

Jamison



# Broadcast News

Volume No. 167, September 1979



TV Transmitters  
Designed for  
Future Dimensions  
In Broadcasting

# THE FULLY-AUTOMATIC STUDIO CAMERA. IT CAN AUTOMATICALLY SAVE YOU SET-UP TIME.

Think about the time it takes to set up studio cameras.

Think about standby time for talent and production crews waiting for your technicians to get the best picture quality.

Think about the savings if that time could be reduced from hours to minutes—or seconds.

## **The TK-47. The world's first fully-automatic camera.**

The TK-47 studio camera performs sequential set-up functions automatically—at the touch of a button.

And it does it in a matter of seconds, rather than requiring the usual hour or two for conventional studio cameras.

Daily performance checks are also done automatically. And with



a Set up Control Unit, any number of TK-47's can be controlled—with truly consistent color rendition.

You get better utilization of technical people, a smoother operation, quicker problem-solving.

## **Inside the TK-47: RCA technology at its finest.**

The TK-47 is filled with state-of-the-art technology. Extensive use of LSI's and digital memory circuits, for example. And we've eliminated troublesome potentiometers.

Everything in the TK-47 is designed to increase reliability, reduce downtime.

## **Automatically backed by RCA, and TechAlert.**

Cost-effectiveness in a studio camera, or any other piece of equipment, depends on many things.

Quality. RCA has a reputation that can't be matched for reliable, enduring products and systems.

Service. Famous TechAlert service, and RCA parts support, can add years to the life of your equipment.

See your RCA representative, or write for details. RCA Broadcast Systems, Building 2-2, Front & Cooper Streets, Camden, NJ 08102.



**Cost-effective  
broadcasting: we make  
what it takes.**




**Page 6      New G-Line TV Transmitters (Cover Feature)**

The TTG Series is a totally new generation of VHF television transmitters designed to meet worldwide standards, and incorporating newest technology. These advanced RF systems achieve new levels of performance and reliability, with more automatic functions and less operator involvement. Many design features are covered in this article.


**Page 16      Oral Roberts Television Productions—  
At Home and "On-the-Road"**

High standards of quality and professionalism have been hallmarks of this major teleproduction operation. Its well-traveled mobile unit and Tulsa studios are staffed and equipped to deliver a consistently top quality audio and video product.


**Page 22      KCET Puts TK-47 Cameras On-Line**

Six new TK-47 cameras form the centerpiece for the extensive revitalization of technical facilities at KCET, Los Angeles. The automatic cameras are meeting the critical production demands of a new \$8 million "Cosmos" series now being shot at KCET studios.


**Page 28      CKY's Versatile Mobile Unit Does Double Duty**

CKY-TV, Winnipeg, Manitoba, keeps its 4-camera OB unit rolling on routine local assignments and exciting sports shoots. The OB unit is only one phase of a major upgrading of CKY technical facilities highlighted in this article.


**Page 32      Film House Swings to Video with "Sophisticated Portables"**

Within seven months after activating their video operation, Palette Productions, Toronto, switched from film to 95% video. Their equipment is packaged to travel—hence the name "Sophisticated Portables".


**Page 36      KMTV, Omaha, Moves into a New Broadcast Center**

After outgrowing their original downtown facility, KMTV chose to design a new one from the ground up. The modern broadcast center that resulted is pictured and described.


**Page 41      Designing the TK-47 Automatic Camera**

Camera engineer Laurence Thorpe provides insights into the design philosophy which resulted in the TK-47 camera. Also covered are some of the design features which make it a user-oriented camera.

# View Finder



Neil R. Vander Dussen



J. Edgar Hill



Stanley E. Basara

## RCA Executive Appointments

Recent corporate senior management promotions and re-alignments have resulted in top management changes in the RCA Commercial Communications Systems Division, which includes Broadcast Systems.

**Neil R. Vander Dussen** was promoted to Executive Vice President for RCA Corp.

**J. Edgar Hill** is now Division Vice President and General Manager, RCA Commercial Communications Systems Division, succeeding Mr. Vander Dussen.

**Stanley E. Basara** has been named Division Vice President and General Manager, RCA Broadcast Systems.

**Vander Dussen Named Executive VP**  
Continuing his RCA career of assuming new responsibilities and building a success record, Mr. Vander Dussen moves on to new challenges as Executive Vice President, with operating responsibility for several diverse corporate operating units: RCA Records; Banquet Foods; Coronet Industries; the Oriel Foods Group, and Random House.

Joining RCA in 1957, Mr. Vander Dussen served as a broadcast equipment salesman, with a promotion to district manager in 1962. Later he held sales, product and engineering management positions, leading to promotion to Division Vice President and General Manager, RCA Broadcast Systems. From this post he was promoted to Division Vice President and General Manager, RCA Commercial Communications Systems Division.

## Hill Heads CCSD

A seasoned veteran of more than 40 years with RCA, Mr. Hill has established an enviable performance pattern, including 30 years of marketing to broadcasters. In 1969 he became Manager, International Sales for Commercial Communications Systems Division. After three years in this post he was appointed Division Vice President, Marketing for RCA Broadcast Systems, with a subsequent promotion to Division Vice President and General Manager, RCA Broadcast Systems.

In heading CCSD, Mr. Hill holds responsibility for four major business units:

**Avionics Systems**, which produces weather radar and other airborne equipment to the aviation industry.

**Broadcast Systems**, which supplies a broad range of television and aural broadcast equipment.

**Cablevision Systems**, which provides a variety of headend and distribution equipment as well as turnkey services for cable TV operations.

**Mobile Communications Systems**, which markets two-way radio systems to a wide range of users.

## Basara Manages Broadcast Systems

Mr. Basara has executive responsibility for RCA's worldwide businesses in radio-TV broadcast and closed circuit television equipment, including sales, product management, engineering and broadcast functions.

Prior to his promotion, he was Manager, Studio and Control Equipment En-

gineering and Product Management for RCA Broadcast Systems. A native of Philadelphia, Mr. Basara joined RCA in 1956 in the company's computer activity and served in various managerial posts in computer hardware design and engineering, and as program manager for the company's on-board computer program for the automobile industry. He was General Manager of RCA's Palm Beach Operation, West Palm Beach, Fla. before joining Broadcast Systems in 1977.

## Major Camera Buy For Capital Cities

Capital Cities Communications Inc. is upgrading and expanding the technical facilities of three of its group television stations with RCA equipment valued at more than \$1.4 million. Eleven studio and field model color cameras and a 60-kilowatt transmitter are included in the equipment purchase.

KFSN-TV, Channel 30 in Fresno, Calif., is replacing its existing transmitting facilities with an RCA TTU-60D, 60-kilowatt UHF unit, and is installing two TK-46 studio cameras.

WTVD, Channel 11 serving the Durham-Raleigh area, expands its facilities with three RCA TK-47 fully-automatic studio cameras; two TK-760 studio/field production cameras, and two TK-76B cameras.

WKBW-TV, Channel 7 in Buffalo, N.Y., also increases its electronic newsgathering activities with two TK-76B cameras.

## New WFUM-TV, Flint, Orders RCA Transmitting Systems

WFUM-TV, a new public television station serving the greater Flint, Mich. area, will begin broadcasting early next year with RCA transmitting equipment valued at approximately \$750,000.

The new station, operated by the University of Michigan, Flint, will transmit on Channel 28.

The equipment order for the new outlet includes a 55-kilowatt UHF transmitter; a directional pylon antenna, and full remote control system.

## Bulgarian Television Orders Fifteen RCA TK-76B Cameras

Bulgarian Television, headquartered in Sofia, Bulgaria, will expand the news-gathering and program production capabilities of its network stations, with 15 RCA TK-76B portable color television cameras.

Nine of the cameras are being placed in service this summer throughout the country, for both electronic newsgathering and electronic field production. The remainder are due to be in operation early next year.

The self-contained color TV cameras are manufactured by RCA Broadcast Systems in Jersey, Channel Island, England.

## Ziff-Davis Broadcasting Upgrades Group Stations

Ziff-Davis Broadcasting Co. is upgrading the technical facilities of six of its group television stations with RCA transmitting and studio equipment valued at more than \$1.5 million. The purchases include two 50-kilowatt high-band VHF transmitters, remote control systems, and associated equipment.

WROC-TV, Channel 8, Rochester, N.Y., will install one of the transmitters this fall, and WRDW-TV, Channel 12, Augusta, Ga., will place its new transmitter in operation early next year.

WJKS-TV, Channel 17, Jacksonville, Fla., and WRCB-TV, Channel 3, Chattanooga, Tenn., each will install an RCA TR-600 quadruplex video tape recorder.

Telecine equipment included in the purchases include a complete TK-28B film island for WEYI-TV, Channel 25, Saginaw, Mich., and two TP-66 film projectors for WSTV-TV, Steubenville, Ohio.

## New Full-Service Teleproduction Facility For Houston

The Production Company, a new TV commercial and program production and post-production organization in Houston, Tex., is set to open this fall with RCA television equipment valued at more than \$1.5 million. Included is studio and field production cameras; quadruplex and one-inch video tape recorders, telecine systems and a mini outside broadcast production vehicle.

Gene Milligan, Operations Manager, said the new company will bring to the Houston area an ultra-modern, sophisticated video facility, able to meet the most demanding requirements of commercial and industrial TV clients.

The in-house studios will be equipped

with RCA TK-760 color cameras, augmented with a TK-76B portable unit. TR-600 quad VTR's and TH-200 one-inch machines will provide flexibility in recording and editing.

TV film handling is provided by a complete TK-28B telecine island, interfaced with a PM-86SL magnetic sound recorder/reproducer for "sep sound," and an FR-35B 35mm projection system.

In the field, the RCA TV production van will be equipped with two TK-760 cameras, and a TK-76B in the Steadicam configuration. A third TK-760 can be added if required. A TH-200 video tape recorder, and a TH-50 portable one-inch model, also will be carried.

The mobile unit will have the capability to record and do switched production on the scene, Mr. Milligan said. In addition, the producer will be able to shoot "film style" with a portable or tripod-mounted roving camera, and the portable recorder, he added.

## WBTW, Florence, S.C., Moves To Circular Polarization

WBTW-TV, Florence, S. C. will begin broadcasting a maximum-power circularly polarized TV signal in mid-1980 with a new RCA transmitter and CP antenna valued at more than \$1 million.

The equipment order includes a TTG-30/30H, 60-kilowatt parallel transmitter system. Introduced earlier this year, TTG transmitters feature completely solid-state circuitry to the 1600-watt visual and 100-watt aural driver output power level, and require only two tubes in each 30-kW transmitter unit.

The Florence station, operating on Channel 13, will use RCA's TCL-16 Tetra Coil broadcast antenna, a top-mounted model with a circularly polarized power gain of 16. The antenna will be mounted atop a new 2,000-foot tower.

Joseph B. Foster, Vice President and Station Manager, said the new transmitter-antenna-tower combination will enable WBTW to broadcast the maximum authorized 316-kilowatts of effective radiated power in both the horizontal and vertical polarizations, from the maximum allowed height. This will provide the strongest possible signal to the station's viewers in North and South Carolina.

## New TV, Radio Systems For Radio Difusora do Maranhao

Radio Difusora do Maranhao, S.A., a major broadcaster in the State of Maranhao in Brazil, has ordered RCA transmitting and studio equipment, valued at more than \$600,000, for three television and radio stations.

The equipment order includes a 15-kilowatt transmitter and associated superturnstile antenna for the broadcaster's television station in Sao Luis. The station also will install two RCA TK-760 studio/field production cameras, as well as switching and audio systems.

Radio Difusora's FM outlet in the city will install a 5-kilowatt radio transmitter and BFG antenna, and the AM station will place in service a 10-kilowatt transmitter.

## Ten TCR-100's For Corinthian Broadcasting

In a major expansion of technical facilities of its five group TV stations, Corinthian Broadcasting Corp. has ordered RCA video tape recording systems valued at more than \$2.8 million. The purchase contract includes ten TCR-100 video tape cartridge recorders, and four TR-600A video tape recorders.

Two TCR-100 machines will be installed in each Corinthian station: KHOU-TV, Houston; KOTV, Tulsa; KXTV, Sacramento; WANE-TV, Fort Wayne; and WISH-TV, Indianapolis. In addition, the Houston and Indianapolis stations each will receive two TR-600A recorders.

The TCR-100 machines for KHOU-TV, Houston, will be equipped with RCA's built-in automation accessory which allows the unit to be totally integrated into a TV station's technical automation system. The automation accessory provides for electronic cartridge identification, automation system interface, and programmable random play of any cartridges loaded into the TCR-100.



\$2.8 MILLION VIDEO TAPE CONTRACT  
M. Art Biggs (left), Vice President, Engineering, Corinthian Broadcasting Corp., presents order to James A. Gimbel, Director, Marketing, RCA Broadcast Systems for a major group video tape recorder purchase. The order includes ten TCR-100A video tape cartridge recorders and four TR-600A quad tape machines.



TV ANTENNA MAST atop the World Trade Center's north tower in New York City is "topped out," as signified by the American flag attached to last antenna section put in place. The RCA-designed antenna stack rises 351.5 feet above the building roof and will accommodate ten television stations and up to 15 FM radio stations. The next construction phase involves installing transmitters in the building below and connecting them to the antennas with approximately one and one-half miles of copper transmission line.

### JSL Video Services Expands Post Production Capabilities

JSL Video Services, Inc., New York City, is expanding its film and video tape post-production capabilities with the addition of RCA video tape recorders and 16mm film handling systems.

JSL Video Services specializes in the color correction of film during the film-to-tape transfer process. It recently added video tape editing facilities and is installing three RCA TR-600A quad tape recorders.

George Sharpe, Secretary-Treasurer, said JSL will use the new recorders to make dubs of commercials after production of color-corrected masters.

Also on order are two RCA FR-16 16mm film handling systems for use in film-to-tape transfers. Introduced earlier this year, the FR-16 features such specialized teleproduction capabilities as "instant" start/stop, variable speed in either forward or reverse mode, and freeze frame (still) mode.

### Syntrak Adds TV Production Capability

Syntrak, Inc., Hollywood, Fla., is expanding its operations with the opening of a full-service TV program production and post-production facility.

The new video tape operation includes three TR-600A quad machines with full time-code editing. A one-inch helical scan recorder with slow motion and still picture capability also will be available in the editing suite.

Syntrak's film operations feature RCA's TK-28 remote control telecine island, capable of scene-by-scene color correction, and of transferring negative film. The telecine system will be interlocked with a PM-86SL magnetic sound recorder/reproducer.

Equipment for field use includes a one-inch video tape recorder and a TK-76B portable color camera equipped with a 14:1 zoom lens.

The new equipment being installed by RCA's project implementation specialists is valued at more than \$500,000. Syntrak's facility presently provides animation, sound, and motion picture services to producers in South Florida.

### New Television Studio For Los Angeles City College

The Los Angeles Community College District has ordered RCA equipment and installation services, valued at more than \$1 million, for a complete on-campus TV studio for student education.

The new studio, to be installed by RCA at Los Angeles City College in Hollywood, Calif., will be used for training students in all aspects of TV program production and in technical equipment operation and maintenance.

Scheduled to be in operation late this year, the studio will have two RCA TK-46 color cameras, a TK-28 telecine island, one-inch video tape recorders, and complete switching, audio and monitoring systems.

### New Studio/Transmitting Systems For Gross Telecasting

Gross Telecasting, Inc. has ordered RCA television studio and transmitting equipment, valued at \$1.2 million, to upgrade and expand the technical facilities of its TV stations in Lansing, Mich., and in LaCrosse, Wisc.

WJIM-TV, Channel 6 in Lansing is installing a TT-50FL, 50 kW transmitter. The two parallel 25-kilowatt units in the transmitting facility will operate in an alternate-main configuration, with one unit on constant standby. The

transmitters, scheduled to begin service at the end of this year, include facilities for remote control operation.

WJIM-TV is increasing its local commercial and program production capabilities with the addition of two RCA TR-600A quad VTR's equipped with AE-600 editing systems for sophisticated time code editing requirements. A new TCR-100A video tape cartridge recorder will handle airing of commercials and other short video taped segments.

WKBT, Channel 8 in La Crosse, also will free existing video tape equipment for production purposes with the installation of a TCR-100A cartridge recorder.

### Seven TK-76 Cameras For Channel 2, Porto Alegre, Brazil

Televisao Guaiba Ltda. will establish comprehensive electronic newsgathering operations and expand the program production capabilities of its television station in Porto Alegre, Brazil, with RCA TV equipment valued at approximately \$1.1 million.

The equipment order includes seven TK-76B portable electronic newsgathering cameras. The station's seven ENG news crews also are being equipped with portable videocassette recorders, as well as with portable microwave systems for relaying news pictures to the station for direct on-air use.

TV Guaiba's equipment purchase for Channel 2 in Porto Alegre also includes two RCA TK-760 cameras, one-inch video tape recorders and switching and audio equipment for use in a new production studio being established at the station.

### Fresno Cable TV Ltd. Quadruples Facilities

Fresno Cable TV Ltd. will nearly quadruple its cable facilities in the Fresno, Calif. area with RCA Cablevision Systems equipment and installation services valued at approximately \$4.5 million.

The system will have grown to approximately 1,200 cable miles by the end of next year and added thousands of new subscribers, according to Ms. Sylvane Walters, Executive Vice President.

The turnkey contract for the major expansion program provides for RCA Cablevision to supply head-end, amplifier and distribution equipment and to manage the equipment installation, checkout and testing.

Ms. Walters said her company acquired one of the existing Fresno cable sys-

tems in March 1978, and later merged it with a second system in which her company held a majority interest. Fresno Cable now has 9,000 subscribers and some 330 miles of cable lines.

### **Ten-Fold Increase In ERP For WLYH-TV**

WLYH-TV, serving the Lancaster, Lebanon-Harrisburg, Pa. market on Channel 15, will greatly increase its effective radiated power (ERP) with a new RCA transmitter and antenna valued at approximately \$600,000.

The new transmitting equipment for the Gateway Communications Inc. station includes a TTU-55C, 55-kilowatt UHF transmitter and a TFU-30J pylon antenna. The transmitter will replace an RCA unit in operation for more than 25 years. The RCA pylon antenna will be mounted atop a new 1000-foot tower. It replaces one which is believed to be the oldest RCA pylon antenna still in operation. This early antenna remains in service on the old tower, as a standby unit.

George Koehler, President of Gateway Communications, said the new high-power transmitter and antenna combination will result in an ERP of approximately 1.3 megawatts, a ten-fold increase over the station's current signal output.

### **WJET-TV, Erie, Pa., Upgrades Technical Facilities**

WJET-TV, Erie, Pa., is upgrading and modernizing its studio and transmitting facilities with RCA television broadcast equipment valued at more than \$500,000.

The Channel 24 order includes a new UHF transmitter exciter, TFU-25G pylon broadcast antenna, and a new studio complement of two TK-46 studio cameras and a TR-600 quadruplex video tape recorder, as well as a complete TK-28B telecine system.

### **Two Golden West Broadcasters' Radio Stations Add New RCA FM Transmitters And Antennas**

Golden West Broadcasters is upgrading the transmitting facilities of two stations in its FM radio group with RCA transmitters and antennas valued at approximately \$250,000. The new equipment includes BTF-40ES1 40-kilowatt FM stereo transmitters for KVI-FM, Seattle, and for KQFM, Portland. Each station also will install a BFM-6, high power circularly-polarized FM antenna.

### **Disc-Go Inc., Kansas City, Expanding Into Post-Production**

Disc-Go Inc., a TV program production equipment and facility renting company in Kansas City, Mo., is expanding into production and post-production operations with RCA quadruplex video tape recording equipment.

The company, whose name is derived from its rental of slow-motion disc machines, has ordered three RCA TR-600 video tape recorders, equipped with AE-600 time code editing systems, as well as a full-capability production switcher.

Disc-Go will field a mobile production vehicle for recording commercials and other material on location, with editing accomplished in the company's studio.



C. Musson

### **Musson Appointed Manager, Studio and Control Equipment**

Carleton H. Musson has been appointed Manager, Studio and Control Equipment Engineering and Product Management, for RCA Broadcast Systems.

Mr. Musson is responsible for managing RCA's line of "live" television cameras, TV film systems, and associated control equipment. These responsibilities include the marketing, manufacturing, and design and development functions. Previously Mr. Musson was Manager, Transmitter Equipment Engineering and Product Management.

Mr. Musson originally joined RCA in 1958 as a leader, design and development engineering, in the field of commercial and military high-power transmitters. In 1963 he went with Wickes Industries, Camden, and became Vice President, Eastern Operations.

Mr. Musson rejoined RCA in 1970 as Manager, Transmitting Equipment Engineering and Product Management.

He is a licensed Professional Engineer, a member of the National Society of Professional Engineers, and a licensed 1st Class Radio Telephone Operator and Amateur Advanced Radio Operator.



V. Mattison

### **Mattison Named Manager, Transmitter Equipment**

Verne S. Mattison has been appointed Manager, Transmitter Equipment Engineering and Product Management, for RCA Broadcast Systems.

He is responsible for managing RCA's line of radio and television transmitter equipment, including the marketing, manufacturing, and design and development functions. Previously, he was Manager, Transmitting Equipment Product Management, a position he had held since 1971.

Mr. Mattison joined RCA in 1951 and served in various product management positions for RCA's TV studio equipment and camera systems, as well as a field sales engineer in Kansas City, Mo.

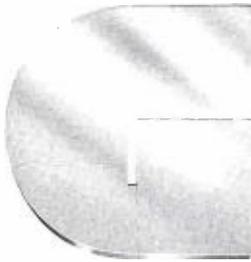
A native of Lamberton, Minn., he was graduated from the University of Minnesota with a bachelor's degree in electrical engineering.

### **WYNF-FM Upgrades Transmitting Facilities**

WYNF-FM, serving the Tampa-St. Petersburg, Fla. market, will upgrade its broadcast facilities with new RCA transmitting equipment. The Taft Broadcasting Company station has ordered a RCA 40-kilowatt FM transmitter and panel antenna for installation later this year.

The BTF-40ES1 transmitter consists of two individual 20-kilowatt units, operating in parallel to produce 40-kilowatts of output power. A motorized switching system automatically keeps the transmitter on the air at reduced power in the event of a failure in one unit.

WYNF-FM's new BFJ-6 six-layer antenna on order is designed to provide broad area coverage as well as good close-in coverage.



## New G-Line VHF Television Transmitters: The Future is Now

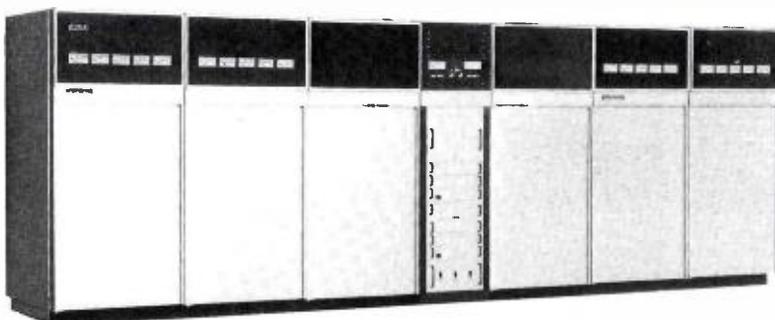


Single G-line transmitter, complete in three compact cabinets.

### CAPSULE OF KEY FEATURES

- Entirely solid state, broadband driver for 1600 watts of peak visual drive capability, with no driver tubes, no driver tuning and no high voltage in the entire driver unit. Result: higher reliability, reduced maintenance, no driver tubes to replace.
- Only one tuned visual tube amplifier and one aural tube amplifier in the entire single ended transmitter. Result: only 6 visual and 4 aural tuning adjustments in the transmitter; unique for a transmitter in the TTG power range.
- Power levels from 10 to 30 kW visual peak and from 2.2 to 6.6 kW aural from the single ended transmitter, whether high band or low band. That means up to 60 kW visual and 13.2 kW aural from the parallel transmitters. Result: more power reserve to handle tall towers with long transmission runs, extra power for a CP antenna, or more power "headroom" for stations who won't actually use the extra power capability.
- Exclusive high precision Surface Acoustic Wave (SAW) visual band shaping filter, with a filter response typically  $\pm\frac{1}{2}$  dB (0.25 dB peak to peak including ripple) across the entire visual passband. Result: virtually ideal video response for finest picture quality.
- Universal Crystal Oscillator—only one TCXO per transmitter—always the same crystal frequency regardless of channel or offset—made possible by a frequency synthesizer which is merely programmed by jumper connections for the assigned channel and offset. Result: no more crystals tailored to the individual transmitter frequency. Also, aural-to-visual frequency separation is accurate within  $\pm 5$  Hz.
- Automatic power reduction with deterioration of load VSWR. Result: transmitter stays on the air at reduced power when the antenna ices up, saving both audience and air time.

