



# Video tape commercials in a cartridge

...and a cartridge tape recorder that makes and plays them automatically



Now you can put your TV commercials in a video cartridge . . . only 2½ x 3½ x 5 inches . . . low in cost . . . and available in one and three minute cartridges.

Now you can automate your station breaks—eliminate errors and make goods. You get flexibility in programming because news segments, fashion events, announcements, may be loaded into the system, and even changed at the last minute. You save on equipment too, since there's no tying up several video recorders for one station break.

Tapes are protected—untouched by human hands. Cartridge doors open only within the controlled environment of the cartridge machine. There's no exposure to dust or dirt. And, you can erase and reuse the cartridges.

Twenty-two cartridges can be loaded and played in sequence. A complete station break can be played automatically—at the push of a button—with each event triggering the next. Nine sequences, each handling as many as eight cartridge events may be pre-programmed into the machine's memory.

The cartridges are easily loaded and replaced. You can even make changes while your station break is on air.

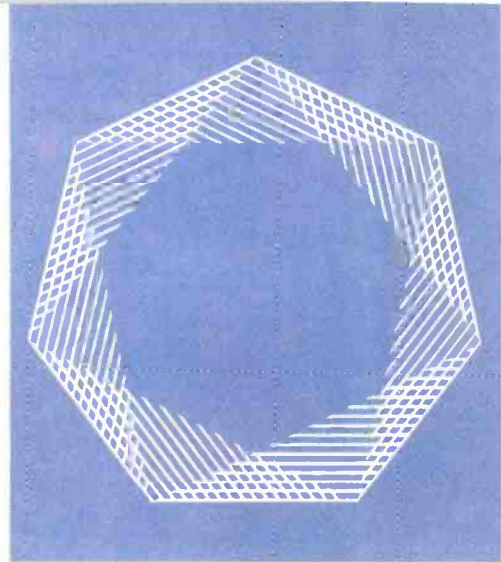
The RCA Cartridge Tape Recorder may become the nucleus of your automation system. Besides controlling your station break it can cue other machines also.

Want to hear more? Call your RCA representative!

**RCA** Broadcast  
Equipment



## PEOPLE: VITAL FORCE IN MARYLAND PUBLIC TV NETWORK



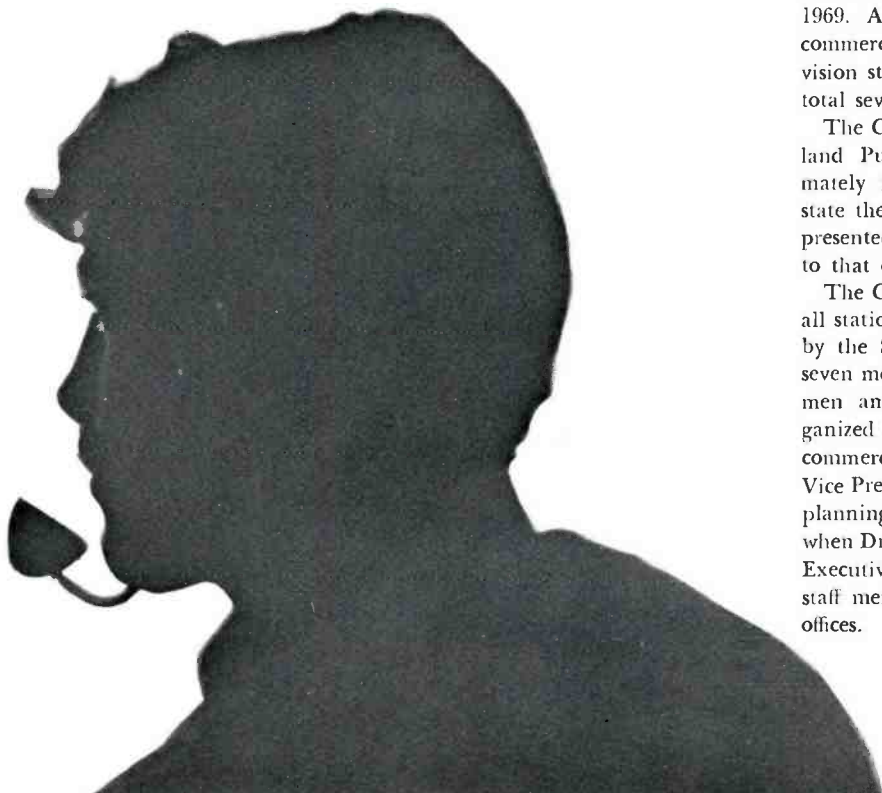
Television service to special-interest audiences, both "in school" and "at home" is the programming aim of the Maryland Center for Public Broadcasting. And people are the force which makes it work—the audiences, enthusiastically responsive to the varied program fare; the staff, young, energetic and eager to communicate; and volunteers, who find community involvement a relevant and fulfilling endeavor.

A walk down the corridors of the Center presents the visitor with a refreshing view of public television in action. The picture is of today, of clean modern lines, efficient and functional equipment in an atmosphere of youthful exuberance and dedication to the community's future.

An integral part of the Maryland Center is WMPB, Channel 67, which officially went on the air in Owings Mills, Maryland, on October 5th, 1969. At that time, it became the first non-commercial station in the state and the first television station in a state-wide network planned to total seven stations by the mid 1970's.

The Center, an institution of the 11-man Maryland Public Broadcasting Commission, is ultimately intended to provide all citizens of the state the best available programming and talent, presented with a production quality comparable to that of leading commercial stations.

The Commission, which is the FCC licensee for all stations in the Maryland network, was created by the State Legislature in 1966. Comprised of seven men from educational fields, three businessmen and a representative of the privately organized Maryland ETV council, it is chaired by a commercial broadcaster, Herbert B. Cahan, area Vice President of Westinghouse Broadcasting. The planning for the Center began that same year when Dr. Frederick Breitenfeld, Jr., was appointed Executive Director and became the first full time staff member in temporary downtown Baltimore offices.

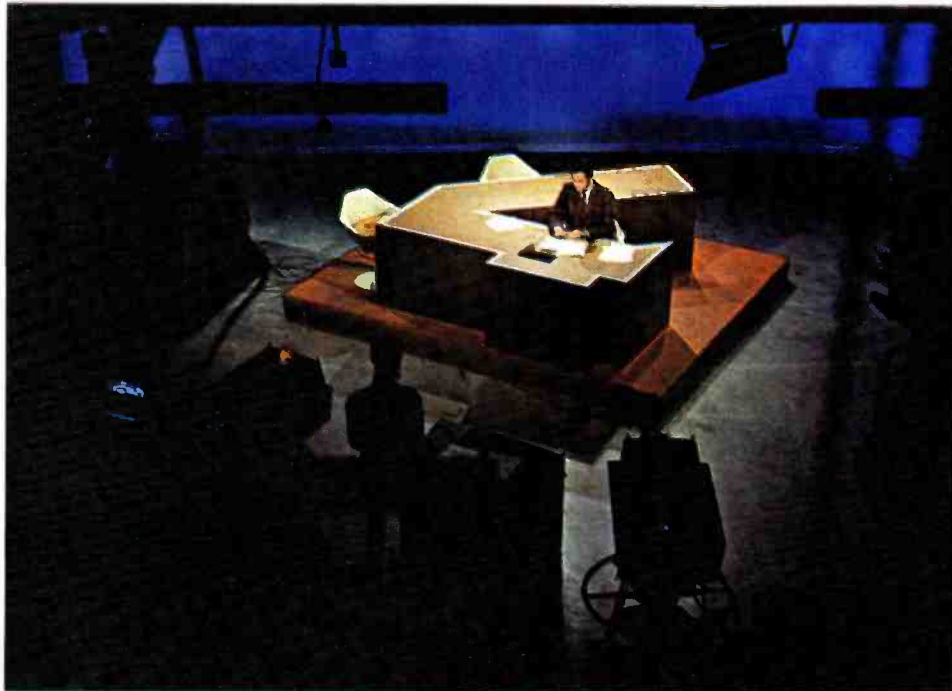




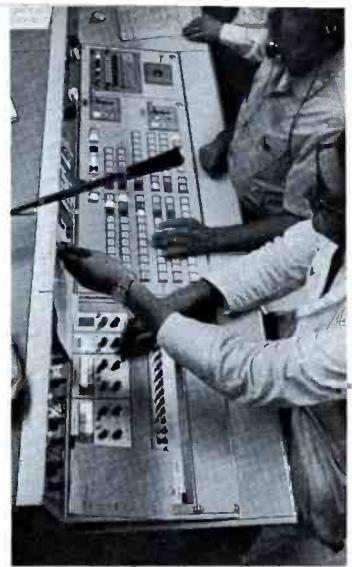
And the weather. And documentaries. Four separate shows with two and one half hours of locally-produced news each day. Plus community interest specials.

In fact, KRON's first revision to its newly completed building was the expansion of its news department. Public demand for the news—especially that of the San Francisco scene—encouraged this expansion. Today KRON-TV employs a team of over 40 writers, field reporters, cameramen and producers to collect, interpret, and present the news.

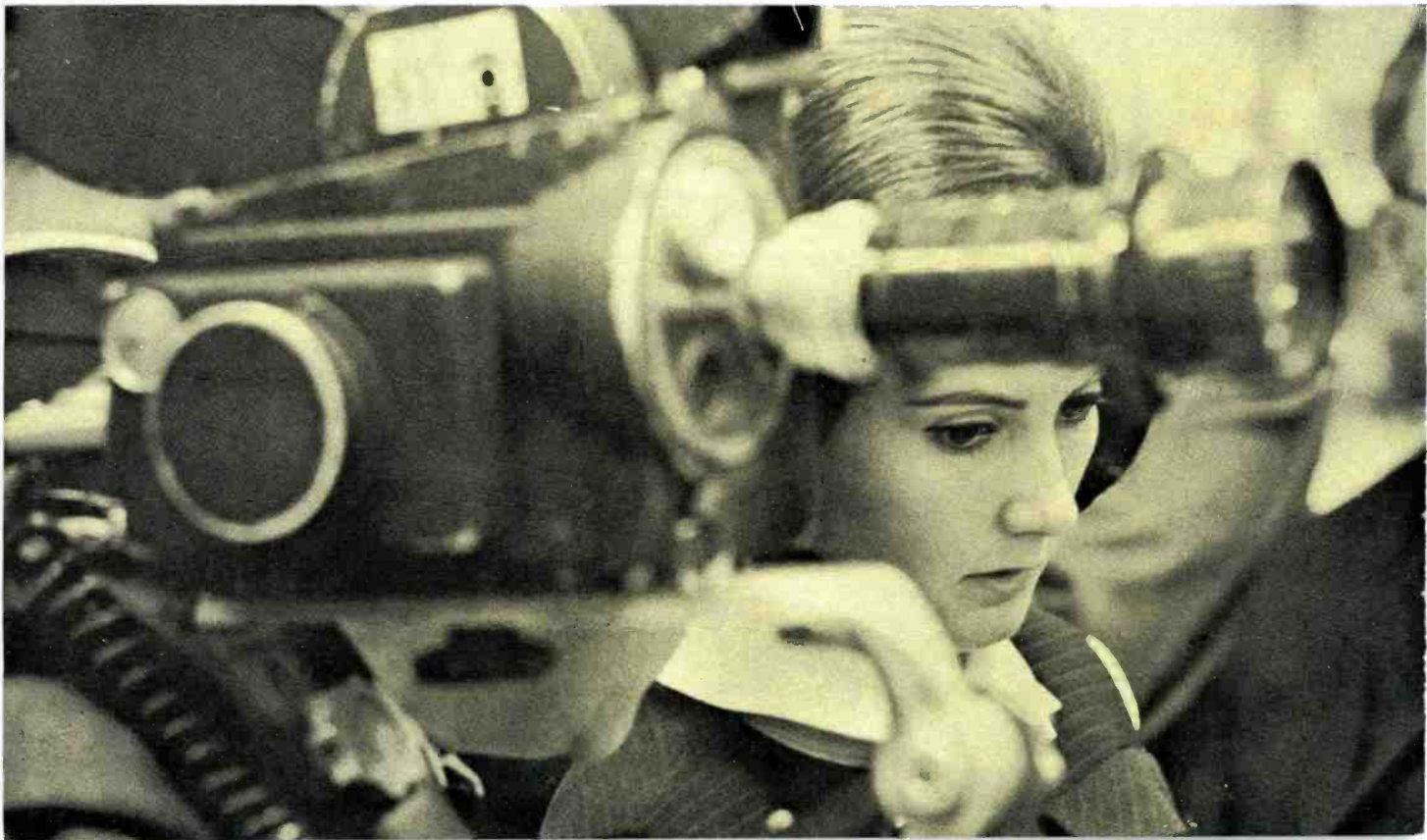
Photos on these pages portray the station's "spirit" of the news. Because the news is the "spirit" of KRON-TV's local programming. And that's what they've equipped to do.







In Local Programming . . .  
It's the News





with its linear faders and other special provisions, to determine the emphasis that KRON places on superior program sound.

But the emphasis on superior operation doesn't stop at the audio. The TS-40 Switchers associated with each video console (and master control console) incorporate all of the most modern concepts—including "program" and "preset" buses, transition control by cut-bar or levers, built-in dissolves and special signals, and all the latest techniques.

The audio consoles house multiple audio control facilities which with the associated audio equipment racks form the basic audio system. Each audio console is, in effect, "tied" to its associated video console. Thus when a film or tape source is assigned to a particular video control by the assignment switcher, the associated audio is simultaneously routed by the audio section of the assignment switcher to the corresponding

audio control console. Microphones in the studios may be similarly associated if desired. A special feature of the audio consoles are voice-triggered AGC-type microphone channels for multi-microphone panel discussions or similar applications.

The camera consoles incorporate camera control panels, switching and machine control. Camera control panels are switched to perform with the assigned cameras (live and/or film) by the control portion of the assignment switcher (as are the VTR controls). Control functions for live cameras are Gain, Iris, Lens Cap and Pedestal as well as on-air tally. There are corresponding controls for film cameras—and for operating modes of tape machines, film projectors and slide projectors.

In its totality, this is a custom system conceived to meet the growing needs of most sophisticated television programming for many, many years to come.





## Individuality Through Custom Switching

"A highlight of the KRON-TV installation will be the control consoles which RCA engineers designed especially for KRON-TV and which are being built in the RCA plant at Camden, New Jersey."

It's been said that no two stations operate alike. This becomes especially apparent as you visit their control rooms—for it is here that the engineering staff really expresses its individuality.

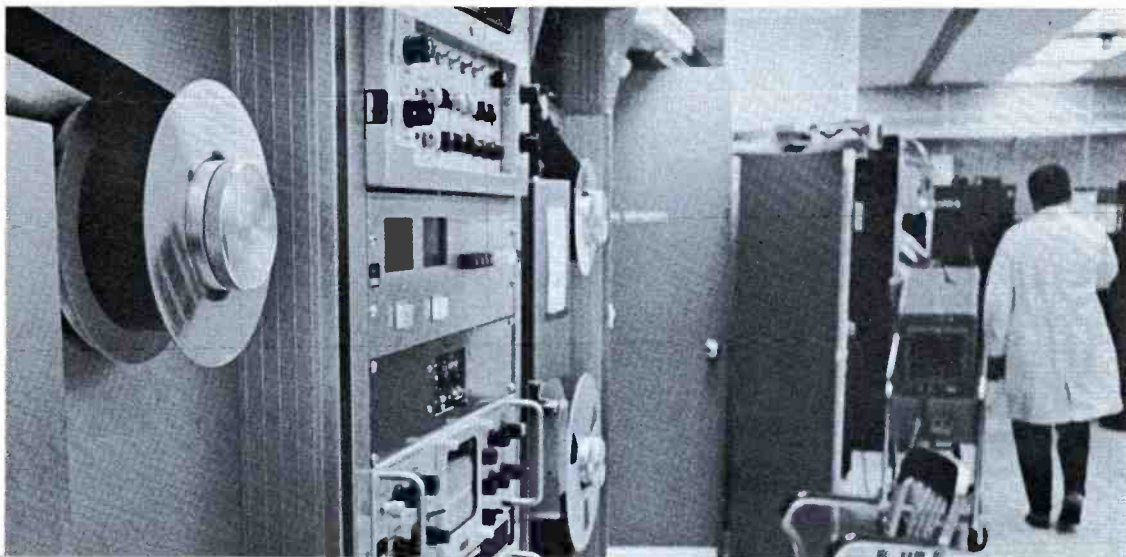
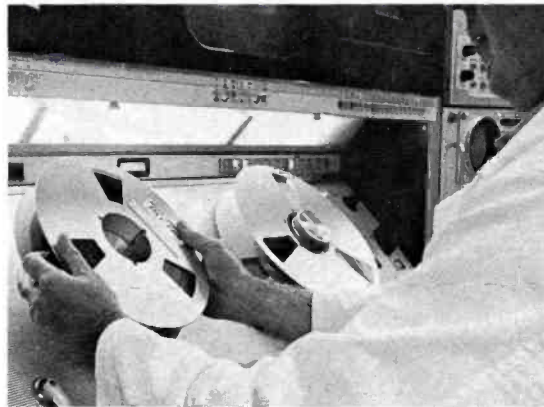
The two studio control rooms at KRON are mirror images of one another and identically equipped. One of these control rooms is pictured here. The video switcher, and director's position is fronted by the classic bank of monitors. The audio man sits alone at his console in a separate room. A glass partition gives him full view of the activity and monitors in the adjoining room. It only takes a glance at his console,





added—bringing the equipment complement to four TR-70 series recorders, two TR-3 tape players, and four TK-27 color film chains. Two control centers, each handling two film islands, are also located in the room.

The whirring of reels, both tape and film, characterize this busy room. The equipment here is in constant use—providing a commercial or public service announcement to master control at station break time, dubbing the news for the evening show, auditioning a tape on the house monitoring system, flashing a title for a commercial in preparation, and handling the hundreds of everyday programming tasks.



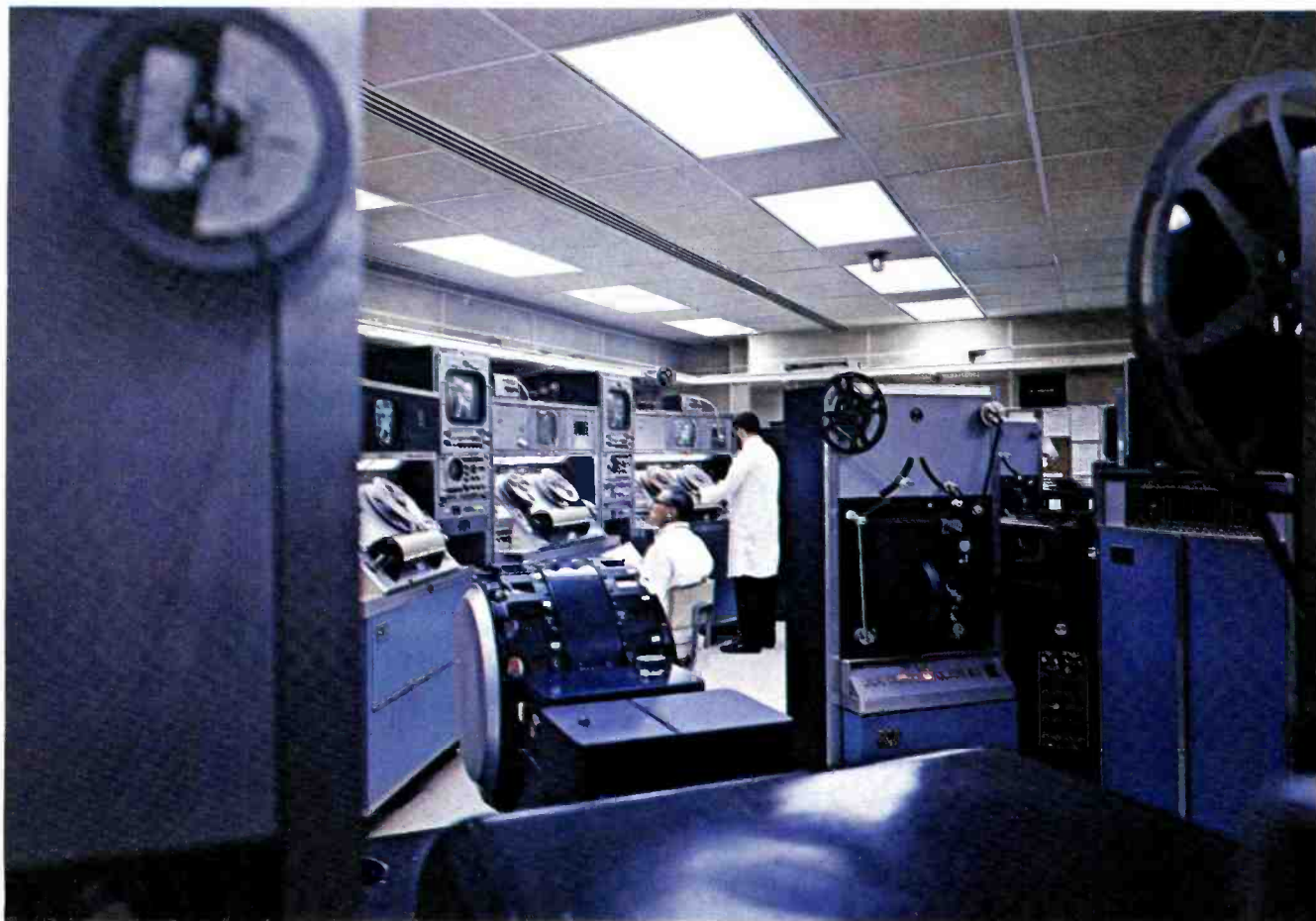
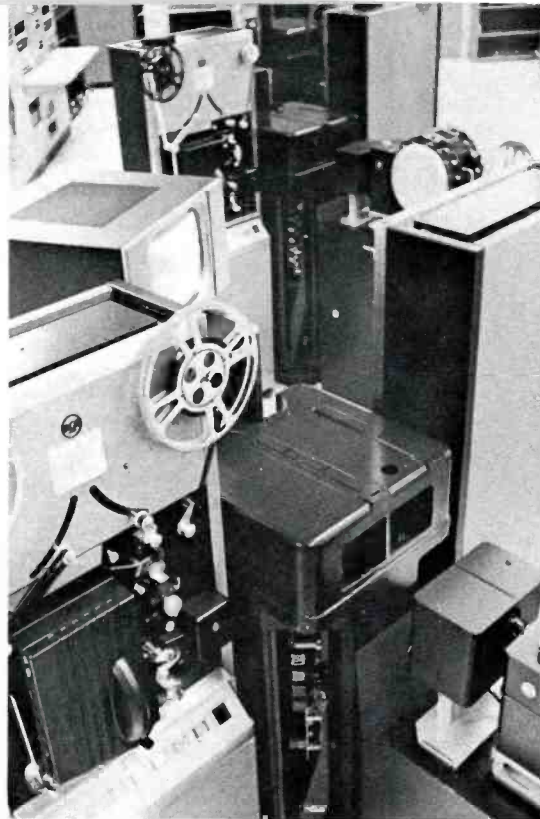


## Tape and Film . . . to be Delegated

The original article described the delegate system for film and tape—where any of five tape machines or four film chains might be arranged to operate independently or as an adjunct to either studio control room or master control. The article went on to mention:

“A notable feature of the technical area is a large film-tape room. Noting the increasing trend to recorded programs, KRON-TV has planned generously for this type of operation. To begin with, this area will have four color film islands and five color tape machines. There is a room for future addition of more tape machines and a TV film recorder.”

This planned generosity of space has already been rewarded. Since the photos on these pages were made, another TR-70 highband color recorder has been



## Solution to Unrestricted Operating Flexibility: the Assignment Switcher

“The heart (or maybe it should be called the brain) of the KRON-TV studio system is an assignment switcher. An essential feature of KRON-TV’s planning was that either of the two studios, or master control, be capable of operating as a completely independent operation center. Thus, for example, Studio A might be producing a taped show while Studio B was being used for rehearsal and Master Control was airing a program from tape, film or network. Most stations can do this to a limited degree by patching or manual switching. KRON-TV wanted complete, unrestricted flexibility—with automatic switching. The answer RCA systems engineers arrived at was the assignment switcher.”

Pictured on these pages are views of master control—operating control room (OCR), as KRON calls it. Here the operator’s job is to keep feeding the signals (network, tape, film or live) to the transmitter. He’s not concerned with production at all, just with keeping the station on the air. He calls out the assignments. And they are physically executed at the film, tape and camera control position. Readout at his console keeps

him apprised of what is being assigned where. Equipment most likely to require his attention is located close to him. Other equipment not likely to require attention is progressively farther away.

