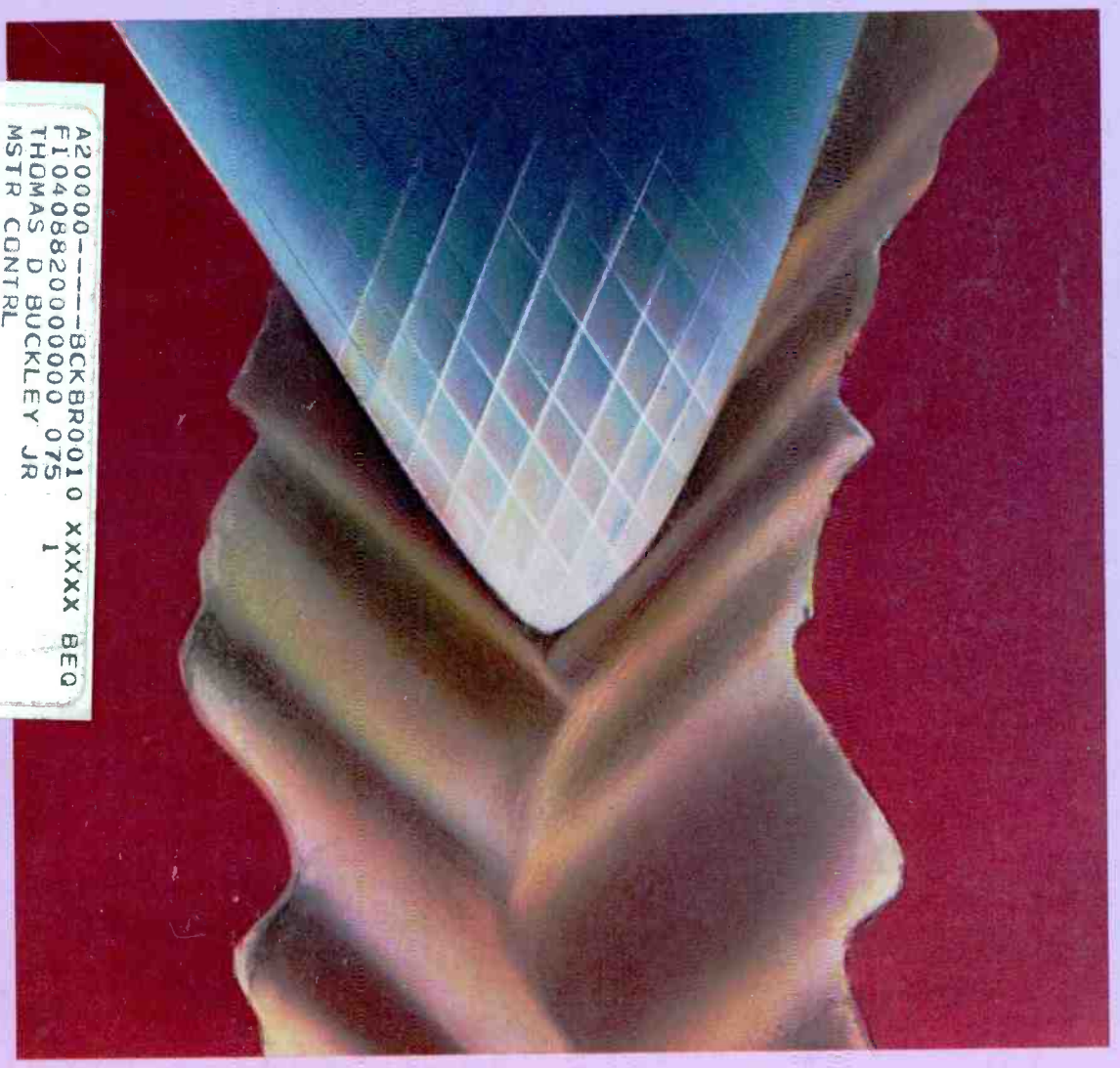
BROADCAST engineering®

August 1982/$3



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BROADCAST engineering

The journal of broadcast technology

August 1982 • Volume 24 • No. 8

FEATURES

DEPARTMENTS

ISSN 0007-1994.

BROADCAST ENGINEERING (USPS 338-130) is published monthly by Intertec Publishing Corporation, 9221 Quivira Road, P.O. Box 12901, Overland Park, KS 66212-9981. Postmaster, return form 3579 to P.O. Box 12938 at the above address.

THE COVER shows an artist's enhancement of an electron beam enlargement showing a stylus tracking a recorded groove. An informative article on cartridge/stylus performance and maintenance, the resulting record wear, as well as the effect of that wear on audio quality begins on page 16. The report was prepared especially for **BE** by George Alexandrovich, Stanton Magnetics, vice president, field engineering, and professional products manager. Alexandrovich is a recognized authority on achieving top audio quality from records.

Cover design by Kim Nettie.

Tech Tips...

...our latest exclusive department, is designed to provide our readers with concise tips on technologies related to broadcasting that do not warrant in-depth articles. In purpose and scope, it parallels our *Station-to-Station* department that allows broadcasters to communicate short, vital bits of information to each other. However, it differs in that *Tech Tips* is available to all contributors, especially to manufacturers' staffs wishing to present crucial tips to **BE** readers.

The kickoff for this new department is on page 73. Read it and let us have your suggestions on topics you would like to see covered in future issues.

Interested readers may submit items for consideration in future issues to: Tech Tip Editor, **Broadcast Engineering**, P.O. Box 12901, Overland Park, KS 66212.

NEXT MONTH we will feature our 15th annual *Buyers' Guide*, the industry's most comprehensive directory of products and sources for broadcasters. The issue will also be packed with timely articles on radio and TV broadcasting.

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BROADCAST ENGINEERING is edited for corporate management, engineers/technicians and other station management personnel at commercial and educational radio and TV stations, teleproduction studios, recording studios, CATV and CCTV facilities and government agencies. Qualified persons also include consulting engineers and dealer/distributors of broadcast equipment.

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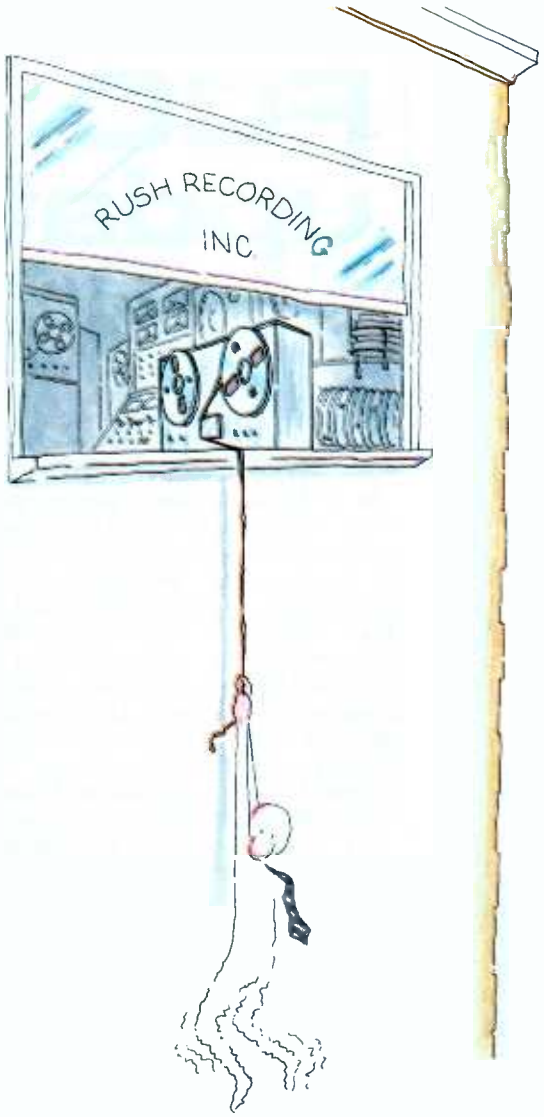

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FCC update

August 1982

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Daytime applications on Class I-A clear channels accepted

In a Memorandum Opinion and Order released June 18, 1982, the commission announced a partial "thaw" of its freeze on the establishment of daytime-only stations on the Class I-A clear channels. Applications for daytime AM stations on the Class I-A clears will be accepted if they specify transmitter sites inside the protected nighttime contour (the 0.5mV/m 50% skywave contour) of the existing co-channel Class I-A stations and meet existing daytime protection criteria.

The commission said that permitting the establishment of new daytime stations within the protected nighttime contour of the clears would not significantly compromise the establishment of new co-channel, full-time stations outside the Class I-As' protected areas.

The commission has been accepting applications for new full-time Class II stations on the 25 Class I-A clear channels since Aug. 1, 1980, but has refused, until now, to accept applications for daytime stations on these frequencies.

DBS approved

On June 23, 1982, the commission adopted interim rules for licensing and operation of direct broadcast satellites (DBS). It conditioned its authorization of the new service on the outcome of the 1983 Regional Administrative Radio Conference. At that conference, to be held in Geneva next year, international standards for space segment usage in the Western Hemisphere will be adopted.

The following resolutions of the issues in the DBS proceeding were made:

- The commission allocated 500MHz of spectrum in the 12GHz band for downlinks and 500MHz in the 17GHz band for uplinks.
- License terms for interim DBS systems were set at five years.
- A flexible regulatory approach to classification of DBS service offerings was adopted so that operators could determine the characteristics of their service offerings without having to fit a conventional regulatory mold (i.e., broadcaster or common carrier).
- No restrictions were placed on ownership or control of DBS systems or program channels.
- No technical standards beyond those required by international agreements were imposed.

The commission's staff advises that the nine applications for authority to provide DBS service will be acted upon within the next 90 days. Those applicants who are granted authorizations will be required to begin construction, or complete contracting for construction, within one year of issuance of a construction permit, and begin operation within six years of the grant of a construction permit. DBS service to the public is expected to begin in 1986 or 1987.

STV deregulation

The commission has made significant changes in its rules governing over-the-air subscription television (STV) operations. The rule changes include the following:

- The "complement of four rule," which restricted STV operations to communities served by at least four standard commercial TV stations, was eliminated. This means that stations even in the smallest TV markets now may convert to STV.
- The requirement that STV stations carry at least 28 hours of conventional programming per week was eliminated. Stations operating in the STV mode still are required to serve the community needs of their service areas, but they may do this in either a subscription or non-subscription mode.
- The rule which required that STV decoders be leased rather than sold to subscribers was eliminated.
- The requirement that applicants for an STV authorization ascertain community needs and interests regarding STV programming was eliminated.

These rule changes are expected to spur the development of STV and result in the establishment of more UHF TV stations.

ABC Superadio debut delayed

The start of national distribution of ABC Superadio, the satellite-delivered program and promotion package, has been delayed indefinitely, according to Michael Hauptman, vice president in charge of ABC Radio Enterprises.

Superadio was scheduled to begin broadcasting on July 1, 1982.

Announcing the delaying of the Superadio service, Hauptman said, "Superadio, perhaps the most ambitious of the new satellite-distributed program products, was conceived in the extremely healthy national advertising environment of early 1981. We have found, after a careful study of the marketplace at this time, that the environment is not now conducive for the introduction of the service.

"Starting the Superadio service now would not be in the best interests of the subscribers or ABC Radio Enterprises. We continue to have complete faith and confidence in the concept and believe it may still represent the wave of the future. It is our intention to continue to monitor the marketplace for a more favorable time to introduce the product."

At the time of the postponement, six radio stations had agreed to carry the service. Discussions are now under way with station operators to assure them that ABC Radio Enterprises will assist them in making alternative programming plans, Hauptman said. Hauptman also said that the Superadio air staff and support personnel will be aided in locating other career possibilities.

ABC Radio Enterprises also produces TalkRadio, the talk format that began broadcasting in May. The TalkRadio service, which is marketed to affiliate stations by the ABC Radio Network, has 21 major market facilities on-line.

MPAA responds favorably to new Kodak technology

Motion picture industry leaders reacted enthusiastically to Eastman Kodak Company's recent demonstration of a new capability for applying a layer of magnetic material across the entire back surface of motion picture film. This technology would enable filmmakers to automate many costly and time-consuming post-production operations.

"Kodak's new development holds great promise," Ed Di Giulio, president, Cinema Products Corporation, said. Di Giulio is also chairman of an ad hoc committee formed after the demonstration to further evaluate the new technology.

"It may be the *missing link* between film and videotape that we have sought for years," Di Giulio said. "It will give the industry the advantages of superior quality photographic film, and at the same time provide the significant benefits of computer-assisted, post-production editing and final assembly."

Representatives of 35 organizations of the motion picture industry, invited by the Motion Picture Association of America (MPAA), attended the special seminar at the Academy of Motion Picture Arts and Sciences.

Joining Di Giulio on the committee are Fred Scobey, Deluxe Laboratories; Richard Stumpf, Universal Studios; Dr. Roderick Ryan, Kodak; Allen Cooper, MPAA; Howard La Zare, Consolidated Film Industries; Bill Hogan, Ruxton Ltd.; and Michael Strong, World Wide Pictures.

The committee's primary function is to help Kodak explore the feasibility of this new technology and determine how it might be integrated into the production of theatrical films and TV programs.

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Studer receives Gold Medal

The Audio Engineering Society has presented its highest award, the Gold Medal, to Dr. Willi Studer, founder and director of the company that makes Revox high fidelity components. Studer was honored for his lifelong outstanding contributions to the development and making of the highest quality recording equipment, according to the AES.

The presentation of the Gold Medal marks the fourth time Studer has been honored by the society. In 1970, he was chosen as a Fellow of the AES, and in 1976 he was simultaneously chosen a Life Fellow and awarded the Silver Medal. Also, in 1975, Studer was elected an AES governor.

National Association
of Broadcasters
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Washington, DC 20036
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FCC asked to reconsider LPTV policy

The NAB has asked the FCC to reconsider parts of its recently adopted LPTV station rules dealing with diversification of control.

In its petition, the NAB said that the commission seriously departed from the mandates of the Administrative Procedure and Regulatory Flexibility Acts when it adopted comparative LPTV licensing criteria that it had not proposed nor put out for public comment. The result of the rules on comparative criteria, the NAB said, is a distortion of the FCC's 1965 policy statement.

SMPTE

862 Scarsdale Ave.
Scarsdale, NY 10583
1-914-472-6606

Friedman named editor of *SMPTE Journal*

Jeffrey B. Friedman was recently named editor of the *SMPTE Journal*. Friedman succeeds Jack Christensen, who resigned. In his new position, Friedman will be responsible for publishing the *Journal* and other SMPTE publications.

Friedman moves to the new position from his job as manager of advertising, conferences and publicity, which he has held since 1968. He has been employed by the SMPTE since 1964.

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HARRIS

editorial

Energy:
The crunch is coming

The '70s and '80s have just begun to see the impact of rising costs of energy affecting the economy. *Black gold* is not just a play on words. As the world's supply of hydrocarbon fuels become depleted, the black fluids may become more precious and costly than gold itself.

Is the energy crunch real? You'd better believe it. At current rates of energy consumption, the world will probably be without fossil fuels within about 50 years. That's not fiction, and coal will not extend us for 1000 years or so as some would like us to believe. And long before the last drop of oil is gleaned, the nation that has the energy can control the world.

Our handling of energy—its conversion, utilization and conservation—is a national disgrace. It is high time that our politicians and citizens put energy and the future into perspective. We've buried our heads in the sand for more than two decades, and politicians and highly paid executives in the auto industry have been the most flagrant abusers of this blindness.

The world must change dramatically to meet the challenges of reduced energy supplies. We are already late in reading the indicators of this challenge. Untold billions of dollars have already been lost to foreign auto manufacturers—with attendent loss in jobs, revenue, prestige and precious fuels. Countless millions have been lost also in non-recycled fuels in waste products, including oils from service stations. Add to those losses millions of dollars wasted by automobiles at stoplights because the lights are not regulated for efficient traffic motion.

As private citizens, we should all be concerned about energy and the future generations. Energy-wise, we've lived on plush times. Future generations must face challenges we've been spared.

Time may be running out, but it's not too late. If we are to survive as a people and a nation, we must have a solution to the energy needs of the future. We need efficient people movers, on/under land and sea and in the air; we must have modern cities designed to function on minimum energy requirements; we need a national program to consider energy conversion, especially fusion and fission power for the near and long-term needs and coal for the short haul; we need to harness the natural elements to stem the tide of fossil fuel consumption; we need visionaries in industry and government to lead future generations into a vastly different society; and, we need realistic plans now to help the transitions along.

As broadcasters we are doubly concerned. First, as communicators, we can help inform the public as future trends demand. Second, as energy users, we are directly involved in energy consumption. Right now, power usage is not a major factor in station design/operation—but the time is coming when this will not be true. It is not too early to consider efficient power operations in the near future.

There is a simple step that will help us. If we can get manufacturers to improve the front end circuitry on AM radios (with or without AM stereo), it is possible to reduce transmitter power without reduction in coverage. Thus, new receivers could conserve millions of kilowatts annually—that helps broadcasters and the country.

Your opinions on our editorial, on other critical issues facing broadcasters, or on the views of our authors is welcome. Address comments to The Editor, Broadcast Engineering, P. O. Box 12901, Overland Park, KS 66212.

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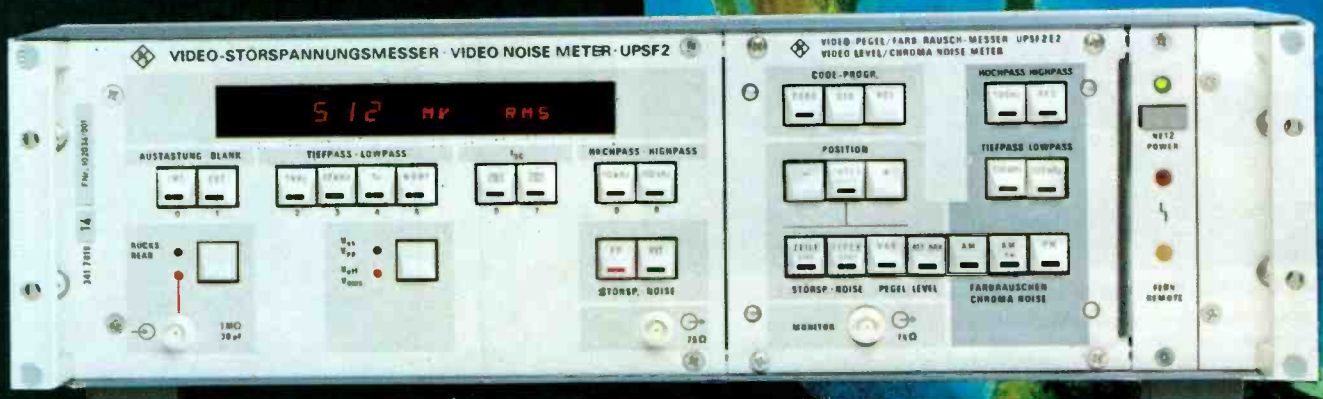

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NAB update

In our continuing effort to keep you informed of industry occurrences, we are using this column for updates, revisions and corrections to our June wrap-up coverage of NAB-'82/Dallas. More information about these products may be obtained by using the reader service numbers.

AVT TELEVISION PRODUCTION
The Performer

In the outside display area, The Performer provided a glimpse inside a 45-foot van trailer production facility. The unit was designed and built by AVT Television, not Lerro Electrical Corporation, as was stated in **BE** June 1982. Curtis Allin III engineered the project using equipment, technical advice and support from the Lerro organization.

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AMPEX CORPORATION
BCC-20, BCC-21

The Audio/Video Systems Division demonstrated the BCC-20 and BCC-21 cameras at the show. These two members of the digicam series include digital electronics to control registration on a point-by-point scheme. The Spatial Error Correction System (SECS) maintains registration accuracy to 0.05% over all three zones. With the capability of triax, multicore or fiber-optic cable operation, the BCC-20 is priced at $55,000; the BCC-21 at $67,000.

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THE CAMERA MART
Ikegami EC-35

A featured item in the Camera Mart booth was the Ikegami EC-35. Also available from the company is its new 1982 catalog of rental items. The organization offers many popular cameras for television and motion pictures as well as audio, film editing, film projection, lighting and associated equipment from its New York distributorship.

Circle (202) on Reply Card

DELTAMOD CORPORATION
CNR-6

The CNR-6 noise reduction equipment implements the Dolby C technique. Automatic matrixing of sum-and-difference information may be used with any audio source. The system was not mentioned in our June 1982 audio processor article by Gary Breed.

