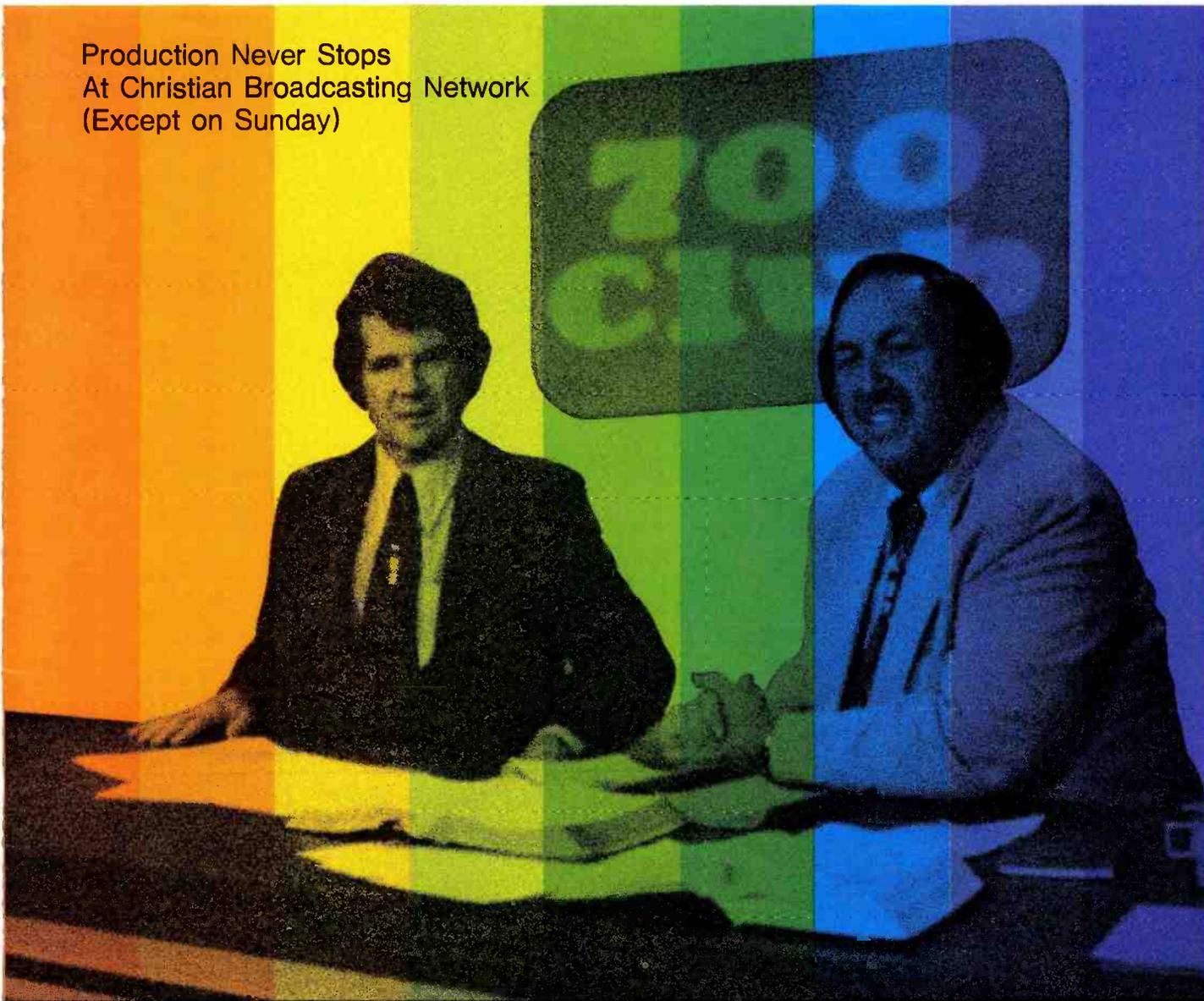


Volume No. 152 February 1974

Production Never Stops
At Christian Broadcasting Network
(Except on Sunday)



The Automatic Color Camera

Comes the Evolution!

- 1969** RCA introduces the TK-44A, a new generation of color cameras.
- 1970** New features added. New colorplexer, miniature cable and equalizer. Improved camera cable and joystick control panel.
- 1971** The TK-44B. With more new features. Bias Light to reduce lag and RGB coring to minimize noise at low light levels. Scene Contrast Compression to bring out details in high-contrast scenes.
- 1972** First automation designs demonstrated at NAB.



1973. The TK-45A.

What's behind our new TK-45A color camera system is a four-year tradition of dynamic design advances in our TK-44 Series. The result: a reputation for producing the highest quality pictures in the broadcast industry.

Now, the TK-45A offers an even higher standard of excellence. Because it does everything the TK-44 does. And more, automatically.

So the TK-45A is easier to operate. And there's less that can go wrong.

White level is set by simply

focusing on a white area of the scene being shot (or a white reference card) and pushing a button.

Black level is automatically set every time the lens is capped.

And should lighting conditions change, automatic iris compensates without the help of an operator.

The new circuitry has been incorporated into a newly designed camera control unit, which reduces the number of interconnecting cables. So clutter is kept to a minimum.

With all its time-saving automatic features, the TK-45A makes top operating efficiency possible. It lets your station produce the best color pictures ever.

In other words, the TK-45A sees things your way. Automatically.

For details on its performance, and the cost-effective design approach behind it, contact your nearest RCA representative.

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

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Published by
RCA Communications
Systems Division

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OUR COVER—Producing twelve religious shows weekly, including 30 hours of syndicated programming, plus "specials", keeps the dedicated people and extensive production facilities at Christian Broadcasting Network going full tilt.



IN THE VIEWFINDER

New Explorer Satellite Provides In-Depth Study of Thermosphere

The most comprehensive study of the earth's upper atmosphere ever taken by a satellite is being made by a new RCA-built spacecraft.

The satellite, called Atmosphere Explorer, was launched by NASA on December 15 from the Western Test Range in California.

The spacecraft carries 14 experiments designed by scientific investigators from seven colleges and universities and four separate government research agencies. It will fly an extremely elliptical orbit ranging from 2,500 miles apogee (high point) to as low as 75 miles perigee (low point).

This is the nearest that any NASA spacecraft has ever approached earth on a regular basis. Atmosphere Explorer thus is providing the first systematic measurements of a little known region of the upper atmosphere called the Thermosphere.

Its mission is to help scientists understand the complex physical and chemical processes occurring there that could ultimately affect weather, environment and health here on earth.

The part of the atmosphere being probed by Atmosphere Explorer has been studied previously only sporadically by sounding rockets. The new satellite will thus venture into the scientific "no-man's land" that is too high for aircraft observation and, until now, has been too low for satellites.

By firing a set of on-board rockets, the satellite will be able to resist the pulls of gravity and atmosphere drag as it dips into the Thermosphere.

The satellite also has been designed to withstand the heat generated by friction from air as the speeding spacecraft streaks through a relatively dense part of the atmosphere.

Atmosphere Explorer will gather information on ion, electron and neutral particle activity in the thermosphere and their dynamic interaction with x-rays and ultra-violet radiation from the sun.

Though most data will be collected while the spacecraft is in the low point of its orbit, some information, particularly related to solar storm activity, will be gathered at higher altitudes outside the Earth's atmosphere.

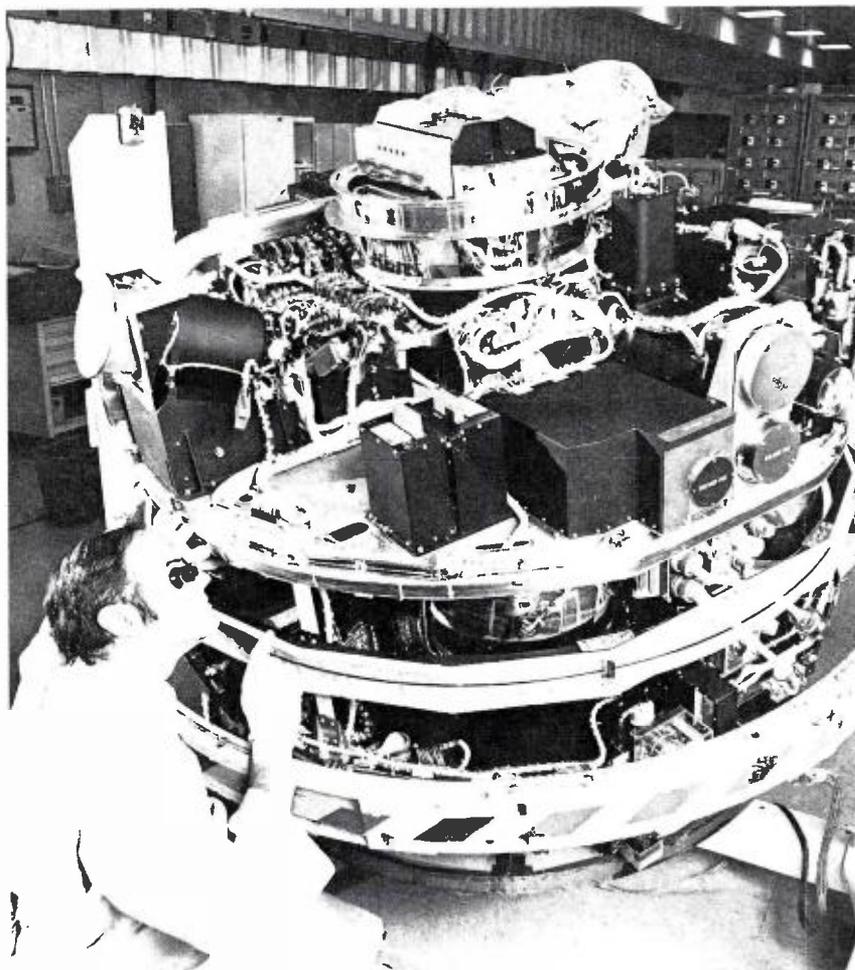
The satellite's drum-shape bears a close resemblance to RCA-built TIROS and ESSA weather satellites launched in the 1960's.

It measures 45 inches high and 53.5 inches in diameter, and weighs 1,450 pounds. Except for the instrument apertures, the

body of the spacecraft consists mostly of a mosaic of solar cells which convert sunlight into electrical power.

The satellite's instrumentation can be remotely commanded by NASA at any point in orbit. Experiment data can be transmitted to ground stations either via Very High Frequency (137.23 MHz) or by S-band link (2289.50 MHz).

Atmosphere Explorer was designed and built by RCA's Astro-Electronics Division under the technical direction of NASA's Goddard Space Flight Center.



RCA engineer Ricardo de Bastos checks one of fourteen scientific instruments carried aboard the Atmosphere Explorer satellite, the first ever designed to provide systematic measurements of a little known region of the upper atmosphere called the thermosphere—a "no-man's land" that is too high for aircraft observation and, until now, too low for satellites.

TCR-100/TR-60 Is An Effective Combination for Australia's Southwestern Telecasters

Southwestern Telecasters initiated tape operations in March 1972 with the installation of a TR-60 at BTW Channel 3, its TV station in Bunbury, Australia.

In June 1973, the six year old station declared its first dollar profit—and General Manager Brian F. Hopwood credits the TR-60 with a solid contribution to earnings.

Recently, a TCR-100 tape cartridge machine was brought into the operations, and the profit picture couldn't look brighter. The traffic in tape commercials is accelerating and the TCR-100 is really paying off.

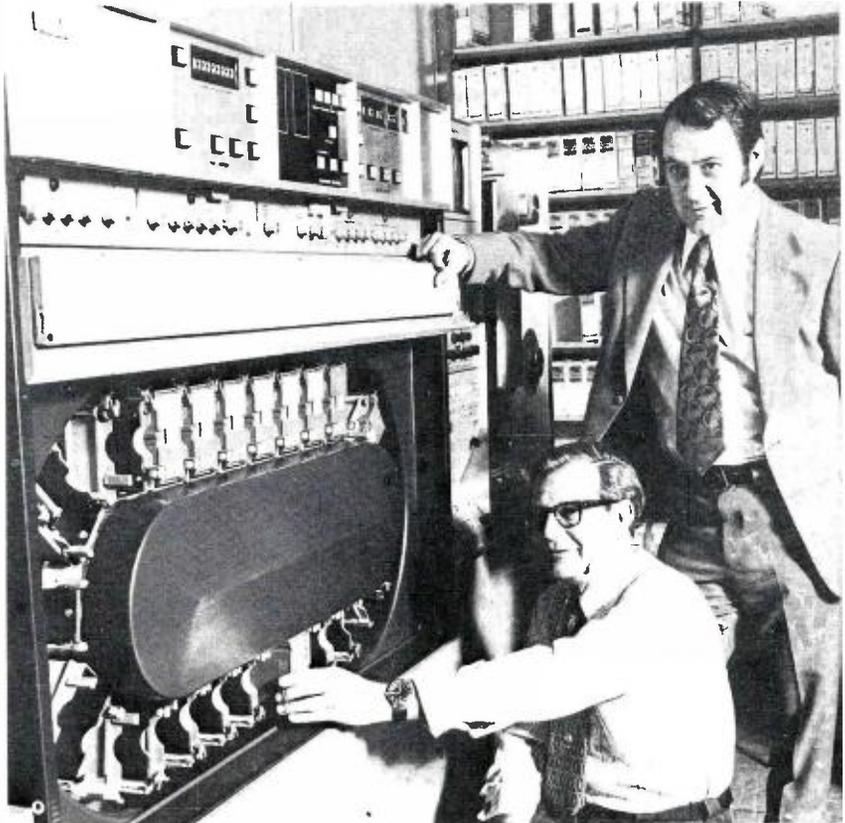
With the TR-60 as "master" and the Cart Machine as "slave", the combination is doing a lot more than each could do alone. The station now has the capacity of five reel-to-reel machines for replaying commercials. But that's not all. Through proper cueing, the TR-60 automatically airs regular program tapes one after another.

According to Assistant Manager/Chief Engineer Alex Stewart, there are still other advantages of this tape equipment combination, including human benefits. "As more and more commercials are dubbed onto carts, there is less strain on the person doing the video switching," Mr. Stewart explains.

The station already has 150 carts in use, and has recently taken delivery of 200 more to cover an ever-expanding tape-storage bin.

When the full effect of the TCR-100/TR-60 pairing is realized, Southwestern Telecasters is looking forward to even more profitable operations.

BTW-3 relays programming to its sister station, GSW Channel 9 in Albany. The two stations cover a 27,000 square mile area, serving a potential viewing audience of 140,000. The current program day is 5½ hours, except for one which carries 16 hours of transmission.



General Manager Brian Hopwood (standing) and Assistant Manager/Chief Engineer Alex Stewart discuss the profit potential of the TCR-100/TR-60 combination.

WSB-TV Atlanta Orders RCA Transmitting System for Alternate-Main Operation

WSB-TV, Cox Broadcasting Corp., has ordered a complete RCA TV transmitting system including two 25 kilowatt transmitters and a new broadcasting antenna.

The type TT-25FL lowband VHF transmitters will be placed in operation as

an alternate-main system, allowing convenient daytime maintenance and adjustment of the equipment on standby. In the event of a failure in one system, the back-up transmitter is immediately engaged to keep the station on the air at full power. Input and monitoring equipment associated with the transmitters provide for full remote control of both units.

The new antenna is the TF-6AL, an RCA Superturnstile type. It weighs approximately seven tons, stands 121 feet high and will be mounted on top of the station's new 1000-foot tower.

IN THE VIEWFINDER

Cinemobile Video Systems Equips New Teleproduction Vehicle With Portable Quad VTR's

Cinemobile Video Systems, a new TV production company based in Hollywood, CA., has ordered two RCA TPR-10 portable quadruplex recorders for the first of its video tape production vehicles.

The highly maneuverable production vehicle will be used for originating material for television broadcasts—everything from commercials to full-length motion pictures. The rolling TV facility will be backed up by other Cinemobile units when special lighting or other equipment is necessary.

The portable recorder, designated the TPR-10, is RCA Broadcast Systems smallest tape unit, and provides 20 minutes of "on-location", studio-quality recording in full color. The recorder originally was designed for airborne use, and its mod-

ular construction provides the ruggedness and reliability necessary for in-the-field service.

Tape speed, format and highband signal system of the TPR-10 are fully compatible with quadruplex videotape machines such as RCA's TR-60 and TR-70.

Cinemobile Video Systems was formed early this year as a joint venture of Republic Corp's Consolidated Film Industries and the Cine-Group, a part of Taft Broadcasting.

RCA Develops Electronic PABX For Telephone, Business Markets

An all-electronic private automatic branch exchange (PABX) with large-scale integrated circuits so tiny that 64 switching cross points fit into a pencil-point area has been developed by RCA, Government Communications Systems, Camden, N. J.

Designated the RCA Model 600, the new product line will have a capacity of up to 600 lines. Modular construction will permit a variety of applications in PABX-using markets, and the extensive use of LSI circuit chips only .03 inches square will reduce the new system's size to one-tenth that of conventional electro-mechanical switches now in use.

In addition to the 64 cross points, the tiny chips will house the logic needed to set up and maintain telephone connections. Similar size chips used for logic control functions each will contain the equivalent of 1,500 transistors. The use of sophisticated LSI technology achieves the advantages of small size, light weight, low power consumption and high reliability.

The 300-line system will require a single cabinet measuring 24 x 28 x 80 inches; two such cabinets will provide a 600-line system. This equipment will be supplemented by an attendant's console with 20 trunk lines, although an optional version has 40-trunk capacity.

The system will have such standard PABX features as a flexible numbering plan which, in a typical installation, will permit intermixed one, two, three and four digit

dialing for extension number or location code to telephone number correlation.

Optional features are being designed to add such services as centrex operation, direct inward dialing, automatic identification of outward dialings, call forwarding, and several others.



New electronic PABX system developed by RCA makes extensive use of LSI's for smaller size and increased reliability.

WBEN-FM Pioneer Buffalo Station Replaces Transmitting Plant with RCA Two-Unit System

WBEN-FM, Buffalo's pioneer FM station which began broadcasting in 1946, has replaced its entire transmitting facility with a new two-transmitter RCA system.

The transmitting system guards against any interruption in the broadcast signal by keeping one of the two 40-kilowatt

transmitters on constant standby in the event of failure in the on-air unit, according to Jerry Klabunde, Chief Engineer, Radio, for WBEN, Inc. If required, switch-over to the standby transmitter is automatic.

RCA has also supplied an eight-bay circularly-polarized FM antenna, mounted on the WBEN TV tower at Colden, N. Y., some 25 miles from the studio. The antenna is designed to improve radio reception when automobile vertical whip or windshield antennas and built-in "line cord" antennas are used.

WBEN-FM has been broadcasting in mono, with stereo operation set for February 1974. The station will also have the capability of adding quadrasonic programming in the future, he added.

The new RCA system provides full automatic logging, emergency backup stereo generators and audio processing equipment, as well as a dual microwave system linking the studio with the transmitter site.

Republic of Zaire Moves Toward Color TV Broadcasting

In preparation for the beginning of color TV broadcasting, the Republic of Zaire has ordered \$1.6 million in RCA television broadcast equipment and services.

The new equipment and support services will augment television facilities in Kinshasa, the Central African nation's capital.

A complete mobile unit will permit color television coverage of cultural, sporting and news events around the country.

The mobile van, to be equipped at RCA's Camden facility, will contain three of RCA's new color television cameras, the TK-45A, as well as video tape recording, signal switching and microwave equip-

ment. The unit will enable the Zaire station to broadcast "live" shows from remote locations and to record events for later telecast.

Two RCA TR-60 video tape recorders also will be installed in the station's studio facilities in Kinshasa.

Automatic Scorekeeper by RCA Keeps Track of Strikes and Spares

Electronic systems are replacing the familiar bowling score sheet, and bowlers need only to check the Rapid Score display to follow the game's progress. This RCA-built automatic scoring system uses electronic sensors to observe the fallen pins after each ball is thrown, and a mini-processor to tally up the score automatically.

The automated system was developed and is being produced by the RCA Electromagnetic and Aviation Systems Division in Van Nuys, Calif., and is marketed through Rapid Score, Inc., a subsidiary of Conbow Corporation.

A special electronic camera, located in front of the pins at each lane, records the number of pins standing after each

thrown ball. This information is converted to digital data and transmitted to the computer at the player's console. The score is calculated and appears on a TV-like screen. The player's console is mounted on a pedestal placed at each pair of lanes. An electronic keyboard is used to enter players' names into the system. Scores can be kept for up to six bowlers at each lane.

The RCA system handles scoring for individual bowlers and provides running team scores in league and open play. It is capable of handling calculations for handicaps, missing player blind scores, pacers, and other complexities in league play scoring.

Rapid Score gives bowling lane managers more effective internal control by accurately determining the number of games played during a given period of time. The system's central processor, which is located at the manager's lane assignment desk, is interconnected with a printer. By pushing a button on his console, the manager is provided with printed score sheets of the games played on any specific lane.

Strikes and spares—and all the in-between scoring details—are recorded automatically with the new Rapid Score system developed by RCA.



New Transmitting Systems For WKTQ-AM; WSSH-FM, Pittsburgh

In a major improvement of facilities, Heftel Broadcasting Company has installed complete RCA transmitting systems valued at \$160,000 in their Pittsburgh, Pa., stations.

The broadcast equipment includes two FM transmitters, two AM transmitters and associated equipment.

Two RCA BTF-20E1 20-kilowatt FM transmitters for WSSH-FM are operated in an alternate-main configuration, providing the 24-hour-a-day station with a back-up transmitter in case of failure. The system also allows convenient daytime maintenance and adjustment of the equipment on standby.

An RCA BFC-2B circularly polarized antenna and two studio-to-transmitter radio links complete the new FM transmitting plant.

To provide alternate-main capabilities for WKTQ-AM, two RCA BTA-5L1 5-kilowatt Ampliphase AM transmitters have also been installed. These transmitters include a new all-solid-state Ampliphase exciter and require only four vacuum tubes. The AM facilities include a special phasing network, and a custom-built antenna system consisting of two 320-foot towers.

The Christian Broadcasting Network Inc.



Dominating the attractive lobby of Christian Broadcasting Network's headquarters building in Portsmouth is this colorful two-story mosaic created and installed by CBN personnel.

Faith Television Makes Its Mark

At 3:00 P.M. October 1, 1961, when Ch. 27, WYAH-TV, Portsmouth, Va., began broadcasting, there was a minimum of fanfare and an infantismal audience.

It was, however, an auspicious occasion, marking the culmination of an incredible chain of events and the overcoming of innumerable obstacles. For Rev. M. G. "Pat" Robertson it was the opened door to reach out to the world via television ministry.

The first program originated in a small studio on Spratley Street in a seedy section of Portsmouth. The set was lighted by a few 1000 watt spots, and one monochrome camera provided the picture pickup.

From the beginning, Mr. Robertson insisted on calling his single under-powered station a "network"—Christian Broadcasting Network. That vision has been fulfilled. Today, just twelve years later, the network includes four CBN-owned TV stations, (plus a fifth under negotiation) and six FM radio outlets. Supplementing these are nine commercial station affiliates which broadcast more than 20 hours per week each of CBN-produced programming. In addition, more than 200 cable television systems around the country pick up the CBN programs, and about 20 systems telecast these programs on a syndicated basis. Flagship station WYAH-TV is the oldest religious-oriented station in operation in the U.S., and Christian Broadcasting Network is one of the largest producers of religious TV program material in the world.

Providing syndicated program material for its rapidly expanding network keeps CBN's production facility going full tilt.

