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**This Month:**

- Remotes from 45,000 feet
- Power-conditioning systems



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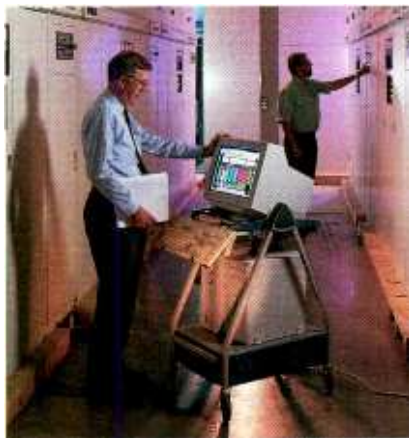
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**ON THE COVER:** A remote weather reporting system where the signal is MPEG-encoded by a FutureTel MPEGThere system. Image created by Douglas Schwartz, Santa Clara, CA, and Rick Der Photography, San Francisco.

BROADCAST ENGINEERING (ISSN 0007-1994) is published monthly (except semi-monthly in June and December) and mailed free to qualified persons by Intertec Publishing, 9800 Metcalf, Overland Park, KS 66212-2215. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address changes to Broadcast Engineering, P.O. Box 12902, Overland Park, KS 66282-2902. CORRESPONDENCE: Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2215. Phone: 913-341-1300; Edit. fax: 913-967-1905. Advert. fax: 913-967-1904. © 1996 by Intertec Publishing. All rights reserved.



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## Tower owners have to register towers

According to a new FCC plan, tower owners, rather than licensees of facilities located on them, will have to register their towers. The FCC is now the single point of contact for FCC or FAA business concerning towers.

Tower owners have primary responsibility for marking, monitoring lighting and maintenance. The FCC has developed a staggered schedule for existing tower owners to register over a 2-year period. Those applying for tower modifications or for new tower construction will begin registering July 1, 1996. For more detailed information, see this month's "FCC Update" on p. 8.

## Panasonic makes donation to The Museum of Television & Radio

The Panasonic Broadcast & Television Systems Company has donated video equipment to The Museum of Television & Radio in New York City. This donation will let the institution duplicate its extensive collection for its new West Coast facility in Los Angeles with no decrease in program quality. The new facility will open on March 18 and will be located at 465 North Beverly Drive, Beverly Hills, CA.

The museum is a non-profit organization founded by William S. Paley in 1975 to collect and preserve radio and TV programs and to make these programs available to the public.

Panasonic's equipment donation includes 10 AJ-D350 D-3 digital composite videotape recorders, 12 FT-2700 27-inch color video monitors, RAMSA audio mixing consoles, power amps and condenser microphones and two 51-inch Panasonic consumer projection televisions. The D-3 equipment will help in duplicating the New York archives and help in preservation efforts.

## ANSI proclaims SCTE as a standards developer

The American National Standards Institute (ANSI) has recognized the Society of Cable Telecommunications Engineers (SCTE) as a Standards Developing Organization (SDO) for the broadband telecommunications industry.

ANSI works with a variety of industries to determine that their proposed standards have been given due process and proper evaluation. According to SCTE president Bill Riker, the society can submit standards developed by its engineering subcommittees to ANSI. ANSI will certify that the industry

has had proper input in the development of SCTE-submitted technical standards. Upon ANSI approval, SCTE's standards will have increased credibility and visibility in the industry. This can assure their adoption and use by broadband telecommunications companies nationwide. The SCTE plans to submit 16 standards developed by its Interface Practices Subcommittee to ANSI for approval.

## WavePhore gets more patents

WavePhore has been allowed two additional patents by the United States Patent and Trademark Office. These are extensions of previously issued patents dealing with WavePhore's proprietary in-band transport of digital data within the NTSC TV signal. The two additional patents deal with transmitting data with video and transmitting data with dynamic data injection control.

WavePhore's advanced multimedia datacasting was recently approved for field testing by the National Data Broadcasting Committee (NDBC), a joint effort of the NAB and the EIA.

## Microsoft exec to speak at SMPTE Conference

SMPTE's 30th Advanced Motion Imaging Conference, to be held Feb. 1-3 in Seattle, WA, will feature speaker Steve Raney of Microsoft. He will address some of his company's relevant technologies associated with the conference theme, "The Convergence Continues... Computer Technology and Television."

The conference will also address the technologies that are changing the face of the motion-imaging industry and will feature a day-long course on an introduction to digital video.

For additional information, contact the SMPTE Marketing Department by phone at (914)761-1100 or by fax at (914)761-3114 or by E-mail at [mktg@smpte.org](mailto:mktg@smpte.org). More information can be found on the SMPTE home page on the web at <http://www.smpte.org>.

On another SMPTE note, 1996-1997 officers and governors have been announced. Mark S. Richer, PBS, is engineering vice president; Neil B. Feldman, Video Post & Transfer, is financial vice president; and Fung Fai Lam, Sony of Canada Ltd., is sections vice president. Edward P. Hobson II, Graham-Patten Systems, has been re-elected as conference vice president. Newly elected governors include Gary Teltscher, Astral Tech, Canadian region; Donald T. Adydan, Post Effects, Central region; Tho-

mas M. Jordan, Leitch, and Robert J. Ross, Westinghouse Broadcasting Corporation, Eastern region; Robert B. Kisor, Paramount Pictures and Gavin Schutz, Four Media Company, Hollywood region; Edgar A. Schuller, Entertainment Video Systems, New York region; Clyde D. Smite, Turner Entertainment Networks, Southern region; and Peter D. Symes, The Grass Valley Group, Western region.

## The Weather Channel creates interactive and on-line programming

The Weather Channel and Time Inc. are creating and distributing interactive programming for a series of ventures launched by Time Inc. New Media Division.

TV programming from The Weather Channel appears on The News Exchange, Time Inc. New Media's news and information service on Time Warner Cable's Full Service Network (FSN) in Orlando, FL.

As part of the service, viewers will be able to view on-demand local, regional and national weather that is produced by The Weather Channel. The News Exchange provides customized news and information selected by cable subscribers.

The Weather Channel will also provide global forecast information, maps and graphics to the Pathfinder Weather Center. This feature is located on Time Warner's web site at <http://pathfinder.com>.

## SMPTE welcomes international section

The Society of Motion Picture and Television Engineers (SMPTE) has formed its 28th section worldwide. The society inaugurated the Hong Kong section during a reception at the Park Hotel at Tsim Sha Tsui, in Hong Kong.

Michael Cheng and his group from AV Technology formed the section because international cooperation is important to SMPTE in its standardization efforts. ■

### CONFERENCE CALENDAR

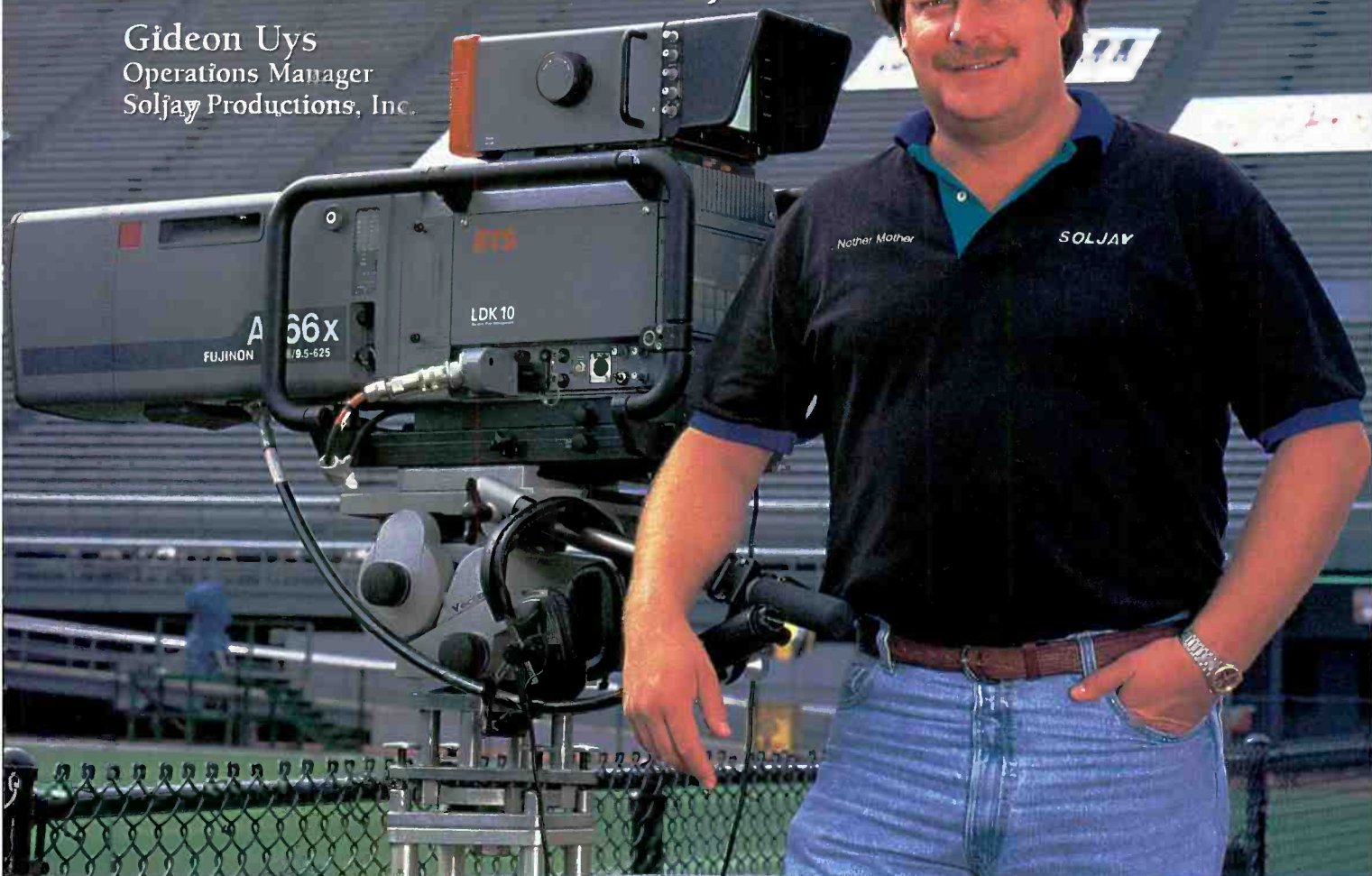
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## When the Government giveth, it also taketh away

I'd laugh if it weren't so serious. First, there was the trial balloon idea that the government would sell the needed UHF ATV allocations to broadcasters. For the billions (yes billions) the sale might generate, the government would then "give back" \$50 vouchers to consumers so they could buy set-top decoder boxes. These boxes would be needed to convert the UHF digital ATV signals back to NTSC for display on current TV sets.

After broadcasters blasted the idea of forcing them to buy ATV allocations (see the November "Editorial"), the Clinton administration floated a second proposal. This plan involved selling the spectrum vacated by broadcasters to new users. The money generated from that sale would be counted toward the national debt. (Oh yeah, I believe that!) In addition, vouchers of \$100 would be given to consumers to upgrade their TV sets (note the amount has now doubled).



Now, another so-called industry pundit has suggested that part of that "revenue windfall" be given to broadcasters in the form of \$2 million vouchers to purchase new equipment for ATV transmission. Whoa, isn't that a nifty idea? Free money!

When was the last time the government *gave* you anything? Nary a dollar comes from Washington without strings attached. If you think the government is in your pocket now, just cash a \$2 million voucher and see what happens.

Current EEO guidelines might seem lightweight compared to what could be mandated upon a station's participation in such a voucher program. Also, stations who saw a free meal in this idea might find their Uncle Reed telling them how many hours of children's programming to carry, the number of commercials permitted each hour and the amount of community service programming they'd have to provide. There's no telling what strings Washington would put on these so-called vouchers. When the Government giveth, it also taketh away.

Also, equipment manufacturers are not likely to discount anything when it's a seller's market. That's especially going to be the case if the suppliers know that the broadcast station is going to be getting \$2 million in free federal bucks. A program like this is more

likely to increase the real price of those very products needed by stations to get ATV on the air.

Politicians don't give anything away, let alone money, without getting something in return. It's the give a dollar, get a vote syndrome.

The idea of giving vouchers to consumers or broadcasters based on revenue from spectrum sales is a wolf in sheep's clothing. The process will merely place government more squarely than ever on the backs of the American consumer and broadcaster.

The last election clearly indicated that the American public wants less, not more, government involvement in their lives. I think the U.S. broadcaster is too smart to follow the pied piper of DC, even if he is throwing (someone else's) money around.

*Brad Dick*

Brad Dick, editor

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## Owners must register towers with FCC

meaning as "accepted for filing," a term of art at the FCC.

Broadcasters with mutually exclusive AM, FM or TV applications that have been pending since before the February 1994 comparative freeze probably will not be affected by the auction mandate, since in those cases, mutually exclusive applications already have been accepted for filing. However, because none of the mutually exclusive FM applications filed with the FCC after the February 1994 freeze have been accepted for filing, they would not fall within the exception to the auction language just discussed. (Unlike FM applications that are filed only during a designated window, AM and TV applications are filed in response to cut-off lists that include previously accepted applications. Thus, an AM or TV application filed after the freeze may have been accepted for filing.)

The commission has adopted a streamlined procedure under which tower owners will register antennas that require FAA clearance and special painting and lighting because of aviation safety concerns. In addition, the FCC has revised the painting and lighting requirements in Part 17 of its rules to conform to the specifications in two FAA advisory circulars on tower marking and lighting.

Under the new scheme, each antenna will be registered by its owner rather than by each individual licensee that uses the structure. The owner will be the only point of contact for resolving antenna-related problems. Now, the burdens associated with the antenna clearance process will be reduced for the commission and the licensees.

Beginning July 1, 1996, under the new antenna clearance procedures, owners of all proposed antennas requiring FAA notification or of existing structures with alterations requiring FAA notification will be required to register such structures with the FCC, prior to the construction or alteration. The commission will also establish a phased 2-year window for registration of all existing towers (i.e., constructed prior to July 1, 1996) that require FAA notification. During the period between July 1, 1996 and June 30, 1998, the owners of all existing towers must register them with the FCC.

### Auctions or no auctions?

The budget reconciliation bill, not the highly publicized telecommunications bill, will control the future disposition of facilities for which mutually exclusive applications are pending. The budget bill includes language that provides for the auction of any facilities for which mutually exclusive applications are filed after the effective date of the bill. With respect to mutually exclusive applications pending, the bill provides that such proceedings will be determined by an auction unless the application has been "accepted" prior to the effective date of the bill. Little guidance is available on the definition of "accepted" as used in the bill. "Accepted" may or may not have the same

LPTV/TV translator in the near future is hopeless, an option does exist. The FCC does allow, without the need of a window, the purchase of existing operating stations and stations under construction permits.

*Recent discussions with the FCC indicate that it does not plan to open a window for applications for new low-power TV or TV translator stations anytime soon.*

### EEO sanctions levied

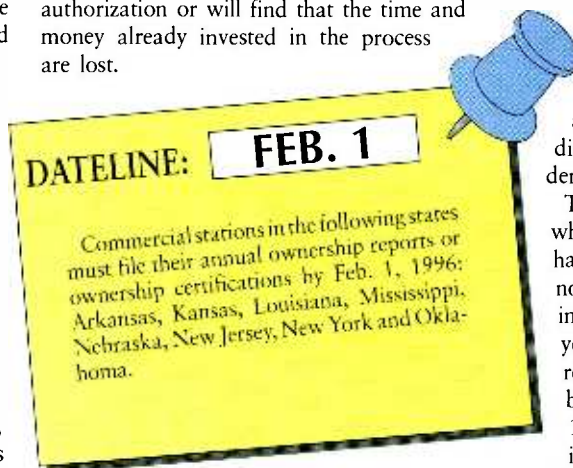
The FCC granted the renewal of a North Carolina station subject to reporting conditions, and issued the licensee a notice of apparent liability (NAL) of \$15,000 for violations of the EEO rule. The action was taken following its approval of a joint request for settlement agreement between the NAACP and the licensee, and the subsequent dismissal of the NAACP's petition to deny the pending renewal application.

The record indicated that in an MSA, which was 17.8% minority, the licensee had maintained an average of 15% minorities on its staff, and 11% minorities in upper-level positions during the 5-year period preceding the filing of its renewal application. During the period between July 31, 1988 through July 31, 1991, the licensee had 29 full-time hires, including 19 for upper-level positions.

Although the licensee claimed to have contacted a variety of general and minority-specific recruitment sources for 29 of its full-time vacancies, it was unable to provide any recruitment data for 15 of its 29 full-time job openings. Specifically, the licensee could not provide recruitment sources for 135 of its 216 applicants, and could substantiate the use of only five general recruitment sources for any of its remaining applicants. Moreover, the licensee was unable to provide data regarding the race or national origin of any of its applicants.

The FCC concluded that the licensee did not keep adequate records and failed to conduct a self-assessment of its EEO program until the end of its license term. ■

Harry C. Martin and Andrew S. Kersting are attorneys with Fletcher, Heald & Hildreth, P.L.C., Rosslyn, VA.



### LPTV/TV translator window not expected till '97

Recent discussions with the FCC staff indicate that it does not plan to open a window for applications for new low-power TV (LPTV) or TV translator stations anytime soon. There were some expectations that the commission was going to open the LPTV/TV translator window by the end of December.

However, the FCC's staff advises that a window for new stations will not open until the Advanced Television (ATV) spectrum has been allocated. The ATV allocations could reportedly take anywhere from one to two years. However, a window may open to allow for major modification of LPTV/TV translator stations as early as January of 1996.

Although it seems that applying for a new

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# EAS update

## Operational areas

By Leonard Charles

The federal government's Emergency Alert System (EAS) commitment is to distribute national emergency messages to each state. Each state will be divided into operational areas defined by its State Emergency Communications Committee (SECC) to disseminate the national, as well as the state EAS messages. Additionally, the SECC will determine the EAS designation and two monitoring assignments for each broadcaster and cable operator in the operational area. This information, along with actual emergency procedures, will be published in your EAS state plan and distributed to you after FCC approval. Because many SECCs are small, they would welcome any input into formulating this plan. To find out the chairman of your SECC, contact the FCC's EAS office at (202)418-1220.

Operational areas can be further broken down into local operational areas (LOAs). Each LOA can be thought of as the "last-mile" path to the public for an EAS message. Because most emergencies are local in nature, the role of the LOA in disseminating local EAS information is immense. It is here where the web architecture of the EAS will see its full development. When properly implemented, this web will carry emergency messages through the LOA on *background* (non-broadcast) channels.

### Background channels

To facilitate these channels, additional monitoring inputs will be necessary on your EAS decoder. The strength of using background channels comes from their availability 24 hours a day, every day of the year. Any broadcaster or cable operator monitoring these channels will have emergency information delivered to them as soon as it is available. They can then make the decision to broadcast based on the event and area data encoded in the digital header. No longer will one station's decision not to relay prohibit other broadcasters from receiving the message.

A typical background channel is the NOAA weather radio and its *Specific Area Message Encoding* (SAME). The SAME and EAS protocols are identical. Add to that the fact that a high percentage of emergencies are weather related, and it becomes clear that the NOAA weather radio makes an excellent choice for an additional monitoring input to your EAS decoder.

In counties equipped with a 911 center, an EAS encoder outfitted onto an existing communications channel from that center would be another excellent background channel. Broadcasters and cable operators monitoring that channel would be in constant connection to each government agency served

by that 911 center. In counties not fortunate enough to have a 911 center, developing a background channel from the county sheriff or the local police department would accomplish the same goal.

### Header codes and local planning

An important part of any local EAS plan involves the identification of message-header codes that will represent life-threatening situations vs. codes that will precede advisory information. This is essential for those automated or unattended facilities in your LOA and any facility choosing some level of automatic relay.

EAS equipment will allow such facilities to choose automatic relay of messages containing life-threatening codes and manual relay of all others. Though the EAS rules publish the only codes permitted in an EAS digital header, the FCC recognizes that more codes could be necessary to effectively design a local EAS. As such, they will accept additional code requests from LOA committees submitted through the state plan. Deciding on these additional custom codes will be part of the LOA organizational effort.

Because each LOA is unique, its EAS design is best accomplished through the cooperative efforts of the broadcasters, cable operators and local government officials within it. Local SBE chapters can be valuable starting points for this organizational effort. The result will be an LOA plan that includes participants, paths, procedures and header codes to be used in it. This plan must be submitted to and approved by your SECC and the FCC before implementation. ■

Leonard Charles is an SBE board member and engineer at WISC-TV in Madison, WI. He chairs the SBE National EAS Committee.



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- National and state EAS plans
- Local EAS plans
- The EAS web
- Guide for SECC chairs
- EAS FAQs and more!



Photo courtesy KSAN-FM

For more information on how to obtain the primer, call the SBE at 317/253-1640.



# Command Performance.



## Ikegami's HK-366 Wideband Studio/Field CCD Camera System



The HK-366P Portable Camera employs the same 450,000-pixel CCDs as the HK-366, and can be operated through the same Base Station and control panels as the HK-363. When the HK-366P is docked to a VCR, it becomes a high-image quality EN3 camera.

Our HK-366 camera incorporates many new features demanded by video professionals. For superior studio performance that draws encores, the HK-366 offers a newly-developed Snap-Shot Memory-Card, V/F DT, and Picture-In-Picture, Skin Detail including Auto Skin Hue Set-Up, and Six Vector Color Correction.

During the development of the HK-366, every identifiable operating nuance came under

close scrutiny. Exceptional image quality was achieved with 450,000 pixel CCDs. Cable runs up to 2400 meters are handled with the new long-range triax transmission system.

Commitment to essential functions plus production features,

combined with exceptional picture quality, results in the HK-366's superb performance.

The HK-366 achieves a horizontal resolution of 800 lines (V-C), a S/N ratio of 62db, and a high sensitivity of f8, while offering startling picture quality typical of the HK-Series Cameras.

When an optional Digital I/F unit is added, the base station can provide a composite serial digital signal (143Mb/s) or a component serial digital signal (270Mb/s). This allows the HK-366 to be interfaced with a variety of digital systems.

The HK-366 and its portable companion are readily upgradeable to a 16:9 aspect ratio.

Take command and lead. To learn more, call the nearest Ikegami Regional Office.



The HK-366/366P cameras have the Skin Tone Detail feature which received the Engineering Emmy Award for technical achievement.

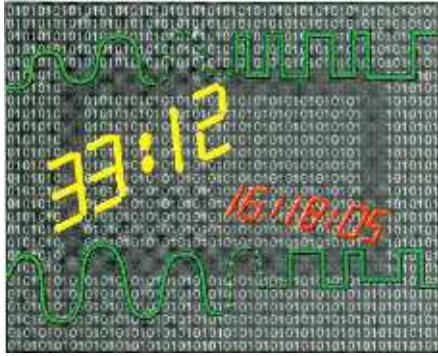
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## Choosing a system integrator, part 1

The transition from an analog to an all-digital facility is no longer a question of if, but rather when, and there is no better time than the present. Enough products are currently on the market to ensure a smooth and successful transition. However, it won't be accomplished without some forethought and pragmatic planning.

The ideal situation would be to design a brand-new all-digital facility and switch over after final checkout. The major constraints here are time and money. Some can afford this luxury, but for many, it will be a step-by-step process, replacing one section or functional area at a time. The objective is to capitalize on existing equipment investments and arrive at an all-digital facility as quickly and cost-effectively as possible, avoiding the traps and shortcomings that the pioneers have encountered on the way.

Having worked as a technical support engineer for a leading manufacturer of digital products, such as production switchers, routers, DVEs, editing and format conversion products, I have been involved in working through many of the initial problems that have been encountered. Many of these solutions have become industry standards. There are still lessons to be learned and problems to solve, but progress has been made. There are many choices to make and many paths to follow on the way to an all-digital facility. This article will help you make better choices when deciding how to upgrade your facility.

### Which digital format?

The format of choice is clearly digital component. A major factor is the lower cost of the new digital component videotape recorders. Component digital costs are still slightly higher than composite, but the advantages far outweigh the cost difference. Some of these ad-

vantages include:

- Higher signal quality due to the absence of subcarrier artifacts;
- Quantizing resolution for a 10-bit component signal is higher than a 10-bit composite signal because component digital does not digitize below black;
- In component, bit rates for 525 and 625 serial digital are similar;
- Most component products can switch between 525- and 625-line formats by merely changing a software or hardware switch and/or the reference signal;
- Most production switchers, DVEs and routers are 16x9 ready;
- Because this is the emerging standard, manufacturer's support will take you well past the new century; and
- Available converters allow for use of analog component as well as composite analog and digital signals.

Using a component production switcher with composite VTRs, although possible, should be approached with caution. The

choice of various composite VTRs, production switchers, converters and translators should be carefully studied to make sure that the whole system can be properly timed, especially in edit facilities where the pre-read capability of VTRs is a requirement. Timing is usually not a major problem when one or two composite VTRs are used as sources only. However, advanced reference of a line or two may be required to compensate for the decoder and/or digital converter.

NTSC composite digital may be a viable choice for some facilities, based on current equipment investment and client requirements. However, PAL composite digital applications have never been viable due to editing limitations.

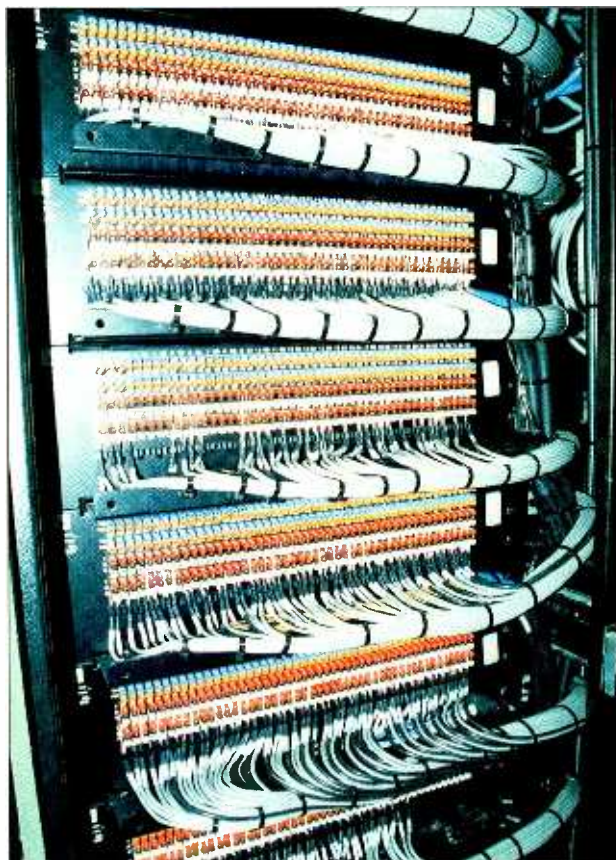
### Choosing equipment

Choosing major pieces of equipment, such as large-scale routers, production switchers, DVEs and edit controllers, is an important step toward the future success of your facility. Take your time, don't be pressured into making a hasty decision. Exhaust all avenues and get all the information before deciding. The best decisions are usually made by a team rather than individually. First, make a list of requirements and consider items such as:

- Budget;
- Industry standards;
- Client preferences, especially for leading edit facilities;
- Availability of free-lance operators;
- Important features specific to your needs;
- Extent of intercontrol of various equipment — extremely important when considering automation;
- Reliability; and
- Manufacturer's technical support and financial stability.

Put a team together by getting operators and maintenance engineers involved in the selection process. People are more likely to support the changes if they are involved. Seek operator input, because they will ultimately use the equipment and make money for you. They can provide information as to ease of use and important feature sets.

Maintenance engineers usually have valuable information as to



*If planned and implemented properly, changes can be incorporated while keeping cabling neat.*

which products are reliable and which manufacturers have the best technical support. All the features, bells and whistles mean nothing when you have a major piece of equipment down, and there is no tech support and spare parts are unavailable.

Armed with your team of advisers, set up as many demos as possible and compare features, keeping in mind the requirements list. Trade shows are an excellent place to gather comparable data.

If the product is fairly new on the market, find out how many are currently installed in working facilities. If possible, have the sales person set up a demo at an existing facility. This way, you will get an opportunity to ask the end user some practical questions about the equipment's functionality and reliability.

Once the field is narrowed down, ask the sales person to arrange for the equipment to be left at your facility for a few days. Then have the operators spend some time working on it. As the time to make a purchase decision nears, make sure that a manufacturer's checkout, operational and technical training, along with a full set of service literature, also is included in the negotiations.

### Staff engineers or outside integrators?

Unless your facility has a department dedicated to installing systems, it's not wise to use maintenance support engineers to design and install a digital facility. Even though they may best understand the facility's specific needs, they usually do not have sufficient time, system expertise or project management skills to pull it off smoothly. Despite this, their participation at various steps of the design process is of utmost importance. It's a good idea to assign a maintenance engineer to work with and communicate their needs to the system integrator.

The system integrator and or independent consultant will ultimately put the facility together; get them involved in the process as early as possible. It is important that they have a good understanding of the facility's requirements and procedures.

System integrators come in many shapes and sizes, from the conglomerate "we-do-it-all" manufacturer/system designer/architect/contractor to the 1-man video- or audio-only system engineer. All are capable of doing an excellent job in their respective field, but they do not necessarily do a good job all the time. The bigger and/or most expensive companies are not necessarily

the best in all cases. Many factors need to be considered, such as who will manage the project? Does he/she have the relevant experience and a good reputation? Does the company have more projects than resources at present? Have any of their top project managers recently left the company?

Larger companies are financially more stable, can throw in more resources if needed, and will probably be around for a while after the installation is completed. On the other hand, smaller companies or individuals are usually chosen for their specific expertise and reputation, which may be worth more than financial stability.

Just as on the artistic side where clients tend to follow artists as they move from one company to the next, companies stick with engineers they know and trust. Many large companies will stick with the same project manager/design engineer as he/she moves from one company to the next. Large contracts have been awarded to small companies rather than to a large system integrator because of previous experience with an individual at the small company.

Dealers, or "systems houses" as they are referred to, sell equipment from various manufacturers and will design and install the video/audio part of the system. They normally



"YES! THE WAY AHEAD TO DIGITAL CAN BE PRETTY TRICKY" CAUTIONED SNELL.



handle smaller-sized projects and usually do not have a staff engineer, or they have one who is overworked, and thus many times will look outside for additional help.

Regardless of their size, the quality of work tends to vary when companies use outside design engineers. To ensure quality work and overall satisfaction, check the reputation of the company as well as the system engineer.

When choosing equipment manufacturers and a system integrator, make sure that they have a good working relationship and that the manufacturer will support your system integrator. This should be carefully considered when the equipment manufacturer and system integrator are competing for the same project.

If you are working with a company that will sell you the equipment and also design your facility, it is wise to hire an independent consultant that will research and give you an impartial opinion on the recommendations they make. You don't want to buy a product only to find at the last minute that it does not perform as promised.

Some large manufacturing companies may be interested in taking on the project management of large installations. The managing company can put together a team where

by the best in each field is chosen for the project. The client can choose from a list of possible candidates, or may request a specific company or individual to be part of the team. The client gets the best of both worlds, the backup and support of a large corporation and the cumulative expertise of industry leaders. This way, you are assured the manufacturer will support the integrator during the installation and your facility long after the project is completed.

### Planning and scheduling the change

The biggest mistake facility owners or managers can make is to wait too long before getting an integrator involved. It does not make sense to spend hundreds of thousands or even millions of dollars on equipment and then undermine the entire operation by not allowing enough time for due process.

Some facilities seem to wait forever to decide whether they will go for the change or not, and once they decide, they rely on sales representatives to come up with an equipment list. Getting the integrator involved after the equipment orders have been placed is doing it backward, to say the least.

Not allowing enough time for the design and installation puts everything in a state of chaos.

Enough time needs to be allowed for each of the following stages:

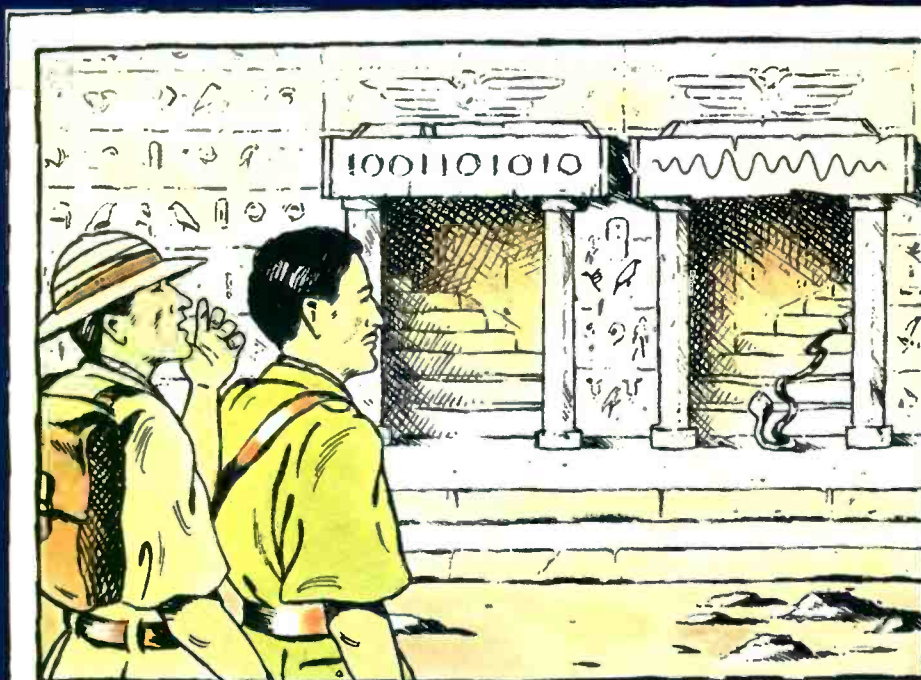
- Equipment selection;
- Equipment delivery planning;
- Design and installation;
- Check out equipment problems and solutions of any system;
- Operator and technical staff training; and
- Operations changeover.

Next month, we will discuss things to look for in choosing a system integrator, as well as what to look for during and after the installation. ■

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## The ABCs of management

**D**uring the past decade when the broadcast industry was in a slump, many facilities spent much of their time looking for another management or re-engineering concept. They spent little time following up on the one they had already taught their managers. Because this is the month to make New Year resolutions, it's time to relearn ways in which you can better manage yourself and others.

You can't discover new oceans without having the courage to lose sight of the shore, so take a leap of faith and build from the management style that you already have. Don't try to reinvent yourself and your management style.

### The management process

The ABCs of management are:

- **A = Activator** — What a manager does before a performance.
- **B = Behavior** — Performance or what someone says or does.
- **C = Consequence** — What a manager does after performance.

As a manager, your job is to make sure that your employees are clear on their key areas of responsibility (accountability) and what good performance in each of those areas looks like (performance standards). Goal setting is the most important *activator* for managers to remember because it gets the ball rolling. During this process, make sure that you clarify your own priorities. Weigh the value of each project and estimate the time you'll need to do it well. Then set your priorities according to the objectives that you should already have. Rate and organize your activities to gain a clear perspective on all of the functions of your own work. Remember, you can't lead your staff if you can't even organize yourself.

Next, you should watch what your employees do or say while trying to accomplish the tasks you've given them. This is a measure of their performance or behavior — the B portion of the ABCs. It's important to observe your staff's behavior so that it can be measured. Similarly, you have the same behavioral goals to attain. In other words, to be effective, you must clarify and orga-

nize your objectives in the plan that will work best for you. Structure your current and future projects according to priorities, set due dates and deliverables. Thinking further ahead, consider breaking down your long-range goals into monthly, weekly and daily plans, while working out a scheme that will allow you to revise and update them as necessary.

The C of the ABCs is responding, since that has to do with consequences. As the manager, the C is the response you give to your employees when they perform or attempt to perform a task. A note of caution: Avoid giving praise or reprimands if you think it's dependent on your mood swing...it's a good way to lose your credibility fast.

*The important thing is not what happens when you're there to supervise, but what happens when you're not there.*

Another way to look at it is if a person *can't* do something, then go back to goal setting, because this is a training problem. If the person *won't* do something, reprimand him or her, because this is an attitude problem.

