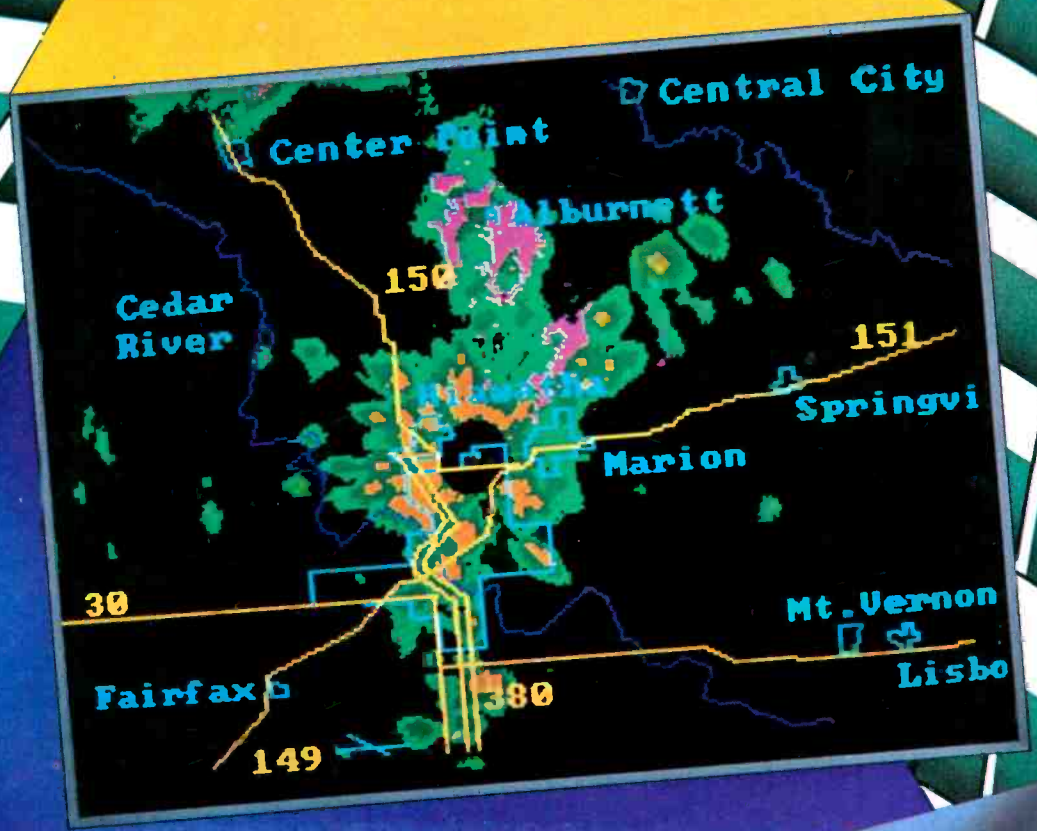
BROADCAST ENGINEERING

January 1986/$3



Inside weather radar

ENG network design

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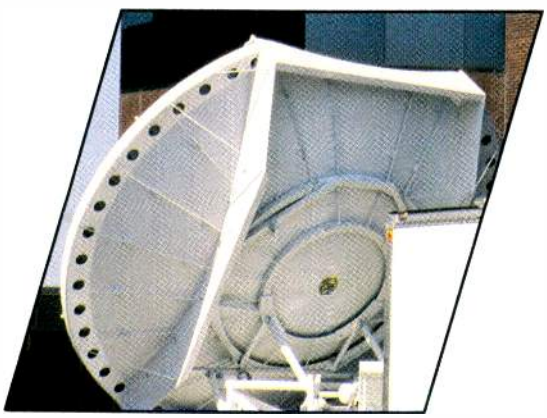
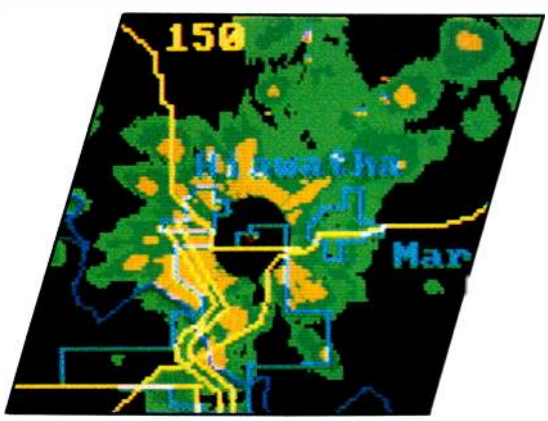
Contents

January 1986 • Volume 28 • Number 1

Page 26



Page 44



Page 80

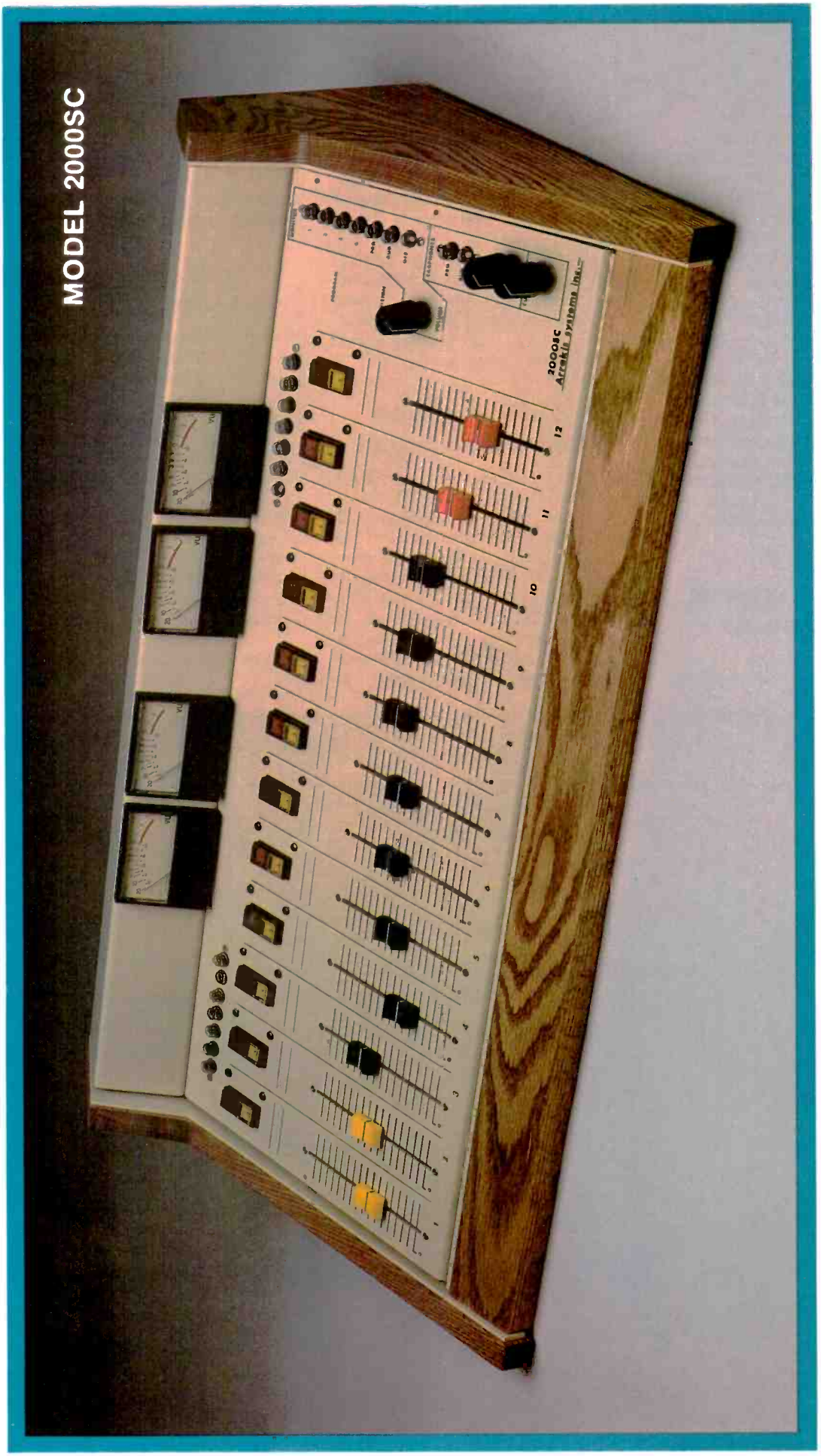
ON THE COVER
The advancement of color radar systems involves more than just color displays. The cover photograph shows what were later identified as tornadic-type winds at Alburnett, IA. Doppler radar, which was used to generate the display, seems to be more accurate than other methods in identifying potentially destructive air turbulence. (Photo courtesy of Rockwell International/Collins Avionics. Illustration by Todd Meyers, graphic designer.)

BROADCAST engineering

ENG/RENG SPECIAL REPORT:
The news operation of a radio or TV station has always been an important part of a station's image in the community that it serves, but never has it been more important than it is today. A key aspect of any successful news operation is the capability to go into the field for taped and live reports. We examine these requirements and the solutions that new technologies have to offer, in this issue.

OTHER FEATURES

DEPARTMENTS



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News

CCIR approves DTTR

CCIR working groups have unanimously approved a recommendation for a component digital TV tape recording format (DTTR) for worldwide TV program exchange. The agreement completes the final step in the technical review process prior to consideration of various proposed world industry standards at the CCIR Plenary Assembly, which will be in May in Dubrovnik, Yugoslavia.

The DTTR proposal resulted from close cooperation between the CCIR and the European Broadcasting Union (EBU). Approval of the format is another step toward establishing standards for an all-digital TV studio. The first step came four years ago with a component digital video encoding standard, CCIR recommendation 601. These standards are significant, because they represent agreement among manufacturers and broadcasters from around the world toward equipment commonality.

Report brings request for RF standards

The NAB has requested the FCC to reconsider its decision not to adopt interim standards for RF lighting devices. Without the reconsideration, RF lighting devices will be free of limitations on radiated emissions in the AM spectrum.

The NAB request is based upon a report from the AM improvement subcommittee indicating that emissions from RF fluorescent lamps and similar lighting equipment constitute a major source of potential interference for AM broadcasters. Copies of the report, prepared as a part of the NAB's ongoing effort to improve the AM radio service, are available from the NAB Department of Science and Technology Call 202-429-5346 to request a copy.

NAB offers stereo recommendations

EIA/NAB recommended practices for transmission of multichannel TV sound have been published and provided to all NAB member TV stations. Copies of the publication also may be obtained by contacting the EIA Consumer Product Engineering Department, 2001 I Street, NW, Washington, DC 20036. Questions or comments regarding the information should be directed to the NAB Department of Science and Technology at 202-429-5346.

The recommended practices are directed toward manufacturers of broadcast and consumer multichannel TV sound equipment. Broadcasters will find useful information for evaluating stereo and SAP channel performance and overall system operation and for testing of the companding process.

TV tech demos might get their attention

The Association of Maximum Service Telecasters (MST) and the National Association of Broadcasters (NAB) are considering sponsorship of a series of demonstrations of advanced TV systems. Highlighted in the program would be terrestrial performance of such innovations as improved NTSC, enhanced 525-line scan and HDTV systems.

Both associations hope to bring potential improvements in TV service to the attention of the public, the U.S. Congress and the FCC. In the process, the needs of local broadcasters will be demonstrated to broadcast equipment manufacturers.

In announcing plans for the demonstrations, both MST and NAB indicated

Continued on page 117

BROADCAST ENGINEERING

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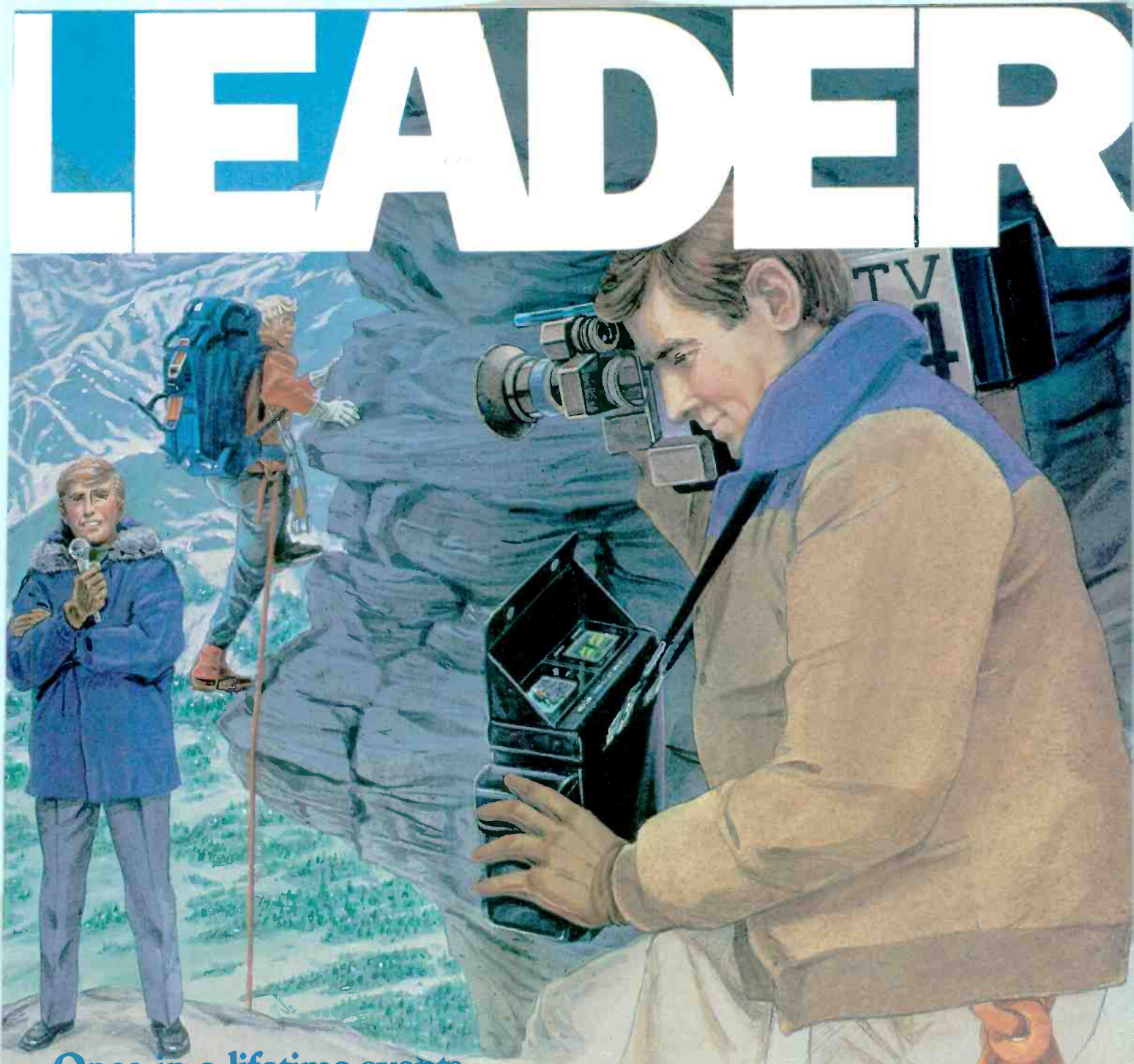

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Fighting city hall

You've heard it a hundred times. *You can't fight City Hall.* Right? Fighting a firmly entrenched organization is like punching a big marshmallow. Even if you make a minor indentation, after a time it reverts to its normal state.

Until recently, arguing with the NAB about the problems with the exhibit portion of the association's annual convention resembled the classic City Hall fight. Requests for change, redress of grievances and answers to questions were rarely seen actions from the St. Louis convention staff, which manages the exhibit portion. Now, however, things are at least *beginning* to change. Manufacturers that exhibit at the NAB have banded together to test that old theory about fighting City Hall.

This magazine hasn't made any secret about its concern regarding the planning and execution of the exhibits. In an editorial ("Organized Confusion," June 1985), we took the association to task for the problems at the 1985 show, and the many complaints exhibiting manufacturers loudly voiced. We were concerned about the show management's lack of responsiveness to the needs of exhibitors. After all, it is the manufacturers that make the NAB convention what it is today: the greatest broadcast equipment show on earth. But in our view, planning for past conventions has—in some instances—resembled only a 3-ring circus.

But wait, there is hope. And interestingly, the hope is coming not from within the NAB, but from the equipment exhibitors who have suffered with the show's problems long enough.

The NAB, in response to a storm of complaints during and after last year's convention in Las Vegas, set up an exhibitor's advisory committee to seek input from exhibitors and provide suggestions on ways to improve this year's convention. Many exhibitors are worried, and rightly so. We will leave the predictability and comfort of Las Vegas for another try at Dallas.

Planning for the NAB convention should be more than just a passing interest to attendees. Sentiment among some manufacturers is running so high that an alarming number of large, well-established exhibitors are talking about the possibility of starting an "alternative NAB" for those who have had enough of the mess. Manufacturers have realized that only through an organized effort can they effect any substantive changes in the planning process. Broadcast equipment users should, likewise, recognize the importance of a well-run convention to their industry in general, and their stations in particular.

We should note that the NAB convention is not, in the final analysis, designed to benefit exhibitors. Its primary goal is to serve the members of the association—7,800 or so radio and 1,100 TV stations. We believe, however, that the interests of these groups are not mutually exclusive. The needs of both can—and should—be satisfied.

The NAB Exhibitors Advisory Committee held its first official meeting in August. At that time, NAB representatives assured the committee of a commitment to "a cooperative spirit on issues of mutual concern." The committee's purpose is to represent the views of all exhibitors as a group to the NAB. The committee will not be an advocate in cases in which an individual exhibitor is having a problem. Instead, the committee is intended to address issues that affect many or all exhibitors. This is an excellent charter, and we commend the NAB for its foresight. Now, we ask that the committee's recommendations be given careful consideration.

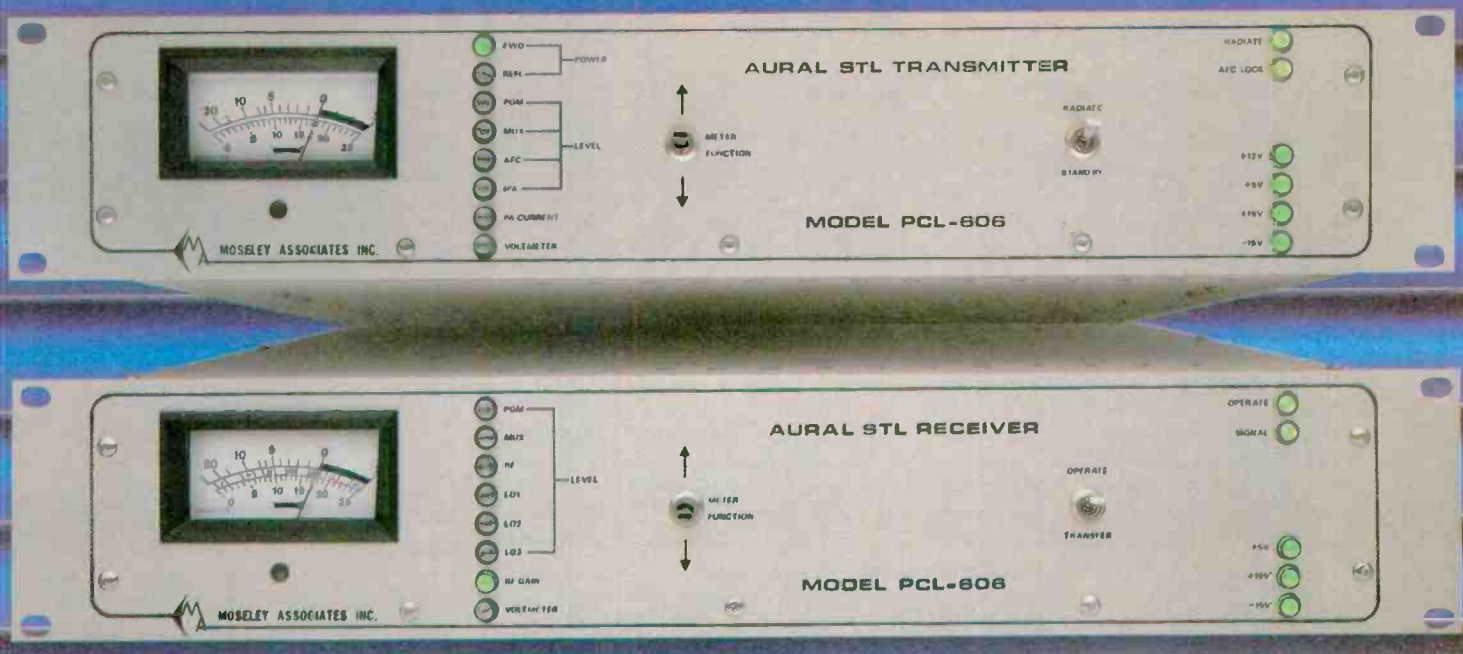
At its first meeting, the advisory committee presented a number of common sense suggestions that exhibitors and attendees alike could support. These suggestions included:

- Placing larger exhibits (more than 3,000 sq. ft.) throughout the hall to enhance traffic flow to all booths, instead of clustering them near the main entrance.
- Implementation of a uniform, equitable and understandable method of assigning booth space.
- Reducing booth space equally among all exhibitors if space limitations are a problem in Dallas (a foregone conclusion).

Makes sense, doesn't it? The committee's recommendations, however, are just that: *recommendations.* The panel cannot *require* that NAB adopt any of its proposals.

We urge the NAB to carefully consider *all* of the committee's recommendations as a package and not as a group of individual ideas. The association cannot pick and choose the recommendations that it wants to implement, and then say that it has followed the group's suggestions.

The convention is a major source of funding for the NAB. The association should, therefore, be sensitive to the recommendations of the people who pay the bills. We are encouraged by NAB's initial support. We hope that it will continue. Looking for ways to improve the convention should not resemble a City Hall fight.



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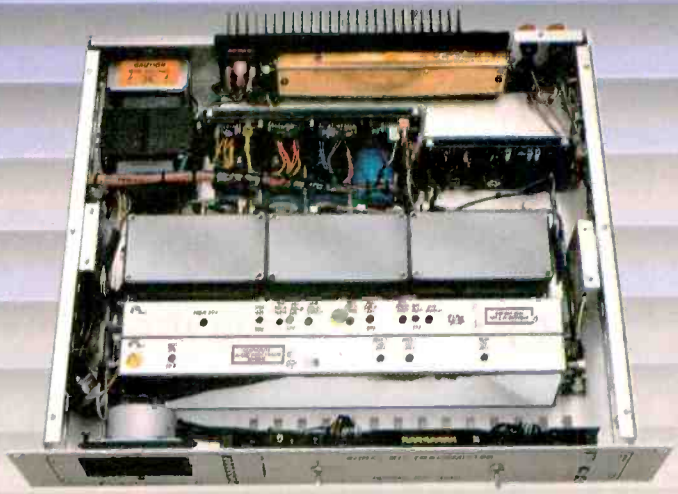

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Must-carry rules revisited

By Harry C. Martin

In mid-November the FCC initiated an inquiry and rulemaking proceeding looking toward the development of a cable TV must-carry rule that would meet First Amendment muster and provide a reasonable formula under which local broadcast stations would be required to be carried on cable TV systems.

In July the U.S. Court of Appeals for the DC Circuit had ruled that the commission's previous must-carry rules violated cable operators' First Amendment rights. The court did not go so far as to find that *any* version of such rules would be unconstitutional, however. Since July, TV industry representatives have pressed the commission to take a new look at the issue.

The commission announced that it would consider the communications policy implications of cable's "compulsory" copyright license. The broadcasters' argument is that it is unfair to permit cable operators to carry local stations' programming at a minimal fee, which the compulsory license permits, when such carriage is strictly voluntary. The Association of Independent Television Stations has advocated the adoption of a new must-carry rule that would require cable operators who wish to benefit from the compulsory license to carry all local signals. Systems that prefer to avoid the must-carry obligations would have to bargain with individual stations for program carriage rights.

Relatedly, the commission closed several pending proceedings that addressed issues such as the carriage obligations of "saturated" cable systems and the carriage of "significantly viewed" signals. Other proceedings, dealing with mandatory carriage of TV stereo, teletext and data transmission on the vertical blanking interval, were incorporated into the new proceeding.

Non-technical AM acceptance criteria eliminated

The commission has amended Section 73.37(e) of the rules, which sets forth eligibility requirements for AM proposals, by deleting the following non-technical acceptance criteria:

- At least 25% of the area or population to be served has neither AM nor FM primary service.
- The principal community to be served has fewer than two authorized local services and no FM channel is available.
- At least 20% of the area or population of the principal community receives fewer than two aural services and no FM channel is available.

Under the new rules, daytime stations technically qualified to apply for full-time authority no longer will be required to move their facilities to a suburban community with fewer than two stations. The rule change also means that large communities will be eligible for new AM facilities if interference criteria can be met. Previously, communities with two or more stations were not eligible for a new AM station except when a minority applicant asked for assignment on one of the 25 U.S. clear channels to the community.

In changing its rule, the commission noted that there no longer is any need for rules that discriminate in favor of unserved or underserved areas. To the extent there has been demand for new AM stations in such areas, there has been ample time for such services to develop.

The new rule was scheduled to become effective in mid-December.

Field-strength measurement standards relaxed

Effective Jan. 1, directional AM stations were no longer required to make annual partial or skeleton proofs of performance. Instead, directional AMs are required to make periodic partial proofs according to the schedule they deem most appropriate to ensure compliance with their authorizations.

The commission also modified the requirement that directional AM stations without approved sampling systems take measurements at their monitoring points on a weekly (or monthly) schedule. Instead, monitoring point measurements for affected stations are required on a quarterly basis.

In a related move, the commission eliminated its specifications for the design and installation of antenna monitor sampling systems for directional AM stations. In the future, the commission will approve any sampling system that the licensee's stability analysis shows is capable of providing accurate signals to the antenna monitor. The Mass Media Bureau will issue a policy statement containing the general criteria upon which sampling systems will be approved.

Auxiliary spectrum allocation rules modified

The following changes have been made to Part 74 of the commission's rules governing the allocation and use of frequencies for STL and intercity relay stations (aural and television) and for TV pickup stations:

- The aural STL/ICR 950MHz band has been divided into 25MHz *stackable* segments and the 1,990-2,110MHz and 6,875-7,125MHz TV pickup bands have been divided into 1MHz stackable segments. These changes are designed to provide channel bandwidth flexibility.
- The commission established 300kHz as the narrowband criterion for FM stations, 200kHz as the narrowband criterion for AM stations and retained the 500kHz limit as the wideband criterion. Stations licensed as narrowband will be allowed to lease excess capacity on a primary basis, whereas other wideband stations may lease excess capacity on a secondary basis subject to available spectrum.
- Emission standards have been revised to permit single sideband technologies to be licensed in the aural STL/ICR service without further FCC rulemaking.
- STL/ICR stations will be permitted to operate in the UHF TV band with secondary status to current and future TV and LPTV stations. These stations will be secondary to current land mobile authorizations.
- Specific instructions on design and implementation of remote control systems have been eliminated. The new rules require only that remote control systems be capable of controlling the broadcast transmitter.

The first two changes in the rules, involving the use of stackable spectrum segments, will not become effective until the commission has in place the computer programs it needs to process the applications.

Martin is a partner with the legal firm of Reddy, Begley & Martin, Washington, DC.

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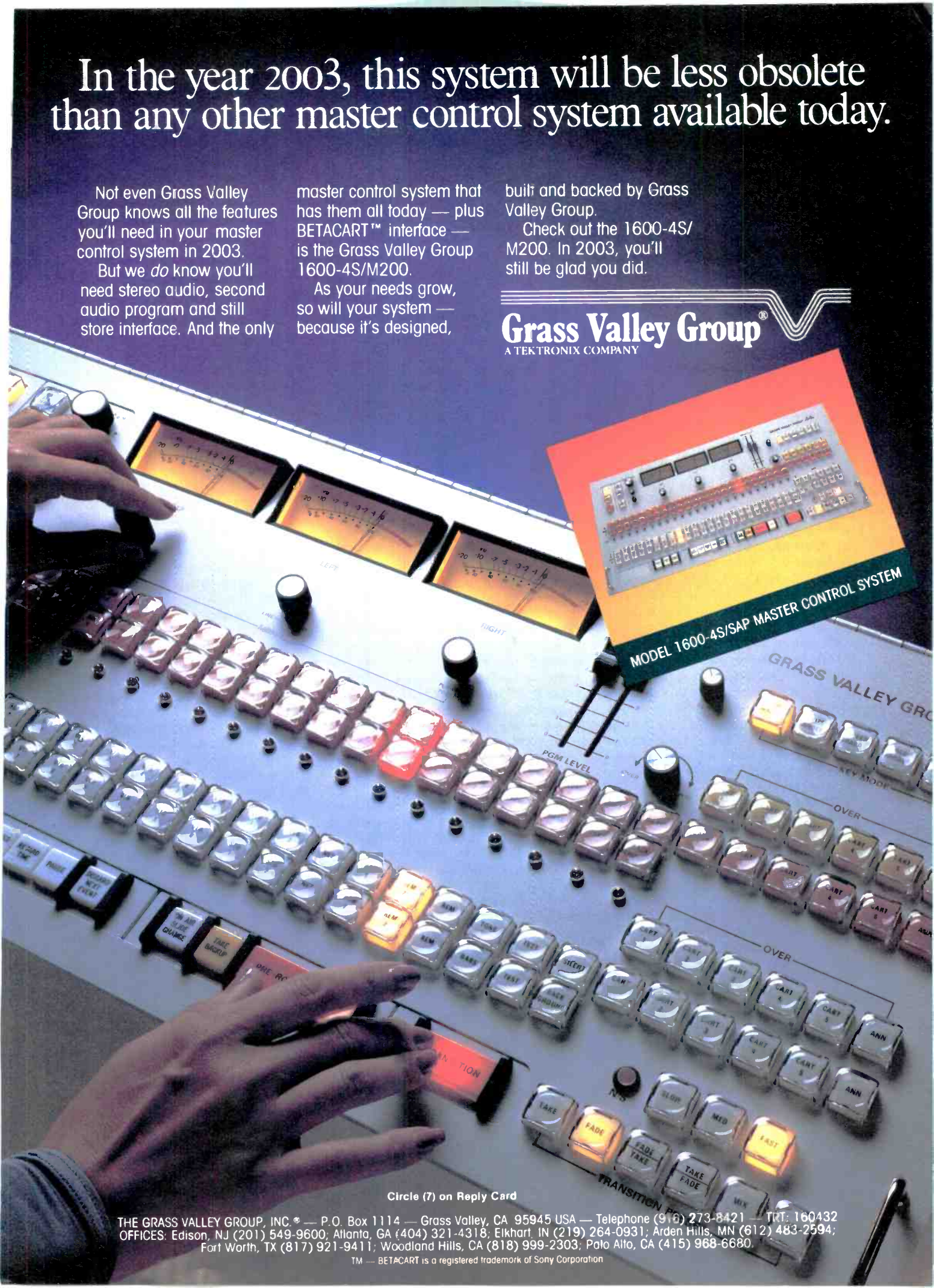

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By the book

By Carl Bentz, TV technical editor

Have you read the *book* lately? Let me rephrase that—have you *ever* read the book? You know the one: the broadcaster's bible. *Volume III, Part 73 of the FCC Rules and Regulations.* I hope you can answer yes. If you say no, perhaps you are not aware that FCC licensees and permit holders are expected to understand the rules pertaining to the radio or TV service in which they are employed. Ignorance of the rules cannot be used as an excuse when an FCC inspection visit finds conditions of non-compliance.

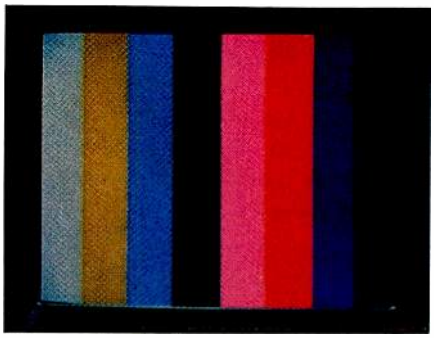
Part of the reason the rules are difficult to understand is that they are in a state of flux. In response to requests of broadcasters, the commission has attempted over the past several years to simplify the rule book. A major, ongoing review of the rules continues to bring quarterly change information. Known as deregulation (or is it reregulation?), the rule changes have touched many segments of the broadcast industry.

Some of the changes are long overdue. Others, broadcasters will find, place the burden of regulation onto the shoulders of the stations and operators. The Orwellian big brother role, in which broadcasters once saw the commission, no longer exists. In fact, the commission would prefer to let broadcasters (in conjunction with viewers) govern themselves.

This *marketplace control* concept implies that if a station does not meet the minimum operating standards, that station's viewing audience will move to other channels. To keep respectable shares of the audience, then, broadcasters must police their own activities to provide signals of the best possible technical quality. Keeping one's house in order requires that all members of the technical staff are familiar with Part 73.

In 1984, the commission published a station checklist that provides a partial list of rules applicable to television. For the next few months, "Strictly TV" will focus on the items noted in the checklist. The purpose is to promote an interest in and a better understanding of these industry guidelines. In the process, some interpretations of rules may need to be made. Readers are cautioned, however, that *all questions of rule applications should be discussed with your station's legal representatives.*

With that precaution in mind, let's turn to Part 73.



The station license

No radio signal of power greater than 100mW shall be transmitted without a license. According to rule 73.1230(a), that station license must be conspicuously displayed at the location the licensee considers to be the principal control point of the transmitter. Any other authorization documents are to be posted at that location as well.

Obviously, the meaning of *principal control point* will vary from station to station and will depend upon the mode of operation. If the transmitter is attended at all times signals are radiated, the control point would most likely be near the equipment operating control panel. For unattended, remotely operated transmitters, the license is posted at the remote control location. Similarly, if an automatic transmission system is employed, the document should be placed at the monitoring and alarm location.

In any transmission system, photocopies of the document are to appear conspicuously at all alternate control points. Failure to properly post the station license may result in citations and fines. A bit of overkill in license display, therefore, is usually a good idea.

Documents involving alternate transmitters and antennas, STL equipment and other auxiliary broadcast systems must also be properly displayed. For simplicity, post a copy of the appropriate license *wherever* RF-generating equipment is *located, controlled or monitored.*

Copies of all instruments of authorization should also be placed in the station's files for reference.

Operator licenses

The subject of operator licenses is clearly stated in 73.1230(b). All operator licenses must be permanently displayed at the operator's duty location. The location, again, is determined by the station's mode of operation. The transmitter, extension meter location, remote control point or automatic transmission system monitoring and alarm point are noted as possible display sites. Because an operator's duty location could change from day to day, no complaint would be made if photocopies were posted at all primary locations.

Operators who serve more than one station must be able to show their licenses upon request. Photocopies are sufficient and should be provided to all other stations for which they work.

Properly licensed operators

Rule 73.1230(b) indicates that all operators must have licenses or operator permits. Part 73.1860(a), however, clarifies the operator requirement. Whenever the station is transmitting, the person who is on transmitter duty and in charge of monitoring and adjusting transmitting equipment must hold a commercial radio operator license or permit.

The transmitter duty operator may be assigned other duties, if they do not interfere with proper operation of the transmitting system. For example, performance of program switching or other related duties may be assigned to the operator. However, the responsibility of transmitter monitoring and control may not be delegated to an unlicensed individual who is assigned to other duties at the control point. Unlicensed personnel *may not* operate the station legally, no matter how well versed they may be about transmitting equipment.

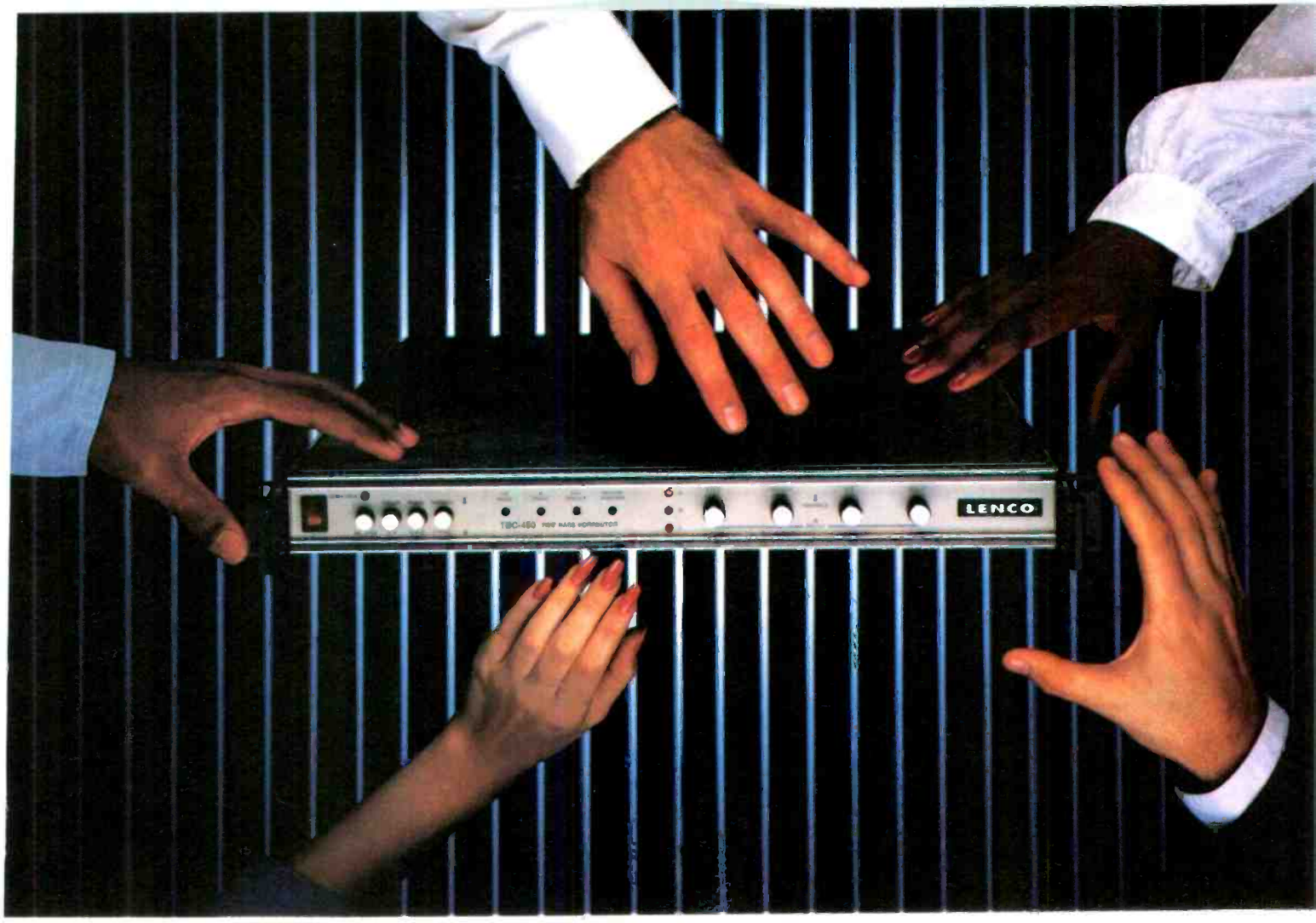
Chief operator

A member of the technical staff should be designated as *chief operator* by the station license holder. A written copy of the designation must be posted with the individual's operator license.

This individual oversees all activities involving the transmission equipment. Such activities include inspections and calibration of metering, monitoring and control systems and repair or adjustment of all associated equipment.

The chief operator, either in a supervisory capacity or as an active participant, is ultimately responsible for the correct operation of the equipment according to the station license. Additional duties include reviewing of station records on a weekly basis to determine that entries are correctly made. When the review is completed, the records must be signed and dated.

The chief operator is not required to be present at all times, but should be available on call.



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Circle (8) on Reply Card

It's not too late to winterize

By John Battison, P.E.

Winter means trouble for broadcast equipment. In many areas, the cold temperatures, wind, snow and freezing rain place unusual stress on antennas, towers and other outside broadcast components. The careful engineer should have already prepared the broadcast plant for winter. However, if you have let this task slip by, it's not too late to attend to some of these important areas.

Painting

It is too late for painting towers in most parts of the country. If your tower needs painting, you will probably have to wait until spring. It is not too early though to begin thinking about who you'll want to paint your tower.

When looking for a tower painter, ask for references. When you call those references, ask for additional references. This technique may uncover someone who has reason to be less than satisfied with the tower painter's work.

Ask about the quality of the workmanship. Did the painter perform the work properly and complete it on time? More importantly, would the reference hire the painter again? Because tower painting is costly, spend some time looking into the background of the company.

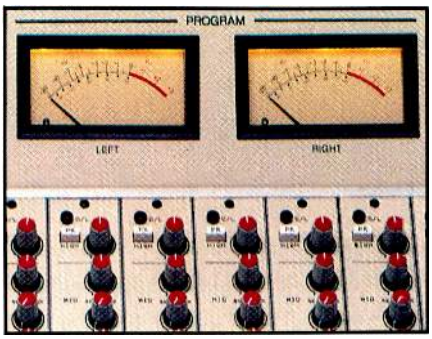
AM towers

If you plan on having any AM tower work done, first measure the base impedance. After the work is completed, again measure the base impedance. If you have a ¼-wave matching stub feeding an FM antenna, a careless climber can cause intermittent connections that result in changing base impedances. Recording the change in the tower base impedance will help you identify any damage that may have taken place.

If you are using a folded unipole antenna, make sure that every climber checks the bonding between the transmission line and the tower. On these systems, it is imperative that all of the conduit and transmission lines are properly bonded to the tower.

Base insulators on series-fed towers are potential sources of trouble. Modern insulators are less apt to absorb water and produce an RF short than older types.

Battison, BE's consultant on antennas and radiation, owns a radio engineering consulting company in Columbus, OH.



Older insulators should be carefully inspected for cracks or dirt that could collect water and cause a short. Be sure the weep hole is dirt-free because if water collects inside, it can freeze and break the insulator.

Guy wires

Perhaps no part of a tower is more important to its safe operation than guy wires. Most towers have several guy wires. However, the loss of just one can collapse a tower. Check the guy wires for proper tension at least once a year. You may want to rely on a qualified tower contractor to check the tension.

Be sure no guy wire insulators are cracked. Stations in rural areas sometimes find that insulators are hunters' favorite targets. Many times a tower will remain standing even if one insulator is broken. Immediately replace broken insulators. Also, a missing or cracked insulator can affect the impedance of an AM tower. Base current measurements and careful visual inspection will help identify these problems.

Anchor points

Inspect every anchor point. Remove any growth or underbrush, which often hides potential problems. Check the anchor rod at the point at which it enters the concrete. This is a common place for rust to develop. If the rod is free from rust, coat it with a protective material to extend its life. If the rod shows any significant sign of deterioration, have it inspected by an expert.

All turnbuckles should be clean and free from rust. The turnbuckles should have some form of locking wire. This short piece of guy cable runs through the turnbuckle and eyelet and prevents it from turning. The threads on the turnbuckle are often painted to help indicate any movement or rotation.

Lightning gap

The lightning gap is often neglected. Because it makes a convenient footstep when climbing the tower, it may not be set correctly. Your station maintenance records should tell you what the gap spacing should be. If you don't know, experimentation is the only alternative.

Set the gap at about one-half inch. Turn on the transmitter with no modulation. If no spark develops, move the gap in until the transmitter trips. Then, move the gap back out to about twice the gap distance. Again turn on the transmitter and apply 100% modulation. If the transmitter trips, open the gap until with 100% modulation (125% if your format requires it) the gap does not ionize.

Antenna components

Antenna tuning units (ATUs) should be cleaned several times a year. Fall is a good time to remove any accumulation of wasps or bird or rodent nests from the ATU. Mark all of the coil taps with a permanent marker before you loosen any clamps. Then remove the clamps and clean all of the contacting surfaces. Tighten the clamps and all connections in the ATU. Clean all surfaces, paying special attention to capacitors. Any moisture clinging to the surface of a capacitor can detune the antenna system. Check the base current meter switch contacts. They should be smooth and free from corrosion. Be sure the labeling on all the ATU components is legible. A few minutes spent sprucing up the ATU will not only help the components last longer, but will help prevent unnecessary repairs and lost air time.

The antenna phasor is usually ignored until something goes wrong. Now is a good time to clean it out. Check all coil taps for secure fittings. The capacitors can be checked for heating if the outside temperature is not too low.

The station's ground system is seldom inspected. Winter temperatures and moisture can force radials and ground strap to the surface. The cold weather usually prevents any major overhaul on the ground system, but you can check for broken radials or copper strap. Any loose or broken elements should be brazed or silver-soldered back to the main ground system. If major problems are suspected, plan now for complete repair as soon as spring arrives.

No one likes to repair outside broadcast equipment during the winter. The best way to prevent having to work in the cold is to practice preventive maintenance. If you suspect there may be weak elements in your broadcast plant, attend to them. |:(:-)))|

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Circle (9) on Reply Card

Linking up to SNG

By Elmer Smalling III

Satellite news gathering (SNG) has become a reality within the past couple of years for a variety of users. Some of the reasons for the rapid growth in this application of technology include:

- the high cost of microwave systems;
- the unavailability of microwave frequencies in many areas;
- the wide area coverage that satellite transmission provides;
- the portability of satellite uplink and downlink equipment; and
- the relatively low cost of transponder time.

All three major networks are planning C- and/or Ku-band SNG system start-ups in 1986. Many independent station groups have already formed or are forming specialized or regional networks.

Any station that subscribes to an SNG network covering a given part of the country can usually downlink more than enough stories of regional interest to fill the evening newscast. Many SNG participants have their own stationary or mobile uplinks and all have downlink sets to the transponder used by the SNG net. News is passed back and forth daily, along with sports, general programming and commercials. A large broadcasting entity may have its own SNG system, intended for feeding only its station from mobile uplinks that roam about its entire service area gathering news and sports material.

