SYNERGETIC
SYN AUD CON
AUDIO CONCEPTS

newsletter

P.O. BOX 669, SAN JUAN CAPISTRANO, CA 92693

VOLUME 10, NUMBER 2
WINTER 1983

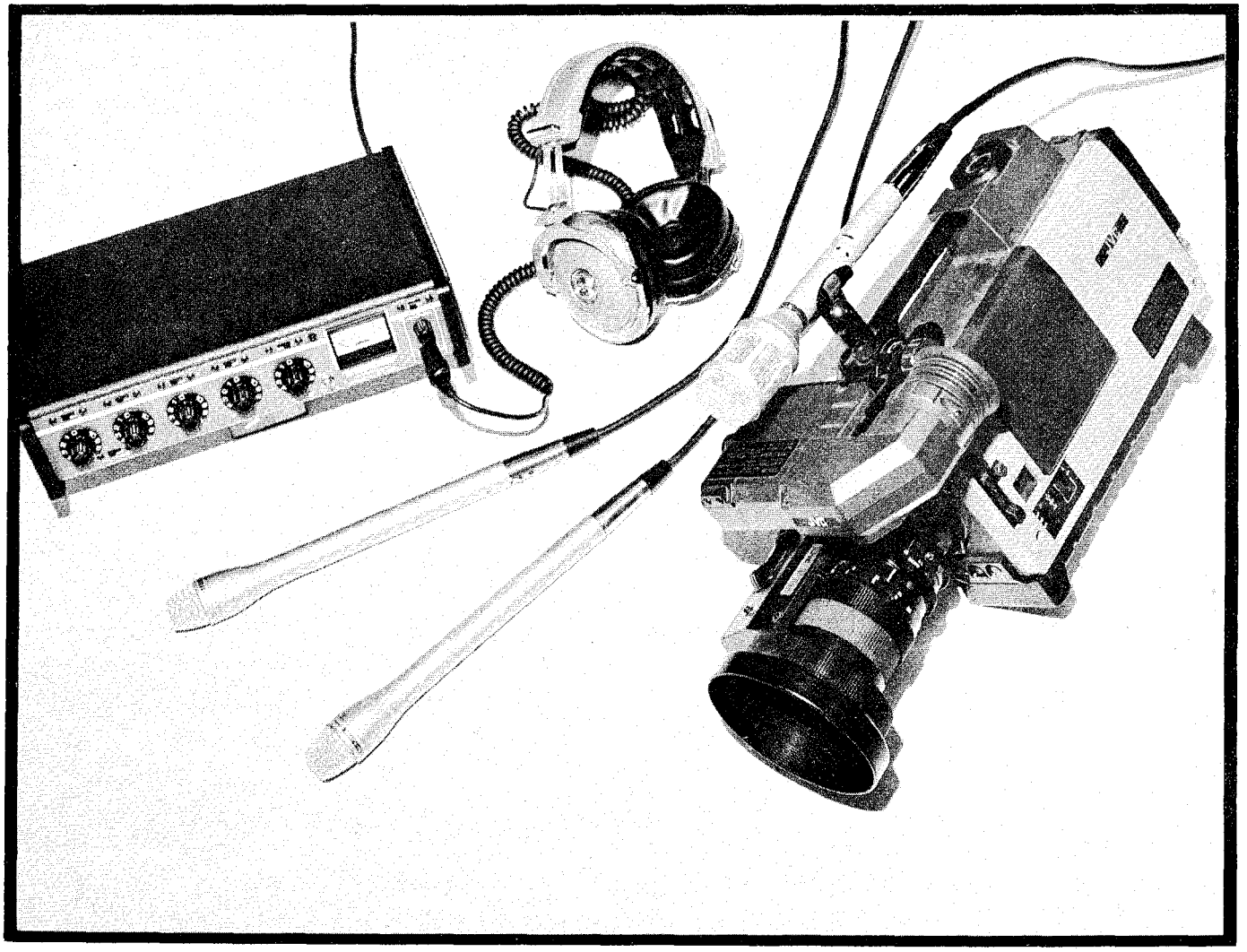
SYNERGETIC
Working together; co-operating, co-operative

SYNERGISM
Co-operative action of discrete agencies such that the total effect is greater than the sum of the two effects taken independently.

EXCHANGE OF IDEAS

I met a man with a dollar
We exchanged dollars
I still had a dollar

I met a man with an idea
We exchanged ideas
Now we each had two ideas



TYPICAL SHURE PRODUCTS USED IN ENG APPLICATIONS

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SYN-AUD-CON SCHEDULE - WINTER/SPRING 1983

2-day Super Saver Classes will be on-the-road, while Workshops will be held at our West Coast Seminar Center and possibly on the road at a later time.

SUPER SAVERS

Super Saver Classes are presently scheduled on the West Coast:

Anaheim. . . . . March 25-26, 1983

Phoenix . . . . . April 15-16, 1983

San Francisco. . . . . April 22-23,1983

If we have sufficient encouragement from our Super Saver mailing, we would like to hold classes in Denver and 5 or 6 cities in the mid-west this Spring and Summer. Fall classes will be on the East Coast and South. If you have people in your firm or know of people interested in the 2-day audio fundamentals class, be sure to let us know.

SCHEDULED WORKSHOPS

TEF® Instrumentation . . . . . .February 1-3, 1983

Microphone Applications . . . . . .February 15-17, 1983

Concert Hall Acoustics (in Europe) . . . . .March 3-6, 1983

Loudspeaker Array. . . . . .April 27-29, 1983

The special workshops listed here are opportunities to invest in yourself and your future. The future belongs to those who work to meet it from a position of strength and knowledge. Syn-Aud-Con is justifiably proud of its presentation of accurate, relevant, useful audio fundamentals. The authorities we have chosen for these special workshops are, in our opinion, the best qualified experts in the world to present the advanced material to be discussed.

The authorities we choose and the manner in which the workshop is conducted, unlike functions conducted by technical societies, is not aimed at displaying the authorities' expertise, great as it is, but in exploring and explaining complex subjects in a language all of us should be capable of understanding. There is a legion of experts who know a great deal about a small area and have no intention of communicating meaningfully about it. The experts we have chosen for these workshops have *demonstrated* their abilities over a wider than usual span within their field, are dedicated to leading others toward the pinnacle they occupy, and are extremely talented in doing so. Yes, these workshops are opportunities for real growth - exceptional opportunities.

**Syn-Aud-Con graduates are capitalized throughout Newsletter.*

NEW FORMAT FOR SYN-AUD-CON CLASSES

2-DAY SUPER SAVERS 3-DAY ADVANCED WORKSHOPS

R. Buckminster Fuller has written: *"Up to the twentieth century 'reality' was everything humans could touch, smell, see, and hear. Since the initial publication of the chart of electromagnetic spectrum. . . humans have learned that what they can touch, smell, see, and hear is less than one-millionth of reality. Ninety-nine percent of all that is going to affect our tomorrows is being developed by humans using instruments and working in ranges of reality that are nonhumanly sensible.*

These comments remarkably describe the investigation of what is labelled "acoustic energy" both in its original form and in its transformations within the electronic components of a sound system.

Leo Beranek wrote one time during his early investigations into acoustics, *"When our equations contain six or more variables, we turn in despair to our measuring apparatus."*

3-Day Sound Engineering Seminars Phased Out

Syn-Aud-Con is particularly aware of the vast chasm between a working technician's audio needs and the needs of those seeking to become genuine functioning audio engineers. We respect both groups, for without both of them practical working systems could not be conceived, designed, installed, maintained and operated. Syn-Aud-Con has, in the past, tried to serve both groups with a single class format and we succeeded to a remarkable degree according to our 4,000 graduates. But we feel we can do even better. After our January class at the Seminar Center, *we will no longer conduct our regular three day seminars.* Instead, we will have two types of courses available to you:

1. The Syn-Aud-Con Super Saver which will cost $350. for two days of fundamentals and basics of sound system design, setup, and troubleshooting.
2. Our advanced workshops which will cost $600. for three days and cover subjects such as TEF® Instrumentation, Loudspeaker Array Design, Concert Hall Design, LEDE™ Control Room Design, Microphone Applications, and, we hope, Computer Programming specifically for audio and acoustic problems.

Charting New Paths

Our feelings about trying new paths are expressed in the following poem sent to us by BILL ZOPHY of Rauland.

THE CALF PATH

One day through the primeval wood
A calf walked home as good calves should
But made a trail all bent askew,
A crooked trail as all calves do.
Since then three hundred years have fled,
and I infer the calf is dead.

But still he left behind his trail,
And thereby hangs my moral tale.
The trail was taken up next day
By a lone dog that passed that way;
And then a wise bell-wether sheep
Pursued the trail o'er vale and steep,
And drew the flock behind him, too,
As good bell-wethers always do.
And from that day, o'er hill and glade,
Through those old woods a path was made.

And many men wound in and out,
And dodged and turned and bent about,
And uttered words of righteous wrath
Because 'twas such a crooked path;
But still they followed--do not laugh--
The first migrations of that calf,
And through this winding wood-way stalked
Because he wobbled when he walked.

The forest path became a lane
That bent and turned and turned again;
This crooked lane became a road,
Where many a poor horse with his load
Toiled on beneath the burning sun,
And traveled some three miles in one.
And thus a century and a half
They trod the footsteps of that calf.

The years passed on in swiftness fleet,
The road became a village street;
And this, before men were aware,
A city's crowded thoroughfare
And soon the central street was this
Of a renowned metropolis;
And men two centuries and a half
Trod in the footsteps of that calf.

Each day a hundred thousand rout
Followed this zigzag calf about
And o'er his crooked journey went
The traffic of a continent.
A hundred thousand men were led
By one calf near three centuries dead.
They followed still his crooked way,
And lost one hundred years a day;
For such reverence is lent
To well-established precedent.

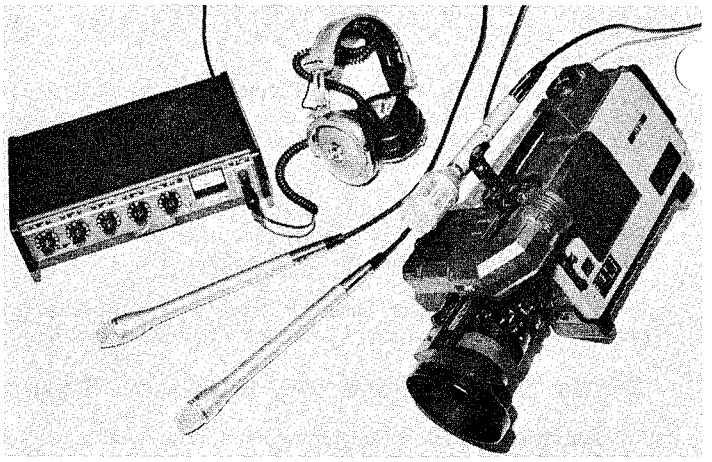
A moral lesson this might teach
Were I ordained and called to preach;
For men are prone to go it blind
Along the Calf-path of the mind,
And work away from sun to sun
To do what other men have done.
They follow in the beaten track,
And out and in, and forth and back,
And still their devious course pursue,
To keep the path a sacred groove,
Along which all their lives they move;
But how the wise old wood-gods laugh,
Who saw the first primeval calf.
Ah, many things this tale might teach--
But I am not ordained to preach.

--Sam Walter Foss--1895

OUR COVER - SHURE BROTHERS

Shure is one of Syn-Aud-Con's oldest sponsors, going back to 1974. Shure is a genuine pioneer company in audio and their original developmental work in audio is legendary.

It was a Shure engineer who first proposed the idea of directivity factor (Q) in connection with their fundamental work in directional microphones. Shure was the first to produce a totally integrated high quality entertainer's portable system, "The Vocal Master," and of course they are a world leader in phonograph cartridge innovation. Though we are not authorities on the subject, we use the Shure V15 Type 5 cartridge for our home music system.



Syn-Aud-Con uses Shure Electronics as "test instruments" in our TEF® measurement work. We know of nothing comparable to their M267 Mixer anywhere near its convenient size and price.

We have compared Shure Microphones of the same model but manufactured 20 years apart and their curves lay exactly on top of each other on the TEF Analyzer.

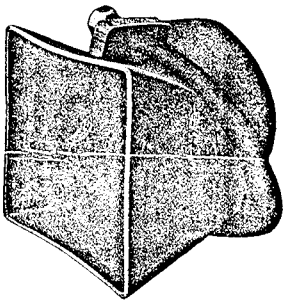
Super basic research, super design engineering, super production techniques, super-super quality control, and super ethical to deal with --- that's Shure to Syn-Aud-Con.

RACON REPRODUCERS

The archival recovery system inherent in Syn-Aud-Con's 4,000 plus graduates is, on occasion, awe inspiring even to us.

JOHN LANPHERE gave us a "lower bowel" horn from the 1930's that he found in a junk store for $5.00. We displayed it in several classes, including Orlando, Florida, where BOB SNELGROVE of Gerr Electro Acoustics in Toronto, Canada, saw it. Shortly thereafter, the data sheet for the device

Bob Snelgrove talking to PHILIP GIDDINGS.



No. 3115 (Illustrated)

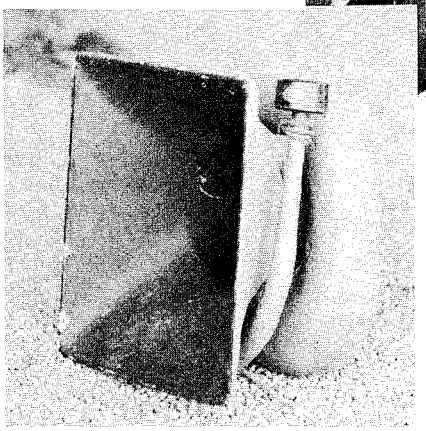
Bell 13 in. x 15 in. Air column 5 feet. Depth 14½ in. Overall dimensions 17½ x 16 x 14½ in.

Equipped with cast aluminum throat, bronze loose coupling.

An excellent horn for monitoring and for all types of sound systems requiring a portable horn.

Weight 7½ pounds.

Code: ROTOR **List Price $19.80**



Horn given to us by John Lanphere.

arrived at our doorstep. Bob had contacted Bill Woods, who is a Canadian-born loudspeaker designer.