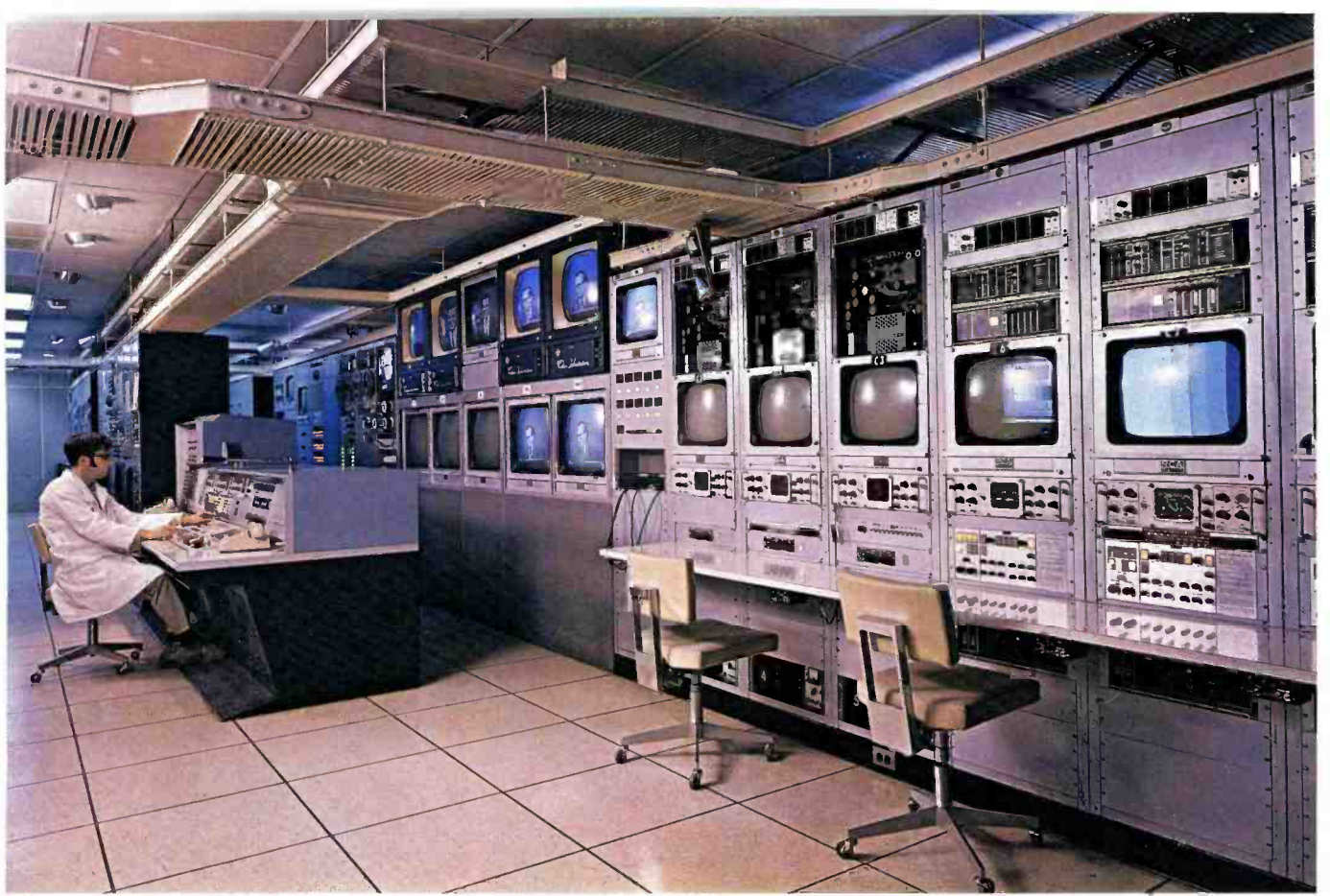
Technically, the assignment switcher consists of a group of individual units, each designed to handle a section of necessary control leads or signals to be switched from one area to another. The groups are broken into Video, Pulse Intercom and Control Circuitry. The group switchers are not mounted next to each other, they rather appear within the associated equipment racks of their function sources. (Audio racks, Video, etc.) A control panel enables the operator to assign any of 17 input sources to one of the three operating areas. (OCR, A control, or B control.)

The system here meets not only the present, but the future needs of KRON-TV. It is designed and built for integration with fully automated operation. Interface equipment is already installed; automation equipment need only be added.

CLOSEUP ON MASTER CONTROL where the operator’s job is to keep the station going. A preset switching system, TSA-3, at left, is used to automate many of the station break sequences.







COLOR CAMERA CONTROL dominates this view of OCR. Three TK-42 and two TK-43 cameras are controlled from this location. They can be assigned to studios or OCR for use in production or on-air operation.

LONG VIEW OF VIDEO SWITCHING SYSTEMS looms large at the opposite end of OCR. Five TS-40 systems are housed here—assignment, Studio A, Studio B, master control, and house monitoring.





AN AGENCY LOOK. Through this main reception area passes the everyday business traffic of KRON . . . to sales offices equipped with conference-projection facilities for both large and small groups.



third classification, "talent", away from both of the other two. Usually it is not possible to do this entirely, but good planning will avoid all but occasional intermingling of traffic patterns."

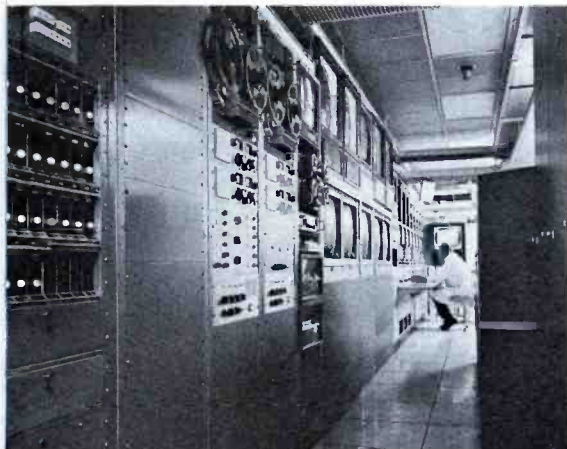
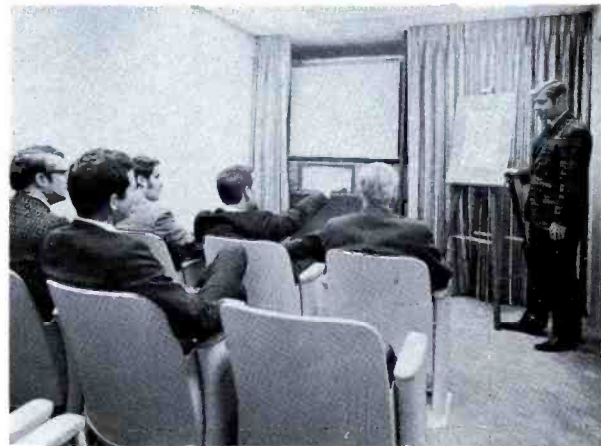
"San Francisco style" refers here to topography—a factor that station planners used quite ingeniously. Situated on one of the local hills, the building has street access to three of its four floors.

The main, "business", entrance is at 1001 Van Ness. This is the bottom of the block . . . the first floor with its sales offices, reception, and access by elevator to promotion, community affairs, and general administrative offices.

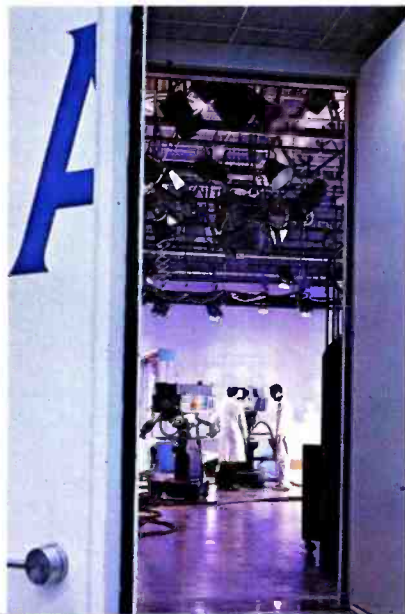
Up the block, on O'Farrell Street, is the "general public" entrance . . . to the second floor. Here a spacious lounge and waiting area accommodates visitors, before they ascend a flight of stairs to the third floor studios for some special show.

Farther up the block (still on O'Farrell) is the "receiving" entrance . . . with truck access to the third floor. This is the delivery area for films, supplies, and technical equipment. It permits drive-in access directly to the studios for props, automobiles . . . even cable cars. See front cover.

And thus the many workings of a television station are conducted . . . expeditiously, efficiently . . . each in their own area . . . with minimum crossover, maximum utility.



A BACKSTAGE PERSPECTIVE. Drive-in access to third-floor studios is at street level to serve technical, property, and production needs without ever interrupting the normal flow of business or public traffic.







## Traffic Flow; San Francisco Style

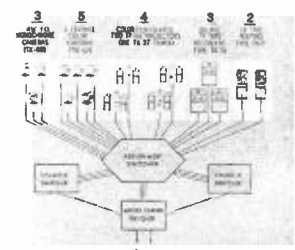
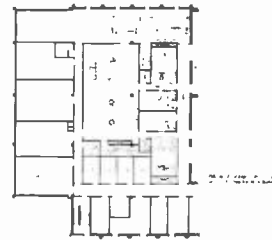
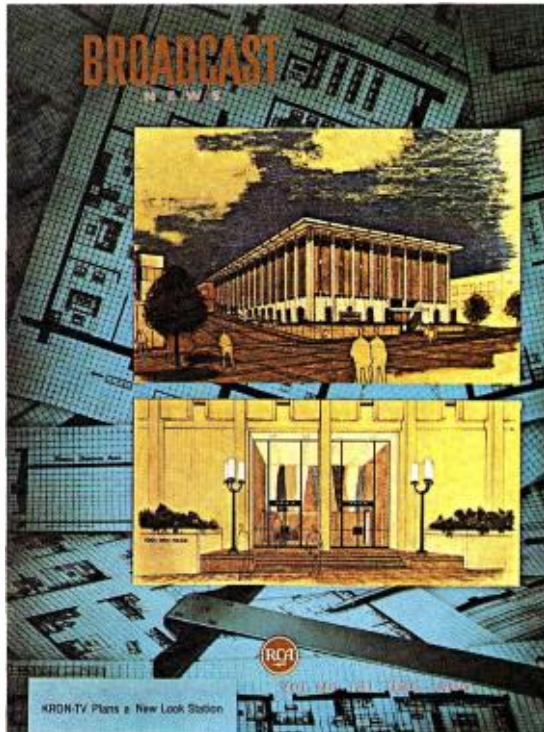
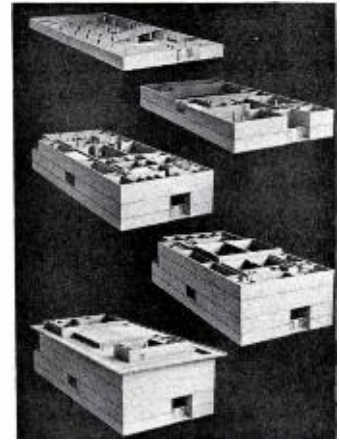
THE PUBLIC VIEW. Picasso-print tapestries and original sculptures greet program audiences as they pass up the stairs to third-floor studios where programming is full-color.



“One additional type of information is required before the architect or planner can start making his floor plans. This is a prediction of traffic flow patterns. A standard approach to this is to make up a functional and/or departmental flow chart. The planner (and architect) use this chart in planning the location of the various areas. The goals, of course, are (1) to keep the high-density traffic paths as short as possible, and (2) to keep the paths followed by the public separate from the internal station traffic. In some cases planners also try to keep a



FIRST LOOK at "How KRON-TV Planned an All-Color Station" is reported in BROADCAST NEWS, Vol. No. 131, December 1966.



Back in 1966, the pages of Broadcast News featured the master plan of an "all-color, New Look, television station, KRON-TV".

In the first few paragraphs, it was reported:

"None of the notable features of the new KRON-TV installation—the beauty, the efficiency, the flexibility, the modernity—happened just by chance or good fortune. On the contrary, it was all planned to come out that way. Harold See, President; Al Constant, Vice President; and Lee Berryhill, Chief Engineer, started planning the new KRON-TV more than four years ago. More than two years of intensive planning preceded the letting of contracts. Another two years will have elapsed by the time the new installation goes into use early next year. It could have been done quicker—but not so well. Harold See, whose record in broadcasting goes back to the early thirties, had envisioned this 'dream' station for a long while. When the time finally came to build it, he wanted to be sure it came up to his dream in every way."

The article—written at the time when KRON-TV was completing construction and beginning to install the first of their all "new look" equipments—details the careful preparations, planning and design of this "dream station" . . . this whole new studio plant to be built from scratch.

In the following pages, we revisit KRON-TV. And present a "through-the-lens" tour of a dream which has become a reality.



# KRON-TV REVISITED

Yesterday's "Dream Station"  
is Today's Reality



## N. J. Public Broadcasting Authority Orders Four TV Transmitting Systems

A \$3,300,000 contract to supply complete transmitting systems for the four new TV broadcasting locations has been awarded RCA by the New Jersey Public Broadcasting Authority. Major items covered by the award are four high-power UHF television transmitters, four broadcast antennas, two 900-foot towers and two 500-foot towers.

The Authority is establishing sites for the four broadcasting locations near Trenton (Channel 52); New Brunswick (Channel 19); Atlantic City (Channel 18); and Montclair (Channel 77). The Trenton station will be first to go "on the air," with broadcasts to begin early this fall.

Programs will originate from a production center complex in Trenton containing two studios and a master control and distribution facility. The center is being equipped with color TV cameras, TV tape recorders, color film originating systems, audio and switching equipment under an earlier contract awarded RCA for approximately \$2 million.

Authority officials said one of the color studios already is operational and the second studio, along with the control and switching systems, will be completed in June. The Authority has begun to recruit a program production and technical staff in preparation for the start of broadcasting.

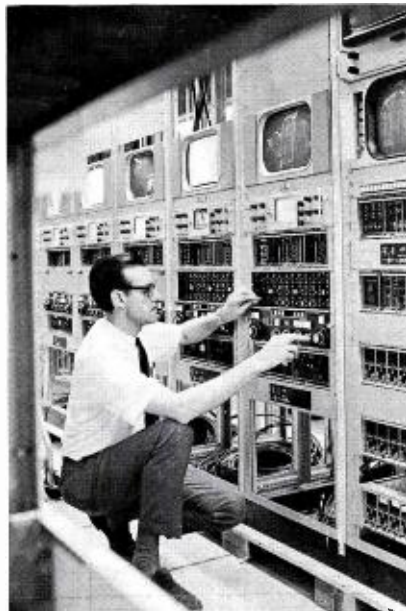
The transmitting systems, which RCA will provide under the new contract, will be engineered to provide TV coverage for nearly all of New Jersey's 7½ million population.

The multi-ton antennas, which will be mounted on the tall broadcasting towers, are custom designed to emit television signals to

reach the household areas specified by the Authority.

The contract also includes installation work and checkout of the towers, antennas, transmitters and transmission line. Among other auxiliary items, RCA will supply four 30-function remote control systems which will permit the transmitters to be operated from the studio location.

Master control equipment for the Authority's production center in Trenton gets an engineering "check-out" prior to installation.



**E. T. GRIFFITH**

Retired Manager of Customer Relations and Sales Services for Commercial Electronic Systems, E. T. Griffith, 61, died April 24 at his home in Broomall, Pa. He had been with RCA for 39 years when he retired in October, 1968.

"Griff", as he was widely known to the broadcast industry, was a ham radio operator (W3HUV), and host to hundreds of technical training seminars and the Broadcast Systems' hospitality suite at numerous NAB conventions.

## TR-70/TR-60 Seminar in London

A recent TV tape seminar, in London, was attended by thirty-six engineers from the United Kingdom, Europe, and the Middle East.

Representing the United Kingdom were seven engineers from London Weekend TV, two from ITA, four from Yorkshire TV, two from the BBC; and from the Highlands, one from the Scottish TV, and one from the Glasgow TV.

The European contingent included five engineers from RAI, Italy; three from MRK, Norway; two from WDR, Germany; two from ORTF, France and one from ORF, Austria.

Two representatives from Saudi Arabia, one from Israel and one from the U.S. Corps of Engineers attended from Middle East.

The two week seminar was held in the Wellington Room at the Hilton Hotel. The engineers received TR-70/TR-60 courses similar to those conducted domestically. In addition, one day was devoted to PAL color circuits. Diplomas were presented to the participants.





### Advertising and TV Production People Attend Cartridge Tape Seminar

The Video Tape Production Association recently convened in Camden for a TCR-100 Video Tape Cartridge Seminar. More than fifty executive representatives of advertising agencies and TV production units attended. Also participating were representatives of Lever Brothers, Colgate, and Block Drug.

The meeting was opened by Morton Dubin, President, Vidcotape Production Association. Guest speakers were Mrs. Marian Lennox, TV Traffic Manager, Benton & Bowles, who discussed many of the present problems associated with the distribution of film and tape commercials, and Mr. Milton Grant, Vice President & General Manager, WDCA-TV, Channel 20 Inc., who spoke of the role of the video cartridge recorder in broadcast station operation. WDCA-TV is presently operating the first TCR-100 as part of RCA's field test program.

The equipment was demonstrated for the group and the significance of the cartridge recorder to the teleproduction industry was discussed.



### Assisting the Apollo 13 Astronauts

Space systems developed by the Aerospace Systems Division played a vitally important role in the safe return of the Apollo 13 astronauts.

Electronic control systems for the descent engine and attitude control jets of the "Aquarius" Lunar Module—which abandoned its role as moon lander to become a space "lifeboat"—were developed at Burlington, Mass., under subcontract to Grumman Aerospace Corporation. Grumman is prime contractor to NASA's Manned Spacecraft Center for the LM.

The RCA-built Descent Engine Control Assembly (DECA) provided control signals to the LM descent engine, which performed the critical task of maneuvering the docked LM-Command Service Module combination onto a course back to earth. During the engine firings, the spaceships were kept in the proper position by the LM control jets, which received electronic control signals from the Attitude Translation Control Assembly (ATCA), also developed by RCA.

The descent engine was fired first to put Apollo 13 on a free return trajectory—a course that allowed it to swing around the moon and head back toward earth. Then, during the trip back, the engine was fired twice more to alter the Apollo 13 flight path and put the spacecraft into the narrow corridor that brought the astronauts to their Pacific Ocean splashdown.

Throughout the return flight after the emergency, the ATCA system sent control signals to the LM jets which kept the spaceships under control in space. ATCA selected the proper jets to fire when an attitude control maneuver was called for.

### Recent Broadcast Equipment Orders Show Diversity of Applications

A KEY WEST CABLE TV SYSTEM has ordered a \$111,000 color TV studio facility in preparation for originating color programs for its 10,000 subscribers.

The Florida company, Closed Circuit TV, Inc., will become the nation's first cable TV service to install a complete RCA technical system for cablecasting color programs "live" or from film or video tape.

The system includes two single-tube live color cameras, PK-730, and a color film system, PFS-710, also of the one-tube design. Two black-and-white cameras, PK-501, are planned for remote TV coverage of local government affairs. The cameras will be permanently installed in city and county commission meeting rooms where their zoom lenses and pan-and-tilt mechanisms can be controlled via cable from the studios.

A 35-FOOT MOBILE UNIT is part of a \$935,000 purchase by WBEN-TV, Buffalo. The unit is custom designed to carry as many as six TK-44A color cameras (a total of eight are on order)—and two TR-60 video tape recorders to remote program assignments.

WBEN-TV will become the first Buffalo station with a fully equipped van for originating color programs away from the studio. The station has operated a black-and-white mobile unit since 1948, originating sportscasts such as Buffalo Bison baseball, racing regattas, lacrosse, golf and soccer for its viewers.

The new mobile unit will see service handling these shows and other sportscasts direct from the planned Domed Stadium in Buffalo, the Buffalo Memorial Auditorium, which is

scheduled for expansion, Community Service colorcasts from various locations in Western New York are also planned.

A NEW ORLEANS EDUCATIONAL STATION, WYES-TV, is broadcasting virtually all its late afternoon and evening programs in color.

The station has acquired three new TK-44A color cameras, TR-60 and TR-70 high band color recorders, and a complete TK-27 color film system, among other apparatus.

The new equipment enables WYES-TV, which has been on the air for 13 years, to originate color programs to both home and in-school audiences.

KOKH-TV, AN EDUCATIONAL station operated by the Oklahoma City school district, is installing color studio equipment valued at nearly \$500,000. The Channel 25 station has been broadcasting in black-and-white since 1959.

Colorization of KOKH-TV includes installation of three TK-44A studio color cameras, two TR-60 color TV tape recorders, two TK-27 color film chains, two TS-51 switching systems, among other equipment.

Dr. Mervel Lunn, Assistant Superintendent of Schools, said the move to color had long been contemplated and that color has become "almost a necessity" in televising instruction in such subjects as science and art, and for color coding in mathematics.

The station serves a total classroom audience of approximately 55,000 elementary and high school students through its own broadcasts and those by KETA-TV, a Channel 13 state educational TV station in Oklahoma City, to which it feeds a different program schedule.

# **RCA** Broadcast News

---

Published by RCA BROADCAST SYSTEMS DIVISION

## CONTENTS

---

|  |    |
|--|----|
| KRON-TV Revisited .....                      | 4  |
| Maryland Public Broadcasting Center .....    | 16 |
| Experiences with Flying 44A .....            | 25 |
| Automate Your Station Break .....            | 28 |
| The Professional Sound in Broadcasting ..... | 37 |
| New AM Ampliphase Transmitter .....          | 42 |
| Magazine-Load Slide Projector .....          | 46 |
| Television in Nigeria .....                  | 50 |
| Products in the News .....                   | 56 |

---









"Exploring the World of Science"

"Guessing Patterns"



"Management by Objectives"



"African Anthology"

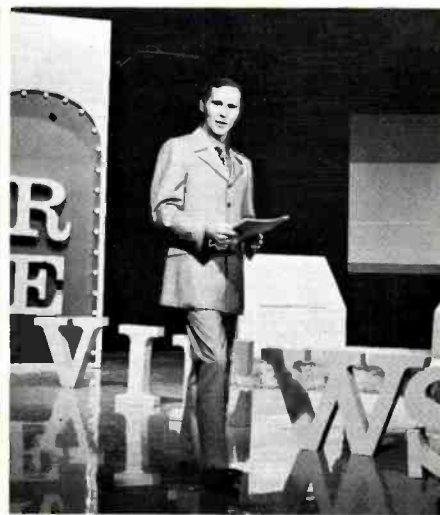


PROGRAMS FROM OUTSIDE SOURCES ARE TYPIFIED BY THESE ILLUSTRATED

## Diversity of Programming Characterizes Busy Broadcast Schedule

The broadcast schedule for Channel 67 shows the diversity of services offered. On a typical week day, the station signs on at 8:00 a.m. with a half hour credit course in modern mathematics for elementary school teachers. At 8:30 a.m., a course for business administrators is aired, and at 9:00 a.m., classroom TV begins, and runs to 4:00 p.m. This portion of the broadcast day is the responsibility of the Division of Instructional Television of the Maryland State Department of Education, and includes programs for elementary, junior, and senior high school levels. The classroom programming has been selected from many sources to fit into the curriculums of Baltimore City schools, and schools in the surrounding counties. The Division of ITV also produces a series of its own, titled *News Lab*, which leads into a class discussion of news events of the previous week. The classroom

LOCALLY PRODUCED PROGRAMS ROUND OUT THE DIVERSIFIED SCHEDULE



"Reviews"; cultural programming

"Our Street"; urban affairs

"Designing Women"; home instruction

"Hodgepodge Lodge"; childrens programming



"Sesame Street"



"The French Chef"



"The Forsyte Saga"



"Folk Guitar"



schedule breaks at 10:00 a.m. for the network presentation of *Sesame Street*.

At 4:00 p.m., a repeat of the *Sesame Street* broadcast presages the more diverse programming of Channel 67, the portion under the direction of the production staff of the Maryland Center for Public Broadcasting (as compared with the Division of ITV which, though housed at the Center, is actually a part of another state agency). At 5:30 p.m., *Hodgepodge Lodge* rounds out two full hours for the very young. The station goes into a science and home instructional mix to 7:30 p.m. when adult cultural/entertainment programming begins with a major NET program, or a locally produced program. At 10:00 p.m., *Urban 30*, a half-hour program of local urban concerns fills this slot nightly. A variety of adult-level shows fills the next half hour strip until *Newsfront*

caps the day from 11:00 to 11:30 p.m.

Home instruction is a major concern of the Center. Currently, it is broadcasting series on chess, arts and crafts, French cooking, the German language, guitar, horticulture, knitting, sewing, and lipreading. Formal courses are offered to business and industrial concerns, at \$25.00 per registrant, in communications skills, supervisory techniques, and efficient reading. This reading course is also open to general viewers. With the cooperation of three nearby colleges, a graduate course in modern math for elementary school teachers is broadcast eight times a week, and carries a three semester hours of credit.

In the planning stage is a "Junior College of the Air," a cooperative venture with three Baltimore area junior colleges who will offer credit courses on Channel 67, beginning this fall.

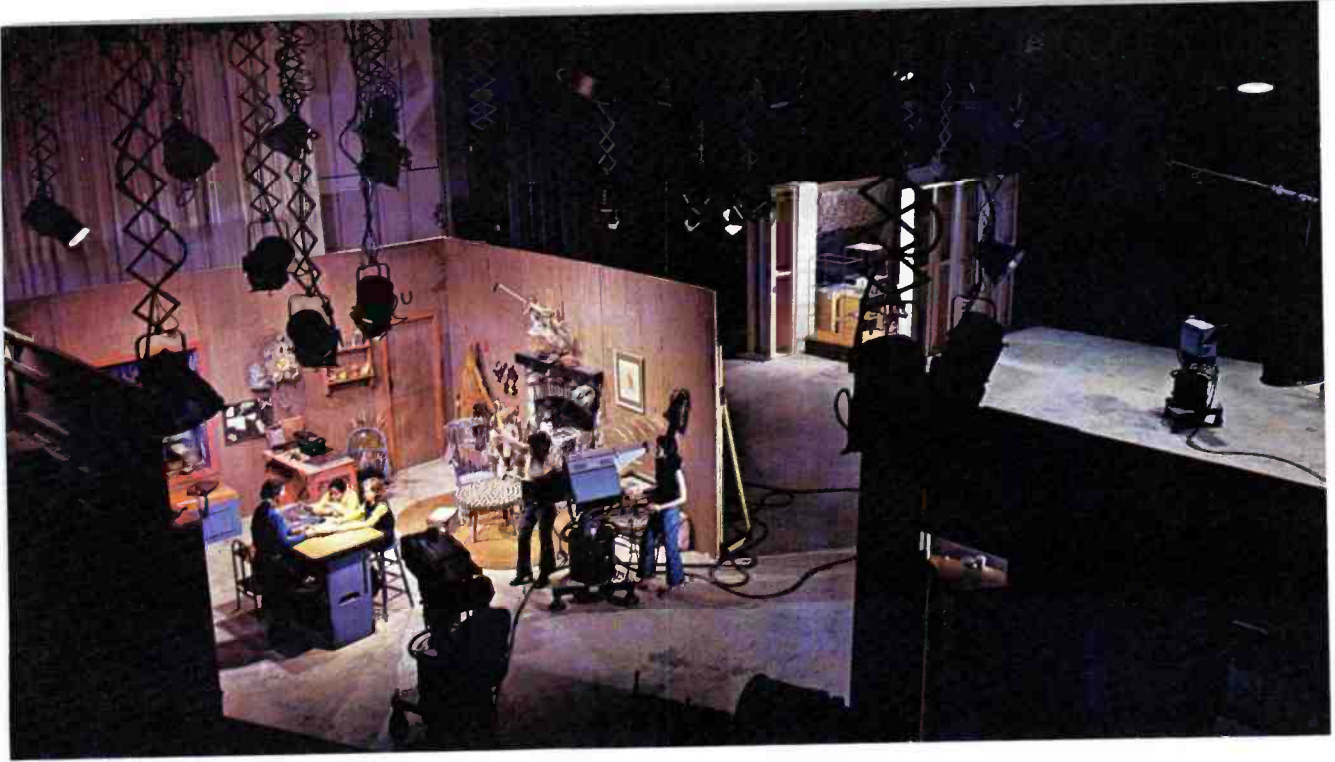


"News Lab"; in-school television



"Stories of Maryland"; historical series







## Local Productions Keep Three Studios Active

The Center already is producing five series of its own. The most ambitious of these is *Urban 30*, a 30-minute program of urban concerns, broadcast every week day at 10:00 p.m. Its Tuesday evening segment titled *Our Street*, is particularly interesting in that it is a continuing "soap opera" approach to the problems of the inner city dweller. Five actors were selected from 300 area applicants, and they have one-year contracts for the series which is directed, produced, and taped at the Center. *Our Street* is written by nationally known TV writer, Ted Shine.

