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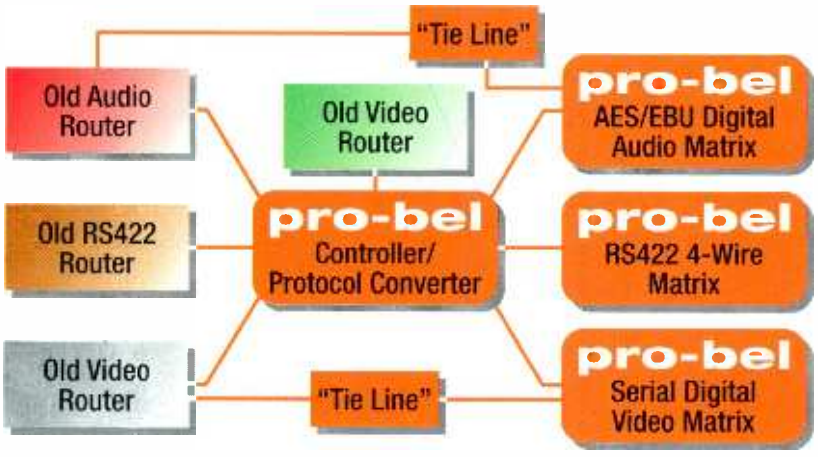

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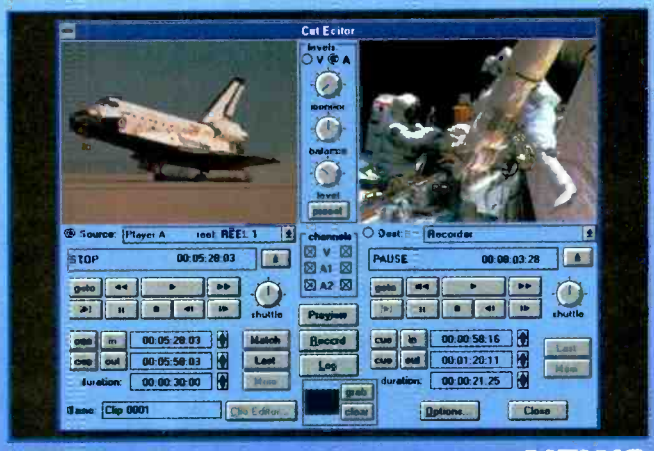

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Remote Production Special Report:

Radio and TV stations often rely on remote broadcasts to highlight their visibility within their communities. Originating these broadcasts usually falls upon the backs of engineers. This month's issue provides insight into how remote broadcasting can be made easier and more reliable.

DEPARTMENTS:

COLUMNS:

THIS MONTH...

ON THE COVER:

Broadcasting the Winter Olympics requires detailed coordination, and crews must often operate in some of the toughest environments. There is never a second chance with this broadcast. Cover design by Stephanie Chiles. (Photos courtesy of CBS Network.)

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Shown above: the US-2000 two-channel main station (one rack space high, half-space wide).

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International News

By Dawn Hightower, senior associate editor

IBC to become an annual event

At a meeting of the IBC Management Committee, a decision was made to make IBC an annual event.

A working party has been formed to study the implications of this important decision, and will report back to the Management Committee with recommendations regarding the wider issues.

Further information regarding IBC 94 may be obtained from the IBC Convention Office; telephone 44 071 240 3839; fax 44 071 497 3633.

Telcor to market video compression products

Telcor, a new international venture, has been formed to manufacture and market video compression products for broadcast and related applications. Initial deliveries begin the first quarter of this year.

Telcor is a joint venture of Digital Vision of Sweden and Vistek Electronics, Ltd. of the United Kingdom. The company will be headquartered in Sweden with sales and marketing based in the United Kingdom.

Alamar expands international reach

Alamar has equipped Telecolor, a privately owned TV broadcasting system in Sicily, with two Alamar MC 2075 systems. The Telecolor system consists of four 486/SX 20MHz computers including two working with the MC 2075 systems, offering centralized control of all record and playback devices and program sources. Each of the computerized systems is subrouted to the other so that the two channels can alternately serve three programming zones. All four computers are tied together via ethernet. Each 2075 is equipped with an Alamar MC-900 for log building and the Media Manager information retrieval library database.

NTL and Pace form digital partnership

NTL and Pace Micro Technology Ltd., two British companies, have announced a partnership that will enable the two companies to work together on digital TV reception equipment. Mid-to-late 1994 is the target date to manufacture the first units.

NTL will supply the video compression technology and Pace will supply the design, manufacturing and worldwide distribution capacity in the domestic market.

The move is important for the two companies and for the future of digital TV broadcasting. Satellite operators are planning to introduce direct-to-home digital services in 1995. Their success will depend on a plentiful supply of receiver-decoder units at consumer prices.

This alliance will allow rapid entry into the digital consumer market as the new multichannel broadcasting formats are introduced. Together, the companies plan to develop a range of digital broadcast receivers conforming to the MPEG-2 digital compression standard.

The partnership announcement follows the appointment of both companies to the Steering Board of the Digital Video Broadcasting (DVB) project, the new initiative of the European Launch Group aimed at defining a European standard for the future of digital television by satellite, cable and terrestrial methods. As a result of a Memorandum of Understanding signed in September by 85 major broadcasters, equipment makers, satellite and network operators and governments, all European digital TV standards agreed to under the DVB project will be based on the MPEG-2 video and audio compression standard.

Thomson-CSF and ABB form THOMCAST

ABB has merged its broadcast manufacturing business with Thomson-CSF. The business transfer included ABB's high-power transmitter manufacturing facility in Switzerland, its antenna and structures facility in Germany, its tube production facility in Switzerland and another factory in Poland. The latter two facilities will become part of the new broadcast group: THOMCAST, a 100% owned subsidiary of Thomson-CSF. The address is 1, rue de l'Hautil/BP 150/78702 Conflans-Sainte-Honorine/France; telephone 33 1 34 90 31 00; fax 33 1 34 90 30 00.

VOA considers sale of Belize station

The Voice of America (VOA) will solicit offers for the purchase of its broadcasting facilities in Belize, Central America.

Last September, the VOA announced that the Belize relay station will be closed in order to meet required budget limitations

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BROADCAST ENGINEERING

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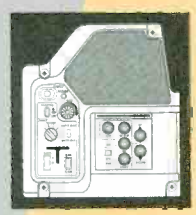

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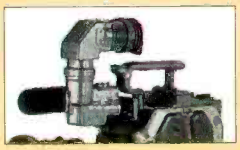

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Editorial

'Tis the season to spend money

Yes, I know that the holiday season is supposed to be over, but listen, readers. I come bearing good news. And after a long holiday, you can probably use some.

This month's issue provides a peek into the purchasing plans for both radio and TV stations. The results are quite encouraging. Not only are station equipment budgets higher than last year, but there is greater optimism in the industry's overall health and future.

Although our research has shown overall growth for the past two years, this year's survey contains the most optimistic news in some time.

Overall, equipment budgets for 1994 are an average 17% *higher* than what was actually spent in 1993. Although this year's increases in equipment budgets for television are still in the single-digit range, radio seems red hot with buying plans.

Measured over all markets, radio equipment budgets are 41% higher than what was spent last year. Combine that with last year's increase of 14% and there is every reason to believe that radio stations are back in business and ready to buy.

I might not be so optimistic about the immediate financial future of stations if this positive trend wasn't reflected in other areas of the survey. When asked if their equipment budget was sufficient, almost 62% of the respondents replied that it was. That's up 6% from last year. Also, more readers are planning to attend trade shows and training seminars than last year.

When asked to rate the overall state-of-the-industry, more readers replied that it was better than last year and far fewer rated 1993 as worse than 1992.

There are still many tough issues ahead for the industry, but the benefits of a low inflation rate and a healthier economy have finally trickled down to broadcasters. It's about time! Now they have money with which to build for the future.

Many exciting opportunities and changes are in store for stations in 1994. To take advantage of them, you have to be informed. Rest assured that the engineers (editors) at *Broadcast Engineering* magazine will help provide the solutions you need for today's problems and the information you need to successfully build for tomorrow's opportunities.

Brad Dick

Brad Dick, editor

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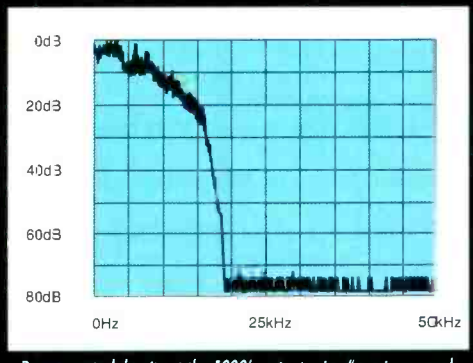

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FCC Update

AM stereo standard selected

By Harry C. Martin

On Oct. 25, 1993, the FCC selected the Motorola C-QUAM system as the single AM stereo transmitting standard for the United States. The commission's action was a response to a law passed by Congress in 1992 that required the adoption of a single standard.

AM stereo was first authorized in 1982. At that time, there were five competing AM stereo technical systems, and the FCC declined to select any of them as the single nationwide standard. Although market forces during the next 10 years narrowed the field to two systems — the Motorola C-QUAM and the Kahn System — the lack of a single standard retarded the development of AM stereo.

The National Association of Broadcasters (NAB) and other industry groups supported the FCC's proposal to name the Motorola C-QUAM system as the national standard.

Stations that have been transmitting stereo programs using systems other than C-QUAM will be permitted to continue such operations for one year. The transition to a single standard should not be difficult because receivers no longer are being manufactured for any AM stereo systems except C-QUAM.

Overnight ATS operations

Section 73.1500 of the FCC's rules permits the use of an automatic transmission system (ATS) with remote monitoring at times when there are no personnel in the studio. Many broadcasters use all-night answering services, convenience stores, or the like, to monitor their stations during overnight ATS operations.

One complication is that the EBS rules require that stations be capable, during all hours of operation, of receiving and responding to EBS activation signals. However, the FCC now considers a station to be in compliance if its monitoring and control plan ensure that station personnel will respond to EBS activations within five-to-10 minutes.

Stations using ATS on an overnight basis may, for instance, place an EBS monitor at the off-premises ATS control point and make provision for the ATS duty operator to immediately telephone station personnel in the event of an EBS activation. Such personnel would have to go to the station or otherwise respond to the activation within five-to-10 minutes.

It is advisable that the specifics of any such arrangement be set forth in a letter and sent to the FCC's EBS Branch (Room 720, 1919 M Street, N.W. Washington, DC, 20054).

Equipment performance measurements and logging

As a result of the sweeping deregulation of radio in the 1980s, many of the FCC's rules regarding proofs-of-performance and logging have been eliminated or modified. However, some basic requirements remain, which are reviewed here.

Measurements

Section 73.1590 of the rules requires AM, FM and TV stations to make equipment performance measurements on their main transmitters as follows:

- Upon installation of a new or replacement main transmitter.
- Upon modification of an existing transmitter.
- Upon installation of AM stereo transmission equipment.
- Upon installation of FM or TV subcarrier or stereo transmission equipment.
- For AM stations, annually with not more than 14 months between measurements.
- When required by other FCC rules or the station license.

Section 73.1590(b) prescribes the methods for radio and TV stations to measure spurious and harmonic emissions. Section 73.1590(c) specifies how TV stations must measure visual equipment performance. Section 73.1590(d) requires that licensees retain a report, including the data and a description of the equipment and procedure used for the measurements. The reports must be signed and dated by the qualified person making the measurements and must be kept on file at the transmitter or remote-control point for two years.

Section 73.61 requires directional AM stations to take field measurements at the monitoring point locations specified in their licenses as often as necessary to ensure that the values specified in the station's license are not exceeded.

Directional AM stations without approved sampling systems must make such measurements once each calendar quarter at intervals not exceeding 120 days. A "partial" proof-of-performance, consisting of at at least 10 field-strength measurements made on each of the station's radials, must be made whenever the licensee has reason to believe that the radiated field may be exceeding the limits within which the station was most recently authorized to operate. The methodology for conducting AM partial proofs is set forth in Section 73.154 of the rules.

Logging. Only a minimum amount of information must be recorded on the FCC-required station log:

- The receipt or transmission of EBS tests or alerts.
- Records of any malfunction of antenna lights, including the time such malfunction was reported to the FAA, and the time repairs were completed.
- A record of the time, date and nature of repairs to the transmission system, including indications of parameters before and after the repairs.
- Other records specifically required by the FCC or an individual station's license.
- Readings of transmitter parameters if required on the station license or FCC rules (e.g., those required for directional AM stations not having a typed-approved sampling system).

* Station logs are required to be kept for two years.

Date line

On Feb. 1, 1994, annual ownership reports (or ownership certifications) are due for all radio and TV stations licensed to communities in Arkansas, Kansas, Mississippi, Nebraska, New Jersey, New York and Oklahoma. New Jersey and New York TV stations and Wyoming LPTVs also must file their renewals by Feb. 1.

Martin is an attorney with Reddy, Begley & Martin, Washington, DC.

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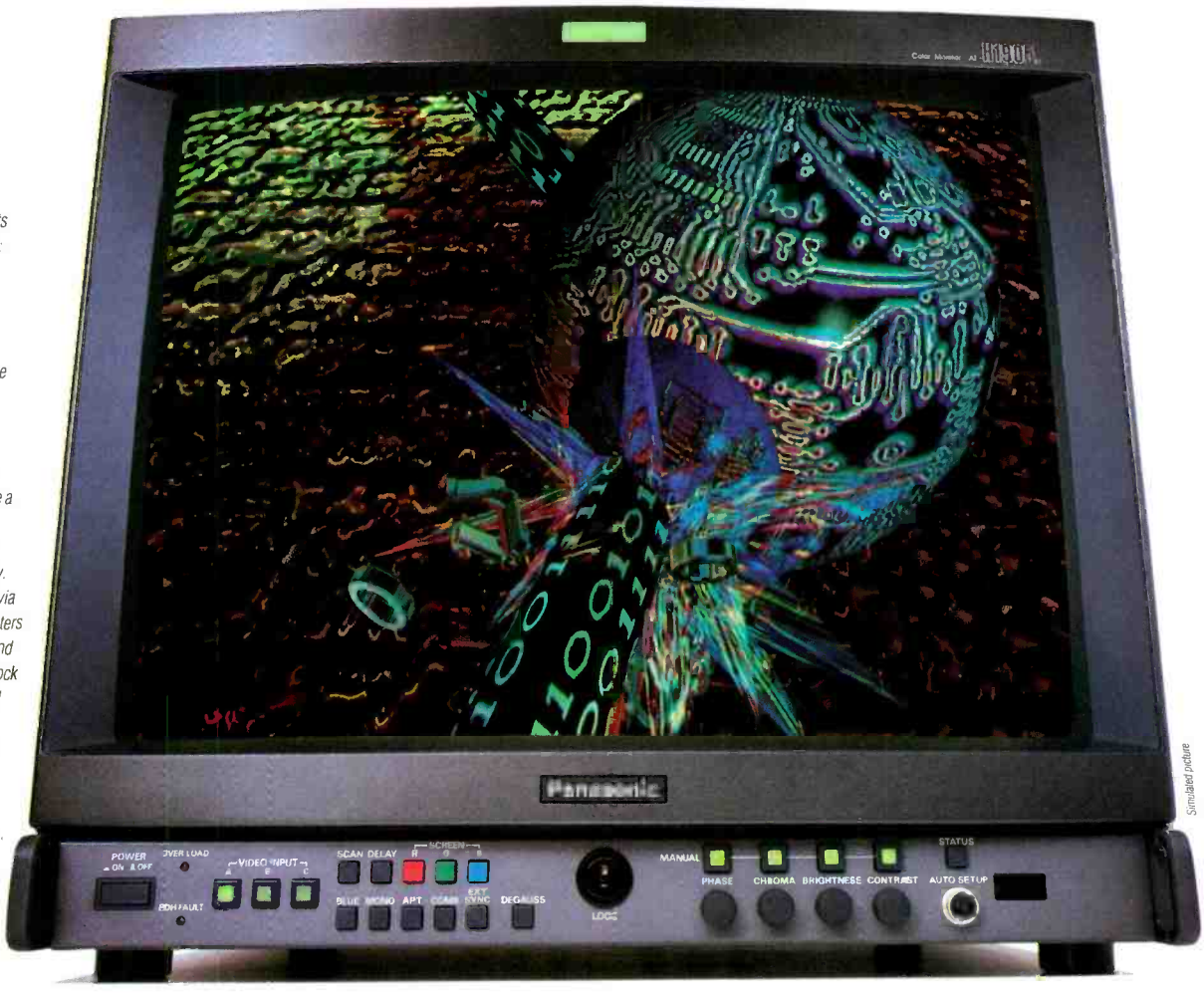

Simulated picture

Part 1

Strictly TV

Digital video

Parallel signal specs

By Curtis Chan

In the last few years, a couple of new phrases have been added to the broadcast vernacular: *bit parallel digital interface* and *serial digital interface*. These terms refer to popular interface schemes that are associated with the D-1 and D-2 standards. During the next few months we'll discuss some of the details within these interfaces to give you a better understanding of how they operate.

Chan is principal of Chan and Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA.

Part 1 begins with the component video signal 4:2:2 bit parallel digital interface (ANSI/SMPTE 125M-1992). The standard defines an interface for system M (525/60) digital TV equipment based on CCIR Recommendation 601. The earlier RP-125 specification has evolved to include 10-bit accuracy.

The video signal is transmitted at the 4:2:2 family level of CCIR 601. The luminance sampling frequency is equal to 13.5MHz and each of the color-difference sampling frequencies is equal to 6.75MHz. Provisions have been made to convey signals at either 8- or 10-bit precision. The digital video signal is transmitted in a parallel arrangement using 11 twisted pairs and a 25-pin "D" connector. One pair is used for the clock signal; the 10 other pairs are used to carry the video information. The bit rate is 27Mb/s with a clock frequency of 27MHz. Cables can be up to 50m without equalization and up to 300m with appropriate equalization. See Table 1 for the encoding parameters.

In Part 2, we will discuss the video data signal format and see how this data can be easily converted to its serial digital equivalent.

Progress on HDTV

In late October 1993, the Grand Alliance and the Technical Subgroup of the Advisory Committee on Advanced Television Service recommended construction of prototype hardware for the audio, compression, scanning and transport subsystems. Testing of the prototypes are scheduled for this month. A decision on the transmission system is expected after this round of tests.

In another area, the alliance has agreed to include the 1,080 active line format. Support of the 1,080 active line format followed a decision by the ATSC task force to recommend formal documentation of a production standard based on 1,080 active lines by 1,920 active samples/line at 60fps. The revision includes an interlace 60Hz 1,080 line format with an option to migrate to a higher line number progressive format when applicable.

Bending to presssure from the Technical Subgroup, the alliance also presented a compression scheme with little or no divergence from the MPEG standard. MPEG-2 compatibility emerged from last August's Technical Subgroup meeting after participants insisted the alliance would need to present a strong justification for any divergence from the standard.

One of the favored considerations of the alliance was the implementation of AT&T's *AC Leak*. This technique improved the system's error robustness and channel changing speed, while giving higher priority to quality pictures over MPEG compatibility. However, as of late last quarter, the group decided there would be alternatives to the AC Leak technology (such as progressive refreshing) and subsequently have eliminated AC Leak from the plan.

The alliance also decided not to carry forward another element outside MPEG-2, the implementation of multiple variable length code tables. The possibility exists that compression tools outside of MPEG-2 would be reconsidered and resubmitted back to the MPEG group if computer simulations using the MPEG standard don't give satisfactory results in displaying high-definition pictures.

The alliance also has conformed with Advisory Committee recommendations against additional audio testing and has selected the Dolby AC-3 system as the alliance audio system. This decision has put to bed the debate between Dolby's AC-3 and the Philips' Musicam system, which according to Philips, may serve as the system backup if the Dolby system exhibits problems. The various resolutions have pushed the schedule back another 4½ months to about mid-October 1994. The previous schedule called for testing to begin around June. As of this month, possible testing of the two remaining transmission proposals, vestigial sideband (VSB) and quadrature amplitude modulation (QAM) will likely take place because the third entrant, SS-QAM, has been eliminated based on evidence that it would not offer any advantage in ATV service.

Coded signals (obtained from gamma pre-corrected signals):

Y = 0.299R + 0.587G + 0.114B

Cr = 0.713 (R-Y) = 0.500R - 0.419G - 0.081B

Cb = 0.564 (B-Y) = 0.500B - 0.169R - 0.331G

No. of samples per line:	Total	Active
Luminance (Y)	858	720
Each color difference (Cr,Cb)	429	360
Total samples	1,716	1,440

Sampling structure:
Orthogonal: line, field and frame repetitive; Cr and Cb samples are co-sited with odd Y samples in each line

Sampling frequency:
Luminance (Y) 13.5MHz
Color difference (Cr,Cb) 6.75MHz

Form of encoding:
Uniformly quantized, PCM, 10 bits/sample, for Y,Cr,Cb

Correspondence between video signal levels and quantization levels:
Luminance (Y) 877 quantization levels
Black level corresponds to 64
Peak white level corresponds to 940

Color-difference signals (Cr, Cb) 897 quantization levels symmetrically distributed about 512, corresponding to the zero signal

Table 1. Parallel digital signal specs.

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Departmental motivation

The vision

By Rick Morris

When Joe took a job as chief engineer at a station across town, he thought it would be a good job, with a better salary, a bigger equipment budget and a nicer working environment. When he was interviewing, he noticed the well-kept facilities and the apparent efficiency of the areas run by the department heads. After being hired, he found out that there was concern about the morale in the engineering department. And it was up to Joe to do something about it.

The other departments in the station were highly competitive in the marketplace, and the station was aggressive and successful in the local media industry. The engineering department, however, was deemed a problem by the other managers in the station. Joe determined that his staff was unresponsive to the needs of the other departments. They were not team players and were perceived as roadblocks to getting the job done.

Motivation: Where to start

The sales, programming and news departments competed with other stations and were kept sharp by the heat of battle. The engineering department, on the other hand, was the sole provider of technical services within the station. It had no direct competition and tended to be complacent and unresponsive to the needs of the other departments. The engineering staff had forgotten it was a *service* department. Joe began by reviewing the company policies.

The vision statement

The rest of the station was operating according to the company *vision statement.* They knew that the company was lean, responsive and competitively balanced by considerations of serving the public interest and looking after its employees while pursuing the profit motive.

The engineering department operated status quo. The staff failed to perceive the important and critical role that engineering plays in the success of virtually every other department. Joe found the copy of the company vision statement and shared it with his department.

What a vision statement contains

Vision statements contain general principles by which the organization is run. These principles are meant to inspire, challenge and set decision-making criteria. They may contain corporate values (public service, employee treatment), the characteristics of the business (lean, responsive) and the nature of the decision-making (innovative, adaptive). They are generally short and easy to remember.

The vision statement must reflect the values of the company.

The vision statement is about long-term ideals of the corporation or department.

Employee empowerment

But what good are mere words? The vision statement is an embodiment of corporate values and facilitates the personal empowerment of the employee. Although there are theories of what motivates employees, most recognize that the work itself, the feeling that an employee is an important and respected contributor, a sense of team participation and other perks are keys to a happy and productive employee.

In the age of downsizing, companies are doing more with fewer employees. These factors lead to something more important in modern management — employee empowerment. All employees are important and each must be responsible for making significant decisions.

The vision statement as a value statement is the first step in empowering employees. It gives them guidance while making decisions. They know and understand what is important to the corporation and can make decisions with confidence. Employees who are trusted and empowered also receive the benefits of morale and motivation derived from their sense of contribution.

The vision statement should be one with which you are comfortable under a variety of circumstances and that accurately reflects your values.

Values of an engineering department

The values of an engineering department revolve around the service mission. Engineering needs to be responsive to other department's requests, have the ability to solve problems, and have the skills to carry out its mission.

The engineering department is rarely a profit center, and usually an expense. The engineering department needs to be cost-conscious in carrying out its mission. It also needs to be innovative and have an ability to improvise.

Nonetheless, the engineering department does face important challenges: changing technology, meeting the requirements of certain skill levels, a continuous need to retrain, and the ability to work odd hours and in unusual circumstances. Because of these factors, engineering employees are valuable.

Consistency and consequences

Words are not enough. The vision statement must be lived and reflect the values of the company and its management. A statement that cannot be accepted or is violated as a matter of convenience will reduce the credibility of those that promulgate it. Care must be taken to develop a workable statement.

The vision is indicative of leadership. It spells out the company's or department's direction and how the goals should be achieved. It is a positive and inspirational expression that embodies your codification of beliefs. It forces employees and management to look past meeting next month's budget, and it provides the framework for the intangible job of providing workplace motivation.

Joe's staff is now reading from the same script as the rest of the station. They have become team players and are contributing to the success of the station. ■

Morris is an assistant professor of radio/TV/film at Northwestern University. He is a former TV manager at station and network levels.

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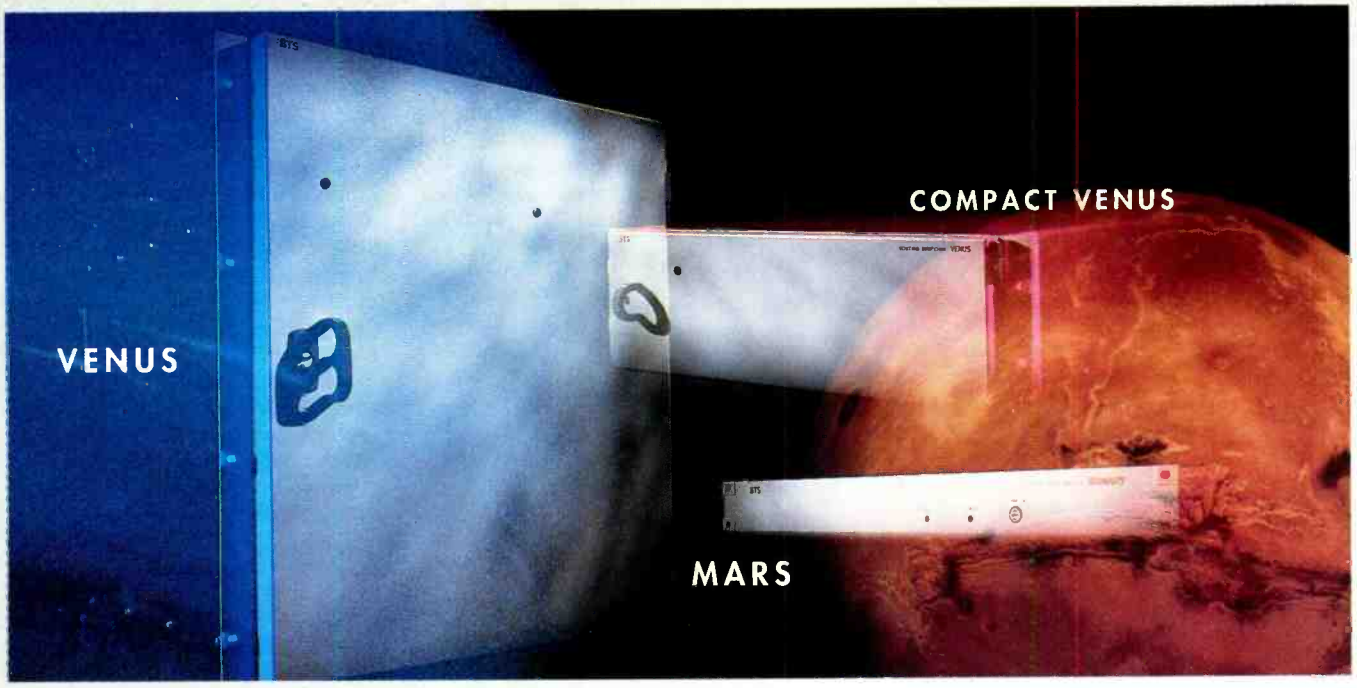

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Part 1

Production

Microphone basics

Microphone design

By Christopher Lyons

Photo courtesy of Analog Devices

Microphones serve only one purpose: To change sound waves into electrical energy, which can then be processed, transmitted, amplified or recorded. All micPhotorophones can be classified and compared according to some basic criteria: *directionality, operating principle* and *physical design.* If you understand the meaning of these criteria, you'll know which microphone is best for a particular task in the production environment.