Bob contributed another excellent truth, *"What books will there be in heaven?" The answer - "Only those loaned or given away." (C. S. Lewis)*

Bob added, *"I am sure the same goes for the sharing of information."*

COURT DECISION WITH IMPACT ON BUSINESS

Store owners who play radio music over loudspeakers in their places of business may be infringing on copyrights. The Supreme Court lets stand a lower-court ruling prohibiting the Gap Stores, a clothing chain, from using radio music in its stores. Seven music publishers sued under the Copyright Act of 1976, which says that such music may not be further transmitted to the public.

CHICAGO – SEPTEMBER 8–10, 1982

WASHINGTON, D.C. – SEPTEMBER 15–17, 1982

EYE COLOR AND SUSCEPTIBILITY TO TTS

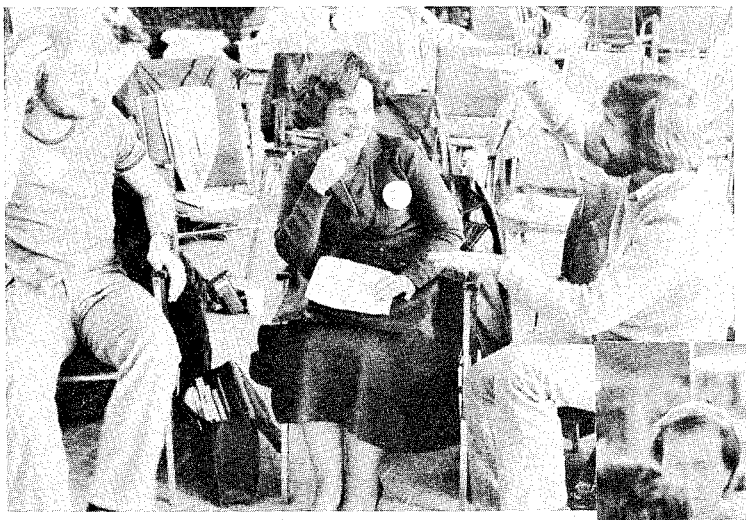
MIKE SULLIVAN of Hoover, Keith & Bruce in Houston, Texas, sent a paper I had completely missed, which appeared in the JASA of March, 1976 (Vol. 59, No. 3, pp. 706-707) written by Hood, Poole, and Freedman. The paper has the intriguing title, "Eye Color and Susceptibility to TTS." To quote from the abstract:

> *The evidence which the data brings to bear in support of the reported correlation is not particularly strong at stimulus intensities of 80 dB (HTL re ISO 1964), --- at 120 dB the evidence seems conclusive, with blue-eyed subjects exhibiting significantly more TTS than brown-eyed subjects. (TTS is 'Temporary Threshold Shift.')*

Do you suppose Syn-Aud-Con can get a grant for the oscillation of the eyeball when firing elephant rifles relative to the subject's eye color?

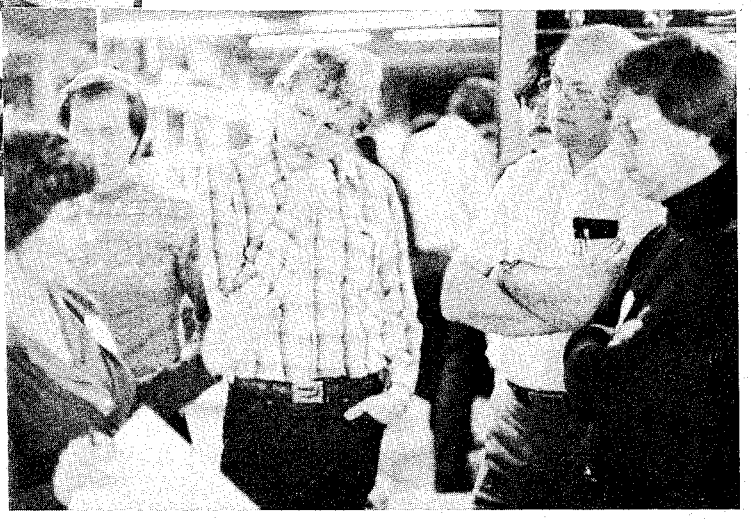
AES PAPERS - OCTOBER 1982

The fall AES convention in Anaheim, California, was, in our opinion, a better than average meeting in terms of quality papers presented and new products exhibited. TEF®, PAL, new UREI time aligned™ monitors, TOA commercial sound loudspeakers, new Crown amplifiers for monitors, and much, much more.



Diana Deutsch's invited paper section was a standing room only session, with people having to be turned away for lack of space. Her acoustic illusions were superbly demonstrated and her mastery of the subject (psychoacoustics) has resulted in one of the longest ovations we've ever heard a paper receive.

Diana Deutsch visited us at the Seminar Center later, during our TEF® Workshop.



GERALD STANLEY's paper on the Tecron TEF® System 10 Analyzer was the outstanding paper in an outstanding session chaired by RUSSELL E. BERGER, II. Deane Jensen presented a beautifully illustrated and documented paper in the same session.

JOHN PROHS (Left) with DAVID HARRIS (Center) and ROD GOLDHAMMER (Right) at the TEF® Workshop. David has had a very active part in the development of the Sphere program.

JOHN PROHS paper on the Sphere array mapping technique was another exceptional experience. His projection of the array onto a large screen via the globe was a devastating example of the difference between a flat and round earth approach.

A presentation by Phillip White of Bruel and Kjaer entitled "Using Time Delay Spectrometry for Evaluation of Studio Microphone Performance" was an example of an ideal AES paper. It was work based on a thorough understanding of TDS fundamentals carried into the measurement of "studio" microphones.

We sincerely hope that B & K intends to publish this excellent discussion. The illustrations of some of the fundamentals is adapted from drawings in White's paper with minor changes of ours in the notation.

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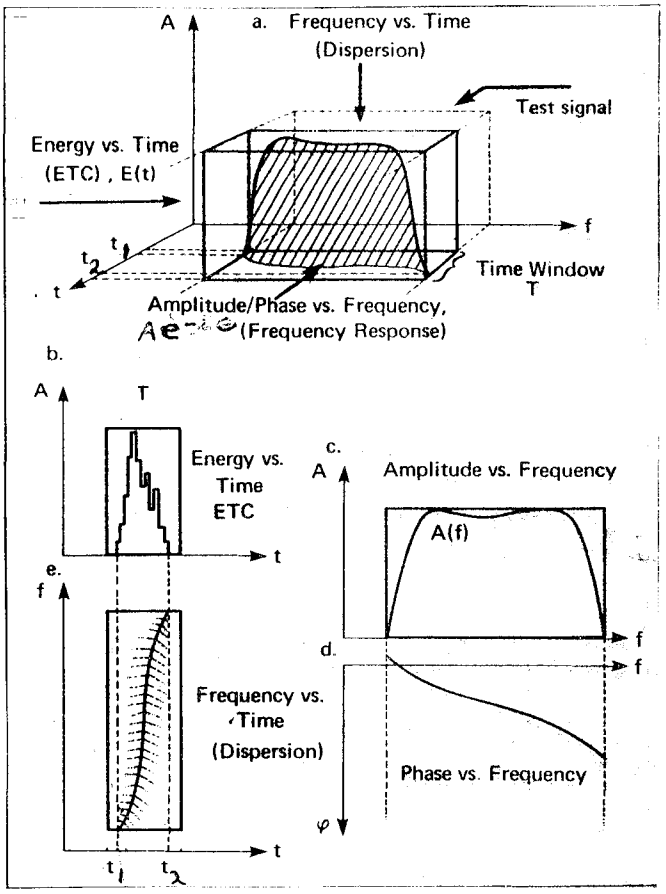
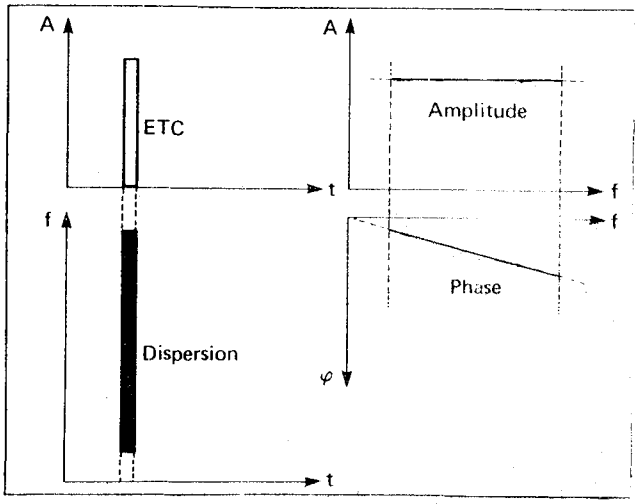


Some Basic TEF® Mappings

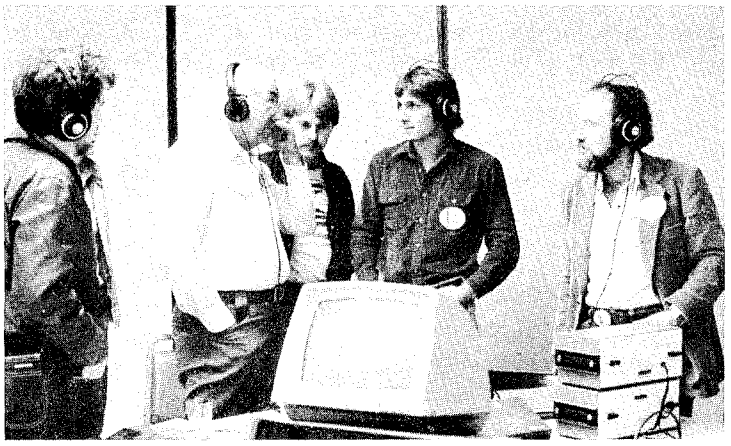


"Ideal" Plots

There were many other fine papers too numerous to list here, one by a Professor from Purdue, David Meyer, explored in mathematical detail, entitled "Development of a Model for Loudspeaker Dispersion Simulation."

Disneyland Hotel and Convention Center, again in our opinion, was a vast improvement over the old Hilton in downtown Los Angeles. We hope that the AES hierarchy has received the message that many of us would enjoy a variety of cities on the east and west coasts, rather than the same ones everytime. Atlanta, Orlando, Nashville, Chicago, New Orleans all provide better possibilities for an AES Convention than does New York City. Seattle, Portland, Las Vegas, Denver, Phoenix, San Francisco, all make excellent western choices. We can at least hope they'll get out of oscillation between only two cities.

THE DEUTSCH ILLUSION



Ken is introducing some of the Nashville class to the Deutsch illusion.

KEN WAHRENBROCK constructed for the fall classes a Diana Deutsch "acoustic illusion" demonstration. The subject wears headphones to which are sent 400 Hz and 800 Hz, only one frequency at a time to each phone.

The photo shows varying stages of Aha!

For instance, if your left ear is receiving 400 Hz, then your right ear at that same moment is receiving 800 Hz. Four times per second the signal each ear is hearing is reversed (i.e., 800 Hz to the right ear and 400 Hz to the left ear). Subjects *hear* 400 Hz always in one ear and 800 Hz always in the other ear. They normally do not hear them switch.

THE TECRON TEF® SYSTEM 10

A Radical New Tool

The Tecron TEF® Analyzer represents the most significant advance in measuring tools the audio/acoustic industry has ever experienced. TEF® stands for Time, Energy and Frequency. When we can simultaneously view all three dimensions as we do with this analyzer, we can then visually inspect the relationship between:

1. The time it took the sound to be generated.
2. The time it took to travel to the listener.
3. The time it takes to become inaudible.
4. The utilization of the generating energy at the listener's ears.
5. The distribution of the energy from the lowest tones (low frequencies) to the highest tones (high frequencies).

Of even greater interest to us is the fact that because this analyzer analyzes in time, we can also observe the arrival of energy that is undesired such as reflections, noise or unexpected surpluses or deficiencies caused by inadvertent misadjustment of the system. We can not only tell the time the energy took to reach us and its total amount but its direction of arrival as well.

In terms of architectural design or engineering factors we have the ability to measure, with several orders of magnitude, greater resolution. This means that compromise alternatives in design can be entertained. In the past it would have been prohibitive from a cost standpoint to "fine tune" should the end result prove unacceptable to the end user. With the Tecron TEF® System 10, the "fine tuning" of the acoustical problems generated as the result of an architectural request for compromise between aesthetic and acoustic conflicts can be handled many times more economically than was ever thought possible in the past. Both man-hours of labor to isolate the problem and the material required to rectify it have dropped dramatically through the use of this advanced analysis system.

Early Reflections Measured

Analysis work already has revealed that early reflections have far greater significance than does the myriad of late but lower level reflections called reverberation. The very practical significance of this discovery is the fact that massive treatment of entire wall areas with acoustic material is no longer necessary.

This was done in the past because of the inability to locate exactly which part of the large surface really was the cause of the problem. We can now analyze the exact area of concern and see step-by-step on the analyzer the exact amount of corrective treatment required and *exactly where to place it.*

Electronic Measurements

The Tecron TEF System 10 is not limited to acoustic measurements but performs complex electronic measurements as well. Again, the speed-up in data acquisition is more than tenfold and several parameters rarely accessed in the past but remarkably relevant in terms of locating system problems are now made at the push of a button.

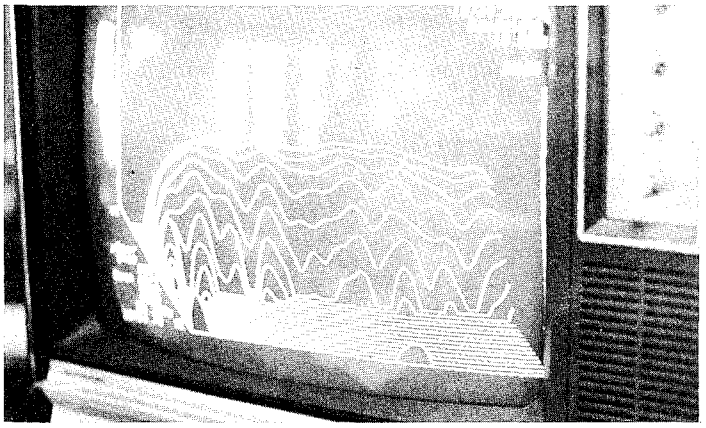
Measurements That Can Be Made On the TEF® Analyzer

For those interested in the tremendously wide scope of measurements now readily accessible in fully documented, accurately calibrated form - the TEF analyzer is a full computer in addition to its analyzer functions - the partial list below is but "the tip of the iceberg."