In the past, many stations relied on their network feeds for ancillary programming, specials and news. Membership in an SNG network provides a greater diversity of programming at low cost to the participant. Often, payment for participation can be made by sharing feeds with other members so that the only cost of operation is hardware purchase and support.

There are a number of points to consider when planning an SNG system:

Licenses

You will need an FCC permit for each portable uplink based at your station. Forms can be obtained from the commission that request standard technical and fiscal information. You must decide whether the system is to be licensed for private or common carrier. You should discuss any ramifications and/or limitations that either selection entails.

Your FCC attorney (as well as the station engineer) should examine and complete these forms. The wait for action on your permanent uplink transmission permit depends upon the commission's backlog of requests. An STA (special temporary authorization) may be issued if use of the system is necessary prior to receiving the license.

There are minor limitations for operation of Ku-band systems. Some interference has been considered possible with U.S. Air Force equipment in the 14.4GHz and 14.5GHz band. That problem is scheduled to be resolved in 1986.

Frequency and allocation

SNG may be accomplished on two frequency bands—the low-frequency C-band (3.7GHz to 4.2GHz) or the high-frequency Ku-band (11GHz to 12GHz). The C-band, currently used by almost every broadcaster, was the first authorized commercial satellite communications frequency group.

Because the C-band frequency is low (in the microwave sense), a rather large antenna is required for receiving with an even larger-diameter unit required for transmission. Large antennas are not a major problem at a permanent installation, but they become unwieldy when used as truckborne mobile units.

Almost every TV station and cable headend in the country (as well as many hotels, conference centers, corporate headquarters and residential back yards) have C-band installations, providing a mass audience for many transmissions. This fact may or may not be important to a potential uplinker.

At this writing, the higher Ku-band is little used, yet it is well suited for SNG work. It requires a substantially smaller antenna than C-band and is free from the many potential sources of terrestrial interference to which C-band is prone, such as common carrier microwave and radar. A Ku-band antenna can be mounted on a truck without having to fold up for transit each time it is moved. Many existing C-band receive antennas can be used for both C- and Ku-band if they are constructed properly.

No rain check

One major drawback of the Ku-band is its susceptibility to signal attenuation due to rain. A heavy rainstorm can obliterate a marginal Ku-band signal at times. However, a 99% effective remedy for rain fading is a higher-than-normal power uplink and a larger-than-normal receive dish. Both are easier and less costly to implement at Ku-band frequencies than at C-band. If you are planning to join an existing SNG network, current members can help you with equipment and frequency selection.

Buying time

If you're planning a satellite distribution system, you have two approaches to buying satellite transponder time. You can call the owner or representative of each satellite and search for the best deal, or you can call a satellite time broker, who will find the best price and satellite location for you. Before you make any calls, however, it is important that you decide on the length and time of your daily usage. The cost for satellite time depends upon the time of day and the length of usage. Once you sign a contract to use the same transponder regularly, you can advertise your location to all potential receive stations.

Choosing equipment

There are two basic methods of satellite news gathering. One method is transmitting on a permanent uplink at the station; the other employs a mobile uplink. The first method is the easiest way to get started in SNG operation with the least capital outlay.

A permanent uplink consists of an exciter, HPA (high-power amplifier), transmission line and antenna. A mobile uplink includes all of these items, in addition to a vehicle, generator and equipment housing. A mobile uplink often requires additional station personnel.

Next month we'll look at the current uplink equipment options and the types of transponders available on present and future satellites. |:-)))|

Smalling, **BE**'s consultant on cable/satellite systems, is president of Jenel Systems and Design, Dallas.

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Part 3

Circuits

Thyristor servo systems

By Jerry Whitaker, editor

There are several possible approaches to thyristor power control in a 3-phase ac system. The circuit shown in Figure 1 consists of essentially three independent —but interlocked—single-phase thyristor controllers. This circuit is probably the most common configuration found in broadcast equipment.

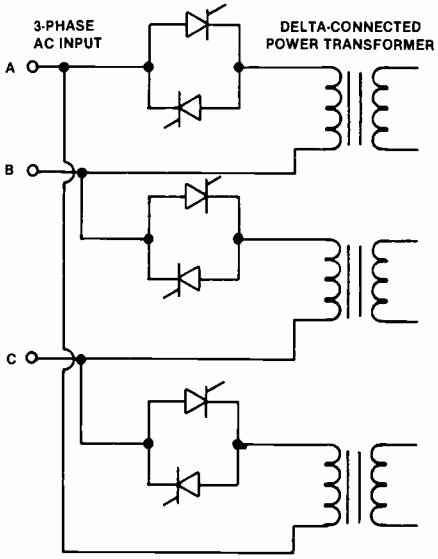
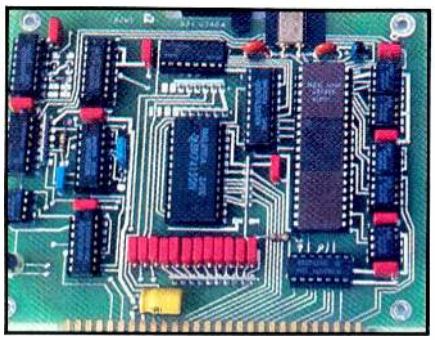


Figure 1. *Modified full-thyristor 3-phase ac control of an inductive delta load.*

In a typical application, the thyristor pairs feed a power transformer with multitap primary windings, thereby giving the user an adjustment range to compensate for variations in utility company line voltages from one location to another. Select the appropriate transformer taps, keeping in mind the recommendations of the transmitter manufacturer.

A common procedure specifies selection of transformer tap positions that yield an RF power output of 105% when typical utility company line voltages are present. The thyristor power control system is then used to reduce the angle of conduction of the SCR pairs as necessary to cause a reduction in line voltage to the power transformer to give 100% RF power output from the transmitter. A servo loop from an RF sample probe in the transmission line is used to automatically compensate for line-voltage variations.

With such an arrangement, the thyristors are kept within a reasonable degree of retarded phase operation. Line voltages will be allowed to sag 5% or so without affecting the dc high-voltage supply and, therefore, RF output power. Utility supply voltage excursions above typical values will simply result in triggering of the SCR pairs at greater phase delays.



Triggering circuits

A critical element in thyristor control of a 3-phase power supply involves accurate, synchronized triggering of the gate pulses. The gate signal must be properly synchronized with the phase of the ac line that it is controlling. The pulse must also properly match the phase angle delay of the gates of the other thyristors in the power control system. Lack of proper synchronization of gate pulse signals between thyristor pairs can result in improper current sharing (*current hogging*) among individual legs of the 3-phase supply.

A loss of synchronization between gate pulse signals feeding a common thyristor pair, on the other hand, can cause a resultant dc current to flow through the affected transformer primary winding. Depending on the extent of mismatch caused by either effect, transformer overheating or component failure may result.

The gate circuit, therefore, must be protected against electrical disturbances that could make proper operation of the power control system difficult or unreliable. Electrical isolation of the gate is a common approach. Standard practice calls for the use of gate pulse transformers in thyristor servo system gating cards. Pulse transformers are ferrite-cored devices with a single primary winding and (usually) multiple secondary windings that feed—or at least control—the individual gates of a back-to-back thyristor pair. (See Figure 2.) Newer thyristor designs may use optocouplers (primarily for low-power systems) to achieve the necessary electrical isolation between the trigger circuit and the gate.

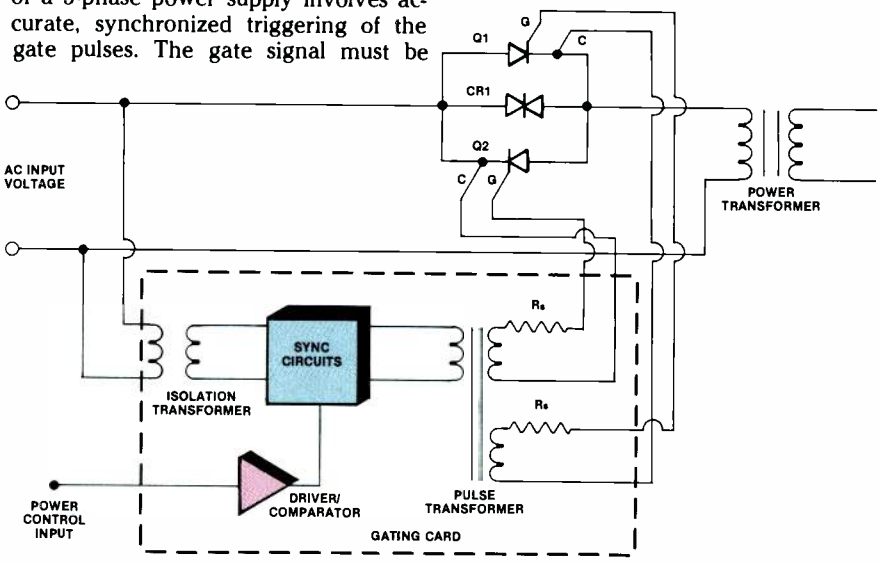
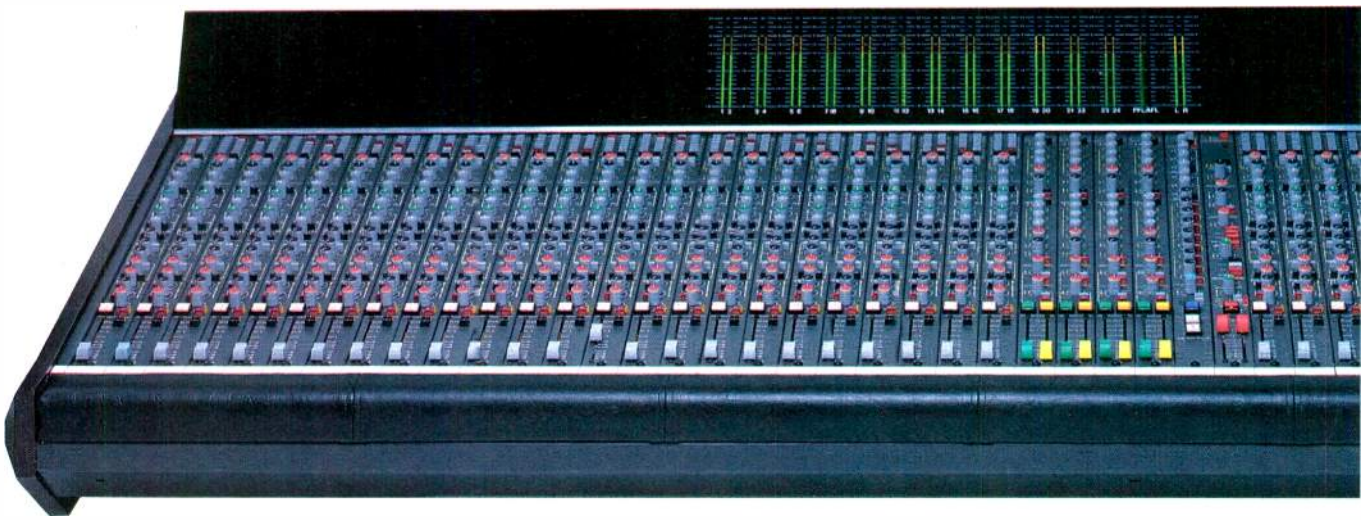


Figure 2. *A simplified block diagram of the gating circuit for a phase control system using back-to-back SCRs.*

It is common to find the leads connecting the gate and cathode of a thyristor pair to the gating card twisted to provide a degree of immunity to high-energy pulses that might inadvertently trigger the thyristor gate. The gate circuit must be designed and configured carefully to reduce inductive and capacitive coupling that might occur between power and control circuits. Because of the high *di/dt* conditions commonly found in thyristor-controlled power circuits, power wiring and control (gate) wiring must be separated physically as much as possible. Shielding of gating cards in metal card cages is advisable. |:-)))|

What's in a name?



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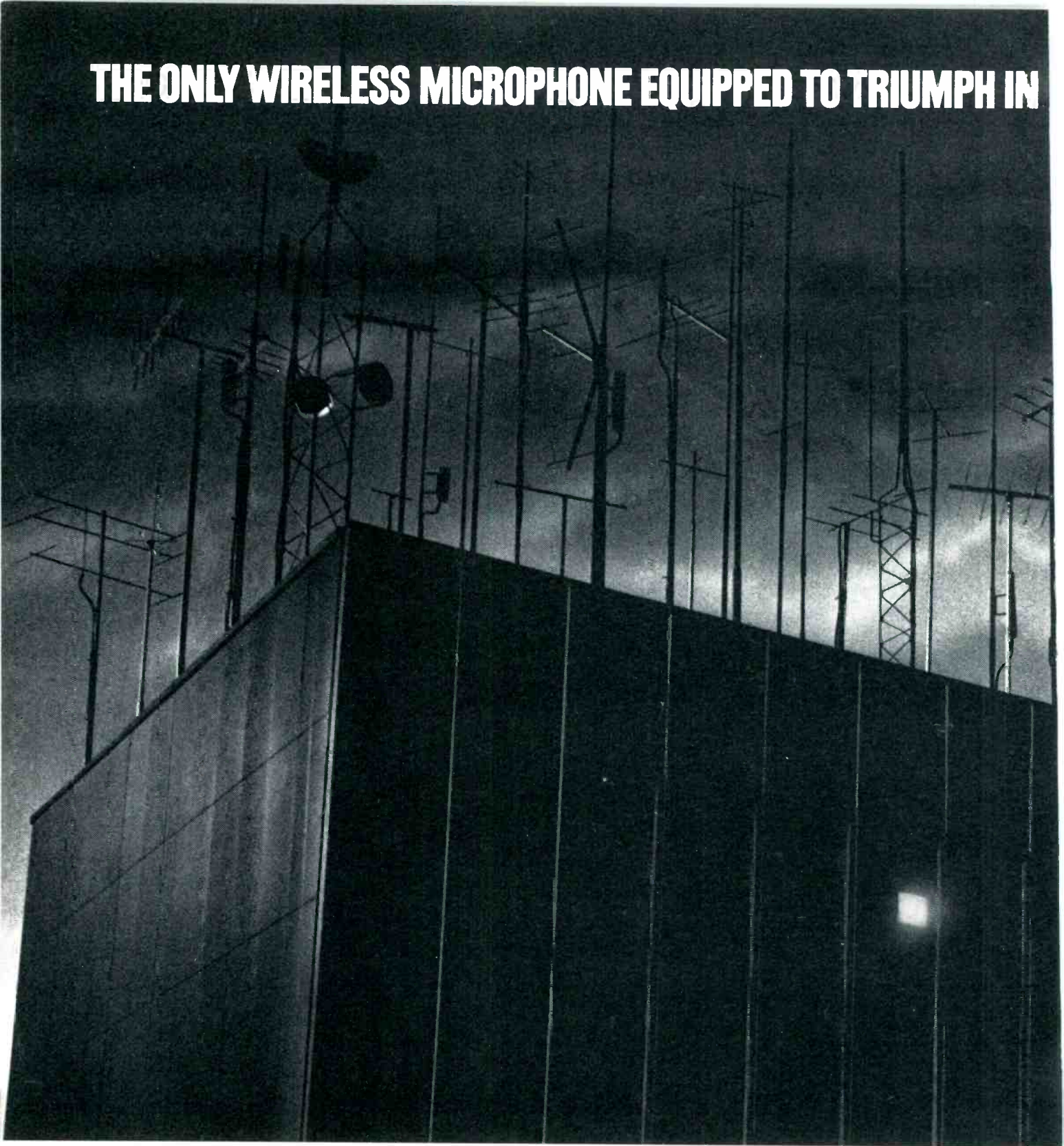


The airwaves are bursting with interference. TV broadcasts, police emergency calls, taxi dispatches, even other wireless microphones.

All of which can make a performer look bad, and an engineer look worse. But fortunately, Sony has created an effective alternative to the anxiety of conventional wireless microphones. The VHF Synthesized Wireless System.

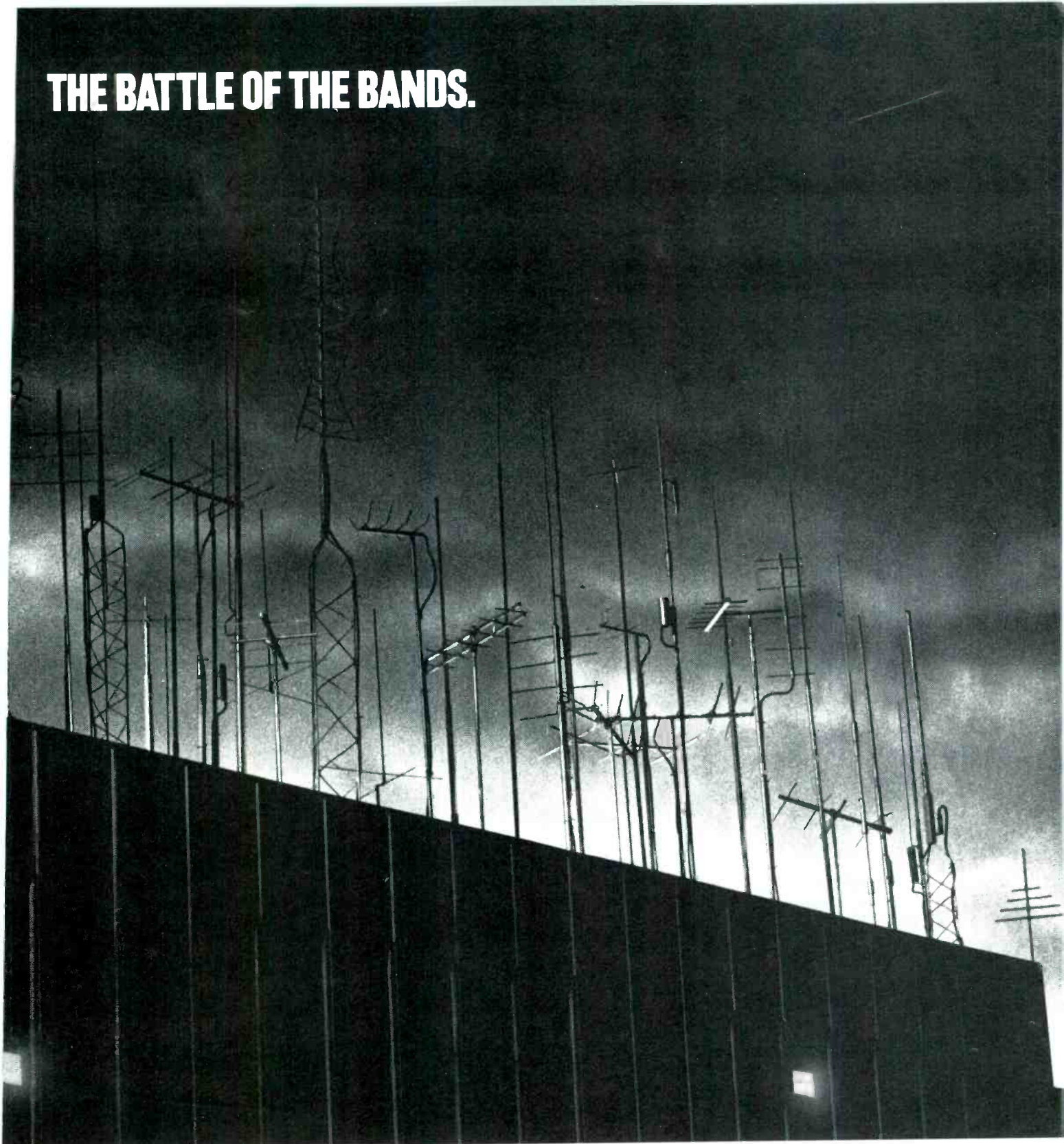
TUNE YOUR WAY OUT OF A JAM.

Other wireless microphones are pre-tuned to just one channel. Each electronically synthesized Sony VHF wireless microphone, on the other hand, gives you 48 channels—48 opportunities to get on the air without interference. With a mere push of a button.

In fact, with as few as 4 Sony wireless microphones and a tuner, you can reach 168 microphone channels. And the Sony Wireless System makes it possible to use up to 13 microphones in the same place at the same time. Also, Sony's tuner gives you an easy-to-read LCD display. Which is an indispensable asset when you happen to be in a big hurry.

In addition, Sony's wireless microphones won't leave you wincing at poor dynamic range. Thanks to a companding technique which yields a dynamic range

THE BATTLE OF THE BANDS.



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in Part 74 subpart H of the FCC regulations and requires an appropriate license.

Circle (12) on Reply Card

Part 5

Troubleshooting

Power supply failures

By Jerry Whitaker, editor

Last month, we outlined the problems that *single-phasing* can cause for a broadcast transmitter operating from a 3-phase power source. Single-phasing means that one of the three wires (or four wires in the case of a *Y system)* from the primary ac power distribution system is lost. The failure is usually caused by a downed utility company power line or a blown fuse at the service drop transformer.

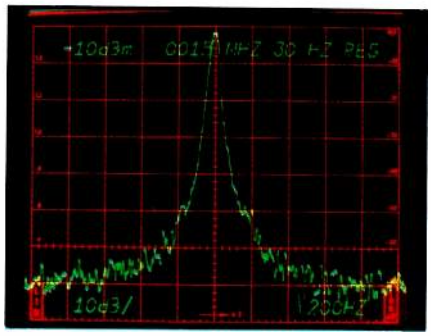
The loss of one leg of a 3-phase line rarely results in zero (or near-zero) voltages in the legs associated with the problem line. Instead, a combination of leakage currents caused by *regeneration* of the missing legs in inductive loads and the system load distribution usually results in voltages of some sort on the fault legs of the 3-phase line.

It is possible, for example, to have phase-to-phase voltages of 220V, 185V and 95V on the legs of a 3-phase, 208Vac line experiencing a single-phasing problem. These voltages often change, depending upon the equipment turned on at the transmitter site.

The loss of one leg of the 3-phase line results in a particularly dangerous situation for 3-phase motors, which overheat and sometimes fail. Common protection methods for transmitting equipment include the relay logic system shown in last month's column. Such circuits are not foolproof, however, even when series dropping resistors are placed in the relay coil leads (an improvement on the original scheme).

Positive protection

Integrated circuit technology has provided a cost-effective solution to this common design problem in medium- and high-power transmitting equipment. Phase-loss protection modules are available from at least one manufacturer.



They provide a contact closure when voltages of proper magnitude and phase are present on the monitored line. The relay contacts can be wired into the logic control ladder of the transmitter to prevent the application of primary ac power during a single-phasing condition.

Figure 1 shows the recommended connection method. Note that the input to the phase monitor module is taken from the final set of 3-phase blower motor fuses. In this way, any failure inside the transmitter that might result in a single-phasing condition is taken into account. Because 3-phase motors are most sensitive to single-phasing faults, the relay interlock is tied into the filament circuit logic ladder.

The phase-loss protector shown in Figure 1 includes a sensitivity adjustment for various nominal line voltages. The unit is small and relatively inexpensive (about $55).

Protection against single-phasing is important because it can save you significant repair bills and lost air time. I personally learned this the hard way a couple of years ago when a PA blower motor failed because of overheating caused by a blown pole-mounted utility company fuse. The transmitter was protected only with the relay ladder technique (using series resistors) discussed previously. Sufficient voltages were present on the affected legs to hold the three relays in and, therefore, to hold a *filament on* condition.

By the time an engineer got to the transmitter site (about 30 minutes), one of the windings of the PA blower motor had failed in a short circuit. Interestingly, the motor's circuit breaker did not trip until *after* the windings shorted. The moral of the story is, "Don't think it can't happen to you."

For stations with the studio and transmitter at the same location, the occurrence of single-phasing will be obvious. Instruct your operators to shut off the filaments if it happens. For stations with a remote-controlled transmitter, instruct your operators to check the primary line voltages on the remote control system before trying to restart the transmitter after an off-air situation. If the primary voltages are not within normal limits, shut off the filaments. (This assumes, of course, that remote control telemetry is returned to the studio via a TSL or wireline link.)

The future

Solid-state technology is making significant contributions to fault analysis in broadcast transmitters. The use of additional sensors in important sections of the system, and intelligent supervision by a microcomputer, promise to simplify the job of the maintenance technician in coming years.

Safety considerations

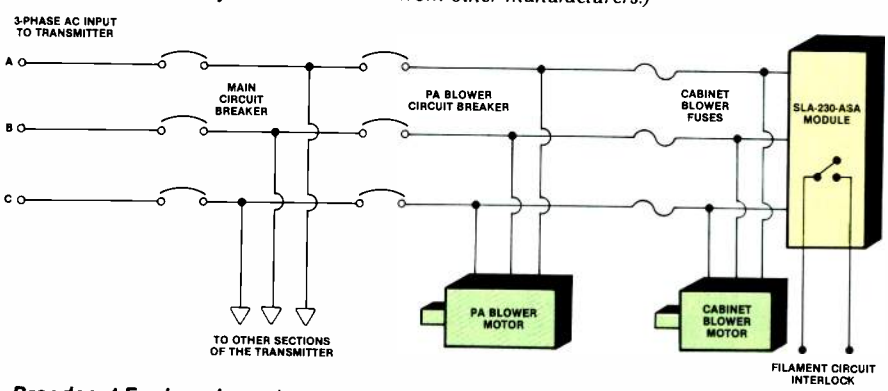
Any troubleshooting work on a transmitter should be approached with extreme caution. High voltages that exist in a transmitter can be lethal. Such work should be performed only when a second engineer is in the room.

Perform work inside the transmitter only after all ac power has been removed and after all capacitors have been discharged using the ground stick provided with the transmitter. Remove primary power from the unit by tripping the appropriate power-distribution circuit breakers in the transmitter room. Do not rely on internal contactors or SCRs to remove all dangerous ac power.

Be familiar with first aid treatment for electrical shock and burns. Always keep a first aid kit on hand at the transmitter site.

Do not defeat protective interlock circuits. Although defeating an access panel interlock switch may save work time, the consequences can be tragic.

Figure 1. *A high-performance single-phasing protection circuit using a phase-loss module as the sensor. (Note: The device shown in this diagram is a model SLA-230-ASA phase-loss protector module manufactured by Diversified Electronics of Evansville, IN. Units performing comparable functions may also be available from other manufacturers.)*



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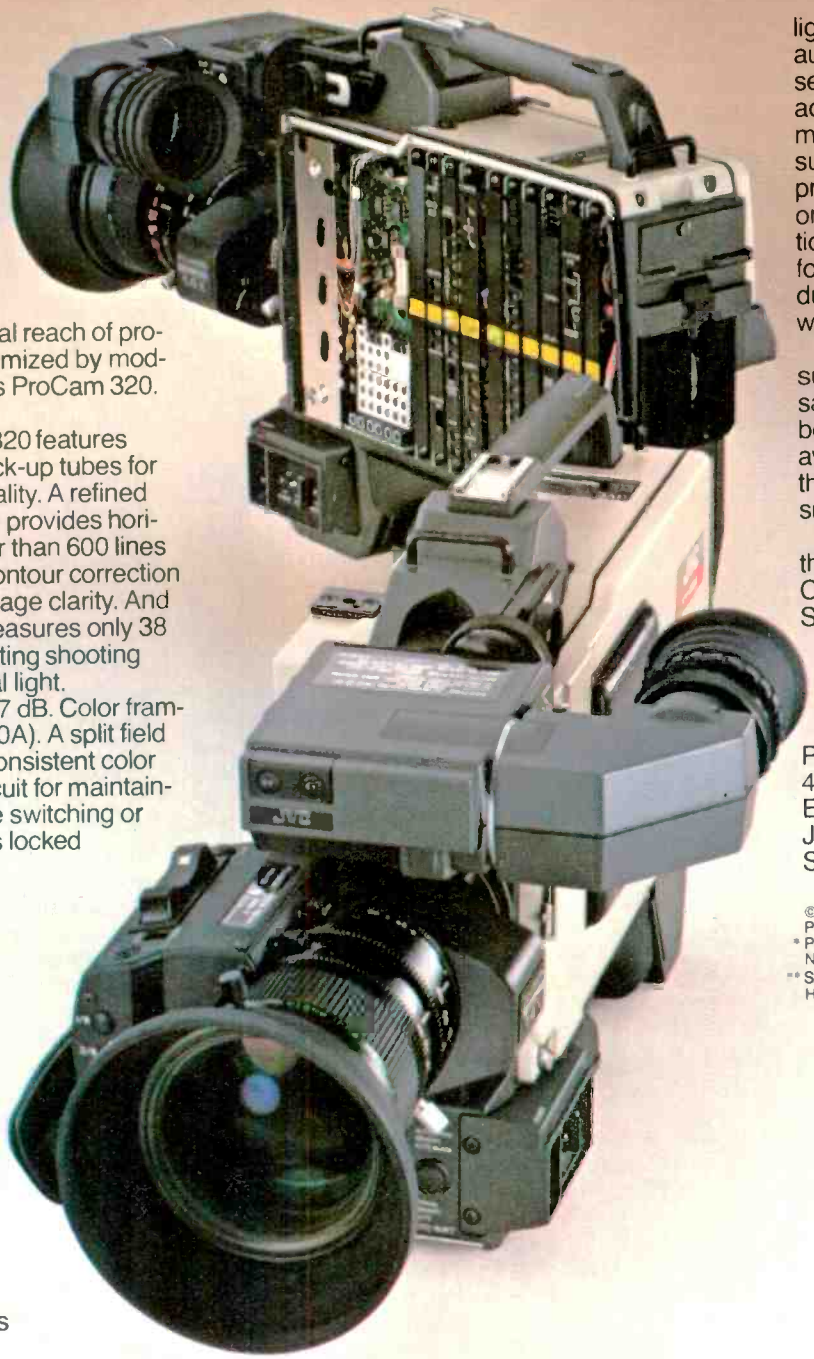

JVC's experience—and success—in designing the highest quality and reliability into compact video production cameras is unmatched. Now, continuing this tradition of high performance at an affordable price, JVC has brought a "high-end" teleproduction camera within the financial reach of production people often victimized by modest budgets. This time, it's ProCam 320.

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Management for engineers

Recognition is what it's about

By Jim Wulliman

With this issue, we begin a monthly column devoted to improving the management skills of technical personnel at radio and TV stations. The broadcast industry is changing, and engineers must move with the times. One way they can do this is to become involved in and knowledgeable about the management aspects of their stations. This column, "Management for Engineers," is devoted to that goal. We begin with a look at the certification program of the Society of Broadcast Engineers.

Recognition is what SBE certification is all about. Those of us who were around when the program was developed during the mid-1970s realized that there were a great many broadcast engineers and technicians who were making significant contributions to the broadcast industry, often without much recognition. We felt that there should be some way to recognize those who were representatives of the *real world* of broadcast engineering as contrasted to the *license mill* first-class ticket holders who were then required to read meters.

The objective of certification was to provide standards of professional competence in the practice of broadcast engineering and to recognize those who met the standards. It was the hope of the society that this would help raise the professional status of broadcast engineers at a time when the value of the first class license was being questioned.

The program has certified more than 2,900 broadcast engineers since it was introduced at the 1975 NAB convention. It has gained industrywide recognition as the best indication of experience and knowledge available to the employer when hiring technical people.

Common questions

Even though the certification program has been quite successful, there are still questions that are frequently asked at meetings and by mail, which are of general interest:

• Isn't certification just a means of increasing membership in the SBE?

No. Certification is open to everyone who meets the qualifications. The first year's membership dues for SBE are included in the initial certification fee because we believe non-members should contribute to the costs of administering the program. Naturally, we hope the applicant will continue to participate in SBE activities, but that is not a requirement for certification.

It should be pointed out that there are many people in the industry who think that to be truly qualified for certification you should already be a member of SBE, as evidence that you are a broadcast engineering professional.

• What do I get out of certification except an ego trip?

The **Broadcast Engineering** 1985 salary survey answered this question. That survey pointed out that those engineers who received the higher salaries tended to hold SBE certification. Whether every SBE-certified engineer makes more money than those who are not certified is not the issue. The issue is that the higher salaries are now being paid for technical personnel with visible skills and talents. SBE certification is an *industry-recognized* indication of ability.

• What right does SBE have to make me take another test to prove myself? I've been a broadcast engineer for years.

The certification program is entirely voluntary. No one in SBE can make you take a test if you don't want to. We hope that you will want to become certified at the level for which you are qualified by your years of experience. However, if you only want to obtain the broadcast technologist level of certification, and you have a first class license (or a general class license), you are automatically eligible—without an examination—if you meet the experience requirement.

• Why does SBE certification place more value on passing one of its exams than on experience?

It does not. In fact, you must meet either the 5- or 10-year experience requirement before you are even allowed to take the appropriate level of exam. You could, for example, have 10 years of responsible-level experience in radio, but only five years in television. In this case, you would be eligible to take the senior AM/FM exam, but only the broadcast level TV exam.

The only certification exam you can take without meeting an experience requirement is the entry level broadcast technologist exam. Even at the entry level, we try to carefully evaluate each student by having the local chapter certification committee and a faculty advisory committee review the entire record of the applicant. We also try to look at the internships or other experience that may have been obtained during the training period.

We have already set up such an evaluation process for a number of broadcast technical schools and are certifying their graduates. We believe that this is much better than simply having the students pass an exam.

• What if I fail the exam?

The SBE does not divulge the name of anyone who fails an exam for any certification level. You can use the experience to learn what areas of technology you need to review before retaking the exam. The certification committee has received some of its highest praise from those who discovered that they needed to brush up on a few subjects after they took one of the exams.

You should not fear the exams, because they are not designed to trick you into failing. In fact, we expect you to pass the exam because your application will first be reviewed by the certification committee. We only approve a level of exam that we believe your experience qualifies you to take.

Something for everyone

We think the SBE has a well-balanced program of certification that offers a specific level of qualification for everyone in the broadcast engineering profession. Whether you are an old pro with more than 20 years of experience, a technical school student just entering the field, or at any level of experience in between, the society offers a class of certification that recognizes your dedication to your chosen profession and your participation in the *maintenance of certification* program.

The certification committee welcomes your comments, questions and suggestions. We constantly try to improve the program. Write to the Certification Secretary, SBE, P.O. Box 50844, Indianapolis, IN 46250. The telephone number is 317-842-0836. When you contact the SBE, request the free booklet that describes the certification program. Application forms and complete instructions will be provided with each request.

Wulliman is manager of engineering for WTMJ-TV, Milwaukee, and is chairman of the SBE certification committee.

Editor's note: The SBE certification committee will be pleased to evaluate any school's broadcast technical training programs for possible addition to the list of programs already certified. Any school interested in this process should contact the certification secretary in Indianapolis. |:-)))|

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Building an ENG network

By Karl Renwanz

Establishing and operating a regional ENG network involves more than routine engineering efforts.

By and large, the most intense competition today among TV stations within a given market involves the gathering, production and presentation of news. The news program of a commercial station is generally the showcase of the entire operation. The primary image in the community of many—perhaps most—stations is established on the evening news program. Entertainment programming certainly has its place in the promotion and image efforts, but when you talk really big budgets, you're usually talking news.

News gathering for television has always been a technology-driven process. And now, with portable, reliable and high-quality ENG equipment available, technology has opened new doors for the news department. With an eye toward gaining a competitive edge, many news operations are searching for expanded capability. With wish lists in hand, they go to the engineering departments to find a way to make their schemes work. This article discusses how the engineering staff of WNEV-TV, Boston, fulfilled its news department's wish list. It should give you some ideas. At the least, it may encourage you to know there are solutions to complicated systems.

Renwanz is vice president of engineering, WNEV-TV 7, Boston.

Planning the network

In a long-range planning meeting during the summer of 1983, WNEV decided to establish news bureaus to provide better news coverage for outlying areas previously unexplored on any regular basis by Boston TV stations. Fifty percent of the area of dominant influence for the Boston market lies beyond Route 128, a highway encircling the city.

The idea of establishing storefront bureaus in neighboring communities was out of the question. Instead, our need to become a part of the outlying areas would be met by establishing bureaus at four suburban newspapers. Such an association with the newspapers would offer us the luxury of tapping the resources of our print media partners while remaining plugged in to local events. A WNEV reporter and photographer/editor were to be assigned to each bureau on a full-time basis.

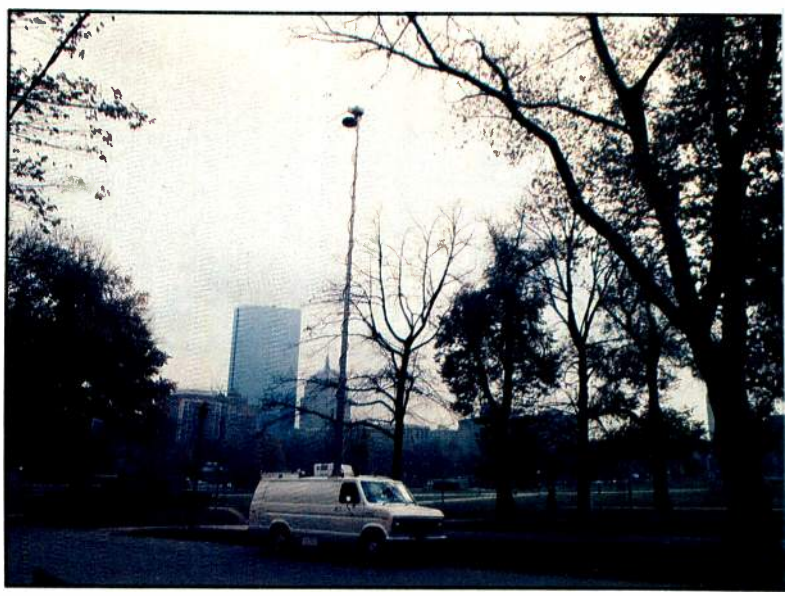
With the bureau sites chosen, the engineering department was given the responsibility to design and to install an ENG network to link the bureaus and other remote sources to our Boston studio. The system required five repeater sites and 2-way links with WFSB-TV in Hartford, CT, and WHDA-AM in Boston. (See Figure 1.) The ties with WFSB and WHDA gave us access to live feeds from the New England News Exchange (NENE), a cooperative organization consisting of several New England radio and TV stations. The association, of which WNEV is a member, was formed to enhance news coverage of regional importance for all participating members. (See Table 1.) Although most material interchange is by videotape, our 2-way connections gave us instant access to feeds when needed.

Preliminaries

Throughout that summer, we examined topographical maps and conducted site surveys and tests to determine the range of possibilities for receiving signals from the bureaus and adding new repeater site locations. The tests involved the use of portable microwave units as well as ENG vehicles. Local cherry-picker aerial lifts were rented to

The WNEV-TV 7 helicopter prepares to perform relay duty from a site that cannot link with the ENG network.

Courtesy of WNEV-TV



One of the remote relay vans, with microwave mast extended, prepares to send pictures back to the station.

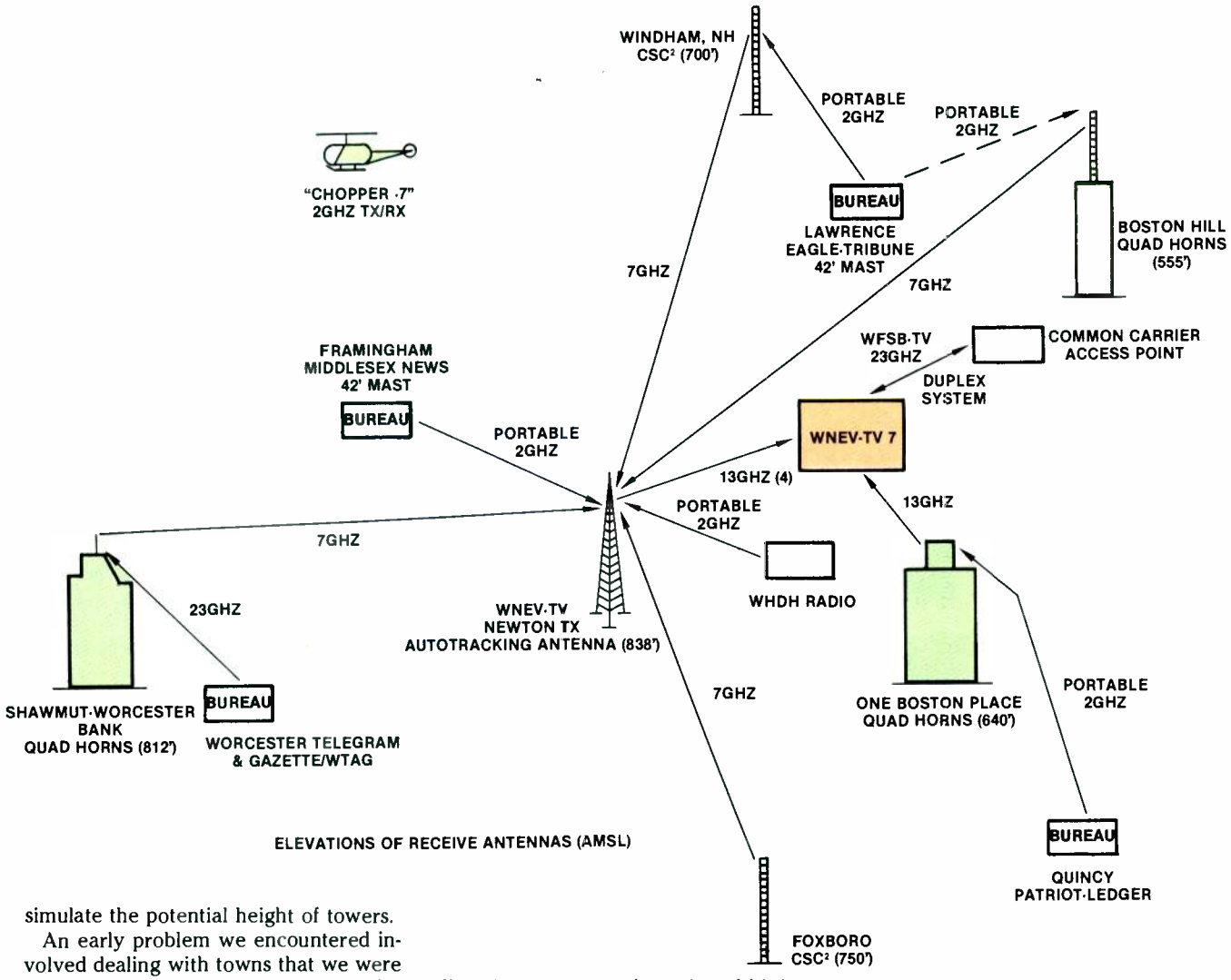


Figure 1. A geographic layout of the WNEV-TV microwave network shows interconnections to bureaus and repeaters.

simulate the potential height of towers.

An early problem we encountered involved dealing with towns that we were considering as suitable locations for repeater sites. City fathers felt they had to make sure that our competitors would have room for their equipment as well. Although we appreciated their interest in fairness, we didn't feel the need to assist our competition in establishing their own ENG networks. Thereafter, we were cautious in dealing with cities and towns.

Probably the single biggest problem we faced was with frequency coordination. We were in the delicate position of not wanting to reveal the scope of our project to our competitors, but needing to coordinate our use of frequencies. When the sites had been selected, we had little time to determine available frequencies in order to avoid delaying equipment orders.

This points out the difficulty of local frequency coordination in a competitive marketplace. If the head of the coordination effort is an engineering manager for a competitor, there may be conflicts of interest. Furthermore, this individual is likely not to have available time (according to our time line requirements) for a big project such as an ENG network.

Our situation was further complicated by the fact that Boston, like most other major markets, has no unused frequencies available for ENG or intercity use. The solution requires reuse of existing allocations, even to the point of hitting the same tower from two different angles with the same frequency.

Constructing the network

Negotiating agreements for tower or rooftop space never follows the time line that you plan for your project. You cannot appear to be in too great a hurry or the price may go up. And when you negotiate with large corporations for space, the agreement becomes bogged down in a corporate paper jungle, even if a separate company is used to negotiate agreements. You simply must allow for lengthy contract negotiation when projecting the final installation date for a microwave system.

The maturation of the NENE network was realized when six 2GHz receive sites became operational. As a result of this, WNEV's ENG coverage improved substantially.

Sites and bureaus

As previously mentioned, bureau facilities were located in each of four suburban newspapers and staffed with a reporter and photographer/editor. The facilities included a ½-inch M-format edit suite and microwave equipment capable of transmitting either directly to our studio or through a repeater site. The transmission path was dependent upon the location of the bureau.

The newspaper buildings were not located with microwave transmission in mind. Most are in low-lying areas, well below the local tree lines. It seemed so easy to consider putting up a 50- to 100-foot tower to transmit the signal back to our studio. However, towers and microwave radiation are not popular subjects with local town appeals boards.

Radiation is an unpopular word. In spite of guidelines provided by the EPA and FCC and the lack of evidence of real hazard from non-ionizing RF radiation, some states and communities have set their own standards to protect the citizenry from radiation hazards. It is uncomfortable to be caught in a public forum, defending the construction of towers and safety of microwave in local neighborhoods.

After one successful, but rather expensive, local appeals board case, we knew another tactic needed to be developed

for local microwave use. Our engineering manager (Al Rouff) conceived the idea of placing a 42-foot telescopic ENG mast on the roof at two of the bureau sites. The mast would put our microwave transmitter antenna at a height of approximately 70 feet and would be lowered after use. This would solve both the transmission problem and our appeals board problem. We still had to obtain proper permits for construction, but the process would be easier when the local town engineer realized the telescopic mast would only be extended during times of actual use (which is relatively infrequent). A typical building-top mast installation costs between $12,000 and $15,000.

An additional consideration for telescopic mast design must include provisions for handling ice buildup. In the New England region, ice can build up quickly and the shutoff switch can be frozen into an unyielding position. Depending upon the direction of intended mast travel, the result can vary from no movement to too much movement, and potential damage.

Microwave equipment

Recent microwave antenna and receiver technology advances helped considerably in the design of the WNEV microwave network. In the past, adjacent-channel and co-channel reception at a site was difficult to accomplish. However, with improved sensitivity and adjacent-channel rejection in newer design receivers, the job of building an ENG network was much easier. In addition, remotely controlled, frequency-agile audio demodulators in the ENG repeater receivers avoided the occasional problem of audio subcarrier incompatibility.