Directionality

Directionality describes how a microphone responds to sounds arriving from different directions or angles. A microphone's directionality is graphically described by a *polar pattern.* This is a diagram that illustrates the relative sound pickup from different directions. Most polar patterns fall into two general categories: *omnidirectional* and *unidirectional.*

Omnidirectional microphones, which pick up sound equally well from all directions, capture much of the ambient sound of the location, giving the listener a greater sense of realism. They are generally less sensitive to wind, handling noises and *plosives* ("p-pops").

Unidirectional microphones, which tend to favor sounds coming from the direction in which the mic is pointed, pick up less of this ambience and are often used in noisy locations, such as on a busy street corner or in a factory. Unidirectional mics also have less tendency to howl or produce feedback when used with a public address system.

Operating principle

The part of the microphone that actually converts sound waves into an electrical signal is called the transducer. Transducers in most modern microphones use one of two operating principles: *dynamic* or *condenser.*

Dynamic microphones are extremely rugged and reliable. They will stand up to long-term use in the most hostile environmental conditions. Condenser microphones use a different method of acoustic-to-electric conversion than dynamics, which allows them to be made extremely small. (See Figure 1.) Almost all lavalier microphones, therefore, are condenser types. Condensers tend to be more responsive to extreme low and high frequencies, and usually have a crisper, cleaner sound than dynamic mics. They also tend to be more sensitive and have higher output level.

All condenser microphones require DC power to operate, which can be supplied by a microphone's internal battery or an outboard power source (usually located in a mic mixer). The outboard source feeds DC voltage to the mic through the microphone cable — a practice typically referred to as *phantom powering.* Condenser microphones' power requirements can range from 9V to 52V.

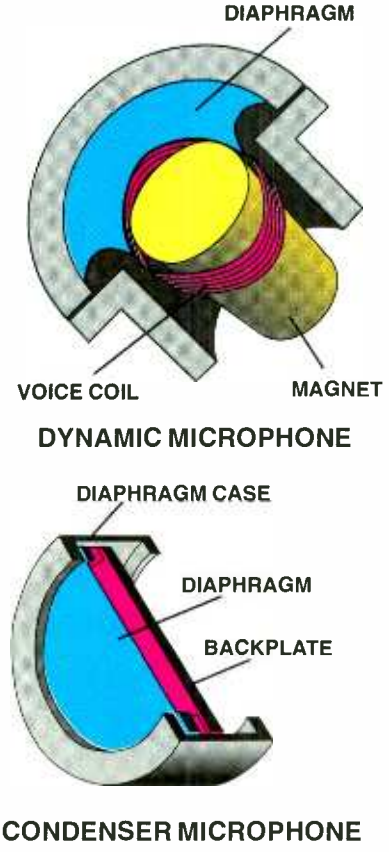

Figure 1. *Cutaway view of dynamic (moving coil type) and condenser microphone transducer capsules. A sound wave hitting the diaphragm in dynamic type moves the coil of wire through a magnetic field to generate voltage. Motion of the diaphragm in condenser type generates voltage by changing effective distance between two plates of a capacitor.*

Physical design

Often, the most important characteristic of a microphone is its physical design or style. Microphones for broadcast production fall into a few general categories: *hand-held, lavalier, shotgun* and *announce.* Each type has characteristics that make it most appropriate for a particular application.

For example, hand-held, omnidirectional, dynamic microphones are usually chosen for field news gathering because they give the reporter control over the microphone, provide an acceptable amount of ambient sound, ignore most wind and plosive noises, and stand up to the wear and tear of field use. (A good hand-held microphone also will include internal *shock-mounting* of the transducer to further minimize handling noise.) Miniature condenser lavalier mics are more common in the studio, where the size and appearance of a full-size microphone is undesirable, and powering can be easily provided.

Shotgun microphones are useful in situations where the microphone cannot be worn or held by the talker. The shotgun mic's long interference tube design helps to reduce the pickup of sounds originating from more than 30° off-axis. This makes the shotgun mic popular for pickup of dialogue when the microphone must be placed a few feet away from the subject, so that it is outside of a camera's field-of-view during a typical interview-style close-up shot. Keep in mind that shotgun microphones do not allow you to "zoom in" on a conversation from 100 feet away. At best, a shotgun microphone can be used at approximately four to five times the working distance of an omnidirectional microphone in any given situation.

Announce microphones are designed to be mounted on a flexible arm or boom. They are typically unidirectional. Because of their large size, they are usually limited to use in studios for voice-overs and radio announcing. The larger size of these microphones allows for a tuned acoustic chamber behind the transducer, which increases their sensitivity to low frequencies and delivers a subjectively warmer, more authoritative sound.

Next month, we'll look at the basics of wireless microphone systems and how they can make audio production easier and more difficult at the same time. ■

Lyons is an applications specialist at Shure Brothers, Evanston, IL.

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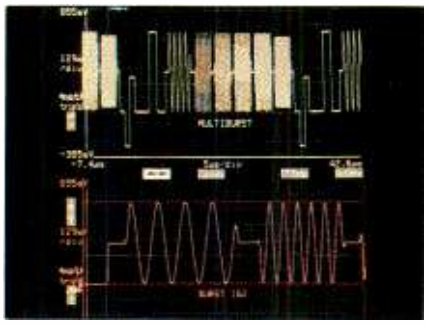
Part 1

Troubleshooting



Lightning and surge protection

The nature of the problem

By Michael F. Stringfellow, Ph.D

Broadcast facilities are among the most challenging for proper power system installation. Power consultants are often called in by broadcast engineers who have been frustrated trying to maintain operation in the face of numerous, and sometimes severe, power disturbances, frequently related to lightning. These engineers' difficulties arise because power conditioning is a new field, rarely included in the syllabus of EE degree courses, and many myths surround it.

Although transients generated by external causes, especially lightning, are the most damaging and often the most obvious, those generated by equipment *inside* the building can be equally disruptive and frequently more elusive. This 3-part series will consider both.

The problem

Broadcast engineers report that power problems have increased in the last 10 years. Although some blame the electric utility for providing poorer power, or even global warming for increased lightning activity, most correctly identify the source of the problem: the increase in sensitive electronic equipment in their facilities.

This rapid rise in transient voltage problems is almost entirely caused by the adoption of microprocessor-controlled equipment and the replacement of vacuum tubes with solid-state components. Integrated circuits represent the most dramatic change. The first commercial microprocessor, the Intel 4004, was launched around 1971. It had approximately 2,000 components on the chip. The latest technology (1993), the Intel Pentium, has three million components on a chip not much bigger. Component size has been halving about every two years and is now more than 1,000 times smaller than the chip of the early 1970s.

It should not be surprising that these smaller components, together with their smaller, more closely spaced connecting wires, can be damaged or upset more easily than their more robust forebears. Modern electronics also operate at much higher speeds. The first microprocessors operated at clock frequencies around 1MHz; today's units often run above 50MHz. This increased speed greatly reduces the level of a transient or noise signal capable of causing logic malfunction.

Transient overvoltages

Transient overvoltages arise on AC power as well as data, telephone and communication lines. Causes include external events, such as lightning and utility power switching, and internal events, such as motor or emergency generator switching. Inside the building, transient voltages are limited by the clearances and spacing between wires. Voltages higher than 5kV or 6kV are rare. Transient duration is short, often just a few tens of microseconds, and rarely longer than a millisecond. Waveshapes usually take the form of a unidirectional impulse or a decaying oscillation and are well-described in ANSI standard C62.41-1991. (See Figure 1.)

Lightning produces the most severe transient overvoltages because of the high currents and voltages involved in the discharge. When lightning strikes nearby, some fraction of the lightning current, perhaps several kiloamperes, can enter the building through the incoming AC power line or possibly through any exposed signal, telephone or data lines. When lightning strikes the building or associated towers or antennas, transient currents flowing through the structure may take shortcuts through low-voltage data or signal lines and damage interface equipment.

Internal disturbances are not as severe as lightning transients, but they are likely to occur more frequently. They do not generally cause damage, but often create "soft" problems, such as hang-ups or misoperation. Transfer switches associated with emergency generators are a major cause of such transient problems in broadcast facilities.

What to do

Solutions to these problems include a properly installed lightning protection and grounding system together with a coordinated transient protection network on all vulnerable services. The function of lightning protection is to control the point of attachment of lightning to the structure and to provide a controlled low-impedance path for the flow of lightning current around the building and into the earth. Transient protection serves to restrict voltages on power and signal lines, and diverts surge currents away from sensitive equipment.

Part 2 will discuss comprehensive lightning protection of the structure, including grounding. Part 3 will describe the design and installation of an effective transient protection network. ■

Stringfellow is chief scientist for the Industrial Products Division of EFI Electronics, Salt Lake City.

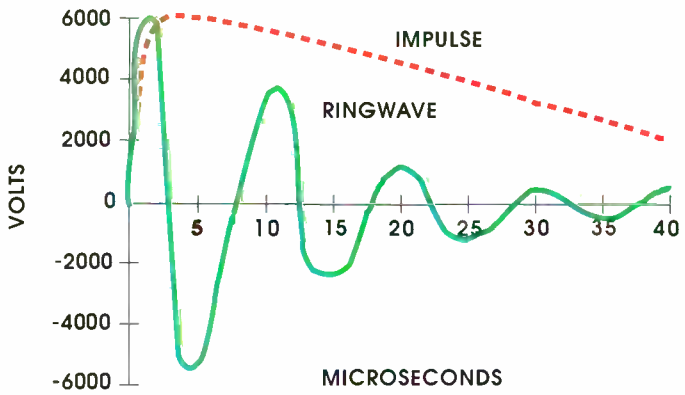


Figure 1. Typical transient waveforms of the impulse and oscillating varieties, as characterized by ANSI standard C62.41-1991.

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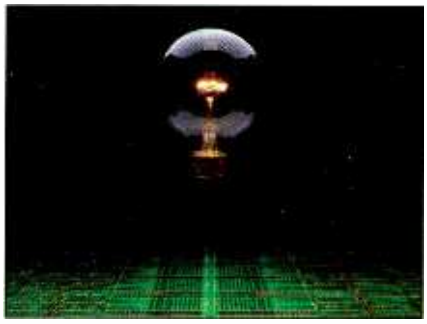
Technology News

Diamonds in the rough



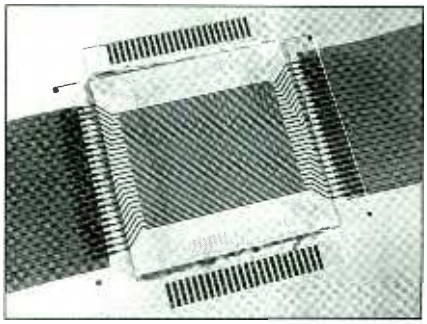
By Curtis Chan

SI Diamond Technology, Houston, and Microelectronics and Computer Technology Corporation, Austin, TX, have achieved a goal that has eluded alchemists for centuries — creating diamonds from a graphite base material.

The companies intend to demonstrate a prototype using diamond's electron-emitting characteristics. Using a patented process for applying diamond crystals at room temperature, they hope to develop a screen that combines the brilliance of cathode-ray tubes with the thin cut and low power consumption of liquid crystal displays.

The technology

Engineers have discovered that diamond operated at room temperature can be an effective material for emitting electrons in low electric fields. The diamond technology, when used in field emission displays, has the potential for beating out all other



materials in brightness, contrast, response time, low-power consumption and manufacturability. Proponents hope this method of diamond deposition will lay down well-ordered, single crystal layers of diamond needed for semiconductor devices. This process seeks to achieve single crystal diamond growth by controlling the deposition process on a molecular level.

Diamond properties

The properties of diamond make it an ideal material from which to construct high-temperature and high-frequency electronic devices. Two of diamond's electronic properties include large "band gaps" and "high electron mobility." These gaps allow diamond semiconductor chips to run at higher temperatures than some current technologies. Also, the high electron mobility implies that higher frequency electronic signals could be processed using diamond rather than other semiconductor materials.

Aside from diamond's electronic properties, the substance has beneficial physical properties that include high thermal conductivity and tolerance against radiation damage. Though most insulators and semiconductors are poor thermal conductors, diamond dissipates heat at a rate even greater than copper. This makes it an ideal heat removal substrate for diamond.

The display (Figure 1) consists of two pieces of glass that surround a vacuum. The first panel is coated with a grid of diamond crystals. The second is treated with phosphor, which glows when stimulated by electrons. The diamond crystals require far less current to emit electrons than a conventional steel cathode and generate negligible heat.

If this process succeeds to market, the technology could be a significant contribution in returning the United States to its leadership role in the high-technology development arena. ■

➡ *For more information on SI Diamond, circle (320) on Reply Card.*

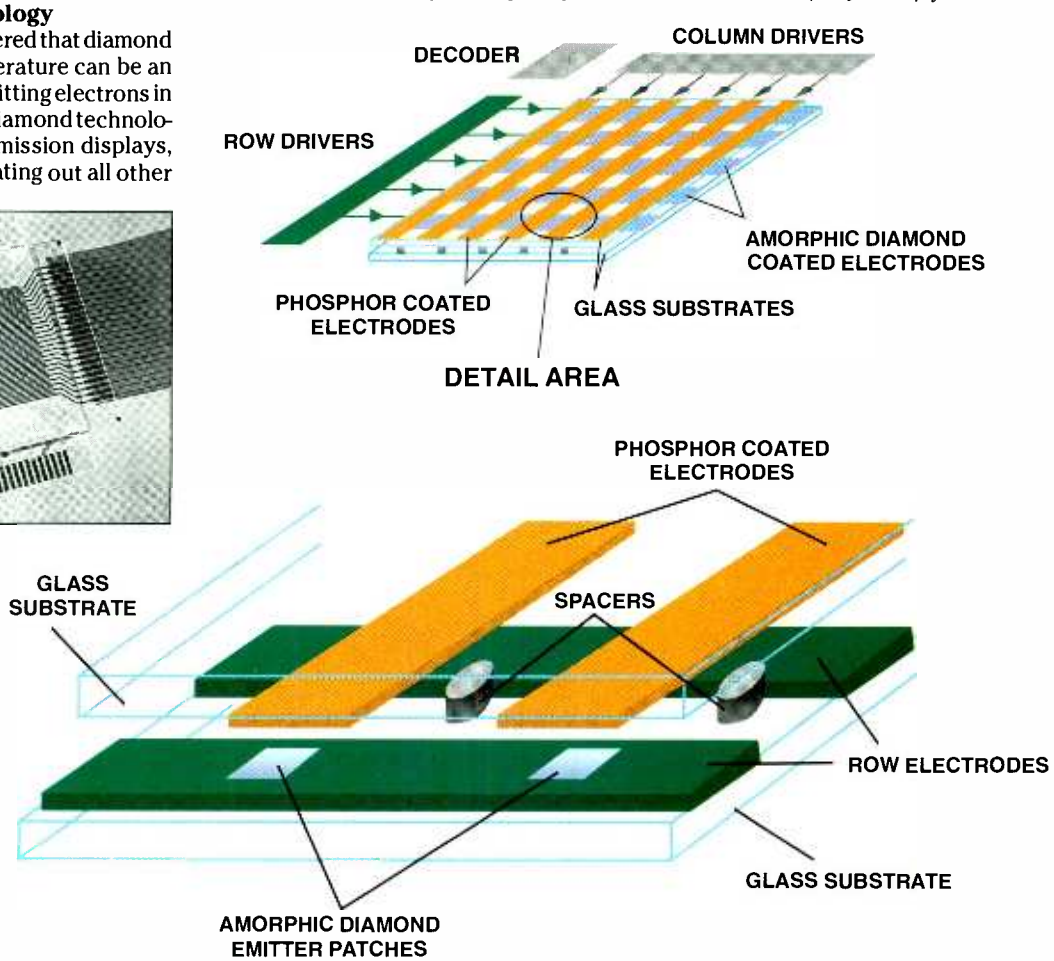


Figure 1. Detail of the structure of flat-plate display developed using diamond technology. (Courtesy of SI Diamond.)

Chan is principal of Chan and Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA.

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Remote production special report

Remote broadcasting can make your station a winner.

When it comes to "bringing 'em back alive" no one shines like broadcasters. From the local car lot to ships at sea, broadcasters know how to bring live programming to their audiences from almost anywhere. Stations know that one effective way to differentiate themselves from the competition is to be seen out in the community. This often means broadcasting from outside the traditional studio setting!

When it comes to remote broadcasting, there is no more important role than that played by the engineering staff. It doesn't matter how wonderful and exciting the talent is, how beautiful the location might be, if the signal can't be captured and relayed to the audience, all is lost. Fortunately, remote broadcasts are something engineers often thrive on — and do well.

This month's issue highlights the technology behind remote broadcasting. Whether it is an international event, such as the Winter Olympics or a live remote from the local car dealership or the local basketball game, remote broadcasting can make your station a winner. Learn how to make the process as simple and reliable as possible.

Brad Dick

Brad Dick, editor

Lightning safety for ENG crews

Broadcast personnel can be prime targets for lightning strikes during remotes.

By Ralph Markson, Ph.D.

The Bottom Line

ENG crews and their equipment can be exposed to danger and damage from lightning strikes. The trend toward increased newscast remotes has heightened this risk in recent years. The danger is especially high when covering storms, but lightning can incidentally threaten many other remotes. The potential effect of such a strike upon personnel health and broadcasters' budgets is often underestimated. Proper procedures and new alerting equipment can minimize this risk.

$

Broadcasters have always had a great respect for lightning and its power to strike transmission towers, power lines and trunk lines, but there is an often-overlooked threat to engineering and maintenance crews in the field. Especially when covering storm-related stories, crews take chances and challenge the storms they cover. Public utilities also send crews out in all weather, but with a different attitude. Utility safety directors expect their people to stop work before, or discontinue work during, a lightning storm. When storms are approaching the working area, their policy generally calls for finishing work up only to the point where it can be left safely.

The question of when to stop outdoor work because of the danger of lightning doesn't have a definite answer. Although primary consideration is always the safety of the people on the assignment, the nature of the work often makes it important to keep activities going as long as it is safe to work outdoors. Staying on the air from a dangerous location also is considered a badge of honor among some broadcast news crews. This issue is particularly critical when there is a relatively large number of people working on the project, and therefore a higher statistical likelihood that one or more might be struck.

Playing it safe is always the best policy. At power utilities, it is the lineman's decision when to stop working. Experience in the field is an important element of this process. After some years in the field, line crews develop a good sense of anticipating when lightning storms are likely to be in the area.

Markson is president of Airborne Research Associates, an atmospheric science research firm in Weston, MA.

The question of when to stop outdoor work because of the danger of lightning doesn't have a definite answer.

Reporters and engineers could do well to follow this example. However, experience can't always warn when a lightning strike will occur with accuracy. Simply depending on hearing thunder and seeing lightning, as most people do, isn't enough. Thunder is only audible five to 10 miles away from lightning, and this may already be too late to react to a fast-moving storm. So-called "heat lightning" (nighttime cloud flashes with no accompanying thunder) is caused by intracloud strikes occurring more than five to 10 miles away. During daytime, these flashes would be imperceptible to the naked eye, giving no warning of potentially imminent local lightning events.

This makes deciding when to stop live coverage during a storm difficult. A sky that doesn't look too threatening can hide active lightning, while some ominous dark clouds may be harmless. You can't rely solely on National Weather Ser-

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vice area alerts either. Thunderstorms can be localized, violent and fast-moving.

The danger is not necessarily caused by lightning directly striking a crew member. The electrical charges generated by lightning striking the ground can affect people and technical equipment as far as 500 feet away from the strike itself.

Fortunately, modern portable lightning detectors can provide some localized warning. Lightning detectors also can be a tool for gathering information about the intensity of a storm being covered, because *lightning rate* (measured in *strokes per minute*) provides an excellent measure of storm severity. (The average lightning flash contains four separate strokes.) It is possible to use these detectors to track storm movements and intensity and report the results. (There will be more on lightning detectors later.)

Some helpful new lightning detection devices are battery-operated and portable.

When potentially dangerous conditions are approaching, you should consider two issues: 1) Has lightning been detected, and, if so, approximately how soon will it arrive in the area? 2) What action should be taken to protect yourself, your crew and its gear?

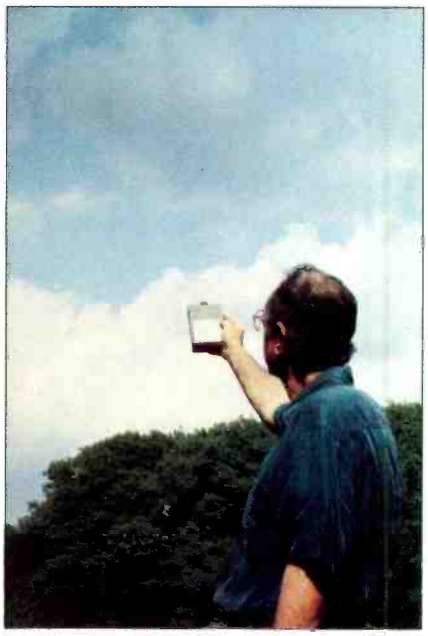
Protective measures

Dealing with the second item first, although thunderstorms and rainy weather are generally associated with lightning strikes, the location of the strike is unpredictable. Lightning does not necessarily strike the ground directly below a thunderstorm, but can strike some distance ahead (or behind) the storm itself. Consequently, reaction to a lightning alert should be swift.

A number of appropriate measures can be taken when lightning is detected in the vicinity. These actions can substantially reduce the danger of injury by lightning. The exact approach depends partly on the topography of the immediate area. First, avoid the temptation to stay on-the-air live no matter what the state of the weather. Staff members' lives are more important than ratings. If you are in a large, open area with no trees or buildings, you should leave as quickly as possible. The best protection under these circumstances is offered by the shelter of the remote vehicle or any nearby building. Go to an electrically grounded shelter, such as a large building or an automobile or van. Fully retract any telescoping or erectable antenna structures on or near the vehicle.

If no structure is nearby, seek a wooded area where the trees are of relatively uniform height. This represents a good shelter from lightning, because it is not likely to strike such an area. Do not stand close to any individual tree in the group. Do *not* head for or stand under any single tall tree or small group of trees that are standing alone in an open area. If the topography is not flat, stay away from open hilltops. Look for low ground or valleys.

If you are wearing work shoes, even with metal toes, do not remove them. Wet shoes will still result in less grounding to the human body than no shoes. Stay away from metal fences or other metal structures. Do not use hard-wired telephones or headsets. Most important, don't use umbrellas — they make great lightning rods. ENG radio whip antennas or microphone booms can have the same effect.



A portable, hand-held lightning detector in use. Lightning flashes imperceptible to the human eye during daylight can be detected by such a device, often at distances beyond those from which thunder remains audible. This provides increased warning time for approaching lightning storms.

If you are going to be in a mobile home or trailer-like temporary structure, such as those used at major sports events, it will provide greatest protection if the structure has a metal skin and is grounded properly with 1/4-inch diameter or heavier cable. Personnel should be instructed to stay away from the outer walls, as near the center of the shelter as possible. Do not lean on or touch any equipment, racks or pipes.

Too close for comfort

Contrary to popular belief, of the more than 1,000 people who are injured or killed annually by lightning in the United States, most of them are not "struck" by a bolt. These deaths or injuries are usually caused by electrical currents that flow through people who are in the vicinity of the lightning strike.

This is caused by two phenomena: 1) the strong inductive electric field that exists in the air near lightning, and 2) currents in the earth surface flowing outward from the ground contact point.

Any grounded object rising above the earth surface (such as a person standing in an open field) will be subject to the first (inductive) effect, which can cause a "streamer" of electric charge to flow from the earth up through the body and into the air toward the main bolt.

The second effect can cause a difference in electrical potential between the feet or

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- **Hybrid UHF/VHF operation to conserve scarce VHF frequencies**
- **Inexpensive VHF monitor receivers to lower system costs**
- **High-quality, low-noise, low-distortion audio**
- **Up to six beltpacks per master station**
- **Designed specifically for broadcast and production**
- **Directly compatible with all standard wired intercoms**
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In the studio or on the set, Vega's wireless intercom systems are the choice of professionals who demand ruggedness, reliability, broadcast-quality audio, and a full set of professional features. Designed from the ground up for broadcast and production work, the Q600 UHF/VHF system provides all the functions and technical capabilities required for these demanding applications.

The Q600 system provides continuous, full-duplex, hands-off communications between up to six people plus an unlimited number of "listen-only" users.

The QTR-600 beltpack remotes are extremely easy to use and provide operation similar to that of hard-wired intercom beltpacks. They are compatible with popular dynamic or electret headsets, such as Beyer, Clear-Com, and Telex. The cases are welded aircraft aluminum alloy with a high-impact, molded Cycolac (ABS) control panel that will withstand the roughest use.

One QX-600 master station supports up to six QTR-600 remotes with "hands-free" two-way communications, and an unlimited number of PL-2 receivers for listen-only users. Circuitry is provided to interface external line audio with the system or to link two QX-600s into a 12-user system. The master station is directly compatible with all standard wired intercom systems such as Clear-Com, RTS, ROH, Telex, and many others via internal programming switches. A local headset position and extensive control, adjustment, and monitoring provisions are also included.

The PL-2 VHF mini-receiver provides a high-performance, low-cost solution to providing one-way "listen-only" communications. Very often, individuals need to receive instructions but are not required to speak. Using PL-2 receivers for this application avoids the expense of additional full two-way remotes and can significantly lower the cost of a typical system. The PL-2 is fully compatible with the Q600 system and is designed to provide reliable communications in the most demanding RF environments.

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any other parts of the body that happen to be grounded, as a result of multiple contact locations along one of the earth-borne current's path. This can result in thousands of volts of potential difference across the body. Current will then flow between the contact points (up one leg, through the body and down the other leg, for example). The greater the distance between the feet (or other grounded extremities), the more the potential difference between them, and the larger the current flow.

If you are caught in the open during a storm, these effects can be minimized by keeping your feet together and squatting down. Do *not* lie down.

Lightning detection

Many devices available today enable you to determine the presence of lightning in the vicinity and to track its movement. Most of these are relatively expensive and are not likely to be sufficiently portable for field applications. Most are designed to operate on 110V power and do not readily adapt to battery operation.