1. Acoustic or electric energy (level) versus frequency curves (EFC).
2. Acoustic or electric energy (level) versus time curves (ETC).
3. Acoustic or electric frequency versus time curves (FTC). (Done in three dimension)
4. Acoustic or electric phase versus frequency.
5. Acoustic or electrical phase in Nyquist form.
6. Impedance magnitude versus frequency.
7. Complex impedance (Nyquist type plot).
8. Energy time curve (ETC) of impedance.
9. Distance or time to source or other chosen reference.
10. Media velocity
11. Harmonic distortion
12. Initial time delay gaps
13. Ratio of direct-to-reverberant sound
14. Absorption coefficients
15. Diffusion
16. Reflectivity
17. Transmission loss
18. Verification of minimum phase performance and detection of non-minimum phase frequencies.

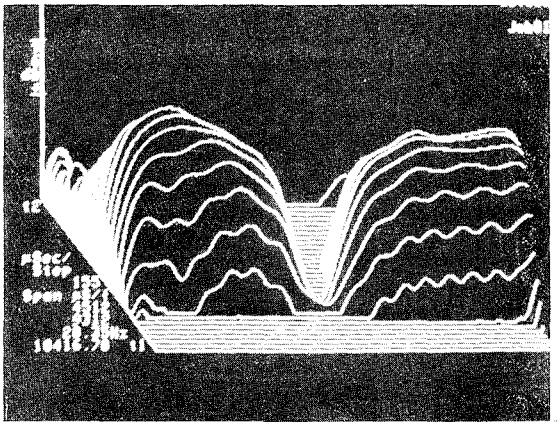
These are but a few of the fundamental measurements, formerly in many cases difficult to do, that are rapid, accurate and, best of all, economical for the first time.

TWO SPEAKERS 1" APART



The "rear view" of the 3 D response of two small loudspeakers with one on top of the other and the microphone equidistant from both. (0 - 18,416 Hz.)

(Picture taken from the TV monitor)



The "front view" of the 3 D response of the same two loudspeakers with one of them 1" in back of the other. Comb filters are dramatic phenomenon as their effects cause not only amplitude degradation, but "time smear" as well.

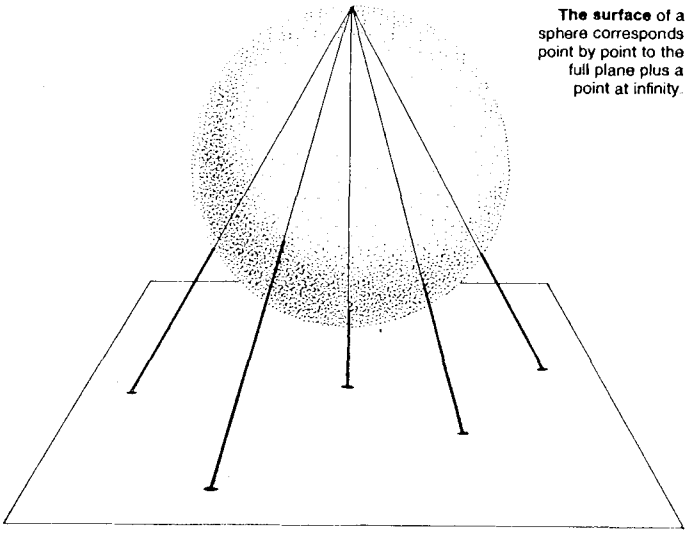
MAPPING A SPHERE

In the March, 1982, *Physics Today* magazine is an article by Isadore M. Singer, entitled "Differential Geometry, Fiber Bundles and Physical Theories" pp. 41-44.

Reproduced here is a segment that refers to mapping a sphere to a plane without undesired artifacts on the plane. A challenging new way to accomplish array mapping on a computer screen.

The singularities can be "gauged away" that is, one can find a phase transformation $\phi(x)$, smooth except at the singular point, p, such that the transformed vector potential, $\phi^{-1}A_\mu\phi + \phi^{-1}\partial_\mu\phi$ is not singular at p. The transformed vector potential is smooth near p, and A_μ is smooth everywhere else including infinity, but the two potentials have a mismatch on a three-sphere S^3 bounding a small ball around p. To compensate for this mismatch we have to construct a fiber bundle on S^4 (four-space plus infinity—see the figure at right) whose fibers have the symmetry SU(2). As in the case of the Dirac monopole, the bundle is constructed by pasting fibers along the boundary-sphere S^3 using the gauge transformation $\phi(x)$. In this way one obtains a vector potential on the entire fiber bundle that has no singularities.

More generally, Karen Uhlenbeck has shown that any solution with finite action and simple (meaning isolated) singularities really lives on some SU(2) fiber bundle over the four-sphere. If fiber bundles had not been invented earlier, they would have been, in the 1970s, to describe these instanton solutions (just as Dirac found the circle bundles on the two-sphere).



The surface of a sphere corresponds point by point to the full plane plus a point at infinity.

SABINE PAPER FOUND

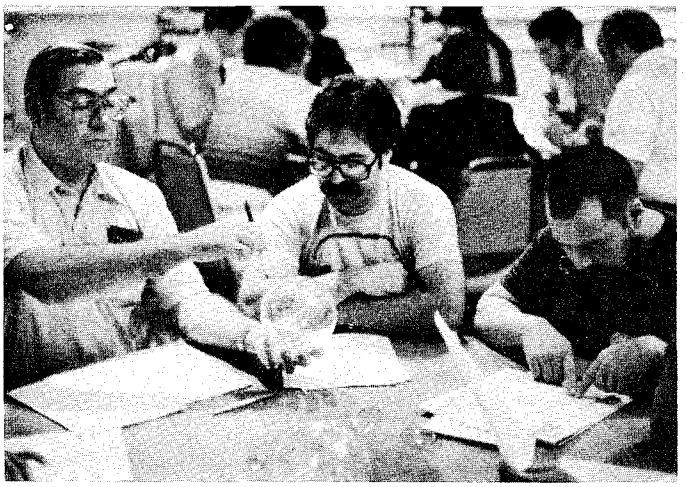
MIKE HOOVER of Audio Technical Services, Ltd., Vienna, Virginia, found a treasure in his attic recently in the form of an early practical engineering handbook of pre-World War I vintage that includes a chapter on Architectural Acoustics written by Wallace C. Sabine.

The elegance with which Sabine wrote these early articles is matched by his ability to explain simply, without violating the integrity of the complex problem, the ramifications of each choice available. A zerox copy of this chapter is now in our hands and our thanks is extended to Mike.

COMMUNITY CLUSTER COMPUTER

Some ideas take a long time to come to full fruition and recognition; others explode onto the scene because of their readily appreciated utility. JOHN PROHS' "Sphere" for mapping loudspeaker coverage is such an idea.

A random selection of photographs from this Fall's classes verify what we are saying.



First of all, John Prohs' idea has fired the imagination of the leaders in audio. Shown in the photo below is JIM BROWN of Bridgewater Custom Sound in Chicago who, incidentally, authored the widely commented on Tech Topic Volume 10, No. 1, Fall 1982 on impedance matching.

Jim is busy instructing the Chicago class in how to visualize the map relative to the source location. When an idea gains gifted teachers of this caliber, it's well on its way.

The remaining photos taken during the Chicago, Washington, D.C., Nashville, and Orlando classes reveal the concentration quickly rewarded by comprehension of this breakthrough in array mapping.

Jim Brown instructing the Chicago class.

Computer Cluster Available 1983

The release from Community reproduced below describes their production of John Prohs' Sphere. Community invites you to write for a copy of John's paper. The paper will help you appreciate the elegance of John's work.

COMMUNITY LIGHT & SOUND, INC.
333 East Fifth Street, Chester PA 19013

CLUSTER COMPUTER - PRELIMINARY PRESS RELEASE
October 23, 1982

The Cluster Computer, invented by John Prohs at Ambassador College in Pasadena, California, is an exciting new loudspeaker cluster design tool. While similar to two-dimensional "mapping" techniques now in use, the three-dimensional Cluster Computer avoids the distortions and inaccuracies of these techniques and offers additional capabilities not possible with a two-dimensional system.

The Cluster Computer will be distributed exclusively by Community Light and Sound, Inc., of Chester, Pennsylvania. Deliveries are expected to begin in early 1983. The Cluster Computer system will include a license, a transparent plastic sphere with latitude and longitude lines every 5 degrees, loudspeaker pattern overlays for Community Light and Sound horns, computer software to allow easy room plotting and accessories to allow projecting loudspeaker coverage patterns onto a room model and to allow a two-dimensional "hard copy" to be made of a completed design. Additional accessories and capabilities are under development. At a later date, Community expects to provide loudspeaker overlays for popular horns from other professional sound manufacturers.

Continued next page.....

THE CONCEPT

Imagine yourself at the center of a transparent sphere. The sphere is inscribed with latitude and longitude lines, much like those found on a world globe, except that these lines are accurately placed every five degrees around the sphere. Now imagine that the sphere has floated upwards to the exact location of a proposed loudspeaker cluster.

Look out at the room. Create an imaginary line from your position at the center of the sphere to some point at the edge of a seating area. Now sweep this imaginary line around the perimeter of the seating area and notice that it traces a shape on the surface of the sphere. This shape is an angular representation of the seating area. From this shape, traced on the surface of the sphere, you can accurately measure required horizontal or vertical coverage angles at the front or back of the seating area, or anywhere inside the seating area using the inscribed latitude and longitude lines as guides.

Next, imagine you are on the surface of a second, identical sphere and you have placed a horn inside the sphere with its apparent apex at the exact center of the sphere. Take an imaginary SPL meter and mark every point on the surface of the sphere where the SPL is exactly -3dB from the on-axis level. Draw a smooth line through these points. For most horns, this will produce a flattened out circle with its center at the on-axis location. Repeat this action for every point on the sphere that is -6dB from the on-axis location as well as the -9dB and -12dB points. This collection of concentric, flattened circles is an angular representation of the coverage pattern of the loudspeaker. If you cut out the section of this sphere containing these circles and place it over the angular representation of the seating area you traced on the first sphere, you can easily see how this particular horn will cover in that seating area.

Obviously, additional horn patterns (for the same type of horn or for different horns) can be combined with the first to evaluate the use of two or more horns to cover the seating area. This is the power of the Cluster Computer at work.

THE CALCULATOR PROGRAM

To create the room plot on the actual Cluster Computer sphere, we have developed an HP41C (Hewlett Packard calculator) program which uses common architectural measurements (from actual room measurements or standard architectural drawings) and allows any or all seating areas in a room to be plotted on the sphere. A CP/M Basic program will also be available.

THE LOUDSPEAKER PATTERN OVERLAYS

We will provide overlays for Community horns and expect to provide overlays for popular horns of other professional sound manufacturers at a later date.

ASSEMBLING THE ACTUAL CLUSTER

When a design is finished, it is a simple matter to read accurate "roll, pitch and yaw" angles for each horn from the Cluster Computer. This allows precise specifications for a cluster to be transferred from the designer to the installer.

ADDITIONAL FEATURES

A feature of the calculator program for the Cluster Computer allows you to calculate the direct sound level at any seat in a seating area, even when covered by several different horns.

An additional feature allows loudspeaker coverage patterns to be projected, using an accessory lighting attachment, onto a scale model of a room (or onto a blueprint if the seating area is flat and parallel to the ground). Using this accessory, the loudspeaker coverage may be manipulated easily to show the effects of using different horns aimed at different areas.

For those who wish a two-dimensional hard copy for permanent records, we will provide an accessory which uses a rear-projection technique to allow you to use a camera to record accurate photos of your finished design.

Other features are under consideration and development and may be announced at a later date.

FOR ADDITIONAL INFORMATION

Community is establishing a mailing list for those who wish to be notified of the availability date of the Cluster Computer. Contact Community at the address below to be placed on this list. John Prohs, the inventor, has written a paper for the 72nd AES Convention in Anaheim, California. Copies of the preprint are available from Community on request.

Community Light and Sound, Inc., Cluster Computer Requests, 333 East 5th Street, Chester, PA 19013. Phone (215) 876-3400.

JBL TECHNICAL LITERATURE

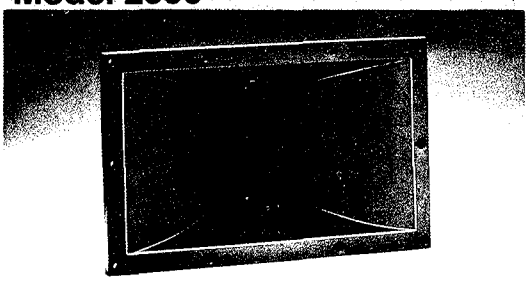
The JBL professional products group has been manifesting the experienced hand of Vice President Ron Means in terms of new literature and product mix. KEN LOPEZ, National Sales Manager, has been keeping Syn-Aud-Con up-to-date in recent months and both Ken and DON KEELE were present at the first Loudspeaker Array Design Workshop this spring.

JBL's new sales literature has, in our opinion, accurate specifications presented in a usable form for system designers. We continue to demur with regard to "Group Delay" data and its relevance. (See Lipshitz, Pocock, and Vanderkvoy, JAES Vol. 30, No. 9, Sept. 1982, page 581, where they feel that what Leach has called "differential time delay distortion" rather than "Group Delay" is the meaningful parameter.) We find the differences we have with JBL to spring from honest differences of opinion that will eventually be decided by our peers.

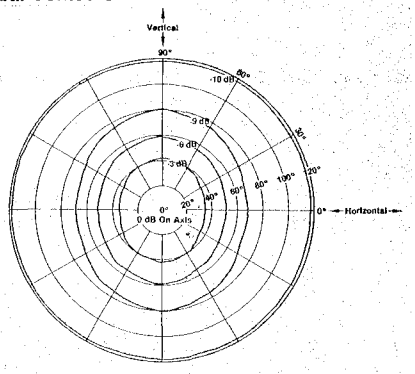
We are pleased that JBL has evidenced a sincere sense of cooperation with Syn-Aud-Con in several projects and we welcome the opportunity to work more closely with their personnel.

A good introduction to their useful approach to specifications can be experienced by writing for their new data sheet on the Models 4430 and 4435 Bi-Radial Studio Monitors. A feature that particularly pleases us is the inclusion of frontal isobar contours for their professional horns such as the 2380 which allows users of the Prohs/Community Sphere system to quickly translate them into overlays for loudspeaker mapping on a sphere.