Parallel G-line transmitter with combining cabinet in center.



Ten years ago RCA introduced the "F" line of television transmitters at the 1969 NAB Convention. Since then, ongoing technological developments have spurred the design of an entirely new generation of RCA transmitters . . . transmitters with advances that were barely foreseeable at the close of the "sixties".

The newly available technologies cover a broad spectrum and are the result of intensive development efforts for space, military and industrial applications, as well as for broadcasting. Examples of such advances include a variety of higher power solid state RF devices; heat pipe cooling; microstrip and stripline circuit techniques; improved surface acoustic wave filters, and new power amplifier tubes for higher power, with better linearity. Also breakthroughs have been achieved in the development of integrated logic circuitry; high power solid state contactors, and broadband RF circuit techniques, to name but a few examples.

As technology has surged ahead, so also the needs of broadcasters have been undergoing change. The demand for qualified maintenance personnel exceeds the available supply—and the gap is widening. The cost of maintenance reflects this trend. Consequently, there is a growing need for "de-skilling" or handling expanded operations and maintenance with fewer skilled personnel. This places a premium on equipment that simplifies or eliminates manual adjustments; incorporates automatic self-protecting functions, and achieves higher levels of overall reliability.

The combination of newly available technology, plus the need for high performance equipment with reduced maintenance and operator involvement, provided an ideal opportunity to design an entirely new family of television

transmitters. The G-line of transmitters—new from the ground up—is the result of that opportunity. The new TTG series transmitters employ to full advantage a wide range of new, advanced concepts and capabilities, and in fact, bear little resemblance to their predecessors.

The technological discoveries and applications by RCA engineers and scientists have brought the G-line to reality. The following discussion provides a straight-on look at how technology and the "TTG" Series transmitters have come together to serve the future demands of broadcasting.

#### Universal VHF Television Transmitters

G-line is designed for broadcasters around the world. The TTG has a visual channel bandwidth capability in excess of 6.5 MHz to accommodate CCIR systems D and K1, well beyond the 5 MHz U. S. bandwidth. Operation on different international standards is accommodated by a choice of plug-in filters and equalizers to handle the range of bandwidths and equalizing curves.

Also, the TTG has extended RF frequency range capability from 47 to 100 MHz in the lowband models, and 174 to 230 MHz in the highband models. This is an advantage to broadcasters operating on channels 2, 6 and 13 in that the transmitter is operating comfortably within its tuning range.

Both single and parallel models are available. Single systems for the U. S. (System M) lowband channels are rated at 16 and 30 kW with parallel systems rated at 32 and 60 kW. Highband single models have 17 and 30 kW ratings, with 34 and 60 kW ratings in parallel. This is a twenty percent increase in maximum rated power output capability over previous generation ratings.

The higher power rating offers the ability to achieve the station licensed ERP at increased tower heights. It also provides the added power capability needed to handle circularly polarized antenna systems. Or it provides additional power "headroom" for extra margin of operating reliability.

Single G-line transmitters are available for CCIR System B, Bands I and III with visual power ratings of 14 and 24 kW. The equivalent ratings for CCIR System D or K1 are 12 and 20 kW.

#### Design Objectives

Reliability has been a traditional objective in the design of RCA television transmitters, and was given increased emphasis in the design of the G-line, for several reasons. The rising price of air-time puts a premium on avoiding equipment down time. At the same time, many stations are operating more hours per day leaving less time for preventive maintenance. Competition for viewers is intensified, resulting in an increased emphasis on received signal quality.

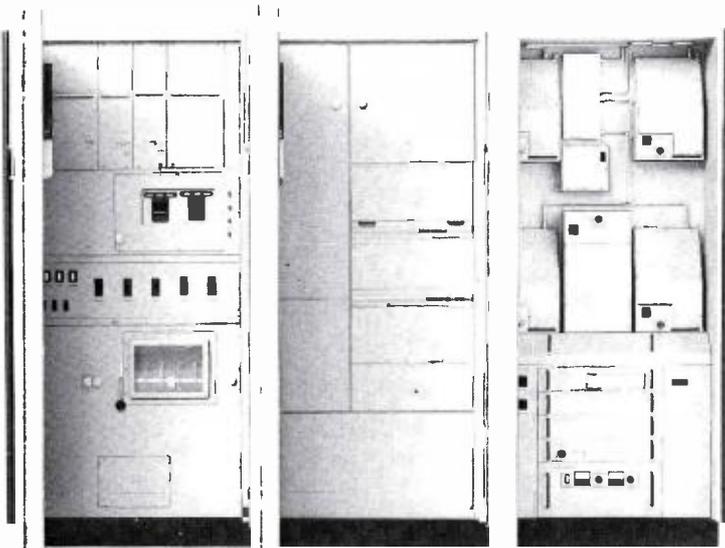
Cost of ownership of a transmitter was a basic consideration, including the total cost of acquisition, plus the cost of installation, maintenance, repair and tube replacement.

Finally, there was a need to respond to the growing awareness of personnel safety considerations; a trend that is becoming more apparent each year.

These were the basic guidelines for G-line, and here are the ways they were met.

#### Compact Cabinets

The TTG transmitter is housed in three cabinets of identical size; each 36 inches (914 mm) wide, 40 inches deep (1016 mm), and 77 inches high (1925 mm). The cabinets are the driver, power am-



Single transmitter. Separately hinged metering and control panels swing back from doors for access when doors are open.

plifier and power supply. Being part of the three basic front line units, the power supply requires no inter-cabinet wiring ductwork, and there is no high voltage outside the cabinet enclosures. Floor space for the single TTG transmitter is minimum.

The power supply and power amplifier cabinets are always installed side-by-side with the power supply on the left. The driver cabinet can be installed on either side and can be separated with the use of special length cables. Maximum separation distance depends on the operating power level but can be as far as twenty-five feet.

In the parallel transmitter configuration, two single transmitters are joined by a combining cabinet to form a par-

allel system. The combining cabinet contains the combined power output meters, the exciter and exciter switching, and the output switching control logic.

Since the G-line combining functions are in a separate combining cabinet, there is a very high degree of isolation between the two halves of the parallel transmitter. If one side should fail, it is possible to work on it without the risk of interfering with the operation of the other side.

With G-line, it's easy to expand from a single transmitter to a parallel system by simply adding the combining cabinet and the second transmitter, plus the necessary motorized output switching and paralleling components. The par-

allel transmitters offer a high level of system installation flexibility. The units can be arranged in a "U" formation . . . in a straight line . . . or at a right angle.

#### Controlled Access

G-line access is controlled on the basis of priority and frequency to which it is required. All controls and meters are located behind the front doors of the cabinets. The meters are illuminated, behind plexiglass windows. An access port in a horizontal "racing stripe" panel makes the basic on-off pushbutton controls easily available.

Folding down the panels reveals the motorized tuning controls and multimeter switches. The meter panels are hinged so that they can be swung into view while the doors are open. There are no meters in the door of the driver, and there are no tuning controls, because there is nothing in the driver to be tuned.

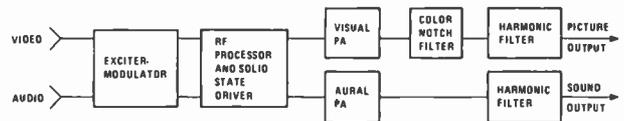
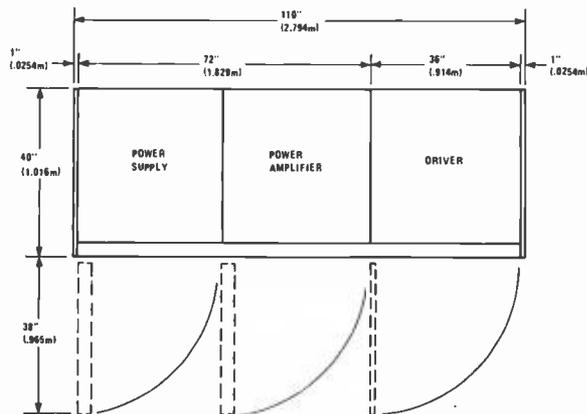
#### The G-Line System

Before proceeding into each of the separate cabinets, a brief look at the system is warranted. The simple block diagram of the TTG Single Transmitter depicts this.

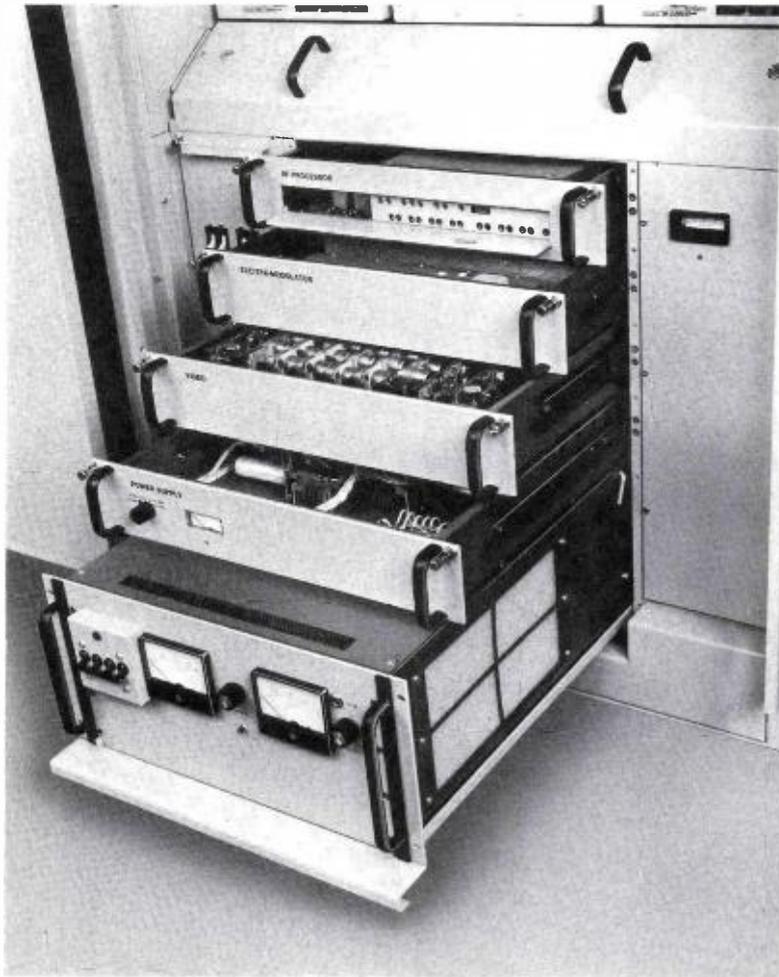
Audio and video enter the exciter-modulator system which is located in the driver cabinet. The modulated RF signals proceed to the driver where they are amplified separately. From there they go to the power amplifier which contains a single aural and a single visual final amplifier stage. The power supply cabinet contains power supplies for only the final amplifiers. The driver contains its own solid state power supply system.

Compact design requires little floor space for installation.

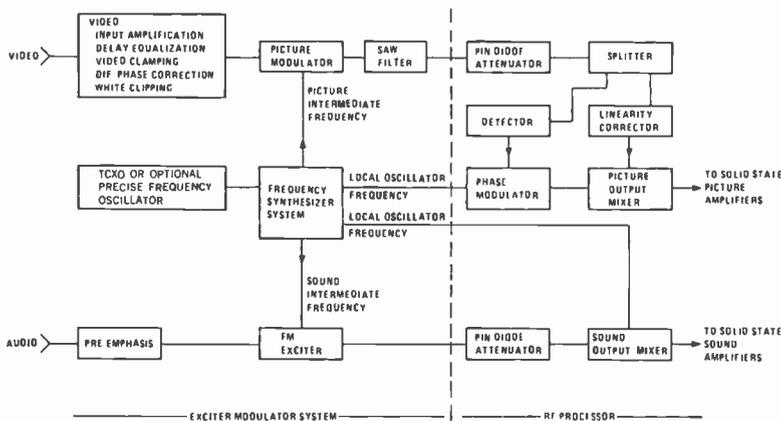
SUGGESTED CLEARANCE FOR REAR ACCESS: 36" (0.914m)



Simplified functional diagram, TTG Single Transmitter.



Lower section of Exciter-Driver cabinet includes trays for RF-Processor, Exciter-Modulator and Power Supply circuits.



Simplified functional diagram, TTG Exciter-Modulator and RF Processor.

### Driver Cabinet

The driver unit may be located on either the left or right end of a G-line single system. In a parallel system, the two drivers are located on either side of the combining unit.

The lower half of the driver cabinet houses low level circuits which are mounted in sliding trays (drawers). At the top is the RF Processor tray and at the bottom is the Power Supply for the solid state driver amplifiers. The exciter-modulator group occupies the three center trays labeled:

- Exciter-Modulator
- Video
- Power Supply

### Video Tray

The Video Tray is the third drawer from the top. The video signal flows from left to right through a series of nine plug-in circuit boards and two adjustable gain controls which are interconnected to a mother board. The *video input amplifier* is a video differential amplifier to eliminate common mode ground loop hum and noise. This amplifier has a "looped through" input, so a video DA is not required to feed parallel transmitters with dual exciters. Nearby the video input amplifier is the motorized video gain control, which is remotable.

Next are six passive plug-in group delay equalizer modules. These modules are:

- two notch equalizer boards*
- receiver equalizer*
- two low frequency equalizer boards*
- high frequency equalizer*

No group delay equalization is required for the vestigial sideband filter since the Surface Acoustic Wave (SAW) filter is phase linear. Also, no group delay is required for any of the broadband solid state RF amplifiers in the visual driver. Group delay correction is required only for the notch diplexer, when used for the one tuned visual power amplifier stage and for receiver delay.

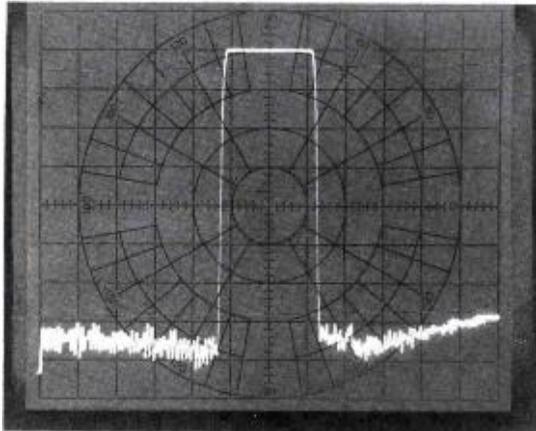
The remainder of the drawer contains two more modules. The *video clamp module* which clamps at blanking level and the *video output module* with an adjustable white clipper circuit. Nearby the video output module is the remotable, motorized sync gain control.

### Exciter-Modulator Tray

The video signal proceeds from the Video Tray to the Exciter-Modulator Tray. In the U.S. model transmitters,



G-line transmitters incorporate Surface Acoustic Wave (SAW) filter for vestigial sideband shaping.



Swept response of SAW picture sideband filter from 29 through 59 MHz at 10 dB per vertical division.

visual modulation occurs at a universal frequency of 45.75 MHz, while the CCIR version operates at a visual modulated frequency of 38.9 MHz.

The G-line uses a double balanced diode modulator, specifically designed for extremely low incidental phase distortion. The circuit has the advantages of excellent linearity, broad dynamic range, and high isolation from input to output.

Aural modulation occurs in the FM exciter module. The aural exciter is enclosed in a cast housing which is shock mounted to protect the signal from mechanically induced interference.

#### The RCA SAW Filter

Vestigial sideband shaping is accomplished in a Surface Acoustic Wave (SAW) filter immediately after modulation. The SAW filter has virtually ideal characteristics, including extremely flat amplitude-frequency response throughout the passband and a very sharp cut-off at both edges of the pass-

band. An important advantage of the SAW filter is the absence of any large amounts of group delay distortion at the edges of the passband. This eliminates the need for the substantial amounts of group delay correction that are required for conventional lumped constant filters.

#### Universal Frequency TCXO

The G-line exciter uses only one temperature compensated crystal oscillator (TCXO) as a reference to generate all of the frequencies employed in the transmitter. The TCXO operates on a standard frequency of 10 MHz and does not require temperature stabilization.

Since the standard TCXO operates at 10 MHz, it is possible to substitute any stable 5 or 10 MHz frequency source as an emergency replacement.

#### Frequency Synthesizer

A frequency synthesizer enables the universal TCXO to serve any channel and offset. The synthesizer is programmed to the assigned channel and offset by making appropriate jumper connections. Since all frequencies employed in the transmitter are phase locked to a common reference oscillator, the aural-to-visual carrier frequency separation is stable within  $\pm 5$  Hz.

With a G-line transmitter, handling the requirement for Precise Frequency Control is a simple matter. All that need be done is replace the standard TCXO with an oven-stabilized precise frequency oscillator operating at 10 MHz. The result is control of the final carrier frequency within an accuracy of  $\pm 2.5$  MHz over a 30-day period. A storage battery with trickle charger is provided to maintain operation of the oven for a period of up to eight hours in the event of a power failure.

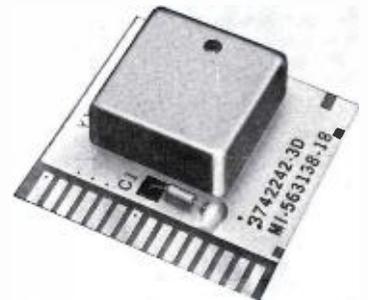
#### RF Processor Tray

From the Exciter-Modulator Tray the visual and aural signals proceed to the RF Processor Tray, the top drawer. In a TTG transmitter, this drawer provides the functions of aural and visual power level control and pre-correction for distortions that occur in the process of RF amplification to final power level. Up-conversion from universal frequency to carrier frequency occurs after the corrective functions.

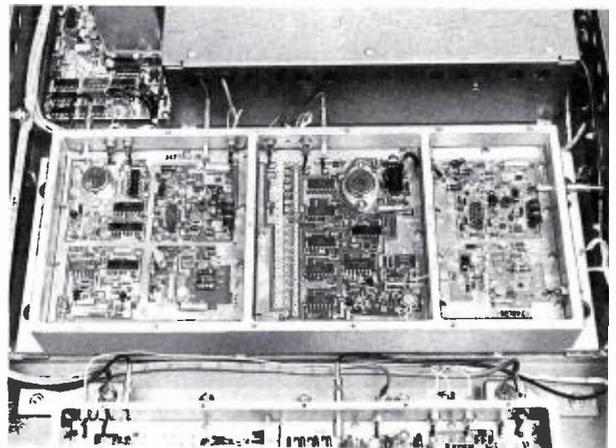
Linearity correction occurs at universal frequency, immediately before up-conversion to carrier frequency. Incidental phase correction is also provided by detecting a sample of the modulated IF signal and applying the resulting video to a phase modulator located in the local oscillator feed to the final frequency mixer.

There are three benefits from the proper correction of incidental phase errors. First, it suppresses visual-to-aural interference in the form of "sync-buzz". Second, it avoids hue shift in the received

Only one TCXO is required in the TTG Transmitter exciter.



Frequency Synthesizer Assembly.



signal. Third, it reduces sync tip ringing and spiking in the transmitted signal. The resulting signal is not only technically superior, but allows improved reception on many home receivers.

#### Power Supply Trays

The power supply for the exciter-modulator and the RF Processor is in the fourth tray from the top. Here, four regulated DC voltages are provided.

The G-line Driver Power Supply is the bottom drawer in the Driver cabinet. It provides regulated DC voltage to the solid state aural and visual amplifiers in the driver system which is described next.

#### G-Line Driver

The aural and visual signals from the RF Processor tray enter the driver amplifier system at a level of one half watt.

The entire amplifier system is solid state to the 1600 watt visual output level. Further, the driver is broadband across the full range of operating channels. The low band driver covers the range from 47 through 100 MHz, and the high band driver covers 174 through 230 MHz—all without tuning adjustments. Since the driver uses no tubes, it contains no DC voltage above 48 volts in the lowband model (25 volts in the high band model). The elimination

of all tubes and high voltages from the driver results in simplicity, increased reliability and improved personnel safety.

The half watt visual signal from the RF Processor enters a predriver amplifier and its output is then split. The levels are balanced by attenuators before being fed to a system of solid state IPA arrays operating in parallel, each capable of 400 watts of output. The outputs of the IPA arrays are then recombined in a stripline combiner.

Two 400 watt units are used for driver power levels up to 800 watts, and four are used for power up to 1600 watts at peak of sync. The stripline combiners are also broadband across the entire range of channels. They combine the advantages of low attenuation, low VSWR and virtually flat response across the entire band.

The aural signal also enters a solid state predriver, followed by a solid state output amplifier. The aural output is 100 watts in the high band model and 75 watts for low band.

#### Microstrip Wiring

Microstrip circuitry is used for the input splitting and output combining circuits of the 400 watt IPA arrays.

Microstrip circuitry offers a number of

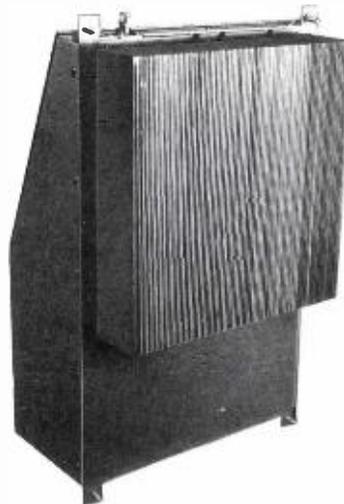
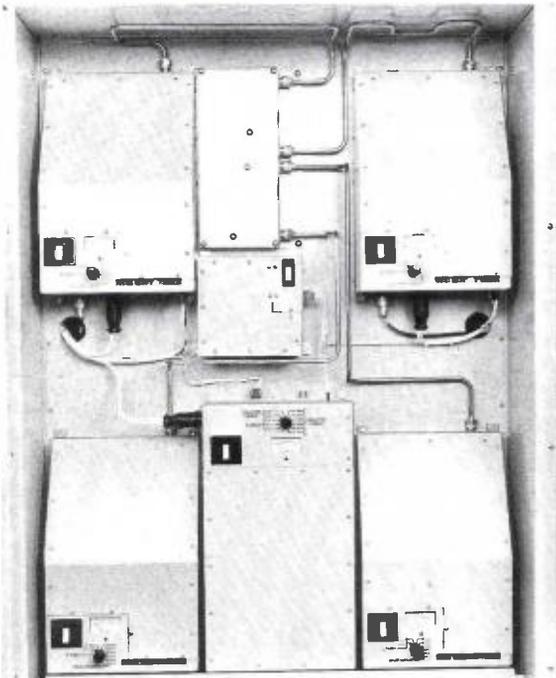
advantages for this application, including very low attenuation and uniformly excellent performance across the entire operating band. Once the optimum circuit configuration has been developed, it is readily duplicated with extreme precision through normal printed circuit manufacturing techniques. Also, it is mechanically stable and reliable throughout its useful life.

#### Heat Pipe Cooling

A major achievement which made the 400 watt solid state broadband amplifier possible was the development of appropriate cooling techniques for the amplifier transistors. The transistors in these amplifiers are cooled by embedded heat pipes, a technique originally developed for space applications and extensively proven in satellite service.

