association.

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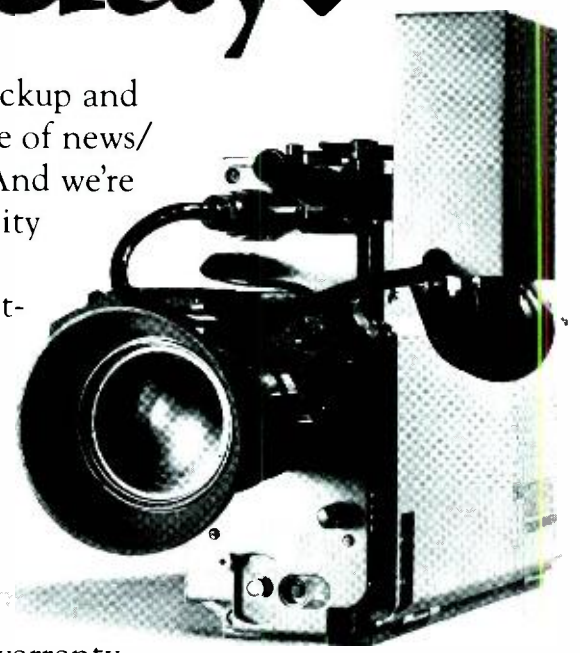

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9 kHz question

proposal to extend the AM spectrum to 1800 kHz, and he expects this will be the US position in the World Administrative Radio Conference to be held in Geneva in September. This panelist placed great emphasis on the adjacent channel interference that would be created if the 9 kHz plan were adopted. He chided Livesay for using the word "discrimination" indiscriminately as the DBA chairman used it in reference to the people not being served by a fulltime local radio service.

Harold Kassens was another of the panelists. For nearly 34 years he was with the FCC and at the time of his retirement he was assistant chief of the Broadcast Bureau. He is now a partner in the consulting firm of A. D. Ring and Associates and represents the Clear Channel Broadcasting Service. Kassens gave a brief history of the development of broadcasting in the US. He pointed out the daytimers came into being so the clear channels could be used during the day when interference from dominant stations was no problem.

Based on the research of his firm, Kassens said that broadcasters could expect at least a 2% to 3% drop in their service areas if the 9 kHz plan were put into effect. Kassens expressed grave concern over the conversion of directional systems to the new separation plan and estimated conversion costs could run as much as $10,000. As for AM stereo, he could see no particular problem. He did cite the problem of the synthesized radio receivers in the more expensive cars which tone themselves automatically in 10 kHz increments.

Kassens surprised many of those attending the session when he said the clear channel broadcasters are not opposed to the 9 kHz plan advanced by the DBA. However, he concluded, "We don't know whether it's going to work or not."

Roger Jeffers appeared on the panel to represent the Community Broadcasters Association, an organization of Class IV stations. This group is seeking 1 kW power day and night. Presently, Class IVs operate with 1 kW days and reduced power at night. Since the DBA plan did not aid the Class IVs in that direction, he said they were opposed to it.

By the time the panelists had presented their views on the 9 kHz proposal there was very little time for questions. Most of the questions were directed to Livesay and the tone of the questions indicated opposition to the plan. One questioner stated he presumed Livesay was an astute businessman, but when he received his license for a daytime station he knew what he was getting into and, therefore, should be content with it.

That brought an impassioned response from the DBA chairman who pointed out that times have changed in favor of local radio service. He said this country has changed many things that were once considered proper. "This country changed the Panama Canal treaty, and it's time to change radio allocations." To the questioner he said, "I'm ashamed of you."

With several more questioners going to the microphones, but with no more time, the session on *9 kHz—To Be or Not to Be* ended.

Final Comments

For years the conflict has been between daytimers and the clear channel stations. Judging from some of the questions in this session there is strong opposition to the 9 kHz plan from fulltime stations not on clear channels. Comments made later during the convention by broadcasters with whom I talked were in line with the questioner who felt daytime operators were aware of the operating restrictions when they got their licenses and they should be content with what they have. One broadcaster said he had a choice of buying a fulltime station and a daytimer and bought the fulltimer, but had to pay more for it simply because it was a fulltimer. "Why," he asked, "should I want to see the daytimer in my market go fulltime?" That feeling surfaced from many who have fulltime stations competing with daytimers.

The session brought out graphically the solution to providing fulltime status to daytime stations contains a lot of diverse elements. Included are engineering, politics, economics, service to the public, tradition, change and emotions. The degree of emphasis that will be placed on each of these elements make up the adventure that is before broadcasters. □

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If you'd like to know what else Herb Friedman thinks about the B77, please circle reader service number or write to us for complete information including a reprint of his article and a list of professional audio dealers where you may see and hear the ReVox B77 demonstrated.

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industry news

More stations test AM stereo

The FCC has issued special AM stereophonic test authorizations to stations KFRC in San Francisco, KHJ in Los Angeles, KCMO in Kansas City and WOW in Omaha. The authorizations permit the stations to conduct over-the-air testing of the AM stereophonic system proposed by Kahn/Hazeltine.

Under terms of the authorizations, they may not use the test authority for promotional purposes though the tests may be announced. During the test period the stations must comply with the requirements of Section 73.40 of the commission's rules. After completion, the stations are to submit test results to the commission for inclusion in the record in Docket 21313. The authority granted KFRC and KHJ extends from April 17 until July 17, 1979. The authority granted KCMO and WOW extends from May 3 until August 3, 1979.

The Meredith station WOW in Omaha, NE, went on the air with AM stereo May 24th, and its sister station KCMO in Kansas City began June 5. Both Meredith stations are scheduled for 24 hour/day programming to evaluate the Kahn/Hazeltine independent sideband system. They will be looking at the 0.05 mV contours and beyond to evaluate skywave effects and adjacent channel interference (if any). James Dickson, director of radio engineering for Meredith and Tim Sawyer, chief engineer, are both looking forward to their test results and to gaining valuable experience that will help the Meredith group make the transition to AM stereo when the industry is ready.

On the West Coast, KHJ in Los Angeles went on the air testing the Kahn/Hazeltine system on April 17. A considerable amount of data has been compiled to date, but the tests are continuing; KHJ may seek an extension from the FCC to continue its evaluation. Tentative results to date, according to Robert Kanner, chief engineer, indicate no loss in modulating capability; 30 dB of separation between left and right channels is easily obtainable; co-channel interference is less troublesome than in mono AM; and in terms of skywave reception, there has been no apparent degradation in mono.

KFRC in San Francisco began its on-air testing on May 25th. Again, the test results are preliminary, but KFRC chief engineer Phil Lerza reports that they are quite impressed with the early results. A proof of performance measurement for AM stereo was quite good compared to mono; separation measurements were excellent, and the low distortion was impressive. Spectrum analysis at one mile and beyond, perhaps at 20 miles, were scheduled for mid to late June.

AM stereo was mentioned in **BE's** first issue in 1959, but it's still not a reality for the public. Although the industry is moving closer to AM stereo, progress hinges on critical decisions from the FCC. The current tests on the Kahn/Hazeltine system (and others on the Belar, Harris, Magnavox and the Motorola systems) are expected to bring the advantages and disadvantages of the potential systems into sharp focus for the FCC to make its decision. That decision is expected within the next few months, and **BE** will report on that decision and its industry implications when the FCC makes its move.

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No matter which configuration you choose from those shown in the photo and three diagrams, the Hitachi SK-70 offers the precision and reliability of three 2/3" Saticon tubes in the camera head to insure excellent picture quality, combined with all the latest advances in broadcast camera technology.

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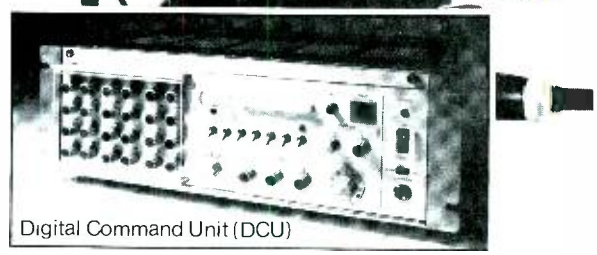
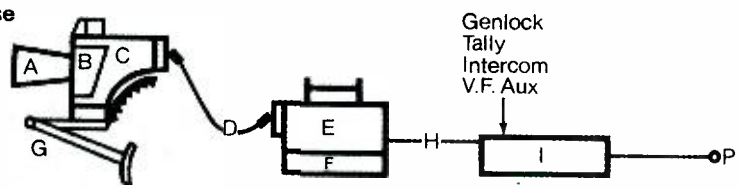
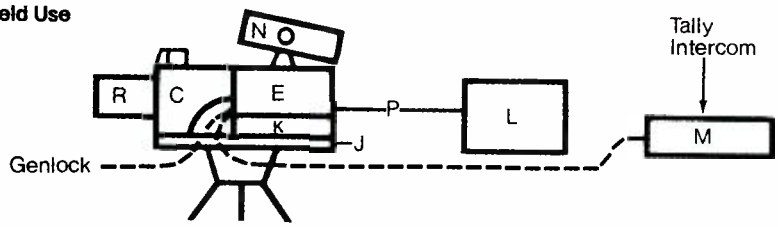


Digital Command Unit (DCU)

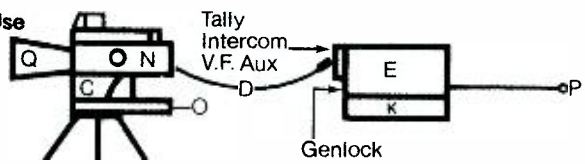
2. Portable Use



3. Field Use



4. Modified Studio Use



A)	Portable lens
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F)	D.C. pack
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Circle (51) on Reply Card

Radio superstation ready to go coast-to-coast pending approval

WFMT/Chicago will be the first radio "superstation" in the country pending FCC approval. The full-time stereo fine arts station will be relayed by satellite from coast to coast 24 hours a day, according to Roy Bliss, executive vice president of United Video of Tulsa, OK.

United Video is carrying WFMT experimentally via RCA's Satcom I satellite. WFMT's signal will be transmitted by microwave from Chicago to the RCA satellite uplink station at Lake Geneva, WI, and then to Satcom I orbiting the earth 22,300 miles above the equator. Transponder 3, leased by United from RCA, will be used to receive and retransmit the signals back to earth.

Through agreements with United Video, cable systems with earth stations will be able to pick up the satellite signals and distribute WFMT by cable to their subscribers. This will be the first time that any radio station has had all of its programming relayed to listeners across the country via satellite.

Broadcast museum

Plans are underway for a broadcast museum to open soon in Dallas, TX. According to the founder, William J. Bragg, the Texas Broadcast Museum is dedicated to the preservation of the history of the broadcast industry. It now includes over $50 thousand worth of exhibits from the years 1879 to the present, with access to a vast collection of antique as well as modern communications equipment. Plans call for the non-profit museum to open later this year. For more information contact William J. Bragg, The Texas Broadcast Museum, Dept. BE, 2001 Plymouth Rock, Richardson, TX 75081.

Emmy to audio engineer

Gene Piotrowsky, audio engineer at the Sound Shop in New York, won an Emmy for tape sound mixing at the Sixth Annual Emmy Awards for Daytime Programming. The award, presented for his work on *A Special Day in the Year of the Child*, was sponsored by the National Academy of Television Arts & Sciences.

PBS plans restructuring

Public Broadcasting Service (PBS) president Larry Grossman offered a plan for restructuring the service at a recent PBS executive meeting. According to PBS executive staff, the Grossman paper is an attempt to synthesize the multiple program service principles advanced in other public television planning efforts.

The plan would reduce and divide the PBS board into two subgroups with separate responsibilities for distinct program services: PTV-1, a high-visibility prime-time service; and PTV-II, with regional, station consortia and special interest programming. There would be a separate PBS president responsible for the common needs of the program

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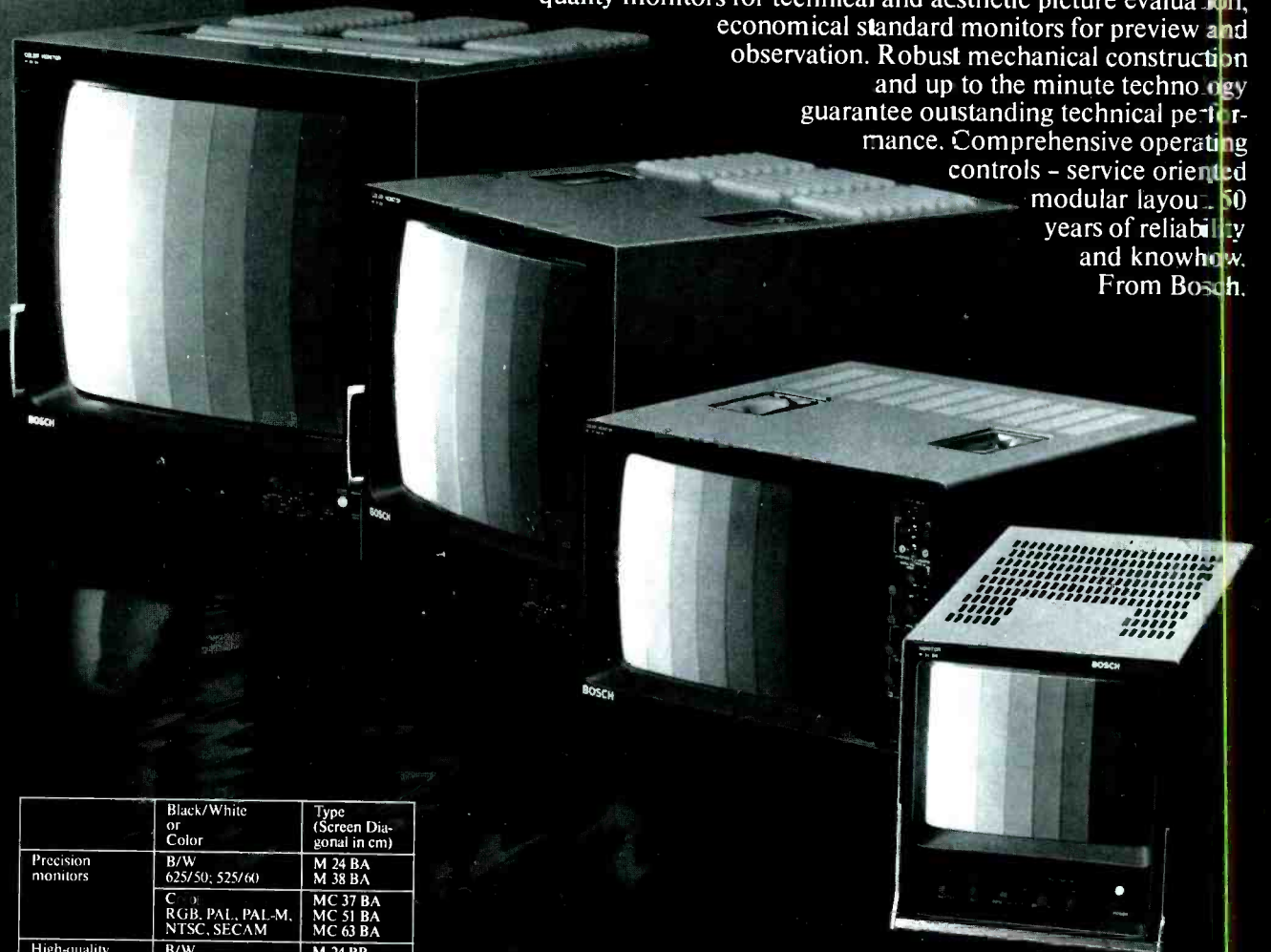

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Precision monitors	B/W 625/50; 525/60	M 24 BA M 38 BA
	Color RGB, PAL, PAL-M, NTSC, SECAM	MC 37 BA MC 51 BA MC 63 BA
High-quality monitors	B/W 625/50; 525/60	M 24 BB M 38 BB M 50 BB
	Color RGB, PAL, PAL-M, NTSC, SECAM	MC 37 BB MC 51 BB P 12 (67 cm)
Standard monitors	B/W 625/50; 525/60	T 14 BC T 23 BC T 31 BC T 50 BC T 61 BC
	Color RGB, PAL, PAL-M, NTSC, SECAM	C 21 (67 cm) C 31 (67 cm)
Special monitors	B/W Viewfinder 625/50; 525/60	K BB (2,5 cm) K 14 BB

Your Video System Partner

BOSCH

Television Systems Division

Further information obtainable from our regional representatives, subsidiaries or head-office in Darmstadt · Robert Bosch GmbH, POB 429, D-6100 Darmstadt, Fed. Rep. of Germany · Robert Bosch Ltd., PCB 166, Watford, Great Britain · Robert Bosch Corp., 279 Midland Ave., Saddle Brook N.J. 07662, USA · Robert Bosch Pty. Ltd., 69 Edward Street, Pyrmont NSW 2009, Australia · Robert Bosch Pte. Ltd., POB 4, Thomson Road, Singapore 20.

Circle (53) on Reply Card

services, including distribution, finance, administration, legal and others.

Other restructuring plans were offered at the meeting, and PBS vice chairman Hartford Gunn has been asked to further consolidate them.

AP wins news award

The Associated Press Radio Network has been awarded the Ben Grauer Award for Best Radio Spot News from Abroad by the Overseas Press Club. Tom Fenton, Lew Wheaton and Hal Moore were cited in the award for their coverage of the battles in Nicaragua on AP Radio during September, 1978.

The three correspondents filed regular reports from battlefronts and from the cities of Matagalpa, Masaya, Estili, Managua and Leon. They were frequently under fire by a National Guard helicopter gunship.

Also honored was AP Radio staffer Bob Berkowitz with a Citation for Best Radio Interpretation of Foreign News.

FCC releases April station totals

The FCC has released the following totals for broadcast stations on the air as of April 30, 1979: 4549 AM radio, 3111 FM radio, 993 FM educational, 218 UHF commercial, 517 VHF commercial, 158 UHF educational and 102 VHF educational.

Arizona Senate amends advertising statutes

Senate bill 1087 was signed by Governor Bruce Babbitt, April 10, which amends that state's statutes on advertising to clarify specifically that only local advertising is intended to be taxed, thereby prohibiting any expansion of the tax to national advertising. On April 16, James Duke Cameron, chief justice of the Arizona Supreme Court, ordered a 1-year trial "to allow for television or radio photographing, recording, or broadcasting of proceedings in the Supreme Court and the courts of appeal in the State of Arizona" beginning May 31, 1979.

EIA develops standards for multichannel TV

Two subcommittees have been formed by the Electronic Industries Association's Broadcast Television Systems Committee. The purpose of each group will be to develop recommended broadcast standards for both multichannel television sound and teletext. The move is in line with the interest of the FCC and the industry and commitments of other nations to implement the services.

Multichannel sound is stereo or second language broadcasting plus other non-broadcast services placed on the television aural carrier. Teletext is the generic term for the transmission of data and graphics on lines in the vertical blanking interval of the television video signal.

For more information, contact: Eb Tingley, Electronic Industries Association, Dept. BE, 2001 Eye Street, N.W., Washington, DC 20006.

The 2020 Video Signal Processor An Even Better Industry Standard

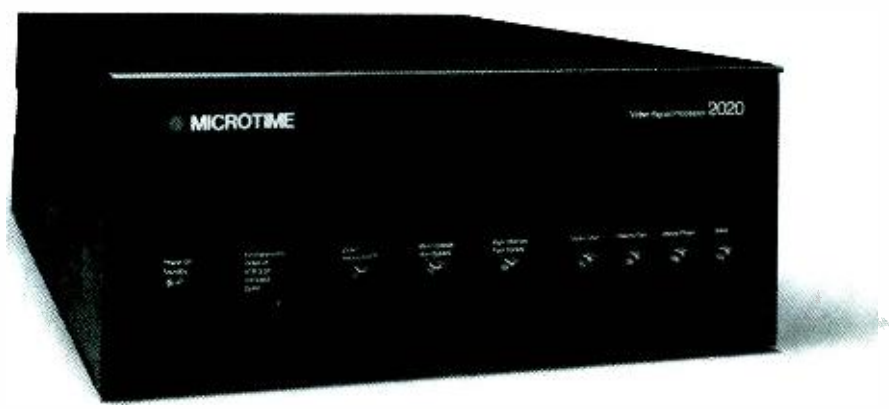
When MICROTIME introduced the 2020 Electronic Signal Processor, it quickly became the "standard" of the Broadcast Industry. Recognized as the leader in advanced video correction technology, the 2020 opened new roads in signal processing by combining sophisticated circuitry with refined and simplified design to produce the most reliable system achievable.

Today, backed by MICROTIME'S proven tradition of performance, the new 2020 Video Signal Processor has become the concept in complete video correction. The 2020, an even better industry standard.

The 2020 VSP, combining our creative design capabilities with advanced technology provides the modular flexibility to offer the

options to precisely fit your applications– exactly the features you need, whenever you need them.

Just as with all MICROTIME products, the 2020 VSP is available and supported through our worldwide distribution network with representatives and technical support teams to serve you everywhere. Only MICROTIME with its experience, people and technology could create the 2020 Video Signal Processor. Call today for the name of the distributor nearest you.



MICROTIME

1280 Blue Hills Avenue, Bloomfield, CT 06002 Telephone (203) 242-0761 TWX 710-425-1165

Circle (55) on Reply Card

business news

Ampex records Oscars & offers new service

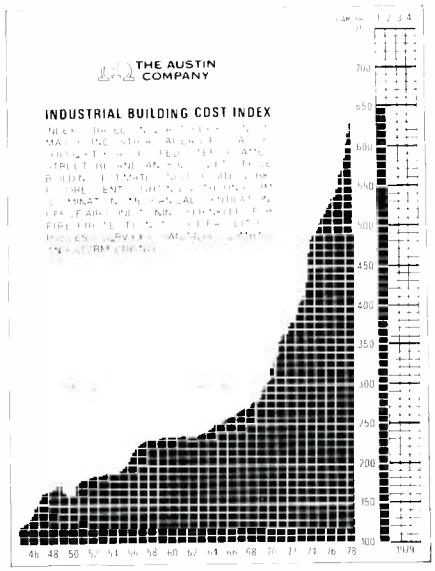
ABC Television employed seven Ampex VPR-2 1-inch helical scan videotape recorders to record and broadcast key segments of the 3½-hour Academy Awards broadcast. Audio for the broadcast was provided by Heider/Filmways of Hollywood using two Ampex ATR-104 audio recorders and a 24-track Ampex MM-1200 audio recorder to record and mix down music used in various production numbers staged during the broadcast.

Two Ampex ATR-100 audio recorder/reproducers will be the only professional audio systems featured in an exhibit of American technology that will begin a 2-year tour of Eastern European nations. The recorders will be part of *America Now*, a display of US products organized and sponsored by the International Commerce Agency of the US Department of Commerce.

Ampex's audio-video systems division has inaugurated a 24-hour toll-free telephone system for ordering spare and replacement parts for the division's professional audio and video products. The toll-free number for California is (800) 982-5875; the number for the remaining contiguous states is (800) 227-8402.