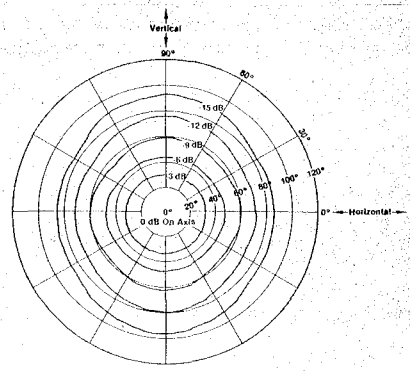
Model 2380



Frontal Isobar Contours

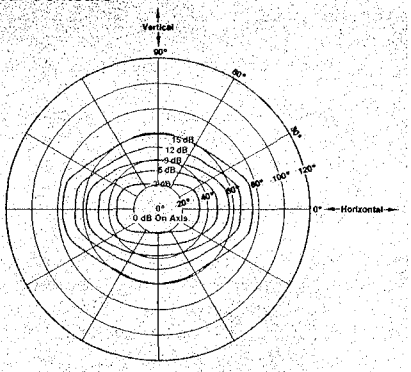


500 Hz octave bandwidth constant sound pressure contours of 0 to -15 dB in steps of -3 dB. The contours are plotted on polar grid lines with on axis being the center of the plot. The data was gathered by taking an octave polar plot at all oblique angles from 0° (horizontal) to 90° (vertical) in steps of 15°. Same test conditions as horizontal polar response.

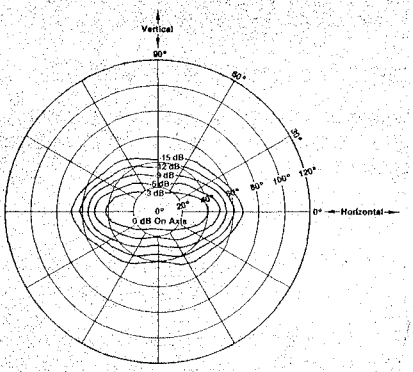


1 kHz octave bandwidth constant sound pressure contours
Same conditions as 500 Hz contours

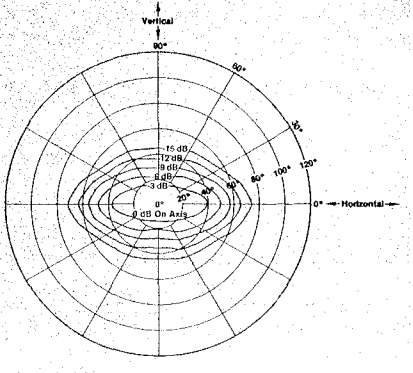
Frontal Isobar Contours



2 kHz octave bandwidth constant sound pressure contours.
Same conditions as 500 Hz contours.



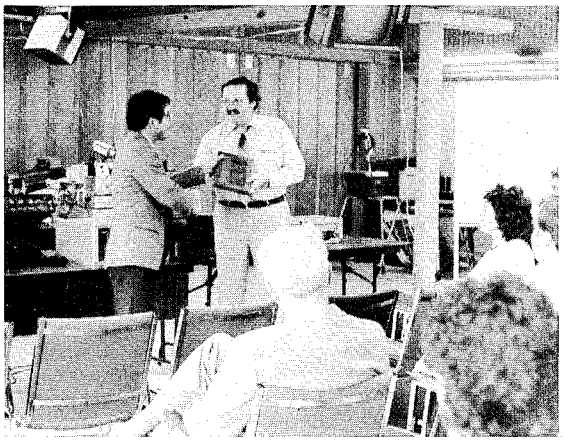
4 kHz octave bandwidth constant sound pressure contours.
Same conditions as 500 Hz contours.



8 kHz octave bandwidth constant sound pressure contours
Same conditions as 500 Hz contours.

HME SALES MEETING

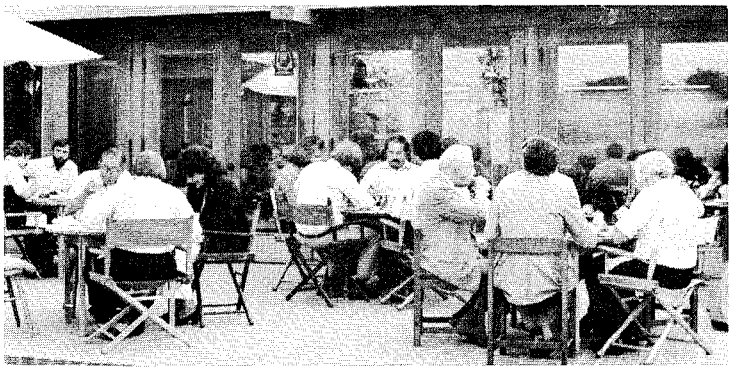
HME, one of Syn-Aud-Con's sponsors, and the leading manufacturer of professional wireless microphones and intercoms, held their National Sales Meeting for their representatives at our Syn-Aud-Con Seminar Center in October.



HARRY MIYAHIRA, President of HME; Dale Scott, Sales Manager; DON KUTZ, V.P. and Director of Engineering; and John Kenyon, Sales Operation Manager were instrumental in organizing the meeting. We were extremely pleased to have them be the first manufacturer to hold a National Sales Meeting at our facility.

Approximately 30 people were in attendance at the meeting, which included the introduction of several new HME products. Of high interest to Syn-Aud-Con followers was their new wireless Precision Audio Link (PAL). (The performance and application of this product was reviewed in our Fall, 1982 newsletter.) They also introduced their second-generation handheld wireless microphone, the System 85, a major step forward in wireless technology, and announced their entrance into the cabled intercom market with their 700 Series.

The meeting was followed by a Rancho Carrillo steak cookout.



RANDY VAUGHAN

Pictured here (on the left) is RANDY VAUGHAN, one of Syn-Aud-Con's staunch supporters on the East Coast. Randy sent four people to the Washington, D.C., class last September and brought his latest new ideas in to share with us.

SMILE

DAVE PIERCE from Memphis, Tennessee, called Carolyn a cattle rustler.....for trying to steer Don through a class.

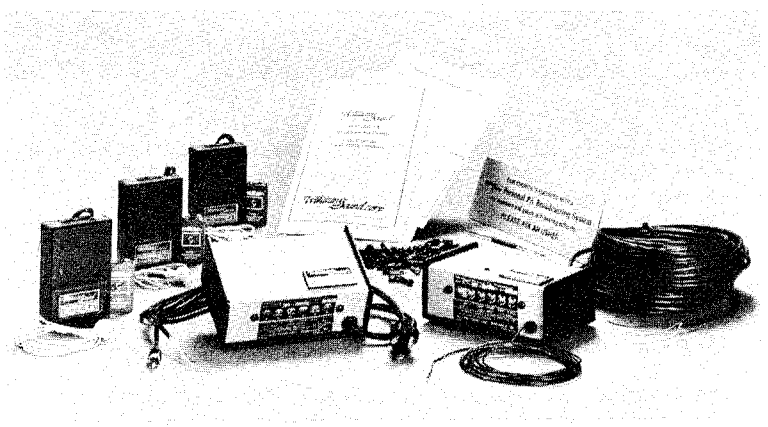
HARD OF HEARING SYSTEMS

We hear that many sound contractors install a hard of hearing system with every church sound system. In fact, the systems for the hard of hearing are so simple to install and inexpensive that it is reasonable to ask if any sound system should be installed without a system for the hard of hearing.

Williams Sound Corporation in Eden Prairie, Minnesota, and Communications Company in San Diego, California, are two companies that we are acquainted with that provide systems for the hard of hearing. Williams has the most extensive line as it is his only activity while Communications Company, an outstanding sound contractor, has developed an extensive line of products -- products that were designed by DAVE JOHNSON and VIC HALL because they could do a better job than what was on the market or they could do it so much cheaper than what was available, i.e., the Reverberation Timer for $600 when the only way to make reverberation measurements at the time was something like a $6,000 GR. They have a dozen similar items to make a sound contractor's life easier.

GERALD WILLIAMS worked for Control Data when he attended a Syn-Aud-Class in Minneapolis in 1974. A few years later we heard from him and his part time business of making systems for the hard of hearing has progressed to the point that he was able to go full time.

Williams manufactures an AM broadcasting system, a new FM system which will be shipped in early 1983, and a Pocketalker™ which allows people who do or do not wear hearing aids to "boost" the talker's level (and inexpensive - $125 approximately).



PERSONAL PA BROADCASTING SYSTEM

- Designed to meet the needs of hearing impaired individuals in churches, synagogues, auditoriums, and theatres.
- FM Transmitter and Power Unit connect to the existing sound system and broadcast the program or service throughout the listening area.
- Hearing impaired listeners use the compact, wireless receiver, pre-tuned to the transmitter.
- Preamplifier and microphones available for installations without sound systems.
- No seating restrictions, no "plugging in."
- Users control their own volume.
- Excellent sound quality, FM System inherently free from interference.
- No FCC license required, easy installation.
- Easily expandable, no limit to number of users.

THE BASIC SYSTEM

The Power Unit — Connects to the tape or line out jack of the sound system amplifier, or to the Williams Sound Preamplifier.

NEW FOR '83 FM SYSTEM!

Provides automatic level control and fully regulated power supply for the Transmitter. Features rugged design and low power consumption.

The Transmitter — Connects via a 4-conductor cable to the Power Unit. May be mounted adjacent to the Power Unit or remote from the sound system amplifier. An 80 inch, coaxial antenna and 50 foot coax cable may be mounted near the listening area, along a wall, ceiling beam, or moulding. Frequency-synthesized, phase locked-loop provides a stable signal and multi-channel capability for multiple-transmitter installations. System coverage in excess of 300 feet from antenna may be expected.

The Receiver — Compact, lightweight, easy to use. No tuning required, users control their own volume. High quality earphones are comfortable and provide excellent sound quality. Uses readily available 9V batteries (batteries included). Optional rechargeable batteries allow plug-in rechargeable convenience. The receiver and earphone are used in place of a hearing aid or as a supplement. A full range of receiver accessories is also available.

Installation Kit — Contains detailed Service and Installation Manual, all hardware, and all cables needed for a complete installation. A full range of accessories is also available to complement the Personal PA System.

Description	Price
Personal PA Basic System 3 receivers with batteries and earphones, Power Unit, Transmitter, audio cable, interconnection cable, antenna and coax, Instruction Manual, installation hardware, wall plaque and prepaid shipping and insurance via UPS:	$750.00
Additional Receivers with batteries and earphones when ordered with system	$ 45.00
When ordered later:	
1-3 receivers:	$ 48.00
4 or more:	$ 45.00

Prices and Specifications subject to change without notice.

Williams Sound corp.

Williams Sound Corporation, 6844 Washington Ave. So., Eden Prairie, MN 55344 (612) 941-2896 or 800-328-6190.

Continued next page....

Communications Company manufactures an Inductive Loop Pocket Type Paging and Hearing Aid System, ELA-1, which sells for $109 for the receiver.

INDUCTIVE LOOP POCKET TYPE PAGING AND HEARING AID SYSTEM

ELA-1

GENERAL DESCRIPTION
AND
APPLICATION NOTES

1. The ELA-1 is a high-gain, high-power, body worn, loop amplifier which may be used as a waitress call system, silent page system, actors prompting system and a hearing aid system for churches, theaters and other public places.
2. The system is comprised of an audio amplifier, a loop of cable, as many ELA-1 receivers as listeners and a program source.
3. The output current on an audio amplifier flows through an externally connected loop, encompassing the area where the listeners will be. The current in this loop creates a powerful inductive field.
4. When used as a hearing aid in large rooms, the hard of hearing person hears as though they were located at the microphone, eliminating the hearing problems associated with large spaces.
5. The ELA-1 is housed in a light weight, attractive, smoothly-finished anodized aluminum case.

Simple to operate, the ELA-1 has only one user control conveniently located at the top of the case. It is a combined ON-OFF switch and volume control.

No license is required for this system.

ELA-1 SPECIFICATIONS

Type:	High-gain, high-power, body worn.
Case:	Light weight, smooth-finished, bronze anodized aluminum, with stainless steel reversible clip.
Size:	2-9/16" x 1-1/2" x 11/16" (65 mm x 38 mm x 17 mm).
Weight:	1½ ounce (43 grams) with battery.
Inductive Pickup:	High sensitivity, 125 dB SPL (HAIC average) for 5 mA/m magnetic field. When used in the ear as a hearing aid.
Receivers:	100 ohm, center tapped, magnetic. No. 4121RD
Cords:	600:61 three conductor, tinsel. Length 20" (51 cm).
Volume Control:	Adjustable over a range of 40 dB uniformly with rotation.
Circuit:	Four stage, class AB push-pull output, temperature compensated silicon transistor amplifier.
Battery:	Eveready E401, 1.4V Mercury Cell, 800 mAh capacity. Current drain 5 mA idling. Operating current depends on sound input level, selector switch setting and volume control adjustment. Typical life 80 to 90 hours.

Accessories:
Horn & Cup Assembly: For collar or lapel use, No. 18309-003.
Ear Clip: Holds unit in ear, No. 870083.

Communications Company, 3490 Noell Street, San Diego, California 92110. (714) 297-3261. Ask them for their complete catalog of innovative, hard-to-find products like AF-3035 Adjustable Flasher, PP-2255 Projector Patch, RAD-30 Room Audio Director, RP-3030 Record Patch, CP-15 Cue Phone Amplifier, BONG-2 Burst Octave Noise Generator, ARA-412B Real Time Analyzer, RT60B Reverberation Time read out device, I-C 28 Programmable Dual Channel Amplifier.

If you have not installed systems for the hard of hearing, you will want to be in touch with Williams Sound and with Communications Company.

ATMOS - DIMMING CONTROLS

GERALD WILLIAMS of Williams Sound Corporation addressed our Minneapolis class in May on his hard of hearing systems. He mentioned that he had found a superior dimmer control made by Atmos-Dimming (Prescolite Lite Controls). We wrote Atmos for their catalog, which is very extensive with sections on cinema/theatrical systems, commercial (pre) engineered systems, component systems 2000 W and up, and dimmer switches 600 W to 2000 W.

If you aren't completely satisfied with your source of dimmers, contact Atmos Corporation, 1206 Tappan Circle, P. O. Box 173, Carrollton, TX 75006. Telephone (214) 242-6581.