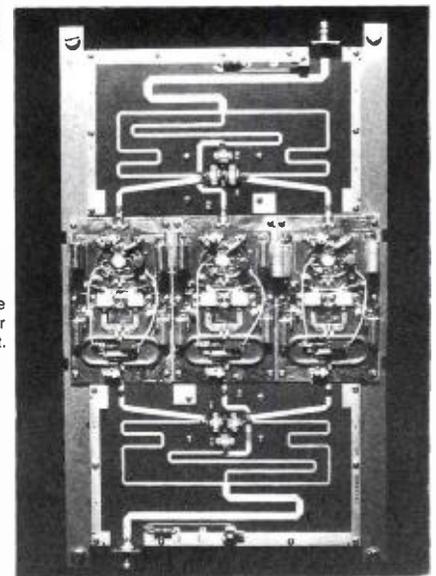
The heat pipe principle employs a vapor chamber fluid in a sealed module which is embedded in the baseplate on which the transistor is mounted. Heat from the transistor causes the fluid to vaporize and rise to the top of the sealed container which is cooled by a heat sink, causing the vapor to condense and sustain the cooling process. The heat sinks are cooled by an air stream provided by a small blower in the driver cabinet. The result is a highly effective cooling system which requires little or no attention.

Solid state driver amplifiers are mounted in the upper section of the Exciter-Driver cabinet.



Rear view of solid state driver, showing heat sink.

Stripline combiner circuit.



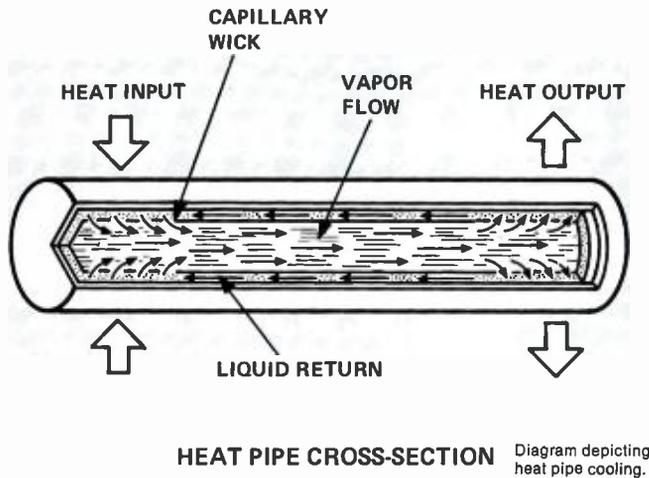


Diagram depicting heat pipe cooling.

**Front Panel Access to Driver Cabinet Components**

The solid state driver amplifier system is physically arranged to allow maximum accessibility. The layout of the Driver Cabinet is simple and efficient. All of the solid state amplifiers are mounted flat on the wall and are accessible by removal of front covers. Each amplifier can be serviced in place, even during operation.

**G-Line Power Amplifier**

Occupying the center position of a G-line single transmitter is the Power Amplifier Cabinet. This cabinet contains the single visual and the single aural tube amplifier stages. These are the only tubes in the entire transmitters.

In a TTG transmitter the same tube types are used for high and low bands. Because there are only two tuned tube amplifier stages, there are only ten tuning adjustments in the entire transmitter.

For cabinet cooling, a single blower in

the base of the unit handles up to 7000 foot elevation at full rated transmitter power. Higher altitudes can be accommodated on a custom basis. Since the blower is a direct drive unit, no drive belt is used. Each tube amplifier is equipped with a separate air monitoring and air interlock protection system. Both low and high band models utilize new, high performance visual power amplifier tubes. A 9007 tetrode is used in the 30 kilowatt models and an 8976 tetrode is used for the 16 kilowatt low-band and 17 kilowatt highband units. An 8977 tetrode is used as an aural power amplifier in all models.

**High Efficiency Cavities**

The tube cavities utilized in the TTG transmitters are in the familiar rectangular configuration which has been developed and refined by RCA over a period of many years. The results are cavities that have low power loss for efficient and cool operation. Access to cavities is provided through removable

front panels—so each cavity can be inspected and serviced in place.

**G-Line Power Supply Cabinet**

The Power Supply Cabinet of the TTG transmitter provides plate, screen and bias voltages to the power amplifier tubes. Since the Power Supply cabinet is located next to the Power Amplifier, there is no high voltage external to the cabinets. Also, no inter-cabinet ductwork is required. The primary power circuit breaker is factory-installed in the Power Supply cabinet, thereby simplifying and reducing installation effort.

The Power Supply Cabinet contains many innovations in transmitter design. The high voltage power supply components are combined in a rugged frame, on casters. This unit rolls out of the back of the power supply cabinet for easy service, and also to provide improved accessibility to the cabinet interior.

*Modular Screen and Bias Supplies* are mounted in the top of the power supply cabinet. There are two sets of these with one pair delegated to each power amplifier tube. Plug connection permits easy removal for bench service.

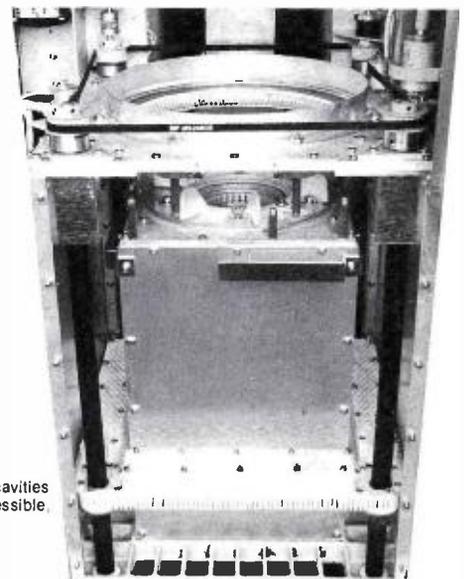
A *solid state Power Controller* replaces the usual mechanical contactor in the primary circuit of the plate voltage supply. With the solid state controller, voltage is applied at a controlled build-up rate to relieve stress on tubes and other components. Also, turn-off is faster for quicker protection.

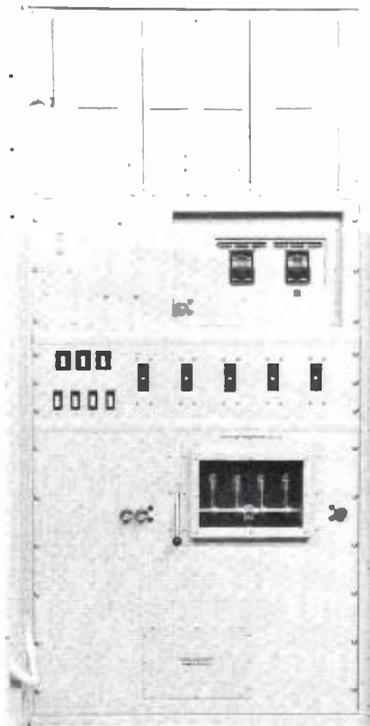


Only one visual and one aural tube are used in TTG Transmitters.



High efficiency cavities are easily accessible.





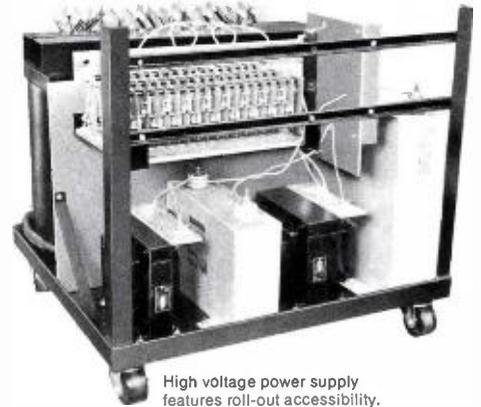
Power Supply Cabinet includes many design innovation

#### Automatic Power Control

Stable picture power level is maintained by detecting a sample of the final RF output and comparing the peak of sync level to a reference signal. The resulting error signal is applied to the power control pin diode attenuator located in the intermediate frequency signal path. Sound power level is similarly stabilized by pin diode attenuator control. The power level to be maintained by the automatic control circuit is established by adjustment of the reference signal.

The primary function of the power control system is to maintain aural and visual power at 100% of licensed power level. But there are times when 100% power could cause system damage or failure. This could occur in the event of a deteriorating load VSWR caused by severe antenna icing conditions.

The G-line transmitter power control system employs a VSWR protection circuit which senses a rising load VSWR and automatically reduces the output power at a controlled rate. Should the load VSWR reach a pre-determined limit, the VSWR overload circuit will take over and shut the transmitter down. Until that time the transmitter stays on the air, at reduced power, operating and maintaining audience.



High voltage power supply features roll-out accessibility.

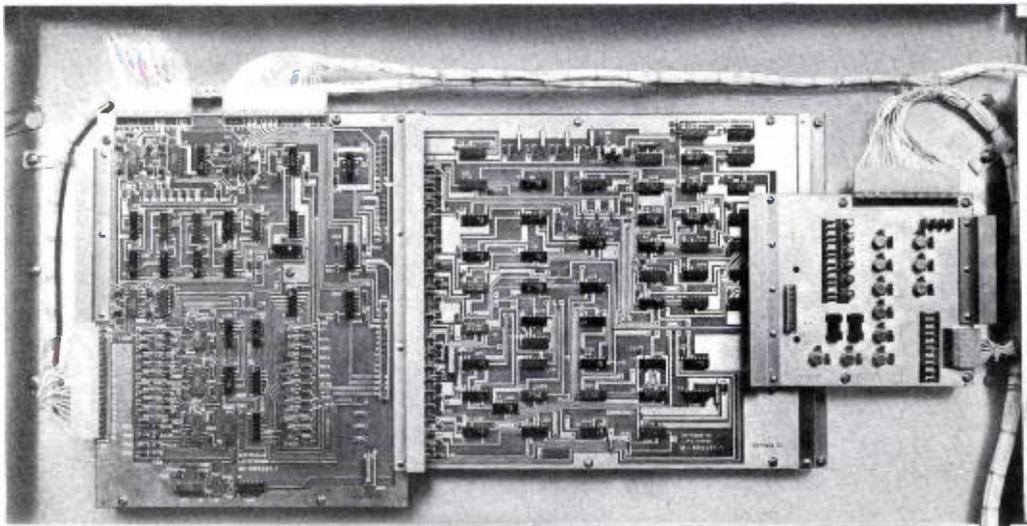
The automatic power control system also compares the input and output signal levels of the driver amplifier system and holds the input signal level constant in the event of a loss of driver gain. This avoids the risk of overdriving the solid state driver system to make up for loss of system gain.

A battery-powered memory circuit assures quick return of signal to the air in the event of a power failure. If there is a power interruption of 10 seconds or less, the transmitter automatically returns to the air within two seconds.

These automatic functions mean less attention need be paid to the transmitter to maintain signal continuity and audience protection.

#### Solid State Control Logic Circuitry.

In the G-line transmitter, the control logic center is mounted on the rear of the front door of the power supply cabinet behind a drop-down panel. This is the logic circuitry that controls: start-up and shut-down sequencing; overload sensing and protection electrical interlock functions, and all status reporting functions. The logic circuitry is laid out so that no extender boards are needed for circuit inspection.



Control and protection logic circuit boards.

For interruptions longer than ten seconds, a G-line transmitter can be returned to the air within four seconds by manually bypassing the normal time delay. The tubes used in the TTG transmitter employ thoriated tungsten filaments for quick start-up without damage. The normal start-up time is only two minutes after filament turn on.

#### LED Status Indicator Panel

On the logic control board, a series of LED's are visible through openings in the cover panel. These indicators provide status indication and overload information.

An indicator is illuminated at the conclusion of each step of the transmitter start-up sequence as follows: Visual air, Aural air, Visual filaments, Aural filaments, Visual bias, Aural bias, Plate voltage, Visual screen and Aural screen.

In the event of a malfunction which interrupts transmitter start-up, an LED indicator immediately identifies the level at which the sequence was halted and therefore assists in diagnosis and correction of the cause.

Other LED readouts include: Mode switching completion, AC Line Phase Loss, Cabinet High Temperature, Exhaust High Temperature, Power Supply Control Circuit Fault, Multiple Overload Fault and Fault Mode Selection (single vs. multiple). An LED lamp test button is provided to identify any failed LED for replacement.

LED indicators provide extensive reporting of transmitter status.

#### Safety Engineered

To meet increasing demands for more stringent safety standards, the G-line transmitters employ both mechanical and electrical interlock protection systems.

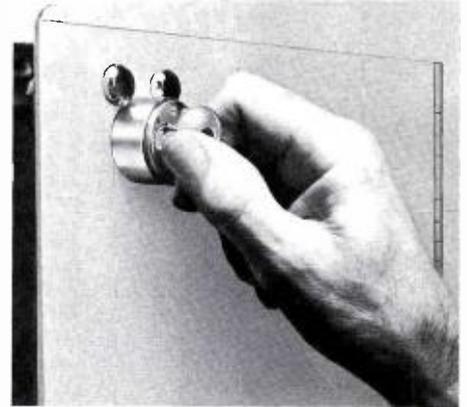
A key interlock system assures that adequate steps are taken to ground the high voltage before normal access is gained to high voltage areas. A manually operated grounding switch provides positive contact to ground.

Only after the system is grounded can two keys be removed and reinserted in the tube compartment doors to gain access to the tubes. In addition, a TTG transmitter is protected by electrical interlocks and high voltage grounding switches.

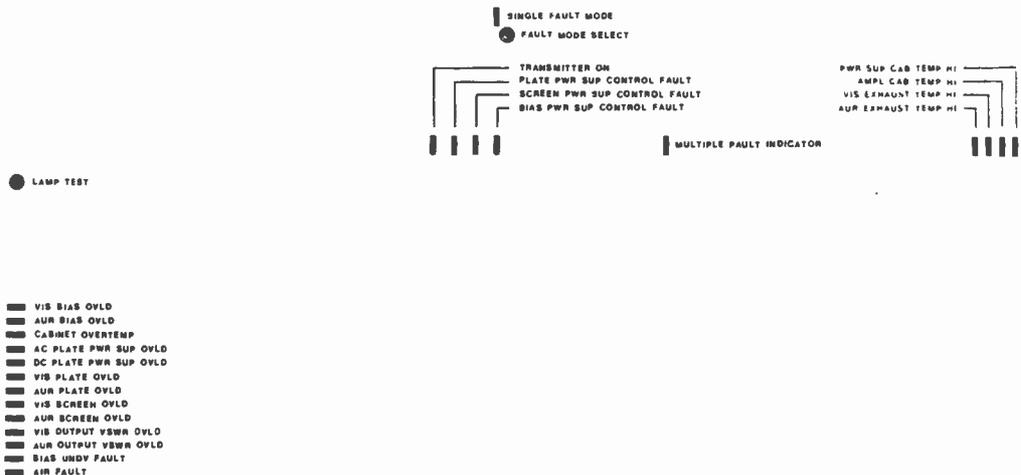
#### G-Line Parallel System

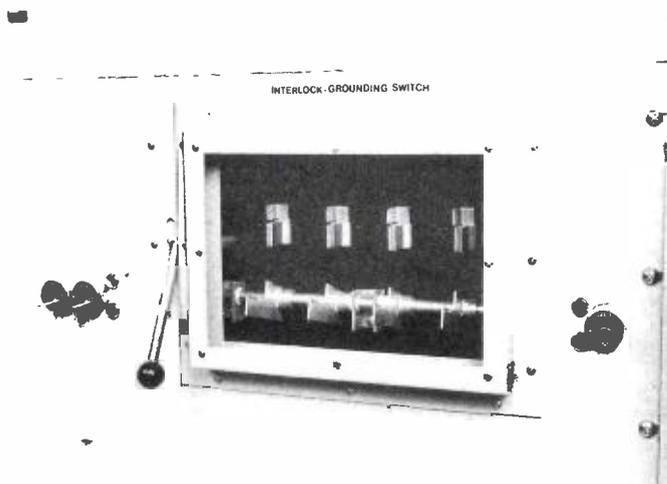
The TTG parallel transmitter models are comprised of two single units combined to operate as one transmitter with double output power capability. In the event of failure of either transmitter unit, the other unit continues to operate without interruption of transmission.

In addition to providing a very high level of operating reliability through equipment redundancy, the parallel transmitter offers characteristic improvements in transmitted signal quality. The combined system is inherently capable of absorbing reflected signal



Key-operated interlock system offers positive safety in gaining access to tubes and cavities.





Interlocking manual grounding switch for plate and screen supply voltages.

components (ghost images) caused by an imperfect load impedance match. Reflected signals are reversed in phase in the combiner system with the result that they emerge in the combiner reject load. Signal quality is further improved by the ability of the parallel system to "average out" minor imperfections which may be present in the signal from either transmitter. As a result the performance of the combined system tends to exceed that of either one of the two transmitter units operating alone.

Output power combining is accomplished by 3 dB couplers in the picture and sound outputs. Upon failure of one transmitter unit, the total output power is reduced to one-fourth of normal level with half of the power from the non-failed transmitter delivered to the output load and the other half delivered

to the combiner reject loads. Motorized coaxial output switching is provided to permit bypassing the combiners when operating in the single transmitter mode, thereby restoring the output level to one-half of normal level. Output mode switching is controlled locally by pushbutton and is also remotable.

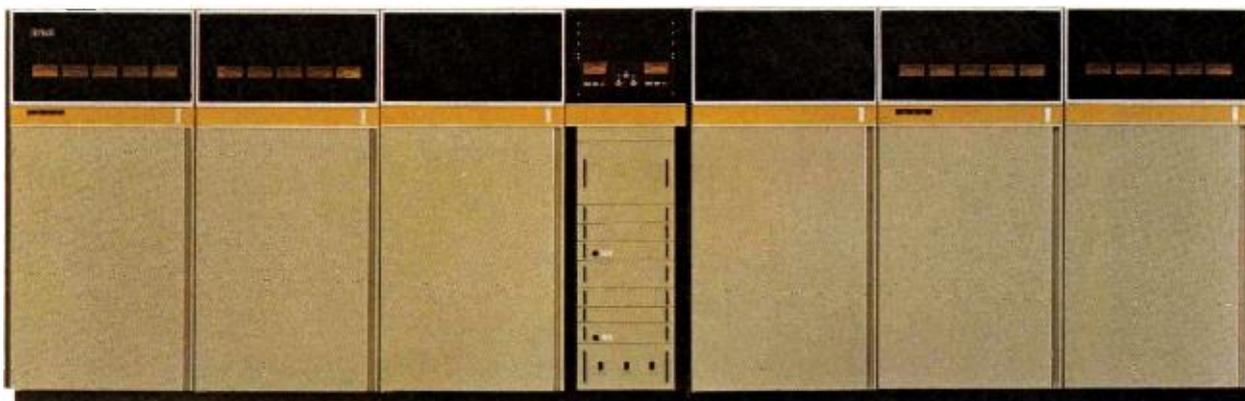
#### G-Line . . . its time has come

The TTG Series represents a new era in television in all facets . . .

- design innovation
- technological implementation
- manpower efficiency
- consideration for future need

The television transmitter typically has the longest operating life of any equipment used in a station. Up to twenty years of operation or more is not unusual for a well-designed transmitter. In designing the G-line, RCA engineers

anticipated the needs of the broadcaster into the next century. An examination of a G-line transmitter reveals immediately how far ahead the technology of television RF transmission has been moved toward that objective. □



TTG parallel transmitter with doors closed. Center combining cabinet contains combined power output meters, exciter and exciter switching and the output switching control logic.



Oral and Evelyn Roberts get double coverage in Studio One by two TK-44 color cameras.



## ORAL ROBERTS TELEVISION PRODUCTIONS

Personal standards set production standards

TULSA

*L*ights were set, audio level established, production crew ready. Oral Roberts entered the set, sipped water from a carefully concealed glass, struck that familiar pose and began his message. For the next thirty minutes a calm professional air prevailed over the segment taping. Two TK-46 color cameras equipped with 12X Angenieux lenses and shot boxes plus one TK-44 captured Reverend Roberts' every movement. Three tape machines recorded the isolated video signals. The entire philosophy of the Oral Roberts Television Production facility became immediately apparent during that taping . . . "it isn't as important to just get it on tape as it is to do the best job possible."

### **"Baby" Mabee Facility**

Located in Tulsa, Oklahoma, the Oral Roberts Television Production facility is situated on the campus of Oral Rob-



Technical Director, Mike May (left) and Director, Matt Connolly, Jr., conduct an isolated camera taping session in Master Control.



A sunny day at ORU is captured by a TKP-45 (left) and TKP-46 (right). The Mabee Center and adjoining production facility are in the left background.



A TK-44 and TK-76 share the work during a remote shoot at ORU.



On location at Oral Roberts University, a production team prepares for a taping session with the mobile van.

Oral Roberts University. Affectionately referred to as the "Baby" Mabee Center, the two year old television complex adjoins the Mabee Center, home for many Oral Roberts' religious shows plus ORU basketball games. In fact, it was due to the increasing popularity and success of the Oral Roberts teams that the production staff and facilities were relocated from the Mabee Center Arena, where the adjacent TV production facility was an RCA turnkey project, to their new annex.

The attractive bi-level production center houses administrative offices, studio, scene shop, wardrobe, video control, audio control, sound studio, and post production and tape areas. Chris Miller, Director of Operations, remarks, "The facility is currently quite busy . . . running two shifts per day."

Studio One, with a floor area of up to 8600 square feet and a seating capacity of 1750, is the source of the syndicated "Oral Roberts and You". A comple-

ment of three RCA TK-46 cameras with Angenieux 12X zoom lenses and "shot boxes" are normally used here. During the production of elaborate seasonal specials, the studio can handle up to six cameras which may also include TK-44s, TKP-45s or TKP-46s. This studio is also equipped with a Chapman crane and Skirpan Auto Cue lighting system.

With the addition of Studio One, the Oral Roberts production staff has ample room to have sets standing and to fly major parts of them. There is a 360° cyclorama with cye pit in the major cye area.

Adjacent to Studio One is Master Control. Although Master Control is primarily tied in with the main studio, it can be used to control cameras in an insert stage (Studio Two) and in the main Arena. Adjoining Master Control is the video control area where all camera shading is done. Here are located the TK-46 Camera Control Units.

#### Oral Roberts on the Road

Although the studio facility is a vital part of the Oral Roberts production philosophy, location and remote productions will assume an even more important role. Handling a major part of this challenge will be the mobile van. This unit is equipped with four RCA TKP cameras . . . two TKP-45s and two TKP-46s. Chief Engineer Gridley Quihuis comments on the selection of the TKPs for van use, "The camera is really ideal in that function, it doesn't require a lot of space with the lenses allowed for in the packing cases." Like the studios, the van is set up for the Oral Roberts style of isolation shooting, which is detailed later. Accompanying the TKPs are four BCN-20 1" tape recorders, with a total van capability of handling six units including field playback.

Assuring the Oral Roberts standard of quality in audio also, the audio system



Original "Oral Roberts and You" programs were produced at NBC Burbank. Here a TK-44 moves into position behind Reverend Roberts.

### Oral Roberts Television Productions — from Burbank to Tulsa

The use of television by Oral Roberts goes back to the mid 1960's. At that time, Reverend Roberts used the NBC Burbank facilities. Peggy George, General Manager of TRACO, Inc. (the advertising/media arm of the Oral Roberts organization) remembers that it was then that the desire for quality—and the benefits it brought—were instilled. Many of the engineers and technicians that joined the Mabee Center when it opened in 1972 had worked in the network atmosphere and adopted the Oral Roberts style and standards.

When the television center was planned, RCA was selected to install the total turnkey facility. The original package included: Four TK-44 color cameras, three TR-70C video tape recorders, a TS-switcher, a BC-100 audio console, an RT-21 reel-to-reel audio recorder, plus complete supplementary equipment and the later addition of one-inch VTR capability.

"Oral Roberts and You" is seen by over three million viewers in the United States and carried by 350 television stations worldwide. Specials are carried to more than 30 million viewers worldwide by 550 broadcasters, cable distributors and re-broadcasters. The syndicated show is reputed to be number one in religious programming since 1971. Tapes of "Oral Roberts and You" were originally "biked" to stations, but the new program format will see the adoption of weekly direct shipments. This will result in a program with added relevancy and audience appeal.

The high quality and diversity of the programming is partially attributed to an archive filing system that makes all film and video tape readily accessible. Computerization of the system will facilitate locating file footage for use during the new format "Oral Roberts and You".

in the van is set up for multi-track recording. The one-inch tapes recorded on location are brought back to the production facility for later dubbing to quad.