Production is a major effort at CBN, involving a substantial plant and equipment investment. The facility includes two complete studios; a sophisticated lighting system; set construction and storage area; four TK-44 color cameras; six video tape recorders, including five TR-70's; two complete color film systems—a TK-27 and a TK-28, and comprehensive switching and control systems. To provide more tape capacity for network production use, a TCR-100 "Cart" machine was added in 1973 for Ch. 27.

W. T. "Bill" Gregory, Director of Network Engineering reflects on his operation, commenting that it seems to be in a constant state of flux. In the early years it was a matter of holding the submarginal equipment together with baling wire and prayer, while building an adequate broadcast system.

More recently, the bursting forth of the production facility to supply network programming needs has again made it necessary to change the layout. Presently Master Control is being re-arranged to separate broadcast from production as much as possible. Two TR-70's and the TCR-100 will be delegated to WYAH for on-air operation. The other four tape machines will be used for production and dubbing.

Equipment for CBN, Mr. Gregory notes, is bought for full utilization. With this value criterion established, quality and long-term performance as well as price dictate brand selection. For example, he says, the tape machines at CBN headquarters are never turned off. During the day, three TR-70's and the TR-4 are used for production, and two TR-70's for on-air programming use. In the evening, the production VTR's are used for dubbing tapes. And after station sign-off, the other two TR-70's also handle dubbing requirements.

All of the tape machines have the CAVEC accessory. CBN finds this useful, since their production sometimes involves multiple generation inserts and the best quality picture is essential so that the inserts do not have the "tape" look.

The tape complement includes a TEP unit for editing, Mr. Gregory says, but for production work, the editing capability of the TR-70's is used more frequently.

The tape machines at CBN have provided excellent service. Headwheel life is consistently in the 1100-1200 hour range. Equipment performance is aided by the fact that heads are cleaned before and after each play and because smoking, food and beverages are not permitted in the equipment or control rooms. Air conditioning and a preciptron system provide further environmental protection.



Program production keeps a constant strain on CBN's studio and tape facilities.

Production schedule includes more than 50 hours of religious programming each week.



Production Department

Jerry Horstmann, Production Manager, is young, dynamic and totally committed. He is dedicated to making CBN productions the finest quality that resources permit. Their Production Department, he says, is structured like those of major networks, with a unit manager, lighting director, scenic designer, as well as the technical staff involved in all production planning and execution.

According to Mr. Horstmann, the biggest differences between local and network production are in the sets and the lighting. This is one of the reasons the CBN studio features a comprehensive lighting capability, with a 2000 Amp system. The system includes a 60-dimmer board with 5-scene pre-set that can be remote-operated

from the Production Control room. Lighting includes 5,000 Watt spots as well as strip lights for the top and bottom of the cyc. The patching panel permits as many as 506 different lighting combinations.

Another area which is frequently ignored in local production, Jerry Horstmann claims, is audio. The emphasis is always on getting a top-quality picture, he says, and the audio follows along as a necessary but less important production element. At CBN, however, the audio receives equal treatment. Their production facility includes a BC-100 custom audio console which provides complete flexibility for achieving quality sound performance to complement the video.

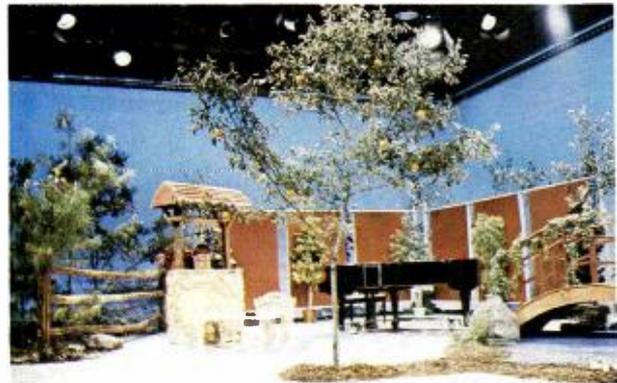
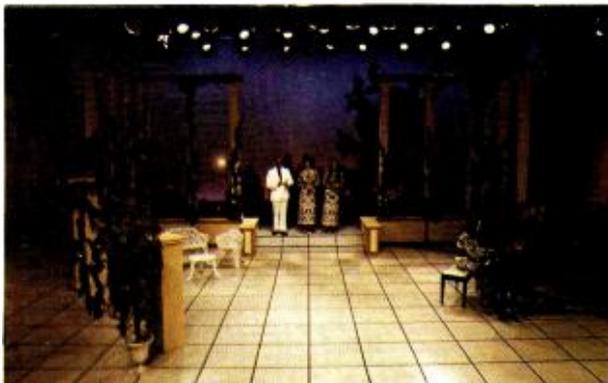
CBN also has a complete scenic design facility for set fabrication and storage. One

of the functions of this group is designing the sets which are used at affiliate stations during the local fund-raising telethon held twice a year at each of the affiliate stations to pay for the programming costs. A six-man team from CBN handles the total local production, including set construction, lighting, direction, camera operation, and telephone response.

Jerry Horstmann feels the growing demand for production time. The production facility is now working a six-day week of 2½ shifts—from 8 A.M. to 11 P.M.. His goal is to raise this to a full three-shift operation. The late evening period is now used for producing promos and spots for the network and affiliates.

There are twelve shows produced at CBN which are aired daily or weekly by the

Emphasis on quality at CBN is reflected in the complete set design facilities incorporated in the network's production center.



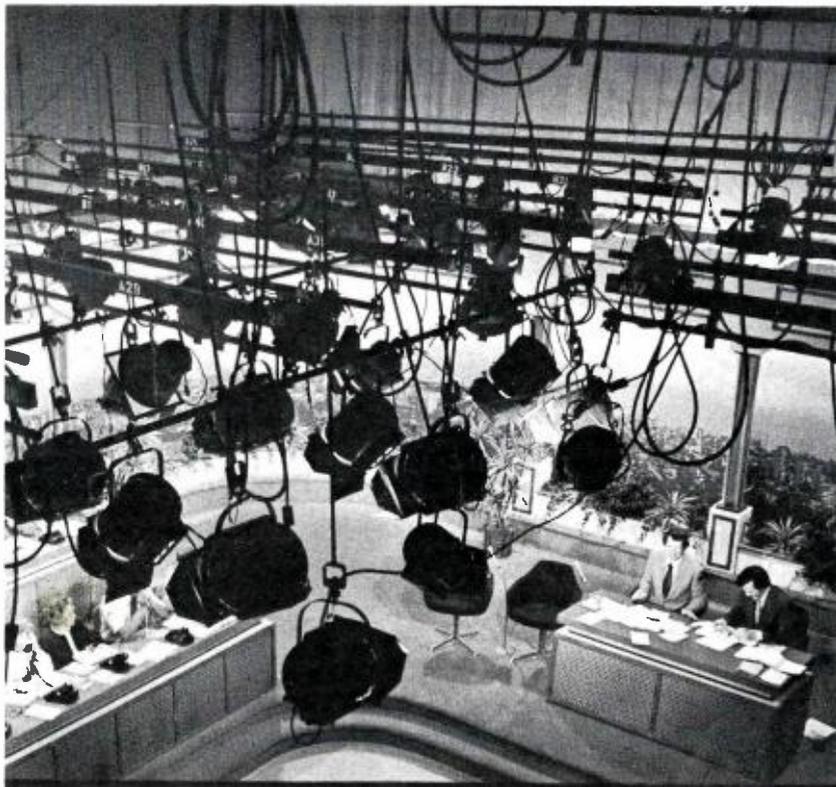
network affiliates—plus a number of "specials". The production schedule includes more than 50 hours of religious programming each week, plus ID's, promos and PSA's. And more than 30 hours of this programming is syndicated for distribution to TV broadcast affiliates and to cable television systems. To meet the demand for quad tapes, all six VTR's are used for dubbing during the midnite to 7 A.M. period.

In addition, with the increased exposure to CBN-produced shows, many religious organizations are requesting use of the Portsmouth production facility and staff for their needs.

The CBN production staff numbers three Directors and three Assistant Directors. More important than numbers, however,

remarks Mr. Horstmann, is staff versatility. Cameramen, for example, serve as directors on one show, handle cameras on another, and are performers when the occasion demands. The interchangeability of people provides for a flexible, fast-paced operation.

The versatility of the staff and their dedication permit handling a heavy production schedule. One major show originating from CBN is "Bozo the Clown". Production for the current season involves 130 half-hour shows including Bozo and cast, guest audiences of school children, puppets, and cartoons. With tight scheduling and careful planning, the CBN production crew completed 41 shows in 11 days before breaking the set for other productions.



The smaller of CBN's two studios is permanently set up for production of the daily two-hour "700 Club" show. Versatile lighting system helps expedite production schedules.

CBN (WYAH-TV) Equipment Complement

Video

- 4—TK-44 Color Studio Cameras
- 1—TK-27 Color Film System
- 1—TK-28 Color Film System
- 5—TR-70 Tape Recorders
- 1—TR-4 Tape Recorder (Hi-band)
- 1—TCR-100 Cartridge-Video Recorder (With SPU)
- 4—Helical Scan VTR's

Switching

- 1—TS-40 Switcher
- 1—TS-51, System 26, 3 lap dissolves; 2 special effects; 16-in, 8-out
- 1—TS-51, System 20, Audio-follow-Video, 16-In, 4-out

Lighting

- Kleigl: 2,000 Amp, with 60- 12 kW dimmers; 506-combination patch panel; remote board

Audio

- 1—BC-100 Custom Audio Production Console
- 2—BC-6 Consoles
- 2—RT-21 Reel Tape Recorders
- 9—RT-27 Cartridge Tape Recorders
- 2—Turntables

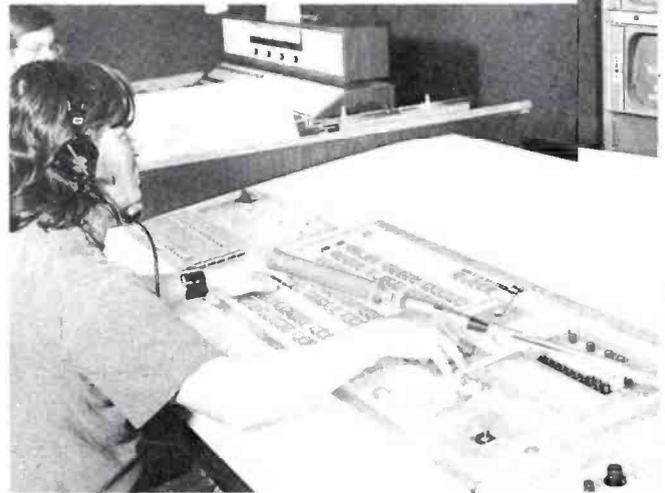
Antenna/Transmitter

- TFU-46K Pylon Antenna
- TTU-60 60 kW UHF Transmitter
- Fully remote-controlled, with BTR-30 System
- TVM-6 Microwave System
- BW-75, BW-85, BW-95 Monitors

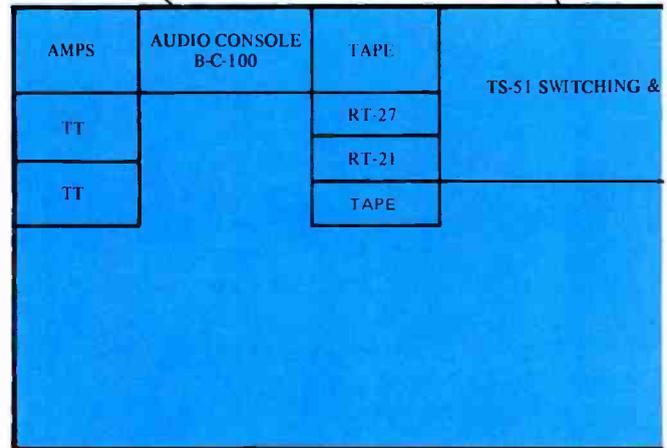
Versatile BC-100 custom audio system provides complete audio control.



Video switching is handled by TS-51 system with wide range of special effects. Wall of monitors gives director picture from available program sources.



Spacious main studio easily accommodates large groups of performers and sets, with ample operating room for all four TK-44 cameras.



Equipment Arrangement, CBN Production Control

Production—Studio

A logical starting point for discussing production is with the picture at the source. At CBN, the four TK-44 cameras have been giving excellent service. Production Manager Horstmann is elated with their performance. "They're second to none—in color fidelity, stability, ease of set-up and operation."

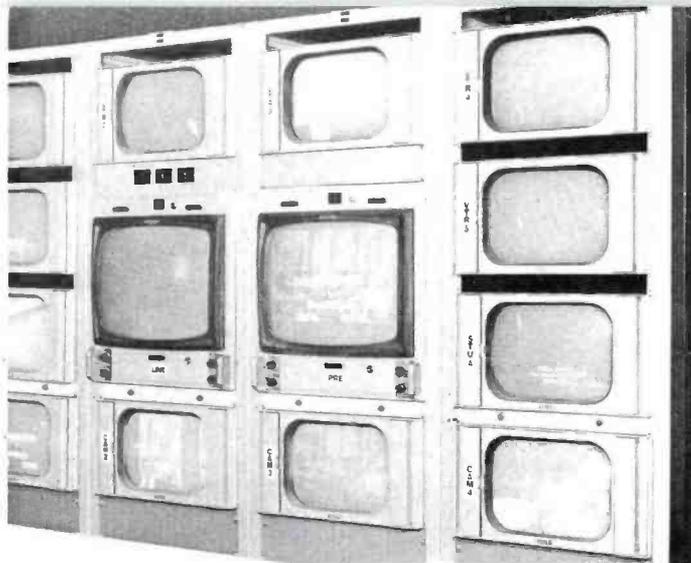
While Chromakey is used frequently at CBN, Mr. Horstmann feels it is a much

overworked technique which he avoids wherever possible. As with the tape machines, the TK-44 cameras at CBN are never turned off.

There are two studios at CBN headquarters. Studio "B" (48' x 50') is set up permanently to handle the daily production of "The 700 Club". The larger Studio "A" (72' x 48') is used for all other production requirements.

Production Control

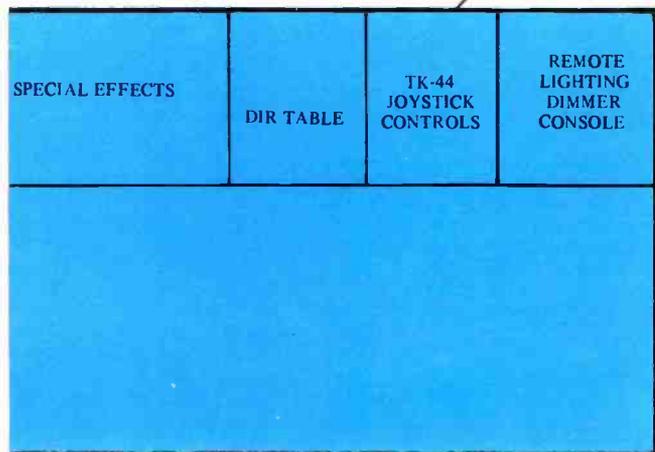
Production Control is a long, narrow room, 31' x 13'. The walls are lined with the same charcoal gray carpet as used on the floor. This, Bill Gregory points out, has an acoustical value in deadening sound. It also eliminates distractions and makes the recessed wall monitors the focal point. The room has just been re-arranged for added efficiency and self-sufficiency, he says. The central point remains the monitors and the switching position



Joystick controls for TK-44 cameras are now located in the production area rather than in Master Control.



Time-saving remote dimmer lighting console features a 5-scene pre-set capability.



manned by the Director. He is flanked on the left by the Audio position, while on his right two new control positions have been added.

Joystick controls for the TK-44's which were previously manned at Master Control are now remoted to Production Control. And a Remote Dimmer panel in the room gives the director command of the pre-programmed set lighting.

The TS-51 Production Switcher is a double

reentry, with three Chromakeyers and background generators. The switcher provides a choice of 100 special effects—enough for just about every requirement, Mr. Gregory comments.

A BC-100 custom console handles audio for production work, and this system is given high marks for performance by CBN audio technician Jeff Harrington. "It lets me do the work formerly requiring two men," he says.

The ability to delegate submaster functions and to pre-set controls are a real advantage, he finds.

Best of all, Mr. Harrington says, "With the BC-100, life is less hectic. It is smooth, easy to handle, and puts the audio operator in full control." Along with the BC-100, Jeff Harrington's corner of the Production Control room includes two turntables, two FM tuners, two reel tape machines, and three RT-27 cartridge tape units.

Master Control

Master Control at CBN is a sizable area (45' x 38') which is fully occupied by an impressive battery of broadcast equipment. There are two fully equipped film islands—a TK-27 for on-air use, and a TK-28 devoted to production.

The Tape area is filled by five TR-70's, a TR-4 and a TCR-100 with Signal Processor Unit. There also are four helical scan VTR's, used for dubbing tapes for the cable TV affiliates.

In the center of the room is the Master Control console, with TS-51 switcher (audio-follow-video); Camera Controls for the four TK-44's, the TK-27, and TK-28; and Multiplexer remote controls. The Remote Controls for the Transmitter are also rack-mounted at the left of the console.

There are usually three men on duty in Master Control—one responsible for Tape, one for Film, and a Master Control operator. The equipment arrangement, Mr. Gregory says, was devised to permit one man to handle the complete air operation.

The TCR-100 now handles the total station break for WYAH-TV. This has been a big help to CBN because of the heavy demands on the reel-to-reel tape machines.

The "Cart" machine has eliminated the expense of making up a spot tape reel each night, which was a three-man operation. All spots are now dubbed to the "Cart", using the TK-28 for film dubbing.

The TK-28 and TCR-100 complement each other, Mr. Gregory claims. The definition, clarity and color balance of the TK-28 enhances the consistent color quality achieved on the "Cart".

"The TK-28 makes beautiful pictures," Mr. Gregory affirms. "It's more like the TK-44 in set-up, operation and in results. And, it gives us much better control of our film situation."

Although the station has been operating with the "Cart" machine for only a few months, Mr. Gregory is convinced that it makes a difference. He says:

"You can talk all you want about the big dollar savings gained from using the TCR-100—and they're there. But, even more important is what it does for station personnel. The tape room is a hectic, tension-filled place to work even under normal situations. When you're committed to a heavy production schedule involving several tape machines—and at the same time have a station break coming up—then it really is a hassle. That is where the TCR-100 carries the load and pays for itself.

Relieving the break-time tension is a really plus, but on top of that, the "cart" provides a consistently better on-air picture. And, of course, the TCR-100 frees our tape machines for production and dubbing."

Control units for TK-44's are in Master Control, with joystick controls remotored to the Production Control room.

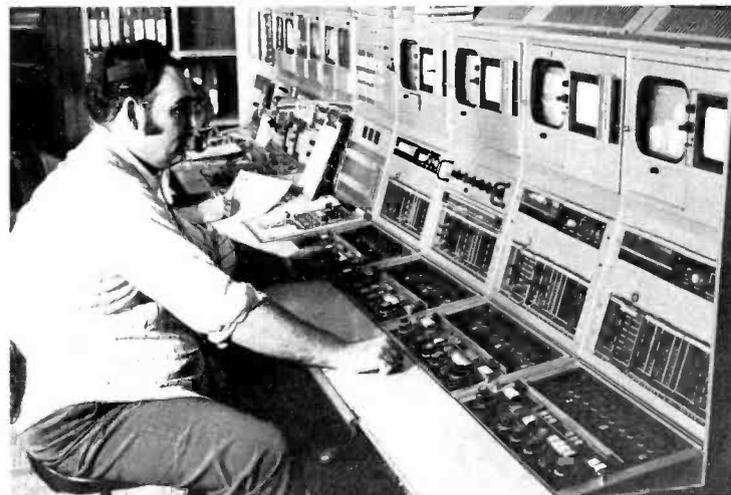
With the re-arrangement of Master Control and the allocation of two TR-70's and the TCR-100 to Ch. 27, the station is in a position to move to semi-automatic operation on Sundays, Mr. Gregory notes. Most of the programming then is on tape, and with the TCR-100 handling PSA's and ID's, switching between the program TR-70 and the "Cart" could be cued for automatic operation.



Compact control console line-up Includes transmitter remote controls; switching and machine controls; and TK-44 CCU's.



Master Control is set up so one man can handle complete on-air operation at Ch. 27 (WYAH-TV).

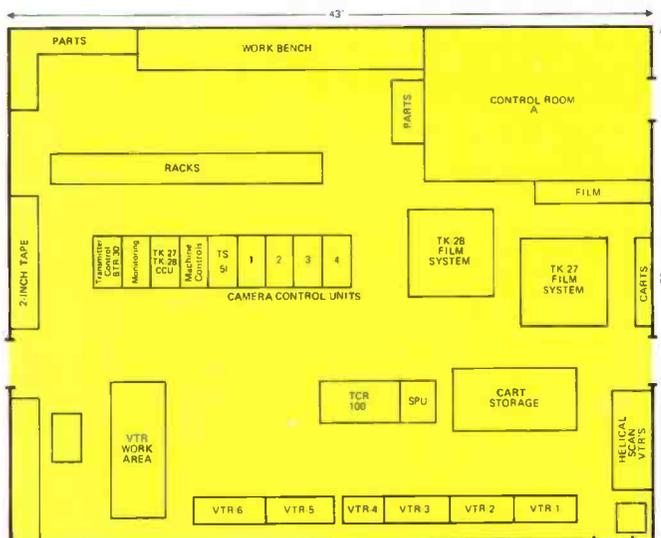
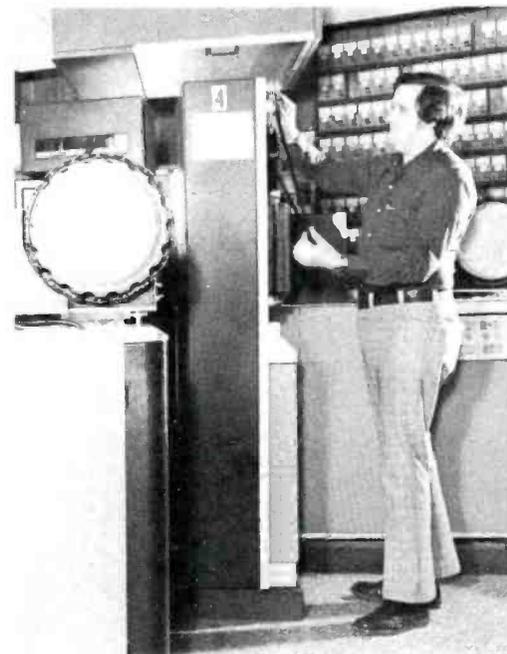


Video tape machines at CBN work around the clock on programming, production and dubbing assignments.



TCR-100 is now handling total station break for WYAH-TV.

Automatic color correction features of the TK-28 film system make it particularly useful for dubbing film spots to "carts" on the TCR-100.



Master Control Room, WYAH-TV.

Growth of CBN

Christian Broadcasting Network started in 1960, when Rev. M. G. "Pat" Robertson agreed to purchase a "dark" UHF station. The "network's" assets at the time amounted to \$3—donated by a well-wisher.

The "buy" included a run-down, vandalized facility, a low-power 1 kW transmitter with 17.1 kW ERP; one monochrome camera, a film island, and a small switcher. In 1962, the "network" expanded with the addition of an FM station, WXR1. It went on air operating from an abandoned garage, with an ancient 3 kW transmitter.