BOSE - NEW SYN-AUD-CON SPONSOR

Syn-Aud-Con is pleased to announce a new sponsor, Bose Corporation in Framingham, Massachusetts.

In 1978 ROY KOMACK and JOHN CARTER from Bose attended a Syn-Aud-Con class in New York and since that time we have had a pleasant association with Bose.

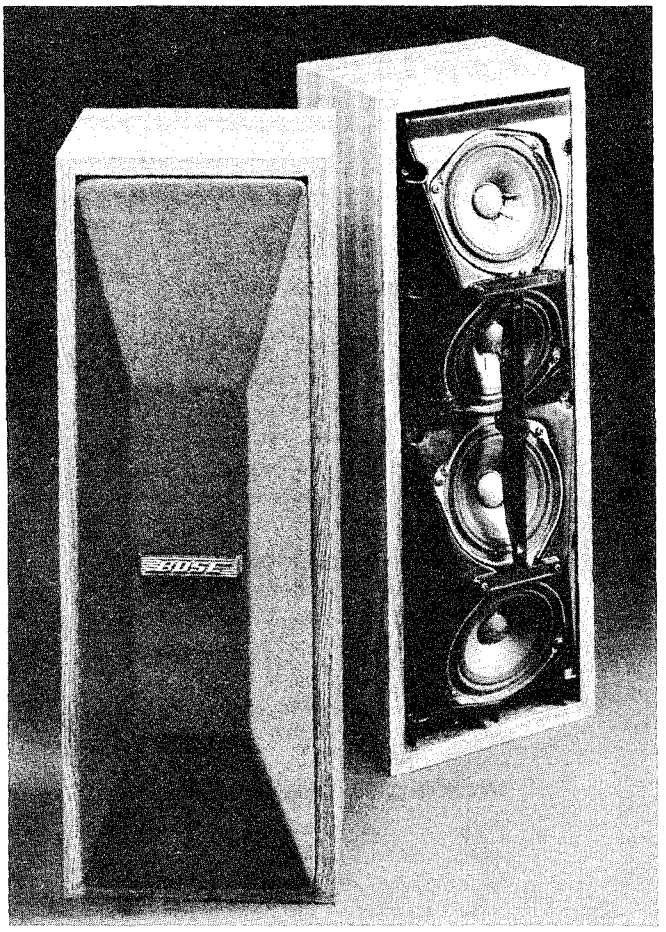
The Bose Corporation has charted a unique path for itself in our consumer audio industry and Syn-Aud-Con feels that their engineering depth coupled to their "systems" approach will result in innovative professional and commercial sound products.

Bose recently hired an exceptionally talented Syn-Aud-Con graduate, STEVE ROMEO from Boulder, Colorado, who is capable of helping solve just about any kind of systems problems a sound contractor might encounter.

We are including Bose Technical Data on the 402 and 402-W with this Newsletter. In our opinion, the 402 and 402-W Technical Data incorporates a nearly ideal method of specifying professional sound products.

Bose Corporation was founded in 1964 by Dr. Amar G. Bose, a Professor of Electrical Engineering at M.I.T. The company's commercial activities got into high gear with the introduction of the Bose 901 in 1968. Bose has grown steadily since that time with its products now represented in home high fidelity, car stereo, portable sound reinforcement, and engineered sound.

Bose has become known for its innovative and unconventional products in all of its business areas. A strong engineering department of over 60 people has produced advanced packages such as the 802 and 402 portable speaker systems, the Articulated Array™ acoustic designs, and a variety of Direct/Reflecting® speakers for the home environment.



Bose 402-W

Bose Corporation has manufacturing facilities in Massachusetts, Canada and Ireland and maintains sales subsidiaries in Japan, Australia, and all of the major countries of Europe. Their workforce now totals over 1,000 people worldwide. The people at Bose are looking forward to the synergy that will come from their affiliation with Syn-Aud-Con in their program to participate more vigorously in the installed sound system business.

A NOTATIONAL FORM CONFUSING TO SOME

In our work in acoustics and audio we encounter equations using the Napieran base "e." These take two forms. The first "e^{X}" and the second "e^{iX}" are handled in entirely different ways.

"e^{X}" means the base 2.718281828···· raised to the 'χ' power or exponent.

"e^{iX}" is the exponential form of notation for expressing the "polar" coordinates of a set of "rectangular" coordinates on the Agrand plane or similar vector forms. "e^{iX}" is identical to "the phase angle" in notations such as $Ze^{i\Theta} \equiv Z\angle\Theta$.

To solve e^{X} we merely place our unknown in the "χ" register of an HP-41 and press the e^{X} key.

To solve e^{iX} we use the relationship $e^{iX} = \cos\chi + i \sin\chi$, where "$\chi$" normally is in radians. Thus, if $\Theta = 45^{\circ}$ (i.e., $\pi/4$ radians), then by placing $\pi/4$ in register "y" and 1.0 in register 'χ' and pressing S.K (shift key) followed by P→R (polar to rectangular) we obtain the ratio between rectangular coordinates 0.707 to 0.707 or 1 to 1. If we now return the HP-41 to the degree mode (exQ, alpha, DEG, alpha and then press S.K, R→P, we find our 1.0 in the 'χ' register and by $x \overset{\rightarrow}{\leftarrow} y$ we find that indeed $\pi/4$ equals 45°.

If it seems we have put a lot of e^{iX} in recent Newsletters and Tech Topics, it's because that's the language you'll want to speak with the upcoming TEF® analyzer.

NASHVILLE – SEPTEMBER 28–30, 1982

ORLANDO – OCTOBER 6–8, 1982

NOVEMBER TEF® WORKSHOP

The November 16 - 18, 1982 TEF® Workshop was a fully attended dynamo of uncharted and, at times, semi-under control new insights into old problems.

Departing from our normal practice, we are not issuing the 12 page Tech Topic on the accomplishments of this workshop except to those who attended. We will be sharing much of importance from the current TEF measurements in future Newsletters, but we're supporting these pioneer TEF users by not prematurely publishing the remarkable data they are in the process of gathering and evaluating.

Dick Heyser's letter of endorsement for the Tecron TEF analyzer is reproduced here.

Attendees,

May I take this opportunity to welcome you to this latest Synergetic Audio Concepts Class. Unfortunately because of prior commitments I cannot be with you in person, but consider me there in spirit.

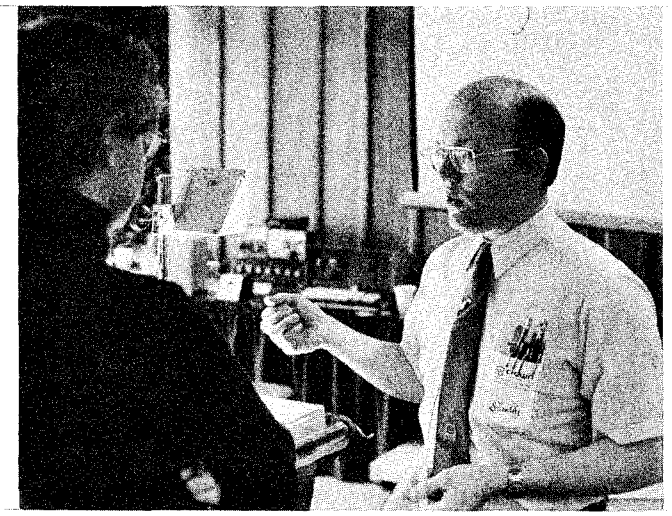
You will have the opportunity to be among the first to gain hands-on experience with the all-digital Tecron TEF Analyzer. Gerald Stanley has done a fantastic job in developing this instrument and I am enthusiastic not only about its present performance, but its virtually unlimited capability for expansion.

The TEF System 10 had its baptism under fire at the recent AES Convention when it was used to measure a stage playback loudspeaker in an auditorium, with people moving around and talking, and with almost no reasonable time to set up, measure, and tear down prior to the next paper session. It functioned flawlessly and uncovered a problem which could be corrected on the spot. The stage system had been set up in the best MI tradition - if one system will do, then a second system stacked on top and run in parallel will do better. The TEF analyzer spotted the one inch offset between stacked systems and showed the deep interference notches which were created by this condition, then demonstrated that disconnecting the lower box gave quite good sound. From that time onward, the lower speaker box was disconnected and used in its proper task as a loudspeaker stand.

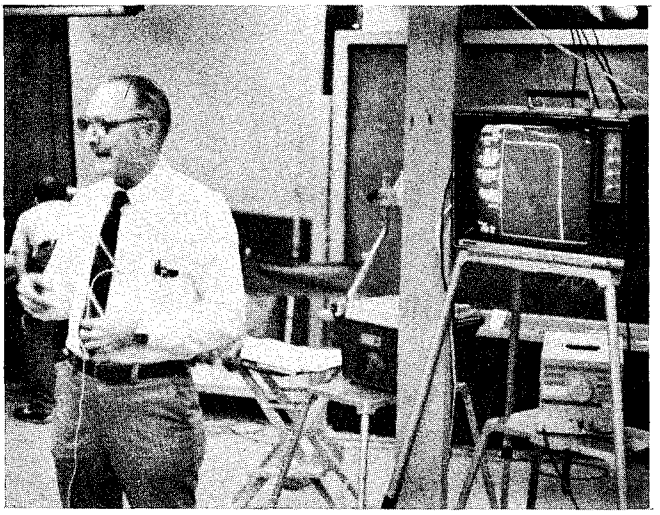
Enjoy the class.

s/Richard C. Heyser
Pasadena, California
November 12, 1982

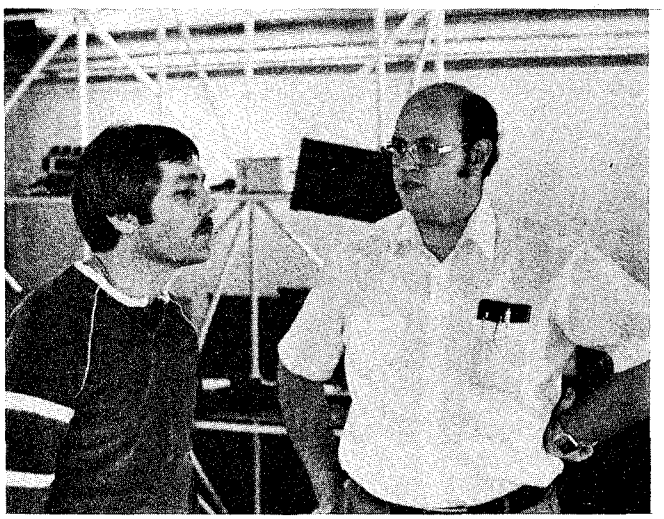
Dick Heyser
in
TEF® Workshop
Feb. 10 - 13,
1981



GERALD R. STANLEY, Designer of the TEF® analyzer



DR. EUGENE T. PATRONIS, JR., Georgia Tech, Atlanta, GA.



DON EGER (right) with CHIPS DAVIS (left)

Continued next page...

The next TEF Workshop is scheduled for February 1 - 3, 1983, and will concentrate on the interpretation of TEF data in terms of real life acoustical and electronic devices. Dr. Patronis will again "chair" the workshop and JOHN CARTER, Manager of Acoustic Research at Bose Corp. will assist Dr. Patronis in the analysis of loudspeaker artifacts that appear during the measurements. The Bose Corp. attainments in the analysis of automotive interior acoustics during the past three years through the use of computer controlled measurements has given them a headstart in such analysis.

If you want to know what TEF is all about and come away with the realization that you can do it too, then this workshop is for you.

ROD GOLDHAMMER of Sunn Musical with Gerald Stanley.

Gerald Stanley talking with Don, Dr. Patronis and BOB SCHULEIN of Shure Brothers.

MARK UREDA of Altec with JOHN PROHS and DAVID HARRIS of "Sphere" fame.

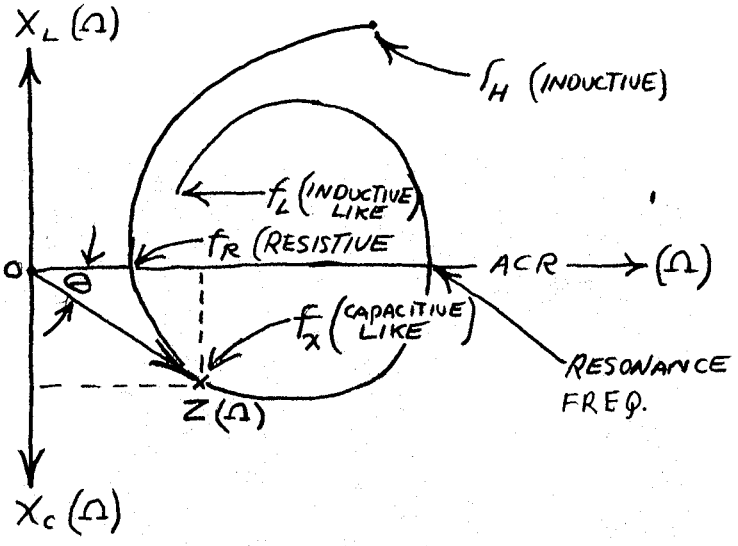
HANS SAHLIN and CHRISTER GUSTAVSSON of the Swedish Local Radio Corporation, Stockholm, Sweden.

Dr. Patronis explaining "wrap around" to MARY GRUSZKA and DAVE ANDREWS.

A measurement team analyzing their measurements.