Gridley Quihuis has taken virtually every step to assure that on the road, the van is as independent as possible. The electrical system is a prime example of this. Two different 220 volt AC feeds supply the van, one for utility and one for equipment. The truck can also be run on 110 volt AC as the total drain is only 60 amps, including the air conditioner. Electric dryer and range connectors carried on board make it possible to tap power from normal home service during a remote shoot.

#### Syndications and Miss Teenage America

Additional in-house facilities at the production center include two studios located in the Mabee Center. The insert stage (Studio Two) has been the source of several syndicated programs. It is presently equipped with three TK-44 color cameras, but is capable of handling four cameras.

Studio Two is assuming a more important role as an instruction center for ORU Telecommunications students.

Though hardly a typical studio, the Mabee Center Arena was the original production center. The Arena studio with its 11,000 seating capacity and TK-44 cameras was used for the televising of two Miss Teenage America pageants. Now, primarily used for entertainment and sports, the facility is still functional for productions.

#### One-to-one Philosophy

The calm aura in master control is primarily due to the elimination of the need to switch a segment or production number during taping. This is especially critical considering the importance of the message continuum required for religious broadcasting.

A normal recording session will involve four cameras. Three of these will be TK-46 color cameras, which were acquired in November 1978, while the fourth camera may be a TK-44 or TKP, which will operate from the new TK-46 Camera Control Unit. Remarks Quihuis, "Compatibility is very important. I can run three cameras off the one CCU dedicated to Studio One then add the TKP to that system." During a production, the Auto White Balance feature becomes extremely valuable in

shortening set up time. The stability of the TK-44 and TK-46 is evident when informed that even though the cameras are routinely inspected for drift, they seldom require set up more than once a week. Cameras have been moved from pedestal to pedestal and still retained their registration. Mr. Quihuis sums up an operator's opinion of the TK-44 by stating that, "Stability on the 44's is great." He adds, "RCA equipment has been extremely dependable and durable."

Once the cameras are selected for a production, each one is fed to a routing switcher. Each video tape recorder (either an RCA TR-70C or TR-600) has its input fed from the routing switcher. This is the key to the high product quality at the Oral Roberts Production Center . . . *the entire production is recorded in an isolation mode.* Each camera is delegated to a particular 2" machine. There may be a single back-up VTR or an entire duplication of VTRs in case a recording segment runs beyond tape capacity time.

While each camera is fed in isolation to a dedicated tape machine, the program may also be assembled on an additional tape machine using a Grass Valley 1600 24-input switcher. If the production staff is dissatisfied with the "switched" feed, the video of all cameras is available on isolated tape for total reconstruction. Each of these camera master tapes plus the final edit master is kept in storage indefinitely.

During the recording process, a black & white camera shoots monitors (corresponding to the number of cameras employed) grouped together. The output of the black & white camera is fed through a character generator where time code is superimposed over the image of the monitors. A half inch VTR records this and the tape is later used by the director to pick shots prior to going into postproduction.

An interesting sidelight is that an audio cassette of the taping is made during the recording session. Within three hours after the session is completed, a typed transcript is available to the director for time code notation and edit assignment.

Once program segments are committed to tape, the Oral Roberts team go into high gear . . . the actual compilation of video and audio into a final tape.

#### **Totally in Sync**

Once the master tapes are in the can,

the headwheel on the VTR used to record from each camera is designated as the master headwheel for that tape and will follow it through the edit process. With the headwheels, all the normal technology tests to monitor quality are employed, but when it comes right down to keeping a unit as a master, retiring it to duping status, or refurbishing, "it all comes down to eyeballing," expounds Jim Taylor, Assistant Director of Engineering, "We take personal interest in the evaluation of our product." Gridley Quihuis relies on RCA for headwheel service, "We've tried other refurbishing houses for headwheel units but they've not been able to give the repeated quality that RCA gives." This exceedingly high quality standard is set by the Oral Roberts staff. They pride themselves in having gone out of their way to learn

how to keep all equipment operating at peak performance.

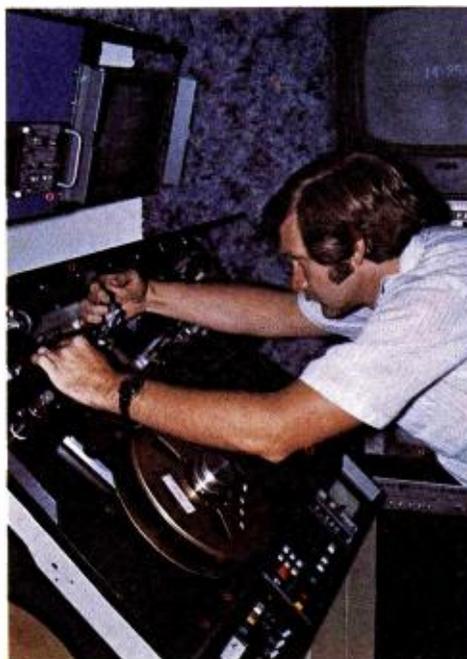
Four RCA TC-70C video tape recorders and two newly acquired TR-600s handle all the recording, editing and dubbing duties at the production facility. The machines are played back in synchronization through an RCA TCE-100 Unit Programmer . . . "a very reliable piece of equipment that will do more than some other units . . . It gives full control over all machines."

No age considerations in the tape area . . . the TC-70Cs and TR-600s all share the same duties, often extending their 8 hour work day minimum to round-the-clock duty.

Gridley Quihuis and Jim Taylor both agree that preventive scheduled maintenance helps keep all machines up to standards. They also count on full time



Gridley Quihuis, Director of Engineering, makes final shading adjustment to a TK-46.



Jim Taylor makes a headwheel adjustment on a TR-600 VTR.

The sub-freezing cold of Banff, Canada, tested the endurance of both crew and equipment . . . here a TK-76 and one-inch VTR production unit.

RCA parts back-up which is always there when needed. "We have a very definite need for extra parts availability, especially in tape . . . they're going all the time . . . sometimes up to 24 hours a day to get tapes out." To the Oral Roberts team, the isolation style of production means that tape machine downtime is critical. "Losing a tape machine in this heavy post-production atmosphere is like losing a camera in the studio during a normal broadcast set up."

Distribution of the syndicated shows is normally on 2" tape. As several international users require PAL versions, two of the TR-70C VTRs have been adapted for the 625-line standard and are used to dub programs that have been converted from NTSC to PAL at Image Transform in Los Angeles.

The actual switching of the show takes place through a Computer Image 8-input switcher. The switching and show compilation is not just a video operation with accompanying sound. At Oral Roberts, audio carries equal clout when it comes to quality.

#### The Sound of Success

Oral Roberts University is an audio-oriented facility. This consciousness for audio fidelity and quality carries over into the programming and production at Oral Roberts Television Productions:

The original RCA turnkey project included a BC-100 custom audio production console and RT-21 reel-to-reel recorder. Barry Krueger, ORTP audio specialist, has worked with this board and audio facility since its installation. He has even mixed a record album on the BC-100 . . . quite a feat for a console without pan pots.

But the facility's needs outgrew the original capabilities, so the Mabee Center audio room is now primarily used for student instruction and eventually one-inch and  $\frac{3}{4}$ " editing.

What replaced this older facility is impressive.

Looking more like a record studio control room than a television recording studio, the new audio rooms reflect the high goals in audio quality. Krueger, himself a classical organist, mans a partially automated 32-input audio board. The board is designed for master record, overdubbing and post-production capabilities.

A 24-track recorder is used to lay in final musical show segments so that



Chris Miller, Director of Operations, with assistant in Israel capture local color with a TK-76 and Steadicam.



show master dubs contain second generation music. Time coding of the video tape aids in synchronization of the multi-track with the VTR in the final editing stages.

#### ORTP Around the World

Just as ORU students expand their work to international as well as domestic locales, so too does the production team cover that work to bring the message in pictures back to the ministry's supporters.

Recently, Gridley Quihuis, Chris Miller and production aides visited the students at work in various locations: Israel, Caribbean, India and Trinidad/Tobago. All taping was accomplished by a truly "mobile" unit consisting of a handcart, TK-76, BCN-20 VTR, compact audio system, and batteries for power. Throughout most of the tour, a back-up TK-76 and BCN-20 were on hand, but never had to be used . . . evidence of the equipment's capability to withstand heat, cold, dryness, hu-

midity and, most of all, airport hand-dying. Comments Quihuis, "Best thing about the TK-76 is its colorimetry in matching with other RCA cameras . . . also its stability."

The tape accumulated during the tour is primarily used for activity promotion, but more than ever it has been inserted into weekly programs to visually stress portions of Reverend Roberts' messages to viewers. This mixing of remote and studio originated material punctuates an important equipment philosophy at the center . . . compatibility. A demonstration tape viewed on  $\frac{3}{4}$ " video cassette showed the intermixing of video from TK-76, TKP-46, TK-44 and TK-46 . . . with tape sources being both one- and two-inch original . . . all in a three minute segment with virtually no noticeable picture quality difference. Production staff members view equipment compatibility as both a cost factor and time saver . . . always leaving open the option of equipment interchangeability.

### From Cadavers to Prime Time

The Oral Roberts Television Production staff plays an active role in training Telecommunication students and meeting the stringent video needs of the University. Two RCA TK-28 film chains are located on the main campus, although one is scheduled to be installed at the production facility in the near future. To achieve the standards required, these two TK-28 units are equipped with 30mm Plumbicons. When the medical school required the highest quality transfers "they just would not settle for anything less than that," remarks Chris Miller. In addition to the high quality, the Plumbicons become a cost savings factor because, again for compatibility, all studio cameras are equipped with them. When the studio camera tubes fall below ORTP standards, (i.e. due to microphonics) they may be retired to the film chain because the TK-28 is less susceptible to such problems.

The TK-28 units are also used for archive film transfer and mastering for the syndicated "Oral Roberts and You."

It is not rare to see a production team armed with one of ORTP's two portable TK-76s and a one inch recorder taping medical students or faculty working in the lab or on a cadaver. Many of the production members are students in training with the high quality ORTP equipment. They utilize the studio and control room facilities in the Mabee Center. As a result, students get hands-on experience with such equipment as: TK-44 color cameras, TS-100 switcher, BC-100 audio console, both one- and two-inch VTR, Colortran lighting and a diverse range of other professional equipment.

Both of the TK-76 color cameras and the one inch recorders were originally purchased for high quality intra-university production. Since then, this equipment has been increasingly employed for EFP-type production.

### A New Look for a New Challenge

For a facility and ministry that relies heavily on television to survive, the Oral Roberts Television Production team is making some bold innovations. In the near future there will be a format change from musical-entertainment to current events with visits to ministry members in their homes and at work. Following a popular trend in commercial broadcasting of going on the road to the people for and about current events, "Oral Roberts and You" will



The World Action Slingers perform for Chris Miller and a Steadicam-mounted TK-76.

take in-depth looks at lifestyles, human needs, and the ministerial message as they pertain to today.

The new format program will be the culmination of all that the ORTP staff has learned about their craft. It will be a segmented-type show shot in the camera isolation technique.

Studio segments will not always be taped before an audience, allowing for re-shooting when needed. The on-location spots will then be inserted in the program. These location segments will require an increased emphasis on film-style shooting. The TKP-45 and TKP-46 along with the one-inch recorders will carry the responsibility of increased mobility, low light levels, unobtrusiveness and maximum equipment reliability.

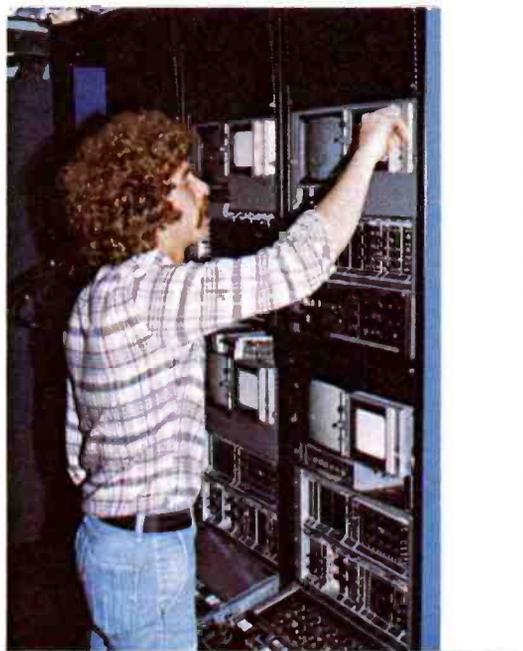
### Upon a New Epoch

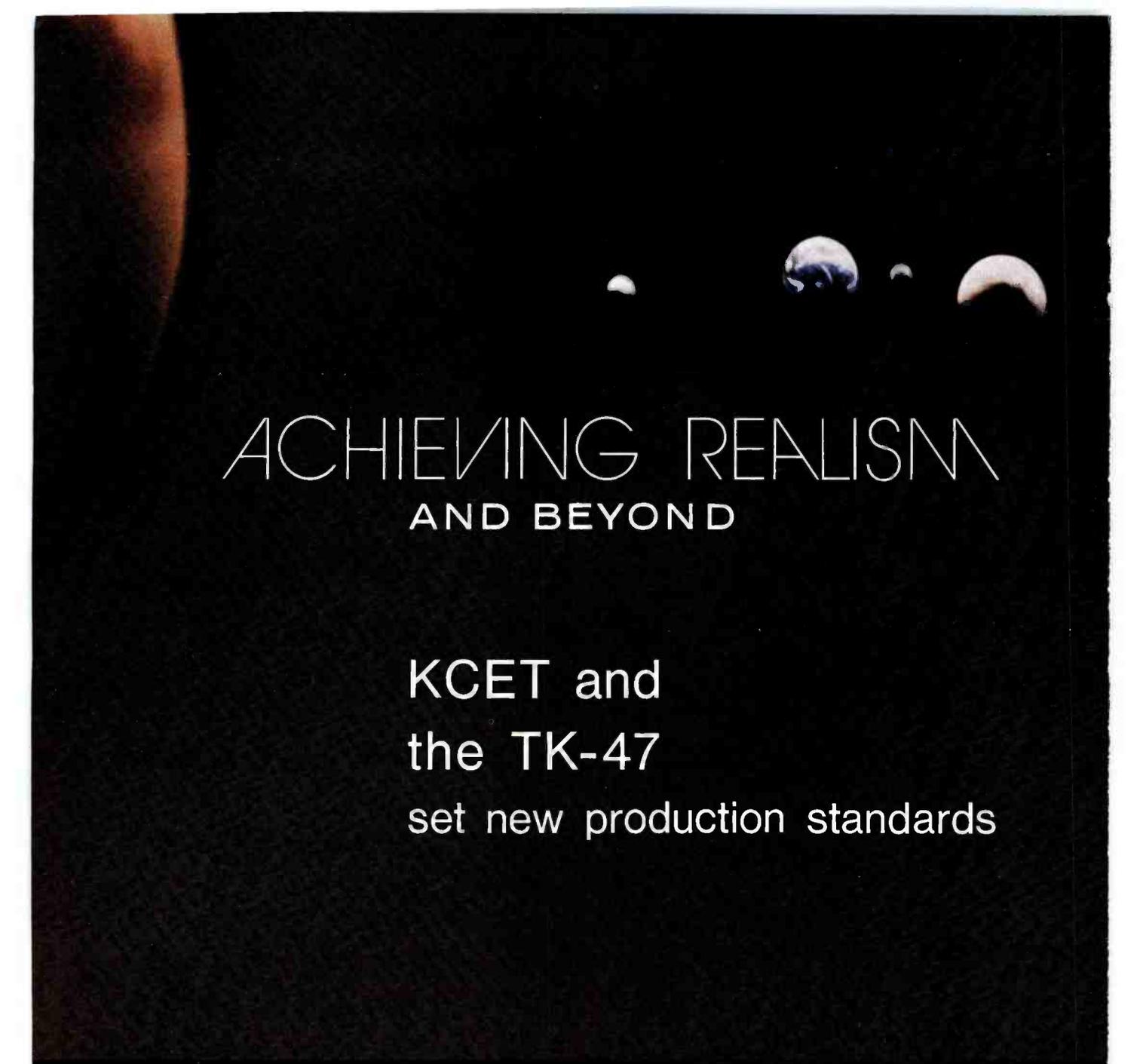
High personal standards have joined with strict equipment requirements to turn out productions with undisputed standards. Since 1968, when Oral Roberts introduced his concept of utilizing television, until today, when television ministry will be brought directly to the people, Oral Roberts Television Productions has been an innovator. "Oral Roberts and You" shows will introduce a "new step forward in religious programming", yet also be a continuation of the philosophy to "do everything first class". In Tulsa, Oklahoma, the "Baby" Mabee Center will put new emphasis on TV's ability to be a one-to-one medium. □

Mike May adjusts scope at the Camera Control Unit location, situated adjacent to Master Control.



The RCA BC-100 audio board gets a run-through by an ORU Telecommunications student.





# ACHIEVING REALISM AND BEYOND

KCET and  
the TK-47  
set new production standards



This set up is indicative of many "dark" sets employed in shooting *Cosmos*. The lighting style and clapboard look like film . . . but the camera in action is the TK-47.



Relaxing between takes, a TK-47 cameraman watches as Dr. Carl Sagan fine hones a piece of action.

Challenges! KCET—Los Angeles Community Supported Television—faced a pack of them when they took on the production of *Cosmos*, a thirteen-part, eight million dollar man-in-space series. The foremost challenge of all was the stringent production requirements that exceeded their available technical capability. Camera performance was particularly critical, since the *Cosmos* production demanded highest quality pictures at extremely low light levels. The solution to this challenge—and more—was the new RCA TK-47 automatic color camera.

In service at KCET's Los Angeles studio complex, the TK-47 has proven to be a valuable time, money and manpower-saver—in addition to opening new horizons in video production.

Six TK-47's are on line, maintaining KCET's well-established position as a leading PBS production facility.

To complement the high technology cameras, KCET has revitalized their entire facility with new audio areas, RCA one-inch VTR capability, and unique video control rooms.

*Cosmos* and the dynamic new video styles demanded of the TK-47 for the production are the beginning of a story—a story of how KCET has recognized

and responded to rapidly evolving production demands.

#### "We're Going To Pick Up Production Time"

*Cosmos* (a co-production of KCET and Carl Sagan) demanded a specific requirement for low light video. Steve deSatnick, Vice President, Operations and Engineering, recalls the original plans of the producer, whose film orientation was deeply entrenched: "He didn't want the obvious flaws that video displayed in the past, such as lag and noise."

deSatnick convinced KCET management that now was the time to replace their ten year old TK-44 cameras, not just to satisfy the *Cosmos* needs but also to be the keystone of the KCET technical revitalization.

The TK-47 became the only choice when testing proved that not only would it produce "pictures that are short of phenomenal compared to other existing cameras", but would also save time, money and manpower. Previously, KCET had spent a great amount of time in chipping, registration and standard alignment procedure . . . time that is especially valuable to a community supported broadcaster.

Alan A. Hart, Associate Director of

Engineering, summarizes the pre-TK-47 situation, "We spent one and a half hours to set up our three TK-44's in order to meet our meticulous standards. Additionally, we often needed time, particularly after breaks, to check for and correct any drift." He points out that in figuring set up time it's imperative to allow for warm-up time to assure that the camera achieves stability. Video operators and skilled assistants/camera operators were required to arrive an average of an hour and a half prior to tape time.

States Hart, "Now, with the 47, we don't need two technicians to set up . . . the camerapersons need not be as technically skilled as long as the artistic goals can be accomplished. The video operator can now do it all from the console using the camera Set-up Terminal and Remote Control Units." With the new cameras, everyone arrives on set at the same time, usually a half hour prior to call time. And the set-up itself is simpler adds Hart, "because the video man can do everything with the four knobs on the Set-up Terminal".

Time is saved in setting up, and also in daily camera checks at KCET. Often no adjustments are required from the previous day. In addition, precise pic-



In reality, the celestial bodies in all the photographs were detailed scale models. Here a TK-47 moves in to capture a high key sequence.

tures are produced consistently.

Steve deSatnick comments that the scarcity of highly trained personnel, plus the higher expense of those technicians available has resulted in equipment that depends less on maintenance and service and, of necessity, has become more reliable.

With all these benefits considered, the RCA TK-47 became the obvious choice. Justifiably, deSatnick has laid a heavy responsibility on the cameras. "Quite frankly, I expect to gain an hour and a half of production time per day," he says.

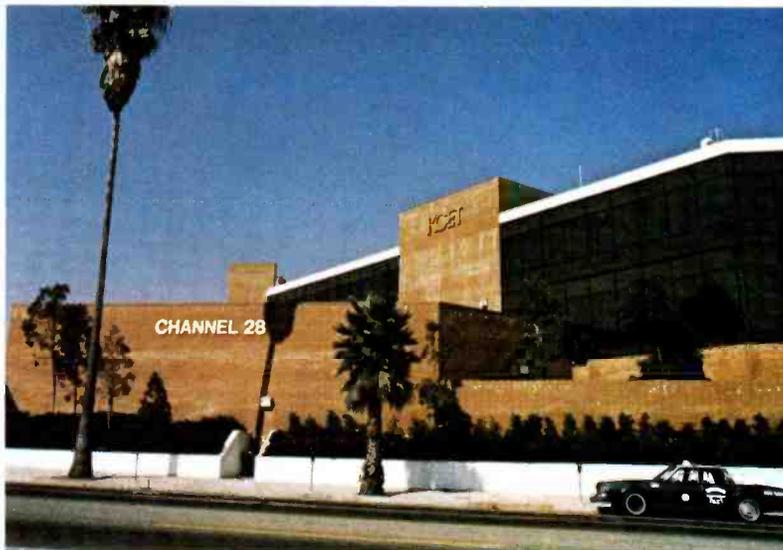
#### **Satisfying A Creative Philosophy**

The realization of having to satisfy the needs of a new breed of producer is strongly felt at KCET. Outspoken on the subject, Steve deSatnick relates how today's producers are as adept in talking product features as are engineers because technology has forced them to learn the jargon and techniques to effectively use video. He adds that the impetus for many new designs has come from producers mainly because they are the closest to the creative demands of the productions. KCET's additions of Digital Video Effects and E-mem functions to their Grass Valley 1600 switcher, plus the TK-47's capa-

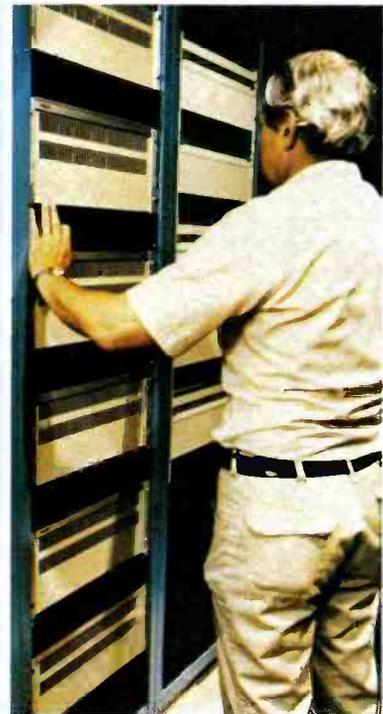
bilities for low-light, film-style shooting have all come about to fill producers' special needs.

Steve deSatnick relates the TK-47 to KCET's innovative new video control center, "RCA, with its systems approach to camera control will alter the face of a typical studio control room. No longer will we see control rooms for multiple cameras systems as a densely packed array of knobs, switches and monitors." This entirely new technological approach to camera chain set-up and control opens the door to a re-thinking of video control monitoring and control needs. KCET has accomplished that re-thinking.

A total environment has been created for the video operator including pleasing lighting, good audio quality, and independent climate control. The operator is really a unified part of the program, not a detached person riding video. The video control area will be illuminated with 6500° K fluorescent lighting to enable the operator to match video quickly and accurately, to a color reference panel. The TK-47 system has greatly added to the possibility of such an arrangement because of the replacement of multiple racks of equipment and control units by the TK-47 Set-up Terminal and Camera Processor Units.



KCET's attractive home on Sunset Boulevard offers staff and visitors an open, airy welcome.