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VLAHOS GOTTSCHALK RESEARCH (VGR)/ULTIMATTE
Ultimatte-4

The Ultimatte-4 was designed for single-camera, film-style production techniques. The Newsmatte system is intended for integration with a switcher for live news or production applications. Both systems incorporate linear keying techniques, rather than typical chroma-keying. Because of the circuit operation, foreground camera video detail remains linear and quiet, with blue edges and tinting removed.

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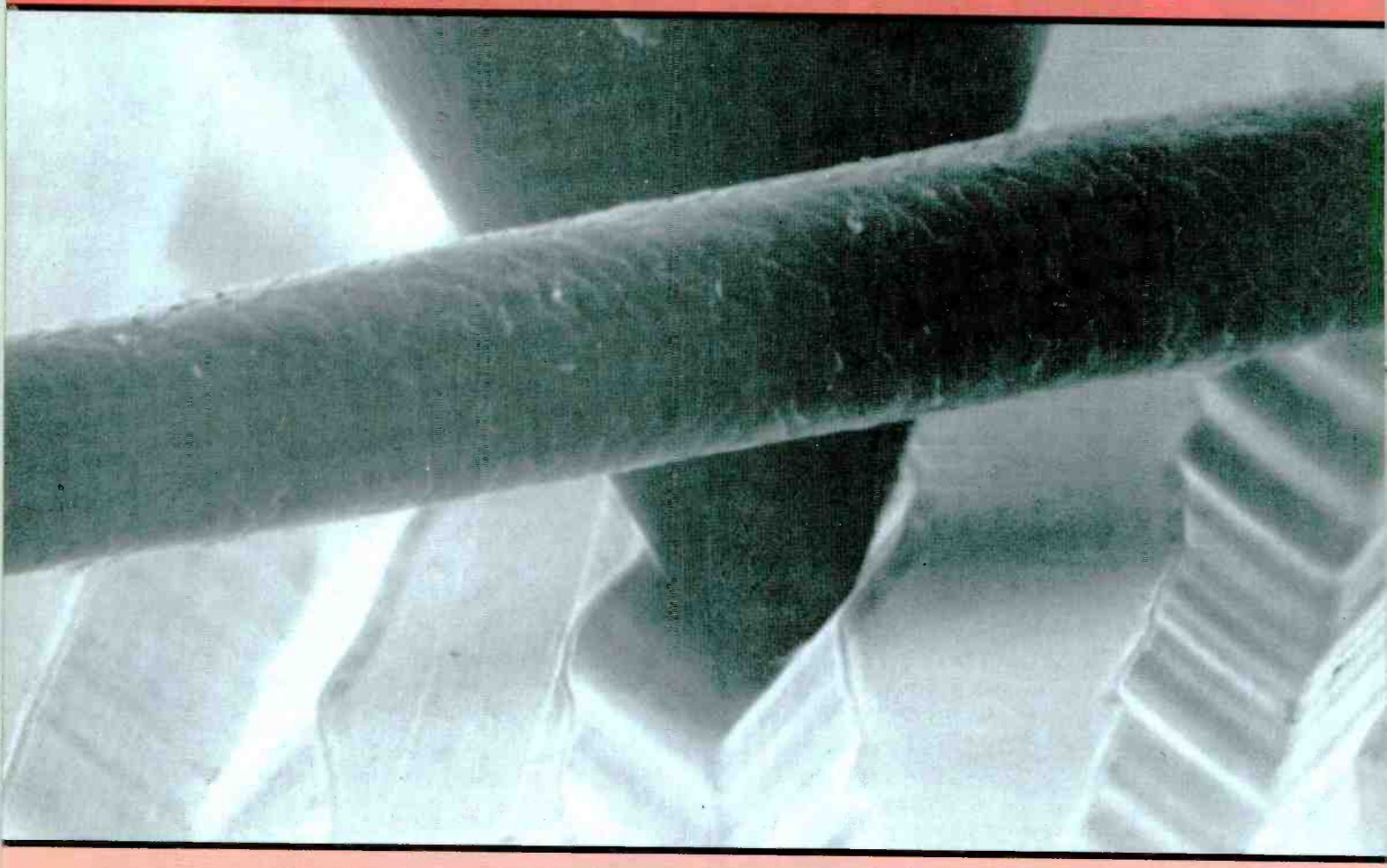
Phono cartridges & communications



A stylus in a stereo disc groove. A human hair, approximately 0.002-inch in diameter, shows comparative sizes. (magnified 800X)

By George Alexandrovich, vice president, field engineering, Stanton Magnetics, Plainview, NY

If you attended the NAB-'82/Dallas convention, you are undoubtedly aware of the breathtaking advances in the fields of video and computer technologies applied to the discipline of communications. RF systems, transmitters, antennas, video cameras, consoles, automation equipment, video recorders and thousands of other devices were featured at the convention. Computer processing of video signals, special effects devices, programming and automatic billing are all now being handled by sophisticated machines and computers. Things we have never dreamed about are unfolding in front of our eyes.

But there was another group of companies at the exhibition: manufacturers of audio equipment. These companies shared only a small part of the overall excitement. All they were hoping for was that AM stereo and stereo TV would become realities. It looked almost as if everyone took audio for granted—audio, that small part of the communications industry that plays a supporting role to everything else. And yet, is it so? If we stop and think about the role of audio in the field of communications, we can conclude without hesitation that without audio there would be no communications industry as we know it.

From the day Thomas A. Edison called Watson over his first experimental telephone line, sound became the center of our attention. A new era began when spoken words were transmitted over long distances by wire. Since that time, engineers have mastered the basics of a simple means of communication and have worked on improving the quality of the transmitted signal.

The advent of motion pictures ex-

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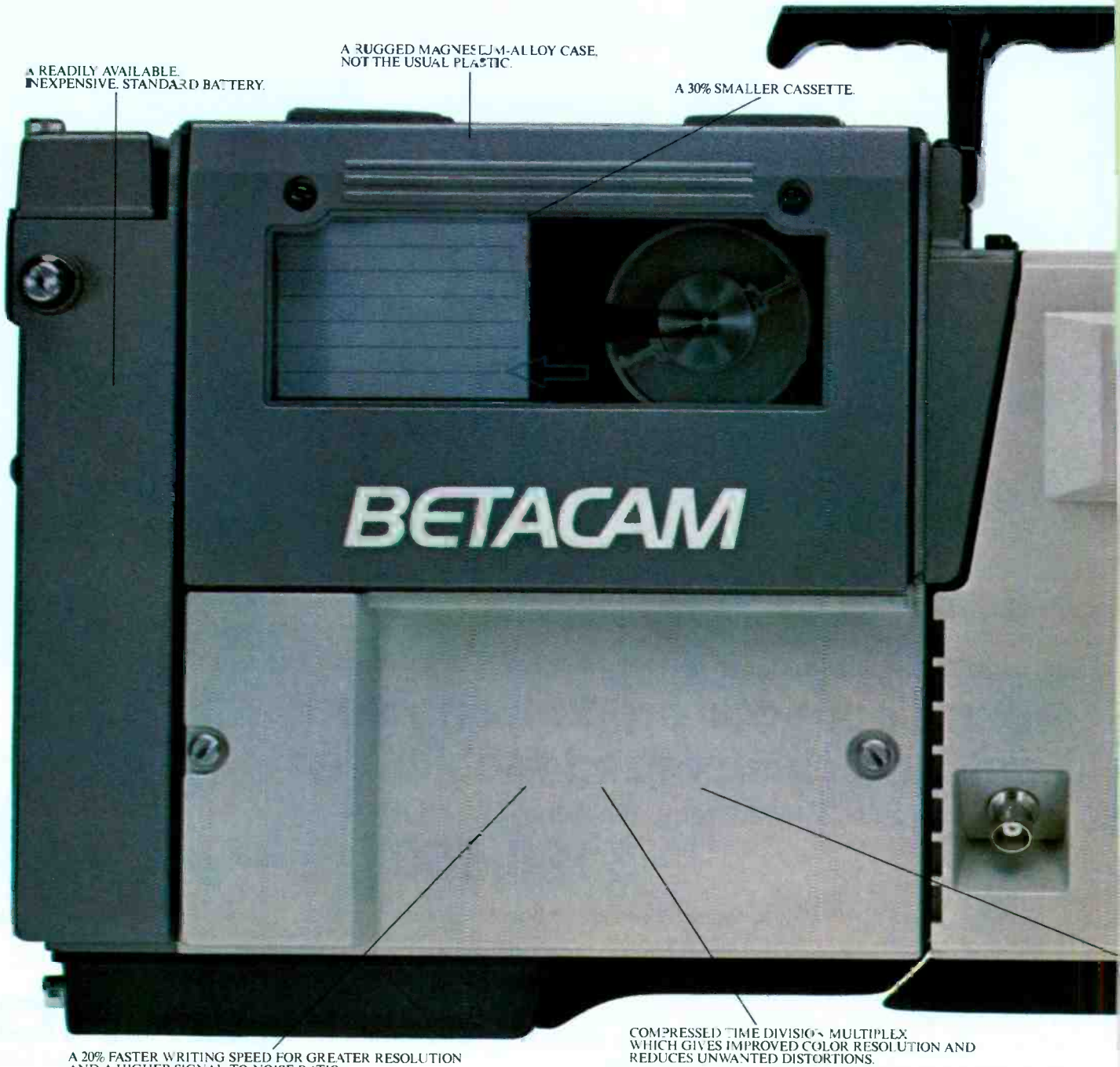

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cited the imagination of scientists, and soon there was a marriage of picture and sound. Many historical accounts of those days seem to indicate that a majority believed that sound was added to the picture. Yet we all know how difficult it is to watch a silent picture for any length of time, but how easy it is to relax and enjoy good music for hours or to listen to an exciting radio program. Even with the visuals in the days of silent movies, it was necessary to have background music to build suspense or add to the excitement. This music completely influenced the mood that the picture was supposed to create.

Today TV programs are superior to anything we had at the turn of the century or even in early '20s or '30s. Mixing of picture and sound has reached an extremely high technological level, and yet the same relationship between the picture and sound holds true. If something goes wrong with the picture, it doesn't bother us as much as if we lose the sound. Many of us glance at the TV picture only occasionally, mostly listening to the sound.

The importance of sound is indisputable. What most of us take for granted, sound engineers, disc jockeys and recording engineers are struggling to perfect. Just ask any one of them about audio and what it means (be it AM, FM or even TV sound), and you will probably get a lecture about what it takes to bring good sound to your home entertainment system.

Disc records are often thought of as a part of an old technology that is fading rapidly, overshadowed by automation, by tape, and soon, by digital. However, most of the radio programs come from records, whether they are an automatically programmed station or from a local, 1-man small town transmitter. Radio stations now seem to buy their programming from companies that specialize in taping programs for radio from large libraries of disc records. In today's era of high technology, the disc format remains the most elegant form of signal storage. Computers use it, and the new digital technology is heavily dependent on it. It offers the highest density of information with the easiest search and retrieval properties and lowest manufacturing cost.

"Well," some may say, "we had the disc for more than 100 years, and now we have something better, such as the Digital Audio Disc (DAD). Why don't we re-record the best material onto the digital records and dispense with the old gramophones?"

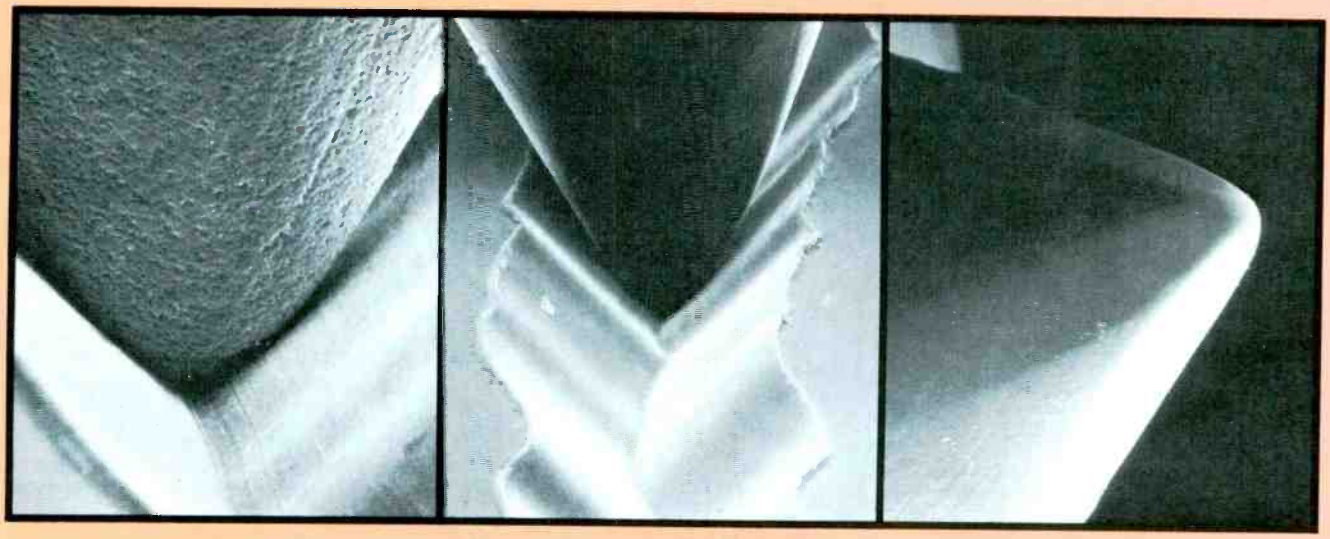
The fact is that so much has already been recorded using disc technology, that it would take more than the life of one generation just to re-record the best recordings. This estimate assumes that digital could be recorded as fast as old analog records, which is not true. No matter what we wish would happen, we are stuck with disc records for a long, long time. So let's make the best of it.

Imagine that we are at the mixing console of a studio. In front of us are two turntables sitting on their shock-mounts, waiting to be turned on to spin the record. The tonearms are resting on their armrests with cartridges carefully cleaned and adjusted to play modern records that are notorious for high modulation of the groove and complex music content. Will the cartridge cope with this challenge? Will it stay in groove and track, or will it jump the groove? What makes the cartridge tick, and what can we do to help it accomplish its assignment?

Actually the phonograph cartridge (or pickup, as many still call today), is the most complicated and demanding transducer we know. The term *transducer* means a device that converts one form of energy into another. A phonograph cartridge converts mechanical motion of the stylus into electrical impulses that are almost a perfect replica of the mechanical modulation of the groove in amplitude, crosstalk between channels and signal form. This true reproduction of all signals on the record has to take place at all frequencies from subsonic to supersonic regions of the audio spectrum.

A phonograph cartridge is sensitive to magnetic fields, vibration, shock, temperature and strong acoustic fields. But at the same time, when properly installed and used, it can supply us with signals having a dynamic range of more than 80dB and the same magnitude of signal-to-noise. The vital prerequisite here is *when properly installed*, meaning proper selection of the cartridge for the job, use of the specific tonearm designed to perform certain functions, followed by proper alignment and mounting of the tonearm assembly and, application of adequate tracking force and corrective bias or anti-skating force. Other requirements are *proper use* and *maintenance:* including care in the handling of the tonearm and records in preparation and during playback, as well as record and stylus care.

Regardless of the fact that phono cartridges for broadcasting applications are extremely reliable today, it may be interesting to know a few points of trivia about the cartridge, in order to appreciate the importance of proper care and maintenance. For instance, did you know that the area of contact between the stylus tip and the



A spherical stylus sits in a phono disc groove. Note the space between the tip and the bottom of the groove. The radius of the stylus is 0.7mil. (magnified 2500X)

A Stereohedron stylus rests in a disc groove. (magnified 2000X)

A Stanton Stereohedron stylus tip providing a large contact area. (magnified 1200X)

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Hysterysis Circuitry for pointer crossing compensation	YES				
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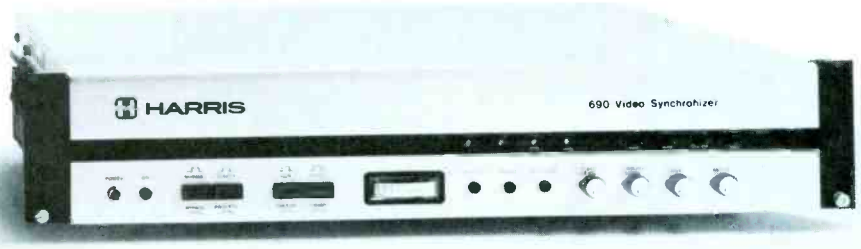
Built-in, Infinite Window TBC with Look-ahead Velocity Compensation	YES				
Heterodyne & Direct for all VTR formats	YES				
Multiple-criteria Hot Switch Circuitry	YES				
Freeze Frame or Freeze Field	YES				
3.5-inch Vertical Rack Space	YES				
Price	$15,500 (F.O.B. HVS)				
Initial Deliveries	July				

Or, to save time just buy the HVS 690



Go ahead, compare if you wish. But, we must warn you, it'll probably be a waste of time. Not only does the HVS 690 have all the features above, it also has such things as a 59dB S/N ratio, a 1% K Factor, very low power consumption, and readily available industry standard components.

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HARRIS

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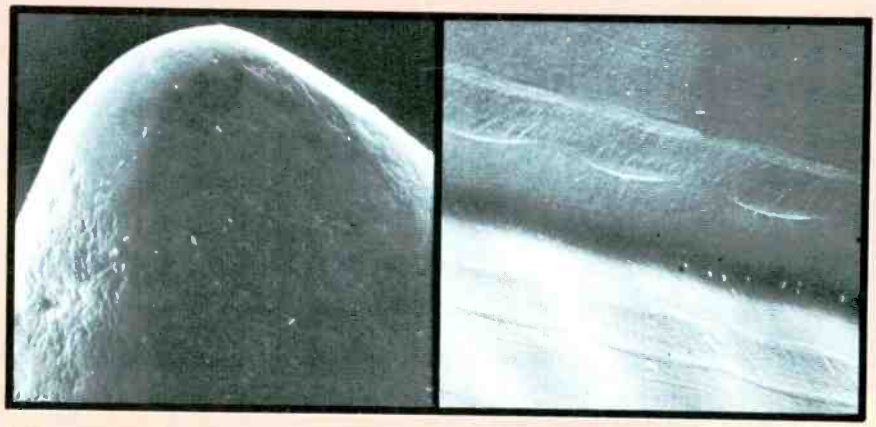
groove wall is on the order of 2 ten-millionths of a square inch and that one gram of vertical pressure produces tons of force per square inch on the record groove wall? Would you expect that the instantaneous temperature of the contact area during the playing of the record is about 480°F—the melting temperature of vinyl? Do you realize that the stylus tip can easily change its direction of travel more than 40,000 times a second with an acceleration/deceleration of more than 1600 Gs? Astronauts experience an acceleration of about 10 Gs—the bullet accelerates along the rifle bore at less than 1600 Gs.

This same stylus simultaneously supports the tonearm and carries it across the record. A cantilever that interconnects the stylus tip and the generating element inside the cartridge (usually magnetic) is made of aluminum tubing, which has a wall thickness of 0.001- or 0.002-inch. Human hair is about 0.002-inch thick. Now that you know a little more about the cartridge and what it has to do to give us a clean and loud signal, I hope you will understand why I consider the cartridge to be the most complicated transducer. And the job a cartridge has to do for broadcasters is probably the most complex as well, so let us see how we should go about buying the right cartridge.

It is not news that several considerations influence one's decision when selecting and buying a cartridge. Unfortunately, part of this decision-making process depends largely on economic factors, which often are the deciding factors. But, there are many good affordable cartridges available today that can do an excellent job. Unfortunately, decisions are also made based on advertising slogans, recommendations of friends and, sometimes, by guessing.