Each of the six repeater sites was designed to meet parameters based on local terrain. In the case of our Newton, MA, broadcast tower site, we upgraded the 2GHz receive antenna to an automatic tracking system to accommodate helicopter and ENG van sources in the surrounding areas. With the antenna located at 838 feet AMSL, we found the range to be quite satisfactory.

A previously existing site atop a building in downtown Boston, using a 4-horn array for reception, was left intact. We upgraded the receiver to achieve the required adjacent-channel rejection for ENG operation in the congested downtown area.

The southern repeater site was located in Foxboro, MA, and equipped with a cosecant-squared (CSC^2) reflector receive antenna at 750 feet AMSL. The design allowed a wide range of source elevations, but only horizontal panning movement. Another receiver, designed for high adjacent-channel rejection, was installed at the site. The intercity microwave signal returned to the Newton communications hub via 7GHz, and then to our Boston studio at 13GHz. This southern site has provided valuable pickups from Providence, Pawtucket and Newport, RI.

The western repeater site, 40 miles west of Boston in Worcester, MA, has the 4-horn array, previously used on the Newton tower, perched at 812 feet AMSL (atop the Shawmut Bank building). The intercity relay again returns to our Newton broadcast tower via 7GHz and then to the studio on 13GHz.

The bureau at *The Worcester Telegram and Evening Gazette* is only one block from the repeater site. A 23GHz system makes this short hop.

A second western bureau is situated 25 miles west of Boston in Framingham, MA. Framingham has numerous hills and valleys that make daily ENG activities a challenge. A telescoping mast on the *Middlesex News* building allows us to transmit to either the Newton tower hub or Foxboro repeater site. Full pan and tilt antenna control is available inside the bureau office building.

The primary northern repeater site is situated 24 miles north of Boston on Boston Hill. This installation began with a pan-steerable CSC^2 antenna system, but was changed to a 4-horn array. The original antenna was moved to Wind-

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Courtesy of Bill Leverton, KTSP-TV

Live from Goulding's Trading Post in northern Arizona, KTSP-TV anchors Deborah Pyburn and David Patterson enjoy a backdrop of Monument Valley.

Code name: Celebrate Arizona

KTSP-TV 10 in Phoenix wanted to bring its viewers closer to their home state. To do that, the staff planned Celebrate Arizona, *a 4-week remote project in the picturesque countryside with daily live news shows at 5 p.m. and 10 p.m. The project was successful in winning the station a 58 share during the ratings sweep. It also provided engineering experience in "getting the act together and taking it on the road."*

Two engineering vehicles—a control/production unit and a transportable uplink unit—toured with the company. Because terrestrial microwave facilities were unavailable, all signals were sent from the remote sites to Phoenix through the Ku-band G-Star satellite.

The satellite relay worked flawlessly, except on the second day out. Incompatibilities between a newly installed receiver at the station and other satellite equipment forced the signal to be received in Atlanta, converted to C-band and fed back to KTSP on another satellite. Two 600W uplink HPAs in parallel proved more than adequate. In fact, transmitting powers between 150W and 250W have been found sufficient in subsequent remote projects.

Adequate local power was questionable at some sites, so a 30kW generator was towed along as part of the system. Communications between the studio and the remote site provided more of a challenge, however. The most difficult sites required that 2- to 3-mile audio lines had to be strung to reach the nearest telephone for a landline communications link. By the end of the trip a 5-mile length of 3-pair cable had been cut and respliced numerous times.

Both 2GHz and 13GHz microwave equipment allowed various production possibilities. The most unusual included live shots from the floor of the Grand Canyon during the 5 p.m. news show, produced from the canyon's south rim.

The greatest challenge, according to project engineer-in-charge Glen Hills, was working against time. In some cases, setup for two shows a day was a matter of moving cameras, lighting equipment and mics from one venue to another at the same location. At other times, the remote sites might be 10 to 40 miles apart.

Subsequent to the trip, KTSP purchased its own transportable uplink. A CBS affiliate of the Taft group, the station plans other such projects and regional coverage for the group.

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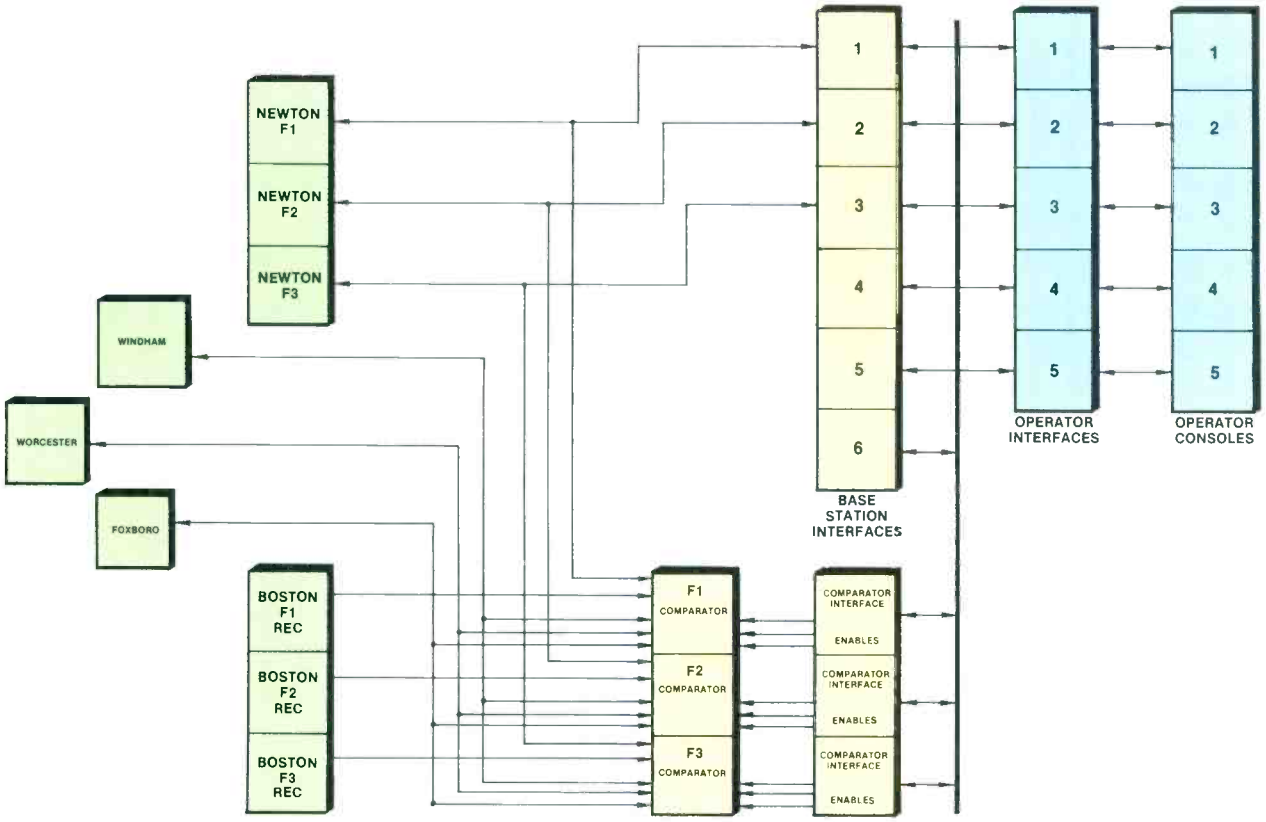

Figure 2. *A simplified block diagram of the 2-way radio communications system indicates its complexity.*

Continued on page 36

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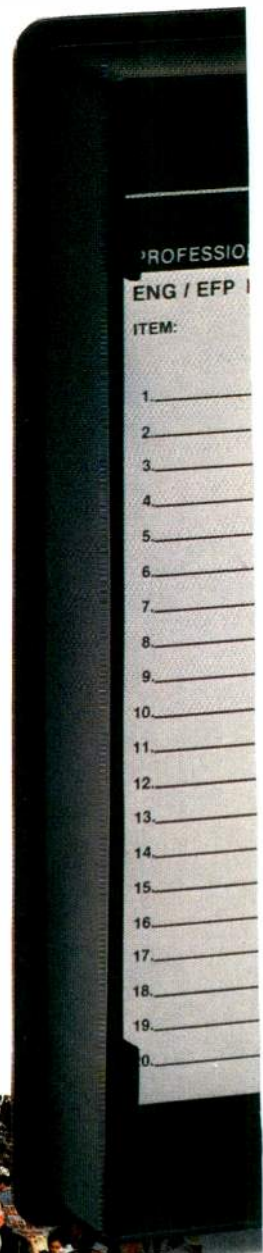

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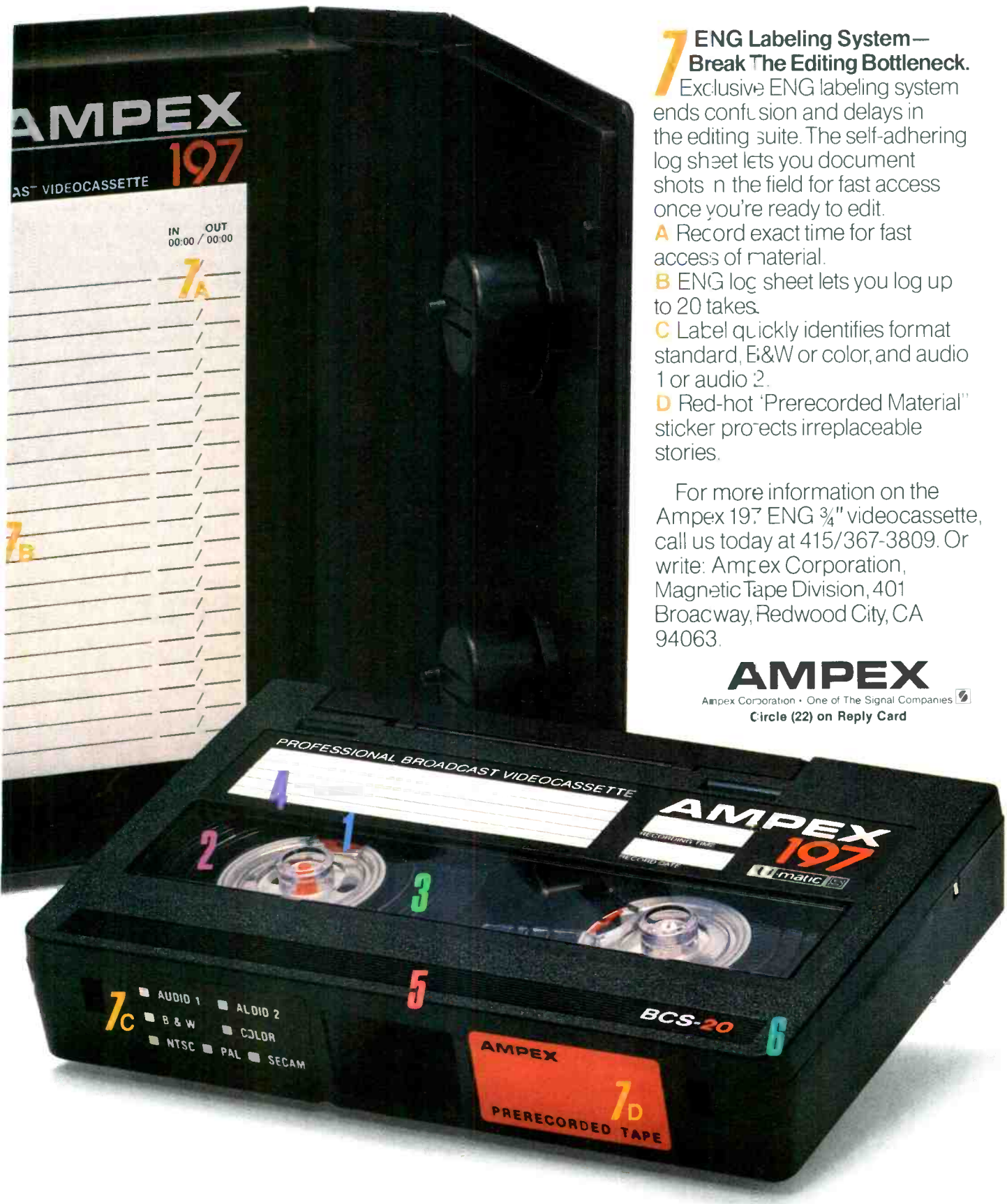

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Circle (22) on Reply Card

Continued from page 32
ham, NH, which improved our coverage into New Hampshire. We now go live quite easily from Manchester or Concord, NH; this is quite a change from the long hours of work once needed to operate live from campaign headquarters of various candidates in New Hampshire elections.

The return microwave from Windham is 7GHz to the Newton tower and 13GHz to the studio. The north 7GHz signal had to be polarized vertically to avoid interference with the southern feed from Foxboro, which at 7GHz, is polarized horizontally. The Foxboro receive dish is also located 400 feet lower on the tower, providing isolation of the two links.

The northern bureau is located in the *Lawrence (MA) Eagle-Tribune* building. Using the telescopic mast, we can feed through either of the northern repeater sites. This mast is also remotely controlled from within the newspaper building.

The southern bureau, at *The Patriot Ledger*, Quincy, MA, feeds to our downtown repeater site at 2GHz and then to the studio on 13GHz.

Costs of expansion

We had originally budgeted for extensive 2-way radio expansion for year two of the New England News Exchange. But with the ENG expansion came the need for additional improvements in our 2-way radio system. Because we use 2-way radio to cue talent in certain situations, some difficulty was experienced in the Boston control room in communicating cues and countdowns to live remote locations.

Placing additional base stations in Worcester, Foxboro and Windham helped to match our 2-way radio capabilities to the expanded ENG network. The frequency-agile base stations provide coverage on all UHF frequencies used by WNEV. A base station can be tuned to the desired frequency from push buttons at any one of five different operator positions in the studio.

The outputs of the receivers are steered to the correct voter (repeater system) automatically, so that at any given time all receivers on a frequency will be in the proper group. After this function is accomplished, it is relatively easy to determine on which base to transmit (whichever receiver audio has the best signal-to-noise ratio, as determined by the repeater voting control system).

To avoid purchasing new receivers for each of the three frequencies at the Foxboro, Windham and Worcester sites and incurring additional telephone line costs, a special control system was devised by adapting available (Motorola) hardware. The control hardware and the addition of signal quality modules to each voter comparator allows each frequency-agile receiver to vote with the proper group of receivers at other locations. The concept is illustrated in Figure 2.

Additional lockout controls were needed to prevent simultaneous transmissions from multiple base stations. This was not a concern when there was only one transmitter on each frequency, but was required as the system grew.

Another feature available with multiple base locations is a patch function to emulate repeater operation with simplex equipment. WNEV's control system permits patching of any two base stations on different frequencies, for mobile-to-mobile communications over long distances. This patch is initiated and monitored at a control position at the studio and also allows the studio control operator to transmit simultaneously to both mobiles. Although it is electrically complex, the control system is easy to use and is flexible for future expansion.

IFB and cellular

As extensive as our 2-way radio system has become, it does not fulfill all the communications needs of our field crews. For example, IFB is critical during live event coverage. As a result, there must be a method of providing IFB in every situation.

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Circle (24) on Reply Card

Newspapers	
The Lawrence Eagle-Tribune Lawrence, MA	The Patriot Ledger Quincy, MA
The Middlesex News Framingham, MA	The Worcester Telegram and Evening Gazette Worcester, MA
TV stations	
WNEV-TV Boston, MA	WFSB-TV Hartford, CT
WLNE-TV Providence, RI	WCSH-TV Portland, ME
WLBZ-TV Bangor, ME	WMUR-TV Manchester, NH
Radio stations	
WHDH-AM Boston, MA	WOKQ-FM Dover, NH
WTAG-AM Worcester, MA	WTSA-FM Brattleboro, VT
WKXL-AM/WKXL-FM Concord, NH	WJHN-AM/WUPE-FM Pittsfield, MA
WCIB-FM Falmouth, MA	WINE-AM/WRKI-FM Brookfield, CT
Cablevision of Connecticut News 12 Westport, CT	

Table 1. Members of the New England News Exchange.

verted from a 39kHz SCA;
- 2-way radio remote pickup units; and
- Cellular telephones.

The cellular telephone is a recent addition to our remote vans, enabling us to take advantage of an auto-answer telephone IFB system in the studio control room. The cellular telephone output is connected to a 26MHz transmitter in the vehicle, then received by the talent with a pocket receiver. We have experienced cases in which our SCA equipment is overloaded by other local transmissions, and the cellular telephone is then the chosen alternative for IFB.

The cellular telephones assist our reporters in following breaking stories. Confidential communications among the assignment desk, writers and reporters occur without fear of aiding the competition. This has also proved valuable in efficiently using what used to be dead time while traveling to a story.

Remote alignment

One of the outgrowths of a network such as NENE is a rather complex and busy ENG receive/control center. With five vehicles in the field, four bureau sites and a helicopter, setting up ENG feeds for a newscast can be quite hectic. Furthermore, the acquisition of microwave signals from the field can be time-consuming, as you try to set up a difficult

Continued on page 42

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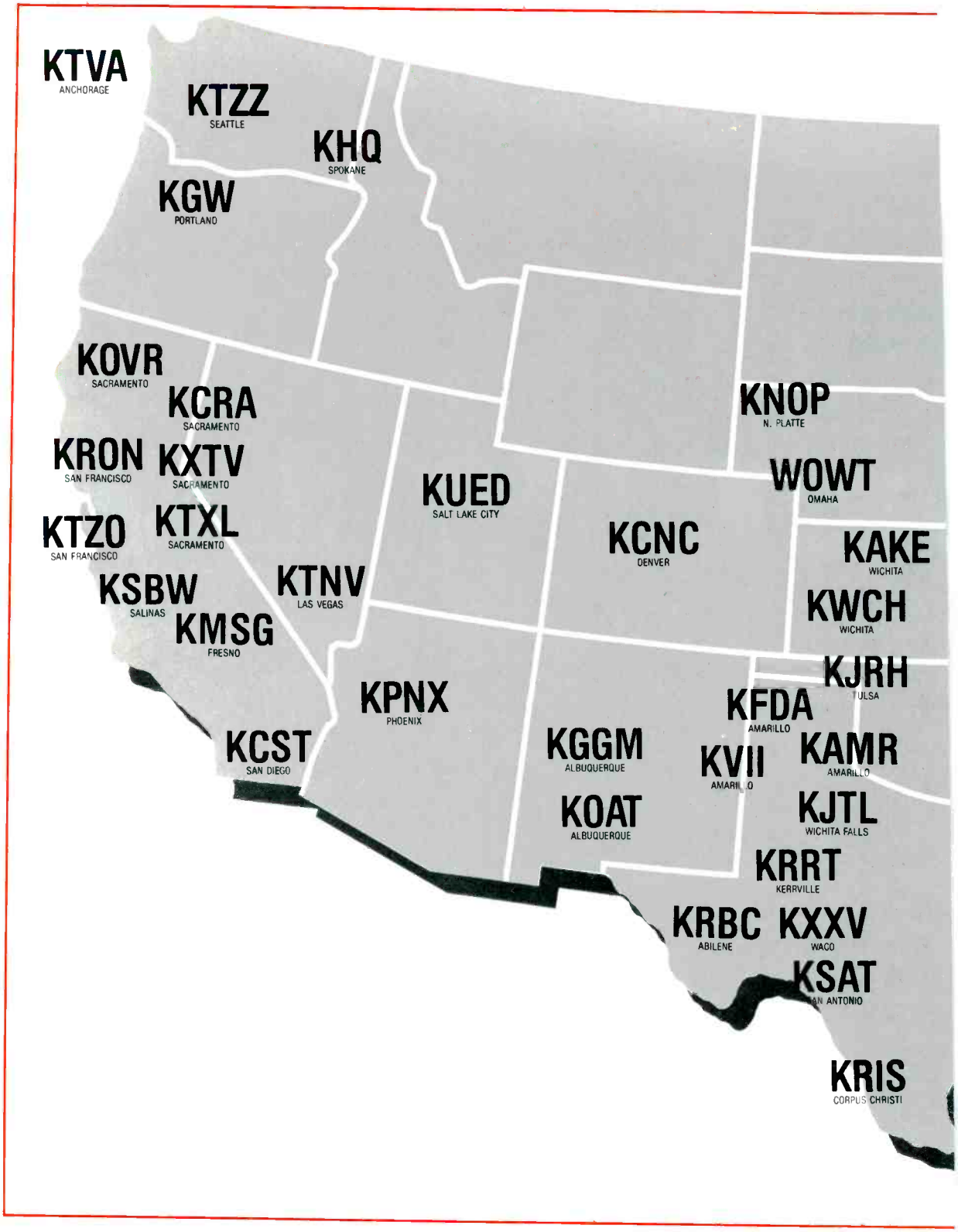

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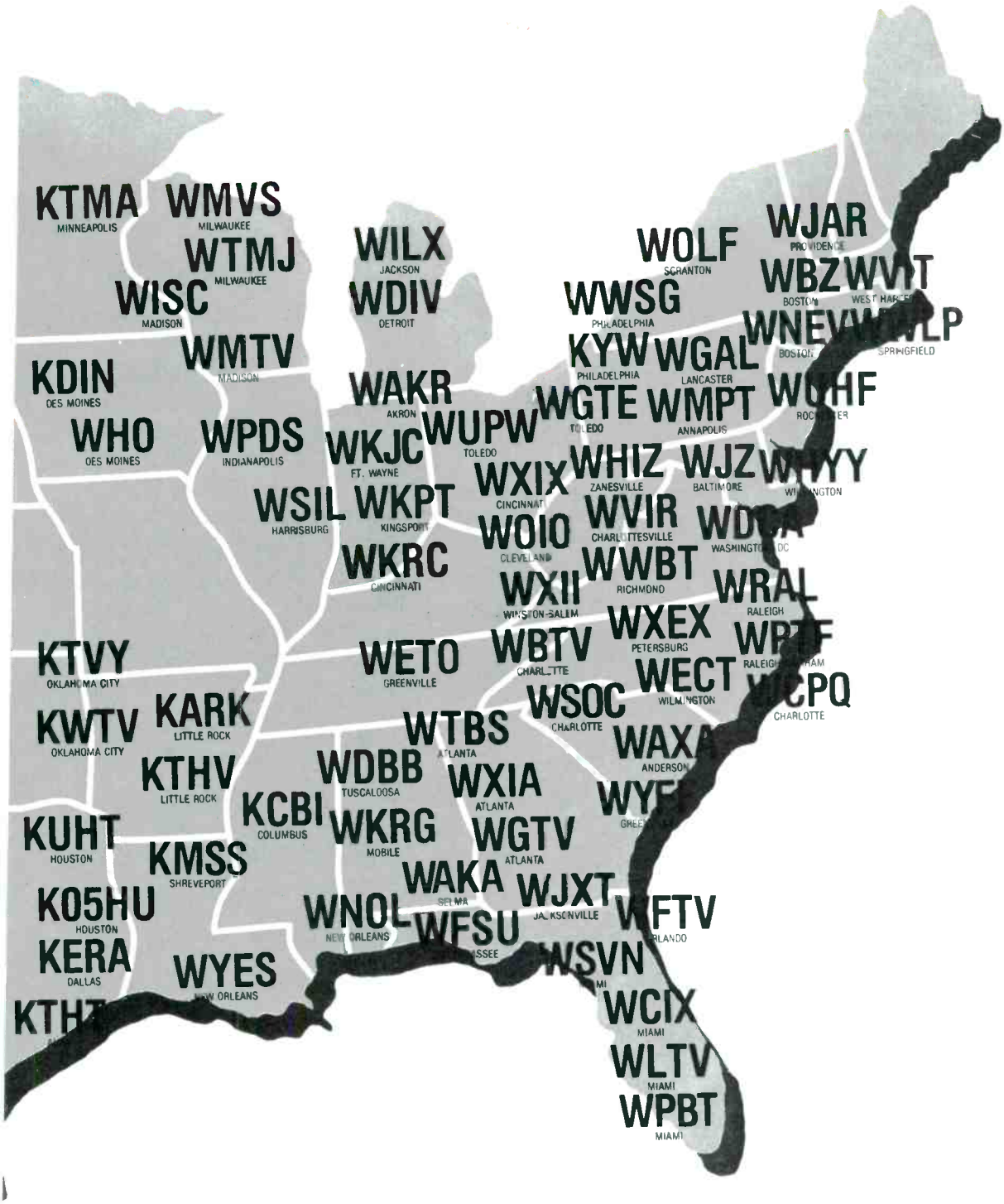
*In respect for the confidential business plans of our clients, we are not disclosing the names of the many stations that have taken delivery but are not yet publicly on-the-air, or have placed orders that are not yet delivered.



ORBAN'S FIRST 100 STEREO TV STATIONS ARE NOW ON THE MAP.

Circle (27) on Reply Card

Continued from page 38

bounce shot or to create a small window for other reasons.

WNEV engineers developed a method to allow the receiver rack technician to have remote control pan and tilt functions of the ENG transmit antenna. With only one person involved in the antenna alignment procedure, a significant amount of time can be saved in path alignment.

The equipment to accomplish this is available off the shelf (manufactured by Motorola under the trade name Intrac). With relatively minor modifications to the equipment, a signal can remotely control any desired function at the van or bureau location. The control signals are transmitted to the van via the station's 2-way radio system.

Five live ENG trucks are in operation every day, with one functioning strictly as a repeater truck. The repeater truck offers separate 2GHz and 2.5GHz receive and 2GHz transmit capability from its telescopic mast. Our helicopter also is equipped as a repeater vehicle and has provided long-haul relays from more than 100 miles away.

The overall system

With the multiple repeater sites, bureaus and vehicles in the system, we have found virtually no regional location to be beyond our reach. In a time when satellite news gathering (SNG) is gaining popularity, we have strived to maximize the usefulness of terrestrial microwave. We have avoided satellite usage fees as well as the tight feed windows associated with transponder scheduling.

An extensive terrestrial microwave network costs about the same as one SNG vehicle and offers the flexibility of feeding from numerous sites within a single newscast. We saw no advantage to feeding the signal 46,000 miles through space, when the field crew was located within 20 to 30 miles of the studio.

One objective of the NENE is to use the live capability of affiliated stations for news pickups. When a story breaks, we use live video from the closest member station, whether covered by live truck or helicopter. For example, a WLNE-TV van covering a story in New Bedford, MA, can turn its antenna toward our Foxboro site and save us valuable travel time.

We have established a 2-way microwave connection between Hartford and Boston with 2GHz, 13GHz, 23GHz and common-carrier channels. Material exchange between WNEV and WFSB occurs regularly.

Pooling of equipment and personnel occurs for major event coverage throughout New England. During President Reagan's 1985 visit to Concord, WMUR-TV in Manchester added its live vehicle's camera to our three cameras covering the event. Not only did both of us benefit, but all NENE stations benefited via live or videotaped coverage.

Microwave transmitters, receivers and ENG vehicles are loaned out among the stations for brief periods to assist in local event coverage or during maintenance downtime.

WHDH-AM in Boston has 2-way radios capable of operating on our frequencies, so that we can benefit from their perspective daily. This also enables us to assist WHDH when both of our helicopters are flying during an important news event.

At WNEV, we employ a separate maintenance group for transmission, which includes the broadcast transmitter, earth stations, 2-way radio, microwave and helicopter equipment. This concentration allows us to focus on and respond quickly to areas that traditionally may not have received proper attention.

The New England News Exchange has proved itself efficient in many ways, from the sheer coverage power of a network to the elimination of the need to drive a story back to the station for editing, which can be difficult in metropolitan areas. Still, the future holds numerous possibilities for expanding our current regional capabilities.

Stay tuned. |:-)))|

David Peters, Assistant Engineer KGLT Radio Station, Bozeman, Montana.

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Satellite uplink trucks

By Brad Dick, technical editor

The new generation of satellite uplink trucks provides stations with almost unlimited potential for live, on-the-spot TV coverage.

There is a new game in town, in case you haven't heard, and it's satellite news gathering (SNG). Although the ability to use a satellite for news transmission and reception certainly is not new, the current craze for Ku-band transmission is.

Almost every radio and TV station has a satellite receiving dish. The proliferation of news and entertainment networks has made it almost mandatory for a station to be capable of receiving material from satellites.

Networks have been using satellites for years. In the early stages, the networks used satellite transmission primarily for cross-country and separate time zone feeds of news and entertainment programming. As the technology became more familiar and less expensive, more uses were found for satellite transmission.

Soon, groups of stations found it economically feasible to install and to operate not only downlinks, but uplinks. By the mid-70s, it was often less expensive to distribute programming via satellite than by tape. The conversion from taped distribution to satellite distribution marked a major change in the way U.S. broadcasters received their programming.

A 2.4-meter uplink truck with a roof-mounted antenna.

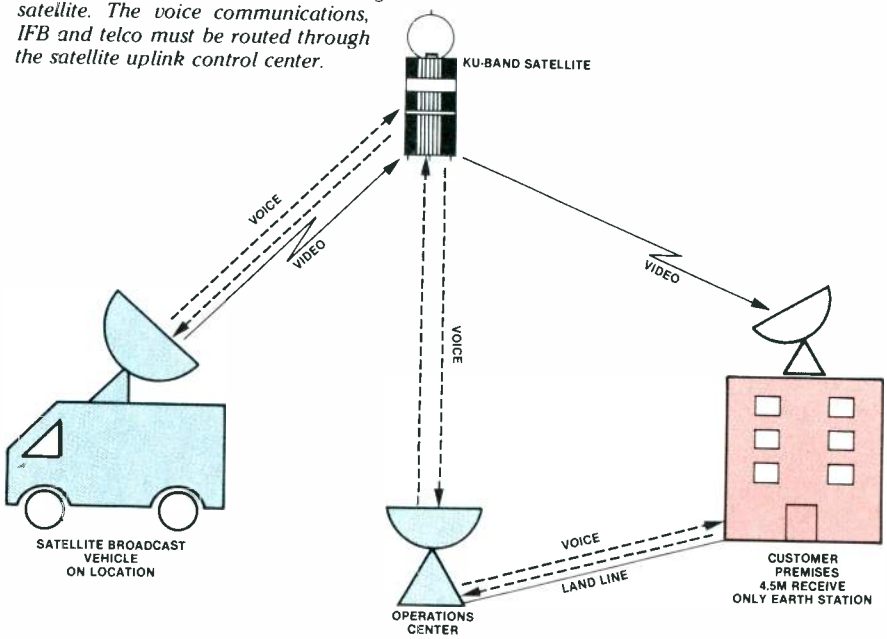
Ku-band

Until recently, almost all satellite transmission was in the C-band (4GHz and 6GHz). This band provided reliable communications but had the inherent disadvantage of also requiring large antennas (dishes). It was not unusual for a video uplink dish to be about 30 feet (10m) across. The downlink dish had to be even larger.

In addition, the C-band was highly congested. Terrestrial microwave systems frequently caused interference to the satellite signals. Sometimes there wasn't enough transponder space for all the users.

In the late 1970s a different breed of satellites provided new opportunities for stations. These new satellites operated in the Ku-band (12GHz and 14GHz) and provided several advantages over C-band satellites. Perhaps the most important advantage of the Ku-band satellites was the lack of interference from terrestrial microwave systems. Previously, it was not possible to install downlinks in most locations without having to worry about reception problems.

Figure 1. *The process of satellite uplinking is really quite simple. The broadcast video and audio are relayed to the studio through the satellite. The voice communications, IFB and telco must be routed through the satellite uplink control center.*



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*As required by BTSC Standards, EIA Systems Bulletin No. 5, Section 3.2, Monitoring and Measuring.

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The second advantage, critical to SNG usage, was that uplink dishes could be smaller. C-band dishes may have been 30 feet or more in diameter; the new Ku-band dishes may be only eight feet across. The small dimensions allowed the dishes to be easily mounted on relatively small trucks. Truly portable video uplinks were now possible, and satellite news gathering was born.

The basic idea behind SNG is not complicated and is rooted in C-band technology. Broadcasting from remote locations has been possible for several years with C-band equipment. However, it was the advent of Ku-band capability that started the rush to SNG equipment.

A satellite news vehicle (SNV) is a truck or trailer that contains sufficient equipment to both broadcast and conduct 2-way communications between the satellite and the studio. The video and program audio are relayed to the studio through the satellite (Figure 1). These signals may or may not be routed through a control center for coordination or when there is a need to amplify the signal. Generally, if there is a need to convert the signal from Ku-band to C-band, it will be done at the studio for rebroadcast, although it can be done by some satellites.

The communications audio is routed through the control center. In addition to the standard telephone circuits, the IFB and auxiliary program line (PL) circuits both to and from the studio and truck are all controlled by the satellite control center.

Operating an SNV is, not surprisingly, a bit more complicated than a normal remote pickup unit. First, any SNV must be licensed through the FCC's common carrier division. To obtain such a license requires a bit of work and certification. The technical portion of the application is usually handled by the manufacturer of the vehicle.

The license issued to the SNV usually allows operation in most areas of the country. In cases of uplinking near certain government or military installations, prior frequency coordination is required. With these few exceptions, the trucks can operate almost anywhere the unit can provide an adequate signal to the satellite.

The 1985 NAB convention provided some engineers with their first opportunity to see the new generation of satellite uplink trucks. These new trucks provide uplink access to a satellite from almost any place in the world. The trucks are usually self-contained and capable of being operated by one person. Their primary advantage is that a station can provide live feeds from almost any location, with a minimum of planning. In addition, the news crews are no longer bound by the limitations of microwave systems or telephone circuits.

If your station is interested in entering the world of SNG, there are many important elements to consider. Not only must you be aware of the technical requirements for satellite transmission, but you need to be aware of the tremendous financial commitment that will have to be made. You should also realize that it's not possible to simply buy a truck and go into business. The truck is only a part of the system. Someone else owns the satellite.

Few stations will undertake the task of building their own SNG trucks. The technology is so complex and the financial risk so great that it's usually better to work with a company that has the expertise to provide the equipment and support you will need. These companies can also provide you with the necessary contacts to arrange the needed satellite time. In any case, you must understand the basics of what goes into the design of an SNG truck if you want to be an informed consumer.

The chassis

The chassis is, perhaps, one of the more important elements in designing an SNG truck. All of the elements of a TV broadcast depend on that chassis.

Many SNVs use a European-built *walk through* truck chassis. The primary reason centers on the size and load requirements. An SNG truck should have a GVW rating from 13,000 to 18,000

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Other new features in the 961/962 Series include improved extruded guide faders, balanced insert points, FET switching, electronic muting, Littlite® socket, and multi-frequency oscillator.

Thanks to its light weight, DC converter option, and sturdy transport cover, you can put a 961/962 mixer on the job anywhere. And, with Studer ruggedness and reliability, you can be sure the job will get done when you get there.

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pounds. Many U.S. trucks with that capacity are either too long or have tilt cabs, both of which create problems for SNG work.

Just as important to the load requirements is the length of the truck. There are trucks that meet the load requirements, but they might be 30 feet long. An SNV is going to have to be able to negotiate crowded streets, alleys and congested areas. A long wheelbase can make access difficult for a driver.

Typical SNG trucks range from 19 to 28 feet in length. A truck in this size range can be maneuvered in close quarters with relative ease.

Not all SNG equipment needs to be mounted in a truck. Some companies provide trailer-mounted satellite uplinks. This option has several advantages. The most obvious one is cost. With the equipment mounted on a trailer, the station doesn't have to purchase a relatively expensive, modified truck chassis. A trailer will require less maintenance than a truck and operational costs will be lower.

The disadvantage of a trailer is the lack of mobility. It is more difficult to travel with a trailer than it is with a self-contained truck. In addition, the weight of a fully equipped trailer will probably be too much for the station's ENG truck to pull. If that's the case, the station will have to purchase an additional vehicle just to pull the trailer. From an opera-

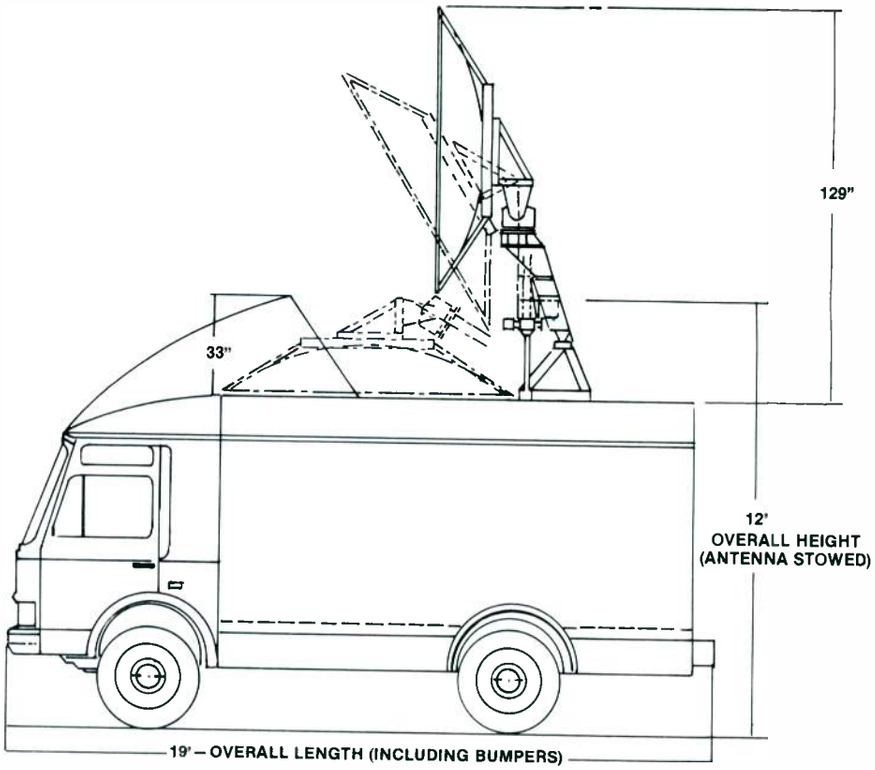

Figure 2. *The 2.4-meter antenna on this truck can be stored and then raised into final transmit position from inside the truck.*

Continued on page 52

AT THE STARTING LINE YOU CAN'T TELL SEATTLE SLEW FROM MR. ED.

Until the horses bolt from the gate, you can't tell a champion from an also-ran.

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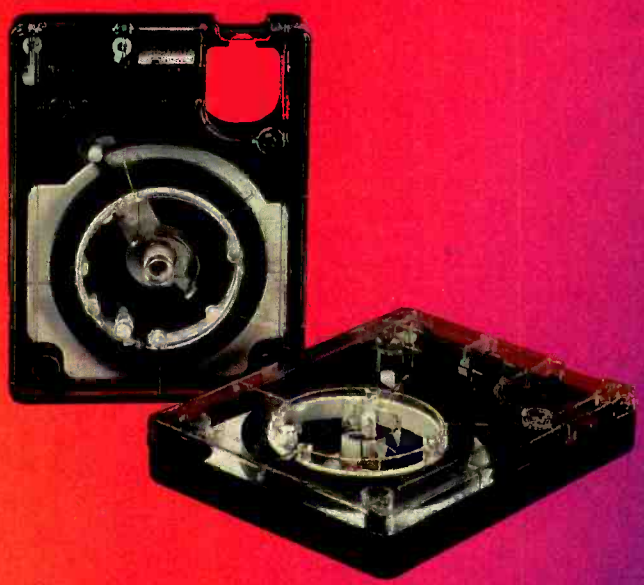

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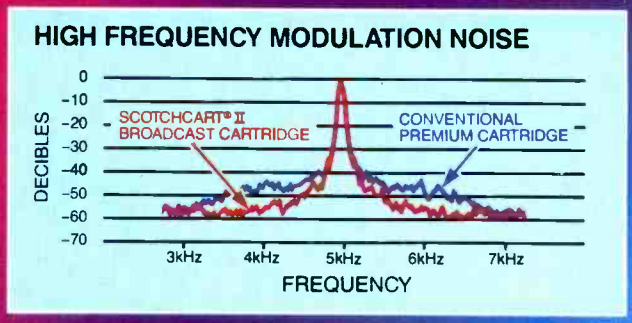
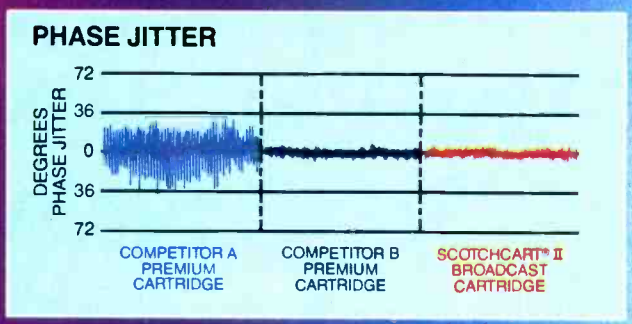
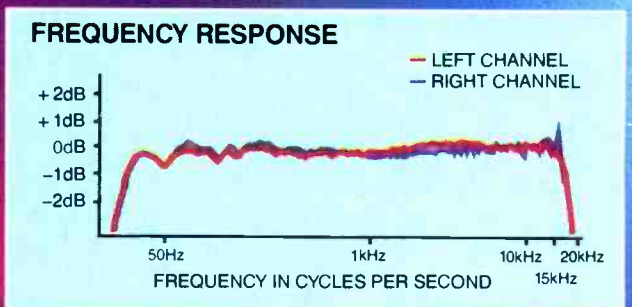


The Revolutionary ScotchCart® II broadcast cartridge design eliminates the excessive audio sideband noise which results from the rubbing effects of pressure pads and the mechanical irregularities of rotating hubs found in conventional cartridge designs.



Some competitive cartridges sound muddy on the air because of excessive phase jitter. ScotchCart® II broadcast cartridges sound crisp and clean.



The new tape was conceived as an integral part of a complete cartridge system. When used with high quality equipment, such as an ITC "99B" cartridge machine, the ScotchCart® II broadcast cartridge is capable of frequency response equalling professional reel-to-reel performance.

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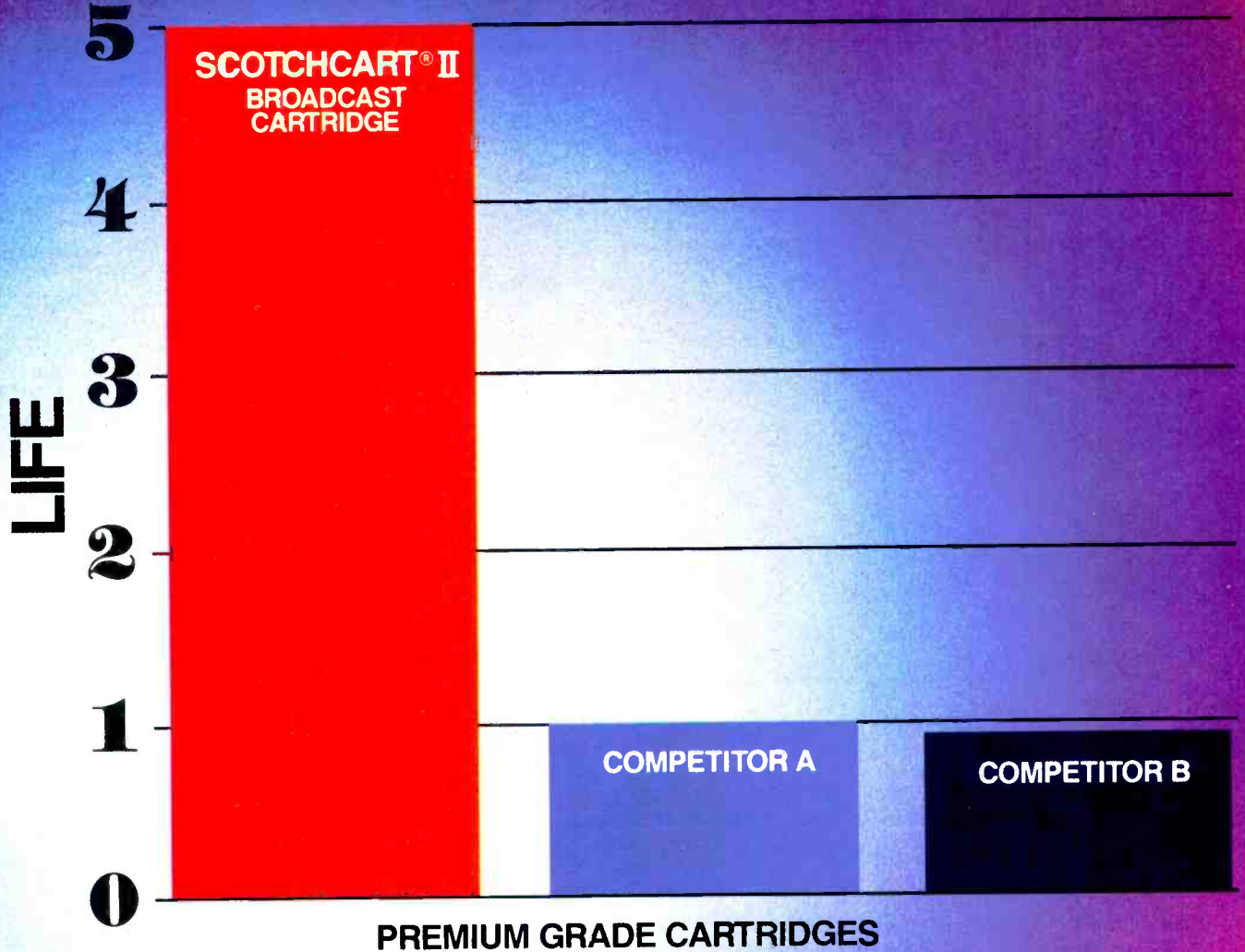

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Continued from page 48
tional point of view, both approaches have advantages and disadvantages.

Well-engineered trucks usually have dual generators that provide redundant ac power, permitting full uplink operation by using only one generator. Utility power for peripheral equipment (heat, air conditioning, etc.) would be supplied by the second unit. However, there are disadvantages because dual generators require larger fuel tanks and require more space. They also add significant weight to the vehicle. But even the smaller trucks may have two generators for operational reliability. In all cases, the trucks are equipped to take power feeds from local sources.