### In training

The five steps to training a learner (your employee) to be a good "performer" are:

1. Tell (what to do);
2. Show (how to do it);
3. Let the person try it;
4. Observe his or her performance; and
5. Praise the progress or redirect it.

It has been said that only positive consequences encourage good future performance; therefore, performance is determined mainly by consequences. If this is true, then all the goal setting without any managing of consequences — praising good performance and reprimanding poor — will only get things started and provide short-term success. As a manager, the important thing is not what happens when you're there to supervise, but what happens when you're not there.

The secret to getting good performance from your staff when you're not in the office is how effectively you deliver consequences

when you are there. The last bit of advice in this area is *when you end a reprimand with praise, people think about their behavior, not your behavior*. After all, you want your people to think about improving their behavior instead of focusing on how you scolded them and missing the point entirely.

### The PRICE system

Now that you have an overview of the ABCs of management, let's expand on it a little with an acronym called the PRICE system. The PRICE system is targeted at achieving excellence in all parts of your life as well as helping to attain positive results for your employees. Using the system, you can make your New Year's resolutions come true, rather than having another unfulfilled promise for yourself and your staff. Here's a brief summary of the system:

- **P (pinpoint)** — Determine the performance area of interest;
- **R (record)** — Measure current performance level on a graph that you develop;
- **I (involve)** — Agree on performance goals and strategies for coaching and evaluation;
- **C (coach)** — Observe performance and manage consequences; and
- **E (evaluate)** — Track performance progress and determine future strategies.

If everyone in your organization sets up PRICE-specific projects, then the goals themselves are the *pinpointed* areas of interest. Present performance on each of these goals will be *recorded*. Then each employee will be *involved* with setting his or her own goal, as well as establishing coaching and counseling strategies. Next, *coaching* can begin. Finally, everyone can join in to *evaluate* their own progress and make corrections where needed.

In the end, the system won't work unless you start it, so what is important is not that it's done right the first time, but that you and your staff get under way. Of course, that means overcoming procrastination, but that is another lesson. ■

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

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## Editing on the fly

(Of course, Murphy's Law dictates that these will only rear their ugly heads in front of the most demanding clients.) Most manufacturers soon become aware of these problems and generally solve them on their next software version. Although each revision can hold its own new set of bugs, a good system will generally get better with every new software release.

**E**ding "on the fly" implies a post-production process that goes directly from acquisition to on-line editing, with no preparatory off-line steps. This style of production has become significantly faster and easier with the arrival of digital non-linear editing.

For example, the ability to copy an entire sequence with the stroke of a pen or a few keystrokes frees the editor from an entire array of old-school, time-consuming tasks. As a result, an editor gains freedom to concentrate on the essence of the project at hand, as opposed to being burdened by the pure mechanics of the effort. Those who have become accustomed to working in the non-linear domain generally find it difficult to return to linear editing.

### Linear vs. non-linear

In the days of linear editing, the editor's work was largely dictated by the equipment that he or she used. Time-based errors, changing tapes, routing signals, multiple machine control and work prints were part of every editor's routine. These tedious tasks were never questioned. They were just part of your job in the linear world.

In the non-linear world, when footage is put into the system, the only thing left to do is edit. You don't worry about frame delays or whether the matte and beauties are on the same tape. You can often change a shot faster than a producer can change his or her mind. You may also find that you're able to communicate much more effectively with the producer because you're not forced to wait for the result every time an edit is made. This results in a better product, a shorter session and a happier client.

Most non-linear on-line editing systems are extremely expensive, however, and not all of them deliver everything they promise (at least not yet). Some of these systems also have to render many transitions and effects, which can slow down the process significantly — although the overall result is still faster than linear editing. The technology is still fairly new, which implies that there also may be numerous software bugs.

### Selecting a system

Your decision to go non-linear may be an easy one, but finding a system to fit your needs may not be. Most of today's editors have learned and refined their skills working in traditional linear edit suites. Over the last few years, more and more clients have come to the sessions in such facilities with EDLs from non-linear off-line systems. This means that editors working in the on-line suite have found themselves conforming these projects instead of actually building the projects as they used to do.

*Your decision to go non-linear may be an easy one, but finding a system to fit your needs may not be.*

Many of these editors found that they were missing the creative process, so they learned how to run non-linear off-line systems. Once exposed to this technology, most editors realize that non-linear is a much more efficient way to work. But non-linear converts with on-line backgrounds may miss working with the *quality* of an on-line suite.

To satisfy these needs, you'll have to find the ultimate non-linear, real-time on-line system for your operating style. Prepare a list of requirements and go shopping.

### Friendly, fast and reliable

The most important quality of a non-linear system is that it meets the needs of yourself as well as the client. You'll need something that your clients will be comfortable with, because they may be reluctant to use a system that they are unaware of or have negative feelings about.

To get the utmost from your system, it should be friendly, fast and reliable. It should also have real-time CCIR-601 input and output and plenty of storage, along with

digital video effects requiring minimal rendering time. Depending on your applications, you may also find that *integration tools* (such as *stabilization* and *color correction*) are important. They may be useful for minor "fixing" of scratches and film dirt.

Of course, technical support is always a critical issue. The true acid test for this parameter is to call after hours and measure how long it takes to get a technician on the phone.


Friendliness is a factor because the more producers understand when they look at the screen, the more they can be involved in the process. Furthermore, the speed of a non-linear system frees up an entire realm of possibilities unknown in the linear world.

Some clients, unaccustomed to the speed of the non-linear world, may be reluctant to request changes in the middle of a session because they think it would be a major time-consuming task. A learning curve is inevitable for some, but once they adjust to the notion of non-linear on-line digital editing, they are never the same. Clients are also beginning to realize that taking a project to a non-linear facility from the beginning (from conforming an EDL list through revisions and fixes to final effects) actually saves them money because of the system's speed.

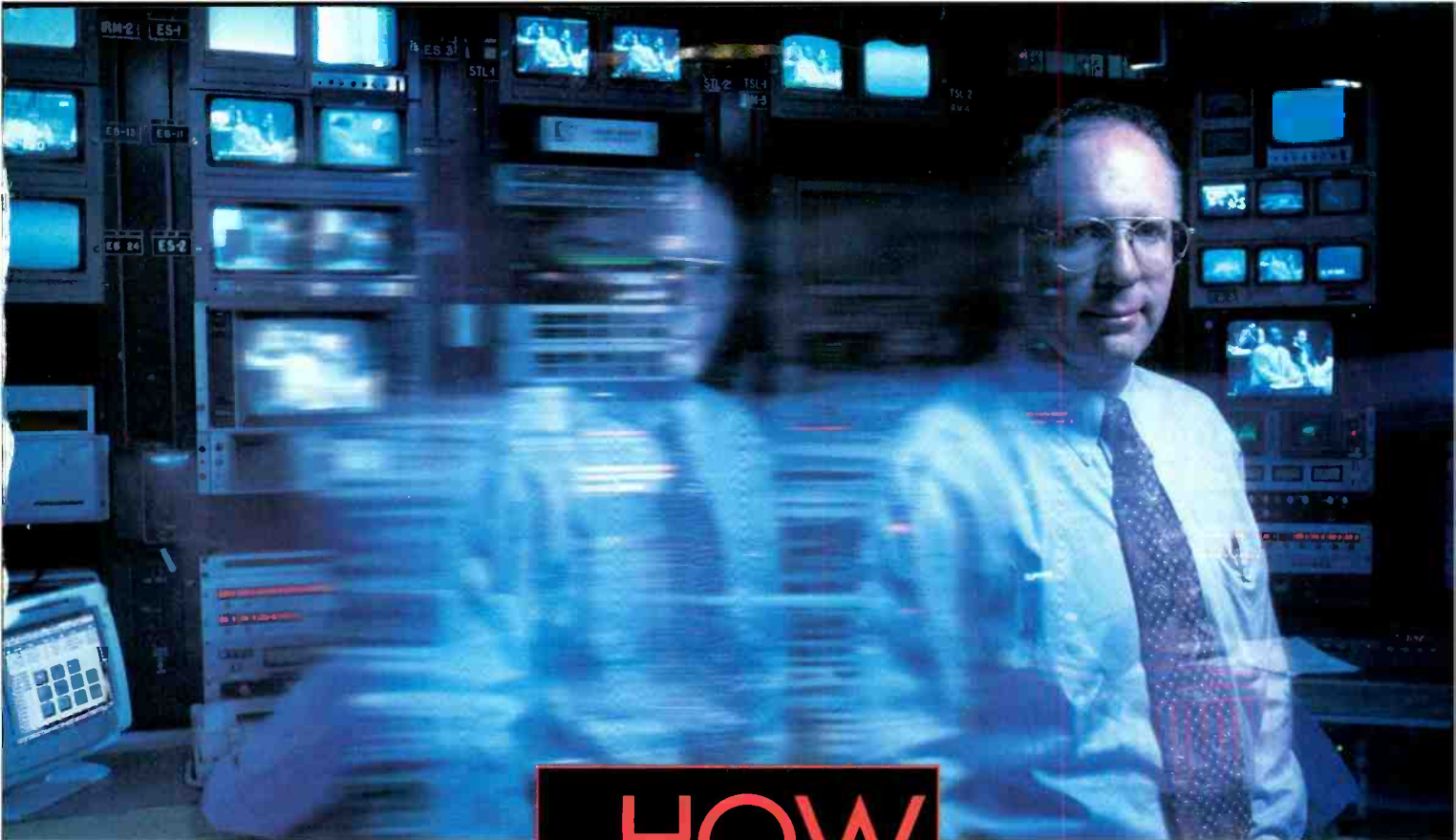
Reliability is another key factor. When it is midnight and the producer has decided to make the tenth shot revision of the evening — and the project airs at 6:00 a.m. — speed is useless if the system is constantly going haywire.

Many users that have made the move to non-linear report that they are convinced it represents the future of post-production. Their clients like the system, they are booked solid weeks in advance and they can pump out a large amount of material in a short period of time. In the words of one recent non-linear convert, "It's nice to feel that I am finally the master of the technology instead of its servant." ■

Harold Sellers is vice president and James Klotz is president of 11th Street Post, Atlanta.

 For more information on non-linear on-line editing systems, circle (154) on Action Card. See also "Editing Controllers," p. 74 of the 1996 BE Buyers Guide.

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**IF** you want to make the move from tape to disk, Ira Goldstone has a few quick words of advice:

**Q:** As Director of Engineering at Tribune Broadcasting, you're in the midst of updating your entire system. How do you deal with the pressure?

**A:** *Carefully.*

**Q:** Right. So did you choose the Louth ADC-100 automation system to bridge to disk or give you future flexibility?

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**A:** *Yes.*

**Q:** Meaning you liked Louth's ability to control all types of different devices?

**A:** *Yes.*

**Q:** And you weren't worried about any problems with propri-

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A U T O M A T I O N

etary automation software or choosing any disk vendor you wanted?

**A:** *No.*

**Q:** So if you were to give advice on how to make the transition to disk, without worrying about where your station goes in the future, what would it be?

**A:** *Louth.*

**Q:** And what about the multi-casting environment?

**A:** *Louth.*

**Q:** Of course, you'd still need a media management and traffic interface system to tie it together. Any final words of advice?

**A:** *Louth.*

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**B**y now you're probably tired of all the Internet hype. It's been touted as the '90's panacea, a cure for our dysfunctional educational system and a new home shopping environment. While Vice President Al Gore and Newt Gingrich discuss the societal changes taking place in the "Information Age," there are some practical aspects of the Internet. The Internet grew up — behind our backs — first and foremost because it was practical. And it still is.

### *Immediate information when you need it, that is the promise of the Internet.*

Have you ever had to install a hard drive in a computer, then set the esoteric information required by the BIOS only to find out that you lost the manual? Well, now you can log onto most of the hard-drive manufacturers' sites and get that information with a mouse click. No more waiting on hold for an hour or more for the tech support people. Immediate information when you need it, that is the promise of the Internet.

For today's broadcast engineer, the net offers many opportunities. You can:

- 1) Seek specific information on manufacturers' products and technologies;
- 2) Keep updated and save time and money with direct downloads of drivers; and
- 3) Network with colleagues who can help you solve specific problems and help you grow professionally.

#### **Internet offerings**

So, what is out there for the broadcast engineer to access, and why should you care? First, there is Sony (<http://www.sony.com>) where you can get everything from pin-out configurations on equipment to specs on the new consumer digital

## *Using the Internet and what is out there*

camera. This came in handy a few weeks ago when we were on the road and missing a cable. As Murphy's Law dictates, we were also missing the manual, and it was late Friday night when we realized we needed to build a cable. Knowing that the information was just a call away brought my stress level back down to zero. I hooked my Mac portable to my cell phone through a Motorola black box and dialed my access number. Within two minutes, I had navigated to the proper screens and was calling out the pin-outs to our engineer. The problem was solved, and we were on to more important things.

Next, as an engineer you are probably always asked, "What kind of \_\_\_\_\_ should I buy?" You can fill in the blank with anything that has a wire attached to it. As you navigate the net, you can actually comparison shop for everything from printers and computers to video cameras. You can access Digital Equipment Corporation's site (<http://www.dec.com>) or Hewlett Packard's (<http://www.hp.com>) and look over their entire catalog of equipment. While you are at it, you may want to look at Silicon Graphics (<http://www.sgi.com>) or Sun (<http://www.sun.com>).

For more thorough research, you can open multiple sessions (windows) and actually do real comparisons. This ability recently came in handy while looking for a new laser printer. Instead of having to drive down to my local store to see what they carried, I was able to decide on two different printers (<http://www.hp.com> and <http://www.canon.com>) and find a retailer that carried both of them.

#### **The tools**

Here's a quick recap of the hardware and software you'll need to get on the net: a computer, a modem (14.4 baud or higher), an Internet connection and a web browser. This can cost as little as \$1,000 or as much as a new Viper. The going rate for an unlimited Internet connection is about \$30 a month in most U.S. cities. Commercial on-line services, such as CompuServe, Prodigy and America Online, now provide Internet gateways. As a general rule, these proprietary browsers do not function quite as well as Netscape or Mosaic through a direct connection. In any case, you need the fastest modem you can get — a 9,800 baud will not be satisfactory.

When the net becomes part of your daily routine, even a 14,400 baud modem just doesn't cut it. You may wind up spending as much time waiting for the download as

reading it. Consider going to your boss (time is money) to suggest that he/she pay for your connection. Have a plan of action demonstrating how you are using the Internet to achieve better efficiencies in your job.

### *Have a plan of action demonstrating how you are using the Internet to achieve better efficiencies in your job.*

In this plan you should also include a path for upgrading your connection. Ask your Network Services/MIS manager if he/she can provide you with an Ethernet connection to your T-1 line (if you have one). The net comes alive when you have a T-1 (1.54Mb/s) access line. The graphics pop on your screen, and the information is literally only a click away.

Here is another example of why the net will become an everyday process in your work. You have been editing a client's video for the past two days, and the last few elements show up in a format that you are unable to handle. No problem. You have your traffic person call the local rental house, and in a few hours your problems are solved, or so you think. You get the machine hooked up only to find out that the drivers you have in your editor are so old they barely control the machine. Never fear, remember that account you begged your boss to pay for . . . you log on, then search for the machine you just installed, call up that page and hyperlink to the editing company so that you can FTP the newest machine drivers. With the problem solved, you log off and are back to your client's show.

#### **Satisfying your information needs**

I hope we have demonstrated some of the more important business aspects of the net. With just a little effort, you will find more and more of your information needs satisfied by the net. Oh, and when you find something on the net that you think other readers might find valuable, let us know (send to Steve or Mark at: [gtechsup@im.gte.com](mailto:gtechsup@im.gte.com)), and we'll pass it on in future columns. ■

Steven Blumenfeld is vice president of technology and studio operations and Mark Dillon is director of on-line services with GTE, Carlsbad, CA.



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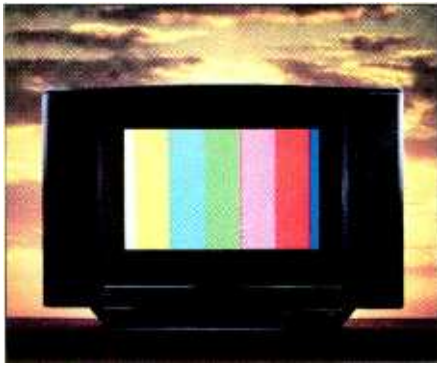


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Circle (18) on Action Card





## VSB modulation (some of the details)

The Giant Step is about to take place in TV transmission in the United States. Last month's column introduced you to the 8-VSB transmission system. The 8-VSB system is a digital system, unlike today's analog NTSC system. Last month, we reviewed the basis for the NTSC analog system and explained the basics of a digital modulation system. Also described were the two VSB modes that were approved by the technical subgroup of the FCC's Advisory Committee on Advanced Television Systems (ACATS) for field testing: the trellis-coded 8-VSB terrestrial mode and the 16-VSB cable mode.

These two modes share many of the same fundamental characteristics, such as channel and excess bandwidth, symbol rate, field and segment syncs, segment length and pilot power. However, they differ in several key areas. System robustness is determined by the amount of white noise that can be handled before data errors occur. This is defined by segment error probabilities. The white noise thresholds are 15dB for trellis-coded and 28dB for 16-VSB modes, respectively.

The VSB transmission system uses three supplementary signals for synchronization: a small pilot for carrier acquisition; a data segment sync for synchronizing the data clock in both frequency and phase; and a data frame sync for date framing and equalizer training. A classic data modem (such as Quadrature Amplitude Modulation or Quadrature Phase Shift Keying) achieves all these functions by using the data signal alone, but will lose all synchronization if the re-

ceived signal drops slightly below data threshold.

### Power measurements

Power measurement is different for NTSC and ATV. The NTSC signal is typically measured at peak sync, since the average signal power of an NTSC signal varies greatly with picture content. NTSC peak sync power is the average power of the RF carrier during sync intervals. The ATV signal, being random in nature, does not have a consistent peak level to measure. However, its average power is stable. Therefore, it is used instead of peak power.

Peaks of the transmitted ATV signal are often described in terms of statistical cumulative distribution functions. Typically, 99.9% of the transmitted VSB signal peaks are within 6.3dB of the average signal power.

### Performance

The results of the trellis-coded 8-VSB terrestrial field test clearly showed that the VSB

transmission system performed significantly better than NTSC, on both VHF and UHF. On VHF, satisfactory ATV reception was found at 82% of the sites when only 40% of the sites had satisfactory NTSC reception.

### The VSB spectra

The VSB channel occupancy is shown in Figure 1. The NTSC vestigial-sideband spectrum has the familiar three carriers (visual, chroma, aural), which carry most of the energy in the 6MHz channel. The channel is not efficiently used, in terms of either bandwidth or power. The VSB spectrum, also contained in a 6MHz channel, is flat throughout most of the band due to the noise-like attributes of randomized data.

Two steep transition regions (each 620kHz wide) exist at each end of the band, making it an efficiently used channel in terms of bandwidth. Only one small pilot carrier is present at the lower band edge making it efficient in terms of power and insignificant in terms of interference into co-channel NTSC.

### Baseband data format

The baseband data format is illustrated in Figure 2 for a trellis-coded 8-VSB signal. Note that there are eight discrete data levels. The original VSB transmission system has the flexibility to transmit any one of five different VSB modes (2, 4, 8, 8-trellis and 16), with the data rate depending upon the number of discrete levels and the use of trellis coding.

The Grand Alliance selected two of these modes: trellis-coded 8-VSB for terrestrial HDTV broadcasting and 16-VSB with no trellis coding for carrying (at least) two HDTV signals in one 6MHz channel on cable systems.

The data signal is broken down into 832-symbol segments, including a 4-symbol binary data-segment synchronizing signal (sync). The symbol rate for all VSB modes is 10.762MHz. The transmission segment is

*Continued on page 102*

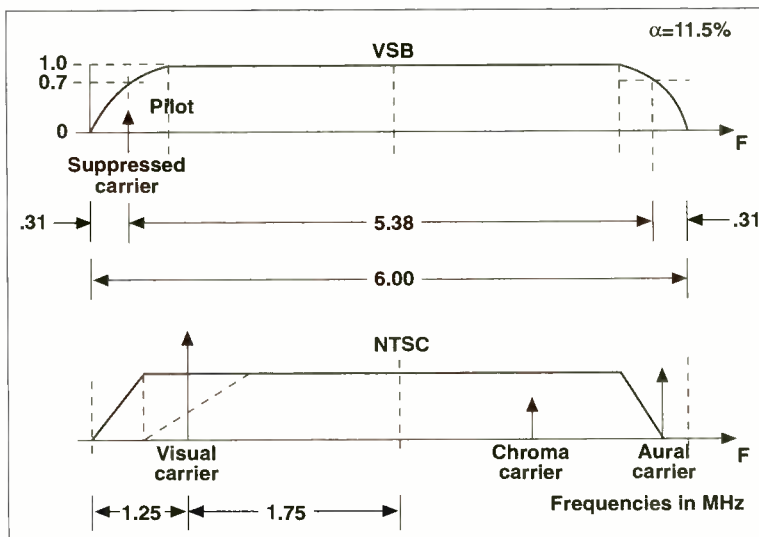


Figure 1. VSB and NTSC RF spectra.

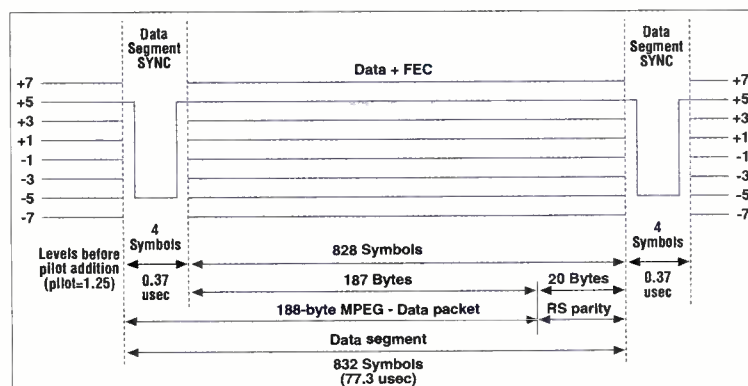
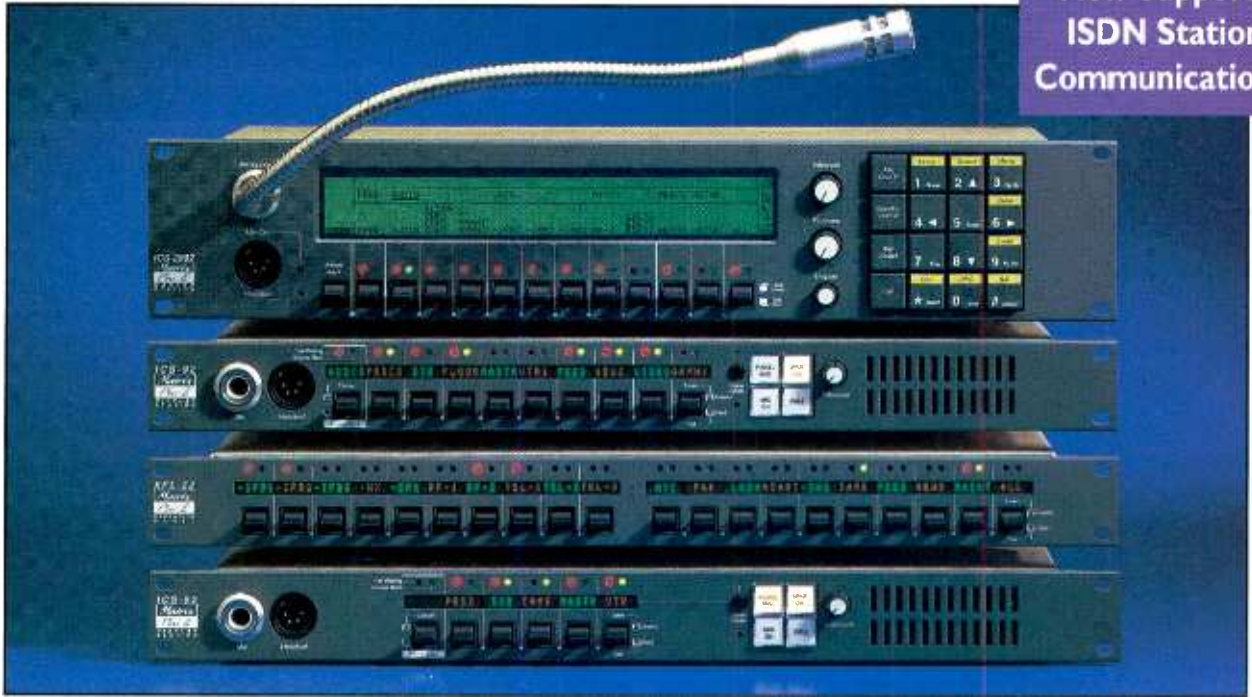


Figure 2. Trellis-coded 8-VSB baseband and data segment format.

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# Remotes from 45,000 feet

*Sometimes it's not how far out you go, but how far up.*

## *The Bottom Line: —*

*For video professionals, remotes are a double-edged sword. No matter how well-planned, Murphy's Law must always be considered. At the same time, a well-executed remote goes a long way to strengthen a facility's professional image. Simply put, the ability to do quality remotes increases the opportunities available to see and be seen by your viewers. — \$*

NASA Ames Research Center in Mountain View, CA, is home to the Kuiper Airborne Observatory (KAO). The KAO is a highly modified C-141 4-engine jet and is the world's only airborne infrared astronomical research facility. Cruising at up to 45,000 feet, the KAO flies above 85% of the earth's atmosphere and more than 99% of the earth's water vapor. In this clear, dry environment, extremely weak infrared sources, such as star-forming regions at the center of the galaxy, can be studied in detail. This is done using a 6,000-pound, 36-inch-Cassegrain telescope floating on an air bearing, guided by an elaborate tracking system and looking through a large opening forward of the aircraft's left wing.

The KAO typically flies two to three 7½-hour missions a week. Last October, it served as the center piece in a series of historic live broadcasts designed to stimulate interest in science and technology among school children. (See Figure 1.) While we cruised in the stratosphere doing actual science, students throughout the country watched us on television, asked questions and interacted with the flight crew and astronomers. To make all this possible, a bidirectional data and TV link was built, installed and integrated into the aircraft's systems.

### **NASA/JPL ACTS satellite**

Using existing commercial satellites for this project would have been impossible due to the extremely large antenna required on the aircraft,

and since we flew across most of the United States at seven-tenths the speed of sound, a link directly to the ground was not feasible. Fortunately, a NASA geosynchronous satellite called Advanced Communication Technology Satellite (ACTS) was available. Built by the Jet Propulsion Laboratory to explore future commercial applications, it operates in the K/Ka microwave bands at 20GHz and 30GHz. The use of these extremely high frequencies allows extremely small antennas to be constructed, which can easily fit on an aircraft.

*Each antenna is a waveguide slot array fabricated from five layers of machined aluminum brazed into a single 0.66-inch thick sandwich.*

### **Aircraft antenna**

Successfully constructing the aircraft antenna was one of the project's first major challenges. And for that, engineers from the Jet Propulsion Laboratory turned to a company called Electromagnetic Sciences. The antenna system the company constructed is a thing of beauty. The transmit and receive antennas each measure a little more than 4"x8" in size. Each antenna is a waveguide slot array fabricated from five layers of machined aluminum brazed into a single 0.66-inch thick sandwich. Inside the sandwich, power is distributed to eight resonant cavities. From these cavities, RF passes to 54 additional reso-

*Above photo: The NASA Kuiper Airborne Observatory with the telescope aperture door open forward of the left wing. The ACTS antenna, not shown in this picture, was mounted above the rear crew door and forward of the tail. (Photo courtesy of NASA Ames Research Center.)*

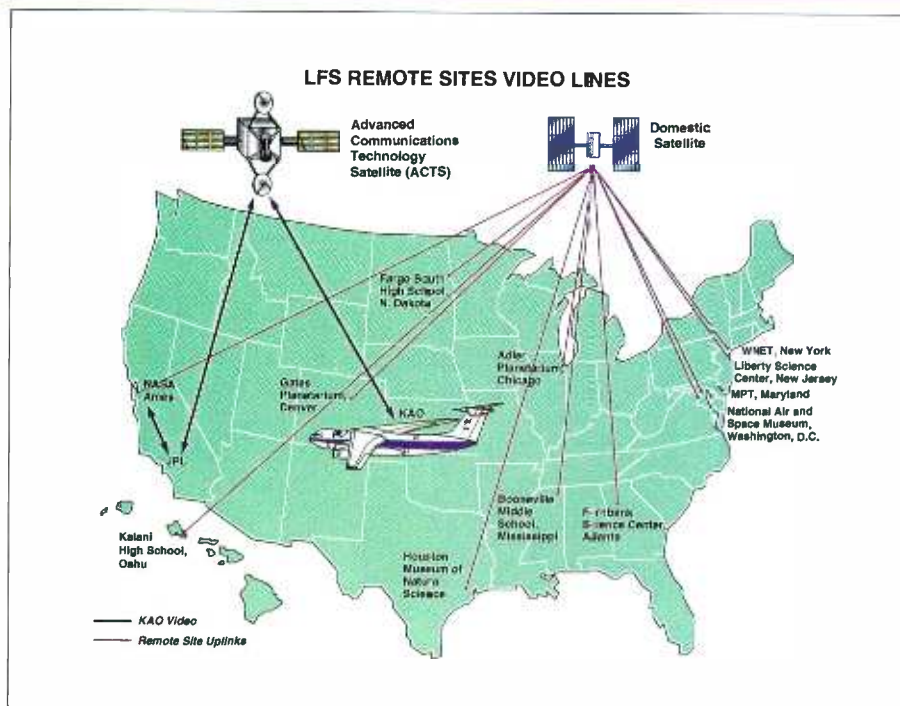


Figure 1. Hundreds of students at ground sites throughout the country were linked sequentially via C-band satellite to Maryland Public Television for the first broadcast, and to WNET for the second one.

nant cavities in the next layer, then to 366 slant slot elements and finally through a polarizer, which converts the linear polarization to right circular — all of this in an antenna that you can hold in one hand.

The two antennas were mounted on an az/el positioner and protected by a custom 5-layer radome consisting of alternating layers of special epoxies and foam. The thickness and electrical properties of each layer were carefully controlled to appear transparent at both 20GHz and 30GHz. Even the paint was special, and due to a tight development schedule, the entire array was designed and fabricated without the usual prototyping step. Our antenna was serial number 1A.

### ACTS broadband aeronautical terminal

JPL designed and built the aircraft's broadband aeronautical terminal (BAT). The system permits simultaneous bidirectional high-bandwidth video, voice and data communications. (See Figure 2.) As with the antenna, most of this extremely complex equipment is custom one-of-a-kind technology. The BAT components were assembled into a 4-foot high, dual 19-inch rack and mounted in the rear of the aircraft directly below the antenna.

The various analog signals are compressed, digitized and multiplexed with additional digital data by a codec, which was also a critical element in the chain. There were several requirements, which are not normally of concern on the ground. Due to expected

higher-than-normal bit error rates, it was essential that the codec degrade gracefully and recover quickly. Some codecs have a tendency to lock up, requiring the power to be cycled. It was also important that the video quality remain high at our intended rates of 128kb/s to 384kb/s. Image motion

handling and resolution were also concerns. After a detailed, exhaustive survey and laboratory testing of many commercially available units, a codec from NEC was selected.

A sophisticated modem was designed by JPL to counteract the peculiarities of the K/Ka aeronautical channel. It used BPSK modulation combined with coherent demodulation

*Due to expected higher-than-normal bit error rates, it was essential that the codec degrade gracefully and recover quickly.*

and robust error-correction coding. It has the ability to deal with Doppler shift of up to 30kHz and recover within one second from signal outages. Commquest Technologies Inc. modified a commercial satellite modem to meet these requirements.

### Aircraft antenna pointing and tracking

The KAO antenna's azimuth 3dB transmit beam width was only 2.6°. To keep the satellite in the middle of the main lobe, the antenna had to be kept pointed within a

*Continued on page 28*



The mission director console occupies the middle of the cabin area. Researchers occupy the area toward the front (left of picture), and the ACTS/BAT and audio/video equipment and personnel were stationed aft.



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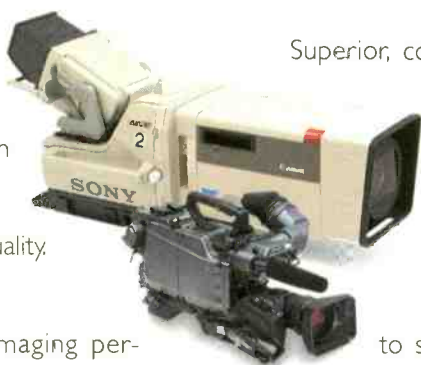
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tolerance of less than six-tenths of a degree. Errors that had to be contended with included gear backlash, positioner lag, vibration, misalignment between the receive and transmit arrays, and radome beam shift. And it all had to work over a temperature range of -60°F to +120°F. To do this in an aircraft bouncing down the runway during takeoff is an extremely difficult requirement.

A 3-loop system controlled the antenna pointing and required custom control software. The first loop took its input from a miniature 3-axis inertial rate-sensing package, which is visible at the bottom of the antenna. The output voltages from this loop were proportional to the angular velocity of the aircraft in pitch, roll and yaw. The tracking computer then integrated those rates to generate azimuth and elevation commands to the antenna's positioner.

Navigational data was supplied to the second loop from the aircraft inertial navigation system and a GPS receiver. The tracking computer used these inputs for blind pointing during initial satellite acquisition and long-term drift correction.

And finally, the antenna constantly dithered. The small cyclic changes in signal strength provided the third loop's input. If, for example, the signal was stronger while the dither cycle was to the right, then the center of the dither was too far to the left of the satellite, so a correction was made. The result was an antenna that stayed pointed at the ACTS satellite during two takeoffs and landings and eight hours of flying without a single loss of signal.

The ACTS satellite uses a steerable antenna with a 3dB contour that is only 280 miles

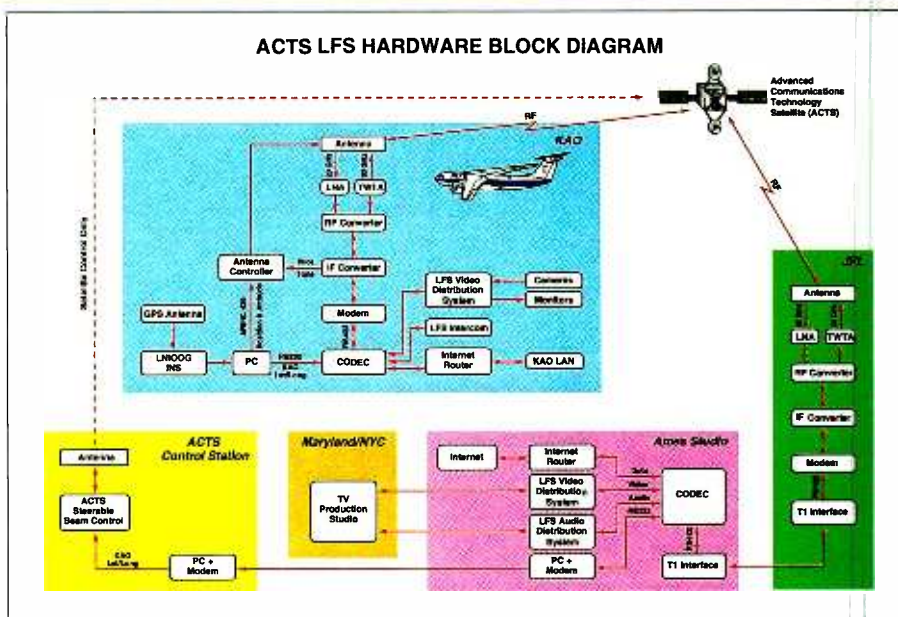


Figure 2. Basic block diagram of the equipment used. Nearly all of this is experimental one-of-a-kind cutting-edge technology.

wide at ground level, requiring the satellite to track the KAO. This was accomplished by multiplexing KAO geographic coordinates along with the audio and video programming and Internet data. At JPL, the KAO positioning data was demultiplexed and passed to the ACTS ground control site for processing and satellite control.