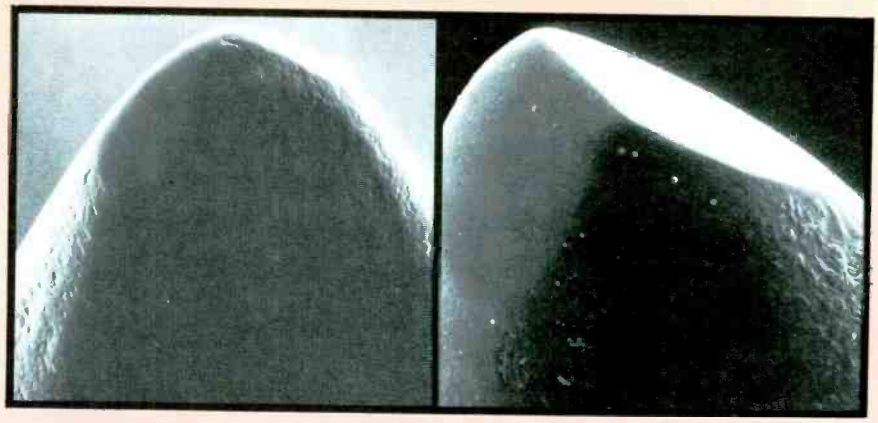
However, certain facts will help you make a more intelligent choice of a cartridge model. First, buy products from a reputable and established supplier of professional transducers, because you will be looking for availability of the replacement styli, speed of service, and cost. There are too many cartridge models on the market today that will not be here tomorrow, and there will be no styli for them. Never get a cartridge unless you can replace the stylus. You are buying a cartridge that will be used eight hours or more a day. The best diamonds under the most favorable conditions will wear out after 1000 hours of use when working with 1 gram of tracking force. Higher tracking forces and dirty records will make it necessary to replace the stylus every 200 to 300 hours. Check the diamond stylus at least that often for wear. When you shop for the cartridge, pay attention to the construction of the stylus tube or

A disc with high groove modulation, as found in many modern recordings. Such modulation would be almost impossible to trace properly. (magnified 2000X)



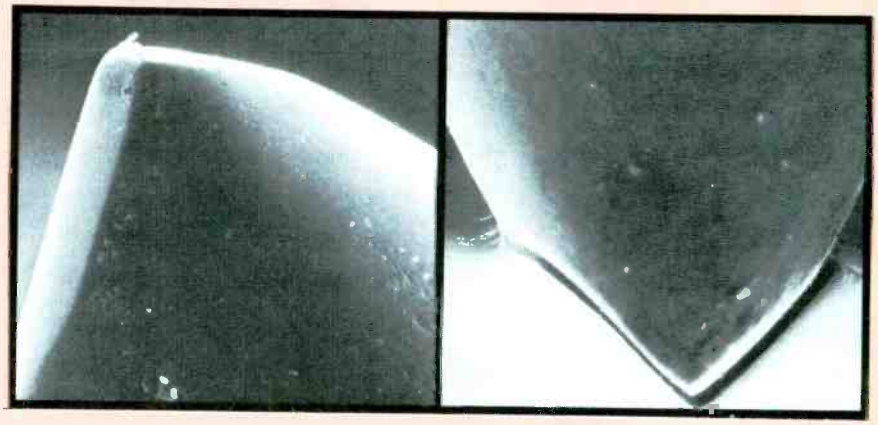
An elliptical stylus beginning to wear at approximately 100 hours of use. (magnified 3000X)

Tracking at 1.5g, an elliptical stylus leaves definite evidence of record wear after 200 hours of use. (magnified 3000X)



An elliptical tip shows increased wear after 500 hours of playing time. Note smooth polish of the contact areas. (magnified 2000X)

A tip that should have been discarded shows the equivalent of 2000 hours of use. (magnified 2000X)



The tonearm that carried this stylus was not compensated for skating force. Note uneven wear. (magnified 2000X)

A badly worn stylus in a disc groove. Its continued use will soon destroy the groove modulation. (magnified 2000X)

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cantilever. Flimsy and long-exposed needles will bring you troubles, especially when operated by heavy-handed DJs. Select the models designed to retract their styli into the cartridge body when there is an excessive downward pressure or side-thrust.

One of the most destructive tests professional cartridges have to withstand occurs when the tonearm is dropped onto the records and then, under pressure, slid across the record. The next most demanding test involves backcueing of the record. If you plan to backcue, consider a very durable stylus designed to withstand the extra force with the tip specially designed to minimize the effect of digging in and damaging the groove. The tips recommended for backcueing are usually spherical with a 0.7 mil radius or a large tracing elliptical radius (0.4 x 0.7 mils).

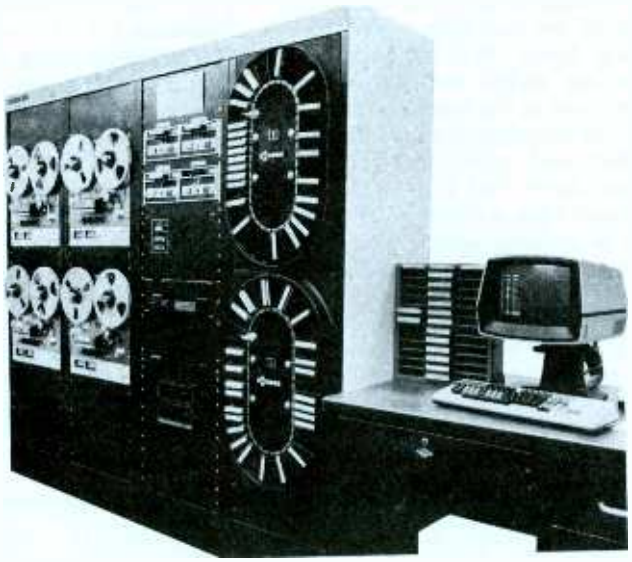
Another factor affecting the behavior of cartridges during backcueing is the polish of the diamond. Generally speaking, good polish will reduce the abrasion of the groove wall. However, don't forget that the best polish of the diamond is achieved in playing records. We are so conditioned to think in terms of everything being new and perfect that we forget that the stylus is new only for a few days. After that, the stylus shape determines how fast the stylus will wear and what shape it will take. The fastest stylus wear will take place during the first few hours of playing time, when the contact areas of the tip are curved and the pressure per unit is the highest. Actually, I consider the stylus at its peak performance after it has been broken in for a few hours. The stylus will last longest if the position of the cartridge with respect to the record surface remains the same for the life of the stylus. Plug-in styli help to achieve this. If you use plug-in headshells, it is fine, as long as they are not used in a variety of tonearms with different alignments.

A 45 rpm disc shows peeling of the outer shell of polystyrene material after backcueing 10 times with a spherical tip. (magnified 10,000X)

Most of the backcueing today is done with 45 rpm discs, although some backcueing is also done on LPs. Years ago, 45 rpm discs were pressed using vinyl, like their big 12-inch LP brothers. But today, for economic reasons, almost all 45s are made of polystyrene; a material that is bad news as far as long life of the record is concerned. In a few playings, the outer layer of the record surface starts peeling off at the area of contact—like old house paint. When the stylus starts touching the inner portion of the record material, which is very grainy, there is an increase in noise. This deterioration of the record surface is especially noticeable during backcueing, creating the famous *cue-burn*. Some records can be ruined in only a few plays.

By using a super polished (or used) stylus you can delay the destruction of the outer skin of a record surface, but you cannot avert it. By reducing the tracking force, you can achieve the

This employee turns on your audience *and* your coffee pot



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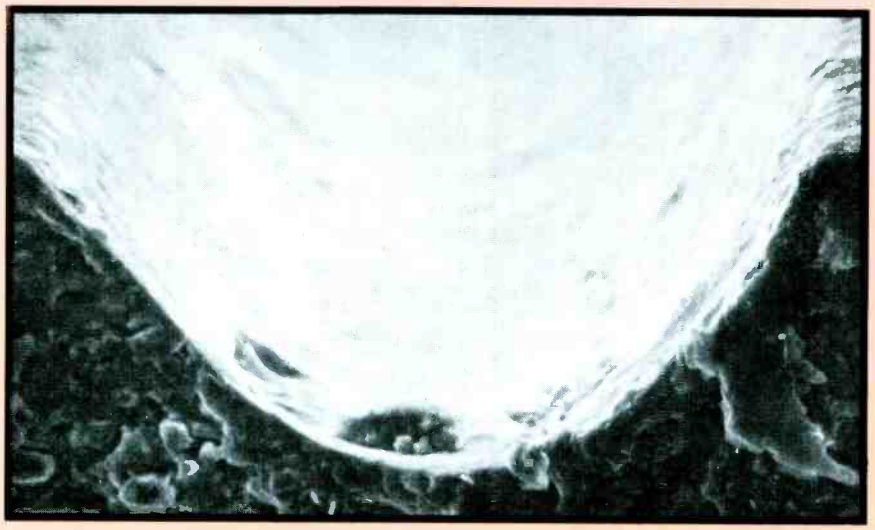
same effect, but then you are exposed to increased danger of tracking light, which most broadcasters and DJs are afraid of doing.

Tracking force

This brings me to another important aspect of the cartridge operation—a tracking force. We all know that record and stylus wear are directly proportional to the tracking force, yet almost all broadcasters tend to ignore this fact and apply the maximum tracking force that a cartridge can withstand. This is all for good reason. There is nothing worse than losing contact with the groove or having a cartridge get stuck in one spot. There is always the danger of blowing your transmitter off the air as the tonearm skids across the record surface, producing incredible transient spikes from the phono input.



A cross-sectional view of an old 78 rpm record. (magnified 1000X)

This use of heavy tracking force is also a leftover from the days of old 78 rpm transcription discs. The stylus tip was spherical then with a 2.7 mil tip radius and the tonearm looked more like a railroad crossing gate. Today, to track the groove, we do not need all this weight. We can get by with two grams of tracking force. Naturally, the tonearm should be of contemporary design and performance.

Speaking of broadcast tonearms used for backcueing, no one has come up with a design that would allow control of anti-skating forces depending on the direction of turntable rotation. Compensation, bias or anti-skating force should he applied only when the turntable (and record) is rotating clockwise and the stylus is in the groove. If the record is stationary, no anti-skating force is needed. But during backcueing, the direction of the skating force is reversed and, by right, the anti-skating should be reversed as well. If it is not reversed, the two forces will add together and the stylus may easily jump out of the groove.

This is one of the main reasons broadcasters don't like to use tonearms with anti-skating compensation. Somehow I don't see tangential tracking tonearms being used by DJs and broadcasters to get away from this problem. Besides, I don't think that the servos that move this tonearm would behave properly when the cartridge and stylus are pushed backward toward the pivot. If anyone decides to construct an arm with switchable and reversible anti-skating, don't forget where the idea came from.

Now that we've talked about anti-skating, don't forget that if you use brushes attached to the cartridge to clean the record, you have to increase the anti-skating force to compensate for an increase in friction caused by the brush. These brushes are excellent for keeping records and styli clean. Unfortunately, you cannot backcue with the brush attached. The brush is the simplest way to preserve the records and get a clean signal. Commercial devices for cleaning records are not very convenient for professional use, and there are no elegant cleaning accessories that would require a minimum of distraction for DJs to use while working live with disc records.

Broadcasters are very much into the preventive maintenance of the transmitters, tape machines, telephone lines and other devices, so it would not be difficult to include a meaningful program of disc/playback equipment care that would include cleaning of the records, turntables, cartridges and styli. Just as the tape heads require cleaning, a cartridge stylus needs cleaning too. Tape scrubbers are being used more and more. Discs would like to be scrubbed clean too. Tape heads wear; so do styli. Azimuth alignment is being constantly checked. Cartridge mounting and stylus positioning do not get the same share of attention, but should. Tapes are stored, then rewound periodically. Discs need to be cleaned and checked for possible warpage.

The maintenance of the turntable starts with cleaning of the mat. If the mat is made of felt, it should be vacuumed almost daily. The electrostatic charges carried by the record can be transferred onto the mat, which attracts and traps dust. If the mat is made out of rubber or a similar substance that can be washed or wiped using a damp cloth or sponge—do it daily. Records can be cleaned with dry brushes or by using special liquids that clean. Some of them make records electrostatically inert. Cleaning the record using a wetting agent just before playing time is impractical for professionals. To preserve the cleanliness of the stylus, never play records moist or wet. Just look at what happens to the stylus. Moist records may sound fine the first time you play them. But as you play them, part of the surface may dry. Particles of dust that were trapped in the liquid will cake up into small balls and settle to the bottom of the groove. The record will never sound the same again, especially if you decide to play it dry again. The small dirt globules will be pushed into the vinyl material and embedded into the groove wall permanently. To dissolve and remove this dirt is almost impossible. Meanwhile, your signal-to-noise ratio gets worse.

The cartridge is the last link in the chain of equipment before the mechanical motion of the stylus is converted into electrical signals.

In order to achieve this type of energy conversion without distorting the signal, the stylus has to be clean. Special cleaning brushes for diamond tips are almost indispensable. Use them daily or as needed. Follow instructions judiciously—clean the stylus by brushing carefully only in the direction of record motion—away from the tonearm pivot point. Never brush sideways or inward. The brush can be used dry or moistened.

Use a special stylus cleaning liquid or water-alcohol mixture—a safe substitute for exotic formulas that remove almost all of the deposits without affecting the metal tube or the material surrounding the stylus. Avoid applying the liquid to other parts of the stylus assembly, especially the elastomer-damper, which is a seal, pivot and damper at the same time. Basically, only the stylus tip has to be

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cleaned. Use a minute amount of cleaning liquid by depositing only one drop of it on the top of the stylus cleaning brush. If the liquid gets between the damper and the stylus assembly support surface, compliance of the stylus may be affected.

But what is compliance? Compliance is a measure of stylus deflection of a given force applied to the tip. We distinguish two forms of compliance: one being static, the other, dynamic. Static compliance can be determined by observing, through a microscope, deflection of the tip when various amounts of tracking force are applied to the tonearm. The dynamic compliance of the stylus assembly is a measure of stylus deflection when alternating force is applied to the tip. Dynamic compliance can be measured at different frequencies and will have different values.

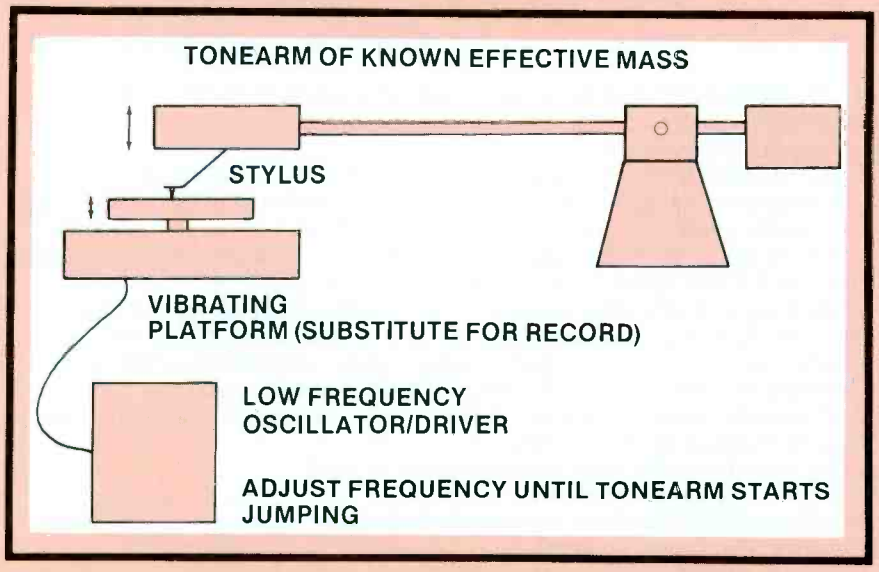


Figure 1. Measuring compliance of a cartridge

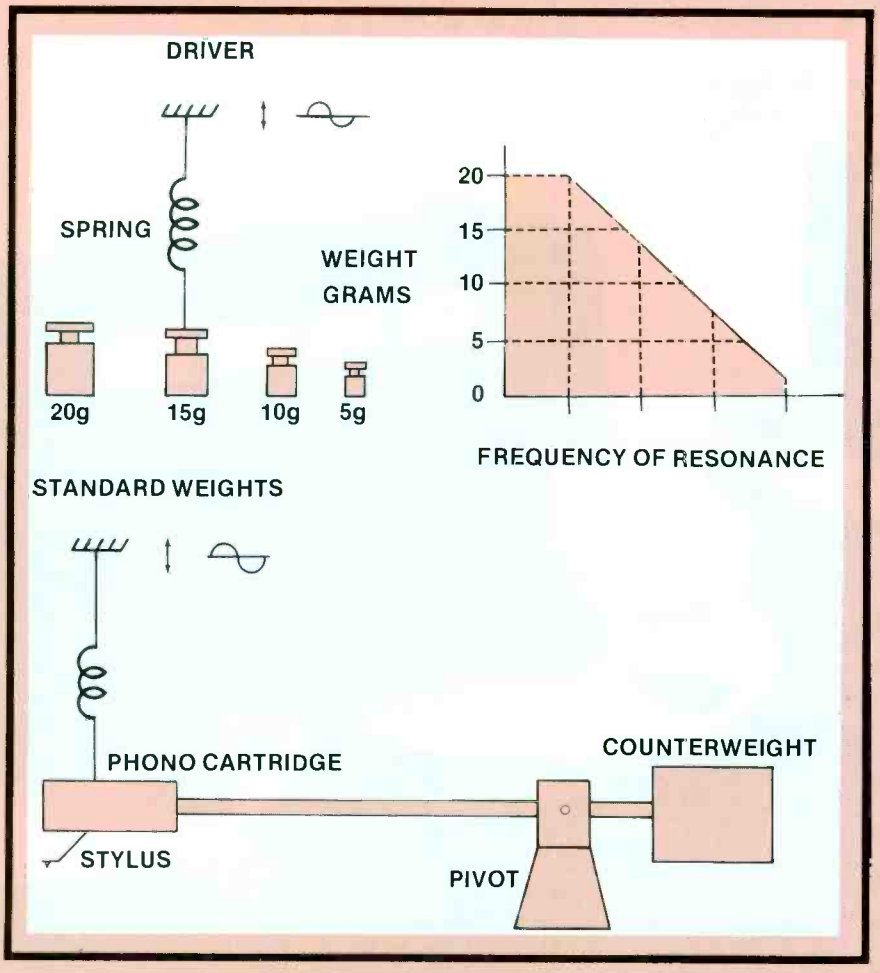


Figure 2. Measuring effective mass of a tonearm

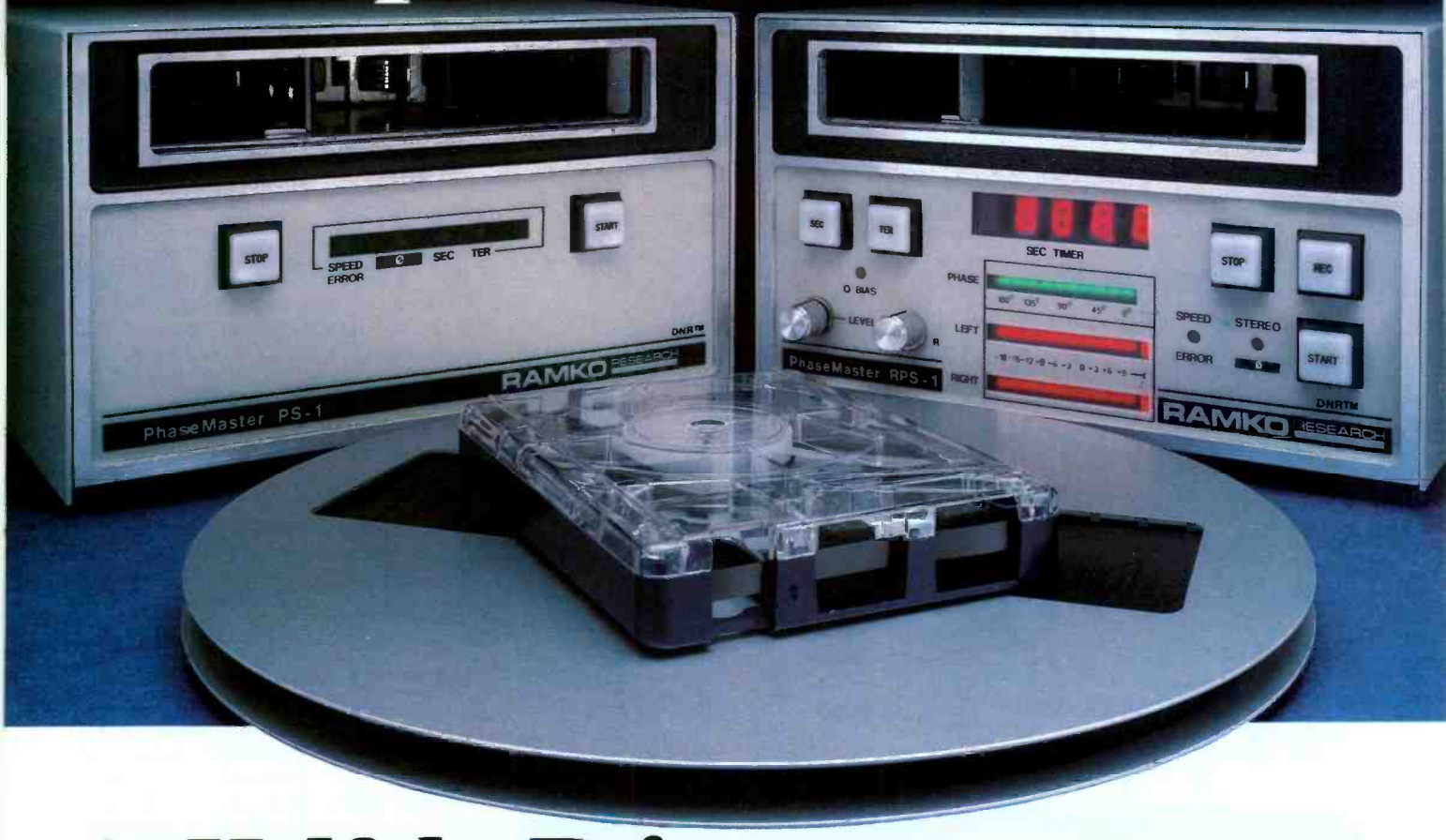
The reason we are concerned with compliance is because it is closely related to the tracking ability of the cartridge. The higher the compliance of the cantilever, the easier it is to track low frequency modulation of the groove. But with higher compliance, we also encounter the problem of tonearm instability, which is aggravated by warped records. Compliance can be compared to spring action. (See Figure 1.) If you attach a weight or mass to the spring it will have its own resonance. Vibration of the spring/mass combination is a function of the spring constant (compliance of the stylus) and mass (tonearm-cartridge assembly).