RF equipment

From a news utility standpoint, only the Ku-band is acceptable for uplinking. This band allows the antennas to be small enough to easily fit on the truck or trailer and still provide the necessary RF power to properly illuminate the satellite. Again, size considerations come into play.

It is really not practical to trade off the size of the antenna for an increase in the power capability of the high-power amplifier (HPA). Equipment manufacturers usually allow you to trade off some antenna size, and therefore truck size, for a higher-powered amplifier. If you elect to use a large antenna and operate with a smaller HPA, you will need a larger chassis.

Don't be fooled into thinking that you can make up the difference in antenna size by using a bigger HPA. Although more RF power will help offset the smaller antenna size, you still have to be able to *see the bird*. In other words, your uplink antenna system must be able to operate as a downlink and receive both video and audio if the system is to work properly. This is largely a function of the antenna efficiency trade-off against aperture size.

The efficiency of the uplink antenna is important. The more efficient it is, the less HPA power is required and the better reception you will have. Modern SNG antennas are 55% to 70% efficient.

Although the larger antennas provide more gain, they have their own disadvantages. The 4.5-meter, lower frequency, larger aperture antennas must be folded for transportation, reducing their effectiveness. Deployment time is also increased, particularly during high wind and bad weather.

Because of the way in which these antennas must be mounted on the trucks, their ability to rotate is restricted. The trucks must be carefully positioned so that they can *see* the satellite before the antennas are deployed. They also sustain more loading from wind than a smaller antenna. One of their advantages is that they require less power from the HPA.

Also, under rain fade conditions, the additional gain may be necessary in fringe areas. The smaller 2.4-meter antennas provide less gain and require a higher powered HPA.

The smaller antennas usually can be automatically stored by commands from within the truck. This feature is helpful if it's important to get on and off the air quickly. Also, the smaller antennas can rotate almost 360°, thereby placing fewer restrictions on how the truck is parked. Usually, the larger antennas cannot be rotated beyond 135° and require careful placement of the truck.

These trucks are equipped with either 300W or 600W HPAs. The amplifiers are offered in redundant configurations for backup. The HPA and antenna argument even goes past antenna and truck size. A larger antenna can use a smaller HPA or allow a higher powered HPA to run at a lower power level. This type of operation can reduce maintenance costs and extend the life of the HPA.

Positioning the antenna

The entire structural and positioning system for the antenna is important. Considering the fact that the whole vehicle is involved in maintaining the position of the antenna, a great deal of attention must be paid to this aspect. Because the positioning references for the satellite are based on a stable platform, the truck

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must have leveling jacks. Electrically operated jacks level the truck through operator-controlled switches and remote indicators. The jacks also provide a stable base for the antenna by isolating the truck's shock absorbers and springs from the antenna platform (which is provided by the truck body/chassis) and they create a bridge to the ground.

After the truck is level, the antenna can be positioned. To position the dish, the operator must first know where the truck is located and what satellite will be used. The vehicle's exact geographic location can be found from topographic maps. At least one manufacturer offers a complete navigation system that will provide the exact location using information received from a satellite. Another approach involves the use of a simple onboard engineering-type calculator or computer. The operator can then place the antenna in approximately the correct position, as described below. Future systems will automatically locate the antenna for the operator.

Once the dish is close to the correct position, both video and audio are usually present for monitoring. The easiest alignment procedure requires that the operator simply look at the video being received and tune the dish azimuth and elevation until the picture is as clear as possible. The final tweaking can be done while observing the satellite carrier on a spectrum analyzer. Because the trucks generally operate in the same areas (within approximately 300 miles of the station), trained operators can position the dish in about five minutes.

Communications

The communication system is critical to effective field production. Modern SNG communication systems provide IFB, PL and even dial-up access to telephone lines.

Operationally, about 30 minutes of background work is required for every 10 minutes of actual air time. The customer usually pays only for the amount of time the satellite is used. Therefore, to keep costs as low as possible, good coordination is important.

Typically, satellite operators rely on SCPC channels for coordination purposes. In one case, the program audio is carried on a video subcarrier. The first communications between the truck and the satellite operator may take place on a *meet me* channel. This is an SCPC channel set aside for initial communications only. After initial contact has been established, the communications may then move to another channel. Other methods are also employed by which low-power-level voice communications channels are established at the band edges of the transponder. (See sidebar for information on a digital communication system.)

To communicate on the coordination channels, the truck operator first powers up the HPA at a low level, at approximately 5W. At this point, there is still no video being transmitted, only voice. Once voice contact is made, the control center will assign the operator video and audio channels for voice, IFB and PL if needed. The operator will also be told what time slot is available for the video feed.

Some satellite operators use separate transponders for audio and video. Others use a split-band technique with SCPC channels at the upper and lower portions of the transponder. Some satellite companies provide operators with daily assignments of audio and video channels. In this case, after the truck operator has positioned the antenna and activated the telco circuit, the appropriate SCPC carrier will be transmitted to the control center.

After receiving this carrier, the control center will transmit back the associated duplex carrier. This action completes the link and the SNG truck has full direct-dial telephone capability. The truck can send and receive telephone calls.

At the proper time, the satellite control center will assign an SCPC carrier for IFB to the SNG truck. When the TV station calls the control center it is automatically connected to the SNG truck and the IFB link is established.

Continued on page 58

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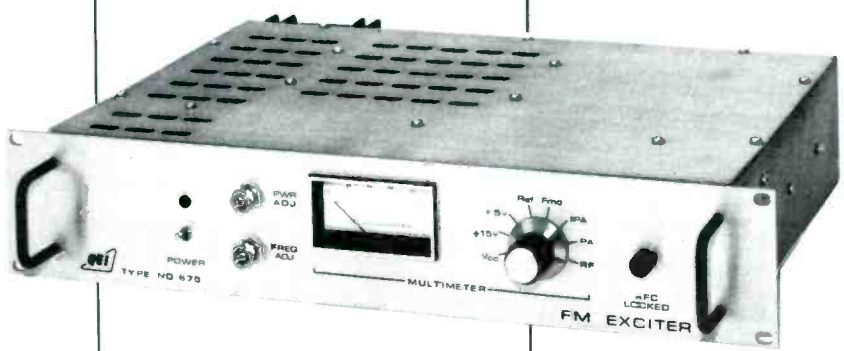

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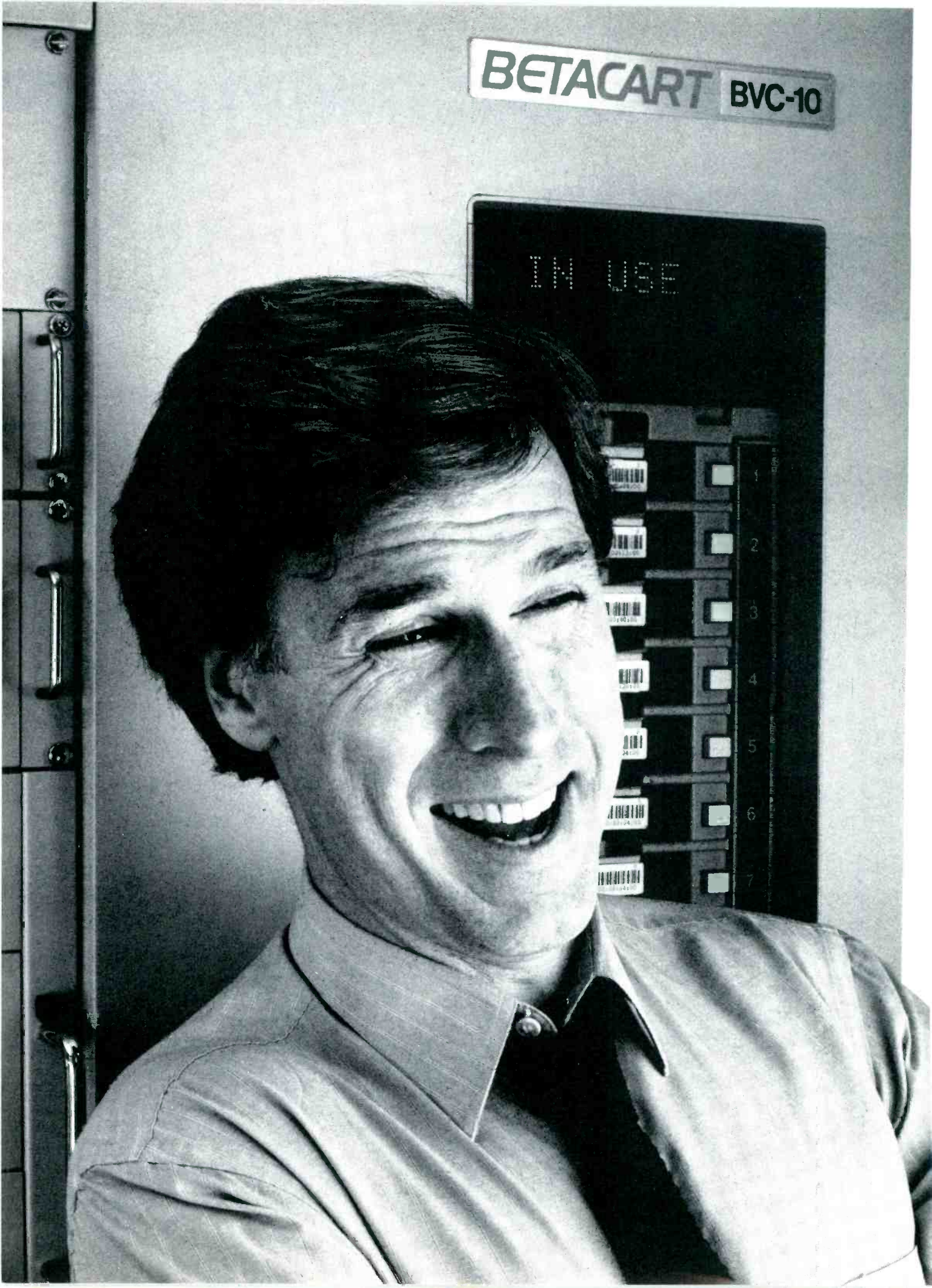
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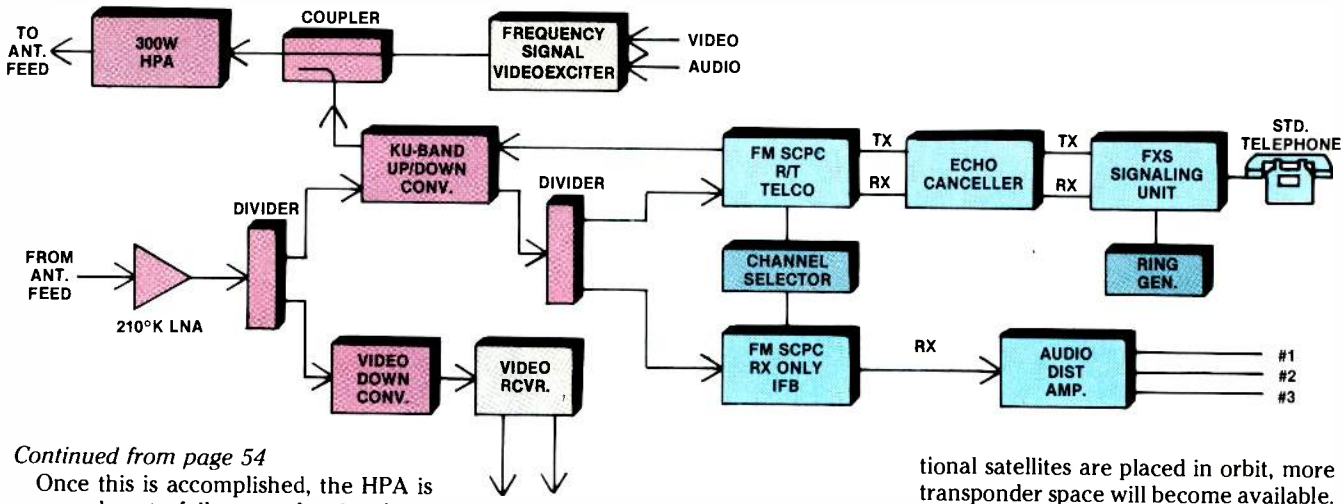

Figure 3. A block diagram for a typical SNV. In this instance, only one 300W HPA is required.

Continued from page 54

Once this is accomplished, the HPA is powered up to full output for the short-term video transmission. This process allows several trucks to be in the planning stages of broadcasts at the same time. By sharing the transponder, many stations can get on the air, although not at the same time.

A line drawing of an SNV is shown in Figure 2. The video portion typical for a 4.5-meter system is shown in Figure 3. Note that it requires only one HPA. The 2.4-meter system, Figure 4, also may use one HPA but usually has two for added reliability.

Stations typically must purchase blocks of transponder time for use during the year. Because most of the country's news coverage takes place between 3 p.m. and 11 p.m., and there is a limited amount of transponder space, not everyone can be on the air at the same time. This means that stations must share the transponder channels. Through careful coordination, stations can usually be assured of access to the satellite, but not necessarily at 6 p.m. every night.

There are various ways to share and prioritize access to the satellite. As additional satellites are placed in orbit, more transponder space will become available. Methods are also being developed whereby multiple video signals can be placed on the same transponder at the same time.

In addition to the basic satellite communications equipment, SNG trucks are typically supplied with a minimum of video equipment. A basic video switcher, audio console, monitors, 2-way radios, ¾-inch tape players, cellular telephones and even radar detectors can be supplied with the trucks. Because each user's needs are different, the trucks, when ordered, are often customized to suit individual requirements. Stations can purchase the truck with a minimum of

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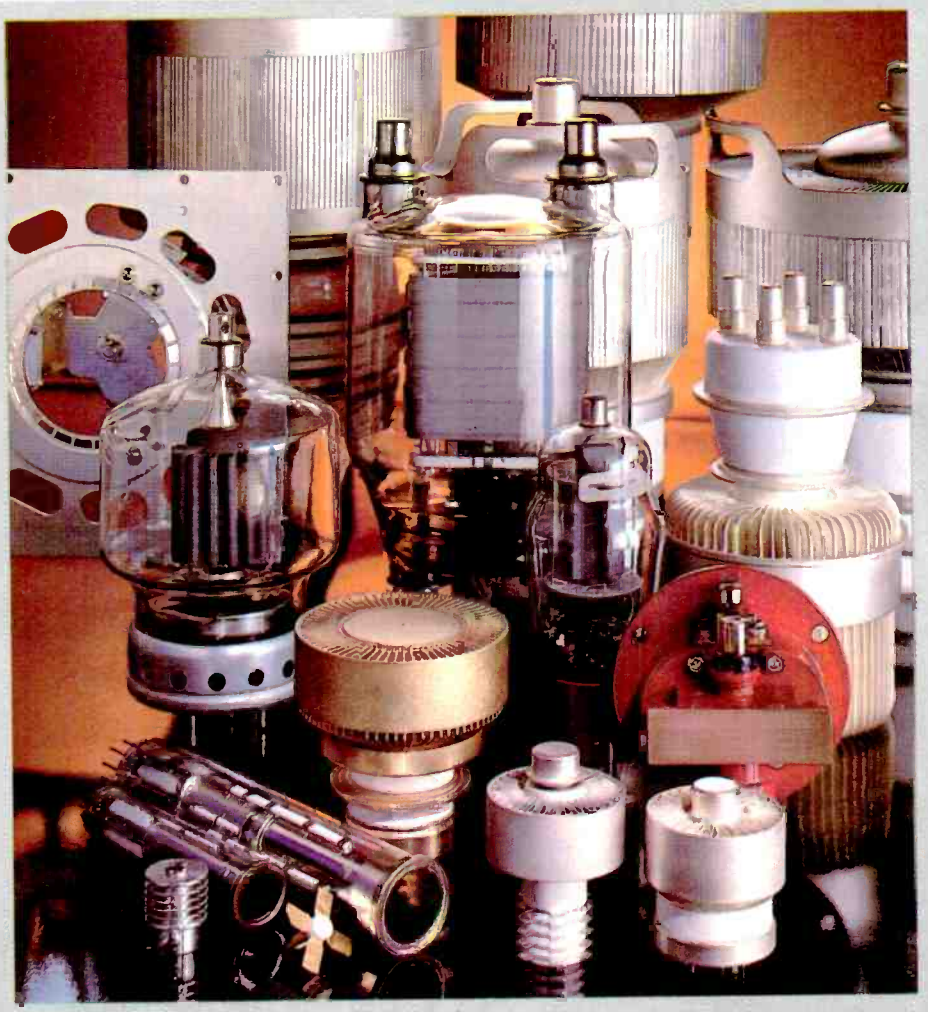

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Digitally speaking

Although most SNG trucks rely on analog SCPC transmission for the audio circuits, at least one manufacturer uses digital transmission techniques. The digital communication system, shown in Figure 1, provides a full duplex telephone circuit, one IFB circuit and even an optional data channel.

The audio is first digitized using a continuously variable slope delta (CVSD) modulation technique. This conversion technique is more efficient than conventional pulse code modulation (PCM) in that toll quality circuits can be provided with bit rates of 32KB/s as opposed to the 64KB/s rate required by PCM. The reduction in required data rate translates directly into reduced space segment operating costs.

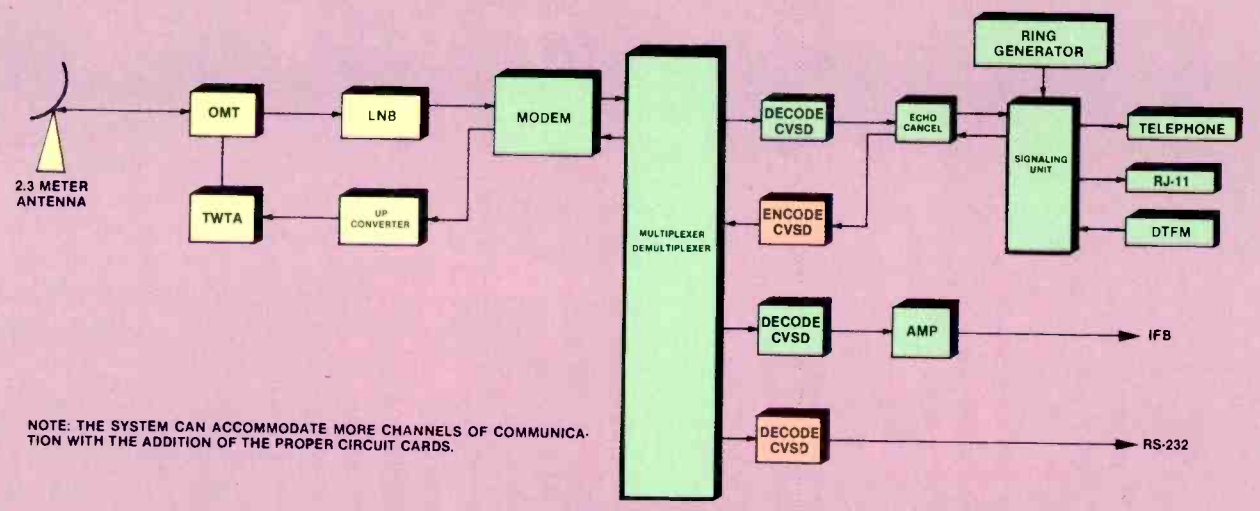
Before transmission, the individual data signals are multiplexed onto a single composite datastream for transmission to the satellite. To reduce transmission errors, a forward error correction scheme (FEC) is applied to the signal. The FEC encodes the data with additional information that is used by the FEC decoder at the downlink site. The decoder uses the correction information to compensate for any missing bits of data.

A primary advantage of this method of audio transmission is that it allows a reduction in required satellite power by a factor of four, which reduces operating costs.

Courtesy of BAF Communications Corp.

This SNV uses a roof-mounted 2.3-meter dish. Coupled with the digital transmission system, the equipment can provide economical audio and video transmission capabilities.

Figure 1. Block diagram of a digital audio transmission system on an SNV. Digital transmission requires less satellite power and may reduce satellite operating costs.



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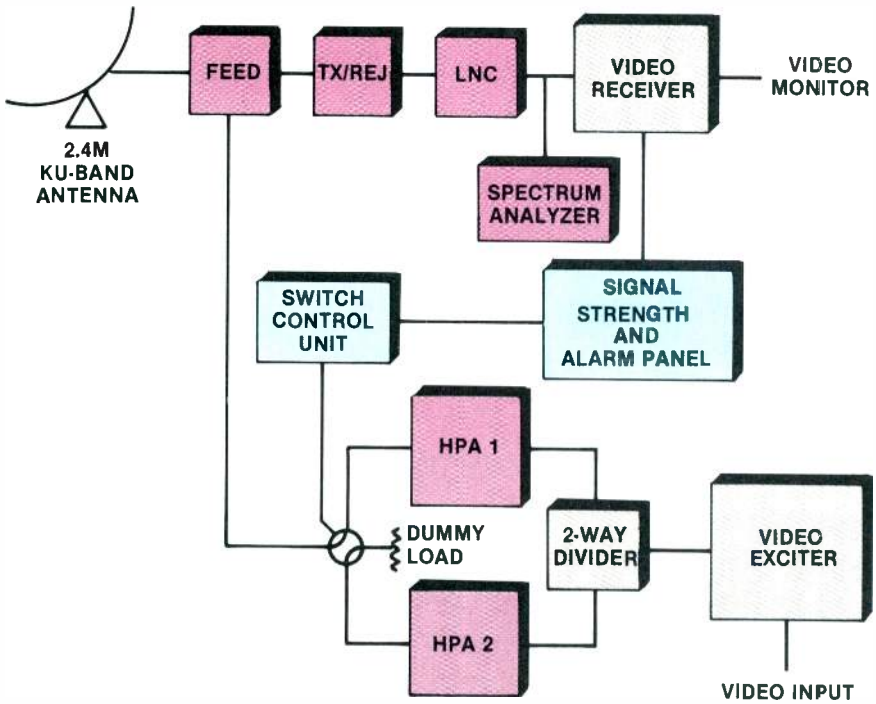


Figure 4. *The video transmit and monitoring system for a 2.4-meter SNV. Two HPAs are required in this configuration.*

equipment, installing additional components later as the need is justified, thereby lowering the initial cost.

Problems

Weather affects satellite transmission more than other forms of communications. The location of the truck may even dictate what type of antenna is required. Rain, snow and wind can affect the signals from and to the satellite. If the broadcast signal needs to pass through a heavy rainstorm for many miles, breakup or loss of signal can occur.

Because there is a limit to the number of uplinks and satellites available, not everyone may be able to have a system. Even with 2° satellite spacing, a limit on the number of uses may be reached. There are methods under development that allow more than one video signal that can be carried on a transponder.

Current technology allows up to eight video signals to be placed on the same transponder at one time. However, limiting the bandwidth of a video signal affects the quality of the picture. For most applications, this degradation will not be noticeable. The result is a *smeared* picture in the area where rapid movement occurs, similar in appearance to slow-motion replays of televised sporting events.

A 4.5-meter dish uplink truck. These trucks tend to be larger than those equipped with smaller dishes, but can use lower-powered HPAs.

Courtesy of Dalsat

Building your own

Because the technology required to build an SNG truck is complex, few stations will want to undertake such a construction project. The capabilities an SNG truck can provide, however, may force the engineering staff to become involved in its purchase.

The key to a successful purchase of an SNG truck lies in two areas. First, the station must be able to carefully specify what the truck is supposed to do. This step is best completed by working with programming and management to develop specific programmatic requirements. Once the programming requirements have been agreed upon, engineering can work with a manufacturer to see that the truck meets the station's needs.

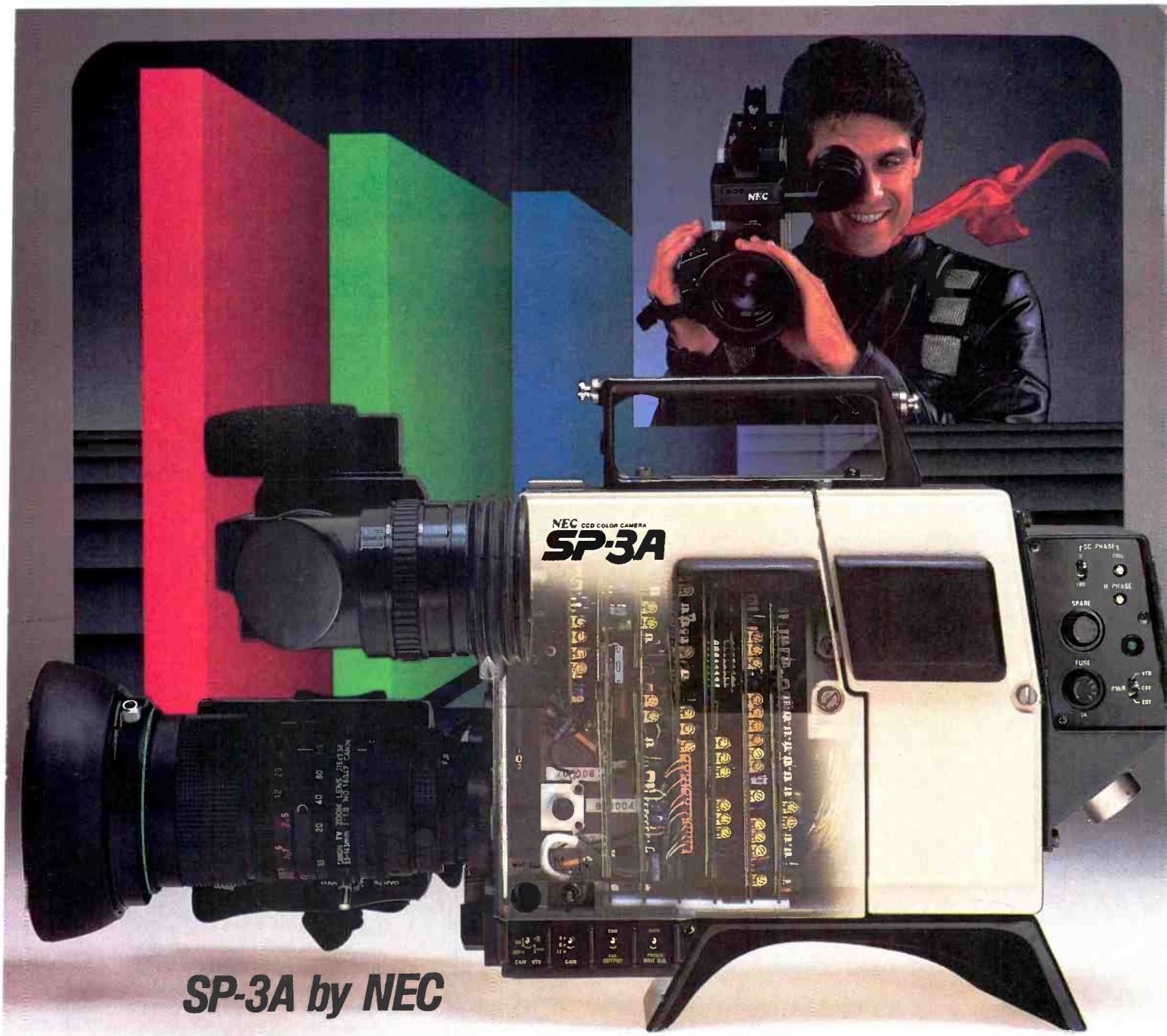
If you decide to purchase a satellite truck from any of the several vendors, there are a couple of safety items to keep in mind. Because additional Ku-band satellites may soon be launched, it is important that your truck be able to operate under 2° spacing requirements. You should request that your vendor certify that the completed vehicle will meet all operational requirements for 2° satellite spacing.

The importance of proper truck chassis design cannot be overemphasized. You may want to obtain some assurance that the final truck design will meet your state truck load and clearance requirements. If you plan on operating in any other states, the truck should also meet their requirements. According to some vendors, the key is to be conservative in the initial truck design. Because an empty truck does not accurately reflect its operating weight, be sure to account for the personnel and any equipment that may be carried on the truck.

Finally, there may be some precautions that need to be followed with respect to radiation from the antenna. You may want to measure the radiation levels near the antenna. The last thing you want is someone raising a concern about personal safety when in the vicinity of your truck. SNV manufacturers may be able to provide you with actual radiation measurements taken from your truck prior to delivery. You may want the manufacturer to assure you that the truck and antenna assembly meet appropriate state and federal requirements.

Satellite news gathering promises to be one of the most lucrative and exciting areas for television in the near future. Stations that budget and plan now for this important capability stand to profit from their foresight.

Acknowledgement: The author wishes to thank Jim Delany, director, antenna and facilities engineering, Comsat General Corporation, for his help in preparing this article.



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Circle (43) on Reply Card

Engineering radio remotes

By Skip Pizzi

Radio remotes can offer the listener programming that might not otherwise be available. Proper planning and setup are the keys to successful remotes.

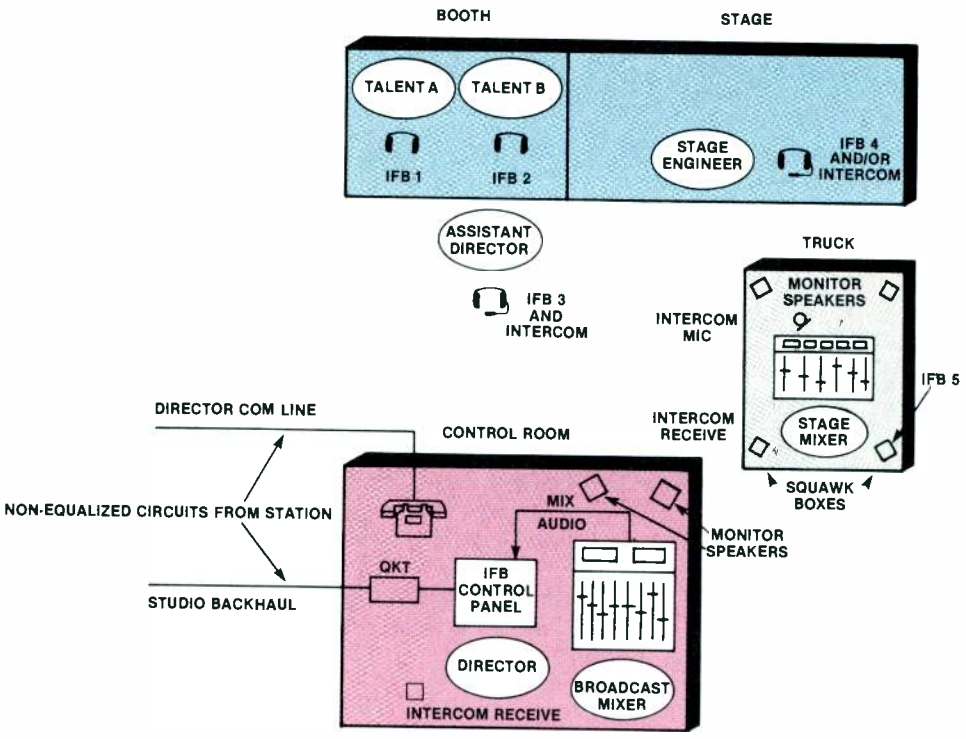
The contagious excitement and programming value of a live on-location radio broadcast is no secret. Yet, in recent years, its use has dwindled in most radio formats for a variety of programming and economic reasons. Although no one can claim that a remote is cheaper to produce than a typical studio-originated program, radio remotes are certainly a bargain compared to TV remotes. In fact, radio crews may be able to originate programs from locations where TV origination is not even possible. Radio broadcasts remain extremely mobile, and this advantage can make the difference in a competitive market.

Some astute broadcasters, realizing its fringe benefits, are bringing back the remote broadcast. Beyond increasing listenership, a remote can be a lucrative venture when it originates from a sponsor's location. It also can have excellent promotional value for the station and provide a competitive edge over those stations not so equipped. More philosophically, it is perhaps the best use of the mobility of radio, in that it brings to listeners over a wide geographic area the sounds of events *as they happen.*

This article will discuss some of the many aspects of on-location radio broadcasting for a variety of formats. Many of these tips have been learned the hard way, so here's hoping that you can learn from my battle scars.

Pizzi is training coordinator for National Public Radio's technical production unit, Washington, DC.

Figure 1. *Careful planning of a communications setup allows crew members to hear the program as well as the director's cues.*



NOTE: DIRECTOR'S CUES TO BROADCAST MIXER ARE ACOUSTICAL BECAUSE THEY ARE IN THE SAME ROOM AND NEITHER IS WEARING HEADPHONES. THE DIRECTOR CAN TALK TO ANY OF THE FIVE IFB STATIONS INDEPENDENTLY OR COLLECTIVELY. PROGRAM AUDIO SELECTION CAN BE VARIED BETWEEN EACH IFB STATION. ALL INTERCOM MICS ARE PUSH-TO-TALK.

Site survey

The first priority for any remote is a thorough site survey. It should be conducted as long before the broadcast as possible. When conducting the survey, take along a tape measure, ac circuit tester, note pad, flashlight and perhaps a microphone, mixer and a pair of headphones. If you have a small oscilloscope, take it too.

The physical space should be diagrammed in detail with actual measurements. This will help determine the length of cable runs. The site should be surveyed at the same time of day and week that the broadcast will occur. The disco upstairs may not be open when you show up at 10 a.m. Monday to do the survey, but it might be going strong at 8 p.m. Saturday when you broadcast.

In cases in which a remote vehicle will be used, parking, cable access and ac power for the vehicle should be checked. In many areas, permits, and/or special parking arrangements may be required. Lead time here may be essential. Observe any low clearances that the vehicle may have to negotiate at the site or enroute. Verify code regulations with the appropriate authorities whenever cables must be run overhead across an automotive or pedestrian thoroughfare. When a vehicle is not used (or when the vehicle alone is not sufficient for the entire production), appropriate space must be found and mapped.

Acoustical isolation between rooms should be checked along with ambient

Continued on page 68

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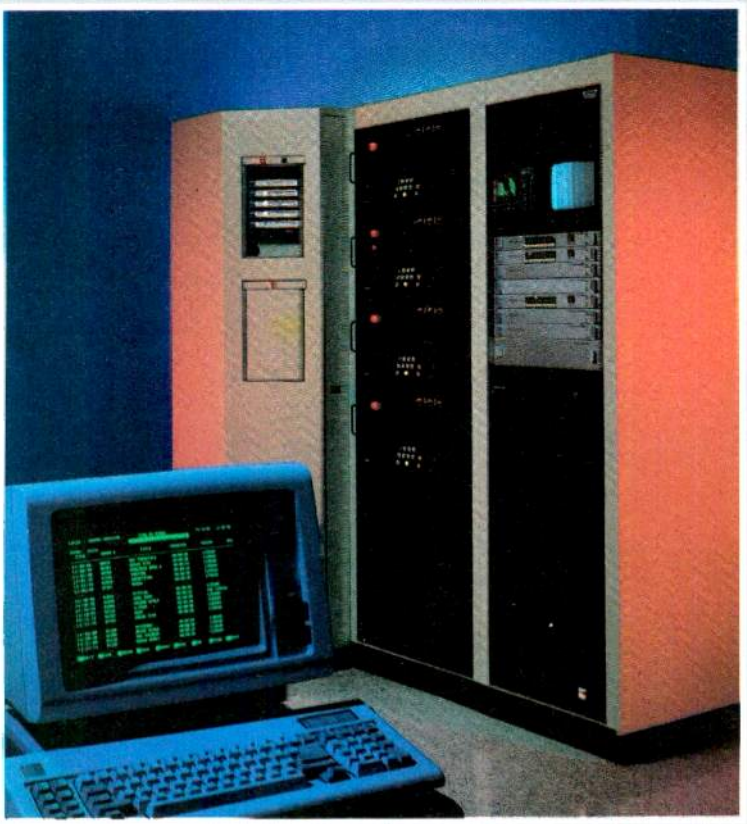

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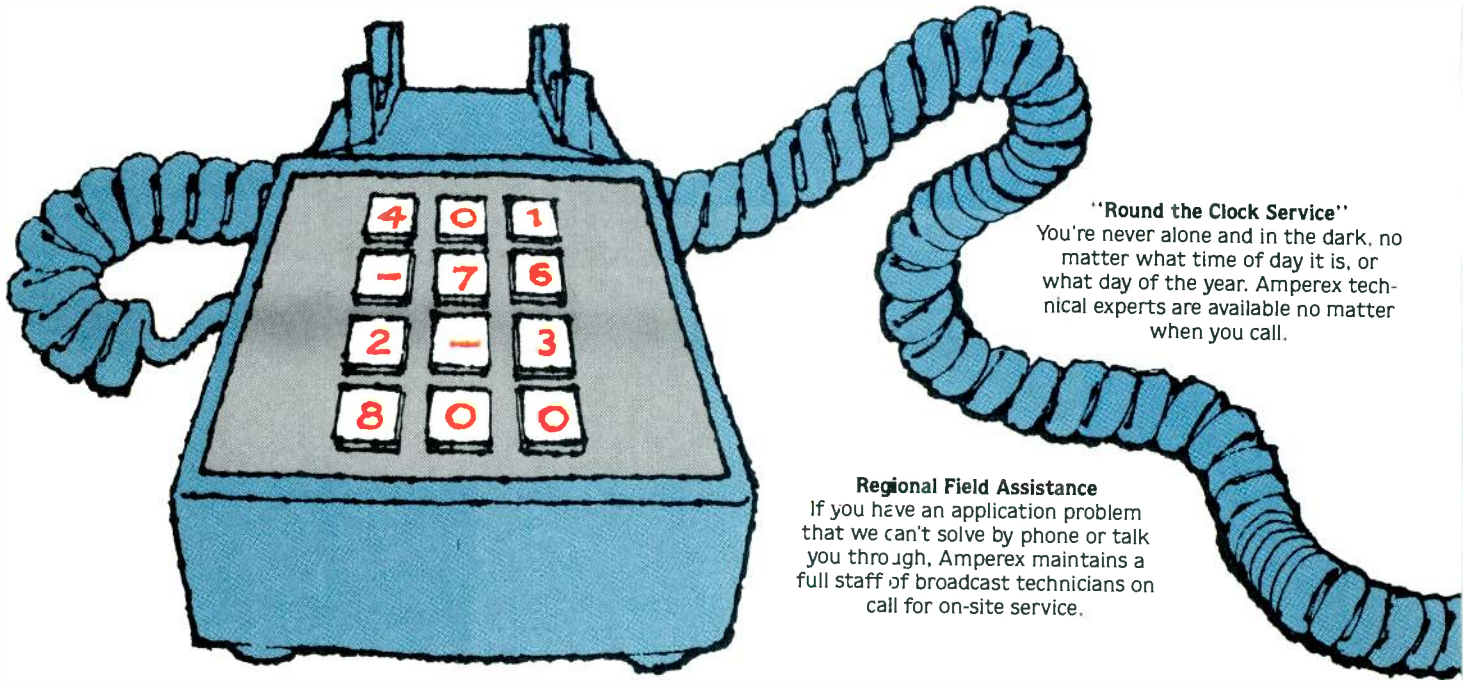

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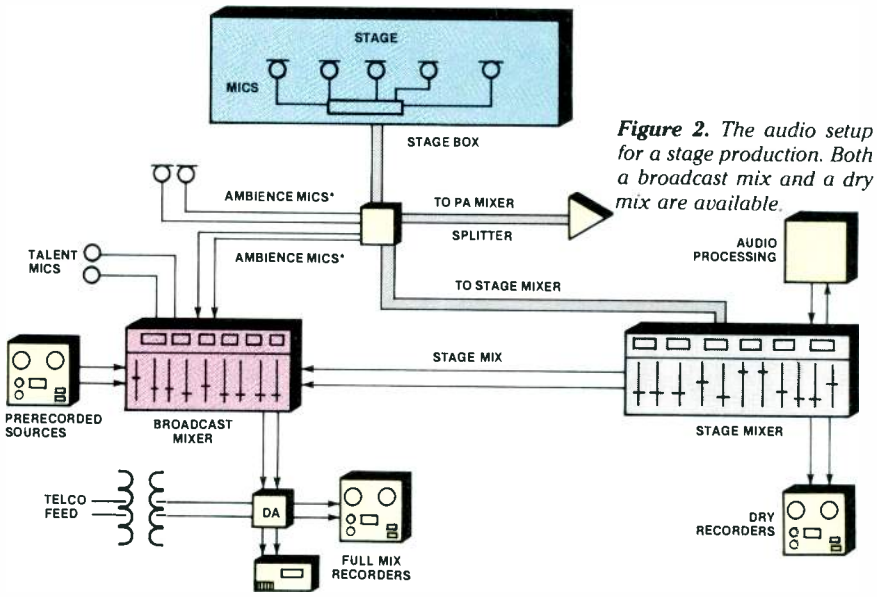

*NOTE: THE AMBIENCE MICS ARE SPLIT BETWEEN THE STAGE MIXER AND THE BROADCAST MIXER. ALL OTHER MICS ARE SPLIT BETWEEN THE STAGE MIXER AND THE PA MIXER AS REQUIRED.

Figure 2. *The audio setup for a stage production. Both a broadcast mix and a dry mix are available.*

Continued from page 64

noise levels and *liveness*. Be especially critical of these factors for any room where microphones will be used. Verify that all air-handling systems are operating properly. Find out if, and how, they can be turned off. On news remotes you may need editing space in addition to studio and control room space.

Check all ac outlets with a circuit tester for voltage, polarity and ground faults. Report any anomalies to the facility owner or operator. Aside from the fact that they could wreak audio havoc, such conditions may be downright dangerous. Locate the fuse or circuit-breaker box and note it on your map. Buy some spare fuses if you have to. If telephone lines are used, find the telco incoming wiring block and note its location on your plan.

Also, note the optimum location for the termination of any telco lines that will be installed. If an RPU is used, a test broadcast must be conducted. You should also check with your local SBE frequency coordinator for a rundown on the frequencies that will be available (or that must be shared) at the time of the remote.

As previously suggested, it's not a bad idea to bring along a microphone, small mixer and headphones. With them you can check the broadcast locations for ac cleanliness and RFI problems. An AM radio, tuned between stations, can be used similar to a geiger counter to track down any RFI-emitting devices. Make sure that all the house lighting systems (interior and exterior), appliances and HVAC equipment are operating during your tests. In particular, watch out for pops and clicks from marquee *chaser* lights and buzz from SCR dimmers. On news remotes, other RFI sources can include microcomputers and photocopiers. In most cases, these problems can be solved, if enough time is available. Finding out about potential difficulties at the time of the survey may make the solutions possible. In remote work, time is a valuable and elusive commodity.

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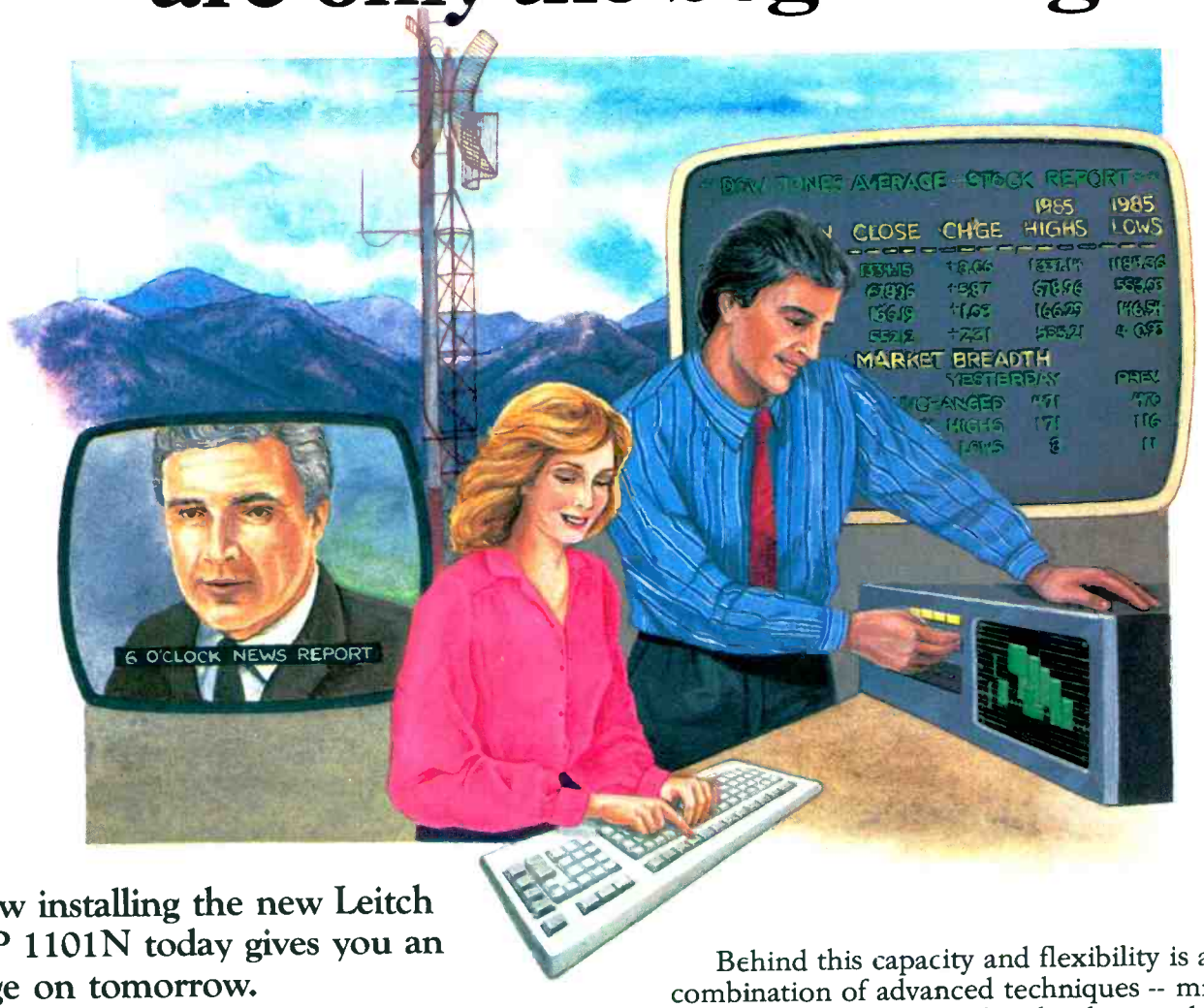

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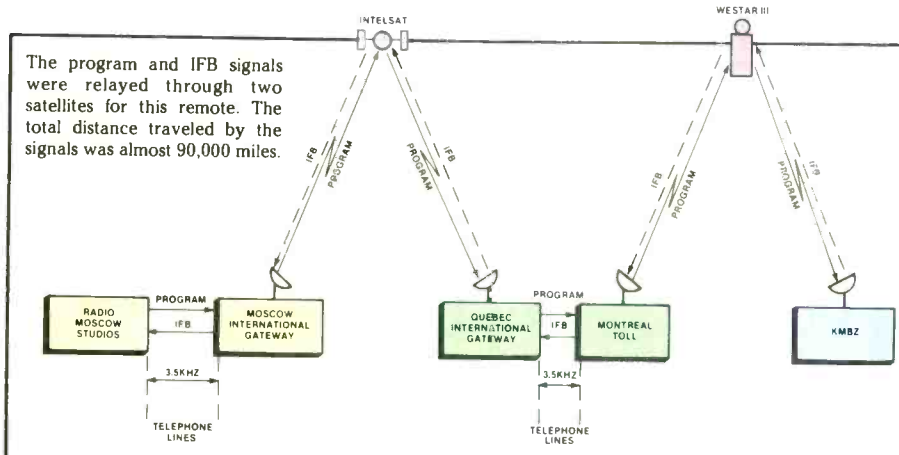

The program and IFB signals were relayed through two satellites for this remote. The total distance traveled by the signals was almost 90,000 miles.