This facility was re-located in the CBN headquarters building in 1964, with a new 10 kW BTF-10 transmitting plant and studio equipment. In 1970, a 20 kW BTF-20E Stereo FM transmitter combined with a circularly polarized BFC antenna was added. In 1965, a radio automation system was added. And, in January 1969, the "Northeast Network" of five FM stations in upstate New York was added to CBN, and upgraded on a regular basis.

In 1963, the struggling broadcasting facility added a full-time engineer—W. T. "Bill" Gregory—who is now Director of Engineering for Christian Broadcasting Network. He moved over from WAVY-TV, Norfolk, where he had been a Transmitter Engineer. That same year—1963—WYAH-TV became a two-camera operation, the TK-31 camera being traded in on two RCA TK-11's. Switching equipment was improved and more equipment added gradually.

1967 was a milestone year for CBN. The headquarters building on Spratley Street was enlarged, and the broadcasting operation was colorized. Color equipment included a tape machine, a film island and two new TK-41 cameras—the last ones available from RCA.

Christian Broadcasting Network was fulfilling its mission and gaining a rapidly enlarging and responsive audience. Consequently, another major change came in 1969, with a \$2.5 million contract with RCA which included a complete studio and transmitter installation for WYAH, plus additional studio equipment for WHAE-TV, the newly acquired station in Atlanta. Transmitters, antennas and other radio equipment for the Northeast Radio Network were also a part of the package.

With the new 60 kW UHF transmitter and antenna, located in Driver, Va., Ch. 27's signal of 2.3 megawatts gave them parity with the "V's" in the area. Today, the "N" in CBN is more than wishful projection. CBN is indeed a Network, comprising four owned television stations, a fifth under negotiation, and six FM radio outlets. Plus nine commercial television station affiliates in some of the nation's largest market areas, and about 20 cable TV systems which broadcast the network's shows on a syndication basis.

Since CBN was built on faith and answered prayers, "Pat" Robertson is not in the least surprised at its success or achievements.

Programming

John Gilman, Network Program Director and Executive Producer of "Bozo", qualifies as a home-grown CBN talent, having handled a variety of jobs during the past seven years, from graphic arts, to tape operator, cameraman, director and producer. He is proud of the programming achievements of CBN and the progress being made by the network. During daytime and pre-prime time, flagship station WYAH-TV features popular family and youth-oriented programming.

According to Mr. Gilman, the station audience has quadrupled in a year and now reaches close to every second home in the market.

Programs aired on Ch. 27, Mr. Gilman stresses, must be wholesome and entertaining. Where possible, counter-programming is used to provide alternates to the available major network offerings. The scheduling format is geared to build maximum audience during the pre-prime time period to obtain a carry-over for the Christian programming which occupies prime time daily.

"The 700 Club", hosted by Rev. Pat Robertson, is broadcast for two hours each evening, and is taped for distribution to affiliates and cable TV systems. The program features popular entertainers, prayers, and guest interviews. A battery of volunteer counsellors in the studio and at other locations answer the phones telethon-style. The program encourages involvement and has a spontaneity that is heightened by the jangling of the telephones and the continuing flow to reports about what is happening with the viewers. A central telephone number is flashed on the screen to enable viewers in various

cities to call "The 700 Club" for free counselling with their problems.

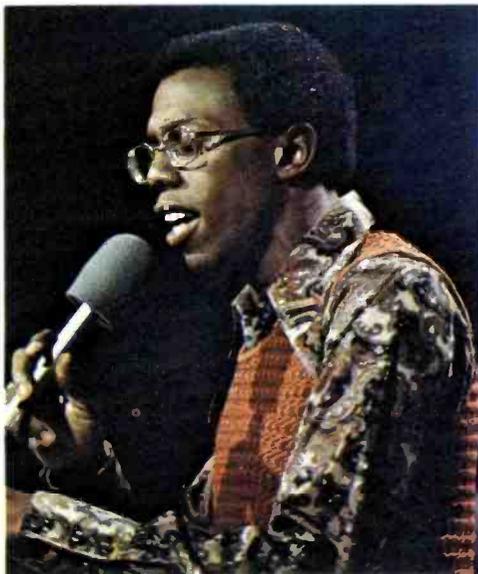
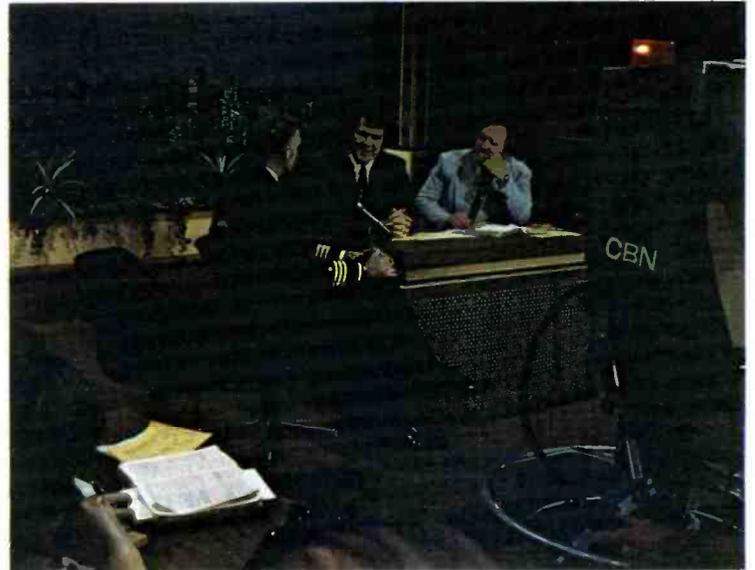
The programs CBN produces have given the term "Christian television" a new meaning. There's "Right On", a lively black gospel program featuring Don DeGrate which is the most popular show of its kind in a number of major cities. "The New Directions", is a half-hour program with vibrant young entertainers in colorful settings bringing "Jesus music" to a wide television audience. "The Deaf Hear" is an audio-visual outreach to the aurally handicapped. "Charisma" is directed to the youth and young adults.

"Charisma" is directed to a general, mature audience. This half-hour show features well-known Christian personalities, businessmen and sports figures. Past programs have included Elvin Hayes, Pat Boone, Gen. Ralph Haines and many others, in an interview setting with Harold Bredesen, one of the nation's best-known charismatic leaders.

WYAH-TV is now on the air from 7 A.M. to 12:30 A.M., with a combination of secular and religious programming, Mr. Gilman notes. The secular shows are supported by commercial sponsors, while the religious programs depend on gifts from viewers. The fifty-five hours of religious programming each week includes two "700 Club" shows daily, each running two hours.

One broadcasting responsibility which is emphasized at CBN is Public Service Announcements. CBN has earned a number of awards for its PSA efforts, and the network has a policy of running at least one PSA every hour on each of its radio and TV outlets. On Sundays, when there is no secular programming, a heavy schedule of PSA's is carried.

While CBN productions are religious-oriented, there is no lack of variety in the programming formats. Depicted here are the ever-popular "Bozo the Clown"; "The 700 Club" hosted by Rev. "Pat" Robertson, and "Right On", featuring gospel singer Don DeGrate.



Fast-Growing Network

The meteoric growth of CBN has come in the past two years, beginning with the FCC requirement that cable television systems show more independent programming. Provided the opportunity, cable systems quickly snapped up the CBN package.

In April 1972, the expanded programming concept was accepted by a commercial UHF station—and suddenly CBN launched into a large-scale syndication operation, sending programs to stations as far apart as Detroit and the Virgin Islands. "Pat" Robertson's ministry quickly enlarged, making him a television minister to millions. The "network" dream of 1960 had become a reality twelve years later. ■

Versatile TCR Automates Satellite Station Break And Serves As A Production VTR

The TCR-100 installed at WDAY-TV, Fargo, N.D., refutes the expression, "You can't be in two places at the same time." This "cart" machine is also working for satellite station WDAZ-TV in Grand Forks, some 80 miles away.

A microwave link permits WDAZ to remote-operate the TCR and other program sources. The Fargo-located sources are accessed from Grand Forks by means of a multi-frequency tone. The operator can select an input from 10 sources, including the TCR-100, TR-70, or TK-27 film system. He also can preview sources remotely, and has "Start-Stop" control.

With the TCR-100, programming and scheduling for the two stations has been greatly simplified, according to Technical Director Sumner Rasmussen.

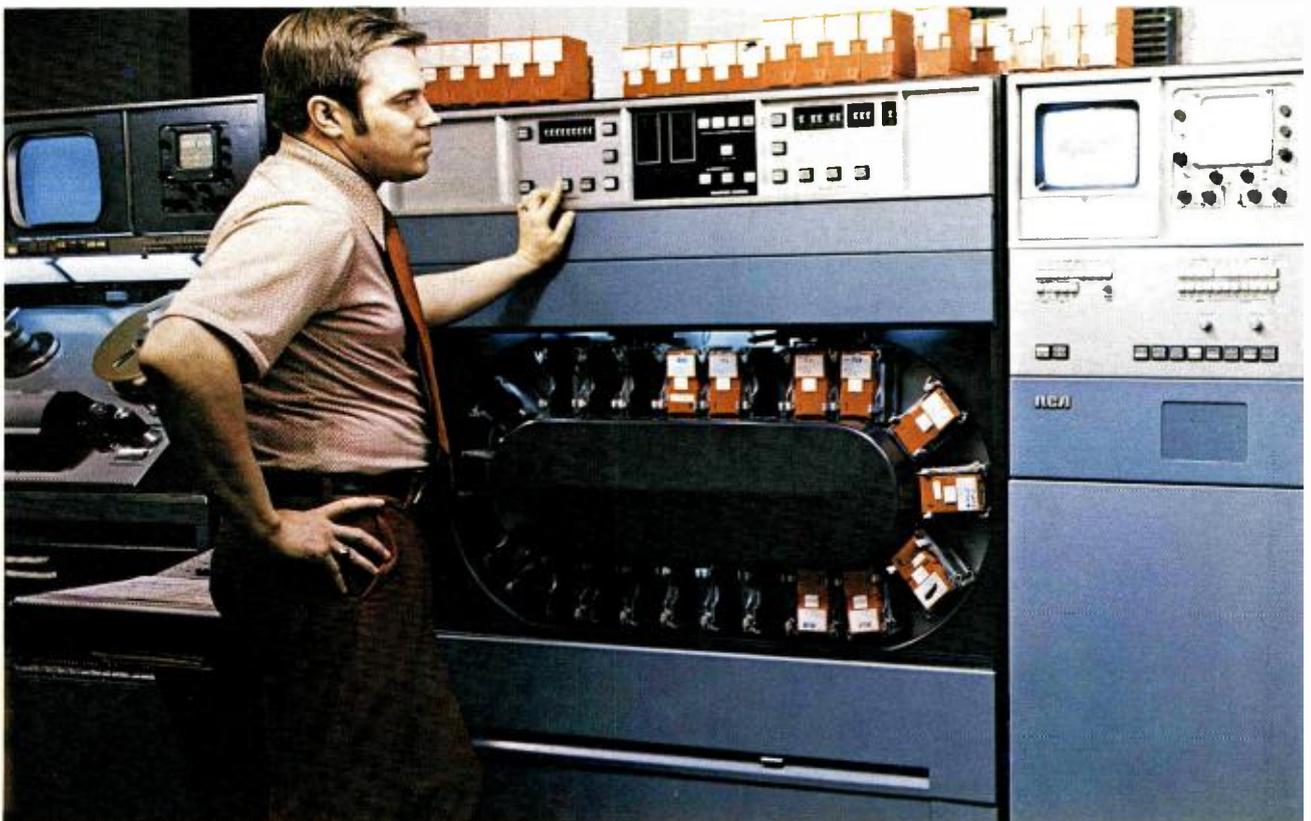
WDAZ in Grand Forks has a studio, but its programming is generally limited to live announcers. All commercial content, including news film, originates in Fargo. Program logs and traffic are initiated and coordinated in Fargo.

The TCR-100, Mr. Rasmussen notes, is a simple way to automate operations. It provides flexibility to accommodate quick changes in programming, saves time, manpower and aggravation. Before the

TCR-100 was installed, coordination of on-air programming for WDAZ involved a video operator at both Grand Forks and at Fargo. Telephone communication was used to select various program and commercial sources which were then activated at Fargo.

This voice communication proved cumbersome and strained WDAY's limited video tape facilities. The addition of the TCR-100 had the effect of adding three tape machines to the station, Mr. Rasmussen says. Its automated functions simplified programming and eliminated the need for a video operator at Fargo for punching

Versatile TCR-100 at WDAY-TV is used for station breaks; for news clips; weather reports—even for production assignments. It is used for handling all station breaks for satellite station WDAZ-TV.



up the program sources. This is now handled directly and automatically from Grand Forks via the microwave link. All station breaks for WDAZ are now being programmed by the TCR-100.

Usually the "cart" is loaded for one break at a time during the day, so the machine can be utilized for making dubs and for production.

For the 6 PM and 10 PM news programs, the TCR-100 is dedicated to WDAZ programming and loaded for the entire block. In addition to commercials, news segments are also recorded on cartridges and played back-to-back on command from WDAZ. A special Grand Forks weather report is recorded on the "cart machine" shortly before air time, and is integrated into the news program. Two "carts" are used for this 5- to 6-minute segment. Also, when news film is required for use by both stations, the selected clips are recorded on "carts" for use in the WDAZ news slot.

All film commercials are dubbed to the "cart" as well as promos and ID's for WDAZ. Six hundred "carts" are maintained by WDAY, and the TCR-100 performs 200-300 plays per day.

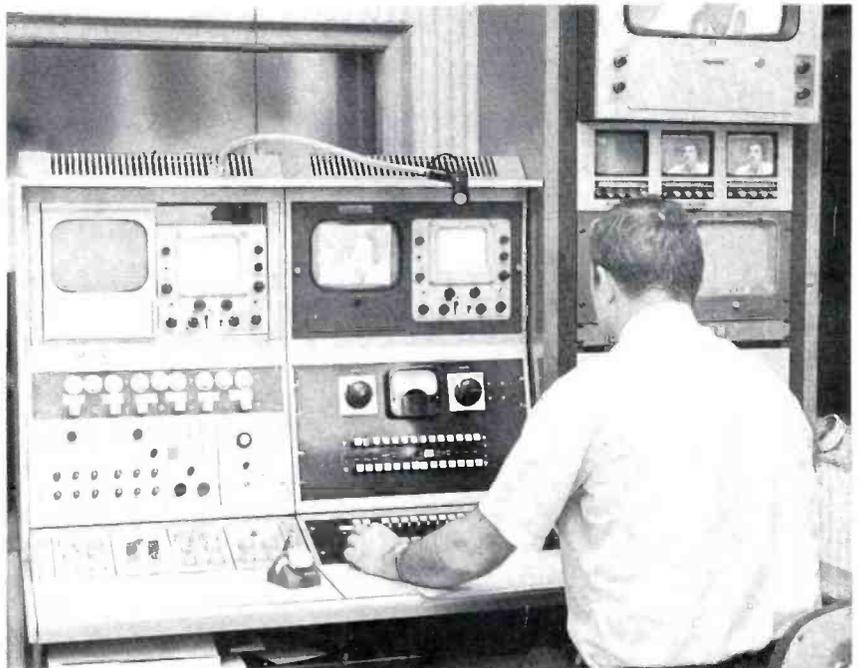
What makes it work at all is scheduling the commercials bought for both stations as the opening sequence of "carts" in the station break. For the rest of the break, WDAZ commercials are handled automatically on the "cart," while WDAY uses their tape and film equipment.

WDAY has developed the TCR-100 into a valuable production resource—a convenient, economical means of extending their production capability. In this application, the "cart" is used as an editor for recording and assembling programs and commercials. The shows are shot like movies—in short takes—and recorded on cartridges. When a recorded sequence is longer than 3 minutes, the EOM cue switches to the next cart automatically. The cartridges are identified, labelled and put aside for assembly later when the "cart machine" and TR-70 are free.

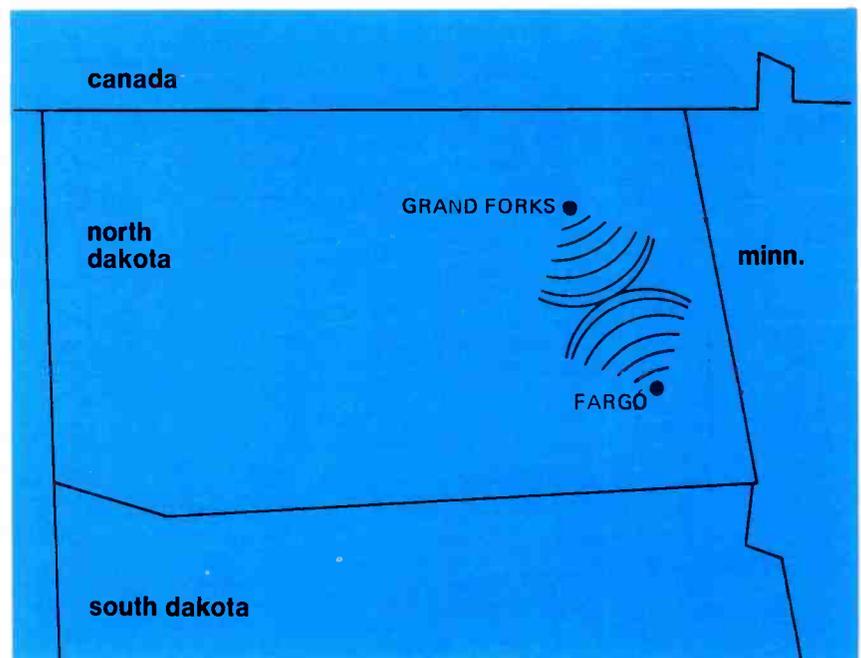
Dick Berdahl, a WDAY director is delighted with the TCR-100 and its versatility.

He reports, "WDAY has only two color studio cameras so the TCR-100 has been used as a third and fourth camera on our daily live hour long variety program called "Party Line" and for video taping of commercials which can be done better with 3 or 4 cameras.

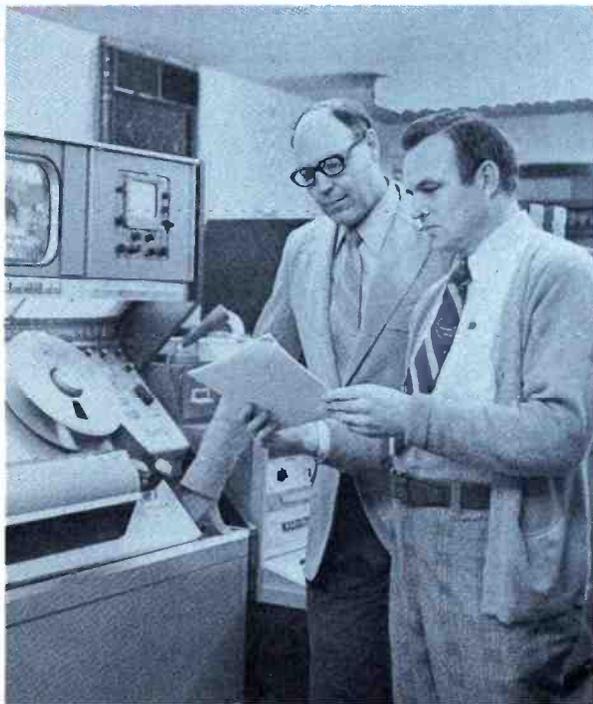
Remote control room for feeding WDAZ-TV, Grand Forks. System permits accessing program sources at WDAY-TV, Fargo via microwave link.



Microwave link connects WDAY-TV, Fargo, with WDAZ-TV, Grand Forks, 80 miles distant. TCR-100 aids in maintaining program and commercial schedule.



WDAY-TV Technical Director Sumner Rasmussen and Production Director Dick Berdahl check log for TR-70.



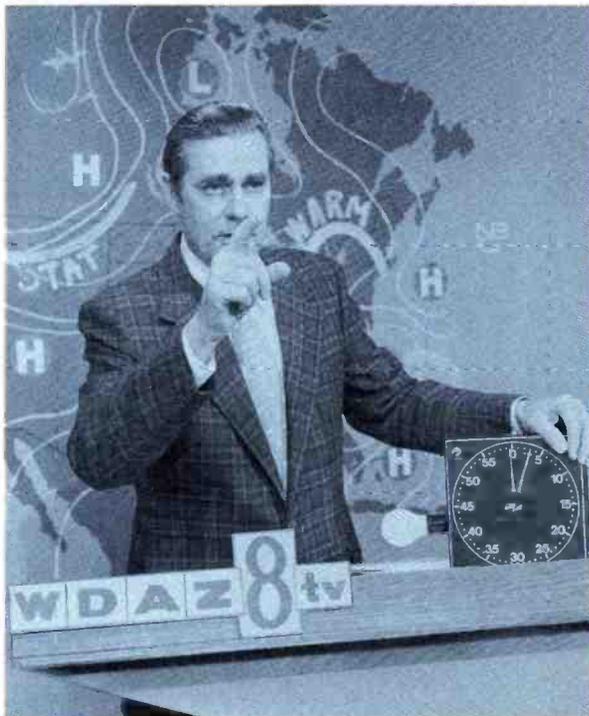
With the TCR-100 handling station breaks, more TR-70 operating time can be dedicated to production assignments.



Main studio set up for product commercial. "Cart" machine is frequently used for inserting pre-recorded material in assembling commercials.



Weatherman at WDAY-TV studio prepares to record weather program for WDAZ-TV, Grand Forks, utilizing two 3-minute carts. Note time clock.





One of the two TK-27 film islands in use at WDAY-TV.

"When used for commercials, we pretape the shots that our two cameras cannot cover, using the TCR-100. Then when we tape the whole commercial on the TR-70, the prepared shots on the TCR-100 are punched up where called for in addition to the shots from our two studio cameras. We find that using the TCR-100 in this manner allows a smaller market station without all of the "goodies" of a large market station, to produce very competitive commercials.

"On our "Party Line" program we may decide to use an action sequence chroma key background with a singer or musical group. In this case, we shoot the action sequence before the program on one or more "carts" so when the musical number is done live, the TCR-100 is rolled and we chroma key the talent into the previously taped action sequence. We would not be able to do production of this type with only two cameras. The TCR-100 makes it possible."

Also, notes Mr. Berdahl, the "cart" machine has helped the station add production income and has effected substantial

savings to clients. For example, in putting together a series of half-hour travel shows for a Canadian client, the "cart" was used to tape the live portions of each show—the introduction, closing and transitions between film clips.

These live segments—five for each half-show program—were taped on the "carts" sequentially. One loading of the TCR-100 handled four weeks of programming

Once the live recordings were made, the client could leave while the individual programs were put together later. In this situation, the carts might be identified as "Jamaica" #1, #2, #3, etc. Each cart would be timed and the EOM cue added for switching to the film projector. In this manner, the programs could be transferred to the TR-70 at any convenient time, with a minimum of effort.

In producing commercials, Mr. Berdahl makes use of the TCR-100 as an editing device. Standard client openings and closings are recorded on "carts." (A local furniture dealer chroma-keyed on a flying carpet, for example.)

Different sets are recorded on carts—such as a dining room, living room or other featured grouping. These televised scenes feature camera action only, with audio added later. The "cart" sequences are assembled into a series of individual commercials, using the stock opening and closing "carts" and with an announcer recording the main commercial content which was shot without sound. These finished commercials are then dubbed from the "cart" to the TR-70. Later they are dubbed back to the "cart" for on-air play.

An interesting technique is used for handling the Grand Forks weather report, which requires two 3-minute carts. A large studio timer clock is set for 2 minutes and 45 seconds. At the end of that time, the EOM cue is added to the "cart," and the second "cart" is used to complete the report. The timer clock is re-set for the second "cart" segment. The transition is made so quickly that it is unnoticeable.