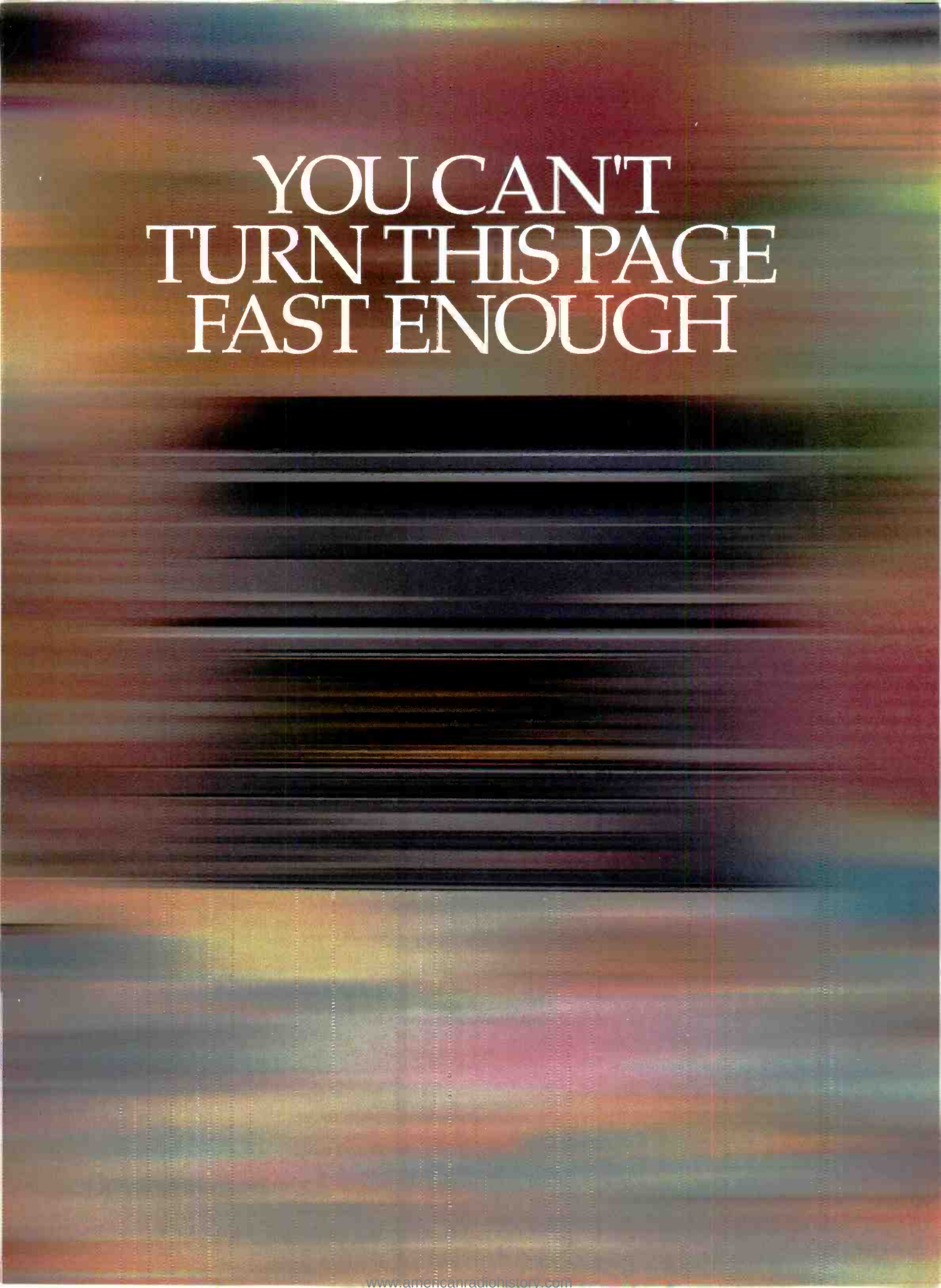
Some helpful new lightning detection devices are battery-operated and portable, however. They can detect intracloud lightning (invisible to the eye) 10 to 30 minutes before dangerous cloud-to-ground lightning begins. One type of device senses rapid, subtle changes in light intensity from the area of the sky toward which it is pointed, and sounds an audible alarm. During the early phases of a storm, when specific lightning flashes can be definitively associated with specific thunderclaps, the operator can also determine the distance to the storm by counting the seconds between the sensor's alarm and the sound of thunder. (Every five seconds of time difference indicates approximately one mile of distance from the lightning. Remember, however, that the distance can be horizontal and vertical. A 5-second difference, for example, could come from intracloud lightning *directly overhead*, and the next event could be a cloud-to-ground strike in your vicinity.)

Lightning does not necessarily strike the ground directly below a thunderstorm.

A more sophisticated portable lightning detection unit offers omnidirectional coverage, detecting intracloud as well as cloud-to-ground lightning by sensing rapid changes in light intensity and electric field changes. This dual-detection mode reduces the likelihood of false alarms. A control output jack can be used to trip other external warning alarms or activate user-provided circuitry (automatically switching off sensitive equipment, for example). This system also includes an adjustable range control that sets a threshold for lightning detection distance. Detection also can be set to "field-change only" mode (i.e., non-optical, RF-only sensing) for long-range storm warnings.

Lightning can be a threat to field crews who must work during a storm. If you understand what measures can be taken when weather becomes hazardous, you can maximize your remote crew's efficiency and minimize personnel danger. ■

➡ *For more information on portable lightning detectors, circle (300) on Reply Card.*



Building ENG microwave links

How one station gathers the news.

By Marvin Born

The Bottom Line

Years ago, ENG systems were almost a luxury. Today, they are required for news stations that want to remain competitive. To excel in the news arena, multiple links allow stations to bring back the news from several locations at once. Sometimes, deciding to upgrade ENG systems is much easier than the implementation. In congested areas, microwave channels can be difficult to get and even harder to use problem-free. Careful planning and cooperation between everyone involved can assure the news makes it back from the field.

$

Electronic news gathering, or ENG for short, used to be a premium available to only a few stations. In 1993, multiple trucks, channels and receive sites were required to stand out. In today's news business, portable transmitters are hot stuff. They provide a means to instant news. There are a few vertically polarized omnidirectional receive antennas. However, the typical system uses 4-horn antennas, with each antenna viewing a 90° segment of the horizon. For best results, the receive antenna should be mounted in a high location. Additionally, mounting the transmitter atop a 40-foot truck-mounted air mast significantly increases range. Over the last few years, stations have increased the complexity of some of these systems. We will examine some of the design considerations for a state-of-the-art ENG system, composed of five receive sites, four trucks, three portable transmitters and two helicopters.

The system

The primary receive site has a 4-foot rotating dish at 1,000 feet on one end of a candelabra. A high gain, low-noise preamp drives an 1,100 foot run of 7/8-inch coaxial cable to the receiver below. Receiver baseband is fed via an optical fiber to the tech center for demodulation. Once at the studio, the signal is frame-synched for recording or use on air. Remote control can be wire line, fiber or (the latest) Pro-Channel subcarrier control.

Born is vice president of engineering for WBNS-TV, Columbus, OH.

The system supports three audio subcarriers, two of which are used for stereo or main and backup audio. The third subcarrier is for the LogicTrack system used with the helicopter. The antenna system supports LogicTrack and also contains a SuperTrack module, which is an RF-sensing tracking system. Operators can easily change channels, select audio subcarriers, control antenna direction, polarity and gain, and switch the receiver's IF bandwidth. With a 42-foot mast, the ENG trucks have a range of 35 to 40 miles in average terrain.

A second receive antenna is mounted at 900 feet on the same tower. This system uses four 90° horn antennas and a receiver, fiber and demodulation system similar to the one mentioned earlier. This site is close to downtown, and the horns allow quick setup for short-masted trucks and portable microwaves within a few miles.

Like many near-downtown locations, there can be heavy shadowing on the opposite side of the tall buildings. Because of this, a directional dish antenna is mounted on the far side of the tallest building. This antenna can see all the way down to the street below and out approximately 20 miles. Baseband is returned to the studio via a 23GHz bidirectional microwave link. Manual antenna control is provided via the microwave link.

Occasionally, there was a problem receiving signals from locations that have worked for years. The usual problems were suspected — leaves on the trees, excess moisture in the air and even equip-

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ment failures. Signal loss could last from a few minutes to a few hours and could occur during dry days. It was finally concluded the problem was thermal layering of the air. A layer of warm air was believed to occur near ground level with a colder layer above. The receiving antenna was located in the second layer. Signals would be reflected by the second layer and not reach the receive dish. The problem was solved by installing another set of quad horn antennas at 250 feet and connecting them to another receiver system. It's strange to see a microwave signal perfectly clear on a 250-foot horn antenna when a high-gain dish at 1,000 feet is unusable.

Adding another receive site

As the population center moved to the northern part of the city, there became an increasing need for a high-gain directional antenna located near the new population center. Unfortunately, the other news operations in town also had the same need. One of those had a contract for using the only tall tower in the area. The tower owner did not have a news operation and welcomed the increased revenue from a second ENG receive antenna. However, shortly after our design and planning phase,

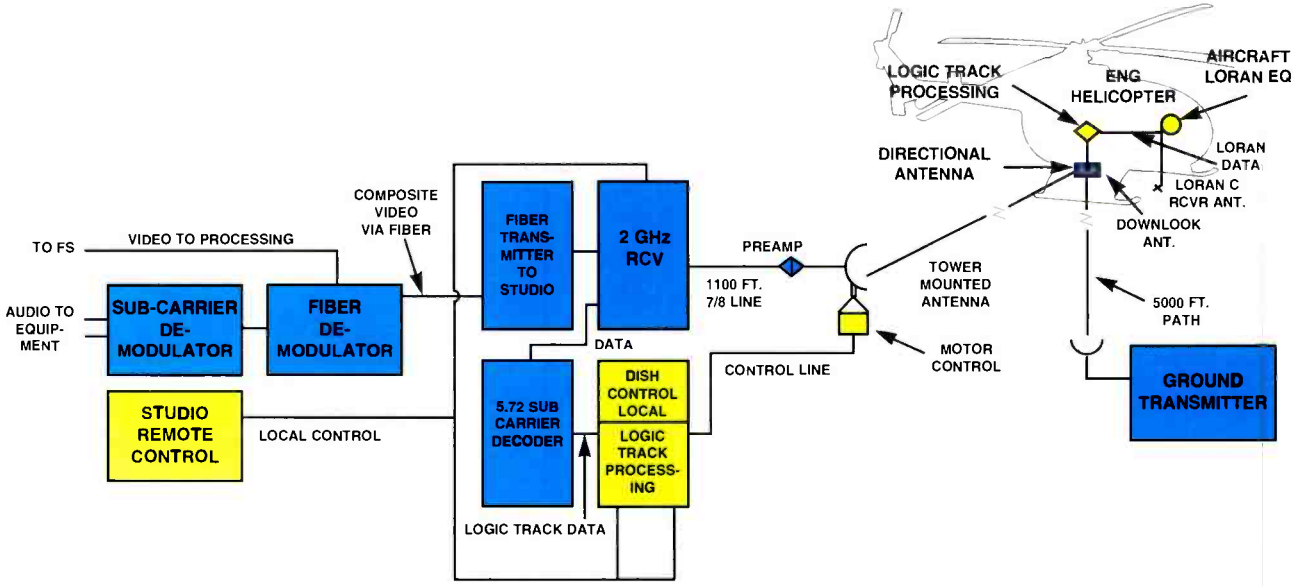

Figure 1. *Block diagram of a typical ENG receive system using an aircraft. Ground transmitter can be used to uplink signals to the aircraft if necessary.*

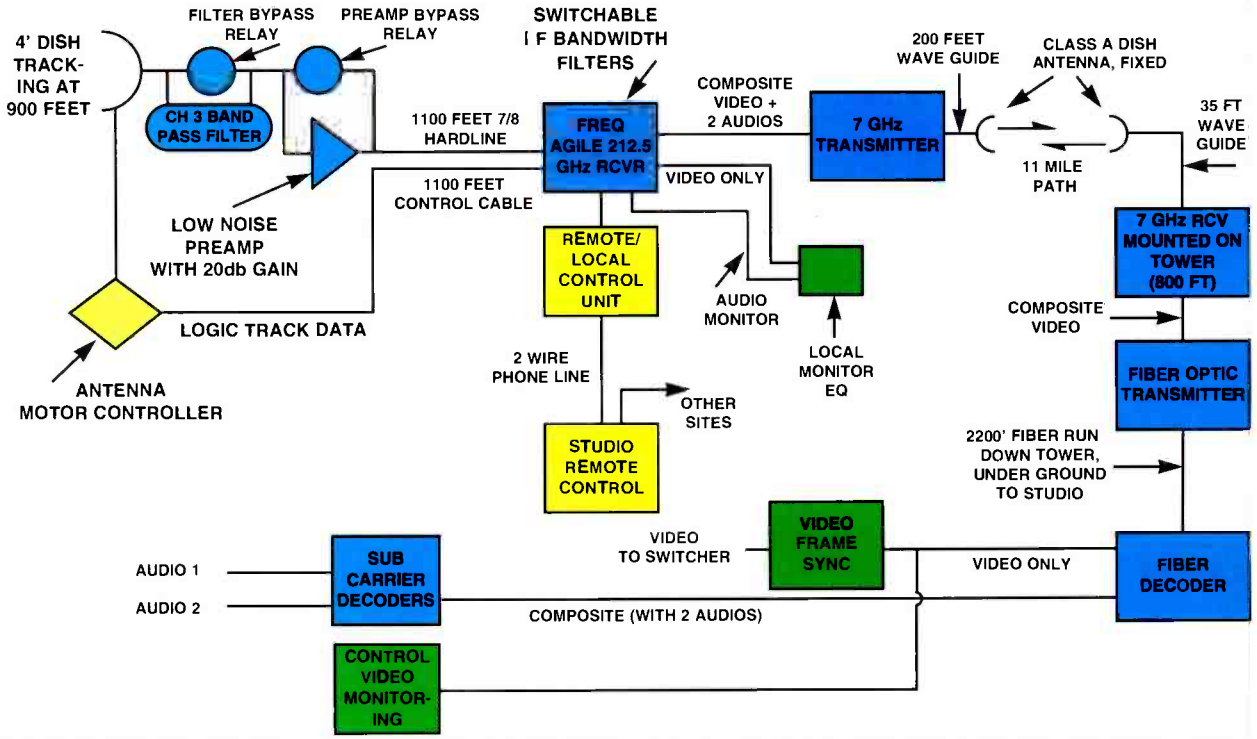

Figure 2. *Block diagram of northern ENG receive site, including receive and control system located at the studio. Note: The 2GHz receiver decodes three audio subcarriers and filters/decodes the 5.72 subcarrier for LogicTrack. Video is passed with 6.2 and 6.8 as composite to the 7GHz transmitter for the link to the studio.*

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it also welcomed the increased revenue from a third ENG antenna.

We now faced the possibility of three trucks transmitting to the same receive site during a breaking news operation. Further complicating the site was the installation of an LPTV transmitter whose company insisted on using a 2GHz STL.

In reviewing the tracking antenna literature, the major manufacturers were similar in design and cost. Switchable polarization and 26dB gain were available, with the low-noise pre-amplifier built into the feed horn. In addition to wanting continuous rotation on the antenna, a switchable filter installed ahead of the pre-amp also was desirable. It was necessary to give up the continuous rotation to have the filter.

The antenna filter protects the pre-amp from overload caused by adjacent signals.

In Columbus, OH, the 2GHz band is congested, with ENG from three commercial news operations, a state educational network and an LPTV that uses 2GHz as an STL link. The other two news operations have their primary ENG channels on either side of our primary channel. From experience, it was assumed there would be wildly varying signal levels at the receive site. To prevent possible interference, a means to prevent pre-amp overload from adjacent channels was needed, while maintaining maximum gain on our assigned channel (Channel 3).

A switchable (in/out) single channel filter was installed ahead of the pre-amp. This filter has steep sides and removes

The author doing a final checkout of the system located at the northern site. Note the LPTV antennas mounted on the tower.

most, if not all, adjacent-channel signals. Despite the $2,100 installation cost, the filter has been a blessing. We have made 60-mile shots on our channel while both adjacent channels were occupied locally. Of course, with the filter in line, the system can only operate on Channel 3. The pre-amp also is switchable in or out, and drives 950 feet of 7/8-inch LDF to a Microwave Radio ProStar double conversation receiver. The receiver is frequency agile and covers the range from 1.9GHz to 2.5GHz.

The receiver was ordered with 10MHz and 20MHz SAW IF filters. When necessary, we can operate on a channel other than Channel 3, and the 10MHz IF filter eliminates many problems. It also eliminates one of the audio subcarriers. That is not a problem, because few of our remotes require stereo audio.

This filter arrangement allows us to block interference and still use three subcarriers or tighten down the system to reject all but the worst adjacent-channel problems. The antenna filter also protects the pre-amp from overload caused by adjacent signals and blocks signals that may cause problems due to IF mixing.

Helicopter tracking

This site also is used as an ENG helicopter receive site. The tracking control system uses LogicTrack and NavTrack (NavTrack is a product of Troll Technology, LogicTrack is a product of NSI). The aircraft has LogicTrack technology and the receive site is NavTrack. The two systems are compatible with each other.

Once the receiver sees a NavTrack or LogicTrack signal, it locks on and keeps the antenna pointing toward the aircraft.

The ProStar receiver has the NavTrack subcarrier decoder built in and provides a datastream to the ProScan antenna pedestal controller. The tracking electronics are from Troll Technology and are part of the remote-control system. Once the receiver sees a NavTrack or LogicTrack signal, it locks on and keeps the antenna pointing toward the aircraft.

When the ProScan antenna has the additional filtering as described, it does not have continuous rotation. There is a 10° overlap and a field-adjustable stop. In our case, the stop is installed toward the tower leg. To date, we haven't had the problem of the aircraft flying past the stop, causing a loss of signal while the antenna rotates the opposite 360° to catch up. The additional filtering outweighs the restriction of the antenna having a stop. Anyone considering this arrangement should weigh the alternatives. Neither of the major manufacturers build a continuously rotating antenna with pre-amp and filter switching.

The receiver provides baseband video with the two audio program channels, the tracking signal and program video and audio. The tracking subcarrier is filtered, and the baseband is passed to the backhaul transmitter. Program video and audio are used for local maintenance and monitoring.

The backhaul microwave is a standard baseband 7GHz transmitter and matching receiver system. Frequency coordination showed all the 7GHz channels to be in use,

Continued on page 78

Telephone talk technology for TV

When you're talking telephones, talk TV is tougher than talk radio.

By Elaine Jones

The Bottom Line

Interfacing telephone audio from call-in guests is hard enough to do well on radio, but it's even more difficult in TV applications where calls must run through a studio PA system. Nevertheless, the use of call-ins on TV talk shows is on the increase, so an understanding of the special problems and available solutions is timely and worthwhile. The right equipment, facility design and operational techniques can make all the difference.

People are talking. They're on radio, television and cable. Talk show formats are in vogue, in a big way. In addition to the upsurge of chatty hosts with special (and strange) guests, programmers are involving their audiences as never before. However, bringing the home audience into the action can present some challenges, especially for shows where a studio audience is involved.

The problem is simple: How can you bring a telephone call into the studio and provide clear communication to the caller, host, guests and studio audience, while maintaining high audio quality for the air signal?

The role of the hybrid

First, you need to get the phone call into your audio system. This is accomplished with a telephone *hybrid*. A telephone hybrid takes the telephone line — a *2-wire* medium with combined send and receive audio — and converts it to the balanced, line level, *4-wire* audio needed for broadcast audio systems. The hybrid's prime function is to separate the two sides of a phone conversation into independent audio paths. The hybrid, therefore, has *three* ports — an audio input from the broadcast studio console, an audio output to that console and a combined input/output (I/O) for the phone line connection. (See Figure 1.) The two separate circuits for I/O on the studio side of the interface give rise to the 4-wire terminology. The single, bidirectional circuit on the telco side of the hybrid is the 2-wire environment. For this reason a telephone hybrid is sometimes called a *2-wire-to-4-wire interface*.

Jones is marketing director at Gentner Communications, Salt Lake City.

The hybrid's prime function is to separate the two sides of a phone conversation into independent audio paths.

Audio from the hybrid to the console (i.e., caller audio) typically is routed to a standard line-level input, while audio to the hybrid from the console (i.e., studio "backfeed" to caller) generally comes from an auxiliary mixing bus on the board. It is important that the hybrid's output is *not* delegated to this auxiliary bus, so that the caller audio is not fed back to the caller (which could cause feedback or echo).

This process is generally referred to as *mix-minus*, whereby the caller hears the entire mix of the show coming back through the phone, except for his/her own voice. Where no mix-minus port is available on the studio console, the user must either create a separate outboard mix-minus feed or tap audio directly from the host's microphone pre-amplifier. (See "Talk Radio Technology," September 1992.)

Before telephone hybrid devices were available off-the-shelf, broadcasters de-

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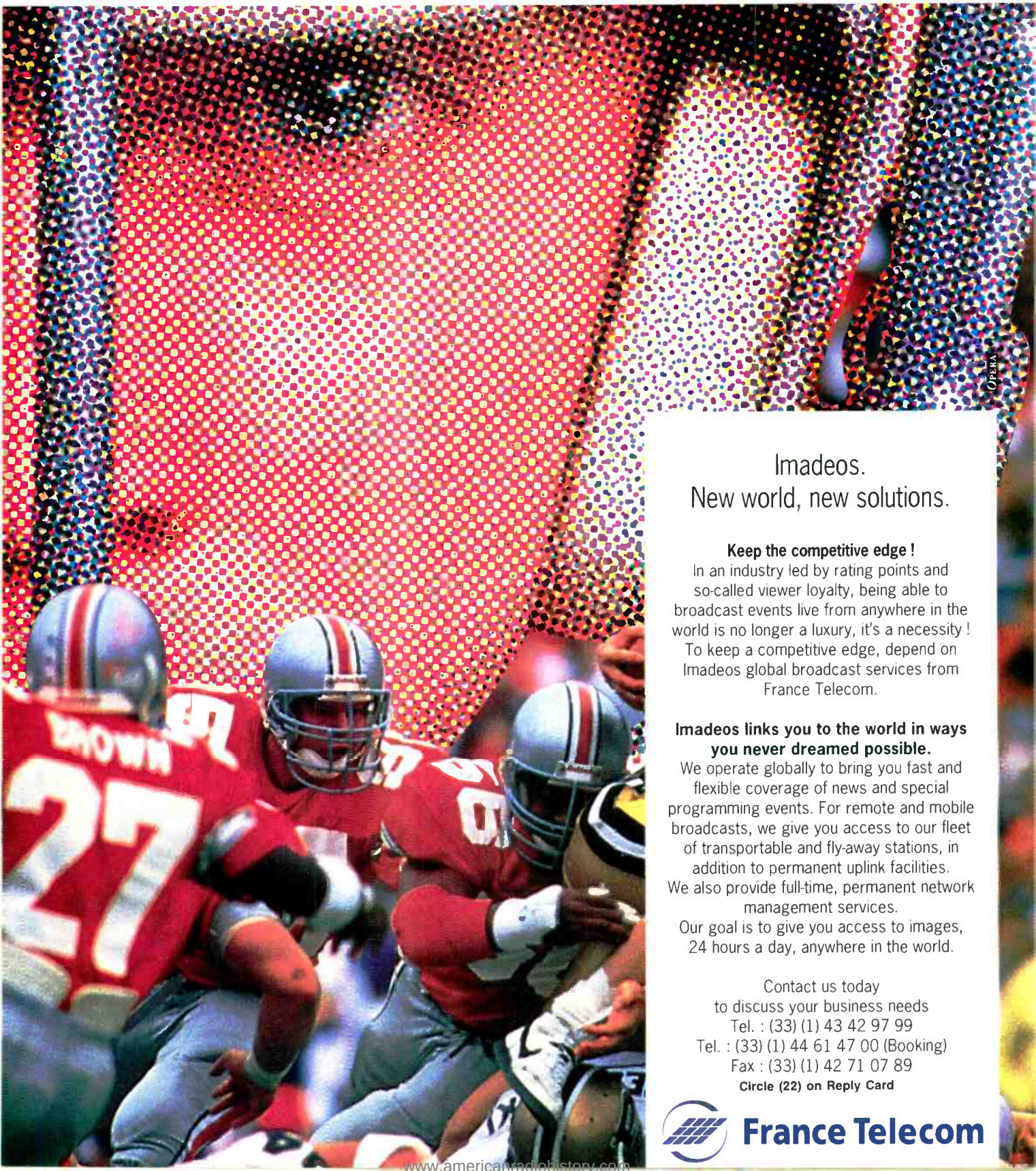

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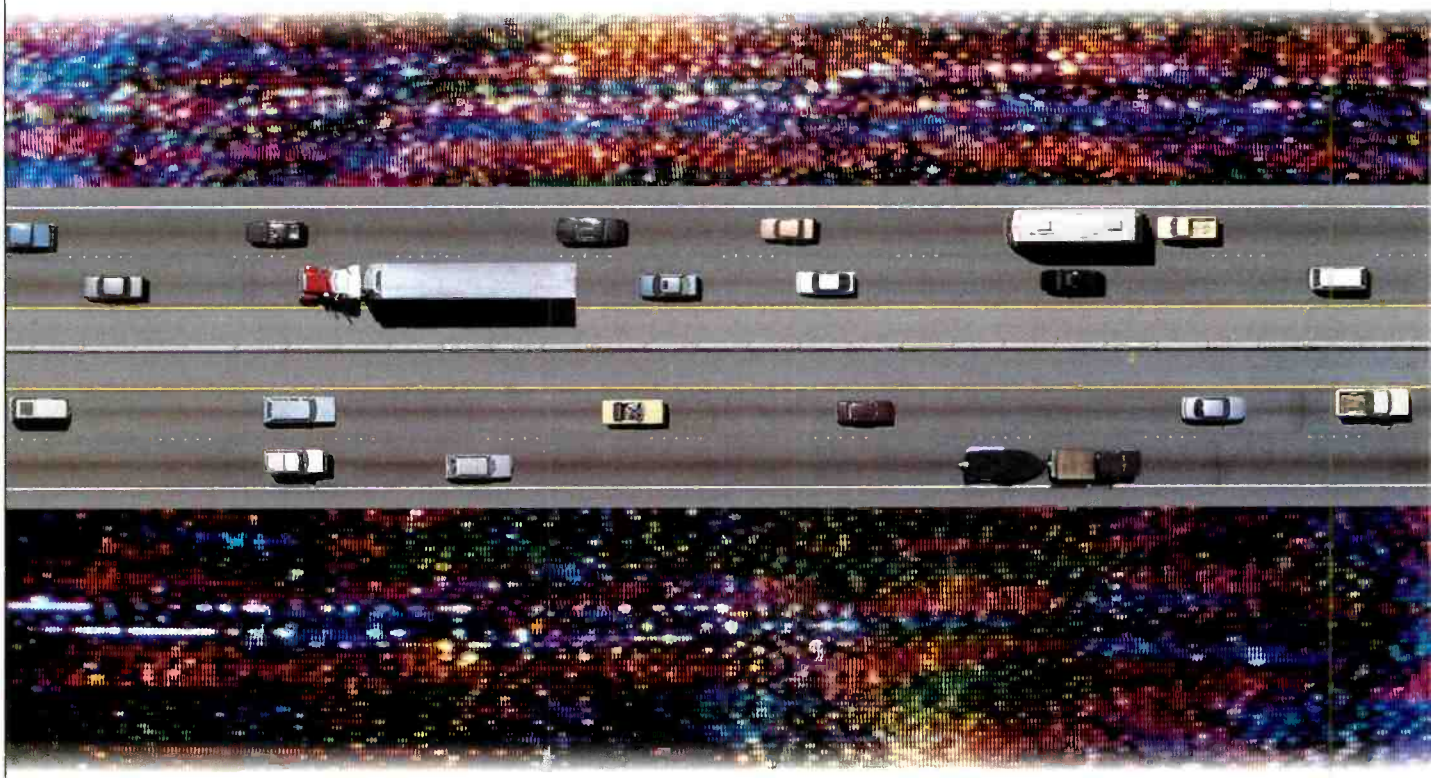

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Sally Jessy Raphael is one of many TV talk shows using audience call-ins.

signed their own hybrids. These were often rudimentary devices — nothing more than a transformer with capacitive and resistive adjustments to obtain an impedance match to the phone line. Another common approach back then was the modification of speakerphones, using their gating to switch off or greatly attenuate caller audio whenever the studio talent spoke. In either case, the primary qualitative goal of the telephone interface was to remove as much of the studio send audio from the caller receive audio, while still allowing the caller to clearly hear the studio send. (This parameter is called *trans-hybrid loss* or *sidetone suppression*.)