Other Center productions include *Jim Dale Reviews*, a weekly half-hour of commentary on local film, plays, and other performing arts; *Session Seventy*, a weekly interview series with members of the Maryland Legislature; and *Designing Women*, a weekly home instruction sewing show, starring Anne Darlington, of the Center staff, a well-known local TV personality.

Another program series produced at the Center is *Hodgepodge Lodge*, a nature series for six- to ten-year-olds. The show, produced by Jean Worthley, is taped both in the studios and on location in the wooded acreage surrounding the Center building. Mrs. Worthley also appears on camera.



MASTER CONTROL DIRECTOR AT WORK. Nancy Shakelford is one of several women making careers in the various directorial and production assignments at the Center. She is shown in this picture series performing various daily duties associated with her position as master control director. Local productions keep center personnel and equipment on a busy and varied schedule.

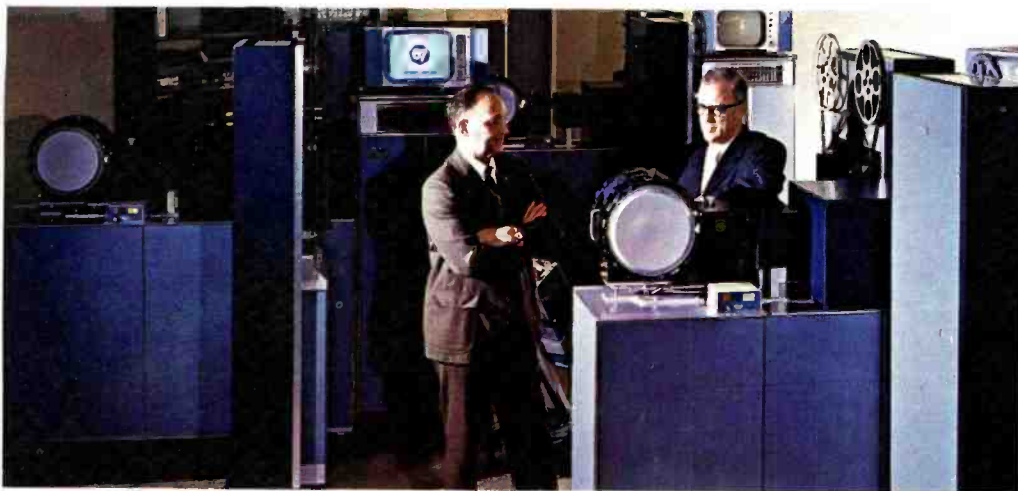


## Service to Viewers Necessitates Extensive Equipment System

Under Warren S. Park, Jr., Director of the Division of Programming and Operations, planned production requirements were to so far exceed those in the average commercial broadcast station that Richard S. Duncan, Director of the Division of Engineering, and RCA engineers determined that engineering facilities should include six TR-70-B video tape recorders, two of them with complete editing facilities; six complete film islands utilizing the new TP-55 multiplexers; seven TK-44-A studio cameras; a TTU-60-A 50 KW Transmitter, and TFU-30-J Antenna.

The production facilities include three studios, two of them 30 x 40 feet, and one 60 x 80 feet. All studios have 25-foot ceilings and are equipped for dual track cycloramic curtain operation. Each studio has its individual control room and is equipped with remote control lighting with the capability of placing 300 foot candles over any 70 percent of the floor area at any given time.

The Master Control Room is arranged with a row of operating consoles through the center and a row of equipment racks on each side. The operating consoles contain remote control equipment for the TK-44-A studio cameras and the TK-27 film cameras, as well as the routing switcher and waveform monitoring equipment. Announcing is done from a booth adjacent to this area. All program switching is done from the master control position, including feeds to the Eastern Educational Network or to the local Bell Telephone Company offices for distribution to other stations proposed in the Maryland network. These stations will eventually be located in Salisbury, Waldorf, Annapolis, Frederick, Hagerstown and Cumberland. Remote operation of any video-tape recorder or film island may be delegated to this master control switching position, or to any studio control room. Audio breakaway is available at this point with separate reel-to-reel and cartridge tape playbacks mounted in the consoles and racks and also remotely controlled. The Master Control Room provides a constant feed-through of Eastern Educational Network programming from Washington to Baltimore and return on a 24-hour-per-day basis.



EQUIPMENT FACILITIES are extensive; as shown by the pictures on these pages. A completely equipped film room with six TK-27 film islands; three studios utilizing seven TK-44A color cameras; master control and tape production areas, each with two TR-70B highband color tape recorders.





In design discussions which considered the methods currently in use for carrying wiring between technical areas, numerous disadvantages were noted in both the cable tray and trench systems. The former method is very unsightly and subject to undesirable accessibility to the public. The trench method also is unsightly, unsatisfactory for the quick addition of more wiring and some times dangerous in the moving of heavy equipment. The Division of Engineering, in cooperation with the architects, evolved a system of tunnels connecting the film and tape room, master control room and all individual studio control rooms in which cable trays were mounted and all interconnecting wiring laid in them. The size of this tunnel is never smaller than 8 feet high and 8 feet wide. Under the master control room and portions of the film and tape room, it widens to a full basement. The additional space provided has also been used to mount the compressors for the videotape recorders, thus greatly reducing the ambient noise in the Master Control Room. Access to the tunnel is through hatchways at each end thus discouraging any traffic except that required for actual work in the cable trays.

All wiring between engineering areas is carried

through the tunnel. Cabled bundles of coaxial cable go directly through the concrete slab which is under the racks and consoles in the equipment rooms, into the cable trays and are routed to their final destinations in this manner. The network of trays as installed makes it extremely simple to add wiring from any area to any other area without unsightly cross-overs or floor trenches. Adequate space is available in these trays to accommodate foreseeable future expansion.

All facilities are housed in a one-story 50,000-square-foot building set in a background of existing trees and new landscaping. Two parking areas provide space for 150 cars and buses. Special routes within the building have been arranged for tours for school children and the general public. Sound-proof viewing windows are provided at various points along these routes so that visitors may observe the operation in studios, control rooms and the master control room.

The size of Studio A enables the Center staff to produce shows with a live audience. The first of these was produced in December when supporting members of the Center were invited to attend a musical Holiday Special at which the performing artists were entirely recruited from the 150-member Center staff.





More than 200 attended the show, which was the second live audience activity at the Center. The first was in October, just after Channel 67 went on the air. Some 120 members attended a special viewing of *The Advocates* in Los Angeles, and voted by special phone hook-up on the subject under debate on the program.

The transmitter facilities at WMPB, the station housed in the Center building, consist of the RCA TTU-60-A transmitter and normally associated accessories. Two radio frequency patch panels are utilized, enabling the station to provide maximum flexibility at the transmitter outputs. By means of this patching system, visual and aural transmitters may be fed either to the artificial antenna or to the main radiating antenna and other required patches may be accomplished with a minimum of delay.

WMPB's tower is a 700-foot guyed uniform cross-section triangular structure on top of which is the familiar RCA TFU-30-J antenna. Field intensity

measurements made after the beginning of normal operation indicate that the predicted field intensities at salient measurement points around the area are either equal to or slightly better than predictions. There is every indication that the coverage of WMPB on Channel 67, radiating 1,000,000 watts in the main lobe, is such that adequate service is provided to the public and to schools within the service area.

The Towson, Maryland, firm of David H. Wilson and Associates, were architects for the Center, and Albert P. Gipe and Associates were the engineers. George R. Lewis, Director of the Department of Public Improvements, had overall responsibility for the State of Maryland. Colonel Garrett Billmire, Assistant Director of Department of Public Improvements, was project director. Also representing the state were Principal Architect Colonel Laurence P. Sangston, and Principal Engineer Frank L. Byron. The prime contractor was Industrial Engineering, Inc., Baltimore.





# Experiences with a Flying 44A



An itinerant engineer plots his travel plan.

From Parkhill to Stevens to Stevens to Parkhill to Stevens . . . and so it flew. A flying TK-44A camera demonstrator. To a prospective customer for evaluation or perhaps a side-by-side test with the competition.

Experiences? You bet! Just listen to Colin Parkhill and John Stevens of our camera technical assistance group, who have been participating in this air shuttle for more than a year. This is the combined chronicle of some of their more interesting encounters.

You should see my three-crate demonstration kit. Not exactly hand luggage, the first crate contains a console housing, complete with camera controls, monochrome and waveform monitors, camera processor, and its own sync generator. It weighs in at over 700 pounds including the crate. The second holds camera cable, lens, tripod and dolly, spare parts, and assorted props for our camera show. It weighs a little less than 700 pounds. The third is a real lightweight at a little over 100 pounds including packing case. It houses the camera head. On occasions we take our own color monitor along too.

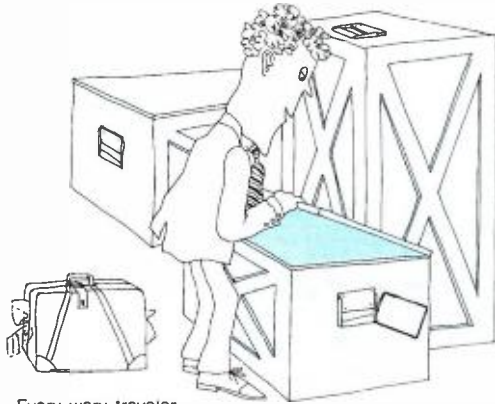
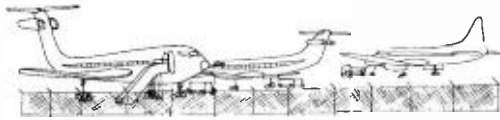
Our packing design must be OK, because somehow we manage to get it all aboard jet freighters and out to prospective customers for demonstration. Actually, after more than a year, we're getting to be somewhat the freight traffic experts.

But the most gratifying part of this whole shipping business is the stations' reaction to how quickly we are able to set up. Typically, we can get useable pictures within an hour and a half from the time the crates arrive at their loading docks. People look in wonderment that we are able to start so soon. And this gets any demonstration off to a very good beginning.

I guess sensitivity impresses people most . . .

The camera has performed well under all kinds of lighting conditions. The lowest was about five foot-candles. Actually it was too low to get a very accurate reading on the light meter. It was a closed-circuit demonstration for a government installation in New York. They were doing a high-voltage thing with huge transformers and metallic spheres and millions of volts zapping all around. The lighting was fluorescent and hanging from about a 50 foot ceiling. I gave it a try—turned up the gains and crossed my fingers. The camera made good pictures and everyone seemed to be quite happy.

We've done very well under all kinds of field conditions. Another time in Salt Lake City we were shooting in the Tabernacle where there was a nominal 100 to 125 foot-candles. However all the cameras were stationed rather far back from the subject. So we switched in the lens range extenders. This of course cut our lens aperture considerably, but it did produce tight closeups without compromising picture noise.



Every wary traveler checks his luggage carefully.



The choir looked great at only 15 foot-candles



The contours demo, another "Portrait of Dorian Gray".

In a similar situation at the Cathedral of Tomorrow in Akron, the TK-44A turned out to be a winner primarily because of its ability to produce good pictures of the choir. And they were only illuminated by about 10 to 15 foot-candles.

In the normal demonstration of sensitivity—where the light level is progressively lowered on a model—it's the production people that are most impressed. Their first reaction is to whip out their meters and check the light level. Sometimes they even question the need for all the lighting on the set. I've reminded them that it might be kind of difficult to do a creative lighting job all the way down to 15 foot-candles. However, many of them have suggested that the TK-44A might find very practical use at normal black-and-white type level—the order of 50 foot-candles. Which is something to think about.

The most fun is really the contours demonstration

... at least I like it most of all. I demonstrate contour enhancement by getting a closeup of someone's face. Without any contour enhancement the picture is fairly "soft". As you increase the contours the picture comes up snappy and clear, without any increase in noise. And as you turn it up beyond the normal setting, it's like an aging process. Facial lines are accented, pores get larger and larger, tiny little blood vessels in the eyes become more prominent, normal perspiration turns to shining beads of sweat. It's something like "The Portrait of Dorian Gray". And the spectators are fascinated.

Practically they appreciate that there is more sharpness than they really need, because some subjects will need more contour enhancement than others. Or if they are taping and get into multiple generations, they know they need something extra and that the noise isn't going to build up and show through.

I'm glad we made it rugged . . .

because this makes things a lot easier for me. On this busy shuttle-type schedule, you don't always know what you are going to find when you open up the crate.

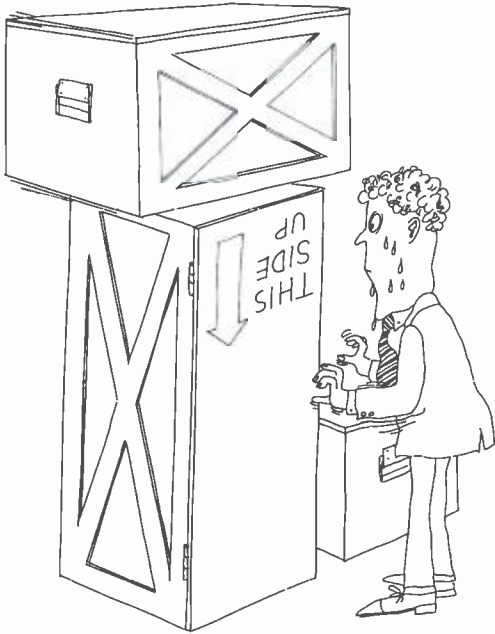
And when you're taking the camera on location, you're not always handling it in the crate. Like the time we were hauling it in a station wagon on the freeway, when somebody cut us off. We jam on the brakes, and there goes the camera—lens and all—sliding the whole length of the station wagon. It winds up on its side, the paint is scarred, but there's no mechanical damage inside.

Or then there's the time in Toronto, when the camera had come all the way from Virginia by truck. We opened the console crate and all you could see was glass. A picture tube in one of the monitors had smashed completely. Once we got all the glass out and replaced the picture tube, the camera control worked perfectly.

Sometimes I haven't even had time to set it up . . .

I ran over to Philadelphia with the camera to put on





You don't always know what you'll find when you open up a crate.



Production people prefer pictures . . . and the "44A" makes 'em best.

a show. The engineers were waiting when I got there. I asked where I could hook into power, and they pointed inside. I opened up the truck and went inside to check the power situation. When I returned the camera was gone. I raced upstairs to the studio and there it was, all cabled up and ready to go. "OK turn the power on and let's go," said one of the engineers impishly. So that's what I did, and that's how it was—ready to go. The whole thing was set up perfectly.

And that's one thing we always emphasize—camera stability. Also that if the picture looks all right, *leave things alone*. There is no need to tweak or go through setup, just for the sake of going through it. I guess it's a hard thing for some people to get used to. But that's how it is with the TK-44A.

We demonstrate all the important features

. . . sensitivity, contours, Chromacomp, production aids . . . and then pretty well let the station take over. They'll use it right along side their existing cameras, to do the news or make a recording or two. This usually gives me the opportunity to demonstrate Chromacomp, because the first thing I have to do is match the TK-44A to their existing cameras. This is accomplished simply by viewing the Chromacomp test chart—with a chip of each of the primary and secondary colors—on their cameras, and marking the color positions on a vectorscope. The TK-44A is turned to this same chart, and the Chromacomp controls are adjusted until the vectors coincide with these markings.

Of course everyone is always interested in seeing just how much control we have with Chromacomp—without changing gray scale. This is very dramatic. But in a practical sense, they really appreciate the subtle changes you can make in the color of a product or package to get it just right. And stations that do chroma-keying are very impressed with the way you can change the background color to be almost exactly 180 degrees opposite from fleshtone.

After a brief orientation, I usually let the stations operate the camera themselves. I'll show one of the engineers where all the knobs are, and then go back to the hotel in the evening and watch them do the late news. I come back the next morning and find that they are really enthusiastic with the operational simplicity. There's a minimum of controls . . . and each one does exactly what it says it does. If it says green height, it changes green height. If it says red gamma, it only changes red gamma—not video gain. Simple.

When the engineers have given it a good going-over, they often call in the production people. And they usually want to check it out on the weather set or sometimes even use it on a commercial or promo they have scheduled for that day. The production people are primarily interested in good color pictures, and that's what the TK-44A does best.

In all, these experiences have been fun . . . and very gratifying. To my knowledge, I don't know of a sale we've lost on the basis of a demonstration of technical performance.

# AUTOMATE YOUR STATION BREAK:

L. V. HEDLUND and B. L. DICKENS\*

The solution to today's  
most vexing problem

The increasing trend in broadcasting towards short recorded messages on both tape and film, especially during station breaks, has created a multi-faceted problem. Numerous spots must be aired within brief intervals with great precision. This ties up people and machines, raising operating expense. Moreover, the possibilities for error are multiplied.

Automatic handling of these short sequences is an obvious solution, made possible by the advent of the TV Cartridge Recorder (Fig. 1). This system satisfies both the small station with no automation equipment as well as the larger station, which may already have some degree of automation. It is a system acceptable to producers of commercials, that fits into or improves present methods of production and distribution.

The new system makes use of a video tape cartridge, using quadruplex recording. It embodies magazine loading of cartridges, automatic threading of tape, and computerized IC controls. Once loaded the system handles several station breaks without attention. In addition, changes may be made at any time by removing the unwanted cartridge and substituting the desired one. Finally, the system is designed to automatically produce uniformly high quality recordings and playback, without operator adjustment.

## Video Cartridge Concept

Using this concept, each cartridge contains sufficient video tape for one complete recorded message, including appropriately placed start cue and end cue for use in the internal automation of the machine. Cartridges can then be used in any combination to form a complete station break or other sequence of short messages, such as news flashes or fashion events.

Growing from the cartridge concept came the idea of a completely automatic transport, having provisions for automatic threading and unthreading of the video tape in the cartridge.

To produce a satisfactory system it is obvious that each event should form an integral part of a contin-

uous sequence of events. This is accomplished by using two basically independent cartridge transports capable of producing a continuous program without video or audio interruption.

A cartridge magazine was developed (Fig. 2), which would feed cartridges to the two transports automatically. The magazine is placed in front of the two self-threading transports. The magazine holds 22 cartridges in individual carriers or bins—a capacity sufficient to meet the programming needs of the average station for several station breaks.

Since the number of cartridges which would be played in any sequence would vary, a means is provided to handle this situation. An Automatic Sequence Control permits programming a specific number of cartridges to play automatically on command. The cartridges play in numerical order, then the machine stops with the next sequence ready to play upon receipt of a single play command.

To provide maximum utilization of the equipment, the system is designed to have recording as well as playing capability. While not in itself new, the idea of AUTOMATIC control of duration is. The operator is required only to tell the machine (through use of thumbwheels) how long the recording is to be, then the machine automatically records the exact message length—together with appropriate start and end cues. After recording, the cartridge will automatically rewind and recue, ready for preview.

In the cartridge system both transports are not required to play at the same time, therefore the reproduce electronics can be shared between the two transports. In a similar manner the transports are designed to record the same video signals and the record electronics can also be shared. Carrying this one step further, the cartridge recorder can be slaved to a standard reel-to-reel master recorder and the common electronics shared.

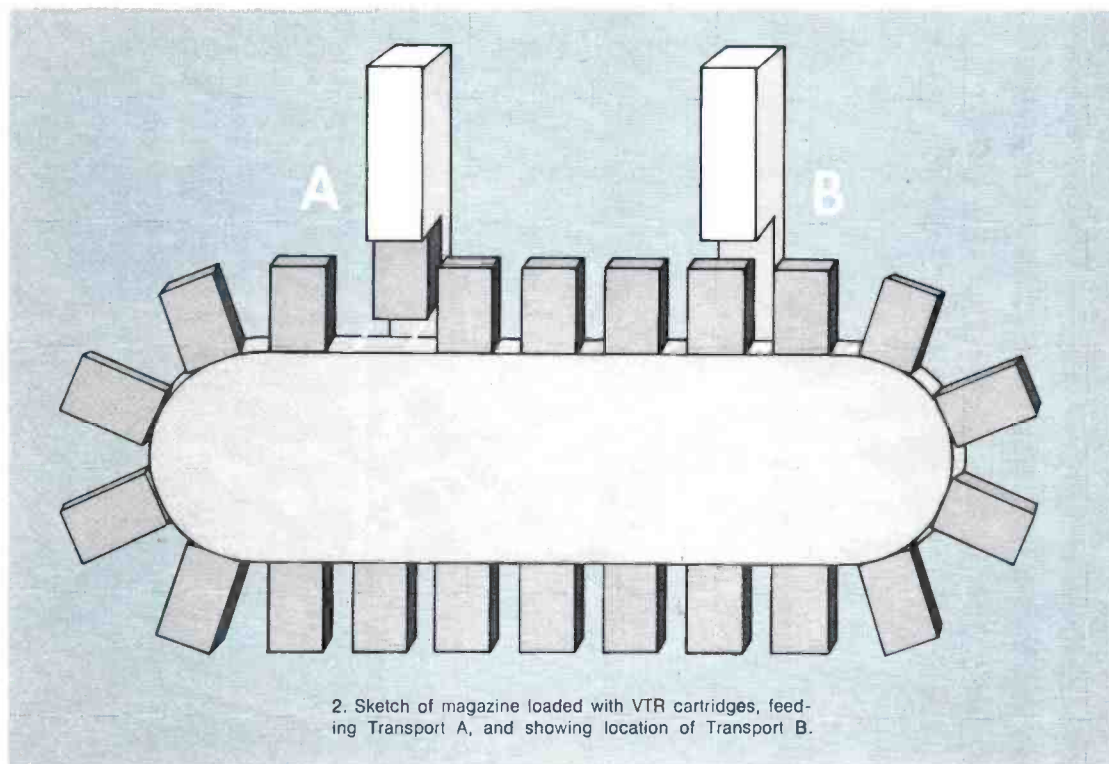
In installations where it is not desirable to have this master/slave combination a signal processing unit can be used to obtain greater versatility.

\*Electronic Engineering Leader and Mechanical Engineering Leader, Electronic Recording Equipment





1. Type TCR-100 Television Cartridge Recorder.



2. Sketch of magazine loaded with VTR cartridges, feeding Transport A, and showing location of Transport B.

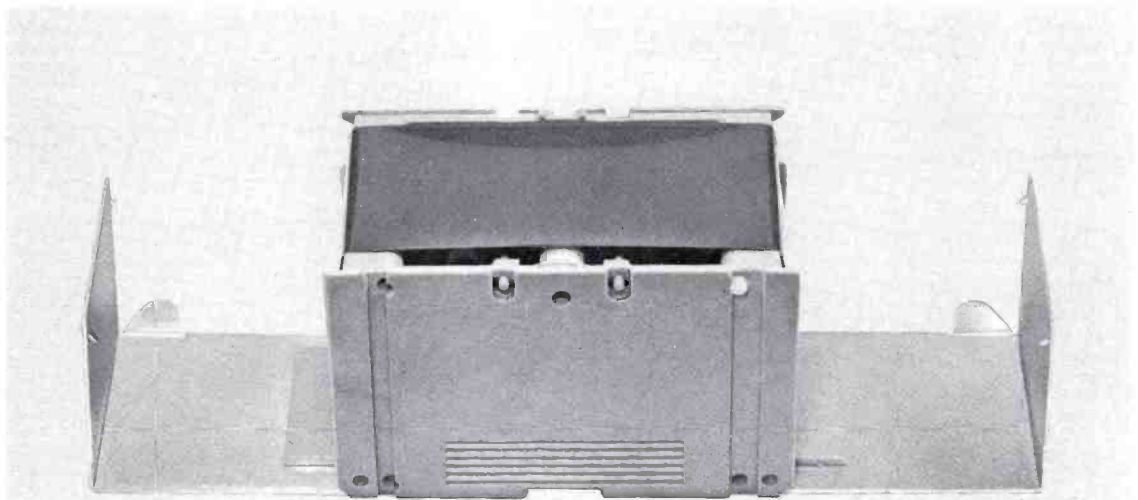


3. Video Tape Cartridge is molded plastic case approximately  $3\frac{1}{2}$  x 5 inches.

### Protected Video Cartridge

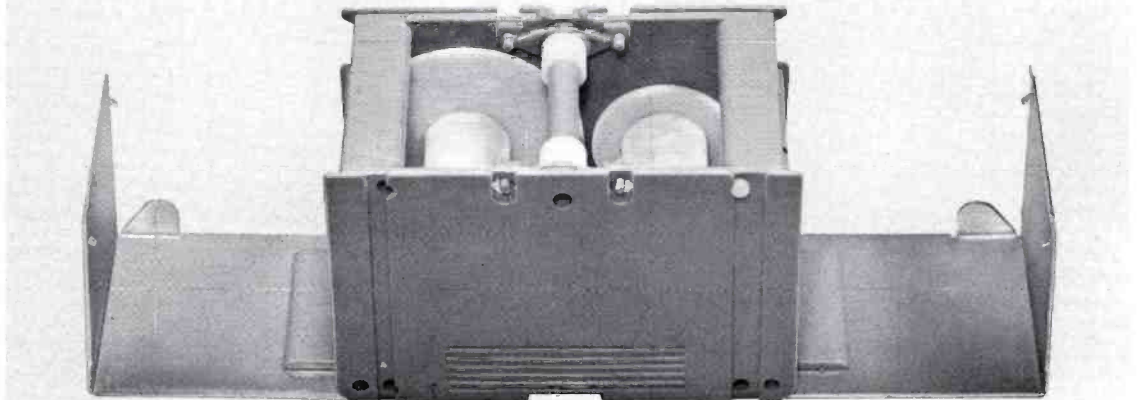
The cartridge (Fig. 3) is a molded plastic case  $3\frac{3}{8}$  x  $2\frac{5}{8}$  x  $5\frac{1}{8}$  inches with tape capacity adequate for three minutes of program time. When not in the machine, the cartridge is completely enclosed to protect the tape during handling and storage.