### Signal sources

The video sources consisted of three double image-intensified extreme low-light monochrome cameras boresighted up the axis of the telescope. (These cameras are about 10,000 times as sensitive as a normal broad-

cast camera.) They're used by the telescope systems for acquisition and tracking.

Next came six color micro cameras that were fixed throughout the cabin and flight deck, and finally, there was one hand-held broadcast-quality mini cam. All sources were gen-locked and H-phased carefully to prevent time base errors from disturbing the codec. A 12-input vertical interval switcher selected the program source.

*All sources were gen-locked and H-phased carefully to prevent time base errors from disturbing the codec.*

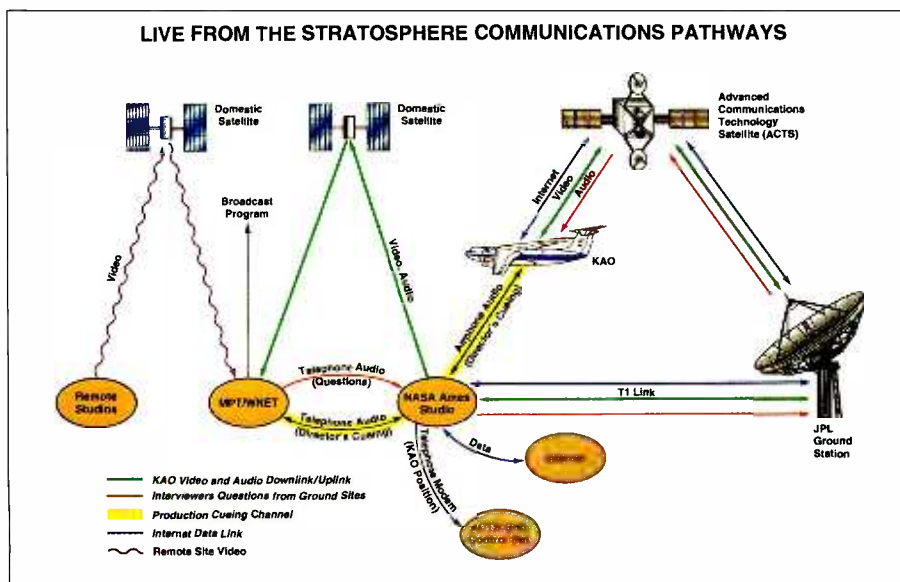


Figure 3. Communications and data links to and from the KAO required not only the ACTS satellite, but a flight phone as well. At any given time, at least four satellites were in use: ACTS between the KAO and Ames Research via a T-1 line from JPL, C-band from Ames to MPT/WNET; at least one and sometimes two more from remote ground sites to MPT/WNET, and program distribution via C-band. In addition, NASA Select carried most of both shows on its transponder.

Since the noise level during flight precludes unaided conversations (80dB to 100dB), everyone involved in the show was on a noise-canceling headset with a belpack. We had three channels of audio in our ears: mix-minus from the ground, program audio and a cue channel. To add to the confusion, there was a completely separate aircraft interphone system with its own headsets. So while the program was on the air, we had to constantly change headsets depending on whether we were doing science or involved with the show. And finally, we installed a flight phone with three handset positions. It provided our cue channel, our technical hot-line, and general all-around backup link to the ground. It was not uncommon to see someone with two headsets clamped around his

Continued on page 32



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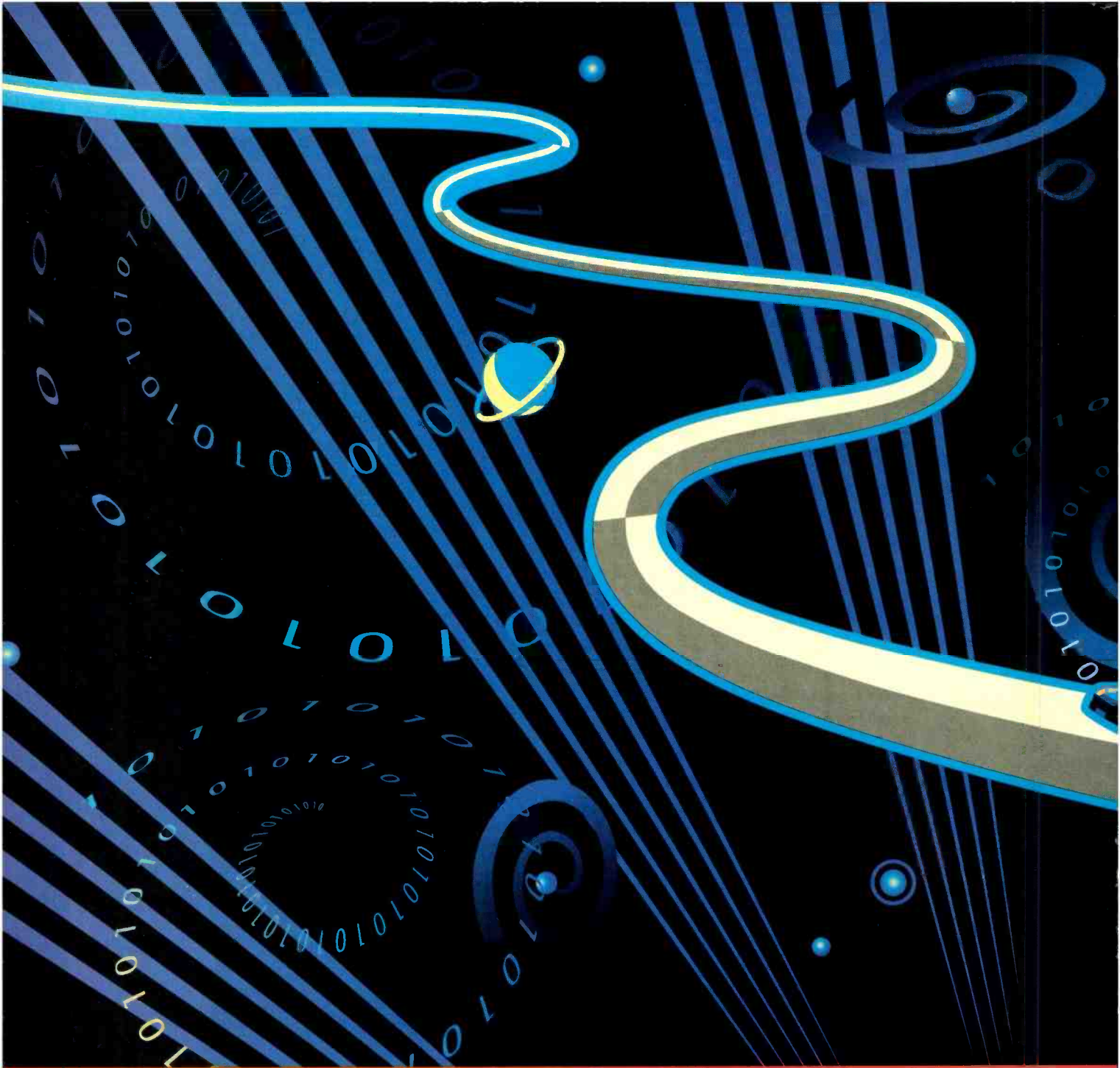
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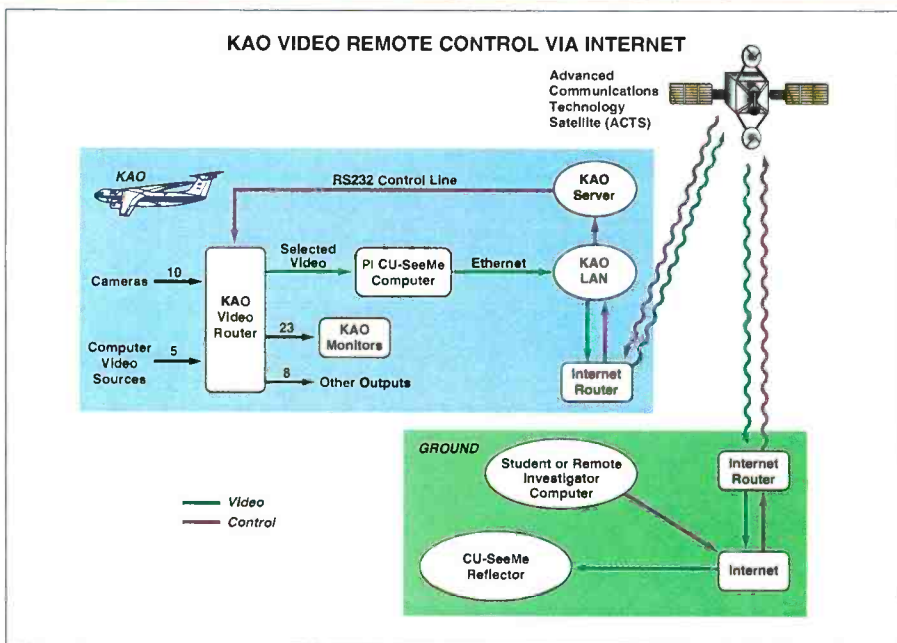


Figure 4. Another first was the use of Internet connectivity during the flights to allow interactive teleconferencing via CU-SeeMe. Students on the ground were able to remote control the KAO's 32x32 video router to select video sources for themselves. This Internet link also provided real-time system health monitoring and remote control of the aircraft's telescope from the ground.

neck, a finger jammed in one ear and the phone handset in the other, while madly shaking his leg trying to get it free of several tangled intercom cables.

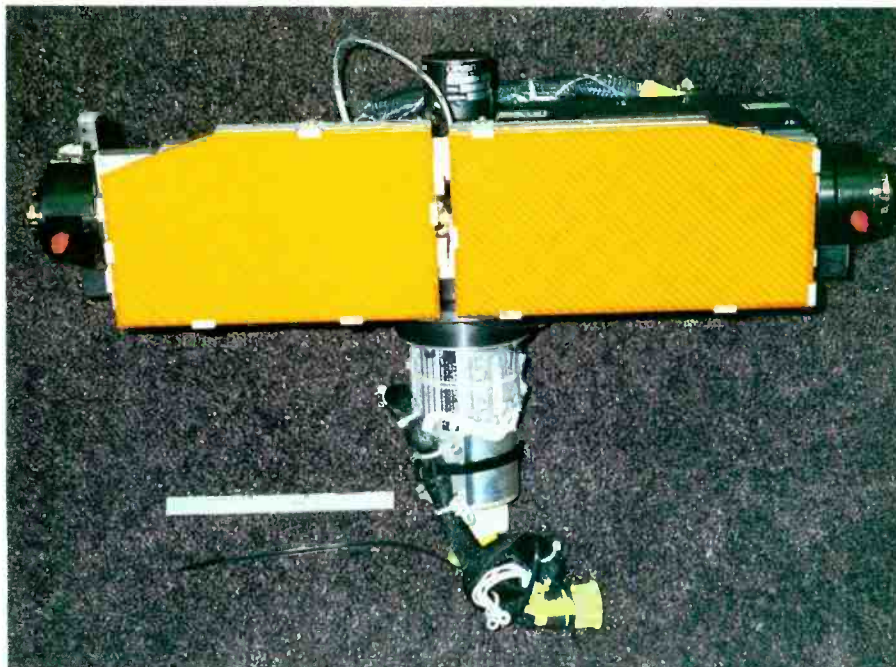
Also onboard were five Sun workstations on an Ethernet that was connected to an onboard Internet router for real-time Internet connectivity.

### Putting it all together

The compressed and digitized bitstream included bidirectional video and audio,

KAO positional data, system health-monitoring data, telescope remote control of instruments and Internet communications. This was passed through the ACTS satellite, which acted as a stovepipe relay between the aircraft and JPL in Pasadena. (The KAO's RF output was 120W at 30GHz.)

Data passed through JPL via a fractional T1 line back to our home base at Ames Research Center in the San Francisco Bay Area. From there, it was fed to a remote



Bidirectional interactive television from a moving aircraft was made possible by this small experimental antenna system. A 6-inch ruler is shown in the foreground for scale.



The left bay contains all the video equipment and the right side contains the ACTS antenna tracking computer and audio equipment.

truck that also originated programming from our hanger. From the truck, it passed via C-band back to Maryland Public Television and WNET on the East Coast. Students' questions from remote sites on the ground were a reverse of this path, resulting in a 6-satellite round trip and some impressive delays. (See Figure 3.)

While the show was on the air, students were able to log on to the Internet and send up E-mail. Some sites were able to access our video router and select the camera they wanted to see using a low-resolution system called CU-SeeMe. One group was allowed to actually control the telescope remotely, while our onboard astronomers logged into an observatory on the ground and remote controlled it. (See Figure 4.)

The last broadcast was also the last research flight of the KAO. After 21 years of operation, the KAO has been shut down for good as a cost-saving measure. NASA hopes to replace the KAO with a 747 version called SOFIA. Hopefully, it will receive funding shortly after this article goes to print. If SOFIA is funded, it is scheduled to become operational about 2002. Who knows? Perhaps these weren't the last live remotes from the stratosphere. ■

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- F-number: 2.8



**TELE1500**

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- Image Format: 2/3"
- Zoom Ratio: 55X
- Focal Length: 13.5-740mm (with extender): 27-1480mm (2X)
- F-number: 2.0



**J55X SUPER (J55X9B IE)**

- Image Format: 2/3"
- Zoom Ratio: 55X
- Range of Focal Length: 9-500mm (with extender): 18-1000mm (2X)
- F-number: 1.4
- 1/2" Model: **PH55X Super (PH55X7B IE)**



**SUPER21**

**SUPER21 (PJ21X7B IE)**

- Image Format: 2/3"
- Zoom Ratio: 21X
- Focal Length: 7-150mm (with extender): 14-300mm
- F-number: 1.5



**J20X SUPER (J20X7.5B IE)**

- Image Format: 2/3"
- Zoom Ratio: 20X
- Focal Length: 7.5-150mm (with extender): 15-300mm
- F-number: 1.5
- 1/2" Model: **PH20XSUPER (PH20X6B IE)**



**J45X9.5BIE (Type-C)**

- Image Format: 2/3"
- Zoom Ratio: 45X
- Focal Length: 9.5-430mm (with extender): 19-860mm (2X)
- F-number: 1.7
- 1/2" Model: **PH45X9.5B IE (Type-C)**



**J20X8.5B IE (Type-C)**

- Image Format: 2/3"
- Zoom Ratio: 20X
- Focal Length: 8.5-170mm (with extender): 17-340mm (2X)
- F-number: 1.6
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Standard Range Zoom Lens

- Image Format: 2/3"
- Zoom Ratio: 13X
- Focal Length: 9-117mm
- F-number: 2.7







**J14aX17B KRS-V**  
Telephoto Zoom Lens



**J13aX9B KRS-V**  
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The IS-20B, an exclusive Vari-angle Prism adapter for Canon's popular J20aX8B /H20aX6 ENG zoom lenses stabilizes the image captured by these lenses, while maintaining overall performance of the original lenses.

The Vari-angle Prism is the primary component in the Optical Image Stabilization System which also includes vibration sensors, prism drive actuators, prism angle sensors and a micro-computer, all built-in to the size of a standard broadcast ENG lens.

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- Zoom Ratio: 15X
- Focal Length: 8-120mm  
(with extender): 16-240mm (2X)
- F-number: 1.7
- 1/2" Model: **H15ax6 IRS/IAS**



### J9ax5.2B IRS/IAS

- Image Format: 2/3"
- Zoom Ratio: 9X
- Focal Length: 5.2-47mm  
(with extender): 10.4-94mm(2X)
- F-number: 1.8
- 1/2" Model: **H9ax3.8 IRS/IAS**



### J20ax8B IRS/IAS

- Image Format: 2/3"
- Zoom Ratio: 20X
- Focal Length: 8-160mm  
(with extender): 16-320mm
- F-number: 1.7
- 1/2" Model: **H20ax6 IRS/IAS**



### J33ax15B IAS TELE

- Image Format: 2/3"
- Zoom Ratio: 33X
- Focal Length: 15-500mm  
(with extender): 30-1000mm
- F-number: 2.7
- 1/2" Model: **H33ax11 IAS TELE**



### J33ax11B IAS

- Image Format: 2/3"
- Zoom Ratio: 33X
- Focal Length: 11-363mm  
(with extender): 22-726mm
- F-number: 2.0
- 1/2" Model: **PH33ax8.5B IAS**

## Professional Lenses:



### J15X9.5B IRS

- Image Format: 2/3"
- Zoom Ratio: 15X
- Focal Length: 9.5-143mm  
(with extender): 19-286mm
- F-number: 1.8
- 1/2" Model: **PH15X7B IRS**



### YJ17X9.5B KRS

- Image Format: 2/3"
- Zoom Ratio: 17X
- Focal Length: 9.5-162mm
- F-number: 1.8
- 1/2" Model: **YH17X7 KRS**



### YH13X7.5 KRS

- Image Format: 1/2"
- Zoom Ratio: 13X
- Range of Focal Length: 7.5-97.5mm
- F-number: 1.4

## Tele-Com/Remote Control Lenses:



### J15X9.5B ITS A

- Image Format: 2/3"
- Zoom Ratio: 15X
- Focal Length: 9.5-143mm  
(with extender): 19-286mm
- F-number: 1.8



### YH17X9.5 KTS A

- Image Format: 2/3"
- Zoom Ratio: 17X
- Focal Length: 9.5-162mm
- F-number: 1.8
- 1/2" Model: **YH17X7 KTS A**



### YH13X7.5 KTS A

- Image Format: 1/2"
- Zoom Ratio: 13X
- Focal Length: 7.5-97.5mm
- F-number: 1.4

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# Broadcast helicopter considerations

By Fida Waishek

As an electronic news-gathering (ENG) platform, the helicopter has obvious advantages. It takes off and lands almost anywhere, dashes to the story and hovers over unfolding events. It also provides a clear line-of-sight over mountains or city skylines to transmit or relay imagery back to broadcast stations. Less obvious are the aerodynamic, structural and electronic considerations involved when integrating ENG equipment into a helicopter.

The capabilities of the news-gathering electronics aboard the helicopter depend on the size of the aircraft and the budget of the operator. The Bell 230 helicopter carries a complete TV production facility for the Korean Broadcast System (KBS) and can stay on station for more than three hours with a crew of four. A Bell 206 or Eurocopter AS350 carries a smaller, less-sophisticated ENG suite. Whatever the equipment package, an ENG helicopter demands careful integration by a qualified completion house.

Civil helicopters bear Type Certificates from the U.S. Federal Aviation Administration (FAA). New radios and other modest additions with no impact on handling or safety can be authorized with Form 337 field approval through an FAA Flight Standards District Office. More extensive changes, such as external cameras and deployable antennas, require a Supplemental Type Certificate (STC) with extensive engineering documentation verified in ground and flight tests by FAA engineers and pilots. STC documentation goes so far as to include flight manual supplements and maintenance manuals.

## Certification

ENG options can range from a sliding door for a cameraman all the way to post-production consoles. Dollars and expectations drive the design, but the completion house applying for an STC has to brief the FAA on proposed changes and work to government ground rules and safety requirements. For example, the deployable skid antenna on the KBS aircraft is designed to break off safely if not retracted on landing.

ENG equipment has to fit within payload, center-of-gravity and structural constraints of the air vehicle. Less easy to define are the aerodynamics of camera gimbals and antennas. Handling qualities have to be verified by flight tests. Any modification that changes the speed of a helicopter also requires a new sound footprint analysis to satisfy the FAA.

Potentially more complicated is the electronic integration of air vehicle and ENG equipment. For broadcasters, helicopters pose an inherent problem with rotor blade signal modulation. Engineers first try to locate antennas to minimize interference with broadcast signals. However, real estate on the outside of a helicopter is limited, and notch filters to block specific frequencies are usually necessary.

Aircraft beacons, transponders and high-power tactical radios can also interfere with ENG electronics. The



*This Bell 230 was equipped with a full video production suite by Heli-Dyne Systems Inc.*

filters in airborne radios are not generally found in commercial broadcast equipment, so custom filters are typically required. Equally important is the electromagnetic compatibility of ENG equipment with the navigation and communications avionics needed to fly the aircraft. The completion house must perform a spectrum analysis and give special attention to the location of the equipment, wiring harnesses and shielding. Antenna mounts or other items may have to be relocated to eliminate electromagnetic and radio frequency interference. Fortunately, airborne transmitters usually need less power than ground broadcast equipment. The 15W or 30W transmitters in ground units can be derated to 10W or less for a helicopter.

## Adapt and repackage

The commercial broadcast equipment in ground stations and mobile units is familiar to technicians but not always available in airborne form. Most ground equipment adapted to a helicopter requires modified power supplies. AC transformers are replaced by custom supplies compatible with 28VDC aircraft power. The single-engine JetRanger makes about 100A available and cannot support much equipment. The twin-engine Bell 230 provides up to 300A.

More than simple power, the real issue in most ENG helicopters is power management. The FAA requires broadcast systems designed so a crewmember can turn all power off with one master switch. An independent, fault-tolerant design means failures on the ENG bus cannot affect power to standard aircraft equipment.

In the confines of a helicopter fuselage, heat dissipation from extra electronics also is a concern. Cooling requirements have to be addressed early with equipment location, venting and fans. Broadcast industry equipment designed for ground stations is seldom compatible with the sustained vibration of a helicopter. Vibration isolation mounts for ENG equipment must be tailored to specific aircraft frequencies.

## Unique requirements

Helicopters put unique requirements on broadcast monitors. Monitors bright enough for ordinary applications lack the intensity to be seen in direct sunlight. The FAA requires that cockpit monitors not distract pilots, so directional polarizing filters are used to make the display black to a crewmember sitting to the side of the screen.

As a reporter, the helicopter has enormous flexibility. However, outfitting the helicopter for ENG requires expertise covering the aircraft and its specialized systems. ■

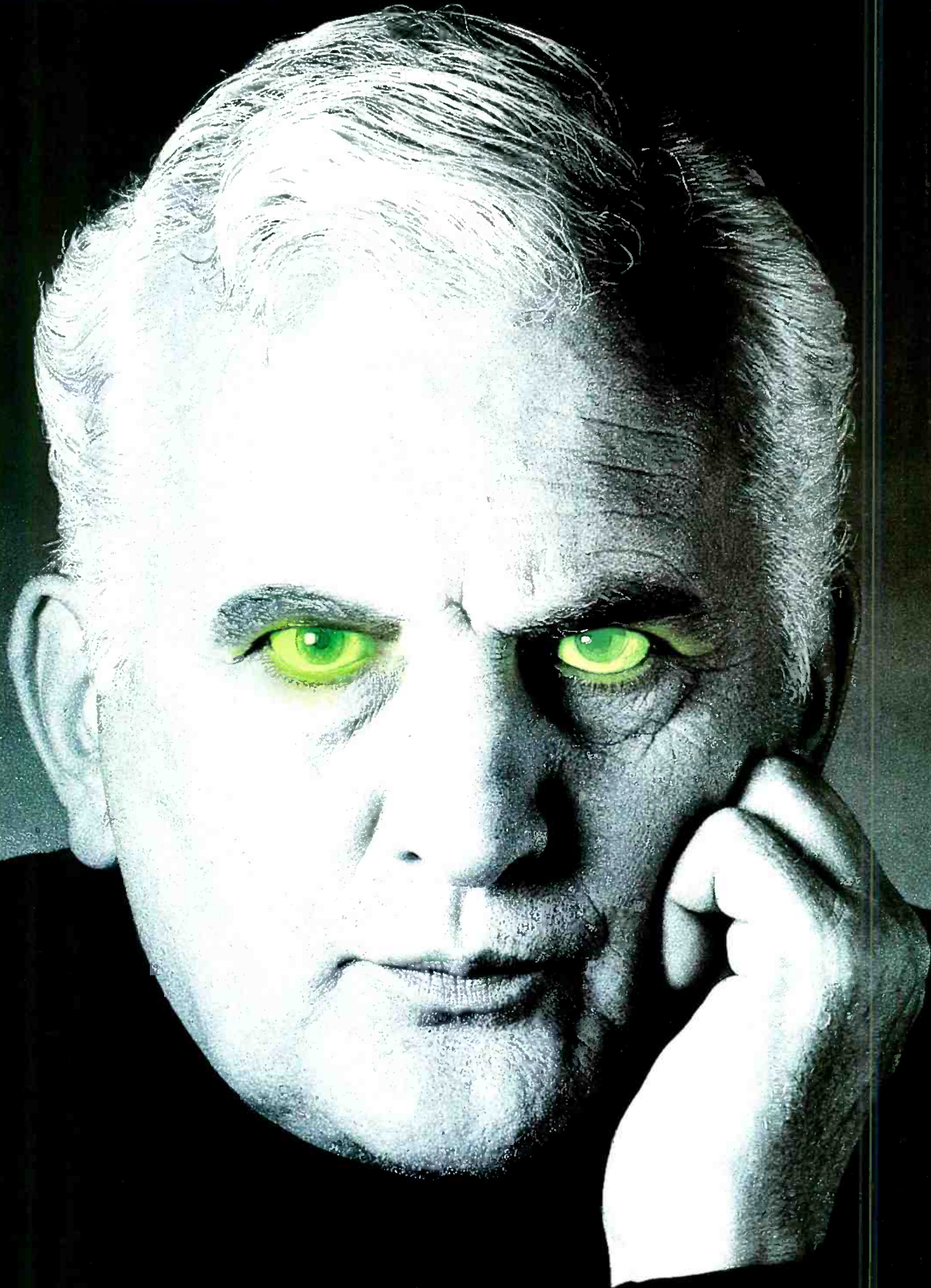


*The installation of a sophisticated production system in a helicopter like that shown above, should be handled by experts. Don't assume you'll even know about, let alone, get all the needed FAA clearances.*

**Editor's note:** Heli-Dyne Systems Inc. is a helicopter systems integrator and completions house with extensive experience in aeromedical, law enforcement, corporate, electronic news gathering and military completions.

Fida Waishek is systems engineer for Heli-Dyne Systems Inc. Hurst, TX.





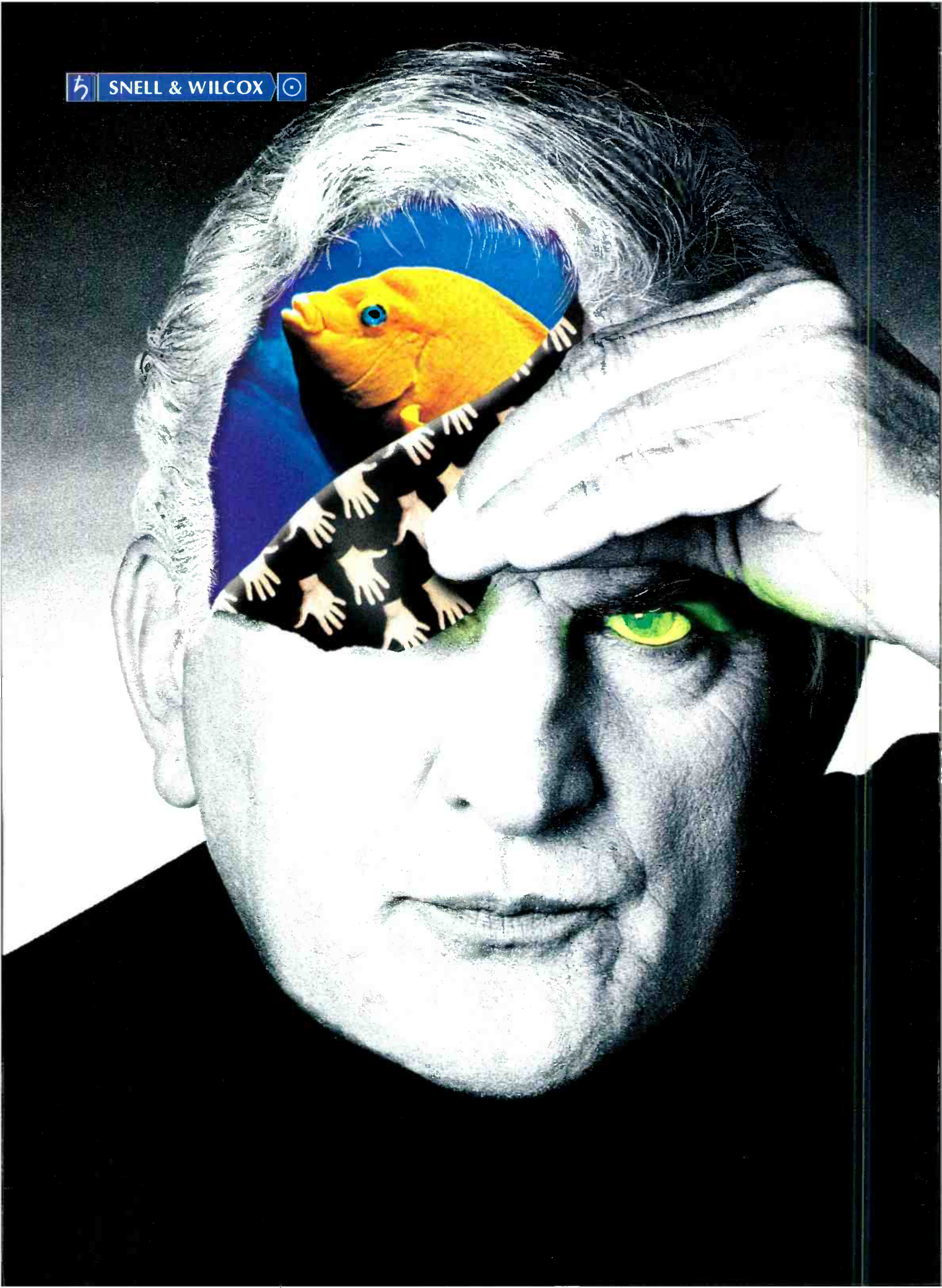
*'I can  
give you  
amazing  
powers.'*



How can he do it for the price?

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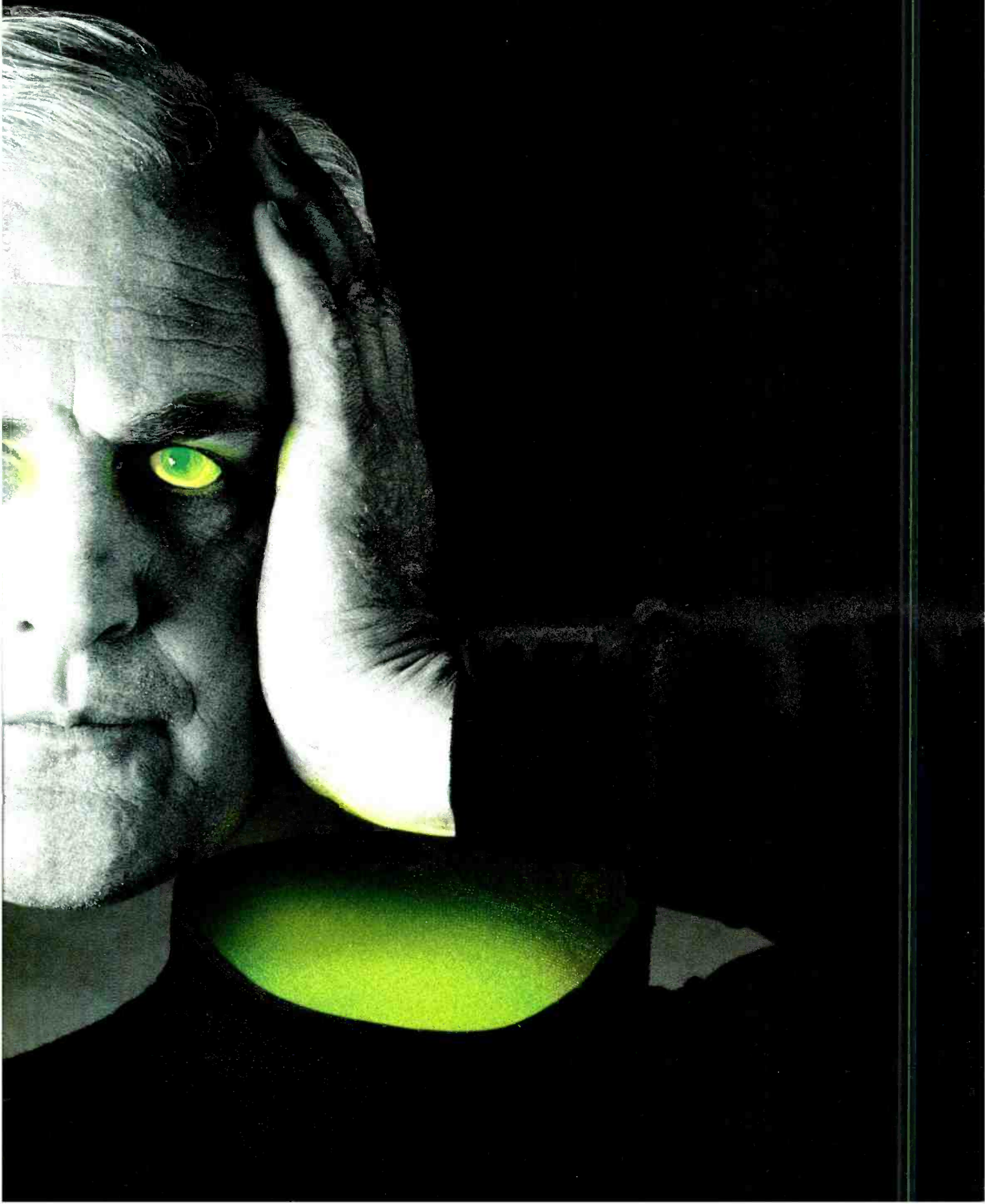


*I can*  
give you  
powers you  
thought were  
*out* of your  
*reach.*



How can he do it for the price?



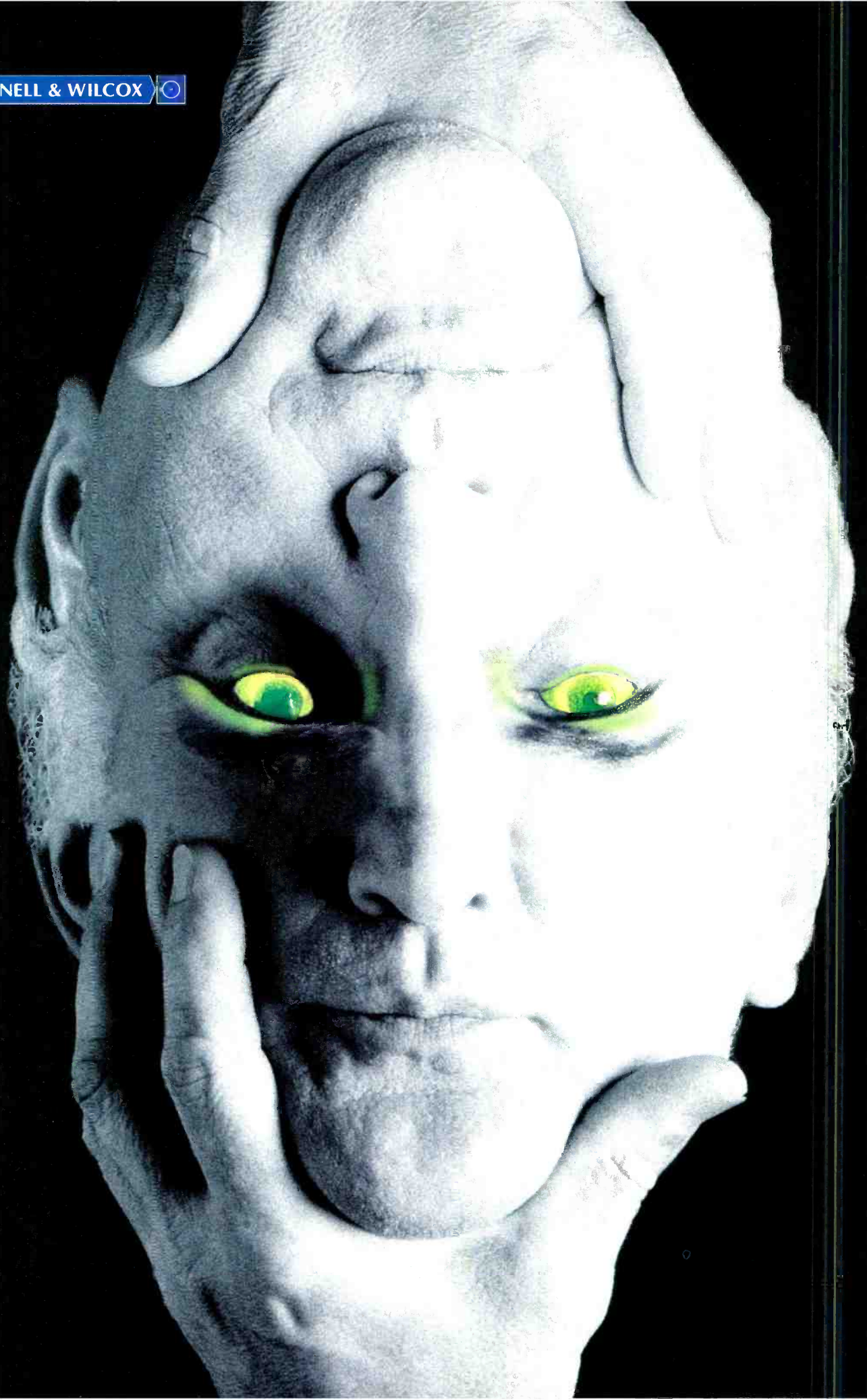


*I can*  
push out the  
boundaries  
of your  
*imagination.*



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*I can*  
channel  
your dreams  
twice as  
*effectively.'*



How can he do it for the price?