Long-distance remotes

Most radio engineers have been called upon to coordinate more than a few remote broadcasts. The task usually involves ordering a telephone loop, a dial-up circuit or two and perhaps arranging for access to the location. Did you ever wonder how much trouble it would be to arrange a 5-day remote broadcast? And, by the way, when we use the term remote, we do mean remote—Moscow.

This was the situation for the staff at KMBZ-AM in Kansas City, MO. The station recently originated drive-time broadcasts from several distant locations. In one case, the station broadcasted from El Paso, TX, for three days in an effort to better understand the problems with illegal immigrants. Another broadcast originated from Washington, DC.

In each of these cases, the talent was required to conduct the shows as though they were in the studio back in Kansas City. That meant talking with the airplane pilot who gives traffic reports, with the meteorologists who submit the station's weather forecasts and even with listeners calling in on the telephone. After several successful broadcasts, KMBZ decided to broadcast the station's 5 a.m. to 10 a.m. drive-time segment live from Moscow. The broadcast took place during the week of the summit talks in Geneva, Switzerland.

Arrangements

The broadcast required many hours of planning. The most critical aspects were the program and IFB channels between Moscow and Kansas City. Satellite coverage was selected as the most cost-effective means for the broadcast. In order for the signal to travel from one side of the globe to the other, two different satellites were needed.

Shown above is the communications path between Moscow and Kansas City. The total length of the path was approximately 90,000 miles. The station requested a 5kHz telephone link from Moscow to Kansas City. However, the Soviets were unable to provide a 5kHz telephone line between the Radio Moscow studio and the uplink. The Kansas City station finally had to accept 3.5kHz service on that portion of the link.

The return audio (IFB) was relayed from the KMBZ studio using a portable uplink. The main console audition channel provided a separate feed for return program and communications.

Interruptions are possible with any broadcast, and this one was no different. In the three cases in which program outages did occur, two were related to landline circuits, not satellite problems. Even when the satellite system was at fault, it was the local downlink that had failed.

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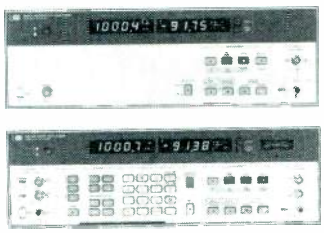

The HP 8903B packs a lot of instruments in one low-cost box. Besides the analyzer, there's a source, an ac/dc voltmeter, a frequency counter, signal-to-noise meter and a sweeper.

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"Not only does the SK-970 have complete auto setup, but it's a genuine studio camera that's lightweight enough to send into the field."

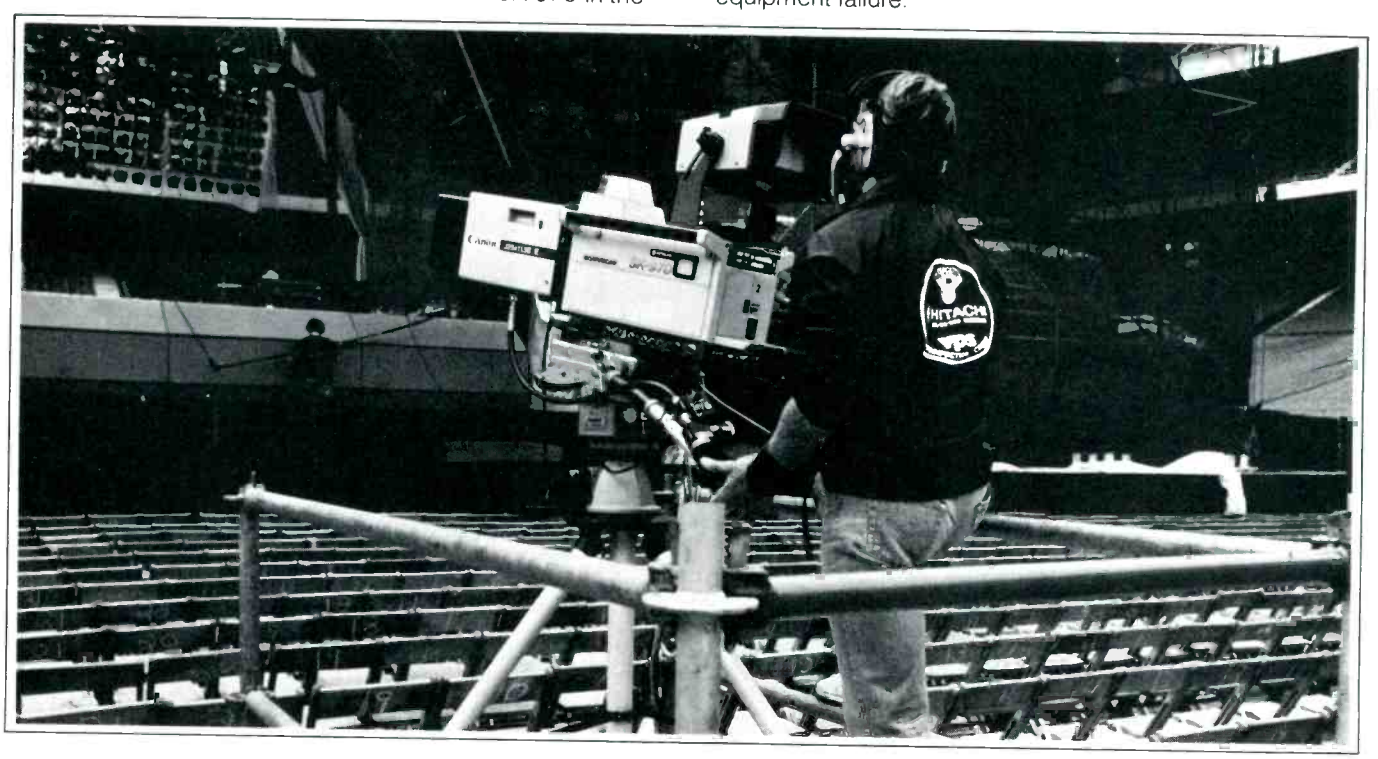
I. Jay Azimzadeh, President
Video-Pac Systems, Ltd.
Hollywood, CA

The largest producer of live concert videos in the U.S., VPS requires lightweight, low-maintenance broadcast cameras it can put on the road for long stretches.

Azimzadeh considers the SK-970 the only studio camera with 2/3-inch mobility and EFP handling. So it can meet the demands of often makeshift stadium facilities, while delivering the broadcast images that are needed for larger-screen multiple projection.

Since each of the four SK-970s and two SK-97s in the travelling package has complete self-contained auto setup, a separate box isn't needed. And any potential problems are confined to one head.

Although VPS earmarks two SK-97s and SK-970s for studio use, the ability to use both wherever they are needed is a welcome economy. Still, the greatest asset of the SK-97 and SK-970 is rockbottom reliability. To Azimzadeh, concerts are just like live TV—no one can afford any slip-ups, or an equipment failure.

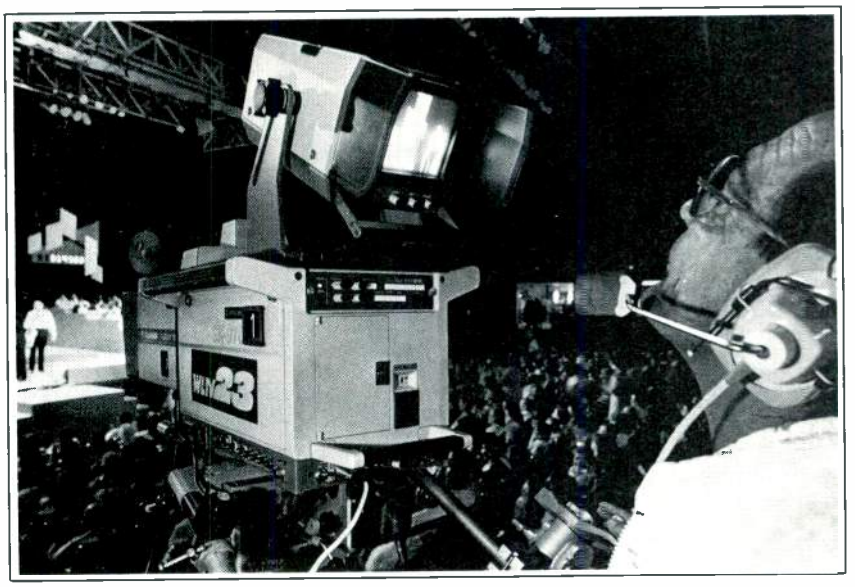


"Since each SK-97 and SK-970 has its own on-board computer, I can set everything up at the same time automatically."

Terry McIntyre, Remote Supervisor
F&F Productions, Inc.
St. Petersburg, FL

As a mobile production facility covering sports and large outdoor events for local and network TV, F&F needs broadcast quality on location.

They also need fast, independent setup. So they keep three handheld SK-97s and four compact studio SK-970s permanently stowed on one of their trucks. And with complete computerized auto setup on-board each camera, the crew can set all of them up at the same time from parameters stored in memory without having to worry about drift or last minute adjustments.



The SK-97 and SK-970 also perform superbly under low-light conditions. As a result, notes Chief Engineer Dennis Lusk, both can use very large lenses. And with real-time registration compensation automatically correcting for any changes throughout the travel of zoom lenses, the cameras are ideal for the demands of sports coverage. Resolution and colorimetry are also unsurpassed, according to Bill McKechnie, another Remote Supervisor. In fact, the SK-97 is often run by F&F as a "hard" camera, in place of the SK-970. Location recording is done on two Hitachi HR-230 1-inch VTRs.

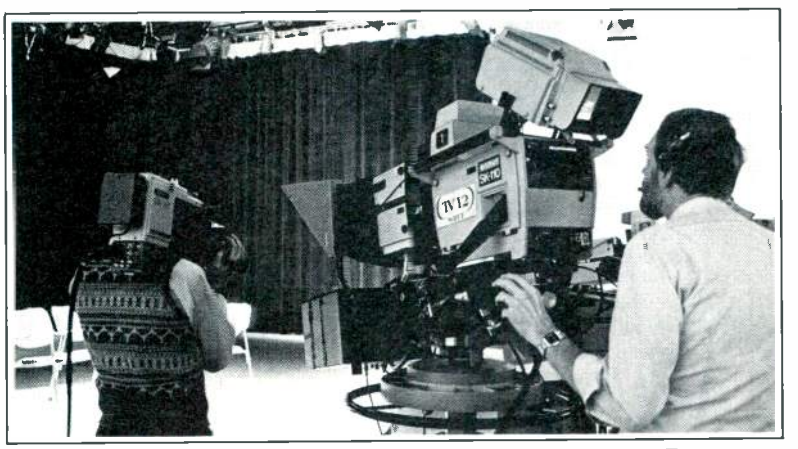
Most important, however, is the almost complete interchangeability of both cameras. Not only are they easy to work with, but they are also easy to link up. And so similar electronically, a single set of spares can cover any potential emergency.

"The SK-97 is a real mini-cam that can be completely integrated into a total studiowide auto setup system."

Bill Weber
Vice President for Engineering
WHYY Television
Philadelphia, PA

WHYY has extensive production facilities at Independence Mall and more studios on the drawing board. To plan for this rapid growth, WHYY sought a family of broadcast cameras that was as flexibly integrated as it was advanced.

While evaluating computerized camera systems, Bill Weber and his staff found that the Hitachi SK-110 studio unit and the portable SK-97—with the same basic complete auto setup—were so perfectly matched in colorimetry and resolution that pedestal and handheld work could be combined without a hitch. And because the SK-97's auto setup is also completely self-contained, both cameras are as electronically independent as they are geared toward common console control.



Staffers like Senior Video Engineer Bob Miller consider the SK-97's auto setup easy-to-use, as well as accurate and reliable. And the on-board lens and scene files give operators instant filter and color correction at each camera head, in addition to the console. So the staff looks upon the Hitachi SK-97 as a studio camera that they can shoulder.

As facilities grow, WHYY's Weber knows that he will have the flexibility to configure and reconfigure SK-110s, SK-970s, and SK-97s to meet production requirements of most any complexity without encountering technical snags. In fact, with Hitachi cameras at other sister stations in the Eastern Educational Network, joint productions can even be assured of a common look.

For a demonstration of the SK-97 and SK-970 in your studio, contact Hitachi Denshi America Ltd., Broadcast and Professional Division, 175 Crossways Park West, Woodbury, NY 11797; (516) 921-7200, or (800) 645-7510. Canada: Hitachi Denshi Ltd. (Canada), 65 Melford Drive, Scarborough, Ontario M1B 2G6; (416) 299-5900.

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HITACHI

Planning

The site survey provides a groundwork for the planning and paperwork that follows. Before the survey, your assignment from the producer(s) should have included at least a rough idea of what the production requires. Armed with the program requirements and the information gleaned during the site survey, you are ready to create a workable broadcast system. If you discover any serious impediments to the production plan, report them to the producers immediately. Many of these difficulties may be overcome or worked around if identified early enough.

The next step is drawing a system block diagram. Any special adapters or unusual arrangements should be circled or highlighted. Next, generate a detailed equipment list from a line-by-line perusal of the block diagram. Add spares and slack wherever possible, especially with regard to time schedules. If other media are involved, avoid conflicts by coordinating load-in/out times.

Place any telephone line orders as early as possible. Order the lines to be in place several days before the broadcast and take into account weekends and holidays. Although emergency service personnel are available on such days, the staff often consists of skeleton crews and/or less senior technicians.

Be prepared for a financial shock when ordering telco lines, especially if significant installation work is required. Don't let the telephone company off the hook without making sure it has fulfilled the order as placed. If something seems amiss, ask to speak to a supervisor. If that doesn't help, call for that person's supervisor. Keep it up until the entire order is correct.

Be especially careful with communications lines, because they are handled by the regular installers. Program circuits are usually handled by more experienced installers who work on a less harried schedule. It may be wise to order the communications lines to be in place a few days before the program circuits. You'll need this extra time if the regular telco staff is running behind schedule.

Try to be at the remote site when the telco installers arrive. Verify that the installation is satisfactory. Minor changes are easier to make with the installers than they are when the main office becomes involved.

When you are required to interface with a PA system, additional advance work is necessary. Call or meet with the PA operators and verify all arrangements *in writing*. Splitting microphones can be accomplished painlessly using a well-designed transformer-isolated mic splitter with ground lift capability. Splitting mics with the PA and doing your own mix is usually preferable to taking a mix from the PA operator. Your mix may require some additional mics that the PA does not need.

Communications

An on-site director is essential to the success of any remote. This person must be connected to all key personnel on the broadcast team. The director needs clocks, telephones and a communications control panel. A sexagesimal calculator and work space for scripts and notes are also helpful. Good monitoring provisions at the director's position are a must.

The best communication system provides IFB (interruptible foldback). IFB allows the crew to hear the program audio and the director. The director's commands can be targeted to an individual, to a group or to everybody at once through the IFB. Some IFBs simply drop the program audio level when the director's cues are transmitted. Others cut the program audio entirely. On some

Loveboat remote

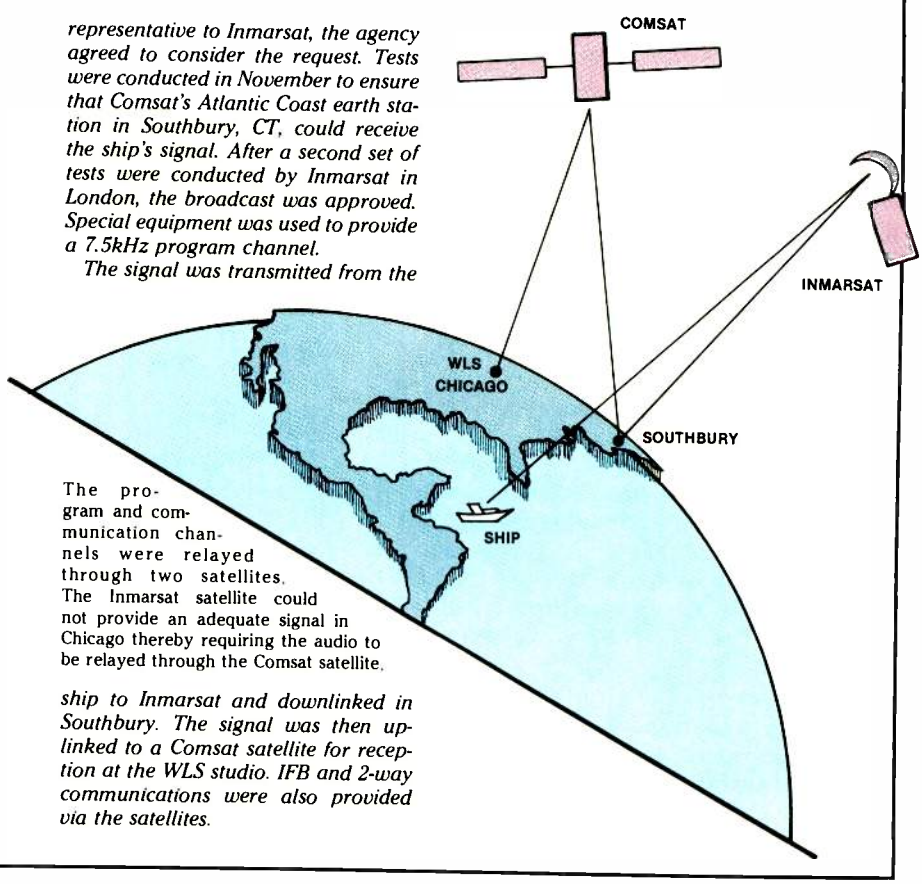
Remote broadcasting from a ship at sea has, until now, been almost impossible. Any station attempting such a feat was limited to the range of normal communications band radio equipment. However, WLS-AM, Chicago, and a California company (IDB Communications Group, Culver City) have developed the technology to allow a radio station to broadcast aural programming from a ship at sea.

The project developed from a request by WLS to broadcast the station's afternoon drive programming from the Royal Princess. It culminated in a promotional campaign in which the station sent five contest-winning couples and the on-air team on a week-long December cruise from San Juan, Puerto Rico, to Acapulco, Mexico.

The initial proposal suggested use of the ship's earth station and transmission equipment. However, additional equipment was needed to allow the liner to provide both emergency and broadcast communications. Also, the project required the approval of Inmarsat (the International Maritime Satellite Organization), which had never before been involved in this type of project.

Working through Comsat, the U.S. representative to Inmarsat, the agency agreed to consider the request. Tests were conducted in November to ensure that Comsat's Atlantic Coast earth station in Southbury, CT, could receive the ship's signal. After a second set of tests were conducted by Inmarsat in London, the broadcast was approved. Special equipment was used to provide a 7.5kHz program channel.

The signal was transmitted from the ship to Inmarsat and downlinked in Southbury. The signal was then uplinked to a Comsat satellite for reception at the WLS studio. IFB and 2-way communications were also provided via the satellites.



The program and communication channels were relayed through two satellites. The Inmarsat satellite could not provide an adequate signal in Chicago thereby requiring the audio to be relayed through the Comsat satellite.

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systems, the director's voice can be directed to one side of a pair of stereo headphones and a monaural mix applied to the other side. A good IFB system allows a choice of audio feeds to each of its individual outputs. For example, one crew member may receive the full program mix, while another can receive an isolated *mix-minus* feed. Of course, the director can still jump in with cues discretely to each channel or to the entire crew.

For full 2-way communication with crew members, an intercom (com) system is required. Two-way communication with talent can be achieved by putting the appropriate mics in cue and talking to them on the IFB. Because the crew is not miced for air, the separate com is used to provide a channel for crew responses to the director. The crew members can *listen* through the IFB if they need to hear the program. A cheap and simple way to install this system is to use lip mics on headset booms equipped with push-to-talk switches. The intercom (or *talkback)* audio is fed to the broadcast mix console and assigned to the cue speaker only. Or, the com audio can be fed to a small mixer and then into a speaker amplifier. Of course, a full-blown, separate intercom, independent from the IFB, may be used if necessary.

Whenever an engineer must hear the intercom on a loudspeaker while mixing program audio, it is helpful to physically place the com speaker off to the side or back. Because the com voices come from a different direction, their identification is easier, allowing the engineer to concentrate on the mix while still being able to hear com.

The director usually needs a telephone to speak to the station, network master control, uplink engineer, telco service personnel or other external location. Cellular phones can be used for this purpose if the line is needed only occasionally. When the remote site is feeding live audio to a studio that is originating programming back at the station, and 2-way conversation between station and remote talent is required, two full-time non-equalized (or *D-line* circuits) should be ordered. One may be used for the studio backfeed (mix-minus) to the remote site and the other for communication between the two locations. (See Figure 1.)

The setup

On large, complicated remotes it may be advantageous to split the mixing chores between two operators in separate rooms or vehicles. The rooms should be acoustically isolated from the venue and from each other. This arrangement is helpful when the stage or source audio is complex, such as in the case of a music broadcast, a large sports event or news story. In these situations, the stage mics are mixed by one operator, with a large console and full complement of audio-processing devices. The stereo (or mono) resulting mix is sent to the smaller, less complex *broadcast mix* position. The broadcast mix position adds all of the continuity, talent voices, prerecorded intros, features, bumpers and spots.

Ideally, some hall ambience microphones are split and shared between the two consoles. Then, when a set change occurs on stage, the stage mixer fades out all the mics in the mix except the ambience mics. Meanwhile, the broadcast mixer can fade the stage mix under some continuity audio during the break. After

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confirming that only the ambience mics were left in the stage mix, the broadcast mixer performs an inaudible crossfade under the continuity between the stage mix and the broadcast mixer's own split of the ambience mics. At this point, the stage mixer is free to perform mic checks, and to reconfigure the console at will, until it's time to return to the stage. When the set change is complete, the broadcast mixer simply crossfades back to the stage mix. (See Figure 2.)

Often, a *dry mix* or *cleanfeed* must be obtained to feed a pool or your own on-site recorders. For example, you may need a recording of only the music or speeches from the stage, without the program continuity, for later production or archiving. The cleanfeed audio can be obtained directly from the stage mixer.

You may also want to make an on-site recording of the full-mix program, because there is always the chance that a problem with the backhaul transmission will affect the studio recording. If this type of problem occurs, you will still have the on-site recording for rebroadcasting or archiving. Even without any backhaul problems, the specifications of the backhaul circuit to the station or network may be sufficiently poor to degrade the quality of the audio. If so, the on-site recording will be significantly better than the studio copy. Of course, if anything less than 15kHz backhaul service is used, the on-site recording is essential.

Nuts and bolts

When installing your equipment, run the ac first. Keep it neat, but don't dress too much until everything is finally set. Next, set up all monitor systems and check for clean audio. Start putting in the consoles, *snakes*, splitter and microphones, in that order. Avoid running audio and ac lines parallel for any great distance. Try to have audio lines cross all ac lines at 90°. Beware of running mic lines near any large electromagnetic field such as the house ac transformer vault, or any large motorized device. You should check the audio in the monitors after each step, to ensure that any hum and buzz sources will be immediately identified. If you wait until everything is hooked up, it will be difficult to track down an offending noise source. Solve the problems as they arise, then move on.

Lay in the communications system last. You can use the snake lines in reverse for IFB sends if the level does not cause crosstalk into the mic lines. Avoid running such lines through the splitter.

Once your system is up and running to your satisfaction, you can interface to the PA, if necessary. Ground lifting on the splitter may be necessary, but make sure all mics are still grounded to *one* console. Try to obtain all of your ac power from the same circuit as the PA system. Ideally, both ac feeds will be on a different phase than the house lighting system.

There may be ground loops within your own system. This is especially likely if a good deal of audio processing is used. Unbalanced console inputs and unbalanced processing equipment are typical causes of ground loop problems. Set up the audio processing last and try to eliminate any audible ground loops by maintaining the ac and chassis grounds, and lifting the audio grounds, whenever possible.

Usually, mic-level lines are the only ones in which ground loops create audible problems. Avoiding any unbalanced equipment (or active-balanced equipment with poor common-mode rejection) can prevent a lot of problems in the field, even at line-level interfaces.

Transformers have gotten a bad name of late, and not without reason. However, a high-quality (expensive) transformer can be an indispensable aid in field production. Keep the number of these transformers to a minimum, but be mindful that the input and output isolation that quality transformers provide between certain components of a system is imperative in many cases.

Wireless microphones

Wireless microphones can be wonderful additions to any broadcast. They do, however, create their own kinds of problems. When wireless microphones are used, allow extra time for special attention at setup. Put them in fairly early, and leave them up for a while to observe whether any stray RF problems surface. Check the receiver placement by walking around the stage and listening for dropouts. Always try to use a diversity system. My advice is to use wireless microphones only when necessary.

Quite often IFB is required for the talent using a wireless microphone. Here, a less common but generally available device called a wireless receiver is used. The system is the inverse of a wireless mic. The wireless receiver uses a stationary transmitter with a single antenna and a belt-pack receiver feeding a small earphone. Usually a monaural IFB is fed to the transmitter. This provides IFB capability similar to that of any other station.

Monitoring

Set up a quality monitoring environment with reliable speakers in the quietest room available. Make sure the speakers are wired with proper polarity. Keep the front part of the room as dead as possible. Monitor speakers usually should not be set up against the wall. If the broadcast is stereo, check the mono phasing with your ears and an X-Y scope.

Whenever possible, avoid mixing with only headphones, and never try to mix in the same room as the sound source (except for unamplified voice). The additional sound from the PA system will prevent you from properly hearing the quality of the mix. Familiarize yourself with the monitoring environment after setup by playing a recording that is well known to you.

Telephone lines

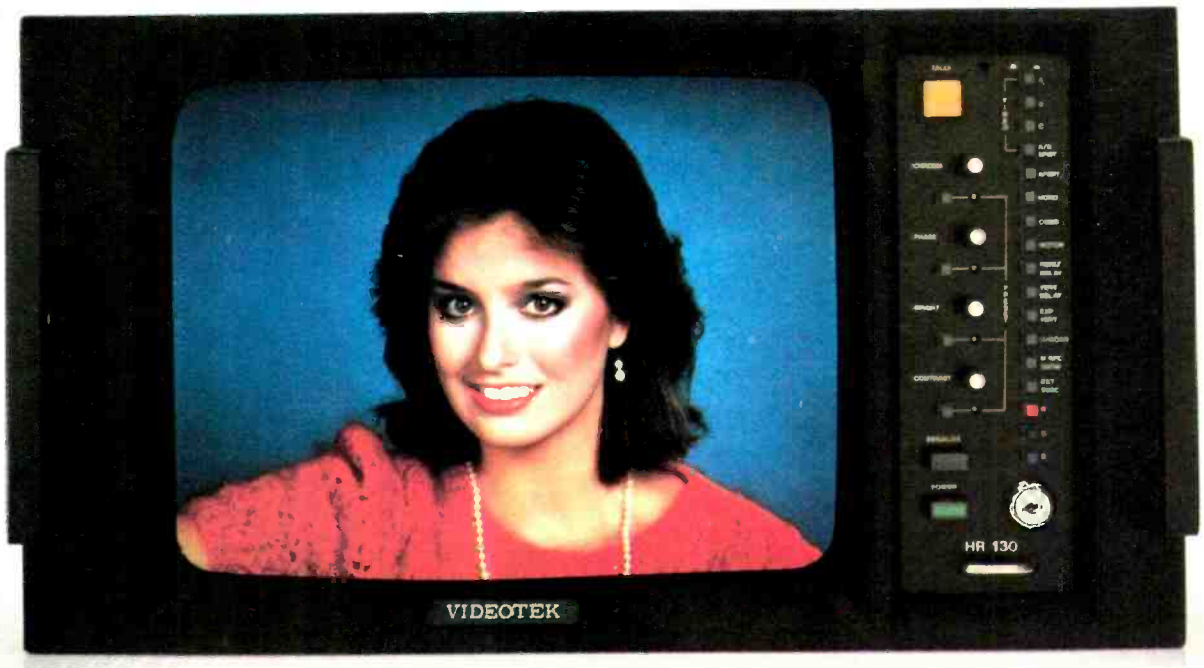
Remember to feed and to terminate your telco program lines with a true 600Ω impedance. Today's extremely low-impedance console outputs and high-impedance inputs are great in bridging situations. Telephone lines, however, still need a matching 600Ω source impedance. The phone lines are highly reactive loads; improper impedance matching will create frequency response errors. Don't call the phone company to complain until you're certain that you are feeding the loop with a true 600Ω source and terminating at the studio with a proper 600Ω load.

Check for polarity, phase response, signal-to-noise ratio and headroom at the studio end of the loop. For all test tones above 400Hz, use 0dBm levels. Although telco calls +8dBm the reference level, headroom is usually more of a problem than S/N. A +4dBm reference transmit level generally works well. It provides an extra 4dB of headroom, albeit at the expense of 4dB of S/N.

The biggest problems with remotes in urban areas are impulse noise and crosstalk. Companding noise, haloing, gating, modulation noise and similar aberrations are common with microwave or fiber-optic links. These kinds of noise are hard to measure, but easy to hear. It is difficult to obtain any kind of required loop specifications for these types of problems. However, with the new telephone rates, there is no excuse for anything short of complete customer satisfaction. Don't quit until you get it.

Finally, spread the work around. If you don't, you'll be so exhausted when you finally hit the air that you can't concentrate on the mix. Schedule more than enough time so that even with Mr. Murphy (who never misses a radio remote) by your side, you still have time to relax and to listen to what's coming out of the loudspeakers.

Acknowledgements: Much of the information here was shared with me by my colleagues and mentors Neil Muncy (Neil Muncy Associates, Toronto) and Paul Blakemore (Blakemore Audio, Takoma Park, MA). It is with these gentlemen, among others, that I am privileged to present workshops in remote recording techniques around the country under the auspices of NPR's training programs. |:7-)))|



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Circle (54) on Reply Card

Weather radar systems

By Carl Bentz, TV technical editor

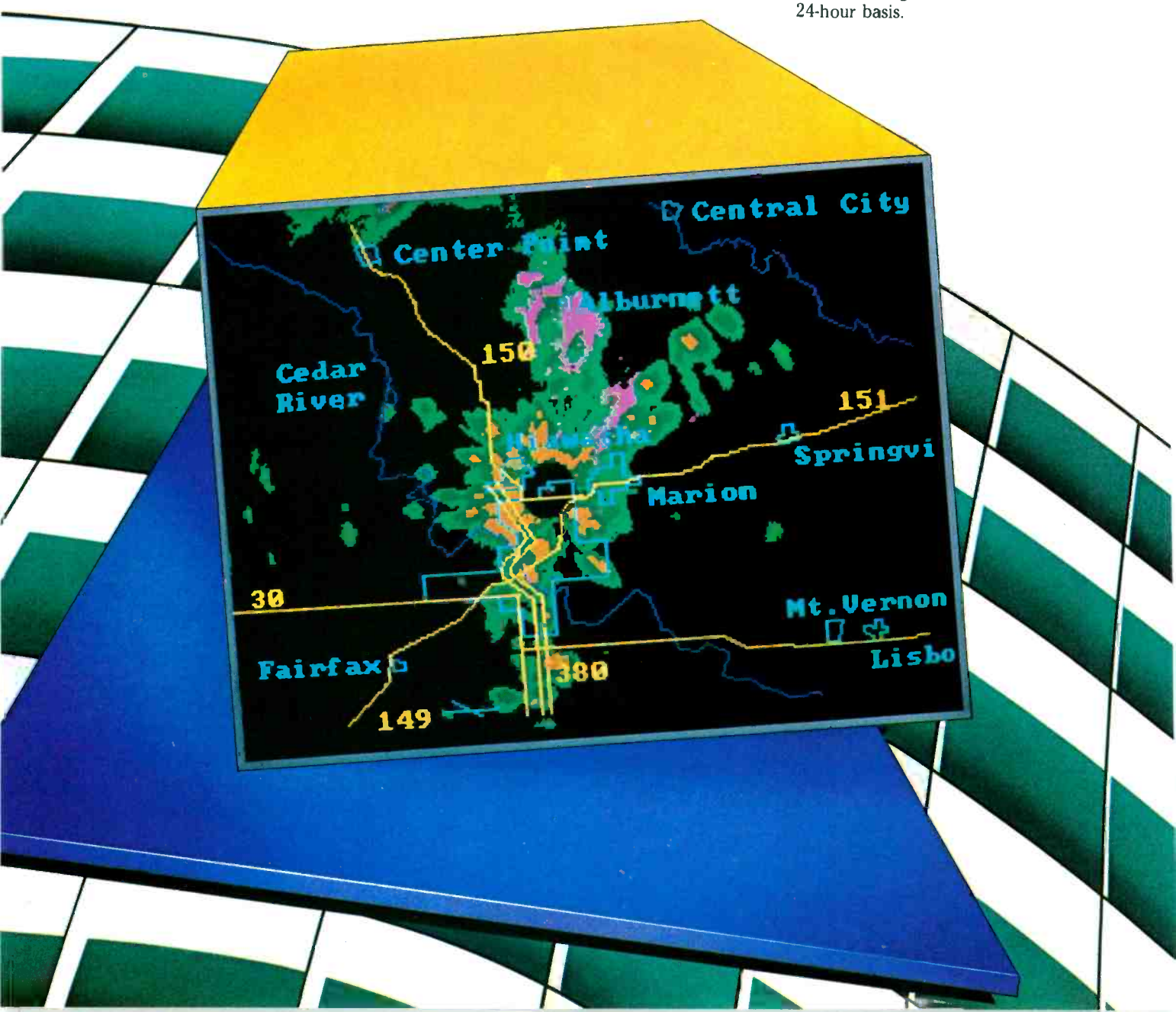
What is at best an inexact science is becoming a little more predictable, thanks to radar and digital technology.

How important is the weather? When it is calm outside, the forecast takes only a few minutes during a newscast. If conditions require, however, the weathercaster breaks into regular programming with updates and warning information. The broadcast audience expects such weather information, because our lives can be affected by what happens.

We can't change the weather—yet. But by combining data from satellites and radar with digital video display technology, improved (but not yet absolute) predictions and monitoring of turbulent air and potentially damaging conditions are possible.

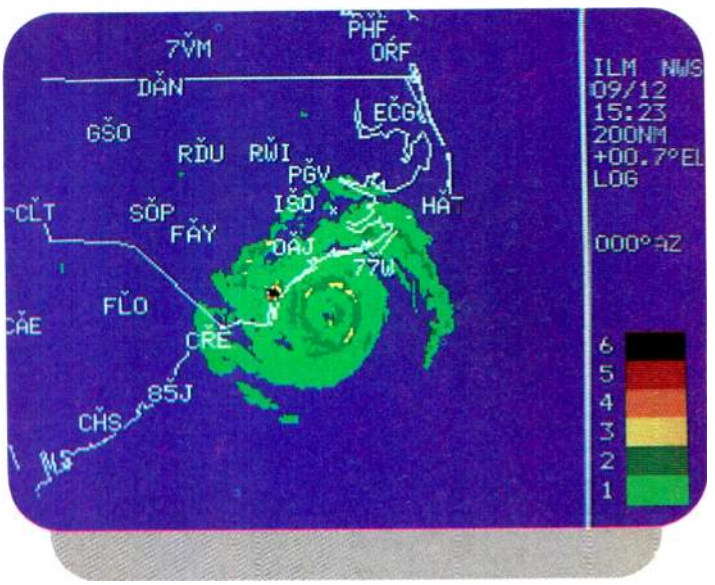
Bird's-eye views

For general weather data displays, television relies heavily upon imaging from geostationary and polar orbit satellites. Cameras aboard these weather satellites scan the earth and its atmosphere both in visible (0.55-0.75μm) and infrared (10-12.5μm) light. The infrared sensing allows current data on a 24-hour basis.



EIGHT QUESTIONS YOU SHOULD ASK WHEN BUYING WEATHER RADAR.

1. Where does the data come from?
The National Weather Service is now fully operational with a series of radar transmitters called RRWDS: it's their primary precipitation detection tool. The Alden C2000R is the color radar display system which allows its subscribers to access any of these RRWDS transmitters, on a direct line or dial-up basis.



2. What if I only want three or four sites?
With the Alden system, there's no need to pay for access to the whole country if you only need data from a few radars. You specify the sites you want, and we program your auto-dialer phone to receive these sites. You pay only for the sites you need.

3. Will I get busy signals?
Probably not. The system is designed so multiple users can call simultaneously. And because we know who has access to each radar, we can expand the system as subscribers increase.

4. What about service?
Of course the transmitters are maintained by on-site government technicians. And for Alden equipment, we maintain a nationwide service network for reliable operation.

5. What features are included?
The Alden C2000R has a number of built-in features that are costly options in other radar display systems. Zoom, range rings, sweep line, NTSC/RGB compatibility, time lapse and level flashing are included in the standard C2000R. And there's no hookup charge to connect to any radar.

6. Are there options?
You can add additional memory, clutter blanker, alarm, customized backgrounds—even a high-resolution printer for color print or transparency. And for a surprisingly small additional cost, you can convert the C2000R to the C2000R/S, which lets you receive color weather graphics from private data bases.

7. Can we afford it?
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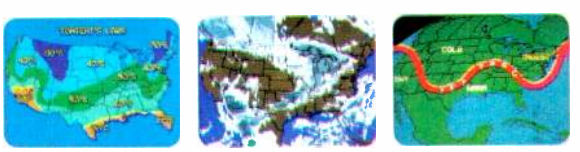

ALDEN ELECTRONICS

Circle (66) on Reply Card

Information from satellite cameras is digitized and stored in weather databases maintained by the National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service. Primary data centers are located in Anchorage, AK; San Francisco; Washington, DC; Miami; Honolulu; New Orleans; and Kansas City, MO.

Local stations may dial up the database and request individual or sequenced images for on-air presentation. The images are also available through fax communication systems. From the data, meteorologists develop forecasts.

For conditions closer to home, radar offers a different view. Radar (radio detection and ranging) was first developed for the military to determine the direction and distance of aircraft. And now, radar is an important part of radio and television.

Inside radar

Radio transmissions use continuous wave carrier signals, modulated by changing the signal amplitude or frequency. TV signals combine AM and FM techniques, with sync pulses forcing the signal into a pseudo-pulsed type mode. Radar modulation is pulsed, each pulse being a burst of an RF signal, similar to Morse code transmissions.

Rather than a wide-angle energy dispersion typical of broadcast signals, radar energy is confined to narrow beams with highly directional antennas.

When a pulsed signal in the 5.4GHz microwave spectrum encounters any change in density of the atmosphere through which it is passing, some portion of the signal is reflected. Originally, the expected change was the radio-opaque metallic skin of aircraft.

Today, ground-based weather radar looks for droplets of water or ice crystals in the air. The reflected energy is received by a high-gain directional antenna and processed to determine the distance and direction of the reflecting material.

X, Y and R

The position of the reflecting object relative to the radar station is determined from the antenna azimuth and elevation. Resolvers in the antenna mount sense the angular horizontal and vertical antenna orientation. Azimuth angles are referenced to due north, while elevations are usually specified in degrees above the horizon.

Resolvers develop X and Y Cartesian components that define the antenna heading. From this data, the object can be plotted on a standard raster display along with the sweeping vector often seen on radar CRTs.

A second approach uses a binary encoded switch. A disk, attached to the

No guarantees

Doppler weather systems have received a good deal of press coverage, particularly after the airliner crash at Dallas last summer, an event reported to have been caused by wind shear. Most reports state that Doppler radar will detect wind shear. Such statements are not categorically true, however.

A number of Doppler radar systems have been installed within the last year at various airports across the country. NOAA weather scientists are testing the equipment to determine what limitations exist and how effective this tool will be.

To date, research on Doppler radar has shown a high degree of correlation between detected and known turbulence, if atmospheric moisture is involved. Without rainfall, turbulence has not been reliably detected. Unfortunately, wind shear and clear air turbulence occur within dry air masses. Work with laser detection systems shows promise for detecting such phenomena.

A high correlation exists between information on the Doppler radar display and reported property damage. This indicates the system may yield greater predictive capabilities than standard radar equipment. Doppler radar enhances accuracy but does not preclude errors.

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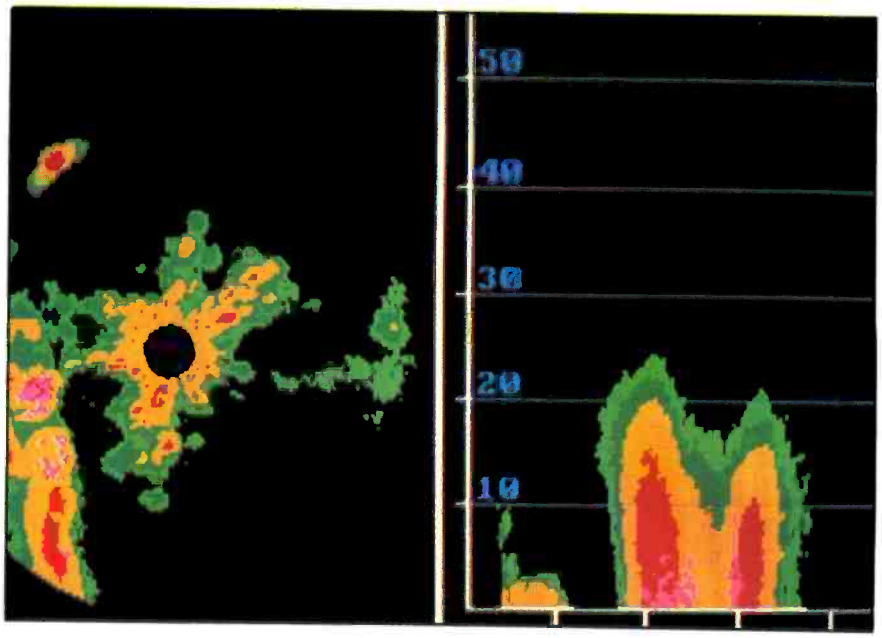
antenna, is divided into 360 sectors. Metal traces forming each sector follow a binary scheme, with contacts touching the sector traces to produce a group of open or closed conditions (binary numbers) to define the angular position. Sine/cosine function blocks convert the binary code into X-Y coordinates for the raster-scanned screen.

A third method of antenna orientation uses a phased array approach. A number of slots cut in a flat plate form the transmitting and receiving elements of the antenna. To control the direction of the signal, the phase and current amplitude of the signal driving each slot element is controlled. The antenna may effectively scan a large sector of a circle without any physical movement. On the display, positions are related to the driving element signal controls.

A pulse in time

The time interval between sending and receiving a radar pulse determines the distance and direction of the object. Traveling at the speed of light, energy pulses leave the antenna, hit the object and return to the antenna in milliseconds. The elapsed time, divided by two, and a velocity factor are used to determine the distance. An internal system clock allows the radar equipment to measure and calculate the elapsed time and distance and to display the object as a blip on the radar CRT. The system starts a timer as the pulse is transmitted and stops timing when a verified return signal is received.



This photograph shows how information from Doppler radar can be displayed. Here, a storm and its turbulence are shown as a vertical profile.

The spacing of pulses determines the amount of time the receiver listens for echoes from one pulse before another is transmitted. This rate sets a maximum range in which the receiver knows it is receiving echoes from the desired pulse. The distance relating to this rate is called the *unambiguous range* of the radar system. A maximum *unambiguous velocity* is also calculated.

To gather large amounts of data, however, a fast stream of pulses is necessary, particularly if multiple or large objects and motion are involved.