Selection of the cartridge for a certain tonearm involves, first of all, matching of compliance of the cartridges so that the resonance of the ready-to-play tonearm will be between 8 and 12Hz. For this we have to know the effective mass of the tonearm. The reason we want the tonearm to resonate between 8 and 12Hz is because this range of frequencies is just above the region of frequencies produced by record warps and just below the lower end of audio range. A higher resonate frequency will affect lowest musical notes and may emphasize turntable rumble. Lower frequency resonance will produce tonearm instability when playing warped records.

Some cartridge manufacturers are developing methods of measuring the effective mass of a tonearm and the dynamic compliance of the cartridge so that the most popular tonearms can be measured and their masses tabulated. Until now there was no easy method of measuring the dynamic mass directly. The new method I use consists of suspending a ready-to-play tonearm by a spring attached just above the stylus pivot point. (See Figure 2.) By vibrating the spring over the range of frequencies, resonance of the spring/tonearm combination is found. At that point, the tonearm starts jumping violently up and down. You cannot miss the resonance. At this point, frequency of excitation is noted. Then the tonearm is disconnected and various standard weights are attached to the spring and their resonances found in the same manner.

Now we have a record of weights and respective frequencies producing resonance. It is a simple matter of comparing the frequency of oscillation of the tonearm to the frequencies of various weights. By interpolating the readings, we can find accurately

The Performance of an Open-Reel Recorder.



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Let's face it, the secret to better cart machine performance isn't in the cartridge, it's in the machine.

The new generation of improved cartridges and tapes alone can't solve the serious phase stability and noise problems. The plastic cart and its guiding system are highly imprecise, at best. The new "hot" tapes bring a slight decrease in audible noise, which is not terribly significant considering the noise base. The maintenance of precise machine-to-machine head phase alignment has been practically impossible in even the best installations.

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Separation (Stereo):	50 dB
Output Level:	+25 dBm
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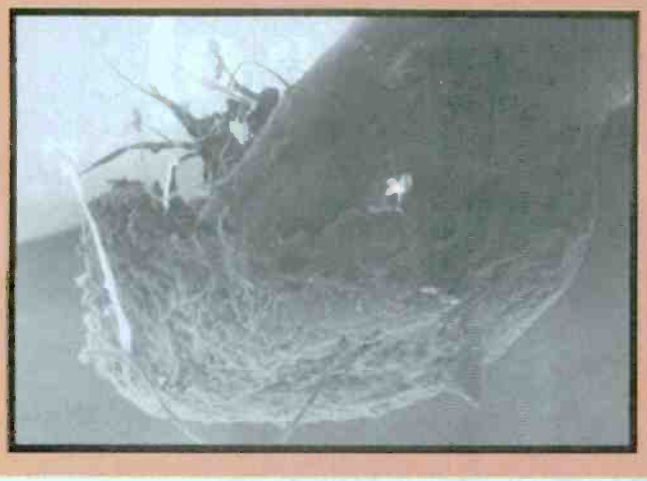


The most probable cause of mistracking of disc groove modulation is dirt. (magnified 300X)

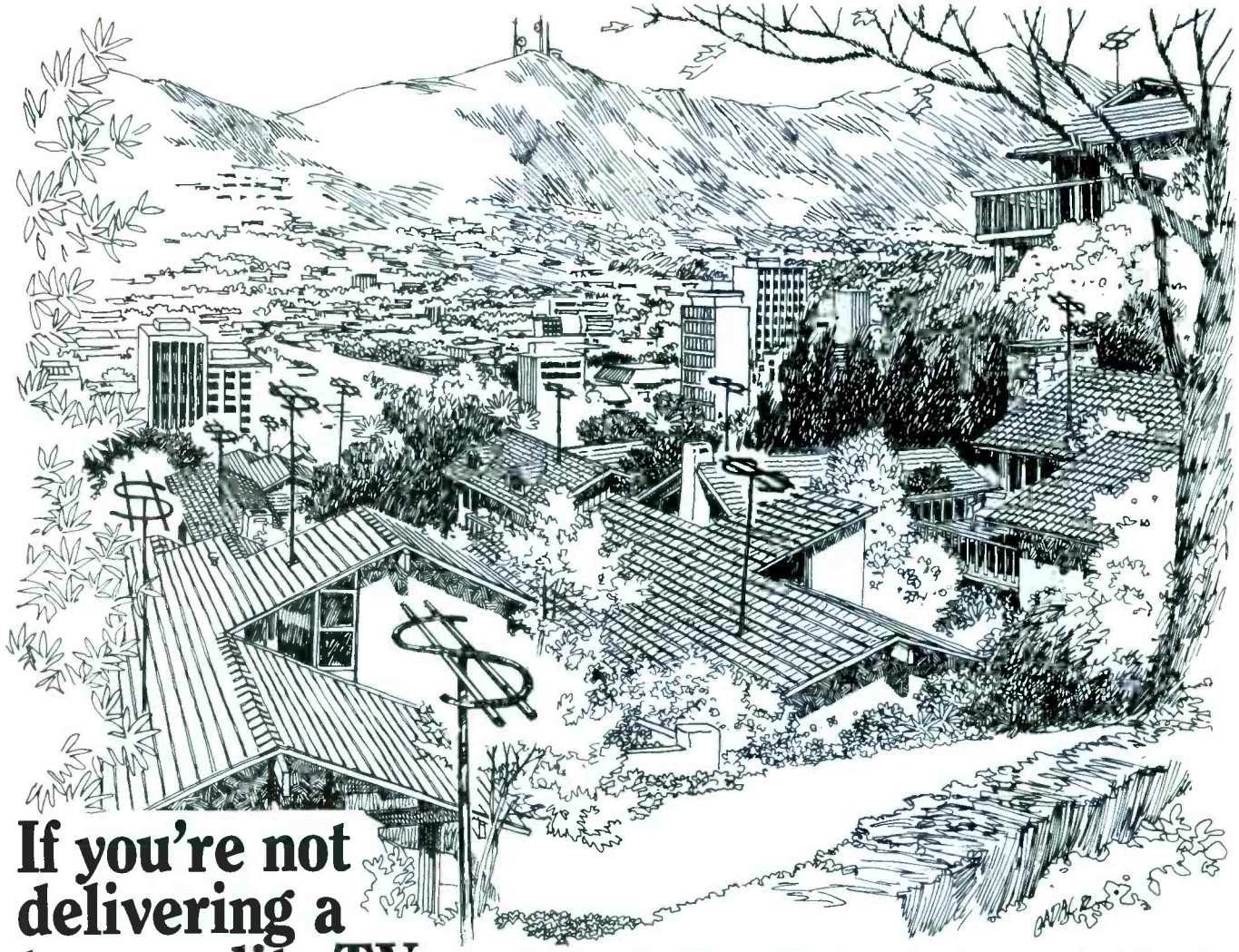
the mass of the tonearm. The accuracy of the result is exceptional and beats a mathematical approach when separate moments of inertia are added together. The mass of the tonearm varies with different settings of tracking force and also with cartridges having different weights. By moving the counterweight, the dynamic mass of the entire tonearm changes. When you are calculating the mass of the tonearm, it is pointless to talk about the mass of the tonearm itself (without the cartridge), because you cannot apply this value to the formula or even get the correct feel for actual mass of the tonearm with the cartridge. Assume that the average cartridge weighs about 5g. If you counterbalance it with the counterweight, the dynamic or effective mass is already 10g, not including the mass of the tonearm. Offsetting the counterweight in order to apply 1g to 2g of tracking force reduces the overall mass and changes the resonance point.

For those who like to calculate the resonance of the tonearm/cartridge combination for themselves from the mass and the compliance of the cartridge, the formula is:

$$f = \frac{1}{2\pi\sqrt{MC}}$$

where
- f = resonance of the tonearm as determined by the compliance of the cartridge, measured in Hertz or cycles/s
- M = dynamic or effective mass of a tonearm including cartridge, measured in grams
- C = compliance of the cartridge stylus, measured in μm/mN (micrometers per millinewton) or cm/dyne (1 dyne is 1/980 of a gram)

From this formula you can find any one of variables f, M or C, providing you know the other two. If you want to find compliance of the cartridge, you have to know the mass of the tonearm and resonant frequency of the tonearm/cartridge combination. Because you know how to find the mass of the tonearm by suspending it by the spring, the resonant frequency of the tonearm/cartridge can be found by playing the test record, which has frequencies recorded in the range from 5 to 14Hz, or by placing the tonearm with the cartridge on a vibrating platform and finding the frequency at which the tonearm will start jumping up and down. Don't forget to express compliance correctly with all decimal points in the right places. (Many times people wind up with



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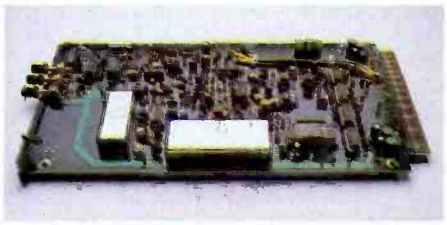
And the tape transport system, signal system, and control section can either be combined into a single unit, or separated easily and installed in a 19" rack or console.

The BVH-2000 (shown with Type-III control panel).

The BVH-2000 also gives you far greater latitude in setting up your entire recording system. Various remote-control connectors enable you to interface your system in a variety of ways for studio, mobile, and editing configurations. Direct interface with U-matic® and Betacam™ is possible, too. The BVH-2000 also has an optional plug-in time base corrector.


A range of plug-in accessories is available.

What's more, the BVH-2000's lighter weight and smaller size (almost 50% less than its predecessor) make it as ideal on the road as it is in the studio.

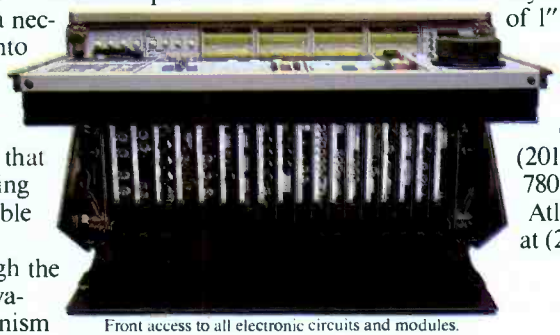
And because of the ever-increasing number of applications requiring longer program times, the BVH-2000 provides up to 2 hours of tape time.

A VTR THAT LEADS THE SIMPLE LIFE.

In the BVH-2000, unlike most other VTR's, microprocessors are used to their full advantage. All data necessary for servo control are channeled into a central processing unit, making the operator's control over all systems and functions simpler and more precise.

Life is made simpler yet by the fact that every necessary function control, metering facility, and electronic module is accessible from the front.

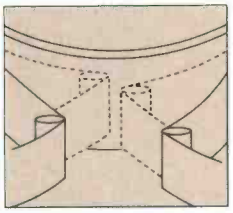
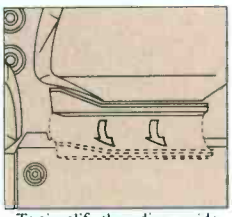
Even the way the tape moves through the recorder has been simplified. One innovation—an extremely precise servo mechanism—permits the entrance and exit guide posts to move about 10mm away from the drum during threading. The result is the easiest threading system ever in a 1" video recorder.


Front access to all electronic circuits and modules.

THE MOST ARTICULATE VTR EVER BUILT.

The BVH-2000 removes much of the mystery from maintenance, too. It literally tells you about malfunctions—usually well before you'd notice them yourself—through a microprocessor-governed self-diagnostic system.

The system includes various alarm functions and numerous checks to confirm that everything is working properly. Most defects can be easily found—allowing for far less complicated maintenance and repairs, and reducing downtime considerably.



To simplify threading, guide posts automatically move away from drum, and audio head cover opens.

And because the best way to simplify maintenance is by lessening the need for it, the Sony BVH-2000 has been designed to be virtually maintenance-free down to the last detail. For example, only brushless DC motors are used, and all incandescent lamps have been replaced with high-brightness LED's.

Other welcome advances include a greatly expanded dynamic tracking range (from reverse at normal speed to forward at 3 times normal); programmed play (allowing you to vary playback speed across a range of ±20% of normal speed); and video and audio confidence.

Display board for self-diagnostics and other data-processing functions.

Remarkably, these are only some of the Sony BVH-2000's innovations. All of them add up to form the answer to virtually every need ever expressed by the users of 1" video.

To find out how it can answer yours, write Sony Broadcast, 9 West 57th St., New York, NY 10019. Or call us in New York/New Jersey at (201) 368-5085; in Chicago at (312) 860-7800; in Los Angeles at (213) 537-4300; in Atlanta at (404) 451-7671; or in Dallas at (214) 659-3600.

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wrong answers by forgetting to multiply compliance by 10^{-6}).

Let's assume that we want the frequency of tonearm oscillation to be 10Hz and compliance of the cartridge is stated as being 15×10^{-6}. Let us substitute these values into formula.

Given $f = \frac{1}{2\pi\sqrt{MC}}$,

and solving for M $= \frac{1}{4\pi^2 Cf^2}$, *then*

$$M = \frac{1}{4 \times 9.87 \times 100 \times 15 \times 10^{-6}} = \frac{10^6}{59{,}217}$$

$M = 16.88g.$

So the mass of the tonearm including the cartridge is 16.88g. It means that the cartridge with a compliance of 15.10^{-6} in the tonearm, all having mass of approximately 17g, will produce resonance of 10Hz. This is the ideal combination. So if your tonearms have effective mass of 17g ± 2g for argument's sake, they will work well with cartridges having compliance of $12\text{-}18 \times 10^{-6}$.

So much for the mechanical properties of the cartridges and tonearms. Now let us see what we can learn about the electrical interface of the cartridge and the preamp input.

Electrical current is generated by moving magnetic lines of force through the coil or a single conductor. The electrical parts of the cartridge we are dealing with are realistic components having dc resistance, inductance and capacitance. Coils used in the cartridge have fairly large inductances and dc resistance with interwinding capacitance, as well as capacitance to ground. The current that flows through these coils is small and the method by which we use this current affects the quality of reproduced sound. The termination of the cartridge is important and effects of loading begin with the wires attached to the terminal pins of the cartridge. The wire has some inductance, dc resistance and interwire capacitance. Inductance and resistance are so small that usually, with the cartridge having 500mH inductance, they can be completely ignored. However, capacitance of the wire may be in order of 100pF or more, depending on the length and type of the wire. This capacitance across the inductance of the coil and in series with the resistive component of the coil can affect the frequency response of the output signal.

If you add all the capacitances of the cartridge terminals (see Figure 3), which includes capacitances, tonearm wiring, interconnecting cables and the preamp input circuit, including all connectors and switches, you will accumulate a total capacitance of several hundred pF. To be aware of possible problems caused by excessive capacitive loading, ask for manufacturers' data showing curves taken with a few cartridges under different load conditions. You will appreciate the need for proper capacitive loading. A word of advice—find out the input capacitance of your phono preamp and add the value to the capacitance of cables.

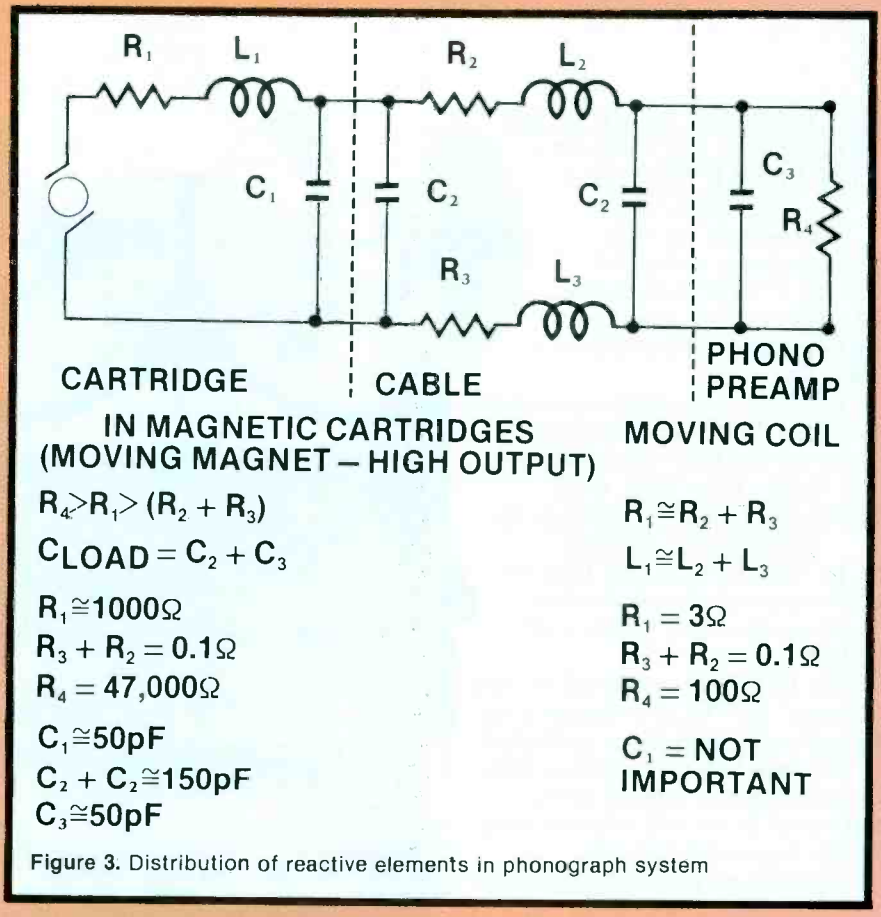

Figure 3. Distribution of reactive elements in phonograph system

Manufacturers of cartridges usually state what capacitive load cartridges should be terminated with. The only cartridges that are insensitive to the capacitive loading in the range we are talking about are moving coil cartridges or low impedance moving magnet types. The MC cartridges or MM low impedance cartridges have low source impedance, which means small inductance and dc resistance. These cartridges also require additional preamplification because their output voltages are low. But more important is the selection of proper wires and cables when using low impedance transducers. Because source impedance of the cartridge is low, cable inductance and dc resistance are part of the cartridge electrical circuit.

Today, for economic reasons, many commercial and consumer cables are manufactured with wrap-around shield where thin wire is inductively wound over the inner strand insulation. It presents a problem.

First of all, such shields are not 100% effective. As a matter of fact, they are usually only 60% to 80% effective. In strong RF fields they work very well as an antenna coil. Stay away from such cable. Use only woven or foil type shields.

Instead of using additional preamplification for MC or MM low Z cartridges, many have elected to use step-up transformers. There is nothing wrong with it, unless we forget that the more you step-up this minute voltage, the more sensitive the secondary of the transformer becomes to resistive and capacitive loading. You may be well-advised to get a high output ordinary cartridge that does not require additional amplification.