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# Power system protection alternatives

*In the realm of power quality, you can pay now or pay later. But you will pay.*

## *The Bottom Line: —*

*In this industry, nothing can shut a facility down quicker than a complete power loss. Redundant systems can provide a backup, but what about the spikes, surges and brownouts that can sneak in undetected? Today, power quality is just as important as the power itself. Taking steps to ensure clean, reliable power will pay dividends for years to come. \_\_\_\_\_ \$*

Utility companies make a good-faith attempt to deliver clean, well-regulated power to their customers. Most disturbances on the AC line are beyond the control of the utility company. Large load changes imposed by customers on a random basis, power factor correction switching, lightning and accident-related system faults all combine to produce an environment in which tight control over AC power quality is difficult to maintain. Like it or not, the responsibility for ensuring AC power quality must rest with the users of sensitive equipment. And, there is an abundance of sensitive hardware at the average TV station or video production center.

The selection of a protection method for a given facility is as much an economic question as it is a technical one. A wide range of power-line conditioning and isolation equipment is available. A logical decision about how to proceed can be made only with accurate, documented data on the types of disturbances typically found on the AC power service to the facility.

The protection equipment chosen must be matched to the problems that exist on the line. Using inexpensive basic protectors may not be much better than operating directly from the AC line. Conversely, the use of a sophisticated protector designed to shield the facility from every conceivable power disturbance may not be economically justifiable.

Purchasing transient-suppression equipment is only one element in the selection equation. Consider the costs associated with site preparation, installation and maintenance. Also, consider the operating efficiency of the system. Protection units that are placed in series with the load consume a certain amount of power and, therefore, generate heat. These considerations may not be significant, but they should be taken into account. Prepare a complete life-cycle cost

analysis of the protection methods proposed. The study may reveal that the long-term operating expense of one system outweighs the lower purchase price of another.

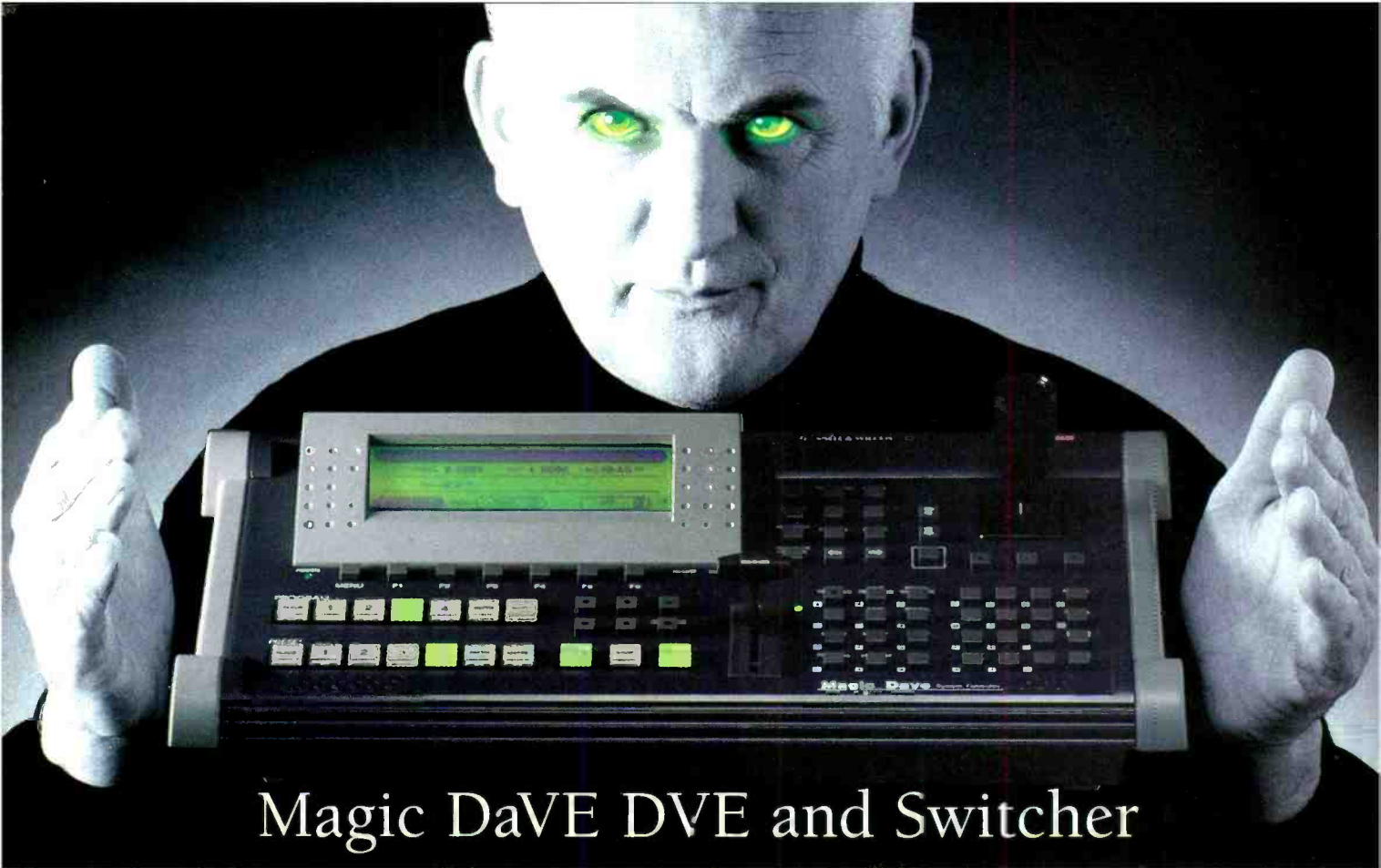
The amount of money a facility manager is willing to spend on protection from utility company disturbances generally depends on the engineering budget and how much the facility has to lose. Spending \$125,000 on system-wide protection for a top-10 market TV station is easily justified. At smaller operations, justification may not be so easy.

## **The Key tolerance envelope**

The susceptibility of electronic equipment to fail because of disturbances on the AC power line has been studied by many organizations. The benchmark study was conducted by the Naval Facilities Engineering Command, Washington, DC. The far-reaching program, directed from 1968 to 1978 by Lt. Thomas Key, identified three distinct categories of recurring disturbances on utility company power systems. As shown in Table 1, it is not the magnitude of the voltage, but the duration of the disturbance that determines the classification.

In the study, Key found that most data-processing (DP) equipment failure caused by AC line disturbances occurred during bad weather. According to a report on the findings, the incidence of thunderstorms in an area may be used to predict the number of failures.

The type of power-transmission system used by the utility company also was found to affect the number of disturbances observed on power company lines. For example, an analysis of utility system problems in Washington, DC; Norfolk, VA; and Charleston, SC, demonstrated that underground power-distribution systems experienced one-third fewer failures than overhead lines in the same areas. Based on his research, Key developed the "recommended voltage tolerance envelope"



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shown in Figure 1. The design goals illustrated are recommendations to computer manufacturers for implementation in new equipment.

### Assessing lightning hazards

As identified by Key in his Naval Facilities study, the extent of lightning activity in an area significantly affects the probability of equipment failure caused by transient activity. The threat of a lightning flash to a facility is determined, in large part, by the type of installation and its geographic location. The type and character of the lightning flash are also important factors.

The Keraunic number of a geographic location describes the likelihood of lightning activity in that area. Figure 2 shows the Isokeraunic map of the United States, which estimates the number of lightning days per year across the country. On average, 30 storm days occur each year across the continental United States. This number does not fully describe the lightning threat, however, because many individual lightning flashes occur during a single storm.

The structure of a facility has a significant effect on the exposure of equipment to potential lightning damage. Higher structures tend to collect and even "trigger" localized lightning flashes. Because storm clouds tend to travel at specific heights above the earth, conductive structures in mountainous areas attract lightning activity more readily. The exposure factor is a function of the size of the facility and the Isokeraunic rating of the area. The larger the physical size of an installation, the more likely it is to be hit by lightning during a storm. The longer a transmission line (AC or RF) or the taller the tower, the more lightning flashes it is likely to receive.

The relative frequency of power problems is seasonal in nature. As shown in Figure 3, most problems are noted during June, July and August. These high problem rates can be traced primarily to increased thunderstorm activity.

### Transient protection alternatives

A facility can be protected from transient disturbances in two basic ways: the systems approach or the discrete device approach. Table 2 outlines the major alternatives available, which include:

- UPS (uninterruptible power system) and standby generator;
- UPS stand-alone system;
- Secondary AC spot network;
- Secondary selective AC network;
- Motor-generator set;
- Shielded isolation transformer;
- Suppressors, filters, lightning arrestors and;
- Solid-state line-voltage regulator.

PARAMETER	TYPE 1	TYPE 2	TYPE 3
DEFINITION	Transient and oscillatory overvoltage	Momentary undervoltage or overvoltage	Power outage
CAUSES	Lightning, power network switching, operation of other loads	Power system faults, large load changes, utility company equipment malfunctions	Power system faults, unacceptable load changes, utility equipment malfunctions
THRESHOLD (Note 1)	200-400% of rated rms voltage or higher (peak instantaneous above or below rated rms)	Below 80-85% and above 110% of rated rms voltage	Below 80-85% of rated rms voltage
DURATION	Transients 0.5-200 $\mu$ s wide and oscillatory up to 16.7ms at frequencies of 200Hz to 5kHz and higher	From 4-6 cycles, depending on the type of power system distribution equipment	From 2-60 sec if correction is automatic; from 15 min to 4 hrs if manual

Note 1: The approximate limits beyond which the disturbance is considered to be harmful to the load equipment.

Table 1. Types of voltage disturbances identified in the Key report.

SYSTEM	TYPE 1	TYPE 2	TYPE 3
UPS system and standby generator	All source transients; no load transients	All	All
UPS system	All source transients; no load transients	All	All outages shorter than the battery supply discharge time
Secondary spot network (Note 1)	None	None	Most, depending on the type of outage
Secondary selective network (Note 2)	None	Most	Most, depending on the type of outage
Motor-generator set	All source transients; no load transients	Most	Only brown-out conditions
Shielded isolation transformer	Some source transients; no load transients	None	None
Suppressors, filters, lightning arrestors	Most source transients; most load transients	None	None
Solid-state line voltage regulator	Most source transients; no load transients	Some, depending on the response time of the system	Only brown-out conditions

Note 1: Dual-power feeder network.

Note 2: Dual-power feeder network using a static (solid-state) transfer switch.

Table 2. Types of system-wide protection equipment available to facility managers and the AC line abnormalities that each approach can handle.

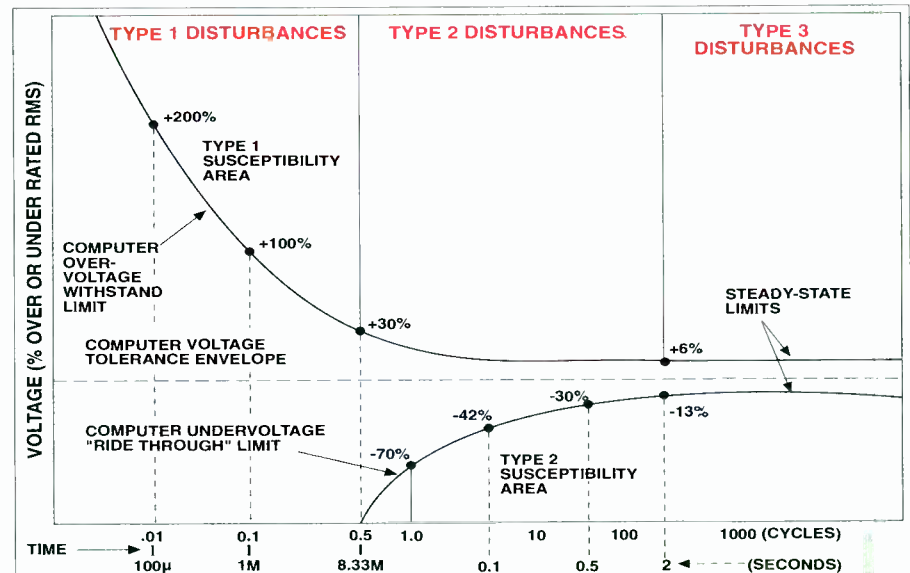


Figure 1. The recommended voltage tolerance envelope for computer equipment is shown above. This chart is based on pioneering work done by the Naval Facilities Engineering Command. The study identified how the magnitude and duration of a transient pulse must be considered in determining the damaging potential of a spike. The design goals illustrated in the chart are recommendations to computer manufacturers for implementation in new equipment. (Adapted from: Lt. Thomas Key, "The Effects of Power Disturbances on Computer Operation," IEEE Industrial and Commercial Power Systems Conference, Cincinnati, June 7, 1978.)

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Table 3 lists the relative benefits of each protection method. Because each installation is unique, conduct a thorough investigation of a facility's needs before purchasing equipment. The systems approach offers the advantages of protection engineered to a particular application and need, and (usually) high-level factory support during equipment design and installation. The systems approach also means higher costs for the end-user.

Developing specifications for system-wide power-conditioning/backup hardware requires careful analysis of various factors before a particular technology or a specific vendor is selected. Factors in this process relate to the load hardware and load application. The electrical power required by a sensitive load may vary widely, depending on the configuration of the system. The principal factors that apply to system specification include the following:

- Power requirements including: voltage, current, power factor, harmonic content and transformer configuration;
- Voltage-regulation requirements of the load;
- Frequency stability required by the load, and the maximum permissible slew rate (the rate of change of frequency per second);
- Effects of unbalanced loading;
- Overload and inrush current capacity;
- Bypass capability;
- Primary/standby path transfer time;
- Maximum standby power reserve time;
- System reliability and maintainability; and
- Operating efficiency.

An accurate definition of critical applications will aid in the specification process for a given site. The potential for future expansion also must be considered in all plans.

Power requirements can be determined either by measuring the actual installed hardware or by checking the nameplate ratings. Most nameplate ratings include significant safety margins. Moreover, the load normal-

SYSTEM	STRONG POINTS	WEAK POINTS	TECHNICAL PROFILE
UPS system and standby generator	Full protection from power outage failures and transient disturbances; ideal for critical DP and life-safety loads	Hardware is expensive and may require special construction; electrically and mechanically complex; noise may be a problem; high annual maintenance costs	Efficiency 80-90%; typical high impedance presented to the load may be a consideration; frequency stability good; harmonic distortion determined by UPS system design
UPS system	Completely eliminates transient disturbances; eliminates surge and sag conditions; provides power outage protection up to the limits of the battery supply; ideal for critical load applications	Hardware is expensive; depending on battery supply requirements, special construction may be required; noise may be a problem; periodic maintenance required	Efficiency 80-90%; typical high impedance presented to the load may be a consideration; frequency stability good; harmonic content determined by inverter type
Secondary spot network (Note 1)	Simple; inexpensive when available in a given area; protects against local power interruptions; no maintenance required by user	Not available in all locations; provides no protection from area-wide utility failures; provides no protection against transient disturbances or surge/sag conditions	Virtually no loss, 100% efficient; presents low impedance to the load; no effect on frequency or harmonic content
Secondary selective network (Note 2)	Same as above; provides faster transfer from one utility line to the other	Same as above	Same as above
Motor-generator set	Electrically simple; reliable power source; provides up to 0.5 sec power-fail ride-through; completely eliminates transient and surge/sag conditions	Mechanical system requires regular maintenance; noise may be a consideration; hardware is expensive; depending on m-g set design, power-fail ride-through may be less than typically quoted by manufacturer	Efficiency 80-90%; typical high impedance presented to the load may be a consideration; frequency stability may be a consideration, especially during momentary power-fail conditions; low harmonic content
Shielded isolation transformer	Electrically simple; provides protection against most types of transient and noise; moderate hardware cost; no maintenance required	Provides no protection from brown-out or outage conditions	No significant loss, essentially 100% efficient; presents low impedance to the load; no effect on frequency stability; usually low harmonic content
Suppressors, filters, lightning arrestors	Components inexpensive; units can be staged to provide transient protection exactly where needed in a facility; no periodic maintenance required	No protection from Type 2 or 3 disturbances; transient protection only as good as the installation job	No loss, 100% efficient; no effect on impedance presented to the load; no effect on frequency or harmonic content
Solid-state line voltage regulator	Moderate hardware cost; uses a combination of technologies to provide transient suppression and voltage regulation; no periodic maintenance required	No protection against power outage conditions; slow response time may be experienced with some designs	Efficiency 92-98%; most units present low impedance to the load; usually no effect on frequency; harmonic distortion content may be a consideration

Note 1: Dual-power feeder network.  
Note 2: Dual-power feeder network using a static (solid-state) transfer switch.

Table 3. Technical merits of various transient protection equipment.

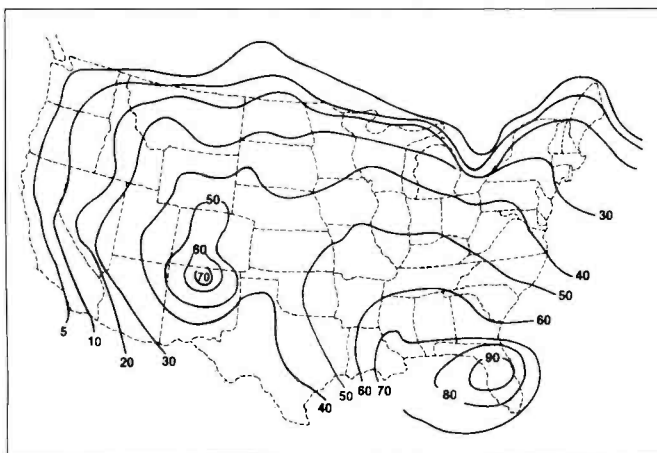


Figure 2. This Isokeraunic map of the United States shows the approximate number of lightning days per year.

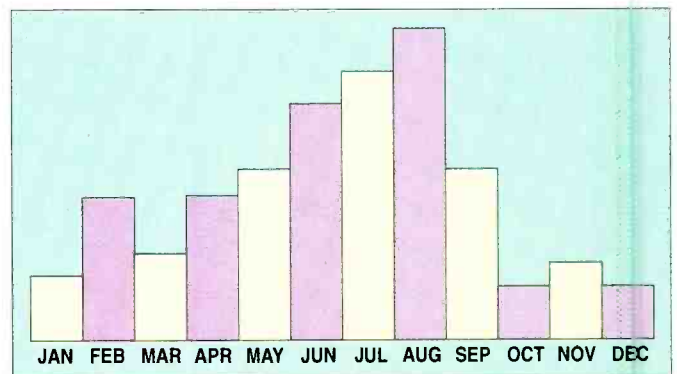


Figure 3. The relative frequency of power problems in the United States, classified by month.

# AC Power Distribution SHOWCASE

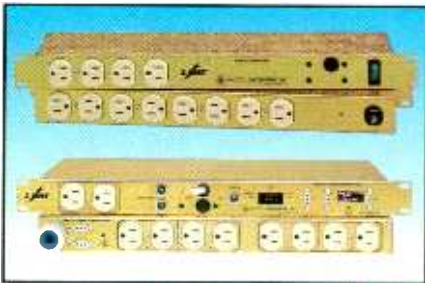
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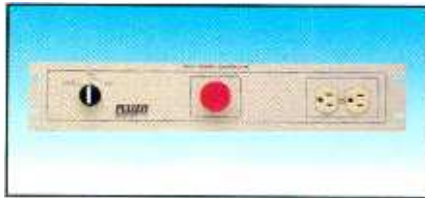
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Satellite Antenna Lightning Arrester System



The solution to multiple line protection problems. Protects all circuit functions, including motor drives and sensors, linking a satellite tracking station with a remote receiver. Can withstand spikes and surges as extreme as lightning strikes on AC power, RF and telephone lines. Provides EMI/RFI filtering on low frequency circuits. NEMA connectors available for AC lines, RJ45 for phone and data lines, terminals for motor drive and sensor circuits as well as "F" type connectors for coaxial cables. Convenient, easy to install 19" rack mountable steel enclosure is a slim 1.75" high, 6" deep.

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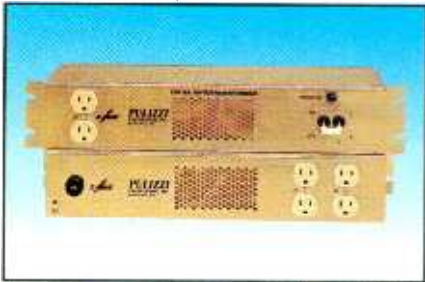
## Remote Power Control Panel



Centralize your system's power controls. Controls all Power Conditioners with standard industry configuration 3-pin remote connectors. Panels for both standard and latch type controllers. Needs only 3-1/2" height. Includes a utility convenience outlet, red EPO mushroom switch and reset (on/off) switch. Finished in light textured gray, FED-STD 595 #26559.

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## Step Up, Step Down Voltage Controllers, Auto Transformers



Change European voltage to 125VAC or step up domestic voltage to accommodate 220VAC. Current ratings from 10 to 30 AMPS, 750 to 2880 Volt AMPS. Up to 12 NEMA or IEC receptacles. Optional protection from spikes and surges, EMI/RFI filter. Only 3-1/2" high (2U).

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µP Controlled RS232 Remote Power On/Off Intelligent System



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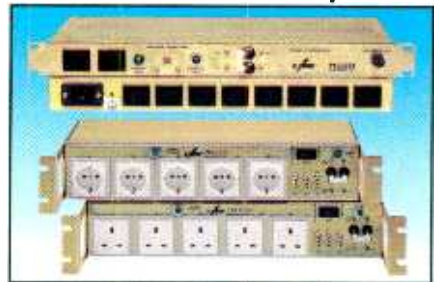
## 3-Phase Power Controllers



Rack mounted. 3-1/2" (2U) high. Depths from 8-1/2" to 14-1/2". Includes spike and surge protection, EMI/RFI filter, remote I/O connectors for power on/off, EPO and power-up of additional equipment down line; precision electromagnetic circuit breakers and power indicator lights. Options include Multiple Time Delay® power-up between sections, receptacle type and output voltages of 125 or 208 VAC. Designed to meet UL 1950 and CSA 22.2-950.

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## International Power Control Systems



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ENVIRONMENTAL ATTRIBUTE	TYPICAL ENVIRONMENT	ACCEPTABLE LIMITS FOR DP SYSTEMS	
		NORMAL	CRITICAL
Line frequency	$\pm 0.1$ to $\pm 3\%$	$\pm 1\%$	$\pm 0.3\%$
Rate of frequency change	0.5 to 20Hz/s	1.5Hz/s	0.3Hz/s
Over- and undervoltage	+5 to 6%, -13.3%	+5% to -10%	$\pm 3\%$
Phase imbalance	2 to 10%	5% max	3% max
Tolerance to low power factor	0.85 to 0.6 lagging	0.8 lagging	less than 0.6 lagging or 0.9 leading
Tolerance to high steady-state peak current	1.3 to 1.6 peak/rms	1.0 to 2.5 peak/rms	Greater than 2.5 peak/rms
Harmonic voltages	0 to 20% total rms	10 to 20% total 5 to 10% largest	5% max total 3% largest
Voltage deviation from sine wave	5 to 50%	5 to 10%	3 to 5%
Voltage modulation	Negligible to 10%	3% max	1% max
Surge/sag conditions	+20%, -30%	+10%, -15%	+5%, -5%
Transient impulses	Varies widely; 1.0 to 1.5kV typical	Less than 400V above sinusoid	Less than 200V above sinusoid
RFI/EMI normal and common modes	10V up to 20kHz, less at high freq.	Varies widely; 3V typical	Varies widely; 0.3V typical
Ground currents	0 to 10A plus impulse noise current	0.001 to 0.5A or more	0.0035A or less

Table 4. Power-quality attributes for data-processing hardware. (Adapted from: Federal Information Processing Standards Publication No. 94, "Guideline on Electrical Power for ADP Installations," U.S. Department of Commerce, National Bureau of Standards, Washington, DC, 1983.)

ly will include a diversity factor; all individual elements of the load will not necessarily be operating at the same time.

Every load has a limited tolerance to noise and harmonic distortion. Critical data processing and computer equipment loads typically can withstand 5% THD with no adverse effects where no single harmonic exceeds 3%. The power-conditioning system must provide this high-quality output waveform to the load, regardless of the level of noise and/or distortion present at the AC input terminals.

If a power-conditioning/standby system does not operate with high reliability, the results often can be disastrous. In addition to threats to health and safety, there is a danger of lost revenue and hardware damage. Reliability must be considered from three different viewpoints:

1. Reliability of utility AC power in the area.
2. Impact of line-voltage disturbances on DP loads.
3. The ability of the protection system to maintain reliable operation when subjected to expected and unexpected external disturbances.

The environment in which the power-conditioning system operates will have a significant effect on reliability. Extremes of temperature, altitude, humidity and vibration can be encountered in various applications, most notably, transmitter sites. Extreme conditions can precipitate premature component failure and unexpected system shutdown. Most power-protection equipment is rated for operation from 0°C to 40°C. During a commercial power failure, however, the ambient temperature of the equipment room can easily exceed either value, depending on the exterior temperature. Operating temperature derating typically is required for alti-

tudes in excess of 1,000 feet.

Table 4 lists key power-quality attributes that should be considered when assessing the need for power-conditioning hardware.

### The next step

A detailed examination of each of the power-system protection alternatives available to TV stations and production facilities is beyond the scope of this article. There are, however, a number of publications that describe the various approaches in detail, including the following:

- Product literature from power-conditioning manufacturers. A comprehensive listing of vendors is located under the heading ancillary & support equipment beginning on p. 87 of the 1996 *BE Buyers Guide*.
- The book "AC Power Systems," J. Whitaker, CRC Press, Boca Raton, FL, 1991.
- The booklet "EC&M Practical Guide to Quality Power for Sensitive Electronic Equipment," A. Berutti and R. Waggoner editors, Intertec Electrical Group, Overland Park, KS, 1994.

Protection against transient disturbances is a science that demands attention to detail. This work is not inexpensive, and it is not something that can be accomplished overnight. Facility managers will, however, wind up paying for transient protection one way or another, either before or after problems occur. In the world of transient protection, there is truly no such thing as a free lunch. ■

Jerry Whitaker is a *BE* contributing editor.



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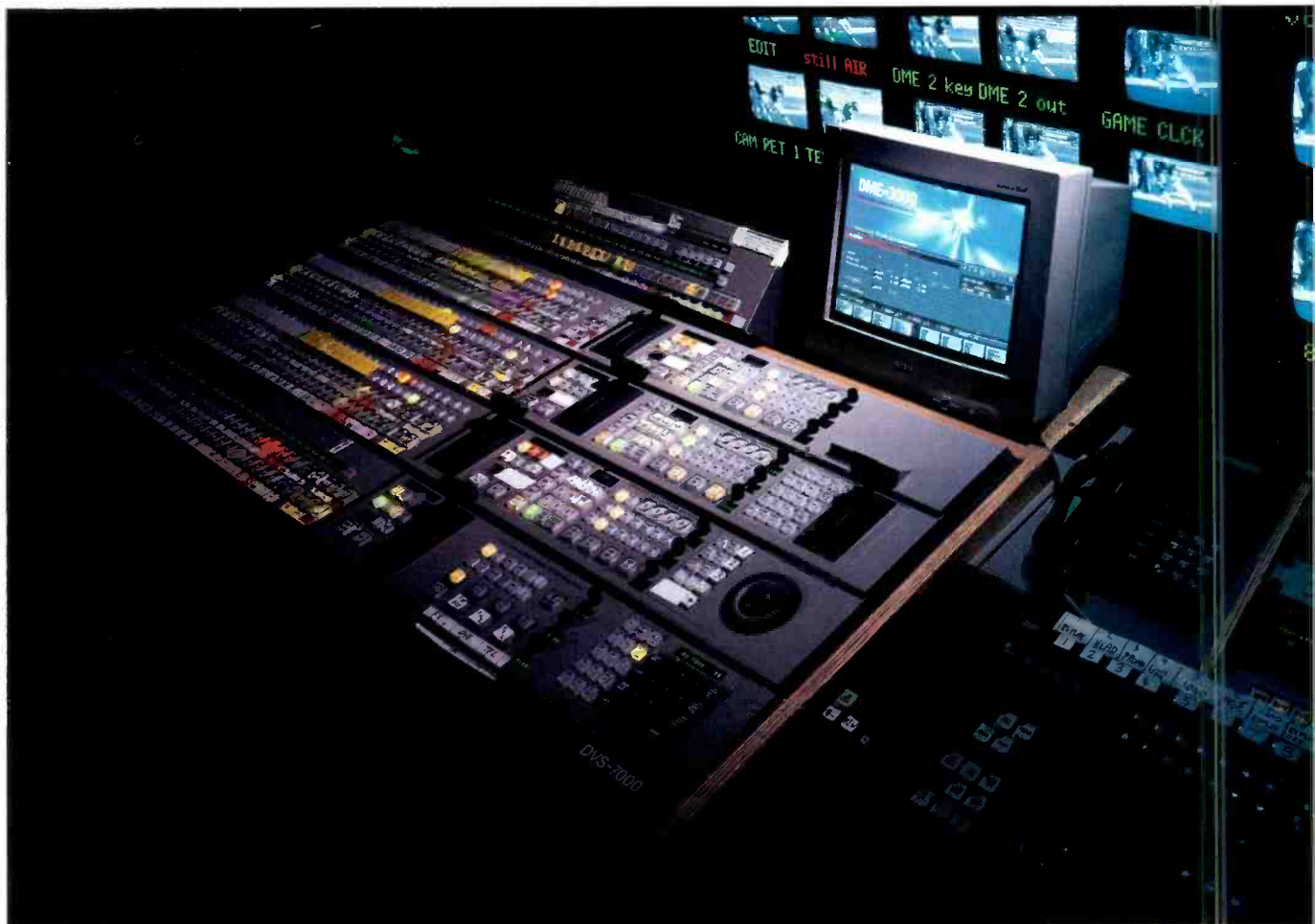
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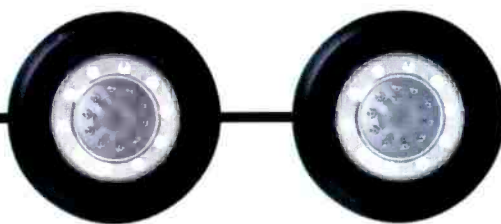
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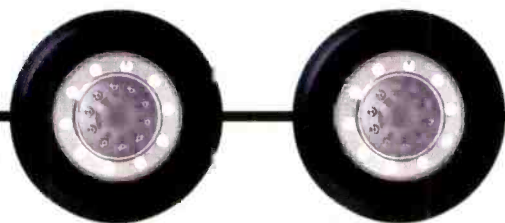


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# Using fiber in the field

*As costs come down and reliability goes up, the advantages of fiber-optic signal transport on remotes become undeniable.*

In the recent movie *Sabrina*, Harrison Ford illustrates his character's business vision when he states, "I know it the way I knew that fiber optics would replace coaxial cable." This replacement has been steadily occurring in fixed TV broadcast communications, just as it has already occurred in data communications and voice communications. One area where the transition from coax to fiber is taking place now is outdoors in remote production environments, where it is gaining momentum fast.

A few years ago, fiber optics were unheard of as the primary cabling from camera sites to the production vehicle. Now you see fiber at all the grand sporting events — the Olympics, Super Bowls, the World Cup, Formula One racing and the like. The same applies to entertainment events (like *Woodstock* and the *Three Tenors in Concert*) and news events (such as elections, coverage from Bosnia and papal visits). To appreciate where fiber systems best fit, it is important to understand the advantages and limitations of fiber optics.

## Applications

There are two main application areas for fiber in remote broadcasting. The first involves feeding video and audio program material from the production site to an uplink or the demarcation point of a common carrier. This has been the predominant use for fiber in the field for the last 15 years. The other emerging application is for lightweight "snakes" linking cameras and microphones to the production control room(s). This is the area that has required significant development of specific systems.

In general, these fiber-optic systems are standard interface adapters that convert electrical signals on copper to/from optical signals on fiber cables. These adapters may be inserted whenever and wherever desired, and they can be moved easily from location to location.

Fiber-optic systems made their field debut in 1980, in such televised events as the Democratic

National Convention and the Winter Olympics. At that time, and throughout the '80s, broadcasters adapted conventional rack-mounted systems by "suitcasing" them in shock-mounted roadcases. Although these systems offered the inherent advantages of fiber-optic communications, they were inconvenient to carry and power. Today's portable fiber systems make field teleproduction a much easier and more reliable undertaking.

Those traditional rack-mounted systems still are the mainstay of fixed video and audio communications for studio-transmitter links, campus and intrabuilding networks, as well as medium- to long-haul telecommunications. Typically, such systems employ FM video with multiple audio subcarriers diplexed above the video baseband or, in long-haul systems, one or more video channels digitized and multiplexed with their associated audio channels onto one optical fiber.

Like all fiber-optic systems, they provide superior signal transmission and eliminate virtually all the problems associated with copper, including ground loops and hum, electromagnetic or RF interference, crosstalk, lightning problems and high-frequency rolloff. The newest generation of fiber systems couples these advantages with the enhanced portability and weight reduction. The fiber-optic cables used have also become more durable, more so than coaxial or triaxial cables, and the electronics are now housed in miniature enclosures built for field environments.