JVC's Hermes receives video service award

Hank Hermes, US JVC Corporation's vice president of service & engineering, has received the first annual Distinguished Video Industry Service Award. Cited for his work in expanding and coordinating the work of service personnel with that of dealers and distributors, Hermes has increased the number of service specialists from six to 75 since 1973.



Building costs soar

The Austin Company's long-term index of industrial building costs rose 19 points during the first quarter of 1979, bringing the index to 649 (1926=100). The cumulative growth of the index since April 1, 1978, has been 66 points, the equivalent of an 11.3% increase in the past twelve months. According to Charles A. Shirk, president and

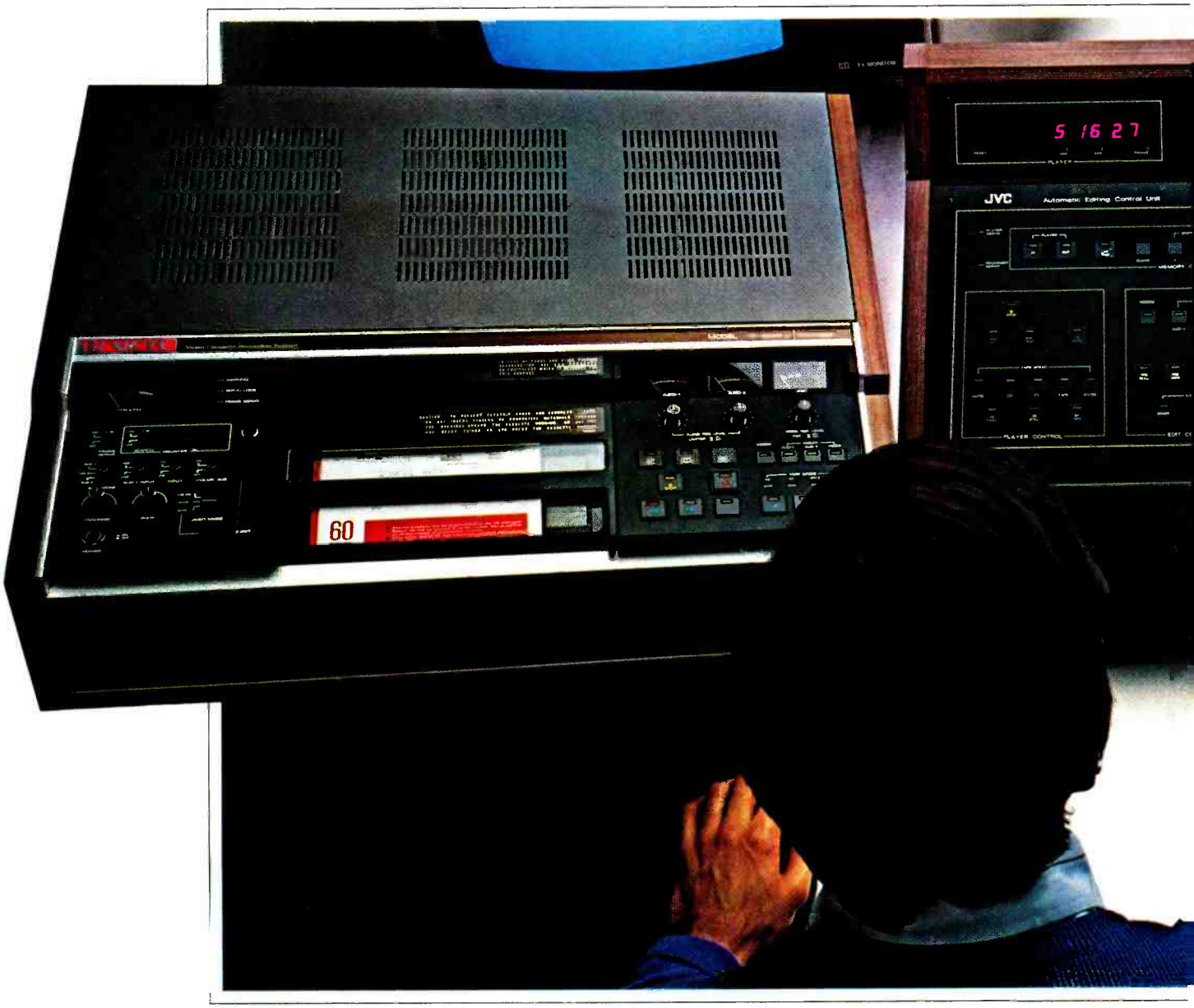
If you think their character generator is easy to operate, just go ahead and exawkm.

Before you invest in a top of the line character generator, you should know more than just what it can do. That's why the versatile new 3M D-8800 character generator could be just the one for you. You see, all instructions are in English, not in code. And we've put them on a convenient L.E.D. panel above the keyboard for less wasted eye motion. So even a beginner can soon be composing in all kinds of fonts and colors. See your 3M representative right away for the character generator any of your people can run, or call 612-736-1032 for more information. Unless of course, you'd rather exawkm.

3M

Circle (44) on Reply Card

JVC's $17,000 editing system.



If you think a third audio channel and 10 extra lines of resolution are worth an extra $6000 in a ¾" video editing system, read no further.

But if you'd like to save $6000 compared to the nearest performing competition...yet perform advanced editing functions at tape speeds up to 10 times normal (a JVC exclusive)...and produce broadcast quality tapes even if you're not an expert...then the CR-8500LU system including RM-85U Editing Control Unit is for you. It has many features you won't find elsewhere except on that higher priced system. Plus some you won't find even there.

Fast, no-glitch editing

With pushbutton ease, you get distortion-free frame-to-frame editing, thanks to JVC's built-in rotary erase head, blanking switcher and advanced servo mechanism. First, you have a choice of 11 forward and rewind search speeds, from still-frame to an unequaled 10 times normal. After picking edit points, you also have a wide choice of automatic preroll times. (The more expensive system limits you to 2 or 5 seconds.) Then you can preview your edits and adjust edit points. Preroll again, and edits are made automatically, electronically, at exactly the selected points ±2 frames—an accuracy equal to the higher priced system. There's also a horizontal sync phase compensator to minimize timing error. A patented dubbing switch for maintaining stable color. And much more.

The RM-85U Editing Control Unit has independent LED displays for player and recorder. Each gives elapsed tape time in

For those who need funds, not frills.

minutes, seconds and frames. Or, the exact length of one edit —a JVC exclusive. But wait! Maybe you don't even need a full system.

Stand-alone versatility

Let's say you just want to assemble or insert edit live material onto a tape. All you need is one CR-8500LU Recorder/Editor...which still gives you the benefit of automatic preroll. By contrast, the higher priced brand makes you buy a control unit as well.

Let a JVC dealer show you how our editing system gives you much more for your money. For the name of your nearest dealer, call one of these numbers collect: East, 212-476-8300; Midwest, 312-364-9300; South, 713-741-3741; West, 213-537-6020. US JVC Corp., 58-75 Queens Midtown Expressway, Maspeth, NY 11378.

JVC®

PROFESSIONAL VIDEO DIVISION
US JVC CORP.

Circle (57) on Reply Card

BE-7/79

Mail to US JVC Corp.,
58-75 Queens Midtown Expressway,
Maspeth, NY 11378.

I'd like to know more about the CR-8500LU editing system including RM-85U Editing Control Unit.

Name _____

Title _____

Company _____

Address _____

City, State, ZIP _____

Phone _____

Type of operation _____

_____

chief executive officer of the international design-build company which also builds TV facilities, the index continued to rise and the slope of the curve steepened during the first quarter of the year.

Company forms

Gene Bidun, former district sales manager for Harris Corporation, has formed Gene Bidun & Associates to sell and service broadcast equipment. The firm will be responsible for sales of Cetec Broadcast Equipment in Maryland, New Jersey, Pennsylvania, Delaware, West Virginia and Washington, DC. Technical services such as proof of performance, station equipment repair and engineering assistance will also be available.

Sescom moves

Sescom, formerly of Gardena, CA, has moved into new facilities in Las Vegas. The toll-free number is (800) 634-3457. The new address is 1111 Las Vegas Blvd., North Las Vegas, NV 89101.

So does Logitek

Logitek Electronic Systems moved into a new office/manufacturing facility May 1, 1979. The plant is located at 3320 Bering Drive, Houston, TX 77057.

The company has also announced the appointment of several new sales reps. Linrose Electronics will represent Texas, excluding the Houston metro area; Guarantee Radio Supply Corp, Mexico; Tran-Sonic Limited, Canada; Geisler Broadcast Supply, Houston metro area and all of Louisiana; and H. M. Holzberg & Associates, Northeastern US.

SALES/CONTRACTS

Bosch

The Television Systems Division of Robert Bosch GmbH Darmstadt, will deliver a complete three camera studio containing six BCN 50 B-Format VTRs with editing and additionally up to 10 EJ units for the Winter Olympics in February 1980.

The central Soviet procurement organization Mashpriborintorg has placed a substantial order for 39 BCN B-Format VTRs with Bosch. The contract includes both production and portable VTRs that will be delivered in time for the coverage of the 1980 Olympic Games.

Chyron

Chyron Corporation has received orders from Ampex International Operations for $972,000 for Chyron III and Chyron IV Graphics and Titling Systems. The equipment, for distribution abroad by Ampex, is scheduled to be delivered over a 12-month period through June 30, 1980.

Consolidated Video Systems

Radioteleviosione Italiana (RAI) has ordered 11 CVS 517 digital time base correctors from Consolidated Video Systems. The new order is worth over $150,000.

NOW HEAR THIS! IT'S NEW! IT'S FABULOUS!

Listen to what's missing from TerraCom's new digital program channels.

The noise is missing. Now, with TerraCom's THP-2T20 you can send high fidelity digital program channels without the noise and crosstalk of analog systems. And none of the "sizzling" sound caused by digital companding (because the THP-2T20 uses analog companding).

Send stereo or up to four highest quality channels simplex — or four channels duplex. They can go on either a T1 line or can be multiplexed above video baseband in a microwave link — such as our TCM-6 series all-bands tunable microwave radio.

These four channels are provided in a 1.544 Mbps digital data stream. They have a signal-to-noise ratio of better than 75dB at full output. Interface options are available to meet individual requirements. And for portable or restoration uses we offer a weatherproof enclosure.

Another version, the THP-2T25 provides six simplex channels, or four duplex channels, at a 2.048 Mbps data rate . . . with the same high quality performance.

So hear what you've been missing with your own ears. Call us at TerraCom (714) 278-4100, or write 9020 Balboa Avenue, San Diego, CA 92123

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Loral Corporation

DIGITAL PROGRAM SYSTEM

the noiseless revolution

Circle (59) on Reply Card

Harris

Recent contract negotiations between Buford Television of Tyler, TX, and the Broadcast Division of Harris Corporation ended in a $1.4 million order for the purchase of Harris transmitting and camera equipment including a new television transmitter and studio equipment for three of the four stations owned by Buford Television.

Orion Broadcasting of Louisville, KY, bought the Harris TC-50A and TC-80 demonstration models. The total order signed by Orion Broadcasting included four TC-80s, and two TC-50As for use at their Cedar Rapids, IA, station, and their Evansville, IN, station.

McMartin

McMartin Industries has been awarded a subcontract by the Collins Transmissions Systems Division of the Commercial Telecommunications Group of Rockwell International for the design and manufacture of coordination channel modulators and demodulators for satellite communications.

Marconi

Australia Television station Ten-10 has ordered five cameras from the Mark IX family of Marconi Communication Systems, a GEC-Marconi Electronics Company.

RCA

TV Globo, Rio de Janeiro, has ordered an RCA 50 kW television transmitter, valued at approximately $500,000 to increase its station signal power. WYNF-FM, Tampa-St. Petersburg, has ordered an RCA 40-kW FM transmitter and panel antenna for installation later this year.

Scientific-Atlanta

WGN Continental Broadcasting has awarded an order to Scientific-Atlanta for a 10-meter diameter receive-only video earth station to be installed at the broadcast center in Chicago. The station will consist of a 10-meter diameter parabolic antenna with automatic motor drive and redundant receiving electronics for radio and television programming.

Tele-Cine

Tele-Cine has announced the sale of 40 30X continuous zoom Schneider lenses to NBC sports for use on their newly equipped RCA TK-760 mobile vans.

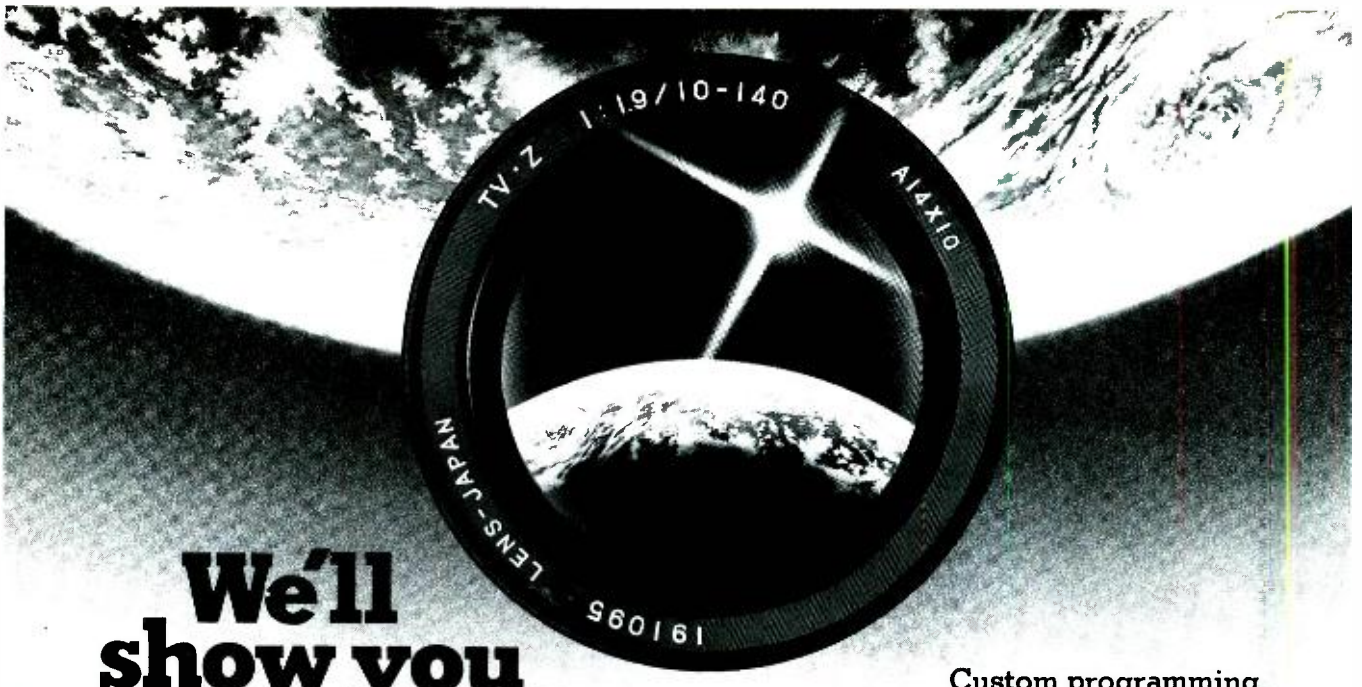
Thomson-CSF

Koweit's Ministry of Public Works broadcasting house will feature Thomson-CSF electronic and specialized studio equipment.

Following negotiations Thomson-CSF and Solid State Scientific have agreed to the principle of the acquisition by Thomson-CSF of SSS's RF Transistors Division. The acquisition will be made by Dumont Electronics of Clifton, NJ.

Victor Duncan

Victor Duncan has completed negotiations for the full range of industrial and second level broadcast equipment from Panasonic and JVC. The company has sold a complete Bosch 1-inch B format editing system to Cinema-Video Processors of Chicago. □



We'll show you how to see things our way.

Needs for video support vary.

Which is why we design COMPLETE VIDEO SYSTEMS around those needs. To solve problems. Some you may not see, but we can. In all areas of surveillance, broadcasting, audio visual centers, security, training, or monitoring.

Communications is our specialty.

We start with conversation and appraisal. Followed by a clear and concise recommendation which covers exactly what equipment you will need, your options, as well as whether you should rent or buy. We'll discuss personnel and their necessary qualifications. And installation deadlines. A lot of things concerning costs.

Total package service.

Once your requirements have been determined, we focus on the installation. The initial engineering and design of a video system are critical. They're the key to efficiency and effectiveness. They're something our clients consider us expert at.

We take on communication jobs of all sizes. From single cameras to complete broadcast installations with transmitters, towers and antennas

Flexible equipment specification.

A total system is only as good as its parts. We purchase from a wide range of equipment suppliers, allowing full latitude for the needs of your system. Unarco/Midwest represents and installs the products of RCA, Sony, Conrac, Rohn, Digital Video, 3-M, Jerrold, Hitachi, Ikegami and other fine manufacturers.

Expert installation and training.

Precision installation with a keen eye to timetables is our forte. From the simplest one-camera set-up, to the most sophisticated and complex job, we do it right the first time. After installation, we provide in-depth operational training, including complete maintenance procedures.

Custom programming.

If you don't want to invest in 'video hardware' or if you are not staffed to meet production requirements, we can produce programming from script development through the final product. From video taped instructional programs to video sales aids. In the studio or in the field.

Our people have it.

Years and years of industry experience. Since the first private TV camera came on the market

From coast to coast, the Unarco/Midwest Experts have helped to make us the largest company in the nation doing what we do.

Complete Video Systems

MIDWEST CORPORATION

Communication Systems Division

A subsidiary of
Unarco Industries, Inc.

I am interested in finding out more about Midwest.

Please:
- ☐ Have a Midwest Sales Engineer contact me
- ☐ Send me the Midwest catalog.
- ☐ Send me the Midwest GSA catalog

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

PHONE ( ) _____

Mail to:

E. W. Midkiff
Vice-President
MIDWEST Corporation
Communication Systems Division
4700 Boston Way
Lanham, MD 20801

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Circle (61) on Reply Card

association news

National Association of Broadcasters

1771 N Street, NW
Washington, DC 20036

Full-time chief operator requirement under fire

The National Association of Broadcasters (NAB) has asked the FCC to reconsider its rules pertaining to the requirement of AM stations employing a chief operator on a full-time basis.

Section 73.93 of the FCC's Rules states that, "all non-directional stations operating with power of over 10 kW and directional stations of any power utilizing non-critical arrays to employ at least one first-class radiotelephone license holder (chief operator) on a full-time basis."

According to the NAB the requirement is unnecessarily expensive. The chief operator's duties can be accomplished in less than a full-time period of 35 to 40 hours per week.

Inquiry into FM broadcast rules requested

The National Association of Broadcasters has filed a request with the FCC that a National Telecommunications and Information Administration petition for rule-making to revise FM broadcast rules be the subject of a Notice of Inquiry. NAB has also asked again the FCC to establish a joint advisory committee to study methods of guaranteeing that all radio stations be authorized to provide full-time service without significantly diminishing service by other classes of stations.

Thirty questions were raised which NAB believes should be addressed in the inquiry.

FCC asked to drop refund waiver requirement

The FCC has been asked by the National Association of Broadcasters (NAB) to drop the waiver requirement tied in with the court-directed order to refund illegally held fees paid by broadcast licensees. The FCC has directed that to receive refunds broadcasters must sign a waiver accepting a commission-specified amount as full satisfaction of their claims. NAB said the FCC should inform broadcasters that the waiver provision is without legal effect.

The fees in question were collected between 1970 and 1976 and have been held by the government interest-free for up to nine years.

NAB anticipates receiver design regulation

While preferring that private industry solve the problem, the National Association of Broadcasters (NAB) says the federal government may have to regulate design and manufacture of radio and television receivers to reduce interference. Due to the increase in interference caused by legal and illegal citizens band transmitting equipment, standards must be set. The commission's statistics show that radio frequency interference is caused by transmissions in services other than citizens band. NAB says it does not think the average consumer may be willing to consider interference factors when making a consumer purchase even with a massive educational campaign. □

"This Auditronics 501 was one of TM Productions' first

boards six years ago and it still runs a tightly packed schedule of original vocal session recording and mix-downs", says Ken Justiss, Operations Manager of TM Productions in Dallas. "Since we do more commercials and station ID's than anybody else in the world, we produce literally thousands each year, and at some point they've all gone through this Son-Of-36-Grand (serial number 0110)."

"There's not a faster board to work with than the Auditronics 501 whether we use it for building demos or complex production tasks. It's compact; all its controls are so very accessible even trainees become proficient on it quickly."

"Its reliability is outstanding. We've literally worn out the faders once, and we've changed a switch or two, but the things I've seen go wrong with this board in six years are so minor, it's a waste of time to even talk about. It's an excellent creative tool and I'd find it hard to fault our Auditronics 501 in any area. In fact, our success with this board was largely responsible for our buying three more Auditronics consoles."

If you'd like to know more about what Ken Justiss at TM Productions and over 300 other satisfied users think about Auditronics consoles, circle reader service number or contact:

3750 Old Getwell Road, Memphis, Tennessee 38118 (901) 362-1350

auditronics, inc.

Circle (63) on Reply Card

association news

NRBA

National Radio Broadcasters' Association

1705 De Sales Street, NW
Washington, DC 20036

Board members oppose some HR-3333 provisions

Several NRBA board members testified before recent hearings on the broadcast portion of HR-3333 of the House Subcommittee on Communications. Jim Gabbert, president; and board members Sis Kaplan, Steve Heater, Ray Livesay and Dutch Doelitzsch appeared in support of the bill in general but objected to certain proposed provisions.

The spectrum tax, the revocation procedures, the loosely drawn discovery clause, the unlimited ownership provision and the proposed conversion of public radio to commercial radio were the clauses NRBA members were most critical of. Kaplan and Gabbert also expressed the commitment of broadcasters to equal employment and affirmative action programs but were opposed to the FCC or the proposed Communications Regulatory Commission (CRC) being involved in the enforcement of rules.

Radio providing more news than required

While working on radio deregulation options papers, the FCC staff compiled data which indicated that radio stations are currently providing news and informational programming in excess of FCC guidelines. It was also found that many of the stations are carrying fewer commercials than the maximum of 18 minutes per hour.

Abe Voron, executive vice president of the NRBA, reacted to the findings and said "it was no surprise to us...the most encouraging development is that it now appears that the FCC is seriously considering deregulating radio beyond the original experimental plan and may extend deregulation to all radio markets, large and small."

Publication focuses on over-regulation

The NRBA has begun publishing a weekly *Editorial Service* which focuses on the inhibiting burden of over-regulation and represents efforts by the NRBA to bring the pitfalls of over-regulation to the attention of Congress, the regulatory agencies and the American public. The weekly publication is being distributed to member stations.