Today's hybrid technology

Now that a variety of manufactured hybrids are available off-the-shelf, it's easy to connect a phone line to audio systems and obtain good sonic results. Two types of hybrids are available today: analog and digital.

Analog hybrids are a step above the transformer approach, providing filtering of line noise and some operational flexibilities. Their method of adapting to the telephone line is no different than the old transformer approach, however. The user sets a 1kHz test tone on the send path, calls several telephone numbers in succession, and adjusts capacitive and resistive settings to get the best null of the test tone over all the calls. Results will differ on each call because of the changing line loading and therefore variable impedance presented to the hybrid by each call.

Analog hybrids are inexpensive, but because most cannot automatically adapt to the particular telephone line in use at the moment, their send/receive isolation can be compromised by inconsistent telephone lines.

In large studios, caller audio fed via speakers arrives back at the microphones after a short delay.

Digital hybrids use digital signal processing (DSP) technology to achieve an automatic match to each phone line's impedance characteristics. Upon connection, a burst of shaped noise is sent down the phone line, then the DSP builds a digitally adaptive filter based on the impulse response of the line as determined by the reflected noise signal. Digital hybrids are especially useful when the broadcast facility is located some distance from the telephone company's central office, because telephone lines have a tendency to degrade over distance. In addition to auto-nulling, digital hybrids can do a better job

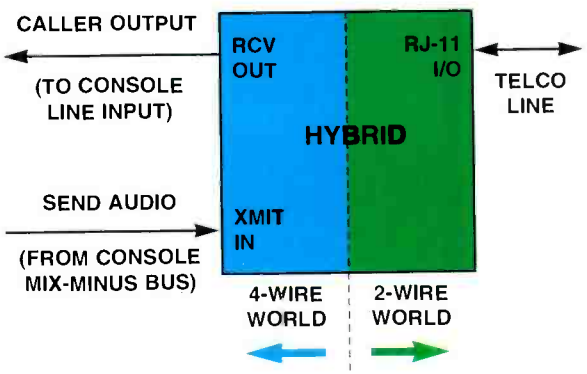

Figure 1. *Basic block diagram of 2-wire-to-4-wire interface of the telephone hybrid.*

of eliminating telephone line noise (high-frequency hiss and low-frequency hum).

Some recently introduced digital hybrids also are capable of generating their own mix-minus signals, allowing the user to feed full program audio to the send input. These devices again use DSP to cancel the caller output signal out of the full-mix send input signal, and then send this internally created mix-minus signal down the phone line to the caller.

Acoustic considerations

Although a good telephone hybrid and a proper mix-minus will eliminate echo and reflected audio caused by the telephone line interface, a second possibility for feedback exists in teleproduction and TV studios — acoustic reflection. In large talk show studios and rooms that do not have proper acoustic treatment, caller audio

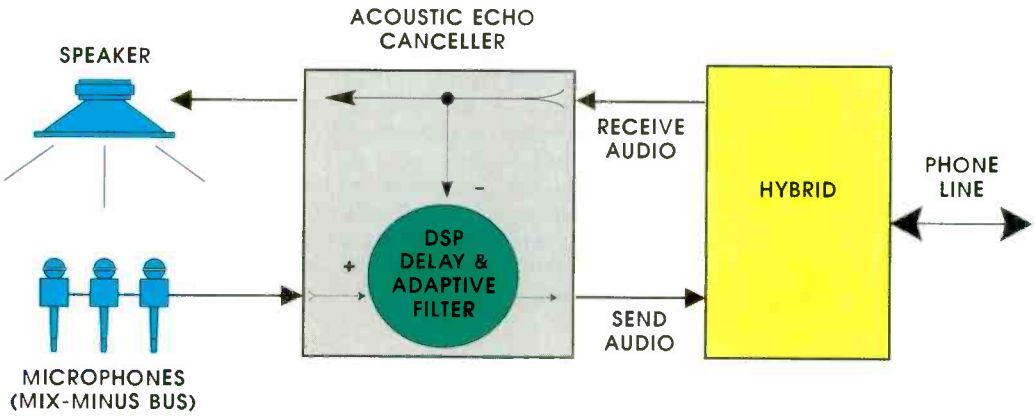

Figure 2. *Acoustic echo cancellation uses DSP for adaptive filtering and delay to remove room effects on caller voice from the send audio.*

fed into the room via speakers arrives back at the studio microphones after a short delay.

Most hybrids will simply feed this audio right back to the caller, along with the desired host and guest voices that are intended to be picked up by those microphones. Even the hybrids mentioned earlier that can accept full-mix send audio may not cancel these acoustically reflected signals because the echo-canceling process in these units compares the send and receive signals *in real time*. The acoustically delayed caller audio is not detected as something that should be nulled out of the send path by these devices. As a result, the caller hears an echo of his/her own voice and, in some cases, feedback howling can occur.

Solving the problem

In small rooms, these difficulties can be greatly reduced through acoustical treatment — placing sound-absorbing materials on walls, ceilings and floors, and minimizing the number and size of reflective surfaces. Minimizing the number of open microphones also can help. (This refers to only those mics that are assigned to the hybrid's send audio mix-minus bus. For example, audience-reaction microphones should not be delegated to the mix-minus bus so that their potentially substantial pickup of caller audio from the PA will not be returned to the caller.)

Even the hybrids that can accept full-mix send audio will not cancel these acoustically reflected signals because the echo-cancelling process in these units compares the send and receive signals in real time.

However, in larger rooms, such as TV talk show sets, these techniques may not be sufficient to prevent significant caller-audio reflections from getting into the primary microphones (i.e., those that must be assigned to the caller's mix-minus send — typically the host's and guests' microphones). Although reflected audio is absorbed by materials on walls and ceilings, the *direct* audio path from speakers to mics may still be strong and have a significant acoustic propagation delay. The further the speakers are placed from the microphones, the longer the delay effect will be.

Pickup of this direct-path, delayed caller audio can be avoided to a certain extent through careful placement and minimal volume of studio speakers, but this frequently results in callers that can barely be heard by the studio audience. Proper choice and placement of microphones also can help. Another alternative, recently available to the industry, is a digital acoustic echo canceler. This DSP-based product compares its receive audio with send audio and, taking into account a delay of up to a few hundred milliseconds, adaptively removes any receive audio — including reflections — that appear in its send path. (Sound travels at approximately 1 foot/ms, so this range of operation should handle reflection paths in even the largest studios.)

Acoustic echo cancelers are now offered as an integral part of some digital telephone hybrids.

Because the caller's voice — including its acoustically delayed direct and reflected iterations — is now canceled out of the send audio to the caller, the sound reinforcement speakers used for bringing the caller's voice to the studio can be set at a comfortable listening volume.

Acoustic echo cancelers can be purchased individually or as an integral part of some digital telephone hybrids. (Remember, these devices will not cure traditional feedback from the host/guest microphones into the studio's sound reinforcement system.)

With the judicious use of acoustical treatment, proper physical layout, acoustic echo cancellation and advanced telephone hybrid technology, callers can be brought into a live TV talk show environment successfully. Nevetheless, what they say when they get on the air remains beyond our control. ■

➡ *For more information on telephone interfacing equipment, circle (302) on Reply Card. Also see "Telephone Related Equipment," p. 58 of the 1994 BE Buyers Guide.*

BE readers

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Remote power systems

Sometimes you need more than batteries.

By Paul Hines

The Bottom Line

In the world of remote broadcasting, reliable, stable power is critical. When considering remote production, the power source needs to be evaluated in terms of both capacity and reliability, because without power, nothing happens.

$

A decade ago, the thought of using a rental generator as the sole source of power for a live field remote made many a field manager or site engineer wish they had chosen another career. Rental units on the market were mainly open screamers. With little or no sound isolation, the noise level alone made using generators almost impossible. Output stability also was a major concern. Mechanical speed governors were only able to keep the alternators between 58Hz and 62Hz, with voltage regulation also in the 3%-5% range. This article looks at how one company solved the problem of continuous stable power in the field.

A new generation

In 1987, diesel-powered alternators from Aggreko, constructed entirely in closed, silenced housing, began to appear on the U.S. rental market. Sound operating levels of these new units were 10dB-15dB below the operating levels of the environmental systems on most mobile production units. With the diesel-powered alternators running quieter than the production trucks, the problem of operating noise was solved.

In addition to the noise controls, these units also had electronic governor controls. These enable the diesel power plant to maintain a tight, consistent control of the RPMs on the alternator. The electronic governors have a reference signal that is constantly compared to the alternator RPMs. As the load on the alternator increases or decreases, the electronic governor increases or decreases the fuel flow to the engine, which provides stable power. An automatic voltage regulator (AVR) was developed to monitor the input excitation voltage compared to the alternator's output. The AVRs make adjustments as the load increases and decreases. Governors, combined with the AVRs, have solved the problem of power stability.

Hines is national broadcast coordinator for Aggreko Inc., Bridgeport, NJ.

Further improvements

The next problem to overcome was providing uninterruptible power for long durations. Diesel engines must be periodically serviced to ensure smooth and accurate operation. To be done properly, the systems must be shut down. This was an inconvenience on remote productions. The solution was to install two identical gensets in one container. The alternator outputs of each machine are connected to a single bus bar with an electronic synchronizer in the unit's control room. In single operation, the unit acts as any other standalone. A 300kW gen-set can output 1,000A, 208V/3-phase. In a dual unit, for synchronized operation, one machine is started and the load is connected to it. The second machine is started and its electronic governor and voltage regulator are switched to the synchronizer for control.

The synchronizer monitors the on-line machine's frequency, voltage and phase angle, then manipulates the off-line unit electrically so the frequencies, voltage and phase angle are matched perfectly with the on-line unit. Once locked, the second unit begins sharing load on the main bus. This enables the operating technician to

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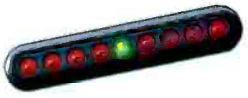

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Diesel-powered generators in use in the broadcast compound at Super Bowl 1993 in Pasadena, CA. (Photo courtesy of Aggreko.)

sync two machines together or drop a unit off the common bus without power interruption. Units can be shut off, serviced and synchronized quickly and easily.

With the diesel-powered alternators running quieter than the production trucks, the problem of operating noise was solved.

Another important feature is running both machines synchronized during critical power needs. Each gen-set has an electronic safety system that constantly checks critical systems on the gen-sets, including output parameters. If any sensors detect values outside of the normal range, the main circuit breaker on that unit opens, thereby disconnecting the load from the generator. The second generator senses the increased load and automatically increases its output. The fault can be located, adjustments made and the unit can be resynchronized without any noticeable interruption of power.

Gen-lock

Despite the stability of the electronic governors, when it came time to start doing film and TV production work, they were not stable enough. The electronic governors were fitted with a quartz-crystal, time-based reference module. The unit offered a preset reference of either 60Hz or 50Hz.

For TV production, this was taken a step further. Originally, the control system was designed for use with electronic governors on gen-sets supplying power and lighting for television outside broadcasting and film-making. The new system enables the gen-set to be phase-locked to the video sync. The phase lock prevents strobing, which looks like hum bars in the picture. The control system accepts blackburst from the production truck. The controller also has a pulse relay circuit that enables the hum bars to be moved out of the picture. The control system becomes critical in multiple production truck and generator systems.

The 1993 Super Bowl telecast from Pasadena, CA, was completely generator powered. Four Twin Packs were put on-line to power NBC's domestic broadcasts as well as the NFL Production's International Broadcasts. Thirteen mobile units, three KU-band uplinks, two C-band uplinks and 12 production trailers were interconnected. NBC's Master Production Truck supplied the sync reference signal. The four gen-sets were locked together, which enabled four different power sources to operate as one. Without the system, four separate power systems would have been powering equipment in the compound. Electronic noise, hum bars and grounding problems would have been rampant. Instead, the worldwide audience of more than 1 billion watched a clean and crisp signal. Most recently, these units were used for the APEC Summit in Seattle. (See the related article, "Powering APEC," on this page.)

➡ *For more information on remote power systems, circle (303) on the Reply Card. Also see "Power Generators" on p. 78 of the 1994 BE Buyers Guide.*

■

Powering APEC

On Saturday, Nov. 20, 1993, President Clinton was host to the Prime Ministers of Japan, Singapore, Malaysia, China, Canada, South Korea, Australia, Thailand, New Zealand and Indonesia. The occasion was the annual meeting of the Asian Pacific Economic Conference that took place in Seattle. The main talks took place on Blake Island, a 550-acre island in Puget Sound, in northwestern Washington state.

President Clinton addresses the crowd on Blake Island, flanked by leaders of the Asia-Pacific Economic Meeting. (Courtesy of AP/Wide World Photo.)

The island is part of the Washington State Park system, with only a few structures, including an Indian Long House and some ranger huts. There were no facilities to handle the 500 members of the press. Temporary tenting was set up, as was a microwave link to the mainland. For security reasons, the site was announced only a week before the conference. Transportation to and from the island and the limited electrical power were obstacles that had to be overcome. A landing craft that ran 16 hours a day was mobilized by the Navy, transporting service vendors and press to a beach on the south side of the island. Unfortunately, it was not enough.

On Wednesday, just three days before the conference, because of transportation problems, there still was no electricity, heat or lighting. The Army National Guard decided to activate a unit with larger landing craft. Eight tractor trailers loaded with generators, heaters, lighting towers and cable needed to be transported to the island. By 7:30 Wednesday evening, they were delivered by the 275' USS Summerville. Twelve technicians worked 36 hours straight setting up 800kW of temporary electric heating, 2.2MW of temporary power and 3.5 miles of electrical cable. An uninterruptible twin 300kW and 200kW generator powered the lighting in the Long House and technical power for the media. By noon Friday, all the systems were up and running.

Saturday at 8 a.m., a fleet of Coast Guard vessels arrived with President Clinton and his honored guests. The next eight hours were spent between closed door sessions and press conferences. Live broadcast feeds were sent worldwide from the island. Despite the problems with the load-in, the conference was a success, even though the load-out took place in six inches of snow.

❑

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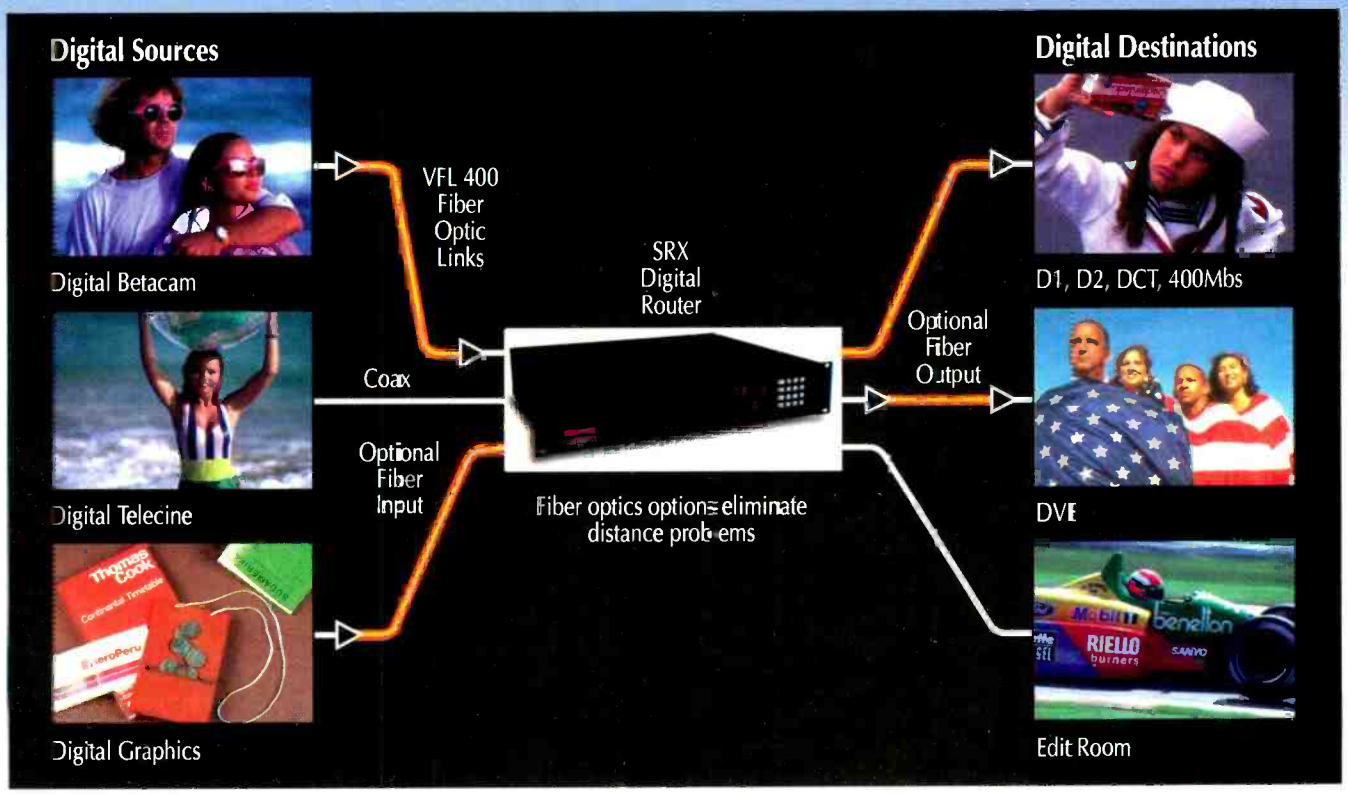

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LIGHTHOUSE

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Live from Norway

CBS covers the Winter Games.

By Jerry Walker and Richard Dean

The Bottom Line

*As winter settles in, CBS has been preparing for the 1994 Olympic Games in Lillehammer, Norway. **BE** will take a behind-the-scenes look at how CBS is preparing for this international event and how they will bring it to the world in a series of live remotes.*

$

TV coverage of the 1994 Winter Olympic Games in Lillehammer, Norway, Feb. 12-27, may be considered one huge remote or, more accurately, a combination of smaller remotes all happening at the same time. That is how CBS Sports prepared for coverage of this year's Games, bringing together microwave, fiber-optic and Ku-band satellite links with unique camera positions, plus PAL feeds from the host broadcaster, ORTO. CBS is the largest unilateral broadcaster at Lillehammer. It will occupy the most space at the International Broadcast Center (IBC), with more than 50,000 square feet, and will account for the most personnel (between 700 and 800) and broadcast equipment.

Having paid the most for the Olympics broadcast rights, CBS plans to make the most of it by broadcasting approximately 120 hours to the United States; more than 50 hours in prime time during the February sweeps. The CBS *This Morning* show will broadcast live from Norway for two weeks. Weekends during the Olympics — one of them a 3-day holiday — will feature a combination of live and prerecorded coverage. In addition, the late night recaps of each day's events have been extended to one hour.

CBS Sports is well-prepared to cover the Winter Olympics after having broadcast the 1992 Games in France. Barry B. Zegel, director of operations for the Olympics, said that CBS benefited in a number of ways by being able to keep a core Olympic team together. In addition, many of the designs and systems and racks that were built for use in Albertville, were stored in France and will be reused to some extent in Lillehammer. Being able to reuse some of the designs and subsystems from an engineering standpoint is a plus.

Unlike Albertville, which was too mountainous to use microwave links effectively, Norway's venues are well-suited to remote setups with microwave and fiber-optic links to the IBC. It also is an engineering challenge, because CBS views the Olympics as a sports, entertainment and news event and will cover the Games from these three perspectives.

For example, the morning show, which is news and personality oriented, will be broadcast live from a farmhouse overlooking Lillehammer. The entertainment aspect will include remotes from the Olympic Village and from tourist attractions in the region.

For the sports events, CBS has built three "mega-venues" at the figure skating, speed skating and one alpine skiing venue for its supplemental unilateral feeds. However, it will use the host broadcaster's international feeds for all but ice hockey, which means that material in NTSC and PAL will be handled at the IBC. CBS and Canada's CTV have combined to cover figure skating for the host.

At the IBC

CBS has 10 customized Vistek standards converters at the broadcast center to convert to NTSC for post-production and trans-

Walker is editor-in-chief of *World Broadcast News* and Richard Dean is chief correspondent-Europe for *World Broadcast News*.

Buyers Guide Update

This page includes **new** and **revised** information for companies serving the broadcast industry. You may wish to remove this page along the perforated line and keep it with your copy of the **Broadcast Engineering** *Buyers Guide* (published in November 1993).

ADC Telecommunications
4900 W 78 St.
Minneapolis MN 55435
612-896-2715; Fax: 612-896-2720

ADC Telecommunications manufactures digital video fiber-optic transmission equipment, electrical/optical digital video converters and standards independent routing and patching for fiber optics. These products are intended for use with signals at frequencies that might exceed 1.2Gbit/s. ADC also manufactures the most comprehensive line of digital and analog patchbays in the industry. Audio, video and RS-4:2:2 are represented in a multitude of designs to satisfy any application.

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716-436-2720; Fax: 716-436-3942

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Continental Electronics Corp.
PO Box 270879
Dallas TX 75227-0879
214-381-7161; Fax: 214-381-4949

Since 1946, **Continental Electronics** has provided superior quality RF transmission equipment, designed and built to meet the industry's highest standards, to commercial and government customers in 75 countries throughout the world. Our committment to excellence is reflected in products bridging the spectrum from ELF to UHF, S-band and beyond; with powers from watts to megawatts. Continental's breadth of experience in high-power transmitters has led to many innovative adaptations of RF technology for specific applications, such as HV power supplies, RF power sources, particle accelerators, fusion plasma heating, radio astronomy, line-of-sight radar and over-the-horizon radar.

Continental continually explores new applications for RF technology in areas of broadcasting, communications, medical research, nuclear research and industrial heating. To obtain this expertise for you station, contact Continental first.

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Ottawa, Ontario, Canada K2B 8H6
613-596-4120; Fax: 613-596-4863

International Datacasting Corp.
Spalding Woods Bus. Park
3850 Holcomb Bridge Road #420
Norcross GA 30092
404-446-9684; Fax: 404-448-6396

IDC manufactures equipment for satellite broadcast transmission/reception, capable of CD-quality digital audio and up to 256kb/s multiplexed data broadcast information. Products include digital audio encoders (using ISO-MPEG or APT-X), multiplexers and modulators, as well as integrated satellite receivers and decoders. Transmission formats include BPSK, QPSK, subcarrier-above-video and Bandedge for cost-effective radio networking and data broadcast industry requirements.

Jampro Antennas
3640 Sky Creek Dr.
Sacremento CA 95828
916-383-1177; Fax: 916-383-1182

Jampro supplies FM, TV transmitting antennas; power combiners, diplexers and dividers; transmission line; RF coaxial switchers.

JVC Professional
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201-794-3900
Fax: 201-523-2077

JVC Professional Products Company, based in Elmwood Park, NJ, is a world leader in the professional video field. As the inventor of S-VHS, JVC is continuously developing new technology for digital video, advanced analog recording and data compression with the objective of manufacturing products that offer both practical and productive solutions. Its versatile S-VHS format appeals to every area of the video community - from broadcast to post-production and duplication. For more information on the JVC complete line of S-VHS products, inlcuding cameras, recorders and edit controls, contact David Walton at 1-800-JVC-5825.

Microwave Filter Company
6743 Kinne St.
E Syracuse NY 13057
315-437-3953; 800-448-1666
Fax: 315-463-1467

Microwave Filter Company supplies a variety of RF filter products, including devices for the elimination and control of interferring microwave signals.

Old Dominion Broadcast Engineering Service
9505 Lakewater Court
Richmond VA 23229
Phone/Fax: 804-740-4717

Old Dominion Broadcast Engineering Service is a source for audio mixers, audio bandwidth extenders, intercoms, rebuilding services, rental services, tape erasers, telephone hybrids and interfaces.

Readers:
We suggest that you remove this update page along its perforations and keep it with the Buyers Guide, which you recently received.

The Editors

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England CB6 4LD
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Fax: +44 (0) 353 648867

Our legal name in England is **Studio Audio and Video Limited**, but we seem to be better known as SADiE. The company, founded in 1991 by Joe Bull, Michael Kemp and David Mortimer, is based north of the university town of Cambridge. The SADiE disk editor was launched in 1992. More than 200 systems have been sold to radio and TV broadcast, audio and video post-production, music and mastering recording studios, cassette duplication facilities and industrial and educational institutions. Studio Audio Digital Equipment (SADiE Inc.) was incorporated in the United States in 1993 to serve U.S. and Canadian customers.

Sadie, Inc.
PO Box 4392
Ann Arbor MI 48106
313-572-0500
Fax: 313-434-22981

Larcan-TTC
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Television Technology Corporation
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Louisville CO 80027
303-665-8000
800-TTC-HDTV
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Additional copies of the **Broadcast Engineering *Buyers Guide*** are available from the Intertec Customer Service Department (1-800-441-0294) for $20.00.

Data on the following UHF TV and FM radio transmitter systems was unavailable when the Buyers Guide went to press. The Reader Service numbers will bring you information about these products.

Transmitters, UHF TV

Manufacturer:	**Larcan-TTC, Inc.**	
Model:	**HDR-30M1A**[1]	**XLS-1000MU**
Application:	Band IV/V	Band IV/V
Visual peak power:	30kW	1kW
Response vs. brightness:	<0.5dB	5%
Low-frequency linearity:	0.5dB	0.5dB
Diff. phase/gain:	3°/5%	+2°/+2%
K factor at 2T/12.5T:	2%/2%	2.5
PA devices:	IOT	Solid-state
Aural output power:	10% of visual	10% of visual
Aural carrier deviation	±25kHz	±25kHz
Stereo capability for:	BTSC/NICAM	BTSC/NICAM
Audio distortion:		0.5% 0.5%
AM/FM noise:	-55/-60dB	-55/-60dB
Cooling System:	Forced air/Water	Forced air
Input AC power:	220/480Vac 3ø	220Vac 1ø
Power consumption:	36kW	3.6kW
System efficiency:	90.7%	85%
Reader Service No.	**201**	**202**

[1]This model is available from 10kW to 240kW. Models to 30kW can use forced-air or water cooling. Models above 60kW are water-cooled only.

Transmitters, FM

Manufacturer:	**Larcan-TTC, Inc.**
Model:	**FMS Series**
Applicable for LPFM:	Yes
Suggested exciter:	8090X (TTC)
Output power range:	1kW-8kW
Typical SWR rating:	2:1
VSWR protection:	Yes
Auto mod control:	No
PA device:	Solid-state
PA circuit type:	Broadband class C
IPA device:	Solid-state
Integrated remote ctl.:	Yes
µP diagnostics	CMOS
Input power:	...
Power consumption	See below
Reader Service No.	**203.**

FMS 1000	1kW	2.2kW
FMS 2000	2kW	3.7kW
FMS 4000	4kW	6.5kW
FMS 8000	8kW	13kW

mission. However, the center has PAL and NTSC tape recorders in the current formats to handle interviews with athletes' families, from European and U.S. sources. If a tourist gets a unique shot on a consumer Hi-8 VCR, CBS is ready to use it. There are even two switcher/routers, one small unit for PAL and a main one for NTSC, both supplied by BTS. The NTSC unit is a BTS Venus with 144 video inputs and 192 outputs, featuring four levels of audio and time code, and smaller matrices for RGB and key signals. The PAL router for receiving signals from ORTO, the host broadcaster, has 48 video inputs by 48 outputs. The 4-level audio router is divided into two parts: two audio routers with 48 inputs and 48 outputs, the other two with 32 inputs and 32 outputs.