Composed of a U-shaped molded plastic frame, the cartridge (Fig. 4) has two wrap-around doors, enclosing the three open sides. The tape is captured between two plastic reels and wrapped around the outer edge of the cartridge. Two plastic reels (Fig. 5) are loosely supported by the frame to keep them approximately in position for engagement by the reel drive. The reels are spring loaded against one side of the frame to secure them during handling. Since the tape is always returned to the supply reel before the cartridge leaves the recorder, the tape is protected by the full flange during handling. To minimize the size of the cartridge the take-up reel is placed close to the supply reel. As the tape is transferred from supply to take-up reel it builds up into the area originally occupied by the tape on the supply reel.

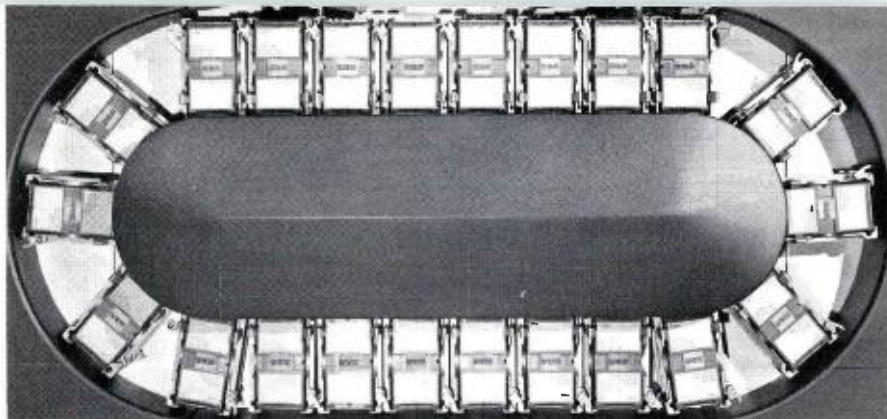


4. Cartridge doors open to show tape.

5. Inner construction of cartridge showing tape reels.







6. Magazine loaded with 22 cartridges.

### Magazine-Loading

The magazine (Fig. 6) is the cartridge storage device and the physical interface between operator and machine. The magazine contains 22 individual bins for storing cartridges. The bins are mounted on a continuous belt which can be indexed on command, clockwise or counterclockwise, to get the desired cartridge to line up with the entry portals. Indexing is accomplished by a photo electric sensor, which controls the actuation of a clutch and gearhead motor.

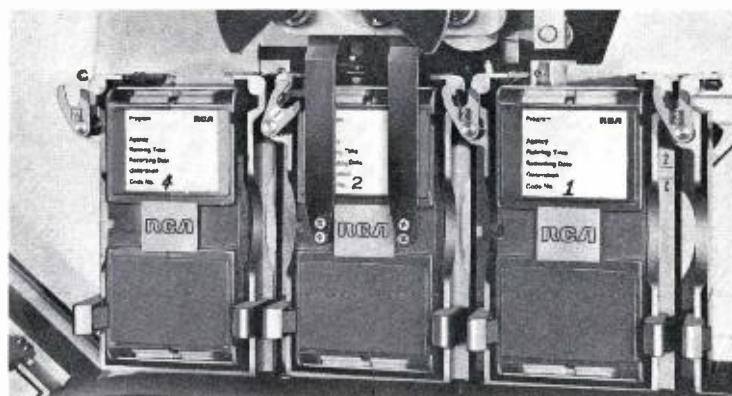
To transfer the cartridge into the recorder each entrance portal is equipped with a transfer station, containing pneumatically actuated claws and carriage. These claws engage the cartridge and as the carriage travels, pushes the cartridge through the entry portal. To retract the cartridge the reverse procedure is followed and the cartridge is pulled back into the bin.

All of the bins are continuously accessible to the operator for loading or unloading, however the operator needs to know which bins are being used. For this, small V-shaped, numbered flags are used as shown in (Fig. 7). By their position they indicate the status of the bin. If the flag is tipped to the right it physically blocks the entrance to the bin, indicating that its cartridge has been transferred into the recorder.

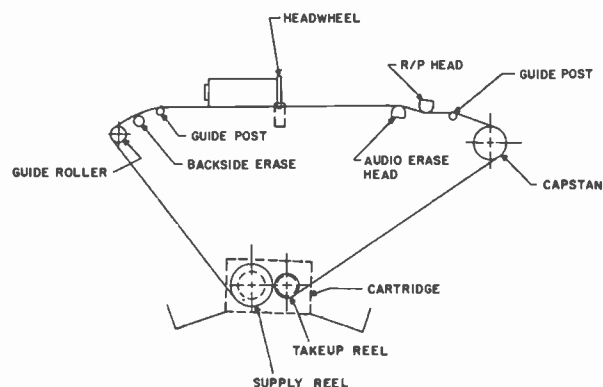
In addition to the mechanical mechanism, the magazine contains the logic required to perform the basic functions of indexing clockwise, counterclockwise, and transferring in and out. A photo electric reader provides continuous information to the recorder control system on the belt location.

### Protecting Tape

The two transports contain automatic threading mechanism in addition to the normal transport elements. To provide long tape life, the tape path (Fig. 8) and the threader have been designed to minimize contact with oxide side of tape. In the tape path, erase heads and guiding elements contact only the back side of the tape. A urethane coated capstan is used to provide the necessary tape drive force—without the



7. Close-up of transfer station.



8. Automatic tape threading path configuration.

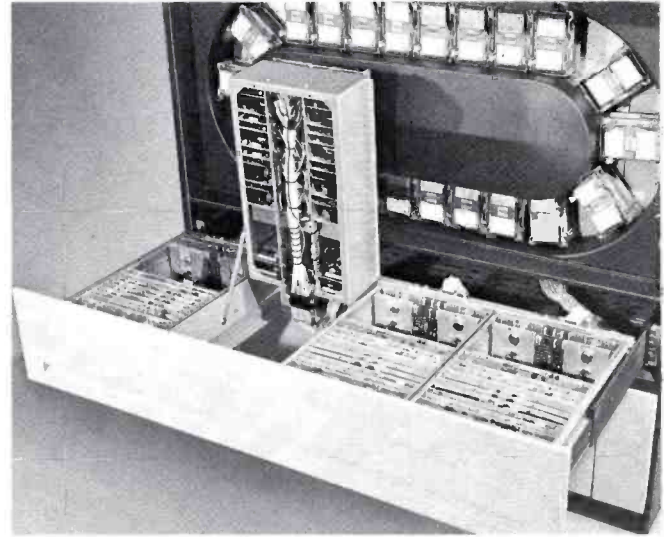
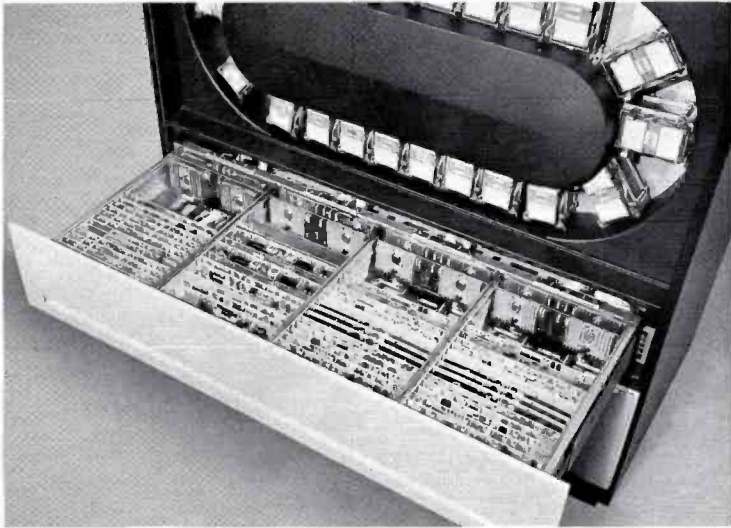
use of a pinch roller—and contacts only the back side of the tape. Therefore, the only elements that contact the tape on the oxide side are video, control track, audio and cue record play heads.

Besides the usual signal electronics which are mounted close to the magnetic transducers, the transport contains the control logic required to thread and unthread the tape. Photo-electric sensors have also been included to detect fail-safe reflective foil markers placed on backside of the tape near the start and end.

### Human Engineering

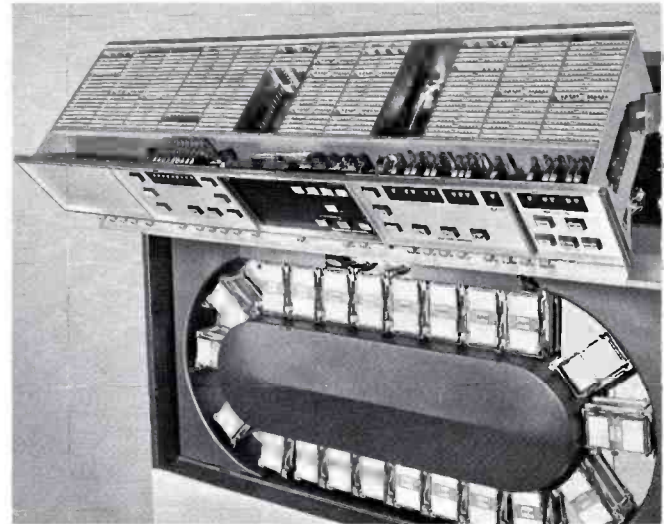
The console design and location of electronics and mechanisms has been human engineered to be con-

9. Signal and servo electronics accessible from front.



10. Electronics arranged for convenient servicing.

11. Control electronics swivel down for easy access.



sistent with the overall emphasis on simplicity and convenience to the operator. The magazine is located in the front, center portion of the console (Fig. 1), because in this position all cartridges are easily accessible. Transports are mounted vertically with the headwheels to the rear of the machine and the receiver of the automatic threader mechanism is in line with the magazine transfer stations and directly behind them.

The signal and servo electronics (Fig. 9) are located in a drawer that runs the width of the recorder immediately below the magazine. The drawer can be slid out, completely exposing four nests (Fig. 10) of printed circuit cards. The control panels are conveniently located above the magazine on a slide out drawer containing the control electronics (Fig. 11). The control drawer can be swiveled to provide access to the printed circuit cards and to the wire wrap connections on the under side of the nest. The control electronics consist of 215 standard integrated circuit logic cards.

#### Convenient Controls

The operating controls are grouped on three panels: Record Control, Play Control, and Transport Control.

Conveniently located across the top front of the machine, this complete control center is within easy reach of the operator.

The Record Control Panel (Fig. 12) contains three sets of controls. First is a group of thumbwheel registers which provide the input to the automatic record function. The Message End Time register controls the length of the recording and the location of the start and end cues. The Start-Cue Shift register can be used to shift the effective start of the message by plus or minus 29 frames. The External Source Pre-Roll register controls the starting of an external piece of equipment—as the source for a cartridge recording.



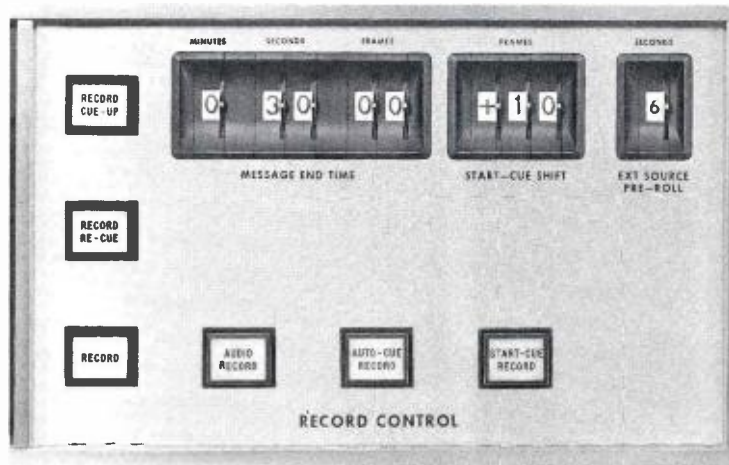
The second set consists of the Record Cue-Up and Record Re-Cue controls which are used to select the cueing of the cartridge before a recording can be made. The third set of controls is used to make recordings. The Record button is used to make a complete recording and the Auto-Cue Record is used to make a new start cue and a new end cue. Both of these record functions are controlled in length by the Message End Time register. Finally, there are the Start-Cue and Audio Record controls. After any one of the recording cycles just described has been completed, the cartridge automatically rewinds and re-cues ready for previewing.

Located on the Play Control Panel (Fig. 13) is the "Automatic AB Sequence Control" and the "Automatic" pushbutton for selecting this mode of playback operation. There are nine thumbwheels in the sequence control, each representing a sequence which can be programmed to play up to eight cartridges automatically. There are also controls to select the Cueing or Playback of the cartridges as well as previewing an Automatic Sequence.

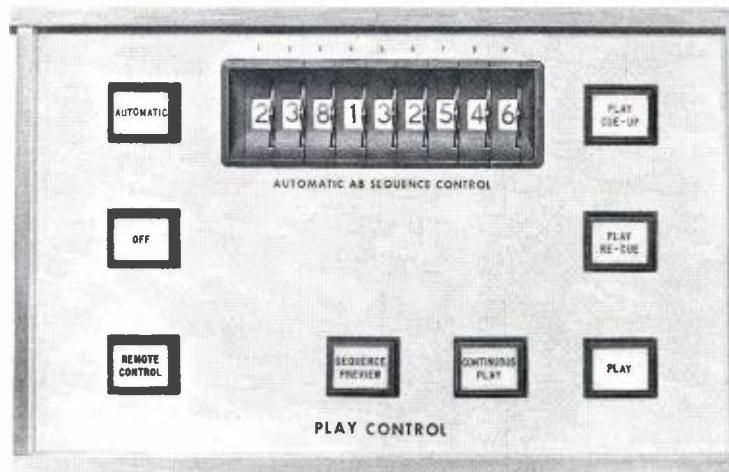
The controls on the Transport Control Panel (Fig. 14) are used to select the transport option in which the machine is to operate and the magazine position. This panel also has a cartridge reject control. A reset control is used to stop all operation of the machine and to reset all logic functions to the initial conditions. The left half of this panel is a back-illuminated status indicator. Capable of displaying 40 status and mode situations, the indicator marks a very significant contribution. The operator knows at all times what is happening inside the machine.

#### Automatic Operation

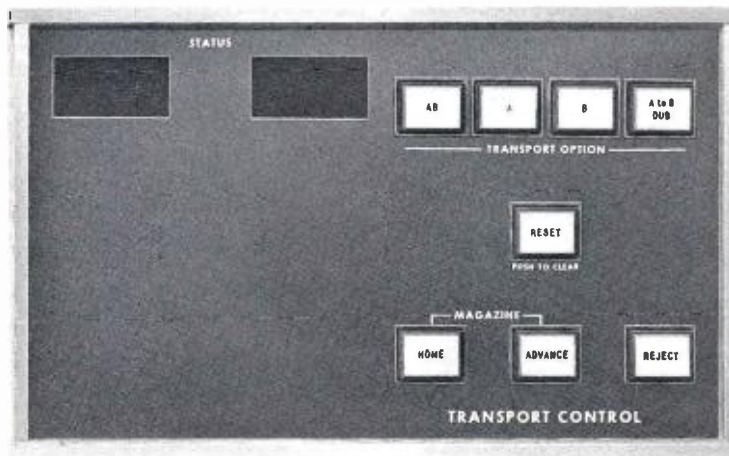
Up to this point, the essentials of the system have



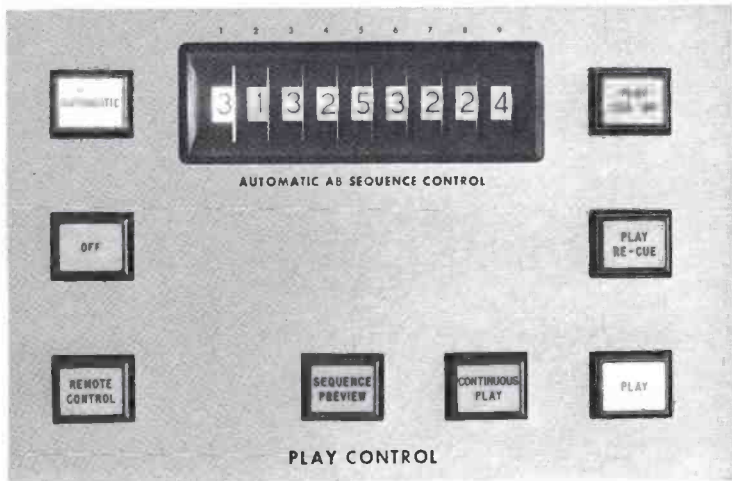
12. Record Control Panel.



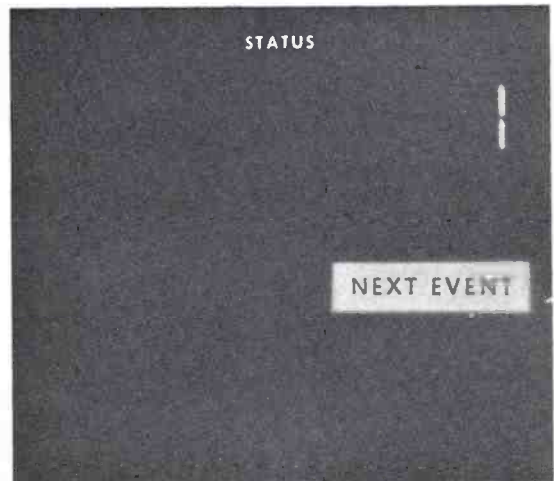
13. Play Control Panel.



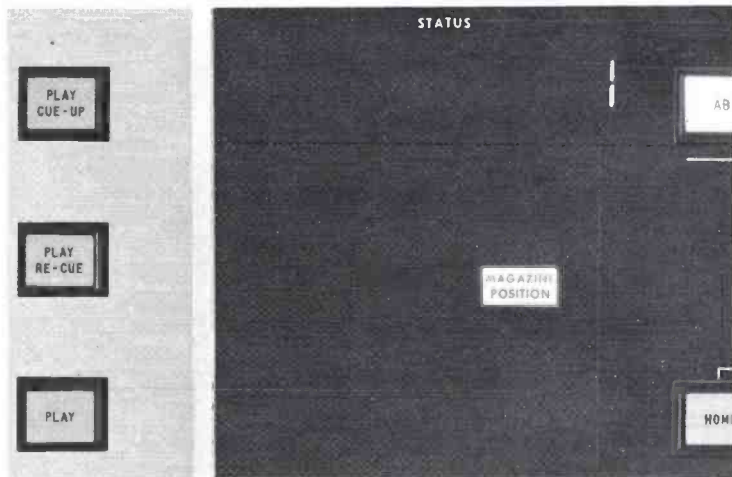
14. Transport Control Panel.



15. Play Control Panel—Set to automatically air 3 events during station break.



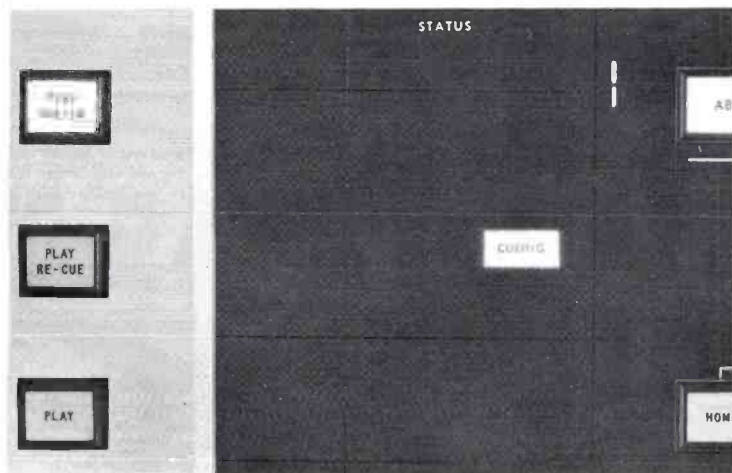
18. Event No. 1 is Next Event.



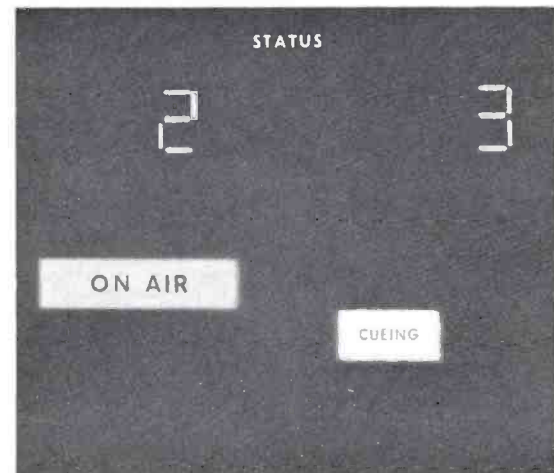
16. Status Indicator on Transport Control Panel—Showing Event No. 1 is in magazine position.



19. Event No. 1 On Air, No. 2 is Next Event.



17. Event No. 1 is Cueing.

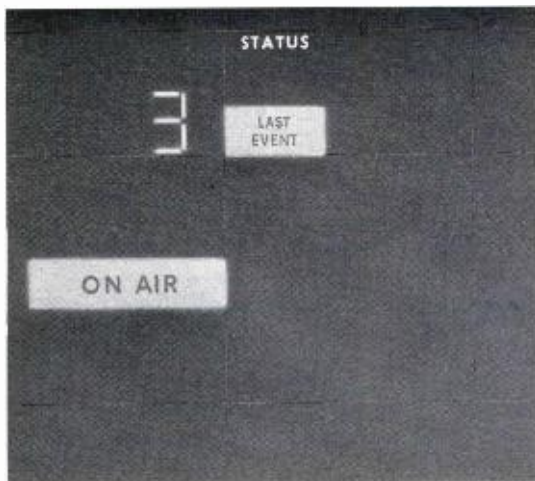


20. Event No. 2 is now On-Air; No. 3 is Cueing.





21. Event No. 2 is still On Air while No. 3 is ready for Next Event.



22. Event No. 3 is On Air and is Last Event.



23. While No. 3 is still On Air No. 4 is Cueing.

been described. Now the operation of the machine in its most useful mode, the Automatic AB Sequence, will be described. Illustrations from the Status Indicator will be used to show what the operator sees during automation of a station break.

Consider a sequence of three cartridges, containing a commercial, a promo, and an ID, all to be played during a station break. The sequence starts from the Home (No. 1) position. The automatic AB Sequence Control thumbwheel has been set for Number 3 and "Automatic" operation selected, as indicated by the illuminated areas on the Play Control panel (Fig. 15). The Transport Control panel (Fig. 16) indicates the AB transport option has been selected and that the magazine is in position and ready to deliver the No. 1 cartridge to the appropriate transport. A Play Cue-Up command (Fig. 17) has been issued (required only to start the first sequence, the remaining cartridges are loaded automatically in sequence) and the No. 1 cartridge has been loaded and is now cueing. At the end of the Cue-Up cycle, No. 1 is ready to put ON AIR and is so indicated as the NEXT EVENT (Fig. 18).

An ON AIR-PLAY command is issued from Master Control (Fig. 19) and the No. 1 cartridge is ON AIR in just two seconds and cartridge No. 2 is now the NEXT EVENT. Two seconds before the end of No. 1, a cue derived from the pre-recorded end cue is used internally to pre-roll No. 2 on the other transport. When No. 1 is finished playing cartridge No. 2 is ON AIR (Fig. 20) No. 1 rejected and No. 3 is cueing.

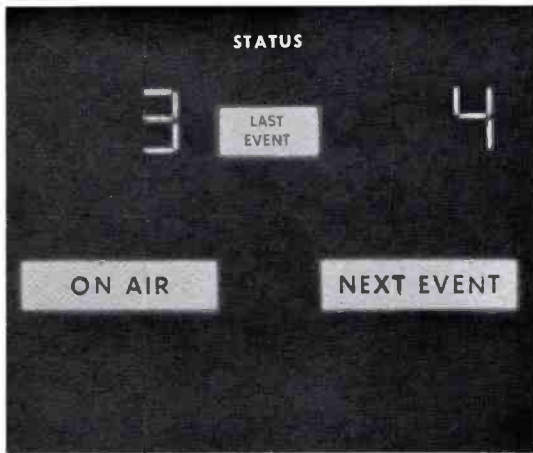
When the cueing cycle is complete No. 3 is the NEXT EVENT (Fig. 21). Two seconds before the end of the ON AIR No. 2 cartridge, a start cue is sent to the NEXT EVENT transport and No. 3 (Fig. 22) cartridge is ON AIR in two seconds.

In addition to an ON AIR status, No. 3 is also the third event in a sequence of three and is therefore indicated LAST EVENT. Since this is the last cartridge in the sequence, a start cue for the next event will not be sent to the waiting transport but instead an earlier cue derived from the prerecorded end cue is sent to Master Control 10 seconds before the end of the message as a cue for the next program source.

In the meantime (Fig. 23), cartridge No. 2 has been rejected and cartridge No. 4 is cueing and will become the NEXT EVENT (Fig. 24) as well as the first cartridge in the next sequence.