In putting together a weekly half-hour round-up show, Mr. Berdahl uses the "cart" machine for recording random segments during the week when the studio is available. This makes it much easier to load the "takes" on carts in the proper sequence for dubbing to the TR-70 for the finished show.

Station promos are handled in the same fashion—fitted into the studio schedule. By using the cart extensively for short-term storage of material for later assembly, the TR-70 becomes far more productive.

With the addition of a second TCR-100, Mr. Berdahl sees tremendous opportunities for production applications—of using the cart machines for recording many short "takes" as well as for storing "wild" footage for later assembly into commercials and programs.

The TCR-100 has helped WDAY make full use of its production capability, has improved operating efficiency, reduced "make-goods" to practically zero, and has automated the station break for satellite station WDAZ.

No wonder they're looking forward to the second TCR-100. ■

KSD Finds That TV Transmitter Remote Control Isn't Easy But Results Are Worthwhile

"The early bird gets the worm."

So goes the well-worn axiom. To which Ed Risk might add, "Sometimes he gets a whole canful of them!"

Mr. Risk, Director of Engineering for KSD-TV, St. Louis, might be referring to his experiences in installing the very first remote control system to control a TT-30FL VHF transmitter.

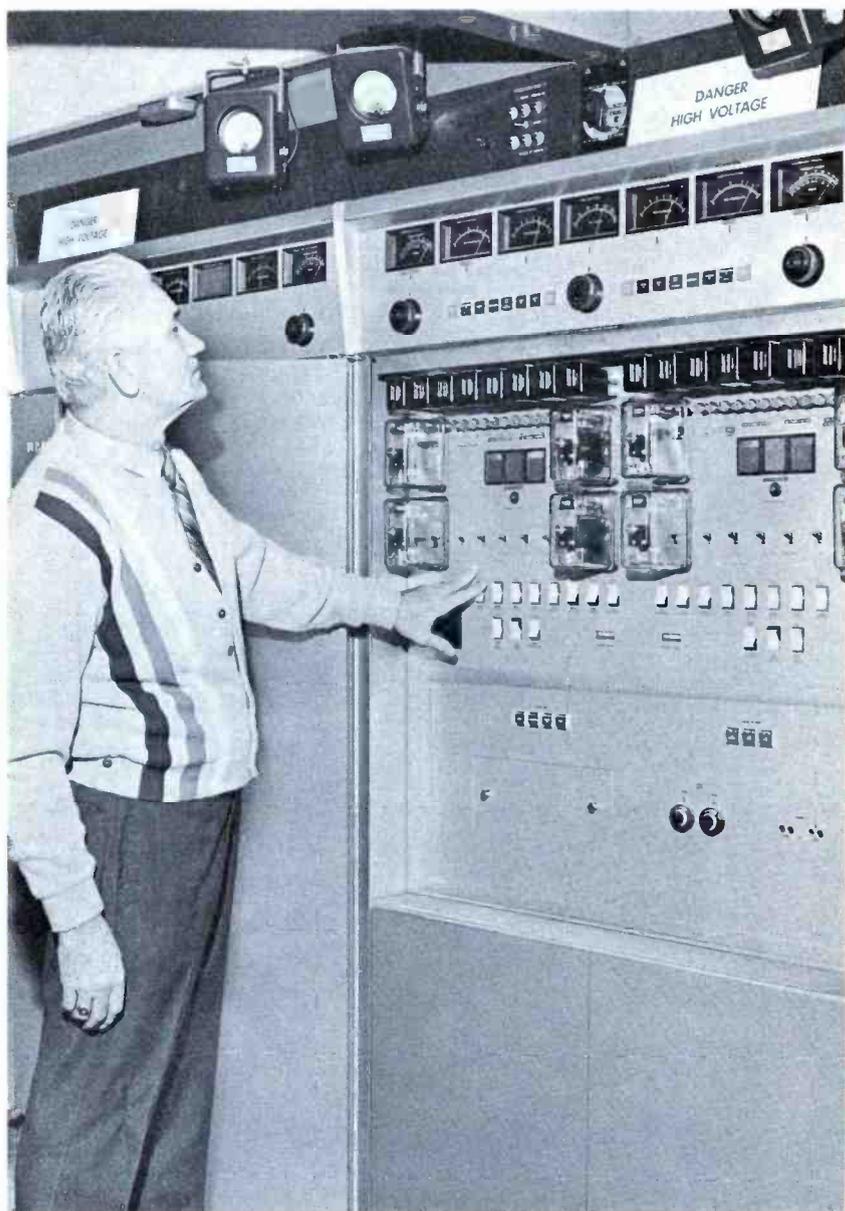
In replacing the TT-25CL transmitter which had served Ch. 5 since 1955, with the TT-30FL Mr. Risk had definite ideas for remoting it. He also had a couple of idea generators and implementors to handle the task of setting up the remote control system from scratch.

Gordon "Rusty" Rustemeyer, Transmitter Supervisor, a KSD man since 1940, and Fred Steurer, a bright, dedicated staff engineering supervisor, provided the blending of talents which resulted in a remarkable remote control system—one so redundant that lost air time is the remotest of possibilities. Monte Walpole, now Engineering Manager for KSD-TV, was active in the studio phase of the remote control and in working out the necessary routines and inspections to make the system a viable operation.

The transmitter went on-air December 22, 1970, and remote operation started July 1, 1972. On this same date, the station shifted to the 4-day work week, one of the early broadcasters to adopt this operational pattern.

"Our transmitter site is manned from 11 P.M. to 8 A.M. daily," Mr. Risk notes, "which permits us to have a man there for shutting down after the station goes off-air, and for starting up in the morning. The successful functioning of the remote control system and the numerous backup controls have permitted a reduction in manpower for transmitter operation. A total staff of three men now handle this function. And the Transmitter Supervisor has more time to supervise the operation of the transmitter and take care of the many administrative details involved in such an operation."

Quoting Mr. Risk again, "Going to remote control was not a difficult decision. We knew that this was the way to go. Deciding the what and how of remote operation were tougher. Then came the



Transmitter Supervisor Gordon "Rusty" Rustemeyer checks operation of TT-30FL, the first of these 30 kW parallel systems to be remote controlled.

R/C STEP #	CONTROL	METERING	METER SCALE	FAILSAFE 1 HR.	ON/RAISE	OFF/LOWER
0	Calibration	Calibration	Center	—		Zero Check
1	Trans. On A/B	A-Visual PA Fil V	0-8 V	—	Trans. A	Trans. B
2		B-Visual PA Fil V	0-8 V	—		
3	Plate V On A/B	A-Visual PA Plate V	0-8 Kv	—	Trans. A	Trans. B
4		B-Visual PA Plate V	0-8 Kv	—		
5	Plate V Off A/B	A-Aural PA Plate V	0-5 Kv	X	Trans. A	Trans. B
6		B-Aural PA Plate V	0-5 Kv	X		
7	Trans. Off A/B	A-Visual PA Plate I	0-5 Amp	—	Trans. A	Trans. B
8		B-Visual PA Plate I	0-5 Amp	—		
9	Overload Reset	A-Aural PA Plate I	0-2 Amp	X	Trans. A	Trans. B
10		B-Aural PA Plate I	0-2 Amp	X		
11	Aural Excitation	Total Aural Power	Percent	X	Raise	Lower
12		A-Aural Power	Percent	—		
13	Audioline Switch	B-Aural Power	Percent	—	Telco PGM #1	Microwave PGM #2
14	Aural PA Screen	Aural Reject Power	Percent	—	Trans. A	Trans. B
15	Tower Lights	Aural VSWR	0-140	—	Manual/On	Automatic
16	Visual Excitation	Total Visual Power	Percent	X	Raise	Lower
17	A Video Gain	Visual Reject Power	Percent	—	Raise	Lower
18	Video Line Switch	A. Visual Power	Percent	—	Micro #1, Proc #1	Micro #2, Proc #2
19	B Video Gain	Visual Reject Power	Percent	—	Raise	Lower
20	News Radio	B. Visual Power	Percent	—	On	Off
21	A/B Video Gain	Total Visual Power	Percent	—	Raise	Lower
22	A Sync Gain	Visual Reject Power	Percent	—	Raise	Lower
23	B Sync Gain	Visual Reject Power	Percent	—	Raise	Lower
24	A/B Sync Gain	Total Visual Power	Percent	—	Raise	Lower
25	Video Bypass	Visual VSWR	0-140	—	Normal	Bypass
26	Mode: A/B PAR/EBS	Total Aural Power	Percent	—	Mode: A/B	E.B.S.
27	Mode: A-Air B-Air	Total Aural Power	Percent	—	A-Air/B-Test	B-Air/A-Test
28	Exciter Switching	Visual Frequency	Freq.	—	Manual	Automatic
29	Exciter A/B	Aural Frequency	Freq.	—	Exciter A	Exciter B
30	Auxiliary Stepper		0-140	—	Step	Reset

Metering and control functions assigned to BTR-30A Remote Control System.

myriad of nitty-gritty details in laying out, checking and hooking up the system. Fortunately for us, "Rusty" Rustemeyer and Fred Steurer got a handle on the job and bulldogged it through."

The resultant remote control system goes far beyond the scope of normal remote operation—into complete redundancy and back-up capability that all but precludes the possibility of going off-air.

First of all, Ed Risk acknowledges, the twin transmitter design of the TT-30FL lends itself especially for remote operation because the system already includes interface terminal connections as well as removable control functions and metering to minimize loss of air time.

Starting with these, and the group of periodic measurements required by the FCC, a "laundry list" of other desired remote control functions was developed. This list was sifted, and to it were added a new set of inputs—other possibilities for back up operation, including security measures.

The KSD remote control system is built around a BTR-30A which provides 30 metering channels and 60 individual control functions. A 20-function ADP-220 Automatic Logging System is also employed. The typewriter print-out and the studio remote control panel are located in Master Control.

The BTR-30A system at KSD provides for a total of 54 metering functions. The first 29 positions on the BTR-30A handle the normal control and metering functions as noted on the accompanying Chart. Position #30 on the unit is a control position which activates a 4-pole, 26-position resettable auxiliary stepper switch.

The first two positions on the auxiliary switch sample incoming audio for each side of the transmitter.

#3 is a building temperature sensor

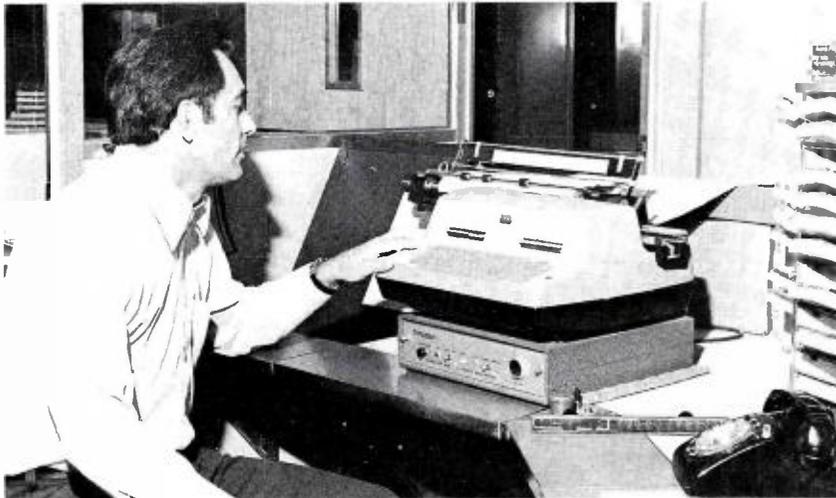
#4 is not presently used.

#5 through #24 permit monitoring each individual lamp on the tower "Christmas tree."

#25 monitors the De-Icer.

#26 is the "home" stepper position and also includes reference voltage for calibrating the system.

Provision is also made for turning on the tower lights remotely from downtown if for



Printout for ADP-220 Automatic Logging System is located in KSD-TV Master Control.

Autolog and Tolerance Assignments for KSD-TV system.

AUTOLOG STEP #	METERING	TOLERANCE ALARM
1	A-Visual PA Plate Voltage	—
2	B-Visual PA Plate Voltage	—
3	A-Aural PA Plate Voltage	Yes
4	B-Aural PA Plate Voltage	Yes
5	A-Visual PA Plate Current	—
6	B-Visual PA Plate Current	—
7	A-Aural PA Plate Current	Yes
8	B-Aural PA Plate Current	Yes
9	Total Aural Power	Yes
10	A-Aural Power	—
11	B-Aural Power	—
12	Aural Reject Power	—
13	Aural VSWR	—
14	Total Visual Power	Yes
15	Visual Reject Power	—
16	A-Visual Power	—
17	B-Visual Power	—
18	Visual VSWR	—
19	Building Entry	Note 1
20	Fire Alarm	Note 1

NOTE 1: Normal if the number prints black, active alarm if the number prints red.

some reason they are not on when needed. A two-way radio system for the KSD newsroom is mounted on the TV antenna tower, and this also can be turned on or off either from the transmitter building or from the studio.

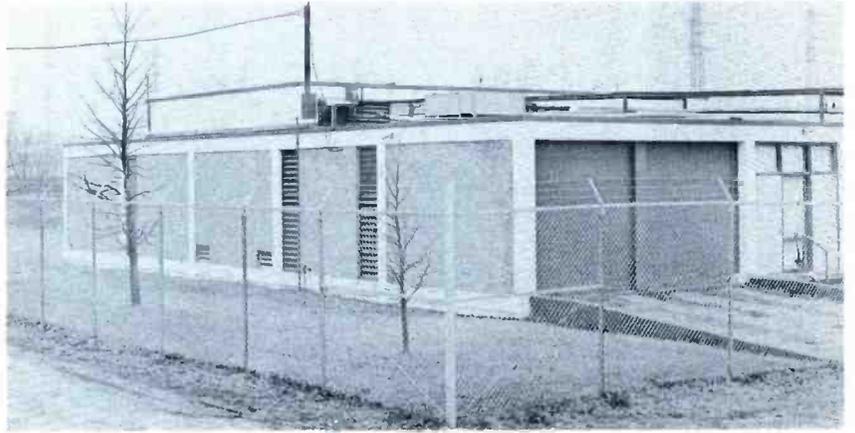
The metering functions recorded by the ADP-220 system are listed in the table. Columns 19 and 20 are noteworthy in that they are a part of the extensive security system incorporated in KSD's remote transmitter operation. Column 20 is connected to an ADT electronic protection system which includes switches on transmitter building doors. Contact switches for the system are supplied by ADT and are also integrated into the typewriter print-out of the Automatic Logging system. In the event of illegal entry into the transmitter building, the logging system typewriter in the studio sounds an alarm and prints numbers *in red* in Column 20 of the printout, notifying the studio of this condition. Normally, this column is blank.

Column #19 operates in a similar fashion, and is a fire warning.

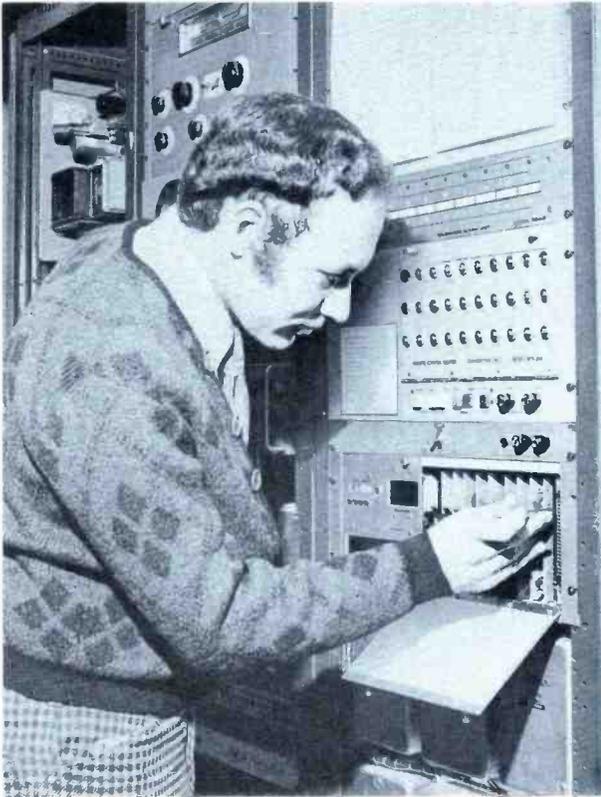
(As a sidelight; to avoid having someone type or print the individual column headings for the Automatic Logger each day, one of the KSD engineers got the bright idea of making up a rubber stamp. The stamp is so long that it requires two handles and an oversized stamp pad—but it's fast and neat.)

Security Measures

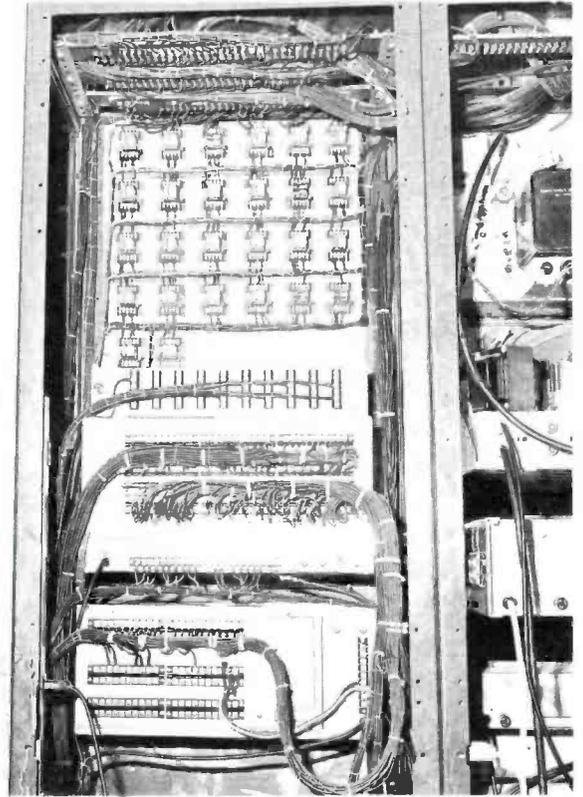
Since the transmitter building would be unmanned most of the time, particular attention was given to adequate security. The building itself is enclosed by an 8-foot high heavy-duty steel mesh fence. All but two windows were bricked up, and these are protected by a sturdy stainless steel screen. As noted previously, the property is protected by an ADT electronic security system. Protection for the microwave dish is also unusual. KSD uses microwave for the STL, with a reflector on the tower directing the signal to the microwave dish which is located inside the roof of the transmitter building. This microwave "bubble" is protected by a plastic cover as well as an 8-inch mesh steel grid. Tests made before installation proved that signal deterioration was minimal for the 8-mile microwave STL hop.



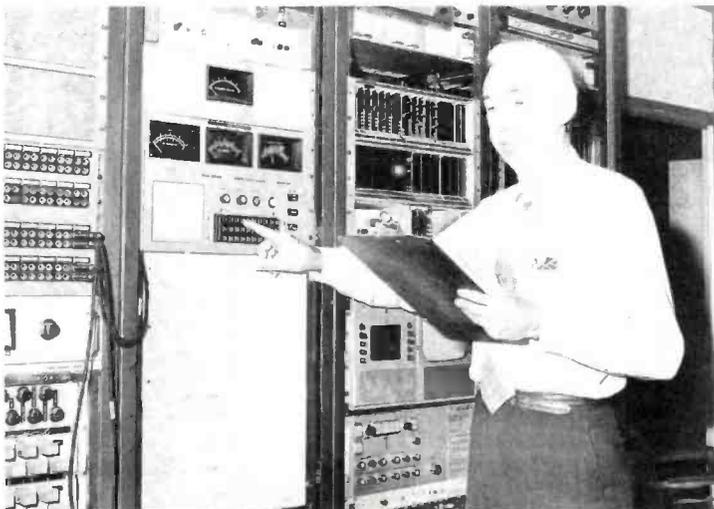
KSD-TV Transmitter Building.



Fred Steurer, KSD-TV staff engineering supervisor at the front of the Remote Control System rack in the transmitter building.



Rear of Remote Control System rack showing bundles of wiring and interconnections required for system operation.



Studio Remote Control System rack in Master Control.

Microwave STL

The microwave STL serves as the prime video carrier, with an audio subchannel. Audio is normally carried via phone line, but in the event of a failure, the back-up microwave subchannel can be switched to handle the audio.

The microwave system includes two receivers at the transmitter location, each with its own processing amplifier and a relay. The signal from either receiver can be selected remotely from the studio for best signal. In case of the failure of one receiver, the second is automatically switched on. In addition, the two microwave receivers are separately powered from two different lines. As a further backup, microwave transmitters may be switched from the studio or transmitter locations.

If the phone line carrying the remote control data fails, the system can be patched into the transmitter room telephone line for emergency operation.

Power System Protection

The KSD transmitter building receives 1000 Amps of power, which is then split into two separate circuits—one 400 Amps and the other 600 Amps. Failure of one circuit will not shut system down. For further protection against power outage, provision is made for bypassing the voltage regulators should they malfunction. In this case transmitters and lighting would be operated directly from the incoming power circuit.

A backup diesel generator in the rear of the transmitter building kicks on automatically when power fails and provides 125 KVA of power—ample to operate the transmitter, tower lights and other building requirements.

Studio Backup Transmitter

Prudent KSD re-located the old TT-25CL transmitter in the downtown studios, where it is hooked up to the standby antenna mounted on the original TV tower, ready for emergency service in the unlikely event that it should be needed. With the TT-30FL as reliable as it is, the primary purpose is insurance against a major mishap such as fire or wind damage to the main transmitting plant. This grounded tower is also used as a shunt-fed radiator for a KSD radio standby transmitter.



(Inset) Microwave dish for KSD-TV STL is mounted *inside* the transmitter building, protected by a heavy duty plastic covering and 8-inch steel mesh.

Transmitter site for KSD-TV is encircled by the greens of a Par 3 golf course.



TT-30FL Does Its Part

This report covers KSD-TV's remote control operation, and barely touches on the TT-30FL transmitter that makes the system play. Now in service more than three years, the transmitter has performed reliably, delivering excellent color pictures while requiring minimum attention.

"Rusty" Rustemeyer readily acknowledges that "The TT-30FL is very stable and has given us trouble-free service." To which Fred Steurer adds, "What's nice about the TT-30FL, aside from its superb performance, is that it adapted so well to remote control. Now the whole transmitting system can be monitored and controlled from the studio."

With the proven dependability of the overall remote control system and the total backup capabilities, it is no longer necessary for KSD-TV to man the transmitter site on a full-time basis. This, of course, permits more effective utilization of technical personnel, and enhances operating efficiency.