INTERPRETING IMPEDANCE CURVES

Interpreting "Complex" Impedance Curves



$$Z = \sqrt{(ACR)^2 + (X_L - X_C)^2},$$

$$\theta = TAN^{-1}\left(\frac{(X_L - X_C)}{ACR}\right) = Z_{L\theta} = Ze^{i\theta}$$

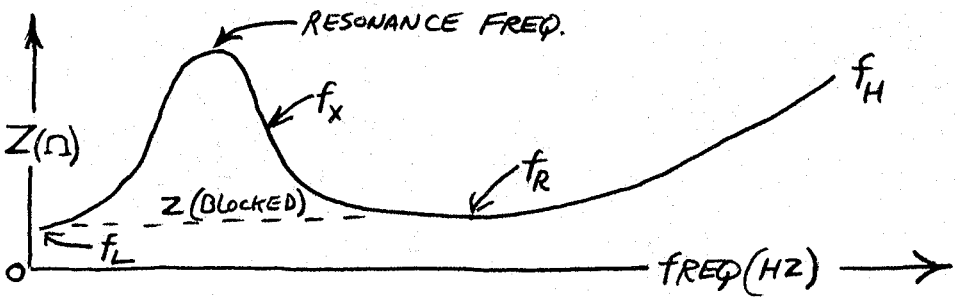
And:

$$ACR = Z\cos\theta, \quad (X_L - X_C) = Z\sin\theta$$

$$(X_L - X_C) = \sqrt{Z^2 - (ACR)^2}$$

Where:
- X_L is inductive reactance in Ohms
- X_C is capacitive reactance in Ohms
- ACR is ac resistance in Ohms
- Z is the impedance in Ohms
- θ is the phase angle in degrees (as in $Z_{L\theta}$) or in radians (as in $Ze^{i\theta}$), (COSθ) = Power Factor (P.F.)
- 0 is the origin point (zero Ohms)
- OZ is the impedance vector Z (magnitude)
- f_L is the lowest frequency measured
- f_H is the highest frequency measured
- F_X is any specific frequency measured

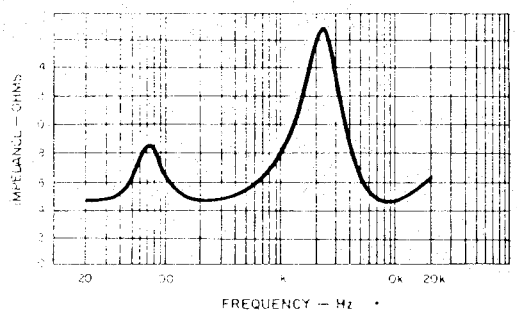
Interpreting "Magnitude" of Impedance Curves



Additional Notes on Impedance Measurements

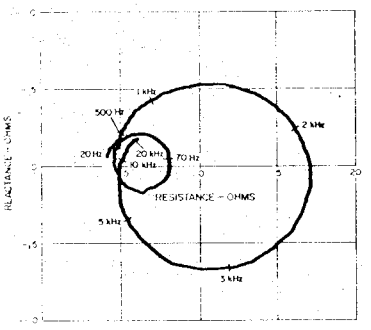
Care should be taken to distinguish between "lumped" and "distributed" parameters. Monitoring of current and voltage phase relationships allow such distinction. (Eli the ice man)

"Motional" Z is found by measuring "blocked" Z. When phase angle calculated for an f_X from the "magnitude" mode does not match the phase angle actually measured, it may be a non-minimum phase frequency for the given device.



←Magnitude of terminal impedance.

Complex → impedance plot.



Heyser review of Black Night. From Audio Magazine, August 1982

LEDE™ CONTROL ROOM IN SWEDEN

INGEMAR OHLSSON of Audio Data Lab, Stockholm, Sweden, recently attended the TEF® Workshop here at the Seminar Center. (Ingemar had formerly attended a regular Syn-Aud-Con class at the center plus the special one day class in Montreaux, Switzerland last year.) He brought along with him photographs of Park Studio in Stockholm, which is, as far as we are aware, Sweden's first LEDE control room. Ingemar uses the Bruel and Kjaer TDS equipment and has on order, in addition, a Tecron TEF System 10.

The Park Studio control room was rebuilt within an existing "shell" in the summer of 1981. Control room size is 7x5x3.2 meters with an acoustic crossover to "mode control" at 320 Hz. Ingemar tells us he has an initial time delay gap in this room of 10 msec. He achieved rear wall diffusion by using alternate areas of absorption and hard surfaces.

It occurred to us in looking at these pictures that there are certain activities of mankind that know no language or cultural barriers: Flying an airplane, skiing, target shooting, computers, and recording arts and sciences. If this seems trivial, then think of the major differences in language, music, dress, cars, etc. We're grateful to recognize that audio supports all meanings of the word "communicate."

CALCULATING WARBLE TONE BANDPASS VALUES

Given:

A "warble tone" labeled 1/10 octave and centered on 2000 Hz. Find its bandpass in Hz and as a percentage of the center frequency.

Solution:

First, recall that bandpasses labeled 1/10 octave are actually $1/33^{1}/_{3}$ of a decade (i.e., 33-1/3 SERIES spacings in the Renard number system). Next, remember that in the Renard number system the exact numbers used for spacing f_Cs is not the same as the label except at even decades. Therefore, an f_C labeled 2000 Hz is actually 1,995.26 Hz (to two places).

In *SOUND SYSTEM ENGINEERING*, page 174, Equations 9-4 and 9-5 give an easy solution.

$$0.5^{(0.5)(1/10)} \times 1{,}995.26 = 1{,}927.29 \text{ Hz}$$

and

$$2.0^{(0.5)(1/10)} \times 1{,}995.26 = 2{,}065.62 \text{ Hz}$$

$$(2065.62 \text{ Hz} - 1927.29 \text{ Hz}) = 138.33 \text{ Hz}$$

$$\chi\% \text{ of } 1995.26 \text{ Hz} = 138.33 \text{ Hz}$$

or

$$\chi\% = \left\{\frac{138.33 \text{ Hz}}{1995.26 \text{ Hz}}\right\} \times 100 = 6.9\%$$

Proof:

$$\text{Octave interval} = \frac{\ln\left\{\frac{2065.62}{1927.29}\right\}}{\ln 2} = 0.10$$

THE DELAY COMB FILTER - USEFUL EQUATIONS

By Joseph G. Mitchell
Saint Germain Foundation, Schaumburg, Illinois

The delay can be expressed either as a time in secs or a distance in feet or meters. The delay predicts the "initial null frequency" (INF) and the null frequency interval (NFI)(i.e., the distance in Hz between nulls).

Basic Equations

$$INF = 0.5\left(\frac{c}{D}\right) \qquad NFI = \frac{c}{D}$$

$$D = 0.5\left(\frac{c}{INF}\right) \qquad D = \frac{c}{NFI}$$

$$c = \frac{D(INF)}{0.5} \qquad T = \frac{D}{c}$$

$$D = Tc$$

Where: c is the velocity of sound in ft or meters per sec

D is the distance in ft or meters of the delay

T is the delay time in secs

Example No. 1

We observe a 1.0 msec time delay causing a comb filter. What is the INF? What is the NFI? What are the first three null frequencies? What is the delay expressed as a distance in ft?

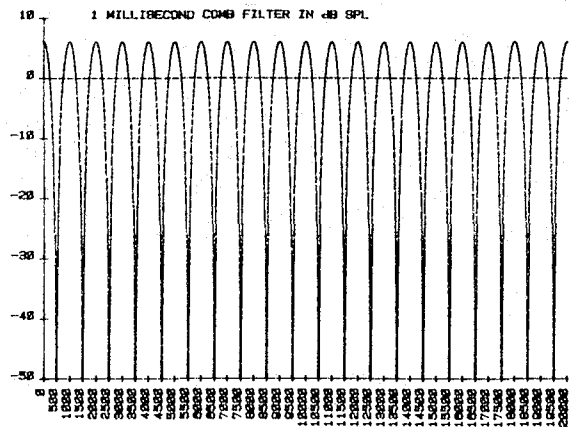


FIGURE NO. 1

$$D = Tc$$

$$D = .001(1130) = 1.13 \text{ ft}$$

$$INF = 0.5\left(\frac{c}{D}\right)$$

$$INF = 0.5\left(\frac{1130}{1.13}\right) = 500 \text{ Hz}$$

$$NFI = \left(\frac{c}{D}\right)$$

$$NFI = \left(\frac{1130}{1.13}\right) = 1000 \text{ Hz}$$

The first three null frequencies are:

INF, (INF + NFI), (INF + NFI + NFI)

500, (500 + 1000), (500 + 1000 + 1000)

500 Hz, 1500 Hz, 2500 Hz

(See Figure No. 1)

Example No. 2

The INF = 10,000 Hz. What is the delay time (T) and the delay distance(D)?

$$D = 0.5\ \frac{c}{INF}$$

$$D = 0.5\ \frac{1130}{10,000} = 0.0565 \text{ ft}$$

(i.e., 12(0.0565) = 0.678")

$$T = \frac{D}{c}$$

$$T = \frac{0.0565}{1130} = 0.000050 \text{ secs}$$

(i.e., 50 usecs)

(See Figure No. 2)

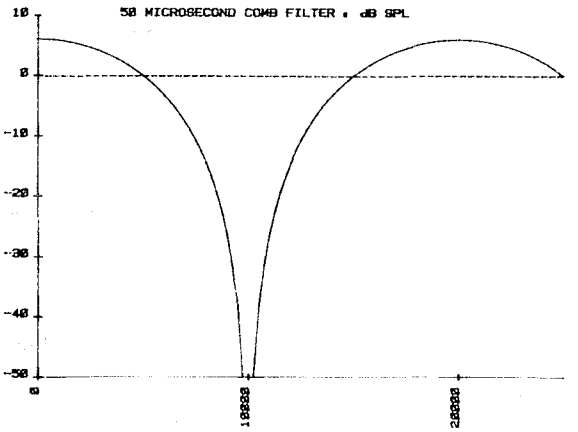


FIGURE NO. 2

Continued next page....

Example No. 3

We have a T = 15 usec (i.e., 0.000015 secs). What is the INF? What is the delay in inches?

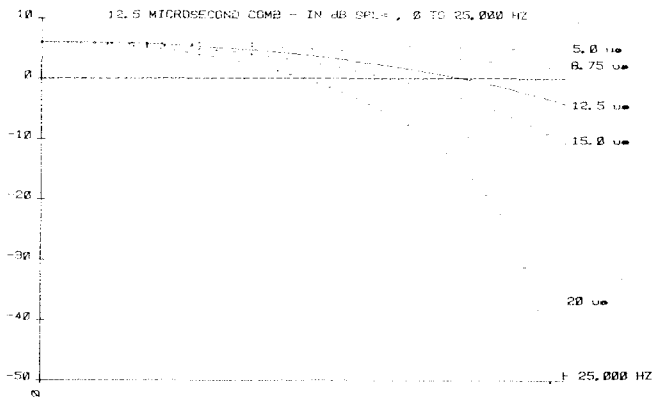


FIGURE NO. 3

$$D = Tc$$

$$D = 0.000015(1130) = 0.01695 \text{ ft}$$

$$\text{or} \quad 12(0.0169 \text{ ft}) = 0.2034"$$

$$INF = 0.5\left(\frac{c}{D}\right)$$

$$INF = 0.5\left(\frac{1130}{0.01695}\right) = 66{,}666.66\cdots \text{Hz}$$

(See Figure No. 3)

Just as a single glance at a Lissajous figure tells us frequency ratios so a single glance at a set of comb filters can provide us with a wealth of delay information.

"BASIC" TIME EQUATIONS

In *SOUND SYSTEM ENGINEERING* we write the conventional distance, velocity (rate of propagation) and time (time delay) as:

$$D = VT \qquad V = \frac{D}{T} \qquad T = \frac{D}{V}$$

Using these equations allows for quick solutions to standard problems. For instance, it is 3,000 miles across the United States. Assuming a telephone call traveled at the speed of light (186,000 miles/sec), how long would it take a signal to travel 3,000 miles?

$$T = \frac{D}{T} = \frac{3{,}000}{186{,}000} = 0.016 \text{ secs} \qquad \text{or 16 msecs}$$

Remember our friend, Joe, a block and a half away hearing our *acoustic* signal (assume a block is 1/8 mile):

$$T = \frac{(1/8 + .5(1/8))(5280)}{1130} = 0.876 \text{ secs} \quad \text{or 876 msecs}$$

Equations Rewritten in Time Delay Form

We can easily adapt these general case equations into a useful special case set with regard to time delay T_D problems.

$$D = T_D \text{ (velocity of medium)}$$

$$T_D = \frac{1}{f} = \frac{D}{\text{(velocity of medium)}}$$

$$f = \frac{1}{T_D} = \frac{\text{(velocity of medium)}}{D}$$

Where: The f is the frequency of the first notch caused by the T_D between two signals

These are quite useful forms because the Tecron TEF® analyzer can easily and very accurately provide both f and T_D from the cursor readout. This means we can then instantly find D.

$$D = \frac{\text{(velocity of medium)}}{f} \qquad \text{and} \qquad D = T_D \text{ (velocity of medium)}$$

Handy Velocity Numbers

$$1130 \text{ ft/sec} = 13{,}560 \text{ in/sec}$$

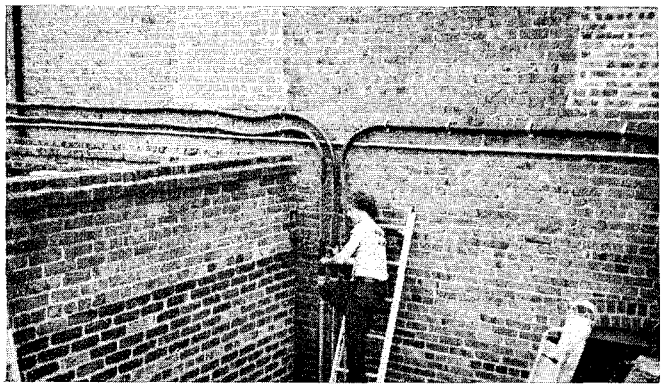
$$186{,}000 \text{ mi/sec} = 982{,}080{,}000 \text{ ft/sec} = 11.78496 \times 10^9 \text{ in/sec}$$

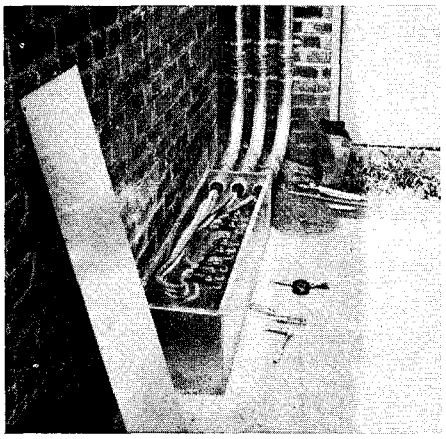
To convert tenths of feet to inches, multiply by 12. To convert tenths of inches to fractions of an inch, multiply the value in tenths of an inch times the fraction value desired (i.e., 4ths, 8ths, 16ths, etc.).