Real space savers! Hal Smeder adds a final face plate to the rack of six TK-47 "black box" Camera Processor Units.

Alan Hart remarks, "The space saving is really incredible, plus, the CPU is nice and orderly—once installed, you never should have to return to it."

It is possible to control all six cameras from one of the two new video control rooms due to system arrangement and the unique design of the control package. But normally each control room will handle three cameras. Custom designed camera delegation and transfer switcher capabilities give video operators at KCET total camera, monitor and scope control without concern over unauthorized interference with each other. The desire to satisfy the creative needs at KCET has been well met. Both design philosophy and ease of operation are going to increase the morale of video operators and productivity is expected to go up—as is the quality of work—because the operators are more comfortable.

#### Increasing Studio Production Time

Today's producers want the most out of production time available—they don't want to sit around for long camera set-ups. Predicts Alan Hart, "We'll be able to deliver more working time on stage in a given ten-hour production day because work can continue without talent and crew having to wait for us to set cameras."

Both deSatrik and Hart concur that a major contributor to meeting the producer's needs is the stability and ease of set-up inherent in the TK-47. Two of the TK-47s were literally taken out of the box and used on a four day session with virtually no problems. It is predicted that KCET will be able to turn into production time all the time that was spent to re-register and re-balance when a camera drifted.

So far, considerable savings in studio time have been confirmed. Even before the automatic modules were installed, video operators used the semi-automatic set-up mode and were able to cycle through the cameras so quickly that it took only twenty minutes to set up three cameras.

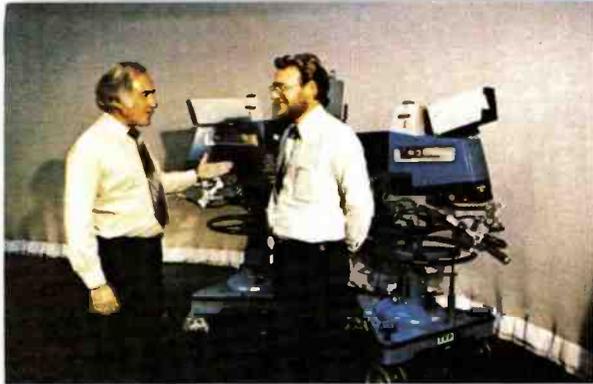
Now, with the automatics in operation, major camera set-ups take even less time. After using the TK-47 automatics for a major tube replacement, Al Hart commented, "You put a tube in, set the back focus, and push the button and you're instantly ready to go. It's the fastest thing in the world to change tubes in that camera."

Certainly the cameraperson's function at KCET has been made easier. For example, no longer is it necessary to spend time on a chart for registration. The camera operators are well satisfied

with the TK-47 and its "nice balance and profile." Additionally, in the studio, the air conditioning has always been shut off to eliminate noise picked up by microphones. With the high light levels previously used, this often proved uncomfortable to cast and crew. The lower light levels employed with the TK-47s have meant a minimizing of human discomfort, less strain on tubes, and, certainly not to be discounted, an energy savings.

#### Cosmos

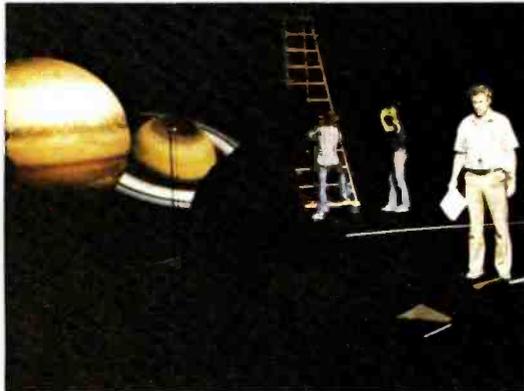
With an air date of fall 1980, KCET and the *Cosmos* production team already have a large quantity of insert shots completed. At times, both crew and equipment have literally been working in the dark. Even so, it was possible to maintain a depth of focus of two inches during a twenty-foot dolly. Many of the insert shots revolved around detailed planetary models where the TK-47 was "operating at -3 dB at 100 foot candles and making really pretty pictures", states Charley Lux, *Cosmos* Technical Director. During many of the space sequences, the TK-47 Comet Tail Suppression (CTS) was used to control hot spots on the planets and moons. Adds Lux, "CTS enables you to hit highlights and not have them peel off the line."



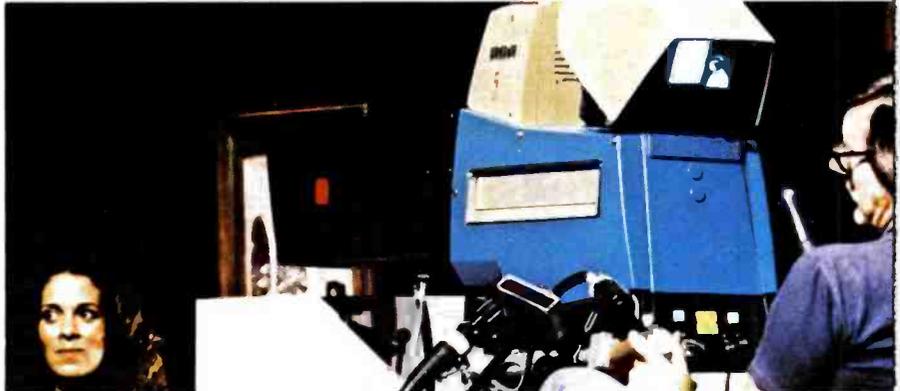
Between set-ups, Steve deSatnick (l) and Al Hart (r) discuss the next camera deployment.



Hal Smeder employs one of the TK-47 RCUS to fine tune a camera.



Cue the universe! *Cosmos* producer, Adrian Malone (right) prepares the most heavenly of ballets.



Picking up her cues from a nearby monitor, *Cosmos* cue girl keeps the script moving under the nose of a crane-mounted TK-47.

Although the producer is going for a film style look, the attempt is more to expand the varieties of video looks beyond those of accepted video standards. He notes that video pictures are now at the point where you can do film effects with them. Running extremely low in enhancement, pictures will now maintain an adequate degree of sharpness without that artificially enhanced look.

Remarks Charley Lux, "The cameras are sharp . . . maybe too sharp. We're running very little contour or aperture. The sharpness is inherently better and can be achieved simply." deSatnick and Hart attribute the increased picture quality to the precision yokes and 30mm Plumbicons in conjunction with superior pre-amps. The light bias tubes have proved to be great contributors to the low light level achievements.

On October 17, when Studio B sees the beginning of the "ethereal spaceship" sequences of the *Cosmos* production, the TK-47's crew will really be put through their paces. These sequences will test the full adjustment range desired by the producer, involving chroma key, special mood effects, and shooting front-projected film.

From a producer's viewpoint, Adrian Malone, veteran co-producer of *Amer-*

*ica, The Ascent of Man* and other BBC productions, shares some interesting highlights, "The problem in dealing with video cameras as opposed to film cameras is tradition on the one hand and technicality on the other." Malone reveals that up until the TK-47, film and everything that goes with it (people and equipment) has always been much more versatile. "The 47 is a breakthrough on this," Malone relates. "They will accept the low light levels and variation of light levels unheard of before with television . . . no longer require a flat, studio television look. A traditional breakthrough has also been achieved with the cameras. Television cameramen will no longer be forced by the machine to limit their creative eye. What I am determined to do on the next studio shoot is to show that video cameras can be handled with as much expertise . . . as much artistry as a film camera. All the cameras will be on cranes and will move with a waltz-like freedom."

Mr. Malone summarizes, "So far what we've done in the studio has been the least difficult, and it was done quite deliberately so I could see what the cameras were capable of. It seems to me that they're capable of almost anything."

To save double set-up time and to offer video operators full creative freedom, KCET has partitioned the set-up memory file among its operators. Here, many of the creative effects for the spaceship sequence will be stored. The file and recall capability of the TK-47 has been used—and is seen to be an increasingly valuable asset—to allow each operator to store picture set-ups of his preference.

When all shooting and post production are completed, *Cosmos*, hosted and co-written by Dr. Carl Sagan, will be mastered on one inch tape and distributed worldwide.

#### Beyond *Cosmos*

KCET has immediate and long-term plans for the TK-47s and newly renovated production facilities. In early September, three of the cameras began work on "28 Tonight", a five-day per week production. As seen by Al Hart, "The 47 is versatile. It'll go all the way to the highest quality demands, yet still handle every day routine assignments."

One such routine assignment for the TK-47's involves the KCET fund raisers.

Plans for this include using the camera in the fully automatic mode of opera-

During a low-light level scene, a critical iris adjustment is made using a TK-47 Remote Control Unit.



On the set of "28 Tonight" three TK-47 color cameras cover all the angles.



tion. Lights will be set once at the outset of the show, different shots will be tested, then the final result will be used for the length of the fund-raising period which can last ten days or more. A video/cameraperson will be assigned to the show. This person's function will be to turn the cameras on, go through the automatic "pre-flight" check of each camera, then set them in automatic operating mode and go on air.

Even though there are no plans to use the TK-47 on location, Al Hart realizes, "They'd be natural for a remote truck . . . taking up so little space . . . easier to set up . . . making it a livable situation for the technicians."

KCET has realized and prepared for evolving developments in production styles. These developments include a new dependence on the reliability of equipment and tight scheduling that permits a minimum of time for set-up prior to and during a production.

At KCET, independent producers are provided with creature comforts, plus well-equipped and staffed technical facilities. These resources, combined with an advantageous location, are excellent inducements for attracting more PBS production assignments.

#### Dynamic Production Philosophy

With the impressive array of TK-47 cameras, RCA TH-200 one-inch helical VTR's, all new video control, audio and editing facilities plus other equipment of the latest technology, KCET has achieved a state-of-the-art position unique in the PBS network. But new equipment alone doesn't make

a top-notch facility. It's what a dynamic production philosophy and the creative professional staff do with the equipment that really counts.

At KCET, the revitalized technical facilities are bustling—handling hefty production schedules, and setting new production standards. □



Lee Reynolds is an experienced video operator who did not let his handicap lessen his desire to perfect a skill. Now a full time employee at KCET, Lee has found his work made easier by the simplified procedure required to set up a TK-47. The convenient Set-Up Terminal with its pushbuttons and four large control knobs eliminates the need to work in cramped positions at various locations and heights. Lee states that the TK-47 system enables him to concentrate more on creative expression than on overcoming manipulative dexterity required to properly set up other type cameras.



The CKY-TV mobile unit poses near its Polo Park, Winnipeg headquarters operating base.

# CKY'S New Mobile Unit Showcases A Major Facilities Investment

When Moffat Communications Limited, Winnipeg, Manitoba, invested more than \$1,000,000 in a new mobile TV production unit from RCA, a few skeptics wondered whether the new facility would be sufficiently utilized to justify the purchase.

The skepticism proved to be both unfounded and unnecessary, as Moffat divisions CKY-TV and Winnipeg Videon Limited have been keeping the OB unit busy ever since it arrived on the scene in August, 1978. In fact, says Engineering Manager Don Dennis, as a result of extensive usage, the interior of the unit is now being revamped for improved operating efficiency. The new layout provides space for additional production personnel needed on major location shoots.

The new Outside Broadcast unit was included in a 1978 major upgrading of technical facilities by CKY which also added RCA tape and transmitting systems. A TT-35FH, 35 kW parallel transmitter was installed, and video tape recording and editing capability was enhanced by the addition of two TR-

600A quad VTR's, each equipped with AE-600 time code editing systems.

#### Four TK-760 Cameras

The CKY mobile unit was delivered by RCA complete and operational. Built on a Gerstnslager body, it is equipped with four TK-760 cameras with Angenieux 15:1 lenses, and wired for a fifth camera. The video switcher is a custom RVS-16-4C made in Canada. The audio board is a 15-input, two channel system. The second channel is essential, Mr. Dennis notes, because many of the Canadian broadcasts are in two languages. The intercom is also split to accommodate the dual language requirement.

The tape complement includes two 1-inch VTR's (which are removed and also used in the studio); a Slo-Mo unit and a 3/4-inch cassette. Auxiliary power is supplied by a 30 kW generator which is carried in a separate trailer.

One of the TK-760 cameras was supplied with the conversion kit and can be operated as a hand-held TK-76B portable camera, with the hip pack providing video control through the CCU aboard the mobile unit. This camera conversion facility has been particularly useful in providing added camera mobility for handling sports events, according to Dennis.

When a fifth camera is needed, the station's TK-76B which is normally assigned for EFP operations can be utilized by the mobile unit.

#### Local Program Origination for Cable

The CKY mobile unit leads a double life. For a part of each week it is operating to provide local program origination for Videon Limited, the Moffat Communications cable system serving Winnipeg west of the Red River (with 70 percent of the homes wired). This is relatively routine work for the unit, covering various meetings and local events of interest to cable customers. These are recorded on 3/4-inch cassette, with little editing required.

As a further public service, Videon makes occasional use of the mobile system to produce documentaries. One popular documentary covered the training and operations of the Winnipeg Police canine corps. The tape of this production was made available to the Police Department and has had a long, useful life as a program source for schools, clubs and other community groups.

## WINNIPEG



Thunder Bay International Ski Championship competition, with —25 degree (F.) temperatures provide a stern test for the CKY mobile unit. Photos show the 90-meter ski slope with a cameraman perched on one side; the mobile unit being towed into position by a snow plow, and the TK-760 cameras on location.

#### Extensive Sports Coverage

The mobile unit's more exciting moments come when it is operating on CKY assignments. Many of these are contract productions ordered by CTV Television Network of which CKY is an affiliate. In most cases, the network supplies a producer and staff, while CKY provides the technical facilities and operating manpower.

These assignments are varied, but most frequently involve sports coverage. The need for flexibility and multiple camera coverage was a prime consideration for CKY in investing in the new mobile unit.

#### Ski Jump Championships—A Frosty Test

Many of the sports assignments covered provide Canadian inserts for the popular weekly "Wide World of Sports" production. One such winter assignment provided a stringent test for the new OB unit. It involved covering an International 70 and 90 Meter Ski Jump Championship competition at Thunder Bay.

Three TK-760 cameras were used, one of which was converted to a TK-76B configuration. This shoulder-mount

camera was operated from a small ledge near the top of the jump, providing a precarious perch for the cameraman as he caught the contestants as they left the chute at the top of the jump, then pivoted to follow the skier part way down the slope.

A second TK-760 camera was mounted on a scaffold beneath the judge's stand, halfway down the jump. The third camera at the bottom of the slope covered the landing action.

The mobile unit drove as far as it could up the hill, then was towed by a tractor with snow plow closer to the action. The incline was so steep, Mr. Dennis says, that the slo-mo tape machines had to be blocked up to a level position. After setting up on Thursday and Friday, the 70 meter jumps were recorded on Saturday and the 90 meter on Sunday. The material was recorded on 1-inch tape and edited on site.

Editing was completed by 5 P.M. Sunday, and the mobile unit was on the road back to Winnipeg by 8 P.M.

The generator was operated continuously for the weekend, when below zero (25°F below) temperatures pre-

ailed. The cold didn't bother the contestants, the cameras, or the tape equipment, but it got mighty chilly for the cameramen.

#### More OB Action

The CKY mobile unit is a frequent visitor at the Winnipeg Convention Centre, which is provided with ramps so that the unit can be moved to upper levels of the Centre if desired. The availability of the mobile unit simplified production of the annual Telethon conducted by the Manitoba Lion's Club to raise money for handicapped children. The 20-hour event, televised live from the Convention Centre, raises over \$500,000 each year. Another major mobile unit pickup from the Centre was a Harry Bellefonte concert.

Mondays are usually reserved for maintenance on the mobile unit. It is also assigned 3-4 days weekly for cable system program origination, while much of the sports coverage is handled on the weekend.

#### Convenient Studio Location

CKY's studio location at Polo Park, a major shopping mall, is also ideally suited for covering major area sports



In deference to the severe weather conditions, CKY had special cold weather jackets made up for their TK-76 and TK-760 cameras.

events. It is immediately adjacent to the Arena, which is being expanded to provide added seating needed for the Winnipeg Jets NHL Hockey team.

Adjoining the arena is the Football Stadium used by the Winnipeg Blue Bombers of the Canadian Football League. Nearby is the Velopede, a facility designed for cycle competition.

Both the Arena and the Stadium are wired for television, with cabling for cameras, audio and intercom.

#### Production: Studio and EFP

One of CKY's two studios is used regularly for commercial production, using TK-44 cameras. However, Mr. Dennis remarks, more local advertisers now prefer to have commercials produced on location.

CKY presently has one TK-76B, designated for EFP use, with a 1-inch VTR for recording. The second TK-76 with hip pack and CCU is available by

converting one of the TK-760's from the mobile unit for hand-held use.

More program assignments are also being handled as electronic field productions, using a single camera and portable VTR. As an example, Mr. Dennis noted that the Winnipeg Blue Bombers weekly football show is assembled using the TK-76 to provide player profiles, interviews, and a run-down on the week's activity in training camp and at practice sessions.

#### New Quad Tape Editing System

The technical area at CKY is a cluster arrangement. Master Control occupies a glassed-in area, with a passageway for access to the new quad tape editing room on one side, and the main tape area on the other. Telecine is located in a separate larger space behind Tape, with the perimeter walls stacked with shelves of tape and film reels and TCR-100 "carts". The telecine area has been upgraded with the addition of

a newly-installed TK-28B film island.

The new quad tape editing facility, housed in a separate room, is equipped with two TR-600A VTR's with built-in AE-600 Time Code Editing systems. This facility, is fully utilized for production editing of commercials and program material, and the tape machines are infrequently used for on-air program playback, Mr. Dennis notes. In fact, he adds, the tape room is manned for 22 hours a day.

#### Two TCR-100's Air 300 "Carts" Daily

Both of the TCR-100's are used on-air, and all dubbing is done at night. CKY's "cart" machines are averaging about 300 plays per day, Mr. Dennis says. All film and tape commercials are dubbed to the cart, as are PSA's and station ID's. Carts are also used for opening and closing billboards and bumpers on some shows, including the evening news. Mr. Dennis noted that the trend to tape is very noticeable, with 75% of national commercials now coming in as tape spots.

One of the TCR-100's shares electronics with a TR-60 VTR. The other has its own Signal Processing Unit (SPU), and is also equipped with Random Home and EPIS (Electronic Program Identification System). CKY has 3,000 "carts" on hand.

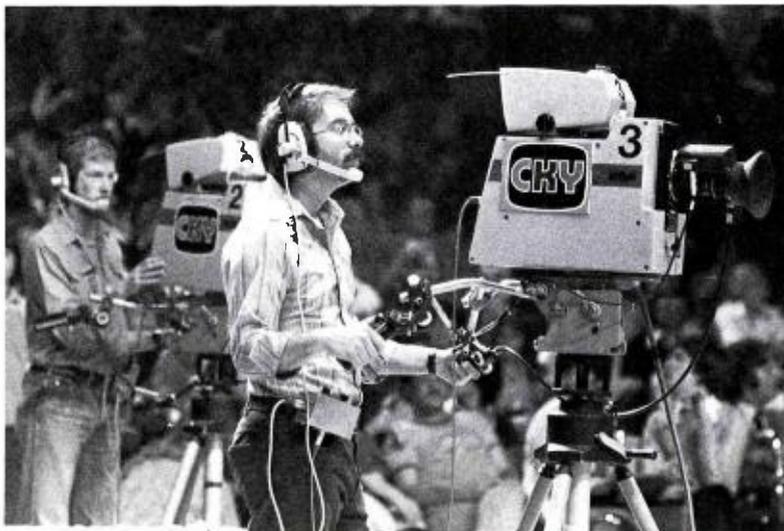
A TR-70 and two VR-2000 reel-to-reel tape machines are used for production and program playback. Increasingly, however, the tape production workload is shifting to the TR-600A/AE-600 editing system and the 1-inch machines.

Beyond the main technical area are two production control rooms, one for each studio. One of the studios has a large permanent set used for televising the weekly "Western Express" lottery drawing. The other has a news set in one corner, with most of the space available for commercial production.

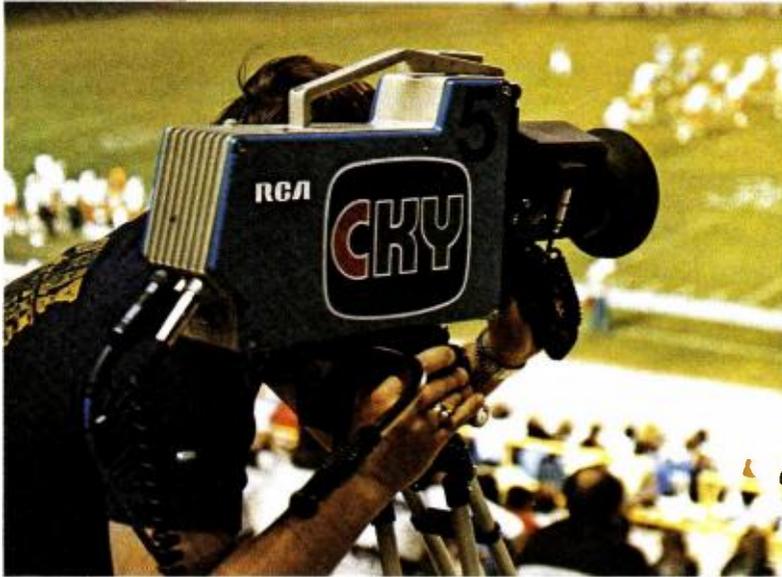
#### New Parallel TV Transmitting System

A major investment in 1978 was in the TT-35FH, 35 kW parallel transmitter, which is "loafing along", operating at 25 kW output.

It is equipped with RCA's OPTO Switcher (Optimized Parallel Transmitter Output), which allows the visual and aural outputs of the individual transmitters in the system to be operated in various configurations. An advantage of the optimized parallel system, Mr. Dennis points out, is that



TK-760's at Winnipeg Civic Centre for the 1979 Lions' Telethon.



TK-76B in action with the Winnipeg Blue Bombers football team.



Technical area at CKY includes two TCR-100 video "cart" machines; two-600A VTR's with AE-600 Time Code Editing Systems, and a new TK-28 Telecine system.



the combined transmitter output effectively eliminates signal reflections caused by an imperfect load impedance match. The remote controlled system is stable, reliable and delivers the quality color signal expected of it, Mr. Dennis adds.

The transmitter and antenna are located some 25 miles south of Winnipeg. The TW-18A7 Travelling Wave Antenna on a 1,000 foot tower was installed when CKY went on-air in 1960, and was not replaced.

The standby transmitter, located in the basement of CKY's Polo Park facility, is a well-used, but still-performing TT-2BH. The standby antenna, a four-bay RCA wing-type, is mounted on the roof.

#### Five Rebroadcasters Extend CKY Coverage

The CKY transmitter provides the Ch-

7 signal to five re-broadcasters in population centers throughout Manitoba, permitting the station to provide television coverage for 97 percent of the population of the sprawling province. Multi-hop microwave systems deliver the signals to the distant re-broadcast facilities.

Three of the rebroadcast transmitters are 300 watt; one is 3 kW and one 10 watts. All these low power systems are IF modulated and solid state, with a single tube and low level diplexer. All were built by RCA in Canada.

In rebroadcasting, Winnipeg commercials are replaced by those of local sponsors for the outlying areas, which also insert their own ID's and have limited studio facilities for handling local news. The communities of Brandon and Dauphin are served by rebroadcast systems which are 50 percent owned by CKY.

D. F. Dennis, Engineering Manager, and J. S. Purvis, General Manager, discuss CKY-TV facility plans.

#### 20-Hour Broadcast Schedule

CKY operates on a daily 20-hour broadcast schedule, from 6 A.M. to 2 A.M., providing CTV programming, augmented by a variety of syndicated shows and movies, and locally produced programming. The latter includes two major newscasts, a noontime children's program and numerous public service productions. "Western Express" Lottery draws are televised live each Wednesday from the Ch. 7 studios.

#### "Management By Objectives"

News is presently covered by four film crews, but Mr. Dennis indicates that ENG is being phased in, with one unit scheduled to be in operation later in the year. This careful approach is typical of CKY. The station operates on a Management By Objective system, according to Mr. Dennis, with five-year projections required for budgeting operating and maintenance expenses and capital improvements.