Inquiry into FM allocation revisions requested

The NRBA recently filed comments with the FCC urging the institution of an inquiry rather than a rulemaking proceeding into NTIA proposals to revise FM allocation standards. The NRBA comment stated "The information presently available relative to the terrain shielding proposal is insufficient to justify the issuance of a notice of proposed rulemaking at this time." The NRBA noted that NTIA has not performed field tests and stated that proper testing and evaluation must be completed to prevent losses in existing stations' service areas. □

association news

AMERICAN SOCIETY OF
TELEVISION CAMERAMEN, INC.

P.O. Box 296, Sparkill, NY 10976

Take 1: Training for TV

The question of what, if any, formalized training is available for the person interested in getting into the operations area of the TV industry is a problem that confronts many young people who have hopes of making it with the networks, the production houses, the indies, or the professional video (cable) outfits.

In the many letters that arrive at our desk, a good percentage ask: Is college training necessary? At the risk of alienating the academic community, we must answer with an emphatic no. However, and here is the kicker, if an individual plans on getting his apprenticeship in the operations area and then going on to the plans-policy and administration area, college training is an advantage. If you can twirl your Phi-Beta-Kapa key with your left hand while adding the olive (or the two lumps of sugar, if you're a tea totaler) with your right, it wouldn't hurt.

Can you become a good cameraman, tape-editor, lighting director, TD, etc. without the 2- or 4-year degree? The answer is yes. The larger stations would probably encourage one to obtain the degree but, as of now, it is not a hard-and-fast requirement. There are areas involving operation of UHF/microwave equipment that must meet FCC requirements. For this, you must be prepared.

If this is true, what kind of training, preparation or experience should one have before knocking on the personnel director's door? We would advise that a hitch with a small station can be a most rewarding experience. Who knows, you might decide that you like breathing clean air, finding an abundance of parking spaces for your car, and not fighting off the muggers and other assorted mutants on a regular basis. However, should you decide that mass-transit and high-rise apartment living is to be a part of your future in some large market area while employed at one of the biggies, even then, the year(s) of experience you achieve while working at that station in the hinterlands, will prove most valuable. Certainly as valuable (probably much more so) than the college years spent seeking the same goal.

Would it be a good idea for the high school graduate to enroll in some technical-vocational school or take specialized college-level (non-matric) courses prior to approaching any job market? By all means. The individual who knows the basics in electronic theory, equipment-design, operation and maintenance will find that a distinct advantage when handing in his resume and subsequently approaching any personnel interviewer.

Once again, we must point out that we are still speaking in terms of those individuals interested in the technical/operations areas of the TV industry. We do not address ourselves to those who may be seeking careers as writers, directors, news personnel or in-front-of-the-camera talent, although here again we point out that more than one good cameraman has gone-on to non-technical areas including sales, sports and program planning and administration.

In future issues, we plan to report on some of the technical schools and courses available nationwide that might be helpful to the TV job-seeker.

Take 2: Letters to the editor

(**ASTVC Editor's note:** From time to time, letters addressed to the editor of the ASTVC column ask questions relevant to the aims and goals of the society and also questions regarding the requirements for the various membership categories. The following represent questions of general interest and are published for the reader who may be considering membership.)

"Dear Editor, I have just come across a copy of **Broadcast Engineering** and was interested in reading about the ASTVC. Are you a guild or a union? Please send information. Sincerely, LD."

Dear LD: We are not a union. We can be considered a guild if you use the definition set forth in Webster's Dictionary, as follows: "guild: an association of men (Ed: or women) with similar interests or pursuits." We point out that approximately 50% of our members have no union affiliation. We are chartered as a professional-fraternal association.

"Dear Editor, I am currently employed by KXXX-TV as a program director. I wonder if you believe that I may qualify for membership as I am a former cameraman? Sincerely WGP."

Dear WGP: You would be welcome, indeed! You might apply for the affiliate category. Affiliates are those who have qualified for the regular membership by virtue of their job experience and then gone on to some related area of TV production.

"Dear Editor, I have heard about a possible affiliation between the ASTVC and the British Guild of TV Cameramen. If I join the ASTVC, do I automatically become a member of the British Guild? Sincerely, OBE."

Dear OBE: At the present time, no affiliation or international federation is an accomplished fact. When, and if, an affiliation does take place, you would be a member of the international federation (composed of whatever number of countries are in). You would not be a member of the British Guild (or any other constituent association) unless you specifically applied for membership in that organization.

We plan on printing more of these general interest letters in future issues of **BE**. □

State broadcasting organizations and other associations

State associations

Colorado Broadcasters Association
Plans for the summer convention July 11-19 in Tamarron are underway. CBA president Steve Heater and director George Jeffrey are co-chairmen of the convention. A long license renewal session is scheduled.

Georgia Association of Broadcasters
The summer convention at Callaway Gardens will feature Dennis James, Jane Pauley and Squire Rushnell. Sessions on sales, improving sound, EEO requirements and many others will be included.

Kentucky Broadcasters Association
New directors of KBA are Charlotte Tharp, WHAS Inc., community relations director; G. Nolan Kenner, general manager of WSFC/WSEK and Jimmie Wooley, vice president/general manager of WHIC, Hardinsburg.

Missouri Broadcasters Association
MBA radio-TV sales clinics will be held the week of August 20 with Carleton Loucks. Locations are not yet finalized, but there will be five around the state during that week. The one-day affair is entitled, "Back to Basics."

Nebraska Broadcasters Association
Nebraska Broadcasters board of directors adopted six goals for radio deregulation. Included were goals to eliminate ascertainment requirements, repealing of rules requiring program logs, abandoning regulation affecting program formats, refraining from imposing additional restrictions on broadcast facilities ownership, changes in technical standards and the allocation system governing AM and FM radio stations, and abolition of the "fairness doctrine."

Ohio ETV Network Commission
WCET, Cincinnati began telecasting from a new tower March 2. The implementation of the new system comes after a year-and-a-half of planning and construction.

Tennessee Association of Broadcasters
The Tennessee Association of Broadcasters' Legislative Reception was held at the National Life Center in Nashville. Appreciation was expressed to the National Life and Accident Insurance Company and to Andy Sutton, vice president, manager of buildings division. Those attending included 24 senators, 65 representatives, 107 legislator guests and 115 broadcasters and their guests.

National/International groups

Association of Maximum Service Telecasters
According to the MST, educational FM stations cause interference to television channel 6 stations. Part of the problem stems from the FCC decisions allocating the frequency band immediately adjacent to channel 6 for use by educational FM stations. The FCC has in the past assigned educational FM stations on an ad hoc basis, often failing to recognize the severity of the interference to channel 6 stations or the difficulty in alleviating it, the association states.

In other actions the MST says it believes Texas Instruments' proposal that the spurious emissions from home computers be governed by standards that would permit severe interference to television reception be denied. MST states that it would be inappropriate to adopt the proposed standards at this time, when it is probable that the results of the commission's current study and analysis of the problem will argue for a change in the same restricted radiation standards.

Electronic Industries Association
According to Eb Tingley, secretary for two subcommittees formed by the Electronic Industries Association's Broadcast Television Systems Committee, industry participation is essential to start the development of recommended broadcast standards for multichannel television sound and teletext. Chairmen have been appointed to form task forces to accomplish recommended broadcast standards.

Proponents of the proposed multichannel television sound and teletext systems are requested to indicate their intention to submit systems for analyses and tests. Industry participants planning to submit such systems and those desiring to serve on task forces may contact E.M. Tingley, Dept. BE, Electronic Industries Association, 2001 I Street, N.W., Washington, DC 20006.

National Cable Television Association
Ralph M. Baruch, chairman of Viacom International, told the House Communications Subcommittee that a proposed new federal communications law giving broadcasters and major television studios "veto power" over programs carried by cable television would quickly halt the growth of new viewing options now becoming available to consumers. The retransmission consent provision would repeal the "compulsory license" to carry broadcast signals granted to cable television systems under the new federal copyright law that took effect last year. □

meetings, events&seminars

BFM convention

September 16-19—The 19th Broadcast Financial Management Association convention will take place at the Waldorf-Astoria, NY. As **BE** goes to press, the 19th BFM convention program and format is still being assembled and evolved. Robert McAuliffe, executive director, is reluctant to release details of the BFM meeting because trade-offs are still being made in terms of speakers, events, schedule, etc. These details are expected to be firmed up soon and reported in the August issue of **BE**.

Ron Doerfler, conference chairman for BFM '79/New York, has completed an extensive survey of BFM membership to determine hot topics to be covered in workshops. Subjects of high interest include internal controls; 10-year economic outlook; organizing budgets; Communications Act rewrite; technology for the 1980s; accounting standards; understanding ratings and demographic reseach; Revenue Act of 1978; and program concepts and sources for the 1980s. The final BFM '79 program will incorporate selected hot topics as requested by members through this interest survey.

Although BFM '79 Conference details are scheduled for **BE's** August issue, further details may be obtained directly by contacting Robert E. McAuliffe, CAE, Broadcast Financial Management Association, Dept. BE, Suite 910, 360 N. Michigan Ave., Chicago, IL 60601, (312) 332-1295.

July-December—Data Communications Systems' seminar will be held in seven major cities. The seminar is of interest to EDP managers, facilities management personnel, operations support personnel, EDP systems analysts, designers and programmer personnel. For more information contact the Institute for Advanced Technology, Dept. BE, 6003 Executive Blvd., Rockville, MD 20852.

August 14-17—The Georgie Educational Television Network seminar workshop will be held in Atlanta, GA. Contact Karen Mooney, Global Village, Dept. BE, 454 Broome St., New York, NY 10013 for additional information.

September 9-12—The NAB will sponsor a radio programming conference to be held at Stouffer's Riverfront Tower, St. Louis.

For more information, contact: NAB, Dept. BE, 1771 N Street NW, Washington, DC 20036.

October 7-10—The National Radio Broadcasters Association (NRBA) will hold their Sixth Annual Conference and Exposition at the Washington Hilton hotel in Washington, DC. For more information contact the National Radio Broadcasters Association, Suite 500, 1705 DeSales St., NW, Washington, DC 20036.

October 21-26—The 121st Technical Conference and Equipment Exhibit of the Society of Motion Picture and

Meetings, events & seminars

Television Engineers (SMPTE) will be at the Century Plaza Hotel in Los Angeles, CA. The conference will feature five days of technical sessions on motion pictures and television. The SMPTE equipment exhibit, beginning Monday, is expected to have more than 250 booths of equipment with many of the major film and video equipment manufacturers participating. For additional information write SMPTE Conference, Dept. BE, 862 Scarsdale Ave., Scarsdale, NY 10583.

October 29-31—Scientific Atlanta's 5th annual Satellite Earth Station Symposium will be held at the Marriott Hotel in downtown Atlanta. The meeting is offered to executives and technical managers of cable systems, broadcasters and other communications firms. The symposium will feature the experiences of communications firms now receiving satellite-relayed programs and signals by the use of satellite earth terminals. For additional information contact Kenneth F. Leddick, broadcast marketing manager, Scientific-Atlanta, Dept. BE, 3845 Pleasantdale Road, Atlanta, GA 30340.

November 11-15—The National Association of Educational Broadcasters will hold their *55th Annual Convention* at the Conrad Hilton in Chicago. Highlights include the 2nd Annual Video Fair, a preview of programs being distributed to public broadcasting.

For more information, contact: National Association of Educational Broadcasters, Dept. BE, 1346 Connecticut Avenue NW, Washington, DC 20036.

November 27-29—The National Telecommunications Conference will be held at the Shoreham-Americana Hotel in Washington DC. NTC '79 is co-sponsored by the Communications Society, Aerospace and Electronic Systems Society, and Geoscience Group. For more information contact Dr. Thomas P. Quinn, chairman, Technical Program NTC '79, Dept. BE, P.O. Box 31031, Temple Hills, MD 20031.

April 13-16, 1980—Las Vegas will be the site of the 1980 convention of the National Association of Broadcasters. For additional information contact NAB, Dept. BE, 1771 N St., NW, Washington, DC 20036.

Home study program—Cleveland Institute of Electronics, an accredited technical school specializing in independent study courses in electronics offers a course in broadcast engineering which includes FCC license preparation. Completion time allowed for 76 lessons is 18 months. For additional information contact CIE, Dept. BE, 1776 East 17th St., Cleveland, OH 44114.

Copyrighted broadcasting course—St. Joseph College, Portland, ME, has a contract arrangement with the non-profit Broadcast Center of St. Louis for that college's 2-year communications course giving St. Joseph the ability to offer a BA degree in broadcast communications. The broadcast communications curriculum will first be offered to St. Joseph students in the fall under the tutelage of professional broadcasters now being selected by a Broadcast Center official, who will also supervise the new curriculum at St. Joseph. For more information contact the Director of Admissions, St. Joseph College, Dept. BE, North Windham, ME 04062. □

people in the news

Radio/Television

CBS has announced the appointment of **David Horowitz** to the position of director of audio/video engineering. Horowitz has been associate director in the audio/video section since 1973.

George J. Ziadeh, vice president/general manager, Ampex, congratulates John Bosak (left), WITF-TV chief engineer, drawing winner of an Ampex ATR-700 at NAB. Charles V. Andersen, Ampex executive VP looks on.

In two recent personnel changes made at Cox Broadcasting, **William A. Schwartz** was made president of the broadcasting division, and **Stanley G. Mouse** assumed responsibility for the publishing, auto auction and program production divisions. Schwartz will remain a vice president of the company and Mouse will remain executive vice president.

Snider Corporation, which owns several Arkansas radio stations and affiliated broadcast companies, announced three personnel changes. **W. H. "Hi" Mayo** was named executive vice president. **Tim B. Scott** has been promoted to operations manager of radio stations KARN, KKYK and the Arkansas Radio Network, succeeding **Harris Owen**, who has retired.

Benjamin B. Bauer, former vice president and general manager of the CBS Technology Center died March 31 of a heart attack. Bauer was active in the audio and acoustics fields and had remained a CBS consultant after his retirement last year following 21 years with the company.

Agencies/Associations

The newly organized International Tape Association's European Advisory Board, which met in London late last year to establish groundwork to make ITA the same dominating force in Europe that it is in the US, appointed **Ted Naef** to the position of acting chairman and **Silvio Nuzzo** to vice chairman. Naef is the managing director of EMI Tape and Nuzzo is the product manager for 3M Europe. The new board consists of executives from base film, tape and hardware manufacturers and will act in the same capacity in Europe as does the ITA executive committee in the US. The board met in Brussels

People in the news

February 14 to adopt a formal charter and hold election of officers.

The FCC has announced the retirement of **Wallace E. Johnson**, chief of the Broadcast Bureau since 1971. **Philip L. Verveer** is the new Broadcast Bureau chief. Verveer was chief of the Cable Television Bureau.

William B. Garrison, Jr., has been appointed director of Congressional Relations and Public Affairs for the National Telecommunications and Information Administration. Garrison was assistant director of North Carolina's Washington Office.

Manufacturers/Distributors

Donald J. Power has been named vice president and general manager of the US operation of Electro & Optical Systems Limited. Power comes to the company after 24 years with Ampex.

Don Dunbar has been named director of national marketing for Cinema Products. Dunbar will assume overall responsibility for marketing the video equipment line of MNC-71CP ENG/EFP portable cameras, 1-inch VTRs and related accessories, as well as professional 35 mm and 16 mm motion picture equipment, including the GSMO 16 mm camera. Prior to joining Cinema Products, Dunbar was Ikegami's western regional manager.

Don Dunbar (right), Cinema Products' newly appointed director of national marketing, discusses the advantages of the MNC-71 CP camera with Frank Lowe of Adolph Gasser.

Mathew S. Ceterski has been named national field sales manager for VTR sales and service division of Sony Video Products. For the past three years Ceterski was the regional sales manager for the northwest region.

Nubar Donoyan, Vital Industries president, died of a heart attack May 19, 1979. Donoyan founded Vital in 1963 and led it through many successful years. His brother, **Christopher Donoyan**, has assumed responsibility as president of Vital Industries.

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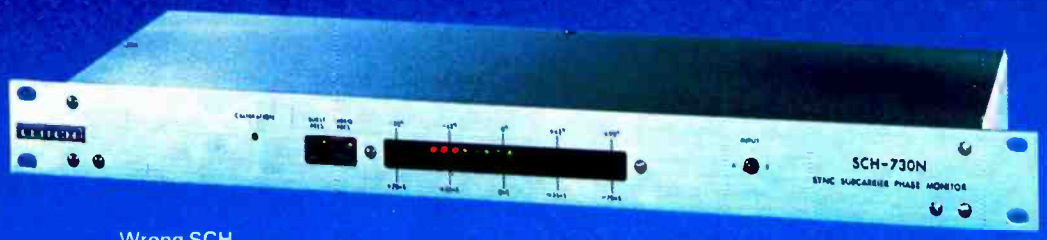

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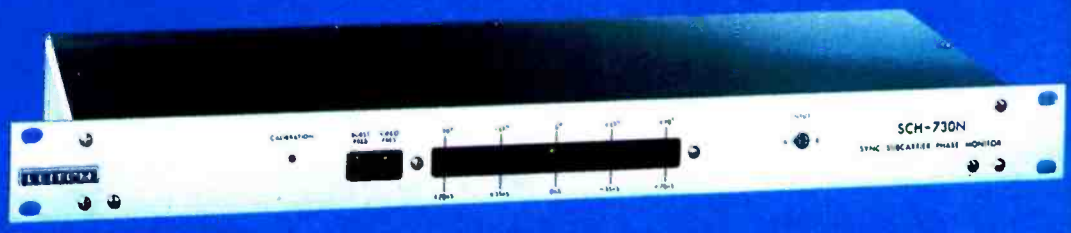

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THE EDITORS

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Broadcasters descend on Montreux

This is part 1 of a 2-part article on the '79 Montreux International Television and Technical Exhibition.

Riding high on the tail of exceptional interest present at NAB/Dallas '79, the International Television and Technical Exhibition at Montreux is in full swing as **BE** goes to press. Although final registration figures are not yet available, advance notices indicate (just as at NAB) record attendance this year. Early exhibit reservations are running slightly more than one third as many exhibitors at Montreux as were at NAB; about 28% of them are US manufacturers.

Those planning to attend future Montreux symposia will be delighted with the announcement by J. J. Cevey, mayor of Montreux and member of the Swiss parliament, that their magnificent new hotel will be ready for the 1981 event. While this new facility may ease the space problem in Montreux, it is not likely to relieve the high costs that already keep many away from this important international show.

Some of the new equipment, both production and experimental, expected to be exhibited at Montreux is highlighted below. Where literature is available, reader service numbers at the end of each manufacturer's listing may be used to obtain pertinent data.

Ampex shows PAL digital VTR

Following up on the momentum established by their experimental digital VTR demonstration at the February SMPTE Television Conference in San Francisco, Ampex hit Montreux with its PAL format experimental system.

In addition, the experimental digital VTR was described in a technical paper presented by David Fibush, an engineering department manager for Ampex's audio-video systems division in Redwood City, CA. In his paper, Fibush stated that the experimental PAL recorder demonstrates "the video quality expected of a digital VTR without answering the questions relating to size and features required for a long-term digital format."

Donald V. Kleffman, vice president and general manager of AVSD, reiterated Ampex's position that several more years of development will be required before a practical digital VTR is a reality.

"This is a second status report on an experimental recorder," he said. "Although its video performance is extraordinary," he continued, "it is not a product and we are not even suggesting the format we have chosen is close to ideal. We feel an obligation to keep the industry informed and to help it maintain a balanced view. This report and the demonstrations serve that purpose. We hope that others will continue to follow our example and give the industry further insight into the status of this technology, and we also hope to encourage the users in this industry to tell the manufacturers in turn what it expects from digital television."

As previously noted, Ampex demonstrated its experimental digital VTR in the NTSC format at the SMPTE conference. In comparison, the PAL system demonstrated at Montreux has an increased bit rate and packing density.

The PAL system is an Ampex AVR-2 quadruplex VTR that has been modified for test purposes. It has a special video head assembly with eight transducers and a writing speed of approximately 2100 ips. The digital video signal is recorded on two channels with each channel accommodating a bit rate of 67.5 mbits/s. The composite 625/50 PAL signal is sampled at 4 X fsc, and each sample is digitized into an 8-bit word. Linear packing density is 33 kbits/in.

The experimental unit has conventional tape transport and utilizes standard quad videotape. Track width is 2 mils with a guard band of .6 mils. Longitudinal tape speed is 6.6 ips.

Bosch celebrates 50 years of TV technology

As Montreux '79 opened, Robert Bosch GmbH introduced new equipment and prepared a big welcome to the television industry to celebrate their 50th year of serving it with advanced technology equipment. The celebration was an evening candlelight buffet and festivities held at the Casino de Montreux on May 29.

Equipment displayed at the Bosch Fernseh booth included the following.

• The BCN 5, the first and only 1-inch studio-quality cassette VTR, weighing 12 kg (about the same as a 90 min quadruplex tape) is battery powered, has insert/assemble edit features, and has optional color verification playback. It can be remote controlled from a separate panel or from an ENG/EFP camera. Reels can be extracted from the cassette in seconds for replay on any other BCN B format VTR.

Circle (1) on Reply Card

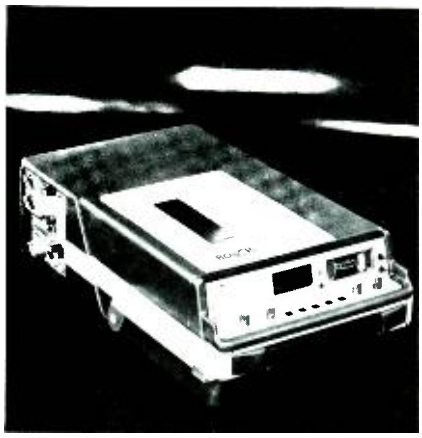
• The BCN 100 automatic multicassette VTR (announced at NAB but not shown) is the decisive high order extension to the broadcast quality BCN VTR system. Rapid random access to 32 cassettes with up to 30 minutes playing time each and a choice of up to three tape decks ensure many new production applications in addition to news or commercial insertion. The BCN 100 records, edits and plays its own cassettes or processes those previously recorded on the briefcase sized BCN 5 cassette VTR.

Circle (2) on Reply Card

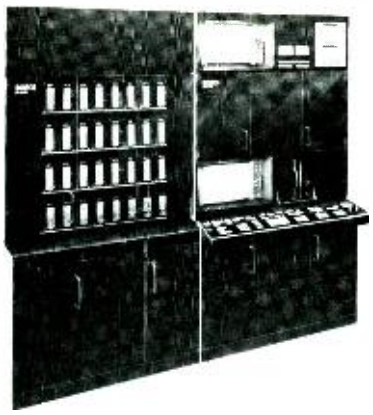
• The FDL 60 digital telecine employs CCD line sensors and a digital framestore and provides undistorted full color pictures in forward and reverse shuttle, slow motion, stills and jogging mode. Film transport is continuous and capstan driven. CCD sensors eliminate field lag and afterglow effects, do not require high voltages and have much longer life expectation than pickup tubes.