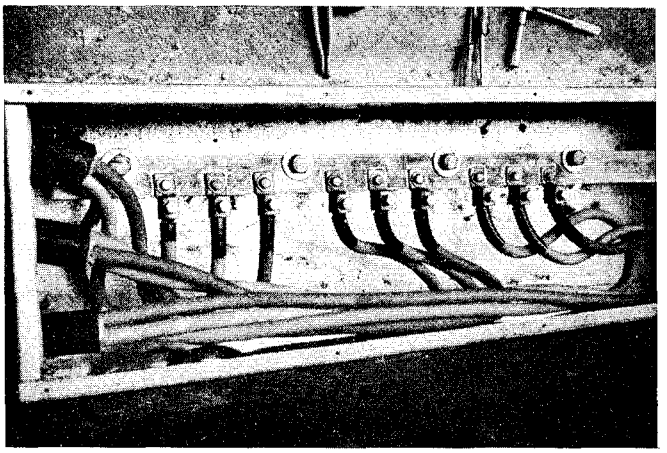
$$\frac{0.5 \text{ inches} \times 16}{16} = 8/16\text{ths of an inch} \qquad \frac{0.5 \text{ inches} \times 4}{4} = 2/4 \text{ or } 1/2 \text{ of an inch}$$

WELL GROUNDED IN AUDIO

Are you well grounded in audio? Certainly Alpha Audio in Richmond, Virginia, is. Here are some photographs brought in by KIRK BOWLING and DAVE JONES during the Washington, D.C., class. I don't know how the rest of you feel, but I'm impressed.







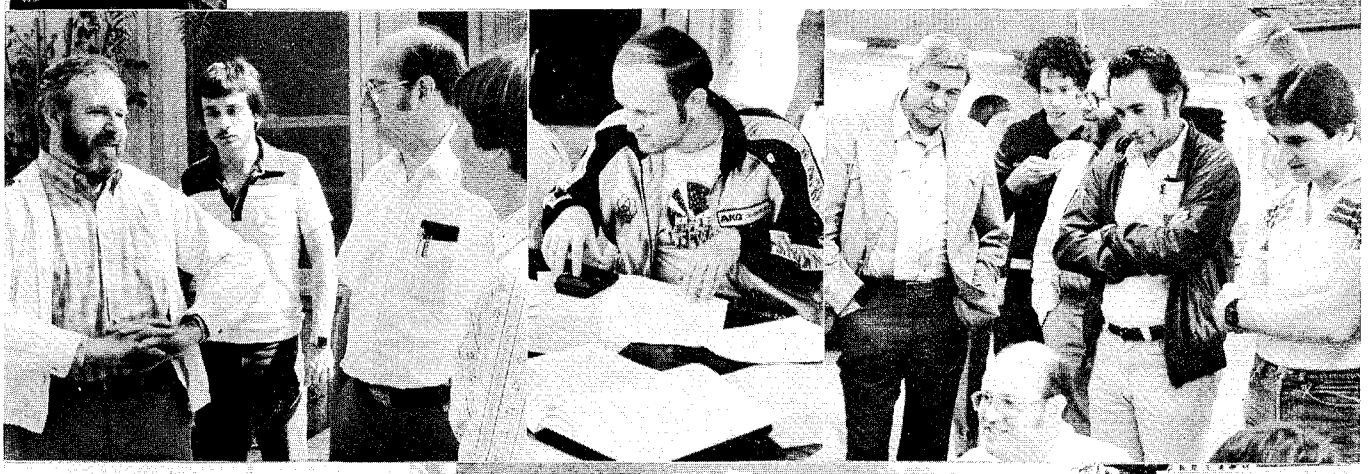
ERRATA

V9 N4, p. 8 - LEVEL AND TIME DIFFERENCES:

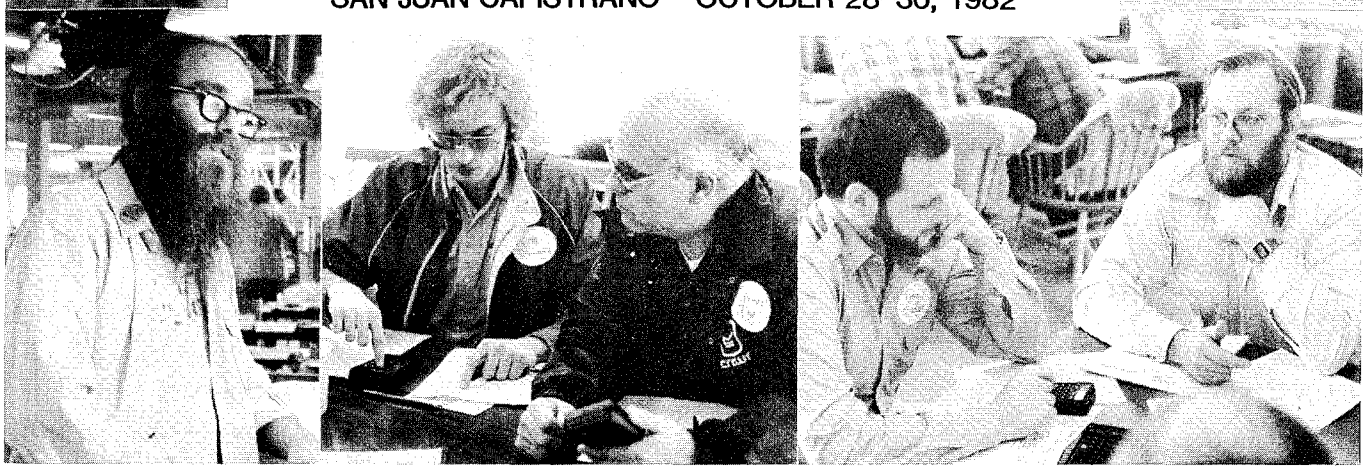
> *During the Minneapolis class, we were able to demonstrate the highly audible effect caused by two loudspeakers at equal level but about 1" out of time alignment. (This effect sounds like a low pass filter is in the circuit.) At this point in the demonstration we tried mixing in a second demonstration. We switched in and out our 3dB pad on one of the two loudspeakers. The results were startling to say the least. Over the majority of the listening area the subjective loudness increased by 10 dB when one of the two equal level loudspeakers was dropped by 3 dB.*

We were able to demonstrate *"the highly audible effect caused by two loudspeakers at equal level but about 1" out of time alignment,"* but there is *"not a subjective loudness increase of 10 dB when one of the two equal level loudspeakers is dropped by 3 dB."* We had a switch mislabeled, as FARREL BECKER pointed out to us in the DC class.

SAN JUAN CAPISTRANO – OCTOBER 19–21, 1982



SAN JUAN CAPISTRANO – OCTOBER 28–30, 1982



APPLES, OSBORNES AND TECRONS

The ABC's will soon be Audio, Brains, and Computers. When all three come together, real synergy is developed.

Like Biblical times when Joshua made the sun and moon stand still, one of these devices can use up a day before you think: it's 10:00 in the morning.

GERALD STANLEY of Tecron/Crown is the designer of the TEF analyzer. Marshall Buck of Cerwin-Vega in the background.

JIM WORDINGER, project engineer for the Tecron System 10.

KEN WAHRENBROCK's Osborne, JOHN LABERDIE's Apple, and Tecron's TEF® System 10 manned by DON EGER and JIM WORDINGER. (Jim Wordinger is the Project Engineer of the TEF® project who worked closely with Chief Designer, GERALD STANLEY.)

Note the interested bystander looking over DON EGER's shoulder.

MAY I SPEAK TO YOUR SUPERIOR?

Down in Texas, an irate customer talking to a merchant on the telephone asked, "May I speak to your superior?" Back came the answer, "I have *no* superiors and damn few equals."

Inherent in many humans is the seemingly inborn desire to serve a master (usually a King or other exalted title). Counter to this thought is the man quoted above, who would rather starve free than feed full as an "inferior."

Respect for authority is a noble trait, so long as it is strictly limited to the area of authoritative expertise. The man or woman who dedicates a portion of their life to achieving genuine dominance over a universal problem deserves respect and admiration *for that accomplishment.*

A recent article in *U. S. News* discussed so-called superior class Americans and how they supposedly set standards for the rest of us. The writer, apparently an academic snob, proceeded to describe a herd of fad followers as, in his opinion, leaders of thought here in America. We were interested to read in the letters to the editor shortly thereafter a flood of disapproval of the entire concept. It seems the man in Texas is not a loner.

Abraham Lincoln is reported to have said, "I don't like that man; I'll have to get to know him better." Indeed, most humans possess deep pools of talent not discernible at first meeting, but a short acquaintance with Channel 19 reveals how well a few can hide all human traits.

THE "ELEPHANT" PROGRAM FOR LOW FREQUENCY ENCLOSURE DESIGN

DAVID HARRIS has struck again, this time with a Japanese "Sharp" calculator. Multicolor graphics, boxed-in charts, scaled frequency plots, and apparently lots of data storage. The printouts shown here are but a small part of the current programming effort DAVID HARRIS and JOHN PROHS are involved with. We found these elegant, useful and unique. All of this simply goes to show there's more than one way to handle an elephant. As the African hunter replied, one way to stop a charging elephant is to take away his credit card.

VENTED BOX

DRIVER?
ELEPHANT

FS? 25
VAS (FT^3)? 10
QTS? 0.4

MAXIMALLY FLAT BOX

ELEPHANT
VB (FT^3) = 8.25
FB = 23.98
F3 = 22.89
dB RIPPLE = 0.49

Extended Pass?

Non Flat?

DUCT
(From the last VB and FB.)

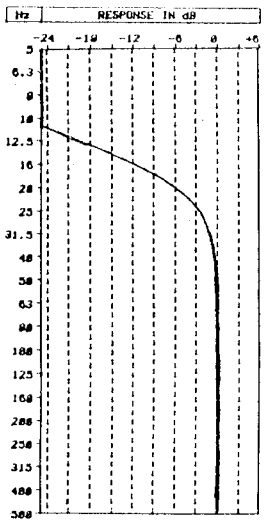
DU (IN)? 4.00
LU (IN) = 4.20

Rerun Duct?

Plot Response?

FREQUENCY RESPONSE
(APPROXIMATED)

ELEPHANT
VB (FT^3) = 8.25
FB = 23.98
F3 = 22.89
dB RIPPLE = 0.49



EXTENDED BASS BOX

ELEPHANT
VB (FT^3) = 10.49
FB = 21.89
F3 = 20.81
dB RIPPLE = -0.12

Non Flat?

DUCT
(From the last VB and FB.)

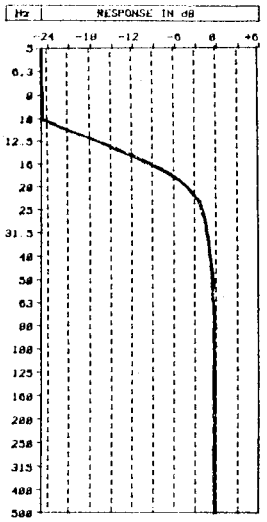
DU (IN)? 4.00
LU (IN) = 3.81

Rerun Duct?

Plot Response?

FREQUENCY RESPONSE
(APPROXIMATED)

ELEPHANT
VB (FT^3) = 10.49
FB = 21.89
F3 = 20.81
dB RIPPLE = -0.12



NON FLAT BOX

VB (FT^3)? 30

ELEPHANT
FB = 16.58
F3 = 12.91

(F3 may not be accurate because Non Flat VB is over 1.5 times greater than Max Flat VB.)

dB RIPPLE = -2.86

Rerun Non Flat?

DUCT
(From the last VB and FB.)

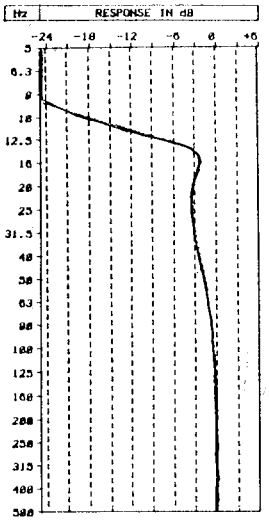
DU (IN)? 4.00
LU (IN) = 1.17

Rerun Duct?

Plot Response?

FREQUENCY RESPONSE
(APPROXIMATED)

ELEPHANT
VB (FT^3) = 30.00
FB = 16.58
F3 = 12.91
dB RIPPLE = -2.86



NON FLAT BOX

VB (FT^3)? 3

ELEPHANT
FB = 32.04
F3 = 35.89
dB RIPPLE = 3.13

Rerun Non Flat?

DUCT
(From the last VB and FB.)

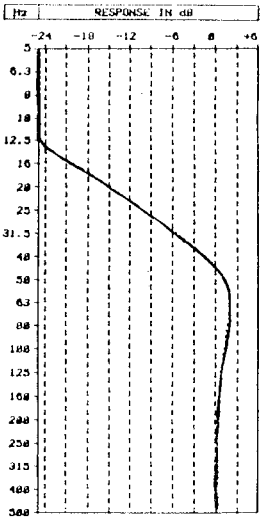
DU (IN)? 4.00
LU (IN) = 8.08

Rerun Duct?

Plot Response?

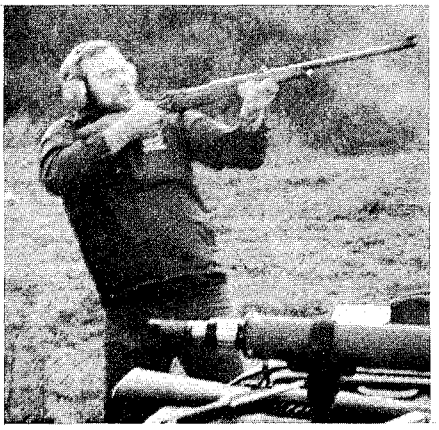
FREQUENCY RESPONSE
(APPROXIMATED)

ELEPHANT
VB (FT^3) = 3.00
FB = 32.04
F3 = 35.89
dB RIPPLE = 3.13

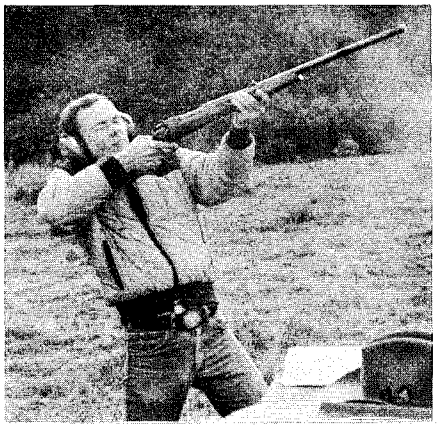


THE RANCHO CARRILLO ELEPHANT HUNT

Headlines: A newspaper declaring "ELEPHANTS SEEN NEAR RANCHO CARRILLO!" appeared at the door of our room in the Disneyland Hotel during the Anaheim AES Convention. That should have alerted us. Subsequent headlines appeared nearly every day. When we arrived back at our offices in Rancho Carrillo, Jan Kreitz, our office manager, told us she had been hearing noises like there were extra large animals out in the forest. Later she asked if it was all right to let DAVE ANDREWS, CHIPS DAVIS and "BIG JOHN" LABERDIE have some hay.