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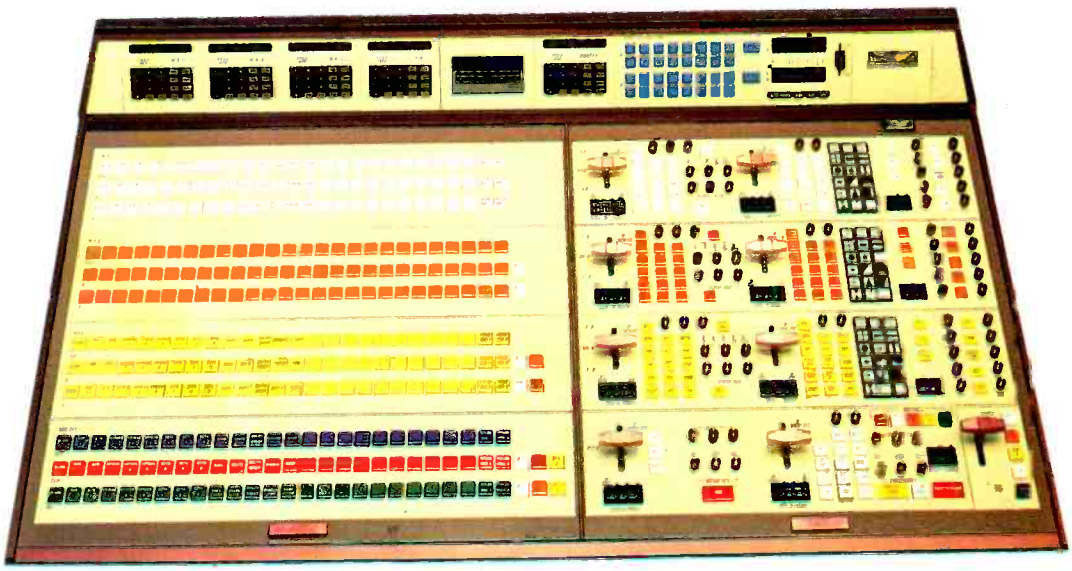

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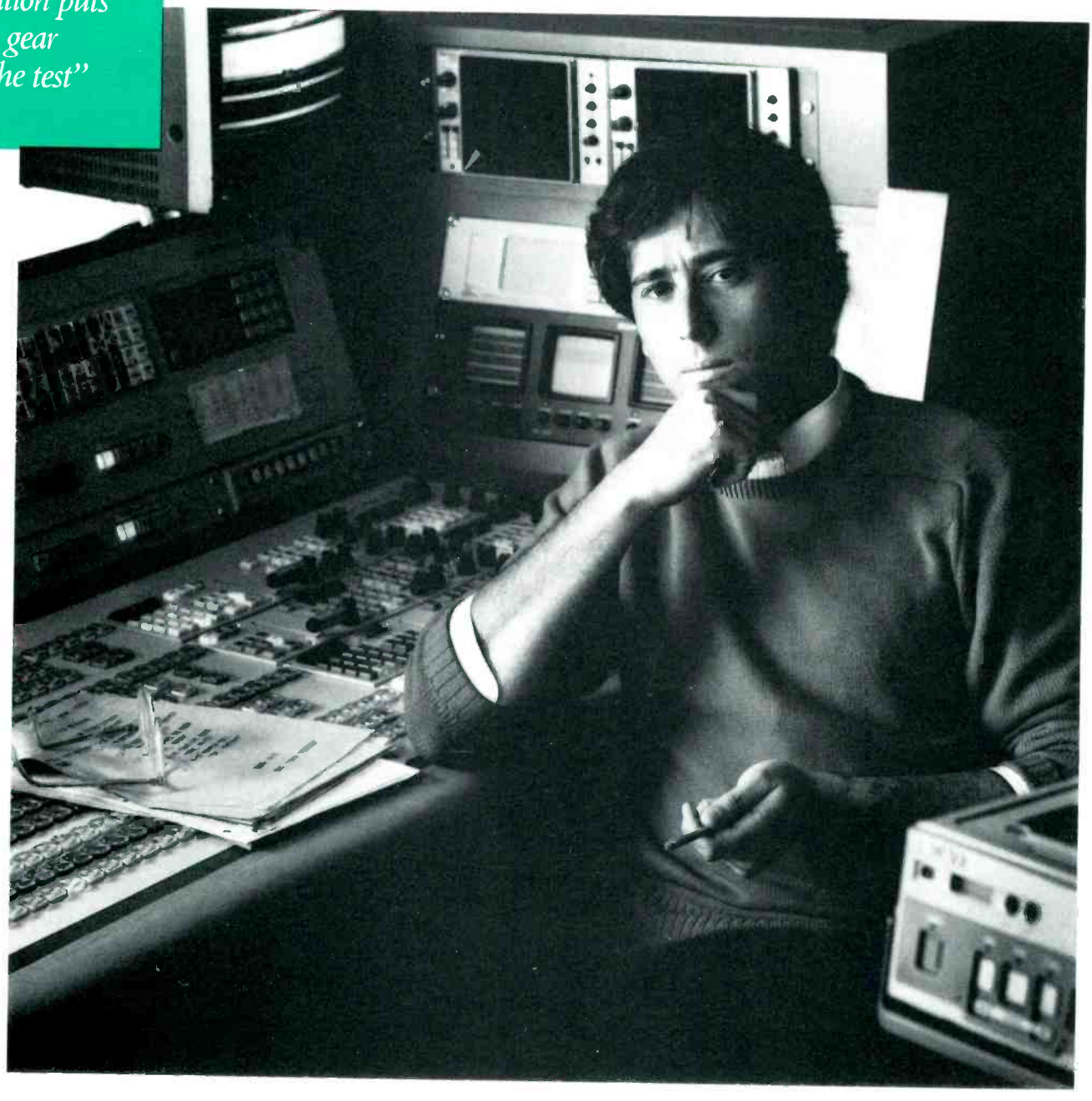

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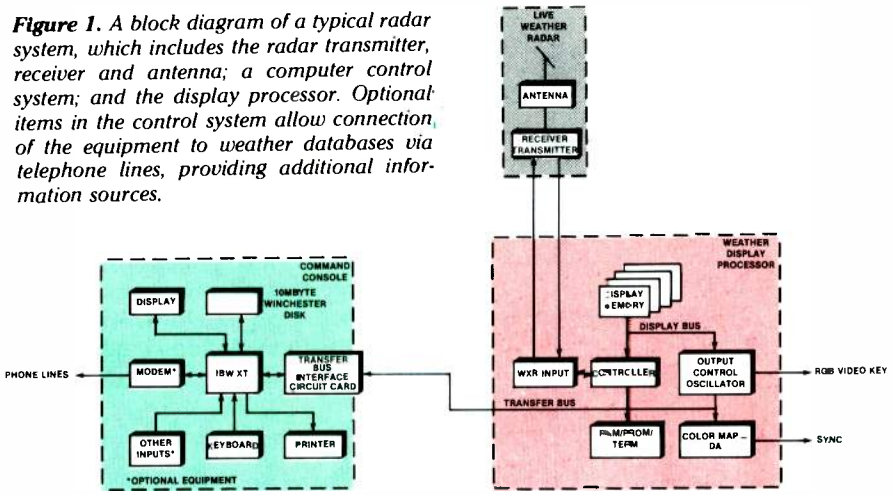

Figure 1. *A block diagram of a typical radar system, which includes the radar transmitter, receiver and antenna; a computer control system; and the display processor. Optional items in the control system allow connection of the equipment to weather databases via telephone lines, providing additional information sources.*

Pulses are transmitted at a pulse repetition frequency (PRF) of approximately 360 pulses per second. As each pulse leaves the antenna, a sample of the signal is routed to a delay line within the equipment. Propagation along the delay line is controlled by the distance range setting of the equipment. For greater range settings, the pulse is clocked along the delay line at a slower rate than for short range work.

When a return pulse is received, it is logically compared to the signal on the delay line. If time coincidence (a logical AND) is found between both the return and delayed pulses, the return signal is counted (verified) as representing an object within the specified distance. The pulse is then passed to other processing circuitry. If coincidence is not found, no further action is taken with a received signal.

With the time lapse known, the distance of the reflecting object is calculated. A series of *range bin* memories represents the distance. If the system includes 256 range bins and the range control is set for 50 miles, each bin equals about 0.2 miles. Range bin clocking of the signal is 1.05μs. The range bin spacing determines the minimum range resolution of the system. All echoes from within one range bin distance are summed as a single return.

The practical distance to which a typical precipitation-sensing radar system is usable is at least partially dependent upon the line-of-sight nature of RF signals in the X-, C- and S-band frequencies (2.5cm, 5cm and 10cm wavelengths, respectively). Seldom would displays showing moisture presence from ground-based systems extend beyond a 250-mile radius.

Viewing rainfall

Standard weather radar handles each return signal sequentially. The strength of the returned signal is determined by the opacity of water or ice causing the reflection. The greater the density of moisture, the greater the reflected signal.

The signal is sampled into digital words, patterns of 1s and 0s, that relate to the signal strength. Because the digital patterns correspond to the water density, the words can be processed to indicate different intensities of rainfall at the display equipment. Therefore, as the antenna sweeps an arc through the sky a profile of the moisture activity is developed.

Precipitation is often associated with turbulent air, and there is a statistical correlation between the two. From such information, meteorologists have only been able to say that "the possibility of damaging winds exists."

The Doppler effect

In the past, when the weather report indicated a potential of damaging winds, the prediction was based largely on the presence and intensity of precipitation. By making parameter changes in the system, the *Doppler effect* of target motion on radar signals can be used to detect turbulence within a storm.

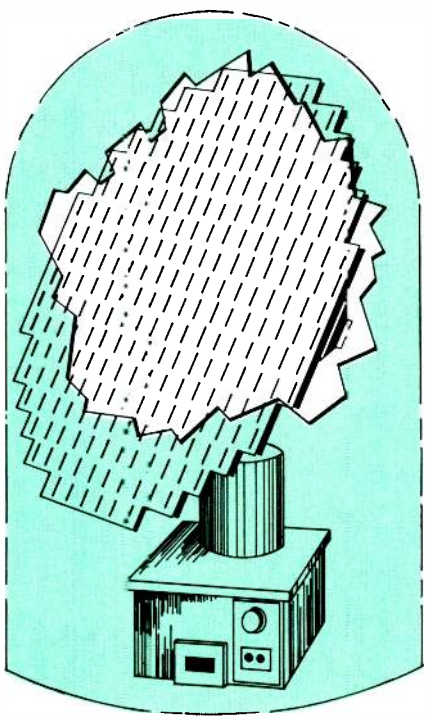

Figure 2. *In a phased-array antenna, each small slot on the plate assembly becomes an active element of the antenna.*

First, the system locates precipitation, operating at a relatively slow 181 to 362 PRF. Once the presence and intensity of moisture are known, a resolution of velocity of motion is made at an increased PRF, about 1,450 pulses per second. The physics of radar at this higher pulse rate requires that the maximum range of detection is reduced to about 70 miles. The more the PRF is increased, the greater the range reduction.

The increase in pulse rate is necessary because more information is needed to sense the changes caused by the Doppler effect. To aid in detecting changes, return pulses are separated into in-phase (I) and quadrature (Q) components. Averaging the two components provides range and rainfall rate (intensity) of the target. The phase shift between the I/Q components is related to the Doppler shift and the range of the target. Because range is already known, phase information is used to determine Doppler motion.

The phase shift for several pulses is analyzed. Non-turbulent targets cause a steady change in phase from one pulse to the next. The statistical variance of pulses returned from a turbulent (moving) target will produce an erratic rate from one pulse to the next and from one range bin to the next. By calculating a running average of phase changes and comparing each phase change to the average, the variance of the target motion can be computed.

The threshold of the variance detection is adjustable, allowing the operator to set the equipment to show a turbulence level between 5m/s and 12m/s. The potential for property damage exists for turbulence levels of only 6m/s. At 12m/s, structural damage to aircraft is likely.

To illustrate what these numbers mean, an interim value of 9m/s is equivalent to a 20.16mph variation in wind direction within 0.1s. At 9m/s, severe turbulence for aircraft will occur. With C-band radar, operating at a 1,450 PRF, an unambiguous velocity of $\pm$20m/s ($\pm$45mph) can be measured.

Objects close to the radar site normally cause images known as ground clutter. Because they are non-moving and generate a steady change in phase, they may be filtered out of the video presentation. As a result, the Doppler system theoretically would allow turbulence at the radar site to be sensed.

Another approach to Doppler processing involves the use of mathematical FFTs (fast Fourier transforms). For statistical accuracy, the FFT method must effectively average a larger number of samples than the pulse pair. Data acquisition is accomplished with an increased PRF rate comparable to the pulse pair (I/Q phase) processing method.

Continued on page 90

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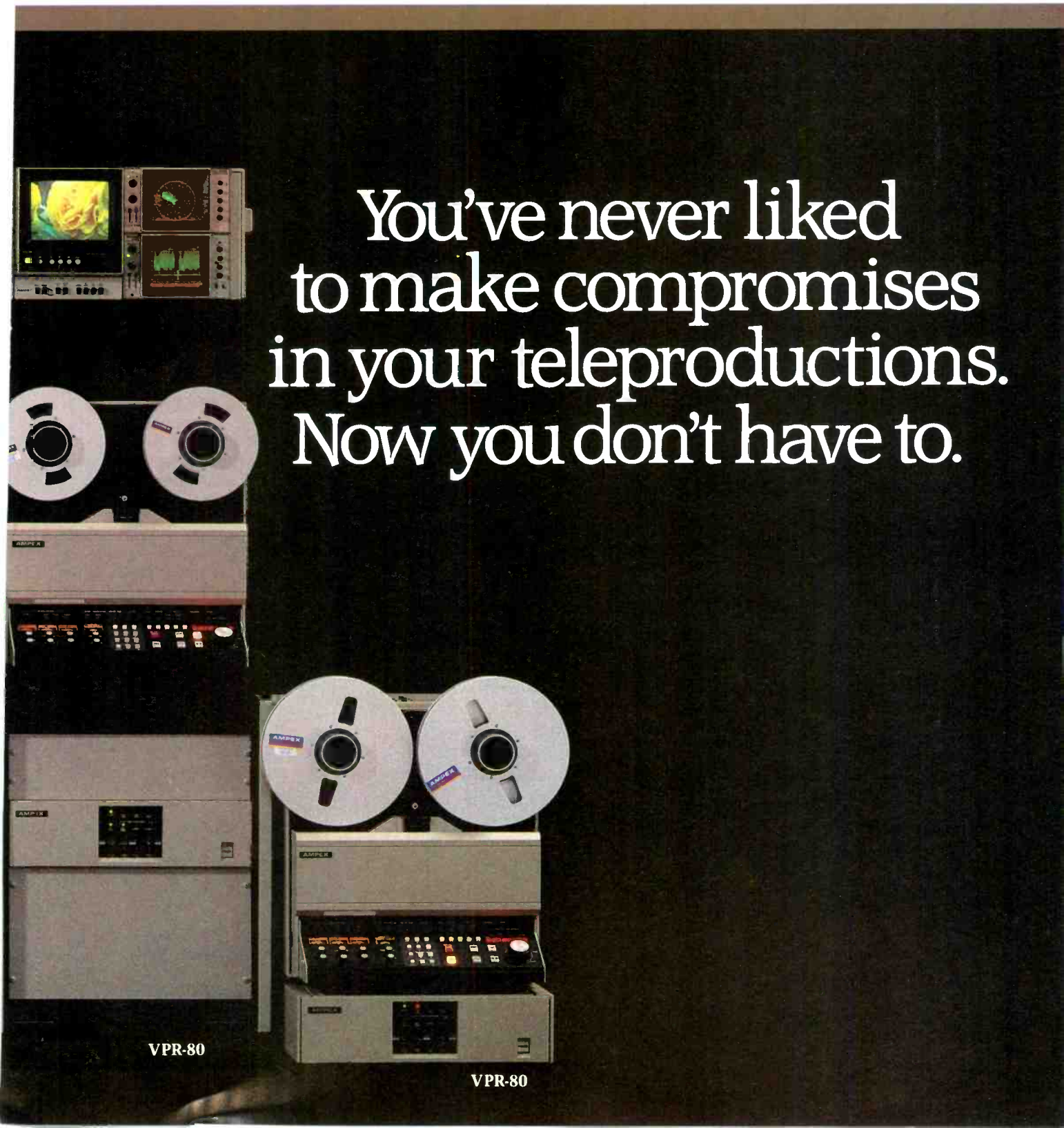

VPR-80

VPR-80

Doppler, stars and train whistles

The Doppler effect, an apparent shift in pitch of a train whistle as the train approaches, passes and departs, is a phenomenon that extends to radio signals and even light. The velocity of the train relative to the observer determines the amount of the shift.

Astronomers depend upon the red or redward *shift to make velocity measurements of objects in deep space. An object receding from earth exhibits a shift of detected light toward red, a lower frequency. Light waves are essentially stretched as the object moves away. Stars hurtling in the earth's direction show a shift toward violet. Velocities of stars, determined through spectroscopic observation of their light and the Doppler shift, range from four miles per second to 30 miles per second.*

Closer to home, Doppler effects are used in astronomy to observe the sun and planets. The rotational speed of the sun, using shifted light color, and of the cloud-covered planets Venus and Jupiter, using radar measurements, have been determined.

The mathematics of Doppler are more down to earth. For radar, the shift produced by the motion of water droplets away from or toward the radar site is $2v/l$, where v is velocity of the target in meters per second; l is wavelength of the radar signal in meters. The shift is the amount of offset in the received signal frequency, as compared to the transmitted signal. The relationship defines both the direction of the motion and the speed.

The limitation of Doppler motion sensing is the accuracy of the transmitted frequency. If the transmitter frequency is known to be only a 1% accuracy, the Doppler shift caused by water droplet movement would be obscured by the uncertainty of the signal.

Continued from page 87

The additional data samples for FFT presentation are obtained from the received signal at a rate higher than the number of range bins. Then, distance-vs.-time data are converted mathematically to a distance-vs.-frequency relationship from which the turbulence information display is determined.

Radar for all

It is not absolutely essential that every station own and operate a radar system. Once information has been processed into an X-Y image format, it may be sent to other locations as digital information over telephone lines or other communications links. Various weather databases, maintained by the NOAA and the National Weather Service, provide dial-up images for weather-capable graphics systems.

For a fee that is usually determined by the amount the database is used, stations can access and select information for nearly any location. Images can include both radar and satellite data. Sequential views of an area may be available for animated presentations showing how conditions change over several hours.

The use of weather radar is not limited to television. Radar installations are at many airports, as weather greatly affects aviation. Doppler systems are replacing standard radar units to allow better knowledge of turbulent air.

Civil defense agencies throughout the country use weather radar to help warn the public of dangerous storms. They use the Emergency Broadcast System and, in some areas of the country, a network of alert sirens.

Also aimed at public service, a number of radio and TV stations have invested in systems to improve reporting of local atmospheric conditions.

Next month

Part 2 of our examination of weather radar systems will look at graphic display equipment.

Acknowledgement: Technical assistance was provided by the staff of Collins Avionics/Rockwell International, Cedar Rapids, IA.

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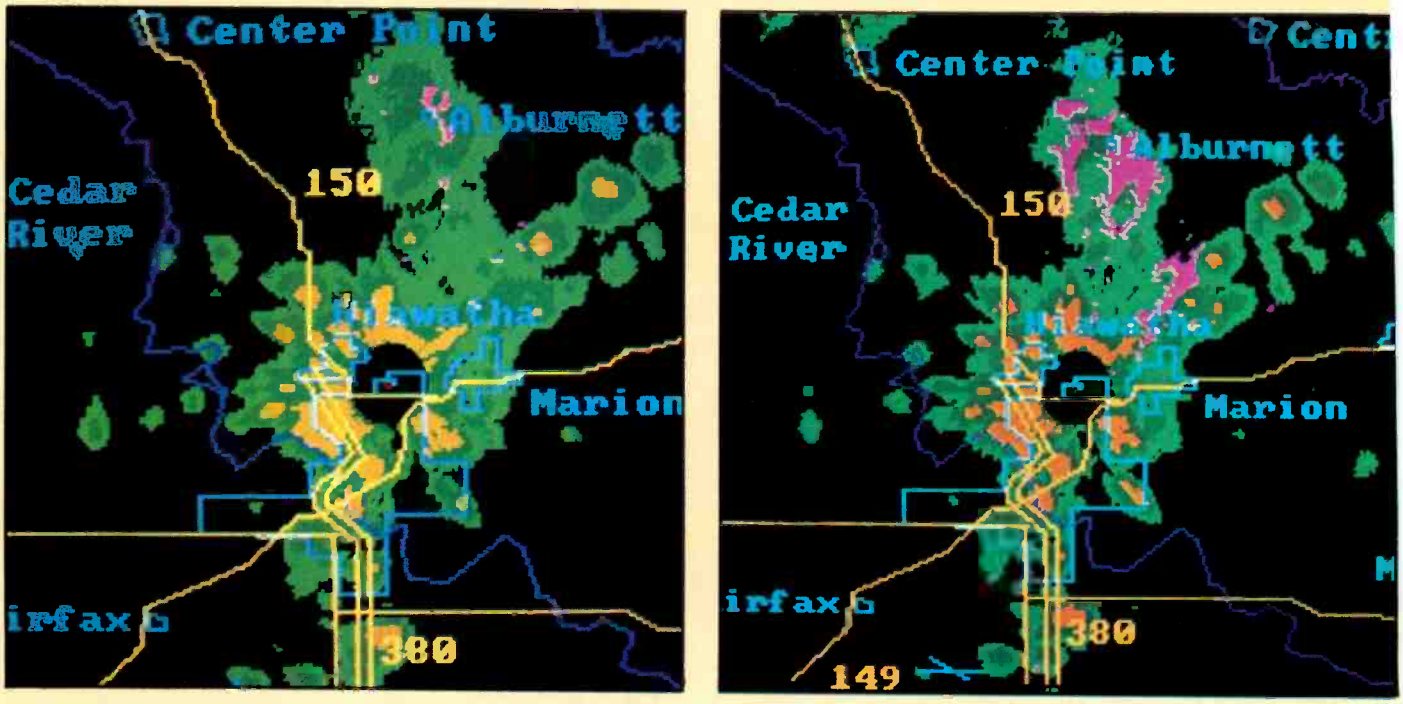
A tornado?

The photos below were taken about one minute apart on April 29, 1984, in the Collins weather lab at Cedar Rapids, IA. In the left photo, a turbulence threshold of 9m/s applies to the magenta area. At right, a lower threshold of 5m/s allows a larger area of turbulence to be viewed. The bow shape surrounding the turbulent area (a bow echo) is a characteristic of storms involving high winds and turbulence.



Courtesy of Collins Avionics/Rockwell International

These photos were taken at the home of George Cobley, a Collins engineer. Cobley's property (located in the magenta area of the left photo on the facing page) is just outside Alburnett, IA. The damage, thought to be from tornadic winds, occurred within five minutes of the time the two radar images were taken.

Courtesy of George Cobley

Automating the newsroom

By Carl Bentz, TV technical editor

Presenting the news is not an engineering function, but engineering analysis can aid in the selection of newsroom automation equipment.

Newsroom automation brings new methods of operation to news production. Whether in radio or television, the major problem the news department faces is efficiency. The news director wants the facts—now. What often keeps a news staff from achieving this goal is dealing with masses of paper, digging through files for background and general office inefficiency.

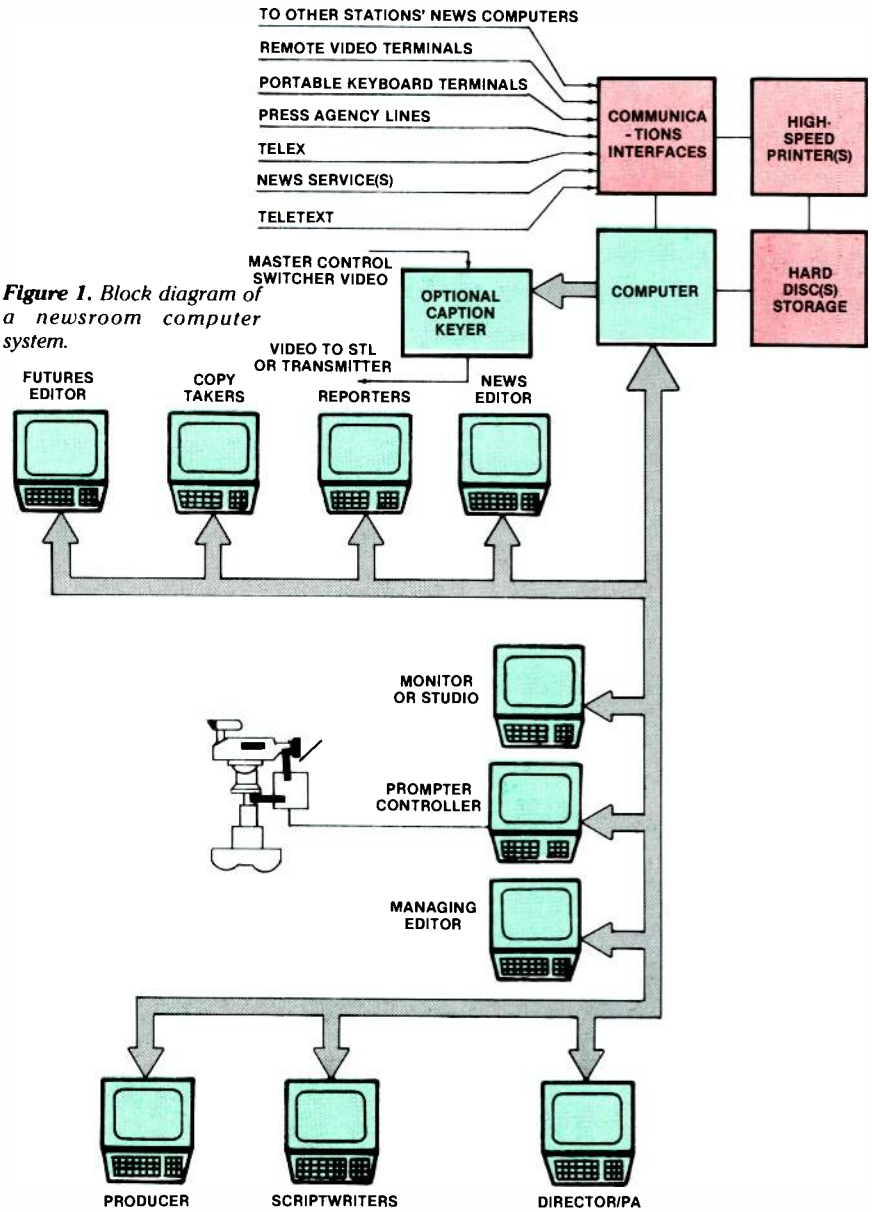


Figure 1. *Block diagram of a newsroom computer system.*

The newsroom computer changes how reporters and producers handle news. Automation improves efficiency because it removes paper. Most story research material is available at the entry of a key word into the computer terminal. Word processing and text editing simplify preparation of the news script, which can be transmitted directly from the newsroom system to the prompter screen.

Automation also introduces flexibility. When facts change at the last minute, the script can be altered, even during the newscast. Late stories can quickly be entered into the system while the talent is on the air.

Digiphobia

To the uninitiated, computers are foreboding. First, the machine is expected to replace personnel. However, automating seldom displaces employees. Additional personnel may not be needed, but current employees remain on the job, usually with their work redirected for greater productivity.

The second fear many users have is that the system will break at the most inconvenient time—as the news show goes on-air. This fear, too, is largely overstated. Electronic equipment can fail, but without moving parts, computers are very reliable. A redundant computer system, backed by standby power, is less likely to disrupt the news show than a failure in master control or at the transmitter.

A third fear is system complexity. Although the younger generation is learning to deal with computers, older employees may view a keyboard with a mysterious black box with trepidation. This fear, too, is unfounded with well-

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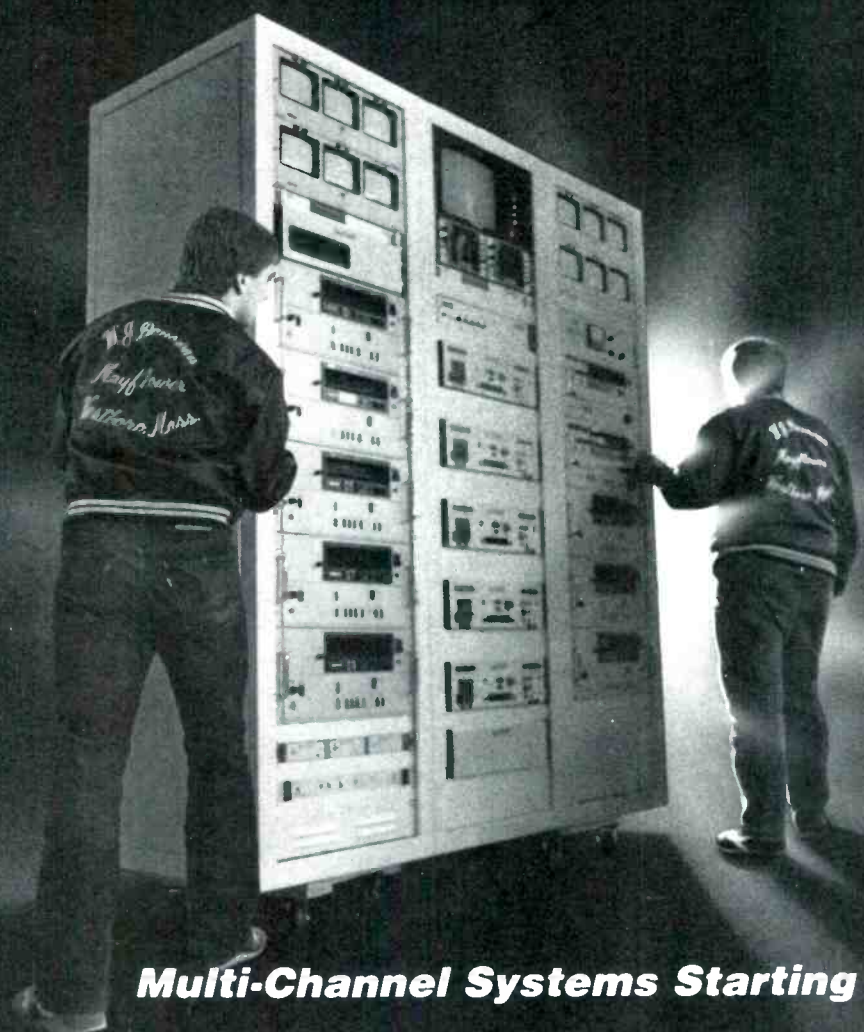

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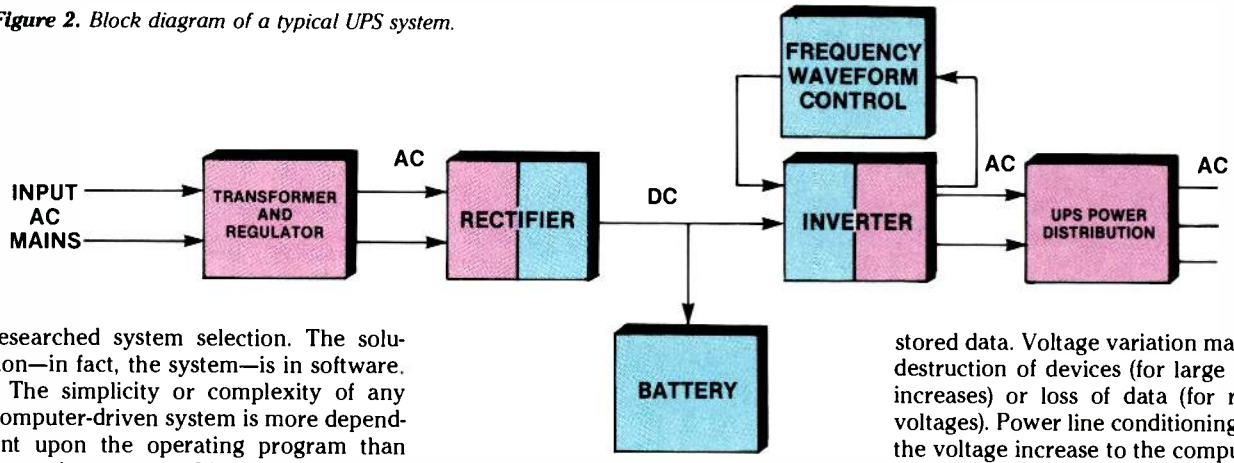
Figure 2. Block diagram of a typical UPS system.



researched system selection. The solution—in fact, the system—is in software.

The simplicity or complexity of any computer-driven system is more dependent upon the operating program than any other aspect. Often-used functions must be easily available. Little-used aspects of the system should be equally accessible to all operators.

Finally, a management fear is the question of cost-efficiency. The expenditure for automation compared to its payoff depends upon station operation. How dependent is the station upon news programming? For stations with an emphasis on news, the question is easily answered. Automation is a plus. For limited news operations, the expenditure may be out of the question. In the ratings race, automation makes no guarantees.

Engineering or production

In theory, the engineer has little to do with day-to-day operation of newsroom automation equipment. Maintenance is usually contracted out to the manufacturer. The system sophistication demands that factory trained technicians perform necessary repairs. Yet, when a terminal fails to respond to the operator's request, a member of the engineering staff will often be called. It's electronic, after all, like everything else the engineer deals with.

If the problem is relatively simple, such as a loose connector or printer failure, an engineer probably can handle it. Calling and waiting for the computer maintenance group is not productive. If the problem is a hardware failure or software bug, however, few broadcast engineers will be willing to get involved.

Integrating the newsroom computer into the facility usually poses no major problem, but the engineer (who is most knowledgeable about the facility) should be consulted. Questions regarding available power, air conditioning loads, wire feeds and ties to production equipment must be considered. Equipment placement and system expansion need to be thought through.

Technical points

When making a purchasing decision, the news production staff must determine what features meet their requirements. Word processing, text editing and archiving of local scripts and wire service inputs are expected functions. A video output direct to the teleprompter screen is also common. And operator terminals must be easily understood.

By and large, the news production staff is most concerned that the system is installed on time and operates as advertised. The mechanics of the installation are someone else's responsibility. Obviously, operator terminals will replace typewriters at reporters' desks. But where will the heart of the system go?

The main computer for most newsroom systems seldom needs attention. For that reason, an ideal location for the equipment rack is in a limited access area. Even a closet can be acceptable if it is clean and there is sufficient ventilation. Air conditioning may be needed for larger systems.

A separate ac circuit should supply the system, with its breaker located so it can't be accidentally turned off. If backup power is not integral to the computer, an uninterruptible power system (UPS) should be installed. A UPS system does not take much space, but may require ventilation. Some manufacturers suggest that UPS equipment be placed in another location to avoid battery charging vapors in the computer location.

UPS

Clean dc power is an absolute requirement for proper operation of solid-state memories. Small power transients conceivably could be misread by the computer as information. More critical, however, is the possibility of component damage from ac power line transients. As a result, a critical part of any computer system is a well-filtered power supply that provides dc operating voltages and keeps voltage levels within allowable tolerances of the system's solid-state devices.

Any electronic equipment should be shielded from electrical transients. Such transients occur when equipment is turned on. Once operating, power line spikes may cause momentary variations in the equipment operation and undesirable stress on components. The stress may result in component failure.

Dynamic RAM memory requires constant voltages to reliably retain the stored data. Voltage variation may mean destruction of devices (for large voltage increases) or loss of data (for reduced voltages). Power line conditioning avoids the voltage increase to the computer circuitry. Uninterruptible power supplies avoid memory losses from the momentary drops in voltage that might not even make the office lights flicker.

All computers operate in conjunction with a multiphase system clock that relies in part on the supply voltage for stability. If the clock rate varies, the result, at best, may be a loss of a particular document in memory. At worst, the operating system may also have had bits in some memory cells altered. Re-entry of the current document means a loss of time. If the operating program has been altered, the entire system may need to be reset, the program reloaded and restarted. In a large system rebooting the computer can be a major task.

To avoid transient problems, a UPS unit, connected to the power mains, may be used. Such a system converts incoming ac power to dc current to maintain a set of storage batteries. The batteries operate a power inverter to which the computer is connected.

The battery and inverter provide a constant power source. Even if the incoming power varies or fails completely, the computer continues to operate within the limitations of the battery. When electrical service is restored, the battery is recharged automatically.

In some backup power systems a fast switch connects the equipment to the power source. During normal operation, the load operates from the incoming ac power source. If a failure occurs on the power mains, batteries provide the power. The switchover time between sources is critical, particularly for computer-based products. If the switching interval is too long, or a change in a clock phase occurs, the clock rate may be altered, causing catastrophic results within memory.

Another method mixes the UPS inverter output with the ac line power. When all is normal, the equipment operates primarily on the incoming ac. If the incoming ac voltage drops, the output contribution from the inverter is increased to maintain a 110Vac (or other) level. An ac regulator in such systems keeps overvoltages from disrupting operation.

Continued on page 100

HERE'S WHAT THEY ARE SAYING ABOUT THE UNITROL SYSTEM

Brian

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Donna

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Brian Rehkoph and Donna Dallas
MAGNUM–Atlanta, Georgia

George

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George Miller
TAKOTNA VIDEO–Anchorage, Alaska

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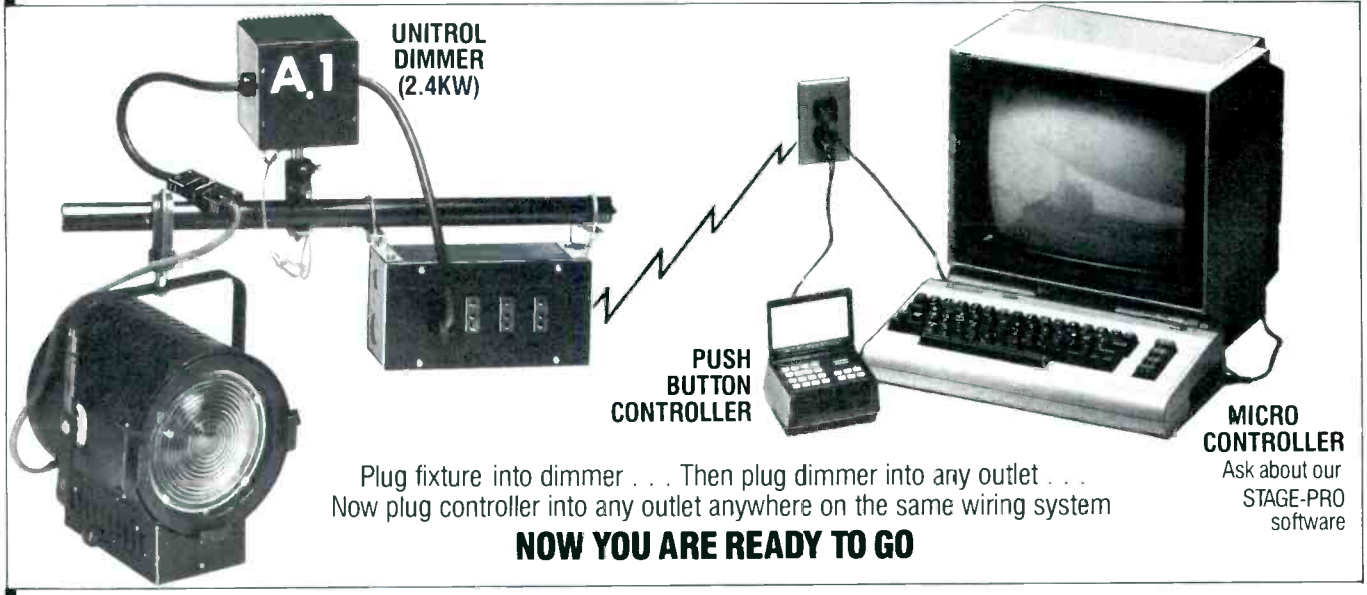

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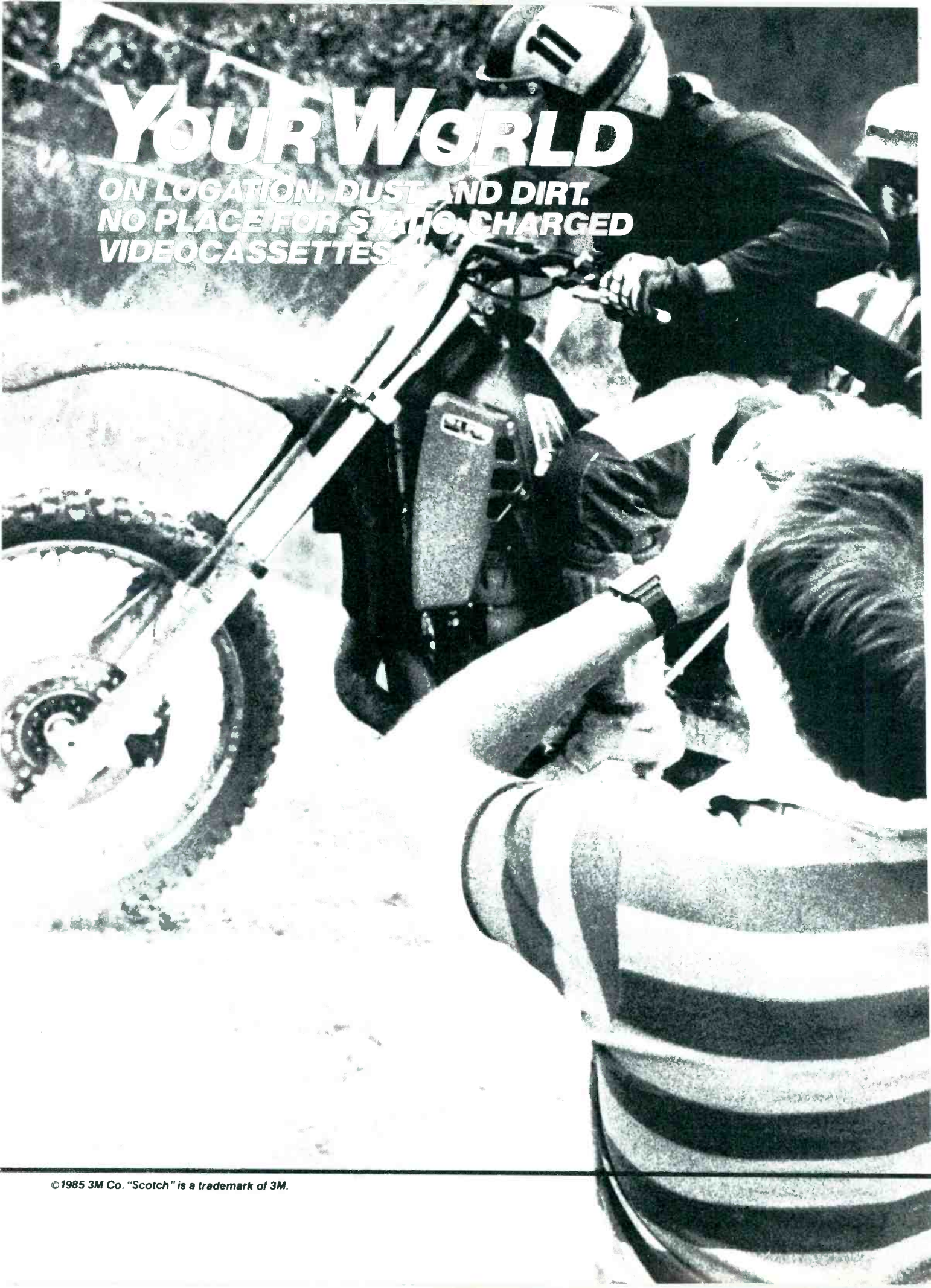

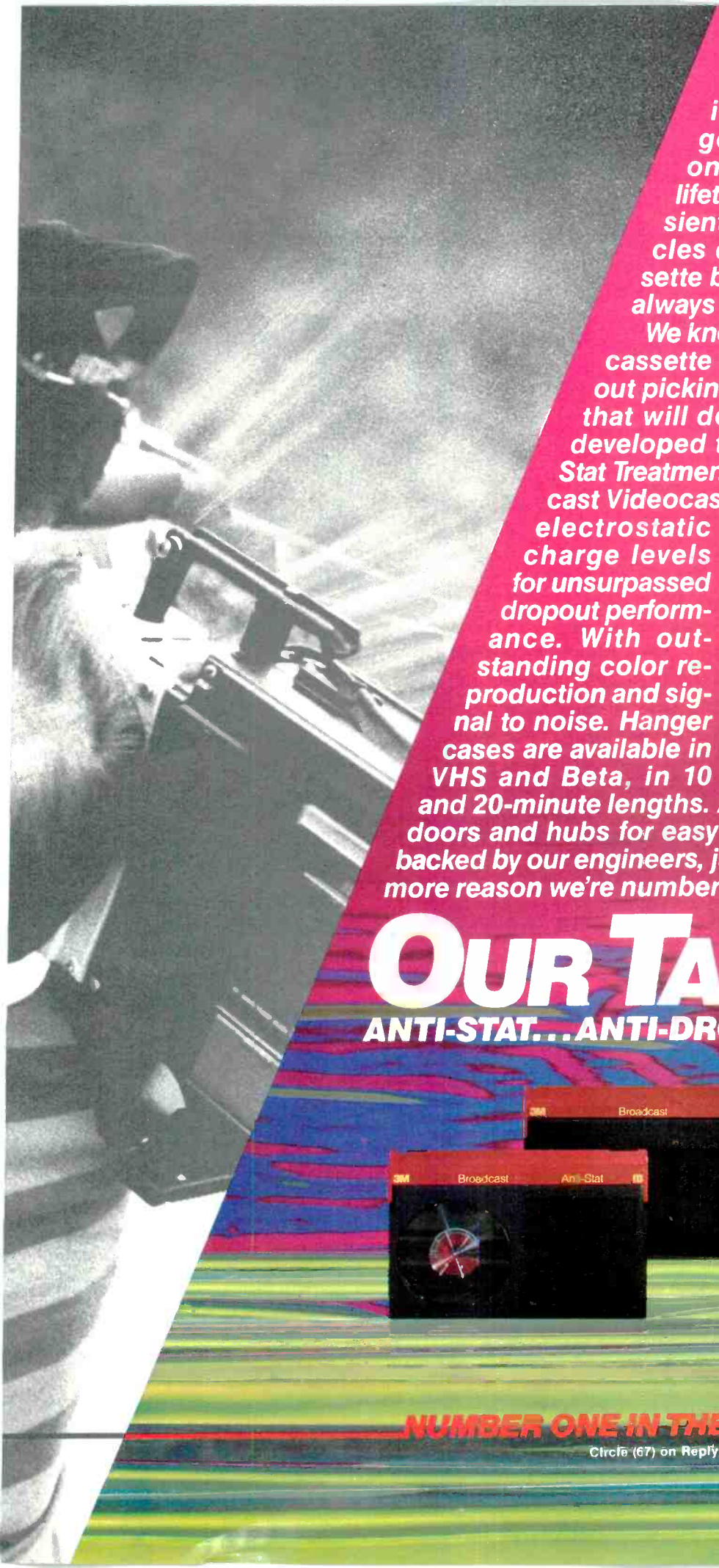

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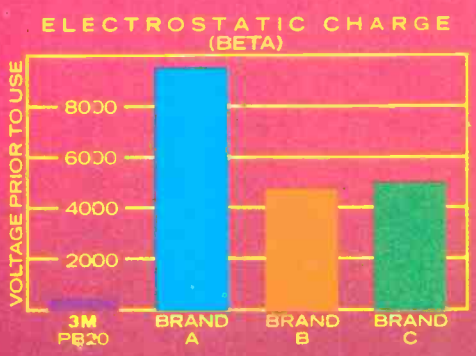

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Continued from page 96

Some inverter systems may not be suitable for operating electronic equipment. The power supplies of most computers are constructed to operate with sine wave ac input power. A square wave or stepped square wave from some inverters could prove undesirable to the load equipment.