Circle (3) on Reply Card

• The KCP 60 broadcast color camera provides an alternative to today's hands-off production cameras or ENG/EFP units. It is a low complexity, low cost, high quality camera for studio or field use



BCN 5 1-inch Type B VTR



BCN 100 VTR

employing ⅔-inch Plumbicon pickup tubes and automatic beam control giving up to four iris stops overload production. Full studio control and monitoring facilities are included.

Circle (4) on Reply Card

Also exhibited was the fully automatic KCK production camera system and the ENG/EFP camera KCA.

Circle (5) on Reply Card

FDL 60 CCD line scan telecine

KCP 60 color camera

MCI/Quantel announces DVE option

Micro Consultants, Incorporated (MCI), announced that Quantel would introduce input options for the DPE 5000 digital video effects system at Montreux.

Designated DPE 5000/PLUS, the new options permit digital manipulations to be performed on three, four or five channels simultaneously, giving television producers an extraordinary range of effects for production sequences.

The basic option, housed in a 48-inch high enclosure, includes two effects units connected to the master DPE 5000, yielding a total of three channels. One or two additional effects units, providing a total of four or five channels, may be added to the system at any time.

Each effects unit is a complete framestore system dedicated to a single input. "This approach," said Micro Consultants' marketing vice president George A. Grasso, "provides much greater operational flexibility than multiplexed systems which have to make do with a single framestore."

The multi-channel systems operate from a single control panel, but each input may be keyed into any other input so that processed video in one channel may be passed through or across processed video from any other channel.

"Not only do we have the only 5-channel system available," Grasso said, "but we are also able to retrofit to any existing DPE 5000 installation."

Since the introduction of the DOE 5000, the company has added a range of options to expand the

Montreux

system, including AUTOSEQUENCE, a mini disc drive for pre-programmed effects sequences; DIGI-FLIP, a software-based effect that permits picture flip, tumble and spin; MULTILINK, a timesharing hookup for installations with more than one self-contained DPE 5000; and AUTOFLEX, a package of unique-programmed shape effects with "OOZE" transition from one to another.

"Our computer-based design concepts," Grasso claimed, "enable us to continually expand the effects system through a combination of software reprogramming and hardware additions to the basic DPE 5000."

Grasso also noted that because DPE 5000/PLUS is modular, any channel can be removed from the system at anytime for maintenance without affecting the operation of the other channels.

Circle (6) on Reply Card

A revolutionary still picture storage device, the Quantel DLS 6000 Digital Library System, also was introduced at Montreux in private demonstrations. Quantel still has this new product under development and was seeking advice from their invited guests as to the final configuration of the system, but it is obvious that the DLS 6000 has fundamental advantages over existing still storage systems.

As demonstrated, it is the smallest such system available. Compactness, together with low power consumption, make it ideal for use in outside broadcast vans as well as in the studio. Capacity is 700 still frames. Additional capacity in 700 frame increments, can be achieved simply by increasing the number of disc drives.

Circle (10) on Reply Card

Quantel also announced that sales of their DSC 4000 series of digital standards converters, outnumbers the combined total of all competitive manufacturers' units ever sold (excluding optical types). The DSC 4002, for use between PAL/SECAM/NTSC standards is a compact unit which can take feeds from satellites, land lines or tape, and directly broadcast them in another standard (live or on tape). The equipment contains a fully automatic noise reduction system, can freeze a picture for post-production work, and incorporates a unique "overscan" facility to eliminate blanking and ¾-inch headswitch problems. The automatic input standards selection provides "hands off" operation, and contributes to the unit's high reliability.

Circle (7) on Reply Card

The PAL version of Quantel's series of digital framestore synchronizers, the DFS 3001, was prominently displayed at Montreux. This family of equipment also is available in SECAM and NTSC. Quantel framestore synchronizers, in use worldwide, can accept non-synchronous feeds from helicopters, satellites, and ENG vans, and synchronize them to a local studio without reverse feeds or the use of gen locking techniques. An optional digital timebase corrector allows direct connection to ENG VTR inputs. A limited number of special effects capabilities include fixed compression, freeze and smooth picture movement under microprocessor control.

Circle (8) on Reply Card

USSR orders Quantel products for Olympics

Quantel, Ltd., announced at Montreux that it has received a contract from Mashpriborintorg (the Soviet buying agency) to supply a DPE 5001S Digital Production Effects system, and a DFS 3001S Digital Framestore Synchronizer, both in SECAM, for use during the broadcasting of the 1980 Moscow Olympic Games.

Quantel recently received a large order for SECAM equipment from NBC to send to the Olympics. This order includes five digital production effects systems, four digital framestore synchronizers, and a DSC 4002 digital standards converter to convert the Soviet SECAM signals to NTSC.

Planning & designing broadcast facilities

By Elmer Smalling, III, Jenel Corporation, New York

As construction costs mount, careful attention to details in planning s necessary to limit costs and to develop efficient facilities.

The planning and construction of a new or expanded broadcast, cable or post-production facility is an area in which few corporate principals or owners are trained. Many attempt such challenging projects wholeheartedly and with as little assistance as possible. In most cases, this approach turns out to be very expensive in developing a complete, functional and cost-efficient facility.

Questions which often arise with clients developing new facilities suggest the following outline, which should help those involved with current expansion plans. It pinpoints the assistance normally required for facility planning, development and construction.

Step I: Rationale

When considering a new or expanded facility, carefully establish a rationale for that facility.

1. Will it perform a unique service within the market?
2. Will clients be available in the market to sustain the facility for at least five years? Often, facilities are developed and built for a special time-limited function and find it difficult to adapt to the general run of business when the special function ceases. These could be considered special functions: the Bicentennial; World's Fair; special government assistance; particularly large clients; and utilization of exclusive electronic equipment.
   Facilities should be planned with room for adaptation of equipment or media.
3. Are there existing leads from clients? Potential

Careful planning is the key

users or clients should be polled prior to constructing a new or expanded facility for potential obligations. Most lending or financial institutions, as well as many venture capital groups, require this.

4. If FCC licensing is required, it must be proved that a new facility will be a service to the community. Business and financial ability to operate even while encumbered by the expenses of establishing and operating a new facility also must be proved.
5. Consider the cost of doing business at the proposed location. This includes labor, real estate, taxes and cost of living. These factors become more important if the cost per unit profits are small or time rates low.

If expanding an existing facility, the following economies should be taken into consideration:

1. Will manpower savings be achieved through the expansion of facilities or will improving the old facilities with updated equipment and manpower rescheduling suffice for the next five years? Purchasing new, miniaturized equipment and

Ask for advice—lots of it

disposing of outdated space-consuming equipment may make efficient use of space and manpower and may not warrant physical plant expansion. Sometimes, although equipment could be refurbished and modernized, the mere name and model number of out-of-date equipment might frighten away some clients unless it can be proven that a top-quality, low-cost product can be effected with this equipment.

2. If purchasing a new facility or expanding an existing one, what will the real estate cost/leases and taxes be? Many people search months for an ideal location to optimize these factors. Since broadcasting and the production/post-production industry is client-oriented, many draw users and clients because of their location and decor. Some plants, where high-level client contact is not necessary, are located in lower rent areas. When contemplating this second kind of facility locale, consider insurability, alarming, possible vandalism, police coverage, fire and flooding when balancing high versus low property purchases.

3. Is the location amenable to easy shipment and easy receiving of goods? Equipment, scenery and raw stock are being shipped constantly to and from a facility. Any facility should include a protected loading area as well as provision for off-street truck parking. If mobile unit television gear is to be used, secure parking and storage areas should be incorporated into the new facility. If expanding a

facility, find room for storage and a shipping/receiving area where controls can be exercised.

4. Is the location convenient and safe for clients talent or employees, who must work at odd or late hours? Many facilities have lost potential clients and talent because of a questionable location. Others spend thousands of dollars each year chauffering people to and from their facility. In a people-oriented trade, proper facility location is paramount, and is worth the added expense. Parking facilities, available as part of a site, will save valuable employee time.

5. Is the location convenient for microwaving, satellite distribution or certain common carrier interfacing? Since these will be arteries of the facility's life blood, have engineers or consultants check each possible new facility for ways to access these "arteries."

Carefully investigate the market to determine the

Broadcast equipment: A peek at 1989

Many broadcasters have recently looked to the NAB/Dallas '79 convention for unveiling new and revolutionary equipment. With this in mind, and to develop a better perspective, what technologies will prevail in the broadcast industry 10 years from now—1989? Because of the exponential growth of technology, it cannot be forecast by comparing the progress over the last 10 years; moreover, the last 20 years must be compared—a span that goes back to the infancy of commercial television! In 1989 many things will be different...

Video storage

Videotape or videodisc as mediums will not exist as known today, except perhaps for archival work. Although the technology with respect to video storage and handling is being improved, it is still tied to costly and failure-prone mechanical devices or media such as disc, tape, cassette etc. By 1989 video storage will be accomplished through the use of solid-state memories and perturbed scanned surfaces. Hundreds of megabytes of storage in a small area will permit recording and playback devices with no moving parts. Having a digital device such as this will obviate the need for peripheral units for video handling such as compression, expansion, effects and editing.

In addition to the research going on today in hardware development, many new algorithms are being developed for processing large amounts of video data. Libraries will exist as large digital storage systems or *firmed* data memory cards.

Video pickup devices

Future cameras already are being developed and prototyped. Large solid-state arrays that are matrix addressable will replace the vacuum tube transducers of today. There will no longer be a need for complicated circuits which provide scanning, geometry, intensity or beam treatment. Most of the problems now experienced with analog pickup devices will no longer exist. These arrays will have large enough surface areas so that an amorphous crystal or charge medium lens of large aperature can be coupled to the camera permitting pickup in standard room lighting. Studio illuminaires will be necessary only for effect lighting, and they will be much smaller than present-day units.

Monitoring and test instruments

Waveform monitors, vector display units, etc., will be completely automated to the degree no human intervention will be necessary for assessment and correction. All signal parameters will be available as digital readouts as well as R.S. 232 type data. With total digital processing, time base errors and geometric distortions will be nonexistant. Waveforms will be broken down with fast transforms and the like so that time base displays will no longer be referred to as standards.

Synchronizing systems

The bane of many modern facilities is the inherent complexity and routing of synchronizing signals throughout the plant. The movement toward encoded systems has already begun, but this does not represent the limit of technology. Digital word oriented systems will not need the synchronizing information of today. This existing information is redundant and easily integrated into a video data stream. Information algorithms will be developed which will reduce the bandwidth necessary for transmitting a video signal so that all transmission will be in digital form—even that to the home!

Satellite reception

There will be hundreds of sources of entertainment and education from around the world available to the home receiver. A high frequency multiple channel and selector/receiver coupled to a small, lightweight, metallized plastic antenna will receive programming from high powered (serviceable) satellites and space antenna arrays. Communications systems will be integrated; instead of having the need for separate television, telephone, utility billing, banking, credit, and education facilities, all will be incorporated in home satellite receiving systems.

These few examples are part of a large and growing list. The amount of skills needed by engineering management personnel will increase and broaden in scope. By 1989 the end will have come of the current hybrid period (analog/digital) and the beginning of a purely digital age will be making many areas of engineering and facility planning simpler, more economical, and more readily integratable into other disciplines.

After 1989, there will be a redefinition of electric forces (currently in research) which might define present quantum-mechanical electrical parameters as worm holes in the ether! But that's another chapter. □

estimated profits from a proposed new or expanded facility. Can a cost savings be offered to clients? Can efficient manpower scheduling be employed? Can the profit line be maintained or improved? Remember, a large investment and high initial operating expenses must be offset.

Step II: Gathering input

1. Collect and assess production and engineering input from clients or users of this facility as well as the staff. Meet with them. Discuss what they would like to see in a facility. It is less expensive to design a facility well than to modify designs to meet operational needs after construction is underway. Many facilities have grown into a mish-mash because operating personnel were not consulted prior to planning. There are existing operations that require 10 persons when three could accomplish the same end in a well designed plant. Human engineering is a very basic and important part of facility design and planning.

2. When designing and laying out a facility it is very important to consider the mobility of persons working within that plant. Paths and accesses (traffic flow) should be examined as well as communications between important groups. Reducing unnecessary steps and fatigue are important and worth possible extra square footage necessary in the overall design. Multi-story operations should be avoided wherever possible if single-level real estate is available. If more than one person is responsible in the design and acquisition of the new or expanded facility, distribute the responsibilities of the staff so that custodial care, building management, administration and operations personnel can be polled for ideas and suggestions.

3. Form a new facility committee with a representative from each major area. (If this is to be a new plant and no staff has been hired, divide area assignments among the principals.) As competent as any one person may be, there is always room for new inputs. If consultants are used for architecture, decorating or engineering, this is the point in the development of the facility to bring them on board to prepare the initial design and to receive their inputs. In an age of so many specialized areas in all aspects of facility design, it is economically sound to retain consultants for particular needs. Expanding the payroll with specialists whose skills are not needed on a full-time basis incurs unnecessary costs.

Step III: Costing

Determine the estimated cost of the proposed new facility. This includes the cost of the physical plant, the building, air-conditioning, heating, telephones, intercommunication, decorating, finishing and the electronic equipment needed to operate and sustain the plant. Once all of these areas have been polled, discussed and costed, develop the economy of the facility.

Step IV: Preparation

1. Prepare preliminary designs, including a proposed floor plan of the plant. Once a floor plan has been generated and approved, provide copies so that proposed equipment and finishing can be sketched-in for planning and approval by the principal or new facility committee. The sketch-in items include: furniture and fixtures; telephones and intercoms; master antennae and cable; floor and wall treatment and finishes; and electronic (racks, wire, trades, etc.) decorations.
   Detailed drawings should be prepared for all these areas, as well as:
   A. Single-line diagrams of the electronic equipment. These single-line drawings must cover every plant area and all intended interconnections. For a new facility, the engineering consultant should talk to all parties involved to assess needs and to generate drawings for explanation, approval, second opinions and documentation.
      A parts list for the facility can be generated from a good set of diagrams (which should, in their legend, explain all symbols and delineate all equipment defined by function, manufacturer, model and quantity).
   B. For a facility expansion, the engineering department and consultant should work together to produce a single-line drawing for the new addition and interconnect interface equipment.

2. A proposed manpower schedule for discussion and approval by the principals/managers should be generated. This schedule should include 24-hour (or full operating time) coverage for the facility taking into consideration working agreements, contracts, and local manpower utilization rules. If special skills will be required, key personnel should be hired early so that experience and on-site training can be gained. It is unwise to ask employees to begin cold with new equipment or methodologies.

3. Once preliminary designs have been completed, discussed, modified, and edited, it is important to prepare a progress chart of the whole project from beginning to final test. Many people like to start a Progress Chart or PERT (Program Evaluation and Review Technic) Chart as soon as the basic facility has begun so that progress, delays, and sub-project synchronization can be ascertained at a glance. There are a number of types of progress charts, and the PERT is popular and easy to evaluate. This progress chart should be updated as work proceeds, and copies should be distributed to the principals.

Step V: Preparing bid specs

At this point, a detailed set of designs and specifications for each area of the facility should be prepared, checked, approved, and released for contractor bidding. There are contractors available for the following jobs in every part of the country: building (general), roofing, ceiling, carpentry, cartage, painting, electrical, telephone, electronic and decorating.

There are many ways contractors can bid on the whole or part of the facility. There is a Turn-Key Bid where a contractor will bid a job from design to final check for approval on any area of the plant, large or small. Often, it is wise to ask for an individual bid in

certain areas of the facility rather than allow one contractor to bid the whole job because of the specialized nature of the facility. Many contractors have special expertise in certain areas, and having a group of experts construct a plant is wiser than employing one generalist who must rely on rigid and difficult supervision.

When breaking a job into many small bids or proposals, coordination and supervision is required by the principals, consultants or their designees. In any case, make certain that bid information includes acceptance by the principals of any portion of the bid before job signoff. Be prepared to discuss with each bidder problems and questions concerning the facility. In many cases the contractor has done something many times, and his expertise might warrant changing something which he can improve upon.

Allow limited job-in-progress changes to the contractor when he makes suggestions which will enhance specifications. Discuss certain costs and certain economies when dealing with a contractor. Often it is more efficient for his crew to work at hours different from the business day. Make certain that the contractors' hours are defined in the contract or agreement, and discuss overtime costs. Excessive overtime may increase costs on the average of 20% to 50% if not checked. However, overtime may be necessary when supply delivery problems arise or when multi-trade coordination is necessary.

Quite frequently it is assumed that a certain contractor can provide all of a certain series of services when some of these can be best provided through original equipment manufacturers. Many manufacturers will supply free or low-cost installation and testing as part of an equipment package. Make certain that this service, if desired, does not conflict with the operating or work rules of other contractors on the job site—another good reason for meetings with potential contractors who have submitted bids!

Put a limit on the time that each contractor has to respond to the specifications with his bid. It is better to allow a time period shorter than one might anticipate the contractor taking; in many cases it will be extended for numerous reasons not anticipated originally.

Step VI: Evaluating bids

As soon as possible after the bid deadline (and with the consultant(s)/attorney) examine the bids and proposals from all contractors prior to making awards. Consider these factors:

1. The expertise of a given contractor. A lot can be determined by examining a proper bid/proposal regarding the competence of a bidder (this is an area where the consultant can offer an economically important service). If a bid or bids are judged imcomplete and the contractor seems to be "in-the-running," it is possible to allow all bidders a week or so to amend their bids to the specification. Check this area carefully with an attorney.

2. Determination of the level of supervision the

contractors supply. No bid or proposal is acceptable unless the job will be supervised by a competent representative of the bidder (the degree of supervision is naturally proportional to the scope of the job). Periodic meetings should be held with the bidder, his supervisor, and representatives of the facility's committee.

3. The track record of the contractor. It is wise to ask the contractor for references consisting of previous customers who have had similar work completed. A reliable contractor will be glad to furnish these references.

4. Check all of the guarantees that the contractor provides on his services or equipment.

5. Examine the insurance and the bonding that the contractor provides. On many large jobs, contractors are required to post a performance bond as well as provide adequate "on-site" insurance for the total job.

These items are very important as they protect the principal/owners of the facility. Items 4 and 5 should be checked carefully by an attorney.

Step VII: Construction

Once construction has begun, have the consultant and management personnel responsible for the various aspects of the project supervise the construction and make certain that it is progressing as planned (the progress chart is invaluable during this phase of the project).

A job-in-progress change is often far less expensive than a major change made after construction is complete. Weekly or more frequently, meetings with the contractor's supervisory people will minimize the costs of changes.

Step VIII: Completion

Check and approve the facility once the construction is complete. It is often wise to have an unbiased party do performance checks on the electrical systems, environment systems, electronic systems, and accoustical treatment to make certain that these systems have been installed correctly, according to specifications, and that the contractor has satisfied his performance promises.

A contractor should never require the total payment of his contract until the principals are satisfied with the job according to the bid and contract—another important reason for having an attorney look over the original specifications and performance contracts before these items are sent out for bids.

Planning a new facility or updating an existing one can be complex, and the planning must be flexible to allow for variances. Experience shows that problems and dissatisfaction generally result from inadequate planning and lack of attention to details. The areas outlined here should help planners avoid common pitfalls. □

Introductory digital circuits

Part I: Mathematical background

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This article covering the basics of digital circuitry is one of a series on digital technology for broadcasters. The continuing series will include applications to audio and video portions of broadcasting and will consider implementing digital into station operation.

Digital equipment, regardless of its complexity, is composed of small building blocks. These blocks may be basic gates, or combinations of gates, or special circuits such as triggers.

A functional block may be made up of several gates such as in the case of a flip-flop and even more complex blocks may contain several flip-flops along with other components. Thus, there is an entire hierarchy of building blocks and, depending on the level at which they are considered, these blocks may be made up of any number of smaller individual blocks.

To understand the design and operation of digital circuits it is necessary to employ a simple algebra that allows a systematic, non-intuitive approach. This algebra is named after George Boole, a 19th century mathematician, who developed it. It was nearly one hundred years after its development that Claude Shannon applied Boolean algebra to digital circuit design and simplification.

Although proficiency in the use of Boolean algebra is necessary for the understanding of digital circuits, an exclusively mathematical treatment of the subject can be boring. However, if a purely hardware approach is taken in dealing with the subject, one tends to think only in terms of circuits or components. A widely used solution to this communications dilemma is to consider Boolean algebra as it relates to logical statements. This approach allows an easy transfer of knowledge to the subject of logic design.

Logic Statements

Basic logical statements may be considered either true or false using a letter to represent such a statement. Thus, X = 1 represents a "true" statement while a "false" statement would be written as X = 0. (Later, a numerical significance may be attached to the 1 or 0, but at this point consider they have only a logic meaning.)

In considering a representation of complicated logical statements, three operations need to be defined: AND, OR and NOT. Consider first the AND statement (X AND Y) as made up of two logical statements such as "The power supply is on AND the transmitter is on." Thus, X = power supply on, and Y = transmitter on. The statement X AND Y may be true or false and can be tabulated as:

X	Y	X AND Y
true	false	false
true	true	true
false	false	false
false	true	false

A more compact notation used to represent the AND statement is X • Y, where the "•" represents

AND. In tabular form, this notation yields

X	Y		X•Y
1	1	=	1
1	0	=	0
0	1	=	0
0	0	=	0

Other symbols are sometimes used to denote the AND operation and care should be taken not to confuse any of them with the meaning attached to them in ordinary algebra.

Now consider a logical OR statement (X OR Y) such as "The power supply is on OR the transmitter is on." Thus, X = power supply on, and Y = transmitter on. A tabulation for this statement would be

X	Y	X OR Y
true	true	true
true	false	true
false	true	true
false	false	false

Using a "+" to represent the OR operation X OR Y would be written as X + Y and the tabulation of this statement would be:

X	Y	X + Y
1	1	1
1	0	1
0	1	1
0	0	0

As in the case of the AND operation, care must be exercised not to confuse the meaning of the "+" in this case with its use in ordinary algebra.

Consider now the NOT statement such as "The transmitter is NOT on," or X = transmitter on. Then,

X	NOT X
true	false
false	true

A bar will be used to represent the NOT operation; thus,

X	$\overline{X}$
1	0
0	1

An example of the use of this notation would be $1 = \overline{0}$ or $\overline{0} = 1$. These define the basic operation of Boolean algebra, and now some useful theorems and definitions will be considered.

Definitions

After a logical statement has been expressed as a letter, such as

Power supply on = X,

the letter, when used in an "equation" or Boolean expression, is a variable. This is analogous to the variables in an ordinary algebraic expression except that the Boolean variable can take on one of only two values—1 or 0.

Determining the complement

It is often useful to employ the concept of a complement. Expressions are said to be complements of one another if one expression equals 1 only when the other equals zero and vice versa. An example would be A and $\overline{A}$. To take an entire Boolean expression and write its complement, (1) Change all ones to zeroes, (2) Change all zeroes to ones, (3) Change all ANDs (•) to ORs (+), (4) Change all ORs (+) to ANDs (•), and (5) Complement each letter in the expression A to $\overline{A}$.