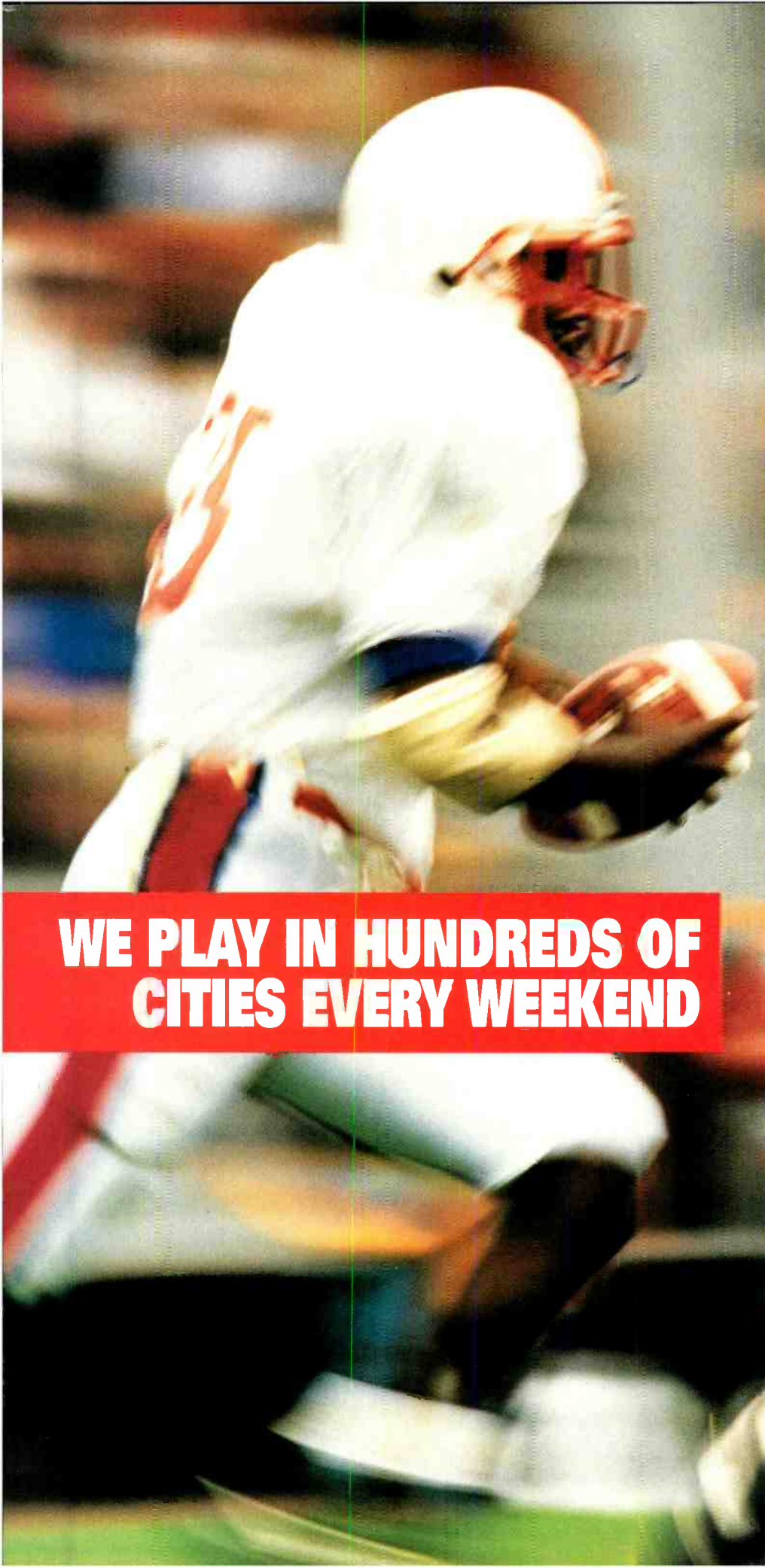
## Rugged fiber cables

One slender (0.25 inch) cable can replace as many as six coaxial cables plus more than 64 audio pairs. As a result, every 1,000-foot section of fiber-optic cable weighing less than 15 pounds can replace more than a ton of copper. Naturally, the labor savings on setups and strikes are significant. However, the savings in troubleshooting are even more impressive.

One of the lingering myths about fiber is that

*Continued on page 56*

**The Bottom Line:** — Beyond the obvious size, weight and setup/strike time advantages, new fiber systems designed for the field offer enhanced reliability, quality and flexibility, plus a measure of future-proofing from their modular, format-independent connectivity. An increasing number of venues are now pre-wired with fiber, and telcos are installing more permanent fiber links to these locations every day. \$



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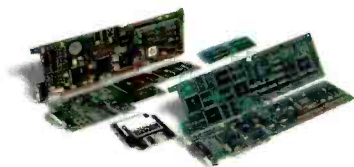
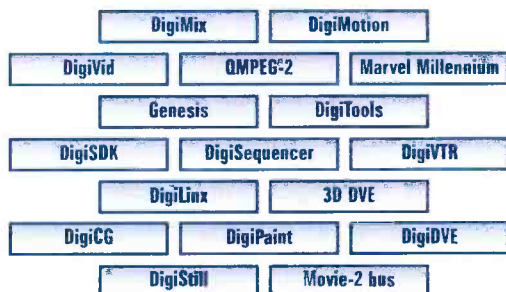


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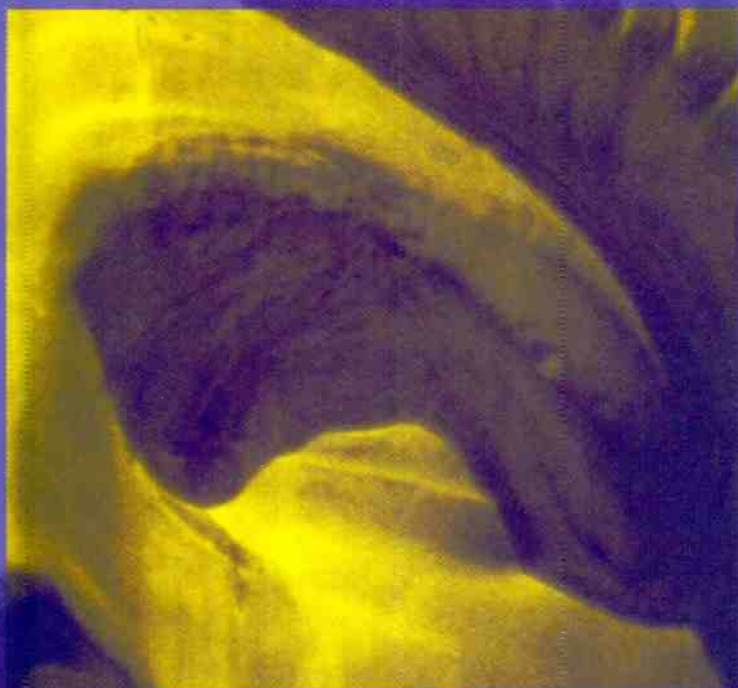
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because it is lightweight, and because the "conductors" are made of glass, it must be fragile. On the contrary, today's fiber elements are stronger than steel, and the cables are designed for battlefield use. Such "tactical" cables have proven to stand up to golf spikes, automobile traffic and even the environmental horrors of Woodstock '94. In order to survive the remote production environment — random knots, slamming doors, forklift traffic and so on — the cable and connectors should have endured substantial testing. Therefore, you will find the term "mil spec" used repeatedly when specifying fiber cables for remote broadcasting.

For use in the field, fiber cables should have a polyurethane (not PVC) jacket for crush resistance. It should be tightly linked to the reinforcing Kevlar yarn, yet it should be strippable. You can test the cable for integrity by taking a 1m section and trying as hard as you can to stretch it. You won't damage the fibers, but you want to see if the outer jacket wrinkles up when tension is released. (It shouldn't.) Then bend the cable into a small loop or knot; the jacket should remain relatively smooth, not wrinkled.

What happens when a lawnmower or street sweeper cuts a cable? The cable can be quickly spliced in temporary fashion to get on the air, or the ends may be reterminated with crimp-on, bayonet-type ST connectors (this requires about two minutes per end) and barreled together. In most cases, after the remote, the cable can be properly terminated and returned to regular service as two shorter cables.

The ST-type connector is the industry standard single-fiber connector. It is a low-cost connector and is commonly used in campus backbone applications. One ST is required for each end of each fiber, similar to a BNC on coax. Cable connectors are always male, so connecting two cables requires a double-female adapter barrel. Today's fiber-optic cables often include multiple fibers, and if you terminate these with ST connectors, you will need to be aware of proper labeling and signal directions for each fiber.

The military multipin hermaphroditic connector is becoming the standard in field applications. Originally developed for the Army, this connector is more reminiscent of a triax connector, but more expensive. It has two male contacts and two female contacts in the screw-on plug. The cable crosses over such that each fiber has a male contact on one connector end and a female contact on the other end. Thus, the cable cannot be installed in the wrong direction, and a 4-fiber cable



*Like BNCs or F connectors on coax, the single-fiber ST connector uses male plugs on all cable ends and female jacks on chassis mounts.*

requires only a single connector. Plugs can be directly interconnected together forming extension cables, with no barrel adapters or intermediate patch panels required.

Fiber connectors become lossy when dirty, so they must be kept clean. Always put the dust caps on fiber connector plugs and receptacles when they are not in use; when in doubt, clean the fiber contacts.

---

*Today's fiber elements  
are stronger than steel,  
and the cables are  
designed for  
battlefield use.*

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#### **A reel light solution**

Reels can be the bane of a fiber-optic field installation. With coax, you don't expect the reels to last long because the cable is disposed of soon anyway, and the reel usually goes away at the same time. But fiber cable will last many years, and it's more expensive, so it warrants better care. A reel can hold anywhere from 500 to 3,000 feet of tactical cable. If the reel gives out or falls apart, the cable can spill off sideways, and the untangling nightmare begins. Avoid a reel with flanges that are bolted through the hub — the nuts may fall off in transit, and there goes the cable. Avoid split reels or reels with external hangers for the inside course of cable. The connectors will find a way to flop, causing possible damage during deployment and take

up. Use reels that have compartments in the hub (without axles) to store and protect the inside length of cable.

The cable may be pulled from a stationary reel or paid out behind the reel as it is carried. Because there is not a multifiber rotary slip joint, the cable is deployed then connected to the electronics. Otherwise, the inner length of cable will twist with respect to stationary electronics. Plugs attach to mating hermaphroditic receptacles mounted on portable shell-type enclosures or on the panel of the production vehicle.

If a production vehicle is dedicated to the fiber system, the electronics can be mounted in standard 19-inch racks. (See Figure 1.) Fiber pigtailed lead from the hermaphroditic receptacle(s) to ST-type connectors on the rear of the electronics frame. The frame

typically contains plug-in modules, each being either a transmitter or receiver for various types of signals — video, audio, intercom or control data.

#### **Portable enclosures**

At the camera location, the corresponding modules have to be housed in a more robust enclosure. Typically, this portable "shell" will have a hinged lid and be gasketed to provide environmental protection. The hermaphroditic connector will screw onto an externally mounted receptacle, and all electrical connectors (BNC, XLR, etc.) will be on side panels. Although the enclosure may be weather-resistant, unused XLRs can leak, so it's a good idea to bag the enclosure in inclement weather.

Field events do not occur in comfortable environments. Both cable and electronics should be able to operate without fans or heaters in temperatures ranging anywhere from -40°C to +70°C (-40°F to +158°F). Military specs are even wider. The same unit has to be capable of televising summer and winter events.

If the vehicle is not dedicated to using fiber, or if you're using a fly-away system, you will want both ends of the cable run to be portable. (This also applies for occasional rentals, or where flexibility is paramount.) In this case, both ends of the system may be housed in modular shell-type enclosures, or one electronics end may be housed in a shell while the other end may be conveniently mounted inside the cable reel. Ideally, all electronics and cable are transported in a single case suitable for checking as airplane luggage.

Modules may be reconfigured as event communications require. A common configuration is the 3-camera shoot. Typically in

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that setup, three remote cameras each send video (NTSC or PAL) plus two audio channels to the vehicle, and they receive gen-lock plus two audio or IFB return channels. Intercom, camera control data and tally/call switch closures are transmitted in both directions.

In remote broadcasting, communications is the tail that wags the dog. With many intercoms, power must be provided to belt-packs from the portable shell. Fiber cables carry lightwave signals, not electrical current, so the remote shell must be powered locally (at the camera end), and the proper voltages sent from there to a number of nearby intercom or IFB belt-packs. The same applies to any phantom-powered audio devices, such as condenser microphones or line amps. Power can be supplied to a shell by AC or batteries. A typical camera battery can power a fiber shell for five to six hours, and a deep-cycle marine battery will power it for an eternity.

Although this can be seen as a disadvan-

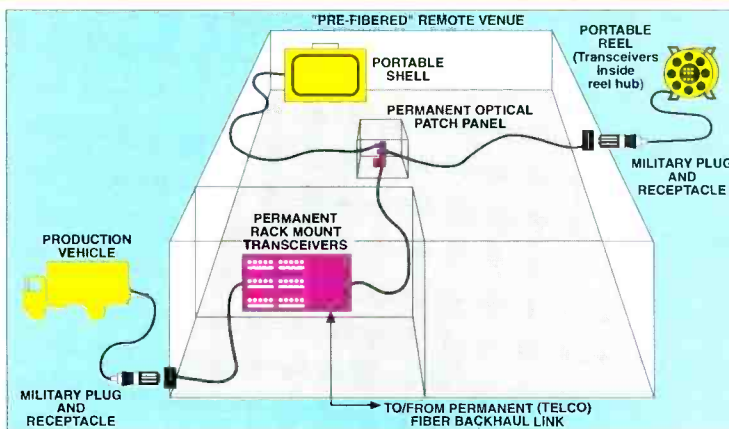


Figure 1. A variety of mobile and portable fiber-optic terminal gear can be interfaced as "first mile" field links to the nearest fixed termination point of a fiber backhaul link. Most systems are inherently bidirectional, and signals can remain in the optical domain from the production location to the broadcast transmission point.

tage of fiber on remotes, a battery is still a lot lighter and easier to transport than a ton of copper. Most portable fiber systems already have internal rechargeable batteries that serve as an uninterruptable power supply in the event that external power is lost or has to be changed.

#### Modulation schemes

Video is transmitted on fiber using FM or

digital techniques. Both offer high quality and extreme stability. Avoid using AM-based video (sometimes called *intensity modulation* or IM) because the optical attenuation of the cable dramatically impacts video level. Even with AGC, AM video levels will vary wildly when the fiber cable is severely bent or driven over by a heavy vehicle. Similarly, AM systems without AGC may have to be recalibrated every time a different cable length is used. With FM and digital, video levels remain steady regardless of cable length or condition.

In specifying video performance, you assure yourself of the highest-quality signal transmission when you demand that the system meets or exceeds the *EIA/TLA-250-C, Short Haul* recommended standard. According to this standard, video signal-to-noise ratio should be  $\geq 67$ dB, but some systems can easily achieve 70dB or more. The better your originating signals, the better they will end up at the receiving end.

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In today's broadcasting and production communities, new video servers and non-linear editing systems are being tested and evaluated. To accomplish their goals of fast multi-channel access and storage efficiency,

most servers rely on video compression. And to help reduce picture distortions caused by high levels of compression, most systems use pre-filtering and sub-sampling to reduce the data that must be compressed. Instead of studio quality 4:2:2 component signals, they work with 4:2:0. Or 4:1:1. Or even 3:1:1.

These sampling structures produce pictures that are acceptable for some applications and may look okay to the eye. But even with no compression, they can prove to be inadequate for high-quality broadcast video productions. Because

once chrominance and/or luminance information has been lost through pre-filtering and sub-sampling, it can never be restored.

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That's why Sony is developing new compression algorithms that can use 4:2:2 signals to produce broadcast pictures that retain their high quality through the rigors of studio editing and post-production.

In the brave new world of digital pictures, "good enough" will no longer be good enough. To protect your investment—and prevent breakdowns in quality—you need to work with the best picture you can get.

And the first step toward maintaining the picture quality you need is to use nothing less than 4:2:2 Digital Component Video.

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The military multipin hermaphroditic connector handles up to four fibers in a screw-on connector with opposite genders on either end of the cable (like XLR connectors).

Video quality will fare much better if you avoid audio subcarriers multiplexed above the video. Similarly, audio signal quality will be improved by avoiding sync buzz from out-of-band components bleeding through.

*The greatest advantage of fiber is its flexibility in that it is not dedicated to a specific signal type or quantity.*

Ideally, audio is transmitted digitally, and you can get practically any number of audio channels multiplexed onto a single fiber. You can add audio channels in pairs by adding plug-in modules, or you can add larger increments of, say, eight or 16 at a time in stand-alone multiplexers. With digital transmission, audio frequency response will typically be flat from DC to 22kHz, and S/N will hover around

*Continued on page 64*



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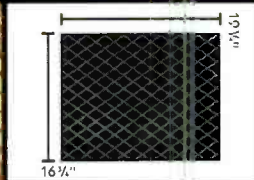
## RELIABLE

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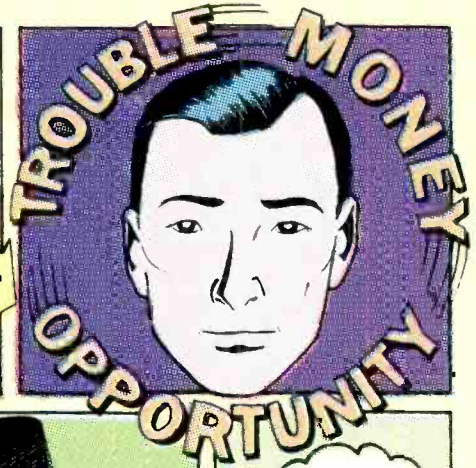


IT WAS JUST ANOTHER PEACEFUL DAY IN THE LIFE OF BERT CANAVAN, SALES MANAGER. THEN, THE PHONE RANG...

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Wow. WEINER INDUSTRIES IS OUR BIGGEST ADVERTISER. STILL, THERE ISN'T MUCH TIME.

THIS MEANS



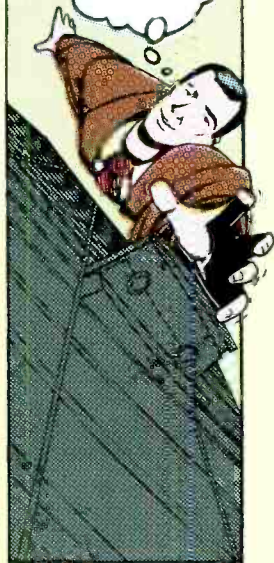
O.K. FIRST I'LL RUN DOWN TO THE LIBRARY AND GET THE SPOT. HOW TOUGH CAN I BE?



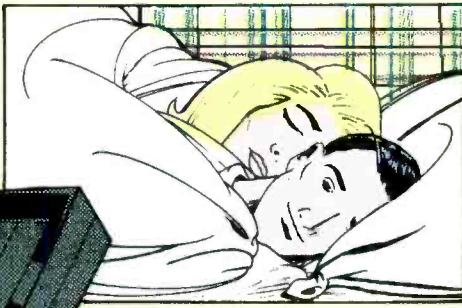
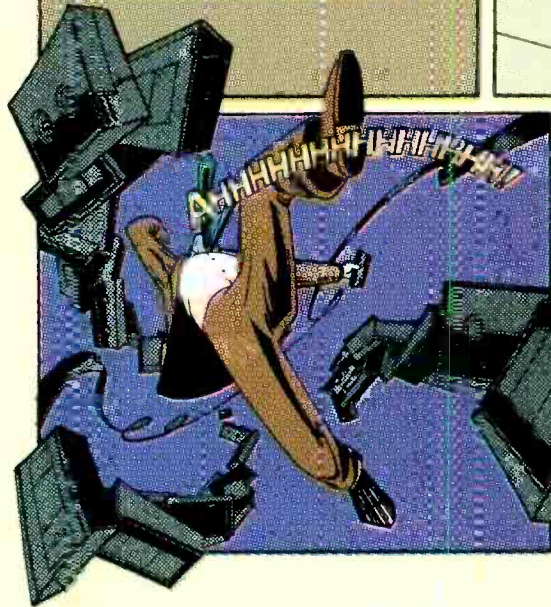
OH NO!

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*the end*



100dB. With subcarrier techniques, the best you will see is about 70dB. In many production applications, this is simply not good enough. In televising golf, for example, when audio gain is cranked up to hear the club hit the ball, background noise becomes unacceptable. Numerous studies have shown that viewers are less tolerant of audio noise than they are of video noise. The growing home theater marketplace has placed even greater emphasis on audio quality.

### In the field

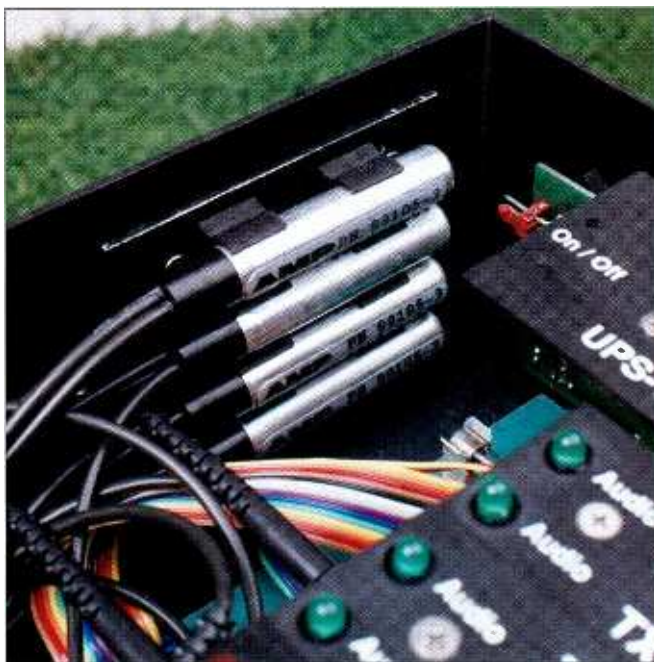
Golf and auto racing are excellent examples of fiber optics in remote broadcasting today. Applications include interconnecting the vehicle to remote cameras, RF towers and announce booths. Distances can be miles long, and copper cables just don't reach.

For example, ESPN and NBC use fiber as a staple for golf broadcasts, as do TV networks around the world. One reason is the speed and ease of setup, but other factors also play a role. Fiber outlasts copper. Triaxial cable punctures easily, and water mixed with fertilizers is terribly corrosive to copper shields. Fiber cable is relatively immune to punctures, because golf spikes just slip off the cable.

An example of a sports-booth link is one that uses a 4-fiber tactical cable fitted with a hermaphroditic connector to bring three or four video monitor feeds to the announce booth, and a Telestrator video back to the truck. It can also bring more than 20 microphone signals back to the truck (delivered at line level) and several separately powered IFB lines to the booth, while carrying two powered 2-wire intercom lines both ways along with various data and switch-closure utility lines in both directions.

For maximum flexibility, cable sections can be 1,500 feet in length, but more than 10 such sections can be linked together to span 5km without any repeaters or amplifiers. All this over a cable that weighs less than 15 pounds per 1,000 feet. Equivalent copper cables (assuming transmission over such lengths were even possible) would weigh more than 1,000 pounds per 1,000 feet.

In most cases, fiber-optic cable is deployed at each event, and reeled up after the event is over. As the technology matures, however, more facilities will be pre-fibered, similar to today's common pre-installation of triax into stadiums and other facilities. At that point, broadcasters will be able to drive up, plug in and get on the



New fiber-optic field enclosures use wavelength-division multiplexers that allow 2-way transmission on a single fiber.

air without having to pull in any cable whatsoever.

Perhaps the greatest advantage of fiber is its flexibility, in that it is not dedicated to a specific signal type or quantity. It is capable of transmitting all forms of signals (and lots of them), whereas triax is for cameras only, wire pairs are for audio only, and so on. For most applications, the fibers' capacity will be limited only by the terminal equipment on hand for the event.

## *Fiber has advanced well beyond the stage of a mere solution to an occasional transmission problem.*

Many non-sports venues are already pre-fibered for video and audio. Government centers, including the White House and the U.S. Capitol premises, have installed fiber-optic video/audio backbones, and smaller state and local facilities have done the same.

For example, at the Texas State House in Austin, nine Texas broadcast stations use the House fiber by plugging in their portable units, thus eliminating the need to string unsightly cables through the beautifully restored edifice. The Texas' State Preservation Board had the foresight to fund this advance, to both the statehouse's and the broadcasters' benefit.

### Looking ahead


As broadcast technology advances, fiber systems will remain expandable to accommodate change. Survey the industry and you will find fiber-optic terminal equipment in either stand-alone or modular plug-in form that carries a wide variety of signals, including digital audio (using AES/EBU I/O), digital video (CCIR-601), lighting control (DMX-512 protocol), Ethernet LAN data and digital-matrix intercom signals.


What will the future bring? New adapters will be introduced to interface yet more types of signals using the same fiber cables. For example, one module will be a dial-up telephone interface that permits phone calls from the remote end of a link without having to rent expensive telco circuits to the camera or production site. Another is a fiber-optic adapter that completely replaces

triaxial cable on existing cameras, sending all component program video, return video and gen-lock, audio, data, intercom and camera control data up to 10km on one optical fiber (four cameras per fiber cable). This will have a monumental impact on metropolitan production networks.

Clearly, fiber-optic systems will have to coexist with conventional copper cables for years to come, so the technology will rely heavily on interface adapters. Widespread use of end-to-end fiber interconnection is still a few years away, and copper terminations will remain in use, particularly in older facilities. But make no mistake, fiber has advanced well beyond the stage of a mere solution to an occasional transmission problem. It is now a key part of remote broadcasting equipment — one that is quickly replacing ordinary copper as the primary production link. ■

Richard Cerny is president of Telecast Fiber Systems, Inc., Worcester, MA.


**For more information on remote fiber-optic equipment circle (151) on Action Card. See also "Fiber-Optic Components," p. 88 of the 1996 BE Buyers Guide.**


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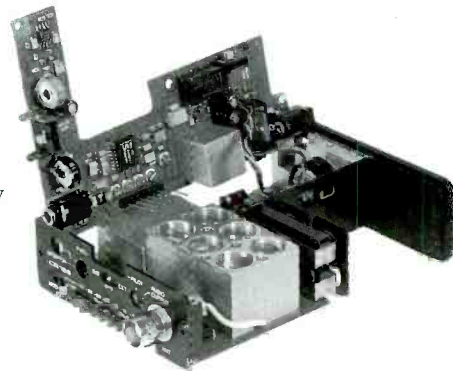
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*The Bottom Line:*

*The law of averages applies to this year's state of the industry. Station budgets and staff sizes will not jump significantly ahead of last year, nor should they take any drastic downturns. Stations are holding their own and that's nice to know in this fast-paced industry. This year, stations will be looking to new technology for the answers.*

# 1996 state of the industry

*The pulse of the industry  
has a nice steady beat.*

**1**995 was a year of positive growth for the broadcast industry. Things were on the upswing...stations had bigger budgets and bigger staffs than they have had in the past several years. Now, the pulse of the industry has evened out to a nice steady beat. On average, stations are spending about the same as last year, give or take a few percentage points across the different market sizes. But it's not time to tighten the budget belt anytime soon. And staff size has remained about the same too.

---

*Stations are still in a buying mode.  
And that's up across all market sizes  
compared to last year.*

---

## **Budget basics**

What stations will be spending on new equipment is always a hot topic. Being able to purchase needed equipment while staying within a budget can be difficult. But this year, that should not prove to be too much of a problem. Overall, stations have the money to spend on equipment, as you will see later on.

Table 1 shows the forecasted equipment budgets from 1994 through 1996. Compared to last year, forecasted budgets are up slightly for the top 50 stations from \$508,724 to \$534,618, which is more than 5%. The top 100 budget is down by approximately 6.5%, from \$274,343 to \$257,933, and the below top 100 budget is up over last year by a decent margin of 9%, from \$186,081 to \$202,855. This year, we were able to

*Photo: Home & Garden TV Network's Avid editing room designed and built by A.F. Associates. Photography by Robert Wolsch Designs.*



include totals for the cable and production categories. The cable budget shows a whopping 60% increase over last year, from \$112,923 to \$180,796, which should enable many cable stations to update some old equipment. The production budget fell back by about 3.5%, from \$167,643 to \$162,246. Even though not all categories saw percentage increases this year, there still continues to be an upward trend in what stations can afford to spend.

### Station spending plans

Compared to last year, stations this year will spend about the same on equipment purchases. On average, the top 50, top 100 and below top 100 TV stations and production companies will all spend about the same as last year. Cable's 60% budget increase is showing a corresponding increase in what equipment will be purchased this year.

The bottom line is that stations want to and need to invest in equipment to remain competitive and up-to-date with all the changes continuing to occur in the industry. Stations are still in a buying mode and new equipment is always on the agenda. Look at Table 2 to find out what kinds of equipment stations are planning on purchasing this year. The table includes 17 different types of equipment.

### The top 10 equipment wish list

Continuing the tradition over the years, the ever-popular audio and video monitors once again top the charts as the number one planned equipment purchase for stations.

Across the board, more than 63% of stations over all markets plan on buying audio and video monitors. That is 10% above last year. The second priority in equipment purchases for TV stations is test equipment. 1994 was the year for graphics equipment; 1995 was the year for new VTRs; and now, for 1996, the priorities have moved to new test equipment.

In 1995, 45.3% of stations bought test equipment. This year, 51.6% plan on buying test equipment. Even though stations will be spending about the same as last year, equipment purchases have stayed the same or gone up across all market sizes this year, except for video recorders. Here's a run-down of the remaining top 10 equipment purchases for 1996 and how these categories compared to 1995:

Number 3 — Video recorders, down by 5.5% over 1995;

Number 4 — Editing equipment, stayed the same as 1995;

Number 5 — Microphones, up by 5% over 1995;

Number 6 — Signal routing/distribution

FORECAST BUDGETS	TV top 50	TV top 100	TV below top 100	Cable total	Production total
1994	\$518,895	\$267,453	\$184,390	NA	NA
1995	\$508,724	\$274,343	\$186,081	\$112,923	\$167,643
1996	\$534,618	\$257,933	\$202,855	\$180,796	\$162,246

Table 1. Equipment budgets for 1994 through 1996. Budgets are broken down by market size.

equipment, up by 1.5% over 1995;  
Number 7 — Cameras, up by 9.5% over 1995;

Number 8 — Signal processing equipment, up by 7% over 1995;

Number 9 — Automation equipment, up by 4.5% over 1995; and

Number 10 — Audio consoles, up by 2.5% over 1995.

The two lowest equipment purchase priorities for stations this year are antenna systems and remote production vehicles. However, even though antenna systems are a low priority, these systems purchases are up slightly by 1.5% over last year. The same goes for remote production vehicles, with an increase in purchases this year by a 1.5% margin.

Buying patterns were similar across the different-sized markets, with of course, the larger markets purchasing equipment from almost all of the categories, because of the bigger budgets.

This year, we also included the spending plans for cable and production facilities. Cable's priority also is audio and video monitors, with their second priority being

test equipment. And with a 60% increase in their budget this year, many cable stations will be updating and purchasing a lot more equipment.

Production's main equipment purchase this year will be editing and desktop systems. Audio and video monitors rate second, with video recorders a close third in equipment priority.

### Engineers are holding their own

Station technical staff sizes will not increase proportionately for 1996, but they are definitely holding their own. Across all markets, including cable and production, staff sizes, on average, have remained the same. Check out Table 3 for staff sizes for 1996.

For top 50 stations, the median staff size is 24.1. For top 100 stations, 11.3 is the average staff size, and for below top 100 stations, 6.4 people seems to be the norm. Cable technical staff size is about equal to that of top 100 TV stations at 11.6. Production, on average, has about 6.3 people, about the same staff size as a below top 100 TV station.

Type of equipment	TV			Cable	Production
	Top 50	Top 100	Below top 100		
Antenna systems	22.4%	5.2%	10.5%	12.9%	2.7%
Audio consoles	32.7%	20.8%	18.4%	22.6%	32.9%
Audio recorders/players	30.8%	20.8%	18.4%	22.6%	28.8%
Automation equipment	37.4%	24.0%	25.4%	19.4%	4.1%
Cameras	46.7%	29.2%	32.5%	32.3%	58.9%
Editing, including desktop systems	54.2%	41.7%	38.6%	35.5%	71.2%
Graphics/effects/titlers	31.8%	32.3%	27.2%	29.0%	50.7%
Microphones	44.9%	41.7%	33.3%	35.5%	49.3%
Monitors (audio & video)	69.2%	60.4%	51.4%	48.4%	64.4%
Remote production vehicles/pgm relay	22.4%	11.5%	13.2%	12.9%	2.7%
Signal processing	43.0%	33.3%	26.3%	32.3%	30.1%
Signal routing/distribution	45.8%	32.3%	37.7%	38.7%	38.4%
Test equipment	61.7%	51.0%	42.1%	45.2%	39.7%
Transmitters	27.1%	14.6%	15.8%	12.9%	0.0%
Video recorders	50.5%	47.9%	43.9%	32.3%	63.0%
Video switchers	27.1%	18.8%	17.5%	29.0%	31.5%
Other	4.7%	12.5%	9.6%	12.9%	2.7%
No purchases planned in 1996	1.9%	2.1%	7.0%	3.2%	1.4%

Table 2. 1996 buying plans by market size and type of equipment.



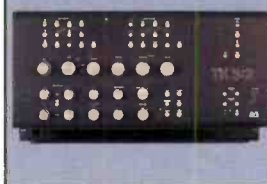


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Base=all respondents	TV			Cable	Production
	Top 50	Top 100	Below top 100		
None	0.0%	1.0%	0.0%	0.0%	2.7%
1 person	1.9%	3.1%	4.4%	19.4%	20.5%
2 people	3.7%	5.2%	17.5%	9.7%	15.1%
3 people	5.6%	5.2%	14.9%	9.7%	15.1%
4 people	2.8%	5.2%	16.7%	9.7%	19.2%
5 to 9 people	17.8%	44.8%	34.2%	12.9%	12.3%
10 to 24 people	26.2%	29.2%	10.5%	25.8%	11.0%
25 to 50 people	24.3%	3.1%	1.8%	9.7%	1.4%
Over 50 people	17.8%	3.1%	0.0%	3.2%	2.7%
Estimated mean	24.1	11.3	6.4	11.6	6.3

Table 3. Station technical staff size by market size.

### Buying power

Engineers (more precisely, vice presidents of engineering, chief engineers, directors of engineering and technical managers) are the ones who've got it when it comes to buying authority. They know the equipment, they handle the budget and they do the recommendations and the buying.

For all markets, including cable, technical managers continue to have the final say on what brands and types of equipment to purchase.

	TV			Cable	Production
	Top 50	Top 100	Below top 100		
	Percent	Percent	Percent	Percent	Percent
Yes	32.7%	22.9%	21.1%	25.8%	28.8%
No	67.3%	77.1%	78.9%	74.2%	71.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4. Stations that use contract engineers, broken down by market size.

Consulting and contract engineers are more in demand these days. See Table 4. Although the majority of work continues to be done by in-house engineering staffs, the contract engineering business is increasing slightly. On average, more than 25% of stations in the different markets use contract engineers. Depending on how you look at it, this can be good or bad. Experienced and qualified engineers are still in demand to create and maintain a quality facility. And this can be done with an existing engineering staff or with engineers who see more opportunities running their own contracting services. The demand is there and the work needs to be done.

### The beat goes on

There is always room for growth. With the fast-paced changes that are occurring in this industry between ATV, spectrum auctions, going digital and dealing with new regulations, it's nice to hear that strong steady beat. Overall, this year, we'll still be holding our own. ■

The information in this year's survey was prepared by the Intertec Publishing research department. The data is based on responses developed from 2,000 mailed surveys forms, of which 421 usable forms were returned.



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*Zaire - 1994*



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## *MegaWave's new set-top antenna: The shape of things to come*

By Marjorie Costello



*MegaWave expects that its antenna technology could be incorporated in a design featuring a more aesthetic and streamlined appearance, such as an eye-catching horizontal winged design that could rest on top of or under the television.*

At the 1995 NAB convention, MegaWave made its own big news at the show. Unlike other exhibitors, the company was not in Las Vegas to promote a product for TV stations or video professionals. Instead, its product-in-development, the next generation in set-top TV antennas, was geared toward consumers. However, the antenna's potential impact could reverberate throughout the consumer electronics and broadcast industries.

After meeting with MegaWave at NAB and following the company's progress in the months that followed, a special demonstration was arranged for this column. We'll share our impressions of the performance of the working prototype shortly.

### **NAB set-top box project**

MegaWave was selected this past March by the National Association of Broadcasters (NAB) as the developer for the organization's improved set-top antenna project. In its selection of the company, the NAB heralded the undertaking as the first major improvement for set-top TV antennas in 30 years. NAB launched and funded the project because research indicated that more than 50% of televisions in the United States depend on set-top antennas to receive TV programming.

The research reflects a real-world reception

reality: While most homes are wired for cable, often the second, third and even fourth television depends on a set-top antenna for reception of VHF and UHF broadcasts. And, notes Kelly Williams, NAB director of engineering, "It was our opinion that there hadn't been a significant improvement in [set-top] antenna technology in the last 20 or 30 years." While companies had added amplifi-

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*"MegaWave solved at least some of the fundamental problems with rabbit ears . . ."*

---

ers and offered different packaging, set-top box technology was, in Williams' words, "a mature technology" that still relied upon the dipole (or rabbit-ear) antenna approach.

During the past few years, it has also become common practice among TV set manufacturers not to include a set of rabbit ears with most models. This recent trend joins the long-time habit among bad-reception-plagued viewers of complaining to the station and asking for advice. As a result, chief engineers

often get calls asking for the name of a good indoor antenna. In fact, it was an NAB board member's request for information on the subject that led to an information-gathering assignment for NAB's science and technology department. Then, in June 1994, NAB released a Request for Proposal (RFP) for its set-top box project.