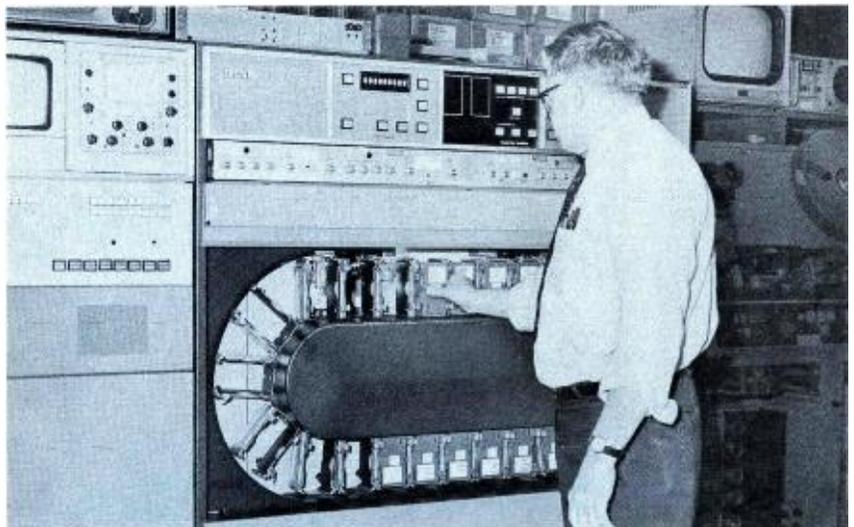
For early-bird KSD-TV, remote control was not easy, but results have definitely been worthwhile. ■

The TT-30FL kW parallel lowband VHF transmitter has been a resounding success, and more than 60 of these systems are now in operation throughout the world. Introduced in 1969, it was endowed with state of art performance characteristics, and was particularly suited for future remote control applications. It provided new standards of stability, vastly improved picture quality, easier tuning, solid state circuitry and control logic, along with numerous other design features. RCA's "F" line of VHF transmitters now includes both highband and lowband systems:

Lowband—TT-15FL 15kW
TT-25FL 25kW
TT-30FL 30kW

Highband—TT-17FH 17kW
TT-25FH 25kW
TT-35FH 35kW
TT-50FH 50kW

Studio equipment complement at KSD-TV includes this TCR-100. Coming soon are a TK-28 color film system and three TK-45A color cameras.





It's Smooth Sailing For England's Westward TV

Advanced Color Capability and Quality Local Programming Chart A Successful Course For This British Independent's Operation.

Westward TV, member company of the Independent Broadcasting Authority, provides the programming for southwest England. With studios located in the Devonshire port city of Plymouth, it has a primary coverage area bounded by the rugged coastline and an imaginary arc through Bath in the north and Weymouth to the east.

Supplying color transmissions for this peninsular-like area, Westward appropriately adopted the pictured galleon as its symbol. It's the Golden Hind, on which Sir Francis Drake embarked from Plymouth

in 1577 for his famous voyage around the world.

With the TV service area practically surrounded by the sea, the logotype is certainly fitting. But anyone visiting the studios might be encouraged to draw a more meaningful interpretation, such as being guided by a pioneering spirit or running a tight ship.

It could be either because the people at Westward seem to have a special attitude generating a combination of pride, enthusiasm and zeal in everything they do. Everything necessary to insure that the Westward galleon sails smoothly onto the TV screens in nearly half a million homes.

What the viewers see is a range and quality of service usually found in bigger companies, and made possible by newly equipped color studios and an outside broadcast van among the most modern anywhere.

Programming

Much of the material on the homeviewers' screens originates in the Plymouth studios. The backbone of the programming is the highly popular weekday nightly "Westward Diary". It has a news and magazine format and is aired live with occasional interviews from London.

Another key program is "Westward Report" which is transmitted each Thursday evening for nine months of the year. More than 100 correspondents contribute to its comprehensive news coverage. And eight news cameramen scour the region for items of general interest.

Each Monday and Friday, there's "Sports Desk" which aims to keep viewers abreast of sports activities in the region.

For these shows, the outside broadcast van is invaluable in obtaining insert material.

The program schedule also includes dramatic productions, children's shows, late-night interviews, pop-music presentations and remotes.

However, the company has established its principal reputation in the field of documentary production and has won more awards for such programs than probably any other TV station of its size in the world.

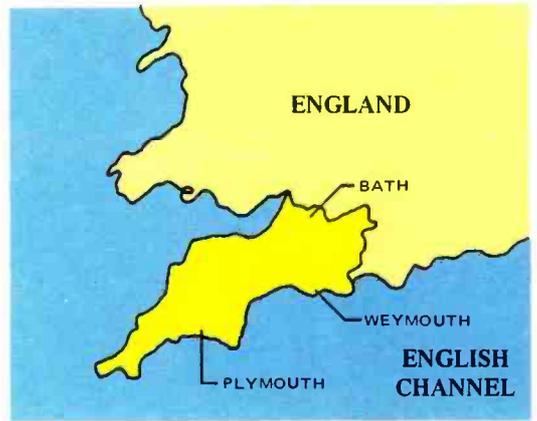
More High Capability

Westward is also known for the quality of the color signal used to transmit these first-rate productions. Management and engineering alike want to make sure that West Country viewers receive the best possible pictures.

Besides their own stringent technical standards, Westward must meet those imposed by the IBA's Code of Practice dealing with the performance of the source equipment and the studio complex as a whole, as well as operational practices.

Engineering for color was another challenge this IBA independent faced and successfully launched a little over a year ago through a major re-equipping and conversion project.

Imaginative planning and novel conceptions were employed to implement a new-purpose television center. For example, one feature is the use of single-pulse distribution, quite significant for a relatively small TV station. Believed to be the first of its size in Britain to use the uni-pulse system, Westward thought it was a gamble. But it proved successful as it was easier to change over from one sync source to another.



Locally produced programs, such as news and special-interest shows as well as dramas like *The Old Days* (pictured here), account for about seven hours of programming each week.



In outfitting the studios, high-performance equipment was deemed essential to handling the heavy production workload, and providing almost continuous seven-day operation. All the technical equipment, much of which was supplied by RCA, is fully color capable and equal to the task.

Technical Facilities

The main camera studio, covering 2500 square feet, is equipped with four TK-44B PAL color cameras. According to David Dickinson, Technical Controller, "Westward chose these cameras because they not only deliver the picture quality we insist on giving our nearly two million viewers, but also that which the IBA technical code requires.

"The direct technical control of what's produced in our studio complex is incumbent upon us. But the IBA, which has overall responsibility for maintenance of high technical standards for color transmissions, does supervise the output of its program companies. A technical quality control section is increasingly concerned with the assessment of the technical performance

Documentary programs, on which Westward has probably established its principal reputation, cover many topics. Some are shown on the IBA national network.



Bring Your Banners . . . the story of the 1973 Tolpuddle Rally commemorating the birth of Trade Unionism.



A picture show on brass rubbing. Here Gordon Honeycombe examines a brass at Callington Church.

of the whole chain of transmission. So the originating equipments' operating characteristics are vital in helping us meet the technical quality rating, and allowing the integration of our color pictures into those from the studios of other IBA member companies."

Outside considerations apart, the TK-44's also directly benefit the station's production people. For example, the cameras' low-light capabilities give the producer wider operating latitude. In the studio, this feature permits creative lighting effects, or reduced light level requirements for comfortable working conditions and reduced operating costs.

All of the cameras' remotable electronic equipment is housed in a separate control apparatus room. This has provided more spacious conditions for the operational personnel in the Studio Control Room.

In the spacious telecine room, there is a new TK-28 film island, one of the first now operating in Europe. It is a three-in, one-out arrangement consisting of a lead-oxide automatic color camera, two TP-66 16mm

film projectors and a TP-7 35mm slide projector.

The telecine operation is extensive. On a yearly basis, the film department—which develops, processes and edits two-thirds of a million feet of 16mm film—also handles around 250 feature films and 35,000 commercials on 35mm film.

With miles of celluloid to contend with, providing good quality of the color output is quite a task. However, Peter Rodgers, Technical Area Supervisor, comments: "With the TK-28's ability to actually improve the quality of color film reproduction, it performs a real service when it comes to showing films obtained from different sources. Such material can be of varying quality—variations in film density and contrast range, low color saturation or film base errors are encountered. With the TK-28, all we do is predetermine the most frequently occurring problems and set up their solutions on the control panel. The TK-28 does the rest while on the air. It's usually used for our 16mm full-film programs including news and documentary material."



A study on the life and work of Dame Barbara Hepworth, renowned carver and sculptor.



The Silent Valley . . . look Westward's production staff 150 ft. below ground in the Wheal Josiah mine.



Westward TV's series on folk music included Sing Inn featuring the Yetties.

The Westward TV outside broadcast van, recently refurbished with an RCA TR-60 video tape recorder and ancillary gear, shares one of the TK-44 studio cameras. It was recently used to cover the Devon County (Farm) Show in Exeter. Another application of the mobile unit is production of on-site commercials for local businesses such as hotels and department stores.

"With the OB van," states Dickinson, "the local advertiser receives good value for his money. We can shoot and edit a color commercial on location, ready for broadcast." Even though most advertising revenue comes from national advertisers, Westward is especially interested in assisting local business this way. It gives the station's output a local flavor and, at the same time, helps justify the cost of operating the van.

Future plans include use of it to provide complete programs such as sporting events and news reports on tape instead of film.

On Course with the Cart

The tape room contains two TR-70C's which are the real workhorses for all of the station's program and production commitments. They are used to record live color programs from the national network and re-broadcast them at times more convenient to average viewers.

These VTR's are also employed for multiple spotting of taped commercials. However, Westward plans to bring a TCR-100 tape cartridge machine into the station's operations.

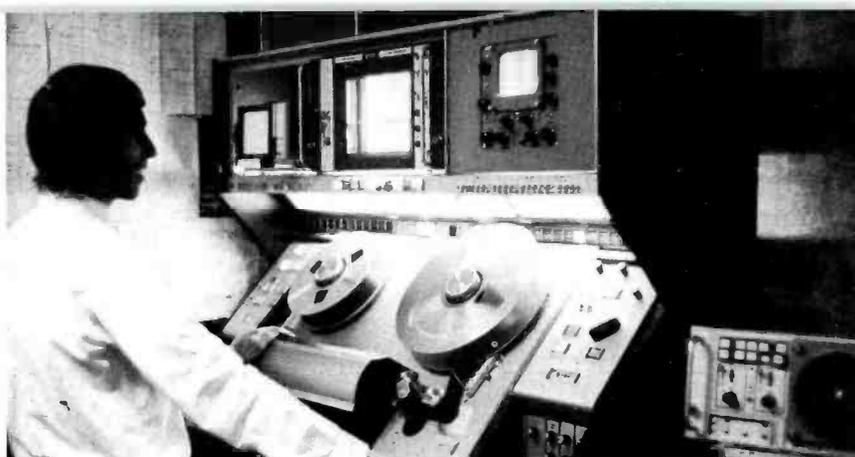
Commercial business is growing rapidly, and the existing tape machines' programming and production schedules are hard pressed to take care of the accelerating tape traffic.

Mr. Dickinson said that a TCR will make life easier for personnel in almost every department of the station: programming, production, engineering and traffic.

"Right now, with just the two reel-to-reel recorders handling our programming and production work, there isn't enough time during the day to dub reel spots. Fortunately, the TCR will free up these reel-to-reel machines, and relieve pressure on the film islands too.

"Our major advertising segment of the day is from noon to midnight. Without the TCR, we're restricted to only two commercials per break, while tying up both VTR's and limiting the business our salesmen can go after. Before going out, they have to first check the VTR schedule. And our production people can't make any last-minute program changes. It's even difficult to insert our own promotional material."

But Westward isn't worried, because a TCR can streamline this part of the operation and put things back on an even keel. ■



Production people rely heavily on the high performance characteristics of TR-70's to record and play back both network and studio produced programs.



Inside Westward's remote unit, an engineer pulls a routine test on the newly added TR-60A VTR. The van is used to cover community events and produce on-site commercials for local businesses.



Typical of the station's use of its OB van is TV coverage of the Royal Cornwall Show, an agricultural exhibition featuring farming equipment, animal judging and ring displays.

“Handiest Machine We Ever Bought” TCR-100 at WFMY-TV



WFMY-TV Technician Jack Merritt gets station's TCR-100 ready for the day's action.

When WFMY-TV, Greensboro, N. C. took delivery of its TCR-100 in June 1972, the station had a well-developed plan for utilization of the "Cart" machine, and high expectations for results. The results speak for themselves: in 1972 WFMY experienced the biggest year in its 25-year history. Helped by the fall political campaign, sales volume accelerated. And, according to Doyle Thompson, Chief Engineer, "We couldn't have done it without the Cart".

The TCR-100 moved in effortlessly and was an instant favorite. Mr. Thompson states that in his more than 20-years in broadcasting, it was the first piece of new equipment which was unanimously accepted as soon as it was installed. "The entire WFMY-TV engineering staff fell in love with the Cart immediately," he said.

The Cart is used on-air for commercials, promos, PSA's, station ID's and opening

and closing billboards. It is averaging about 125 plays per day—and has brought about some significant changes in studio operation.

For example, The TCR-100 now permits the station to handle production work with their four RCA reel-type tape machines. Before the arrival of the Cart, all four tape machines were working to capacity. Production ceased during some tape

syndicated shows when all the VTR's had to be used for handling station breaks.

There were night production sessions involving two men and four tape machines, making up spot reels. Now, it's a one-man, one-machine normal operation. With the Cart, the pace has slackened noticeably, according to Mr. Thompson. The VTR's aren't all running full time and the tape room operators can breathe easier, thanks to "huff-and-puff"—their affectionate nickname for the TCR-100.

In the first nineteen months of operation, the WFMY-TV Cart has gone through more than 57,000 threading cycles, and the original heads are still on the machine. Mr. Thompson notes that since there is only one pass per playback, the video cartridge saves considerably on headwheel wear and tape wear. On a reel-to-reel machine, the tape makes two or three passes over the headwheels for each play, considering set-up, checking video and color bars, and manual cueing. With the Cart, checking and manual cueing are eliminated, making the passes just about equal to the number of plays. This adds up to two or three times more headwheel life.

Extended headwheel wear is not a new phenomenon to Mr. Thompson, since WFMY-TV was one of the earliest members of the RCA 1000 Hour Club. Heads used for recording, he says, are averaging 1200 hours and still have protrusion that would make them satisfactory for further playback use.

A part of this headwheel economy must be attributed to the environmental controls instituted by Mr. Thompson at WFMY-TV. Meticulous humidity and temperature standards are maintained in the machine room, and the tapes themselves are stored in a carefully conditioned area.

The TCR-100 also increases tape life, according to Mr. Thompson. "Since the tape is enclosed in the cartridge and is only exposed while inside the machine, scratched tape has become almost a thing of the past," he reports. "And we don't know how long a cartridge will last—we haven't worn one out yet."

Some of the "Cart" tapes at WFMY have passed through the heads as many as 200 or more times.

Mr. Thompson appreciates the flexibility of the TCR-100. Since Carts can be changed in a couple of seconds, last minute



Chief Engineer Doyle Thompson checks Signal Processing Unit on "cart" machine.

schedule changes are easily accommodated. "We don't have to search through tape reels to find a specific commercial. We just pull the desired Cart from our library and slip it into the machine," he relates. The station maintains a library of over 1,000 cartridges, which are reviewed periodically to keep the file current.

The WFMY Production Department has felt the impact of the TCR-100 on its operation. Jack Forehand, Production Supervisor likes the change. "We used to have to stop production between 9:00 and 10:30 a.m. every day. Our taped shows had eight

one-minute cut-ins an hour. Each break preempted all of our video tape machines, leaving none for production. Now that the Cart handles all the spots in the breaks, we have one-and-a-half hours taping time opened up on the reel machines every day."

"With four video tape machines available for production," Mr. Forehand notes, "we can make our two color cameras act like four. We can run two recorded segments on VTRs, and two cameras on line. It sure gives us a lot of flexibility we never had before."



Addition of TCR-100 permits WFMY-TV to use TR-70 and other tape machines for production.

Engineering and production are not the only departments experiencing changes brought about by the TCR-100. "The Cart has enabled us to clean up the clutter on the log," says Jack Hilliard, a director at WFMY-TV. "A lot of our commercials, both film and tape, involve a slide tag on one or both ends of the spot, which used to create a lot of work for the director and excess entries on the log. Now with the Cart, we dub the entire commercial onto a cartridge. For example, we dubbed 16 special spots involving tags for use at Christmas time. Each ran approximately five times a day. We produced the spots during a slow period, and from then on they were ready to go at the touch of a button."

The TCR-100 also simplifies news program production. During news broadcasts, WFMY-TV used three of its four reel VTRs for commercials and announcements, leaving only one for news programming. News material had to be dubbed onto one tape, in a set sequence, involving waste in time and manpower. With the cart now handling commercials and other spots, all four reel-to-reel machines are free for news broadcasts.

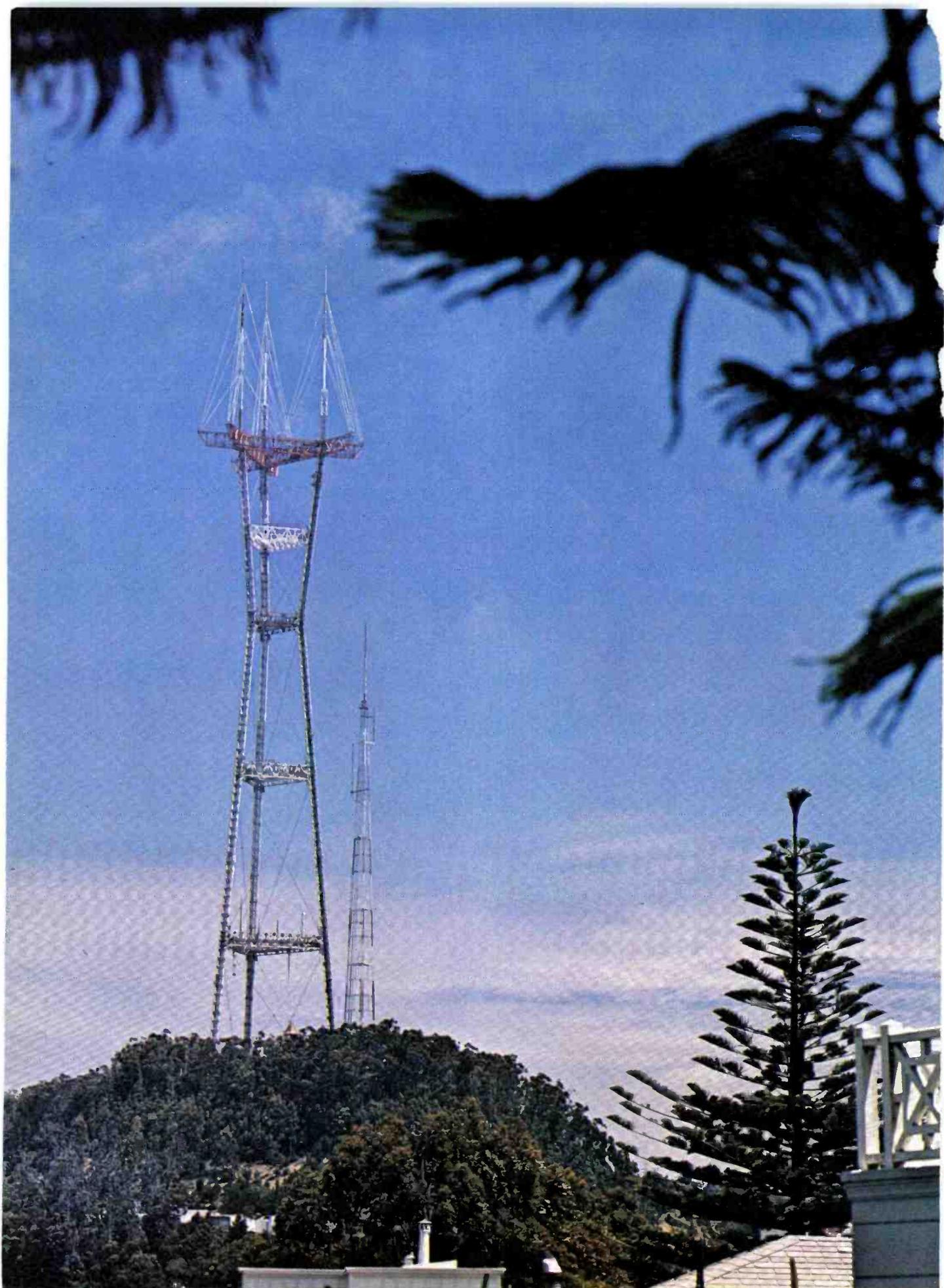
The people at WFMY-TV are very particular about picture quality. And here again, the TCR-100 makes its contribution. Says

Doyle Thompson, "That's the biggest thing about the Cart. Once the machine is set up, there is no variance in picture or color quality from tape to tape. In fact, you can't tell when a switch is made. Consistent picture quality and reduced on-air flubs gives the station an excellent image."

WFMY-TV's TCR-100 is remoted to the master control room, an added operating convenience. The Cart machine's fast reaction time is particularly helpful for error recovery. For example, if a spot is rolled at the wrong instant, it can be recued and ready to go again in a couple of seconds, saving the spot and eliminating make-goods.

Doyle Thompson has no reservations about the economy of the TCR-100. For WFMY-TV, it has effected generous savings in manpower, in tape costs, in headwheel wear. Important as these tangible, monetary advantages of the Cart machine are, Mr. Thompson prefers to cite other benefits: Simplicity of operation. Consistent picture and color quality. Day-in, day-out reliability. Flexibility for last-minute changes. And, of course, the freeing of reel equipment for production.

It's the handiest machine we ever bought," he concludes. ■



A Closer Look At The Sutro Tower Antenna Systems

H. H. Westcott
Antenna Product Management

Broadcast News, Vol. 151, featured an overview of Sutro Tower, the latest and largest of RCA's multiple TV/FM antenna arrays. Covered were the history of the project, a broad outline of the facilities involved, and highlights of the installation.

Response to the article has demonstrated the interest of broadcasters in this unique project. The following article covers some of the more salient technical aspects of the Mt. Sutro antenna system. For topical convenience these will be grouped into three categories: (1) feasibility investigation; (2) multiple antenna design criteria; and (3) unusual features of Sutro Tower antennas.

Feasibility Study

In 1966, with the decision to proceed with the project at the Mt. Sutro site, RCA was asked to propose and subsequently to implement a study aimed at determining an arrangement of antennas on a single tower which would (a) accommodate facilities for all TV stations serving the San Francisco area; (b) provide, to the maximum extent possible, operating characteristics desired by each of them; and (c) insure against adverse effects due to their arrangement and proximity.

To accomplish these objectives, the Sutro Antenna Engineering Committee was formed, consisting of representatives of each of the stations, with their consultants, technically coordinated by Dr. Frank Kear of Kear and Kennedy. RCA was given advisory membership on this Committee. Throughout the next three years, this Committee met frequently to resolve technical questions arising during the study and to act in concert with two corresponding task forces, concerned respectively with the tower and the transmitter building.

The study, which was extended in several directions to investigate special developments, covered a period of 18 months and consisted primarily of two phases.

The first phase was mathematical, using computer techniques to evaluate electrical interactions and the effects the antennas would have on each other in various configurations. The second phase involved the construction and test of operating models of the antennas and tower platform precisely scaled to one-tenth the wavelengths used by the prototypes. (See Figures 1, 2 and 3). These models were used to validate the calculations and to determine other characteristics that would not be made apparent by the mathematical tests.

A number of antenna configurations were explored. At first, the concept was to place seven of the ten antennas on the same level and to mount the remaining four on a second level above them. This would have required an eight-sided tower for dynamic balance. A scale model of such a tower was actually constructed and used during the model tests, with the antennas mounted on it (Fig. 4). As the study developed, it became evident that it would be desirable to have fewer antennas on the same level, and the arrangement was reduced successively to six, five, and four stacks instead of seven. Tests showed definite improvement and this led to the use of only three stacks, with further advantages mechanically and dynamically as well as electrically. Extensive tests on the three-stack approach proved highly satisfactory for all antennas and this arrangement became the basis for the final system design.