Two Boolean expressions are said to be equivalent if one expression equals 1 only when the other equals 1 and equals 0 only when the other equals 0.

The dual

One further operation is useful in analyzing Boolean theorems and simplification procedures. The dual of an expression is obtained by carrying out only the first four steps as outlined in the process for determining the complement.

A simple example will illustrate the operations of complementing and taking the dual:

Given the expression

$$A \bullet B + C \bullet \overline{D},$$

the complement is

$$(\overline{A}+\overline{B}) \bullet (\overline{C}+D),$$

and the dual is

$$(A+B) \bullet (C+\overline{D}).$$

One further comment on notation at this point may simplify some work later on. The symbol (•), i.e. AND, is often eliminated in writing expressions just as it is in ordinary algebra. The symbol will be included only where necessary to make an expression understandable; thus, the term (A•B) will be written as (AB) unless additional clarification is needed.

Theorems and Laws

Several theorems are useful in simplifying logical expressions, or in changing their form. An understanding of these theorems or laws is necessary in manipulating Boolean expressions for analyzing logic circuits.

In Boolean algebra it is possible to prove the equivalence of expressions by substituting all possible values of the variables. This is not possible in ordinary algebra because of the large number of values that variables may have. To illustrate this approach, consider some of the basic laws.

Consider first the statement

$$OA = 0.$$

(A) must have a value of either 0 or 1; if A = 0, then 0•0 = 0. However, if A = 1, then 0•1 = 0. Thus, no matter what value A has, the expression OA will always have a value of 0.

Similar reasoning may be applied to the expression:

$$1+A = 1$$

If 1+A = 1, then 1+1 = 1. However, if A = 0, then 1+0 = 1. Again, by considering all of the possibilities, the validity of the statement has been proved.

Another pair of very useful statements is:

$$1 \bullet A = A$$

and

$$0+A = A$$

The proofs for these expressions can be obtained by the same reasoning procedures outlined for the first pair of statements.

There are several simplification theorems which are best understood from examples; among these are expressions such as:

$$AA = A$$

and

$$A+A = A.$$

Consider the problem of simplifying the expression:

$$(XYY+Z)(Z+Z+XY) =$$

$$(XY+Z)(XY+Z) = (XY+Z)$$

The truth of the last step may be seen by considering the entire term inside a pair of brackets as a single variable.

Two important statements may be made involving the use of complements: Anything added to its complement = 1; Anything multiplied by its complement = 0. A logical analysis of these statements quickly reveals their validity.

Algebraic laws

The familiar laws of algebra involving distribution, association and commutation apply to Boolean expressions, and they may be summarized as

Commutative law:

$$A+B = B+A$$
$$AB = BA$$

Associative law:

$$A+(B+C) = C+(A+B)$$
$$A(BC) = C(AB)$$

Distributive law:

$$A(B+C) = AB+AC$$
$$A+(BC) = (A+B)(A+C)$$

All of these laws may be proven by considering all of the possible values of the variables as was done in the previous cases.

DeMorgan's theorem

DeMorgan's theorem is of importance for two reasons. First, it plays a major role in many manipulations in Boolean algebra. Second, and perhaps more important from the point of view of the designer or user of logic circuits, this theorem shows that a logical function can be realized by using either AND gates and inverters or OR gates and inverters. This is a very powerful algebraic tool for the circuit designer since it allows circuits to be built up of only one type of building block, and this may result in significant cost savings.

The most general statement of DeMorgan's theorem consists of two expressions:

$$\overline{AB\text{- - - -}N} = \overline{A}+B+\text{- - - -}+\overline{N}$$
$$\overline{A+B+\text{- - }+N} = \overline{A}\,\overline{B}\text{- - -}\overline{N}.$$

It is worthwhile investigating proofs for these statements. To accomplish this, consider the case of only two variables:

$$\overline{A\,B} = \overline{A}+\overline{B}$$
$$\overline{A+B} = \overline{A}\,\overline{B}.$$

Truth tables are used to carry out proofs for each statement.

Consider first the statement

$$\overline{A\,B} = \overline{A}+\overline{B}.$$

Taking the lefthand side

A	B	AB	$\overline{AB}$
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

Considering the righthand side

A	B	$\overline{A}$	$\overline{B}$	$\overline{A}+\overline{B}$
0	0	1	1	1
0	1	1	0	1
1	0	0	1	1
1	1	0	0	0

Combining the essential elements of the two tables yields

A	B	$\overline{A\,B}$	$\overline{A}+\overline{B}$
0	0	1	1
0	1	1	1
1	0	1	1
1	1	0	0

A comparison of the columns representing the terms $\overline{AB}$ and $\overline{A}+B$ shows the equivalence of the two expressions.

For the second case

$$\overline{A+B} = \overline{A}\,\overline{B},$$

the table for the lefthand side would be

A	B	A+B	$\overline{A+B}$
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

The righthand side gives

A	B	$\overline{A}$	$\overline{B}$	$\overline{A}\,\overline{B}$
0	0	1	1	1
0	1	1	0	0
1	0	0	1	0
1	1	0	0	0

Combining the essential elements of the two tables yields

A	B	$\overline{A}\,\overline{B}$	$\overline{A+B}$
0	0	1	1
0	1	0	0
1	0	0	0
1	1	0	0

Comparing the columns containing the $\overline{A}\,\overline{B}$ and $\overline{A+B}$ terms, the complete equivalence of the two expressions can be seen.

Simplification aids

Considering DeMorgan's theorem using truth tables provides a general approach to "proving" equivalence of Boolean expressions involving small numbers of variables. However, when there are several variables involved, or the expressions are complicated, the tables become large and awkward to use. In such cases, use of the various theorems and laws of manipulation become imperative to simplify Boolean expressions without resorting to exhaustive proofs.

A theorem which represents the Boolean analogy to factoring in ordinary algebra can be expressed as

$$AB+AC = A(B+C)$$
$$(A+B)(A+C) = A+BC.$$

Note that the second statement is not allowed in ordinary algebra, but its truth in Boolean Algebra is easily shown by truth tables.

An example of the use of this theorem is the simplification of the expression:

$$AB+AC+A(D+\overline{E}).$$

This may be reduced to

$$A(B+C+D+\overline{E}).$$

Another useful pair of statements in simplifying expressions is

$$AB+A\overline{B} = A$$
$$(A+B)(A+\overline{B}) = A$$

Note the dual nature of these expressions as well as the others in this group of theorems.

An example of the use of this theorem would be the simplification of the statement:

$$AB+AC+A\overline{B}+A\overline{C} = A.$$

Reducing redundancy

A theorem involving redundancy and the elimination of unneeded terms (and, thus, unneeded compo-

nents in a design) is given by the following statements:

$$A + AB = A$$
$$A(A + B) = A.$$

This theorem shows that terms may be eliminated to simplify expressions when redundancies occur.

Another useful theorem involving variables and complements of variables is given by the two expressions

$$A + \overline{A}B = A + B$$
$$A(\overline{A} + B) = AB$$

The first of the statement may be proved as follows:

$$\begin{aligned} A + \overline{A}B &= (A + \overline{A})(A + B) \\ &= 1 \cdot (A + B) \\ &= A + B \end{aligned}$$

The second may be proved in a similar way.

Often "included" terms arise in manipulations of expressions and the following statements are useful:

$$AB + \overline{A}C + BC = AB + \overline{A}C$$
$$(A + B)(\overline{A} + C)(B + C) = (A + B)(\overline{A} + C)$$

The theorems and laws listed are not a complete set of statements for manipulating Boolean expressions, but an understanding of these allow manipulation of simple Boolean expressions in following logical design procedures.

The next step in developing an understanding of logic circuits is to use the definitions and laws of manipulation to model actual electronic building blocks and the connections between them as they are used in circuits. The second part of this series proceeds to do this as well as to investigate some methods of minimizing the number of components used and the complexity involved in realizing an actual circuit or system. □

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Digital audio in the BBC

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As digital becomes increasingly more important in broadcasting, the BBC shares their developments in digital audio to show how they have captured and used this evolving technology.

Audio scene observers have perceived the dawn of an era in which digital audio methods are used to attain higher quality sound recording in the studios of record companies and broadcasters. Less well-known is that digital methods have been in widespread use for audio signal transmission-networks in Europe and North America for the past few years.

The British Broadcasting Corporation (BBC) pioneered the use of digits in broadcasting service with the introduction in 1972 of Sound in Syncs, in which compressed and digitized sound is carried in the television line-sync intervals. Sound in Syncs is used by the BBC throughout most of its television network; the system was later adopted for use on the Eurovision network and adapted for use in Canada. It earned a coveted Queen's Award to Industry for the BBC and for Pye TVT Limited. Although early equipment was designed by the BBC, Pye TVT collaborated in manufacturing the commercial Sound in Syncs coders and decoders.

There are two key advantages of Sound in Syncs. First, it removes the need for an audio network to complement the video network transmitting signals between studios and the broadcasting transmitters, thereby saving on circuit costs. Second, it offers a long-haul, high-quality sound channel, with 14 kHz bandwidth and an unweighted RMS signal-to-noise ratio of around 75 dB, which is difficult and costly to attain by analog means.

Digital fundamentals

The original audio signal's form is essentially analog. As shown in Figure 1, it can be represented by a continuous curve on a graph of signal voltage versus time. A numerical description of this analog signal can be obtained by periodically measuring the voltage level along the curve, thereby sampling the signal. The value of the sample can be expressed as a binary number, the quantization accuracy being determined by the number of bits per sample, each additional bit reducing the quantizing noise by 6 dB.

For example, in Sound in Syncs the compressed analog signal is digitized with 10 bits per sample. The analog compression and subsequent expansion are worth about 2½ bits, so that the overall signal-to-noise ratio is approximately $(10 + 2½) \times 6 = 75$ dB. A sampling frequency of 31.25 kHz is used, which is the theoretical minimum for an audio bandwidth of half of 31.25 kHz, i.e. 15.625 kHz (625-line-frequency), given ideal low-pass filtering to suppress unwanted products of sampling in the A/D and D/A conversion hardware. Choosing twice line-frequency as the sampling rate was instrumentally sensible, and it gave the 14 kHz bandwidth with practical, economic filters. (Actually, 14 kHz is 1 kHz short of the 15 kHz bandwidth usually specified for high-quality sound-broadcasting, but the economic and technical benefits of Sound in Syncs outweigh the very small audible difference between 14 kHz and 15 kHz bandwidths.)

The BBC broadcasts four domestic radio programs throughout the United Kingdom, although two of the programs have substantial 'opt-outs' in certain parts of the UK or on certain channels during which locally-produced or specialized educational programs are broadcast. In the 1960s this nationwide networking posed formidable technical and cost problems with regard to stereophony because of the necessary balance in phase and other parameters between the left and right channels that was required of the analog circuits, several hundred miles long, distributing the signals to the transmitters. Indeed, nationwide stereophonic broadcasting of a program was not possible, although a substantial proportion of the population in England was provided with a stereophonic VHF/FM service of one program, the technical quality of it diminishing as the distance between London and the listener increased.

Digital distribution

In 1970 the UK Post Office, which carries most of the sound program signals to BBC's broadcasting

transmitters, agreed that a BBC proposal to distribute its radio program signals digitally over microwave links was an acceptable way to get over the stereo problem and to provide 15 kHz audio channels. Accordingly, a practical plan was made, and the target was to provide a multiplex of up to 13 high-quality audio channels in a digital network covering most of the UK; any pair of channels could be used for stereo. The plan involved all the Specialist Departments of BBC Engineering Division and the first phase was implemented with digital equipment designed and manufactured in-house, with distribution over microwave links owned and operated by the BBC.

The sampling rate for the system is 32 kHz, giving the required audio bandwidth of 15 kHz, and the total bit-rate for the PCM (pulse-code modulation) multiplex is 6336 kbits/s, which in 1970 was a tentative standard bit-rate proposed by the UK Post Office. This arrangement provides, in each sampling period, 14 times slots, each containing 14 bits. Of these time slots, 13 are available for audio channels and the 14th contains synchronizing, switching, and monitoring signals. Each audio channel carries a 13 bit sample plus a parity bit arranged to monitor the five most significant bits in the 13 bit sample. If parity checking at a receiving terminal shows that a transmission error has occurred, error concealment is invoked by repetition of the previous

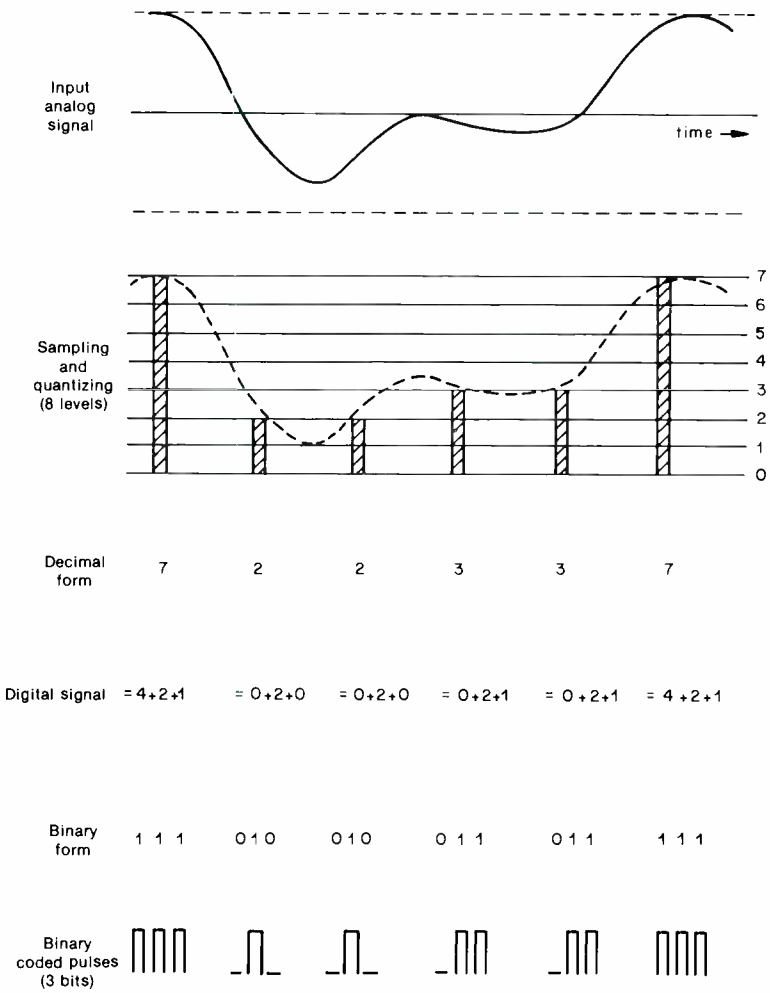

Figure 1 Three-bit analog/digital conversion.

sample, or, if the error-rate is found to be very high, by muting the audio signal. This kind of error protection works well for random errors.

By the end of 1972 the first phase of the system was in service, covering a substantial part of England; since then the network has been spread over most other parts of the UK, still using digital equipment manufactured by the BBC, (See Figure 2), but using Post Office microwave links to carry the digital signal.

Digital video

While one group in the BBC Research Department was contributing to the 13-channel audio work, another group was exploring the possibility of digital videotape recording, giving several advantages over analog methods, such as the ability to make multi-generation recordings without impairment. As a step towards that possibility, a stereophonic digital audiotape recorder was completed in 1971 using certain techniques employed in the 13-channel distribution system. The idea was to investigate experimentally the problems incurred in digital recording on magnetic tape: reliably recovering high-density data from the tape and removing timing errors.

The timing problem, which was basically equivalent to wow and flutter, was overcome in a novel way that has since been used by many enterprises to correct time-base errors in television equipment such as videotape recorders. The tape consumption was 15 ips of ½-inch tape (double that of stereo analog recorders), but the aims were modest on the early machine; the bit-packing density was about 5 kbits.

The sound quality, however, was markedly superior to that from analog machines; non-linear distortion, particularly modulation noise, was made virtually inaudible even on critical test pieces involving piano and glockenspiel music. Wow and flutter were eliminated. Although methods used to combat tape dropouts were not considered adequate, solving that problem for audio was put in abeyance to make way for work on a digital television

Figure 2 This BBC designed and manufactured 13-channel digital audio multiplex encoding equipment, including a complete reserve set and monitoring facilities, forms part of BBC Radio's distribution network throughout the UK.

tape recorder, which was successfully completed in 1974 and demonstrated at the International Broadcasting Convention in London.

The digital VTR gave high-quality PAL color pictures using a longitudinal recording method and a lot of tape, 1-inch wide at 120 ips. It was not a machine for operational service, but it has proved to be a valuable research facility. It also provided considerable experience in protecting video digits from error due to tape dropouts, and of recording at the quite high packing-density of 15 kbits/in. The project pointed the way towards multi-channel digital audio recording and further studies of digital video recording.

Reduction of the bit-rate of a digital audio (or video) signal is attractive for both point-to-point transmission and, at first sight, recording. A PCM audio signal comprises about 500 kbit/s which would appear to need a channel bandwidth of around 500 kHz for transmission or recording. However, the tolerable noise level in the channel can be relatively high for PCM. For example, a peak-to-peak signal to RMS noise ratio of about 20 dB corresponds to a relatively low bit-error rate of between one in 10^6 and 10^7. Therefore, although the channel must be wideband, it need not have a high signal-to-noise ratio to handle high-quality in PCM form. Also, coding methods are available to reduce the bandwidth needed by the digital signal without reducing the bit rate, but obviously it is economically wise to minimize the bit rate without sacrificing quality.

Reducing bit rate

In 1971 an investigation was begun in BBC Research Department into various methods of reducing the bit rate without impairing audio quality, the main target being to maximize the number of audio channels that could be accommodated within the European first-order multiplex digital telecommunications standard of 2048 kbit/s. Initially, syllabic companding and other analog noise-reducing techniques were contemplated, but they were not favored because, although they offered a potential saving of about two bits per sample, as in Sound in Syncs, they required elaborate analog instrumentation at a time when digital hardware was becoming a more attractive proposition. Instead, attention was concentrated on instantaneous digital companding, and on a BBC variant described as 'near-instantaneous' companding. Experiments showed that better quality was obtainable with near-instantaneous companding for a given bit-rate.

The terms syllabic, instantaneous, and near-instantaneous in the context of audio companding simply refer to the rate at which the compression and expansion of the signal takes place. Although instrumentally simple, instantaneous companding varies the degree of compression/expansion for every sample. For a given bit-rate this necessitates a substantially lower digitizing accuracy for high-level signals than can be had with near-instantaneous companding in which the degree of compression/expansion is changed less frequently—say, once every 30 signal sam-

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In the great tradition of Philips portables:

1968...PCP-70 The industry's first portable. The one that started it all.

1969...PCP-90 Step two. World famous Minicam.

1975...LDK-15 First generation of triax field production cameras.

1976...LDK-11 A smaller, lighter, lower cost field and studio camera.

1977...Video 80 An innovation in lightweight camera and production system...**LDK-15L** Latest version of the LDK-15.

Evolving from this long history of portable equipment leadership, Philips' engineers have created a new concept in portable and field equipment. *The LDK-14 broadcast systems camera.*

A futurized camera offering three *advanced* configurations for field and studio use...all achieved *without equipment repackaging:*

1. *ENG*—studio quality portable; self-contained, one piece; film camera handling; weighing less than 15.5 lbs. (7 Kg) lens included; less than 12 lbs. (5.5 Kg) without lens.
2. *EFP*—studio quality portable, with remote control; timing and phase adjustable gen lock; instant convertibility to studio camera use by simple change of viewfinders.
3. *Studio*—compact, maneuverable; full broadcast quality; 5" viewfinder.

The LDK-14 combines innovative design and unique capabilities in a state-of-the-art 2/3 inch camera that is *much lighter* and *uses significantly less power* than the competitive ENG-only camera. Plus the LDK-14 gives you additional advantages in size, picture quality, stability, maintainability and cost.

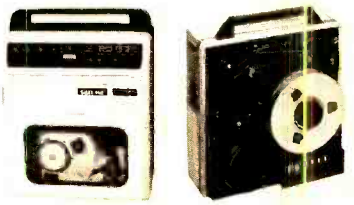
Among its many other unique features for portable and studio use are:

- Only 27 watts power consumption (almost 1/3 less than the ENG-only competitive portable) gives longer continuous operation with choice of battery belt or small battery pack affixed to camera. A standby switch further conserves battery power between takes.

- Viewfinder displays include: contour enhanced camera picture or external video signal; status monitors for video level, color balance, bars on, battery discharge, VTR functioning, intercom call and camera tally.
- Automatics include: color balance; white and black level; centering; noise reduction when operating with extra gain; auto iris with set and hold facility.
- Externally switchable black stretch and contrast expansion.
- Dynamic Beam Control (DBC), regulates beam current to suppress comet tailing and blooming.
- Circuitry designed to maximize advanced capabilities of the latest rear-loading Plumbicons.
- Optional remote control facilities.
- Easy access for set-up and maintenance. Rear casing flips up for access to five main plug-in circuit boards.
- The rugged magnesium housing and titanium quick-release lens mounting holds all optical and electrical components in absolute registration. (Lens mount is strong enough for the heaviest extended range zoom lenses.)
- Rain, splash and RFI proofed.
- Other features include electronic raster rotation for better registration; linear matrix for optimal and Philips compatible colorimetry; and 360-degree hue-selectable chroma key.
- Other competitive cameras may have some of these LDK-14 features—no one has them all.

Camera-Recorder Systems

With this unmatched combination of performance and portability, the LDK-14 is *also the ideal camera for field recording of ENG and EFP.*



And just as Philips has always offered the widest selection of portable and studio cameras to meet your specific needs, the same policy now applies to your choice of 1" VTR's and TBC's. Offering 'C' format and 'B' format VTR's in both portable and studio configuration, Philips can provide the greatest objectivity and cost-effectiveness in packaging systems to match your requirements.

Philips, the company that started it all, now introduces the latest portable breakthrough, the LDK-14 broadcast systems camera. It will be the industry standard for years to come. And for a camera-recorder package to match your requirements, your choice of 1" VTR formats. Only from Philips.

For all the facts on this innovative new camera or camera-recorder system (please specify) write: Philips Broadcast Equipment Corp., 91 McKee Drive, Mahwah, N.J. 07430 (Canada: Philips Broadcast Equipment, 601 Milner Ave., Scarborough, Ontario M1B 1M8)

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ples—its value being determined by the peak signal level during that group of samples.

NICAM

In the latest version of the BBC's nearly instantaneous companding scheme, known as NICAM 3 (Near Instantaneously Companded Audio Multiplex), the number of bits per sample is reduced from 14 to just over 10, which should be compared with 13 bits per sample in the original PCM system, while the audio signal-to-noise ratio is about 6 dB better with NICAM 3 equipped with 14-bit analog-digital converters.