NAB's goal was to fund the development of a new set-top antenna that could be commercialized and sold to consumers. Some of the major problems with rabbit ears, summarizes Williams, include their need for adjustment; the fact that they scratch the wall; and as they get older, the telescoping pieces don't fit. Another drawback is that dipole antennas generate picture interference from near-field coupling: "When you touch the rabbit ears and you tune, and you then let go, boom, it's bad," explains Williams.

### **MegaWave's background**

MegaWave's proposal — one of the five submitted — caught the attention of NAB. The proposal, Williams says, offered an exciting application of defense technology to a common everyday consumer application.

Recalls Williams, "I am an old antenna guy, and we engineers are funny people and get excited over strange things. [The MegaWave approach] was very interesting and intriguing."

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*The MegaWave antenna tuning in television in Manhattan.*

"MegaWave solved at least some of the fundamental problems with rabbit ears: the near-field coupling and the need for minimal adjustment. The company also has built a good antenna in the engineering sense of the word." The MegaWave design method provides flexibility so that different configurations can be tested via computer. And the antenna combines the VHF and UHF antenna in one unit, so consumers don't have to attach the UHF "bow tie." This feature will offer future benefits if plans go forward to co-locate many advanced TV channels in the UHF band next to the NTSC VHF channel.

Founded in 1994 and based in Boylston, MA, MegaWave is comprised of veteran communications and computer engineers, whose work includes the design and testing of innovative military antennas. Before its selection by the NAB, the company had already worked on contracts for the Advanced Research Projects Agency (ARPA) of the Department of Defense. Accustomed to the quick turnaround expected by the military, MegaWave was demonstrating its "black box" prototype by the summer of 1995.

## The technology

Company CEO John Benham, while remaining mum on proprietary specifics of his company's antenna, says that the antenna taps the latest in electromagnetics. Although applying military communications technology to a consumer antenna, MegaWave does not include a microprocessor in the antenna.

The key to the quick project turnaround and overall development effort, explains Benham, was using computer simulations to "make more precise determinations of how an antenna works, taking into account such variables as design of the antenna, distance from the transmitter and the transmitter's power" among other factors.

## Antenna test

Two versions of the 20"x 8"x4" black box prototype were available for the special demonstration arranged by MegaWave: a "passive" antenna, geared toward urban and suburban areas, and an "active" electrically amplified model for fringe areas. The passive antenna receives VHF and UHF signals — like the amplified model — and was tested in a Manhattan apartment and in a suburban New Jersey home 30 miles outside the city. The MegaWave reception was compared with the performance delivered by several major-brand conventional set-top antennas.

The MegaWave models tuned in channels automatically, while the rabbit ears required rod adjustments. The MegaWave antennas could not overcome inherent reception problems at both locations: steel-structure apartment building in Manhattan and the mountain in the suburbs. However, the new antenna offered picture lock and color for more channels than was possible with the conventional antennas in the demonstration.

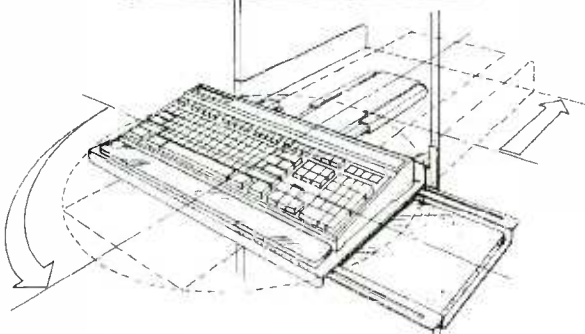
In addition, gone was the annoying coupling effect. Instead, objects, such as the human body or a hand, could be close — or touching —



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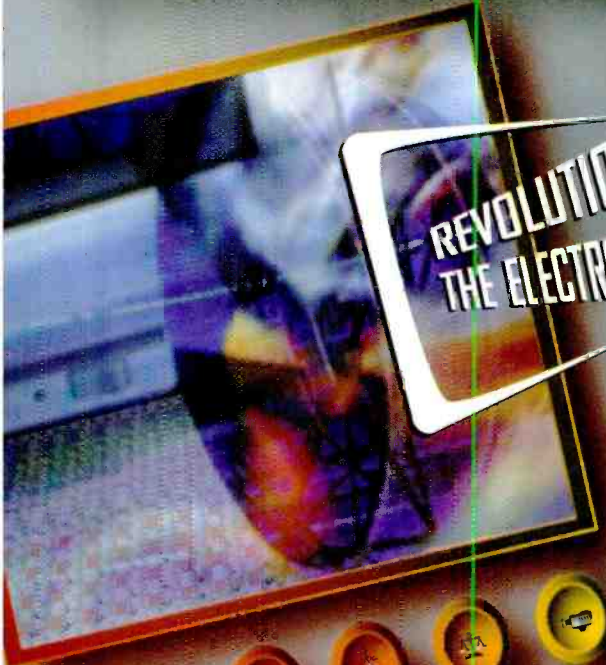


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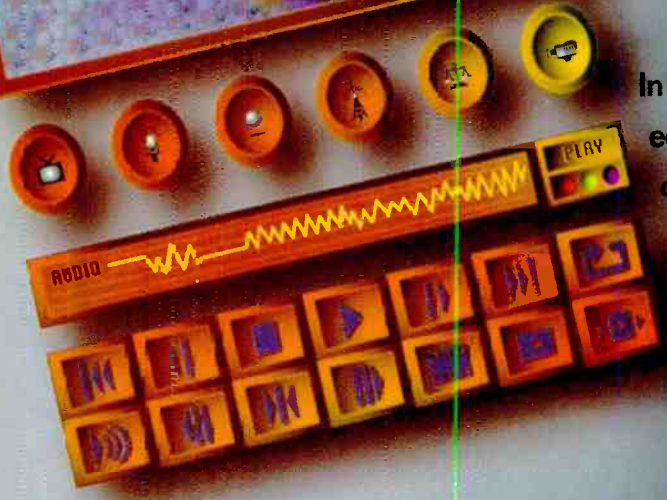


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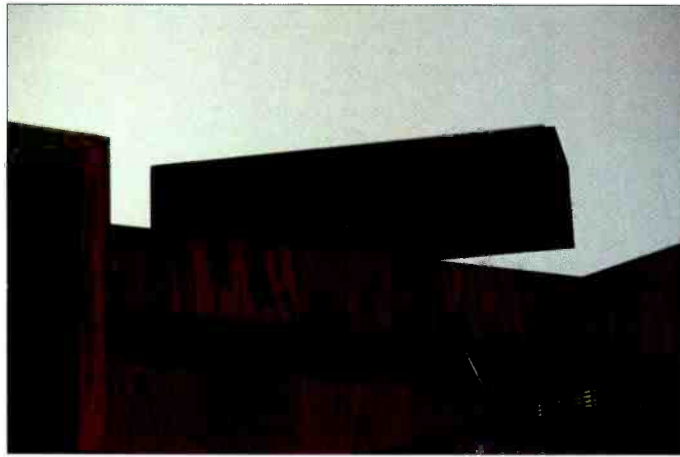


without affecting the MegaWave-received picture. Hands and bodies registered as picture interference with the rabbit ears.

The amplified antenna was also tested in the suburban location. For some channels viewed, only the active MegaWave antenna provided any semblance of a picture. To optimize reception for some channels, the antenna was turned 90°.

The demonstration indicated that if the antenna was used in locations with good over-the-air reception, the MegaWave antenna would most likely outperform rabbit ears. Its "rodless" design underlined the antenna's adaptability for household venues, such as an audio/video cabinet and under the kitchen counter, where consumers find it next to impossible to use extension rods for tuning in.

MegaWave expects that its technology could be incorporated in a design featuring a more aesthetic and streamlined appearance. Currently, the black box approximates the dimensions of an audio component. Examples cited by Benham include a horizontal winged design that could rest on top of or under the television. Or, the antenna could be integrated into the TV's cabinet once shielding issues



A MegaWave antenna.

are overcome. The company also says that its technology could eventually be built into walls or featured in rooftop antennas.

### Marketing plans

MegaWave is demonstrating its antenna to consumer electronics and accessory companies for possible licensing deals. MegaWave is also raising capital to start its own manufacturing operation. Emphasizing that the antenna not only uses state-of-the-art technology, but manufacturing as well, Benham says that the MegaWave antenna contains only 10 parts. This is compared to an esti-

mated 25 to 30 required for current antennas. The company is shooting for a \$40 retail price, hoping to have a product on the market by the third quarter of 1996.

However, it is possible that MegaWave's technology could first appear as part of another system, instead of debuting as a stand-alone box, which is the major goal of the NAB.

### The DSS connection

One industry segment showing particular interest is the Digital Satellite System (DSS). Since DSS, unlike cable, does not de-

liver local broadcast TV channels, an antenna that improves reception of terrestrial signals could help wean potential DSS customers off cable. Both cable and DSS charge for service, and with the exception of local stations, offer many of the same cable networks. DSS, while delivering digital video and audio and offering many more pay-per-view choices than cable, costs consumers a minimum of \$600 for the equipment.

As a result, the MegaWave antenna — if it can perform as promised — could spur sales of DSS home systems currently sold by RCA and Sony. The MegaWave antenna could,

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for example, be marketed as an accessory by those companies or a third-party antenna company. It could even be integrated into components of the DSS system.

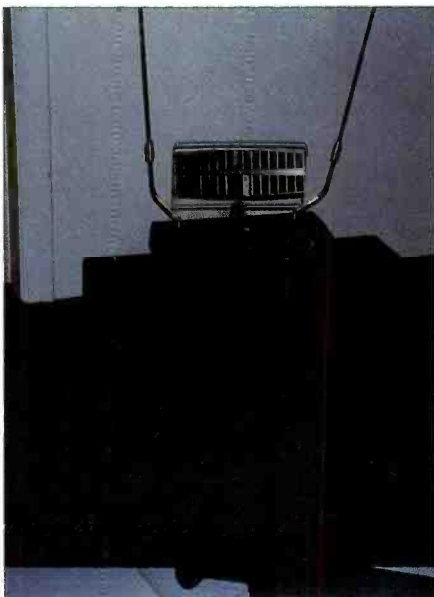
An indication of the impact of DSS on indoor antenna sales comes from Recoton, a marketer for set-top indoor antennas. Selling under the Recoton, Rembrandt and Parsec brands — as well as manufacturing for other brands — the company is among several groups evaluating the MegaWave technology. Dramatic growth at Recoton — which also markets other audio and video accessories — has been driven, in part, by the fact that TV sets today usually don't come with rabbit ears.

According to Peter Ildau, vice president of corporate communications, "People have recognized that when they buy a DSS, they can have a choice of maintaining their cable service for local off-the-air broadcast reception or buying a quality antenna." According to Ildau, in most markets, consumers can use an indoor antenna, which even in their current form, have come a long way since rabbit ears.

### Riding the wave with broadcasters

Judging from the calls and faxes we've received since mentioning the MegaWave antenna in this column in June, broadcasters also are interested in the antenna.

According to Benham, MegaWave has received many inquiries from interested stations



Rabbit ears and the MegaWave antenna.

throughout the country who often discuss individual market reception problems.

The common thread is that off-air is always difficult to receive if a household is far away from the broadcast station and/or in mountainous terrain or on the wrong side of the mountain. Says Benham, a typical successful market for the MegaWave antenna is one

where viewers are relatively close to the transmitter, such as a large urban population within a 50-mile radius.

We asked Benham how interested broadcasters could work with his company to promote the technology when it becomes available. Aside from recommending the antenna to viewers, stations and networks could include coverage of the antenna in science and technology news stories. Sums up Benham, "Rabbit ears are an irritation and anything that makes off-air broadcast TV easier to receive is going to have a benefit to the broadcast industry."

### The shape of things to come

Regarding future plans, MegaWave reports that it already has a modified version of the TV antenna optimized to work for FM rather than television. The radio version is somewhat smaller, among other differences. The company is also investigating other antenna applications featuring its technology, including an integrated AM and FM radio/cellular/navigation antenna.

If you cruise the World Wide Web, MegaWave maintains a home page with updated information at <http://www.megawave.com>. The MegaWave web site is also linked to the NAB's home page. ■

Marjorie Costello is a broadcast and video industry consultant and Broadcast Engineering contributing editor based in New York.

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**A**s ATV transmission comes closer to reality, TV broadcast companies must make some fast decisions. Whether simulcasting signals using existing equipment at half power or purchasing new equipment and duplicating facilities, these decisions may be required in the near future. To help simplify this change, the ideal solution will involve a transmitter facility that is efficient and economical, yet uses the latest advances in ice protection and component-style construction. This same approach can apply to possible future TV duopoly facilities, or for that matter, to any multistation transmission site where real estate and construction costs are problematic.

### Requirements

Many future transmission sites (ATV, duopoly or joint ventures) will have to accommodate more than one station on the same tower. Ideally, a single transmitter building should house all transmitters, and additional space for offices, other equipment and rental to telecommunications tenants is also desirable.

*Many future transmission sites will have to accommodate more than one station on the same tower.*

With experience showing that ice is the most common environmental hazard to transmission sites (particularly with tall TV towers), special attention also should be paid to this issue when designing a new transmitter facility in any location where icing is likely to occur.

Speed, cost and ease of construction are other important criteria for the multistation transmission site, along with the potential for modular future expansion. (See Figure 1.) Considering all these needs, a prototypical

## A new transmission facility design

transmitter building design has been developed (and copyrighted by Thomas G. Crowder, AIA). Resulting from more than eight years of research, this prototype is adaptable to a wide range of applications and geographic conditions, and it takes advantage of the latest in ice-protection technology. It is an appropriate design wherever ice protection, cost and time are factors in the development of a new facility.

### Design features

Today, most transmitter facilities in the ice belt are constructed like fallout shelters to protect themselves from radial ice falling from the tower(s) above. Many existing facilities use roof-protection systems, such as rubber tires, concrete ballast or wood crates, which serve more as "quick fixes" than truly preventive methods.

In this new design, a galvanized steel grating system serves to deflect the ice from the facility below, thereby protecting exterior equipment, the building roof and the transmitter(s) within.

The galvanized steel ribs form an equilateral triangle, a more economical and stronger structural form. This triangulation transfers the force from falling ice to the foundations below. The addition of a horizontal member serves to suspend the mezzanine and roof of the inner building skin. (See Figure 2.) This

same horizontal beam supports the transmission line(s) traveling from the transmitter(s) to the base of the tower. Such double duty of the horizontal member adds significant cost-effectiveness to the design.

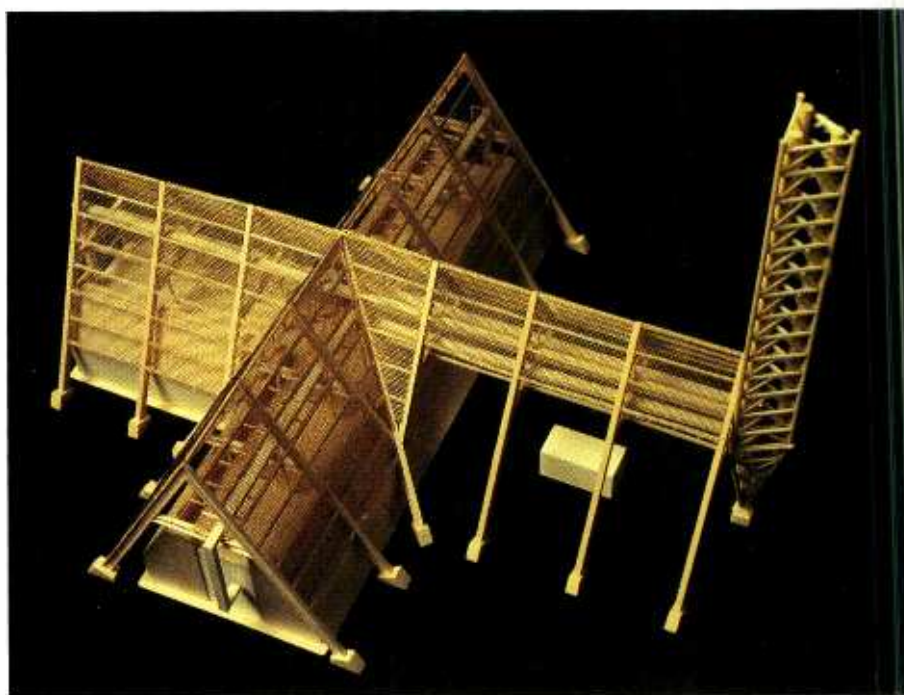
The structural skeleton integrates the ice bridge as its backbone, with the equilateral structural members acting as ribs. All of these

*Ice is the most common environmental hazard to transmission sites.*

members are hot-dip galvanized and built as a separate unit outside and above the transmitter enclosure. Steel grating is placed over the equilateral structural members to form an outer skin that protects the building, transmission lines and other equipment.

### Construction details

The skin of the transmitter facility is comprised of simple, light-gauge steel framing covered with a metal roofing and siding shell, while its interior veneer is built of concrete masonry blocks. This allows for an economical, yet sturdy enclosure for the transmitter equipment. In the transmitter



Overhead view of scale model for prototype transmission facility. This version can accommodate three separate transmitters (one in each building wing), all sharing a common ice bridge to the tower's base. (Photo by Doug Van de Zande.)

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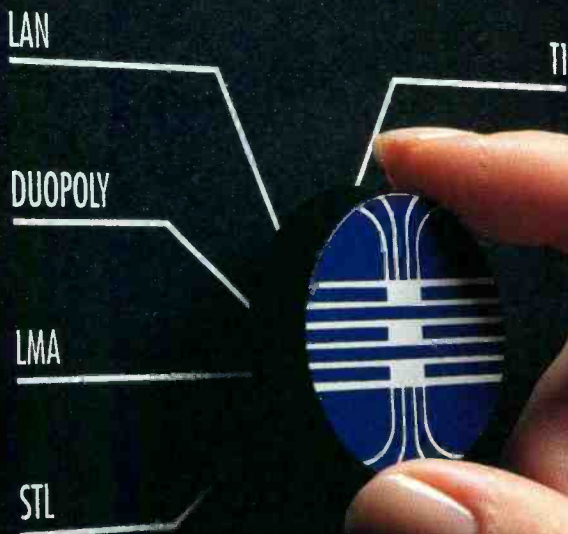
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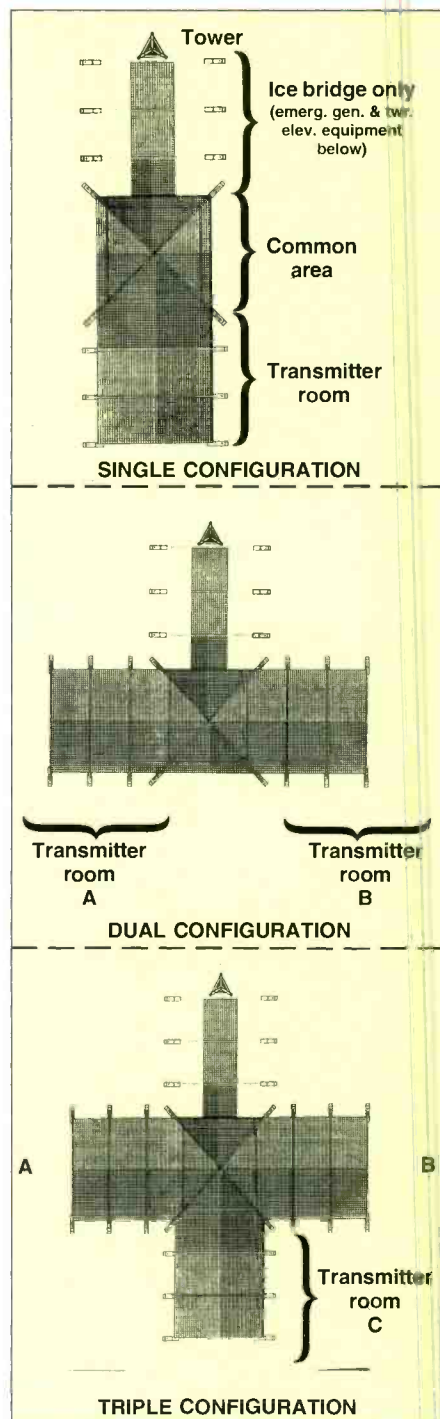


Figure 1. Overhead views of building, showing configurations for use with one, two or three transmitters.

rooms, 4-inch masonry veneer increases the ease of mounting grounding straps, a multitude of panel cans, disconnects and other interior equipment.

Planned on a 20-foot bay system, the facility also allows for expansion, and it provides an open, unobstructed transmitter room to accommodate any manufacturer's standard transmitters. The expandability of the facility makes it easy to include such areas as 2-way and telecommunication rental

spaces, as well as pump and/or high-voltage power supply rooms. Additional structural members and building components can be easily replicated and economically supplied in mass production.

In the central common area, separate work-room/office spaces are provided for up to three stations with a common entry and

*Speed, cost and ease of construction are important criteria for the multistation transmission site.*

bathroom. Above the central section, a storage mezzanine level is provided, which is open to each transmitter below. The mezzanine level also provides access to the ice bridge, tower elevator and building roof via a common area that also provides access to a common tower telephone/electrical room. This central core combines the amenities that can be shared, further increasing the facility's efficiency, while also providing a security entrance for staff.

#### Ice protection

As Figure 2 illustrates, in a space above the transmitter enclosure (between the finished roof of the building and the outer steel skin), a protected cove is provided for standard rooftop HVAC equipment. This allows for more economical rooftop-package systems to cool the spaces below without concern for damage from falling ice. HVAC equipment is also easy and safe to access and maintain.

*The same erector used to install the tower can erect the structure for the building.*

Above this area, a catwalk and hangers for the transmission line(s) provide a truly integrated ice bridge. Although earlier designs may have used an ice bridge of steel box truss design that served as the structural backbone for the facility, this new approach makes the ice bridge an integral part of the entire structure, forming the peak of its equilateral triangle design. Cross members below this peak support the catwalk/ice bridge as well as the roof and mezzanine floor of the transmitter enclosure below.

The equilateral-triangle design also offers simpler construction, which in turn

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reduces time and cost, while providing a stronger and more economical ice-protection system.

### Rapid construction and installation

This system of construction can be manufactured off-site and transported to the site for erection, similar to a broadcast tower's components. The site work begins with the foundations for the equilateral structural system, then as the slab is poured, the same erector used to install the tower can erect the structure for the building. With much of the steel fabrication occurring off-site, the quality of steel fabrication and the hot-dip galvanizing can be held to the same tolerances as the tower. This method is especially important in areas where the construction market is tight or skilled labor is difficult to find.

Next, as the enclosure starts to take shape and the inverted masonry veneer is completed, the spaces are enclosed and equipment installation can begin. The reduced time from groundbreaking to completed enclosure makes for an earlier on-air date, thereby further reducing overall costs of the project.

In conjunction with the designer, one of the world's largest tower fabricators has expressed interest in providing this prototypical facility as a turnkey product with its towers. This arrangement, although not the only method of delivery, can provide installation of the building, tower, transmission line(s) and antenna(s) under

- A. Transmitter room
- B. Storage mezzanine
- C. Waveguide
- D. Catwalk
- E. Building roof & HVAC cove

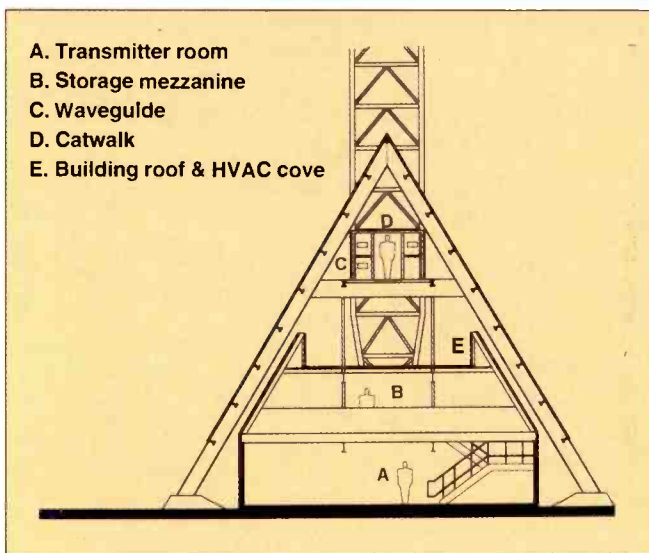


Figure 2. Section view of building's center wing and ice bridge, showing 3-level design. Ice bridge section consists of upper level (C and D) only. Storage mezzanine (B) appears in central common area only.

a single contract. This could further reduce project time, cost and administrative complexity.

### Multiple transmitters

As new regulations and increasing costs make "vertical real estate" more precious, the broadcast industry continues to look toward consolidation of transmission facilities. One of this new prototype's greatest advantages lies in its potential for such consolidated application, either for new or existing towers.

Its economy involves not just the use of a single tower by multiple stations, but the incorporation of all required transmission-facility elements into the structure of a single

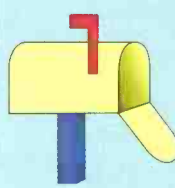
building, as well. This efficiency arises from the use of inner and outer skins to take advantage of the structural, ice protection and enclosure systems, along with the inclusion of more than one transmission line on a single ice bridge. As Figure 1 indicates, the configuration of this prototype can fit up to three separate transmitter facilities within the same building and provide access for all three to a single tower, while combining commonly required areas and services.

The new approaches used in this transmission-facility design will serve broadcasters well as they confront the inevitable marketplace and regulatory changes that lie ahead.

Look for more information on sharing vertical real estate and multistation transmitter facilities and towers in next month's issue. ■

Editor's note: Facility design and all diagrams © 1995, ARCHITEKTUR.

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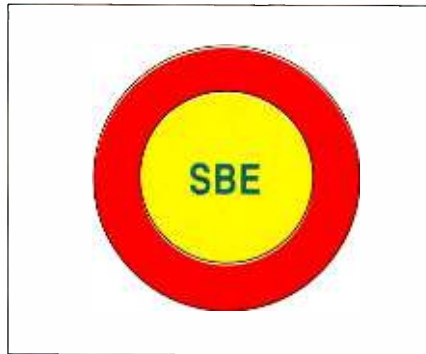


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## Thomson digital remote vehicle

In September 1995, Thomson Broadcast Systems delivered two remote trucks to the Zimbabwe Broadcasting Corporation (ZBC). These vehicles enabled the ZBC, with equipment provided by the South Africa Broadcasting Corporation (SABC), to provide TV coverage of the 6th All-Africa Games. These games are held every four years — on this occasion in Zimbabwe.

Zimbabwe has the most up-to-date digital TV production equipment of any country in southern Africa. The two remote trucks join five existing post-production suites with Thomson 9200 mixers (three of them with Pinnacle PRIZM DVEs) and a digital studio built in 1989 with the TTV 5650 first-generation digital mixer. The trucks act as all-digital, high-capacity, mobile control rooms, using the latest-generation equipment (90% of French origin).

At the beginning of 1995, the challenge seemed ambitious. It was impossible for us to build the two remote vans in time using normal procedures — three months for delivery of the chassis, three months for coach building and two months for cabling and installation, for a total of eight months. The two vehicles had to be finished by the end of June, so that they could be shipped by sea and road to reach Zimbabwe before the end of August. With technical assistance from Thomson Broadcast Systems in training the operators, the ZBC then had to take over the two vans to provide coverage of the 6th All-Africa Games, due to take place from Sept. 13-23, 1995. To meet this tight schedule, Thomson proposed an innovative solution.

### Coach work design

The project really began in mid-January 1995, with time already running short. Because of the long delivery time for the vehicle chassis, the assembly of the upper coach work had to begin before the chassis' delivery. This approach had never before been attempted.

To understand the magnitude of the project, consider some parameters of the 19-ton vehicles

themselves. Each represents the following:

- Several hundred hours of design;
- More than a hundred drawings, including mechanical modifications and wiring diagrams for power, video and audio;
- Several thousand hours of work at the coach builders; and
- Miles of mains, video, audio and triax cabling, as well as two tons of electronic equipment.

### Design and implementation

After studying the general layout of the coach work (using CAD techniques) and checking it with the customer, the many drawings for the vehicle were sent to the coach-building contractors (Hatty) in mid-February, so that construction could begin. Before even starting to build and assemble the body work, our coach builders had to produce their own fabrication plans.

Right from the start it was essential to obtain accurate technical drawings and blueprints for the chassis, in order to be aware of all difficulties and constraints in assembly. We obtained this vital information from Renault Industrial Vehicles, to whom we are most grateful.

Each body was 8.3m (27.2 feet) long and 2.5m (8.2 feet) wide, mounted on a short-cabin 19-ton Renault G230Ti left-hand drive chassis, with a total vehicle height not exceeding 4m (13.1 feet). A sandwich construction was used, which provided a high degree of insulation with good electrical continuity.

Following a detailed study of the ergonomics with the client, the body was fitted with two access doors and steps folding into the floor. The body was divided into three independent compartments: a video control room

(with slow-motion facilities) accommodating six people; an audio control room for two people; and a technical area for two video engineers and a technical supervisor.

A number of small, but unusual, features made these vehicles particularly easy to use. The cable drums located in the underfloor lockers were mounted on sliding trays. The telescopic masts were pneumatic, with manual controls built into the coach work. The ladder for access to the roof was enclosed. At the rear of the vehicle were four manually operated stabilizing legs and a fold-away working platform for access to the patch panels, drums for triax cables and an air-conditioning system.

### The outcome

These custom, left-hand drive vehicles, specially adapted for difficult terrain, were ordered at the beginning of February and arrived at the coach builders in mid-May. The result was convincing: final assembly of the coach work on the chassis took less than a day overall for each of the vehicles.

The challenge had been met. Not all the finishing touches had been completed, but we had saved three months on the overall construction time, that is, the time for fitting out the vehicles. The vans left our contractor's premises just three weeks later (at the beginning of June), painted and ready for fitting.

### Power supplies

The electrical supply system was designed in collaboration with the contractors. The vehicles can be powered by connection to the mains or to a trailer generator.

Safety protection was provided by a high-sensitivity 30mA differential-current detector at the input to the installation. Monitoring of the presence of three phases and neutral was provided. None of the technical apparatus, air-conditioning or services, which were transformer isolated, could be powered up unless the supply was functioning correctly. The monitoring system also displayed the mains currents, voltages and supply frequency.

The equipment was powered up via a phase-changeover contact-breaker, which also handled the power to the air-conditioning, always ensuring phase rotation in the same direction. A neutral-impedance-type system was used for the neutral of the isolating transformer secondary. An insulation monitor triggered audible and vis-



Front section of the truck includes video mix and CG positions (background), plus TD's and slow-motion operator's positions (smaller console in foreground).

ible alarms at the first insulation fault. The audible alarm could be inhibited. If a second fault appeared, a circuit breaker would cut power to the involved circuit.

Each generator, manufactured by Simed, was fitted with a soundproof hood (70dBA at 1m) and was towed on a twin-axle heavy-duty trailer. The trailer was specially adapted to provide covered storage for four cable drums (in addition to those fitted inside the remote truck). Each generator had a nominal output of 50kVA, down-rated because of the high altitude of Harare (1,000m or 3,280 feet). The generators will function independently for 12 hours at full load, with reserve power for lighting if required.

### Air-conditioning equipment

A Gredai air-conditioning system was mounted at the rear of each vehicle. It was a single, compact unit, with a nominal cooling capacity of 15kW for a dissipated heat rating of 11kW for the truck. The air-conditioning system was fitted with dual compression/evaporation systems, providing partial redundancy in the air-conditioning should one of the systems fail.

Cool air was blown in and stale air was extracted via a false ceiling, using a specially designed duct to ensure ideal air speed, uniform pressure and minimum noise in each of the groups of bays and working areas. Air flow was 2,400m<sup>3</sup>/h.

### Wiring

In order to save as much time as possible, power, video and audio cable runs were all preplanned. All the drawings were produced using CAD techniques and submitted speedily to the client for approval.

The relationship between customer and supplier was particularly important. It was essential to reach an agreement before the project started and before work began (supported by validation of the designs) on how the vehicle would finally be built, in terms of design and how it would be operated. A remote vehicle has a design life of at least 10 years and users must be completely at ease working in it.

On that basis, we were able to start all wiring preforms at the beginning of May, using rack layout diagrams, finishing them even before the vehicles were delivered to us from the coach builders. Prewiring saved another month on the overall construction time.

### Completion

When the vehicle arrived in our workshops, we had no more than a month left to complete the work. All the cable preforms had to be drawn through and installed.

The power wiring took four days. The power supply rack, entirely prewired on the workbench, was built directly into the vehicle. Video cabling took four days and audio

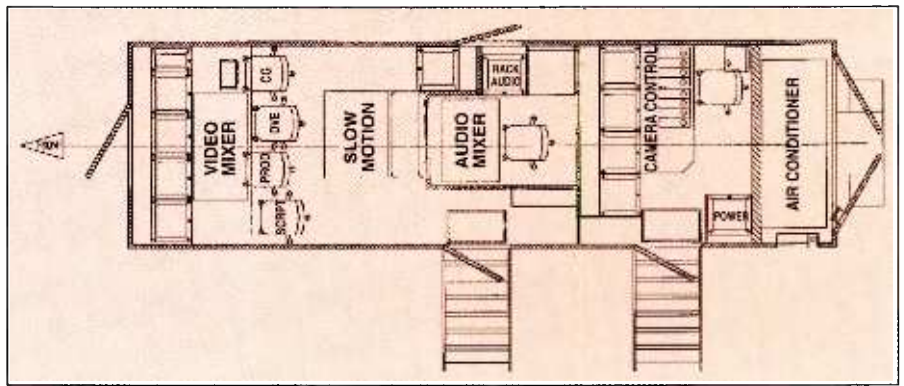


Figure 1. Plan view of Thomson all-digital remote vehicle.

took three days — all the patch wiring had been prepared previously. In less than two weeks, all wiring and equipment had been installed.

The date for shipping was approaching rapidly. We had only three weeks left for commissioning the vehicles and factory acceptance by the client. After the usual minor snags in fine-tuning the systems, the two vehicles were accepted on the due date and embarked from France on July 15 by ship, bound for Durban, South Africa. They were unloaded in Durban on Aug. 17, and arrived in Harare, Zimbabwe, by road without incident on Aug. 22.

## A number of small, but unusual, features made these vehicles particularly easy to use.

Prior to on-air use, full training was provided for ZBC's operators and technicians. This was followed by technical assistance during the maiden broadcasts.

### Equipment

Each vehicle was prewired for eight cameras and four VTRs, and generally equipped as follows:

- Eight Thomson 1657 cameras with EFP 1685 (digital output); this camera has a well-established reputation: FIT technology CCDs, 4:3 or 16:9 switchable, electronic color temperature and pixel correction; 14 cameras have been supplied, five of them in *Sportcam* configuration (1657 + A85 + long lens cradle), with three x40 and two x20 lenses from Angenieux;
- Up to four Thomson 3575 DP digital output VTRs with slow-motion facilities;
- Up to four external PAI synchronizers;
- Up to four external digital signals;
- An Aston Motif character generator with *Grab* option and software;

- A Thomson 9500 digital mixer with 32 primary inputs (24 video + eight key + black + color + matte); two full-function mix/effect units M/E1 and M/E2 (with fade, wipe and key) and one mix unit M/E3 (PST/PGM); four DSKs with independent transition module; auto-phasing of inputs (30µs adjustment, relative to reference) and all outputs; 10 auxiliary video buses, 10 auxiliary key buses and "key-follow-video" mode;
- TTV 5790 digital routing switcher, which operates as a standby router (32 inputs, 16 outputs);
- 24 input Digitec audio console; and
- Clear-Com intercom switching system, with commentator terminal.

The advantage of all these sources was that they have digital outputs. Signals were distributed using digital video distribution amplifiers from the Evolution range, then processed directly by the mixer; the latter was linked to a Pinnacle PRIZM single-channel video effects generator, which also had digital inputs and outputs. The system was backed up by the TTV 5790 digital router.

### Other features

Each vehicle can operate independently, having its own generator. One of the vehicles had a 2.7GHz terrestrial microwave link. The other had a camera Betalink in the 2.5GHz band. Both vans could operate in urban or rural areas with equal facility.