The CBS broadcast center in Lillehammer has two main control rooms. The larger one is built up from the CBS Mobile Unit One with the side taken off, similar to the setup in Albertville. The switcher has been removed and built out into a larger control room, however, the basic truck systems are used, including the Grass Valley 300 switcher along with the audio and video equipment.

The second control room was done a bit differently for Lillehammer. The late night show has been expanded to an hour, so there is a need to be able to do prime time and late night simultaneously. The large stage has been divided into two stages, because there may be more people coming in and more interviews.

Control Room B is a full-fledged control room and an edit room designed during the day to do billboards and graphic build-ups and then in the evening to do the late night show. The control room will be able to work with the stage doing studio pick-ups, and the interviews then convert into an edit facility with its own tape facilities to be able to composite the show right in the same control room.

For Albertville, CBS took two mobile units. At Lillehammer, there is one mobile unit, and the second control room is being built. With the 6-hour delay, prime time and late night are composited shows.

What will tend to happen is that CBS will take isolated feeds from the host's camera positions and then supplement where more personal coverage may be needed. For example, at the downhill event, CBS has additional cameras at the start house and at the finish. There will be point-of-view (POV) cameras in the middle for coming and going shots as well. The objective is to customize coverage the way Americans like to view television.

Toward this end, CBS has come up with innovative shots to supplement ORTO's creative camera positions. Unique camera uses include:

• *Luge-cam.* CBS Sports has built a tiny camera into the middle of U.S. team member Duncan Kennedy's luge pod between the leg positions pointing forward. It will not affect the aerodynamics of the sled and has been approved by all of the necessary governing bodies, as well as the Lillehammer Olympic Organizing Committee. As Kennedy flies down the luge run, the camera's signal will be sent to a helicopter hovering above the course and relayed to the production truck on site.

• *Goalie-cam.* CBS Sports is planning to equip Hockey Team USA's goalie with a helmet containing a built-in camera. A transmitter and battery pack tucked into the goalie's belt will send the signal to a production truck at the arena. Viewers will see exactly with the goalie sees during the action.

• *Coming-and-going camera.* This POV camera will be mounted on gates in the downhill men's and women's ski competition. It consists of two tiny cameras mounted back-to-back. The first camera will capture the skier as he or she approaches the gate. A video sensor will trigger the second camera as the skier passes the gate, providing a shot continuing down the course. This camera, used for the first time at an Olympics for the women's alpine course in Meribel, France, will now be used for all the

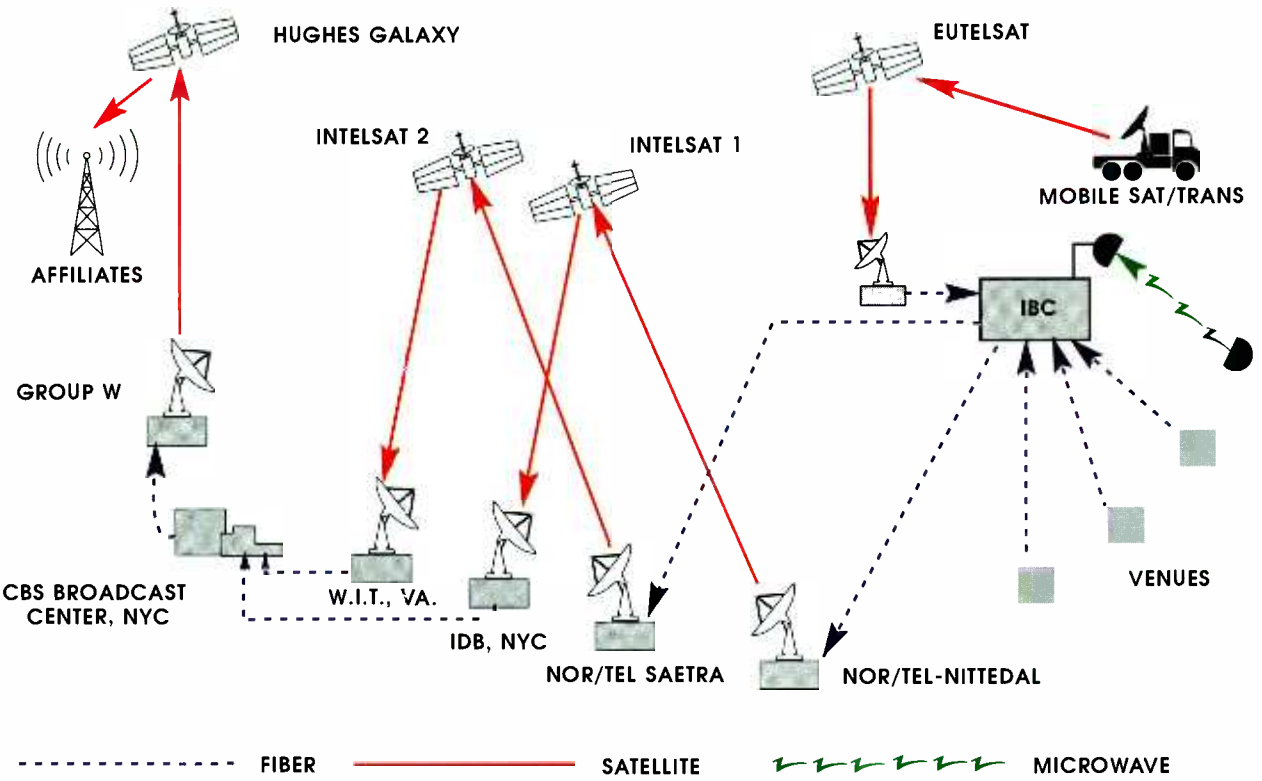

Figure 1. Broadcast path from the European Games to U.S. affiliates.

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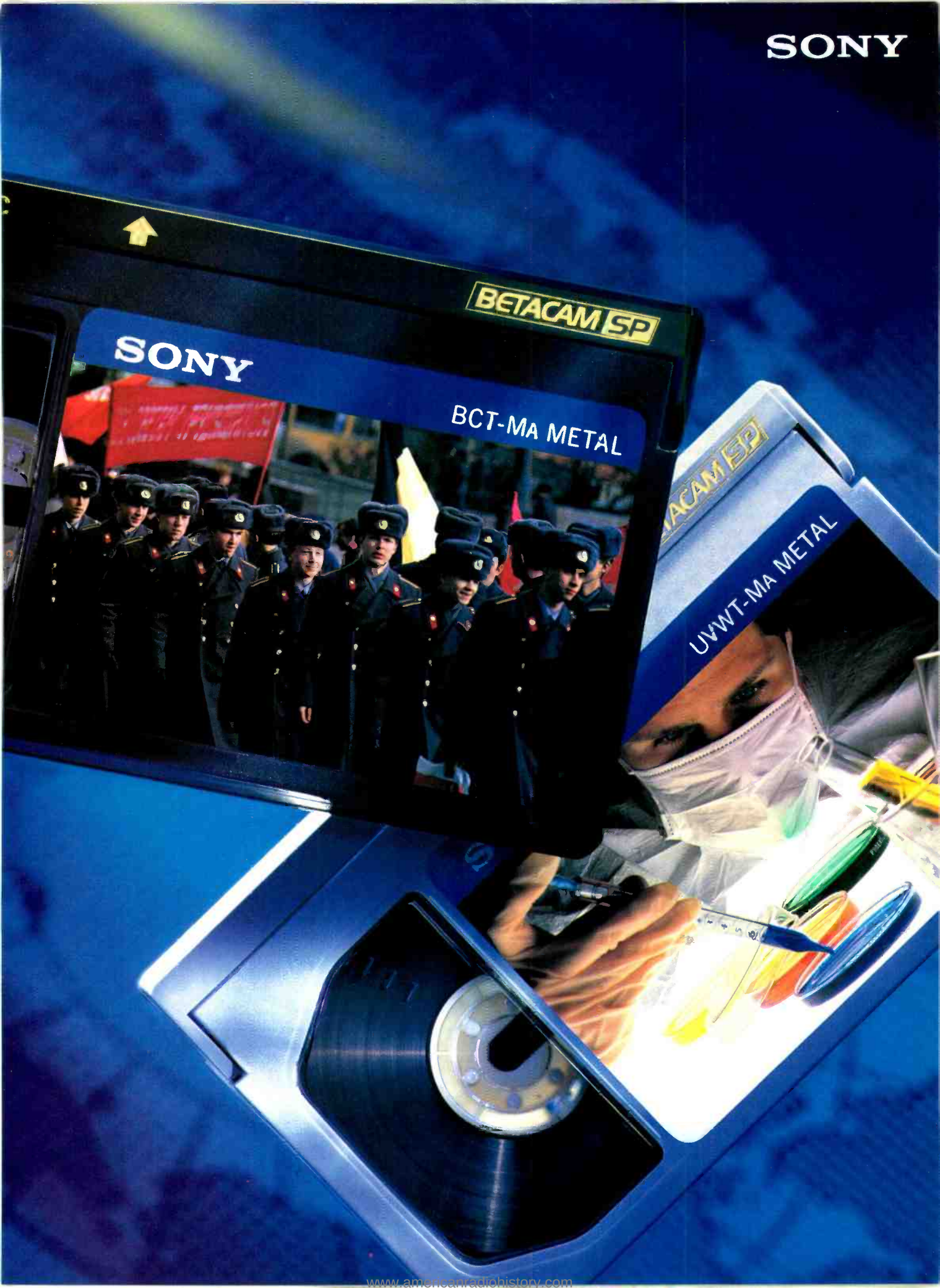


LILLEHAMMER 94

men's and women's alpine skiing competitions at the Kvitfjell venue.

• *Super Slo-Mo.* Two Super Slo-Mo mobile units will follow the action, each containing a Super Slo-Mo camera, videotape recorder and crew.

• *Remote cameras.* Mounted in the start houses of the alpine skiing events, remote-controlled cameras will focus over the skiers' shoulders just before the start of their runs.

• *Blimp.* A blimp will hover over the venues for overhead shots of many of the outdoor events. This will be similar to the way CBS covers American football games.

Conservative buys

Whereas Norway's NRK as host broadcaster via ORTO saw the Olympics as an opportunity to take the digital plunge (See the related article, "Let the Digital Games Begin," on p. 54), CBS had no such notions. The network is a Betacam SP acquisition, D-2 edit shop. Because the equipment purchased or rented with purchase option is destined to end up at CBS facilities in America, there was no reason to consider D-3, D-5 or Digital Betacam.

As for the graphics systems, the basic workhorse will be the Chyron Infiniti!. There also will be some 3-D graphics systems to pre-build images. In addition, Quantel Picturebox and Paintbox will be at the venues. The computer system will interface with the time and results systems provided by the host. The facilities will essentially be an analog house.

The systems in place at Lillehammer should perform because the network scheduled a number of pre-Olympics events, including a 3-show figure skating competition at the Olympic venue.

The big difference between Albertville and Lillehammer is the topography. At Albertville, having microwave trucks at various locations was not possible because of the surrounding Alps. Also, the venues were so spread out that there was not a central place were people congregated. Lillehammer is quite different, with its two gentle sloping mountains and the town in a valley. The team was able to get space on an adjacent tower and put up microwave receivers and have microwave trucks that can cover a good portion of the Lillehammer area. There are also repeaters up at the Hunderfossen area, which is where the bobs and luges compete. These areas can be covered with microwave, whereas Ku (satellite) trucks were used in Albertville. Area IFBs are possible here, so the changes and updates were mostly to adjust to the terrain.

Transmission connections

Responsibility for getting signals from the venues to the IBC and signals coming

into the CBS facilities from other countries rests with David L. White, vice president of Special Projects. He also is responsible for transmitting the assembled material from Norway to the USA and from CBS New York back to Lillehammer.

The CBS facilities at the IBC will receive coverage over a combination of terrestrial fiber optics, microwave and domestic European satellites (for interviews from other countries). (See Figure 1.)Programs to air will be transmitted to the United States via international transponders over two separate INTELSAT satellites. The two signals will be redundant (identical) to ensure nothing is lost.

One signal will be passed via fiber optics to a Norwegian Telecom C-band earth station and then transmitted to an INTELSAT bird over the Atlantic. The signal will be received at the IDB Communications earth station on Staten Island, NY. It will then travel to the CBS Broadcast Center in New York, again via fiber optics.

A second CBS signal will be routed over fiber optics to another Norwegian Telecom gateway earth station. From there, the transmission will be uplinked to a second INTELSAT satellite and accessed at Washington International Teleport (WIT) in Alexandria, VA. Picture and sound will be carried from Virginia on dedicated Vyvx fiber to the New York CBS Broadcast Center.

The two independent transmissions from Norway will be assigned internally to a broadcast operations and satellite distribution management center from which the composite programming (including commercials) will then be sent outbound to the CBS affiliate stations in the United States. These transmissions involve placing the program material on fiber-optic circuits between the Broadcast Center and Group W satellite communications facilities in Stamford, CT. There the signal will be uplinked to Hughes Galaxy U.S. domestic satellites for reception and terrestrial broadcast from the CBS-owned stations and the CBS Television Network affiliates.

CBS

LILLEHAMMER 94

The bulk of the satellite traffic to and from Norway will be on one-month leased transponders, supplemented by occasionals as required. The Norwegian Telecom is providing all of the fiber and a domestic Ku-band transponder channel, as well as a domestic Ku-mobile truck. The microwave services will be a mixture of CBS supplied and Norwegian Telecom support. CBS will be using Telecom's tower and, in some cases, its relay radios with frequencies allocated by Telecom.

The Norwegians studied the operation in France carefully before and during the Olympics and have been on target or slightly ahead of target in many areas all the way through. The "dress rehearsal" events before the Olympics went exceedingly well with the satellite links.

Internally, CBS will have full 24-hour-per-day near-broadcast-quality circuits from New York to Lillehammer. In addition, there will be a full-time audio and video circuit

originating at the Broadcast Center, which will be used to show in Norway what's actually happening on air in the United States. When not on the air, the circuit will be used to bring in material for use in assembling the show at the IBC. It also will be used for 2-way, live interviews.

Turner Broadcasting's cable channel, TNT, will once again share Olympic coverage with CBS, although the cable channel has an independent operation at the IBC adjacent to CBS. TNT will use the same ORTO host pictures and add its own commentary from a single anchor position. TNT will transmit to cable operators during the day from Monday through Friday, when CBS airs its regular day-time programs.

Let the Digital Games begin

1994 Winter Olympics

By Richard Dean and Jerry Walker

Dean is chief correspondent-Europe for *World Broadcast News* and Jerry Walker is editor-in-chief of *World Broadcast News*.

For the first time in Olympic history, the host broadcaster TV system for the 1994 Winter Olympics in Lillehammer, Norway, Feb. 12-27, is based on digital technology throughout the entire transmission chain from the production site to the recording facilities in the International Broadcasting Centre (IBC). Approximately 93 Sony Digital Betacam machines will be used during the Games.

The decision of NRK ORTO 94 (the Olympic Radio & Television Organization led by Norwegian public broadcaster NRK) to distribute the international TV signal in CCIR Recommendation 656-1 serial format with embedded audio was primarily made on the basis of greater reliability offered by component digital video. Substantial savings also are made possible because the video and two channels of audio are carried by the same cable.

Coverage of the alpine events at Hafjell and the cross-country venue will be originated digitally. All others will be originated in PAL, digitized and decoded at the OB van output, and routed as a 270Mbit/s VANDA (Video AND Audio) signal to Norwegian Telecom. To enable signals to pass along its fiber-optic network, Norwegian Telecom bit reduces (and later restores) the video portion of each feed to produce a total data rate of 140Mbit/s.

Located at Storhove, a tiny settlement 4km north of Lillehammer where the opening and closing events will take place beside two huge ski jump tracks, the 5-floor IBC has an area of approximately 26,000 square meters — enough to house the entire 22,000 population of Lillehammer with room to spare.

Late result for HDTV

The decision by the European Commission (EC) to fund high-definition production at the 1994 Winter Olympics in Lillehammer came too late for what many had hoped would be an historic trial of European digital TV technology. But it still promises to produce valuable high-definition experience and the most valuable source of digital high-definition archive to date.

In a collaboration reminiscent of high-definition coverage at the Wimbledon tennis tournament, an agreement was made to exchange material with fellow high-definition producers NHK. HD Thames will be covering the medal awards, slalom and ice hockey, while NHK will handle speed skating and figure skating. Between the two, four of the 12 venues will be covered and they will produce approximately 210 hours of material for Europe which is almost the same number of hours as regular 4:3 broadcasts.

In each case, the benefiting company is responsible for conversion. HD Thames will use a BTS system to convert NHK's 1125/60 material, while NHK has its own system.

Digital link

HD Thames will use a 70Mbit/s digital satellite link for the first time, shipping European high-definition pictures from Lillehammer to France Telecom in Paris. Up to three satellite relays will take signals from Paris to broadcasters across Europe who express interest in broadcasting the February event in high-definition or 16:9 widescreen format.

Only Supervision in France and TV Plus in the Netherlands have been confirmed as broadcast carriers of the HD Thames coverage at press time, using analog D2-MAC to convey widescreen pictures at 625-line resolution. The French high-definition theater chain, Salles de Cinema, also is taking the feed, and France Telecom has a number of demonstration sites across France

HiVision

A ready market for high-definition television already exists in Japan, where more than 20,000 viewers receive direct-to-home HiVision satellite signals from public broadcaster NHK via the MUSE broadcasting system, along with almost 600 public display sites.

NHK's foreign production requirements are met by a wholly-owned subsidiary called Mico (Media International Corporation), which has three operating divisions worldwide. The head office in Tokyo handles Asia and Pacific assignments. There also is a New York office for the United States and a Mico office in the United Kingdom for Europe.

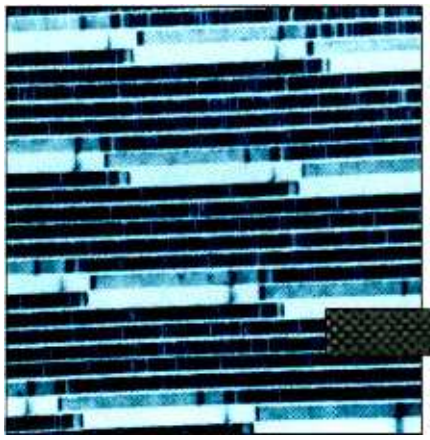
According to Mico UK executive vice president Tada Yokoo, his team will produce approximately 60% of the 100 hours of Winter Olympic coverage carried by HiVision, with the remainder sourced from HD Thames. Mico plans to use two vans with four or five cameras and up to three Sony or Hitachi digital VTRs, a smaller 3-camera van with one digital VTR, plus two sets of 2/3-inch ENG cameras with separate UniHi VTRs to cover the figure and speed skating events.

The HiVision signals will be sent from Lillehammer to Tokyo via the INTELSAT satellite positioned over the Indian Ocean using the MUSE DPCM (differential pulse code modulation) digital transmission system. But with most events starting at approximately 20.00 hours local time and a time difference in Tokyo of eight hours later, pictures would begin to emerge at 04.00 if they were transmitted live to Japan.

Yokoo's team will rely on tape to send pictures during the Japanese day. But this apparently simple procedure will be far from what U.S. broadcasters might call a "no-brainer." Given that NHK has decided to present its high-definition viewers with a 3-hour package of highlights repeated three times daily, rather than verbatim coverage on all but the opening and closing ceremonies, the Lillehammer team will be busy editing footage through the night to be ready for dispatch at 12.00 Japan time, just four hours before the next evening's events begin to unfold in Lillehammer. Only events where Japan expects to win gold will be sent over as additional live broadcasts for the more dedicated (and nocturnal) viewers.

Each of Japan's four DTH (direct-to-home) channels, including HiVision, are broadcast from a VS3 series satellite in analog format. As with everywhere else in the world, a transition to digital is inevitable in the long run. But according to Yokoo, the change is not likely to happen until early in the next century.

Studio videotape recorders



Choosing the right format is no easy task.

By Curtis Chan

The Bottom Line

With all the videotape formats and models currently on the market, and new ones, it seems, coming every day, which format to choose can be a difficult decision. Application, budget, cost of ownership, life expectancy and quality level are among the factors that go into the decision. In the end, each facility must base its decision on its specific needs.

$

Photo courtesy of 3M.

It's been a long time since the 1956 NAB when the quadruplex videotape recorder made its debut. The VR-1000 pulling tape and making pictures was quite a sight.

Over the years, there have been at least 20 formats introduced in the United States. Today, these formats are still being used in one form or another, with more coming. Among the formats in use are Quad (2-inch); Types A, B and C (1-inch); U-matic (SP); VHS; S-VHS; W-VHS (S-VHS extension for high-definition recording); 8mm; Hi-8mm; 1/2-inch EIAJ; Betamax; Betacam (SP); MII for the analog side; and D-1, D-2, D-3, Digital Betacam, DCT and D-5 for digital. The newest format is the D-6 from BTS.

Unless you've been around tape formats all your life, making an investment decision for your facility by simply reading literature specifications is similar to buying a vintage car because you liked the thump you heard when you kicked the sidewalls. Some older formats are still in use and are cost-effective. The simplicity of board repairs and basic maintenance can save a considerable amount of money. If you are skeptical, think about how many U-matics are still in use today. The important thing is to purchase a format, and ultimately a machine, based upon its intended usage, whether it be acquisition, production, post-production, duplication, archiving or distribution.

A single universal tape format that meets the needs of the professional broadcast and post-production industries would be ideal. Unfortunately, because of different standards, economics and requirements for each application, many tape formats proliferate. End-users must decide whether to use a single format for all of their needs and accept compromises in quality and performance or match each application to a format designed for that particular need, thereby creating a cost-effective interformat environment. There is no single best format; each format lends itself quite well to its intended application.

Over the years, there have been at least 20 formats introduced in the United States.

For instance, in the digital domain, D-1 and DCT will continue to find applications where high-quality video and audio are a must, primarily in the post community. The D-2 and D-3 formats will find market share in the broadcast and post communities. Although the D-2 format touts a portable recorder, D-3's camcorder might get the edge in EFP/ENG applications. D-6, if accepted, will likely find use in telecine transfers and archival. For analog, 1-inch Type C is still regarded as the workhorse format for production and post-production; Betacam (SP) and, to a smaller extent, MII are well-suited for acquisition and post-

Story continued on page 60

Chan is principal of Chan and Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA.

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STUDIO VIDEOTAPE FORMATS AND FEATURES

CATEGORY	D-1	D-5	DCT	DIGITAL BETACAM	BETACAM SP	BETACAM	D-2	D-3	Type C	MII	S-VHS	HI-8MM	U-MATIC SP	U-MATIC	8MM	VHS
Video Quality	1,4	1,2,4	1,2,4	1,2,3,4	1,2,3,4,5	2,3,4,5,6	1,2,4,5	1,2,4,5	1,2,4,5	2,3,4	3,5,6,7	3,5,6,7	2,4,5	2,4,5,6,7	5,6,7,8	5,6,7,8
Application	2,3,4	2,3,4	2,3,4	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5,6,7	2,3,4	2,3,4	2,3,4,6	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	2,3,6	2,3,4,6,7	1,2,3,6,7	1,2,3,6,7
Tape Size	19mm	1/2"	19mm	1/2"	1/2"	1/2"	19mm	1/2"	1"	1/2"	1/2"	8mm	3/4"	3/4"	8mm	1/2"
525/60 - Rec. Time S	6	32	32		6,11,21,31	6,11,21,31	32	50-64		50-64			20	20		
(Min.) M	12-34	62	94				94	95-125		95-125			60	60	60	
Cartridge Size L	76-94	123	208	124	8,13,23,34,64,94	8,13,23,34,64,94	208	185-245	Up to 3 hrs.	185-245	Up to 120	Up to 120				Up to 8 hrs.
625/50 - Rec. Time S	5		28				32									
(Min.) M	11-30		84				94									
Cartridge Size L	68-84		187	112			208									
Voltage	100-240VAC	100-240VAC	90-264VAC	90-265VAC	90-265VAC	90-265VAC	100-240VAC	120VAC	100-240VAC	100-240VAC	120VAC	100-120VAC	100-240VAC	100-240VAC	120VAC	120VAC
Power - Watts	400-1200W	500W	500W	170-260W	160-240W	110-170W	450-700W	340W	400-575W	350W	100W	30-50W	90-200W	90-200W	28-80W	28-80W
Average Weight	143-326 lbs	110 lbs	145 lbs	66-75 lbs	59-66 lbs	54-56 lbs	103-132 lbs	68 lbs	147-275 lbs	55 lbs	50 lbs	17-20 lbs	46-88 lbs	46-88 lbs	15-41 lbs	15-41 lbs
DESIGN CHARACTERISTICS																
Tape Speed - 525/60	286.588mm/s	167.288mm/s	131.7mm/s	96.7mm/s	11.86cm/s	11.86cm/s	131.7mm/s	83.88mm/s	244mm/s	83.88mm/s	33.35mm/s	14.3mm/s	95.3mm/s	95.3mm/s	14.3mm/s	33.35mm/s
Tape Speed - 625/50	286.875mm/s		146.459mm/s	96.8mm/s	11.87cm/s	11.87cm/s	131.7mm/s									
Scanner Type	Fixed Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper	Rot. Upper
Head Replacement Method	Headwheel	Upper Drum	Indv. Head	Upper Drum	Upper Drum	Upper Drum	Indv. Heads	Upper Drum	Upper Drum[1]	Upper Drum	Upper Drum	Upper Drum	Upper Drum	Upper Drum	Upper Drum	Upper Drum
FF/Rew Time S	35sec.		34sec.				40sec.						< 150s	< 150s		
M	80sec.		96sec.				75sec.	90sec.					< 240s	< 240s		
L	150-160sec.		214sec.	< 3min.	< 3min.	< 3min.	150sec.		72-150sec.		< 150sec.	< 180sec				< 300sec.
FEATURES/FUNCTION																
Full Split Editing (X = Yes)	X	X	X	X	No	No	X	No	X	No	No	No	No	No	No	No
LTC/VITC	X	X	X	X	X	X	X	X	X	X	No	X (LTC)[2]	X	X	No	No
Slow Motion	X	X	X	X	X	X	X	X	X	X	X (stepped)	X (stepped)	X	X	X (stepped)	X (stepped)
Search/Jog	X	X	X	X	X	X	X	X	X	X	X (stepped)	X (stepped)	X	X	X (stepped)	X (stepped)
Dynamic Tracking (Var. Play)	X	X	X	X	X	X	X	X	X	X	Limited	Limited	X	X	No	No
VIDEO I/O																
Parallel Digital Video	X	X	X	No	No	No	X	No	No	X	No	No	No	No	No	No
Serial Digital Video	X	X	Optional	X	No	No	X	X	No	No	No	No	No	No	No	No
Component Analog Video	No	X	Optional	X	X	X	No	No	No	X	X	No	No	No	No	No
Composite Analog Video	Monitor	X	X	Optional	X	X	X	X	X	X	No	X	X	X	No	X
AUDIO I/O																
AFM Audio	No	No	No	X	X	No	No	No	No	No	X	X	No	No	X	X
Analog Audio	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Quantization - A/D	16 bits+	16 bits+	18 bits	18 bits	No	No	16 bits+	16 bits+	No	16 bits+	No	14 bits+	No	No	No	No
Quantization - D/A	16 bits+	16 bits+	20 bits	18 bits	No	No	16 bits+	16 bits+	No	16 bits+	No	14 bits+	No	No	No	No
Digital AES/EBU Audio	X	X	X	X	No	No	X	X	No	X	No	No	No	No	No	No
Cue Track	X	X	X	18 bits	X	X	X	X	X	X	X	X	X	X	No	No
Time code	X	X	X	18 bits	X	X	X	X	X	X	No	X	X	X	No	No
REMOTE I/O																
RS-422	X	X	X	X	X	X	X	X	X	X	X	No	X	X	No	No
RS-232	X	X	X	X	No	No	X	X	X	X	No	X	X	X	No	No
GPI/Parallel/IEEE-488	X	X	X	Optional	X	X	X	X	X	X	No	No	X	X	X	X

Video Quality: (1) High-End Production; (2) Broadcast; (3) ENG/EFP; (4) Post-Production; (5) Corporate Industrial; (6) Videographer; (7) Prosumer; (8) Consumer
Application: (1) Acquisition; (2) Production; (3) Post-Production; (4) Mastering; (5) ENG/EFP; (6) Duplication; (7) Distribution

[1] Except Ampex machines (Indv. Heads)
[2] Time code is recorded as a data track

Information obtained from manufacturer-provided sources.