A lot has been said, and much more left to be discussed. I would only hope that we all keep on learning from the experience of others who had to learn the hard way. Don't forget the basics of good engineering, most of all good sense. Disc recording has been most forgiving to us. When everything seems to be going wrong and working against many odds, disc has seldom given us trouble. If we would treat the disc the same way we care for tape machines, video, telephones and transmitters, there would be no talk about disc obsolescence.

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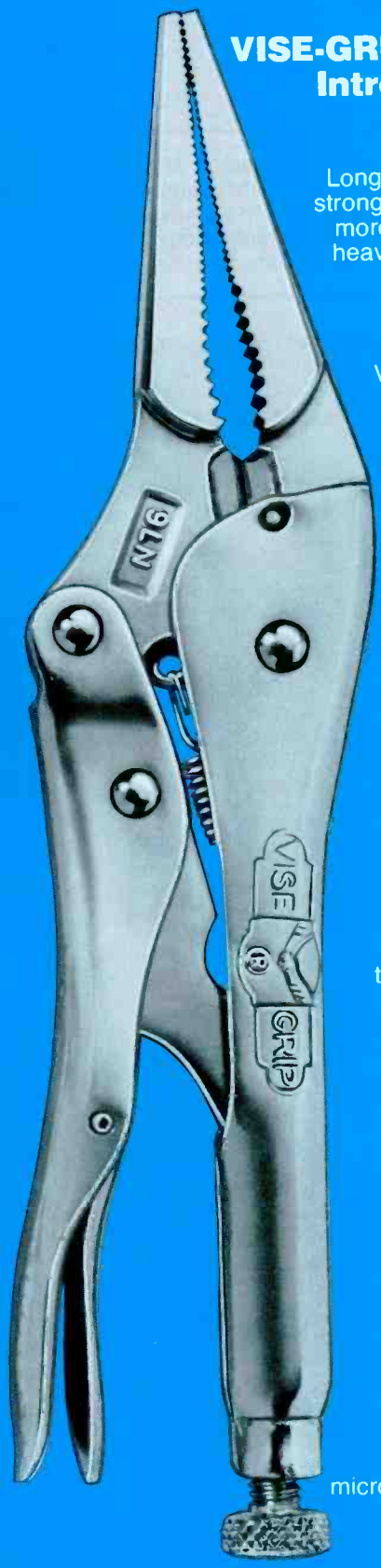

(Shown Actual Size)

Same easy release trigger and micro-adjustment screw.

An update

High definition television

By Blair Benson, TV technology consultant, Norwalk, CT

High definition television (HDTV) has been a subject of considerable interest at recent technical conferences and in special industry showings. But, is that interest waning as the costs for implementing this technology are placed into perspective with its advantages? And how about the relative interests in the film industry vs. broadcasting? To put the HDTV technology into perspective, the author interviewed some of the leaders in the TV industry and asked them to share their thoughts on the direction that HDTV is taking.

Flaherty: A broadcaster's overview

At the high definition television demonstrations held earlier this year, Joseph Flaherty, vice president of engineering and development, CBS TV Network, said that HDTV was in an advanced prototype stage, and that it should be in commercial use within a few years. In June I met with Flaherty in his New York office to explore his views on the current status of HDTV and its future.

Unlike many other experts who pessimistically predict a lengthy period of as many as 20 years before there is any significant use of HDTV for TV viewing, Flaherty anticipates a much earlier adoption by the industry and acceptance by the public, possibly in less than five years and certainly in not more than 10 years.

He pointed out that the compelling reason for this optimistic viewpoint is the fact that technology is advancing at least five times faster than it was, for example, during the 15 years encompassed by the introduction of color broadcasting to its dominance of all programming. We are moving now from the vacuum tubes of the color TV era to greater hardware sophistication by means of solid-state developments, at first discreet transistor components and more recently complex ICs, LSIs and VLSIs.

I asked what type of picture displays would be used for HDTV, and whether or not the viewer would be willing to invest in an expensive new receiver to see the same programs he had been viewing on present-day, 525-line standards. He said that the impact at the CBS demonstrations held in cooperation with NHK earlier this year was striking, not only because of the increased detail, but also as a result of the added dimension of a widescreen display particularly effective on sporting events. (See **BE**, April 1982, page 76.) He said that almost as important as the higher resolution is the cleaner picture produced by component color encoding, compared to NTSC composite encoding. In other words, HDTV will be a new experience, not an extension of existing 525-line television.

Joseph Flaherty, vice president, engineering and development, CBS TV Network, is optimistic about HDTV's future.

Taking today's inflation into consideration, the cost is likely to be no different than that of the first color TV receivers. On the other hand, many viewers may elect to rent, rather than buy, thus requiring less cash outlay.

Another factor effecting the expected rapid progress in HDTV is the large number of diverse means for program distribution. In the days of color growth, there were a limited number of broadcast channels available. Now, however, there are a virtually unlimited number of terrestrial microwave and cable channels, satellite channels and recorded media of videocassettes and discs available to a large number of program production and distribution companies. These organizations are all anxious to offer new services, such as HDTV.

One of the first segments of the industry to recognize the eventuality of HDTV is the TV program producer, Flaherty said. Because of the residual value for future HDTV service and worldwide distribution on other TV transmission standards, 80% of the first-run TV programs aired today are produced on motion picture film, in itself a high definition medium, and many of these are shot in a widescreen scope format with the release prints cropped for current 3x4 aspect ratio standards. In other words, producers do not intend to be left with a backlog of relatively unsalable reruns with the advent of HDTV, similar to what happened in the mid-'60s when all broadcasting converted to color from black-and-white. Nevertheless, with the advent of a viable HDTV system and ample editing facilities on both coasts, equipped with random access systems such as the one developed by CBS, Flaherty foresees electronic production increasing rapidly.

The growth of HDTV, Flaherty said,

Blair Benson has long been associated with broadcasting, predominantly with CBS as consultant, project engineer, director of audio/video engineering, and vice president of technical development (CBS Electronic Video Recording). He has also served as vice president and director of engineering at Goldmark Communications; vice president of engineering and technical operations at Video Corporation of America; and editorial vice president of the SMPTE. He is known for his pioneering work in a number of advancing technologies, including high definition television, which is now becoming a reality.

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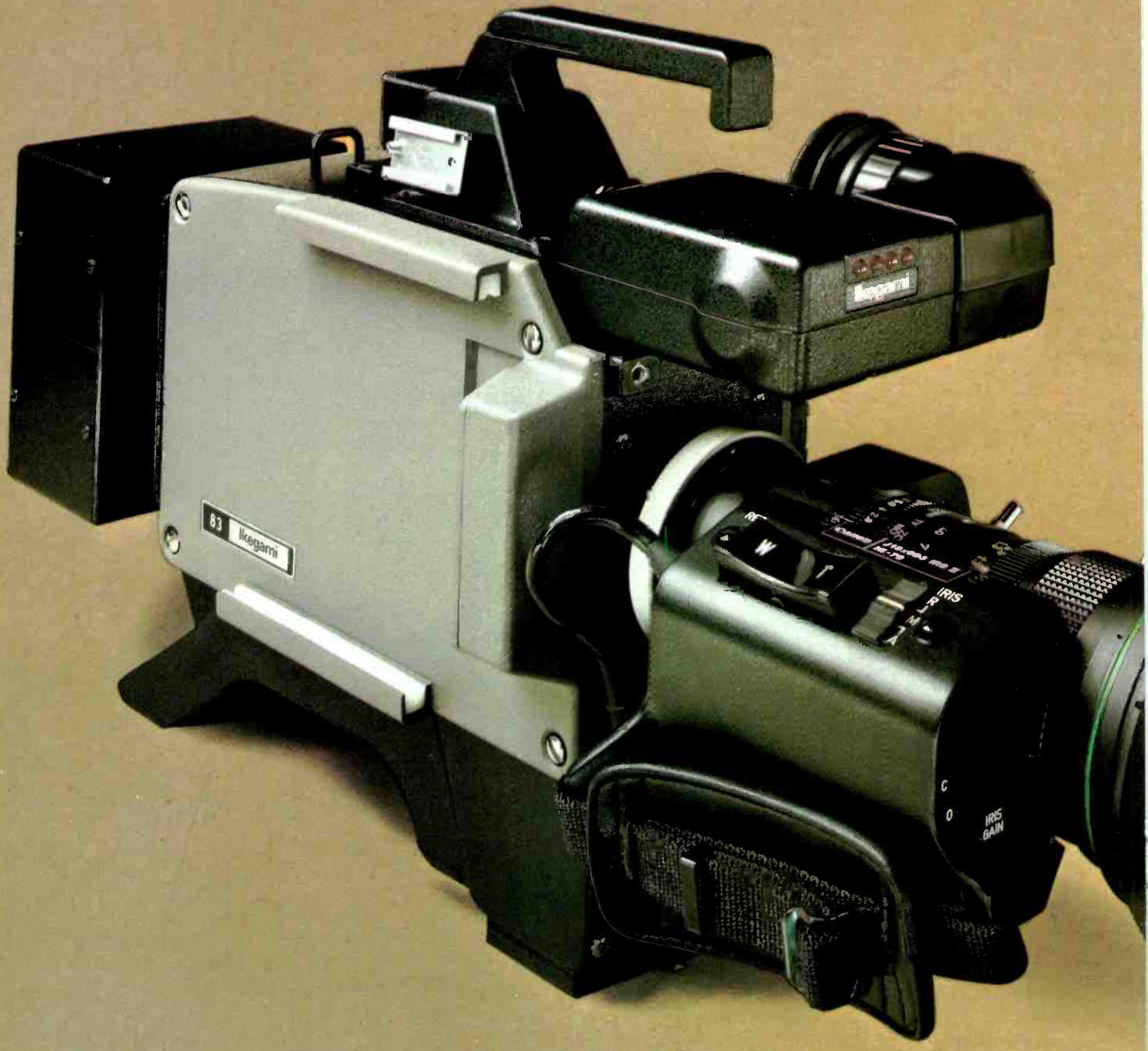

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For starters, the HL-83 is extremely compact and well balanced. It's about the size of competitive one-tube cameras—yet, it's a top quality, three-tube, prism optics design that's truly up to the highest broadcast standards. And it uses proven, readily available components. Inside are ⅔" Plumbicon* or Saticon** pickup tubes coupled to advanced Ikegami circuitry that delivers usable pictures in low light with up to 18 dB of gain. Automatic white balance corrects colorimetry over a wide color temperature range with the touch of a single button—there's no need to fumble with filters. The HL-83 is ready to go when you are—where you are. Simple to set up. Simple to operate. Get set for the action in the standby mode and the camera's up and air-ready in less than two seconds when you hit the switch. And you can keep on shooting for up to 3 hours with an on-board 4 lb. Nicad battery.

The HL-83 can easily adapt to your changing needs. For ENG there's direct interface to existing ¾-inch VCR's. And with adaptor, there's interface to either on-board or hip-mounted component recording ½-inch high-speed VCR's.

For EFP it can be connected to a full feature remote control unit through 150 meters of multicore cable with individual RGB as well as encoded outputs.

For sports it's part of the ML-83 Microlink system for complete remote control and transmission for wireless operations.

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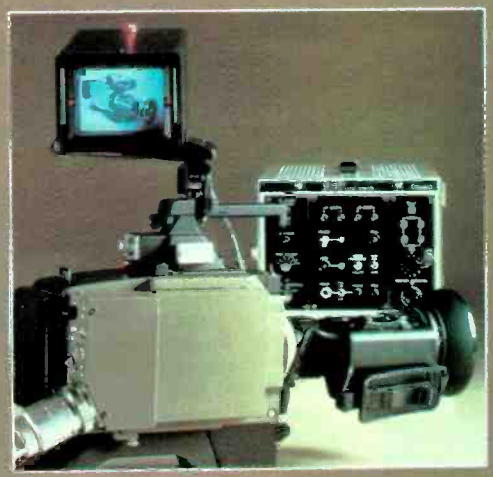

Ikegami HL-83

*Registered trademark of N.V. Philips
**Registered trademark of NHK

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will undoubtedly have a significant effect on theaters. Those that survive will be the small neighborhood establishments—and these will be converted to videotape or satellite program sources shown by TV projection systems. This will result in a higher quality picture, as well as lower operating costs through unattended automated equipment, and lower maintenance costs by the use of locally available TV servicemen.

On the question of what CBS intends to accomplish by its demonstrations of HDTV and its continuing activity in standardization work, Flaherty explained that CBS is attempting to stimulate interest in a new, higher quality TV service and to promote a single worldwide HDTV standard as was done with motion-picture film. Also he commented that in order to provide in the future a direct HDTV broadcast satellite service to the home, the industry must press for spectrum allocations now. With the CCIR Region II (America) meeting on 12GHz satellite channel allocations set for the summer of 1983 in Geneva, there is only one year to stake a claim on the channels needed for DBS. (A meeting to prepare for the 1983 CCIR meeting convened in Geneva in July of this year.)

Because DBS transmissions to the United States are received at a low angle from the horizon, obstructions such as trees and buildings may make reception impossible in many locations. Consequently, terrestrial microwave transmission systems, with transmitting antennas as high as 2500 feet, may be more workable alternate distribution systems for areas with moderate or dense populations. The

Sony & HDTV

In May of this year, Grant Smith, executive vice president and general manager, Sony Technology Center, Palo Alto, CA, appeared before the American Society of Cinematographers and presented a paper on electronic means of film shooting. The first generation designs of this equipment, he said, were shown in demonstrations sponsored jointly by CBS and the Japanese Television Network, NHK. These demonstrations were held during January of this year in Hollywood, New York and Washington, DC.

He went on to describe the nature of the high definition video standard used for this work: 1125 scanning lines instead of the 525 lines normally associated with NTSC; an interlace ratio of two complete image fields per frame; and a frame rate of 30/s. He further delved into the problems of aspect ratios and attendant bandwidth constraints, and discussed in detail the *component* vs. *composite* signal encoding.

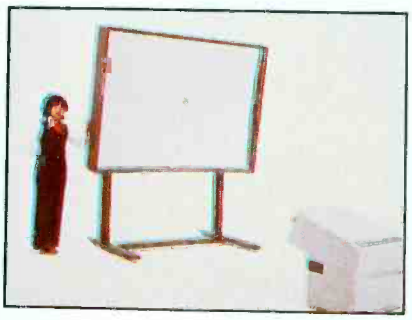
In slides he illustrated some of the equipment being used for HDTV demonstrations.

The HDTV system demonstrated included a modified portable 1-inch, C-format machine that provides 3-channel component recording of R, G and B. Here the higher tape consumption reduces the normal 1-hour operation to about 20 minutes.

As shown, the machines used are reel-to-reel. Although such equipment is not totally impractical, a compact cassette will probably be more acceptable in the future working environment.

The HDTV camera was produced by Sony for the mentioned demonstrations. It is capable of more than 1200 lines resolution and uses a new high definition pick-up tube design based on the Saticon technology. (Saticon is a development of which NHK holds the basic patents.)

Because this camera employs state-of-the-art technology, maintenance of its critical adjustments would, a decade ago, have been a full-time job for several engineers. Today, however, with the availability of the microprocessor, the range of correct adjustments can be automatically executed, yielding full specification performance with a minimum of maintenance. It is possible, for example, to electronically memorize special adjustments for later recall to permit the same camera to produce consistent results on several sets, under different lighting conditions. With special circuits, including dynamic focus, it is possible for corner resolution to be nearly equal to center resolution. Thus, the performance will be as good as the lens in front.



Here is a 100-inch (diagonally) projection screen monitor that operates on the 1125-line signal of high definition. The advantages are that it has none of the resolution limitations of shadow mask or Trinitron stripe picture tubes.

Ultimately, the full-size, wide-screen theater display will be possible with electronic projection. The source of the projected signal could be either magnetic tape or, for security from piracy, by satellite or cable transmission into the theater.

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practicability of this approach has been verified by the success of recent tests by CBS wherein a 70cm dish was found to give excellent results, even in cases where it was necessary to use a signal bounced from a building rather than a direct signal.

As with satellites, there may be a shortage of channels in the 12GHz band, requiring the use of frequencies at 22GHz or higher. He said this should pose no problems, although transmitters with adequate power are not available at present. At the present rapid rate of technological advances, when the need arises, higher power transmitters will be developed.

McMann: A researcher's viewpoint

Renville H. McMann has been in the forefront of TV technology development for many years, first at NBC, then at CBS Laboratories, which he headed up after the retirement of Peter Goldmark, and now as president of Thomson-CSF Laboratories in Stamford, CT. A member of Don Fink's SMPTE HDTV Study Group, he recently accepted the chairmanship of the newly formed subgroup charged with the study of HDTV distribution and transmission.

He has frequently advocated the early development and adoption of worldwide compatible HDTV standards. (See **BE,** April 1982, page 72.) The following are his views on the adequacy of available hardware, a prognosis on the pattern for system standardization and implementation.

Circuit components and design techniques in use today are suitable for HDTV. Unfortunately, the pickup tubes used to successfully demonstrate HDTV (Hitachi, NHK and Sony) are prototypes and are not in production. The most suitable type, however, appears to be the Saticon. Its major advantage over the popular Plumbicon is the fact that it is not limited in resolution by the photo-conductive surface, as is the Plumbicon. Current production Saticons are limited by gun construction, which can be improved without the need for any technological breakthrough. Furthermore, the sensitivity of cameras can compete with the new Fuji and Eastman Kodak color film stocks in equivalent speed, and can closely approach their exposure latitude.

McMann independently expressed the same opinion as Flaherty that the major improvement in picture quality probably will result from the use of component color encoding as much as from an increase in resolution, compared to NTSC composite encoding.

Renville McMann, president, Thomson-CSF Laboratories, shown with a production camera. This camera will be suitable for adaptation to HDTV, providing that one of the tubes can be mass-produced.

Reaffirming previous statements made at the SMPTE Television Conference in Nashville, TN, he said he believes the introduction of HDTV will first be in EFP and studio production for television and theaters. Initially, though, the TV programs will be converted to 525-line and 625-line standards for release before adoption of HDTV standards and the availability of a viewing audience. Theater

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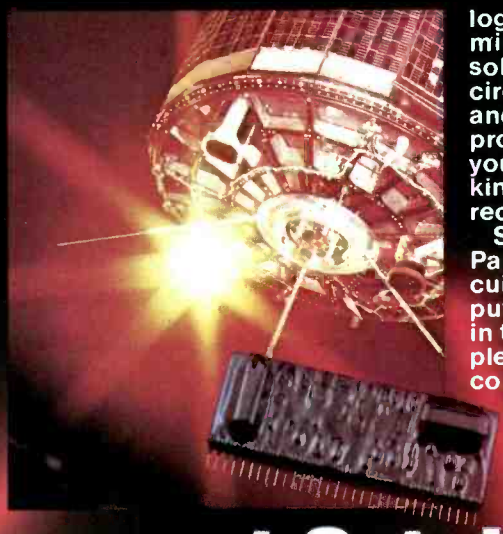

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presentation initially will be by film from laser recording or electron beam recording (EBR). He pointed out that the advantage of laser recording is color film can be used directly, whereas EBR produces color separation black-and-white negatives which must, in turn, be printed onto a color intermediate.

Eventually, TV projection will be used in the popular, small local theaters and will provide a quality better than the generally used 16mm film projection. He echoed Flaherty's viewpoint regarding the ease in automating and servicing a TV theater system.

Because of the limitations in satellite spectrum availability, McMann said he thought that some form of bandwidth conservation will be necessary. Of the several schemes proposed, he prefers time-division multiplexing proposed by the ITA in England and Charles Rhodes of Tektronix in the United States.

In response to the key question of when we may see production use of HDTV, he said he would predict only for EFP, at the earliest in five years.

Roland Zavada, vice president, SMPTE Engineering, is a key industry representative who oversees the committees engaged in the development of HDTV standards.

Zavada: A look at industry

We asked Roland J. Zavada, engineering vice president for the Society of Motion Picture and Television Engineers (SMPTE), to bring us up-to-date on the work of SMPTE in HDTV and the direction he anticipates in the development and adoption of standards. He said that since the last meeting of the HDTV Study Group in February 1982, chaired by Don Fink in Nashville, TN, chairmen and members of four task force subgroups have been appointed to undertake detailed studies of specific problems and issues concerning HDTV. The four areas of investigation are *production, distribution and transmission, psycho-physical considerations* and *equipment*. Work of the subgroups is expected to commence during the summer with preliminary findings to be reported to the study group at the November 1982 SMPTE Conference in New York.