#### Uniform Standards

The subject of record control and automation of playback is not complete without consideration of record standardization. An inherent requirement is that recorded cartridges must be played with the machine at one condition of adjustment, since the system is designed to eliminate operator adjustments for each individual recording. This kind of performance is possible because the system includes all of the automatic correction devices available (guide servos, ve-

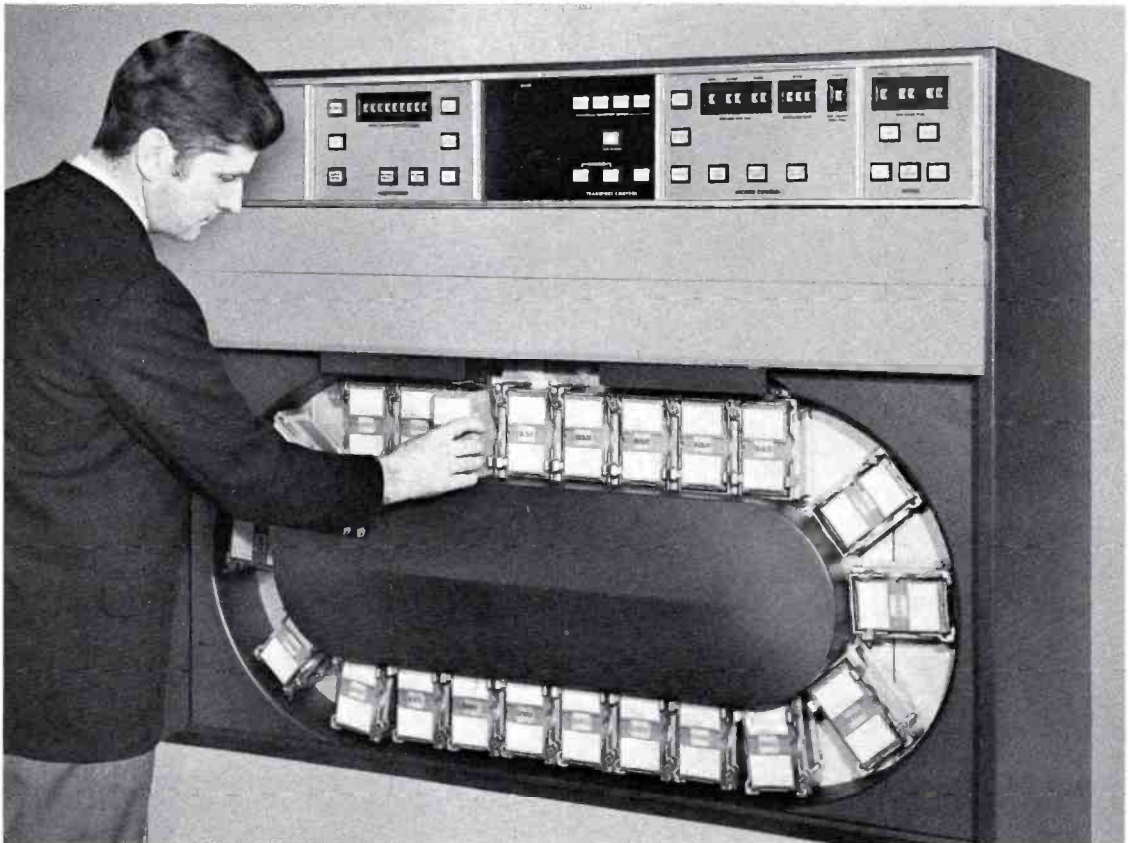


24. No. 4 will be Next Event in the following station break.

locity error corrector and line-by-line chrominance amplitude compensator). The electronics is designed to have excellent long-term stability of adjustment, and—most importantly—all recordings are certified for correct performance in the system at the time they are made.

This last point warrants more explanation: Normal

25. Changes in programming may be made by merely changing cartridges.



operation of the system requires that a set-up routine be performed periodically, probably daily in most installations. In this routine procedure, the playback system of the cartridge recorder is equalized for optimum playback of a standard test cartridge. With the playback system adjusted this way, the machine's own recording is then checked and adjusted, if necessary, to insure that the playback system and its automatic correction devices are still in center-range. This will guarantee that the system is recording in a range that can be accommodated in playback, even when interchanged into another machine.

#### Accuracy and Economy

In summary, two fundamental innovations—automatic tape threading, and a compact system of specialized logic, made feasible by integrated circuits—have been combined to yield a totally automated tape handling system, employing preloaded video cartridges. This system presents a solution to the increasing problem of handling many short program segments in rapid sequence. It frees men and machines, it eliminates handling of video tape, it switches faultlessly. It automates the station break and at the same time provides the nucleus of a television station automation system.



# THE PROFESSIONAL SOUND IN RADIO AND TV

Echo send . . . echo receive . . . slating . . . panpots . . . performer reinforcement . . . audience reinforcement . . . foldback . . . dub down . . . mix down . . . submastering . . . backloading . . . all are audio techniques once used only in film and disc recording. The sound was alive and exciting. But the special processing equipment that made it possible was bulky, difficult to operate and very expensive.

Later, advancing circuit technology brought equipment of this kind to within reach of the broadcaster. The new systems were compact, simpler to operate, and their performance capabilities greatly expanded and improved.

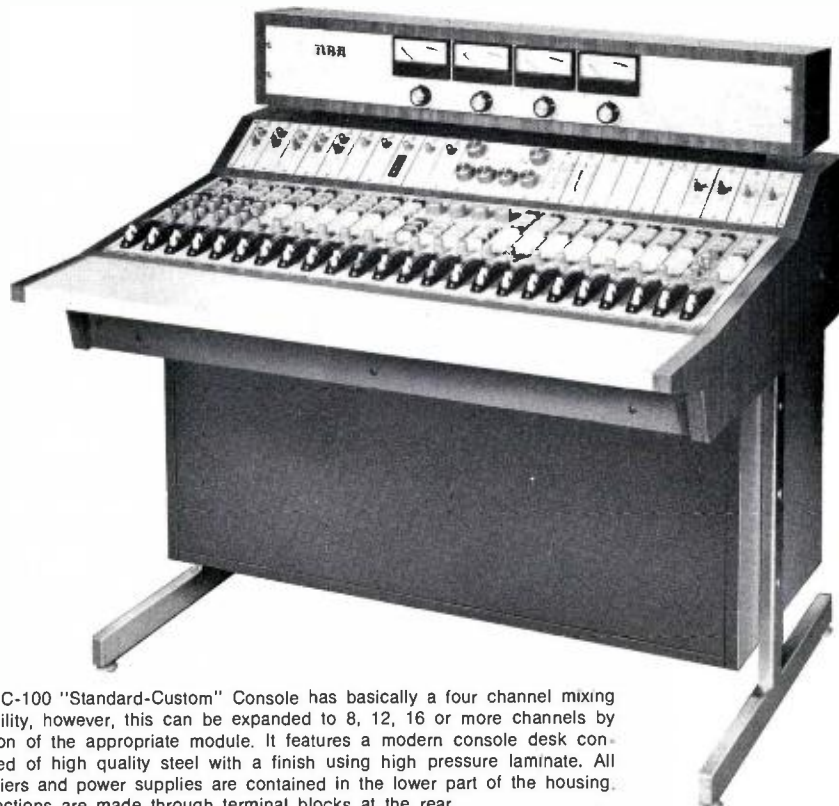
Today, leading producers—in television and in radio—are using this new equipment and sound recording concepts to produce programs for syndication.

## New Emphasis on Audio

Widespread interest in stereo, and other factors, have combined to give audio the prominence in radio and

TV broadcasting it deserves. Television stations are placing more and more importance on the audio portions of their programs. Many stations video tape most of their programs, and so they need elaborate facilities to produce the desired audio effects. Many radio and TV plants are completely replacing antiquated audio systems rather than attempting to modify them, plus the sophisticated audio that is now required for mobile production facilities.

Some programming does not call for elaborate audio mixing systems. For these, "standard", off-the-shelf consoles are adequate. However, where requirements are far beyond the ordinary, custom designed equipment may be needed. Custom consoles are generally one-of-a-kind systems, designed to a set of specifications. They are somewhat more costly, and require close communication between customer and manufacturer. This will ensure that the final product meets the customer's needs.



The BC-100 "Standard-Custom" Console has basically a four channel mixing capability, however, this can be expanded to 8, 12, 16 or more channels by addition of the appropriate module. It features a modern console desk constructed of high quality steel with a finish using high pressure laminate. All amplifiers and power supplies are contained in the lower part of the housing. Connections are made through terminal blocks at the rear.

### "Standard-Custom" Console

Having filled a wide variety of audio equipment requirements over the past several years, RCA has evolved a series of fully modularized, "standard-custom" consoles, Type BC-100. They are standard because they use building block modules; custom because they allow anyone, in effect, to design his own console. They provide a ready solution to satisfy the chief engineer's design requirements and allow a substantial reduction in time and design cost. It is a simple matter to expand a system by use of the standard modules.

Modular techniques also allow a great deal more circuitry in a package of given size. The beautifully styled, laminated cabinet accommodates any number of standard mixer and submaster modules. Approximate dimensions for a 20-input, 4-output console are only 54 inches wide by 42 inches high by 37 inches deep. Illuminated alternate action pushbuttons permit simultaneous multiple output feeds. This feature may be used for simulcast with breakaway capabilities for separate commercials or announcements. Master gain controls are rotary attenuators which may be either ganged or separate.

The flexibility of the BC-100 provides so many variations around a basic design that it finds wide application in TV and radio studios, in production facilities, recording studios, and wherever there is need for high quality custom audio.

### Input Versatility

The BC-100 offers a choice of five self-contained input modules. Two of these, the BA-101 and BA-103, are for low level inputs. The BA-101 is a single input module, the BA-103 a three-input module. Each includes a plug-in solid state operational amplifier. Both units have a gain reduction switch to prevent input overloads, and will accept a high level input.

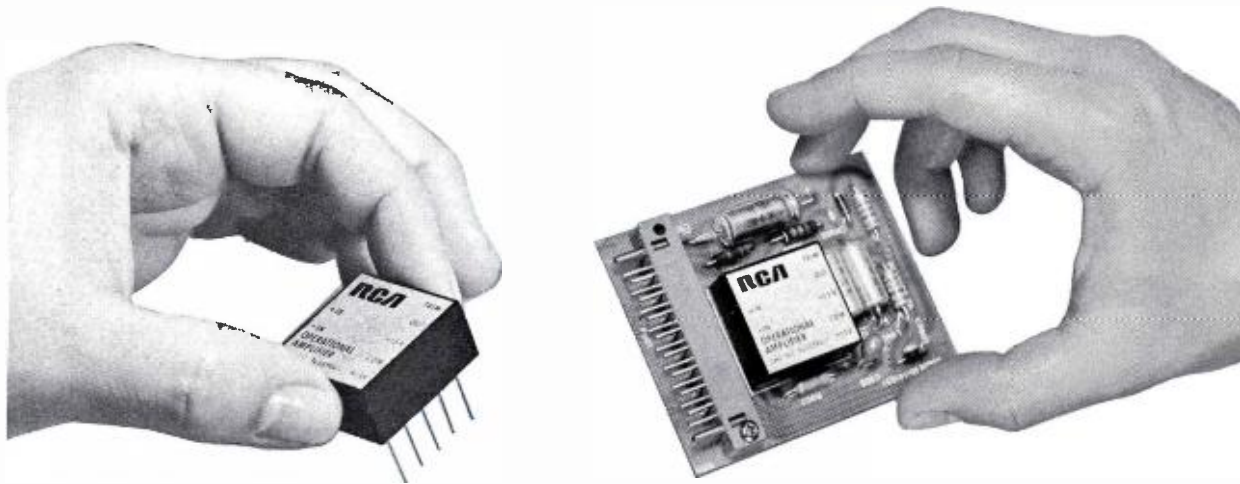
Three of the five modules are for high level inputs. One of these, the BP-101, accepts a single high level input. The BP-103 is switchable to any one of three inputs, and the BP-107 is a pushbutton, 7 x 1 relay switcher. The BP-107 inputs can be arranged in pairs to give cross-fade capability between inputs. Jackfield patching may also be used to provide increased input selection.

### Mixer Facilities

Standard mixer modules consist of a vertical sealed attenuator, Op-Amp booster amplifier, echo select and level control, submaster delegate switches, cue and fold-back select switch. These modules are interchangeable and are mounted by their plug and jack connectors. All are wired to accept a plug-in equalizer any time. Signals are mixed through a bridged-T attenuator. A dual concentric switch allows pre- or post-selection of echo and adjusts the level of the signal.

### Audio "Op Amp"

The RCA Audio Operational Amplifier is a high-



Operational Amplifier in miniaturized module, showing use in finished audio amplifier.



quality module assembled with miniature discrete components in a small rugged package, taking up little more than half a cubic inch of space, and completely sealed and potted for reliability and long life.

Its outstanding electrical characteristics, such as wide bandwidth, extremely high gain and high input impedance, permit the adaptation of analog computer circuits to audio design. This allows the engineer to design circuits having greater precision and flexibility and with more consistent performance between finished audio products.

A typical finished audio amplifier consists of an Op Amp with a feedback circuit that precisely sets the overall characteristics, and an input and/or output transformer if needed. For example, in a pre-amp circuit, the Op Amp, as the active device, will provide all the necessary gain while passive devices (resistors and capacitors) in the feedback path set the desired audio characteristics of the total unit. Amplifiers with more complicated transfer functions—such as equalizers—may be provided by proper selection of the feedback components. In addition, when compared to a conventional transistor design of similar quality, the Op Amp unit will contain fewer components, since all the gain is in one small package.

The Op-Amp operates from a supply voltage of  $\pm 16$  V DC and provides a +20 dBm signal into a 600 ohm load. Noise and distortion specifications are equal to, or better than, present transistor equipment.

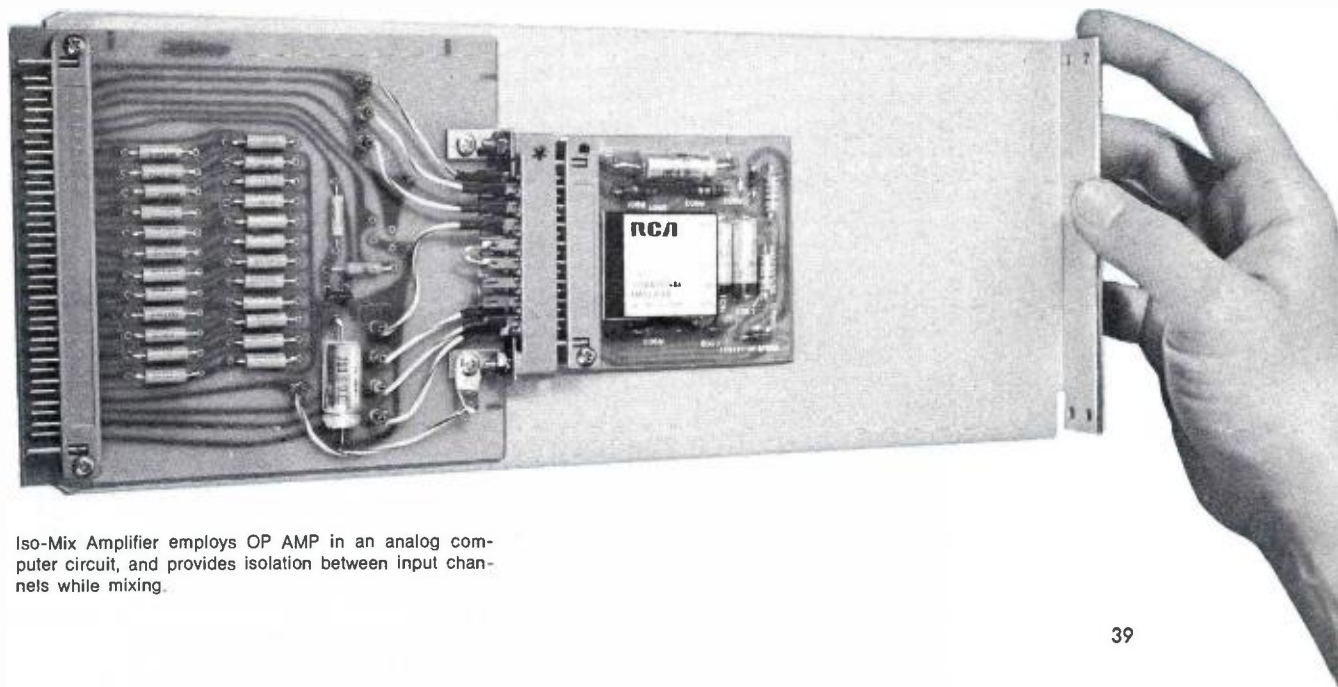
### Submaster Modules

Any number of submaster modules can be accommodated depending upon requirements. Each submaster module contains an echo mixing network, echo return and level control, attenuator, program output selectors and a submaster monitor gain control. Program-out channel select switches allow all submasters to feed any output line. Multiple output feeds permit simulcast programming with breakaway capability for separate commercials or announcements.

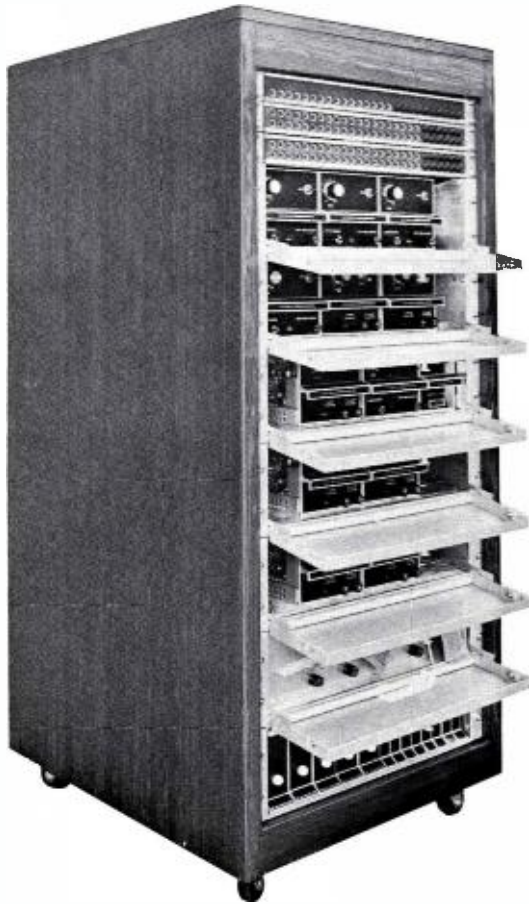
### Monitor Control Panel

The monitor control panel may be designed to customer preference. Generally, it contains the following controls: cue level, monitor, performer reinforcement, foldback, echo master and a combination of pushbuttons to select the desired monitor.

In the most basic facility, a control monitor and VU meter are permanently connected to output channel one. A VU meter is also tied to each of the other outputs. A second monitor amplifier bridges the four output lines through a four-position select or switch. Four speaker feeds may be provided if required. From each submaster module there is a manually controlled bridging feed which may be used as a separate monitor feed. It may also be used to feed a four track recorder from the submasters, while mixing down to one or two-track feeds in the program output circuits. Standard pre-hear facilities are provided by a com-



Iso-Mix Amplifier employs OP AMP in an analog computer circuit, and provides isolation between input channels while mixing.



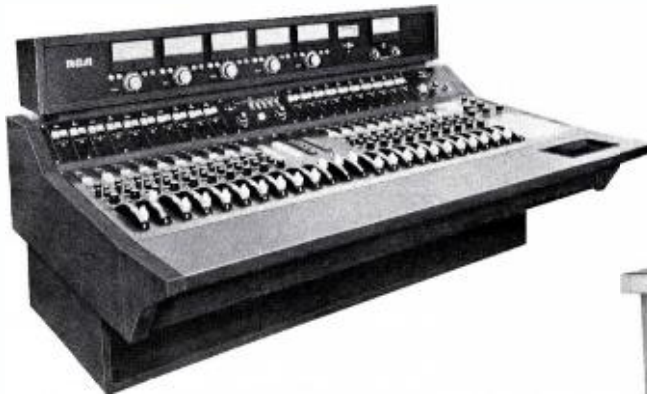
mon monitor amplifier fed from the cue position of the mixer module.

#### Foldback Features

The use of a foldback monitor eliminates the need for microphone muting circuits. This speaker feed to the studio provides selected high level sound into the studio with the microphones on. The fifth selector switch on the high level mixer modules provides this feature for "lip-sync" operation with a performer, as well as standard cue functions. The foldback feed is also useful for audience reinforcement functions. On the designated low level mixer modules, the foldback switch is unwired. The third selector switch on sub-masters one and two are also unwired. If desired by the customer, either of these outputs may be wired to provide monitor feeds to the studio. When used under guarded conditions, this audio is convenient, for example, to provide sound reinforcement of a soloist to an orchestral group. If the soloist is at a distant part of the studio, or even at another location, it is essential that performer reinforcement be provided for timing purposes. Another important utilization of this feature is for playback of a particular track during a re-dubbing session. Some audience reinforcement problems may also be solved using this facility. Of course, if conventional microphone muting circuits are desired, they can be provided.

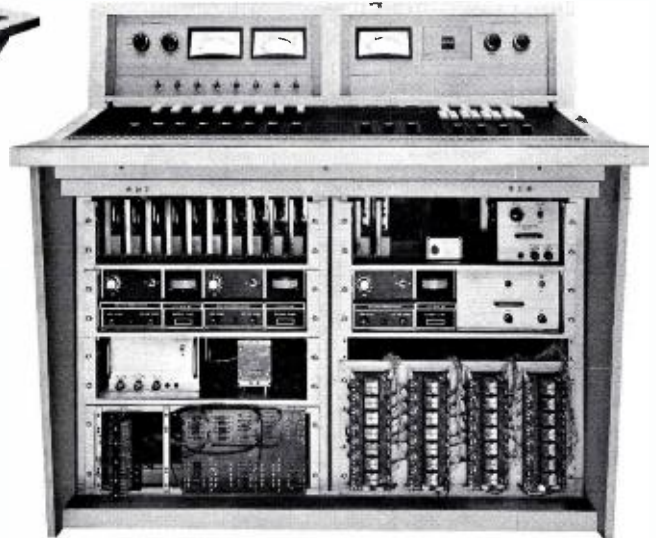
#### Echo Facilities

Echo send facilities include the echo select switches and level control on the mixer module. These are



Custom console built for LewRon offers 20 inputs, which can be fed to any or all 4 output channels. A fifth output channel is equipped with AGC. Each channel feeds a one-by-two splitter. Slating switch and tone oscillator are included. A matching rack houses mike input plugs, power supplies and jack fields.

New custom console for WWL mobile unit provides 12 input faders, 8 of which are switchable to 3 mike inputs. Four connect through switchers to 7 high-level inputs. All inputs can be delegated to any of 3 output channels. Includes PA bridging, AGC, cue, a panel mounted cue speaker and selectable intercom facilities.





combined in the echo send "Iso-Mix" unit which provides isolation between inputs and 15 dB gain to the signals. A master echo send level control and booster amplifier provide proper signal level to the reverberation device. One of the popular audio delay devices requires a single combined input and produces two out-of-phase outputs. For this reason, a single echo send feed is desired. The echo return is controlled by a three-position selector switch and level control located on each of the submaster modules.

#### "Iso-Mix" Amplifier

The RCA "Iso-Mix" amplifier provides isolation between input channels while mixing input signals into one output. It will mix together any number of inputs up to 30 at no loss and at the same time effectively isolate the inputs from each other by more than 90 dB.

These improvements over the conventional resistor mixing bus circuit are achieved by using the Op Amp in an analog computer adder circuit specially adapted for audio use. Since the circuit contains an active device, loss-less mixing is accomplished. Mixing with gain is also possible should it be desired.

Iso-Mix operates from a  $\pm 16$  V DC supply and has a maximum output of +20 dBm. Impedance at each input is high, bridging a 150/600 ohm source.

#### Program Output Options

The BC-100 has basically a four channel mixing capability. However, this can be expanded to 8, 12, 16 or more channels by addition of the appropriate module.

#### Modern Console Desk

The attractive and durable console housing is constructed of high quality steel with a finish using high pressure laminate. All amplifiers and power supplies are self-contained in the lower part of the housing. Connections to the console are made through terminal blocks at the rear. The front arm rest is removable allowing the console to fit through a 30-inch door opening. A matching short rack is also available to house patch panels, additional amplifiers, test equipment, etc., if required.

#### Audio Processing Terms

**ECHO SEND**—The amount of signal which is introduced into the reverberation unit.

**ECHO RECEIVE**—The amount of signal returned from the reverberation unit.

**FOLDBACK**—A system of monitoring without the use of muting relays.

**MIX DOWN**—Electronic re-recording from multiple monophonic tracks to 2 or 3 track stereo or composite mono.

**AUDIENCE REINFORCEMENT**—A system where audio from the audience mikes is fed back to the studio to boost the level of audience sound relative to program.

**BACKLOADING**—Placing of a load on a circuit to effectively terminate it.

**PERFORMER REINFORCEMENT**—A system where audio from a performer's mike is fed back to the studio to boost the level of performers sound relative to program.

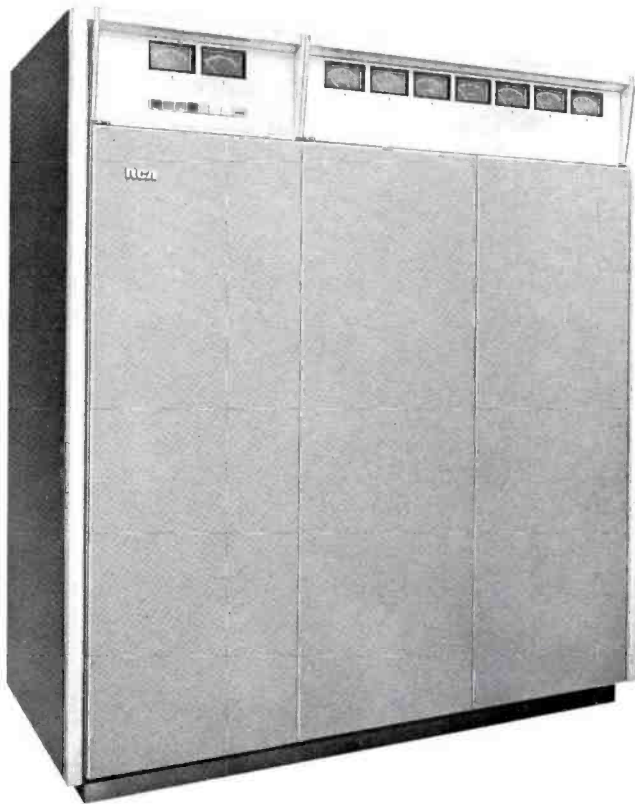
**PAN POT**—An electronic control for positioning of program material from one side to the other without affecting the overall level.