Multiple Antenna Design Criteria

Of the characteristics and effects evaluated in the study for Mt. Sutro, and requiring

consideration for any array of TV antennas in proximity, the most important were: (1) the visible echo produced by the delayed arrival of a secondary signal reflected from interfering antennas or structures; (2) the effect of these reflections on horizontal pattern circularity; (3) the effects of the reflections on video characteristics—a function of pattern alteration as the frequency changes across the channel; (4) mutual coupling between antennas; and (5) the effect of the tower structure, if any, on vertical patterns.

Echo

As the name implies, an echo is the appearance of a second picture displaced from the primary picture. In the case of antenna arrays it occurs as a result of the delayed arrival at the receiver of a reflection from another antenna of the primary signal. Viewer awareness increases with the amount of displacement of the two images and the magnitude of the echo.

The amount of signal reflected from a given type of antenna is dependent upon its size and distance away and the degree to which its physical and electrical characteristics cause it to re-radiate.

Experience indicates that a 100-foot separation between antennas is a maximum workable distance. It is short enough that a rather large reflection cannot be distinguished from the primary image and yet far enough that mutual coupling effects are reduced to a small value. By judicious choice of the types and number of antennas facing each other on the same level, the amount of energy picked up from the incident signal and re-reflected can be minimized. The problem then resolves itself to determining a combination which will provide an echo level that is unobjectionable.

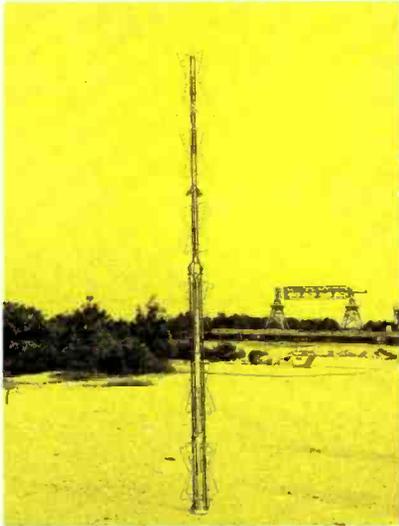


Fig. 1. Assembled operating model of diplexed Superturnstile for KRON-TV/KPIX-TV (Chs. 4 and 5).

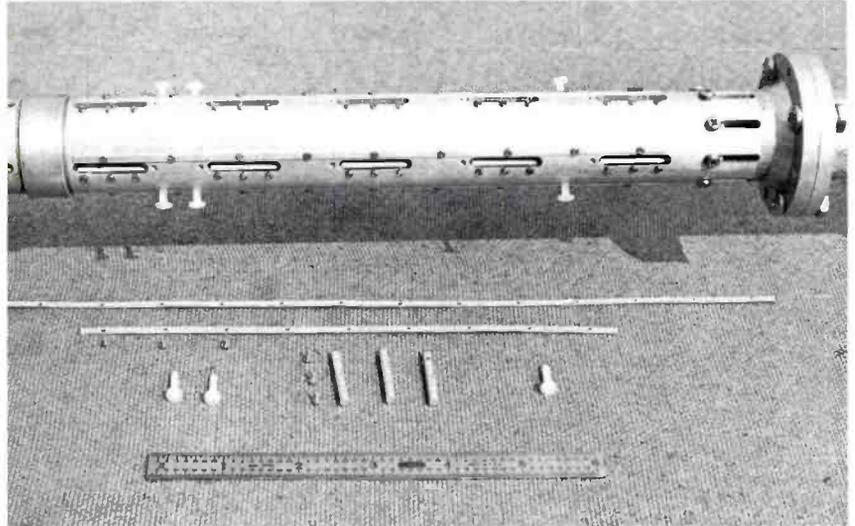


Fig. 2. Section of model of Pylon antenna for KBHK-TV (Ch. 44).

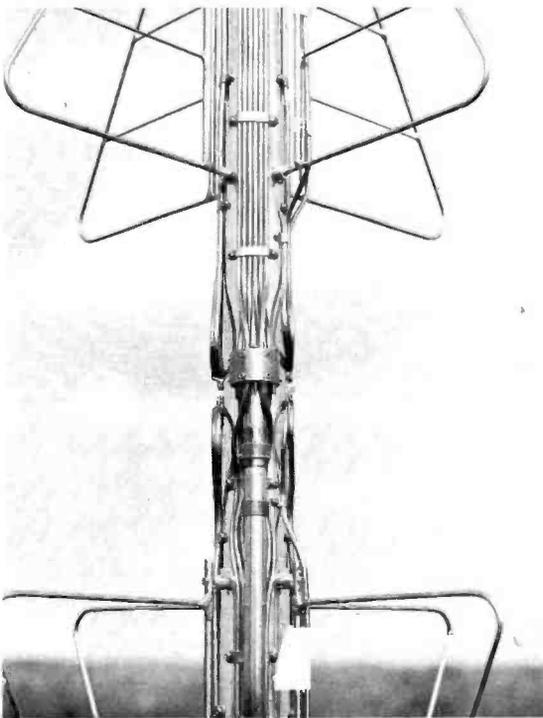


Fig. 3. Detail of Superturnstile model junction box with 1/8" diameter coaxial feedlines.

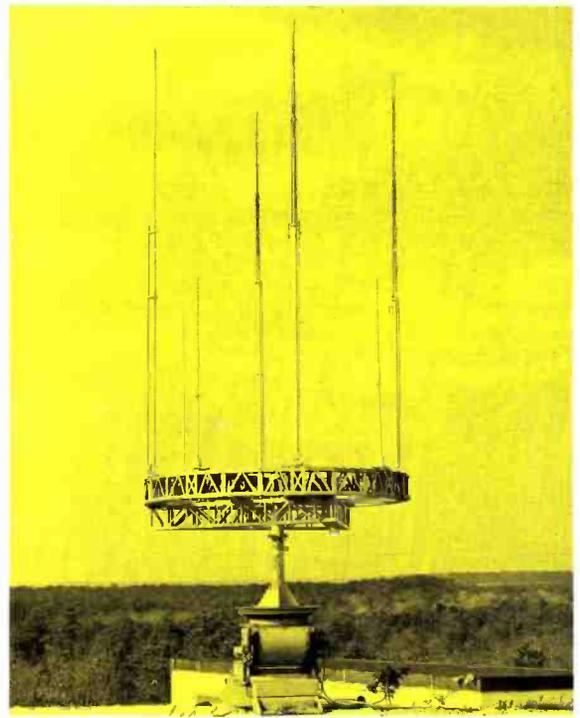


Fig. 4. Operating model array with seven antennas on lower level and four on upper level.

The determination of an acceptable norm such as the ability of an "average viewer" to see the echo and agreement on a method of measurement which will provide qualitative measurement of this norm are probably the most difficult and elusive aspects of this part of the analysis but reasonable approaches have been determined and experience has justified them.

Horizontal Pattern Circularity

The second important effect is that of reflections on horizontal pattern circularity. This shows itself as a difference in the strength of the signal received at various points around the periphery. This difference, which should be held to a minimum, results from the phase and amplitude relationship of the reflected and direct rays.

The free space pattern of the radiating antenna and the "scatter pattern(s)" of the reflecting antennas of course influence the combination. See Fig. 5 for a characteristic "scatter pattern".

As one moves around the array, these rays go through a cycle of addition and subtraction, producing a variation in the magnitude of the received signal. Knowing the patterns of the primary and reflecting antenna(s), it is possible to calculate the resulting combined pattern (See Fig. 6). For the purposes of the mathematical portion of the study on this project, a computer program was developed to handle the numerous variables for any number and type of antennas.

Results of the use of this program were borne out in a very gratifying manner by the measurements made with the scaled models. (See Figure 7 with four reflecting antennas as an example.)

Video Characteristic Effects

The third consideration, video characteristic effect, is more complex. It involves the differences in signal magnitude in a particular direction that occur as the frequency changes across the channel, or what amounts to horizontal pattern variations with frequency. It is due primarily to the fact that, with changes in frequency, the distance to the reflecting object changes in terms of wavelength. Consequently, there are phase and amplitude changes in the reflected signal as it comes from the object depending upon which part of the wave struck the reflecting surface. At any one receiving point, therefore, signals received for each of the frequencies across the channel will have a different magnitude depending upon the addition or subtraction of the phase and amplitude of signals from the primary source and the various reflecting objects.

Fig. 7. Comparison of calculated and measured (model) horizontal patterns. Five antennas in array with one radiating.

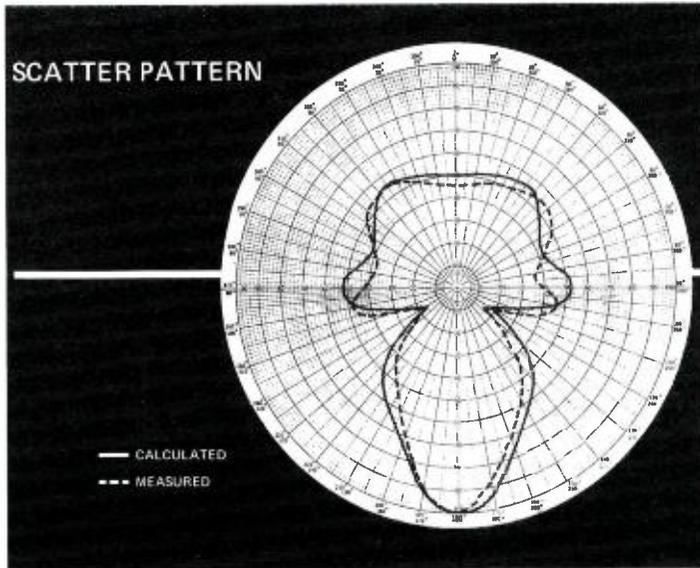


Fig. 5. "Scatter pattern" of a cylinder acting as a reflecting object.

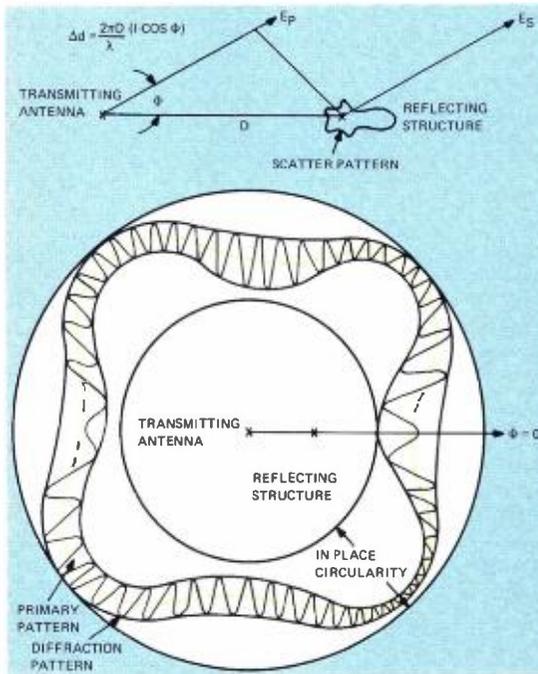
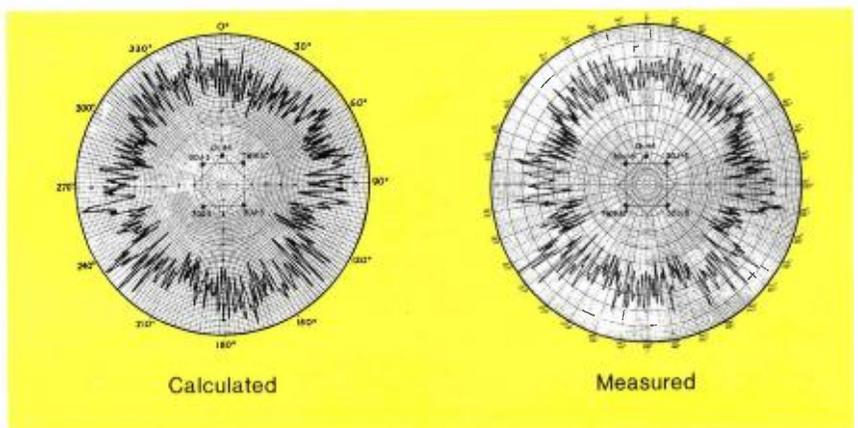


Fig. 6. Serration in a horizontal pattern due to a reflecting structure.



There are limits to the amount of departure that can be tolerated from an ideal relationship between, say, the magnitudes of the picture carrier and the color sub-carrier, and this subject occupied a lengthy part of the Mt. Sutro study. It required evaluation by several experts in various fields. The complexity of the matter was increased by the large number of reflecting objects. But with the proper programming of the computer and insertion of the pattern characteristics previously obtained, standards were finally established which could be used to judge results of the study. This proved to be the most important of any of the factors considered, and the one on which many decisions were made as to the location and arrangement of antennas.

Mutual Coupling

The fourth factor, mutual coupling effect, involves reception of a transmitted signal by another antenna in the array, and the passage of that signal down the line into the transmitter. This can have two effects: the first being a reflection by the transmitter, where the delayed signal goes back up the line and is radiated from the antenna, appearing as a ghost. The second effect can be cross modulation of the transmitted signal by the unwanted incoming signal with resultant spurious effects at other frequencies. Experience with this problem in multiple arrays has been that with the distance and frequency separations used, the amount of energy intercepted is at a very low level and is normally negligible. Calculations in this study confirmed that, with 100 feet horizontal separation, and the combination of antennas used, no concern needed to be felt for mutual coupling problems.

Isolation in the vertical direction, that is, between antennas mounted one above the other, is no problem because the pattern formation is such that very little energy goes straight up or straight down. It has been found from past installations that mutual coupling of this sort can be ignored.

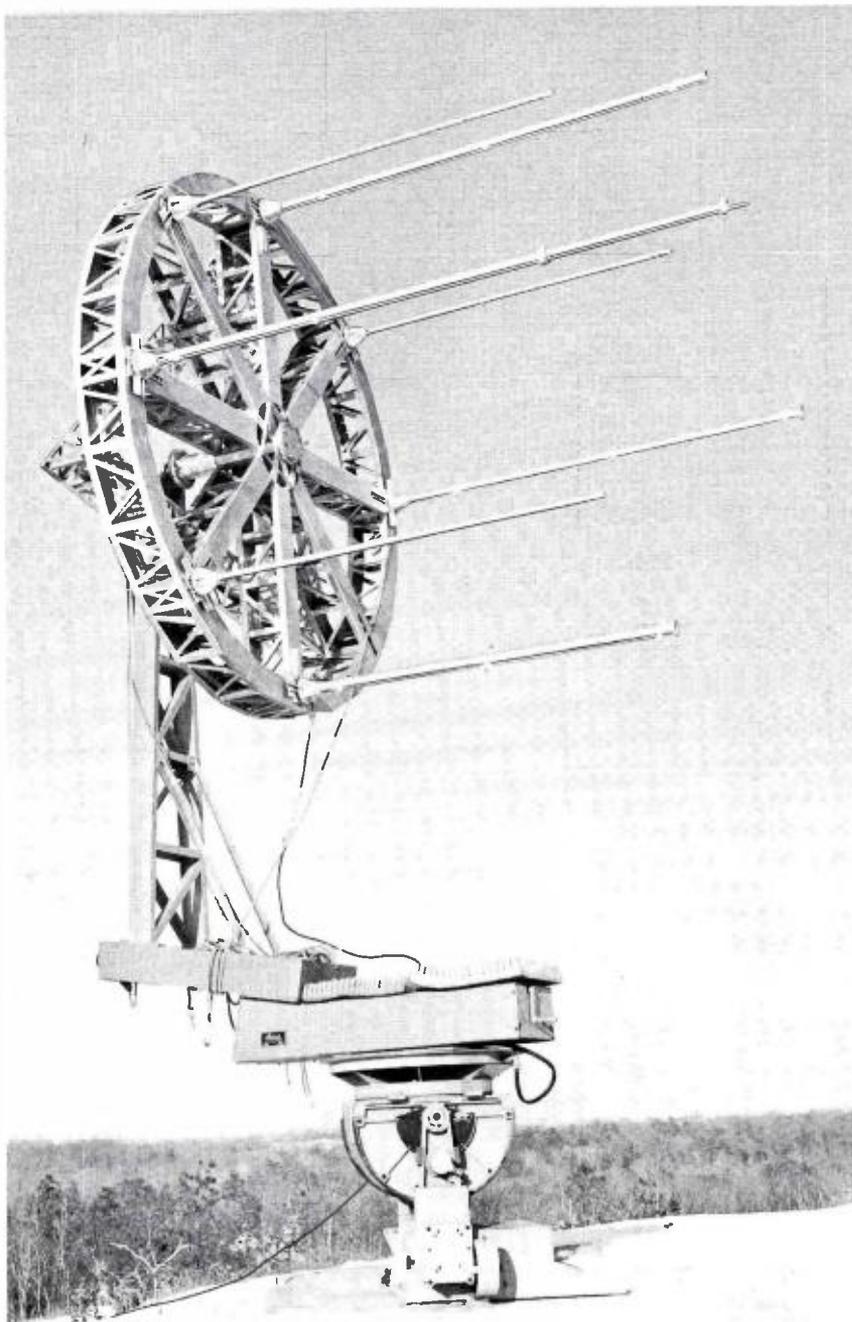
Effects on Vertical Patterns

The fifth effect to be investigated was that of tower structure or the tower platform on vertical radiation patterns. Measurements were made with the models and it was determined that the effect was negligible. See Fig. 8.

Unusual Features of Sutro Tower Antennas

With the completion of the study and the

Fig. 8. Model measurement to determine effect of tower platform on vertical pattern.



choice of a configuration of the array, the project moved from the theoretical stage to the "nuts and bolts" development of the individual antennas. Much might be written of the problems encountered and challenges met but we believe that a sampling of some of the unusual aspects of the designs employed would be of greater interest.

Effects of Stacking

In the stacking of the antennas, it was, of course, vital that the operating characteristics of each one not be impaired by structural requirements or by the passage of transmission lines from upper antennas through the lower ones.

Structural strength to support other antennas was of course a prerequisite for antennas in the lower level. In the case of the Superturnstile stack, this was accomplished by use of the lower half of a 12-section antenna for the KTVU (Ch. 2) antenna. Designed to support a standard 6-bay, Ch. 2 antenna with its (2) feedlines, the strength of its 26" diameter pole was more than adequate to hold the 6-bay Ch. 4/5 antenna. The only question then was of the effect on horizontal patterns of the additional two 3½" lines from that (diplexed) antenna. Tests with the scale model used in the study demonstrated that the effect of their presence was inconsequential.

In the cases of Polygons (Ch. 32 and Ch. 44) supporting Traveling Wave antennas on the other two stacks, the size of feeder transmission lines used (6½") was such that mounting them on the outside of the Polygons would have affected both pattern and impedance and potentially the video characteristics of other antennas on the same level. Limitations on panel widths of the Polygons imposed by the pattern characteristics desired meant that the walls must be thick and the space inside very constricted. (The entire shell of the Ch. 32 antenna would fit in a 34" diameter circle.) In spite of this, room was found to accommodate the lines to the upper antennas as well as the sizable feed systems of the Polygons. Handholes through the walls provide for disconnecting the lines from the outside and lowering them, in event of need.

In "B" stack, which included the antennas for Ch. 7 and Ch. 44, an additional refinement in the form of a small diameter "dummy" (non-operating) Polygon shell

below the two antennas minimized reflection effects on the patterns of the antennas on the A and C stacks while supplying the necessary strength.

Diplexed Superturnstile for KRON-TV/KPIX-TV

Diplexing for Channels 4 and 5 has been accomplished many times on RCA antennas. The unusual feature incorporated here lay with the requirements for standby operation on either upper or lower three bays by either or both stations and for full input power operation into either half in such an eventuality. Sectionalizing of the transmission line systems and larger than normal feed lines accomplished this.

By suitable switching either station can change to lines leading to separate standby antennas at the 190' tower level (two and three-bay Superturnstiles, respectively).

An additional interesting feature in the main antenna systems is the ability to compartmentalize the gas pressure in either the Channel 4 or 5 transmission lines (terminated as they are in common coaxial couplers) in the event the lines of the opposite station become incapable of holding their pressure by damage or removal, while still maintaining pressure on the antenna.

Sectionalized Superturnstile for Channel 2

This antenna is divided for standby purposes into a 2-bay (lower) and a 4-bay

(upper) system. This is an unusual combination, as normally such a division is 3 and 3. Special junction boxes were required, with corresponding non-standard broadband transformers.

The four lines to the junction boxes are combined at the tower top so that the two portions of the antenna are each fed with a single 6½" line from the transmitter room, where the desired mode of operation is obtained by switching.

Because of its size, it was necessary to raise the antenna in three separate sections and to perform final impedance refinement of the antenna while it was in place on the tower.

Directionalized UHF Polygons

Most interesting, in many ways, of the antennas were the five-sided Zee Panel type Polygons. Designed a number of years ago for just this kind of service—high power, flexibility in directionalizing and strength to support other antennas if necessary—the Polygon fitted the application ideally. See Fig. 9.

To meet the terrain requirements of an ocean within four miles of the site to the west and a semi-circular prime coverage area to the east, a cardioid shaped horizontal pattern (See Figure 10) was chosen. Four of the Polygon's five Zee Panel faces were fed full power from the

Fig. 9. Polygon antenna with radome following pattern development at Gibbsboro.

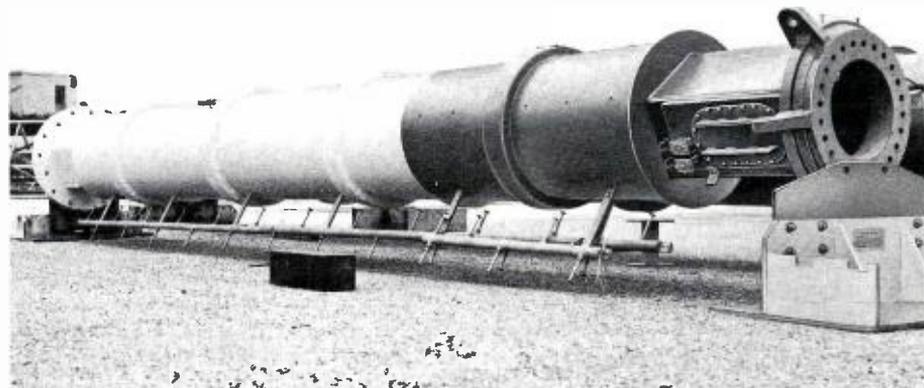


Fig. 10. Horizontal field pattern of Polygon antenna.