#### Technical Staff Steps Lively To Keep Up

The CKY engineering staff of eleven is responsible for the installation and maintenance of all technical facilities. Recent upgrading and expansion have added the new four-camera mobile OB unit; transmitting system; quad editing facility; 1-inch VTR's; a second TCR-100 "cart" machine, and a TK-28B telecine system. With these new acquisitions, plus routine operations, the engineering department has been operating at a brisk pace. And, with scheduled on-going improvement plans, that brisk pace is likely to be a regular routine at CKY. □



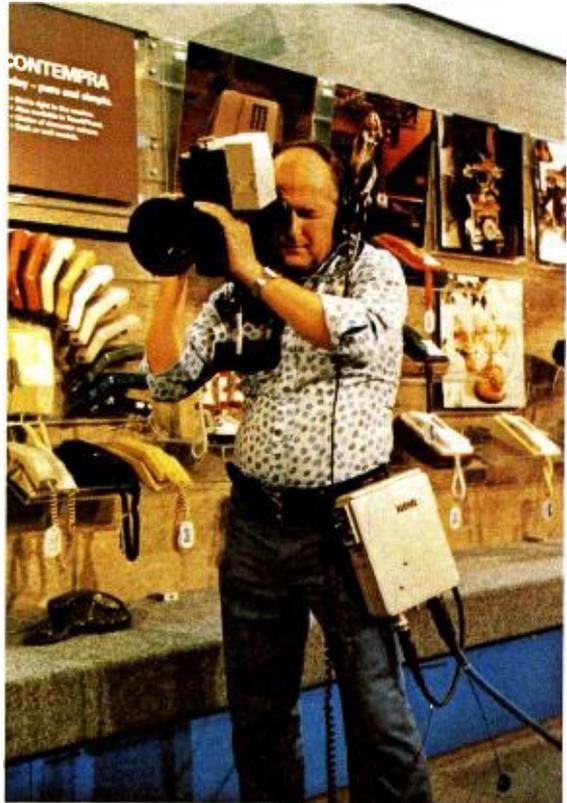
**W**hen Don McMillan, President of Palette Productions, Toronto, made the move from film to video production, the change was swift and decisive. In October 1978 when his video installation was activated, Palette's operations were 95% film and 5% video. In less than seven months, that ratio was reversed. Today Palette is 95% video.

Palette's video complement from RCA includes three TK-760 cameras, a TK-76; a TH-100 1-inch VTR, and a TH-50 portable VTR. This equipment is augmented by audio and video switching, monitoring, test and support facilities needed for systems operations. A valuable adjunct, too, is a Winnebago Recreational Vehicle which was converted to a full scale video production mobile unit.

#### **Film Style Video**

The investment in video equipment is nearly a half million dollars, and represents the fulfillment of Don McMillan's conviction that video has arrived as a production vehicle. Mr. McMillan's roots in film run deep, spanning 30 years and including 15 years of operating his own film production company, Palette Productions. With the trend to smaller cameras capable of quality color performance, and compact, reliable 1-inch format VTR's, Mr. McMillan seized the opportunity to switch to video, using film techniques and expertise. The portable video equipment now available lends itself to film-type operations, he notes.

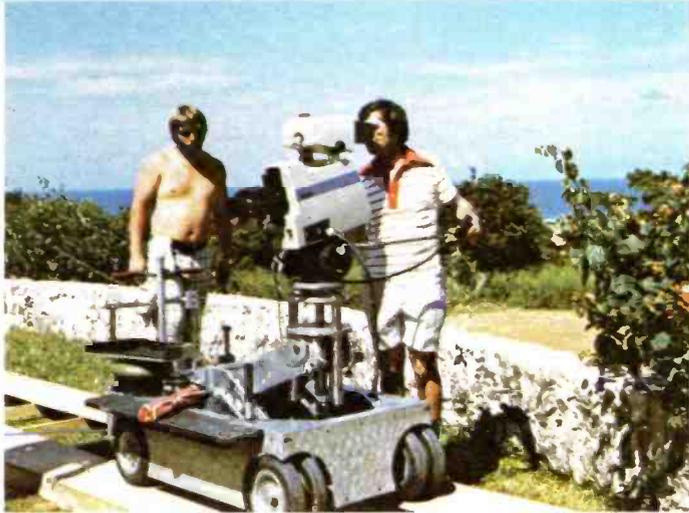
One of the early video acquisitions by Palette was TK-76, Serial #3. This camera provided the base for building video experience. As noted, with the advent of new generation small cameras and VTR's, Mr. McMillan decided to go full swing to video. Related to this decision was the need for technical expertise to set up the facility and to keep it going. Ron Hutcheon, then Chief Engineer of Global TV was just right for the job, with excellent technical credentials and a wealth of experience with mobile facilities, both at Global and previously from his years with CFTO's engineering department. Ron is now Vice President, Engineering, for Palette.



Don McMillan, President of Palette Productions operates TK-76B camera on production shoot.

## Palette Productions Switches from Film to Video

**TORONTO**



The "Ann Murray Show" taped on location in Jamaica marked the debut of Palette's new video equipment. One TK-760 rolled about on a carriage for special shots, while another operates waist-deep in water. Ashore, a TK-76 roves about capturing footage of local settings.

**Off To A Flying Start**

For a fledgling video operation, Palette displays some very impressive credits. The first "shoot" for the new equipment was for CBC, taping the "Ann Murray Show" in Jamaica. This production provided a critical test for the equipment and a challenging one for Ron Hutcheon who had to improvise to keep the technical operation going. Thirty hours of tape were recorded during the shoot.

(Palette's first major video production, turned out to be a real winner. The

"Ann Murray Show" was CBC's top-rated program for the Spring of 1979, drawing 4.8 million viewers.)

From Jamaica, the scene shifted to California, where Palette's portable equipment package was used to shoot an "Irish Rovers" show from Disneyland. Here a basic control room was set up in a rented truck. From Disneyland, the next excursion for Palette's "sophisticated portables" was to the Bahamas for taping a "Star" sports competition for CBC.

**"Sophisticated Portability" Pays Off**

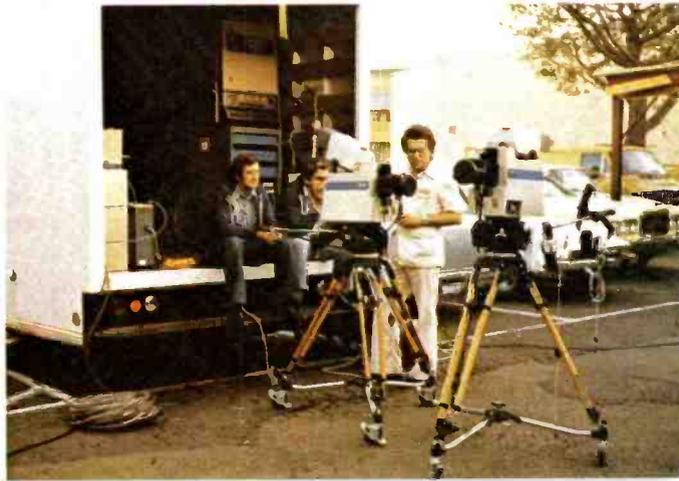
On return to Toronto, the video gear was mounted in the Winnebago and driven to Nashville, where the "Carol Baker Show", a one-hour special was taped. From this fast start, Palette is moving on with corporate productions, commercials, sports, and other program assignments.

Don McMillan's video concept of "sophisticated portability" is paying off for clients and for Palette. The capability of providing broadcast quality facilities in a variety of configurations and tak-

Colorful Disneyland was the locale for this three-camera shoot of the "Irish Rovers" production.



Basic, but functional. A rented truck becomes a temporary control "room" for the Palette crew during the Disneyland shoot.





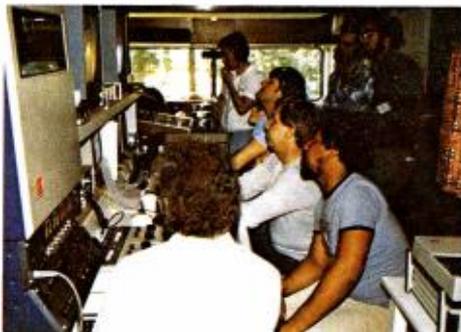
Palette's recreation vehicle/production unit rests in background as crew prepares to tape segment of the "Carol Baker Show" from Nashville.



To get a better angle, this TK-760 goes "up the creek".

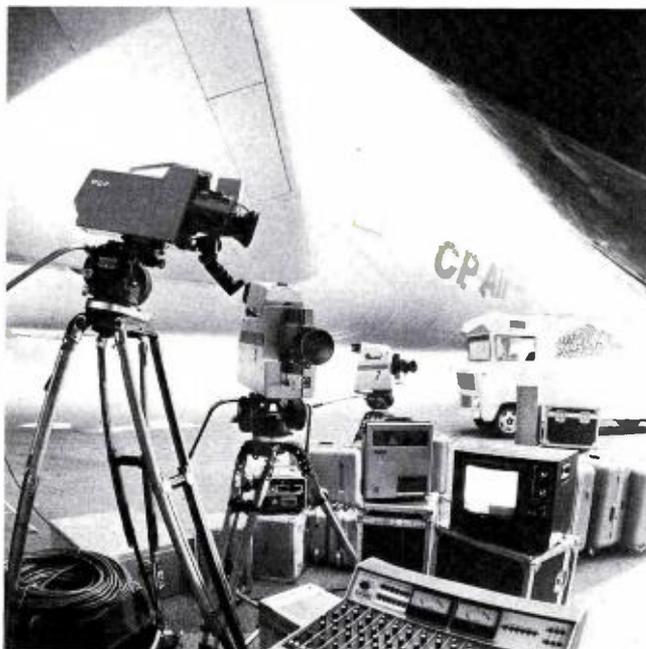


TK-760 rides comfortably on short mount, with a viewing receiver as a base.



Production crew in control room of Winnebago on location in Nashville.

Palette Productions' "sophisticated portables" sit for an airport portrait.



ing it anywhere on location is an idea whose time has come.

Already Palette has handled assignments for all three Canadian networks. The roster of corporate clients includes such prestigious names as IBM; Bell of Canada; GM, and Shell. The productions are varied, involving training, sales, employee communication and similar requirements. All are done on location, as specified by the client. Palette's ability to deliver broadcast quality color even in low light levels and adverse operating conditions has been an important factor in handling both corporate and broadcast assignments. The end product is a 1-inch video tape, with time code, ready for editing.

Among the reasons cited by Mr. McMillan for purchasing the RCA equipment package was the close identity of that company name with broadcasters and producers. The acceptance of RCA equipment has provided a good selling point for Palette in generating business, he notes. In addition, of course, the numerous contacts made by Mr. McMillan in his years in film have been beneficial in selling the new video service.

Palette operates with a small staff, utilizing free lance camera talent. Most productions are shot film style, usually with cameramen who have film experience. A film background is a valuable asset for video cameramen, according to Mr. McMillan. "Film cameramen are trained to be creative, to be conscious of composition, continuity and artistic effects," he says.

#### Performance and Reliability

Palette's video capability is built around the TK-760 cameras and the 1-inch VTR's. The performance and durability of these products in handling demanding remote productions have contributed to the company's early success.

"The TH-100 and TH-50 have been excellent machines; very reliable," Ron Hutcheon says. "We have recorded 40 hours of tape on the machine without record optimization. The addition of dynamic tracking will provide slo-mo capability and enhanced versatility."

Why were the TK-760 cameras selected? Mr. Hutcheon ticks off several reasons: "First, I wanted cameras from a supplier who could be relied on for service and parts. RCA's reputation and record for supplying back-up sup-

port was a significant factor. In addition, the RCA name is a marketable commodity. Producers readily recognize that the RCA equipment will measure up to their desired quality levels.

#### TK-760 Used In Three Configurations

"A 'plus' feature for the TK-760 is that it has the look and feel of a studio camera, which is what we wanted. And yet it is readily portable and sets up quickly. The small camera control unit is helpful because we use the cameras in the mobile unit and separately, so size and weight of the CCU are important. Low power consumption is one more advantage for our operation.

"The flexibility of the TK-760 enhances its value, especially so for us, since we use it in all three configurations: as a studio camera; as a hand-held EFP camera with hip pack and CCU, and as a self-contained camera with encoded output."

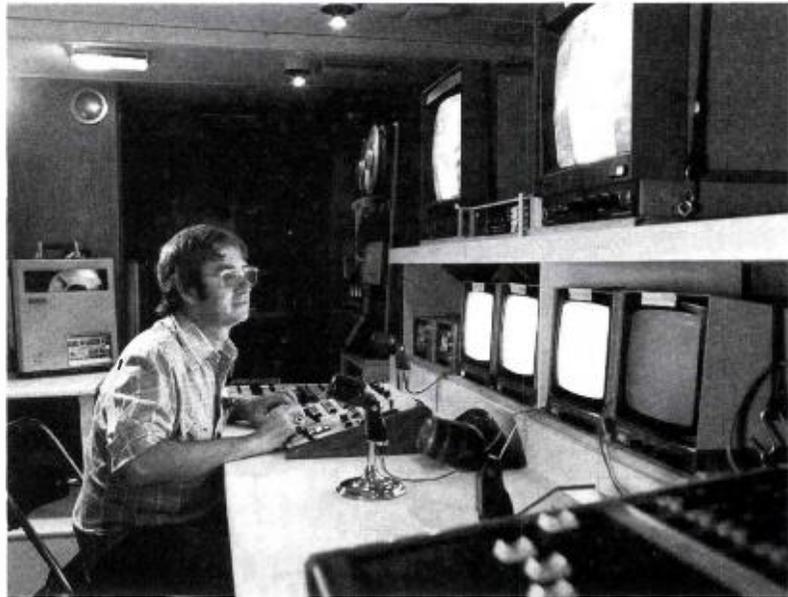
The ability of the TK-760 to operate either with or without the CCU is another feature that suits Palette's operating style. One of their TK-760's includes the hip-pack and case covers for converting to the TK-76B portable configuration, which takes about fifteen minutes, Mr. Hutcheon confirms.

Two of the cameras are equipped with 12:1 lenses; the other with a 14:1 lens with 2X extender. Two of the cameras are also fitted with star filters.

#### Portable System Packages

Among Ron Hutcheon's many immediate tasks is that of grouping his video equipment into a series of systems packages, in individual shipping containers for ready mobility and use anywhere. Systems are packaged for various levels of performance, starting with the basic TK-76/TH-50 camera/tape package, with a modest audio system, and battery-operated color monitor. The TK-76 and TH-50 are both battery-powered, so this system is compact enough to go anywhere regardless of power availability. For more extended shoots with this package, a small 300 watt gasoline power generator is used. This unit permits taping rehearsals without using the batteries. A 3.5 kW portable power generator is available when more video equipment is required on location.

In adapting the Winnebago for a mobile video unit, Palette retained the recreation vehicle convenience features of a refrigerator, stove, sink and wash-



Ron Hutcheon, Vice President, Engineering, conducts equipment check in Palette's mobile unit.

room at the rear. Propane gas is used for heating and cooling. Also at the rear is a built-in 7 kW generator which can be operated while en-route to a location shoot, providing warm-up time for the equipment and expediting set-up. The Winnebago is 27 feet long and 8 feet wide.

The equipment complement carried includes:

- TH-100 1" VTR, with TBC
- TH-50 Portable 1" VTR
- 2 Color Monitors
- 4 Monochrome Monitors
- 3 CCU for TK-760 Cameras
- Time Code Generator
- Vectorscope/Waveform Monitor
- Video Switcher, 10-input, 4-bus
- Audio Console, 10 input, 2 output
- Audio Patch Panel
- Sync Generator
- Color Bar Generator
- Video Distribution Amps

#### Fast Set-Up On Location

All of these items are designed for quick disconnect and individual packaging for remote use wherever needed. For distant remotes beyond the range of the Winnebago, a complete portable control room can be shipped and set up within two hours after arrival on location, according to Mr. Hutcheon.

The control area is made up of four separate tables with fold up legs. Two of the tables are 2' x 4', with 30-inch legs. One of these has cutouts to ac-

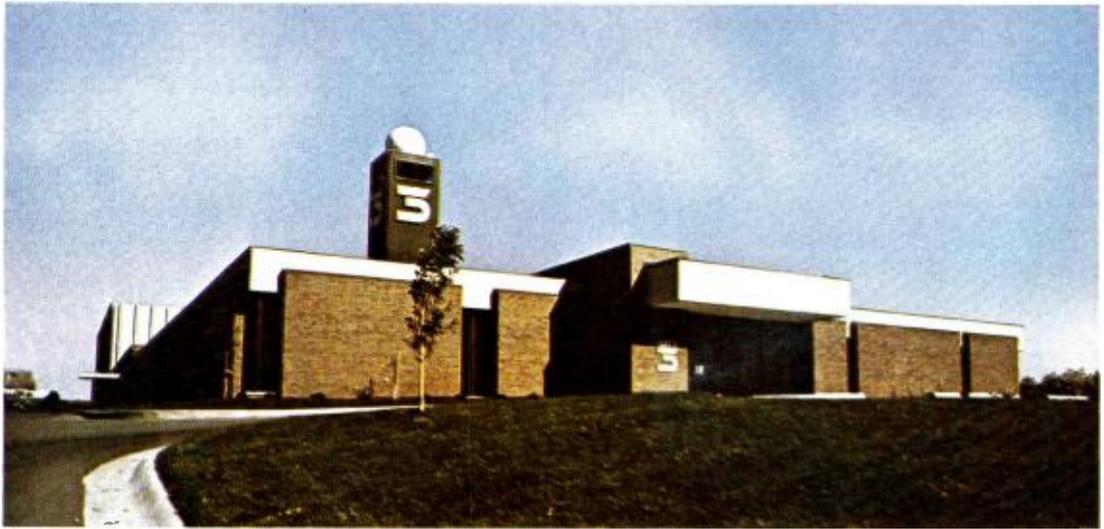
commodate the TK-760 CCU's and video switcher, and the other has a flat desk surface for use by a production assistant.

The second pair of tables are 24" x 42" with 12-inch legs. These mount on top of the base tables and provide space for mounting the color monitors, monochrome monitors, vectorscope and waveform monitor and time code generator.

A 10 x 10 intercom system mounts in a separate case. Another case holds the sync and pulse generator, and color bar generator. The audio system and monitor speakers are also cased for easy shipment and set-up. This complete mobile control room can be set up easily and quickly in almost any size rental van or truck, notes Mr. Hutcheon. The arrangement may lack some of the amenities of custom mobile production units, Ron admits, but it gets the job done with professional results.

#### The Switch To Video Is Working

For Palette Productions, "sophisticated portability" is more than a catch phrase. It is an operating credo that accurately describes the company's major strength—the ability to go anywhere on short notice and to deliver broadcast quality pictures. The concept that spurred Don McMillan's abrupt switch from film to video is working. □



New KMTV broadcast center rests on a grassy knoll, with the radome-topped tower serving as an easily recognized landmark.

Attractive lobby environment extends a cheery greeting to KMTV visitors.



# KMTV

## Is Experiencing Technical Pride ...

**W**hen KMTV signed on-air from their new broadcast center on December 17, 1978, the changeover had been so carefully planned and orchestrated that only one small flaw was noted: the sign-on audio tape had not been changed to give the new station location. This minor omission was quickly corrected.

KMTV, owned by May Broadcasting Company, started operations in September 1949 from a downtown Omaha building which had been remodeled for television. Subsequent expansions in 1953 and 1962 filled all available space, with the facility covering 22,000 square

feet on two floors. With continuing growth, an expanding news operation and increased production activity, the station's downtown quarters became cramped and inefficient. Studio space was restricted and hampered by low ceilings and columns.

"We had a problem—and an opportunity," notes Gale Totten, Vice President, Engineering, for May Broadcasting. "We took advantage of the opportunity to design a new television broadcast center from the ground up, with ample room for economical expansion when needed.



LAYOUT, KMTV, OMAHA

Simplified floor plan for KMTV's broadcast center accents its functional efficiency.

**An Easily Recognized Landmark**

The new KMTV broadcast center is modern, functional and is readily recognized as KMTV's new home. The instant identity comes from an 87 foot tower rising from the middle of the building and which is topped by what looks like a giant golf ball on a tee. This is the radome that houses the station's weather radar unit. Also contained in the tower are three microwave antennas.

**Form Follows Function**

The KMTV building is replete with design and layout features that enhance the efficiency of the operation. Administrative offices are logically located at the front, with the technical area as a core and the studios at the rear. The News Department, News Center 3, occupies its own spacious wing of the building.

The basement area is 10,000 sq. ft. and contains the electrical cable distribution to engineering facilities, and also houses mechanical, heating, electrical, telephone terminal equipment, and tape and film storage.

There are five independent air conditioning systems:

1. Technical area (This is also humidity-controlled).
2. Studio A
3. Studio B (air from this system can be diverted through a by-pass duct to cover the technical area if that system fails).

4. Office Area
5. Prop Storage Area

**Complete Installation By KMTV Staff**

While construction was still in process, Chief Engineer Larry Steele and five of his staff members moved on-site in June 1978 to handle the technical equipment installation. The entire systems layout, assembly, installation and system checkout were performed by the KMTV technical staff—without disrupting operations from the downtown facility.

Setting up a new technical facility is never simple, but making the change-over was simplified for KMTV because major new equipment purchases were made prior to the move-in, and these

systems were wired in and installed in the new location.

New equipment included: two TR-600A quad VTR's with AE-600 Time Code Editing Systems; two TK-28 telecine systems; a TFS-121 Frame Synchronizer; a Master Control Switcher; a routing switcher; a new STL system, and a full complement of terminal equipment—pulse DA's; video DA's; sync generators.

Wiring and equipment interconnections were also made easier because cable trays were used to carry the cabling. The cables for the technical areas—Master Control; Video Tape and Film, and Production Control—are carried on cable trays in the basement beneath. Cable trays are also located around the

Larry Steele, Chief Engineer, KMTV (left) and Gale Iotten, Vice President, Engineering for May Broadcasting were totally involved in the planning, layout and installation of technical facilities.



Computerized retrieval system in Media Dept. offers instant access to video "carts" and film spots.



Studio A and B perimeter walls. The use of cable trays with easily accessible wiring eliminates the need for separate computer type flooring and is more efficient, Mr. Totten has found.

#### Completing the Changeover

Four days prior to the changeover, the TCR-100 video "cart" machine was moved from downtown to the new location. This made the Tape/Master Control operation more hectic, since tape spot reels had to be made up to cover commercials that would have been aired by the "cart" machine. These were played on the TR-22 VTR's which are continuing to provide excellent service for KMTV.

In addition to the new equipment, other audio and video systems were removed from downtown for installation in the new center. The GV-1600-7K video production switcher which had been in service for a short time was moved to the new site, and the earlier switcher which it had replaced (a custom system designed and built by KMTV) was put back in service temporarily.

The BC-100 audio console was dismantled and re-installed in Production Control "A" beside the GV-1600-7K video switcher.

Some equipment units which were needed for daily broadcast operation were taken to the new building for a few hours to set timing. These included a TK-44 camera and a character generator.

#### Sign-Off, Sign-On

Saturday night, December 16, 1978 marked the end of KMTV's broadcast era at the antiquated downtown location. The Sunday AM sign on, December 17, 1978 came from the new KMTV broadcast center. As noted, the only hitch was a last minute discovery that the sign-on audio tape gave the old address.

KMTV Production Control "A".



#### Control Center for Tape and Film

Contributing to the smooth changeover of facilities by KMTV is the station's efficient procedure for handling commercials and program material. These are controlled by the Media Department, which is also responsible for filing, storage and the archiving of film and tape.

Incoming video tapes and film are received by Media, checked, and given to Traffic for assigning computer identification numbers. All tape and film program material and commercials for daily operations are provided to Master Control by Media. A computerized retrieval system permits quick access to all current tape and film spots. Attesting to the efficiency of the system, Media Manager Ken Michelsen notes that only two spots were lost in the first seven months in the new facility. In addition to program films and tapes, KMTV maintains a file of 2160 TCR-100 "carts"; over 10,000 film spots, and some 1500 video tape commercials.