ALL DAT TAPES ARE NOT THE SAME

In recommending DAT as the format for exchanging digital audio*, the European Broadcast Union also warned its members that the tape itself should be chosen with great care. Block errors, archiving stability – even head wear are affected directly by the quality and design of the tape and the shell in which it's housed.

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Story continued from page 56
production. On the industrial side, U-matic (SP) is still a contender as a general workhorse, although S-VHS is making headway. Newer entrants, such as S-VHS and Hi-8mm, are being used for acquisition at several levels. On the low end, U-matic, VHS and 8mm are being used for distribution and duplication.

New digital formats

D-1 or 4:2:2 digital component was introduced around 1986. At the time, most of the United States was still using either 3/4-inch, Betacam or 1-inch Type C. D-1-based equipment was relatively expensive compared to today's prices, and, although a digital component facility could be built at the time, not many companies supported the format for several reasons. However, all three formats have taken a back seat to the new formats introduced in July 1992, when Panasonic's D-5, Sony's Digital Betacam and Ampex's DCT were announced. These new formats raised questions concerning videotape cassette compatibility, format compatibility and, to some extent, facility compatibility. A further variable was added to the equation at the recent SMPTE convention in Los Angeles, where BTS showed the D-6 machine.

D-5

D-5 is based upon the current D-3 platform, recording techniques and cassette. The D-5 DVTR will be able to record the SMPTE 259M signal at 270Mbps 4:2:2 signal at the full 10-bit uncompressed form. End-users can purchase the same cassette and tape stock for both formats. The same mechanical transport and platform also can be used, which saves money on both sides. Finally, users can start with D-3 knowing that full playback compatibility of D-3 tapes is guaranteed on the D-5 recorder.

Once you have made a format decision, you have plenty of models to choose from, and from more than one manufacturer.

On the compression front, Panasonic believes that video data compression is still a developing technology, with the constant emergence of ideas and algorithms that provide more elegant and efficient schemes. Panasonic recognizes that data compression will play an important role in video recording's future, but it believes more investigation is required before compression will provide practical benefits in post-production videotape recording.

Digital Betacam

The introduction of Sony's Digital Betacam strategically safeguards the existing Betacam user base. It offers compatibility, performance and features that exceed those of current analog standards and it touts a cost-effective price point. As with Ampex's DCT, Digital Betacam uses a mild bit-rate reduction technique called *coefficient recording*. The 2:1, picture-dependent intrafield compression scheme doesn't introduce the kinds of motion artifacts found in other compression techniques. The intrafield scheme applies the compression algorithms to each field discretely and independently. By employing a discrete cosine transform, the low-frequency component of the signal is preserved.

There is no single "best" format; each lends itself to its intended aplication.

The bit rate remains unchanged and the I/O carries the full 10-bit 4:2:2 signal. Two models in the DVW line also permit playback of analog Betacam and Betacam SP.

DCT

Ampex correctly forecasted the market direction and gave us Digital Component Technology (DCT) as a packaged deal for the high-end markets. In addition to DCT tape drives, you can purchase a DCT switcher, editor and DVE. Like Sony, DCT uses a mild 2:1 compression scheme and 19mm tape. Three-hour recordings are possible with the large cassette, and the company touts perfect picture quality after 30 generations. Aside from what is arguably the most robust and performance-laden transport in broadcasting, DCT's strength lies in its error-correction scheme. Ampex believes the sophisticated data-rounding methods employed on the front end of the DCT 700d drive answer the question of whether to use 10-bit or 8-bit.

Features of the 700d drive include switching between 525/625, serviceable transport (it can be physically rotated 90°), pinch-rollerless and frictionless air-lubricated tape guides, astounding shuttle-acceleration speeds (you can recue a 30-second spot in 1.5 seconds) and even a built-in 3.5-inch floppy drive for adding features or programs. I/Os include parallel digital, with serial digital and analog I/O as options. An analog composite output is available for making window dubs.

D-6

The DCR6000 gigabit recorder from BTS is the first high-definition cassette recorder to comply with SMPTE-D6. This recorder is different than the machines previously discussed in that it was built as an HD machine. Its main purpose is to record images from the new BTS/Kodak HD telecine, which also was shown at SMPTE. The recorder is capable of uncompressed recordings at 1.2Gbit/s. The machine has digital parallel and analog signal interfaces, and it can record up to 12 digital audio channels. Sampling frequency is 72MHz for luminance and 36MHz for chrominance. Luminance bandwidth is 30MHz; chrominance is 15MHz.

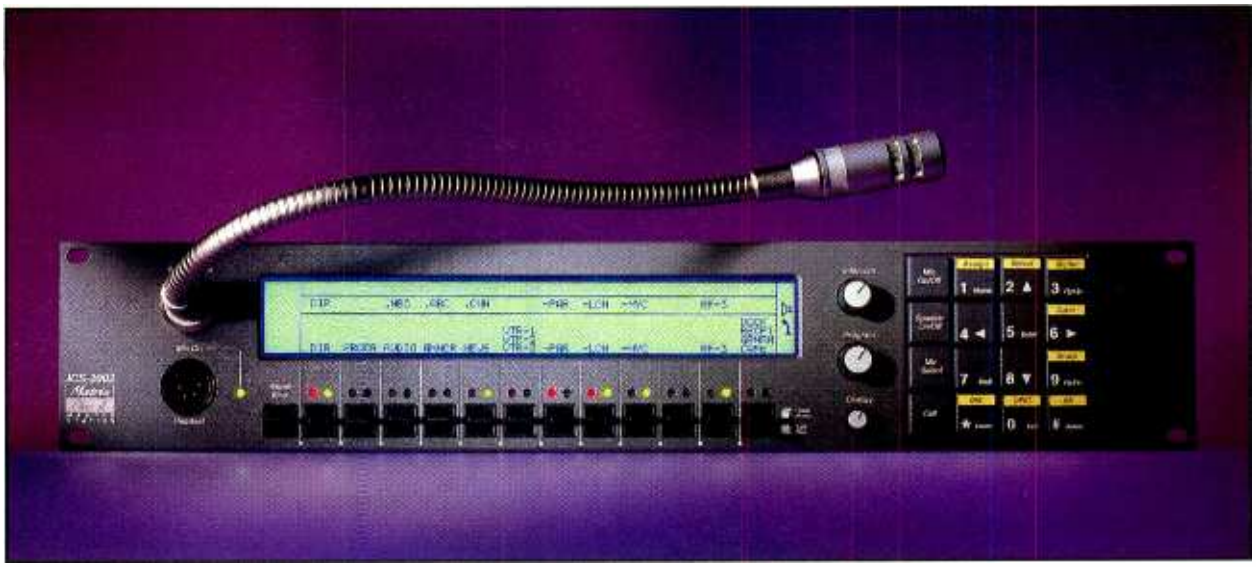
Although the main reason for buying a D-6 machine would be for archiving film masters to a high-definition digital format, the machine is not limited to that application. With a recording time of 64 minutes on the large cassettes, D-6 can also be used for applications in post-production and other areas, including recording HD computer images.

Chart specifics

Rather than go into a long discussion of the pros and cons of certain formats, *Broadcast Engineering* has included a comparison chart to allow you to determine for yourself the best format for your needs. (See Table 1 on page 56.) Instead of presenting individual models, we have detailed some of the specifics of each format. Once you have made the format decision, you have plenty of models to choose from, and, in many cases, from more than one manufacturer. All formats allow for editing, both insert and assemble, as well as split audio and video edits. Except for 1-inch Type C, all of the formats are cassette-based. Because they are all capable of making reasonable pictures, and because the electronic specifications don't really tell the whole story, we have left them out. In their place we have listed application categories to give you an idea as to what quality to expect from the format and, to some extent, the cost. ■

For more information on studio videotape recorders, circle the following numbers on the Reply Card:

Ampex (304)
BTS (305)
Canon (306)
JVC (307)
Panasonic (308)
Sony (309)
Toshiba (310)



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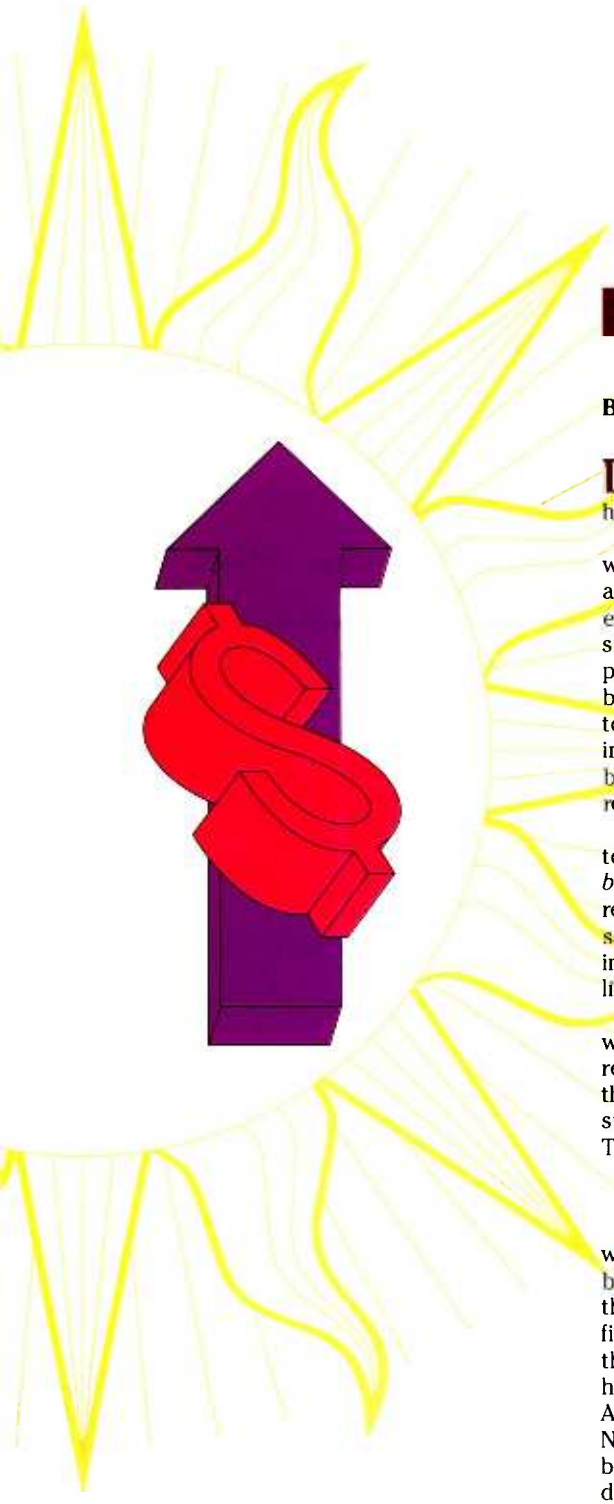

By Brad Dick, editor

I feel like quoting Rush Limbaugh when he says, "See, I told you so!"

The broadcast industry is headed skyward just like *Broadcast Engineering* magazine predicted two years ago. For the past eight years, *BE* has been providing exclusive detailed coverage on the technology plans for broadcasters. The information, based on surveys of *BE* readers, has proved to be highly accurate. Armed with this information, stations have been able to better plan their equipment purchases to remain competitive.

Although we'd never be so pompous as to tell *BE* readers *the way things ought to be*, it is gratifying to see this year's survey results confirm what *BE* magazine has been saying for several years. The broadcast industry is in recovery and the patient will live.

The information in this year's survey was prepared by the Intertec Publishing research department. The data is based on the responses developed from 2,000 mailed survey forms, of which 668 were returned. This represents a 33.6% response rate.

Upward trends

The 1991 survey pointed toward an upward trend. The 1992 survey confirmed better times were at hand. And this year, the 1993 industry forecast survey confirms that broadcasters are investing in their future. That's a point that seems to have been lost on some print journalists. As I discussed in this month's "Editorial," Not everything is doom and gloom in the broadcast industry. Stations are not going dark, and executives are not jumping out the financial window in desperation.

Rather, stations have been slowly re-grouping, re-establishing a more solid financial foundation upon which to build for the future. It appears from the survey results that station equipment purchase plans are coming to fruition at a rapid rate. New hardware is on the way.

The broadcast industry is headed skyward just like Broadcast Engineering magazine predicted two years ago.

The fog clears

All of us have been hoping and even praying that the fortunes of the industry would finally turn around. It has been a tough few years and a lot of our members have suffered because of these conditions. Staff reductions were common. Station sales first climbed, then plummeted as overleveraged, high-interest rate deals created back-breaking debt load for stations. Managers, faced with increased debt payments and reduced revenues, dealt with the issues as any capitalist would — by cutting spending. That often meant cutting people. At the same time staffs were cut, equipment budgets also were slashed. *If it wasn't broke, it wasn't replaced* be-

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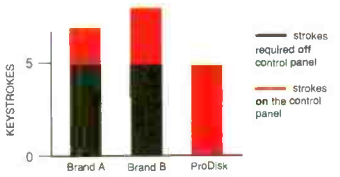

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Purchasing plans for radio and TV stations by equipment category.

	RADIO	TV
Audio recorders/players	46.0%	20.0%
Microphones	34.1%	39.5%
Test equipment	29.5%	46.1%
Signal processing	29.3%	26.0%
Audio consoles	24.1%	18.0%
Automation equipment	20.9%	20.1%
Monitors (audio & video)	17.9%	57.5%
Antenna systems	18.1%	10.6%
Transmitters	17.8%	13.7%
Signal routing/distribution	13.2%	28.0%
Editing, desktop systems	8.8%	37.9%
Cameras	4.3%	40.7%
Video recorders	2.9%	52.6%
Remote production vehicles, Program relay	3.8%	13.4%
graphics/effects/titlers	1.8%	29.2%
Video switchers	1.1%	24.3%
Other	11.1%	10.6%
No purchases planned in 1994	16.8%	5.3%

Table 1. *The table shows the percent of respondents indicating plans to purchase the type of equipment listed. Results are measured over all markets.*

came standard operating procedure.

Now times are different. Despite the talk of new competition, stations are ready and willing to invest in their future. Let's look at some numbers.

Staffing on the increase

The engineering staffs at radio and TV stations have basically been getting smaller every year since 1985. Radio did see a small up tick three years ago, but it was only by 0.2 of a person. Today, the average radio engineering staff consists of two people. In the top 50 markets, it increases to three engineers.

Engineering staffs at TV stations are considerably larger. Measured overall, TV stations average 19 engineers on the staff. This runs from a high of 28 in the top 50 TV markets, to 15 in the top 100 markets, to 11 in the below top 100 markets. Compared to last year, TV engineering staffs have increased slightly. That's good news.

One area to monitor is the use of outside contract engineering services. Measured overall, almost 28% of the radio stations report the use of contract engineers. More AM stations report that they use contract engineers than do FM stations (31% vs. 26.5%).

Surprisingly, about the same percentage of TV stations report the use of contract engineers. Measured overall, 24% of the TV stations use contract personnel. The larger-market stations are more likely to use contract engineers than are small market TV stations.

The average radio station equipment budget for 1994 is $36,769.

When asked to report on what percent of technical maintenance was handled by contract engineers, AM stations reported 49% and FM stations reported 41%. Those figures were much smaller for TV stations. The top 50 markets said that 10% of the technical work was handled by contract engineers, 11% in the 51 to 100 markets and only 8% of the technical work is handled by contractors in the below top 100 markets.

Now the budget numbers

The average radio station equipment budget for 1994 is $36,769. That is a 41% increase over actual equipment expenditures for 1993. Radio stations are keen on improving facilities in 1994.

TV station budgets are approximately 10 times larger than those for radio stations. For this reason, even a small percentage increase in spending represents, in the

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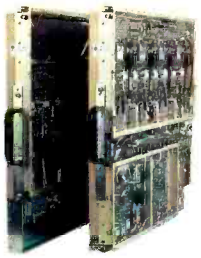

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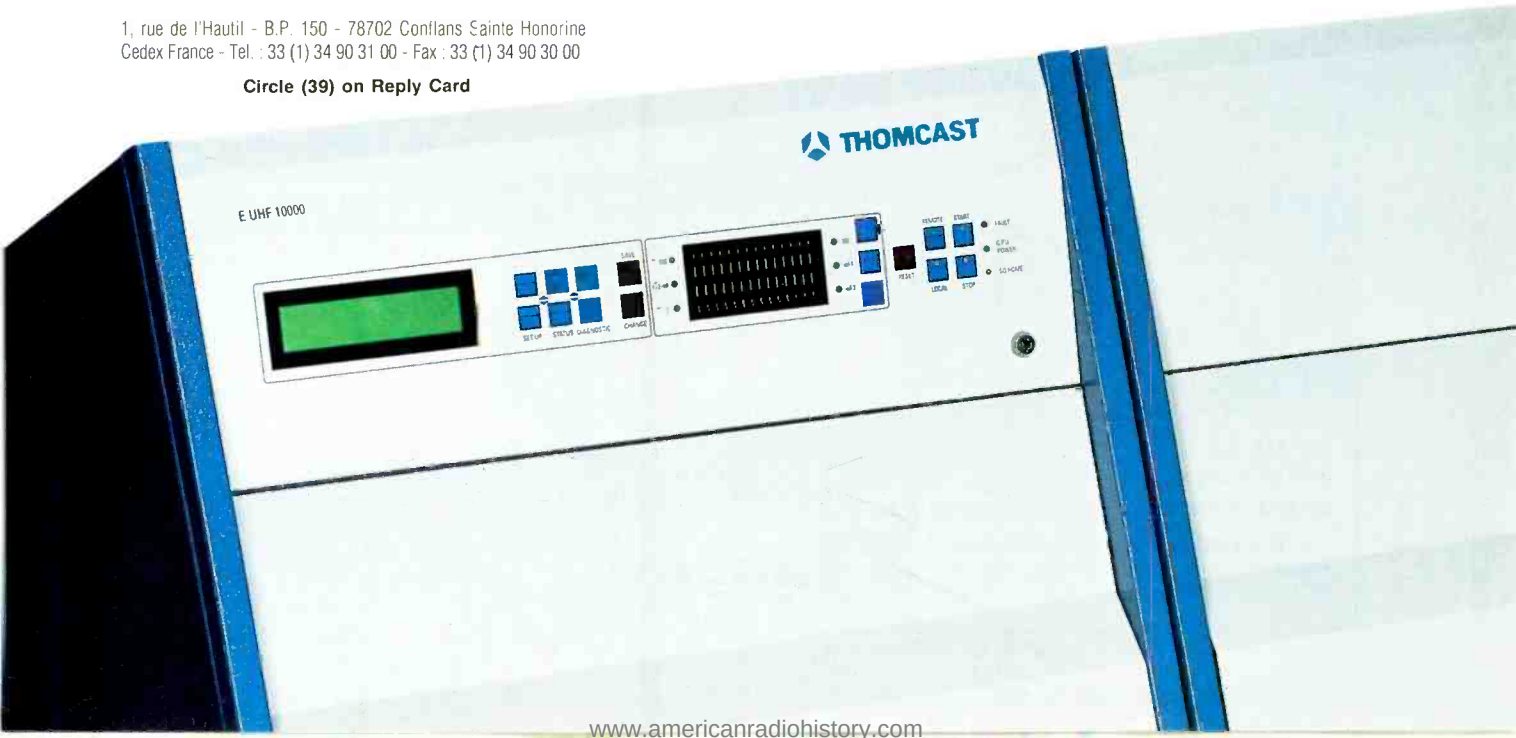


total marketplace, a tremendous amount of money. The top 50 market TV stations plan to spend $520,914 on equipment in 1994. The 51 to 100 stations' budget is $246,406, and the below top 100-market TV station equipment budget is $135,228.

When asked whether their equipment maintenance budgets were sufficient to meet their needs, almost 62% replied yes. Last year, 57% answered yes to that question. More FM stations are satisfied with their equipment budgets than are AM stations.

The TV stations see things differently. Measured overall, only half of the TV stations see their equipment budgets as adequate. The top 10 market response was the same (50%). The small market stations were less satisfied, with 46% of them calling their equipment budgets adequate.

Shopping list

Enough of the big picture. What do stations want to buy? Table 1 lists the 16 equipment categories used in the survey. The radio results represent combined data for AM and FM stations measured across all markets. The TV data also is based on all markets combined.

When stations want to buy equipment, they often see conventions as the best place to review the options.

Radio stations want audio recorders and players (46%). The next most desired items are close in popularity: microphones (34%), test equipment (30%) and signal processing equipment (29%).

Not surprisingly, TV stations have different priorities. Monitors and videotape recorders are the most sought-after items in this year's survey. More than half of all respondents indicated plans to purchase such equipment. The next most desired categories of equipment were test and measurement (46%) and cameras (41%).

Engineers should be happy with the results of this year's survey. A very good year has just begun.

Convention attendance

When stations want to buy equipment, they often see conventions as the best place to review the options. Of those planning to attend any convention, 59% selected the spring NAB followed by 51% for the fall show. It should be noted, however, that two-thirds of the survey's radio respondents said that they would not be attending any convention.

Almost 48% of the TV respondents plan to attend some convention in 1994, with the spring NAB show being the most popular (89%). That percentage runs fairly constant across all market sizes. It is interesting to note that fewer than one-third of the TV respondents indicated any desire to attend the fall broadcast show. We're interested to see how that is reflected in attendance for the combined SBE/RTNDA/SMPTE/NAB fall show.

Spend, spend, spend

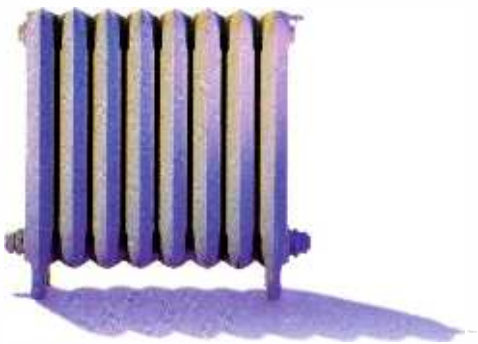
Engineers should be happy with the results of this year's survey. Budgets are up and stations are planning upgrades. Now is the time for stations to plan their 1994 purchases. TV stations will be looking for hardware that can carry them forward to the advanced TV era of 16:9 and even HD. Fortunately, many manufacturers are ready with solutions to the transition dilemma.

Although radio station engineers don't face the same time bomb scenario of HD, they too have to purchase carefully for the future. With DAB and cable radio around the corner, now is the time for radio stations to upgrade their RF and audio chains.

In 1966, Frank Sinatra released the song, "It Was a Very Good Year." In the song, he sings of the different periods of his life that were special and good. Well, it looks like it's time to sing it again. A very good year has just begun.

Acknowledgment: Appreciation is expressed to Dataworld and the M Street Directory for their help in preparing this article.

Editor's note: The complete survey is available in bound form from Intertec Publishing. It contains more than 30 pages of tabular data from the survey. Detailed spending plans, convention attendance and purchasing authority are included in the results. Copies of the directory are available for $150. Contact Renee Hambleton for more information at 913-967-1732 or fax her at 913-967-1735. ■



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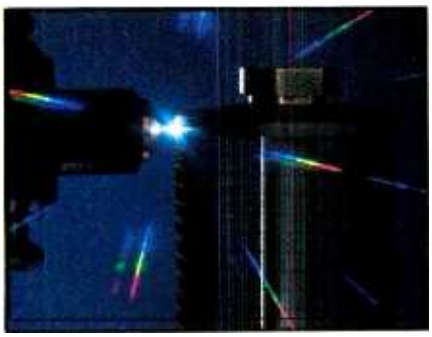
Magni Signal Creator



By Phil Dunk and Adrian Tuckwell

One of the keys to a successful manufactured product is quality control. In the case of professional videotape recorders, that process is intensive. A zero-defect production process is highly desirable and also required by today's customers.

A zero-defect production process is highly desirable and also required by today's customers.

In the case of Sony Broadcast International's Basingstoke, UK, manufacturing site, the desire to produce zero-defect products resulted in the adoption of a completely automated quality-assurance (QA) testing system. The first-of-its-kind automated QA test suite is now a key ingredient in the quality measurement process for VTRs, audio products and cameras (including CCUs) built in the plant. The process adopted in this manufacturing facility also can be adapted to other video facilities that operate a large number of videotape recorders. This article will describe how the automated testing system works and show that it could be similarly adopted in video production facilities.

ATS, a worldwide QA standard

A new process, the automated testing station (ATS), was adopted as the preferred QA testing methodology first at Basingstoke and later for worldwide manufacturing plants. Like many of Sony's facilities, Basingstoke had relied on costly, monolithic systems to handle specification testing. Measurements typically involved dedicated functions, routinely taking several hours to execute. The ATS, built around the latest test equipment, promised to reduce testing time to minutes. The greatly reduced cost of this equipment meant Basingstoke could achieve consistent, high-quality testing at acceptable budget levels.

The ATS is designed to provide fast, efficient checks of key product performance specifications. It relies on a networked workstation providing consistent measurement of all parameters; once a measurement path is defined for a product, every unit is measured in the same way every time.

Specific capabilities of the ATS include the ability to perform a variety of video measurements (in either PAL or component) without having to change equipment or wiring. Multiple video formats are supported, including Betacam, D-1 and D-2, parallel and serial. Audio measurements include analog and digital formats, and allow the system to incrementally monitor up to 100 channels. Such performance is important, for example, when testing the 48 channels of a PCM-3348 digital multitrack recorder.

Configuration and operation

The ATS equipment setup includes a personal computer with VGA display, the Magni Signal Creator, a Tektronix VM700A video analyzer, an Audio Precision System 1 audio test generator and Signal Management's RF coax relay switchers.

In operation, the PC and VGA display comprise the workstation from which operators enter and verify product data and control the testing equipment. Testing procedures are selected from the engineering PC network by menu and continuously loop until complete. PC software automatically calculates measurement values and reports PASS/FAIL status on every product undergoing a test. Following notification, the operator can initiate testing of a similar unit or select another product model for evaluation. Units that fail are returned for repair, accompanied by a hard copy report of the test results. In addition, test data on all products is archived on disk, facilitating further analysis. The test results are used to address customer questions on product performance and provide feedback on the impact of product modifications or enhancements.

Custom test signal generation capability

A key ingredient to the successful implementation of the test system was Magni's Signal Creator. The 1/2-rack unit provides the ability to generate signals for most TV formats and standards, and to quickly change from one signal set to another without cumbersome hardware or com-

Dunk and Tuckwell are QA principal engineer and QA engineer, respectively, for Sony Broadcast International, Basingstoke, United Kingdom.