**SLATING**—The introduction of titles or instructions into the program material.

**SUBMASTERING**—The feeding of all inputs to a group of centrally located faders for ease of operation.



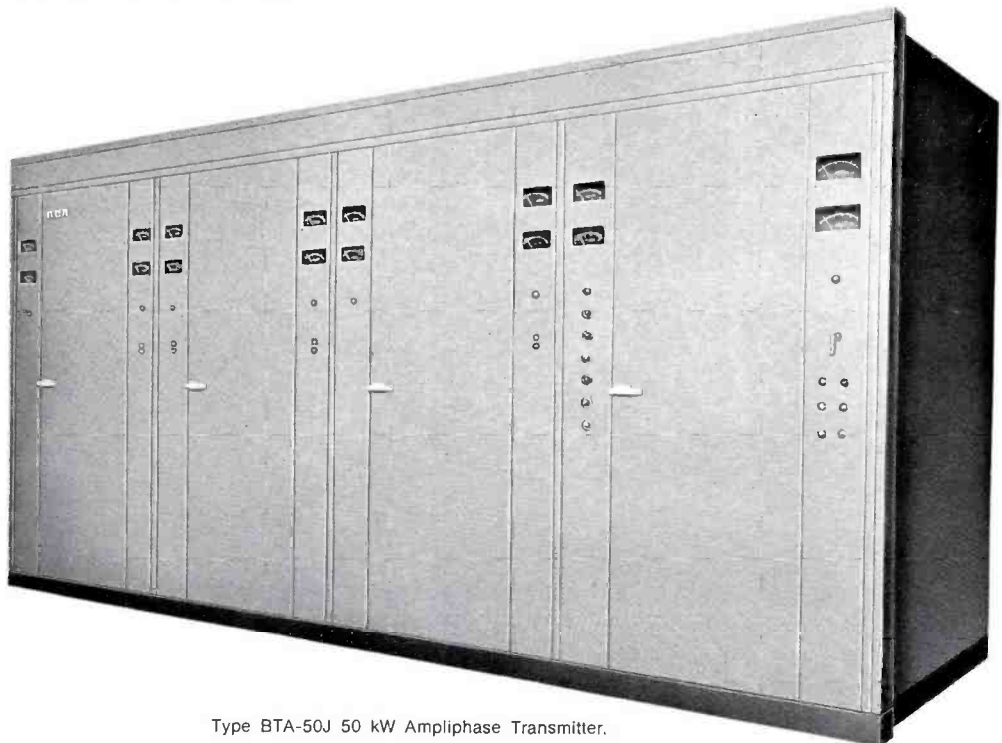
Custom console for KOMO color mobile unit handles 10 mikes and 14 high level inputs. Three mixer busses and three submaster controls combined into three output channels with one-by-two splitters. The console also includes ten-by-two switching matrix, cue, echo send and receive, foldback and output monitoring.



# NEW SOLID STATE AM AMPLIPHASE TRANSMITTERS

J. L. PRESTON\*

Type BTA-5L/10L New 5/10 kW Ampliphase Transmitter.



Type BTA-50J 50 kW Ampliphase Transmitter.



The large selection of solid state components on the market today and their inherent advantages of long life, high reliability and maintenance-free performance prompted the design of a series of medium and high power AM transmitters using the ampliphase system of modulation.

Included in the new line are the 5 kW BTA-5L, 10 kW BTA-10L, 50 kW BTA-50J and, for international use, the 100 kW BTA-100J and 200 kW BTA-200J. All feature drastically reduced tube complements, superior modulation capability and greatly extended audio frequency response.

### Improved Audio Quality

A unique system of high-level modulation known as Ampliphase combined with a completely solid state exciter-modulator makes these new high performance, air-cooled transmitters practical. Ampliphase, with its Class C amplifiers, combines the efficiency of plate modulation with the economy of low level modulation. It produces an amplitude modulated signal with excellent frequency response and exceptionally low distortion. Inherent linearity and the elimination of iron core high level transformers results in a transmitter capable of being modulated over a frequency range of 10 to 30,000 Hz. Even on inexpensive portable AM radios, the outstanding audio quality becomes immediately apparent.

Unlike plate modulated transmitters, these Ampliphase transmitters are capable of continuous (sine wave) 100 percent modulation. This feature permits a higher average modulation level, resulting in a greater usable signal at the listener's receiver. It is the equivalent of a substantial increase in transmitter power, particularly in fringe reception areas. This "bigger sound" is one of the many excellent characteristics of Ampliphase transmitters.

### Reduced Tube Complements

Transistorizing the exciter-modulator, a unit common to all these transmitters, drastically reduced the tube complements—in some cases to as little as one-sixth that required by other transmitters of the same power. The 5 kW BTA-5L has a total of only 4 tubes (two types); 2 drivers and 2 PA tubes. The BTA-10L has 6 tubes (two types); 4 drivers and 2 PA tubes. The 50 kW BTA-50J also has only 6 tubes (three types); 2 drivers, 2 intermediate power amplifiers and 2 PA tubes. The 100 kW BTA-100J uses the same tubes as the BTA-50J but parallels 2 PA tubes in each channel, making a total of 8 tubes. The 200 kW BTA-200J parallels 2 BTA-100J's.

\*AM Transmitter Product Analyst

### 5 kW Expansible to 10 kW

The 5 and 10 kW transmitters are identical except for power supplies, tube types in the PA's, and of course power output. The 10 kW uses parallel 8122 tubes in each IPA driver while the 5 kW uses only one. Each 5 kW PA uses one 3CX-5000H3, and each 10 kW PA uses a 3CX-10,000H3, both ceramic types. The 5 kW is field-convertible to 10 kW.

Both transmitters are completely self-contained in the same size cabinet which occupies less than one and one-half square yards of floor space. There is room in the cabinet for an optional spare exciter. It includes a switching arrangement for fast exciter substitution. All of these transmitters are factory-wired for remote control, and are fully compatible with RCA remote control systems.

### Ampliphase Ideal for Transistorization

Before the design of these solid state transmitters, several amplitude modulation systems—high level plate, low level, Doherty—were explored to determine the one best suited to transistorization.

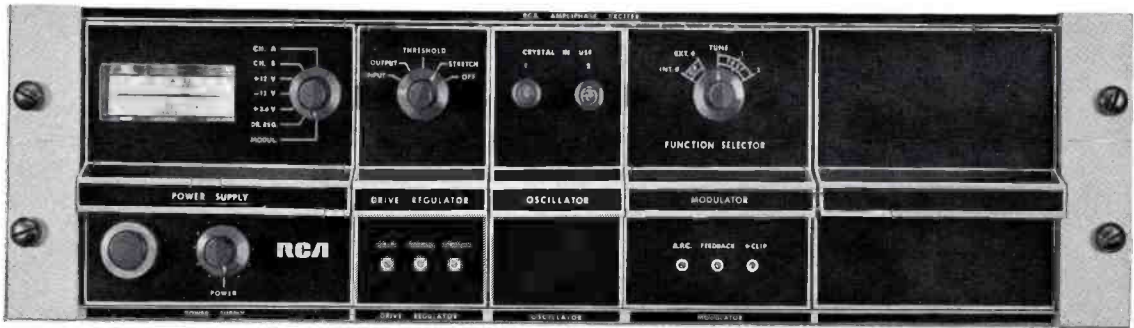
Since transistors must be confined to relatively low power applications, a system using high level plate modulation would not be conveniently adaptable. Of course, many of the audio and RF circuits of these transmitters could be transistorized. However, because of the relatively high power levels in the intermediate stages, the high level, plate-modulated transmitter would still require a large number of tubes, plus the complication of partially transistorizing both the RF and AF channels.

Linear amplifiers were considered and although they offered inherent low level modulation characteristics, medium and high powered transistors would be necessary to produce linear amplification of the magnitude required in these transmitters.

Finally, it appears that Ampliphase, an improved version of the "outphasing" system pioneered in 1935 by the Frenchman, H. Chireix, and first introduced commercially by RCA in 1957, held the answer to transistorization. Ampliphase had the advantage of introducing audio at low power stages and actually producing amplitude modulation within the high power RF stages. It meant that transistorization could take place in the exciter-modulator.

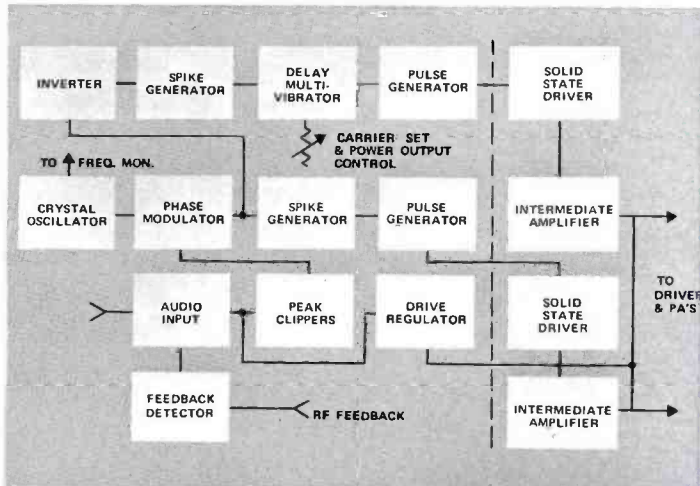
### Phase-to-Amplitude Modulation

Ampliphase is a word that describes phase-to-amplitude modulation. It is a technique whereby amplitude modulation is formed across a single capacitive element coupled directly to the transmitting antenna system. To accomplish this, a portion of the transmitter outside of the active components converts phase

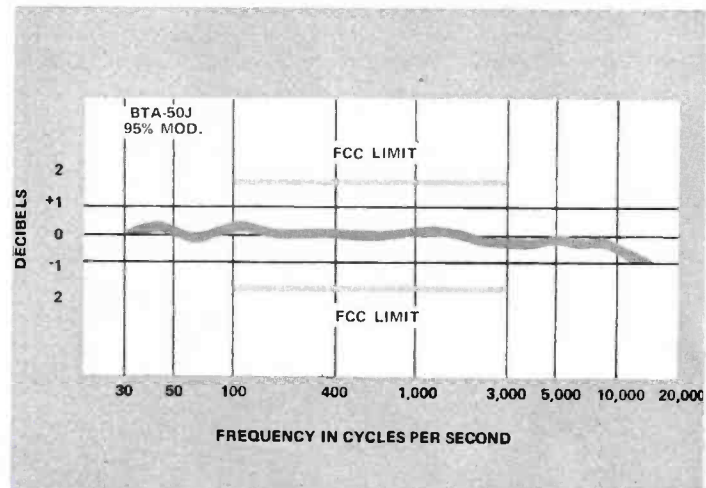


Solid State Ampliphase Exciter-Modulator.

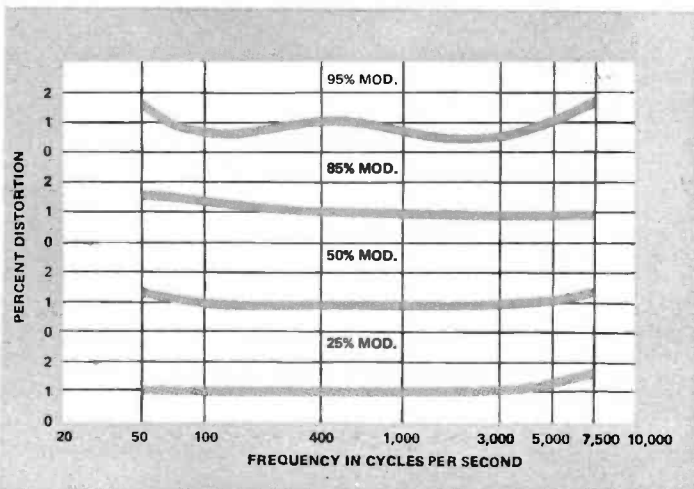
Block Diagram of Ampliphase Exciter-Modulator.



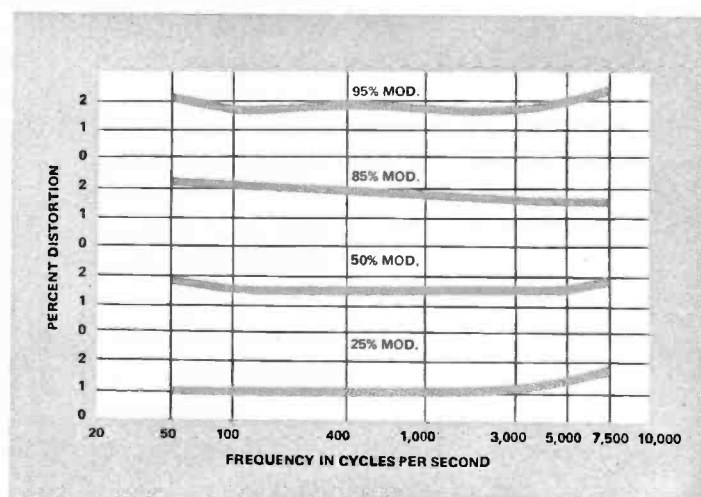
Frequency Response Curve of Type BTA-50J 50 kW Ampliphase Transmitter.



Distortion Curves of Type BTA-50J 50 kW Ampliphase Transmitter.



BTA-50J performance in highly reactive side-band impedances at various modulation levels.





modulation into amplitude modulation. (In order to fully appreciate the advantages of the system, and since it produces an identical amplitude modulated signal, the fundamentals of plate modulation and the means of achieving it should be reviewed.)†

### Exciter-Modulator Circuits

In the solid-state Ampliphase exciter, the basic frequency to which the transmitter is tuned is generated by a highly stable FET crystal controlled oscillator. Two temperature controlled crystals included in the oscillator are switchable by means of front panel controls on the transmitter.

Audio input applied to the transmitter after being shaped by peak clippers is applied to the phase modulator. The output of the FET oscillator is shaped into a symmetrical triangular waveform. The triangular waveform and the audio are compared in a zero crossing detector. This produces a pulse varying in width at an audio rate from something greater than zero to something less than 360 degrees.

The output of the phase modulator is then split and fed to the two separate chains. The first chain passes through a 180 degree phase inverter. The leading edge of the pulse is used to trigger a spike generator in the second chain; the trailing edge of the pulse is used to generate a spike in the first chain.

These two spikes now correspond to the phase modulation moving at an audio rate. One spike is delayed by a multivibrator and set so that when the carrier is not being modulated the time differential between the spikes is 135 degrees. The delay multivibrator has a vernier control, used for fine power adjustments.

The spike in each chain is then used to trigger a pulse generator, which produces a pulse approximately 120 degrees wide to drive the solid-state drivers, which in turn drive the driver tubes in the transmitter. A feedback detector located in the solid-state exciter receives not more than 6 dB negative feedback to help reduce distortion and improve low frequency response.

The solid-state exciter is self-metering, featuring a built-in phase meter by which the phase relationship of not only the output of the exciter, but also of the two PA tubes may be measured. This phase meter allows easy set-up and a quick maintenance check.

### Ampliphase Performance Evaluation

System performance data taken from the 50 kW BTA-50J is typical of the superiority of the Ampliphase system.

The transmitter will operate within RCA's rigid specifications without feedback due to the unusually good linearity attainable. This also provides excellent audio high frequency response, and since there is no

modulation transformer, low frequency performance is not limited by the quantity of iron in the modulation components as in high level modulation systems. However, a moderate amount of overall feedback is generally applied to further improve low frequency performance and help reduce distortion. The excellent frequency response of the system is further illustrated by the curves on intermodulation distortion taken from the same transmitter.

### Inherent Stability

The Ampliphase system is inherently stable in many respects. Reasonable changes in load impedance have little effect on system performance. To demonstrate the range of sideband impedance variation into which the Ampliphase modulation combining point may normally work, a 50 kW transmitter was set up to work into a dummy load which offered a flat characteristic at all modulating frequencies. Transmitter output was fed through a high impedance series resonance circuit that provided 38-ohm reactance at 10,000 Hz above and below carrier frequency. Under these conditions, the performance remained quite normal as illustrated by the curves.

### Superior Modulation Capability

An advantage unique to the Ampliphase system is its capability for full modulation, even for extended periods, without overload. This is a feature brought about by the Class C, continuous-wave power amplifiers of the transmitter, which can run efficiently at peak modulation continually. This is important to stations programming music of high average level and low dynamics. Another advantage of Ampliphase is that it can be overmodulated without the "splatter" so common to other transmitters.

### Conclusion

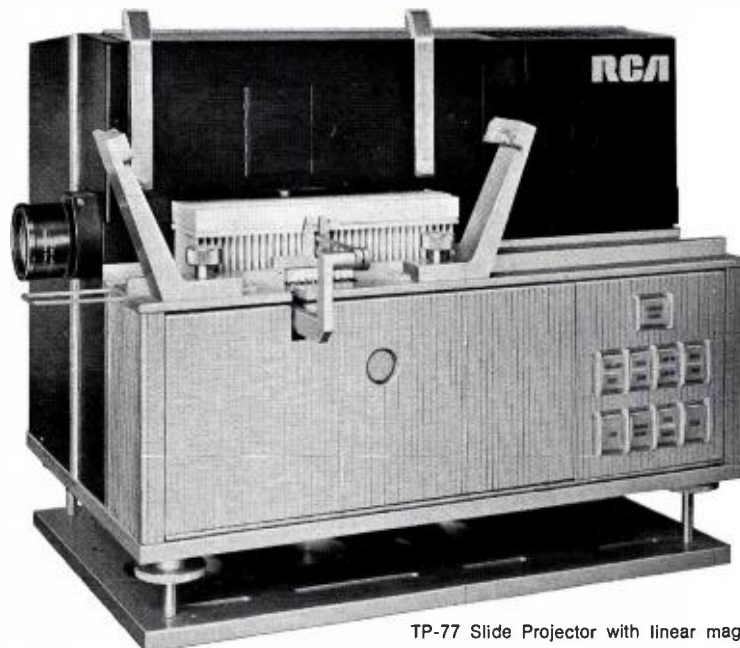
The Ampliphase system provides a new high in transmitter efficiency, performance and stability. The high efficiency of the amplifying and modulating system employs a minimum of primary power. Modulating components do not represent large investments in iron and copper as they do in high level modulating systems. Inherent system linearity means minimum feedback and this means ease in tuning and maintaining performance. Changes in high power tube characteristics do not radically affect the system linearity. By its very nature, the system is insensitive to unusual load impedance characteristics. Audio fidelity of the system is exceptional in the high and low modulating frequencies, assuring high fidelity performance in very high powered transmission systems. The combination of these features makes the Ampliphase system the most desirable for use in medium, high power, and super power AM applications.

†This review appears in the complete text of this paper, available as a separate reprint.



TP-77 Slide Projector with circular magazine.

## LINEAR OR CIRCULAR MAGAZINE USED WITH THIS SLIDE PROJECTOR



TP-77 Slide Projector with linear magazine.



This TP-77 slide projector with its unique features—interchangeable magazines, true sequential forward/reverse operation, dual optical system and automatic lamp change—might just revolutionize your present slide-programming operations. At the very least, it brings to the broadcast industry a flexibility in slide programming not heretofore available.

### **Simplifies Loading and Editing**

Interchangeable circular and linear type magazines are supplied with the TP-77, and the projector uses either one at any time. (The magazines replace the previous method requiring alternate loading into two drums.)

Slides are loaded sequentially into the interchangeable magazines of the TP-77. This feature minimizes slide handling and facilitates program editing. And since the magazine is removable, any number of magazines may be put into use. Program segments can be loaded into separate magazines in the editing room well in advance of air time, then stored in the library. Magazines can be placed in the projector in a matter of seconds.

### **120 Slide Capacity**

Slides are easily removed or inserted into either type magazine at any time. The smaller, linear tray which holds 36 slides is convenient for storing repeat sequences to be loaded into the projector as a “packaged” slide program. Where more than the 36 slides accommodated by the linear tray is required, the circular magazine is used. This new slide storage device contains 120 compartments. Slides may be loaded into all compartments, or they may be sectionalized for repeat programming.

### **Sequential Forward-Reverse**

TP-77 single magazine/dual gate design permits true sequential forward and reverse operation. When the machine is operated in reverse, slides are presented in exact reverse order, so that it is possible to back up any desired number of slides, stop, and go forward without loss of sequence. When a magazine is first placed on the projector, operation of the load switch places the first two slides into the gates. When unloading of the projector is desired, operation of the “clear” switch will replace all slides in the magazine in the proper sequence.

### **Slide Accessibility**

A basic consideration in the design was to ensure that any emergency situation arising from last-minute program changes could be met. There is complete accessibility to all slides in the system including the two in the slide gates. Thus, any slide exclusive of the one being projected may be changed without disrupting the transmitted picture. Access to the slide gates makes it possible to bypass the magazines and to manually insert emergency slides.

### **Added Preview Facilities**

Pressing the preview button permits viewing the next or upcoming slide on the film island monitor while the “on-air” slide is in the gate. This function is available from remote locations as well as at the projector. In addition, a small optical preview screen is built into the top edge of the TP-77 Slide Projector. This permits the operator to view the next slide while the on-air slide is actually being shown. Order and orientation of program material can be checked in advance.

### **Automatic Lamp Change**

Another very important feature of the TP-77 is the automatic lamp change mechanism. Should the projection lamp fail, the automatic changer instantly places a new lamp in position in less than  $\frac{3}{4}$  of a second so that loss of air time is prevented. An indicator lights up whenever defective lamp moves to the standby position.

### **Quartz Halogen Lamp**

Real economy in cost-per-hour operation of the projector is introduced by the use of the automatic changer and the quartz halogen projection lamp. The lamp is rated at 50 hours nominal life and, due to the halogen cycle which prevents blackening of the quartz wall, it may be burned to extinction. Ordinary tungsten lamps are very often removed from service before filament failure because tungsten deposited on the inside of the glass envelope has severely reduced the light output.

### **Douse—Show Operation**

A pushbutton switches the douser in and out of the projector light path. This function is controllable from a local or remote position.

### **Dual Channel Optical System**

The dual-channel optical system of the TP-77 makes possible a very rapid and smooth transition between slides. It has for its light source a horizontally mounted 500-watt halogen quartz lamp. Light is collected from both sides of the lamp and directed by a mirror into the upper and lower gates. A mirror-multiplexing system located between the slide gates and the projection lens permits switching between gates. Switching is achieved by a mirror which moves alternately in and out of the light path. When the mirror is in optical path, the light from the bottom channel is directed into the projection lens and the light from the channel is directed to the small preview screen. When the moving mirror is retracted, light from the upper channel is directed into the projection lens and the light from the lower channel is directed to the preview screen.

The TP-77, with dual gates has two slides always ready for projection. An imperceptible transition from one slide to the other is effected by the rapid move-

ment of the multiplexing mirror. While the slide selected by the moving mirror is "on-the-air," the slide previously shown is returned to the magazine; also, the next slide is positioned in the alternate slide gate ready for programming. The unique mechanism that accomplishes the slide change is described below.

### Moving Gates

The dual-light channels supply illumination to two slide-projection stations or gates centered one above the other.

Transporting of slides between magazine and the two projection stations becomes simple and reliable by making the slide gates movable. For a slide change, the gate is moved vertically in the slide plane to a loading station where the slide is level with the magazine, and only a short, horizontal transfer between gate and magazine is required. The gate employs locating surfaces for the slide and spring-loaded shoes that guide the slide against these surfaces. The shoes allow for normal variations in slide dimensions.

### Slide Pushers

Transfer of slides between the magazine and a gate in the loading station is done by two pushers on a common carrier.

The "in" pusher reaches through the compartments of the magazine and pushes the slide to the proper position in the gate. The "out" pusher takes the slide out of the gate and pushes it completely into the magazine in its original position.

### Magazine Transport Operation

The magazine advances on a one-step-back/two-step-forward pattern during each slide-change cycle. The reason for this is that two slides are out of the magazine most of the time, and that each one must be returned to the compartment from which it was taken. Following is the sequence of events in a slide-change cycle when the projector is loaded with slide #1 on-the-air in the top gate, slide #2 in the lower gate ready for projection, and forward-change button pressed:

1. The movable mirror changes position to block the upper gate and put the lower gate (with slide #2) one-the-air.
2. The magazine moves back one step to line up compartment #1 with slide pusher and gates.
3. The "in" pusher enters compartment #1 of the magazine and then moves to the inner position in the projector where the two pushers are straddling the load station.
4. The upper gates goes down to the load station.
5. The pushers move out to bring slide #1 out of the gate into compartment #1 of the magazine and comes to rest straddling the magazine.
6. The magazine advances two steps to compartment #3.
7. The pushers move in to move slide #3 out of

the magazine and into the gate that has been waiting at the load station.

8. The gate moves up to its projection station. As the gate approaches its proper position the slide is nudged into correct lateral position by a guide on its right.
9. The pushers move out and the mechanism stops with slide #2 being projected and slide #3 ready.

### Load and Clear Cycles—Slide Rejection

The basic operation of the slide-transport mechanism requires that projection start with the first slide in the magazine and end with the last slide. However, an arrangement makes it possible to skip either the first or the second of the two excursions made by the slide pusher during each slide change cycle.

When the load button is pressed the machine runs through two slide-change cycles during which the pusher only makes the second or loading excursion in each cycle. The unload excursion is skipped. This might mean that a leftover slide is already in the gate when the load excursion occurs. This leftover slide will simply be pushed straight through the slide holders of the gate into a chute behind the loading station and into the area below the magazine shelf.

When the *clear* button is pressed, the machine runs through two slide-change cycles during which the pusher only makes the first or unloading excursion in each cycle. The load excursion is skipped. If the clear function should inadvertently be activated when the load function is intended, the pusher will deliver two slides to the load station when no gate is there to accept them, and they will go down into the area below the magazine shelf.

### Solid State Logic Circuits

In equipment of this nature, reliability is of paramount importance. A major step toward achieving this end was the elimination of mechanical relays wherever possible.