There is a separate film and tape storage area in the basement which also houses the archive material. A small elevator connects this storage area with the Media room above it.

#### Master Control

Master Control is in the central core area of the KMTV building, with limited access, to discourage unnecessary traffic. Master Control includes the usual monitoring and remote control facilities for the transmitters.

Also a part of the control area are the joystick remote controls for the TK-28 film systems, and CCU's for the TK-44 studio cameras. Machine controls for the projectors and VTR's are located conveniently above the MC switcher.

In preparation for technical automation, the new MC switcher includes a separate 20-event pre-set unit which

pre-rolls automatically, switches from source-to-source, and can be programmed to make the transition as a fade, key or wipe. The result: a smoother transition and a more professional on-air appearance.

#### Handling NBC Network Regional Inserts

KMTV is handling regional network inserts for NBC and has installed a separate operating position in Master Control for this operation. To accomplish this, a third sync generator is used with advanced timing to sync with the Western Telecommunications Inc. (WTCI) link in Omaha which relays NBC network programs west. To insert regional commercials, one of KMTV's film chains; the TCR-100, or a quad VTR can be split away from house sync and put on the network sync for making the switch to WTCI. In some cases, the inserts are made in network programs not carried by KMTV (regional NFL football games for example).

#### Video Tape Operations

Video Tape and Telecine are separated from Master Control by a sliding door. Since the Master Control operator also loads the "cart" machine, the VTR's are positioned closest to MC. The film operator is also available to assist the Video Tape operator if necessary during a production.

KMTV does not dub film spots to the "cart" at present, preferring to make up spot film reels for commercial blocks. In the future, should a second "cart" machine be added, Mr. Totten notes, all commercial spots, PSA's and ID's will be put on cartridges, with the

Customized Master Control grouping, with transmitter/STL monitoring facilities on left; switching and machine controls in center, and camera CCU's at right.



20-event pre-set automation capability of the Master Control Switcher providing automated station breaks.

Two ¾-inch VTR's are used for airing ENG tapes. Usually only one edited item is on a cassette, and the VTR operator uses a 2 x 1 switcher to air the tape called for by the director.

The two TR-600A tape machines are used primarily for production during the week. The tape editing facilities are becoming popular with local producers and directors as they become better acquainted with the capabilities of the AE-600 Time Code Editing System. Some advertising agencies are now specifying that post-production editing of their client commercials be done on the TR-600A/AE-600 system. The TFS-121 Video Frame Synchronizer which is used for the ENG operation is also fitting in as a production aid for freeze-frame effects and splits. The tape room is now operating two shifts during the week for commercial production.

#### Customized Telecine Projector Remote Control

Telecine includes the two new TK-28 islands and one TK-27 brought from downtown and which is now used for slides.

Mounted on one of the new multiplexers is a custom projector remote control panel, along with a multi-monitor display of video sources. This custom facility is especially useful when the film systems are being utilized for production and programming.

At KMTV, a film operator loads film and pre-rolls for the MC operator to "Take". The remote projector controls are also duplicated at the MC position. Dirt on the film gate is not a problem here — pushbutton-activated solenoids were installed on the TP-66 projectors to blast a jet of air on the film gate to keep it clean.

#### Studios—Inside and Out

The KMTV building was constructed



Video Tape area adjoins Master Control. MC operator also loads "cart" machine.

in two parts, with the studios at the rear. These are constructed with a trussed roof and double-stressed, pre-cast concrete walls. The inner walls of the studio utilize special acoustic concrete blocks for sound isolation. The studio ceilings are layered for sound isolation, and walls and ceiling are separated from the main structural system with isolation for sound control.

KMTV's two television studios occupy a generous 7524 square feet of space, with each studio being served by its own control room. The ceiling height of 24 feet allows for great production flexibility. A large property storage area connects to both studios, and dressing rooms are nearby. Lighting for both studios is by Kliegl, controlled from a patch-panel with two-scene pre-set lighting. For trimming the lights, KMTV uses a Van Ladder self-propelled man lift. On occasion, the bucket has also been used as a camera mount for covering high shots in the studio.

Studio A measures 72' by 57' and is usually reserved for commercial production work. Studio B is 57' by 60' and is used for news and local programming. Three trusty TK-44 color cameras equipped with prompters move between the studios as needed.

Studio C is a bonus facility—an out-

door patio that is used for both program and commercial production. Technical outlets for audio, video and intercom are available from Studio B.

#### Distinctive News Set

Almost circular in shape, the News Center 3 set is functional and distinctive—a combination of warm colors and polished aluminum.

Large monitors on each side of the set permit displaying live pictures from the field, while the 2-way radio hook-up permits direct communications between the studio anchor and the field reporter. Recessed monitors are located in the desk for the anchor team.

Also a part of the set is a large chroma key area which is used for the weather report, to display either the radar picture, a live shot from outside the station, or latest weather satellite photos.

The unique news set was created by New York designer Hugh Raisky.

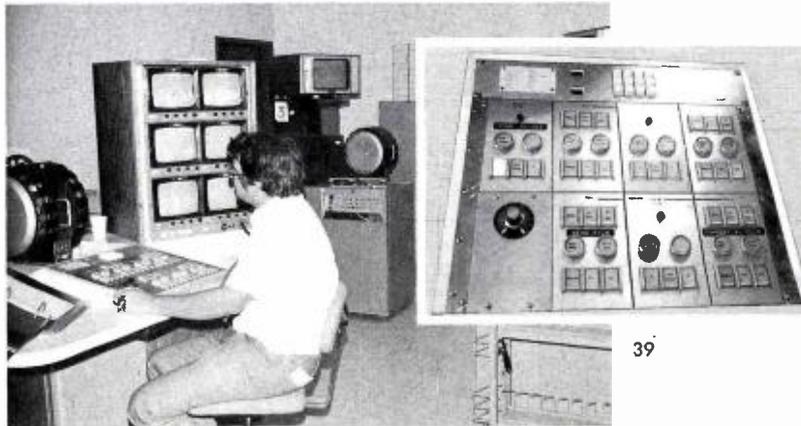
#### ENG and News Center 3

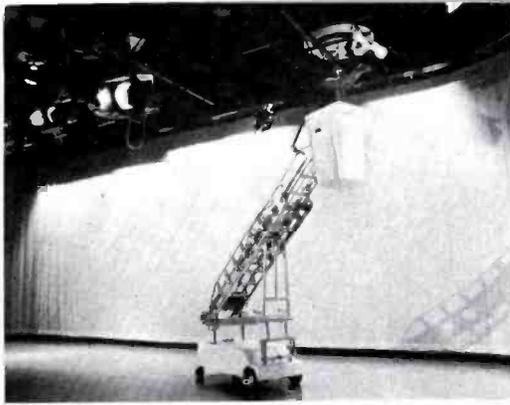
In common with many markets, news is a hotly competitive operation in Omaha. At KMTV, the News Department occupies one side of the new building, with a separate entrance. It is a well-planned and equipped operation, with an airy, roomy space with 18 reporter stations, and a full complement of support facilities—camera

Tape production is handled by TR-600A VTR's equipped with AE-600 Time Code Editing Systems.



KMTV-designed remote telecine machine panel (inset) and bank of monitors aid in production and on-air operations.

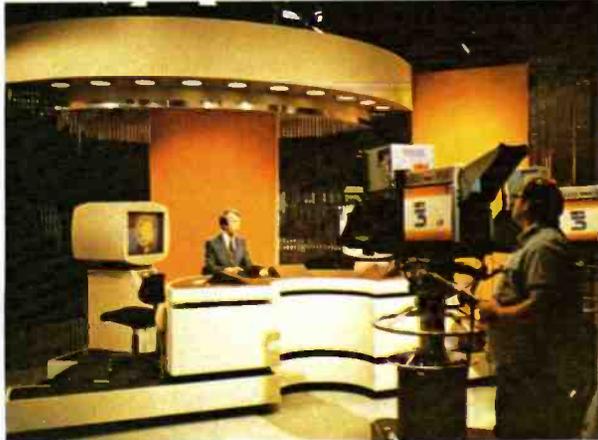




Electric cart with ladder and bucket make studio light trimming less of a chore.



One of KMTV's identically-equipped ENG Editing booths.



KMTV's almost circular news set is a striking combination of warm colors and polished aluminum, with monitors set in behind the newscasters.



The KMTV ENG complement includes a microwave-equipped van for extended distance direct transmission to the studio.



room; three ENG tape editing bays; film processing room; film editing room. There is also a small studio for convenience in handling on-site interviews that can be covered quickly and privately, using a TK-76 camera.

The ENG activity includes four TK-76 cameras, four field units, and a microwave-equipped van.

The microwave ENG unit is a Ford van with sliding side door access, and is equipped with Microwave Associates 2 GHz microwave and a 13 GHz portable microwave.

A Van Ladder atop the vehicle permits quick orientation of the antenna for line-of-sight transmissions back to the

studio. Nurad "Golden Rod" antennas are mounted at the top of the ladder, which is also equipped with a bucket that can be used as a camera mount when necessary. The microwave receiving horns are mounted on KMTV's downtown tower, and are positioned from Master Control, using two-way radio to line up with the AGC on the remote control system from the tower to the studio.

The truck also has a built-in 5 kW gas generator and a 500 watt inverter for use as the power source if the gas generator fails. There are five batteries in the unit—four for operating the Van Ladder and one for starting the generator. Other equipment carried includes

audio; a basic video switcher; BVU-200 VTR; color bar generator and monitoring and test facilities.

Four KMTV station wagons are used for ENG assignments, which are handled by the customary cameraman/reporter team. Usually the stories are taped on location and returned to the studio for editing. The microwave unit covers special news assignments and is available for dispatching to the ENG-unit field locations when deadlines or fast-breaking news situations require direct transmission to the studio.

All ENG material is run through a TFS-121 Video Frame Synchronizer at the studio for smooth, glitch-free transmission.

KMTV is fully equipped for film and is still operating with film crews, but on a reduced scale. With the ENG units now in operation, 65-70% of the news material is now on tape, according to Larry Steele.

#### A Favorable Impression

The new KMTV broadcast center has impacted favorably on the community, on employees and on clients. This view is forcefully expressed by Norman Williams, Vice President and Assistant General Manager of May Broadcasting.

"Our new 46,000 square foot home is not only one of the finest television broadcasting facilities in the country, but an outstanding production center as well," he says.

"The new facility is modern, spacious and efficient, which helps our operations. It has also had an excellent effect on employee pride and morale. Moreover, the public view of KMTV has improved measurably," Mr. Williams adds.

"The new broadcast building has been a magnet for visitors. Group tours are so popular that one member of the Promotion Department is assigned to handle this public relations function. And advertising clients are discovering and utilizing our expanded studio, tape editing and production facilities."

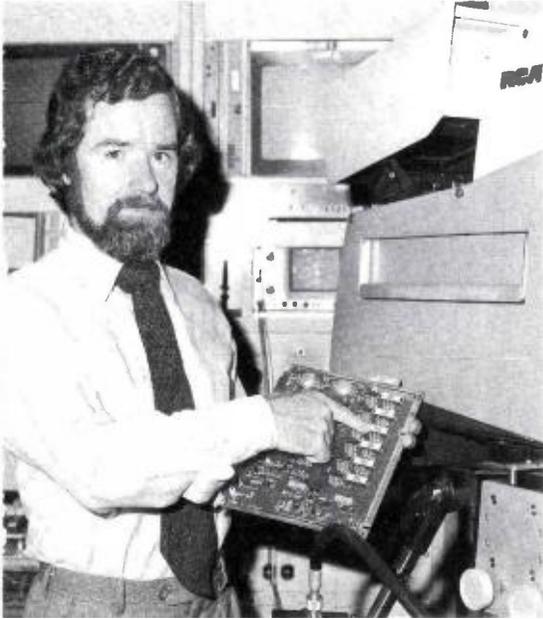
KMTV is experiencing technical pride—and enjoying it.



Norman Williams, Vice President and General Manager of May Broadcasting, expresses delight at the favorable impact of KMTV's new broadcast facility.

# DESIGNING THE TK-47 AUTOMATIC CAMERA

Laurence J. Thorpe, Unit Manager, Camera Engineering, RCA Broadcast Systems, has been involved with the TK-47 automatic camera from its inception—long before it reached the design stage.



Laurence J. Thorpe  
RCA Camera Engineering

*Stability: the preservation of a color camera in an optimally aligned condition has always been—and remains—a task involving disciplined supervision, periodic checkout, and periodic realignment of pertinent controls. Historically this has been an undesirable investment in time, effort and cost.*

*Achieving and maintaining the optimum operational condition automatically has been an elusive, long-standing goal for camera design engineers. That goal has been attained in the fully automatic TK-47 camera developed by RCA.*

TK-47 Automatic Camera

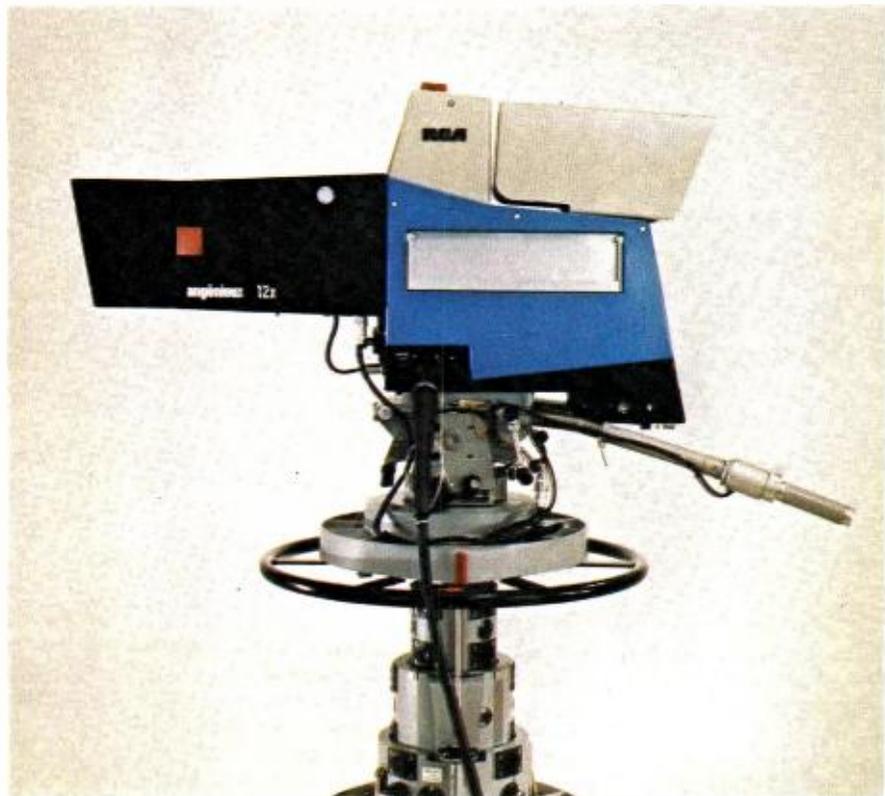
The routes taken in the development of the TK-47 camera offer a useful overview of the progressive achievements as well as the design philosophy from which the new camera evolved.

RCA's initial venture into the development of an automatic camera came in 1971. This design was a totally digital electronic approach, utilizing a core memory to store all set-up parameters.

The approach was felt to be technically sound, but its practical implementation frustrated by the limitations of that day's device technology.

#### Enter The ENG Camera Era

By 1975, a decade following the commercial introduction of the Plumbicon-tubed camera, yet another era had arrived. The development of smaller and smaller pickup tubes and continuing advances in integrated circuit technology paved the way for a new generation of cameras—small, portable and self-contained. Among the newcomers was RCA's TK-76, an unattended color camera designed to operate for ex-



tended periods of time without the encumbrance of conventional sophisticated technical control panels. The "ENG" class of cameras remain unique in that their technical setup is predicated on a stable pre-alignment stored in dozens of potentiometers contained within the camera enclosure. Periodic checkout remains a necessity and the changing of a major component like a pickup tube still necessitates a careful realignment, made more tedious by the compactness of the camera's electronics.

**Technology for "Automatics"**

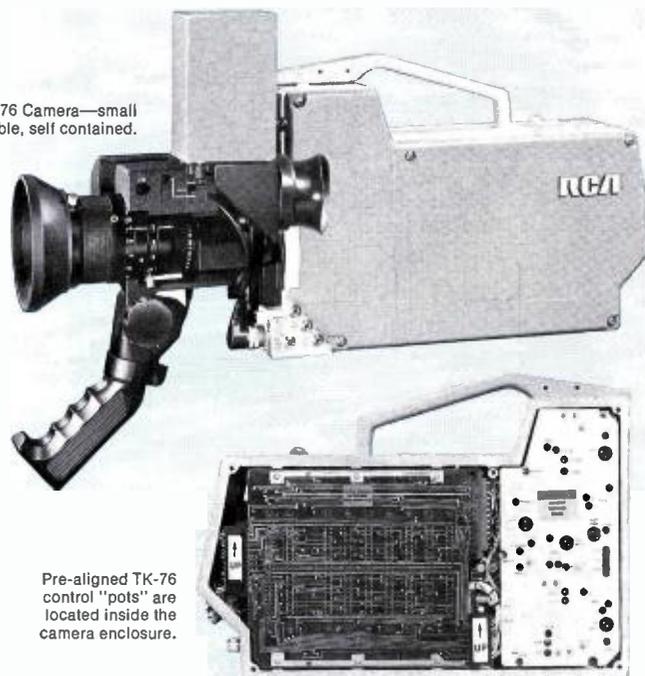
With the introduction of the TK-76, a "hands-off" precedent had been set in camera design. The logical evolutionary advance on this was to produce a camera utilizing modern digital semiconductor memory to store all of the camera alignment information formerly resident in many potentiometers, and to provide means for convenient electronic access to this memory for periodic inspection and, when necessary, readjustment or updating. This concept forms the basis of the TK-47 design.

**Designing the TK-47**

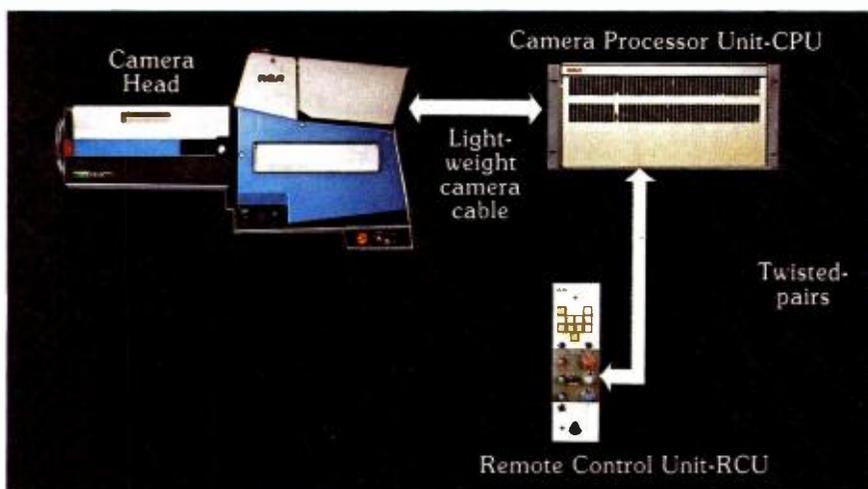
The development effort on the new TK-47 high quality automatic camera was approached on three fronts:

1. The design of a basic camera which coupled the best of prior art and experience with the innovations developed in the ENG type cameras to produce a highly stable, reliable, and simple camera chain.
2. The development of a control system based on the concept of digitally stored setup data, resident within each camera chain; a remote control terminal to permit rapid access to these memories; and a contemporary data bus control system to streamline the interconnection of the elements which form a multi-camera system. This step would be decisive, in that it would completely preclude potentiometer panels from each camera chain, and not preserve these as secondary levels of control, as is the current practice in other "automatic" cameras. Only by placing total reliance on the now proven superiority of digital components over their analog counterparts, such as potentiometers, could we buttress the claim of superior achievements in stability, reliability, and performance and the preservation of an inherent simplicity in each camera chain.

TK-76 Camera—small portable, self contained.



Pre-aligned TK-76 control "pots" are located inside the camera enclosure.



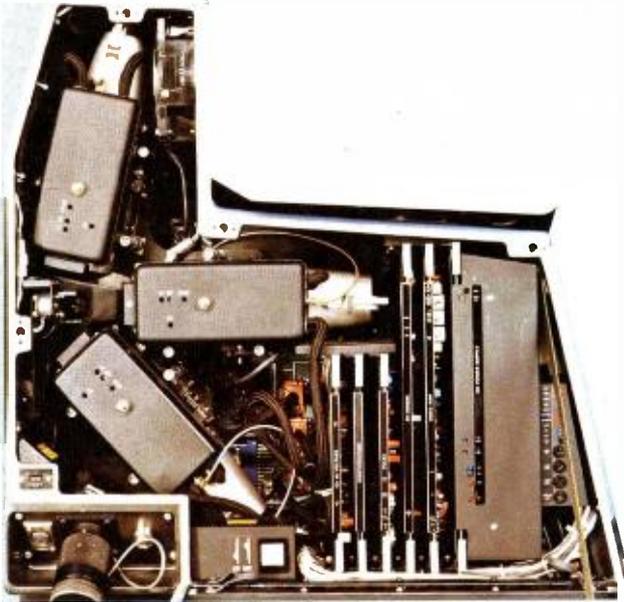
Basic TK-47 Camera System

3. The refinement of this digital control system to embody a powerful automatic capability for full technical alignment of a color camera, with absolutely no attendant complication of the camera chain itself.

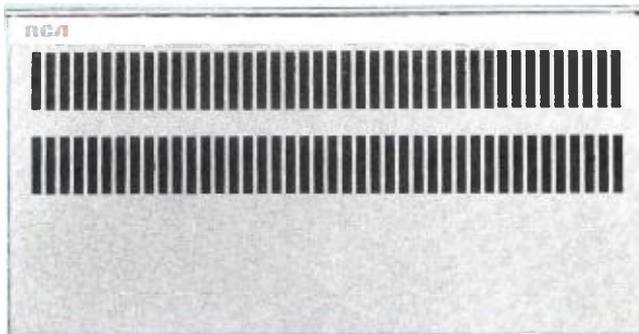
not an integral part of each camera chain represents a major breakthrough in achieving the automatic camera.

The combined thrust of these parallel complementary efforts place the TK-47 at the apex of contemporary digital control systems, spearheading a new direction in broadcast state of the art camera design.

The concept of an updating control system which is truly supervisory and



Camera Head with shock-mounted optics.



Camera Processor Unit (CPU) is the central system interface point for the TK-47 camera chain.

#### TK-47 Camera Head

The camera chain itself centers about a rugged camera head where careful design attention has been given to the more demanding performance requirements for cameras used in field production and Outside Broadcast applications.

There are ample innovations in the camera head alone:

- new precision yoke design
- isothermal coupling techniques
- shock-mounted optics (coupled with a 30mm tube system)
- RGB splitting optics
- cast body (capable of supporting the largest, highest quality lenses)

The net effect of these innovations is a camera capable of delivering superior picture quality under all dynamic scene conditions.

#### Camera Processor Unit

The camera head connects via a simple lightweight flexible camera cable to a single frame Camera Processor Unit (CPU) which processes and finally encodes the video signals generated in the head. This unit also serves as the central system interface point for the camera chain.

The CPU contains a simple rudimentary microcomputer, contained on a single plug-in module. This microcomputer module provides a continuous reading from the camera's central digital memory (which is necessary to sustain the analog setup adjustments). It also supervises the updating of this memory when a Setup Terminal is being employed to align the camera. The memory is a low power CMOS RAM made nonvolatile by battery backup.

The RCA CDP1802 8 bit microprocessor forms the nerve center of this microcomputer and an elegant use is made of its inbuilt Direct Memory Access (DMA) facility to implement the ceaseless reading out of this memory.