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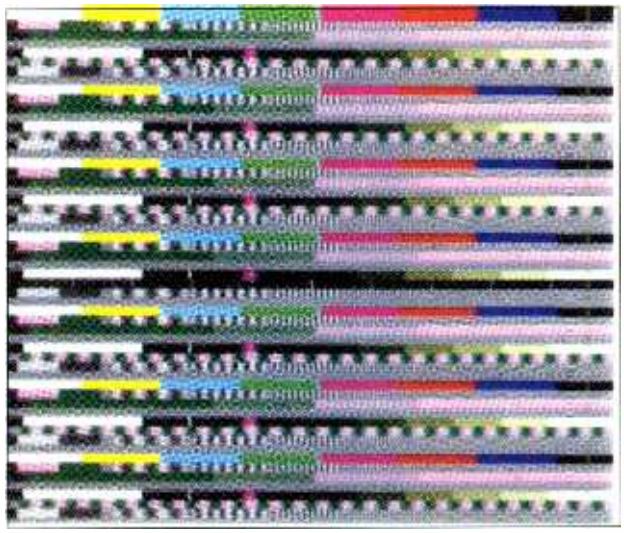

Figure 1. The component version of the Multiple Matrix Test Signal.

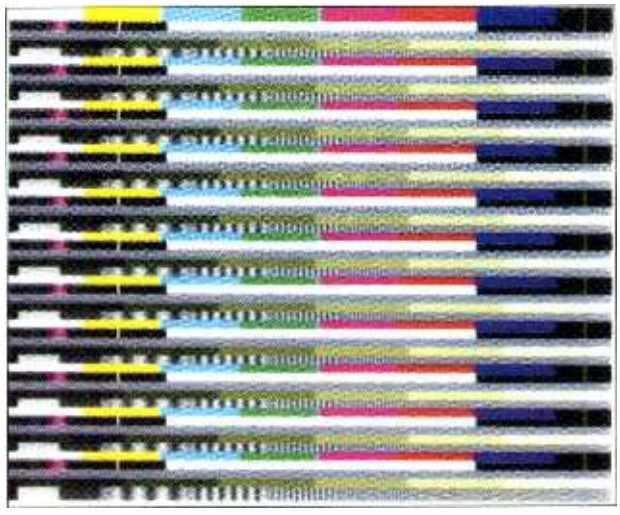

Figure 2. The Multiple Matrix Test Signal for use with composite systems.

plex reprogramming.

Also important to the test process is the generator's ability to create specialized test signals. This feature allows the production of custom Multiple Matrix Test Signals (patents pending). These include one test signal for composite and another for component formats. The signals consist of color bars, multiburst, modulated ramp, pulse and bar and other signals required for specification measurement. A custom signal, combined with the video analyzer's block mode measurement capability, allows the ATS to execute a series of measurements with a single command.

The signals consist of color bars, multiburst ramp, pulse and bar and other signals required for specification measurement.

In another instance, the generator is used to customize multiburst waveforms to include frequency packets specialized for different product models. These custom signals were created in a matter of minutes using the software supplied with the Signal Creator. With this capability, a new generator need not be

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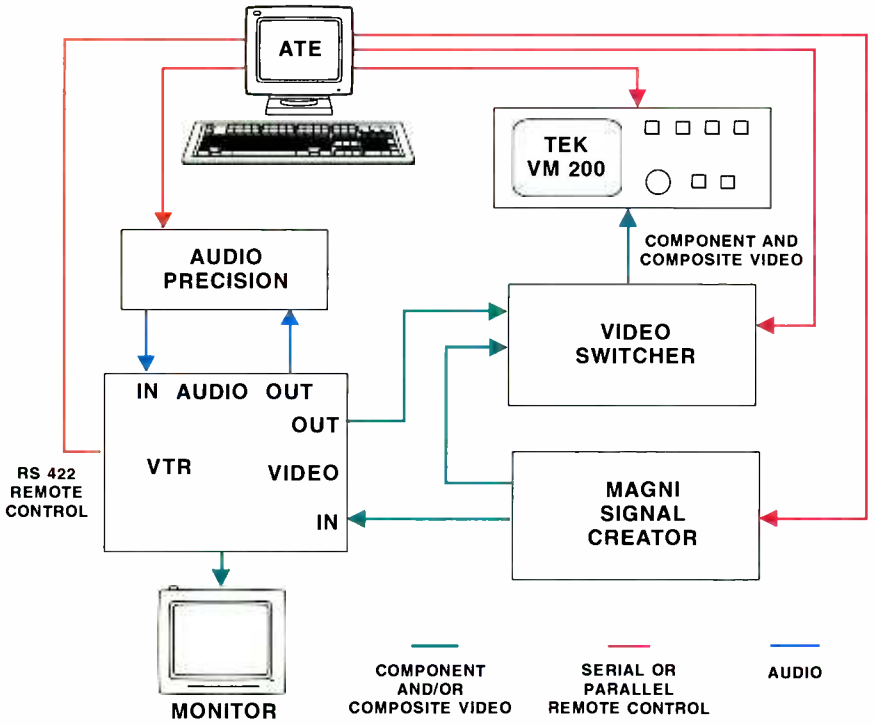


Figure 3. *Simplified block diagram of the setup for tape machine testing. D/A and A/D converters are added for testing digital equipment.*

purchased each time a new or special signal requirement arises.

Operating features and attributes

A key to the effective operation lies in the Signal Creator's ability to be RS-232 controlled. Also, manual operation of the generator is straightforward and simple. The front-panel display and push-button combination simplifies signal selection, parameter setting and the selection of additional menus for test signal generation.

Testing procedures are selected from the engineering PC network by menu and continuously loop until complete.

Memory recalls allow the changing of multiple generator settings with a single button (for example, transferring entire signal sets from a memory card). Memory recalls also can be accessed remotely under RS-232 control. This recall capability will become increasingly important as signal set libraries are expanded to accommodate the testing of new products.

Other features include timeable blackburst, which provides the timing and reference for video inputs to switchers under test. Furthermore, the system can act as an independent analog and digital test signal generator for testing analog and digital VTRs.

Network and database implementation

A Novell network interconnects the manufacturing facility's five ATS stations. It provides the seven QA test engineers with access to any ATS suite from their individual PCs. The immediate benefit of the network is that test engineers can improve existing test procedures or create new ones from their PCs, which avoids interrupting an ATS to make a change. The network also provides database capability for storage of all testing procedures and results, contributing to long-term analysis of test data.

The Signal Creator integrates easily into a network environment. It can generate virtually any video format needed and allows signal sets to be changed instantly, as required by the various test engineers. In addition, it potentially gives network users access to the capabilities of one analog test signal generator and three digital generators all in one device.

The Signal Creator's ability to produce custom test signals, particularly Sony's Multiple Matrix Test Signal, precludes the need to reprogram existing test signal generators and simplifies the testing of an array of audio and video products. ■

➡ *For more information on the Magni Signal Creator, circle (311) on the Reply Card.*

International News continued from page 4

in 1994 and beyond. Scheduled radio broadcasting will cease no later than March 31, 1994, and VOA's presence in Belize will end no later than Sept. 30, 1994.

The relay station is located at Orange Point on the Gulf of Honduras to the southwest of Punta Gorda, Belize. It transmits programs originating in Washington, DC, in Spanish and English to Honduras and Guatemala. The station occupys approximately 240 acres leased from the Belize government. It is equipped with two 100kW medium-wave transmitters, two directional antenna arrays, an on-site diesel power plant, satellite terminal equipment and control and monitoring equipment.

Plans are to determine if there is interest in acquiring the VOA facilities, including the buildings, power generating and distribution systems, radio transmitters and antennas. Although currently employed for medium-wave broadcasting, the site also has the potential for use as a short-wave or FM station.

Sale is the preferred method of disposal, but a lease or a lease-to-purchase arrangement may be considered. Any arrangement with a new tenant is subject to approval of the Belize government.

The offer to sell the VOA facilities does not include the land, nor any right or license to broadcast radio signals from that location. A separate agreement must be concluded between the Belize government and any new tenant for land lease fees, broadcasting license and frequency authorizations.

All inquiries should be addressed to the Washington offices of VOA; phone 202-619-2538.

National News

SMPTE to hold imaging conference

The Society of Motion Picture and Television Engineers (SMPTE) will hold its annual Advanced Television and Electronic Imaging Conference at Chicago's downtown Marriott Hotel, Feb. 3-5.

The 1-day tutorial on "Compression: Expectations and Realities," will introduce the conference on Feb. 3. On Feb. 4 and 5, a 2-day program of technical sessions will be presented.

The reception and luncheon will be held at the Marriott on Feb. 4 at noon. The luncheon ticket will be included with the registration packet. Registrants also will receive a copy of the proceedings.

SMPTE hosts all-day tutorial

SMPTE will host an all-day tutorial called "Pixels, Pictures and Perception: The Differences and Similarities Between Computer Imagery, Film and Video" to be held at New York City's Fashion Institute of Technology on March 5.

An international team of presenters will be led by Charles Poynton of Sun Microsystems. Advance registration is $35 for SMPTE members, $125 for non-members, $25 for student members and $60 for student non-members. For more information, contact Linda Young at 212-757-4580, extension 680; fax 212-333-7647.

HDTV Grand Alliance makes key technology decisions

The Digital HDTV Grand Alliance (GA) has announced a series of technology decisions on key building blocks that will make up the digital high-definition TV system being proposed to the FCC.

The technologies selected – for digital video compression, transport, scanning formats and audio technology – reflect the GA's commitment to excellence and responsiveness to the needs and concerns of consumers, broadcasters, cable operators, computer interests and the telecommunications industry.

Representatives of the alliance presented the technologies to the Technical Subgroup of the FCC's Advisory Committee on Advanced Television Service, which endorsed the technology decisions. The technology decisions incorporate modifications of the GA system that had been recommended earlier by the Technical Subgroup.

Following approval, the alliance can proceed with construction of most aspects of the prototype system.

The video compression and transport technologies selected by the GA are based on proposed international MPEG-2 standards. The scanning formats are focused on computer-friendly progressive scanning, while offering an interlaced mode.

The audio technology is a 6-channel, compact-disc-quality digital surround sound system. The broadcast and cable transmission subsystem decision is expected early this year. ■

Continued from page 35

many of which were shared. The path was too long for 13GHz so the choice had to be 7GHz. Late at night, we coordinated with the other stations involved and tested each channel while everyone watched for interference. A channel was selected and the data was made available to another station wanting a backhaul from the site. With a possible frequency in mind, the equipment was ordered. Several frequencies were tested with the actual fixed transmitters and channel filters. The testing, although expensive, alleviated everyone's fears of interference to their STL. To be good neighbors, minimum transmit power was used. Category A dishes on both ends and minimum line loss helped to lower the power requirements. Waveguide was used on the transmit end.

The receiver was placed on a platform at 800 feet and required only 35 feet of waveguide. Fiber was already installed in a weatherproof housing on the tower. Baseband from the receiver was fed into the fiber, down the tower, underground 1,100 feet to the studio and demodulated in the tech center. The system worked the first time with no interference, even though three stations were within the beamwidth of an older 4-foot dish.

With an eye on expansion, a touchscreen controller made by Troll Technology was used to control the system. The touchscreen gave direct AGC readings, could store several headings, required only a phone line for control, and was software programmable. The screen is intuitive, and learning the system required only a few minutes by experienced operators. Because this is the only system being controlled, it is fast. However, if it was controlling several antennas, the time to change screens might become a factor when handling multiple locations in a short period. For those with a tower camera, the Troll System will operate the camera as it does an antenna. A more expensive color system actually displays a picture within the control screen (in color) to allow positioning of the camera or the antenna.

Conclusion

This article is not a how-to-do-it piece. Its purpose is to describe how some ideas can be used to enhance the art of ENG. We all face the possibility of adjacent-channel interference or pre-amp overload. We have all lost live shots that were perfect until the "other guys" fired up. The $2,100 filter installation has saved many shots and is well worth the money. The use of fiber optics eliminates many possible problems for long runs of signal, and it is definitely less expensive than a thousand feet of waveguide.

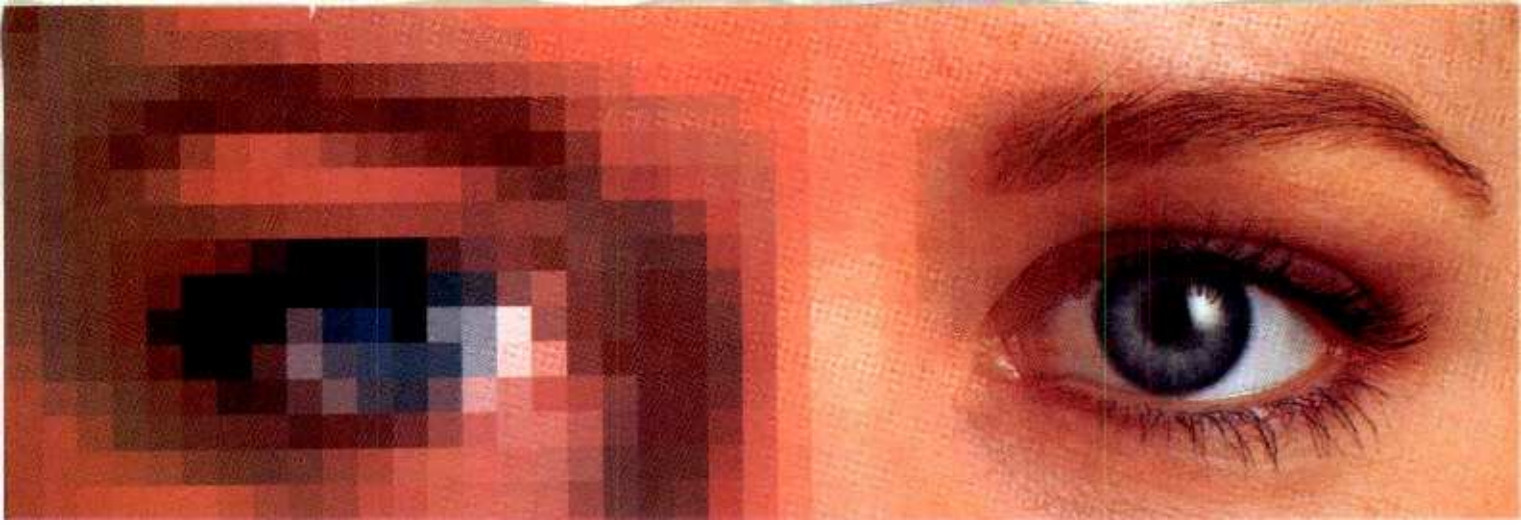
➡ *For more information on ENG systems, circle (301) on the Reply Card. Also see the "RF/Radio" products section, pp. 66-70 of the 1994 BE Buyers Guide.*

Antenna tracking systems

For those not familiar with antenna tracking systems, here's a quick look at control systems for the transmit and receive antennas. NavTrack or LogicTrack (on the aircraft) operate by sensing the location of the aircraft via its own navigation systems, such as GPS or Loran C. The location information is fed to the antenna controller, where it is processed and used to point the directional transmit antenna toward the receive antenna. The receive antenna location is programmed into the antenna controller. In the case of multiple receive sites, the proper site is manually selected in the aircraft. As the aircraft flies, the transmit antenna remains fixed on the receive antenna. The system is practical for omnidirectional or 90° horn-type receive antennas.

A method of tracking the aircraft from the receive site also is needed. If the directional antenna control information from the aircraft could be sent to the receive site, the information could be reversed and used to determine where to point a high-gain directional dish. In fact, that's how it's done. The datastream from the aircraft to the transmit antenna is fed to a modem, which converts the digital data into audio tones. The tones are placed on a third audio subcarrier, which is fed to the receive site along with program video and audio. The data is recovered, then the reverse direction is computed and passed to the dish controllers. Human operators on the ground and in the aircraft must establish the first link via radio to enable the data recovery to begin. Once the path is established, the helicopter antenna always looks toward the receive site and constantly tells the receive dish where to look. (The vertical pattern of both antennas is broad enough to correct for altitude variations of the aircraft.)

The RF tracking system (SuperTrack) uses a system of RF level and phase sensing to determine the direction of an incoming signal. The controller constantly tries to keep the signal peaked. The system works, although it will track a reflection as well as the main beam. It is quite a sight to see the receive tracking antenna look around in the RF sensing mode until it finds the aircraft signal, peak up and then be switched to LogicTracking.



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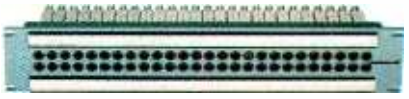

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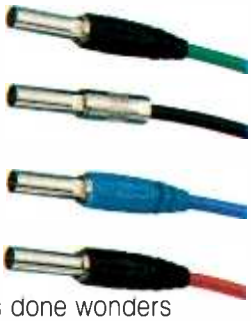

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Circle (49) on Reply Card

New Products

Wireless system
By Vega

• **VegaNet**: first wireless mic system with network capabilities; allows easy control and monitoring of compatible Vega wireless microphone systems from Macintosh and IBM-compatible computers; non-proprietary; hardware is fully modular; software and firmware programmable to adapt to changing requirements and evolving industry standards; features remote control and monitoring for wireless microphones; open, multiple-vendor systems; and industry standard architecture (Lone Wolf MediaLink and AES SC 10-2).

Circle (350) on Reply Card

UHF wireless receiver
By Vega

• **R-662B PRO PLUS**: true diversity UHF wireless receiver; includes remotely controlled frequency selection, muting and forced diversity selection via the control and monitoring interface connector; monitored functions include the currently selected diversity channel, squelch condition, RF signal levels for both diversity channels, audio overload; modulation, power condition and audio output to the XLR connector; accessories include wideband diversity multicouplers, wideband line amplifiers, a variety of antennas, rackmount kits, carrying cases and network components; features LAN interface capability.

Circle (351) on Reply Card

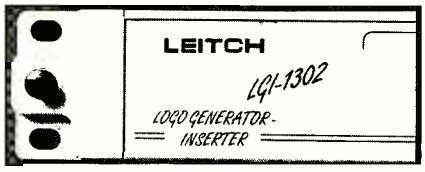
Analog audio mixing systems
By Euphonix

• **CS2000 and CSII**: digitally controlled analog audio mixing systems; SnapShot Recall makes it possible to instantly recall every console setting; offer Total Automation of all controls and switches to code; CS2000 is fully modular and may be expanded even after installation; the frame acts as a platform into which future feature options can easily be added; CSII has a strong but lightweight design; it is suitable for applications where size and portability are critical; each channel strip has many conventional controls, such as the faders pan/bal controls, aux send and input gain controls.

Circle (352) on Reply Card

Logo generator/inserter
By Leitch

• **LGI-1302N**: inexpensive 1RU device that displays and keys a logo over standard NTSC video; the logos serve to identify programming during normal broadcasts



and to "tag" material to help prevent unauthorized use; features a production-quality linear keyer to ensure clean, transparent keys; image quality is ensured by the digital storage of all four fields and the associated key signal in non-volatile EPROM memory; key in and out transition rates are independently adjustable, and remote key control is provided via a simple contact closure input.

Circle (354) on Reply Card

Handbook
By Audio Precision

• **Audio Measurement Handbook**: 188-page book relevant to any good-quality audio test instruments; 96 figures and numerous tables help illustrate concepts from basic frequency response, distortion and noise measurements to DSP- and FFT-based techniques; no mathematics beyond simple algebra are used; includes a 22-page glossary of abbreviations, acronyms and names of standards-setting organizations used in the field; the first section of the handbook describes the measurement tools and techniques used in audio testing; the second section describes applications of those techniques to commonly tested audio devices and provides ranges of commonly expected results from those devices; the book is thoroughly indexed.

Circle (355) on Reply Card

Master clock
By ESE

• **ES-180A**: includes several software and hardware enhancements, which include an improved accuracy to +/-2.5ms of UTC when locked and <10ms/day drift when WWV is not present; other enhancements include the ability to query the RS-232 output as often as 20 times per second and a larger 0.56-inch front-panel LED display; can drive more than 100 digital slave displays; other standard features include five frequency scanning, automatic "2:00 a.m." DST correction, battery backup, RS-232C output, 1pps and a.m/p.m. indication.

Circle (356) on Reply Card

Encoder/decoder board
By Broadcast Video Systems

• **VBI-232**: plugs directly into a Grass Valley Group or Leitch Video DA frame; inserts RS-232 data directly from a PC into a user-selectable line in the VBI of a looped-through video signal; the matching decoder board extracts data at the destination; an optional relay board is available that occupies an adjacent slot in the DA frame and provides eight contact closures; up to eight relays can be driven from one decoder; optional 8-button control system available.

Circle (357) on Reply Card

NTSC/PAL vectorscope
By Leader Instruments

• **Model 5212**: features 3-channel operation with overlay display of all three channels plus burst of the external reference, if used; Y/C monitoring is possible; phase may be set automatically; on-screen readouts include phase of designated vectors and differential gain and phase results; a simplified procedure for DG and DP measurements results in readout to two decimal places.

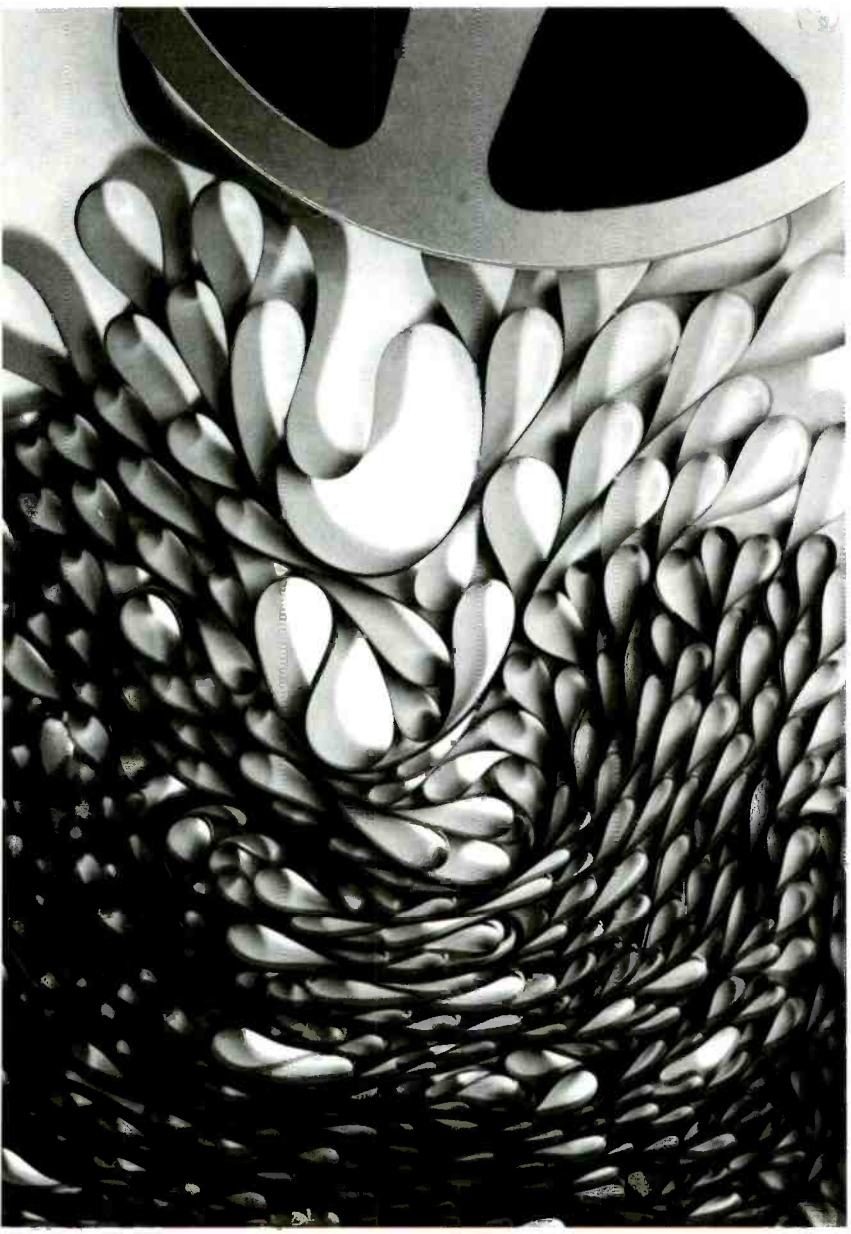
Circle (358) on Reply Card

Switch
By Commercial Video

• **ADF Switch**: designed for unattended operation in facilities that have a bulletin board or TD slide and use videotape sources for programming; can tell the difference between noise and video, and between solid video and the partial video that comes from a clogged head; recognizes an excessive length of time in black and defaults when that time has passed; if power to the switch is interrupted, the default input is selected; contained in a 5"x6"x3" metal enclosure; comes with a plug-in power supply; has two audio/video inputs and one audio/video output.

Circle (359) on Reply Card

UNREEL



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New Products

Scan converter
By D&A Dynamics

• **Translator-LC, Model TR-1200**: broadcast-quality, real-time digital scan converter with outputs simultaneously present in composite, Y/C (SVHS and Hi8) and RGB; stand-alone unit requires no software drivers or boards in the computer; automatically senses the presence of EGA, VGA, SVGA or Macintosh inputs and displays the current mode via front-panel LEDs; supports up to 800x600 resolution; supports 24-bit color boards.

Circle (360) on Reply Card

Digital audio mixer
By Sony

• **DMX-E2000**: cost-effective, one-piece digital audio mixer for video post-production applications; equipped with serial and parallel remote-control interface connectors, it supports Digital Betacam products; features 10 stereo inputs, two mix buses and 2-channel preview/monitoring; conforms to AES/EBU digital format; 16-channel inputs can be connected with up to four Digital Betacam players or other digital audio sources; additional 4-channel auxiliary inputs allow connection with other digital audio equipment; eight AES/EBU output connectors provide four sets of PGM buffered outputs, enabling the DMX-E2000 to supply program outputs to as many as four digital VTRs.

Circle (361) on Reply Card

Waveform/vector rasterizer
By Tektronix

• **WVR500**: combination monitor displays signals on a separate picture monitor; rasterizing instrument with display quality rivaling that of a CRT; measures 1/2-rack wide by 1-rack unit high; performs composite NTSC or PAL signal monitoring functions of a standard 2-input waveform/vector monitor; users can select a color indicator to serve as a visual alarm of any signal exceeding the 100IRE/700mV level; users also can choose a line select function to examine vertical interval test signals.

Circle (362) on Reply Card

S-VHS editing system
By Panasonic Broadcast & Television Systems Company

• **"S" series**: editing system comprised of the AG-7750H hi-fi editing VCR and the AG-7650H source player; features built-in 3-D-type TBCs; also features an RS-422A 9-pin serial interface to high-end professional edit system controllers, professionally balanced XLR connectors and an optional plug-in time-code generator/reader for LTC/VITC recording and playback.

Circle (363) on Reply Card

Analyzers
By Tektronix

• **Advantest R3762AH/R3763B**: vector network analyzers; combine performance from 300kHz to 3.6GHz; make measurements at up to 0.5ms per point; these measurement capabilities are combined with a responsible user interface; feature 10 markers per channel; relative distance between an active marker and any other marker can be displayed by pressing a single button; both instruments have the ability to automatically calculate and display values, such as center frequency, bandwidth at -XdB down, Q and shape factor; designed to function independently without the need for an instrument controller; include 52 32-bit macro commands that can be listed in various sequences to form specific measurement routines; contain an internal 3 1/2-inch disk drive, which stores up to 750kbytes.