Thanks to the joint efforts of the ZBC, Thomson Broadcast Systems and all its contractors, coverage of the All-Africa Games was a success. The two vans made a lasting impression on all who visited them. ■

Pascal Trahy is project manager for Thomson Broadcast Systems, Cergy Pontoise, France.

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## PC bus architecture

### The solutions

The two most common ways to deal with digital video data types are through the system host bus or through a dedicated bus architecture. Digital audio and video data can be communicated through the system host bus, but the bus must be shared with the other common host CPU activities, such as interfacing with the system hard-disk controller (SCSI or IDE), the graphics display device (GUI) and the network interface controller (NIC). Where the bus bandwidth is insufficient to handle the demands placed upon it, normal application response time diminishes and/or the video-stream breaks down.

The desire to use economical general-purpose PCs in demanding professional video applications like non-linear editing, graphics creation, animation recording, 3-D rendering, video-on-demand and commercial insertion continues to grow. In these applications, specialized PC adapters are typically used to handle the massive processing requirements for transporting natural data types in real time. The problem is essentially one of data rate considering that a single ITU-601 4:2:2 digital videostream requires 21MB/s (32MB/s for 4:2:2:4). Additionally, eight 48kHz/16-bit audio tracks require 768kB/s or a motion JPEG-compressed stream at Betacam quality requires 6MB/s.

Commonly used PC subsystems include video I/O, video processing (DVE/mixing), video compression/decompression (codec), audio I/O, audio processing (EQ/mixing), mass storage interface, network interface and video-in-a-window console display. Although it is possible to accomplish some of these tasks with host CPU software and a single highly integrated adapter, most professional systems require more than one adapter.

For example, a non-linear editing system may require a codec board, a videographics board, an audio processor, a console display and mass storage and network interfaces.

How to interface these multiple adapters inside a PC is a question that system integrators have been wrestling with for many years. Many consider the ideal solution to be an open architecture that leads to a wide variety of different price/performance solutions from multiple vendors.

*The two most common ways to deal with digital video data types are through the system host bus or through a dedicated bus architecture.*

Based on Table 1, ISA is clearly useless for professional video applications. Bandwidth is insufficient for uncompressed video or even high-quality compressed video data. Products using ISA can only communicate digital audio data effectively.

Nubus, EISA and MicroChannel (MC) have been used successfully by a number of vendors over the last five years to send compressed video and audio data between adapters. EISA and MC theoretically have enough bandwidth to accommodate a full uncompressed digital videostream interface. In practice, unfortunately, there is not enough band-

width left for the rest of the application, killing overall system performance.

Today, many users are demanding real-time A/B roll systems, 10MB/s compressed datastreams, multiple audio tracks, powerful mass storage, high-performance graphics controllers and LAN interfaces. Clearly, these buses are becoming less than adequate.

At first glance, the PCI bus with 132MB/s throughput seems to be the perfect solution. A number of video chipsets are becoming available that can send uncompressed digital video information over PCI. However, video equipment manufacturers quickly found PCI's limits. Here's why:

Although the theoretical speed of PCI is 132MB/s, the effective bus bandwidth ranges between 40MB/s and 80MB/s depending on the chipset used on the motherboard and various PCI implementation factors. In addition, fast disks, high-resolution desktop displays and fast network cards require incremental bus bandwidth, leaving less bandwidth available to video adapters.

PCI transfers data by grouping the data into packets. Different agents alternately take control of the bus every 10 $\mu$ s to 30 $\mu$ s (depending upon their latency times), leaving enough time to transfer only a small data packet (approximately 3,000 bytes) until the next transfer. Because video is synchronous, video data needs to be fed continuously. The higher the quality of the video, and the more simultaneous streams involved, the more difficult maintaining continuity becomes. This inherent incompatibility creates substantial hurdles for those who want to interface professional-quality video through PCI. To integrate the bus design, manufacturers must devise complicated interfaces.

It has become clear that PCI can be used successfully to interface video adapters for some multimedia applications, but it is not for professional video systems

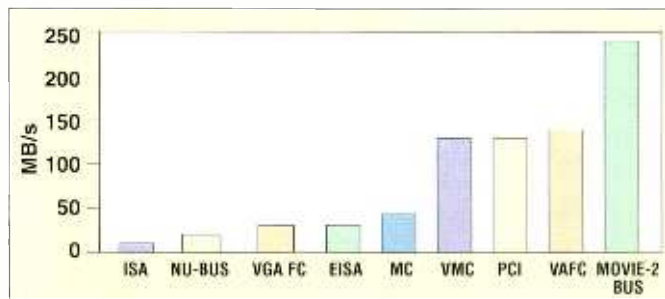


Table 1. Digital audio and video can be communicated through the system host bus, but with this approach, the bus bandwidth needed by the videostream(s) must be shared with the other common host CPU activities. The table illustrates the transfer rate of various buses.

### Expansion buses

The alternative to commercial general-purpose buses are dedicated over-the-top expansion buses. One that has been around for some time is the VideoBahn developed by Intelligent Resources for the Macintosh platform. Several proposals for the PC platform are available in the marketplace including VGA FC, VAFC, VMC and Movie-2 bus.

- VGA FC, the first over-the-top expansion video bus used in PCs, has a single limited video bus

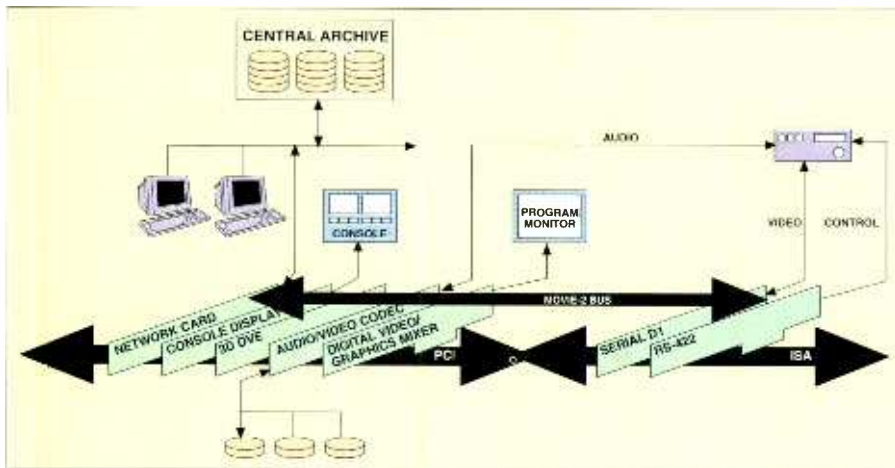


Figure 1. An example of a Movie-2 bus implementation.

and no audio support. It offers little for the video professional.

- VAFC is an enhanced version of the VGA FC. It offers the ability to interface 32-bit RGB with alpha or YUV without alpha, but still is limited to a single video channel and provides no audio support. Its primary application is in computer graphics.

- VMC is closer to the needs of the professional video marketplace. It interfaces multiple videostreams over a unified bus, similar to PCI. Video can be 32-bit RGB or YUV and there is enough bandwidth for designers to implement an alpha channel and audio support.

When it was initially proposed, VMC generated some interest, but it has not found many adherents because, like PCI, it is complicated and costly to implement. And, since both VMC and PCI exchange data through packets, some of the same problems exist in this area, as well. Systems designers ask, "If PCI and VMC accomplish the same task in much the same way, why design the same solution twice?"

The broadcast and professional video industries are converging toward the ITU-601 specification (sometimes referred to as D-1, although D-1 is a tape format, not a video specification). Virtually all professional video chipsets, board-level products and systems adhere to the ITU-601 standard. This specification defines the video parameters, frequency specifications and signal formats for digital video. The Movie-2 bus has been designed around the ITU-601 standard and features an uncompressed 10-bit video bus architecture, which provides board designers with the basics for simple and inexpensive implementation.

The Movie-2 bus carries eight digital video buses, six digital key buses and four serial digital audio buses for a constant data bandwidth above 242MB/s, almost three times the effective bandwidth of PCI.

The concept of modularity is important to the Movie-2 bus architecture. More than 10

leading digital video hardware vendors, including Matrox Video Products Group, Pinnacle Systems, Miranda Technologies, Optivision and Interactive Images, currently have plans to introduce Movie-2 bus-compliant products prior to NAB '96.

### Movie-2 bus product implementation

Matrox has recently announced DigiSuite, a family of PC-based digital video hardware and software development tools built around the Movie-2 bus. OEMs and systems integrators can use these to build a wide variety of cost-effective, PC-based video products, including: non-linear editing systems, virtual VTRs, MPEG-2 video-on-demand servers, live video switchers, commercial insertion systems, CATV barker channels, animation/paint/CG workstations, compositing systems and much more.

Matrox DigiSuite components include:

- DigiMix — a digital video/graphics mixer with 2-D DVE;
- DigiMotion — a motion-JPEG codec/digital audio mixer/Fast-20 SCSI controller;
- DigiVid — a multichannel analog video I/O card;
- QMPEG-2 — a 4-channel MPEG-2 decoder;
- Marvel Millennium — a video-in-a-window console controller; and
- Matrox DigiSDK — a Component Object Model (COM) software development kit for Windows NT 3.51 and Windows 95.

Movie-2 bus-compatible products from third parties include a 3-D DVE unit, a serial digital (D-1) I/O, MPEG encoders and software modules for CG, paint, 2-D DVE and stills storage.

System integrators, VARs, and ultimately, end-users, will benefit from the modularity offered by the Movie-2 bus technology. It will allow them to quickly and economically integrate different digital video building blocks from many different vendors. ■

Alain Legault is video products group director at Matrox, Quebec, Canada.

For more information on the Matrox Movie-2 bus, circle (152) on Action Card. For more information on additional Movie-2 bus-compliant products, circle (153) on Action Card.

Internet: be@intertec.com  
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## BUSINESS

**Philips Electronics North America Corporation**, New York, completed its acquisition of **Alamar Electronics USA**. Alamar will become part of Philips' Business Electronics, but will continue to operate within its existing management structure.

**Hewlett-Packard**, Anaheim, CA, announced that telecommunications companies Hongkong Telecom, Hong Kong, and Deutsche Telekom, Germany, selected the HP MediaStream server to deliver their interactive TV services.

Also, MTV Europe chose the HP broadcast video server as the digital-video-server technology for the new Gulf DTH channels throughout the Middle East.

**Panasonic**, Secaucus, NJ, established a business-to-business on-line service called PO-LAR (Panasonic On-Line Access and Retrieval), and is seeking to qualify video professionals for a free membership to the network. The service provides instant access to a virtual library of information on Panasonic professional video and broadcast products.

**Synergistic Technologies Inc.** moved. The company is now located at: 121 Hillpointe Drive, Suite 700, Canonsburg, PA 15317; telephone: 800-659-7715 or 412-873-0800; fax: 412-873-4770.

**Thomson Broadcast** announced the sale of five of its new 7830 motion-compensated standards converters to NBC for use in Asia.

Also, the company sold its 9500 component digital switcher to Roland House, VA.

Thomson Broadcast Systems, a subsidiary of Thomson multimedia, received the contract to design and build an all-digital production and broadcasting system for Milan's new local TV channel, SEI Milano. In addition, the subsidiary also received a contract by TDF Cable to build the cable network for Aulnoye-Aymeries in northern France.

**Solid State Logic**, Oxford, UK, installed two additional Scenaria digital audio/video post-production systems at Fox Tape Engineering, Los Angeles, bringing the total number of Scenaria systems at Fox to six.

**Ampex Media Corporation** officially became **Quantegy**, Redwood City, CA. Customers will continue to do business with Quantegy just as they did in the past with Ampex. The use of the Ampex brand name on packaging will continue.

**BTS Broadcast Television Systems**, Berk-

shire, UK, announced the purchase of several LDK 10P portable camera systems by QVC, the satellite shopping channel.

**Dynatech**, Salt Lake City, sold a 128x128 video/stereo audio UTAH-300 routing system and a 32x32 serial digital matrix to WXIA-TV, 11Alive, Atlanta's NBC affiliate.

**Louth Automation**, Palo Alto, CA, opened a new sales office in New York. For more information contact: Martin Frange, P.O. Box 3200, Wantagh, NY 11793; telephone: 516-783-6022; fax: 516-221-5209.

**Leitch** moved its European headquarters to a larger location in Basingstoke, UK, for additional office and warehouse space.

**FAST Multimedia**, Foster City, CA, and **Panasonic Broadcast & Television** announced an OEM agreement to market FASTEDIT, an integrated turnkey editing solution that combines Panasonic's AG-1970 S-VHS VTRs with FAST's PC-based video editor, Video Machine Lite.

**Dielectric Communications**, Raymond, ME, received three major contracts for digital HDTV implementation studies. Chris-Craft/United Television granted a contract for digital HDTV implementation studies to the company. Also, both Pulitzer and WABC-TV Channel 7, New York, awarded HDTV/NTSC design contracts to Dielectric.

**ASC Audio Services Corporation**, N. Hollywood, CA, is changing its name to **Location Sound Corporation**. There has been no change in ownership, management or location.

**Macrovision**, Sunnyvale, CA, announced that Fox Latin America has been using the company's VES-TP video encryption system to secure satellite transmissions of weekly Fox National Football League telecasts to Latin America.

**LNR Communications**, Hauppauge, NY, delivered three complete SAFARI digital video flyaway earth stations for use by Taiwan broadcaster TVBS. The station will use the units for news and special-event coverage in Taiwan and other locations in the Pacific Rim area.

**TimeLine Vista**, Vista, CA, announced sales to four new United Kingdom customers, including freelance editors Rodney Glenn and Peter Joly, who purchased 16-track StudioFrames; the De Lane Lea Sound Centre, which purchased an 8-track StudioFrame; and the National Film & Television

School, which now has a 16-track StudioFrame workstation.

**Eimac**, a division of Communications & Power Industries, San Carlos, CA, received its ISO 9001 certification.

**Sony**, Park Ridge, NJ, sold several of its products to full-service production and post-production facility ProVideo, Madison, WI, for its redesigned on-line bay.

## PEOPLE

**William P. "Pete" Mountanos** has been appointed president of FAST Multimedia and chief executive officer of FAST Electronic U.S.

**Robert M. Long** has been appointed to oversee operations of Dynatech NewStar, the newsroom automation branch of Dynatech, Salt Lake City.

**Milton E. McNally** has become vice president and chief operating officer of Clear-Com Intercom Systems, Berkeley, CA.

**James C. McKinney** resigned as chairman of the United States Advanced Television Systems Committee to the ATSC Executive Committee.

**Martin Frange** has been appointed northeastern sales manager at the new New York sales office of Louth Automation, Palo Alto, CA.

**Michael Benya** has been named product manager for multichannel multipoint distribution service (MMDS) low-power products for ITS, McMurray, PA.

Also, **Rick Labuda** has been promoted to sales manager for MMDS; **Keith Ross** has been named product manager for MMDS high-power products; and **Gary Smyth** has been appointed corporate communications manager at ITS headquarters.

**Jack S. Kenney** has been appointed president and chief executive officer of Quantegy, Redwood City, CA.

**Ian G. Miller** has become regional sales director for Harris Corporation's broadcast division in Africa (excluding North Africa).

**Wayne Cook** has been appointed national director of sales for The Winsted Corporation, Minneapolis.

**Alan R. Davis** has become vice president sales/marketing for Lighthouse Digital Systems, Grass Valley, CA. ■



## Oscilloscope Hewlett-Packard

- **HP 54615B:** a 2-channel digital-storage oscilloscope that combines fast sample rate with high bandwidth and a peak detect that captures 1ns events at any sweep speed; features include 1-gigasample/s sample rate and 5K memory depth per channel; automatic measurements of frequency, voltage, pulse width and rise time eliminate time-consuming setup of the scope; waveform storage allows signals to be stored for later comparison with other signals; the HP 54615B has storage and recall of up to 16 scope setups and also features roll mode, built-in power for active probes and built-in calibration signals; the HP 54615B uses the same compact, easy-to-use frame as others in the HP 54600 series, and it is compatible with all current HP 54600 scope modules except for the HP 54655A and the HP 54656A.

Circle (350) on Action Card

## Solid-state power amplifiers Satcom Division of Communications & Power Industries (CPI)

- **Line of solid-state power amplifiers:** the expanded product line includes high-efficiency indoor and outdoor units for satellite communications designed for minimal-current and low-voltage demand applications; the devices incorporate overtemperature shutdown and display current consumption and case temperature; the SSKI-20 to 125W, single-rack Ku-band units (14-14.5GHz) are for single and multicarrier service in transportable or fixed stations where good intermod-to-carrier performance is required; the SSKO-20 to 100W weatherproof outdoor amplifier is available for antenna mount use; the SSCO-30 to 250W C-band (5.850-6.450GHz) unit has weatherproof housing for antenna mounting; the SSCI-30 to 500W C-band (5.850-6.450GHz) unit is for single and multicarrier service where good intermod-to-carrier performance is required.

Circle (351) on Action Card



## Composite decoder and encoder Vistek

- **V4228 (decoder) and V4238 (encoder):** composite decoder and encoder featuring ASIC technology, digital stability and accuracy, flexible interfaces, coupled with Varicomb processing; for fit-and-forget operation, the seamless adaptation of Varicomb provides optimum video processing and the automatic format sensing configures the units instantly for different video standards; if required, full control of all parameters is available from the control panel, with commonly used setups stored in the internal memory; the V4228 provides high-resolution transparent decoding that is virtually free of the artifacts of cross-color and cross-luminance.

Circle (353) on Action Card



## Enhanced digital audio ISDN system Dolby Laboratories

- **Dolby Fax ISDN system:** a reconfiguration of the Dolby Fax system for high-quality ISDN transmission of audio material; the 2-channel, full duplex system now offers AES/EBU, SPDIF, 18-bit ADC, 20-bit DAC and mono/stereo formats; a streamlined Ascend multiband VSX ISDN inverse multiplexer has been incorporated into the system; the package also includes an improved PC interface for the Dolby Fax that features a Windows-based dialer program allowing control of the system from a PC.

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The new 635L  
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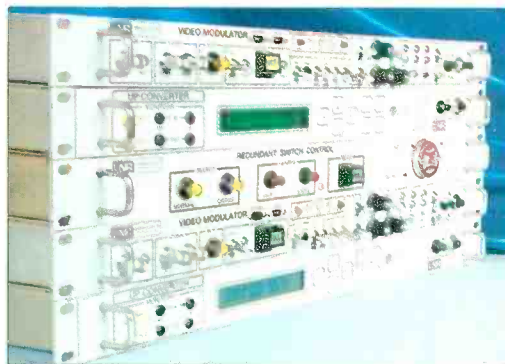
## The new 635L



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## Video modulator/data upconverter

### LNR Communications

- LVM series: a low-profile video modulator/data upconverter designed for applications where a compact baseband-to-RF satellite video modulator/low-phase noise upconverter is required; the synthesizer-tuned agile upconverter was specially designed for low-phase noise requirements in preparation for digital/full-motion or compressed video formats; the LVM series is ideal for

fixed and mobile applications, SNG vehicles and other transportables, uplinks where access to the 70MHz interface is required, split (remote upconverter) exciter operation and systems that must use a data-capable upconverter for inclusion of SCPC data channels in the same transponder and/or future digital video requirements.

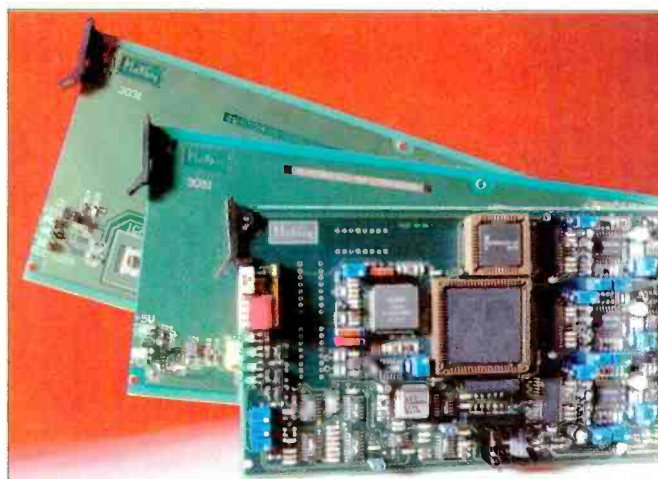
Circle (354) on Action Card

## Camera control/monitoring system

### Telemetrics

- Camera control system: a camera control system that integrates Telemetrics line of camera robotics components with a software control program for comprehensive camera control capabilities on a single touchscreen workstation; by employing a touchscreen graphical user interface (GUI), the Telemetrics control panel software (TM-CPS) provides simple control of all camera robotic and electronic settings, video switching and peripherals; live camera program and preview images and still video preset images can all be viewed on a single PC display; the program and preview windows are viewed in real time, with still video images to view camera presets.

Circle (355) on Action Card



## Digital video interface

### Matthey Electronics

- 3000 series: a series of serial digital video interface cards based on an extended Eurocard format; the 3000 system solves problems encountered when interfacing existing analog equipment with new serial digital products; the range includes 10-bit A-to-D and D-to-A

converters, plus serial digital distribution amplifiers (both reclocking and non-reclocking); processing using quality 10-bit converters and full specification CCIR-601 filtering ensures optimum broadcast performance; serializers and deserializers to component and composite standards are also included; six cards can be housed in the 1RU subrack frame designed to meet the latest EMC directives.

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## KY-27C

### 3-CCD Color Video Camera

- New 1/2" broadcast-quality 380,000 pixel CCDs with advanced electronics deliver resolution of 800 horizontal lines and reduced smear.
- High sensitivity of F9.0 at 2000 lux allows a truly useful minimum illumination of 1 lux with JVC's exclusive LoLux dual pixel readout sampling technique.
- LoLux mode allows shooting scenes that were previously impossible due to insufficient lighting. CCDs are maximized for low light sensitivity equivalent to an electronic gain of 240B. Then the dual pixel readout system is added which provides an additional 6dB. Together they provide +30dB without the noise and picture degradation normally associated with this much gain.
- Signal-to-Noise Ratio of 63dB assures virtually "noise free" images.
- Auto Shooting Mode where you only have to zoom, focus and record. All other parameters are controlled automatically.
- Enhanced ALC (Automatic Level Control) mode for continuous shooting in all light levels. This allows continuous automatic shooting from dark interiors to bright outdoors. Also features an aperture priority mode, manually set the iris for desired depth of focus and the ALC circuit automatically achieves correct video level.
- The Multi-Zone Iris Widening system gives preference to objects in the center and lower portions of the picture. The Automatic Peak/Average Detection (APB) provides intelligence to ignore unusual objects such as bright lights.
- Auto knee circuitry extends a scene's light to dark dynamic range reproduction by up to five times without overexposure.
- Has large 1.5-inch viewfinder with 600 lines of resolution and SMPTE color bars. Status system provides audio levels, accumulated or remaining recording time, VTR operation, battery voltage and camera setup. Zebra pattern indication and safety zones with a center marker are also provided.
- Equipped with Variable Scan function. This allows flicker-free shooting of computer screens. Variable scan enables a precise shutter speed from 1/60.2 to 1/196.7 of a second in 256 increments to be set, matching a computer's scan rate. Almost any computer display can be clearly recorded.
- Star filter creates dramatic 4-point star effects. Users can also select from a wide range of optional filters.
- Advanced Memory System (AMS) stores customizable settings for various shooting conditions.
- Camera head allows direct input of genlock signal and timing adjustment. A wide range optional remote controls, RS-232C interface, multicore and track CCUs are available.
- Docks directly to the JVC BR-S422U, BR-S411UB and BR-S420CU professional S-VHS recorders. Optional adapters for docking to Hi-8 and Betacam SP are also available.



## antonbauer

### Logic Series DIGITAL Gold Mount Batteries

The Logic Series DIGITAL batteries are acknowledged to be the most advanced in the rechargeable battery industry. In addition to the comprehensive sensors integral to all Logic Series batteries, each DIGITAL battery has a built-in microprocessor that communicates directly with Anton/Bauer InterActive chargers, creating significant new benchmarks for reliability, performance, and life. They also complete the communications network between battery, charger and camera. With the network in place DIGITAL batteries deliver the feature most requested by cameramen: a reliable and accurate indication of remaining battery power.



#### DIGITAL PRO PACS

The Digital Pro Pac is the ultimate professional video battery and is recommended for all applications. The premium heavy duty Digital Pro Pac cell is designed to deliver long life and high performance even under high current loads and adverse conditions. The size and weight of the Digital Pro Pac creates perfect shoulder balance with all cameras/camcorders.

- DIGITAL PRO PAC 14 LOGIC SERIES NICAD BATTERY**  
14.4v 60 Watt Hours, 5 1/8 lbs. Run time: 2 hours @ 27 watts, 3 hrs @ 18 watts
- DIGITAL PRO PAC 13 LOGIC SERIES NICAD BATTERY**  
13.2v 55 Watt Hours, 4.3/4 lbs. Run time: 2 hours @ 25 watts, 3 hours @ 17 watts

#### GOLD MOUNT BATTERIES

Logic Series Gold Mount batteries are identical to the respective DIGITAL versions with respect to size, weight, capacity, IMPAC case construction, and application. They are similarly equipped with micro-code logic circuits and comprehensive ACS sensors. They do not include DIGITAL microprocessor features such as the integral diagnostic program "Fuel Computer", LCD/LED display and Interactive viewfinder fuel gauge circuit.

- PRO PAC 14 NICAD BATTERY** (14.4v 60 Watt Hours)
- PRO PAC 13 NICAD BATTERY** (13.2v 55 Watt Hours)
- MAGNUM 14 NICAD BATTERY** (14.4v 72 Watt Hours)
- MAGNUM 13 NICAD BATTERY** (13.2v 66 Watt Hours)
- COMPAC MAGNUM 14 NICAD BATTERY** (14.4v 43 WH)
- COMPAC MAGNUM 13 NICAD BATTERY** (13.2v 40 WH)

## Vinten



### Vision SD 12 and SD 22 Pan and Tilt Heads with Serial Drag

The Vision SD 12 and SD 22 are the first heads with the "Serial Drag" pan and tilt system. The system consists of a unique, permanently-sealed fluid drag and an advanced lubricated friction drag. So for the first time, one head gives you all the advantages of both fluid (viscous) and lubricated (LF) drag systems - and none of their disadvantages. Achieve the smoothest pans and tilts regardless of speed, drag setting and ambient temperature. The Serial Drag system provides the widest range of infinitely variable preset settings with repeatable, consistent drag in each pan and tilt direction.

- Simple, easy-to-use external control for perfect balance.
- Patented spring-assisted counter-balance system permits perfect "hands-off" camera balance over full 180° of tilt.
- Instant drag system breakaway and recovery overcome inertia and friction for excellent "whip pans".
- Constant drag levels in both pan and tilt axis.
- Redesigned flick-on, tick-off pan and tilt caliper disc brakes.
- Greater control, precision, flexibility and "touch" than any other head on the market.
- Touch activated, time delayed illuminated level bubble.
- Environmental working conditions from as low as -40° to as high as +60°C.
- SD 12 weighs 6.6 lbs and supports up to 35 lbs.
- SD 22 weighs 12.7 lbs and supports up to 55 lbs.

### Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

The ultimate in lightweight and innovative tripods, they are available with durable tubular alloy (Model #3513) or the stronger and lighter, axially and spirally wound carbon fiber construction (Model #3523). They each incorporate the new torque safe clamps to provide fast, safe and self-adjusting leg clamps that never let you down. Two stage operation gives them more flexibility when in use as well as greater operating range.

- "Torque Safe" requires no adjustment. Its unique design adjusts itself as and when required, eliminating the need for manual adjustment and maintenance and making for a much more reliable clamping system.
- New hip joint eliminates play and adds rigidity.
- They both feature 100mm levelling bowl, fold down to a compact 28", and support 45 lbs.
- The #3513 weighs 6.5 lbs and the #3523 CF (Carbon Fibre) weighs 5.2 lbs.

### Vision 12 Systems

All Vision 12 systems include #33643 SD 12 dual fluid and lubricated friction drag pan/tilt head, single telescoping pan bar and clamp with 100mm ball base.

#### SD-12A System

- 3364-3 SD-12 Pan and tilt head
- 3518-3 Single stage ENG tripod with 100mm bowl
- 3363-3 Lightweight calibrated floor spreader.

#### SD-12D System

- 3364-3 SD-12 Pan and tilt head
- 3513-3 Two-stage ENG tripod with 100mm bowl
- 3314-3 Heavy-duty calibrated floor spreader.

#### SD-12LT System

- 3364-3 SD-12 Pan and tilt head
- 3523-3 Two-stage carbon fiber ENG tripod w/100mm bowl
- 3363-3 Lightweight calibrated floor spreader
- 3425-3A Carry strap
- 3340-3 Soft case

### Vision 22 Systems

All Vision 22 systems include #33636 3 SD-22 dual fluid and lubricated friction drag pan and tilt head, single telescoping pan bar and clamp with dual 100mm/150mm ball base.

#### SD-22E System

- 3366-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3516-3 Two-stage EFP tripod with 150mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

#### SD-22 LT System

- 3366-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3523-3 Two-stage carbon fiber ENG tripod w/100mm bowl
- 3314-3 Heavy-duty calibrated floor spreader
- 3425-3A Carrying strap
- 3341-3 Soft case

#### SD-22 ELT System

- 3366-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3363-3 Two-stage carbon fiber EFP tripod w/150mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

## Century precision optics

### WIDE ANGLE ADAPTERS Tools For Creative Videographers

Century Precision's wide angle adapters open new possibilities for videographers. By providing a wider angle of view they let you capture more of the action from close up—especially crucial when shooting in tight quarters. Using a wide angle adapter also yields increased depth of field and shorter MOD (minimum object distance), enabling you to move closer to the subject and to arrange subjects within a shot over a greater range of distance relative to the lens. Century's wide angle adapters are divided into two classes: zoom focal length adapters and zoom-through converters. The Wide Angle Adapter Set, 6X Double Asphere and Super Fisheye are designed for use with a zoom lens set at its widest focal length. With one of these adapters a zoom lens performs as a wide or super wide angle fixed focal length lens. (Focus is done by using the lens' macro function.) For zoom-through applications, the 8X Wide Converter is perfect for shooting situations which require wide angle and the ability to zoom.

#### WA-7X5X WIDE ANGLE ADAPTER SET

- Compact, lightweight and economical, the Wide Angle Adapter Set is the industry standard. The set consists of two lenses; the 7X Wide Angle and 5X Super Wide Angle. The 7X attaches to the front of a zoom lens, increasing coverage by 30%.
- For example, when attached to a lens that zooms to 9mm, the 7X W/A adapter shortens the effective focal length to 6.8mm. Adding the 5X Super Wide further alters the wide end of the lens to just 4.5mm. Thus producing coverage nearly double that captured by the lens alone.



WA-7X93	7x Wide Angle Adapter	445.00	WA-7X5X	Wide Angle Adapter Set (WA-7X93 and WA-5X45)	895.00
WA-5X45	5x Super Wide Angle Adapter	535.00	WA-6X	Step-up Ring (specify 75mm, 80mm, 85mm, 90mm)	104.95

#### SUPER FISHEYE ADAPTER

- When you need the widest possible angle of view, the Super Fisheye Adapter produces an extraordinary degree of barrel distortion for a magnification factor of approximately 55X. For example, adding the Super Fisheye to a modern 15x 8 lens results in a 116° horizontal angle of view—a remarkable 145° when measured diagonally.
- Due to the Super Fisheye's characteristic barrel distortion, extreme low and high angle shots are also made more dramatic. An attic crawlspace can induce heightened claustrophobia or a forest of tall skyscrapers made to bend menacingly over the audience. And since the Super Fisheye takes in a much wider angle of view than the human eye, it can also be used to plunge the audience into a scene—surrounding them with a noisy crowd or exiting them to a lonely beach.
- The Super Fisheye's tremendously wide field of view suggests a myriad of creative possibilities—from panoramic vistas that seem to stretch to the edge of the earth, to comical forced perspective close-ups, in which an actor's distorted features seem to pop through the video screen. While extreme telephoto shots tend to flatten the subjects against the background, the Super Fisheye exaggerates depth, pulling nearby objects closer and causing distant objects to recede into the background.
- In addition to the Super Fisheye (designed for the newest generation of internal focus zooms) Century Precision also offers the Fisheye Adapter for industrial video zoom lenses with 75mm lens fronts.

WA-FESU	Super Fisheye Adapter (specify lens front diameter)	1049.95
WA-FE75	Fisheye Adapter for industrial zoom lenses with 75mm fronts	445.00
FA-6X	Step-up Ring (specify 75mm, 80mm, 85mm, 90mm)	104.95

#### .8X ZOOM-THRU WIDE ANGLE CONVERTER

- The .8X Wide Converter offers the high quality, economical way to expand a lens' angle of view when the shot requires a zoom—as well as situations which require both a wider angle of view and the ability to zoom.
- The .8X attaches quickly to the front of a zoom lens, effectively shortening its focal length while maintaining full zoom capabilities. With the converter attached, 20% more coverage is realized when the lens is set to wide angle, telephoto or anywhere in between. For example when added to an 8.5-119mm lens, the .8X Wide Converter alters the focal range to 7-98mm. This can be especially advantageous when shooting in confined quarters.
- The .8X not only expands field of view but also reduces minimum object distance (MOD). The camera can therefore move considerably closer to the subject while maintaining focus. And because there is no light loss with the .8X, there is no need to change exposure or lighting.



WA-8XC	.8X Wide Zoom-Thru Converter	1479.00
FA-388X	138mm Filter Adapter	164.95

#### .6X DOUBLE ASPHERE WIDE ANGLE ADAPTER

- Unequivocally superior to every other wide angle adapter, the 6X Double Asphere utilizes a single element with two aspheric surfaces. This design ensures a performance that is not possible with conventional single element adapters. The adapter minimizes distortion and reduces chromatic aberration while dramatically increasing edge resolution.
- Remarkably lightweight and compact, the 6X was created especially for use with the latest internal focus lenses like Canon and Fujinon's 15x8. The 6X increases their coverage 40%, effectively changing a15x8 into a super-sharp 4.8mm fixed focal length lens.
- The 6X fits most lenses via interchangeable adapter rings. An accessory Lens Shade/Filter Holder accepts either a single 4x5 or Panavision-size filter holder.

WA-6XAS	6X Double Asphere (fixed focal length)	1225.00
FA-6XAS	Sunshade for 6X Double Asphere with slot to accept one 4x5 or 4x5.65 filter in a holder	349.95
FH-4X50	4x5 Filter Holder	199.95
FH-4X565	4x5.65 Filter Holder	199.95

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## TASCAM DA-88 Multi-Track Recorder



The first thing you notice about the eight channel DA-88 is the size of the cassette. It's a sleek all Hi-8mm video cassette. You'll also notice the recording time - up to 120 minutes. These are just two of the advantages of the DA-88's innovative use of 8mm technology.

- Intrinsic to the 8mm video format is the Automatic Track Finding (ATF) control system. This approach records the tracking control information, along with the program material, using the helical scan (video) head. Competing S-VHS based system record the tracking data with a linear recording head, independent of the program data. The S-VHS tape must be run at a higher speed (thereby delivering shorter recording time) to deliver control track reliability, and requires some form of automatic or manual tracking adjustment. Synchronization and tracking must be adjusted, either automatically or manually (just like on your home VCR).
- On the other hand, the ATF system ensures that there will be no tracking errors or loss of synchronization. The DA-88 doesn't even have (or need) a tracking adjustment. All eight tracks of audio are perfectly synchronized. What's more, this system guarantees perfect tracking and synchronization between all audio tracks on all cascaded decks - whether you have one deck or sixteen (up to 128 tracks).
- Incoming audio is digitized by the on-board 16-bit D/A at either 44.1 or 48KHz (user selectable). The frequency response is flat from 20Hz to 20KHz while the dynamic range exceeds 92dB. As you would expect from a CD-quality recording, the wow and flutter is unmeasurable.
- One of the best features of the DA-88 is the ability to execute seamless Punch-ins and Punch-outs. This feature offers programmable digital crossfades, as well as the ability to insert new material accurately into tight spots. You can even delay individual tracks, whether you want to generate special effects or compensate for poor timing. All of this can be performed easily on a deck that is simple and intuitive to use.