Reading is performed at a rate synchronous with the camera's synchronizing system, with one complete digital number, corresponding to one control function in the camera, being read-out every television line. This rate permits the complete sequence of camera adjustments (totalling more than one hundred) to be scanned every TV field. The digital output of memory therefore is a serial output of 8 bit numbers which alter every TV line. These are fed to a single D/A convertor, the output of which is a Pulse Amplitude Modulated (PAM) train. Each pulse occupies a TV line and is an analog representation of the setting of the individual technical controls. This pulse train repeats every TV field. The microcomputer also delivers a corresponding 8 bit address with each data output, which permits simple demultiplexing techniques to be employed. Sample and hold circuits convert each of the pulses into d.c. voltages which then directly adjust the variety of controlling circuits throughout the camera chain.

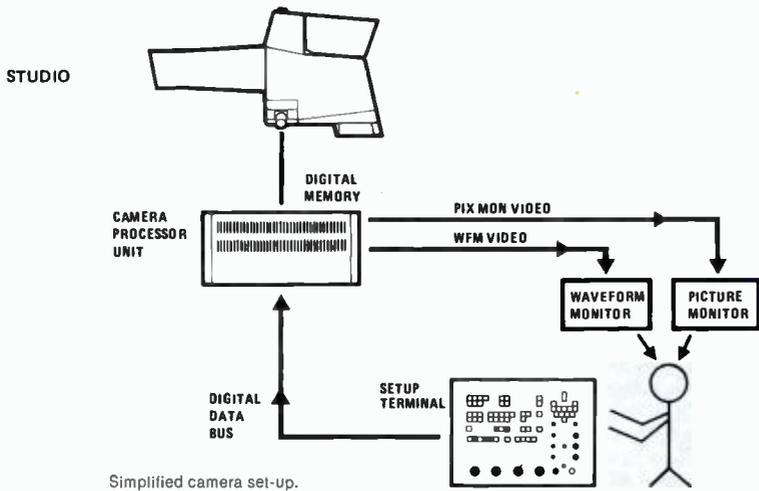
#### Digital Storage/Analog Control

The PAM signal is transmitted to the Camera Head where it is separately demultiplexed to actuate the controls contained in the tube, scanning and video circuits. This approach offers all the advantages of digital storage while preserving the simplicity of direct analog control, utilizing a surprisingly small amount of simple, stable hardware. Where a multiplicity of analog waveforms must be remotely controlled and assembled to produce registration and shading corrections, a custom built analog LSI chip has been successfully developed which is used to afford a substantial reduction in circuitry and an enhancement of circuit reliability and temperature stability.

The original design goal of achieving a new level in camera stability in a flexible, yet simple camera chain has been realized by this elegant marriage of a simple microcomputer to handle the digital domain and simple consolidated analog circuits to instrument the camera adjustments.

#### The TK-47 Automatic System

The basic manual controlling loop of the TK-47 is formed by human interpolation of the many technical param-



eters of the camera, using conventional remote visual inspection of two camera monitoring video outputs (one for a monochrome picture monitor and another for a separate display on a waveform monitor and vectorscope) and, in turn, sending back to the camera chain appropriate correcting or updating signals from a specially designed digital Set-up Terminal. When the camera is satisfactorily aligned, the monitors, the control Setup Terminal, and the human can be dispensed with. That is, the supervisory elements can be detached and the camera now operates indefinitely as a stable "black box". This scheme permits, for the first time, the total supervision, and control, of the entire camera chain itself from a remote location which may be as far away as 900 feet (300 meters) from the camera processing unit (CPU). The attendant strength of this approach is

obvious when it is realized that an entire system of camera chains can be supervised, monitored and completely technically aligned from this single remote location. Precision, consistency and discipline for the first time can now be imparted to the maintenance of high performance in multi-camera systems.

#### Automatic Control Loop

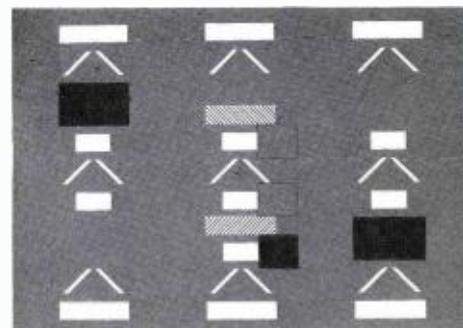
If electronic sensors were developed which could extract from these same two video monitoring signals all absolute and comparative status information relevant to the camera's technical alignment—and, if these sensors could be followed by a decision-making system which could activate the digital updating mechanism—then all the elements for an automatic control loop would be realized. This fully automatic level of control has been successfully implemented in the TK-47 Auto-Cam.

### Three Key Elements For Automatic Alignment

The key elements required to assure a reliable and precise approach to the automatic alignment of an electronic system as complex as a color TV camera can be listed as follows:

*First*, a carefully designed optical source, which can inject into the camera system as much detailed information as necessary pertinent to the many camera parameters required to align a chain.

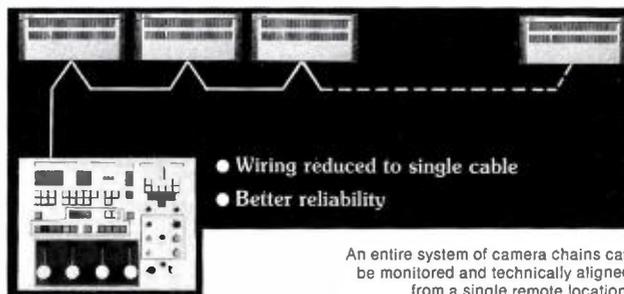
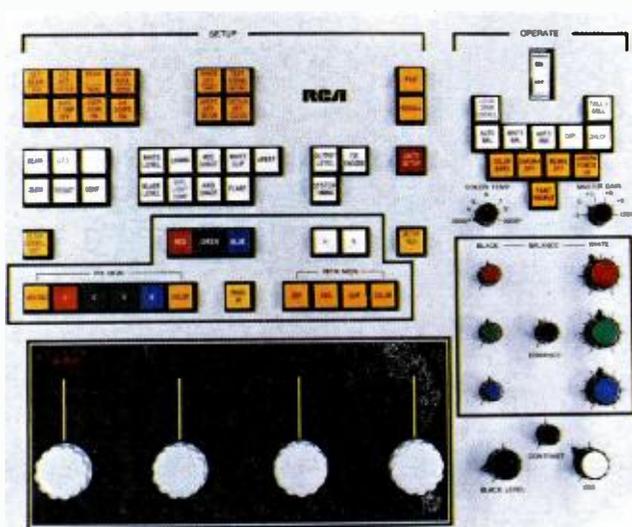
Three years of intensive effort working with the world's leading lens manufacturers has resulted in the successful development of a precision diascope, incorporated in these lenses, which projects an image from a specially developed slide into the camera optics, with the same aberrations incurred as



Diascope—a time-saving test pattern built into the camera lens.

if an external chart, containing the same information, were viewed through the lens itself.

*Second*, a detector system of high precision, reliability, and simplicity. Since this total automatic approach involves



An entire system of camera chains can be monitored and technically aligned from a single remote location.

A single Set-up Terminal can be used with multiple cameras in a system.



**Decision, Decisions, Decisions**

These digital numbers are temporarily stored, and now software assumes a leading role. Powerful algorithms make decisions on which controls should be incremented; calculations are made when necessary and correction data is computed, synchronized and multiplexed for transmission to the camera memory to effect the first update. The resulting alteration in the camera functions are in turn rescrutinized by the detectors and the algorithm computes from the newly presented digital numbers the next appropriate move. This process is continued until a satisfactory convergence, which falls inside a pre-chosen measurement window, is achieved. This window so functions that the camera specification relating to a particular parameter is adequately satisfied.

Controls which interact are carefully handled, because unlike the human intervention, the algorithms can manipulate many controls virtually simultaneously, examine globally for interactions; and patiently, but rapidly, make readjustments until a progressive diminution of errors is achieved. Up to twenty such controls are maneuvered when the registration of two images is being made. An important part of all the algorithms employed are multiple measurements and averaging techniques to minimize errors due to video noise or positional uncertainties.

**Two Levels of Automatics**

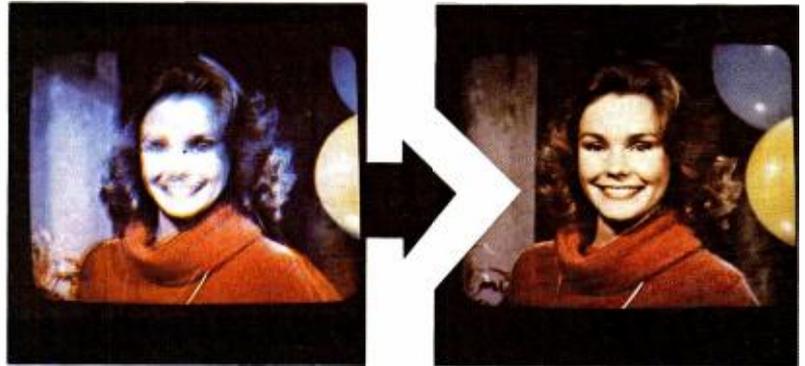
The automatic system has been programmed to offer two distinct capabilities, tailored to address the practical aspects of color camera usage.

In the first instance, the changing of major camera components, such as pickup tubes, dictates a complete realignment of the camera chain, and the TK-47 system can perform this alignment completely automatically. The initiation of this procedure takes place from the Set-Up Terminal's control panel—by pressing a single pushbutton—and starts with the diascope being

automatically brought into the optical path of the camera. The alignment itself is in two phases, which commences with a series of gross adjustments designed to first reconstruct sensible images, then sets the master size and aspect ratio of the Green image, performs a coarse registration correction, and precision setting of beam.

Next, the images are re-focused and precisely registered, and finally the RGB video processing sequence is adjusted, culminating the flare correction and a gray scale color balance.

With the TK-47 automatics, "picture-perfect" is as easy as touching a button.

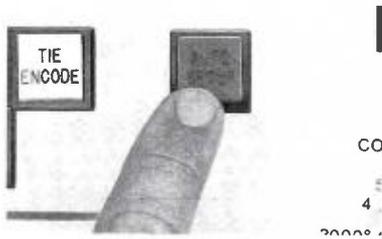


The above alignment is obviously not a frequent requirement, but it does perform rapidly and accurately a procedure which is conventionally quite time-consuming.

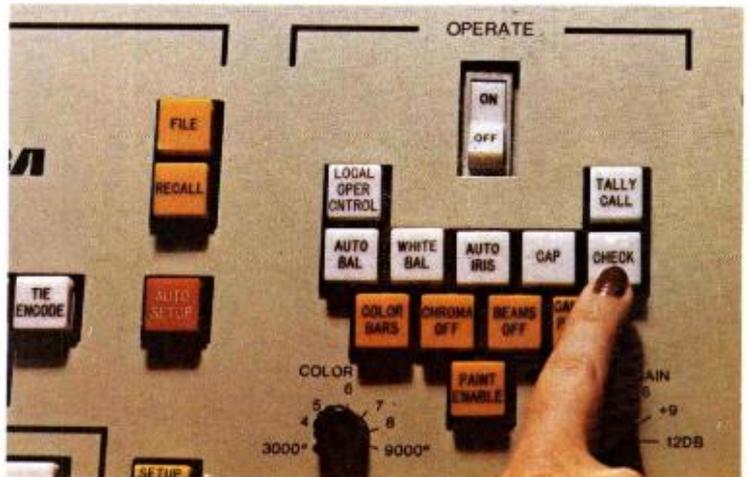
**Ten-Second Checkout**

On a daily basis, however, the TK-47 automatics can be usefully employed to handle the "preflight" checkout normally performed on cameras prior to going on-air. This is accomplished via the "Check" pushbutton and can be initiated from the Remote Control Panel in Video Control, or by the cameraman from the rear of the TK-47 camera head.

In this automatic mode, the electrical focus is examined (and corrected only if necessary); then the Red and Blue image registration relative to Green is checked, followed by Black and White levels; shading, and finally a gray scale balance. Under normal conditions this automatic checkout takes ten to fifteen seconds, during which time some forty-eight controls are scrutinized and re-adjusted (only if necessary). This means a typical studio's complement of cameras can be checked out automatically with a high degree of consistency within a minute or two, effectively eliminating what is conventionally a lengthy and often stressful daily task.



Pressing a single button on the Set-up Terminal initiates completely automatic total camera set-up.



Routine "pre-flight" camera check is accomplished in seconds using the "Check" pushbutton.

### File and Recall Memory

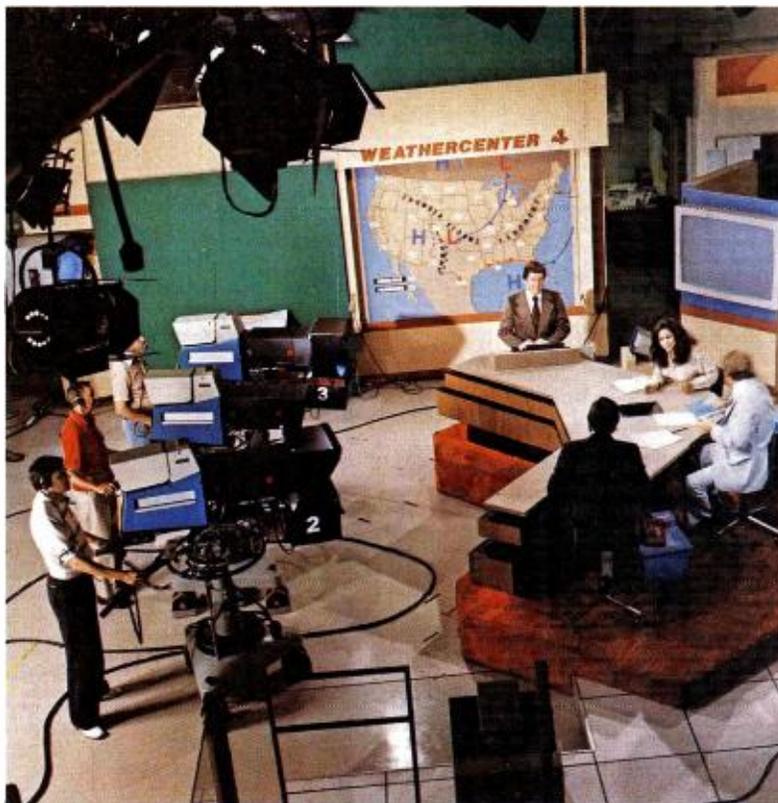
The digital memory in each camera chain, while physically embodied in two small chips, has extensive storage capacity and this is gainfully employed to endow each camera with some very useful operational features. The memory is separated into discrete banks, each having a capacity to store a total technical alignment of the camera. This imparts to the camera an unprecedented ability to contain an alignment optimized for indoor usage (with beams set for 3200° K lighting), and at the same time another total alignment, optimized for outdoor lighting (where beam settings and hence registration, etc., would normally require readjustment). A single "Recall" pushbutton on the Set-Up Terminal control panel permits instantaneous conversion of the camera to either setup. Conversion between these two setups is possible indefinitely. The TK-47 has more than a half dozen such storage banks, which allow even further flexibility in that other alignments, for special effects, special lighting conditions or simple emergency backup can be stored. The filing into or recalling from, these other banks is controlled from the Set-Up Terminal.

The automatic system, too, makes use of this additional memory storage. As one example, the actuation of the Automatic Setup procedure automatically causes the current alignment of the camera to be filed in one of these spare memory banks. Now, if during the course of the automatic setup the system encounters difficulty, the mere re-actuation of the AUTO SETUP pushbutton will abort the automatic system and instantly recall the old setup, returning the camera to an operational status. Maintenance may be conducted then or at a convenient time following the operational usage of the camera. Also when an automatic setup is completed, the new alignment is automatically filed and this too may be recalled at some future time when needed.

### Why The TK-47 Is A User-Oriented Camera

Many of the concepts and features incorporated in the TK-47 camera are familiar to broadcasters around the world—with good reason. Prior to final design of the TK-47, a worldwide market study was conducted to ascertain what features, functions and performance characteristics were desired in this new generation product. The requirements most frequently cited were for a camera producing superior picture performance with a minimum of technical involvement. In short, a camera which is easy to set up and to operate, and which provides consistent high quality output.

The addition of "automatics" to the final design extends the versatility of the camera by taking advantage of the stunning opportunities of microprocessor technology. Further, this step into digital technology opens an avenue to forthcoming developments of considerable import to TV program production. In the world of television cameras, change is constant—and accelerating. □



*First on the line.* The nightly news at KDFW-TV, Dallas, is covered by the first three TK-47 automatic color cameras delivered by RCA. Ch. 4 news viewers saw the first TK-47 on the set at the same time that NAB attendees were watching the RCA camera show at the Convention Center.

# THE NEW TK-76C. MORE CAMERA PER POUND. FEWER POUNDS PER CAMERA. JUST WHAT YOU NEED IN AN ENG CAMERA.

We've built all the features you need in an ENG camera into our new TK-76C. The results: lighter weight, even better performance, and extra value.

A new mainframe makes the TK-76C three pounds lighter than its predecessor, yet it's rugged. Built to take it. And a retrofit kit permits easy conversion of earlier TK-76 cameras (over 1500 in use around the world) to this new lighter version. That's RCA cost-effectiveness in action.

#### **New comet tail suppression, new remote control options.**

New capability for electronic field production, too, with automatic comet tail suppression for enhanced

performance and improved picture quality. It's a production feature that does the job without special tubes and without degrading present tubes. A real cost-effective extra.

Two new belt-pack remote control systems. Choose either a multi-core cable system with automatic equalization and timing for operation up to 3000 feet, or a new multiplex system for wireless or Triax operation up to 5000 feet. Either way, you get new flexibility and convenience.

#### **RCA: one source for all TV broadcast products**

Every item from RCA—camera, VTR, film chain, antenna or transmitter—is designed to start ahead, built to

stay ahead. Count on RCA to save you money over the long haul, where it really counts.

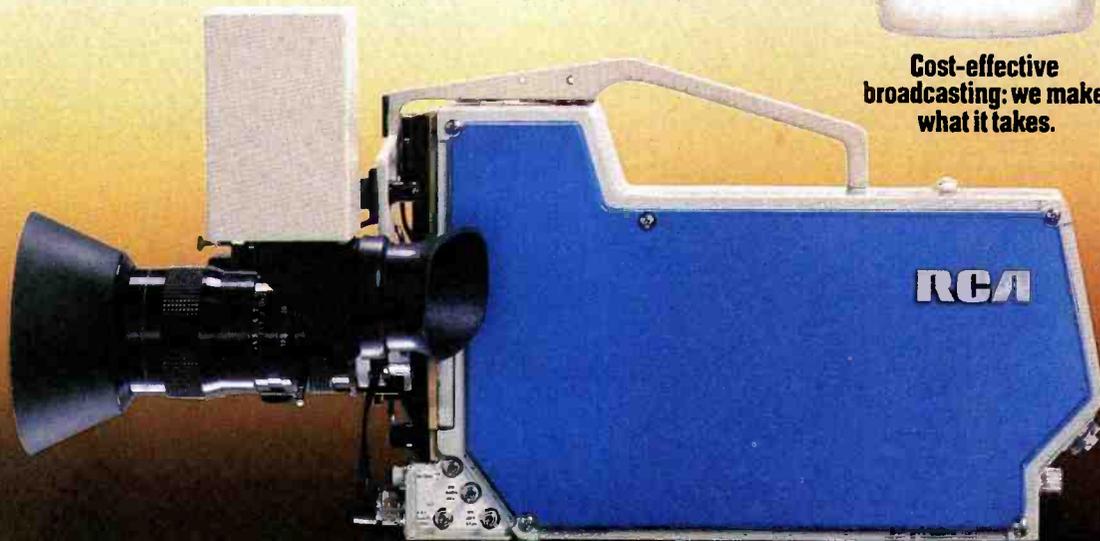
#### **RCA TechAlert protects your investment 24 hours a day.**

If your TV gear isn't on the job, it can't be cost-effective. So we back our outstanding products with service to match: TechAlert. The far-reaching advantages of its non-stop availability are as near as your telephone.

That's how close you are to your RCA representative, too. Why not call him for all the facts on the improved TK-76C, or any other item in our cost-effective broadcast equipment lineup. Or write RCA Broadcast Systems, Building 2-2, Front & Cooper Streets, Camden, NJ 08102.



**Cost-effective  
broadcasting: we make  
what it takes.**



# THE REMARKABLE NEW G-LINE TRANSMITTER. A GIANT STEP FOR TELEVISION BROADCASTING.

RCA introduces the first major advance in television transmission in more than a decade: The new G-line.

Revolutionary. With the highest level of solid-state, the fewest tubes, the most advanced automatics.

It offers so much more than conventional transmitters: in engineering, high performance, and long-range cost-effectiveness.

**Solid state to a new high of 1600 watts. One-stage tuning. Advanced automatics and safety features.**

Day in day out, the G-line is built to cost less.

With only two tubes throughout: one visual, one aural. That means a reduction in spare tube inventory.

With one-stage tuning: amplifier tuning is needed only in the high-power output stage, not in the solid-state broadband driver.

And with real self-sufficiency: the G-line paces its performance, overcoming variables that affect stability. After a momentary power line interruption, it returns to the air in two seconds automatically.

The G-line is designed to meet future safety demands, with a key interlock system plus electrical interlocks to assure a new higher level of protection for your people.

Everything about the G-line is

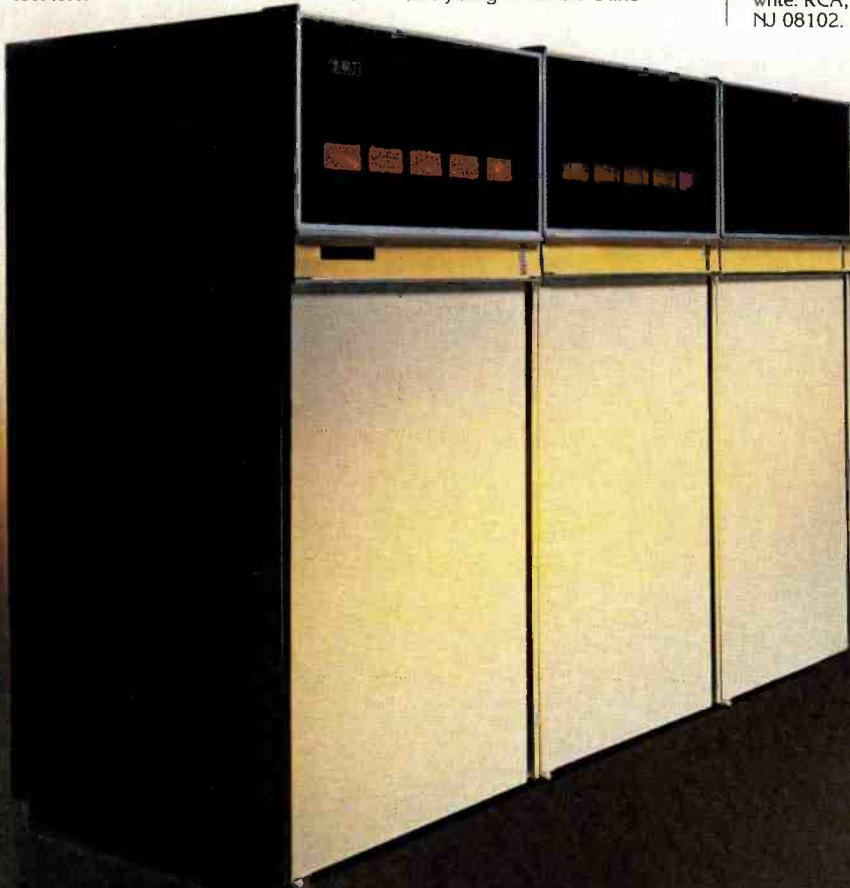
geared toward higher performance that saves you time and manpower—that's RCA cost-effectiveness.

**The G-line is new in design, new in versatility.**

The G-line transmitter also offers great versatility: eight new power levels with 20 model variations, and visual power output of up to 30 kW (60 kW parallel).

It's the newest member of the RCA family of television broadcasting equipment: everything from cameras, to film chains, to antennas. All backed by famous RCA TechAlert service and parts support.

See your RCA representative or write: RCA, Building 2-2, Camden, NJ 08102.



**Cost-effective  
broadcasting: we make  
what it takes.**



**New TTG Series  
VHF Television Transmitters**