An early version of NICAM provided six 15 kHz audio channels within a 2048 kbit/s multiplex. In 1975, such prototype NICAM equipment was used in digital transmission field trials over long cable circuits containing many regenerative repeaters. The trials involved both digital audio and digital video signals, and were centered near Portsmouth, England. They were the result of collaboration between the UK Post Office, the General Electric Company, the Plessey Company, Standard Telephones and Cables Limited, and the BBC. The BBC provided two independent 60 Mbit/s packages, each comprising one digital broadcast-quality PAL video channel and six digital audio (NICAM) channels, bringing the total bit-rate up to the 120 Mbit/s of the cable system.

In 1976 the BBC 60 Mbit/s audio and video package was successfully transmitted to and from an Intelsat satellite over the Indian Ocean via the UK Post Office Earth Station at Goonhilly Downs, England.

These digital cable and satellite experiments were followed by similar field trials in 1977 at 140 Mbit/s over optical fibers in collaboration with Standard Telecommunication Laboratories. All of these field trials contributed greatly to BBC's knowledge of economic methods and technology for the Orbital Test Satellite as part of the BBC's contribution to the European Communications Satellite program of the European Space Agency.

Other digital studies

Several other applications of digital audio transmission have been explored experimentally by the BBC. A digital modulation scheme using 4-phase differential phase-shift keying (4ØDPSK) was devised to provide two NICAM audio channels on a radio-frequency bearer; the method has been used in experimental service to relay contributions into live stereophonic broadcasts. Experimental digital audio broadcasts have been made in the VHF band using a digital 4ØDPSK method.

Other current research includes ways to further reduce the bit-rate of high-quality audio signals to make even more economic use of the increasing number of digital transmission circuits. The methods being tried include separate near-instantaneous companding of each of several frequency bands within an audio signal; the more critical bands are coded more accurately at the expense of cruder coding in the remaining bands. The methods also may prove to be suitable for medium and low-quality audio applications.

Bit-rate reduction for transmission purposes makes good economic sense, but for magnetic tape-recording it is not so attractive. The main reason for this is that one essential requirement of an audio recorder, be it analog or digital, is that the signal recorded on it must be suited to mixing operations, including, for example, multi-generation dubbing or the 'dropping-in' on a given channel of recordings made on different occasions. Such operations are much simpler to achieve on a digital recorder if bit-rate reduction methods are not used, just as multi-generation analog recordings are simpler if companding can be avoided. Again because of mixing, it is highly desirable to correct fully any dropout errors on every tape pass, rather than merely detect and conceal them and run the risk of compounding them as the number of generations of dubbing builds up.

After the digital videotape recorder was completed in 1974, attention returned to digital audiotape recording, but this time the emphasis was placed upon error correction and tape consumption to complement the excellent audio quality heard earlier. Multi-channel recording can be an activity involving a great deal of mixing and multi-generation dubbing, and a large amount of tape for analog recorders with 24 channels. It appeared that digital tape recording had more to offer in multi-channel operations than merely improved audio quality, in view of the practically unlimited number of generations that could be recorded without loss of quality and the potential saving in tape consumption indicated by the work on digital videotape recording.

It was decided that an experimental 10-channel recorder should be built. It was designed to use the same amount of tape as an equivalent analog machine, to have error correction capable of correcting any length of dropout affecting one track, to have the channels individually accessible for editing purposes, and to be compatible with 14 bits per audio sample. The outcome in 1976 was a 10-channel recorder (See Figure 3) using 1-inch tape at 20 ips with 42 tracks, where four tracks were allocated per audio channel and two tracks were available for time-codes and auto-edit instructions. Half the recorded bits were parity bits added for error correction. As before, the sampling frequency was 32 kHz, the bandwidth was 15 kHz, and the signal-to-noise-ratio was nearly 80 dB using 13-bit PCM.

Getting industry involved

The BBC, not being a manufacturer of tape recorders, sought liaison with industry soon after the stereophonic recorder was completed in 1971 to promote the design and production of commercial digital recorders. It was in 1975 that a formal collaborative agreement was arranged with the 3M Company, and the first fruits of this co-operation were shown at the Audio Engineering Society Convention in New York City in November 1977. 3M demonstrated their prototype design of a 32-channel digital recorder (See Figure 4) using 1-inch tape at 45 ips, giving a bandwidth of 20 kHz, as required by the recording industry, and a maximum playing time of 45 minutes. The recorder uses one track per audio channel and 16 bits per sample, giving a very high signal-to-noise ratio; one third of the recorded bits are parity bits added for error correction. The packing density on each track is very high, at about 27 kbits/in; this was found in separate experiments by the BBC and 3M to be usable when complemented by a powerful error correction method which employs cyclic-code redundancy checking in conjunction with simple parity-bit checking. Obviously, with only one track per channel, this error-correcting method cannot be as powerful as that used in the earlier 10-channel recorder, where a whole track could be lost without audible impairment. However, it has

the attraction of affording 32 audio channels on 1-inch tape, without demanding an unacceptably high tape speed or number of tracks on each recording head.

Enter the microprocessor

To complement digital audio recorders, it is a logical step to consider ways and means of digitally processing the signals from such recorders for mixing and editing purposes. At BBC, in early 1976, a feasibility study indicated that the operations required in an audio mix-down desk, to assemble a stereo or quad recording from a multi-channel recording while retaining the audio in digital form, could be executed by equipment based upon microprocessors. It had been known for some years that microprocessors could be used to control audio signals in analog form, but real-time digital processing of digital audio was something of a novelty.

The first set of apparatus brought together by BBC Research Department for digital audio microprocessing experiments was based upon a Plessey Miproc processor, which has a high-speed central processing unit suited to the task. Experiments successfully carried out with the apparatus included mixing of several channels, shaping of the frequency characteristic to meet a wide range of filtering requirements, computer-aided mix-down from the multi-channel recorder, audio level metering, and signal synthesis. All of these functions are applicable to the audio mixing field, but the Miproc apparatus also has proved to be a valuable facility for research into comparisons of digital companding methods, including NICAM, for point-to-point transmission applications.

Figure 3 BBC Research Department's 10-channel digital audiotape recorder was digitally coupled to an experimental digital mixing console, based on a Plessey Miproc computer. The recorder is the forerunner of the 3M/BBC multi-channel recorder.

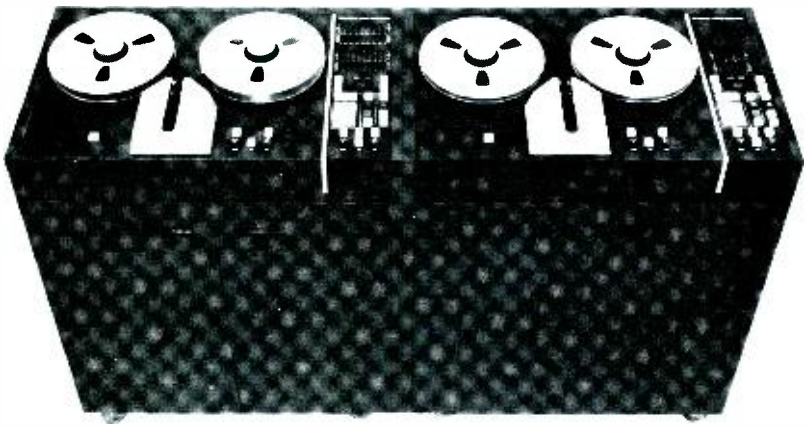


Figure 4 The 3M/BBC 32-channel digital audiotape recorder (left) alongside its 4-channel counterpart records the mixdowns. The control units on the right of the tape decks include signal-level indicators and are removable for remote operation.

Research continues

Current digital audio processing research in the BBC includes experimental studies using a Computer for Processing Audio Signals (COPAS) that is about five times more powerful than the apparatus incorporating the Miproc; the design is based on microprogrammable 'bit-slices' of microprocessors. Editing methods for multi-channel digital recorders also are being studied; generally, such editing will be electronic, i.e., no cutting and splicing of the tape will be done. Economic ways of achieving A/D and D/A conversion, adequate for use in transmission and studio applications, continue to be studied. Surprisingly, the overall audio quality obtained with somewhat cumbersome 14-bit double-ramp counter-conversion apparatus, designed and made in BBC Research Department in 1968 and affectionately known as 'Old Faithful,' is as good as any obtainable with other comparable equipment of recent design. Of course, current equipment is packaged much more compactly and is thermally more stable.

A substantial effort continues to be applied to digital audio transmission research, with emphasis shifting toward improved, economic digital 'packages' of audio and video channels to be compatible with the growing national and international digital telecommunications networks.

To sum up, the value of digital methods for audio applications in broadcasting has been recognized by the BBC for many years. The Specialist Engineering Departments of the BBC have been instrumental in providing new and improved audio facilities embodying digital technology for the operations and maintenance departments, and in contributing significantly to the development of digital audio. □

Case study
Automation at WWDL/FM

By Douglas V. Lane, president and general manager, WWDL-FM, Scranton, PA

Recent implementation of automation has allowed WWDL-FM and WICK-AM to become more flexible in their services and more efficient in their operations. The author shares some of the transitional developments with BE readers.

Today, Lane Broadcasting in Scranton, PA, serves Northeastern Pennsylvania from an attractive brickfront building on West Mountain that houses offices and studios for WWDL/FM and WICK/AM (acquired in mid-1978). But, for its first eight years, WWDL operated in a spartan 800 square foot building on the same site.

Original studio equipment consisted of a Gates stereo control board, one E-V microphone and two Gates Carti-Tape II cartridge units. In addition to sharply updated studio and remote equipment, today's supporting instrumentation includes two Cetec System 7000 automation systems installed shoulder-to-shoulder in a display-case setting; a Verified English Logging system with Texas Instruments printers; four remotely positioned (and portable) CRT terminals; and a Station Business Systems BAT 1500 system built around a Datapoint 2200 minicomputer and recently strengthened with a hard disc memory addition. Tape equipment includes Audiofile II systems from Cetec, ITC reel-to-reel and 3-D equipment.

The BAT (Business, Accounting & Traffic) system, now in its fifth year at WWDL, and the two System 7000s have worked together in some interesting ways since automation was installed last September.

As an example, sales order data is handled just once. After that, the whole process is automatic through billing. Here is the sequence:

1. The order is assigned and logged on the Datapoint mini.
2. A load/dump program (written and designed by Delane Bell, SBS vice president) automatically flags any entry incompatible with 7000 performance parameters—adjacent trays or invalid source, for instance.
3. Decision is made to "dump" or to correct errors, either on the BAT (major) or the 7000 (minor).
4. The entire day's program, including music programming, is dumped into the 7000 memory. By including music programming in the sequence, WWDL has almost total flexibility. If three more avails are

Douglas V. Lane
Author Doug Lane became fascinated with broadcasting at the tender age of 5 and was a professional on-air personality at 17. At the age of 19 he established WWDL-FM and served as his own legal counsel with the FCC and as capital fund raiser. The story here is a case study of his station's evolution. As part of his philosophy in continued community involvement, he is currently teaching a course in radio programming at Marywood College.

WWDL-FM and WICK-AM twin Cetec System 7000s are showcased behind the glass wall which the author, Douglas Lane, is sitting in front of. Carol Beezup is at the CRT terminal.

Traffic manager Jack Winslow and Virginia Lane enter the WWDL-FM log into the BAT system desktop minicomputer. The next step will be to dump the entire day's program into the System 7000 memory.

needed in an hour program, they are just created.

5. The 7000 is loaded with up to seven days of complete programming in a dumping sequence that takes about two minutes. And it can be changed in almost any way up to the last minute.

6. BAT generates a sales journal and stores it daily, compiles weekly and monthly journals, and prints invoices automatically. One manual step, logging on-the-air performance against the journals, ends soon when the appropriate 7000 starts feeding back actual performance data for comparison and adjustment.

The Cetec 7000s have made it possible to operate two stations with one good staff. That staff numbers 15, and almost all the staffers wear two or more hats. Gene Manning is general sales manager for both stations, and is also an on-air personality via voice-tracking. Jack Winslow is FM Traffic Director and also Community Affairs Director. And, the author sells, announces, manages, engineers, and insists on continuing community involvement by all hands.

Both WWDL and WICK air musical programs developed and supplied by Peters Productions. In the familiar FM territory, WWDL knew what it wanted and sought a quality supplier. In acquiring the AM outlet, an in-house market study showed what appeared to be a programming gap, and Peters' advice showed how best to fill it.

WWDL-FM uses *The Great Ones, Traditional* format, described as bright, adult and contemporary. WICK plays *For the Two of Us, Format D*, which is easy-listening, but definitely not background music.

Announcers record commercials, IDs, public service spots, regional news and weather announcements for insertion into the 7000 memory. And, of course, they can voice-track a 5-hour program (all current for that day-part, including random hits) in about 15 minutes before going on to other station tasks.

Of the 15 full-time and part-time staff members, 13 are trained to operate the 7000 terminals, "and some of them are learning to troubleshoot as well."

The adult contemporary FM programming includes total random access to the hottest hits, utilizing the 7000 in one of the most complex uses of subroutines. Current hits are on individual carts with total random access for 7-day scheduling. WWDL is not forced to play any set sequence for days at a time—it can be as flexible as desired. Since voice tracks are recorded for each day-part, music announcements are always in the right place.

In its latest move, WWDL expects to make even better use of voice-tracking and to expand programming capabilities with Level II, the new System 7000 option announced at the NRBA show in September. Lane Broadcasting will serve as a test-base for the advanced firmwave system in the months ahead.

WICK airs Mutual network news for 3½ minutes on the hour. WWDL-FM uses Associated Press Radio news—live network news, regional updates, and teletype service. The station uses its own news intro, and three seconds after the hour, the 7000 joins APR, then cuts away at 3½ minutes after the hour for local commercials, joins again, then cuts to local news updates. In this manner, WWDL is joining and getting away much better than when handling was manual.

WICK carries University of Pittsburgh football on a feed from WTAE, as well as local "Big 11" high school games. For those remotes, the station dispatches a team of four broadcasters for play-by-play, color, statistics and analysis. For each game, the System 7000 is loaded with a "football memory" for cutaways to commercials and interconnects. When it's time to rejoin the live broadcast, the on-duty staff man or woman pushes one button.

There are always remote broadcasts on the schedule from "grand openings" to important trade shows, civic events, and live inserts from the scene of a major traffic tie-up. Both stations covered the November elections from the city room of the Scranton *Tribune*, and fed three other area stations. On the occasion of the Apollo moonshots from Cape Kennedy, Scranton and Wilkes Barre residents got their news flashes from WWDL's on-the-scene staff.

WWDL has been considering automation for a number of years, but didn't move in this direction until this year. Before the newly arrived microprocessor/multiprocessor sys-

Secretary Carol Beezup is among 13 Lane Broadcasting staffers trained to communicate with the System 7000 via CRT terminal.

While planning use of the System 7000 in election night coverage from a remote site, WWDL/WICK staffers check event entries. From left are Reid Blankenship, announcer; Doug Lane; Dan Pregnar, engineer; and Gene Manning, general sales manager.

tems, hard-wired electronics greatly restricted software flexibility. Others had plenty of capability, but were priced too high to be cost-effective for WWDL's plans.

The 7000 systems permit WWDL to be on a cost-efficient basis. Some observers feel that the overall Lane Broadcasting operation may be the most efficient radio operation in the United States.

The key to this efficiency is a knowledge of digital technology—an understanding that is mandatory for every radio station operator today. In another five years, any station that isn't involved with that technology will be in serious difficulty.

Introducing new generation technology into a business is never without incident, nor has it been for Lane Broadcasting. Start-up gremlins crop up unexpectedly. A few are of real concern, others are just cases of glitched communications. WWDL credits its supplier's customer service staffs for major assistance in the settling-down process.

How did service-area citizens (including advertisers and competitors) accept the newly automated WWDL and WICK?

A few advertisers worried in advance that the stations might sound canned. They don't, and their reaction is favorable.

On WWDL, where the programming, personalities and special features didn't change, reaction was gradual. When it came, it was entirely on the side of appreciation of a better sound which WWDL attributes to the absence of unequal audio sources (such as old tapes), to better music control, and to consistent tightness.

Reaction by the WICK-AM audience was more immediate and for reasons other than automation. Under previous ownership, the station signed off on Sunday with a format that included disco music, modern jazz, contemporary music and talk. When it signed on Monday morning under Lane Broadcasting, it was easy listening all the way. That was a surprise to many people, but not a negative one as it turned out, and WICK popularity is building in a market where it faces 11 AM competitor-stations. Seven other FM stations are heard in the WWDL service area.

WWDL and WICK continually watch advances in technology and are ready to adopt new equipment and procedures into their programs in order to serve their listeners. □

Case Study:

Microprocessors and automation equipment

Mike Pierce, chief engineer, Sono-Mag Corporation

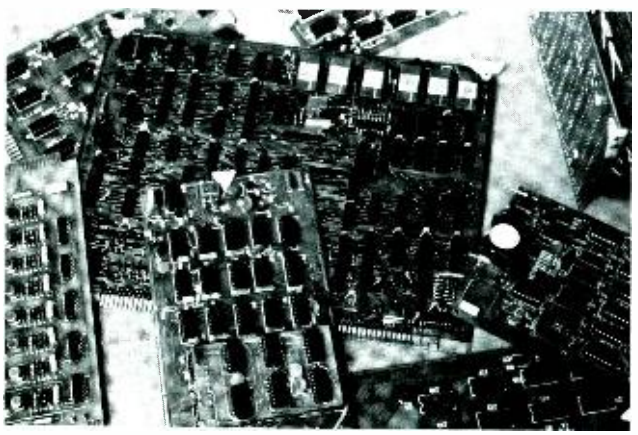
Advances in microprocessor technology have brought about corresponding advances in automation equipment for broadcasters. Systems are simpler, smaller and more functional. And, the microprocessor allows self-diagnostics to be built in.

The broadcast automation industry, along with the electronics industry, is feeling the effects of microprocessor technology. Why are microprocessors so important? It's not that they represent anything new in circuit implementation. The reason is that advances in large scale integration (LSI) technology have made the microprocessor the most effective, reliable, simplest and least expensive way of accomplishing complex electronic functions today. Thus, microprocessors provide broadcast automation equipment with features that would be prohibitively costly by conventional controls.

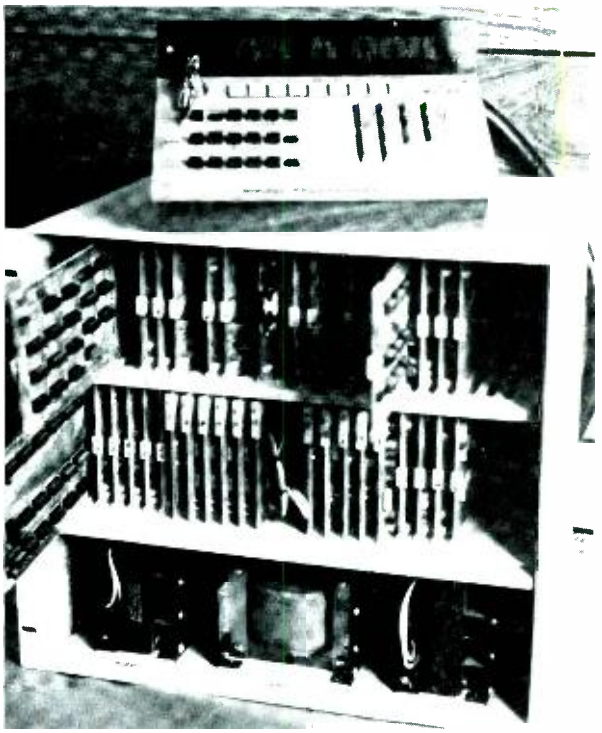
Selecting the microprocessor

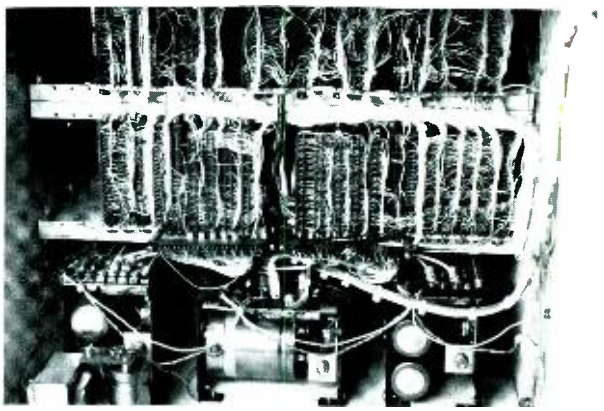
When designing with processors, the first task of the engineer is to choose a microprocessor. The difficulty is that the microprocessor is such a powerful performer that a majority of possible applications could be served equally well by any one of the dozens available. The selection of a particular processor is subject to a large number of considerations. Some of these are word length, instruction set, power requirements, support parts, I/O requirements and cost.

After the microprocessor is selected, it is implemented in the design with consideration being given to the normal cost/performance trade-offs. Microprocessors add a new factor to the development process—software (programming which tells the

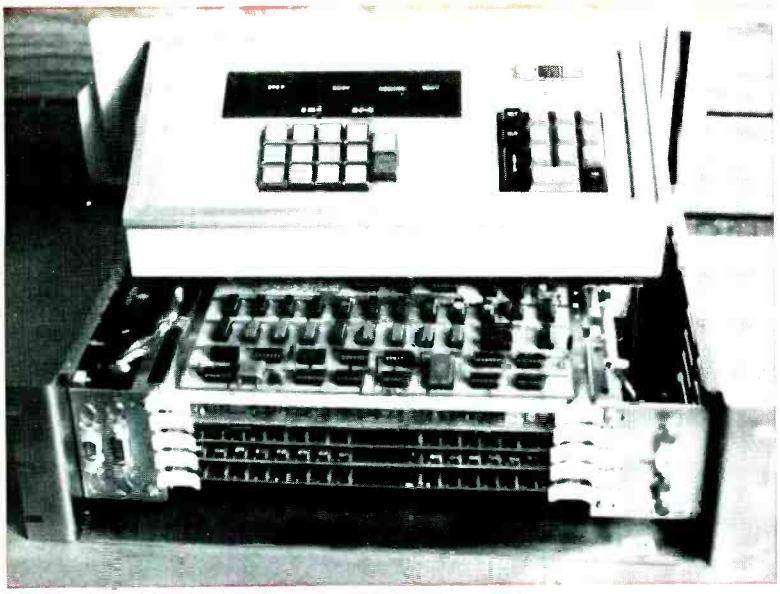


Carefully designed digital circuit cards such as these are used as basic building blocks in producing broadcast automation equipment.