Hooking it up

Planning for a newsroom automation system must include the question of hookup. What interconnections are necessary between the terminals and the main computer? Will cabling into the proposed computer site be a problem? Different approaches may be used. If the studios are co-located with transmission equipment, an increase in incident radio frequency energy can be alleviated through the use of coaxial cable. Newsroom systems should include filtering to reduce the effect of possible interfering energy on interconnecting lines.

It is possible that a twisted-pair hookup can be used. Such an approach may involve a modem-type device at each terminal and at the main computer frame.

In essence, the computerized newsroom is one form of a local area network (LAN). Interactive communication between terminals may be desirable. Typical systems consist of work stations that talk directly to the central computer. At air time, the producer's terminal becomes the hot spot for operation and script retrieval.

Input to the computer from outside sources must also be considered. Can reporters carry a portable computer, dial the station, and through a modem send reports to the main database? How many ports may be available for external inputs from bureaus and wire services? What about special events coverage, such as political conventions and sporting events?

The data format of each system input must also be properly matched to the remote data source. It has been found that even for a single wire service, data formats may vary in different parts of the country. The data format from one service may also change from time to time. In theory, smart modems exist that can deal with variations from standard data formats.

No matter what the format, the wire service requires a dedicated telephone line. Parameters on that line must meet certain quality specifications, if data communications are expected to be consistent and coherent.

How much memory does the system support? Immediate access to archives requires that an immense database is always on line. Typically, Winchester disk equipment is used. Although expensive, hard disks provide high-density data storage in a non-volatile form.

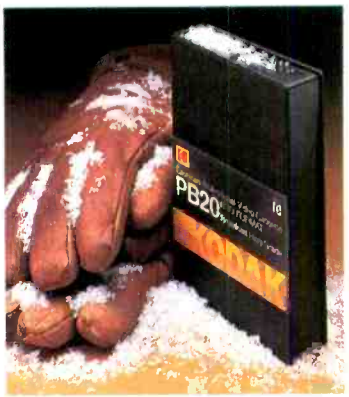
In terms of memory requirements, one station is reported to have tied up approximately 350Mbytes of storage with three years of daily news show scripts and other data. With a total of 530Mbytes currently available, they may expect another two to three years before some material must be transferred onto tape or additional hard disk drives must be purchased.

What ties between the news system and other equipment in the station is expected? For example, is there a link between the news system and graphics for weather information? Will the system control a character generator for open- or closed-captioning?

The obvious connection between news and the studio today is the simple prompter video line. Future links will include using cues in news text to assist in switching functions during live news programs. Such cues might be embedded characters in the script. As the text is serially transmitted, these cues will cause still-store images or the slide chain to be advanced, captions to be dissolved into and out of on-line video, or VTRs and audio carts to be rolled.

Redundant memory

A major fear regarding any type of automation is equipment failure. What if



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Altogether, AVP shot nearly 17 hours of tape during the race. This was edited into a 30-minute production that was seen throughout Alaska via satellite, in the Pacific Northwest on McCaw Cablesystems, and in parts of Canada on CBC-North TV.

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the memory device, solid-state or disk, fails? What if the link between the main computer and the memory system is broken? What if the main computer system becomes inoperative? Can the information be recovered?

Several types of solid-state memory are associated with the computer. Read-only memory (ROM) and random access memory (RAM) devices form a large part of the computer system. ROM devices hold fixed information placed *permanently* in memory. The computer operating system and control functions are contained in such devices. It is unlikely, however, that news data would be stored in ROM.

RAM is dynamic memory in that it is easily changed. Data entered into the computer is stored in RAM until routed elsewhere. RAM requires electrical power to retain the information placed into it. If power fails, RAM data are lost and must be re-entered.

A news story is held in RAM during the editing process. When editing is completed, the story is placed in a non-volatile memory for safe keeping, at least until editing is completed, to avoid the loss of information should power fail.

Non-volatile memory usually means disk systems. Floppy disks are useful for keeping relatively small amounts of information, when compared to hard, rigid or Winchester disk memories. Hard disk storage capacity has increased into the tens of megabytes within the last several years, providing almost instantaneous random access to a large database.

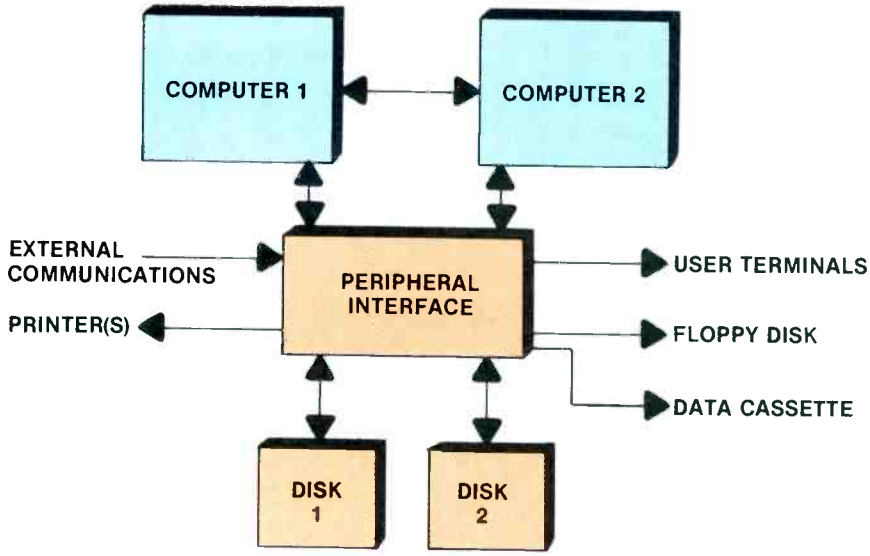
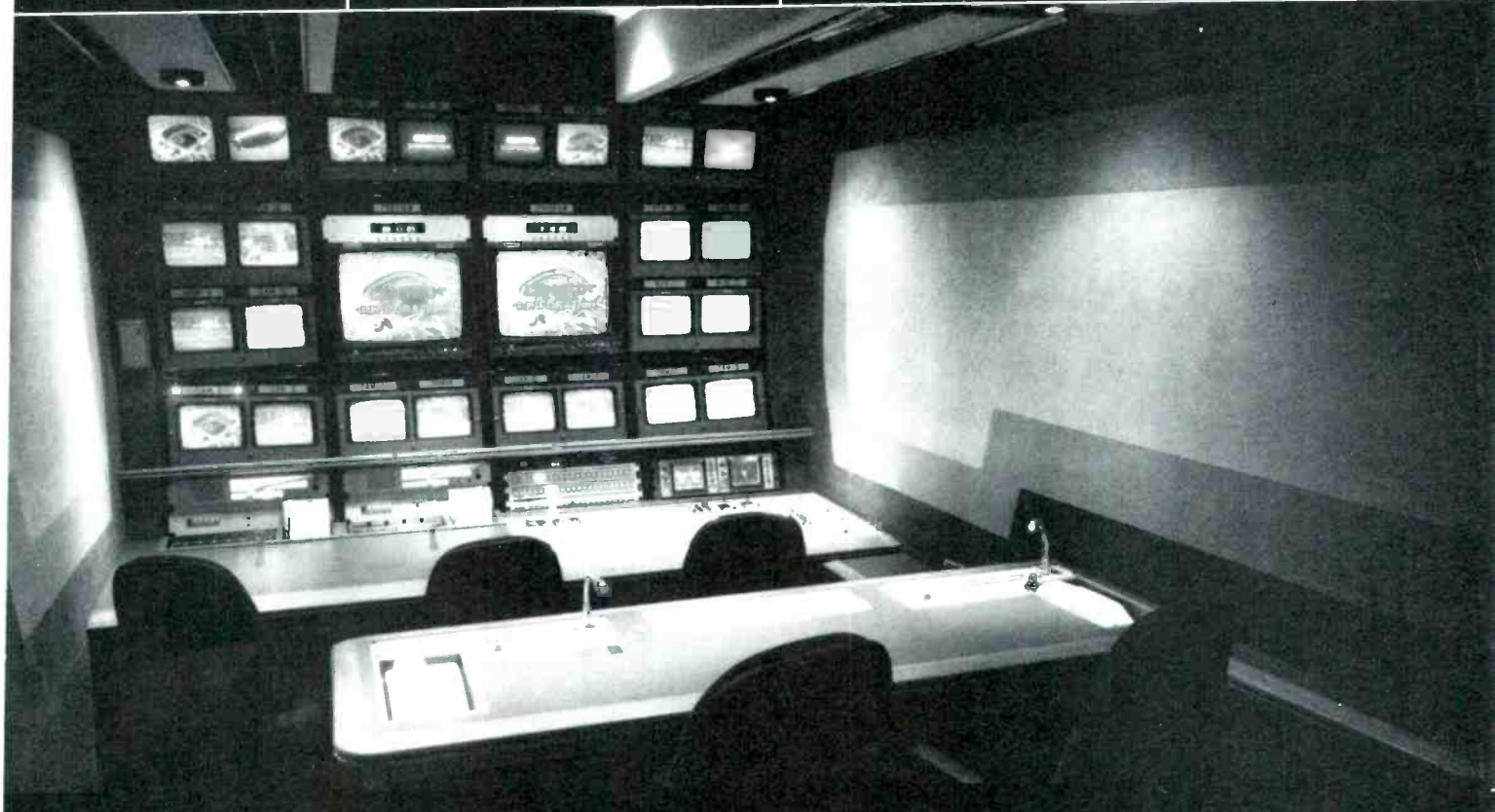


Figure 3. *A redundant computer system includes duplication of all essential functions.*

Data recorded on the thin magnetic surface of the disks remain in place and may be retrieved until the disk is erased, the magnetic retention is altered through some means (heating or magnetic fields) or the surface is damaged.

Failure of a disk memory may mean loss of the information. If the disk drive system failure is mechanical, the data may be intact when the mechanism is repaired. If the failure damaged the magnetic medium, some or all of the information will be lost.

Some systems provide a streaming data cassette archival memory for backing up stored information. Information, not required to be on-line at all times, can be recorded on cassettes for long-term storage, yet is retrievable relatively quickly.



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Memory loss due to equipment failure is reduced through redundancy. Redundant systems are common in broadcasting. Two examples are multiple VTRs for on-air playback and an alternate transmitter and antenna.

In computer systems, redundancy avoids downtime. Multiple disk drives can retain duplicate copies of the data. Several floppy disks can inexpensively archive information from Winchester systems, providing security for data on the more expensive hard disk equipment. Floppy disk users maintain two sets of disks, one in a secure location in case the daily-use disks are rendered unusable.

The main computer may consist of two or more identical systems in parallel. The duplicate portions of the systems are mirror images of one another as far as operation and storage are concerned. Through timesharing, individual sections of the computer appear to be operating separately. Each handles its own set of input and output devices.

Inside the system, however, information entered from the work terminals is stored in the memory of both units. Should one unit fail, the other continues to operate. Some input and output capabilities may be reduced until the system is repaired, but the data remain intact.

Preventing tampering

Computer users are becoming increasingly aware that unauthorized people can penetrate the system. Data tampering may not be obvious until long after the fact and, when discovered, may require a major reconstruction of the database.

Computer security is most important with systems connected to the outside world, particularly when dial-up access is available. Newsroom systems with ties to one or more wire services via modems may be included. Although dedicated telephone lines connect to the computer for each service, penetration of otherwise secure networks has reached astounding proportions.

Tampering with data is not limited to outside sources. In-house computers may fall victim to staff personnel who have access to the system and who may hold a grudge against their employer. In these cases, access control is more difficult.

One of four basic technologies solves most problems associated with dial-up data access. These include software access authorization, call-back, password management and algorithm comparison authentication systems.

Software resident security provides a level of authorization to control access to specific files of a host computer. Designed for specific applications, software-based systems effectively limit access or control tasks a system user may wish to perform. An audit trail of activity may include unauthorized user access attempts. However, user identification relies upon passwords that are too easily broken.

With *call-back* technology, an intelligent port protection device (PPD) connects the incoming telephone line and host computer. When access is requested, the PPD requests the user's ID and a search of acceptable IDs is initiated. If the ID is valid, the system releases the line, then calls the user back at a telephone number stored in the ID memory file.

Call-back systems require a fixed user location. As a result, they impede user mobility and flexibility. Response time can be slow if the system incorporates user priority.

A *password management* scheme generates a unique password at each access attempt. An intelligent controller in the host computer communicates with a random password generator (RPG) carried by the user. When access is requested with an ID code, the controller determines an algorithm appropriate to the calling RPG device and awaits the correct password. The RPG displays a calculated password to the user, who enters the code via the terminal. If the code entered by the user matches that calculated by the central controller, access is allowed.

Password management systems often depend upon synchronization between controller at the host computer and the RPG unit. Battery failure in the portable RPG can sever the user's connection with the computer. Such systems are protocol-dependent, limiting flexibility.

In *algorithm comparison authentication*, a verification dialogue occurs between a PPD at the host computer and a portable key device assigned to each user. The dialogue follows this matching algorithm approach with simultaneous processing of a random challenge initiated by both the PPD and user key. When the dialogue achieves a match in verification codes, access to the database is granted.

Algorithm comparison offers greater security than other techniques to unauthorized access. No passwords or special data protocol are used and the user key portability is dependent upon the specific product.

Only the beginning

As stations automate newsrooms, engineering will play an increasingly important role. Equipment selection and installation, as well as system integration and interaction, should involve the engineer's insight. Although there may not seem to be any direct connection between engineers and the news department today, ties may develop as automation develops.

Marvin McInnis, Overland Park, KS; MicroFrame, New Brunswick, NJ; Aston Electronics, Olathe, KS; and LorTec Power Systems, Elyria, OH, assisted in the preparation of this article. |:-)))|

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A look back at looking ahead

By Carl Bentz, TV technical editor

The future of television was the focus of the 127th Society of Motion Picture and Television Engineers (SMPTE) technical conference and equipment exhibit in Los Angeles Oct. 27 through Nov. 1. An emphasis on component, digital and high-definition video greeted more than 15,000 attendees in seminars, technology demonstrations and manufacturers' exhibits. The title of the conference, *New directions in technology—difficult decisions*, could not have been more aptly selected.

A new NTSC?

Complaints have been heard in recent years about the 30-year-old NTSC TV standard. These rumblings have fueled efforts toward improved imaging, namely component video and HDTV technologies. However, NTSC, PAL and SECAM continue to show adaptability. One demonstration at the conference proved that improved encoding and decoding, based upon filtering, color gamma correction and chroma bandwidth extension at a 525-line rate, can extend the life of NTSC. Results, shown using a large screen projector and side-by-side RGB and typical home receiver CRTs, rivaled higher line-rate pictures in the high-definition TV demonstration room.

Getting digital

Digital TV production was demonstrated by a taped music video produced entirely through digital processing. The short program developed by the Society Francais de Production of Rennes (France) was described in one of the technical sessions.

Audio was handled through classic analog methods, but all video inputs were digitized before recording, mixing and effects processing were undertaken. Conversion to analog was made only for final display purposes. Throughout the multigeneration presentation, no signal degradation was evident.

Although the results of the all-digital studio in France were indisputably outstanding, imaging by separation of color signals into component elements also surpassed standard NTSC pictures. Notably absent in component demonstrations were the cross luminance (dot crawl) and cross color (moire) artifacts seen in today's video.

Component contingencies

If operating with video components is considered, various decisions must be made in regard to signal handling. Should the components be dealt with in analog or digital forms? Should processing be accomplished through parallel or serial paths? And, of course, does one use RGB, Y/I/Q, Y/R–Y/B–Y or their European versions? Both analog and digital component formats offer differing requirements, advantages and problems.

Video components do not find the same interest among U.S. engineers as with those of other countries. To a large degree, American TV engineers are content to achieve mere compliance with NTSC and FCC regulations from origination to reception. An interest to originate in the component domain is much more evident with engineers outside the United States.

Manufacturers have little doubt that even the U.S. engineer will eventually go to a component format. The manufacturers have not, however, satisfactorily answered primary questions raised by doubting American video operators. What is the predicted longevity of component products available today? How soon will a completely new generation of equipment be needed for compatibility with products now being developed? On the surface, the concern is system compatibility. A deeper problem, most admit, is one of budget constraints for new equipment purchases.

In-house components

Compounding the concerns about the lifetime of component equipment is the uncertainty of signal distribution in the production plant. To date, video system bandwidths extend little beyond 4.5MHz to 5MHz. Because NTSC limits system response to approximately 3.5MHz, a move toward components could mean that distribution, routing and other equipment must be replaced by units capable of passing bandwidths to 10MHz or more. The NTSC composite signal requires only a single cable per signal, but component systems require a 3-fold increase in cabling. Bringing components into the TV plant will mean major expenses in facility reconstruction.

With new signal distribution needs, one must also consider machine control, much of which is now handled with multiple-conductor (one function per conductor) wiring. Various control protocols are under discussion. Signal routing of time-code signals and multiple audio channels must also be considered in the difficult decisions that TV engineers must someday make.

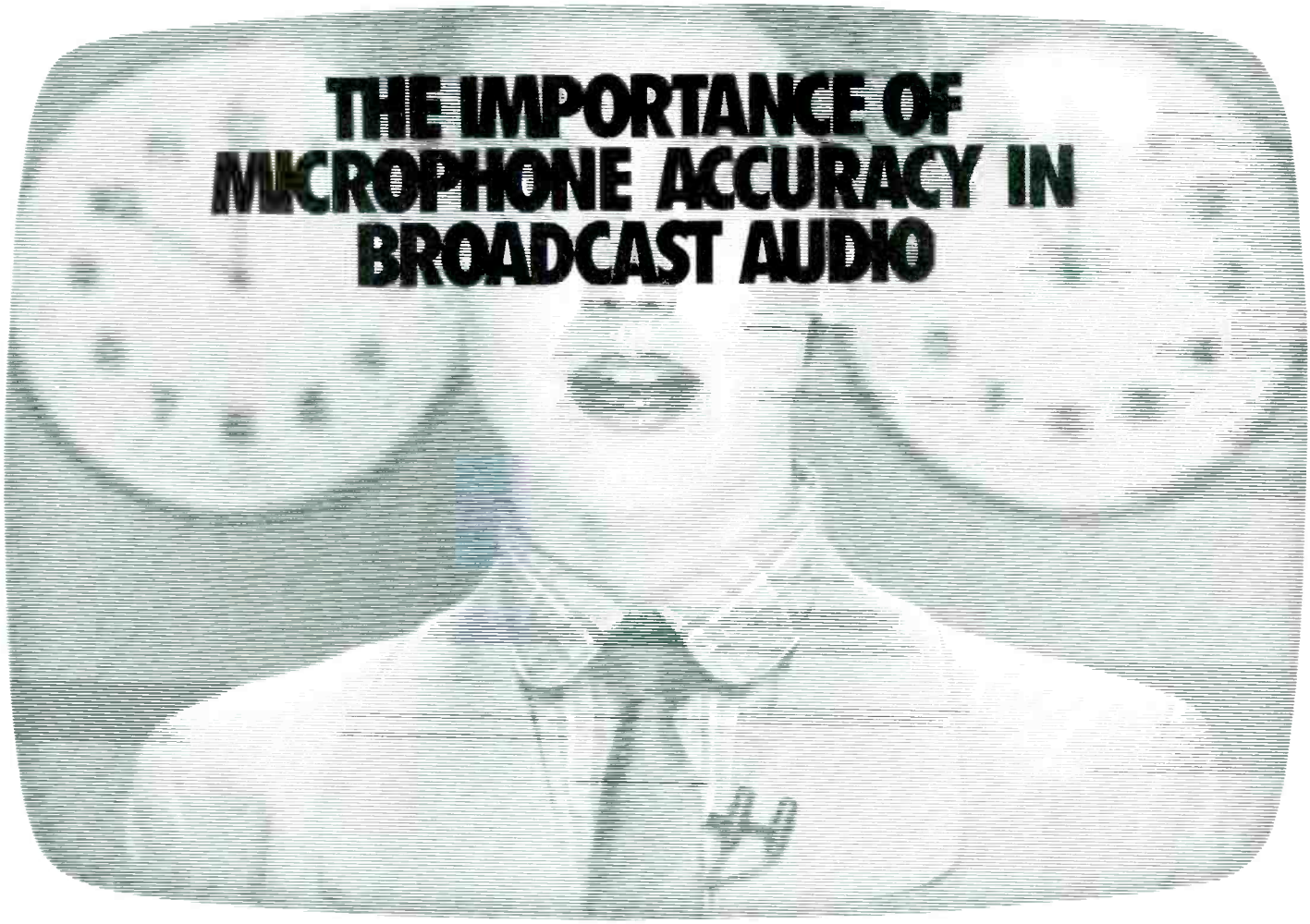
HDTV more defined

An aura of anticipation hovered over HDTV exhibits and seminars. Even as the 127th SMPTE conference began, a meeting of the CCIR was being held in Geneva, Switzerland. While images of cameras, paint systems, telecines and recording equipment appeared painted on monitors and large projection screens, attendees were anxious to know the outcome of the recent recommendation by U.S. and Japanese interests toward an international HDTV system standard.

A telex message was received from the CCIR on the final day of the seminars. It stated that the parameters, essentially as given by the Advanced Television Systems Committee (ATSC), had been adopted by delegates from more than 50 countries. The recommendation, as adopted, calls for an HDTV system based on 1,125 lines with 2:1 interlace and a rate of 60 fields per second. The aspect ratio now stands at 16:9. Sampling by the international 4:2:2 standard will produce 1,920 luminance and 960 chrominance samples per active video line. The aspect ratio, which has steadily approached wider screen presentations consistent with motion pictures, will allow acceptable displays even if the sampling rate is changed to three times the subcarrier. In fact, special displays are possible by varying the sampling rates.

Although the CCIR message was positive, a comment noted the reticence of countries currently using 50-field systems (PAL and SECAM). The 50-field reservations may affect the final selection of an HDTV standard, scheduled to

THE IMPORTANCE OF MICROPHONE ACCURACY IN BROADCAST AUDIO



A distinctive voice remains as important to a successful broadcast announcer as a recognizable visual presence. *Microphones are the critical first step in the broadcast audio chain. Acting as a highly accurate sound "lens," they must be sensitive enough to faithfully transmit all of the subtle personal nuances and inflections that distinguish one announcer's voice from another.*

Today's sophisticated broadcast productions demand more from microphones. Differences in relative mic performance are more readily apparent, and an inferior microphone stands out like the proverbial sore thumb.

In the most basic sense, any microphone need only capture the sound source exactly and convert it to electrical energy — no more, no less. *Obviously, microphones necessarily have different characteristics based on differing transduction technologies and designs. But at Beyer, we believe that the superiority of a microphone is in large part based on how accurately it transduces the source material — with no excuses based on size or applications.*

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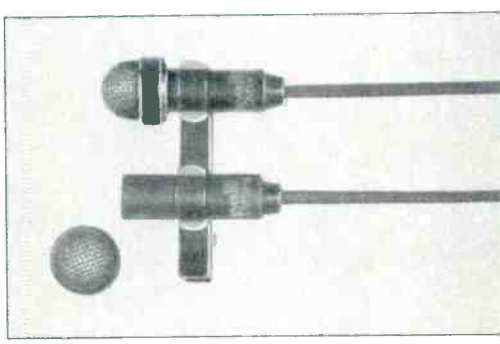

Circle (73) on Reply Card

ACCURACY IN AUDIO — **beyerbroadcast**

be determined at the CCIR plenary assembly in May 1986 at Dubrovnik, Yugoslavia.

Film vs. video

HDTV discussions of the past have centered on the number of lines and the field rates. This year, however, another parameter was highlighted, namely gamma correction to be required by various HDTV users. Predictions for programming include both electronic origination and film. Currently, the gamma or transfer characteristic correction of the two media differs.

NTSC specifications include a required gamma correction during signal origination to compensate for signal transfer characteristics of transmission equipment and display CRTs. To video operators, gamma errors are most notable in the video display of the 10-step gray scale chart. The ideal waveform of the chart appears as an *X* pattern, with the two stepped cross members of the X being straight and ranging between the 7.5IRE setup and 100IRE peak white points. Gamma errors, which appear as a bowing of the cross members, result in compression or stretching of white and/or black detail areas in the picture on the receiver CRT.

In the film community, various aesthetic effects may be accomplished by varying the effective gamma of the film medium. Excerpts from a recently released film were shown to point out how the variation could be used to visual advantage.

It is the difference in gamma handling between film and video that has resulted in the terms *film look* and *video look*. Attempts to expand the latitude of the video camera to more equally emulate film resulted in the electrocinematography TV camera, which includes gamma circuit adjustments that surpass those of standard TV cameras. Manufacturers, admitting their indecision in regard to the gamma question, have suggested that an *HDTV look* will be the result.

They stress that CRT displays of advanced receivers would not necessarily be tied to the old NTSC rules. It is conceivable that an encoded signal carrying information about the appropriate instantaneous gamma correction being used in the origination could provide the receiver with cues to track the correction from scene to scene.

When and if

In a panel discussion that concluded the HDTV session, members of the panel praised the efforts that have brought technology to its present stage. None, however, expect HDTV to be an overnight success. Predictions suggest that, were a system selected at that session, implementation and widespread use of HDTV would not occur for at least five years—probably longer.

Roland Zavada accepts the 1985 Progress Medal for work with Super 8 film as SMPTE's Harold Eady and M. Carlos Kennedy look on.

When asked pointblank whether HDTV was being forced upon the public, the panel members reiterated that high definition is not tomorrow's system, but rather a technology that will be our legacy to our children. They said our progress may have been slowed as we have tried to provide the best system, and a lasting system, for them.

Between now and eventual implementation of HDTV, enhanced- and improved-definition systems will most likely occur. All three imaging technologies will probably spread in the same manner as color television. First, one lounge and restaurant will have a set, and other establishments in town will follow suit to remain competitive. Then, one homeowner on the block will buy an HDTV receiver, and neighbors will feel compelled to acquire the new image quality themselves.

Tubes and CCDs

Reduced TV camera size and improved ruggedness has produced several outstanding cameras using CCDs (charge-coupled devices). Several generations of CCDs later, visual comparisons of solid-state and tube designs have left many viewers impressed with pictures that appear sharper and cleaner than tubed units.

A study to compare CCD imaging with that of small format lead oxide camera tubes concluded that tube technology maintains an edge at present. Comparative values for size, weight, lag, acceptable signal-to-noise ratios and extended life of CCD-based cameras point to an excellent future for the solid-state camera design. Greater power consumption of CCD drive circuits and present-day pixel matrix limitations to less than 800 elements horizontally are seen as undesirable factors of current CCD technology in light of pending HDTV system requirements. Higher resolutions, predicted as achievable by the onset of higher-definition operation, would make the CCD camera more competitive as HDTV becomes a reality.

A new film frame rate

A recent proposal in regard to film frame rates received some heated debate. Motion pictures have been produced at a 24-frame rate for many years. For TV presentation at 30 frames per second, a Geneva intermittent mechanism on the TV projector causes individual film frames to be shown for varying time durations. The result is smooth, nonflickering motion.

Simple presentation of the 24-frame film at the 30-frame rate would produce undesirable faster motion. Without audio processing, a pitch-rise occurs in the sound. It is logical, however, that production of films at a rate of 30 frames per second would simplify TV presentations.

Present projectors operate at the 24-frame rate to comply with the large quantity of material available. The change to a 30-frame rate would require all projection equipment to be modified to allow speed switching. At the very least, new drive motors would be necessary.

Additional costs in film production would be in film stock, as the new rate is suggested to require approximately 25% more photographic material. Although the cost of film is one of the lesser items of the film producer's budget, the proposal found definite opposition, and no decision on the 30-frame proposal was found.

No word on setup

Another proposal undergoing study by SMPTE is the suggestion to remove the 7.5IRE unit setup requirement for production systems that deal with component and composite video. In a mixed system, discrepancies in black levels result between the two video forms unless extraordinary precautions are taken during production. Operating composite video equipment without setup would alleviate much of the variation. No decision was reached on the topic during the meetings.

Difficult decisions

The technical sessions of the 127th SMPTE conference lived up to the title. Decisions in regard to the technology of future television are increasingly difficult to achieve. Finding the answers must involve more than an organization, such as SMPTE, but in the arena for discussion that can be provided by SMPTE, MPTE (Japan) and the EBU (in Europe), a cooperative effort between manufacturers and equipment users can eventually produce workable decisions. Without that cooperation, a multiplicity of standards and methods will cause insurmountable confusion to plague the industry and to retard its progress. |:-)))|

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It'll be in Chicago

By Carl Bentz, TV technical editor

The theme *Tools and technologies for tomorrow's television* has been selected for the 20th annual SMPTE Television Conference, scheduled for Feb. 7 and 8 at the Marriott Hotel in downtown Chicago. The technical program and equipment exhibits will focus on digital television, stereo audio, HDTV and post-production practices.

Those who attend the Friday morning seminar will be treated to a discussion of multichannel TV audio subjects. Recording and broadcast methods for stereo productions and the design of stereo-capable TV receivers will be examined.

The Friday afternoon and Saturday morning sessions will focus on digital TV tape recording. The two sessions will include a complete overview of the SMPTE D-1 format and DTTR equipment.

The afternoon will begin with a presentation on the background of digital television. Following the introductory discussions, requirements of the tape medium, cassette design and mechanical design will be highlighted.

DTTR sessions

Friday afternoon

- *History and background of digital TV receivers*
- *User requirements*
- *Digital overview*
- *DTTR studies in Europe*
- *Magnetic media for DTTR*
- *D-1 DTTR cassette design*
- *D-1 DTTR mechanical machine design*

Saturday morning

- *D-1 DTTR electrical system design*
- *Video processing requirements*
- *Audio and time-code systems*
- *Error control, detection and concealment*
- *Data shuffling*
- *Optimization by simulation*
- *Measurements and system diagnostics*

The Saturday session will continue the examination of the DTTR in terms of the electrical design of the D-1 format, video processing, the associated audio and time-code systems, error control and data handling. Measurements and diagnostics for the proposed recording system will be included.

Papers on Saturday afternoon will highlight signal processing for sound and visual effects and suggested techniques for post-production and editing.

Approximately 30 companies plan to demonstrate their latest equipment adjacent to the lecture hall. The products and exhibits will relate directly to the subjects covered in the technical papers.

The conference is under the general supervision of SMPTE editorial vice president Howard T. La Zare (Deluxe Laboratories) and conference vice president Maurice L. French (Canadian Broadcasting Corporation).

On Friday, Michael Sherlock, executive vice president of operations and technical services, NBC, will be the guest speaker at a luncheon. A reception that evening is open to all registered attendees. A special entertainment program is planned for spouses.

For further information about the 20th annual SMPTE TV Conference, contact SMPTE, 862 Scarsdale Ave., Scarsdale, NY 10583; or call 914-472-6606.

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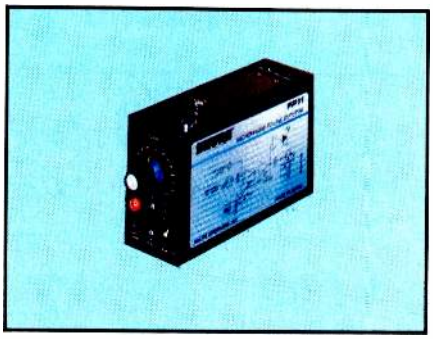
Shure FP11

By Ben Weiss



Performance at a glance

- *Battery-powered portable mic-to-line amplifier*
- *Built-in limiter*
- *Frequency response: 20Hz-20kHz, +1, −3dB*
- *THD 0.5% (40Hz-20kHz at +15dBm)*
- *Transformer-coupled inputs and outputs*
- *Aux-level miniphone jack input*
- *XLR input and output connectors*

Every once in a while, someone comes out with a well-designed product that truly serves a useful purpose. Such is the case with the Shure FP11 microphone-to-line amplifier.

The FP11 is a simple device designed to provide up to 84dB of gain. When used with a standard microphone, the amplifier will drive a telephone or long broadcast circuit at line levels. The unit contains a dual-stage amplifier and a stepped attenuator for volume adjustment. The balanced input and output circuits terminate in XLR connectors for easy interfacing with professional equipment. The amplifier also provides a high-level 1/8-inch input jack for cassette recorders or similar sources. An additional output connector (spring clips) makes it easy to connect the FP11 to bare wires such as those you might find at a telco termination box.

Because the unit is capable of providing high output levels, it can be located at a distance from the remote site mixer or control center. In short, the amplifier is useful in any application in which you need to boost a microphone or line-level signal to drive a telco circuit or long cable.

Features

The amplifier has no fancy frills. It provides only the minimum features you need to get on the air from a remote location. The two inputs are accommodated through an XLR connector and 1/8-inch jack. The XLR connector is a microphone input. The 1/8-inch jack is designed for unbalanced line-level inputs such as cassette recorders.

Although both inputs can be used at one time, there is only one volume control. This means that the high-level source must have its own volume control. The amplifier seems to attenuate the microphone level when the high-level jack is used at the same time. This probably wouldn't be a problem, however, because the operator should know enough to connect the high-level source before the microphone level is set.

The XLR inputs and outputs are fully transformer-balanced. This is an important feature for remote broadcast applications. Although transformers may add to the cost of the unit, any engineer will tell you that for field work, transformers can prevent a lot of problems. The unbalanced input couples directly to the op-amp input, so it is not truly transformer-isolated.

The amplifier is equipped with a belt clip, for quick access to the gain control. A pair of front-panel jacks provide access to the battery terminals for voltage checks. I suppose this is a good idea, but I've never seen a sportscaster or news person with a voltmeter. I would prefer to see some form of LED battery indication. Perhaps a go/no-go indication using a 2-color LED would be appropriate. In any case, you can measure the battery voltage without removing the battery. In fact, you don't need to open the battery compartment.

For a long-term remote, you may want to use the jacks to externally power the amplifier. It will operate on any well-filtered dc supply of 9V to 12V.

The chassis, or box if you prefer, is built like a tank. Constructed of cast zinc, the housing consists of a 5-sided box and a matching cover. The cover attaches to the box with three Phillips screws, making it easy to open. This box is tough and should stand up to practically anything. Once the cover is removed, all of the electronics are easily accessible. The circuit is so simple though, I doubt you will ever have to repair it.

Electronics

The limiter was one of the things I was most interested in. With the limiter switch off, the LED lights when the audio is 6dB below the clipping point. With the limiter circuit on, the LED indicates the onset of limiting.

This 2-sided approach may require some operator training. If the limiter is used, then the LED will be on most of the time. However, if the limiter is off, then you don't want the LED to be on too often. To prevent confusion, it might be best to always use the limiter. Because of the high quality of its circuit, the limiter probably could be left on all the time with no detrimental effects.

To see how effective the limiter was in preventing noticeable distortion, I hooked a scope across the output of the amplifier and used a signal generator for a source. With the limiter off, the amplifier was able to provide +21.5dBV in level before clipping. The specifications require only +18dBm (+20.2dBV).

With the limiter switched on, I increased the input until the LED came on. The output level at limiter threshold is +10.5dBV. Then, to observe how much control the limiter provided, I increased the input level until clipping occurred. The output level was +14.5dBV (+16.7dBm). I was able to increase the input level 24dB before this clipping point was reached.

From limiter threshold until clipping—an input range of 24dB—the output level increased only 4dB. This is excellent performance. With this amplifier, the talent's voice level could wander and the output would remain constant. When there is no operator available to control levels, this unit might just be the solution.

User comments

The Shure FP11 microphone amplifier is an excellent device for applications in which you need a small, portable microphone amplifier. With battery power and transformer inputs, the amplifier can help prevent ground loop problems. The output level also is sufficient to drive any telephone loop, dial-up

Weiss is director of engineering at KLSI-FM, Kansas City, MO.

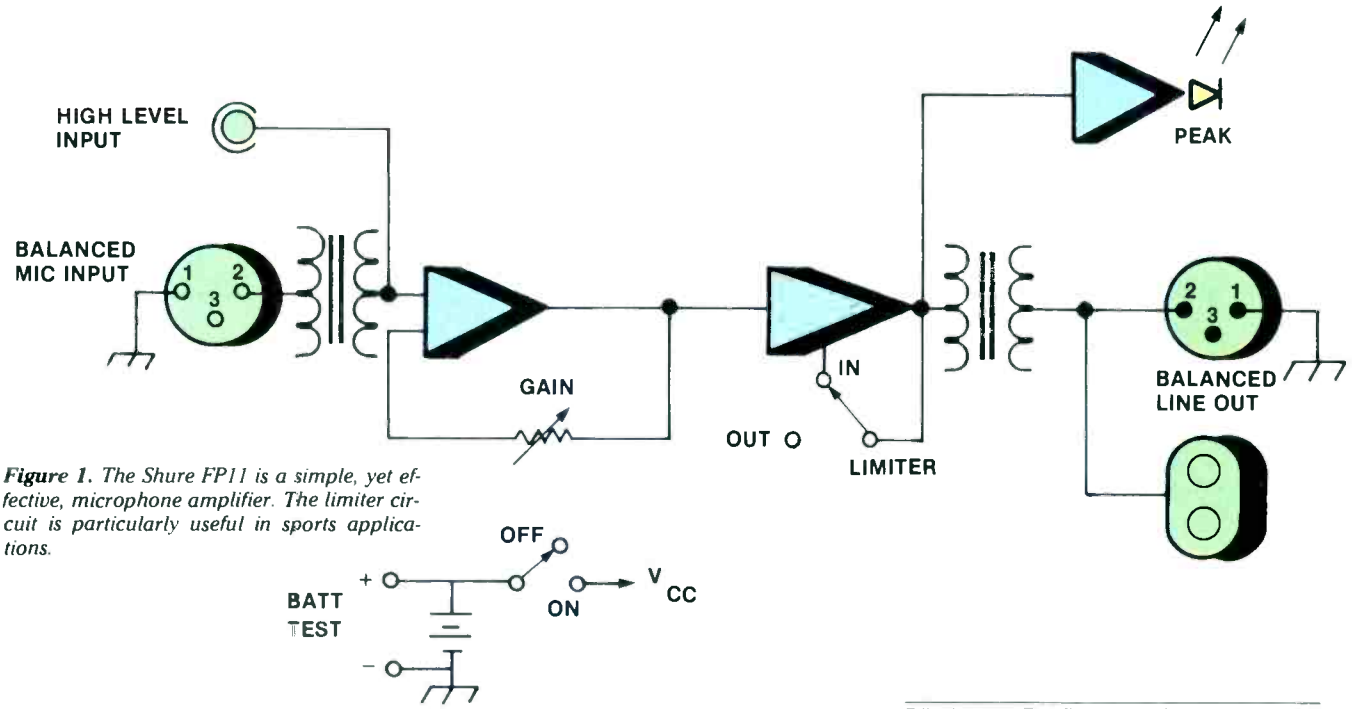


Figure 1. *The Shure FP11 is a simple, yet effective, microphone amplifier. The limiter circuit is particularly useful in sports applications.*

line or other broadcast circuit.

The amplifier is rugged and easy to use. Because a stepped attenuator is used, operators can repeat volume settings exactly. The limiter is perhaps the best feature of the device. With the limiter circuit turned on, the operator knows that the output level will remain constant and distortion-free. There was no audible pumping or swishing in the signal. In fact, the limiter action was among the best I have heard.

If you have an application that could be served by such a device, give the FP11 careful consideration. It's doubtful that you will be disappointed.

Editor's note: The field report is an exclusive **BE** feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting firm.

In essence, these reports are prepared *by* the industry and *for* the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author if support is requested in some area.

It is the responsibility of **Broadcast Engineering** to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement or a disapproval by **Broadcast Engineering** magazine.

SBE Update

Frequency coordination petition brings reply

By Bob Van Buhler

Editor's note: This month, we begin a regular monthly column in **BE** devoted to significant news from the Society of Broadcast Engineers. Because the SBE is the primary association representing radio and TV engineers, the leadership positions taken by the organization are important to all engineers, members as well as non-members.

In October, the Society of Broadcast Engineers (SBE) filed a proposed rulemaking petition with the FCC to make frequency coordination a prerequisite to licensing Broadcast Auxiliary Services (BAS) facilities. The petition would require the applicant to certify that local frequency coordination or engineering studies have been performed and to indicate that the new facility will not interfere with existing facilities. The filing is designed to support the FCC's move to remove itself from the frequency coordination process.

Van Buhler is chief engineer for WBAL-AM and WIYY-FM, Baltimore.

In a surprising move, the National Association of Broadcasters (NAB) filed comments in opposition to SBE's position. The NAB stated that there may be no need to pursue the frequency coordination incentives suggested by the petition. The NAB stated that the commission's current rules on frequency coordination and allocation are adequate to accommodate SBE's concerns.

The society feels that it is necessary to have regulatory sanctions for the coordination process. It foresees continued problems with local frequency coordination without such regulation. The petition simply recognizes that local frequency coordinating committees do not always receive the desired cooperation from broadcasters.

In its reply, the SBE noted that the commission had previously commented on the *value* of local frequency coordination in Docket 85-36. In that docket, the commission noted that it would rely on the cooperation of licensees (for example, through local frequency coordinating committees) to decide on the most efficient use of the available spectrum in a particular area.

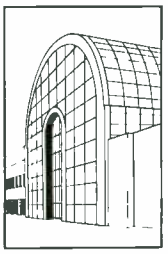
New board member

Former SBE president Jim Wulliman has agreed to serve on the society's board of directors. Wulliman was appointed to the board by president Richard Rudman in the September board of directors meeting. The board vacancy was created when Jack McKain was elected vice president. At that time, McKain was in the first year of a 2-year term.

Wulliman served as SBE president from 1973 to 1974. He continued to serve the society after leaving office as chairman of the certification committee. Under Wulliman's guidance, the SBE certification program continues to grow and

Sponsor	Seattle, Chapter 16	Pittsburgh, Chapter 20	Phoenix, Chapter 9	University of Wisconsin	Central New York, Chapter 22
Date	Nov. 12-13, 1986	Oct. 9-10, 1986	November 1987	Sept. 15-18, 1986	Sept. 26, 1986
Location	Red Lion Seattle-Tacoma Airport	Howard Johnson's Motor Lodge Monroeville, PA	Scottsdale Hilton Phoenix, AZ	Holiday Inn Southeast Madison, WI	Sheraton Center Syracuse, NY
Registration Fee	None	None	None	$180	None
Technical Papers	Yes	Yes	Yes	Yes	Yes
Equipment Exhibit	Yes	Yes	Yes	Yes	Yes
Social Events	Yes—Lunch	None	Yes	No	Yes—Vendor-sponsored golf tournament and buffet
Held in conjunction w/ other event?	No	No	Yes—Arizona Broadcasters Association	No	No
Exhibitors	60	—	—	70	113
Attendees	—	—	—	300	850
Times held	9	12	6	31	13
Contact person	Bob Ingalls 5441 187th Ave. N.E. Redmond, WA 98052 206-868-6407	Roy Hoover KDKA-TV One Gateway Center Pittsburgh, PA 15222 412-392-2565	William J. Strube KPHO-TV Box 20100 Phoenix, AZ 85036 602-264-1000	Don Borchert Director of Engineering, WHA 821 University Ave. Madison, WI 53706 608-263-2157	R.J. Parkhurst WSTM-TV 1030 James St. Syracuse, NY 13203 315-474-5180

Table 1. *Regional conventions for some SBE chapters.*



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Messe Frankfurt

Beihan, Hefter, Lutz.

is recognized throughout the industry. Wulliman is manager of engineering for WTMJ-TV, Milwaukee.

In other changes, Dr. Mary Beth Leidman has been appointed director of the society's student training program. The new program is designed to improve the relevance of broadcast and technical training at colleges and to stimulate interest in broadcast careers.

Leidman, general manager of WIUP-FM, a public radio station, is an assistant professor of communications at Indiana University Pennsylvania.

Chapter spotlight

Did you ever wonder how the first SBE chapter was formed? Chapter One began meeting in 1954. The chapter's luncheon meetings were attended by engineers from the Binghamton-Elmira area of New York. These gatherings allowed the engineers to discuss common problems and to establish lines of communication among stations.

In 1964, John Battison, then editor of **BE,** suggested that a national association was needed to represent broadcast engineers. In response to Battison's editorial, Charlie Hallinan, who would later become the second president of the SBE, called Battison and expressed the New York group's interest.

As a result, the New York group became Chapter One and started a campaign to sign up members from the area. The meetings were soon scheduled in the evenings so more people could attend, and formal programs were adopted. These activities set the pattern for future SBE chapters nationwide.

Now that the society has decided to conduct an annual national convention, some people are worried about the future of the regional conventions. Are the local conventions going to become obsolete? No, not at all. For many engineers, local and regional conventions are the only technical exhibitions they will be able to attend. Some stations do not allow their engineers to attend the NAB or other major conventions because of budget or time limitations. For these people, the local SBE conventions and exhibits are an inexpensive way to gain valuable experience and knowledge.