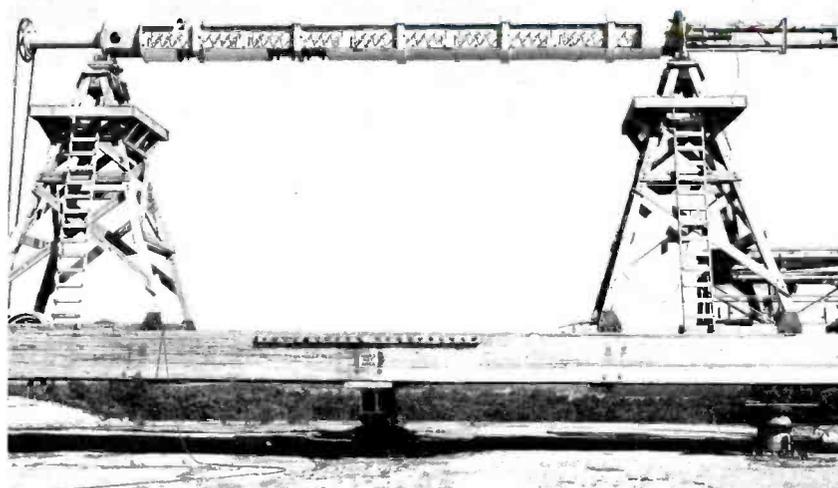
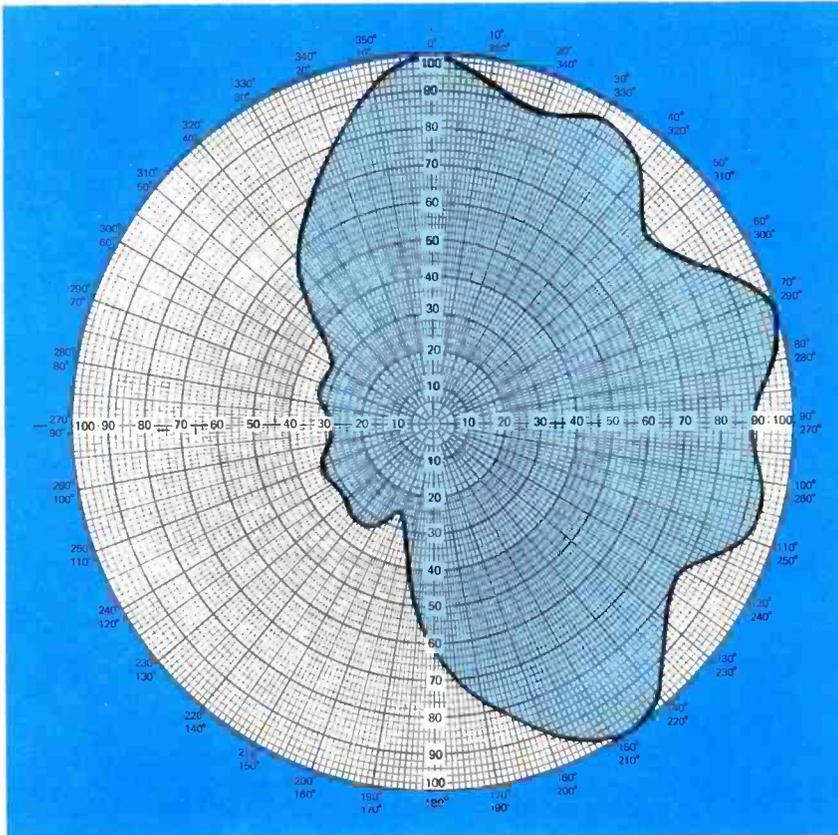


Fig. 11. Polygon antenna during pattern test, showing external "Belt-Line" feed system.

external "belt-line" feed at the center of each layer (See Figure 11) while the fifth received only sufficient power to provide good coverage to the west.

Vertical patterns were sculptured to provide the close-in solid coverage needed for the Metropolitan San Francisco area approaching the very foot of the site, yet reaching out to the mountains and beyond, behind Oakland across the Bay, to Sausalito to the north and San Mateo to the south.

The high power internal feed systems were designed with an eye to economy of internal space (to allow passage of lines from upper antennas; simplicity, and the capability of ready removal should it ever become necessary). A portion of the waveguide feed system for KBHK-TV is shown in Figure 12.

Surrounded by radomes to offer protection against San Francisco's notorious fog and incorporating copper elements and stainless hardware throughout, these antennas are well equipped to withstand the ravages of the salt-laden atmosphere.

FM Panel Antennas

What under most circumstances would be a simple choice of a column of single radiating elements mounted on the side of a tower or on a top mounted pole for the FM stations became in this case a special challenge. With a premium on space above the tower top because of the many TV antennas and their need for a minimum of pattern-affecting "clutter", the necessity for location of FM facilities below the platform early became obvious. The character of the three sloping tower legs (7.5 foot triangular cross section with external sheathing on all faces) is such that side mounted antennas must contend with distorting reflections from the large and tilted sheaths.

To eliminate this problem, panel type radiators were used with the radiating elements (See Figure 13) supported in front of reflecting screens. Three of these, forming a triangle around the tower leg, were used for each "layer". To avoid the effect on pattern of the slanted tower legs, the layers were supported directly above each other, thus requiring varying length supports from the tower. An advantage of these radiators is their greater bandwidth and power handling, rendering them capable of handling a number of channels at once.

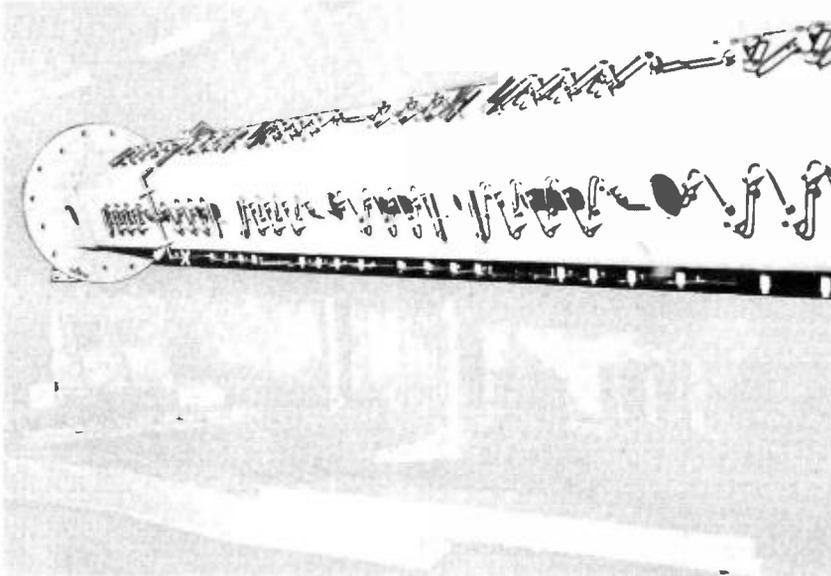
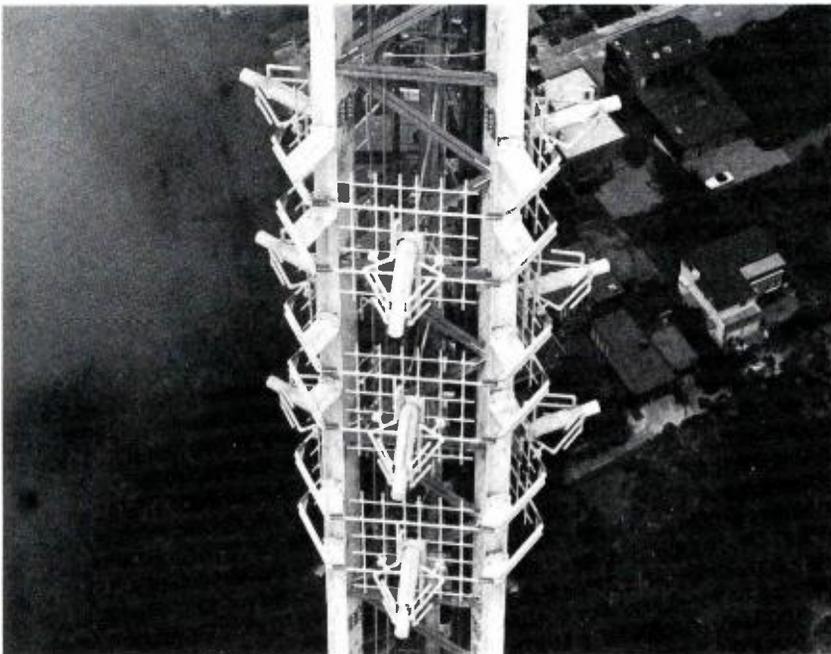


Fig. 12. Waveguide feedsystem for KBHK-TV Polygon.

Fig. 13. FM panel, KRON-FM. Mounted on Sutro Tower leg.



Summary

Behind the techniques employed in the Mt. Sutro antenna feasibility study was the experience gained on similar, though less complex, side-by-side arrays in Texas, Baltimore and Sacramento—and on stacked arrays in New York City, Chicago and at many other locations. This background proved invaluable.

The validity of the extensive Sutro Tower feasibility study was confirmed in two significant ways:

First, by the excellent correlation achieved between the mathematical calculations and the scale model measurements.

And, second, after six months of on-air operation, by the complete absence of any of the effects which were subjects of concern at the outset.

July 4, 1973 was the official "on-air" date for Sutro Tower, marking the culmination of 17 years of cooperative effort on the part of Bay Area television stations. For the RCA Antenna Engineering group, this project has been a stimulating, gratifying experience. ■

Products in the news

NEW 165 kW UHF TRANSMITTER NOW IN OPERATION

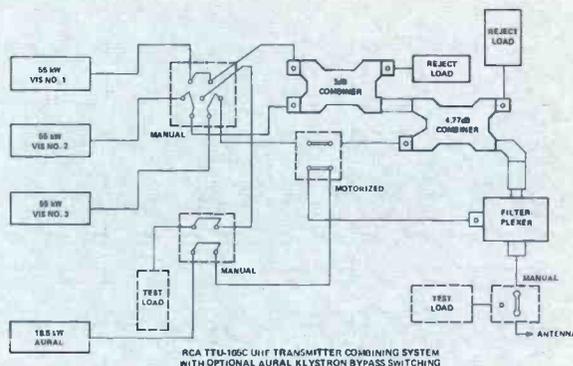
The latest addition to the RCA line of high power UHF transmitters is the 165 kW Type TTU-165C. The first system has already been delivered and is in operation at WTAF-TV, Philadelphia, Taft Broadcasting Company (BROADCAST NEWS, Vol. #151).

The TTU-165C utilizes four five-cavity, 55 kilowatt vapor cooled klystrons to produce a visual peak power output of 165 kilowatts and an aural power of 23.5 kilowatts. The transmitter is housed in five front line cabinets, with a rear walk-in enclosure containing the power switching and distribution equipment. An optional standby exciter/modulator with automatic exciter switching is housed in one additional cabinet section (extreme left in the photo).

A unique triplexing system is employed to combine the outputs of three 55 kW klystrons. Visual amplifiers 1 and 2 are combined through a 3 dB combiner to produce 110 kW peak power. This signal is fed into a 4.77 dB combiner where it is added to the output of visual amplifier 3 for a combined visual peak power of 165 kilowatts.

In the event of failure of any one of the three visual klystron amplifiers, the visual power output will drop to 73.5 kilowatts or 44.5% of normal power. If any two visual klystrons fail, the visual output power will drop to 18.2 kilowatts or 11% of normal power.

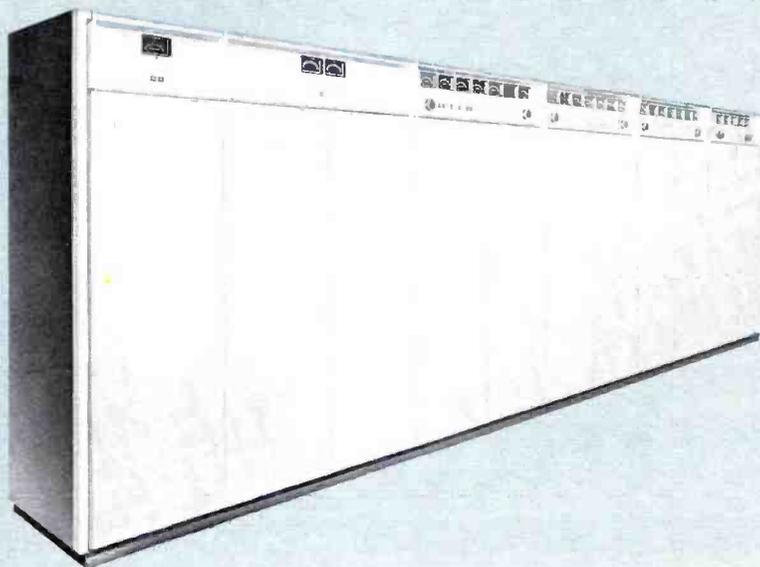
Motorized coaxial switching is available optionally to substitute visual klystron number 3 in aural service in the event of failure of the aural klystron. An optional solid state standby



IPA with coaxial switching and optional spare exciter group with standby switching fulfill the FCC remote control 20% standby power requirement for once-a-week inspection.

The system is cooled by two heat exchangers, although the cooling system is sufficient to operate with one heat exchanger in an emergency. One heat exchanger will operate any two visual klystrons plus the aural klystron at full power for a combined peak visual power output of 73.5 kilowatts.

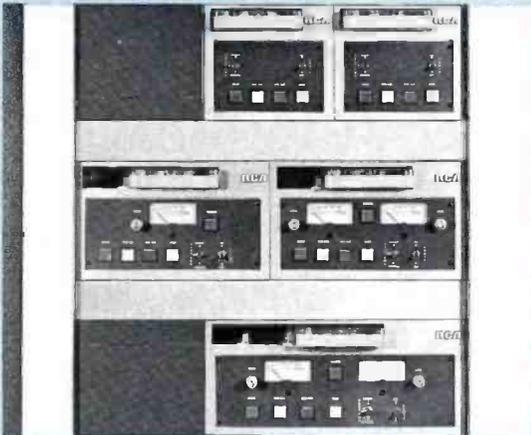
Incorporated in the system is a closed water system for cooling the combiner reject loads. Three unitized beam supplies are provided. Any two beam supplies have sufficient output to operate any two visual klystrons plus the aural klystron at full power, for a combined peak visual output of 73.5 kilowatts.



VERSATILE NEW AUDIO CARTRIDGE TAPE MACHINES OFFER 140 SYSTEM CHOICES

Virtually any cartridge tape requirement can be handled by the new RCA Type RT-125, RT-126 and RT-127 systems. Users can select mono and stereo; playback only or record/playback systems, with a further choice of cartridge size combinations—300, 600 and 1200 foot NAB sizes.

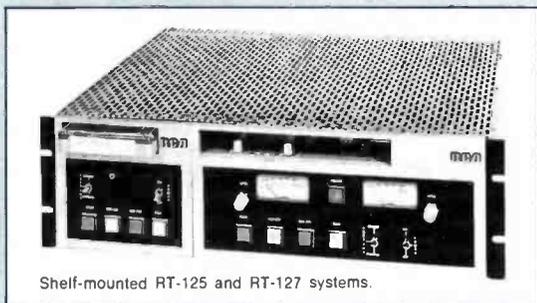
Solid state logic and switching provide superior performance, with significantly improved reliability. All systems exceed NAB cartridge tape requirements.



RT-125, RT-126, and RT-127 Cartridge Tape Systems in rack mounting.

State-of-art electronic and mechanical components incorporated in the new cartridge systems have resulted in a compact, uncluttered design. All systems are available in desk and rack-mount versions (require only 5¼" of rack height).

Tape handling is enhanced by an air cushion solenoid pinch roller action which makes for smoother operation. The pinch roller is self-aligning. For easier set-up, the tape heads can be vernier-adjusted so height and azimuth will not interact during alignment.



Shelf-mounted RT-125 and RT-127 systems.

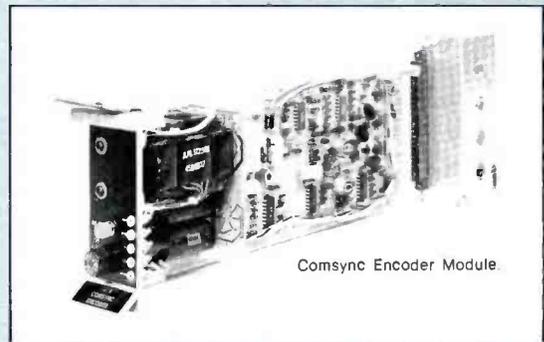
For added operating flexibility, a fast forward option is available on all systems. Basic cartridge systems are expandable to meet changing requirements.

The RT-125 is a play-only machine for NAB Type A cartridges in mono or stereo. It is compact enough to sit on the desk close to the audio console, or three units will fit side by side in a rack shelf.

The RT-126 and RT-127 are both record/playback machines: The RT-126 for A and B cartridges; the RT-127 for Types A, B, and C sizes. (Catalog AU.8420.)

COMSYNC VIDEO DISTRIBUTION SYSTEM

Comsync is a single cable pulse distribution system developed by RCA which provides an effective and economical solution to troublesome pulse timing and distribution problems.



The Comsync system combines several sync generator signals into a composite waveform for transmission over a single coaxial, unbalanced line. The quality of sync information fed to each program source is improved, while system complexity is reduced.

A series of compact plug-in modules and submodules comprise the Comsync system: Encoder, Decoder, Delay, H & V Drive, Burst Flag Generator. The Comsync waveform is a composite of the timing information contained in sync, blanking, burst flag and color subcarrier. The Encoder (TG-8) accepts these signals from the sync generator and forms the Comsync signal for distribution over a single, video-quality co-ax line to almost any number of Decoders at the other end. The Decoder (TG-18) separates the signals, re-establishes the proper level of each and delivers them to eight isolated output connectors—a pair for each of the four signals.

In a modest television system with only a single video switcher, Comsync provides an inexpensive means of distributing subcarrier, sync, blanking, H & V drive and burst flag. Larger installations involving two, three, or more switching systems and a number of signal sources can effect substantial savings with Comsync—in equipment, cable, installation and system phasing expense. (See Catalog TE.2200.)

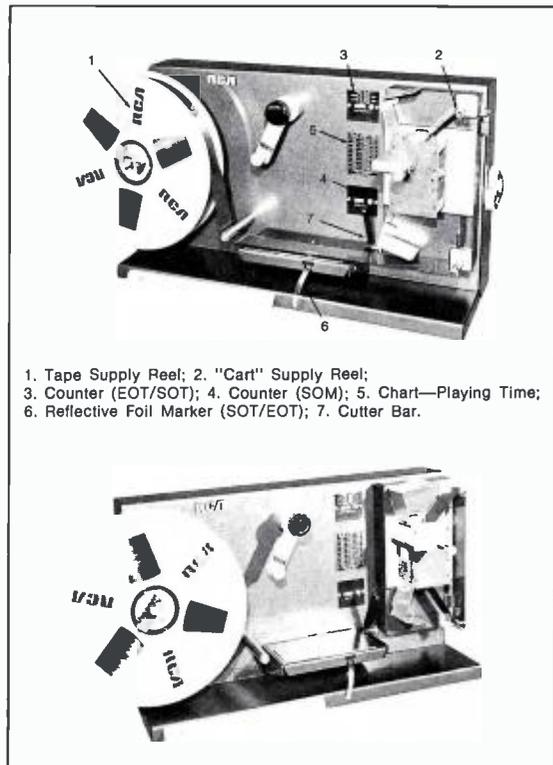
Products in the news

CARTRIDGE TAPE WINDER EXTENDS VERSATILITY OF TCR-100

With more than 150 "cart" machines now installed, many users are finding the need for accessories to handle special requirements. A number of these ancillary equipments have been developed, including: "EPIS" identification system; Electronic Editing; Remote Control Panels; Automatic Control-Track Phase accessory; Respoolable Cartridges; Cartridge Tape Winder, and others.

The Cartridge Tape Winder is a useful device which provides the means for station personnel to load empty "carts" to any desired length up to 3-minutes. The result is even more flexibility of operation and further savings in tape usage. Existing cartridges can also be re-loaded with new tape, using the Winder. It is also adaptable to the new re-loadable cartridges which allow an SMPTE spool to be assembled within the "cart".

Various parts of the Cartridge Tape Winder.

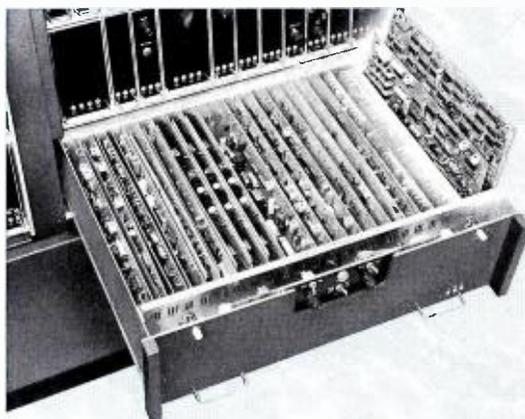


1. Tape Supply Reel; 2. "Cart" Supply Reel;
3. Counter (EOT/SOT); 4. Counter (SOM); 5. Chart—Playing Time;
6. Reflective Foil Marker (SOT/EOT); 7. Cutter Bar.

The Winder set up to accommodate a reloadable type of cartridge, using an SMPTE spool.

Two modes of Winder operation are illustrated. Note that such convenience features as cutter bar, dispenser for the marker foil, and a small crank for external winding of the "cart" reels are included. In addition, the Winder contacts the tape on the rear side only, preventing scratches in the coating.

With the Cartridge Tape Winder, the TCR-100 becomes even more flexible. (Catalog TA.1900A)



AUTOMATIC CONTROL TRACK PHASING ACCESSORY FOR TR-70C

Control track phasing is the process of moving the relative position of the tape with respect to the video head to assure the passage of the head precisely over the pre-recorded track.

This function has now been automated by the Automatic Control Track Phasing Accessory (MI-591713) which can be added to any TR-70C. The key feature of this accessory is the incorporation of a memory which stores the correct playback phase for the particular tape loaded on the machine.

The "cued" tape memory provides for complete lockup within the normal time specified, and additionally permits a "Time Lapse" check/reset capability which eliminates the degradation in system performance which would occur in a continuously operating mode.

TG-6 NTSC COLOR SYNC GENERATOR

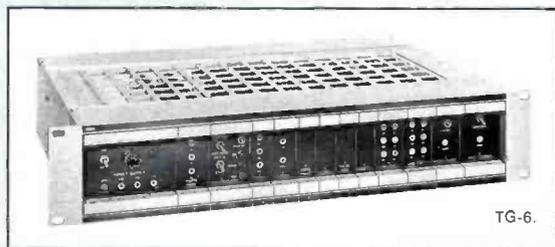
While the TG-6 was designed as a signal source generator, its stability is such that it can easily find application as a primary timing standard.

Sync, blanking, H & V drive, burst flag, and color subcarrier are produced by the basic generator. The TG-6 locks to composite color video, composite color black or a Comsync signal used in single-cable pulse distribution systems. Should the input signal fail, the TG-6 reverts to internal operation to keep the program source on-air, although it is non-synchronous.

A pulse program module in the generator permits adjusting all pulse-timing relationships over the complete RS-170

Standard range, with advance and delay adjustments being made in 70 nanosecond increments.

Available options include a line amplifier module; grating dot generator, and a black burst output module which contains a 3.58 MHz and 31.5 kHz input for locking the TG-6 to an external frequency standard. (Catalog TE.2000.)



TPR-10 PORTABLE VIDEO TAPE RECORDER

Cramped space and rugged operating conditions won't cramp the style or performance of RCA's new TPR-10 Portable Video Tape Recorder.

Especially suitable for "on location" assignments, the TPR-10 records up to 20 minutes of studio quality color video tapes. A monochrome playback capability permits immediate verification of results. And, the system includes erase facilities, so re-takes are easily handled.

Since the tape speed, format and highband signal system are fully compatible with the SMPTE standard for quadruplex recording, tapes made on the TPR-10 are playable in full



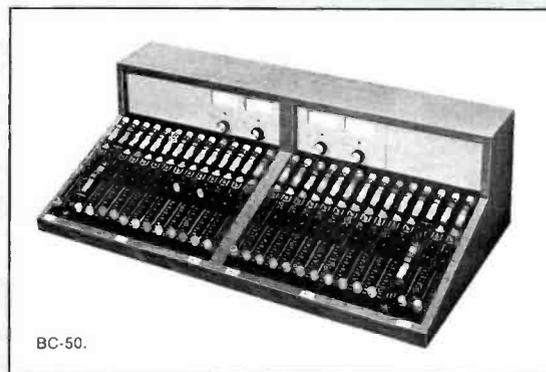
NTSC color on any standard quad recorder/reproducer.