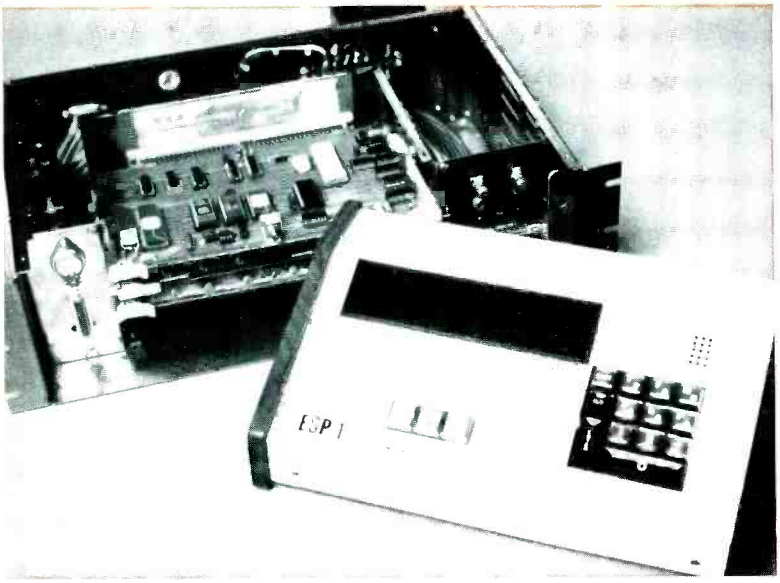


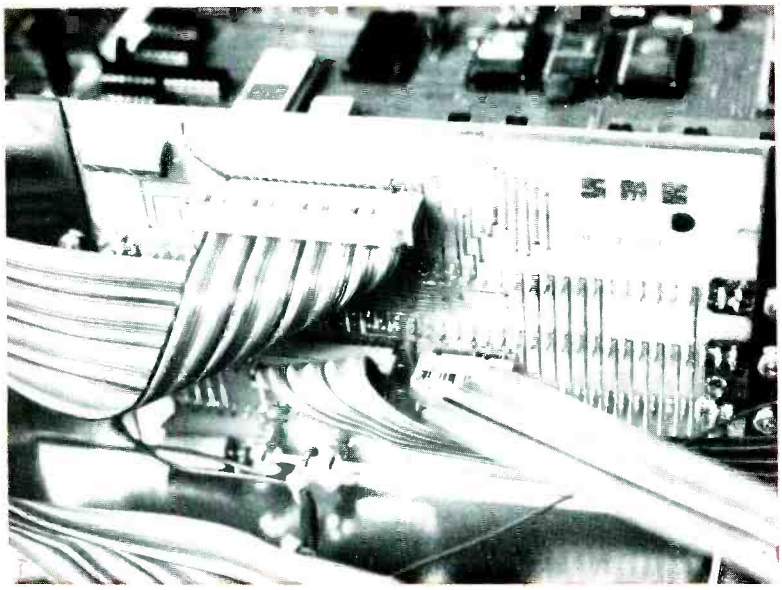


The early design of SMC microprocessor-based automation equipment, the DP-1 digital programmer of 1970: top is the front view of the control head and electronics package; bottom is the rear view showing the board-to-board interwiring.



Second generation digital programmer shows a simpler control head and a less complicated electronics packaging. Note the decrease in the number of circuit cards.





Featuring a new microprocessor, the SMC model ESP-1 controller provides simplified packaging (top) and user-oriented controls plus ribbon cable interconnections (bottom) to external devices.

microprocessor what to do in the application for which it is intended.

Many features can be implemented in hardware or software. The balance between the two depends on the criteria of application, size of market and desired development time. For example, a product to be manufactured in large numbers could afford to be software dominated since the cost of the additional software development time can be distributed over the number of units sold.

Current microprocessor technology permits the design of virtually any combination of features and programming capabilities. Thus, the designer has been freed from the constraints of hardware logic design and he can spend more time improving the man/machine interface. The hardest thing for the designer is to determine the needs of the automation user and to fulfill these needs as completely as possible.

Product design

In designing a product, an engineer must consider not only the use of his device but also the best and cheapest way to manufacture and service the equipment. This means examining production and servicing techniques and including features in the design that will minimize production and servicing costs. The microprocessor, because of its inherent capabilities, can help the development engineer do just this.

- In the production area, the microprocessor aids the designer by keeping parts counts down, power requirements low, package sizes small.
- The microprocessor can aid serviceability of a product because it can be programmed to run diagnostic routines to check for many of the minor failures in the system.

Reliability in processor-based systems tends to be higher than in a similar discrete logic system. The higher reliability results from lower heat, fewer parts, and fewer mechanical connections between boards and circuit packages.

The changes brought about by microprocessor technology to automation controllers are quite dramatic. New, sophisticated circuitry antiquates previous controllers implemented with electromechanical, punched cards or discrete logic techniques.

Evolution of a programmer

Sono-Mag Corporation, a major producer of automation equipment, has kept abreast of the solid-state technological changes. Thus, its equipment reflects the revolution in equipment design that has come about due to the microprocessor in the last decade.

The DP-1 (Digital Programmer-1), released in 1970, was the first automation controller to be produced by SMC which utilized modern digital integrated circuits. This unit had a 2048 step magnetic core memory and used TTL circuitry. As shown in the accompanying sidebar, the front view of this unit shows the number of printed circuit boards and complexity of the control head. The rear view gives an insight into the complexity of the board-to-board hard wiring for this early system.

The next generation of automation by SMC, the DP-2 (Digital Programmer-2) released in 1974, was designed using the IMP-16 microprocessor chip set, a 16 bit processor from National Semiconductor. The DP-2 was designed to accept optional semiconductor memory boards to allow it to handle between 2048 and 8192 steps of automation programming. The electronic

package shows the decrease in the number of circuit cards and the simplified control panel layout.

The latest design

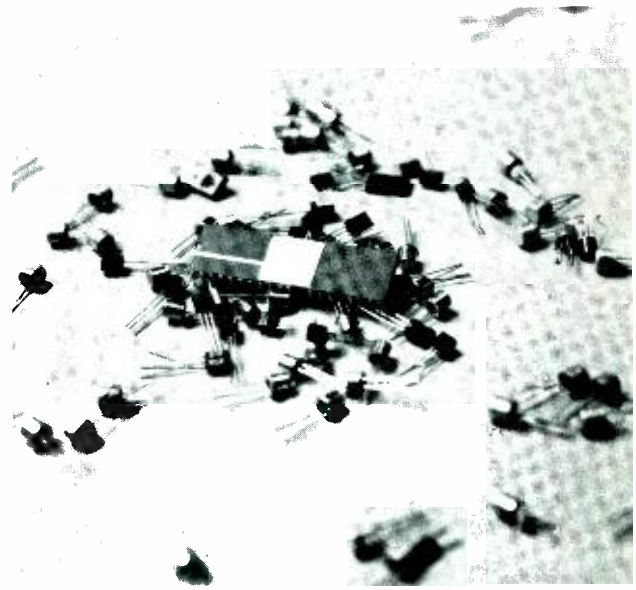
The ESP-1 (Extra Simple Programmer), SMC's newest automation controller, has been designed with low cost and extreme simplicity of operation in mind. The Motorola 6802 microprocessor was chosen as a basis for the unit because of its relatively low cost, internal architecture, availability of support chips and hardware features (on board clock, single 5 V supply and 128 bytes of on-board RAM).

The design has utilized the power of the 6802 to produce a machine which, though simple to operate, is powerful enough to handle anticipated formats. Diagnostic messages have been provided to aid the user in programming the 4000 step memory.

The minimization of costs in all facets of production was considered a major design factor. In so doing the hardware was minimized at the expense of more extensive software development. Many frills were eliminated from the design. However, enough flexibility was maintained to allow optional extras, such as a cassette dump/load and video display, to be added later. Thus, the system is able to grow with the customer's needs.

The ESP-1 (see accompanying sidebar) is a very compact piece of equipment. The simplicity of the control head was a feature intended to minimize the user's learning time. Production and serviceability has been improved through the use of sockets for all ICs and ribbon connectors for I/O feeds.

As can be seen from these three automation controllers, equipment for broadcasters has changed over the last decade, and microprocessors have played a major part in this evolution. In the future the broadcaster will see a proliferation of sophisticated equipment, all of which will have their foundations in the microprocessor revolution. □



Microprocessors, such as the Motorola 6802 shown in the center, contain thousands of transistors similar to those sprinkled around it. This advanced microprocessor packaging is making new equipment for broadcasters possible, less expensive.

new literature

AM stereo brochure

Harris—The broadcast products division has prepared *21 More Questions on AM Stereo* which is designed to answer questions asked by broadcasters regarding AM stereo. The brochure also contains information on Harris' CPM (compatible phase multiplex) AM stereophonic broadcast system.

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Digital multimeters

B&K-Precision—A 6-page brochure features descriptions on the full line of digital multimeters including the model 2830 and model 2810 3-½ digit DMMs with autozeroing and the model 283 3-½ digit lab DMM with high intensity LED display. Features, applications, specifications and photographs of each model also are included.

Circle (111) on Reply Card

Radio book

Donnelly & Sons Publishing—A consumer oriented book by Warren Donnelly, entitled *Traveling With a Radio*, provides information on where to set the radio dial to receive 8096 AM and FM radio stations in 3323 US cities. The 360-page publication outlines which stations broadcast in stereo or quad, which stations operate only during daylight hours, maximum broadcasting power, the program format and network affiliation.

Circle (112) on Reply Card

Radio handbook

Howard W. Sams—*Radio Handbook* by William I. Orr is the 21st edition of the communications handbook for engineers, technicians and amateurs in the electronics industry. The book includes SSB design and equipment; RRTY circuits; expanded section on linear amplifiers, both solid-state and tube types; VHF and UHF transmitters and converters; special-purpose and logic circuitry and narrow-band voice modulation.

Circle (113) on Reply Card

Frequency specifications

Hewlett-Packard—A 34-page application note entitled *Understanding Frequency Counter Specifications* is designed to help engineers better define counter specifications. The note contains such things as input characteristics of counters, operating mode specifications, time interval averaging, rms specifications, effects of wideband noise and measurement of counter contributed noise.

Circle (114) on Reply Card

Intercom systems

Clear-Com—A 12-page brochure contains information on closed circuit intercom systems for high noise environments. Products covered include remote stations, main stations, power supplies, accessories, headsets and handsets. A section on applications is also included.

Circle (115) on Reply Card

New literature

Warning lights

Hughey & Phillips—Hazard Warning Lights for Attended Towers contains product specifications on such items as 300mm beacons, obstruction lights, photo-controls, beacon flashers, microwave tower hazard light controls and lamp failure alarm systems.

Circle (116) on Reply Card

Imaging devices

RCA—Product guide, IMD-100, is a 48-page publication which provides tabulated data and outline configurations for RCA's standard line of imaging devices. Sulfide vidicons, vistacons, SATICON vidicons, ULTRICON camera tubes, Isocons, charge-coupled devices, low light level SIT and ISIT types and image intensifiers are covered. Replacements for more than 350 types of imaging tubes are included.

Circle (117) on Reply Card

Wireless microphones

HM Electronics—A new 16-page catalog of wireless audio products for professional users includes systems and accessories for broadcast engineers and ENG users. The portable Flat Pac receivers for remote applications and the Dynamic Expanded body pac and handheld wireless microphones which offer 95 dB of dynamic range are featured.

Circle (118) on Reply Card

Specification sheets

Echolab—Product specification sheets are available on special effects generators, video production switchers and genlock sync generators. Included are features, specifications, descriptions and photographs of the units.

Circle (119) on Reply Card

TV monitors

Rohde & Schwarz—Master Control Monitors is a 24-page brochure which covers the complete line of Barco professional color TV monitors. Included are technical specifications, display performance, RGB performance, detailed descriptions of all controls, illustrations of each unit and ordering information.

Circle (120) on Reply Card

Projection TV systems

Sony—An 8-page brochure describes the company's television projection systems with information on commercial applications. Design advantages of the units, including the new refractive systems and built-in VIRs, technical specifications and key dimensions also are detailed.

Circle (121) on Reply Card

Splice finder

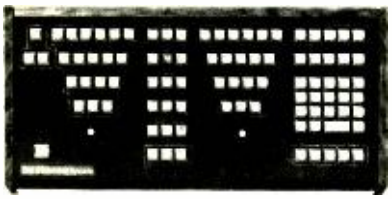
UMC Electronics—A single-page product bulletin describes UMC automatic splice finders and bulk erasers. According to bulletin 106, the UMC model SF-1 automatic splice finder and model SFE-1 automatic splice finder with bulk eraser are designed for broadcasters and other users of NAB endless loop cartridge tape equipment.

Circle (122) on Reply Card □

new products

Editing system

The Z-6 from *Videomedia* utilizes the computer industry's standard IEEE S-100 buss electronics. The heart of the unit is a Z-80 micro-



computer that requires no mechanical modifications to the VTR, according to the manufacturer. The system comes with a 99-event memory, bi-directional shuttle controls, auto search, cruise control, event tag, rehearse, perform review edit and many other features.

Circle (123) on Reply Card

Editing keyboard

The expanded/dedicated keyboard from *CMX Systems* is designed to improve the operation of existing editing systems through a redesigned

keyboard and improved software. The keyboard features direct access to all operational parameters and a separate left side keypad which deals with the decision list and auto assembly functions.

Circle (124) on Reply Card

1-inch VTR

Sony's model BVH-1100 1-inch, high-band videotape recorder meets all SMPTE specifications for Type C format NTSC 1-inch VTRs and incorporates operational and performance advancements.

The dynamic tracking option provides for guardband noise-free video playback of on-air quality with selectable variations in playback speed from ¼-speed to twice speed. The unit features automatic editing

features with programmed in and out entry points, frame-by-frame trimming, auto preview, butt editing, auto preroll and split editing functions.

Circle (125) on Reply Card

Video backtimer

The VBT-2 video backtimer by *QSI Systems* is designed to provide radio and TV production teams with instant time visibility during recording sessions. Hours, minutes and seconds are displayed in a LED and video format.

The desktop unit contains a time entry touch pad, memory with memory display and video time keeping electronics. Automatic turnaround to zero and no count loss in memory-to-video transfer are standard functions.

Circle (126) on Reply Card

Transfer system

The KM-16 film-to-tape transfer system by *Cinema Products* projects an image from any 16mm film to any ENG/EFP type video camera for recording on videotape or transmitting by microwave or cable.

The image is illuminated 60 times a second through a condenser system with one-to-one magnification. The image is further projected to infinity through a 45° mirror for reversal. Film movement is a pin registered friction pull-down of 50°.

New products

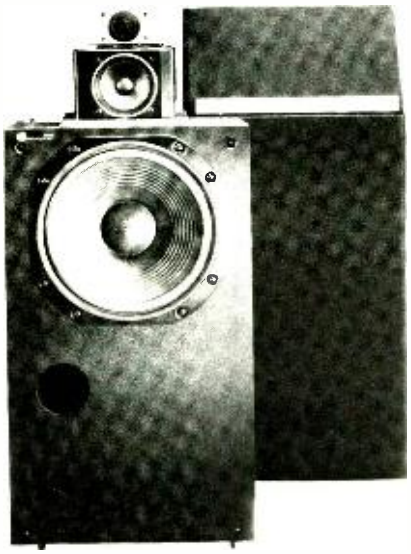
Videocassette

Fuji Photo introduces VHS and Beta Beridox format. Both videocassettes offer realistic video image. The VHS Format features resistance to image deterioration and stop motion performance. Higher sensitivity and a special anti-static treatment for tape and cassette shell are features of the Beta format.

Circle (127) on Reply Card

Linear phase speakers

Technics (*Panasonic*) offers two models of linear phase speakers, model SB-7070 and SB-6060. SB-7070 is a 4-way speaker with a 13 ¾-inch cone type woofer which reproduces solid bass up to 350 Hz. Four thermal relays cut off input whenever heat buildup is too high.



The three-way speaker system, model SB-6060, employs a 12-inch woofer for response in the 27 Hz to 1 kHz range. The speaker will handle 120 W of music and incorporates three thermal relays for protection.

Circle (128) on Reply Card

Recording/remixing consoles

The JH-600 series of recording/remixing consoles by *MCI* is in-line with each I/O module containing one complete mic channel and one complete remix channel. Two frame sizes are available: the JH-618 (18 inputs) and the JH-636 (36 inputs).

Standard features include differential line inputs, differential mic preamps (optional), hi pass and low pass filters and balanced push/pull output.

Circle (129) on Reply Card

Routing switcher

Industrial Sciences' model 982 AFV routing switcher is a self-contained unit featuring a dual voltage power supply and vertical trigger generator. Ten inputs with two video and two audio outputs per bus are featured. Vertical interval switching pulses may be derived from either house sync or video.

Circle (130) on Reply Card

Battery pack

A 12 V rechargeable battery pack which provides portable and standby power for portable communication, entertainment, lighting and tool applications is being marketed by *Kapco Communications*. The pack operates over the temperature range of -40 F to +150 F and is rated at 5 Ah at the 500 mA rate of discharge. Designated the Sidekick, the pack can be recharged up to 200 times with proper maintenance.

Circle (131) on Reply Card

Production switcher

The model 9000 video production switcher by *3M* features a built-in microprocessor to provide event memory and simplified operation. As many as 20 effects can be selected by a 10-key input bank. The new switcher is capable of wipes behind key, dissolves or cuts to key, dissolves to effects, fades to and from black and dissolves behind chroma-key.

Circle (132) on Reply Card

Wireless microphone

The system 25E professional handheld wireless microphone by *HM Electronics* features a special dynamic expander circuit which increases the dynamic range to 95 dB. This feature allows lifelike reproduction of the entire vocal spectrum.

The system includes a crystal-controlled (drift-free) VHF hi-band radio design, a satin-finished transmitter, broadcast-quality receiver and fitted reinforced flight case.

Circle (133) on Reply Card

Choke coils

A series of choke coils and transformers that are half the size and weight of conventional designs has been introduced by *Hitachi*. The devices, designated the Hicoil and the Hiformer, are based on the patented magnet bias concept which utilizes the full potential of a ferrite core.

The Hicoils are available in a number of core types, amperage ratings, inductance values and custom designs. Hiformers are designed

New products

to customer specifications on one of five different cores for circuit board or chassis mounting.

Circle (134) on Reply Card

Digital telecine

The FDL 60 dual format, digital telecine scanner from *Bosch Fernseh* is a tubeless solid state CCD (charge coupled device) which offers good color reproduction and high resolution.

The digital frame store and the continuous capstan driven film transport features allow slow motion, fast motion, jogging stills and search modes in forward or reverse.

Circle (135) on Reply Card

Speed control system

The Selecto-Sync capstan speed control system by *Triple I* provides from 1/15 to 24 times the standard cassette speed. The system functions on the phase-lock principle and provides precise digitally-selectable tape speeds with low flutter and wow. The indirect drive system is operational in ranges as low as .125 ips and as high as 2 to 30 ips.

Circle (136) on Reply Card

Video delay line

Model VP2075 is a toggle switch variable delay line by *Allen Avionics* which offers any delay from 0 to 2075 ns in 25 ns increments. The device has a built-in flat loss of 3 dB and will not vary in amplitude by more than ±.2 dB. Amplitude flatness from 100 kHz to 5.5 MHz is within .5 dB. □

Circle (137) on Reply Card

professional services

advertisers' index

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Advertising Sales Offices

KANSAS CITY, MISSOURI
Helen Hull, P.O. Box 12901,
Overland Park, KS 66212;
Phone: (913) 888-4664

NEW YORK, NEW YORK
Joe Concert, 4 W. 58th Street
New York, NY 10019;
Phone: (212) 888-1977

FT. LAUDERDALE, FLORIDA
Brinker and Brinker,
2240 N.E. 53 Street,
Ft. Lauderdale, FL 33308;
Phone: (305) 771-0064

CHICAGO, ILLINOIS
Jim Reilly, 1011 E. Touhy Ave., Suite 245,
Des Plaines, IL 60018;
Phone: (312) 299-2601

SAN FRANCISCO, CALIFORNIA
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Phone: 930-0525

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Classified columns are not open to advertising of any products regularly produced by manufacturers unless used and no longer owned by the manufacturer or a distributor.

TRAINING

TRAINING (CONT.)

REI has over 5,000 successful graduates and over 95% pass the FCC 1st Class exams on first try. New FCC exams are on the way. Better not take a chance—learn electronics and pass exams too. 5 week course. Rooms at the school. Call or write for information. R.E.I., 61 N. Pineapple Ave., Sarasota, Fla. 33577. (813) 955-6922.7-79-tfn

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ONE STOP FOR ALL YOUR PROFESSIONAL AUDIO REQUIREMENTS. Bottom line oriented. F.T.C. Brewer Company, P.O. Box 8057, Pensacola, Florida 32505. 7-71-tf

HELIAX-STYROFLEX. Large stock—bargain prices—tested and certified. Write for price and stock lists. Sierra Western Electric. Box 23872, Oakland, Calif. 94623. Telephone (415) 832-3527. 1-73-tf

TRANSMITTER TUBES REPROCESSED—Save 40 to 50%. 3CX2500, 4CX5000, 4CX15000 and many others. Write for details. FREELAND PRODUCTS CO., 3233 Conti St., N.O., La. 70119, (504) 822-9222. 6-79-tfn

TOWER SERVICE: Erection. Sales. Service. Painting. Inspections. Maintenance contracts. Pioneer Tower Service, P.O. Box 253, Carrollton, Missouri 64633, (816) 542-0840. 8-78-tf

TELEVISION: Two broadcast quality video taping production units. Latest equipment. Special effects. Large West Coast Clientele. Call for confidential interview. KENNETH BANK, BROKER, (213) 858-0188, 277-7484. 7-79-1t

VIDICOM TO NEWVITRON—We'll update your Panasonic WV-2100P to WV-2150 quality with new Newvitron tubes. LIVE-VIDEO, Parcel 8, Suite 3A, Farmington, CT 06085, (203) 673-4611. 7-79-3t

COMPLETE E.F.P. MOBILE UNIT—3 color cameras with experienced engineer. Geared for the budgeted production. LIVE-VIDEO, Parcel 8, Suite 3A, Farmington, CT 06085, (203) 673-4611. 7-79-3t

WANTED

WANTED: Two reconditioned Sony VO-2850's, editor, interface, character generator, Panasonic WV-2100P and control unit, or WV-2150P with 10-1 zoom, color monitors or equivalents. Write AUDIOACTIVE INC., DELAPLAINE, ARKANSAS 72425. 6-79-3t

WANTED: Pre-1926 radio equipment and tubes. August J. Link, Surcom Associates, 305 Wisconsin Ave., Oceanside, Ca. 92054, (714) 722-6162. 3-76-tf

HIGHEST PRICES PAID for 112 Phase Monitors and for clean, 12 year old or less, 1 KW and 10 KW AM Transmitters. All duty and transportation paid. Surplus Equipment Sales, 2 Thorncliffe Park Dr., Unit 28, Toronto, Ontario, Canada, M4H 1H2. 416-421-5631. 2-79-tfn

INSTANT CASH FOR TV EQUIPMENT: Urgently need transmitters, antennas, towers, cameras, vtrs, color studio equipment. Call toll free 800-241-7878. Bill Kitchen, Quality Media Corporation (In Georgia call 404-324-1271). 6-79-tfn

LOOKING FOR OLD TRANSCRIPTION LIBRARIES: Capitol, Associated, Thesarus. Write or phone: Don Kennedy, Georgia Network, 1800 Peachtree, Atlanta, Georgia 30309. (404) 355-8686. 6-79-2t

EQUIPMENT FOR SALE

SPARTA AND BAUER audio equipment P.C. boards available. New & fully tested. For complete price list: Box 162, Oakview, Calif. 93022. 7-79-1t

EQUIPMENT FOR SALE (CONT.)