The control circuit is divided into two distinct parts—logic and power switching. The logic circuits use dual in-line integrated circuits to provide the flip-flop memories and the NOR and NAND gates required for signal steering. Synchronous AC power switching is performed by triacs and a 120 Hz trigger generator. Power is applied to the inductive loads at zero axis crossings to minimize inrush currents which may cause transients on the power line.

Mechanism position sensing, which provides properly timed signals for specific modes of operation, is achieved by the use of photo-resistors and long-life lamps. These components are not subjected to any mechanical strain and will remain adjusted.

### Local and Remote Control Functions

The TP-77 may be controlled either at the projector or from a remote panel constructed specifically for



this purpose. At the projector the following control functions are available:

1. Forward Change—changes slides sequentially with the mechanism operating in the forward direction.
2. Reverse Change—changes slides sequentially with the mechanism operating in the reverse direction.
3. Load—inserts one slide into each of the two slide gates at the beginning of a program.
4. Clear—returns the slides in both gates to the magazine.
5. Preview—changes the position of the moving mirror without operating the changer mechanism. Thus, the next slide to be shown on air may be viewed on a monitor.
6. Lamp on—Lamp off—operates the projection lamp and supplies tally information to indicate state of the lamp.
7. Remote-Local—transfers control of the projector to a remote location.
8. Douse-Show—permits cut-off of the projected image by interposing a mechanical shutter in the optical path.

All operating controls are gated through inhibit circuits so that the function initially selected must complete its cycle before the mechanism will accept the next command.

Further, circuitry is such that the mechanism will respond but once to a switch closure. If a switch is held closed for a period longer than a change cycle, the device is inoperative until the switch is released.

#### Lamp Change Circuitry

The lamp changer consists of two lamps mounted on a motor driven carrier; one lamp is located on the center line of the optical system and is the lamp in use. The second lamp is the emergency lamp.

Current to the lamp in use is sensed by passing it through the aperture of a saturable reactor. A pulse is induced in the secondary winding of the toroid for each zero axis crossing of the lamp current. This pulse indicates to the logic circuits that lamp current is flowing. When the lamp fails, the current and re-

sultant pulse vanish. The absence of the pulse causes the logic circuits to turn on the power switching circuits which apply power to the changer motor. The mechanism is driven until the emergency lamp is in the proper position in the optical system. This position is sensed by a light switch, the output of which is connected to the logic circuits. The signal from the switch causes the logic circuits to remove power from the motor and apply power to the new lamp. The burnt out lamp now becomes the emergency lamp. An emergency lamp failure tally located on the control panel is then lit indicating the filament of the lamp in the emergency position is open.

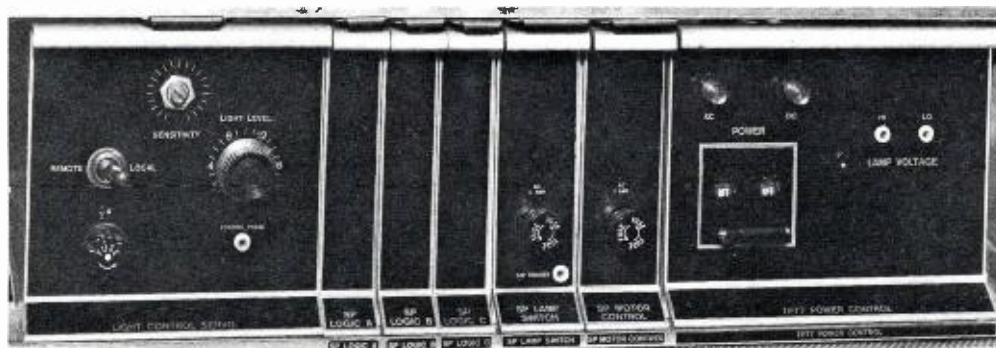
#### Variable Density Filter (optional)

The light output of the projector is 400 ft-candles measured on a 5.58-inch diagonal image at the field lens position. Measurement of uniformity of illumination shows less than 10% variation from center to corners. This high level of uniformity is maintained as the light output from the projector is attenuated through a 100:1 range in order to compensate for a difference in slide density. This range of attenuation is a function of the rotational position of an optional neutral variable density filter wedge located in each optical channel at the crossover point of the relay condensing system. The filter is coupled to and driven by a two phase motor to which a follower potentiometer is geared. The driving mechanism is part of a closed-loop servo system which comprises an amplifier and a control potentiometer so that the video signal corresponding to a high light brightness is maintained at a constant level.

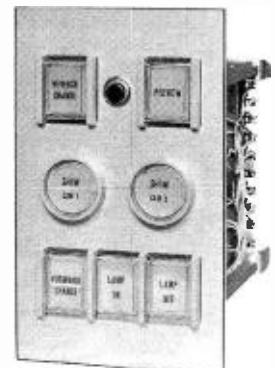
#### Conclusion

Unique use of a single magazine to replace the previous method of loading slides into alternate drums simplifies slide handling and makes possible true sequential forward-reverse operation. A capacity of 120 slides combined with the interchangeable magazine offers unusual opportunities for repeat programming. These and other features of the TP-77 result in a versatility and performance that is unmatched by any other slide projection system.

TP-77 Slide Projector control modules.



Remote control panel.



# TELEVISION IN NIGERIA

## Early Days

The Federal Nigeria Television Service (NTS) was authorized in 1962, in order that one central agency might study the requisites for introducing television in Nigeria and formulate a comprehensive plan for broadcasting. After the plan was developed and staffing and administrative details were finalized, the NTS issued tenders, for the provision of equipment and services, to major firms in the broadcast industry. RCA met the Government specifications and was awarded a contract for the implementation of the system, which later became popularly known as Channel 10 NTS, Lagos. Subsequently, after careful deliberations, the Government finally decided on a full merger of Radio Nigeria and NTS in April 1967. With this consolidation, NTS became officially NBC-TV Channel 10.

## NBC-TV Channel 10 Physical Plant

Situated on romantic Victoria Island, some three hundred yards from the shores of the Atlantic to its South, and about two miles from the center of the city of Lagos, the station occupies an area of approximately one acre. Its Western extremity is bounded by the Lagos Lagoon, the East side by the dual carriage-way Ahmadu Bello Road. The main building is an L-shaped block, with three storeys on the East side housing the administrative and programme offices and two storeys on the West side containing the main technical area. The aerial mast, towering 250 feet into the sky from sea level, is some fifty yards from the main building and seventy yards from the lagoon shore on the West side.

In a tropical climate like ours with rather high ambient temperature and humidity, overall efficiency and good picture quality can be maintained only with the use of extensive air conditioning. Also, besides natural heat and humidity, you have to contend with

the heat generated by studio lights and auxiliary equipment. To provide the necessary cooling, we have a 70-ton central air conditioning unit, installed adjacent to the diesel-generator room. As a precautionary measure, the technical areas are equipped with room air conditioners as standby in case of central unit failure.

After the installation of the transmitter and mast and the initial successful tests, transmission began, in a makeshift studio, a shed converted for that purpose and located in one corner of the premises. The three-camera outside broadcast van was then pressed into service as a temporary control room. However, the studios gradually took shape and were commissioned during the year, each cabled for three-camera operation. The erstwhile make-shift studio was converted into a generator room and currently houses our standby powerplant.

## Engineering Staff

Even before the advent of the Nigerian Television Service, many young Nigerians were involved in the field of electronics. The Nigerian Broadcasting Corporation, hereafter referred to as NBC, had a number of professional engineers on its staff. In 1964, some of these engineers were transferred to the NTS, which was then virtually a separate entity directly responsible to the Government. This group of engineers became the nucleus of the television engineering department.

The recruiting and training of Nigerian staff was effected concurrent with station construction, so when broadcasts began, the operation and maintenance of equipment was performed by Nigerians whilst the RCA team provided supervision where necessary. Thus, when at the end of March 1967, RCA delivered the system to the Nigerian Government, we had a well-trained, experienced engineering staff fully capable of maintaining the system at peak efficiency.

\*Senior Executive Engineer (Operations), Nigerian Broadcast Corporation



Another NBC helps to educate, entertain and inform in Nigeria

MR. ENIOLA BENJAMIN\*

In order to facilitate the training of new personnel, the NBC has established the minimum qualification of either secondary grammar school certificate or G.C.E. with prerequisite courses in mathematics and the sciences, or, alternatively, City and Guilds grouped certificates in the Telecommunications Technicians Course. Additionally, NBC has always operated its own training school and after the integration of Radio Nigeria and NTS, it began to offer both television and basic radio principles to students.

There are three six-man operational crews. Each is headed by a technical director who co-ordinates technical operations pertaining to any programme and includes: two cameramen, an audio man, one boom man on the studio floor and one video man in the CCU area.

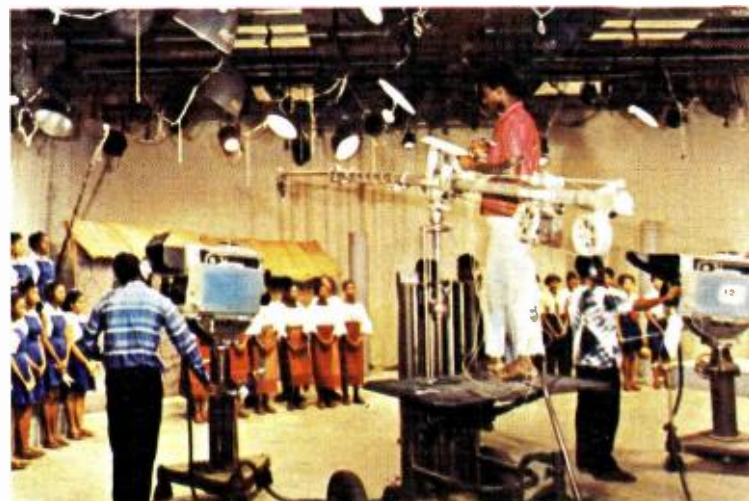
Before a show the CCU operator and the cameraman set-up studio lighting requirements, whilst the sound mixer and the boom operator attend to microphone placement. The crew also handles all other technical problems, but are not involved with equipment servicing, since any equipment requiring service is sent to the maintenance section.

#### Studios

We have two studios, A and B. Since studio A is slightly the larger, we use it for performances such as dramas, press conferences and musical shows, whilst studio B is used for newscasts, interviews, children's programmes and other small events. The floor area of studio A is approximately 3700 square feet and that of studio B is 3500 square feet. Each studio is equipped with individually switchable overhead lights with corresponding master breaker from a type-S lighting panel. Both studios are cabled for three cameras, but until April of this year we had only five RCA TK-60 monochrome cameras, two of which were mounted on pedestals in each of the studios, whilst the fifth was used as a standby. Now we have four



NBC-TV Channel 10.



Telecasting from Studio "A".



An OB from the marketplace.

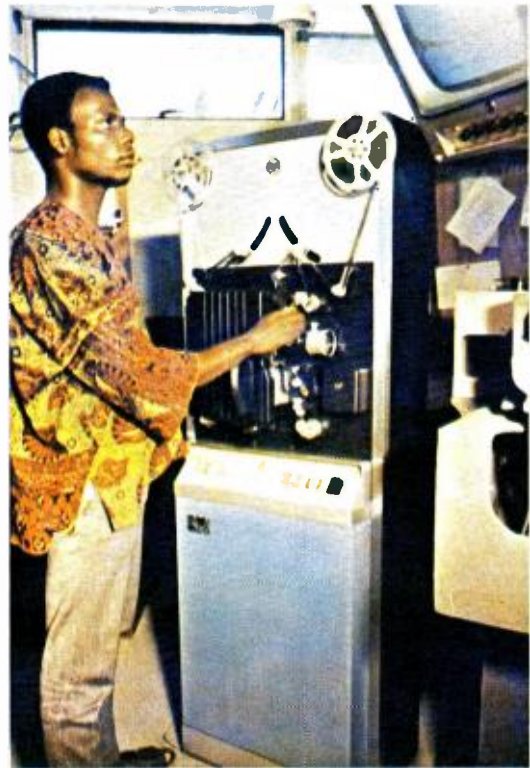
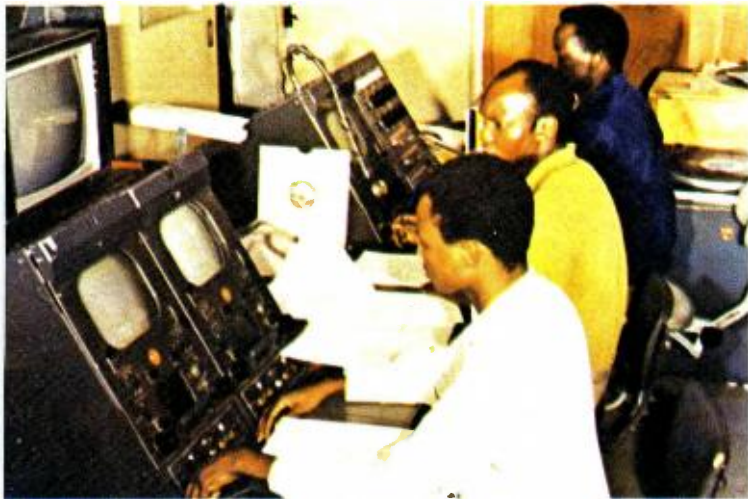
new RCA PK-330/L plumbicon camera chains, so each studio is equipped with its full complement of cameras and we also have units for our OB van and for standby. Each studio control room is equipped with the following RCA equipment: a TS-11A video switcher, five TM-7BC utility monitors, a BC-3C audio console with BQ-2B turntable, and an audio tape recorder. On the studio floor we have a total of four booms—three giraffe and one perambulator.

#### Apparatus Area

This is the floor above the studios and consists of the CCU area, the master control console and the telecine and video tape sections. We use the 625/50 CCIR standard and our two TG-2A system sync generators with change-over switches are rack-mounted in this area. Here are also the TA-4C and TA-3C pulse and video distribution amplifiers, respectively, as well as audio amplifiers for line and intercommunication to the studios and to other sources.

The TK-60 video processors with power supplies are rack-mounted in the camera control units, whilst the TM-35 master control monitors are mounted in an eye-level shelf, along with a TM-6 monitor for camera matching. The master console also contains a BQ-2B turntable and an audio tape recorder. The audio-video switcher feeds the transmitter from any selected source: cameras, video tape recorders, telecine, etc. We feel that for any television station the real backbone of programming is the telecine equipment—virtually 60% of our programmes are on films or slides. The telecine area is sandwiched between the VTR room and the transmitter. There are two complete chains, each equipped with a TK-21C vidicon camera, TP-11C multiplexer, and TP-7A slide projector. Until the middle of 1968, we used a total of four older 16mm film projectors, two on each chain. But

Camera Control Area.



"On-The-Air" from the TP-66.

in 1968 we ordered and received two new RCA TP-66 projectors to handle the bulk of our film programming. They became operational in September of that year in place of two of the older units, which were placed in stores for spares back-up. We modified our existing remote control panel so that it could be used for TP-66 operation.

As mentioned earlier, we have only two studios and we must produce most of our programmes locally in them. Therefore, it is inevitable that we have to do a lot of video tape recordings. Fortunately, we have two RCA video tape recorders, a TR-22A and a TR-22D. We have found the TR-22 to be a very reliable machine and one that produces high quality video tape programmes. Additionally, its explicit circuitry and modular construction ensures a good equipment maintainability factor. In operation, it appears that the most vulnerable parts of the TR-22 are the head-wheel and the capstan power amplifiers, especially the latter. We used to lose the capstan PA quite often, due to mains variations or switching surges so when we had only one machine it became a real touch-and-go situation to have it ready for recording sessions. The TR-22D, our second recorder, has really helped to relieve this pressure. Also, our engineers devised a modification for the power amplifier stage which has resulted in considerable savings in power transistors.





Alignment check on TR-22D.



Radio transmitter exciter adjustment.

### Transmitter

The transmitter area is in a rather small space just behind the master control sector. Our transmitter is an RCA TT-2BHN, 2-KW unit, commissioned in 1962. We transmit in Band III on Channel 10 with a vision frequency of 210.5 MHz negative modulation and a FM sound frequency of 215.5 MHz. By regular preventive maintenance and periodic performance checks, we have kept incidences of breakdown to a minimum. Indeed, we feel very rewarded for our efforts, since although we have had only this transmitter until 1969, we have never been off the air for any length of time. However, in order to permit thorough maintenance of the TT-2BHN, we acquired a second transmitter to fill in. RCA did not have a low power transmitter, so we purchased a 500-Watt Marconi type BD 377A/368.

This transmitter was installed in April 1969, along with provision for the manual switching of the two transmitters to the aerial feeder. The aerial is an RCA TFD-12H, 16-element, 3-panel, full-wave array of dipoles, centre-fed. The mast itself is about 50 yards from the transmitter. Aerial gain is 13-dB (i.e. 20X) thus giving an ERP of 40 KW for the TT-2BHN and 10 KW for the standby transmitter. Our coverage extends up to sixty miles inland with relatively good reception.

In fact, people as far away as Ibadan, 70 miles from Lagos, can receive a useable picture.

The geographical location of Lagos, 6 degrees north of the equator and near the Western boundary of our country, makes it possible for our neighbor, Dahomey, to enjoy our programs. We have another TT-2BHN transmitter at Ibadan which will begin operation as soon as the microwave relay link between Lagos and Ibadan is completed. The survey for this project was completed during 1969 and the NBC has started to acquire land for the three repeater stations required. These sites will be at Likosi, 31 miles from Lagos; Ipara, 34 miles from Ibadan; and Abanla, 13 miles from Ibadan. The link equipment, all RCA, is already on order and we expect to be on the air at Ibadan by the end of 1970. The Posts and Telegraphs of Nigeria has fully cooperated with us to provide the necessary frequencies in the 3.4 to 3.6 GHz band.

### Outside Broadcasts

The telecasting of events outside of the studios used to cause both the expenditure of much engineering effort and pre-production time before we received our new PK-330/L camera chains, because for an OB we had to disable one studio and transfer the complete camera chains into the OB van. Now, we have cameras permanently installed in the mobile unit and they



Antenna mast with microwave "Dish" for OB's.

are only used for telecasting remote events. The van is equipped with permanently installed auxiliaries, such as a TG-12A field sync pulse generator, TS-5A video switcher, BQ-2B turntable, plus suitable wide angle lenses and a zoomer. A TVT-1B microwave transmitter is also in the van, whilst the TVR-1B microwave receiver and the stabilizing amplifier are mounted near the CCU in the apparatus room. The OB van, when it is fully operational and both air conditioners are on the line, demands approximately 10 KVA, which it receives from a supporting diesel-electric generator. For reception of the remote signal, the microwave receiving antenna and the head amplifier are mounted on the aerial mast just below the VHF array and is panned to the designated direction of the OB event. Transmission begins from the source as soon as master control switches the remote unit on.

### Programming

The NBC is a statutory corporation owned and financed by the Federal Nigerian Government but the Government has allowed us to obtain additional revenue by accepting advertisements and spot commercials from business firms and individuals. Some sponsors advertise on both local and foreign programmes (films/tapes), others just buy time spots—the highest paying periods being just before and just after the news at 6:00 P.M., 7:00 P.M., and 9:00 P.M.

NBC studio facilities are also available for sponsors to use to produce their own commercials, either on film or on tape. A special commercial department has been created within NBC to administer these accounts.

When we were on the air from the temporary studio, only two or three hours were broadcast daily, as films constituted the bulk of our programming, except for newscasts and children's shows, which were presented live. Now, on weekdays, we begin broadcasting with a test pattern and station identification from 11:00 A.M. to twelve noon and from 2:00 P.M. until 3:00 P.M. Test transmission starts again at 5:00 P.M. every evening, with programmes following at 6:00 P.M. and continuing until 11:00 P.M., and sometimes even later. Before the national emergency, we have stayed on the air until as late as 12:30 A.M. The morning and afternoon hours are normally allocated to educational television; that is, from 9:45 A.M. to 11:00 A.M. and from 3:00 P.M. to 4:00 P.M., Monday thru Friday. On Sundays, transmission starts at 5:00 P.M. with a test pattern, followed by programmes from 6:00 P.M. until 11:00 P.M. The "Bar Beach Show", a one-hour variety show presented every Saturday at seven o'clock is easily the most popular show on NBC-TV at the present time. Because it features live entertainment, it has won both full commercial sponsorship and a heavy demand for audience-admission tickets, which are available only by invitation. Our most popular "special", was the telecast "live" of a 90-minute historical play "KURUNMI", written by Mr. Olawale Rotimi, a research fellow of the Ife University. We feel that our technical and production staffs presented the drama in a highly professional manner—the play was so successful that the public has continued to demand repeat performances.

NBC-TV commands quite a large viewing audience and random sampling interviews conducted throughout our coverage area indicate a high degree of familiarity with almost all of our programmes. Best remembered are the "Bar Beach Show", the Ogunde theatre party productions "On Stage" and "Village Headmaster" and our women's programme, "Feminine Fancies".

We exchange our cultural and entertainment programs with Ghana and also with the television stations in the Western states of Nigeria.

### Maintenance

Our present equipment has seen continuous duty for several years now and from only a few live programmes in 1962, we now produce approximately forty percent of our programmes locally, for a broadcast day of practically nine hours. This certainly constitutes quite a great demand on the equipment. Considering that the reliability factor of any device diminishes with age and frequency of use, it is not surprising that faults do occur fairly often and of course it is almost always quite a race against time to



diagnose faults and clear them quickly enough. This is where the experience acquired over the years comes in handy and has always stood us in good stead.

Naturally, it is one thing to know what an equipment fault is but often it is quite another to have the suitable components available to repair it. In fact, one really has to be in any part of far-away Africa, where the maintenance of all equipment, however old, is an economic must, to realise what a battle it is to obtain replacement components. Any African engineer realises that comparatively speaking, a lesser equipment with lots of spares can be preferable to a higher quality one with no spares for replacement when it requires servicing—and they all do sooner or later. In this regard we have had good success, both with our RCA equipment, which has performed very reliably, and with the RCA Corporation, whose representatives for Nigeria, Mr. David Hughes, Manager, Electronic Systems for Mandilas & Karaberis, RCA's authorized distributor and Mr. Peter Berben, RCA Field Sales Engineer from Geneva have been most cooperative in satisfying our needs for spares support.

We have a completely air conditioned stores depot to receive and stock spares and we have always developed spares usage flow charts in order to guarantee that critical spares will always be in stock.

#### Administration

The NBC Engineering Division is headed by a Chief Engineer, who has under him the Assistant Chief Engineer (Radio), and the Assistant Chief Engineer (Television). The Assistant Chief Engineer for Television is ably assisted by two very Senior Engineers in both the daily operation and maintenance of the system and in the planning and development of new programmes. The Director of Television supervises overall television broadcasting operation and reports directly to the Director-General, the chief executive of the NBC.

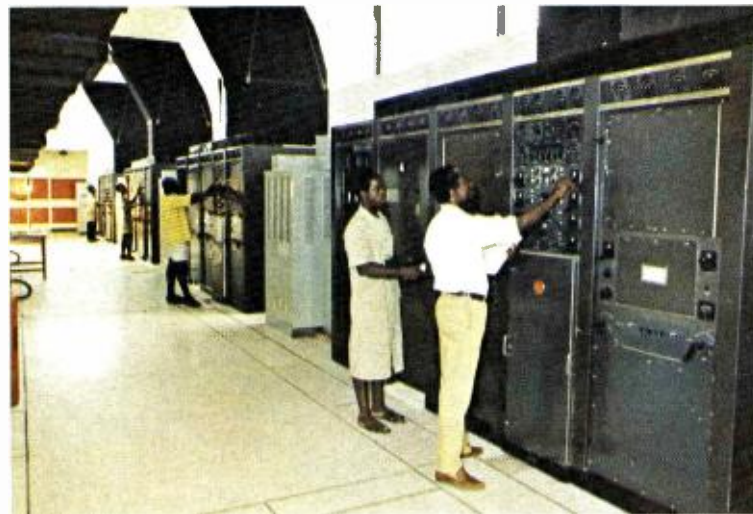
#### Conclusions

It will be noted that apart from the low power transmitter, every item of our equipment is RCA and we are quite satisfied with its performance and reliability.

We have certainly not been doing as many outside broadcasts as we felt necessary, due to our limited facilities, but with the availability of the four new camera chains and hence the installation of permanent chains in the OB van, our plans call for the production of several "remotes" each month. With the Ibadan expansion program we hope to complete the first step towards our goal of providing the benefits of television to the remainder of our country. A conservative estimate of home receivers in Nigeria indicates that the number is approximately 50,000 and rapidly increasing. To us this means that the "telly bug" is quickly catching on in every Nigerian household, which is a very gratifying fact indeed to the NBC-TV.



Preventive maintenance in service shop.

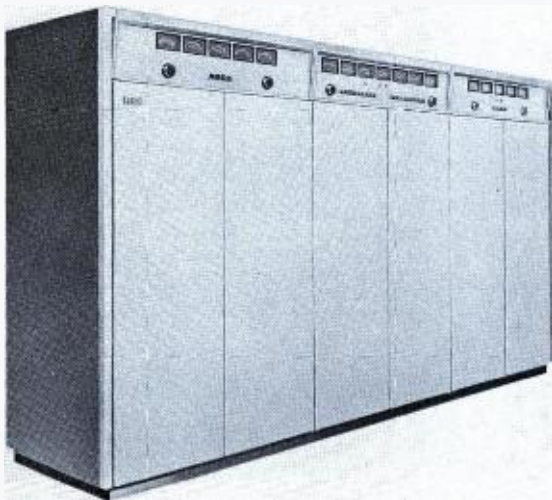


Radio Nigeria transmitter hall.

# Products in the News

## 35 kW TT-35FH VHF Transmitter

Maximum air time—resulting from the highest reliability ever to be obtained—is a key attribute of the new advanced state-of-the-art transmitter, Type TT-35FH. The many features include performance specifications that are “twice-up” from other transmitters, stability that holds specs for 30 days and longer without readjustment, a complement of only



six tubes and two types in the entire transmitter, two complete RF exciters with fully automatic signal sensing and switching, low-pressure air cooling and full remote control.