- RC-808** - Single Unit Remote Control
- RC-848** - System Remote Control
- MU-8824** - 24-Channel Meter Unit
- SY-88** - Complete SMPTE/EBU Chase Synchronization and MIDI Machine Control interface

## Fostex RD-8 Multi-Track Recorder



This digital multitrack recorder is designed specifically for the audio professional. Fostex has long been a leader in synchronization, and the RD-8 redefines that commitment. With its built-in SMPTE / EBU reader/generator, the RD-8 can stripe, read and jam sync time code - even convert to MIDI time code. In a sync environment the RD-8 can be either Master or Slave (D/A's converted) at either 44.1 or 48KHz (user selectable) sampling rates, with 64X oversampling. Playback is accomplished with 18 bit analog-to-digital (A/D's) and 64X oversampling, thus delivering CD-quality audio.

- The S-VHS transport in the RD-8 was selected because of its proven reliability, rugged construction and superb tape handling capabilities. Eight tracks on S-VHS tape allow much wider track widths than is possible on other digital tape recording formats.
- With its LCD and 10-digit display panel, the RD-8 is remarkably easy to control. You can readily access 100 locate points, and cross-lade time is fully controllable in machine to machine editing. Table of Contents data can be recorded on tape. When the next session begins, whether on your RD-8 or another, you just load the set up information from your tape and begin working. Since the RD-8 is fully ADAT compliant, your machine can play tapes made on other compatible machines, and can be controlled by other manufacturers ADAT controllers. Your tapes will also be playable on any other ADAT deck.

- In addition to familiar transport controls, there are a number of logical, user friendly features. This is the only unit in its class with an on-board, back-lit variable contrast LCD display. It provides all of the information you'll need to keep track of offsets, punch points, generator functions and other pertinent data. Three function keys, combined with HOME, NEXT and UP/DOWN buttons, enable you to navigate the edit menu effortlessly. If you need to have access to the front panel controls, the optional model 8312 remote control gives you remote command of the most common functions.

## NOVA SYSTEMS, INC.

## NovaRouter 8x8, 16x16, 32x32 Intelligent Matrix Routing Switchers

A series of serially controlled audio and video matrix routing switchers, NovaRouters are available in 8x8, 16x16 and 32x32 matrices. They are capable of up to five switching levels to support unlimited combinations of stereo audio, component, composite and S-video, RGB/S and VGA graphics. Audio follow video or breakaway routing is controlled by very intuitive computer software or optional XY control panels.



All NovaRouters include an RS-232 interface and software. The software and VGA display provide quick visualization of all crosspoints and facilitates routing operations. An unlimited number of switching configurations may be stored in memory and recalled at the click of a mouse. User defined labels for all sources and destinations provide positive identification of the matrix status. One PC (386 or better) can control several NovaRouter Systems for multiple studio or large presentation system applications. An optional, easy-to-use, push-button XY control panel provides routing functions for basic systems without the use of a computer. All video, audio and audio follow video switching functions are controlled by source select and destination select switches. Changing and verifying the matrix configuration is simple and clear. The XY controls may be front panel mounted or are available as a rackmountable remote control unit.

Broadcast quality audio and video processing and microprocessor control ensure superior quality and performance. Yet the simplicity and modular configurations of NovaRouters make them economical for broadcast, production, cable TV, graphics, presentation, educational and teleconferencing applications.

### System Configurations:

	8 x 8 Matrices:		16 x 16 Matrices:		32 x 32 Matrices:	
Video	NR-8V	1395.00	NR-16V	3299.00	NR-32V	7199.00
S-Video	NR-8Y	2595.00	NR-16Y	5799.00		
Stereo Audio	NR-8A	1299.00	NR-16A	2249.00	NR-32A	4999.00
Balance Stereo Audio	NR-8AB	1750.00	NR-16AB	3299.00	NR-32AB	6695.00

	XY Front Panel Control:		XY Remote Control:	
XY-8P	8x8	275.00	XY-8RM	375.00
XY-16P	16x16	495.00	XY-16RM	595.00
XY-32P	32x32	895.00	XY-32RM	995.00

## CHYRON Graphics

### PC-CODI TEXT AND GRAPHICS GENERATOR

A PC-compatible (ISA bus) board, the PC-CODI incorporates a broadcast quality encoder and wide bandwidth linear keyer to provide highest quality realtime, video character generation and graphics display. Used individually or configured with multiple boards, it is a complete and affordable solution for information displays, broadcast, video production or multi-media applications.

- Standard PC/AT ISA bus interface, 2/3 length form factor
- Fully anti-aliased displays
- Less than 10msec. effective pixel resolution
- 16.7 million color selections
- Fast, realtime operations
- Character, Logo and PCX Image transparency
- Display and non-display buffers
- Bitstream typeface library selection
- Variable edges: border, drop shadow and offset
- Variable flush
- Full position and justify control of character & row
- User definable intercharacter spacing (squeeze & expand)
- Multiple roll/crawl speeds
- Automatic character kerning
- User definable table/facet fields
- Shaded backgrounds of variable sizes and transparency
- User definable read effects playback; wipes, pushes, fades
- High quality composite & S-video (YC) encoder
- Integral composite and S-video linear keyer
- NTSC or PAL sync generator with genlock
- Module switchable NTSC or PAL operation
- Software controlled video timing
- Board addressability for multi-channel applications
- Auto display sequencing
- Local message/page memory
- Preview output with safe-title/cursor/menu overlay
- Composite & S-video input with auto-genlock select

## SONY COLOR MONITORS

- PVM-1350** 13" Presentation Monitor
- PVM-1351Q** 13" Production Monitor
- Employs a P-22 phosphor fine pitch CRT to deliver stunning horizontal resolution of 450 horizontal lines.
- Equipped with beam current feedback circuit which eliminates white balance drift for long term stability of color balance.
- Has analog RGB, S-video and two composite video (BNC) inputs as well as 4 audio inputs.
- Automatic Chroma/Phase setup mode facilitates the complex, delicate procedure of monitor adjustment. Using broadcast standard color bars as a reference, this function automatically calibrates chroma and phase.
- Chroma/Phase adjustments can also be easily performed with the monochrome Blue Only display. In Blue Only mode video noise can be precisely evaluated.
- Factory set to broadcast standard 6500K color temperature.
- Provides an on-screen menu to facilitate adjustment/operation on the monitor. The on-screen menu display can be selected in English, French, German, Spanish or Italian.
- On power up, automatic degaussing is performed.
- There is also a manual degauss switch to demagnetize the screen.
- Sub control mode allows fine adjustments to be made on the knob control for contrast, brightness, chroma and phase. The desired level can be set to the click position at the center allowing for multi-blanking area and sync/burst timing by displaying the horizontal and vertical intervals in the center of the screen.
- Color temperature switchable between 6500K/9300K/User preset. 6500K is factory preset. 9300K is for a more pleasing picture. User preset is 9200K to 10,000K.
- Is also a multisystem monitor. It accepts NTSC, PAL and NTSC video signals. NTSC 4.43 can also be reproduced.
- Equipped with a SMPTE 259M Serial Digital Interface. By inserting the optional serial digital interface kit BKM-01C for video and the BKM-102 for audio the PVM-1351Q can accept SMPTE 259M component serial digital signals.
- Equipped with RS-422 serial interface. With optional BKM-103 serial remote control kit all of the monitor's functions can be remotely controlled with greater confidence and precision.
- Equipped with input terminals such as component (Y/R-Y/B-Y), analog RGB, S-video, 2 composite video (BNC) and 4 audio terminals for complete flexibility. Aspect ratio is switchable between 4:3 and 16:9 simply by pressing a button.
- Underscan and H/V delay capability. With underscan, entire active picture area is displayed. Allows you to view entire image and check the picture edges. H/V delay allows viewing of the



- blinking area and sync/burst timing by displaying the horizontal and vertical intervals in the center of the screen.
- Color temperature switchable between 6500K/9300K/User preset. 6500K is factory preset. 9300K is for a more pleasing picture. User preset is 9200K to 10,000K.

### PVM-1354Q/PVM-1954Q 13" and 19" Production Monitors

- All the features of the PVM-1351Q PLUS:
- SMPTE C standard phosphor CRT is incorporated in the PVM-1354Q/1954Q. SMPTE C phosphors permit the most critical evaluation of any color subject. Provides over 600 lines of horizontal resolution.
- The PVM-1354Q mounts into a 19-inch EIA standard rack with the optional MB-502B rack mount bracket and SLR-102 slide rail kit same as PVM-1351Q. The PVM-1954Q mounts into a 19-inch EIA rack with the optional SLR-103 slide rail kit.

## SHURE



### FP32A PORTABLE STEREO MIXER

This small and rugged portable mixer is well equipped to handle the demands of EFP, ENG, live music recording or any other situation that requires a low noise high performance mixer.

- High quality-low noise electronics, perfect for digital recording and transmission
- Three balanced inputs, two balanced outputs plus tape out and monitor
- Supports all types of condenser mics with internal phantom supply
- Inputs can be switched between mic and line level
- Each channel has own pan pot
- Each channel has illuminated meter and peak indicator
- Two units can be cascaded to provide six input channels
- Internal 1KHz oscillator for record and send level calibration
- Internal (2x3V alkaline batteries) or external power
- Switchable low cut filters

## MACKIE



### MicroSeries 1202 12-Channel Ultra-Compact Mic/Line Mixer

Usually the performance and durability of smaller mixers drops in direct proportion to their price, making lower cost models unacceptable for serious recording and sound reinforcement. Fortunately, Mackie's fanatical approach to pro sound engineering has resulted in the Micro Series 1202, an affordable small mixer with studio specifications and rugged construction. The Micro Series 1202 is a no-compromise, professional quality ultra-compact mixer designed for non-stop 24-hour-a-day professional duty in broadcast studios, permanent PA applications and editing suites where nothing must ever go wrong. So no matter what your application, the Micro Series 1202 is ideal. If price is the prime consideration or you simply want the best possible mixer in the least amount of space, there is only one choice.

### CR-1604

### 16-Channel Audio Mixer

In less than three years, the Mackie CR-1604 has become the industry standard for compact 16-channel mixers. It is the hands-down choice for major touring groups and studio session players, as well as for broadcast, sound contracting and recording studio users. For them the CR-1604 offers: features, specs, and day-in-day-out reliability that rival far larger boards. Its remarkable features include 24 usable line inputs with special headroom/ultra-low noise Unipolys circuitry, seven AUX sends, 3-band equalization, constant power pan controls, 10-segment LED output metering, discrete front end phantom-powered mic inputs and much more.

## TASCAM M-2600 Series

### 16/24/32 Channel Eight Channel Mixers



#### LOW NOISE CIRCUITRY

- Combining completely redesigned, low noise circuitry with Absolute Sound Transparency™ the M-2600 delivers high-quality extremely clean sound. No matter how many times your signal goes through the M-2600, it won't be colored or altered. The signal remains as close to the original as possible. The only coloring you hear is what you add with creative EQ and your outboard signal processing gear.
- Double reinforced grounding system eliminates any hum. World-class power supply provides higher voltage output for better headroom and higher S/N ratio.

#### THE BEST AUX SECTION IN THE BUSINESS!

The most versatile AUX section in its class, rivaling expensive high-end consoles. 8 sends total. 2 in stereo. Send signal in stereo or mono, pre- or post-late. Available all at once. Return signal through any of 6 stereo paths.



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## HORITA

### WG-50 Window Dub Inserter

- Makes burned-in SMPTE TC window dub copies
- Indicates drop-frame or non-drop-frame time code
- Also functions as play speed SMPTE time code reader
- Adjustments for horizontal and vertical size and position
- Dark mask or "see-thru" mask surrounds display
- Provides reshaped time code output for copying TC
- Displays time code or user bits • Display on/off
- Field 1/ field 2 indicator • Sharp characters
- Always frame accurate (on time)

\$269

### TG-50 Generator / Inserter

Combination time code generator and window dub inserter. It includes all features of WG-50 PLUS—

- Generates SMPTE time code in drop/non-drop-frame format
- Jamsync mode jams to time code input and outputs new TC
- Simple "on screen" preset of time code and user bits
- Run/stop operation using front panel momentary switch
- Selectable 30/60/90/120-second automatic generator back-time
- Make a window dub copy while recording TC on source tape

\$349

### BSG-50 Blackburst/Sync/Tone Generator

- The BSG-50 provides an economical means for generating the most common RS-170A video timing signals used to operate various video switchers, effects generators, TBCs, VCRs, cameras and video edit controllers.
- 6 BNC video/pulse outputs
  - Now available: 6 blackburst, 4 sync, 2 subcarrier
  - Each sync output individually selectable for composite sync, composite blanking, H-drive, or V-drive
  - Separate buffer for each output—maximum signal isolation
  - 1KHz, 0dB sinewave audio tone output, locked to video
  - Outputs can easily be configured to meet specific user and equipment needs

\$269



### CSG-50 Color Bar/Sync/Tone Generator

- Generates full/SMPTE color bars, blackburst and composite sync signals.
- Built-in timer can automatically switch video output from color bars to color black after 30 or 60 seconds. Easy and convenient for producing tape leaders and stripping tapes with color bars and black.
- Front panel selection of full-field or SMPTE color bar patterns or color/black (blackburst) video output.
- Includes crystal-controlled 1KHz, 0dB audio tone output.
- Outputs: video, sync, ref frame, 1KHz, 0dB
- Audio tone switches to black and color bars change to black when using 30/60 second timer.
- Fully RS-170A SC/H phased and always correct. No adjustment required

\$349

### TSG-50 NTSC Test Signal Generator

- The TSG-50 generates 12 video test signals suitable for setting up, aligning, and evaluating the performance of various video equipment found in a typical video editing system, such as video monitors, distribution amplifiers, VCRs, switchers, effects generators, TBCs, etc. In addition to the video signals, the TSG-50 also generates composite sync and, with a video DA such as the Horita VDA-50, becomes a high quality, multiple output, house sync generator.
- Fully RS-170A SC/H phased and always correct. No adjustments ever required
  - Built-in timer automatically switches video output from color bar pattern to black after 30 or 60 seconds. Makes it easy to produce tape leaders of color bars followed by black
  - Video signals generated are in accordance with industry standard EIA RS-170A video timing specification
  - Audio tone switches to silence and color bars change to black when using 30/60 second timer
  - Convenient pattern selection - 12 position front panel switch
  - Includes crystal controlled, 1 KHz, 0dB audio tone output
  - Generates precise oscilloscope trigger output signal one H line before start of color field 1
  - Outputs: video, sync, ref frame, 1KHz, 0dB

\$439

#### WE STOCK THE FULL LINE OF HORITA PRODUCTS INCLUDING:

- WG-50 - Window Dub Inserter
- TG-50 - Generator/Inserter
- TRG-50 - Generator/Inserter/Search Speed Reader
- TRG-50PC - Has all of the above plus RS-232 control.
- VG-50 - VITC Generator, LTC-VITC Translator
- WLF-50 - VITC to LTC Translator
- VLT-50PC - VITC-to-LTC Translator / RS-232 Control
- RLT-50 - Hi8 (EVO-9800/9850)TC to LTC translator
- TSG-50 - NTSC Test Signal Generator
- SCT-50 - Serial Control Tiller "Industrial" CG, Time-Date Stamp, Time Code Captioning
- SAG-80 - Sate Area, Convergence Pattern and Oscilloscope Line Trigger and Generator

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# TRUEVISION

## TARGA 2000 PCI

### PC-based Digital Video Capture Board

Designed for high performance IBM compatibles, Truevision's TARGA 2000 PRO PCI brings tremendous power to the desktop video editing market. With the proliferation of PC-based video (and audio) programs, and the domination of the platform by Microsoft's Windows, there has been a demand for high performance hardware that won't tie up the computer's resources. The TARGA 2000 PRO PCI meets that demand with a board that performs all its own signal processing. Realtime CODEC (Compression/Decompression) processing of audio and video, 24-bit video windowing and full motion/full screen print-to-tape are just a few of its many capabilities.

- Allows recording and playback of video directly to/from hard drive at full motion, full frame rates (50 fields/sec - PAL, 60 fields/sec-NTSC). Video is stored and played back at the highest resolution for each format (768 x 576 x 24 bit - PAL, 640 x 480 x 24 bit - NTSC). Compression can be adjusted on the fly to optimize for image quality and/or minimum storage space.
- Equipped with composite, S-video and component (Betacam) inputs and outputs.
- Accelerated Windows 3.1 and Windows NT drivers offer integrated, true-color (24-bit), non-interlaced desktop up to 1152 x 864 pixels.
- Genlock using separate sync input for working in professional video suites.
- Provides a large work area for displaying video, as well as editing application controls. Any part of the display (or even the whole image) can be recorded to tape (video-out-of-a-window).
- The audio is digitized at 16-bit resolution (at 44.1KHz or 48KHz sampling rates), yielding professional quality stereo sound. Since all audio and video processing is done by on-board DSPs, you are assured of perfectly synchronized sound and images.
- View your desktop and video-in-a-window on your non-interlaced high resolution desktop display while the processed video is output at NTSC or PAL resolutions to a video monitor and/or a VCR.
- All Windows, VFW (Video For Windows) and ADI compatible software run perfectly on the TARGA 2000. You have a choice of hundreds of applications, with more to come (see Real Impact below).

**Complete Truevision TARGA 2000/Avid Real Impact Non-Linear Turnkey System:**

- TARGA 2000 PCI digital video capture board • Avid Real Impact software • 220-watt, 6-bay midtower case • PCI motherboard with 256K synchronous cache • Pentium 133 Mhz processor • Diamond Stealth64 Video VGA display card • 32MB of EDO (Extended Data Out) RAM • Quantum 1.28GB IDE system drive • Seagate (Barracuda) 4.2GB SCSI-2 Wide hard drive • Adaptec AHA-2940W Fast Wide SCSI II controller card • 3.5" floppy drive • Plectro 4.5x SCSI Internal CD-ROM drive • Atec-Lansing 300.1 three-piece speaker system • MAG Innovision MXG-17F 17" multiscan monitor • Focus 2001A keyboard, Microsoft MS mouse, Windows NT 3.51 software. **\$12,250**

**Enhancement Options Available:**

- Additional 32MB of RAM • Additional 256K cache memory • Seagate (Elite) 9.1GB SCSI Wide hard drive • Mag 21" multiscan monitor • 8x CD-ROM drive • Adobe Premier 4.0a for Windows

## Real Impact

### Video Editing Software

for TARGA 2000 **NEW!**

With the introduction of Real Impact, Avid provides Windows users with the same professional image quality intuitive cut/copy/paste editing, and instant random access capabilities that have won 2 Emmy awards—for thousands of dollars less than outsourcing an average video. Designed exclusively for Truevision's TARGA 2000, Real Impact lets you create professional-quality video with audio, graphics, animations, special effects and titles—with the speed, flexibility and creative freedom you need. Create, save, training and product videos right on your PC quickly and easily—without compromising quality. Produce video in 24-bit color, with CD-quality sound and perfect lip sync.

**Easy to Use:** A true Windows 32-bit application (Windows NT 3.51 or later). Real Impact's intuitive interface and extensive on-line help get you productive right away. It's powerful editing features let you work with video, audio, graphics, animations and titles with the simplicity of cut, copy and paste.

**Video Capture:** Digitize video and audio from your camcorder, VCR or professional tape deck—without dropping a frame. Your video will be full-screen, full-motion, 30 frames-per-second and your audio in sync. With its Dial-a-Quality image feature, Real Impact allows you to adjust image quality for differing system, storage and delivery requirements.

**Create a Storyboard:** Extensive media management with Real Impact's built-in media library and database let you easily find the video and audio clips that you want. Instant random access makes previewing clips simple and immediate. And, with timeline editing, you just click and drag to experiment with different cuts, rearrange clips and assemble your story. There are 32 levels of undo/redo.

**Add Graphics, Titles and Special Effects:** It's easy to create and seamlessly incorporate audio, graphics and animations into your video using popular Windows-based applications. Real Impact supports AVI video files, WAV audio files, FLC animation files as well as BMP, JPEG, PCX, TGA and TIFF graphics files.

**Add Audio:** Polish your audio with music and narration. Adjust pan and volume in real time. Simultaneous playback of four audio tracks makes audio editing quick and easy. View your four audio tracks in sync with the video; immediately, no waiting for tracks to complete.

**Digital Media Interchange:** Real Impact is compatible with the Open Media Framework (OMF) Interchange, an industry-standard file format for the seamless integration of digital data among applications and across platforms. Through OMF, you can import video and audio files from other OMF-compatible applications such as Avid's Media Composer system.

**Output to Tape, CD-ROM or Over a Network:** Real Impact gives complete control over how you distribute video. There's no long rendering process—creating professional quality tape is a snap. Embedding video in multimedia presentations for distribution on disk or CD-ROM is as simple as the click of a mouse. Support for third-party MPEG tools make it possible to create MPEG files for network distribution.

**Avid's Support Advantage:** Like all other Avid products, Real Impact is backed by Avid's world-class customer service. Toll-free telephone support and bulletin board service are just some of the benefits.

#### Real Impact Features:

- Video:**
  - Real-time MPEG compression, decompression and playback at 60 fields per second
  - Supports Sony serial and VLAN deck control protocols; supports SMPTE time code
  - Edit two tracks of video for layered effects
- Audio:**
  - Edit up to four tracks of 44.1 KHz, 16-bit CD-quality audio
  - Real-time pan and volume adjustments, digital audio scrub
  - Audio waveform for precise audio editing
- Digital Editing:**
  - Instant random access to footage. Cut, copy, paste editing with 32 levels of undo and redo.
  - Instant from editing mode, plays back all edits instantly.
  - AVI/Export:
  - Import video files, WAV audio files, FLC animation files
  - OMF interchange files
  - BMP, JPEG, PCX, TGA and TIFF graphics files
- Special Effects:**
  - Filter effects with previews and adjustable parameters.
  - Transition effects include wipes, dissolves, zooms, pushes and squeezes
  - Layered effects include picture-in-picture, luminance and chroma key
  - Support for Avid TransJammer effects Vol. 2 or later (Vol. 1 requires a free update through Avid Technical Support).
- Integrated Title Generator:**
  - Fully anti-aliased titles
  - 32-bit processing (24-bit color and 8-bit alpha channel)
  - Support for TrueType fonts and international character sets
  - Drop shadows, transparency and color blends
  - NTSC and PAL safe color palettes
- Media Management:**
  - Media library for organizing digital media clips
  - Database with search capabilities
  - Customized views for easy clip access and retrieval



### MM-400

The MM-400 is a combination waveform and vector monitor especially configured for the cost-conscious producer. A low-cost alternative to CRT-based waveform monitoring the MM-400 produces a video picture of the input signal's waveform and displays it on any video monitor. It provides a simple, affordable and accurate way to set camera levels before a shoot, or to check time base correctors and color fidelity in editing. Problems like hue shift, smearing, muddy contrast and loss of detail are easily identified for correction.

- FEATURES:**
- Converts waveform or vector display information into a standard video signal which can be displayed on a video monitor or routed around a video facility, no need for additional expensive monitors. Switch between pictures and waveforms at the push of a button.
  - Incorporates an advanced SC/H phase and color frame indicator that is a must for editing and post production. At a glance it tells you if a signal's subcarrier-to-horizontal phase is properly adjusted and if the signal's color frame matches the house black burst connected to the MM-400 external reference input.
  - Works anywhere and with any analog video format—NTSC, PAL, Component or S-Video. It has automatic detection between NTSC and PAL formats.
  - Three loop-through inputs can accept three composite signals or one component, or RGB signal.
  - No complex displays or special test signals are required for component video monitoring.
  - Interchangeable timing and amplitude display make component analog monitoring easy, has color bar limit markings for Betacam, Hi-8 and SMPTE formats.
  - Waveform and vectorscope controls, including channel, sweep speed, position control, phase rotation are on easy-to-see dedicated pushbuttons.
  - Besides instant toggling between picture and waveform, a mix mode combines waveform and picture displays for simultaneous viewing.
  - The MM-400 can be readily used by even novice operators. It has easy-to-understand set-up menus for display color, interchannel timing, SC/H phase alarm.
  - Usable in any video facility of any size for displaying signals, its low cost makes it affordable by the smallest studio, while its features and performance make it ideal for monitoring in high-end facilities as well.

## LEADER

### Model 5850C

#### Vectorscope

An ideal companion for the 5860C Waveform Monitor, the 5850C adds simultaneous side-by-side waveform and vector monitoring. Featured is an electronically-generated vector scale that precludes the need for fussy centering adjustments and eases phase adjustments from relatively long viewing distances. Provision is made for selecting the phase reference from either (A or B) inputs or a separate external timing reference.

### Model 5860C

#### Waveform Monitor

A two-input waveform monitor, the 5860C features 1H, 1V, 2H, 2V, 1 p/s/div and 2V MAG time bases as well as vertical amplifier response choices of flat, IRE (low pass), chroma and DIF-STEP. The latter facilitates easy checks of luminance linearity using the staircase signal. A PIX MON output jack feeds observed (A or B) signals to a picture monitor, and the unit accepts an external sync reference. Built-in calibrator and on-off control of the DC restorer is also provided.

### Model 5864A

#### Waveform Monitor

A fully portable waveform monitor for field use, the Model 5864A is a two-channel unit that provides 2H and 2V sweeps with MAG, FLAT and IRE response, and normal and X4 gain.

### Model 5854

#### Vectorscope

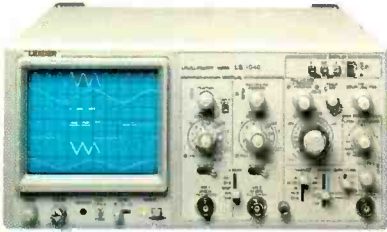
2-channel portable vectorscope is ideal for field use and features A and B phase reference, fixed and variable gain. Both units shown with optional battery holder and NP-1 type battery.



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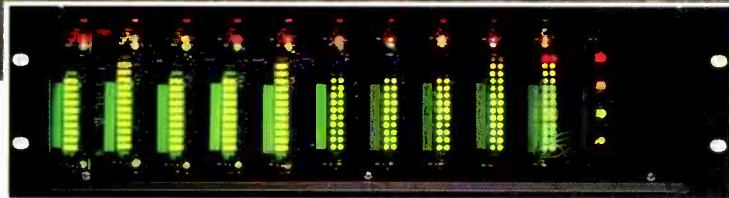
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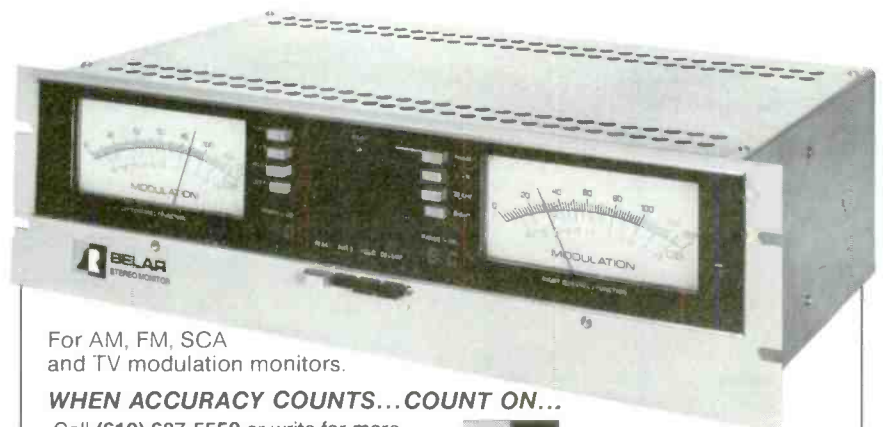


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Continued from page 22

compatible with the 188-byte MPEG-2 data packet standard, commonly used throughout the world. Twenty Reed-Solomon parity bytes for every data packet add redundancy for forward error correction (FEC) of up to 10-byte errors/packet. Since Reed-Solomon decoders correct byte errors, and bytes can have anywhere from 1- to 8-bit errors within them, a significant amount of error correction can be accomplished in the VSB receiver.

### The VSB transmitter

The trellis-coded 8-VSB transmitter block diagram is shown in Figure 3. The transmitter receives the incoming data packets and randomizes the data so that what is transmitted over the air produces a flat spectrum. Random data is needed for all the receiver recovery loops to work optimally. The Reed-Solomon encoding, known for its burst

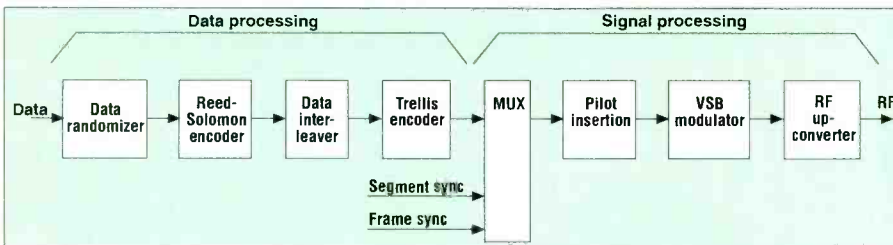


Figure 3. Trellis-coded 8-VSB transmitter block diagram.

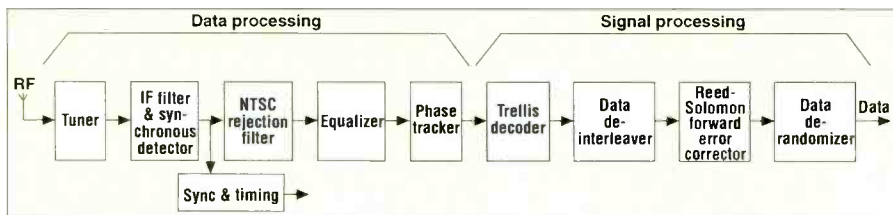


Figure 4. Trellis-coded 8-VSB receiver block diagram.

noise correction capability and overhead efficiency, adds the 20 parity bytes to the end of each data packet before databytes are interleaved over many data segments to a depth of one-sixth of a frame (4ms). The segment and frame syncs are not interleaved. Databyte interleaving helps protect against the effects of burst noise/interference.

In the trellis-coded 8-VSB system used in the terrestrial mode, the trellis encoder adds additional redundancy to the signal in the form of more data levels, as well as creating the multi-level data symbols. In 16-VSB cable applications, there is no trellis encoding, and a mapper creates the multilevel data symbols. The segment and frame syncs are then multiplexed with the multilevel data symbols before the DC offset is added for creation of the small in-phase pilot. The VSB modulator provides a filtered IF signal at a standard 44MHz frequency. Finally, the RF upconverter translates the signal to the desired RF channel.

### The VSB receiver

The VSB receiver block diagram is illustrated in Figure 4. The RF signal is converted by the VSB receiver's tuner to the standard 44MHz IF. After appropriate IF filtering using the root-raised cosine, the pilot signal is synchronously detected using a narrowband frequency-and-phase-locked loop (FPLL). The FPLL exhibits good wideband frequency acquisition and narrowband phase noise tracking, and it also works optimally with a wideband phase tracker.

The VSB modem includes the functions of RF selection, local oscillator and conversion; IF amplification and band shaping; baseband demodulation; AGC; co-channel filtering; synchronization and phase tracking of the carrier, the bit clock, and the data framing; equalization, including ghost cancellation; forward error correction, including trellis and Reed-Solomon codes; and data deinterleaving.

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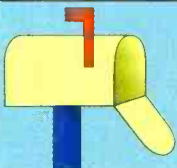
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Louis Libin is director of technology for NBC, New York.



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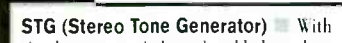
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


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**SUBSCRIPTIONS:** Non-qualified persons may subscribe at the following rates: United States and Canada; one year, \$50.00. Qualified and non-qualified persons in all other countries; one year, \$60.00 (surface mail); \$115.00 (air mail). Subscription information: P.O. Box 12937, Overland Park, KS 66282-2937.

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## The basics of digital video

other digital devices, such as PCs, becomes considerably easier.

The basics of digital video are simple: an analog signal, either composite or component, is digitized by sampling at a constant frequency. The modulation system that is employed is pulse code modulation (PCM). At the instant of sampling, the video level corresponds to a predetermined binary code. The sampling will be taken to the "nearest" digital level. The number of levels of the code that are provided must be sufficient to cover the whole voltage gamut of the composite or component signal, while giving the reproduced signal its required specification of what we will call, for the moment, noise. That, in turn, will determine how many digital bits are needed for the signal.

**T**he tale "The Emperor and His New Clothes" contains a lesson that applies to technology; mass hysteria can persuade people to go along with the majority because they feel that their own view is distorted. It is too easy to assume that the fundamentals of a technology are understood by all, and we often suffer an enormous guilt trip when we miss a development.

This column will put the fundamentals of digital video in front of you. The only assumptions will be a basic understanding of component and composite analog video. We will cover just about anything and everything digital-related in video and audio without trying to turn the column into an academic dissertation. And, of course, we will talk about all the "Ds" and their standards.

### Why digital?

Our eyes are analog devices. The light reaching them is analog. The light reaching a sensing device, such as the pick-up device in a camera, is analog. So, why should we be interested in producing an "unnatural" signal in a digital format? The simple fact is that if we can carry digital signals through a processing and transmission channel or medium, we are most likely to be able to recover the analog display signal in a form that is the closest representation of the original. There is no degradation of a correctly received digital signal, but there is, generally, less cost in handling a digital signal. Storage, delays and manipulation of a digital signal are simpler, and integration with

*The basics of digital video are simple: an analog signal, either composite or component, is digitized by sampling at a constant frequency.*

The sampling frequency used for the digitization must be high enough to allow for the reproduction of the system bandwidth of the TV standard. Nyquist's theorem states that the absolutely highest reproducible frequency is half the sampling frequency. For a 4MHz bandwidth video system, therefore, the sampling would have to be at least 8MHz. Practical engineering considerations demand that a higher frequency be used, and the higher the better.

### Digital composite and component

The two different forms of digital signal are

digital versions of two of our analog forms. The digital composite signal takes an analog composite signal and directly digitizes it, so even the color burst and chroma modulation are digitized. In some texts, you might see a reference to "digitized video;" this is usually meant to be digital composite.

The digital composite signal is carried on a single cable, like its analog counterpart, which can be a great convenience. As we will see, however, digital composite has its limitations. The digitizing is based on 10 bits (1,024 levels) while the sampling frequency is a multiple of the subcarrier frequency. Four times (4fsc) has been chosen, which corresponds to 14.3MHz for digital composite NTSC and 17.7MHz for digital composite PAL. (See Table 1.)

For digital component video, the coding is based on three channels in the Y, R-Y, B-Y format. The sampling is not equal on all three channels; for the Y channel, sampling takes place at 13.5MHz; for the two color-difference channels, sampling is at half that frequency, at 6.75MHz. Sampling of the color-difference channels is alternated, but always coincident with the luminance sampling. So, when a Y sample is taken, an R-Y sample may be taken. At the next Y sample, a B-Y sample will be taken.

The choice of the 13.5MHz sampling is the same for 525/60Hz video and 625/50Hz. In a major agreement, there is a common standard between all (CCIR-601). There is no subcarrier on a component signal, of course, so there is no immediate, magic frequency to be considered. The original standard called for all the bits of the three channels to be carried on separate conductors using a multipin connector. Currently, the move is to put these signals into a serializer, so that the complete signal can be carried on a single cable. ■

**Next month:**  
A more detailed look  
at the composite digital signal

VIDEO FORMAT	SAMPLING FREQUENCY	PIXELS		LINES	
		HORIZONTAL TOTAL	HORIZONTAL ACTIVE	VERTICAL TOTAL	VERTICAL ACTIVE
NTSC D-2	14.32MHz	910	768	626	485
525/60 D-1	13.5MHz	858	720	626	485
PAL D-2	17.72MHz	1135	948	625	575
625/50 D-1	13.5MHz	864	720	625	575

Note: D-2 is the digital composite standard. D-1 is the CCIR-601 digital component standard.

Table 1. The sampling schemes for 525 and 625 digital composite and component systems. The sampling frequency for the component format is for the luminance component.

Paul McGoldrick was trained by the BBC. By a circuitous route, involving some inhospitable locations, he arrived in Illinois with Harris. He has since worked for Moseley Associates, Magni Systems and Snell & Wilcox. He now operates his own free-lance writing and consulting business in San Jose, CA. He can be contacted through CompuServe at 102447.346@compuserve.com.

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