Concurrently, an NAB *ad hoc* committee, headed by Tom Keller, NAB senior vice president for engineering, has been studying the degree of urgency for HDTV standards, and the appropriate organization to be responsible for its development. The findings and recommendations of the NAB committee were to be submitted in a report to the Joint Committee on Intersociety Coordination (JCIC) in July or August. (The JCIC comprises EIA, IEEE, NAB, NCTA and SMPTE.)

It seems unlikely that, as in the case of the first NTSC standards, the FCC will oversee the standardization activity. Instead, it is more probable that, as with the NTSC color standards, an industry-supported committee will be responsible and will submit its recommendations to the FCC for subsequent rulemaking.

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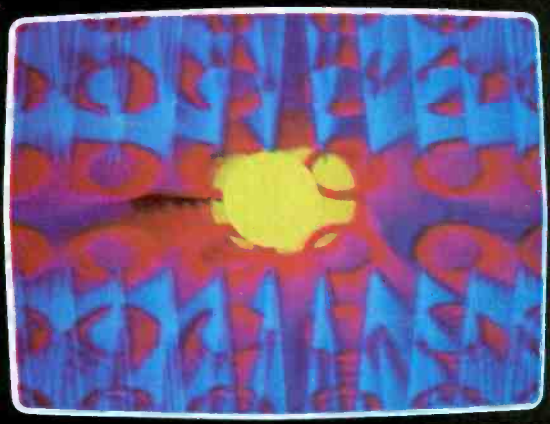

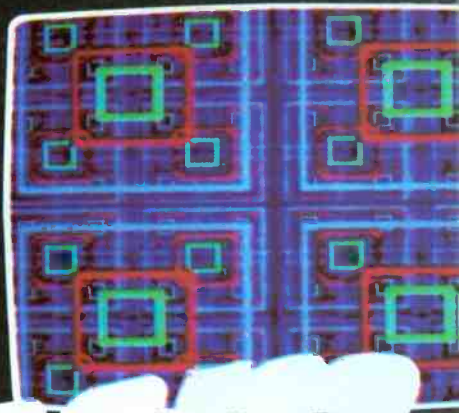

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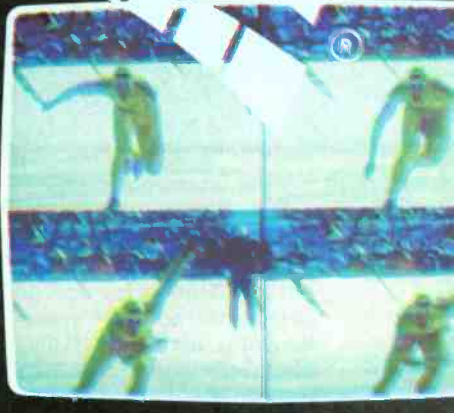

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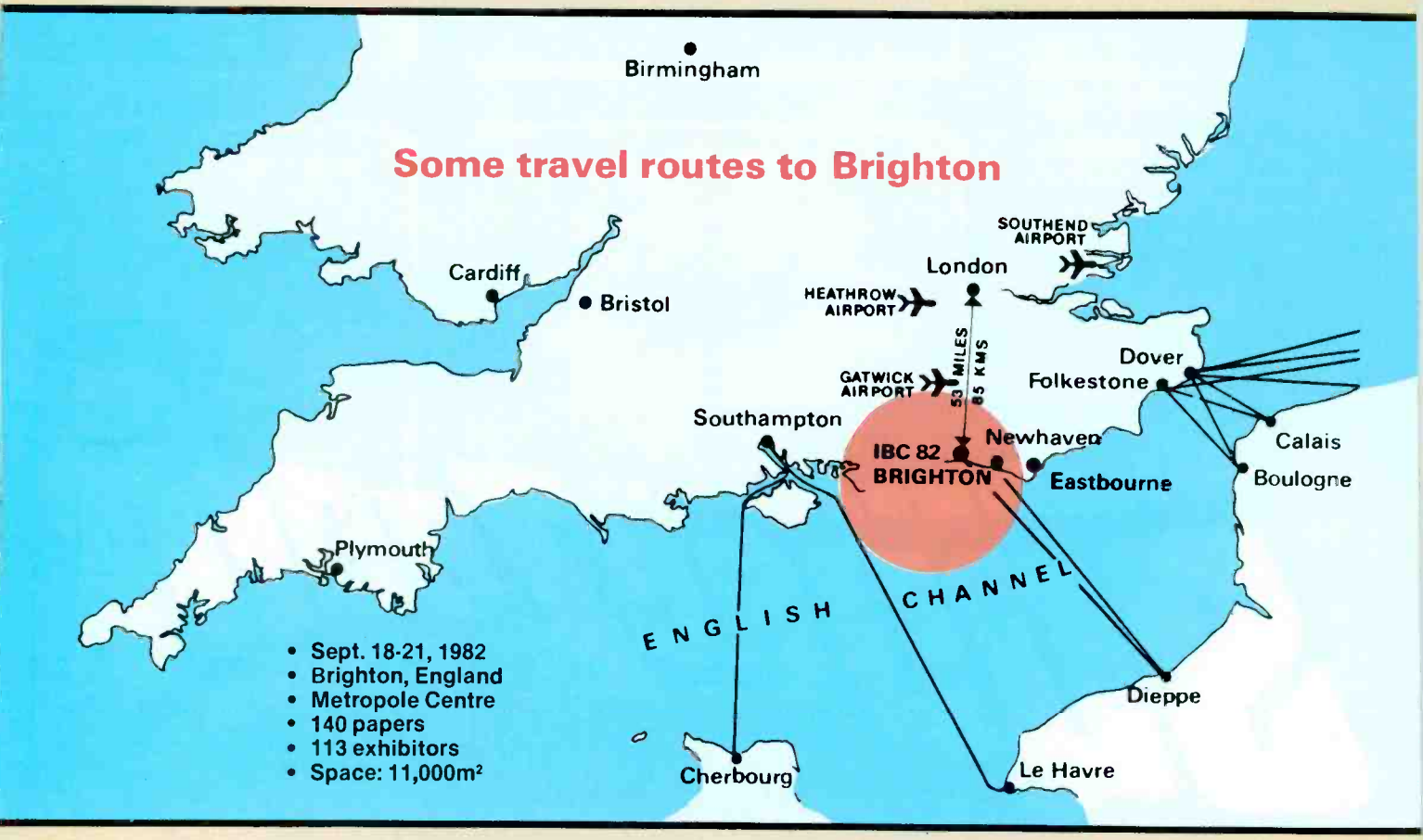
A sneak preview of IBC-'82



The IBC-'82 Convention* will be held at the Metropole Conference and Exhibition Centre, which is a modern purpose-built complex adjoining a first-class hotel, situated on the Brighton sea front. Extensive exhibition areas, conference facilities, bars, restaurants, lounges and coffee bars are all provided under one roof.

Following worldwide response to the IBC *Call for Papers*, a wide-ranging technical program has been announced for the Ninth International Broadcasting Convention. Approximately 90 papers have been selected by the IBC technical program committee chaired by Peter Mothersole.

There will be 14 sessions presided over by international chairmen. Subject headings are as follows:

- Broadcasting Technology for the Future
- Origination Equipment
- TV Transmitters and Transposers
- Radio Transmitters
- High Definition Television
- Recording
- Satellite Broadcasting
- TV Links Including Fiber-optics
- New Services
- Propagation and Planning
- Receiver Technology
- Measurement Technology
- Sound Broadcasting
- Digital Coding Standards

It is IBC policy not only to present papers by acknowledged specialists on subjects that are new and topical, but also to take a look at possible future developments. The scene for this is set in the opening session when invited speakers will address the delegates on *Broadcasting Technology for the Future*. The increasing importance and use of satellites in broadcasting is reflected in the session on this subject in which 10 papers will be presented by authors from the United States, United Kingdom, Japan, Canada and India.

The technical program is complemented by a comprehensive exhibition of broadcasting equipment. There will be 113 exhibitors, many from overseas. Leading world manufacturers will be displaying and demonstrating an extensive range of the latest broadcasting equipment. Eighteen mobile broadcasting units, including a satellite ground station, will be presented along the lower

*The IBC is held biennially and is sponsored by the Electronic Engineering Association, the Institution of Electrical Engineers, the Institute of Electrical and Electronics Engineers, the Institution of Electronic and Radio Engineers, the Royal Television Society and the Society of Motion Picture and Television Engineers.

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esplanade in front of the Metropole complex. The exhibition hours are 9:30 a.m.-6 p.m. Sept. 18-21.

Hotels

The convention will take place at a time when the demand for hotel accommodations in Brighton and the surrounding area is high and participants are advised to make reservations as soon as possible.

Exp-o-tel (Hotel Reservations) Ltd. has secured as many good quality hotel accommodations as possible in Brighton and in areas within reasonable traveling distance of Brighton.

Those wishing to make reservations should contact Exp-o-tel (Hotel Reservations) Ltd., Banda House, Cambridge Grove, London W6 0LE; 01-741-4904 or Telex 8811951.

Costs

The full-time convention fee of approximately $200.10 (exchange rate as of June 23, 1982) entitles registrants to attend the technical sessions, the exhibition, to receive a copy of the convention publication and exhibition catalog, to attend the champagne reception and to obtain morning and afternoon refreshments.

One-day convention passes are available at a charge of approximately $52.20 (exchange rate as of June 23, 1982). This fee covers the cost of the program and exhibition catalog, but not the convention publication or a reception ticket. Purchasers of 1-day passes may obtain the convention publication at IBC and those attending on Sept. 18 may apply for a civic reception ticket.

Contacts

All inquiries concerning the convention and associated activities should be referred to: IBC Secretariat, c/o The Institution of Electrical Engineers, Savoy Place, London, United Kingdom, WC2R 0BL; 01-240 1871 Ext. 222 or Telex 261176.

The IBC-'82 Provisional Program, available from the Secretariat, also gives details of transportation routes to reach Brighton.

IBC-'82 technical program

SATURDAY, SEPT. 18

Opening of IBC-'82 technical program

Welcome address by P.L. Mothersole, Chairman, Technical Program Committee

Session 1: Broadcasting Technology for the Future

- J. Barnathan, ABC
- C.P. Sandbank, BBC
- L.R. Free, Australia
- F.H. Steele, Sony Broadcasting, United Kingdom
- R.V. Arniboldi, Thorn EMI, United Kingdom

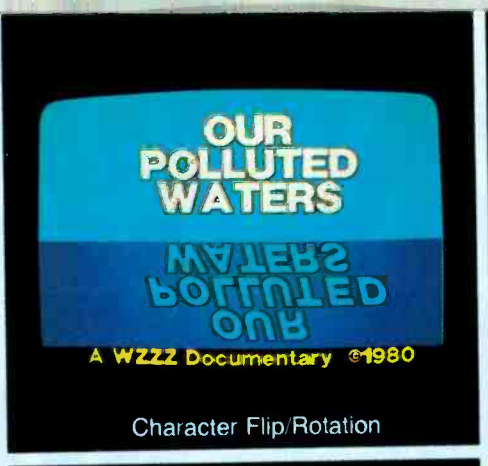
SUNDAY, SEPT. 19

Session 2: Origination Equipment

- Television cameras—the sensor choice
- Sampling structures for solid-state sensors
- The use of CCD solid-state image sensors and delay lines in broadcast TV equipment
- Design considerations in the development of a new automated color camera
- A video rostrum camera and an advanced still store for TV graphics
- Digital video processing for telecine
- Novel uses of digital processing in a modern telecine
- Updating TV production facilities: the present day planning dilemmas
- Automation in network control rooms: the BBC experience
- Computer control of communications in TV studios
- Language dubbing: a video-based system
- A new generation of digital special effects

Continued on page 56

Dual channel mix

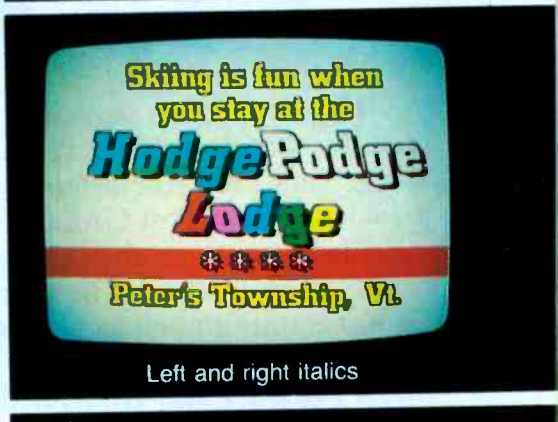


Character Flip/Rotation

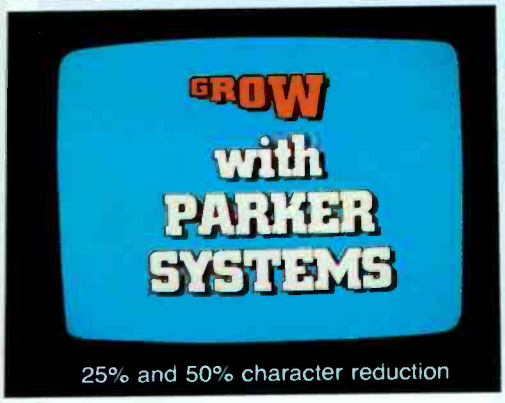
Charting capability

Static headline, changing copy

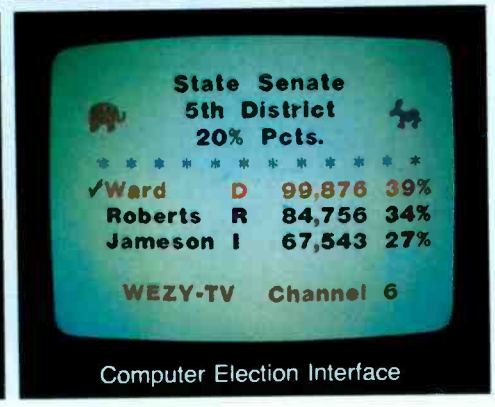
Keyboard logo compose



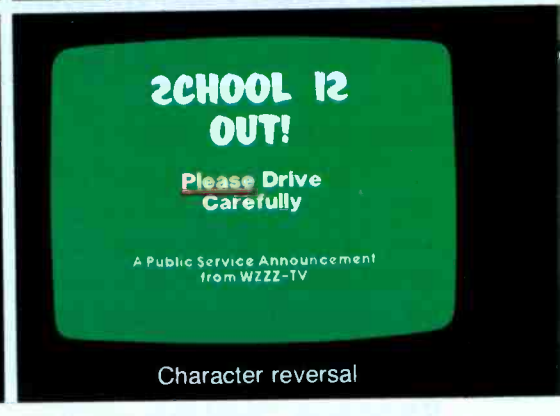
Left and right italics



25% and 50% character reduction



Computer Election Interface



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"It's the perfect combination of U-matic economy and broadcast quality. It's a true mastering process; with the BVU-800, there's no need to transfer to one-inch and lose a generation in order to edit your tape."

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Sony makes a full line of 1-inch and ¾-inch broadcast equipment, including cameras, recorders, editors and digital time-base correctors.

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AM Stereo System	Linear - Same Bandwidth as Mono	Upper Frequency Stereo Limit	Compatibility with Synchronous Detector	Difference Tone IM Distortion	Distortion or noise pops at 100% Negative Peak Modulation	Suitable for Low Cost Receivers	Pre-emphasis Compatible	Well Suited to Directional Arrays
Harris	Yes	15 kHz	Total	Very Low	No	Yes	Yes	Yes
Belar	No	7.5 kHz	None	High	Yes	Yes	No	No
Kahn	No	5 kHz	Poor	High	Yes	No	No	No
Magnavox	No	7.5 kHz	None	High	Yes	Yes	No	No
Motorola	No	7.5 kHz	Poor	High	Yes	Yes	No	No

Select the Harris Linear AM Stereo System

For more information, contact **Harris Corporation, Broadcast Division, P.O. Box 4290, Quincy, Illinois 62305-4290. Phone 217-222-8200.**

HARRIS

Circle (44) on Reply Card

Continued from page 50

- The installation and operational use of a digital slide store system
- Dedicated graphics systems for the broadcaster
- VT80—ITN's advanced graphics generator
- A real time TV animation generator

Session 3: TV Transmitters and Transposers

- An experimental wind- and solar-powered 4-channel UHF transmitting station
- An all solid-state 200W UHF TV transposer
- Frequency synchronization among TV transposer stations
- The application of a novel wideband input circuit in a VHF power amplifier
- A 40/55kW gridded klystron for TV transmitters
- Beam modulation of TV klystrons by means of rugged low voltage electrodes

Session 4: Radio Transmitters

- New directions in high power transmitter design
- A new tetrode for single-tube RF power-stage radio transmitters with more than 1MW of carrier power
- Design options in solid-state FM transmitters
- Pulse width modulator drive for AM broadcast transmitters
- A versatile 10kW medium-wave transmitter
- Energy savings with modern PDM-type high power AM transmitters

Session 5: High Definition Television

- System concepts in high fidelity television
- Experimental work toward high fidelity television
- On picture scanning for future HDTV systems
- Extended definition television through digital signal processing

MONDAY, SEPT. 20

Session 6: Recording

- Development of ultra wideband video recorders
- VT editing—people or machines
- Development of direct color recording ½-inch videocassette equipment for broadcasting
- Betacam—integrated ENG
- Meeting the user requirements for the digital videotape recorder—format considerations
- SMPTE/EBU timecode on the center track of 6.3mm audiotape
- Recent progress in digital audio technology
- Advances in sound dubbing at Independent Television News

Session 7: Satellite Broadcasting

- The use of satellites in modernizing and expanding international high frequency broadcasting
- Satellite broadcasting—modulation methods and the FM channel
- Digital audio/data multiplex for direct broadcasting by satellite
- Multiplexed analog components—a new video coding system for satellite broadcasting
- Consideration of improved quality sound and vision for satellite and terrestrial broadcast services in the United Kingdom
- Effects of snow on received picture quality in satellite broadcasting service
- L-SAT—an opportunity for Pan-European satellite broadcasting experiments
- A news collection and distribution system via satellite
- Transportable satellite terminal for TV program contributions

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ESP Digital Still Store System.

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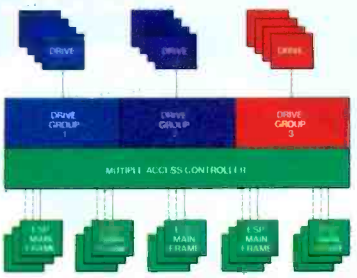

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- Low cost receive terminal for INSAT-based program distribution system of All India Radio

Session 8: TV Links (including Fiber-optics)
- From analog to digital links—the transition period
- A hybrid, optical-coaxial CATV system
- Optical fiber interconnections for digital studio centers
- Simultaneous transmission of two TV programs on a single link

Session 9: Propagation and Planning
- Planning VHF radio services with special reference to the ITU Conference and extended band
- Planning VHF radio services with special reference to the ITU Conference and extended band (Part 2)

TUESDAY, SEPT. 21

Session 10: New Services
- Progress in the development of UK Level 4 Teletext
- Combiner for teletext signals
- Development of VHF/FM radio data transmissions from the European point of view
- VHF radio data
- NEWFOR—an advanced subtitle preparation system
- Zero synchronous frequency modulation

Session 11: Receiver Technology
- Improvement of picture quality by digital processing in domestic receivers
- Modulators and demodulators for hi-fi and stereo sound television
- Research on PAL comb filter and the matrix separation decoder
- Evolution of the receiver and interconnection between units
- The design of domestic receivers and the needs of the hearing impaired

Session 12: Measurement Technology
- Automatic broadcast equipment test system
- MATE (maintenance automatic test equipment)—a comprehensive RF test set for TV transmitter and transposer maintenance
- Analysis of operational and maintenance data
- Subjective assessments for TV—EBU developments in methods and procedures
- Revising proposal to the recommended measurement (1) of errors of PAL chrominance signal demodulation angle
- A verification generator for sound program circuits
- Some new techniques for evaluating high power AM broadcast transmitters
- A unified measurement method and test equipment for audio compander
- A digital ITS generator for calibration purposes

Session 13: Sound Broadcasting
- Latest developments in radio broadcasting sound mixing techniques with special reference to self-operation and engineer-driven applications
- Dynamic distortion in sound broadcasting
- Acoustic scale modeling applied to the design of an orchestral music studio
- A multipurpose radio link system for news coverage
- Radio outside broadcast vehicles

Session 14: Digital Coding Standards

Presentation of contributions will be followed by a panel discussion.
- Worldwide digital video and audio standards—on the threshold?
- Digital TV recording—toward a single format
- High quality decoding for PAL inputs to digital YUV studios
- Experimental TV component coding system for studios

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- Auto correlation of auxiliary trigger signals to data store #5.
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Circle (48) on Reply Card

AES establishes digital audio landmark

By Blair Benson, TV technology consultant, Norwalk, CT

Photo: Laurie Warner

Barry Blesser, AES president, presents a paper to AES' all-digital conference.