This compact system comes complete in two luggage-size cases—one for the transport, the other for the modular, solid state electronics.

Adapted from a spaceborne-design system, the TPR-10 represents the latest advance in technology, reliability and performance.

BC-50 CUSTOM AUDIO SYSTEM

For special audio systems designed for individual application needs, RCA now offers the BC-50 equipment series. This new line provides a further choice—versatile audio systems with a high degree of flexibility and options, custom-assembled in desk-top or pedestal consoles. The BC-50 is comprised of a series of functional modules which are customized in any number of configurations to provide desired inputs, outputs, switching, mixing, equalizing—complete audio signal handling capability. And, in addition to the new BC-50, the popular BC-100 Series of custom audio equipment is still available to meet highest quality broadcast and audio-production system requirements.



TPR-10.

BC-50.

123 practical reasons for owning the RCA Cart Machine.

1. The TCR-100 can make your station breaks totally automatic.
2. Savings of up to \$33,000 a year in head-wheel, tape and manpower costs have been reported.
3. The TCR-100 records and plays commercials.
4. It records and plays psa's.
5. It duplicates cartridges.
6. It records and plays promos.
7. It records and plays news segments.
8. It can be used as a production machine.
9. It can record simple commercials directly from studio.
10. It records and plays openings and closings.
11. Use it to assemble programs.
12. You can dub film spots onto cartridges.
13. How do you make a movie review more useful? Dub it to cartridge.
14. With the Cart, when you need a news "filler", you've got it.
15. The Cart Machine makes it easy to "localize" national commercials.
16. Directly record weather reports for later use.
17. It records and plays station editorials.
18. Use it to integrate live, film and slide material with audio for spots or programs.
19. Use it to make multiple dubs to reel machines.
20. Dealer tags. Make them once and dub onto carts where needed.
21. Some stations use it to dub tapes in quantity for clients.
22. Alfecon II headwheels last as much as 3 times longer than previous materials.
23. TCR-100 design is based on a study of actual station program logs.
24. Cartridges are easy to handle and store.
25. Ready access allows cart changes up to within 30 sec. of air time.
26. Carts available preloaded or reloadable.
27. Tapes recorded on highband VTRs can be loaded into carts and played on the TCR-100.
28. Consistent cart quality makes your station look better on the air.
29. All cartridges in the magazine are always visible.
30. Carts are factory loaded and cue coded.
31. Preloaded carts come in 1- and 3-min. lengths.
32. Tape in the cart is always in a rewind state, ready for replay.
33. Change carts in 3 sec.
34. Some carts have been played over 3,000 times.
35. Consistent color quality from cart to cart.
36. Cartridge doors protect tape while cart is out of machine.
37. Cart shelf area is only 2½ by 3½ in.
38. Carts are labeled so they can be identified in storage as well as in the machine.
39. Carts are keyed to prevent incorrect insertion.
40. Six carts can be stored in the same space required by two 6 in. tape reels.
41. Cartridges are respoolable.
42. The tape in preloaded carts is the best available.
43. The TCR-100 is designed for simplicity, not complexity.
44. Power consumption is low.
45. One to 21 dubs in one load.
46. Can do the work of 3 or more reel-to-reel machines at the break.
47. It eliminates the need for spot reels.
48. It programs 1 to 9 sequences with 1 to 8 events in each.
49. It's easily interfaced with a computer.
50. Operating controls are divided into 3 convenient functional groups.
51. To correct a premature start, just press the "Play Recue" button.
52. The TCR-100 has automatic A-to-B dub.
53. The Cart Machine follows the program log. No need for a bin log or sequence log.
54. Cue tones are audible.
55. "Last Event" warning on remote-control panel tells operator when final cart is playing.
56. Can be teamed up with our newly announced TCP-1624 Cartridge Film Projector.
57. The entire break is pretimed via cues, so cuts are clean and consistent.
58. To record, there are only 7 steps. Competition requires more.
59. Setup is easy with RCA Color Reference Cart.
60. Once reference is set, all tapes are recorded and played to the same standard.
61. Automatic threading, cueing, rewinding.
62. It can time-share the electronics of reel-to-reel TR-60s and TR-70Cs.
63. Traffic departments like it because it simplifies scheduling as well as logging and verification.
64. Machine can preview cart sequence to make sure they're in correct order.
65. Preview the entire cart sequence at the touch of a button.
66. After preview, one button recues the break.
67. It interfaces with and cues other VTRs and film equipment.
68. The TCR-100 switches video automatically.
69. To dub a cart, push only 4 buttons. No shuffling or cueing.
70. Makes possible all-tape station break.
71. Tape is protected from crimping and tearing.
72. You get dependable tape handling. No vacuum used.
73. There's no need for repeated color-bar checks throughout the broadcast day.
74. You use less tape because color-bar leaders, claphboards are unnecessary.
75. To program, just place carts in magazine, dial the number onto sequence register.
76. Smooth cartridge operation minimizes dead air time.
77. Tapes stay untouched by human hands.
78. With the Cart Machine, stations are able to get into more local production.
79. Machine setup takes only 10 to 15 minutes at start of broadcast day.
80. One man can control the entire station break.
81. It's easy to substitute a paying spot for a nonpaying one at the last minute.
82. Drastically cut headwheel cleaning time. Do it once at the beginning of the day.
83. If you receive just one film spot to run on a heavy schedule, the Cart solves the problem.
84. The Cart simplifies adding several different dealer tags to the same commercial.
85. Headwheels are interchangeable with those of TR-60s, TR-61s and TR-70Cs.
86. When time-shared with a TR-60, TR-61 or TR-70C, the reel-to-reel machine has separate video output for loading and cueing.
87. Cart dubs can be edited during dubbing.
88. The TCR-100 can be slaved to RCA TR-60s or TR-70Cs you already own.
89. An automatic actor's tally operates during recording.
90. It's the lowest-priced 2" quad cartridge VTR.
91. It frees up reel machines for production.
92. Its Signal Processing Unit contains picture and waveform monitors, monitor switching systems.
93. External Source Preroll Control for dubbing and recording.
94. There's a more relaxed atmosphere in the tape room at station-break time.
95. The TCR-100 includes its own processing amplifier.
96. There are only 35 control panel buttons compared to a competitor's 60.
97. Lighted status displays on TCR-100 indicate function being performed.
98. Optional remote-control panel also has status lamps for operator assistance.
99. Reference tape is supplied with machine.
100. Time sharing with TR-60, TR-61 or TR-70C provides cue-actuated preroll and audio-follow with TCR-100.
101. Rear-side video erase protects tape.
102. Available in 525/60 or 625/50 standards.
103. Rear-side handling during threading and playing prevents scratching.
104. Requires less floor space than the competition.
105. The signal processor includes a color dropout compensator (CDOC).
106. And a chroma amplitude and velocity error corrector (CAVEC).
107. Record-lockout control prevents loss of recorded material.
108. Only 2 tape contacts—one video, one audio head—means less tape wear.
109. All controls are at eye level.
110. Stations tell us that the TCR-100 frees manpower for other duties.
111. Make-goods are drastically reduced.
112. Optional remote-control panel fits into only 7 inches of rack or console space.
113. Optional Electronic Programming Identification System (EPIS) displays an identification of the cart being played.
114. There's a splicer-editor option for quickly adding last-minute information to carts.
115. Editor performs both video-only and audio-only edits.
116. Record Current Optimizer is standard.
117. Control track phase can be optimized automatically with an accessory.
118. Recording on both decks is available optionally. Most stations don't need it.
119. More than 4 million commercial plays to date.
120. It's the most experienced machine of its kind.
121. One of the best things about it is figuring out what to do with the money you save.
122. The service backup available is second to none.
123. And according to one user, "It makes such nice noises."

123 reassuring reasons for owning the RCA Cart Machine.

1. One TCR-100 delivered to WBAY-TV, Green Bay, Wisc.
2. One TCR-100 delivered to WUTV, Buffalo, N.Y.
3. One TCR-100 delivered to KSLA-TV, Shreveport, La.
4. One TCR-100 delivered to WWL-TV, New Orleans, La.
5. One TCR-100 delivered to WBAL-TV, Baltimore, Md.
6. One TCR-100 delivered to WJAR-TV, Providence, R. I.
7. One TCR-100 delivered to WBRE-TV, Wilkes-Barre, Pa.
8. One TCR-100 delivered to WAFB-TV, Baton Rouge, La.
9. Five TCR-100s delivered to NBC Network, N.Y.C.
10. One TCR-100 delivered to WDCA-TV, Washington, D. C.
11. One TCR-100 delivered to KIRO-TV, Seattle, Wash.
12. One TCR-100 delivered to WSAV-TV, Savannah, Ga.
13. One TCR-100 delivered to KNTV, San Jose, Cal.
14. One TCR-100 delivered to KPLR-TV, St. Louis, Mo.
15. One TCR-100 delivered to KHQ-TV, Spokane, Wash.
16. One TCR-100 delivered to KTSM-TV, El Paso, Tex.
17. One TCR-100 delivered to WAPA-TV, San Juan, P. R.
18. One TCR-100 delivered to WISN-TV, Milwaukee, Wisc.
19. One TCR-100 delivered to WFMV-TV, Greensboro, N.C.
20. One TCR-100 delivered to WTVC, Chattanooga, Tenn.
21. One TCR-100 delivered to WSB-TV, Atlanta, Ga.
22. One TCR-100 delivered to WTAF-TV, Philadelphia, Pa.
23. One TCR-100 delivered to WTAE-TV, Pittsburgh, Pa.
24. One TCR-100 delivered to WPTV, W. Palm Beach, Fla.
25. One TCR-100 delivered to WGR-TV, Buffalo, N.Y.
26. Two TCR-100s delivered to WBNS-TV, Columbus, Ohio
27. Two TCR-100s delivered to WECT-TV, Wilmington, N. C.
28. One TCR-100 delivered to WKBW-TV, Buffalo, N.Y.
29. One TCR-100 delivered to WGN-TV, Chicago, Ill.
30. One TCR-100 delivered to CHAN-TV, Vancouver, B. C. Can.
31. One TCR-100 delivered to WDAY-TV, Fargo, N. D.
32. Three TCR-100s delivered, to NBC Network, Burbank, Cal.
33. One TCR-100 delivered to WRAL-TV, Raleigh, N. C.
34. One TCR-100 delivered to WNCT-TV, Greenville, N. C.
35. One TCR-100 delivered to WKRC-TV, Cincinnati, Ohio
36. One TCR-100 delivered to WTVN, Columbus, Ohio
37. One TCR-100 delivered to WBRC-TV, Birmingham, Ala.
38. One TCR-100 delivered to WDAF-TV, Kansas City, Mo.
39. One TCR-100 delivered to KVRL-TV, Houston, Tex.
40. Two TCR-100s delivered to WRC-TV, Washington, D. C.
41. One TCR-100 delivered to KSD-TV, St. Louis, Mo.
42. Two TCR-100s delivered to WKYC-TV, Cleveland, Ohio
43. One TCR-100 delivered to KWTW, Oklahoma City, Okla.
44. Two TCR-100s delivered to KPRC-TV, Houston, Tex.
45. One TCR-100 delivered to KTBS-TV, Shreveport, La.
46. One TCR-100 delivered to KARD-TV, Wichita, Kan.
47. One TCR-100 delivered to WMAL-TV, Washington, D. C.
48. Two TCR-100s delivered to KSTP-TV, St. Paul, Minn.
49. One TCR-100 delivered to WEAT-TV, W. Palm Beach, Fla.
50. One TCR-100 delivered to KPTV, Portland, Ore.
51. One TCR-100 delivered to WKRG-TV, Mobile, Ala.
52. One TCR-100 delivered to WSPA-TV, Spartanburg, S. C.
53. One TCR-100 delivered to KWGN-TV, Denver, Colo.
54. One TCR-100 delivered to KCEN-TV, Temple, Tex.
55. Two TCR-100s delivered to KRON-TV, San Francisco, Cal.
56. One TCR-100 delivered to WSOC-TV, Charlotte, N. C.
57. Two TCR-100s delivered to KOB-TV, Albuquerque, N. M.
58. One TCR-100 delivered to WBTW, Charlotte, N. C.
59. One TCR-100 delivered to KOMO-TV, Seattle, Wash.
60. One TCR-100 delivered to KATU-TV, Portland, Ore.
61. Two TCR-100s delivered to WBAP-TV, Fort Worth, Tex.
62. One TCR-100 delivered to KTRK-TV, Houston, Tex.
63. One TCR-100 delivered to KBTV, Denver, Colo.
64. One TCR-100 delivered to KOCO-TV, Oklahoma City, Okla.
65. One TCR-100 delivered to WUAB-TV, Cleveland, Ohio
66. One TCR-100 delivered to KTVW, Tacoma, Wash.
67. One TCR-100 delivered to WTOP-TV, Washington, D. C.
68. One TCR-100 delivered to KNOE-TV, Monroe, La.
69. One TCR-100 delivered to WTNH-TV, New Haven, Conn.
70. One TCR-100 delivered to CFTO-TV, Toronto, Ontario, Can.
71. One TCR-100 delivered to KFSN-TV, Fresno, Cal.
72. One TCR-100 delivered to WATE-TV, Knoxville, Tenn.
73. One TCR-100 delivered to KMGH-TV, Denver, Colo.
74. Two TCR-100s delivered to WMAQ-TV, Chicago, Ill.
75. One TCR-100 delivered to KOVR-TV, Stockton, Cal.
76. One TCR-100 delivered to KYTV, Springfield, Mo.
77. One TCR-100 delivered to CFRN-TV, Edmonton, Alberta, Can.
78. One TCR-100 delivered to WVUE-TV, New Orleans, La.
79. One TCR-100 delivered to WTVD, Durham, N. C.
80. One TCR-100 delivered to KCAU-TV, Sioux City, Iowa
81. One TCR-100 delivered to WRTV, Indianapolis, Ind.
82. One TCR-100 delivered to WTMJ-TV, Milwaukee, Wisc.
83. One TCR-100 delivered to WDBJ-TV, Roanoke, Va.
84. One TCR-100 delivered to WMC-TV, Memphis, Tenn.
85. One TCR-100 delivered to WCPO-TV, Cincinnati, Ohio
86. One TCR-100 delivered to WXYZ-TV, Detroit, Mich.
87. Two TCR-100s delivered to WABC-TV, N.Y.C.
88. One TCR-100 delivered to WEWS-TV, Cleveland, Ohio
89. One TCR-100 delivered to WBOC-TV, Salisbury, Md.
90. One TCR-100 delivered to KVUE-TV, Austin, Tex.
91. One TCR-100 delivered to KRIS-TV, Corpus Christi, Tex.
92. One TCR-100 delivered to WLS-TV, Chicago, Ill.
93. One TCR-100 delivered to WJAC-TV, Johnstown, Pa.
94. One TCR-100 delivered to KOAA-TV, Pueblo, Colo.
95. One TCR-100 delivered to KTEN-TV, Ada, Okla.
96. One TCR-100 delivered to WTEV-TV, New Bedford, Mass.
97. One TCR-100 delivered to WZZM-TV, Grand Rapids, Mich.
98. One TCR-100 delivered to WJRT-TV, Flint, Mich.
99. One TCR-100 delivered to WMAR-TV, Baltimore, Md.
100. Two TCR-100s delivered to WTOG-TV, St. Petersburg, Fla.
101. One TCR-100 delivered to KATC-TV, Lafayette, La.
102. One TCR-100 delivered to WTLV-TV, Jacksonville, Fla.
103. One TCR-100 delivered to WYAH-TV, Portsmouth, Va.
104. One TCR-100 delivered to WMTV, Madison, Wisc.
105. One TCR-100 delivered to WAVY-TV, Portsmouth, Va.
106. One TCR-100 delivered to WAPI-TV, Birmingham, Ala.
107. One TCR-100 delivered to WFMJ-TV, Youngstown, Ohio
108. One TCR-100 delivered to WCSH-TV, Portland, Me.
109. One TCR-100 delivered to ATV-O, Melbourne, Australia
110. One TCR-100 delivered to TV-Q, Brisbane, Australia
111. One TCR-100 delivered to BTW, Bunbury, Australia
112. One TCR-100 delivered to YTV, Yorkshire, England
113. One TCR-100 delivered to LWTV, London, England
114. One TCR-100 delivered to Venevision, Caracas, Venezuela
115. One TCR-100 delivered to TIMSA, Mexico City, Mexico
116. Two TCR-100s delivered to WKAQ-TV, San Juan, P. R.
117. One TCR-100 delivered to WCYB-TV, Bristol, Va.
118. One TCR-100 delivered to Global Communications, Toronto, Can.
119. One TCR-100 delivered to WSBT-TV, South Bend, Ind.
120. One TCR-100 delivered to KOTA-TV, Rapid City, S. D.
121. One TCR-100 delivered to KELO-TV, Sioux Falls, S. D.
122. One TCR-100 delivered to WBBH-TV, Ft. Myers, Fla.
123. One TCR-100 delivered to WPVI-TV, Philadelphia, Pa.



For further information, see your RCA representative. Or write RCA Broadcast Systems, Bldg. 2-5, Camden, N.J. 08102.

When a low-priced broadcast camera looks like a good buy, keep right on looking.

Take a good look inside. Check out the design and construction features.

Then think about what they mean in terms of reliability, maintenance, and long-term picture quality after the camera has been put to a lot of hard, daily use.

Look at the RCA TK-630 color camera.

The heart of its optical system is a simple one-piece sealed prism rather than the ordinary arrangement of mirrors.

It's simpler to maintain; stays in perfect alignment; eliminates the secondary reflections that even slight contamination of mirror surfaces can cause.

And for stability, the entire optical system is mounted on a sturdy bed-plate for extra rigid support of pickup tubes, lens and prism.

The result? Less shock and vibration. Extra dependability. And pictures that stay sharp and true.

Components are easily accessible so maintenance is fast and simple. The pickup tubes for example, can be replaced in two minutes. Without disturbing the

optical alignment and causing deterioration of picture quality.

Circuit modules are easy to get at, too. And they're totally solid state for compactness and long life.

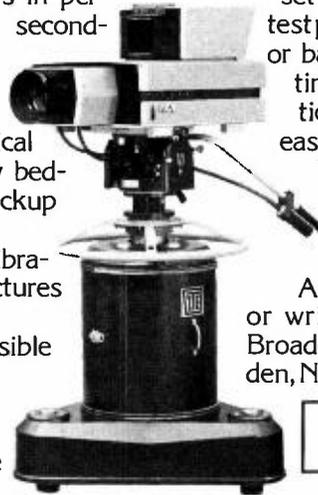
And the TK-630 is made for portability — with a plug-in detachable viewfinder and carrying handle that make it easy for one man to carry.

There are other quality features which set the TK-630 apart: Calibrated test pulse; built-in encoder with color bar generator; automatic pulse timing; deflection failure protection; electronic lens capping, easy setup. And many more.

The new low price is the first thing that looks good about the TK-630.

But by no means the last.

Ask your RCA Representative, or write for new brochure. RCA Broadcast Systems, Bldg. 2-5, Camden, N.J. 08102.



RCA

New TK-630 color camera.

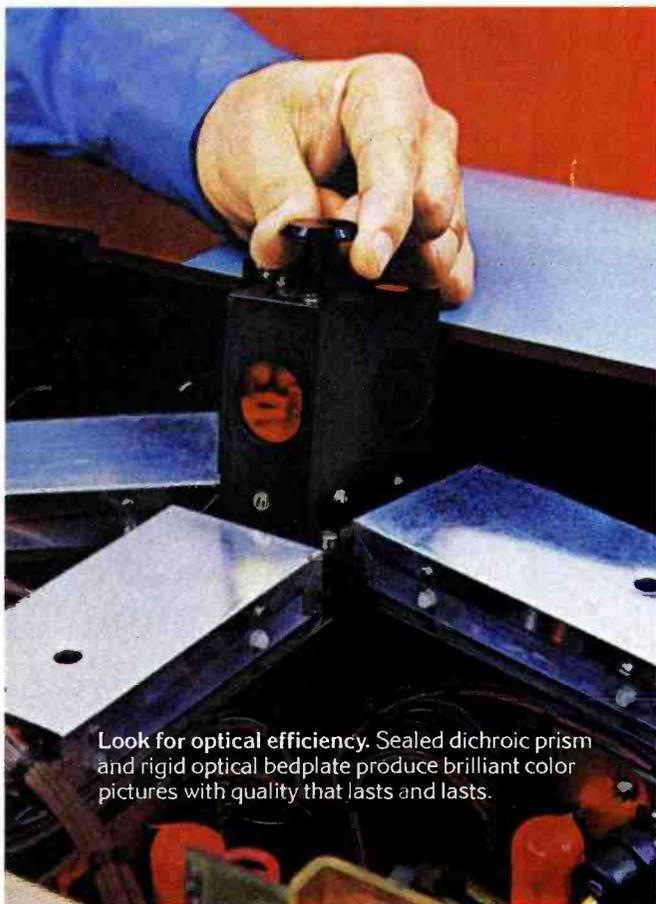




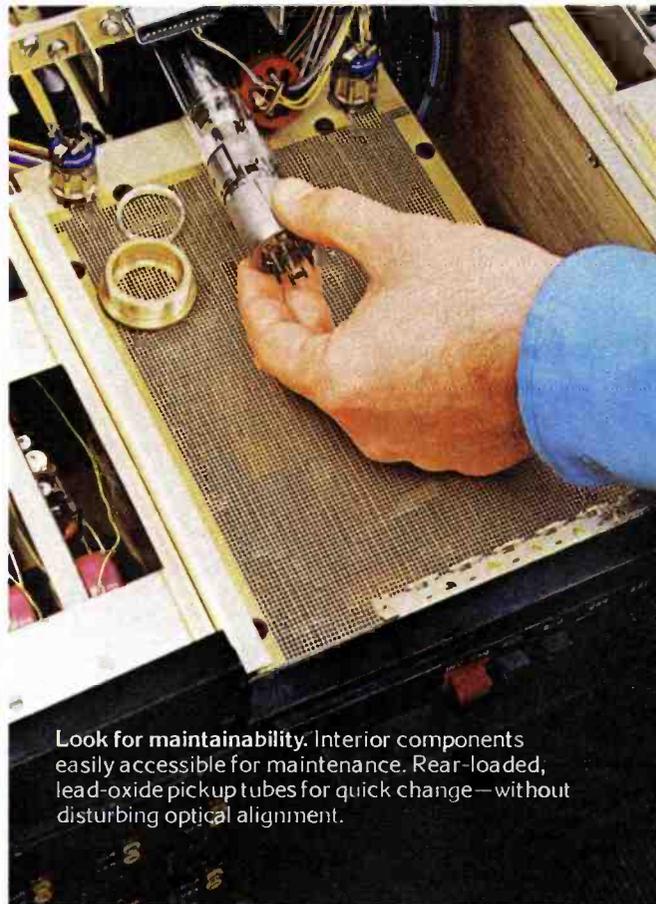
Look for versatility in field or studio use. Plug-in viewfinder quickly detaches for easy portability.



Look for rugged construction. An extra measure of design integrity. Sturdy circuit boards take hard knocks. Premium components for extra life.



Look for optical efficiency. Sealed dichroic prism and rigid optical bedplate produce brilliant color pictures with quality that lasts and lasts.



Look for maintainability. Interior components easily accessible for maintenance. Rear-loaded, lead-oxide pickup tubes for quick change—without disturbing optical alignment.