Circle (364) on Reply Card

Transport system
By American Lightwave Systems

• **DV6010**: medium-capacity digital fiber transmission system for high-quality video transport applications, such as broadcast television; can transmit eight video channels in either one or two directions simultaneously; uses 10-bit uncompressed video technology; transmits all of the digital video and audio information in uncompressed format; available optionally in a fully redundant version, including hot standby switching capability; requires only 19 inches of vertical rack space; supports all of the video options of the DV6000 16-channel system, including 8-bit video encoding, IF carrier encoding and BTSC audio encoding.

Circle (365) on Reply Card

HD videocassette recorder
By BTS

• **DCR 6000**: first digital HD cassette recorder to comply to SMPTE D-6 format; use of transparent HD recording ensures top-quality complete images, eliminating risk of information loss; comprises two portable units, both of which are 40cm in height; transparent image data-recording format provides up to 64 minutes playing time on a single cassette; available in two HD production standards: 1250/50/2:1 (EU95) and 1125/60/2:1 (SMPTE 240M, 260M).

Circle (366) on Reply Card

Op-amps
By Elantec

• **EL2210/EL2211 and EL2410/EL2411**: EL2210 and El2211 are dual video op-amps;

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Circle (52) on Reply Card

New Products

EL2410 and EL2411 are quad versions; EL2210 and EL2410 operate at +/-5V supplies at a gain of +1 with 50MHz bandwidth; EL2211 and EL2411 operate at +/-5V at gain of +2 with 100MHz of bandwidth; El2210 and EL2410 drive a 150Ω load to +2V and -1V with 100MHz bandwidth; slew rate is 130V/microsecond; differential gain is specified as 0.07% and differential phase is specified as 0.15° for the EL2211 and EL2411.

Circle (369) on Reply Card

Degausser

By Garner Industries

• **Model CF750 Type II/Type II-A**: satisfies the Department of Defense specification for purging classified information from S-VHS cassettes; can erase 900Oe media to -90dB in 22 seconds; operates from a 120VAC outlet; can be mounted in a standard 19-inch rack or is available with an optional table-top cabinet; will also erase a variety of other cassette and cartridges, such as VHS, 3480s, DC 600s and 8mm.

Circle (370) on Reply Card

Digital compositing device

By Ultimatte

• **Ultimatte 7**: conforms to CCIR Rec. 601 standards; inputs and outputs are serial D-1 with auto selectable 525/625 line standards; can operate in 8 or 10 bits; internal processing is accomplished in 4:4:4; other features include gray balance, improved matte density controls and cleanup threshold; manual peak detection is available so that peaks can be generated based on critical areas of the picture; includes SMPTE RS-422 editor interface.

Circle (371) on Reply Card

Digital recording/editing system

By Solid State Logic

• **ScreenSound V5**: features a faster processor, higher resolution screen graphics, an extended range of editing options, extended audio Autoconform options and new audio reconform capability; offers a random access video option that provides dual standard 525- or 625-line operation.

Circle (372) on Reply Card

Satellite resource management system

By Alamar

• **SPS-100**: automates satellite downlink broadcast operations; maintains a database for satellite resources, VTRs, switchers and scheduling; the antenna database tracks up to 256 different antenna positions and the receiver database tracks an equal number of receivers of all manufacturers; the satellite database provides access for up to 256 different satellites; the feed database defines the specific parameters used to receive each satellite feed, including the satellite name, transponder number and audio subcarriers; the machine database tracks up to 64 VTRs and laser recorders of all formats and the switcher database tracks multiple destination buses on strip and routing switchers; the satellite schedule database is used to determine when, how often and with what resources a satellite feed is to be received.

Circle (373) on Reply Card

C-band flyaway

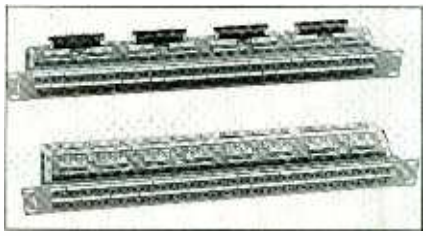
By Advent

• **Mantis**: portable system is compact and light enough to comply with IATA baggage regulations; incorporates the same features as the Ku-band Mantis; features a 1.9m segmented antenna, plus eight identical and interchangeable high-strength aluminum segments; wasp-waisted mount provides structural rigidity; the mount can be deployed and leveled on a variety of terrains, and its large base area allows the system to be operated in high winds without the need for ballast and guy ropes.

Circle (374) on Reply Card

Patchbay

By Connectronics Corporation



• **JB9600**: 96-point Bantam/TT patchbay; 1 RU high; series of DIP switches on the rear give the option of any vertical pair of connectors being set to a full normalled, half normalled or straight-through configuration; available in two types: the "H" version, which is designed for hardwiring, and the "D" version, which is terminated by means of cable assemblies using a 37 pin D subminiature connector.

Circle (375) on Reply Card

Software

By Horizons Technology

• **Power!Video**: compression playback software; allows playback of full-motion

New Products

video compressed using the TrueMotion algorithm under Microsoft Windows 3.1.

Circle (376) on Reply Card

Time domain reflectometer

By Riser-Bond Instruments

• **Model 1205**: low-cost, compact, multipurpose cable fault locator for field testing metallic paired cables; features RS-232 serial output port for computer interface that allows stored waveforms to be downloaded to a PC for post-storage evaluation and analysis; automatic and manual dual cursor operation allows measurement between any two points on the waveform; automatically calculates and displays return loss measurements and distance to the fault.

Circle (377) on Reply Card

Optional module

By Getris

• **16/9 module**: available on Venice and Eclipse; allows user to create video images on the Paint system in the 16:9 aspect ratio on a traditional 625/50/2 signal, preserving all the features of the Paint module.

Circle (378) on Reply Card

ENG package

By Nucomm

• **PT3**: portable ENG microwave package; features 2GHz, 2W transmitter; 12W mast-mounted amplifier; rack-mounted power supply/controller and silhouette antenna; available with 4W or 12W of output power; optional internal signal generator can be installed with SMPTE color bars and ID; power supply/controller features a digital output power meter, antenna polarization switch and power output control.

Circle (379) on Reply Card

Digital input/output module

By Orban

• **Digital input/output mdoule**: for the DSE 7000 digital sound editor; provides universal sample rate conversion for AES/EBU and SPDIF digital formats and digital effects sends as well as synchronization to video and word clock signals.

Circle (380) on Reply Card ■

Industry Briefs

BUSINESS SCENE

Sony, Montvale, NJ, has installed a DVS-6000 digital composite switcher at North By Northwest's post-production facility in Boise, ID.

In addition, WABC-TV, New York, has replaced its tube-based studio cameras with five 3-CCD cameras.

Panasonic Broadcast & Television Systems Company, Secaucus, NJ, has sold 19 EnHanced Series MII VTRs to the University of Houston.

Pioneer New Media Technologies' (Upper Saddle River, NJ) system integrator, Media Touch Systems, Salem, NH, has delivered 34 additional Pioneer CAC-V3200 300-disc CD autochangers to Digital Cable Radio, Horsham, PA, for a total of 69 units.

Solid State Logic, Oxford, England, has installed an SSL Scenaria digital audio/video production system at Tonstudios Z, Zurich, Switzerland. Pro Ton Studio, also headquartered in Zurich, Switzerland, has purchased an SSL Scenaria as well.

The Japanese National Broadcaster NHK, Tokyo, has ordered three SSL Scenaria digital audio/video production systems for installation in its local studios.

Louth Automation, Menlo Park, CA, has delivered an ADC-100 to KHNL-TV studios in Honolulu.

Alpha Image, a member of Dynatech Video Group, Madison, WI, has sold an Alpha 500 component digital production switcher to ABC, Los Angeles.

Also, KULR-TV, Billings, MT, has installed a DigiStore system, the digital tapeless playback system from D^2S^2, a member of Dynatech Video Group. Prime Network, Tamworth, Australia, has purchased a Digistore system as well.

Dynatech Newstar has installed its Newstar II newsroom automation system at Asia Business News, Singapore.

Strassner Editing Systems, North Hollywood, CA, has delivered an SES-2015 with advanced PRO software to California Communications, Hollywood.

In addition, WCSH-TV, Portland, ME, WLBZ-TV, Bangor, ME, and KNME-TV, Albuquerque, NM, have purchased Strassner editing systems.

Quantel, Darien, CT, has sold a Hal digital compositing system to Pittard Sullivan Fitzgerald, Los Angeles.

Ampex, Redwood City, CA, has installed a DCT 700d tape drive at VDI Inc., Hollywood.

Vistek, Palo Alto, CA, has received an order for 100 4022 Varicomb decoders from Synelec USA, Scotts Valley, CA.

AVS, Northvale, NJ, has delivered a PRIME Motion Compensation standards converter to International Image Services, Toronto, Ontario, Canada.

Accom, Menlo Park, CA, has shipped an Axial 2020 visual on-line editing system to Editel, Los Angeles.

Denon America, Parsippany, NJ, has announced plans to extend the benefits of RDS data transmission to consumers in major metro radio markets.

Under the plan, Denon will cooperate with up to 40 FM broadcasters in providing RDS encoders in exchange for airing Denon advertising. The program's initial phase will include broadcasters in San Diego, Los Angeles, San Francisco and New York. More cities are being considered for the second phase of the program. The RDS encoders to be distributed under the program are made by RE Instruments, Cleveland.

DGS Pro Audio has been formed by Gotham Cable of Switzerland and Deltron Connectors of England. DGS, headquartered in Arlington, TX, will provide audio connectors, cables, stage boxes and assemblies for recording and broadcast professionals in the United States. The address is P.O. Box 170426, Arlington, TX 76003; phone 800-292-2834.

Dielectric Communications, Raymond, ME, has expanded its Raymond facility and consolidated all broadcast product manufacturing there. Manufacturing activities at the company's Gibbsboro, NJ, antenna facility will be relocated, but the company will continue to operate its test range there.

SOFTIMAGE, Montreal, has launched an International Value Added Dealer Network with several North American dealers already on the roster. The new dealers will team up with SOFTIMAGE direct sales force to facilitate effective worldwide distribution of the company's entire product line.

Getris Images, Cedex, France, has relocated its Los Angeles sales and demonstration facility. The address is 1680 N. Vine St., Suite 600, Hollywood, CA 90028; phone 213-954-3925; fax 213-463-7259.

Centrex Communications Corporation, Ramsey, NJ, has appointed representatives in Europe. The European team will be headed by John Tucker and will operate from the offices of John Drew Tucker Associates, London. To contact Centrex in the United Kingdom, call 44-737-556-809 or fax to 44-737-556-662.

Sony Electronic Business and Professional Products Group, Park Ridge, NJ, successfully completed a 5-month integration project to design, purchase, assemble and test production systems for renovation of the Ed Sullivan Theater.

The completed systems incorporated more than 2,500 individual products from more than 100 different suppliers, including more than $1 million in Sony products.

The project involved designing, engineering and building a facility comprised of an equipment center, and centers for live production audio, videotape operations, character generation/still-store, music mix, sound effects, audience and stage video monitoring, as well as editing suites for pre- and post-production.

The equipment included Sony BVM and PVM series monitors, BVW-75 and BVW-D265 Betacam SP VTRs, a BVX-100 digital decoder, BVX-D10 digital color correctors, a 24-track PCM-3324 DASH-format digital audio recorder and several 27-inch Sony Trinitron monitors.

Sundance Resources, Inc. (SRI), Dallas, has acquired a controlling interest in Lighthouse Digital Systems, Grass Valley, CA. Lighthouse (formerly Integrated Switching Systems) develops high-speed switching and routing systems designed to work with digital video equipment in video applications. Lighthouse will introduce the Pathfinder and SRX product lines this month.

Also, Lighthouse signed a licensing and technical assistance agreement with Hitachi Denshi of Japan. The company will provide Hitachi with designs for four products over the next three years. During this period, Hitachi will have exclusive marketing rights for these products in the Asian marketplace.

Game Creek Video Ltd., West Newton, MA, has acquired 100% of the assets of the mobile production division of Sure Shot Teleproductions and Transmissions Inc. The purchase included two 48-foot mobile production trailers and the business operations related to the trailers.

Sure Shot Transmissions and Mobile Uplink Inc. are not part of the transaction and will continue to operate as is.

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HDTV NEWSLETTER

September 26-28, 1994
Crystal Sands Resort
Hilton Head, SC

An Industry First.

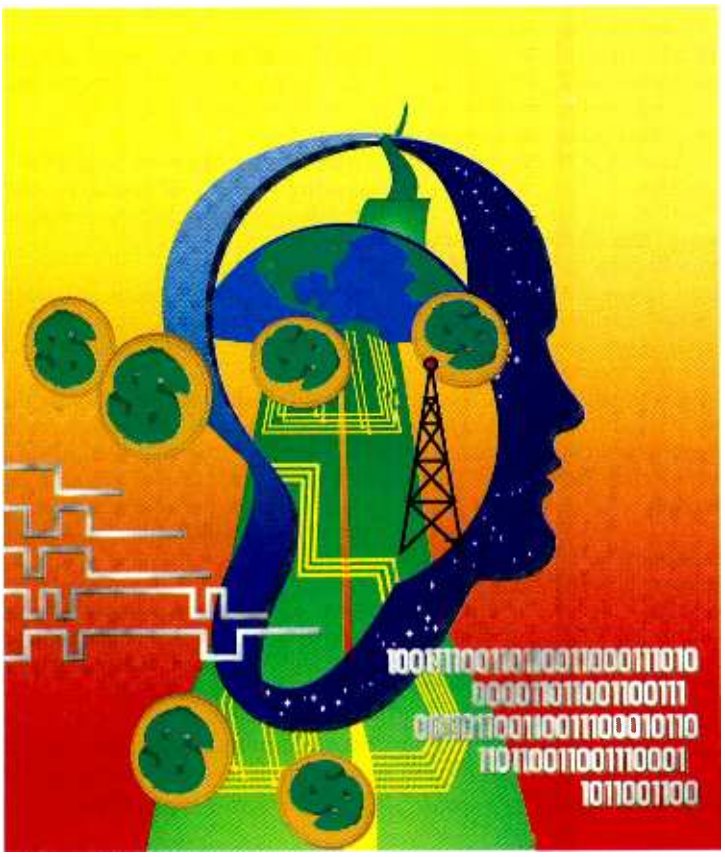
On September 26-28, the broadcast industry's top players will gather at beautiful Hilton Head to set the agenda for the high definition and digital future. Join us for what is sure to be big news—the first national forum to thoroughly air the views of everyone with a stake in HDTV, digital transmission, and our industry's place on the information highway.

Your Future is at Stake.

It's now absolutely critical to understand precisely how and when to incorporate advanced television and HDTV into your operation. Everyone who is responsible for planning, designing, engineering, budgeting and managing advanced television—or marketing its technologies and services—will benefit from this major event.

You'll learn how the industry's leaders are tackling the digital challenge. You'll discover new ways to build today for tomorrow's implementation. You'll learn how regulatory matters will impact your future, and that of our industry. And you'll find out how it is possible to survive in the new world of multimedia, DBS, cable and telco competition.

Plan now to attend. Mark it on your calendar. And fax us right away at 913/922-1408 to be included in all information mailings for this event.



Fax this page to 312/922-1408
Attn: Chris Lotesto
Or call Chris at 1-800-458-0479

I'm interested in this important event, "Advanced Television: Bit by Bit Into the Future." Please make sure I'm included in all the mailings.

Name

Title

Company

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Intertec Publishing, publishers of Broadcast Engineering and World Broadcast News and Advanced Television Publishing, publishers of the HDTV Newsletter.

Broadcast Engineering/Intertec Publishing,
9800 Metcalf, Overland Park, KS 66212

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Industry Briefs

Ensemble Designs, Grass Valley, CA, has delivered its Composite Digital Keyer to HMA Video. The unit works in conjunction with the facility's Grass Valley 200 switchers and allows animation, graphics or DVE passes to be built up with first-generation quality in successive pre-read passes on a D-2 edit master.

Pacific Data Images (PDI) has purchased eight SOFTIMAGE Creative Environment Systems with extended access to the company's new Digital Studio product. The transaction also includes a strategic agreemnt whereby SOFTIMAGE will work closely with PDI and provide access to development engineers to incorporate feedback into future research and development efforts.

Ultimatte's (Chatsworth, CA) Memory Head and Memory Head Utilities are being used on a new pilot series called *Viper.*

PEOPLE

Carl J. Yankowski has been named president and chief operating officer of Sony Electronics, Park Ridge, NJ.

Keith L. Andoos has joined A.F. Associates, Northvale, NJ, as manager of sales technical support.

Richard Farquhar has been appointed vice president of ProVideo Systems, Perrysburg, OH.

Joe Mack and **Mark Olingy** have been appointed to positions with Harris Allied, Quincy, IL. Mack is manager of systems sales and Olingy is studio systems sales engineer.

Ron Chubb has been named Western regional sales manager for Pinnacle Systems, Sunnyvale, CA.

Frank Massam has been appointed president of Siemens Audio, Bethel, CT.

Dan Rutman has joined Ashling Broadcast Group, WPGX-TV, Panama City, FL, as director of engineering.

Ken Barratt has retired as chairman of Sony Broadcast International, Basingstoke, England.

Thor Culverhouse and **Bill Denne** have been appointed as sales managers for TV products for Tektronix, Beaverton, OR.

Andy Sheldon has been named vice president-marketing at Pinnacle Systems, Sunnyvale, CA.

David Hughes is European manager for Ultimatte Corporation. He also is president of Video Graphics B.V., The Netherlands, which has been appointed as the exclusive representative company in Europe for Ultimatte.

Paul R. Basson and **Paul B. Madden** have been appointed to positions with Avid Technology, Tewksbury, MA. Basson is vice president, worldwide field operations. Madden is vice president, engineering.

Janine Masten and **Chris Alfiero** have been named to positions with Electro-Voice, Buchanan, MI. Masten is director of sales and marketing for professional sound reinforcement. Alfiero is market development manager for professional sound products.

Sherri Swingle has been appointed marketing administrator for Symetrix, Inc., Seattle.

Dr. Charles Huang, executive vice president, market research and business development for Anadigics has been elected as a Fellow of the Institute of Electrical and Electronics Engineers (IEEE). Huang was honored for his engineering contribution and technical leadership in the development of high-volume GaAs MMICs for commercial applications.

Paul Dempsey, Jim Slade, Lawrence Hackney, Lynn Regino and **Don McMahon** have been appointed to positions with Pioneer New Media Technologies new Cable and Broadcast Systems Group. Dempsey is vice president; Slade has been promoted to director, national sales; Hackney is Northeast regional sales manager; Regino has been promoted to assistant marketing manager and McMahon is marketing coordinator.

Debra Huttenburg and **Barry J. Cohen** have been appointed to positions with Andrew, Orland Park, IL. Huttenburg has been promoted to broadcast systems business unit manager. Cohen has expanded responsibilities as broadcast antenna products business unit manager, which include design, manufacture and marketing stragegy of the product line worldwide.

David E. Kress has been appointed vice president of marketing for Maxtec International Corporation, Chicago.

Michael C. Engle has been appointed vice president of marketing for Microwave Networks, Inc. (MNI), Houston.

Mishele Vieira has been promoted to operations manager for Xymox Systems, Granada Hills, CA.

Harlan R. May has been named president of Zenith Electronics Corporation's Cathode Ray Tube (CRT) Division, based in Melrose Park, IL.

Peter Sealey has been appointed president and chief operating officer of Interactive Network, Mountain View, CA.

Jeff Kelm has been named director of engineering for Vega, El Monte, CA.

Jim Bauer has joined Antec, Rolling Meadows, IL, as vice president, marketing, telecom.

Jim Christensen and **John Markey** have been appointed to positions with TV/COM International, San Diego. Christensen is director of program management. Markey is director of control systems engineering.

David Molinaro has been appointed Eastern regional sales manager for Wegener Communications, Duluth, GA.

Colin Brown has been appointed the managing director of Kodak's London-based digital imaging facility, Cinesite (Europe) Ltd.

Michael J. Martin has been named to the position of account manager, broadcast and Satcom for Comlink Systems Inc.

Richard E. Elliott, Jr., Martin de la Rosa and **Steven W. Richards** have been appointed positions with LeBLANC Communications Inc., Dallas. Elliott is sales manager, Dallas; de la Rosa is director of engineering; and Richards is quality assurance manager.

Mary Ann Fialkowski has been promoted to vice president of marketing and business development at Rank Video Services America, Los Angeles.

Dixon Representation, Inc. has been appointed sales representative for Prime Image's converter product lines. ■

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HELP WANTED

TV MAINTENANCE TECHNICIAN. Requires self-starter having experience in maintaining cameras, VTR's, VHF transmitter and satellite equipment. FCC license preferred. Send resume to: Marty Peshka, Maintenance Supervisor, WTNH, 8 Elm St., New Haven, CT 06510. EOE. 1-94-1x

NEW YORK TIMES OWNED UHF CBS AFFILIATE seeking studio engineer. Primary experience with Sony Beta and Betacart desired. Sony Technical School training a plus. Familiar with Grass Valley 100, 300, Abekas A53D, Harris Iris, Chyron 4200 and Scribe. Great benefits package and great city. Resume to: Chief Engineer, WHNT-TV, PO Box 19, Huntsville, AL 35801, EOE. 1-94-2x

AV/VIDEO EQUIPMENT SUPERVISOR. Major Global Investment Banking firm located in NY seeks an organized, detail-oriented individual to assume responsibility for Corporate Video and Audio Visual maintenance and facilities. Successful candidate will possess electronics background and superior trouble shooting skills. Ability to adjust and repair cameras, 1/2" and 3/4" recorders, audio and video duplication equipment, video/data/graphic projectors, AV equipment and integrated systems. Intermediate level component electronic repair skills necessary. Familiarity with computer based devices and above average computer literacy required. A minimum of 5 years experience in a supervisory position in TV/AV with a contractor or broadcast/cable entity, or broad exposure in all facets of BTV and Videoconferencing is required. FCC/SBE/CTS licenses or certifications a plus. Must have college degree, excellent written & verbal skills and exp to corp culture. We offer a comprehensive benefits package including major medical, dental & profit sharing. Applicants should send resume along with salary requirements to: Broadcast Engineering, Dept. 739, 9800 Metcalf, Overland Park, KS 66212-2215. 1-94-1x

TOP RATED STATIONS in #14 Market need top-rated Chief Engineer. Advanced technical and personal skills, very "hands-on", years of AM/FM, transmitter, studio and remote experience, concern for preventive maintenance and attention to detail a must. Competitive salary/benefits. Rush letter and resume to WBAB/WGBB, 555 Sunrise Highway, Long Island, NY 11704. EOE. 1-94-1x

SUPERVISORY ELECTRICAL ENGINEER, GS-0850-12: The United States Air Force Academy's (USAFA) Directorate of Educational Visuals is looking for an individual with basic and advanced knowledge of electrical and electronic theories and principles (minimum of a BA in Electrical Engineering). Needed are comprehensive knowledge of television station engineering to operate and maintain television studio equipment, and thorough knowledge of satellite downlink and uplink operations for distance learning and video teleconferencing. This position recommends, supervises and plans for communications technology within USAFA and serves as communications technology consultant, responsible for planning and managing all technological aspects of television broadcasting, satellite operations, cable television, interactive video, (to include videodisc and CD-ROM) multimedia, audio and computer technologies. Also required are well-developed leadership and management skills. This individual must have one year specialized experience equivalent to the GS-11 level. Candidates will be rated on the extent and quality of their experience and training based on their written statements contained in the SF-171, Application for Federal Employment. **Salary:** $44,327 per annum. **How to apply:** Cover letter must address qualifications as a professional engineer and experience in television station engineering, studio equipment, multimedia development and satellite downlink and uplink operations. **Send resume to:** HQ/DPSC, 8034 Edgerton Dr., Ste. 240, USAF Academy, CO 80840. **Who can apply:** Any citizen of the United States. **Closing Date:** 11 February 1994. THE FEDERAL GOVERNMENT IS AN EQUAL OPPORTUNITY EMPLOYER. 1-94-1x

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We have too many openings in the engineering depts. of broadcast stations & not nearly enough subscribers to fill them. Openings from coast to coast from entry level to seasoned chiefs needed in all aspects of broadcasting. 15 to 50 positions listed each week, all within a 4 week window. $20 for 4 weeks, $35 for 8. Call toll-free for info.
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LEITCH

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John Walter
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Leitch is an Equal Opportunity Employer

DIRECTOR OF COMMUNICATIONS TECHNOLOY: The Broadcasting Service, of Southern Illinois University at Carbondale, invites applications for a senior management position as the Director of Communications Technology. This position recommends, supervises and plans for communications technology within the Broadcasting Service, serves as a communications technology consultant to the academic and administratives units of SIUC, and is responsible for planning and managing all technological aspects of Broadcasting Service radio and television stations, satellite operations, cable television, interactive video and audio communications, and computer technologies. Duties include technological oversight of two PBS affiliated television stations (VHF[CH.8 and UHF-CH.16), and two NPR affiliated public radio stations (50,000 watt and 25,000 watt). We offer a real challenge and opportunity for professional growth, an excellent competitive salary with outstanding fringe benefits, and mild winters in a semi-rural setting at the edge of the Shawnee National Forest, only two hours from St. Louis. Minimum requirements include a Bachelors Degree in Electronic/Electrical Engineering, Communications Technology or a related field (Master's preferred), five years of communications technology management experience, and demonstrable knowledge and proficiency with broadcast and other high-technology communications. Also required are well-developed leadership and management skills. Send Letter of Application, Resume & 3 Letters of Professional Reference to: Lee D. O'Brien, Executive Director, Broadcasting Service, Southern Illinois University, Carbondale, Illinois-62901. Southern Illinois University is an Equal Opportunity/Affirmative Action Employer. Minority members and women are encouraged to apply. In your application, please indicate the source of this position notice. 1-94-1x

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Contact Renée Hambleton, at (913)967-1732, for information on frequency and pre-payment discounts. To place your classified ad send your order and materials to Broadcast Engineering, Classified Ad Mgr., P.O. Box 12901, Overland Park, KS 66212-2215.

Ad Index

Advertiser	Page Number	Reader Service Number	Hotline
Abekas Video Systems	33,35	19,20	415-369-5111
AcCetera	90	70	412-344-1520
Anthro Co.	34		503-241-7113
The Broadcast Store, Inc.	89	66	818-551-5858
Belar Electronics Laboratory	70	40	215-687-5550
Broadcast Video Systems, Ltd.	82	51	416-764-1584
BTS Broadcast TV Systems	13	10	800-962-4BTS
CCS Consultants	74	44	908-946-3800
Centennial Video Systems	16A		305-633-2200
Cheetah Systems, Inc.	74	45	800-829-2287
Cipher Digital, Inc.	90	68	301-695-0200
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JVC Professional Products, Co.	17	12	800-JVC-5825
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Leitch Incorporated	BC	3	800-231-9673
Lighthouse Digital Systems	47	29	916-272-8240
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Midwest Audio/Video Exchange	90	72	708-251-0001
Opamp Labs, Inc.	78	56	213-934-3566
Orban, Div. of AKG Acoustics	7	7	510-351-3500
Otari Corp.	63	37	415-341-5900
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Peirce-Phelps	16B		215-879-7220
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Polyphaser Corp.	55	33	800-325-7170
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QSI Systems, Inc.	84	53	603-893-7707
Rorke Data Inc.	83	52	800-328-8147
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Thomcast	69	39	
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