The TT-35FH is actually two independent 17.5 kW units operating in “parallel” to deliver the 35 kW visual power output. A failure in either transmitter merely reduces output power and keeps the station on the air with little or no noticeable change in primary coverage area. There’s virtually no chance of going off the air entirely.

Visual and aural PA and visual IPA stages are the only ones employing tubes. All circuitry below the 25-watt level on the visual side is solid state, while the aural section is solid state up to and including the 80-watt IPA stage.

Every practical design technique is used to increase reliability. Devices are all operated well below their ratings. A unique cavity design reduces cooling air requirements. Filament contact assemblies use “heat-pipe” cooling to eliminate high pressure air cooling. Power supplies (except PA plate) are current limiting and self re-setting types. Components are selected that require a minimum of maintenance. The TT-35FH covers VHF highband Channels 7-13.

## Longer Life VTR Headwheel

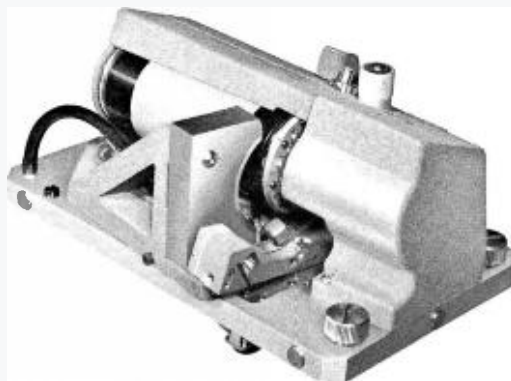
A newly developed alloy, *Alfecon II*, is the principal material in a new longer life HTR series of headwheel panels that reduces VTR operating costs and minimizes the down time usually set aside for system adjustment. Simultaneously, overall performance, uniformity and durability are improved.

Directly interchangeable with earlier RCA highband headwheels, the new 5-mil and 10-mil panels make possible completely automatic and very precise record-guide positioning. No adjustments are required. (Highband recorders before the TR-70C require a simple modification to utilize automatic fixed stop guide positioning.)

Incorporated within the housing are a built-in FM sweep probe for test purposes and an elapsed time indicator to simplify log keeping. Panels are also equipped with a “tool post” for mounting an accessory tip protrusion indicator.

A special safety cover facilitates installation and removal of the panel and protects the headwheel from accidental damage.

The new alloy is now being incorporated into present headwheel panels. By September the entirely new headwheel panels will become available.

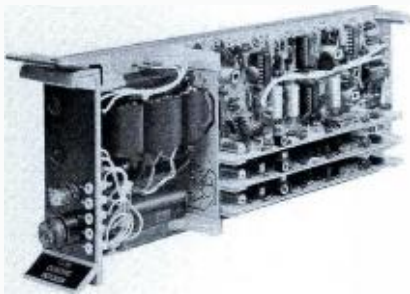


## New Sync Distribution System

Drastically reduced in-house cabling, simplified pulse switching and improved quality of sync are features of a novel sync distribution system now available for broadcast and closed circuit TV systems.

Comsync, as it is called, combines several sync generator signals such as sync, blanking, burst flag and color subcarrier into a composite waveform for transmission over a single





video coax line. At the far end, a decoder separates the signals, re-establishes their proper levels and sends them to eight isolated outputs—two for each of the four signals. Eliminated by this technique are three of the four sync cables that otherwise would be required between the studio and the possibly distant sync generator.

Teleproduction facilities stand to reduce sync switching complexity in direct proportion to the size of the facility. For example, the number of crosspoints needed to channel four sync signals from three sync generators in a three-studio center with production control and master control is reduced from 60 to 15 and the need for output amplifiers drops from 20 to 5. In addition, hum, glitches or other common-mode interference that might ride the sync are balanced out, resulting in cleaner waveforms.

Comsync uses encoder and decoder modules and a series of accessory modules all of which mount in the standard module frame. Many decoder variations are possible to accommodate separate H- and V-drive pulses and for the generation of PAL signals.

### FM Monitor Amplifier

A new RF amplifier, Type BW-100B, will permit many FM stations to move their Type BW-75A main channel monitor out of the transmitter room and into the studio for convenient transmitter signal monitoring.

Employing the principle of down-converting in frequency to 10.7 MHz where band-pass characteristics are much easier to control—plus I-C zero axis limiters to reject interfering signals—the amplifier has superb amplitude and phase characteristics that permit proof of performance measurements from almost any studio location. Amplitude bandwidth is  $\pm 225$  kHz and phase linear bandwidth is  $\pm 300$  kHz. Response at  $\pm 400$  kHz is 25 dB down, and at  $\pm 800$  kHz is 50 dB down compared with carrier frequency.

The new amplifier has an input signal sensitivity range of 100 microvolts to 0.5 volt, or 70 dB. When the input signal equals the minimum of 100 microvolts the amplifier output is adjustable from zero to one watt. Down-converting to 10.7 MHz and up-converting to the original frequency are performed by the same mixing oscillator. The BW-100B Amplifier is completely self contained with power supply.

### TK-27 Contours Accessory Kit

Popular among broadcasters is the Contours Accessory Kit designed for use with all TK-27 film cameras. The accessory greatly sharpens the contours or edges of the TV image with virtually no change in signal-to-noise ratio.

The Contours Accessory Kit generates from luminance video a *correction* signal that is matrixed with processed video only after passing through a “comb” filter. “Combing” selectively filters the signal and virtually eliminates the sub-carrier beatnotes between luminance and chrominance that otherwise produce edge beats and high noise levels. The comb filter allows increased contouring with no significant increase in picture noise.

Packaged as two plug-in modules, the accessory fits in unoccupied space in the base of the camera. Contours “on-off” by remote control is provided by a built-in relay requiring a 12.5-volt DC source. The ordering number for the Contours Accessory Kit is MI-557806.

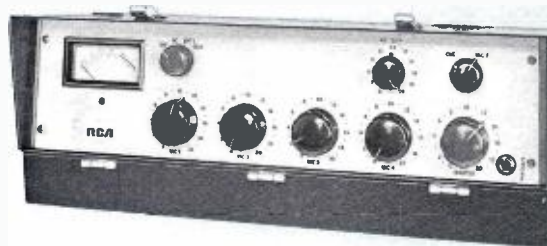
### Four-Channel Remote Amplifier

High gain, small size and low power dissipation are characteristics of a new solid state portable amplifier, Type BN-17A, for remote broadcast use. At the flip of a switch, operation is from long life mercury batteries or an AC power supply, both self-contained.

Facilities include four balanced transformer inputs, two high-level inputs, cueing, earphone monitoring, high-level mixing and a test oscillator. Receptacles provide for paralleling amplifiers to expand inputs. Generous power output delivers a full +18 dBm to the line after a 6 dB isolation pad.

All controls are on the front panel and include the PA gain control, cue switch, power switch, mixer controls and master control, together with a VU meter and monitor phone jack. The VU meter is wired to serve also as a convenient test meter.

The portable amplifier is housed in a leather handled, sturdy steel case the cover of which is used as a tilt rest. A weatherproof canvas case is available as an accessory.



# Products in the News

## Improvements in Cartridge Tape System

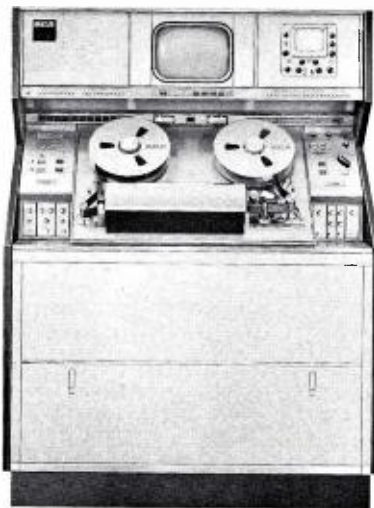
The RT-27A Playback and BA-27A Record Amplifiers have been modified both functionally and operationally. Changes include lighted pushbutton controls and indicators that immediately show the various operating modes of playback, record and cueing. These controls have been clustered for ease of operation. The tape transport features an improved pinch roller which provides positive action, resulting in low tape slippage and better tape tracking.

RT-27A/BA-27A units are available in monaural and stereo versions that meet or exceed all NAB specifications for cartridge tape systems. They feature easily removable and replaceable transports, sturdily constructed panels and supports, and a pinch roller that is automatically cocked and ready for operation when a tape cartridge is inserted.

## New Highband Color VTR

A TV tape recorder that runs itself—instinctively makes the best picture at all times—asks almost nothing of its operator. Such is the TR-70C.

A completely new servo dominated by a whole new generation of integrated circuitry results in a very high order of improvement in reliability and performance. Lockup time is much faster, circuits remain stable for longer periods of time, routine maintenance is required less often and the machine is easier to operate. Other major features include new 5 mil and 10 mil long life headwheel panels.



The new I-C servo minimizes operator attention in many ways. Setup is simpler. He needs only to select the proper servo mode, adjust tracking and horizontal phasing. Machine stability permits changing headwheel panels, use of different kinds of tape, and operation with different reel sizes and in varying environments, with no need for adjustment.

A stabilized color picture locks up in one second (ready mode), reducing normal preroll time. The faster lockup also speeds up recovery from picture disturbances while reducing servo jitter. Automatic "braking" of the rotating headwheel stops it in a matter of seconds.

The new headwheels employ a specially developed alloy that greatly extends the headwheel life and permits a higher degree of uniformity in the heads, improving color performance. Record guide positioning is completely automatic and very precise, eliminating the need for compensating adjustments when playing non-standard tapes. An FM sweep probe is built into the headwheel panel for test purposes and an elapsed time indicator for log keeping.

Also included in the TR-70C are valuable safeguards such as automatic FM standards selection and an automatic stop-cue device that cues the machine at the precise point the commercial is to begin. Available as color playback accessories are the Chroma Amplitude and Velocity Error Corrector (CAVEC) which eliminates saturation and hue-banding on playback, and the Color Dropout Compensator which automatically inserts luminance and correctly phased color in the tape dropout. These accessories assure the highest quality picture at all times without operator attention.

## Heavy-Duty Thick-Wall UHF-TV Pylon

A heavy duty Pylon antenna that is 24 inches in diameter, with a nominal 2½-inch wall thickness that will support several times its height, is being specified for certain multiple antenna installations that "stack" one antenna atop another.

One of the most popular of all UHF-TV antennas, the Pylon is also the simplest, which accounts for its many electrical and mechanical advantages. It consists of a slotted steel cylinder with a concentric copper coaxial feed line, from which energy is coupled to the radiating slots. There are no exposed radiators or transmission line elements. Omnidirectional Pylons are available with power gains up to 46. Directional Pylons have been built with maximum power gains of 85. Choices can be made from omnidirectional or a variety of directional horizontal patterns, with vertical patterns ranging from simple null filled to custom shaped types.

For an example, a TFU-36J Custom Omnidirectional Heavy Duty Pylon was fabricated to support an 89 foot long, 5-ton Channel 4 Superturnstile Antenna for WDAF-TV, Kansas City, at an overall height of 1,100 feet. This Pylon, which is the Channel 41 antenna of KBMA, is 51 feet long, weighs 13.5 tons and has a power gain of 30.



## 15 Standard Video Switching Systems

Shipments are already being made on the recently introduced standard switching systems of the TS-51 series.

For a relatively small investment, these versatile high performance color switching systems often make it possible to efficiently use cameras and tape recorders that otherwise would have to stand idle for lack of adequate switching facilities.

A case in point is the station that is tying up its production switcher to route the program to the transmitter. Any opportunity to do production taping at a time like this would have to be turned down or postponed. Addition of the TS-51 System 20 Master Control Switcher would retain one-man operation at master control but release the production switcher for taping operations.

A convenient two-switcher package for the smaller station consists of the TS-51 System 14 for studio production and System 20 for master control. Both are 16 input by 4 output systems and include transition logic. System 14 provides dual reentry, special effects and cutbar operation. System 20 provides mix reentry into program and preview rows.

There are 15 standard configurations of the TS-51, covering production, master control and distribution switching applications. And there are also 8 audio systems to go along with these switchers. This wide choice, together with the many variations that are possible, make it possible to customize to individual station requirements. The many systems that are available are described in a systems booklet entitled "TS-51 Video Switchers—Standard Systems", Form No. 3J5600, available from RCA representatives or by writing to the editor.



## Compact Zoom Lens for TK-44A

A new Canon high-resolution zoom lens only two thirds the length of other 10:1 lenses and little more than one-half their weight is now available for use with the TK-44A color camera. The lens is 10¾ inches long and weighs 26½ pounds.

Other features include constant zoom range, brought about by a new cam system, and (optional) quick-change, bayonet-mounted range extenders, which are easily installed without having to remove the lens. Its range of object distance is from 5.5 feet to infinity, and the aperture is  $f/2.2$ . An adapter is available to permit focusing to within three feet.

High quality lenses and multi-layer coatings minimize distortion and reflections.

## New Reel-To-Reel Audio Recorder

The RT-21D playback and record system is a new version of the popular RT-21 series of reel-to-reel systems. It features an etched capstan shaft to reduce tape slippage, increased current-handling relays, and improved frequency response at the 7½ IPS speed.

Monaural and stereo units are available in either 3¾ and 7½ IPS or 7½ and 15 IPS speeds. Accessory remote control features can also be provided.

The RT-21D meets or exceeds all NAB specifications for reel-to-reel systems while also providing CCIR equalization and operation from both 117-volt 60 Hertz and 240-volt 50 Hertz lines.



## New Reel-To-Reel Audio Playback System

The RT-20 reel-to-reel playback system is a companion to the popular RT-21 series of recorders. This new system is basically for audio automation, however, stations can use the RT-20 wherever there is a requirement for playing back prerecorded magnetic reel audio tape.

Both monaural and stereo versions are available at tape speeds of 3¾ and 7½ IPS. Remote control accessories are also available. Overall response at 7½ IPS is  $\pm 2$  dB from 50 Hz to 15,000 Hz and is within  $-6$  dB at 25 Hz.





# Altogether now. The best color camera is...

**“The TK-44A makes very sharp pictures. Reaction to a recent live ball game was ‘It’s the finest video ever seen.’”**

—LeRoy Bellwood, Director of Engineering  
KOGO-TV, San Diego, California  
Time-Life Broadcast, Inc.

**“The camera has met with excellent reaction from viewers and sponsors...No question whatsoever—it beats the daylights out of other cameras. Sharpness of picture, by the enhancer...means another generation of quality tapes.”**

—Wayne Barrington, Chief Engineer  
WISN-TV, Milwaukee, Wisconsin

**“...picture quality is outstanding... Quality pictures one minute after turn on.”**

—Eugene R. Hill, Vice-President, Engineering  
Kaiser Broadcasting Corp.  
Oakland, California

**“Many people have remarked how much better our pictures look. Not simply the color, but how much sharper. It’s a better picture.”**

—C. E. Miller,  
V.P., Engineering  
Fisher’s Blend Station,  
Inc.  
KOMO-TV, Seattle,  
Washington

**“Our folks like the way the picture looks and the way the camera handles...We get requests to go on location...agencies from out of town come to us...We are doing a lot of this work.”**

—Rupert Bogan, Director of Engineering  
Carter Publications, Inc.  
WBAP-TV, Fort Worth, Texas

**“We have been impressed with the construction, the dependability and the quality of pictures...The pictures are great and the lack of noise in the black is beyond belief.”**

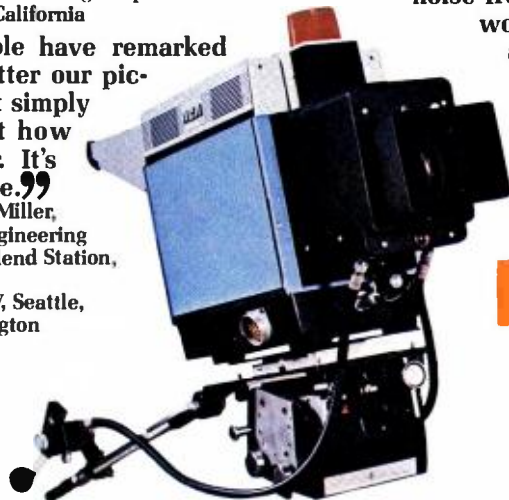
—Vincent E. Clayton, Director of Engineering  
Bonneville International Corporation  
KSL-TV, Salt Lake City, Utah

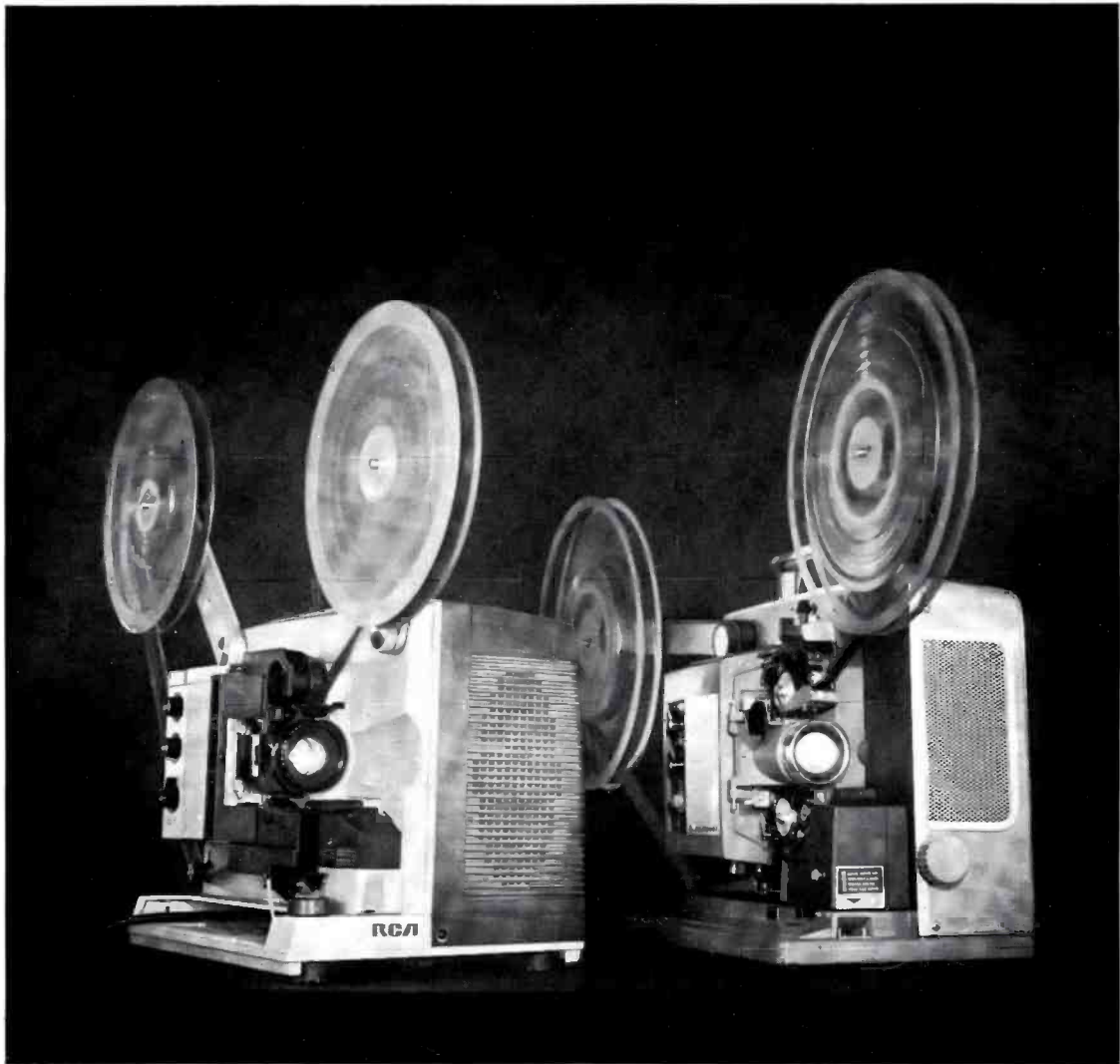
**“They have been used with as little as 25 foot candles of light...and give us noise free color pictures...We have worked with all other makes and models of cameras, but none compare to the TK-44A.”**

—Larry R. Eskridge, Chief Engineer  
WTOG-TV, St. Petersburg,  
Florida

Thank you, gentlemen.

**RCA**





# Compare all two.

RCA and the only other 16mm auto threader.

Let's start with the film going into the automatic threader.

They call their Autoload.\* We call ours "Safe Threader," because it doesn't touch the film at all. Once the leader is threaded, you pull Safe Threader away from the film path.

Autoload is permanently built in to their projector.

With Autoload it takes an expert to thread or unthread the film in mid-

show, or when a jam occurs. Safe Threader lifts off completely so you can get at the whole film path at any time.

Autoload is an assembly of parts which must be adjusted properly to work. Safe Threader is one piece.

What else does RCA give you? A big 15-watt solid-state amplifier. A unique fluid clutch for smoother take-up of large or small reels.

Floating sprocket shoes for extra kindness to film. And a storage compartment for a 1,100-foot take-up reel.

We believe the RCA 1600 is more convenient, more reliable, and easier on film. Compare for yourself. Write RCA AV Products, Building 15-5, Camden, New Jersey 08102.

In Canada: RCA Ltd., 1001 Lenoir St., Montreal, 207 Quebec.

The RCA logo, consisting of the letters 'RCA' in a bold, stylized, sans-serif font.

\*Registered trademark, Bell & Howell Co.



# Contour Enhancement . . .

makes your films and slides  
look better



## Matched TK-27 Color Film System . . . now with the "live-like" quality of a TK-44A

The Contour Enhancement accessory for the RCA TK-27 Color Film Camera improves the TV picture by enhancing image edges, increasing overall definition. In addition, a special filter "combs out" the noise—permitting this improved performance without any increase in background disturbance. Thus film and slides will offer a new high level of picture quality. Even those not quite perfectly focused will produce better images on the TV screen. You'll get the same kind of sparkle and snap that you do from live pictures on the TK-44A.

When you use the complete RCA Color Film System your films come alive, they entertain more, educate more, they sparkle as never before. It's all due to a MATCHED system. The TK-27 Camera is the heart of the "matched design" system. Included is the Automatic TP-66 Film Projector, Solid-State TP-77 Slide Projector with preview feature, and new vertical-mirror-wipe TP-55 Multiplexer. All made by RCA, these units work together to produce the finest color TV pictures.

**RCA** Broadcast  
Equipment

# RCA service keeps all your AM, FM, TV equipment in top condition

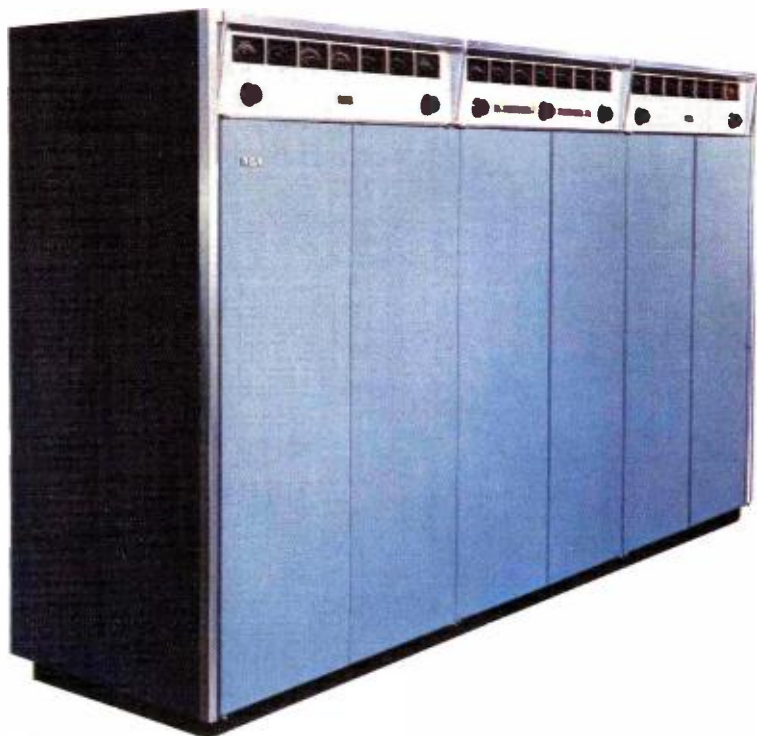
## TAKE ADVANTAGE OF THE FOLLOWING SERVICES OFFERED BY RCA:

- Video Tape Recorder Service • TV Camera Overhaul
- TV Transmitter Overhaul • Installation Supervision
- Microphone and Pick-Up Repairs • Transmitter Performance Measurements • Antenna Inspection Measurements
- Console Repairs • Microwave Service • TV Projector Service
- Custom Fabrication • Teletypewriter Maintenance

Your audience demands a superior signal which requires top performance from all your station equipment. RCA Broadcast Service is planned to assure you of meeting this objective. More than 30 years in the broadcast industry have provided a background of solid service experience. This is the type of protection broadcasters have relied on for years, the kind of protection you can count on . . . contract or per-call . . . from the experts in the service business, RCA Service Company. To guard performance of all your equipment . . . simply telephone one of the following field offices: Chicago (WE 9-6117), Phila. (HO 7-3300). Or contact Technical Products Service, RCA Service Company, A Division of RCA, Bldg. 204-2, Camden, N. J. 08101.







## New Highband VHF Transmitter TT-35FH

The TT-35FH . . . the highband VHF transmitter of the future . . . available today. This 35-kW transmitter is designed for remote operation . . . and will provide the best color signal in town. Color that captivates your audience . . . from a solid state transmitter that just won't quit.

Imagine . . . almost no transmitter off-air time . . . what a savings!! The TT-35FH is actually two transmitters—designed as one unit . . . if either quits the other keeps you on the air . . . and your audience in the primary coverage area probably won't know the difference.

The TT-35FH is reliable solid state with only 6 tubes and 2 tube types. It modulates at high level, with only two tuned linear amplifiers—plus signal shaping at output—to assure signal integrity. An extra margin of safety is achieved by conservative design—with circuits and components operating well below design ratings.

The TT-35FH is far ahead of current transmitters. It has motor-driven controls and remote metering—is ready for full remote control and automatic logging . . . and is even ready for eventual computer control.

And for low band VHF there's the companion 30 kW TT-30FL Transmitter with the same essential features . . . See your RCA Representative for details.

**RCA** Broadcast  
Equipment