- **First all-digital audio conference Audio Engineering Society (AES)**
- **June 3-6, 1982**
- **Rye, NY**

More than 250 engineers and scientists from the United States, Europe and Japan attended the 4-day Audio Engineering Society (AES) conference in Rye, NY, which was devoted entirely to *The New World of Digital Audio*. There were no equipment exhibits to divert the attendees' attention from the in-depth exploration by the speakers of current and future digital audio technology. Instead, it was an all-work meeting with the presentations commencing at 8:30 a.m. and lasting until late into the evening.

Program overview

The organization of the program was described succinctly in a summary by Dr. Thomas Stockham of Soundstream. The conference opened with a tutorial introduction to digital audio, followed by an overview of the field. The next day and a half were allocated to analyses of the various techniques for signal processing and synthesis, optical and mechanical disc recording, magnetic tape recording formats, editing and error correction and detection. Finally, the program dealt with applications of digital technologies, and with detailed descriptions of hardware and manufacturing processes.

Audio recording development

Dr. Toshi Doi of Sony was scheduled to present a review of digital audio technology. However, he elected to deliver a different, and very interesting text, recounting the history of audio recording. The first audio recordings on cylinders were introduced in 1877, he said. These were supplanted in 1901 by the flat disc. The disc system, with its high rotational speed and short playing time, remained the standard for consumer entertainment material until CBS introduced Peter Goldmark's *Long Playing* (LP) record in 1948. Before that time, recordings at the LP speed of 33⅓ rpm had been used only for professional transcriptions.

Finally, in 1977, the first digital audio recording emerged from the laboratory for use in master recording, providing an exceptionally high signal-to-noise ratio with none of the background hiss common to analog magnetic tape masters. And now, in the fall of this year, we may expect to see the introduction by Sony/CBS and Philips/Polygram of an optical digital audiodisc for consumer distribution. Concurrently, digital is being used, or planned, for multichannel broadcasting in Germany, and over cable and satellites in the United States, Japan and Europe. Twenty-four digital audio channels can be transmitted over a bandwidth required for one video channel.

For the future, Doi envisions a much greater packing density for recording of digital audio signals than that possible with discs or magnetic tape. By the year 2002, based on past time cycles of development, he foresees the use of solid-state chip memories as the next technological breakthrough.

Disc mastering and production

Two papers were presented by Philips and Sony on the Compact Disc(CD), to be mass-produced this year. W. Verkaik of Philips described in great detail the commercial mastering facilities and mastering procedures. It was clear that setting up

such a facility requires an investment and considerable technical advice/expertise, which Philips is prepared to offer to the industry.

CD mastering was described as a process in which the digital audio and subcode information is encoded into the CD format and recorded on a disc surface in a spiral of pits, discretely varying in length. The disc mastering process follows tape mastering and provides an intermediate medium for use in mass production replication.

The requirements for cleanliness and the minute dimensions of the recorded pits indicate the rigorous control necessary in the mastering operation. For example, the pits are 0.8 by 1.3 microns long in a spiral track with a pitch of 1.6 microns. The tolerance on the pits is 30nm. Preparation of the master involves the application of thin photoresist layers onto glass substrates. The signals are then recorded by exposing the photoresist-coated disc to a laser beam modulated by the audio and subcode signals. The recording is made in real time. On the other hand, the total time for preparation of a 1-hour master recording is four or five hours.

Senri Miyaoka of Sony said that the CD disc has basically the same cross-sectional structure as the optical videodisc. However, there are three significant differences. First, the diameter of the CD is 120mm, or roughly one-third that of the optical disc. Second, the music, or audio, signal is recorded directly on the disc in digital form, rather than as analog modulation of a carrier. Third, on playback the signal is picked up by an infrared beam from a semiconductor laser.

Miyaoka said that the compact disc, which is based on Sony's optical videodisc manufacturing experience, will be available soon. The installation of a production line has been completed and this year will mark the beginning of mass production. He predicted that in 10 years the compact disc will replace the analog LP disc.

Synthetic music and sound effects

Recently there has been a remarkable increase in the use and sophistication of computers for generating music and sound effects, for acoustical analysis and for studio design. This increased interest in computer music has led to the development of cost-efficient hardware and software systems for composition and program production. Barry Vercoe of MIT described his work, which has brought powerful digital audio processing methods within easy, economical reach of the audio lab investigator and composer. His early work required the use of an IBM 360 computer, but now, with his Music 11

Our Agile 24 satellite receiver system makes things perfectly clear.

Standard Communications' new Agile 24M/S satellite receiver system does everything a broadcast studio model does—except cost as much.

The Agile 24M is a highly cost-effective, reliable satellite receiver featuring advanced circuitry like a fully synthesized phase-lock-loop tuning system, a pre-selector tracking filter, and a PLL demodulator. Dual conversion design converts the incoming signal twice for better selectivity and image rejection. The threshold extension circuit reduces noise by as much as 2 dB on dark scenes, delivering a static threshold as low as 5.5 dB carrier-to-noise. That means blacker blacks in dark scenes, with reduced sparkles.

The Agile 24M is a 24-channel, stand-alone master receiver with sufficient gain to drive as many Agile 24S slave receivers as required to satisfy *any* satellite communicatons system. The unique Agile 24S slave receivers offer all the operating features of the Agile 24M with the exception of the first block down converter. The active amplifier loop-through design of the Agile 24S is cost-effective, eliminating need for redundant passive power dividers.

Nearly all critical adjustments and test functions can be accomplished by accessing the front or rear panel of Agile 24/S receivers. The multi-function front panel meter permits zero tuning as well as carrier-to-noise metering, eliminating the need for special test equipment. Channel indicators display both transponder number and frequency in MHz.

The Agile 24 receiver system carries Standard's full technical support. System installation and alignment is facilitated by enlarged schematic diagrams and an illustrated technical manual. Standard's field engineers offer operator training as well as on-site repairs. Where factory service may be required, 48-hour turn-around and a loan equipment plan are available to minimize system downtime.

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...the TVRO System people

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Photo: Laurie Warner

During an open forum at the conference, Thomas G. Stockham, Jr. (standing), AES president elect, answers questions. Bart Locanthi (at podium), chairman, AES' digital technical committee, leads the discussion.

Program, he has successfully used the DEC PDP-11.

A program of computer-generated music was recently presented at Lincoln Center, and another is scheduled for Boston later this year. A sample stereo recording from the Lincoln Center program was played for the AES audience to demonstrate the realistic reproduction of conventional instruments.

In the study of acoustical ambience and studio design, he described how almost any acoustical characteristic can be simulated using a PDP-11. For the future, he predicts that the more complex computer can be replaced with less expensive groups of microprocessors. For the studio designer, these developments forecast the possibility of meeting more exacting acoustical requirements by laboratory study and design, thus avoiding expensive and imperfect refinement of characteristics by modification after construction.

Final notes

The conference closed with a paper by Stephen Temmer of the Gotham Organization urging engineering and management to take an objective business approach in determining the need and affordability of digital technology. He warned the audience to be wary of the *devil-may-care* attitude that may develop when the threshold of a new technology becomes available to a profession bordering on a hobby. Audio recording shares this problem with some other professions, among which is photography. As a result, the purchase of new, expensive equipment becomes a question of *can we afford not to*, rather than a more balanced *can we afford to*. Thus, it is essential that consideration be given to such factors as amortization, residual value, usage factor and return on investment.

The AES is extremely pleased with the success of this digital audio conference. So much so that plans are already under way for a repeat next year, but dates have not yet been set. Watch the **BE** calendar for an announcement and details.

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Field report:

The Aphex II aural exciter for AM

By Andy Laird, chief engineer, KDAY, and broadcast audio consultant, Los Angeles, CA

For several years, Aphex Systems Ltd. has offered a *black box* device to recording studios called the Aphex aural exciter. The name is mysterious, not to mention that one was only available to broadcasters on an expensive lease program. The Aphex II became the rage of the contemporary recording studio scene.

Recently, Aphex Systems redesigned the packaging and circuitry, devised a purchase program, and offered a model aimed at the broadcast market. Prototypes have been evaluated around the United States, one at KDAY, a 50kW AM station in Los Angeles.

"What is aural excitement?" The manufacturer claims:

- improved intelligibility and clarity;
- improved presence;
- restored natural quality to processed signals; and
- no listener fatigue.

Claims of enhanced stereo imaging and complete mono compatibility do not apply to AM radio at this time.

The manufacturer's claims are subjective listening judgments, not measurable by normal electronic means. Similar evaluation problems occur with phono cartridges, mics, speakers and audio processors. Measurements can be made, but they do not describe the character or uniqueness of sounds created by the device under dynamic musical conditions.

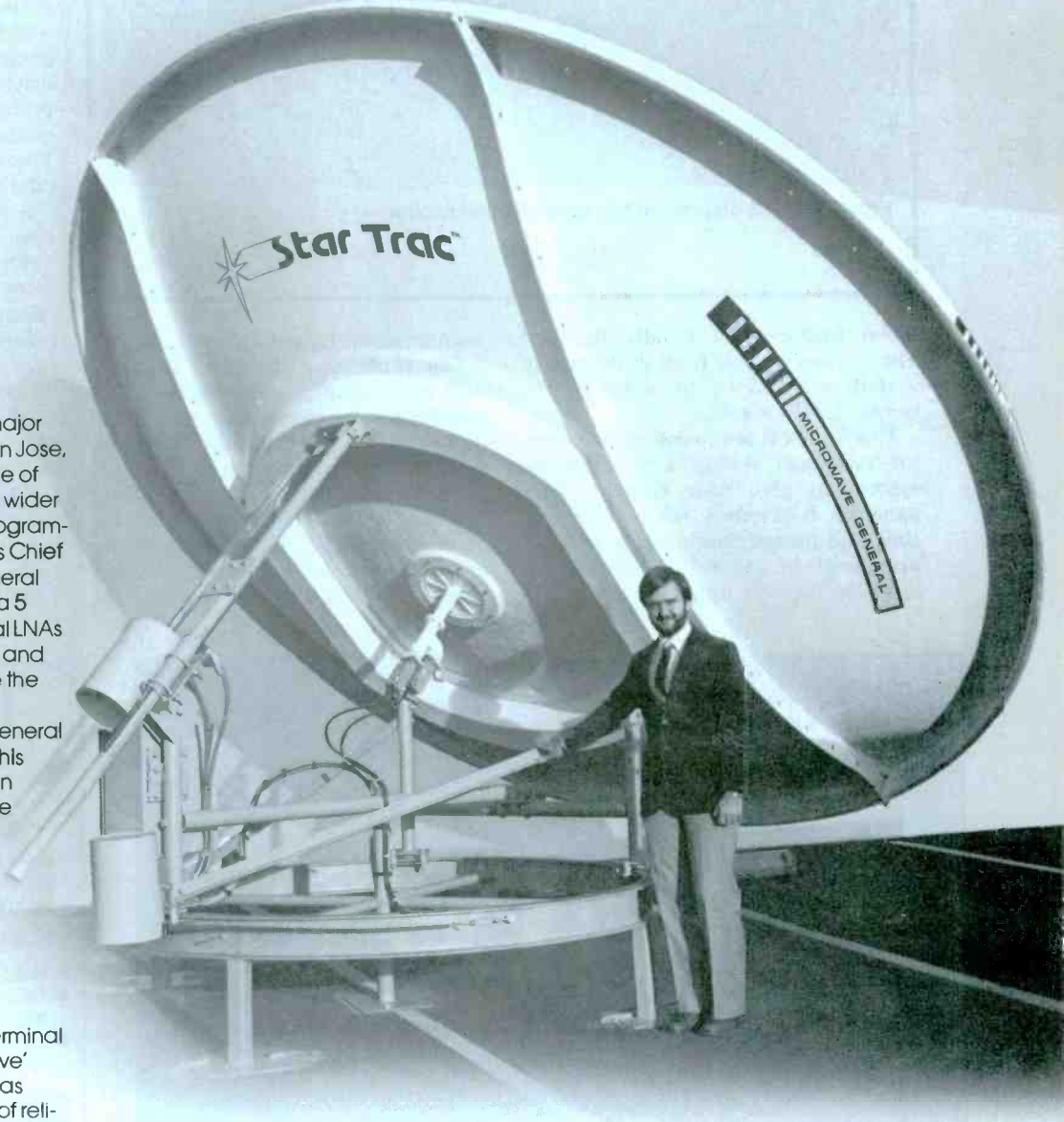
The Aphex II is an audio processing device. A program signal is fed into it, then the unit alters the signal to achieve desired results. The alteration created is a unique feature that sets it apart from anything I have seen in the broadcast industry up to now.

The system is a unity gain line amp with a side chain added: a tunable high pass filter, a buffer amp, a VCA to generate harmonics, a limiter detector and a mute function (Figure 1). Program material applied is split between the line amp and the high pass filter. The corner frequency of the filter adjusts from 1kHz to 6kHz with a tuning control. The damping ratio control, similar to variable Q, adjusts the shape of the corner frequency from a rounded to a peaked response. The high pass audio injection level is controlled by the Aphex drive amp and control, feeding the VCA harmonics function generator. The generator is adjustable anywhere from all even or all odd harmonics by a timbre control. The limiter detector adjusts to restrict the total output of the side chain with threshold and T-release controls. The side chain result is summed back into the unity line amp i

An earlier report on the Aphex II aural exciter in an FM station was prepared by Dr. John Lyons of WRKS. It appears in **BE**, January 1982.

"Now we can access any domestic satellite in less than 90 seconds!"

"And with our Microwave General Remote Control Earth Station we feed our News and Program departments over 6 hours of live programming every day." Joe Perez—Chief Engineer, KSTS-TV San Jose



48
KSTS SAN JOSE

As an independent UHF station in a major metropolitan area, KSTS-TV, CH 48, San Jose, California, recognized the importance of a Satellite Earth Station in acquiring a wider variety of news and entertainment programming. To do this, Joe Perez, the station's Chief Engineer, selected a Microwave General STAR TRAC™ System—complete with a 5 meter dish, prime-focus feed and dual LNAs for simultaneous reception of vertical and horizontal polarization. He also chose the Remote Control System option.

According to Joe, his Microwave General remote controller can steer and lock his antenna onto any domestic satellite in less than 90 seconds, even though the control room is over 200 feet from the dish. This flexibility of operation not only eliminates manual adjustments during bad weather, but also permits rapid "on air" transitions from satellite to satellite...a feature not available on competitively priced systems.

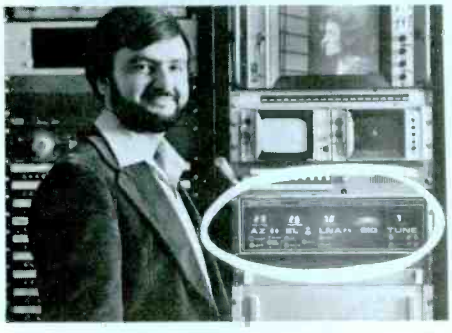
"We use our Microwave General Terminal for a minimum of 6 hours per day of 'live' programming and its performance has exceeded our expectations in terms of reliability, quality of reception, stability and ease of operation," Joe reports. "And all at a down to earth price."

KSTS was able to mount the 5 meter Microwave General dish inconspicuously in their parking lot without need of a special mounting platform or concrete base. In more difficult situations, however, Microwave General's unique heavy duty base assembly permits simple and relatively inexpensive installation.

Microwave General supplies complete four, five and six meter "turn-key" STAR TRAC systems providing studio quality video. A typical STAR TRAC system could have an installed cost that is up to 50% less than "competitive" systems.

Site tests are conducted by Microwave General using trailer mounted antennas of the same type and size planned for the actual installation. Accurate evaluations of signal strength, terrestrial interference and obstruction losses are obtained before any construction begins. Fast, reliable service is always available from Microwave General's manufacturing headquarters in the heart of California's "Silicon Valley."

For more information on how a Microwave General STAR TRAC System can open up a whole new world of satellite access for your station, call (415) 969-3355. Ask for the Broadcast Marketing Department.



The Microwave General Remote Control Center provides simple, push-button control and monitoring of antenna azimuth and elevation, LNA polarization, channel selection, audio sub carrier selection and signal level peaking.

MICROWAVE GENERAL

Microwave General Systems, Inc. 1100 L' Avenida Ave.
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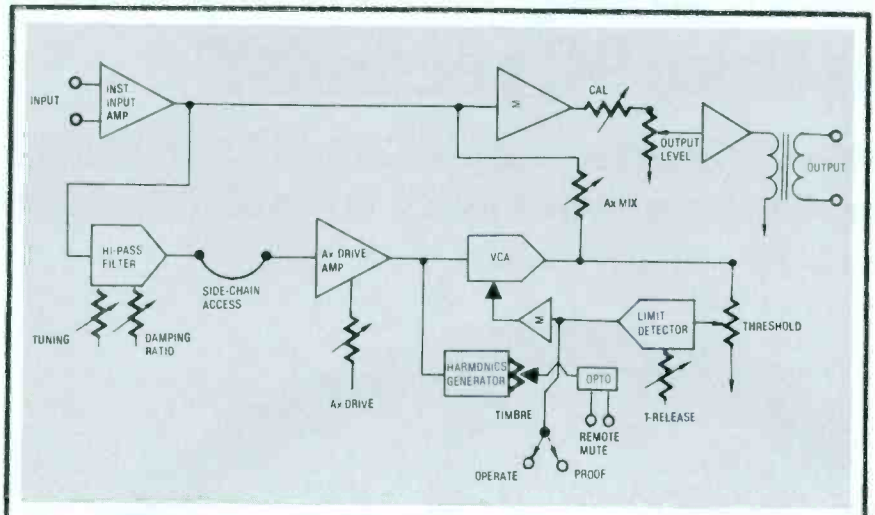

Figure 1. Block diagram of the Aphex II aural exciter.

the AxMIX control. Finally, the total output is adjustable from unity gain to −20dB referred to the input by the output level control.

The Aphex II is a harmonics generator packaged within a filter/limiter system to give user control. Why generate harmonics when so much time and meager engineering budgets are spent to get rid of them? The answers become apparent under dynamic operating conditions.

The input is differential bridging with an externally selectable 600Ω termination. The input gain and headroom remain the same for an unbalanced input. An optional input transformer is available. Relay contacts connect the input to the output in case of power failure. The output of the broadcast version, balanced through a Jensen transformer, is available as single-ended or balanced direct-coupled.

The front panel cover, held closed with a magnet, hides screwdriver controls. When closed, the VTF meter is visible. Switches select input, Aphex return or output metering with a peak or VU response. The metering and gain structure is adjustable with jumpers for 0, +4, +8dBm or a user defined level. A jumper also selects the output clipping level of +21, +24 or +27dBm, to maintain noise performance. Red/green LEDs indicate Aphex drive levels, limiter activity and approach of peak clipping. All of this is placed behind polarized plexiglass. Visual appearance matches the exciter's performance.

A Sound Technology 1710A distortion measurement system and a Tektronix 5L4N spectrum analyzer were used to feed the Aphex II during testing. It was set with +8dBm reference and +27dBm clipping levels, had a differential input and an output transformer. The equipment used 600Ω terminations on input and output. The accompanying chart shows the results.

Spectrum photos show the action of the harmonics generator. A 2kHz tone was applied with the Aphex drive control set to the red/green point on the LED indicator. With the timbre con-

Test results

Frequency response characteristics

(Input and output levels were set to +20dBm. The 0dB reference level was taken from the response at 1kHz.)

Frequency	Relative Level
10Hz	−0.35dB
15Hz	−0.10dB
20Hz	−0.05dB
25Hz to 50kHz	0.00dB absolutely flat
50kHz	−0.05dB

Harmonic distortion tests (THD)

Frequency	+20dBm Output	+8dBm Output
20Hz	0.22%	0.10%
50Hz	0.05%	0.0225%
100Hz	0.0205%	0.0125%
400Hz	0.0046%	...
1kHz	0.0032%	...
5kHz	0.0043%	...
10kHz	0.0067%	...
15kHz	0.0088%	...