The society continues to support local conventions and equipment exhibits. To help the exhibitor and reader to plan ahead, we have listed some of the upcoming regional conventions. As additional information becomes available from other chapters, we will publish it in the monthly "SBE Update."

Editor's note: Although the Wisconsin Broadcast Engineering and Management Seminar is not an official SBE convention, it is listed here as a service to our readers. This program is designed as an intensive 4-day seminar with engineering management and technical presentations.

Continued from page 4

that vast improvements in signal quality delivered to the consumer will be made in the near future. The groups hope to enlist the assistance of other industry organizations in the effort.

SMPTE meets with Chinese film/TV officials

A delegation from the Society of Motion Picture and Television Engineers (SMPTE) toured facilities in the People's Republic of China last fall at the invitation of the Chinese Ministry of Culture. In conjunction with the tour, the delegation met with officials of the Chinese SMPTE organization to lay groundwork for increased cooperation between the two societies in technical information exchange and standards work.

The itinerary included visits to film and TV facilities in the Chinese capital, including the Beijing Film Studios and the China Central TV building. Other sites visited were film and TV studios in Shanghai, Hangzhou and Guangzhou.

A 4-day film and TV symposium was conducted during the visit, for which the SMPTE delegates conducted workshops and presented technical papers to 250 attending Chinese engineers and technicians. Sponsored by the Chinese SMPTE, the symposium considered topics of high-definition television, digital VTRs, CCD cameras, SMPTE time and control codes and TV measurements. Film-related topics included stereo optical sound tracks, electronic film conforming, computer applications in the film lab and archival storage.

SMPTE officials, headed by president Harold Eady (Novo Communications), included executive vice president M. Carlos Kennedy (Ampex), engineering vice president Richard G. Streeter (CBS Broadcast), Eastern region governor Irwin W. Young (Du Art Film Laboratories), governor-at-large Bengt O. Orhall (AB Film Teknik) and secretary Stephen D. Kerman (Tektronix). Assisting in the presentations were members Joseph Roizen (Telegen) and Arnold Brown (National Film Service).

NAB, NRBA suggest another convention

If the recommendation of the executive committees of NAB and the National Radio Broadcasters Association (NRBA) is followed, the third consecutive joint convention of the two trade groups will be held in New Orleans, Sept. 10-13.

In the cooperative effort, both NAB and NRBA have agreed to seek and to discuss areas of common interest that they can jointly pursue for the betterment of the radio industry.

People

John Fazackerly has been appointed a position at Scientific Atlanta, Atlanta, as marketing and sales manager for its Digital Video Systems Division's studio products line. Fazackerly plans to increase penetration of studio products in the United States and Canada. He was a former sales manager with SA's Broadband Communications Division.

Kathleen O'Keefe, Jose Rosado and **George Laughead** have been appointed positions at Shintron, Cambridge, MA. O'Keefe has been promoted to manager, government/OEM sales department. She was most recently assistant to the president. Rosado is Eastern regional sales manager. His territory spreads down the East Coast from Maine to Florida. Laughead is manager, market communications department, a new position in charge of marketing, public relations and advertising.

Jun Sakamoto and **Richard F. Colburn** have been appointed positions at Nakamichi, Torrance, CA. Sakamoto will coordinate sales efforts outside of Japan, Europe and the United States. He will be based out of the Tokyo sales office. Colburn is marketing services manager. He will be responsible for national advertising, literature and public relations.

Stan Peters has joined dbx, Newton, MA, as vice president of marketing and sales. He will be responsible for worldwide marketing and sales for all divisions, including professional products, OEM/licensing and consumer audio equipment under the dbx and ADC brand names. Before joining dbx, Peters was vice president of marketing and sales for Mollard Systems.

David Masnica has been appointed regional sales manager for the West Coast for Mitsubishi Pro Audio Group, San Fernando, CA. He will be responsible for all field sales activities with the film and broadcast industries. Masnica comes to Mitsubishi with extensive background in the motion picture audio industry, including hands-on experience in production/post-production, development and manufacturing and marketing of systems.

Ray Connelly has been named district sales manager for JVC Pro Video Division, Elmwood Park, NJ. Connelly will cover Alabama, Georgia, central Tennessee and the Florida Panhandle. He was a former sales manager with JVC.

Kris Jackson, Dan Burns and **Debbie Bodell** have been appointed positions at Soundcraft Electronics, Santa Monica, CA. Jackson is technical engineer for the upper range of Soundcraft consoles. He will be dealing with series 4, TS 24 and 2400 consoles. Burns will work with Gordon Cochran handling quality control for the mid-range line of consoles. Bodell is parts coordinator and will handle parts inquiries and orders.

Walt Lowery has joined the sales staff of Allied Broadcast Equipment, Richmond, IN. His background includes technical operation, engineering supervision and broadcast equipment sales. Lowery's base of operation will be the Richmond, IN, corporate office.

Al Swain has been appointed chief designer for Prime Image, Saratoga, CA. He and Bill Hendershot, president, received Emmy awards from the National Academy of Television Arts and Sciences for developing the first digital time base corrector.

Barbara McFarren and **Chuck Pope** have been appointed management positions at Ampex Magnetic Tape Division, Redwood City, CA. McFarren is product manager for Ampex ½-inch VHS and Beta videotape. She will have marketing responsibilities for Ampex 188 Beta and Ampex 189 VHS tape, including developing product strategies, implementing marketing plans and creating product enhancement programs for all ½-inch videotape products.

Pope is product manager for Ampex ¾-inch videotape. He will be responsible for developing product strategies, marketing plans and creating and supervising product enhancement programs for Ampex 197 and 187 ¾-inch videotape.

Jerry McElligott, Bruce Heeb and **Ed Larrabee** have been named to new positions at Switchcraft, Chicago, due to management restructuring. McElligott will be senior vice president of operations and will be responsible for manufacturing quality control and industrial relations functions. He was former vice president of manufacturing. Heeb is senior vice president of marketing and applications engineering, responsible for engineering, marketing and sales functions. He was former vice president of engineering. Larrabee will be vice president of coin telephone operations, a new group. He will be responsible for creating a marketing sales, installation and service organization to market Seiscor coin telephone products.

Tom Irby has been named operations manager at Valley People, Nashville, TN. Irby has been involved in the audio industry in various capacities since 1972. He will be responsible for overseeing all aspects of the company's daily activities.

Richard J. Taylor, president and managing director of Quantel, Palo Alto, CA, has received the David Sarnoff Gold Medal Award at the annual SMPTE honors and awards luncheon. The award honors the recipient by recognizing outstanding contributions in the development of techniques or equipment that have contributed to the improvement of the engineering phases of television.

Taylor was cited for his contributions to digital TV techniques through the design and manufacture of digital special effects and graphics equipment used throughout the world.

Phil Rutter and **Paula Bowen** have been appointed positions at GML America's newly formed U.S. company. Rutter of Saftek, Ltd., an English consulting firm, is acting general manager. Bowen is the national sales administration manager. She has sales administration experience in the electronics field, including several years at Knox Video Products.

Bob Arnold has been named sales engineer at RF Specialties, Seattle, WA. He comes to RF Specialties from a similar position with Allied Broadcast Equipment's Federal Way.

William F. Kail has been named director domestic sales for Bird Electronics, Cleveland. His responsibilities include U.S. sales, customer service and advertising. Kail previously held executive positions in sales, service and product management with General Electric Mobile Communications.

Larry Lamoray has been named sales manager of audio systems for AEG, Somerville, NJ. Lamoray will be responsible for the establishment of a national distribution and support network for AEG's professional audiotape recorders (previously known as AEG-Telefunken).

Tom Becker and **Chris Downing** have been appointed positions at International Tapetronics/3M, Bloomington, IL. Becker will serve as broadcast sales representative. Downing will be technical service representative.

Business

GML opens U.S. company to market digital products

GML America, sales and marketing subsidiary of Gunnerfield Ltd., Reading, England, has opened offices at 8150 Leesburg Pike, Vienna, VA 22180; telephone 703-790-0101. It will market digital effects systems to both broadcast and non-broadcast customers throughout the United States.

The sales network will consist of a central staff, headquartered in Vienna, VA, independent manufacturer's representatives and selected professional video dealers, in all key markets.

MBC selects Midwest to design production units

Midwest International, Edgewood, KY, has been selected by the Mumhwa Broadcasting Corporation (MBC) of South Korea, to design and manufacture three teleproduction units for use during the 1986 Asian games and the 1988 summer Olympics in Seoul. The addition of these broadcast vehicles to the three previously contracted for by MBC and one by KBC gives Midwest a total of seven teleproduction units providing worldwide coverage of these international sporting events.

The teleproduction units, the M-35, the M-24 and the M-11 will be custom-built to the specifications sent by MBC.

The M-24 will possess the capability to serve as an electronic field production unit. The vehicle will have an on-board generator and a telescopic mast for microwave transmissions.

The M-11, designed for ENG, will operate from ac or dc power. All three vehicles will be equipped with Ikegami cameras. The M-35 and M-24 will use Grass Valley switching equipment; the M-24 and M-11 will be equipped with MACOM microwave equipment.

Olympsat chooses Wegener

Wegener Communications, Norcross, GA, has received an order for multiple subcarrier transmission equipment associated with the European Olympsat Television Service. The equipment will be used to provide simultaneous English, Dutch, Portuguese and German audio with the associated video.

The Dutch PTT selected the patented Wegener Panda II audio system that provides full 15kHz frequency response with a dynamic range of 90dB. The order was placed with Wegener European agents Megasat, Ltd. of London and Hutronic BV of Holland.

Governments standardize on Aphex Compellor

The Aphex Compellor, an intelligent compressor/leveler/limiter, which provides invisible compression, from *Aphex*, Hollywood, has been selected as a standard for use by the government-controlled broadcast systems of Austria and Australia. Britain (BBC), Belgium (RTB), Germany (ZDF), Italy (RAI) and New Zealand government broadcast systems also have selected the Compellor as a prime processor for production as well as on-line work.

Although the United States has no government-controlled broadcasting system per se, the Defense Department regularly purchases both monaural and stereo Compellors.

SSL expands international headquarters

Solid State Logic plans to expand its international headquarters near Oxford, England. The administrative, research, production and training centers will move from Stonesfield, which has been the company's base for 15 years, to a new site near Woodstock, England. Ground-breaking for the new facility will occur early in this year.

Concurrent with the expansion to more than 62,000 square feet, the company plans to increase research into digital audio designs. SSL products have used digital control techniques extensively, but current research involves digital processing as well. Much of the research is centered on proprietary 24-bit audio processor that includes integral audio storage and editing capabilities.

BDB offers on-line computer network

The Broadcasters Database (BDB), a subsidiary of the Radio Service Company, has announced the development of an on-line computer network for broadcasters. BDB will provide a central point of contact for broadcast-related information in programming, engineering and management areas. The company provides 24-hour access to information on up-to-the-minute chart listings, Starbase (a daily updated compendium of show preparation notes) and feature articles on programming topics. The broadcast engineer can order new equipment and supplies from the Broadcasters Supermarket via any computer terminal.

NAB announces management seminars

The *NAB* has announced the 1986 management seminars for broadcast engineers, sponsored annually by the NAB and conducted at Purdue University in West Lafayette, IN. During the week of Feb. 9-14, the Center of Management Institutes' staff will present the twenty-first in a series of management seminars for broadcast engineers. Three seminars will be conducted at one time, Management I, II and III. There is no prerequisite for Management I, but the other two seminars require you to have participated in the appropriate sequential programs.

The Management III seminar is being offered for the third time as an addition to the management program. The 5-day seminar is designed to provide managers with the opportunity to study and develop coping skills for the rigorous demands of daily broadcast activities. Additional information on the seminars and registration fee are available from the seminar coordinator at the NAB, 202-429-5346. |:-)))|

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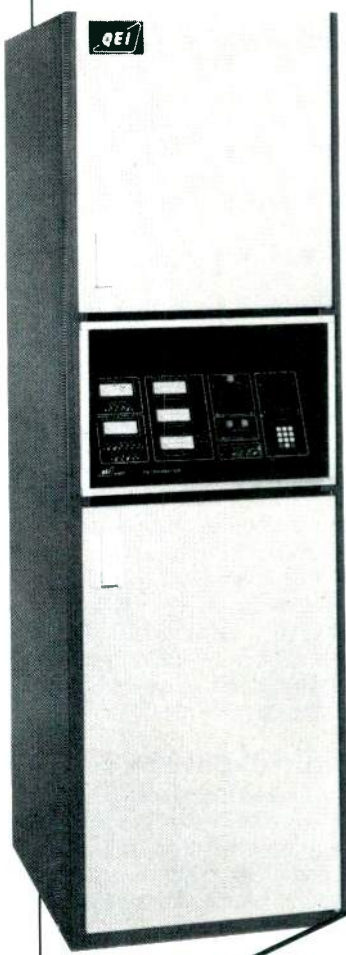

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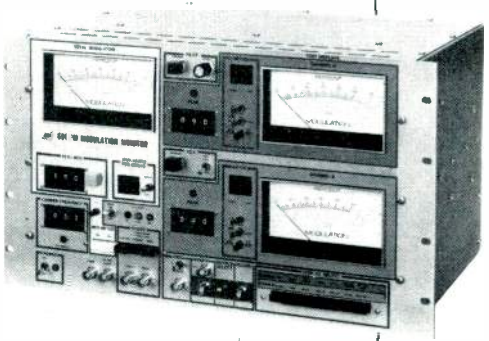

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Circle (92) on Reply Card

New products

Digital multitrack recorder

Sony has introduced the IF-3310 interface unit. The unit allows the tape transport and record-ready functions of the PCM-3324/RM-3310 to be remotely controlled from a variety of mixing consoles and peripheral controllers.

The unit allows users to operate the PCM-3324 from a mixing console by converting the console's commands into a form that is understood by the RM-3310 remote control unit. Tape transport commands from consoles using the SRIF-1 communication standard are translated, and then sent along to the RM-3310 for execution. Also, rec ready commands for all 24 channels in the SRIF-4 standard are communicated to the IF-3310 and converted for processing by the remote control unit.

The unit also provides an additional degree of production flexibility. It allows connections of up to three PCM-3324/RM-3310 s, creating a 72-channel digital recording system. Transport functions and rec ready functions for all 72 channels may be controlled from the mixing console or peripherals.

Circle (353) on Reply Card

Digital tape analyzer

Sony Professional Audio Division has announced the DTA-2000, a computerized CD master tape quality control system used to confirm digital master tape integrity. The system is a standard master tape measuring instrument capable of displaying and/or printing PCM digital audio processor error status along with SMPTE time code. It complements Sony's expanded line of compact disc mastering system products, including the PCM-1630 digital audio processor and DMR-4000 digital master recorder.

The system is designed for users of the PCM-1610 and PCM-1630 digital audio processors, whose master tapes will be transferred to CD cutting plants. The system accepts error status signals from digital audio processors and a time-code signal from a VTR or master recorder.

The VTR also can be connected with a remote control cable, making it possible to read time code in fast forward or rewind modes. Output data is sent to a printer via a Centronics interface. For CD glass mastering systems, the DTA-2000 operates in external mode and is driven by the DAQ-1000 or a cutting controller (computer).

Circle (352) on Reply Card

4-port machine controller

Alamar Electronics USA has announced the SC-2000 intelligent machine controller that works in conjunction with its MC-1050 and MC-2000 sequencer controllers. The unit includes four separate ports that can be configured to remotely control four parallel type machines, two serial type machines, strip switchers, character generators, production and master control switchers, telecine chains and other general purpose broadcast equipment.

The unit communicates with the main sequencer controller unit via a 7-wire serial RS-422 interconnect in accordance with SMPTE specifications PH 207 and RP113. Full remote transport control is available through this communications link. Intelligent information also can be stored on tape using an FSK recording process at a 600 baud data rate. Each unit includes 1 FSK encoder and 4 FSK decoders to record and playback digital information.

The unit is available in a 3½-inch rack-mount enclosure. An optional front panel LCD display may be included to indicate current machine status.

Circle (373) on Reply Card

Wideband video distribution amplifier

Videotek has added the VDA-16WB, a wideband video distribution amplifier, to its line of TV terminal equipment. The amp is designed for applications that require maintaining high bandwidth signal integrity such as HDTV, computer graphics and long-line equalization. The amp has a 40MHz video bandwidth and will equalize up to 1,000 feet of cable with frequency compensation of +0dB, −5.0dB and dc-40MHz. Equalization is adjusted from the front panel.

One looping video input and six isolated video outputs permit signal distribution up to six locations. Test points are also mounted on the front panel for rapid verification of input and output levels. Differential phase is 0.15° maximum and differential gain is 0.15% maximum.

The amp is packaged for use as a stand-alone distribution amplifier or it may be rack-mounted in an optional DAT-1 rack-mount tray with up to two more distribution amps. Power requirements are 115/230Vac and 50/60Hz. The amp measures 1.7" x 5.25" x 9.9".

Circle (372) on Reply Card

High definition paintbox

Quantel has announced its high definition paintbox system. The system has all the features of the broadcast paintbox, but at the 1,125 line, 60 fields per second standard. This increased resolution results in images with high fidelity resembling back-lit transparencies.

The system's V.4 software adds operating features and graphic capability. Blur, a brush, lets the artist soften or smudge areas of a picture. Color gradation of rectangular areas can be made from top to bottom and bottom to top. Tack allows any number of cutouts to be temporarily tacked down so the artist can experiment with different layouts before permanently sticking the cutouts. Confirm, an operating mode, makes it difficult to accidently erase work. Stencils, previously displayed in red, can be made any color.

Circle (371) on Reply Card

Character generator/digital effects system

Digital Services Corporation has introduced the Alpha 2000. The system allows a user to create logos, titles and shapes and manipulate them with illusion type digital effects including spin, flip, rotate, zoom, compress, position and image splitting. These effects can be individually customized under the control of the system.

Cirlce (370) on Reply Card

Sync generator

Tektronix has introduced the SPG-170A high performance, NTSC sync generator. Key features include RS-170A sync generation, digital gen-lock and a high stability color standard. Option 01 adds SMPTE color bars with programmable identification, plus an audio tone output. Its compact size also makes the generator ideal for use in remote vans or where space is a premium.

Circle (369) on Reply Card

½-inch videotape

Eastman Kodak has introduced a ½-inch videotape. The tape provides rugged and reliable performance needed for electronic newsgathering, electronic field production and post-production applications. Physical properties include coercivity and retentivity characteristics. Coercivity is 670 oersteds in the Beta format and 680 oersteds in VHS. Retentivity is 1,300G in Beta format and 1,400G in VHS.

Circle (367) on Reply Card

Lavalier condenser microphone

Shure Brothers has introduced the SM83-CN omnidirectional lavalier condenser microphone. The mic's wide frequency response has been tailored to compensate for chest resonance with an electronically created dip and an acoustically generated high-frequency boost above 3kHz. The result is a natural sound without boominess or excessive brightness. The mic's controlled low-frequency rolloff reduces clothing, handling and room noise.

The mic is supplied with four mounting clips that include a single-mount tie bar, a dual-mount tie bar and two multipurpose mounting clips, which may be connected to a lanyard or sewn, pinned or taped onto clothing. Other features include low noise, minimal RF and magnetic hum susceptibility, a field-replaceable cable that uses steel conductors for strength, a dark non-reflective finish, a foam windscreen for outdoor use and rugged construction for durability and reliability.

Circle (365) on Reply Card

Channel digital audio recorder

Mitsubishi Pro Audio Group has introduced the model X-850 32-channel digital audio recorder. The recording format is in compliance with the PD pro digital format standard among Mitsubishi, AEG and Otari. The unit is fully compatible with the digital recording format of model X-800, providing 45 tracks on 1-inch tape. There are two analog cue tracks, two digital auxiliary tracks and one time-code track, in addition to the 40 tracks used to provide the 32 channels of digital audio.

The unit is the only 32-channel digital audio machine currently manufactured and it can be cut-and-splice edited and then overdubbed over the mechanical splice. Other features include the RS-422/RS-232 serial interface to other recording or synchronizing systems, as well as the capability to accept sync inputs on 9.6kHz or 8kHz, 50Hz, 60Hz or 59.94Hz and composite video.

The unit also features an error-correction system where up to eight tracks could be lost due to tape dropouts, head damage or clogged heads before a noticeable loss in audio quality occurred. All 32 channels are available all of the time, due to the power of the Mitsubishi error-correction scheme.

Circle (361) on Reply Card

Compact disc player

Studer Revox has introduced the A725 QC version of the Studer A725 compact disc player. Outputs provide access to the digital audio data immediately before the A-to-D converters, the high-frequency disc datastream and subcode data and the block error rate counter.

The player may be used for quality control of discs in CD manufacturing plants, and specialized applications requiring access to auxiliary data in the subcode bits.

The player retains all other features of the standard A725, with three sets of analog audio outputs: balanced and floating with XLR connectors, unbalanced with fixed level and unbalanced with front-panel level control.

Multiple disc-cuing modes and cuing accuracy are software-controlled. Start accuracy is ±1 frame, and start from pause takes less than 0.6 seconds. Operating features such as pause, skip, repeat, loop and autostop may be preprogrammed while a disc is playing. Up to 19 steps also are programmable.

Other features include a die-cast disc transport for long-term stability, rack-mount flange and a serial data port for external computer control.

Circle (362) on Reply Card

Compact stereo mixer

Shure Brothers has announced the FP32 stereo field production mixer. The mixer features two transformer-isolated outputs (one for each stereo channel) and three transformer-isolated input channels, each of which includes a level control, center-detented stereo pan pot and a switch permitting mic-or-line-level operation. Stereo capability is enhanced by a concentric clutched stereo master gain control.

Condenser microphones may be powered by the mixer's built-in 18Vdc phantom power of 9Vdc A-B power source. A phantom jack permits the use of an external power supply. Both mini and ¼-inch stereo headphone jacks with level control are provided, as well as a monitor input for monitoring from a VTR.

The mixer also includes a built-in slate microphone with automatic gain control and a slate tone for identifying take locations. Other features include a built-in limiter with adjustable threshold, dual VU meters with lamp and battery check function, 12Vdc external power jack, stereo auxiliary-level outputs and a carrying case. The mixer is designed for field use and portability, measuring 2¼" x 7¼" x 5 5/8".

Circle (354) on Reply Card

Computer-based synthesis/graphics system

Fairlight Instruments has introduced the computer video instrument, a computer-based video synthesis and graphics system. Colors, textures, lines, brush strokes and stencils can be combined in real time with live video offering almost unlimited scope for creating visual effects with ease and speed. The instrument is suited for ¾-inch commercial production with certain broadcast applications.

A microprocessor-controlled field store offers a range of real time digital effects including color generation and modification (more than 4,000 colors), mattes, chroma-key, pixelation and strobe. Paint and draw facilities enable the user to draw directly onto the field store and to select software menus and special functions. The control system makes the instrument easy to operate without limiting the user's creativity and without requiring computer programming.

Circle (368) on Reply Card

Automated editing system

Color Systems Technology has introduced the VECS-8000, an automated editing system. The system provides an automated editing system by interfacing the Sony BVE-800 video editor to the IBM PC or an equivalent computer.

The interface board and computer software manipulates edit decisions made on the Sony BVF-800 by using the IBM PC's memory capacity. Edit decisions can be transferred, stored and manipulated then recorded on diskette for optimum convenience. The system provides portability for the thousands of time-code numbers and event descriptions found in typical edit decision lists.

Circle (366) on Reply Card

Full-frame time-base corrector

Nova Systems has announced the Nova 620, a full-frame time-base corrector. The TBC provides a full frame of storage allowing users to freeze a field or frame of video for special effects applications. This infinite window eliminates the need to feed sync back to the videotape recorder. This allows the TBC to time-base correct ½-inch non-capstan servo type VCRs.

Features include presets for the front panel controls; dropout compensation; a comb filter to process the video with virtually no loss of detail—a 4.2MHz bandwidth; remote control capability; 50 times shuttle operation; and black burst output from a built-in sync generator. Dynamic tracking is an available option.

Circle (376) on Reply Card

Film and video animation system

Cubicomp has announced an enhanced version of its PictureMaker 3-D design and animation system. The system operates on an IBM PC or AT. Features include enhanced imaging capabilities, additional motion scripting functions for animation, 3-D sectioning for sculpting of 3-D surfaces and a new user interface.

System enhancements include improved surface antialiasing; a texture-mapping feature, which allows 2-D images and patterns to be superimposed or wrapped around 3-D rendered objects; translucency, for creating transparent effects; phong shading; and independently controllable multiple light sources.

The system's fast rendering speeds are made possible by software and 16-bit graphics frame buffer that stores and displays two 512 x 512 pixel frame images, shown at 16 bits per pixel.

The frame buffer offers full gen-lock capability, accommodating both NTSC and PAL line rates. Video keying is available, allowing software-controlled mixing of video and computer-generated images.

Circle (378) on Reply card

Twin framestore digital effects system

GML America has announced the Proteus digital video effects system. The unit is a dual channel, multiple input, digital effects device incorporating two full-frame stores. The hardware and its controlling software is designed to work with standard NTSC video inputs or any ¾- or ½-inch or component VTRs, both studio machines and portables.

Modularity of hardware design and software upgradeability should prevent the product from becoming prematurely obsolete. The unit comprises two sections: the digital effects controller and the mainframe unit. The controller can function as either a stand-alone effects unit or to accompany an editing controller. It connects to the mainframe via a single RS-422 interface cable up to a distance of 3,000 feet.

The controller can select one of four inputs from any source and assign it to either channel. Each input can be afforded the full range of digital effects, which are stackable. A positioning joystick and a T-bar for manual control of the A/B effects also are included.

The engineering panel provides control of video gain, chrominance gain, black level, R-Y and B-Y color correction. The mainframe contains two full-frame store synchronizers each with a universal time base corrector. The mainframe houses the digital control electronics together with the central microprocessor. BNC connectors are provided on the back panel for all outputs.

Circle (377) on Reply Card

Digital time base corrector

Lenco Electronics Division has introduced the TBC-450 digital time base corrector. The TBC weighs less than 15 pounds and is 1-rack unit tall, with low power consumption that requires no external cooling. Features include digital pixel-by-pixel dropout compensation, signal-to-noise ratio at 58dB, heterodyne processor/feedback at 3.58 MHz, advanced sync output signal, 4-times subcarrier sampling with 8-bit resolution, constant H-phase for matched frame edit, high speed search handling, full processing amplifier control, adjustable horizontal and vertical blanking, 16 line correction window and transparent operation.

Circle (362) on Reply Card

Differential output amplifiers

Benchmark Media Systems has announced the DOA-1 and 2 differential output amplifiers. These devices are designed to retrofit into equipment that was manufactured without

balanced outputs. Both versions have variable gain from full off to +26dB, and have a peak clip point of ±27dBV when operated from normal supply voltages.

Their low noise, 10W distortion, variable gain, mounting scheme and low output impedance makes them ideal for balancing equipment in the professional environment. The DOA-1 is designed to operate from dual ± power supplies, while the DOA-2 is designed to operate from a single + power supply.

Circle (361) on Reply Card

Broadcast console

JBL has announced its model 1690 12-channel broadcast console. Radio and TV stations can handle up to 12 simultaneous program sources with the console, which includes three different models that offer a choice of mixer controls. The model 1691 is available with rotary conductive plastic attenuators; model 1692 is available with Shallco precision-stepped rotary attenuators; and model 1693 features Penny & Giles straight-line attenuators.

The signal-to-noise ratio of the microphone channel, from input to console output, is more than 74dB with –50dBm input and +4dBm output, or more than 90dB referenced to maximum output. At the full output level of +24dBm into 600Ω, the THD of both program and audition channels is less than 0.25% over the range of 30Hz to 15Hz. Each mixer position has two inputs selectable with a rocker switch. Three banks of four push-button switches may be connected to any mixer input for use with additional sources such as remote or network feeds.

An overload indicator LED is located between the VU meters and its threshold can be internally adjusted to alert the operator that a downstream device, such as an STL, may be clipping. The consoles are supplied with one monaural transformer isolated microphone input preamplifier and 11 stereo line input preamplifiers.

Circle (358) on Reply Card

Wireless mic receiver

Swintek has introduced the Mini-Q, the smallest wireless microphone receiver made to be used with a video camera, measuring 3.5" x 2.7" x 1". The receiver's ultra-light weight construction allows it to be mounted and phantom-powered from many brands of video cameras.

The receiver uses the high VHF FM band to eliminate the possibility of hum bars being introduced into the video recorder. The receiver incorporates dB-S, audio-scaling, signal processing techniques to increase the dynamic range of wireless microphones and improve signal-to-noise ratio.

The receiver provides a low-level or high-level audio output with an adjustable squelch and indicator showing proper power or audio level is present at all times. A headset monitoring plug with an internal level control allows the receiver to be used for cueing, bi-lingual remote listening, recording or for any 1-way communication link. The receiver will work from any power belt which can deliver 10Vdc through 24Vdc at 50mA.

Circle (357) on Reply Card

Extended tube warranty

QEI Corporation now warrants tube life in its 3.5kW and 5kW FM transmitters for 15,000 hours or 2 years of operation, whichever comes first. This warranty applies to the 3CX3000A7 tube originally supplied and factory installed in all future transmitter shipments. The tube is covered by full replacement for the first 10,000 hours with a prorated extention to 15,000 hours. For more information on this warranty plan, contact John Tiedeck, QEI; telephone 609-728-2020.

Circle (389) on Reply Card

Audio mixing console

The Professional Products Division of *Yamaha* has announced the PM3000 professional audio mixing console. The console is available in 24-, 32- or 40-input channels and incorporates improved input circuitry with a 5-position attenuation pad switch and gain control; eight voltage-controlled amplifier groups; eight group mixing buses and eight auxiliary mixing buses; discrete stereo bus; an 11 x 8 mix matrix configuration; eight master mute groups and cue and solo capabilities.

The console also features a VCA grouping system. Eight switches next to each channel fader enable that channel to be controlled by one or more VCA master faders. The console's cue and solo capability includes cue/solo switches on every input channel, and a cue switch on every master auxiliary send, group outputs, stereo master outputs and the auxiliary returns. Additional user-friendly features include talkback and communications capabilities and a built-in fixed and variable-frequency test oscillator with pink noise generator.

Circle (362) on Reply Card

Broadcast console

Sony has introduced the MXP-2000 stereo audio mixing console for on-air and post-production use. Among the console's features for on-air is an optional user-assignable dynamics processor module that provides compressor limiting or expansion of any input. Another is fader start capability, which automatically starts an ATR when a fader is raised from its zero point—giving tape transport control from the fader itself.

For post-production, the console has facilities for a planned video editor interface. When released, the optional interface allows the console to work with certain editors or switchers to control cross-fades and mutes to within frame accuracy.

The console also offers switchable dual mic/line inputs, five kinds of solos, selectable audio grouping or VCA grouping, cough switching, 3-band EQ sweepable from 300Hz to 3kHz, direct outputs for direct multitrack sends, group outputs and on-air rehearsal logic switching. Stereo capabilities include two independent stereo outputs and four stereo external monitor inputs.

The console's standard 20-module frame allows interchangeability, any type of module will function in any slot. The console uses hybrid amplifiers at key points in the signal path and linear crystal, oxygen-free copper cable on all signal runs to enhance tonal accuracy. Hum is reduced with an outboard, rack-mountable power supply. Gold connectors and unipoint grounding methods used throughout also help to ensure a quiet background.

Circle (351) on Reply Card

Betacam plate

In collaboration with Sony Broadcast, a plate for the Betacam has been developed by *W. Vinten Limited*. The plate is designed to replace the shoe supplied with the camera. It has a more rigid fixing with alternative positions to get the right center of gravity. Unlike the pressed shell fabricated shoe, the plate is precision-machined from a solid aluminum block, with 3/8-inch helicoil holes at ¾-inch spacing.

Circle (350) on Reply Card

Pegasus system

A.F. Associates has introduced the Pegasus 5100 system, which automatically enables the off-line compilation of commercials and other short-duration tape material using advanced, digital-computer techniques. Advantages of the system are reduced operational error rates, no mechanical failures and it provides improved quality control of the commercial product.

Circle (375) on Reply Card

Stereo field production mixer

Shure Brothers has announced the FP42 stereo mixer designed for professional stereo remote broadcast and field production applications. The mixer features two outputs and four input channels, all switchable for mic- or line-level operation. Each input channel includes a level control, center-dented stereo pan-pot, and a pull-pot cuing feature for cuing or checking each input via headphones. The mixer also features a concentric clutched stereo master level control for additional mixing flexibility.

The mixer may be ac- or battery-operated and includes a tone oscillator for line and level checks, a direct mix bus and phantom power for condenser microphone operation. Also included are dual VU meters that are calibrated for +4dBm and +8dBm. Batteries may be checked without program interruption and the mixer's built-in stereo peak limiters are equipped with LED overload indicators. The mixer is designed to provide a wide, flat frequency response, plus low noise and RF susceptibility.

Circle (367) on Reply Card

2-head cassette deck

Nakamichi USA has introduced the MR-2 2-head professional cassette deck. The unit complements the MR-1 discrete head professional cassette deck and the DMP-100 digital mastering processor. The unit also has specialized features for the real time tape duplicating market.

The unit uses the silent mechanism transport, which has a microprocessor-supervised motor-driven cam system that removes vibration-induced flutter. It features tape heads that yield smooth response with extended bandwidth to 20,000Hz, custom electronics that provide low-noise/high-headroom performance and quality control.

Performance features include Dolby B and C noise reduction, selectable bias and equalization via interlocking push-buttons and a front-panel bias tune control. Other features include peak level LED meters with a wide range of −30dB to +7dB, playback-only pitch control with ±6% range, memory stop that automatically stops the tape at the 000 counter reading, auto repeat, dual-speed master fader for smooth fade-outs and headphones output with level control.

Circle (370) on Reply Card

Recording/remix console

Sony Professional Audio Division has introduced the MXP-3000, a recording/remix console. An optional ADS-3000 automation system consists of a processor/disk drive, a CRT monitor/terminal and a wireless remote control.

On-line control of the system is performed from the 14-key wireless remote, which glides along a track on the console surface. Most commands require three keystrokes or less. The main terminal operates on menu-driven software.

High-performance hybrid amplifiers form critical input, output and summing stages. Linear crystal, oxygen-free copper cable in all signal runs reduces skin effects for signal accuracy. Unipoint grounding and stable gold connectors also are used.

EQ and mic coupling may be chosen according to application, allowing the console to be field customized without modifications by the user. Users may select either of two plug-in equalizers for each channel input module.

Circle (357) on Reply Card

Remote program meter card

Benchmark Media Systems has announced the RPM-1 remote program meter card. This printed circuit board is designed to convert the standard VU movement to operate as both a VU and a peak program meter. The high impedance balanced input device uses standard DIN attack and decay time constants in the peak mode, as well as normal VU operation and switch-selectable system references of 0, +4 and 8dBV. The card also has a peak hold mode for catching the highest peak during VU operation,and a peak overload indicating LED with separate calibration. Mode switching can be local, using illuminated push-button switches or LED indicators, and it may be gang switched in console applications.

Circle (386) on Reply Card

Fully digital video processor

Ampex has announced the Zeus 1 video processing system integrating time base correction technologies with advanced video processing and variable motion capabilities. The system is the first fully digital processing system to remove picture hopping or blurring associated with other picture correction devices during slow motion and program compression.

Compatible with the entire family of Ampex Type C videotape recorders, the system is designed to meet the needs of the mid- and high-end broadcaster and post-production facility.

The system features bad color frame edit processing, full-frame store capability, enhanced dropout replacement, improved signal-to-noise, elimination of long time-constant velocity errors, full digital controls, reliability and diagnostics and switchable formats.

Circle (374) on Reply Card

Analog mastering recorder

Studer Revox has introduced the A820 ½-inch 2-track and time code versions of the A820 mastering recorder for either ½-inch stereo or ¼-inch stereo with center-track SMPTE code. The ½-inch 2-track format is designed for high quality music mastering applications. The added tape width of the A820 2-½-inch provides improvements in both signal-to-noise ratio and tape saturation characteristics.

The A820-TC features the center-track SMPTE time-code system. Two separate heads are used to record and reproduce the time code, keeping code/audio crosstalk at better than −90dB. A microprocessor-controlled delay line compensates for the offset created between code and audio heads, thereby maintaining code and audio at all speeds, including vari-speed modes.

The recorder's capability to accommodate 14-inch reels permits longer playing times at higher tape speeds. Four speeds (3¾ips, 7½ips, 15ips and 30ips) are standard and front-panel selectable. All operating features are controlled by a network of microprocessor-based systems, allowing software control of virtually all operating parameters. Approximately 40 different user-programmable functions may be assigned to various keys. All audio parameters are digitally set and stored in non-volatile memory.

Microprocessors also monitor all dynamics of the transport, including tape tension, tape winding speeds and reel inertia. A dual thumbwheel control is provided for fast editing: one wheel fast winds at variable speeds in either direction, while the other positions the tape for the edit.

Circle (356) on Reply Card

Compact mixing consoles

Studer Revox has introduced the 961/962 series of compact mixing consoles designed for video editing, remote video production, radio production and remote recording. Modular construction allows each console to be configured to meet specific customer needs. A 961 frame accepts up to 14 30mm modules, while a 962 holds up to 20 modules.

The mixers offer stereo line level input modules, either with or without a 3-band equalizer section. The equalizer is standard in the mono microphone/line input module, which also includes a proprietary microphone input combining active differential and transformer balanced designs.

The master input modules feature a built-in compressor limiter which operates on PDM (pulse duration modulation) principle. Additional module options feature a selection of monitor, auxiliary, talkback and communication functions. Other features include faders with glide characteristics, click-free electronic muting, FET switching, LED peak indicators on each input, electronically balanced insert points and a Littlite socket.

Circle (355) on Reply Card

Digitizing oscilloscope

Hewlett Packard has announced the HP 54110D full-color, high-resolution, digitizing oscilloscope. The scope has a 1GHz repetitive bandwidth and a display with 368 vertical, 576 horizontal pixel-addressable resolution.

The scope displays a flicker-free color representation of the rapidly changing data inherent in the design and test of high-speed logic circuits and in high-speed data communications. With the 9-inch raster display, users may work with as many as seven colors at one time, selecting from 4,096 available colors. A default 7-color palette was designed to provide optimum viewing for users working in standard laboratory environments.

The scope combines digital architecture with a crystal-controlled time base. With a push of a front-panel button, the scope measures frequency, period, pulse width, transition

times, peak-to-peak amplitude, top and base voltage levels, preshoot and overshoot.

Circle (365) on Reply Card

Pocket inspection microscope

Solder Absorbing Technology (S.A.T.) has introduced the self-illuminated pocket microscope. It weighs 4½-ounces and provides a 30-power magnification with the Spirig-30 or a 100-power magnification with the Spirig-100 model of any surface on which it is easily focused.

Circle (364) on Reply Card

Multifunction digital multimeter

B&K Precision, Industrial Products Group, Dynascan, has announced the model 2820, a 4½-digit true rms digital multimeter that provides frequency, temperature, relative, dBm measurement capability in addition to volt, ohm and amp measurements. The handheld dmm features 0.04%dcV accuracy, 10μV resolution, peak and data hold, diode test and audible continuity test.

The dmm uses custom LSI microprocessor-control technology and push-button function selection. When 4½-digit resolution is not required, the dmm can be switched to 3½-digit operation. A built-in temperature function provides °C or °F readings via a K-type thermocouple temperature probe. Frequency is measured from 10Hz to 99.999kHz with auto-ranging convenience. Attenuation is manually selected via the voltage ranges.

The dmm uses true rms reading to allow accurate measurement of triangle waves, square waves, sawtooth waves and other non-sinusoidal repeating waveforms. Ac voltage measurements are provided in five ranges to 750V. Dc voltage measurements are provided in five ranges to 1,000V. Ranges are auto or manual ranging for both ac and dc measurements.

Circle (363) on Reply Card

Waveguide compressor products

Environmental Technology has introduced its ADH-1 waveguide compressor products. These products automatically keep waveguide or coax pressurized with dry-filtered air. Activated alumina is used as the regenerable drying agent. The dew point is maintained at −40F or below with flow rates up to 4 liters per minute. Both 12-inch water column and 6 psig units are available. The products mount in 5¼-inch panel space. A mechanical safety valve protects pressurized components.

Key operating parameters displayed include pressure, temperature, flow rate and humidity. Solid-state pressure, temperature and humidity sensors are used. Operational problems can be selectively displayed. Regeneration is done on demand to extend valve and component life. Extensive fault diagnostics are provided along with a summary alarm relay. Compressor life expectancy is more than 12 years in normal service.

Circle (359) on Reply Card

Dual channel video production system

The Alta Group has introduced the Pyxis system, a digital video production system that combines dual channel time base correction, effects between channels, live video switching and audio mixing in a compact unit. The system is an integrated work station that contains the necessary features for any kind of production without requiring switchers.

The system contains two 16-line window digital time base correctors and a wide selection of wipes, soft wipes, dissolves and digital effects. It also will accept live video inputs from any gen-lockable camera.

Circle (360) on Reply Card

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Ad index

Advertiser	Reader Service Number	Page Number
ADM Technology, Inc.	1	IFC
AKG Acoustics, Inc.		32
Alden Electronics	66	81
Alpha Audio	115	134
Amek Consoles Inc.	11	17
Amperex Electronic Corp.	46	66-67
Ampex Corp. (AVSD)	61	88-89
Ampex Corp. (MTD)	22	34-35
Anton/Bauer Inc.	75	109
Anvil Cases, Inc.	69	90
Aphex Systems Ltd.	62	92
Arrakis Systems, Inc.	35	3
Asaca/Shibasoku Corp. America	113	133
Audio Precision	16	28
Audio Technologies Inc.	28	42
BAF Communication Corp.	21	33
Belar Electronic Labs	85	116
Benchmark Media Systems	99	126
Beyer Dynamic Inc.	73	107
Broadcast Video Systems	84	116
BSM Broadcast Systems Inc.	74	76
C.O.A.R.C.	94	110
Camera Mart, Inc.	77	111
Cartridge Technology	121	120
Centro Corp.	70	103
Cetec Vega	38	46
Christie Electric Corp.	48	70
Cipher Digital Corp.	23	36
Circuit Research Labs, Inc.	9	13
Clear-Com Intercom Systems	63	91
Clear-Com Intercom Systems	64	93
Comrex Corp.	126	100
Continental Electronics Mfg. Co.	87	104
Control Concepts Corp.	97	124
Crosspoint Latch Corp.	111	128
Dielectric Communications	120	38
EEV, Inc.	98	125
Eastman Kodak Co.	68	101
Emcee Broadcast	127	119
ESE	110	127
Frezzolini Electronics Inc.	78	104
Fujinon Inc.	36	54
Gentner Engineering Co., Inc.	117	135
German American Chamber of Commerce	83	115
Grass Valley Group, Inc.	7	9
Gray Communications Consultants, Inc.	20	31
Greco Systems	32	58
Hannay Reels	57	84
Hewlett Packard		71
Hitachi Denshi America Ltd.	50	72-73
Intl. Tapetronics Corp./3M	34	50-51
JBL Inc.	33	49
JVC Company of America	13	21
Lake Systems Corp.	65	95
Landy Associates, Inc.	26	39
LEA Dynatech Inc.	53	82
Leader Instruments Corp.	4-5	5
Leitch Video Ltd.	47	69
Lenco Electronics	8	11
Lerro Electrical Corp.		53
3M	67	98-99
Maxell Corp. of America	58	83
MCL, Inc.	76	117
Microprobe Electronics Inc.	118	120
Microtime, Inc.	24	37
Microwave Filter Co., Inc.	100	126
Midwest Communications Corp.	3	1
Moseley Associates Inc.	6	7
NEC America Inc.	43	63
NEC America Inc.	71	105
NEC America Inc.	96	123
Nurad	17	29
Odetics, Inc.	45	65
Opamp Labs Inc.	124	116
Orban Associates Inc.	40	48
Orban Associates Inc.	27	40-41
Otari Corp.	10	15
Pacific Recorders and Engineering		23
Panasonic	15	24-25
Polyline Corp.	93	110
Potomac Instruments	72	102
QEI	92	121
QEI	37	55
Richardson Electronics Inc.	39	59
RTS Systems, Inc.	60	86
Schwem Technologies	51	75
Shintron Electronics	114	134
Shook Electronic Enterprises, Inc.	18	30
Shure Brothers Inc.	42	52
Sitler's Inc.	123	116
Solid-State Logic	52	77
Solutec Ltd.	128	120
Sony Corp. of America (A/V & Pro Audio)		56-57
Sony Corp. of America (Broadcast)	12	18-19
Spectrum Communications	19	30
Standard Tape Laboratory, Inc.	122	120
Studer Revox America Inc.	31	47
Surcom Associates Inc.	125	116
Symetrix, Inc.	44	68
Tascam division TEAC Corp. of America	41	61
TFT, Inc.	30	45
Total Spectrum Manufacturing Inc.	91	113
Union Connector Co., Inc.	56	97
Varian	29	43
Vid Video	112	133
Videotek, Inc.	54	79
Vital Industries, Inc.	59	85
Ward-Beck Systems Ltd.		BC
Wheatstone Broadcast Group	2	IBC
Winsted Corp.	116	135
Zellan Optics Ltd.	86	119

Reader Service Number	Advertiser
	619/438-3911
15	201/348-7336
93	312/297-0955
72	301/589-2662
92	609/728-2020
37	609/728-2020
39	800/525-6362
60	818/843-7022
51	415/935-1226
114	617/491-8700
18	512/653-6761
42	312/866-2553
123	800/272-6459
52	212/315-1111
128	514/521-5464
12	
19	215/631-1710
122	415/786-3546
31	615/254-5651
125	619/722-6162
44	206/624-5012
41	213/726-0303
30	408/727-7272
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