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RCA BTA - 10H
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$6,500
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Maracaibo - Venezuela
Phone: (61) 76790-72211
7-79-1t

SCULLY 280 ADD-ONS—Accepts a pair of Dolby 361s or any 19" x 3½" electronic panel. Only $49.95 FOB Bridgeport. Send check with order. **Rus Lang Corporation,** 247 Ash St., Bridgeport, CT 06605, Telephone: (203) 384-1266. 7-79-1t

CAM HEADS: 1 ITE - H3 cam heads, one year old, wit 9" cams, capacity 2501 lbs., excellent condition—$1,500 pr. KWTX-TV, (817) 776-1330. 7-79-1t

COLLINS 21E TRANSMITTER, late model. Call 408-475-5527. Write KKAP, 519 Capitola Ave., Capitola, Calif. 95010. 6-79-2t

GE PE-350 COLOR CAMERAS: Excellent condition, 3 available, $8,000 ea. **RCA TR-4 HI-Band VTRS.** New heads, good condition, 2 available, $16,000 ea. **GE 12KW UHF Transmitter:** Ideal for new station, good condition, $14,000. **GE-PE-250 Color Cameras:** Includes lens, cables, CCU's, 2 available, $3,000 ea. **IVC 500A Color Cameras:** With all accessories, excellent shape, $7,000 ea. **RCA TK27B Film Camera:** Available with TP15 Multiplexer, $22,000. **RCA TP66 Projectors:** Good condition, $10,000 ea. **GE PE 240 Film Camera:** Excellent condition, $8,000. **New Lenco Terminal Equipment:** Discount prices, fast shipment. We will buy your used TV equipment. To buy or sell, call Toll Free (800) 241-7878, Bill Kitchen, Quality Media Corporation. In GA call (404) 324-1271. 6-79-tfn

VIDEOCOMPONENTS/EQUIPMENT FOR SALE: MICROTIME 2020 time base corrector—excellent for ¾" VTR production—$10,500.00. **MEMOREX 399**—2" Quad Videotapes, approx. 5-6 passes only in plastic reels, full hour (140 only)—**$50.00** each. **RCA, NORELCO, HITACHI** used cameras available—studio Eng, film chain use. **SANYO** cameras and monitors—brand new—discounted. **CAMERA BROADCAST TUBES**—lowest possible prices on **SPECTRACON®** and other lead-oxide tubes, Vidicons, image orthicons, Newvicons, Silicon Diode Array, CRT-Monitor Tubes—tubes of every description. **MATSUSHITA C.C.T.V.** Vidicons—nation's best source! **TEMTRON ELECTRONICS LTD., 15 MAIN STREET, EAST ROCKAWAY, N.Y. 11518.** (516) 599-6400, (800) 645-2300. 7-79-1t

RCA VTY MODIFICATIONS KITS for TR4/22/50/60/61/70. Splicer (single-frame), TEP Interface, Time Code Edit Interface Kit, Audio Splice Timing Mod (Audio Insert Editor), Wideband Audio Amplifiers, most mod kits, some modules available. LAWHED, LTD., 388 Reed Road, Broomall, Pa. 19008, (215) 543-7600. 4-78-tf

MAJOR NEW YORK PRODUCTION FACILITY offering the following items for sale: **COMPUTER IMAGE 2081** video and audio switcher, 6 inputs plus black, chroma key, softedge, full complement wipes, down stream keyer, auto dissolve for video and audio follow or breakaway, background generator, additive or non-additive mix. Had been interfaced with CMX-340 system. Used approximately 1 year—$15,000.00. **NORELCO PCP-90** portable 3 tube, 1" Plumbicon camera, Canon 6:1 lens, relay optic for C mount lenses, scan reverse switch, genlocks without base station, color bar generator, low noise preamps, lambda power supply. Used approximately 5 years—$10,000.00. **(2) PSI GASP COMPRESSORS** w/holding tanks—$300.00 ea. **NEW RECORTEC CLEANER** w/audio cue slicing package—$9,000.00. **(1) SONY SEG-50** effects generator and switcher—$50.00. For further information call: Walter Hamilton, (212) 759-0822. 7-79-1t

SONY BVU-50 VTR's (New). Convergence ECS-1B Editing System with TT-6, PC-3, 3-VO-2860, 2-9 B&W Monitors and Cases. Mr. Schlansky, (212) 594-8700. 7-79-1t

EQUIPMENT FOR SALE (CONT.)

2 JVC NU-1003B 3-tube cameras with CCUs, cables, and one lense. Used on broadcast television. $7500.00. Dan Coryell or Anna Pyle, (415) 533-8300. 7-79-1t

FOR SALE—LPB 10 WATT TRANSMITTER. New, Used only 1½ months. $1400 or best offer, cost $1550 new. Contact KOJC-FM at 1-319-366-0279 for more information. Write to KOJC-FM, P.O. Box 2937, Cedar Rapids, Iowa 52406, or call 1-319-365-7797 after 5 P.M. 7-79-1t

BROADCAST CRYSTALS for AM, FM or TV transmitters, frequency change, repair or replacement of oven types. Also vacuum types for RCA, Gates, Collins, etc. transmitters. Quality products, reasonable prices and better delivery! Don't be without a spare crystal. Frequency change and service for AM and FM monitors. Over 30 years in the business. Eidson Electronic Co., Box 96, Temple, Texas 76501. Phone (817) 773-3901. 12-74-tf

TELEVISION EQUIPMENT FOR SALE: TR5 HI-Band Color Recorder, new head. Best offer or will trade for any TV equipment. Call Jim Nelson (312) 236-5535. 7-79-2t

400 OR 800 FEET 1-5/8" brand new Cablewave foam low VSWR Wellflex transmission line with connectors. 800' at $3,990, 400' at $2,000. H. M. HOLZBERG ASSOCIATES, P.O. Box 322, Totowa, N.J. 07511 or (201) 256-0455. 7-79-1t

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EQUIPMENT FOR SALE: AMPEX VR-7100 VTR SYSTEM COMPLETE. Reconditioned and updated by Ampex. Offer. AudioActive Inc., Delaplaine, AR 72425. (501) 249-3392. 6-79-3t

EQUIPMENT FOR SALE: G.E. Transmitter with attendent equipment Model TT59 on Channel 17. 50 KW, very good condition. Available approximately June 1. Bargain if you move. Reasonable if I move. Also, three PCP-90U cameras, excellent condition. Sold to highest bidder. Contact for details: E. B. Wright, 1018 West Peachtree St., Atlanta, Ga. 30309, (404) 875-7317. 7-79-1t

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HELP WANTED

TV TECHNICIAN

Small California university television facility needs TV technician with Associate degree in TV Electronics or equivalent experience, to be responsible for maintenance and repair of color studio equipment, ENG equipment and closed circuit system. This opportunity available in August, 1979.

Please send resume to Personnel Department, University of Santa Clara, Santa Clara, California 95053. We are an equal opportunity Title IX employer m/f/h.

TRANSMITTER MAINTENANCE ENGINEER: KCET's Engineering and Operations Department has need of an individual who possesses: 5 years experience as a Television Maintenance Engineer; Understanding of FCC TV transmitter regulations, transmitting system testing, video and audio processing; Knowledge of a digital circuits desirable. If interested, please submit a resume to: KCET Personnel, 4401 Sunset Blvd., Los Angeles, CA 90027, (213) 667-9262. EOE/AA, W/M/H/V. 7-79-1t

HELP WANTED (CONT.)

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DIRECTOR OF ENGINEERING FOR 100KW FM STEREO STATION to sign on in Mobile, Alabama. Five years full-time experience and 1st Class FCC license required. Salary open, excellent fringe benefits. Send detailed resume and references to Mr. Joseph A. Martin, Jr., WHIL-FM, P.O. Box 160326, Mobile, Alabama, 36616. Immediate opening. Equal Opportunity Employer. 7-79-1t

CHIEF ENGINEER FOR 7 KW FM STEREO in rural community of 10,000 an hour drive from Dallas. NPR affiliate at East Texas State University. Applicants should have a strong technical background and be able to communicate with student broadcasters. First Class license required. Previous FM experience and degree preferred. Salary up to 14,000 per year. Liberal fringe benefits including near total employer paid Social Security contribution. Send resume and references to: Station Manager, KETR, Box BB, E. T. Station, Commerce, TX 75428. Closing date July 16, 1979. ETSU is an EOE/AA employer. 7-79-1t

TV ENGINEERING SUPERVISOR. Major Market CBS affiliate requires person who is a self-starter and has ability to develop new technical concepts. Previous supervisory experience, ENG, and digital background preferred. FCC first class license required. Send resume, salary history, reference, and salary requirements to WNAC-TV, Personnel Dept., Government Center, Boston, MA 02114. 7-79-1t

SENIOR TELEVISION ENGINEER: Responsible for the repair maintenance, preventative maintenance, and operation of University-owned television related apparatus; responsible for assumption of the technical operation of the University's television broadcast station as necessary; performs related work as required. Education equivalent to 2 years of television related repair training at the college or trade school level. Possession of a valid first class FCC radio telephone operators license. Supervisory—Technical 6. $5.44-$7.35/hr., with starting salary normally not to exceed $6.39/hr. Blue Cross-Blue Shield. Life, Travel & Disability Insurance. Tuition Refund. Paid Sick Leave. Paid Holidays. Retirement through MPSERS. CMU is a state university offering undergraduate, graduate, provessional and pre-professional programs with an enrollment exceeding 16,000 students. Central is located in Mount Pleasant, a city of 22,000 in the central part of lower Michigan. Apply by June 30, 1979. Central Michigan University, Personnel & Staff Relations, 109 Rowe Hall, Mount Pleasant, Michigan 48859, (517) 774-3753). 7-79-1t

Surprising Things are happening in digital signal processing at RCA.

Digital image processing is a highly sophisticated technology at RCA Broadcasting Systems. It combines hardware, software, firmware, and transducer technologies for our next generation of electronic recording equipment.

This requires creative managers and engineers who can establish the state-of-the-art, who want to move ahead faster in what is essentially an emerging technology.

You should have at least 3 years experience in high-speed digital signal processing circuit and system design, and be familiar with world-wide television standards. A working knowledge of magnetic recording theory is desirable.

For the creative, innovative engineer with the ability to lead rather than follow, these are outstanding opportunities to advance your career.

Openings also exist for the entry level graduate Electrical Engineer who wants to be in the forefront of this fascinating technology.

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RCA

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HELP WANTED (CONT.)

RECORDING STUDIO ENGINEER: To operate and maintain state of the art multitrack facility for music recording and mixing, film and video sound mixing, narration and effects recording, etc. Experience, samples of work required. Send resume to Tim Wolfe, Maryland Public Television, Owings Mills, MD 21117 for interview. EOE M/F. 7-79-1t

LICENSED TV TECHNICIAN experienced in operation and maintenance of studio and transmitter equipment for commercial midwest market. Latest equipment, pleasant environment, full benefits. NBC network/heavy local production. Write Jerry Merritt, WICS-TV, 2680 E. Cook, Springfield, Ill., 62703 or call (217) 753-5665. 7-79-2t

TV MAINTENANCE/OPERATIONS ENGINEERS: On-air and production facility desires some experience in maintenance of live cameras, RCA quad, Sony Helical a plus. Prefer knowledge of design, fabrication and digital technology. Opportunity for creative, resourceful person who prides in accomplishment. Write or call Mr. Rogers, WAKR-TV, Box 1590, Akron, Ohio 44309. (216) 535-7831. Equal Opportunity Employer-M/F. 7-79-1t

HELP WANTED—MAINTENANCE ENGINEERS: Three to five years prior experience in maintaining studio equipment required. Applicants must have expertise in one or more of the following areas: Audio-Video-Microwave-Radar-ENG-Digital Slant track and quad VTRs. Station has modern facilities, good wage levels and extensive hardware with challenging activities. Contact: Chief Engineer, KCRG STATIONS, 2nd Avenue at 5th Street, SE, Cedar Rapids, Iowa 52401. (319) 398-8407. EQUAL OPPORTUNITY EMPLOYER. 7-79-1t

ASSSITANT CHIEF—IMMEDIATE OPENING. NBC/ABC affiliate in beautiful desert southwest, 3 hours from San Diego. Must have maintenance experience with TV transmitters, preferably RCA TT-10, TT-25. Microwave and studio experience desirable. Call K.C. Jones, Chief Engineer. (602) 782-5113. 7-79-1t

MAINTENANCE ENGINEER—Group owned television station with modern facility and greatbelt belt location requires a maintenance engineer with FCC First Class License and experience in all facets of broadcast equipment maintenance, including digital. Major responsibilities are: Quad VTR, camera and associated studio equipment maintenance. Some operating required and must be flexible for scheduling. Excellent salary and benefits for right person. Send resume to Stephan R. Weber, KFSN-TV, 1777 G Street, Fresno, CA, 93706. Capital Cities Communications, Inc. is an Equal Opportunity Employer. 7-79-1t

ASSISTANT CHIEF ENGINEER with knowledge of UHF transmitters. FCC rules and TV studio operation. Resume to Chief Engineer, WJCL-TV, P.O. Box 13646, Savannah, GA 31406. 7-79-2t

ENGINEER WITH THE HIGHEST LEVEL OF TECHNICAL EXPERIENCE needed by Major Production Facility. Work with state of the art equipment; Vital Squeezezoom; Datatron Computerized Editing; etc.; for a top salary and enjoy South Florida living. All applicants must have heavy digital experience. Call: Mike Orsburn, Chief Engineer at: (305) 587-9477 or write: Video Tape Associates, 2351 SW 34th Street, Ft. Lauderdale, Fla. 33312. 7-79-2t

TELEVISION ENGINEER—Major market midwestern network affiliate accepting applicants. Must be strong in theory and have an excellent background in television engineering. FCC first class license essential. ENG remote van experience helpful. An AA/EOE. Send resume with salary requirements to Dept. 460, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 7-79-2t

TRANSMITTER SUPERVISOR NEEDED for WLFI-TV, Lafayette, Indiana. 1st Phone with R.F. experience preferred. Call Ken Gardner, Chief Engineer, (317) 463-3516. 7-79-1t

MAINTENANCE ENGINEER for broadcast facility to maintain all phases of video production equipment. Contact Robert Henderson at (212) 725-8080. 6-79-2t

HELP WANTED (CONT.)

CHIEF TV ENGINEER—Responsible for planning, design, supervision, purchasing and maintenance for university based broadcast quality color TV studio, campus cable system, electronic repair service and consultative activities. This position requires two years college plus seven years related experience or the equivalent combination of education and experience. 1st Class FCC and supervisory experience desirable. To apply please send your resume and salary history no later than June 25th to: Marianne Kiser, Campus Employment Office, 350 Service Bldg., UNIVERSITY oF KENTUCKY, Lexington, Ky. 40506. 7-79-1t

IMMEDIATE OPENING for fulltime, First Phone AM/FM broadcast engineer for 5KW day/1KW night facility. FM application pending. Require experienced, maintenance minded and quality conscious professional in sophisticated audio processing equipment. Good knowledge of FCC Rules and Regulations. Excellent future for qualified person. Send resume and salary requirements first letter. No phone calls. 13-KEIN Radio, P.O. Box 1239, Great Falls, Montana 59403. An equal opportunity employer. 7-79-1t

REMOTE UNIT ENGINEERS—Maintenance and operation—familiar with RCA cameras and tape, Grass Valley switcher, Oktel disc. E. J. Stewart, Inc., 388 Reed Road, Broomall, PA 19008, (215) 543-7600. 6-79-2t

MAINTENANCE ENGINEER—Videotape post production company in beautiful Pacific Northwest has immediate opening. Good pay and benefits. Contact Sterling at (206) 623-5934. 6-79-2t

EDITOR for post production facility in beautiful Pacific Northwest. CMX experience on commercial productions required. Good pay. Contact Sterling Davis, (206) 623-5934. 6-79-2t

TELEVISION CHIEF ENGINEER (CHIEF INSTRUCTIONAL MEDIA OPERATIONS ENGINEER) University graduation with a degree in Radio, Television, or Electrical Engineering **OR** graduation from a recognized electronics institute **and** three years of experience in one or a combination of the following: multi-media systems engineering and operations or radio/television systems engineering and operations. Three years of administrative or supervisory experience. Salary: $1225-$1535 per month.

TELEVISION TECHNICIAN (CLOSED CIRCUIT TELEVISION TECHNICIAN) High school graduation. Two years of training in electronic theory and two years of technical experience in closed circuit television work. Salary: $965-$1045 month. Send resume to Fred Blakey, Personnel Office, Northern Illinois University, DeKalb, IL 60115; phone (815; 753-0455. AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. 6-79-3t

TELEVISION SYSTEMS ENGINEER: If you are a television systems engineer with a track record in designing color television studios, master controls, RF and baseband distribution systems, surveillance systems, and specification writing, or, if you have equivalent design experience in broadcast television or a top CCTV business, industrial, or educational operation; if you want to advance your professional future by working with the leading television and audiovisual consulting and design firm in the field with offices in New York, Los Angeles, and London; if you want to work in New York City, where the action is, with top professionals, on projects which are setting the trend—Send your resume and salary history, in confidence, to: Robert J. Nissen, Vice President, Hubert Wilke, Inc., 280 Park Avenue, New York, New York 10017. Full company benefits. Salary commensurate with experience. 6-79-2t

EXPERIENCED SALES ORIENTED STATION MANAGER for 25 year old daytimer, also need PD. Southern state. Dept. 461, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 7-79-2t

TELEVISION HELP WANTED—IMMEDIATE OPENINGS. Experienced in maintenance of professional closed circuit systems for N.Y. company. Looking for persons with supervisory potential. Many benefits including paid medical and pension plan. Send resume to Technical Operations, P.O. Box 268, New Hyde Park, N.Y. 11040, or call Personnel Mgr., (516) 352-2238. 5-79-tfn

HELP WANTED (CONT.)

HEAD OF ENGINEERING—MASS COMMUNICATIONS DEPARTMENT: Emerson College, a small progressive College specializing in the communications arts and sciences is looking for the right individual to supervise the use, maintenance, repair, installation, scheduling and coordination of our state-of-the-art technical facilities: two color TV studios, two ¾" editing systems; two radio stations, one is carrier current, other is non-commercial FM. Will train student engineers in the use of equipment; color camera alignment, threading videotape, recording, editing and processing; develop and maintain the operational budget and procure all parts and equipment; also responsible for issuance of equipment. Will work under the broad direction of the Department Chairperson and the faculty heads of television and radio; and supervise students as well as subordinate engineering personnel. **Qualifications:** 2 years' broadcast maintenance experience and/or B.S.E.E. or equivalent technical training. Must be familiar with use and repair of television cameras, umatic tape machines, time base correctors, digital control systems, RF transmission, and audio and video systems of supervisory skills and ability to work well with students and faculty in an instructional as well as production setting. **Salary:** negotiable commensurate with experience. Please submit resume and **salary history** by July 15 to Director of Personnel, Emerson College, 148 Beacon Street, Boston, MA 02116. An Equal Opportunity/Affirmative Action Employer. 7-79-1t

CHIEF TELEVISION ENGINEER—$28,587 annually. Requires five years in maintaining a wide variety of color television equipment, two yeras of which must have been in maintaining commercial broadcast quality color television systems. Contact by 7-25-79. Classified Examinations, Los Angeles Community College District, 617 West 7 Street, Los Angeles, California 90017. Telephone (213) 628-7766, extension 241. 7-79-1t

CHIEF ENGINEER—STEPHENS COLLEGE COMMUNICATIONS DEPARTMENT. 12 month appointment. Begins August 1, 1979. Must have First Class FCC license plus at least 3 years experience with desigh, installation and maintenance of audio and video studios, video and film cameras, editing equipment, FM transmitter. BSEE or equivalent desirable. Knowledge of FCC Regulations a must. Good benefits and retirement plan. Salary range $18,000 to $20,000. Stephens is an EOE/Affirmative Action Employer. Send resume to Dr. Faye Elizabeth Smith, Head, Communications Department, Stephens College, Columbia, Missouri 65215. 7-79-1t

ASSISTANT CHIEF ENGINEER: For Western Pa. TV and FM radio operation. 1st Class FCC license, minimum of 3 years supervisory experience along with 6 years experience in the broadcast industry. Management ability with knowledge in TV system design, transmitter operation, studio and remote production. Send resume w/salary requirements to Dept. 459, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 7-79-1t

CHIEF ENGINEER for a large, modern well-equipped, AM carrier broadcast system. Must have experience in AM and have strong performance in audio and studio maintenance repair and construction. Supervisory and carrier current experience highly desirable. Will supervise 1-2 student assistants and be responsible for 6 studios and 13 transmitters. This is a full-time year round position. Starting salary $12,000 or more depending on qualifications and experience. Good fringe benefits package. Reply to: B. Eft, All Campus Radio, Room 8, Student Service Bldg., East Lansing, MI 48824. An Equal Opportunity Employer. 7-79-3t

ENGINEERING TECHNICIAN for major market production facility. Ultimately responsible for maintenance and operation of all TV studio equipment. Graduation from technical school and some work experience in electronics required. TV experience helpful, but will train the right person. Send resume to: Craig E. Blohm, Production Supervisor, CRC-TV, 6555 West College Drive, Palos Heights, IL 60463. 5-79-3t

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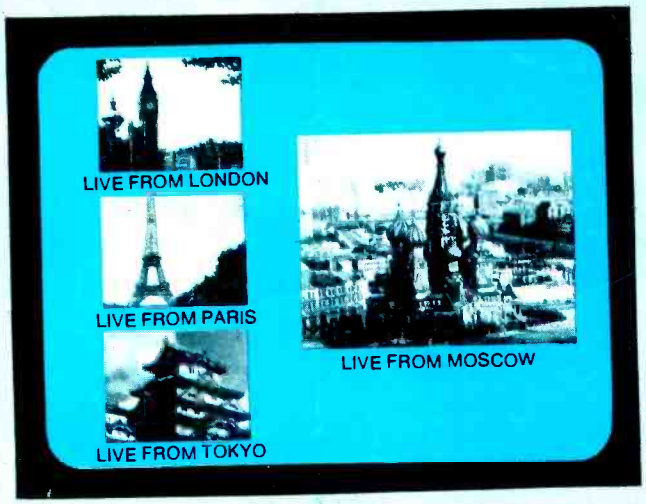

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