Intermodulation distortion (IMD)

With +20dBm input and output levels, the distortion figure was measured as 0.0058%, using standard SMPTE 4:1 frequencies.

Headroom

No clipping was found to +27dBm input and output levels.

Noise measurements

A signal-to-noise measurement of −85.5dB below a +8 reference resulted from 180Hz hum. All other noise was at least 10dB below −85.5dB.

Test environment

All measurements were made with the equipment about 20 feet from a 50kW AM transmitter. The field strength is well above 10V/meter. The Aphex II exhibited no AM RF problems.

trol in minimum or *soft* position, a scan from 1kHz to 10kHz was made and stored (see Figure 2). The vertical scale is 10dB/division. The input level was reduced 10dB, the display displaced slightly to the right for another stored scan. The input level was again reduced 10dB and displaced to the right for the third stored scan. This composite shows strong second harmonics drop at a rate of 2:1 relative to input level changes. The third harmonic was at least 66dB down from the test frequency, while the second harmonic was only down 20dB.

The same technique was used to generate Figure 3, with the timbre control turned clockwise to *hard*. Odd order harmonics become dominant, the third approximately 24dB down, the fifth to 40dB. The second was reduced by −55dB. The odd harmonics also reduced at a 2:1 ratio with the input level change. The timbre control varies the amount of even to odd order harmonics generated as you turn it from *soft* to *hard*.

A musical instrument produces a complex audio tone of the fundamental note with even and odd harmonics at differing levels. The combination gives the instrument its unique sound. The harmonic structure changes with playing techniques and loudness. A loud note has a percussive attack with

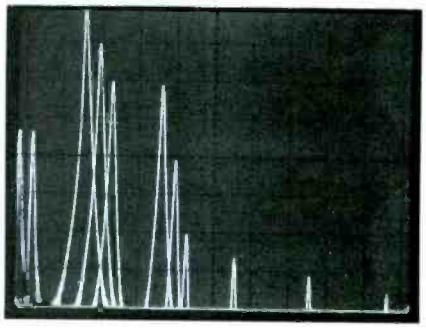

Figure 2. Stored composite shows strong second harmonics dropping at a rate of 2:1.

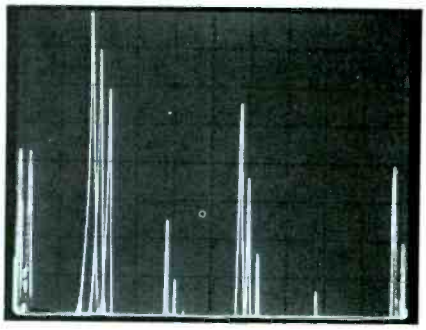

Figure 3. Stored composite, as in Figure 2, except with timbre control turned full to *hard.*

high harmonic content. A soft note has less edge or *bite,* is more mellow with more fundamentals than harmonics.

With multiple generation tapes and abundant electronics, the transient and harmonic structures of an instrument are altered, causing loss of presence, clarity and life. For recording, the Aphex II, carefully tuned, recreates some of the lost harmonic structure. Equalization, the traditional saving tool, brings up tape noise and fails to create the dynamic effect of more harmonics for louder notes. As with any subjective device, the amount of adjustment requires reference and taste to achieve a goal. In a studio the reference might be to make a trumpet or cymbal again. In AM radio, the reference might be to make a narrowband car radio sound more like FM.

AM radio problems are different from those in a recording studio. While recording, you have time to adjust for a specific instrument or cut. In the radio station, you shove everything from phone calls to DJs through the system. You cannot adjust each event for perfection.

As defined by the FCC, the total AM system frequency response should be flat. However, receiver design requires a high end rolloff. Most AM radios have rolloffs taking them down 20dB or more at 5kHz. Broadcasters have various equalization and multiband compression schemes to im-

prove the perceived response through the AM radio. One approach uses super pre-emphasis with multiband compression and limiting to keep the loud high notes under control. The result is a great deal of high end processing, creating a constant *compressed highs* sound. On open, non-dense music (a solo acoustical guitar or a dry voice), this approach works. On dense, bright, loud music, the highs lose dynamic expression compared to the mid and low ranges.

Another approach to receiver rolloff is moderate equalization to 10dB at 5kHz. It adds high end to many radios without the processing activity, but the high end is still down substantially through most radios.

In the recording studio, the Aphex II enhances an already deficient product after degradation. In the AM system, the largest degrading factor is the receiver. Because we cannot install the Aphex II in every car, it must go into the station's audio chain, in front of the degradation.

After initial measurements and listening tests in the production studio, two effects generated by the Aphex II were discovered. First, it added abundant high end dynamic feel to heavily processed material. Second, when remixing is heavy, there is a shelf equalization effect. Some initial setup ideas were tested using an air monitor feed. Then we installed it into the audio chain at various locations. These experiments determined that, for us, the proper location was after the initial AGC and before the multiband compression system.

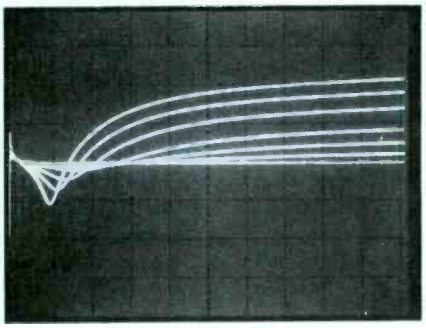

Figure 4. Total system frequency response measured with no AxMix and at six settings up to maximum. (Scope calibration: horizontal, 1kHz/div.; vertical, 10dB/div.)

Adjusting the Aphex II to provide a pleasing effect (switching it in and out while listening to rolled off studio air monitors), we discovered the effect in cars was much more dramatic and overdone. Reducing the Aphex mix from the initial setting greatly improved the sound in most cars.

The next two experiments tried to run the station with reduced pre-emphasis, then with no pre-emphasis, to see if the Aphex II could provide the complete high end effect. The result was an unnatural, unpleasing high end. A midrange hole became audible using this much enhancement.

Earlier tests had measured the response of the high pass filter and the effect of its control. The spectrum analyzer was fed from the side chain access point. The response of the total system with varying Aphex Mix was measured. With tuning, damping and timbre controls set at midpoint, total system frequency response was measured with no AxMix and six AxMix settings up to maximum (Figure 4). The horizontal calibration remained at 1kHz/div., vertical at 10dB/div. The Ax drive control was adjusted so that as the sweep generator was in the filter response areas (above 2kHz), the drive indicator LED switched from green to red.

Figure 4 shows the shelving equalization effect along with a response hole. Both develop as more side chain is added into the direct audio. Time delays of the filter create this summing effect. We discovered that in normal program chain operation, with normal pre-emphasis, injection levels greater than the second trace

above a flat response created too much high end effect. In our final test, the dip was no more than 0.5dB and not audible. There are many dynamic dependent harmonics being added along with this slight shelving effect. Also, various settings of the damping and tuning controls change the width and depth of the response hole. We found that with reasonable AxMix levels the hole is not a problem.

After substantial listening, we set the timbre control almost fully in the soft or even harmonics mode. Approaching the hard setting, the sound gets harsh and non-harmonious with a slight widening of the station's bandwidth.

Sometimes highly processed spots or voice transients can cause spitting sounds to be generated in clippers along the audio chain. Reducing the limiter threshold keeps those transients from adding extra problems due to the dynamic nature of the harmonics generator.

There is a definite improvement in the apparent clarity and high end response from narrow bandwidth AM radios. Along with a moderate preemphasis curve, it creates a clean, clear, high end effect without increasing high end noise or hiss. The effect is dynamic. A cymbal crash or drum tick jumps forward rather than being reduced by a fast high frequency limiter. The more total processing you use in your station, the more the actual loud/soft effect is lost; but high end clarity seems to be retained.

Headroom problems or worn out, distorted records being played in your station will become much more audible when using the Aphex II. After we achieved the music sound we liked, we did not care for the sound of our mics. Our mic preamps and amps have limited headroom. The Aphex II did a great job of showing up our distortion problems. KDAY music is AGC'd separately from the mics. The two are combined in front of the multiband compressor. It was easy to *hide* problems by moving the Aphex II into the *non-live* bus only. KDAY has now purchased a stereo Aphex II. After upgrading the microphone chain, we will use the other channel for mics only.

The Aphex II controls have a wide range of adjustment: from nothing, to enhanced, to destroyed. The range is well beyond tasteful applications in a typical broadcast chain.

Another application was discovered. In an emergency we accepted a dial-up USC basketball game from North Carolina and later, one from Oregon. Because 5kHz lines were unavailable, the Aphex II was connected following a low frequency extender with remarkably good results. We also tried it on some bad agency dubs with great results.

The overall construction quality and packaging of the unit is first class. The enhancement concept works very efficiently for AM. We will never shove FM-like high end response through the bulk of AM radios, but the Aphex II in a moderately pre-emphasized processing system provides a pleasing high end improvement.

Editor's Note:

The field report is an exclusive **BE** feature for broadcasters. Each will be prepared by the staff of a broadcast station, production facility or consulting firm. The intent is to have the equipment tested on-site. The author is at liberty to discuss his research with industry leaders and to visit other broadcasters and/or the manufacturer to track down pertinent facts.

In each field report, the author will discuss the full applicability of the equipment to broadcasting, including personal opinions on good features and serious limitations – if any.

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

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

The system covered in this field report is marketed by Aphex Systems Ltd., 7801 Melrose Ave., Los Angeles, CA 90046. Comprehensive product data may be obtained directly from this firm. Equipment tested in this report was shipped to the author directly for his studies.

tech tips

Monitor setup and the discriminating eye

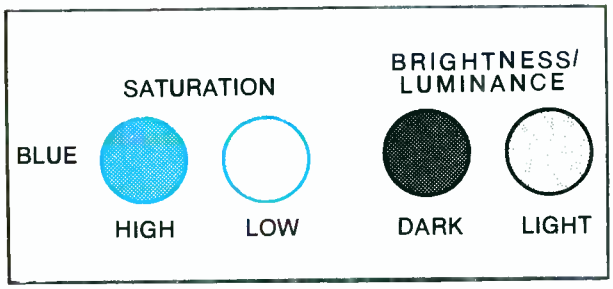

Figure 1. Examples of high and low intensities of blue.

A monitor setup without a photometer or a test generator may not be as difficult as you imagine. When necessary, it is possible for your "discriminating" eye to take the place of electronic equipment. It is simply a question of "eyeballing" it. Follow these simple step-by-step instructions:

- Feed the monitor a good standard color bar signal (first generation).
- Turn the color off. Your monitor now shows only black and white.
- Adjust brightness and contrast (also referred to as picture) until light is barely perceptible in the black area. You arrive at this point by turning both up. You will detect a slight difference in the pure black area with the slight addition of light.
- Turn brightness until seven distinct levels of gray excluding black appear.
- Turn contrast up until blue begins to merge with black.
- Readjust brightness until the blue is defined from black again.
- Turn color up until a satisfactory degree of color intensity is observed.
- Adjust the hue (also referred to as tint). The three colors that are most difficult to obtain are magenta, yellow and cyan. With the slightest touch of the knob, magenta becomes purple or red, yellow becomes green or orange, and cyan becomes blue or green. You should now have the full range of colors before you—white, yellow, cyan, green, magenta, red, blue and black.

Justina Romashko
L. Matthew Miller Associates

Editor's note: *Tech Tips,* our latest exclusive department, is designed to provide our readers with concise tips on technology related to broadcasting that do not warrant in-depth articles. In purpose and scope, it parallels our *Station-to-Station* department that lets broadcasters communicate short, vital bits of information to each other. However, it differs in that *Tech Tips* is available to all contributors, especially to manufacturers' staffs who want to present crucial tips to **BE** readers.

The above tip selected from *In Sync,* published by L. Matthew Miller Associates, is reprinted with permission to kick off this new department. Interested readers may submit their items for consideration in future issues to: Tech Tip Editor, **Broadcast Engineering,** P.O. Box 12901, Overland Park, KS 66212.

people

Chivite

Chivite named editor for Intertec's *Radio y Televisión*

Miguel Chivite has been named editor of Intertec Publishing Corporation's Spanish-language magazine, *Radio y Televisión*. He will replace Juan Artal, who will retire after 12 years as editor. The announcement was made by Cameron Bishop, electronics group publisher.

Chivite joins the company with a solid background in broadcast communications and foreign languages. He is a former sound engineer with Manhattan Sound and the Arena Stage Theater in New York and has served as editor and assistant director for many award-winning films and plays.

Chivite speaks fluent Spanish and French, graduated cum laude with a BA in television and media and holds a MA in film studios from Columbia University. He has previously taught film studies, directed documentaries, and served as a photographer and assistant writer for a textbook. He has also translated technical and legal work for the Rennart Institute in New York.

Panasonic has announced the appointment of **Ralph J. Wolfe** to the position of senior vice president in charge of sales. Wolfe will be responsible for sales across all product lines in the Panasonic Company.

John M. Bailey has joined Frank Barth Inc. as director of public relations. Bailey's responsibilities include planning and directing all public relations activities for the agency's clients.

Precision/Echo has announced the appointment of **Thomas R. Parkinson** to the position of vice president of marketing. In this newly created position, Parkinson will head the combined marketing, sales and customer service efforts of Precision Data and Echo Science Corporation. In another announcement, **Ronald E. Zimbrick** was appointed as regional sales manager for professional video products. Zimbrick will be responsible for sales east of the Mississippi River.

Damon Rarey has been appointed vice president, graphics services, for Aurora Systems. He will be responsible for Aurora's videographic and animation services.

EEV Inc. has announced the appointment of **Stuart Hesselson** as marketing manager, display products. In this capacity, he will be responsible for the marketing and sale of EEV's range of character and LCD tubes.

Charles Mascari has been appointed sales engineer for Sony Broadcast Products Company. Mascari will be responsible for coordinating network stations in New York City.

new products

CCD and CCD cameras

The P8600 CCD imaging sensor from EEV is a frame transfer image sensor having a 576x385 element format. The silicon array is controlled by circuits that provide clock and sync drive pulses in a variety of ways. The P4300 all purpose hand-held camera features complete CCD camera drive circuitry. The camera can be powered by an internal battery or an external 6V source.

Circle (265) on Reply Card

Parametric equalizer

The E51 5-band parametric equalizer from *Phase Linear* comes in a 1¾-inch rack space configuration. A key feature is the option of switchable peak or shelf response on bands 1 and 5.

Circle (266) on Reply Card

Audio distribution system

Bonneville Productions' DA-108 offers state-of-the-art electronic design featuring 990 op-amp and Jensen transformers. Each of the eight XLR outputs is selectable to line or microphone level.

Circle (267) on Reply Card

Portable video unit

TechTran International's PVU 1000 is a combination of the ¼-inch micro-videocassette recorder and a 3.7-inch television. The unit weighs less than 24 pounds. It can record and monitor video signals from any source including its own TV receiver, other videocassette recorders and TV cameras.

Circle (268) on Reply Card

Wireless microphone systems

Edcor's E Com high band systems (150-210MHz) feature improved state-of-the-art circuitry, new switches minimizing RF "pop," battery life indicators and new antennas. The PM low band systems (30-50MHz) have new distortion correcting circuitry, receiver signal strength indicators and new diversity circuits.

Circle (270) on Reply Card

VTR and videocamera

Sharp's VC-130EC has a special long play speed recording mechanism that allows the operator to choose between normal and one-third recording speeds. Up to eight hours of programming or shooting can be recorded on one tape. Its high speed video search system moves at six times the normal recording speed.

Circle (271) on Reply Card

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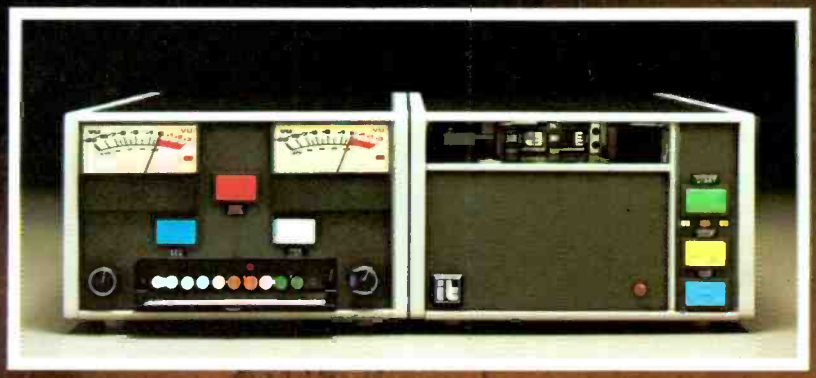

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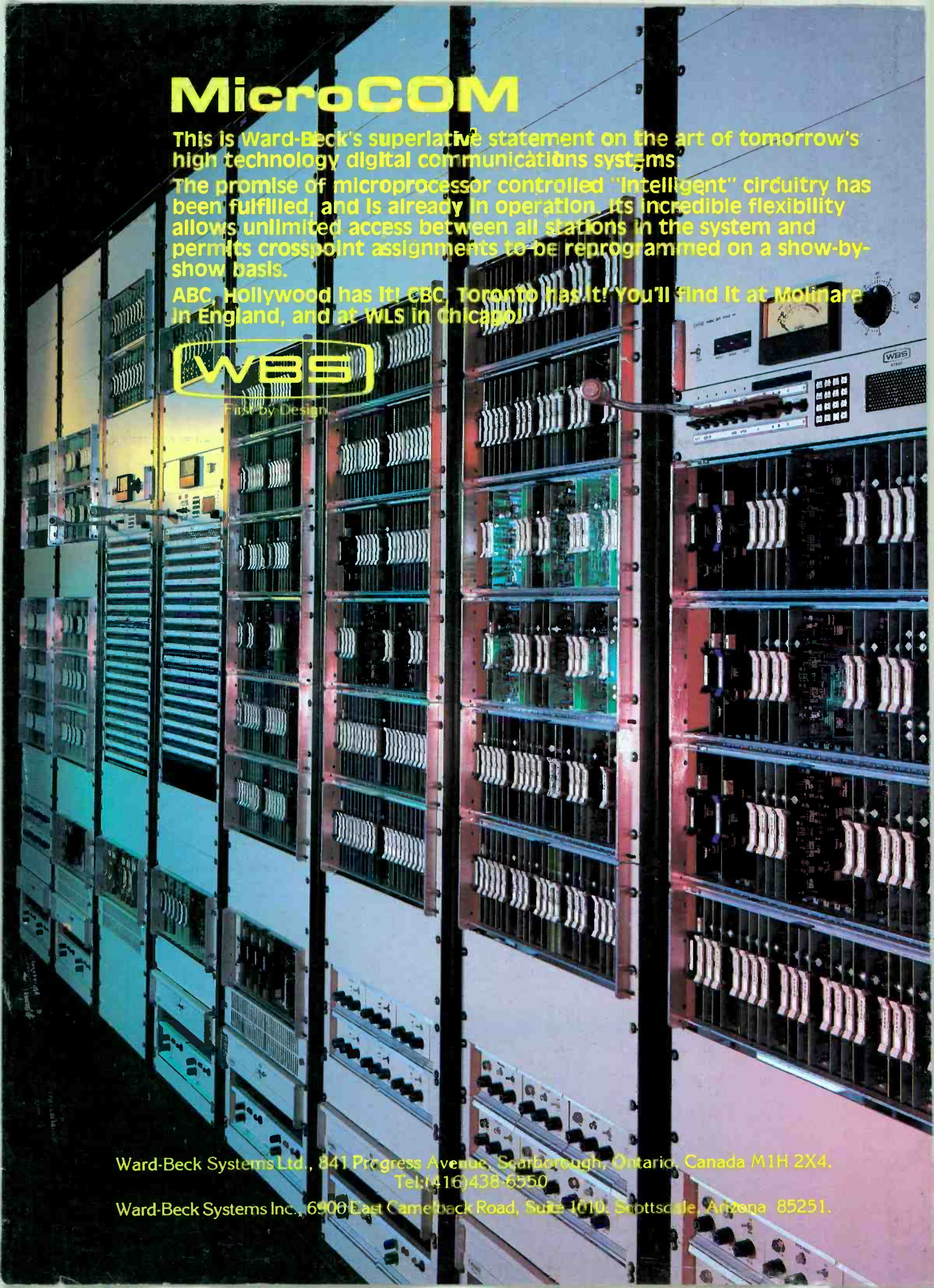
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