JEFF JOHNSON



JIM WISCHMEYER

CHIPS DAVIS

GREG PRANIEWICZ

All of this because we tend to feel everyone should have an elephant rifle even if they're not a Democrat.

We finally met this rampaging herd out at the target range and proceeded to have the first Rancho Carrillo elephant shoot. Just in case you think it doesn't take courage to face a stuffed toy elephant, one look at the expressions on the first two shooters' faces will convince you otherwise. A Weatherby 460 magnum "kills at both ends."

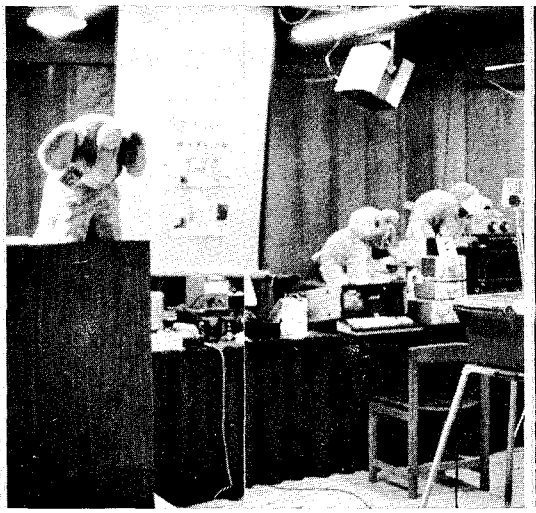
The classic "African Hunter" picture is SYLVIA EGER's "who's afraid of an elephant rifle" attitude. Note her alignment with the sights even in full recoil. The second shot is her elephant, which she retrieved after drilling it cleanly and accurately. The next picture reveals the type of minds behind such scenes, namely, Dave Andrews and "Big John" Laberdie.

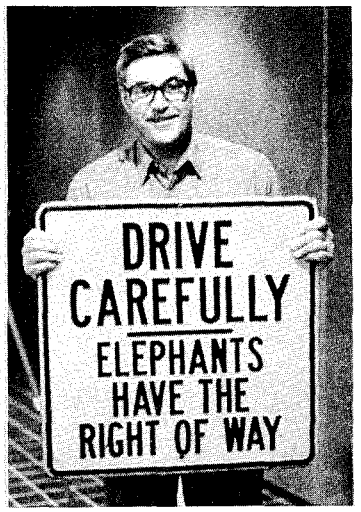
SYLVIA EGER

DAVE ANDREWS, DON and JOHN LABERDIE

Within a few days only, rumors had spread all over the world regarding this shoot. Note the road sign, shown to me but taken back by the owner; the Thanksgiving card that arrived from the DAVID HARRIS's; and finally the capture of still another species shipped back to us at Rancho Carrillo by JOHN PROHS with accompanying missive.

Continued next page.....





Missive from John Prohs:

One cool, dark night while traversing the wilds of the Pocono Mountains we happened upon the most extra-ordinary, unbelievable, stupendous creature as to defy our diminutive imaginations. There crouched on an enchanted shelf within a truck stop shop was an ancient, totally other-worldly animal, the likes (of which) *we'd never seen. We nervously hurried close and spied an eight inch pachyderm.*

We immediately reasoned, "Where could so strange an animal have come from?"

"Ah! But of course! The Davis ranch on Syn-Aud-Con Hill!" That famous elephant stalker of world renown, Don Davis, had never allowed a pachyderm of great size to trample his domain. But it had been rumored that the survival of the fittest had again asserted itself by the evolutionary adaptation to a miniature elephant so small as to be imperceptible in the sights of an elephant cannon.

Suddenly, the shelf shook! Could a customer have run into it? No! The eight inch pachyderm was trying to make his escape.

David seized the pachyderm by the nose while John quickly drew out his wallet and under extreme physical duress we captured the critter. Now, at last, we send him to you, back to the ranch he undoubtedly once knew.

We trust he won't escape you again--at least not until he gets too big.

Farewell, and good-bye.....until the elephant cannon fires again!

ELEPHANTS SEEN NEAR RANCHO CARRILLO

ELEPHANT RIFLE TO THE RESCUE

DAVIS CAPTURES ELEPHANT HERD

Recently there have been rumors of converting the Goodyear Blimp into an elephant or renting a circus beast. Please, Please!!! All this can be handled easily by everyone contributing to the sending of Don to Africa on an elephant hunt (camera hunt). We also accept gifts of 600, 577 and 470 nitro express best grade English double barrel rifles.

USEFUL MATH TOOLS

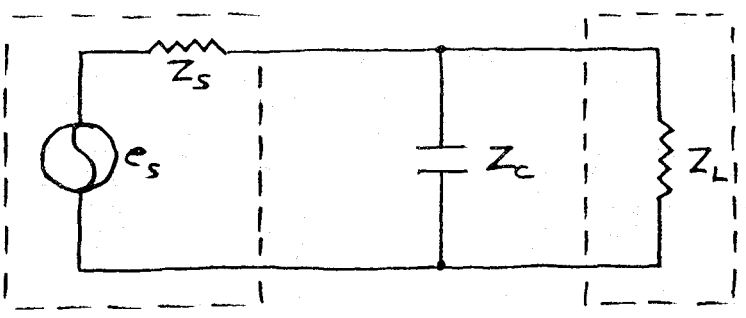
NUMERICAL VALUES

Numerical Magnitude	Power Ten Is Raised To	Prefix	Symbol
1 000 000 000 000	10^{12}	Tera	T
1 000 000 000	10^{9}	Giga	G
1 000 000	10^{6}	Mega	M
1 000	10^{3}	Kilo	k
100	10^{2}	Hecto	h
10	10^{1}	Deka	dk
(10^{0} = 1.0 Unity)			
0.1	10^{-1}	Deci	d
0.01	10^{-2}	Centi	c
0.001	10^{-3}	Milli	m
0.000 001	10^{-6}	Micro	u or μ
0.000 000 001	10^{-9}	Nano	n
0.000 000 000 001	10^{-12}	Pico	p
0.000 000 000 000 001	10^{-15}	Femto	f
0.000 000 000 000 000 001	10^{-18}	Atto	a

TRIGONOMETRIC FUNCTIONS IN TERMS OF EACH OTHER

SIN θ	$\underline{\text{SIN } \theta}$	$\sqrt{1 - \text{COS}^2\ \theta}$	$\frac{\text{TAN } \theta}{\sqrt{1 + \text{TAN}^2\ \theta}}$	$\frac{1}{\sqrt{1 + \text{COT}^2\ \theta}}$	$\frac{\sqrt{\text{SEC}^2\ \theta - 1}}{\text{SEC } \theta}$	$\frac{1}{\text{CSC } \theta}$
COS θ	$\sqrt{1 - \text{SIN}^2\ \theta}$	$\underline{\text{COS } \theta}$	$\frac{1}{\sqrt{1 + \text{TAN}^2\ \theta}}$	$\frac{\text{COT } \theta}{\sqrt{1 + \text{COT}^2\ \theta}}$	$\frac{1}{\text{SEC } \theta}$	$\frac{\sqrt{\text{CSC}^2\ \theta - 1}}{\text{CSC } \theta}$
TAN θ	$\frac{\text{SIN } \theta}{\sqrt{1 - \text{SIN}^2\ \theta}}$	$\frac{\sqrt{1 - \text{COS}^2\ \theta}}{\text{COS } \theta}$	$\underline{\text{TAN } \theta}$	$\frac{1}{\text{COT } \theta}$	$\sqrt{\text{SEC}^2\ \theta - 1}$	$\frac{1}{\sqrt{\text{CSC}^2\ \theta - 1}}$
COT θ	$\frac{\sqrt{1 - \text{SIN}^2\ \theta}}{\text{SIN } \theta}$	$\frac{\text{COS } \theta}{\sqrt{1 - \text{COS}^2\ \theta}}$	$\frac{1}{\text{TAN } \theta}$	$\underline{\text{COT } \theta}$	$\frac{1}{\sqrt{\text{SEC}^2\ \theta - 1}}$	$\sqrt{\text{CSC}^2\ \theta - 1}$
SEC θ	$\frac{1}{\sqrt{1 - \text{SIN}^2\ \theta}}$	$\frac{1}{\text{COS } \theta}$	$\sqrt{1 + \text{TAN}^2\ \theta}$	$\frac{\sqrt{1 + \text{COT}^2\ \theta}}{\text{COT } \theta}$	$\underline{\text{SEC } \theta}$	$\frac{\text{CSC } \theta}{\sqrt{\text{CSC}^2\ \theta - 1}}$
CSC θ	$\frac{1}{\text{SIN } \theta}$	$\frac{1}{\sqrt{1 - \text{COS}^2\ \theta}}$	$\frac{\sqrt{1 + \text{TAN}^2\ \theta}}{\text{TAN } \theta}$	$\sqrt{1 + \text{COT}^2\ \theta}$	$\frac{\text{SEC } \theta}{\sqrt{\text{SEC}^2\ \theta - 1}}$	$\underline{\text{CSC } \theta}$

MICROPHONE CABLE CAPACITANCE EFFECTS



$$\text{Loss in dB} = 20 \text{ LOG } \left[1 + \frac{(Z_S\ Z_L)}{Z_C(Z_S + Z_L)}\right]$$

Where: Z_C is equal to $X_C = \left(\frac{1}{2\Pi fc}\right)$

Where: f is frequency in Hz
c is capacitance in Farads
X_C is the reactance

Z_S is the source impedance

Z_L is the load impedance

Continued next page.....

Examples

I. $Z_S = 50{,}000\ \Omega$, $Z_L = 50{,}000\ \Omega$, $f = 10{,}000$ Hz

Cable 100 ft long with 40 μ μ fd per foot.

$$Z_C = X_C = \left(\frac{1}{2\pi\,(10{,}000)(4000 \times 10\text{-}12)}\right) = 3978.87\Omega$$

$$\text{Loss in dB} = 20\ \text{LOG}\left[1 + \frac{(50{,}000)(50{,}000)}{3978.87(50{,}000 + 50{,}000)}\right] = 17.25\ \text{dB}$$

II. $Z_S = 150\ \Omega$, $Z_L = 3000\ \Omega$, $f = 10{,}000$ Hz

Cable 100 ft long with 40 μ μ fd per foot.

$$Z_C = X_C = \left(\frac{1}{2\pi\,(10{,}000)(4000 \times 10\text{-}12)}\right) = 3978.87\Omega$$

$$\text{Loss in dB} = 20\ \text{LOG}\left[1 + \frac{(150)(3000)}{3978.87(150 + 3000)}\right] = 0.31\ \text{dB}$$

NOTES ON BASIC ACOUSTIC PARAMETERS

I. ACOUSTIC PARAMETERS EXPRESSED IN S.I. BASE UNITS

(A)	Sound Energy	$KG\ M^2\ S^{-2}$	JOULE
(B)	Sound Energy Density	$KG\ M^{-1}\ S^{-2}$	$JOULE/M^3$
(C)	Sound Energy Flux	$KG\ M^2\ S^{-3}$	WATT
(D)	Sound Energy Flux Density	$KG\ S^{-3}$	$WATT/M^2$

II. Energy storage in an inductor = $\frac{LI^2}{2}$ JOULES

III. Energy storage in a capacitor = $\frac{CV^2}{2}$ JOULES

Item I - IEEE Dictionary, pp 8 - 9.
Items II and III - Landee, Davis, Albrecht - "Electronic Engineers Handbook"

CALCULATING THE VELOCITY OF SOUND

$$c = \sqrt{\frac{\lambda P_S}{P}}$$

Where: c is the velocity of sound in M/sec.

λ is the ratio of specific heats and is 1.402 for diatomic molecules (air molecules)

P_S is the equalibrium gas pressure in N/M^2 ($1.013 \times 10^5\ N/M^2$)

P is the density of air in KG/M^3

$$P = \left(\frac{0.001293\ H}{(1 + [0.00367(^oc)])76}\right)10^3$$

Where: H is the barometric pressure in CM of HG*

^oc is the temperature in degrees centigrade (Celsius)

*HG in inches times 2.54 equals HG in CM.

TEMPERATURE CONVERSIONS

$9/5[(^oc) + 32] = {}^oF$ $\quad 5/9[(^oF) - 32] = {}^oc$ $\quad K - 273.15 = {}^oc$ $\quad {}^oc + 273.15 = K$

RECRUITMENT

Jack Wrightson of Joiner, Pelton, Rose, Inc., Consultants in Dallas, Texas, noted a request of ours in a recent Newsletter and replied with the following informative, sharing letter:

I noticed with interest your call for information concerning the change in human auditory thresholds with a change in sound pressure (p. 19, Vol. 9,4). This phenomenon is often labeled 'Recruitment' after a particular theory concerning its origin.

The effect is often observed when audiograms are run at the listener's absolute threshold and then at sensational levels 10 dB or more higher. The characteristic 4KHZ noise induced notch observed with a Bekesey type audiogram will often disappear at the higher level.

There are several theories that attempt to explain the mechanism that results in recruitment. The most widely held idea is that hair cells on the basilar membrane adjacent to the damaged are 'recruited' to provide neural output at high stimulation levels. Another theory speculates that the compensation occurs at a higher level of processing. The support for this idea is essentially anecedotal based on reports of threshold shifts occurring after removal of conductive hearing impairments.

I once participated in an experiment designed to test the latter hypothesis. I was required to wear an ear mold in my right ear for a period of two weeks, similar to subjects in inverting prism vision experiments. Unfortunately, no significant threshold shifts were observed and the data was never published.

Any good otolaryngology or audiology text should give a useful account of this phenomenon. Two more psychoacoustically oriented books are: Brian Moore's The Psychology Of Hearing (the best single introductory text on psychoacoustics I know of), and Jerry Tobias' Foundations of Modern Auditory Theory.

As we wrote Jack, *"Your response is the kind we dream of . . . a writer with knowledge of sources, facility in explaining the data, and 'real life' experience with some portion of the problem."*

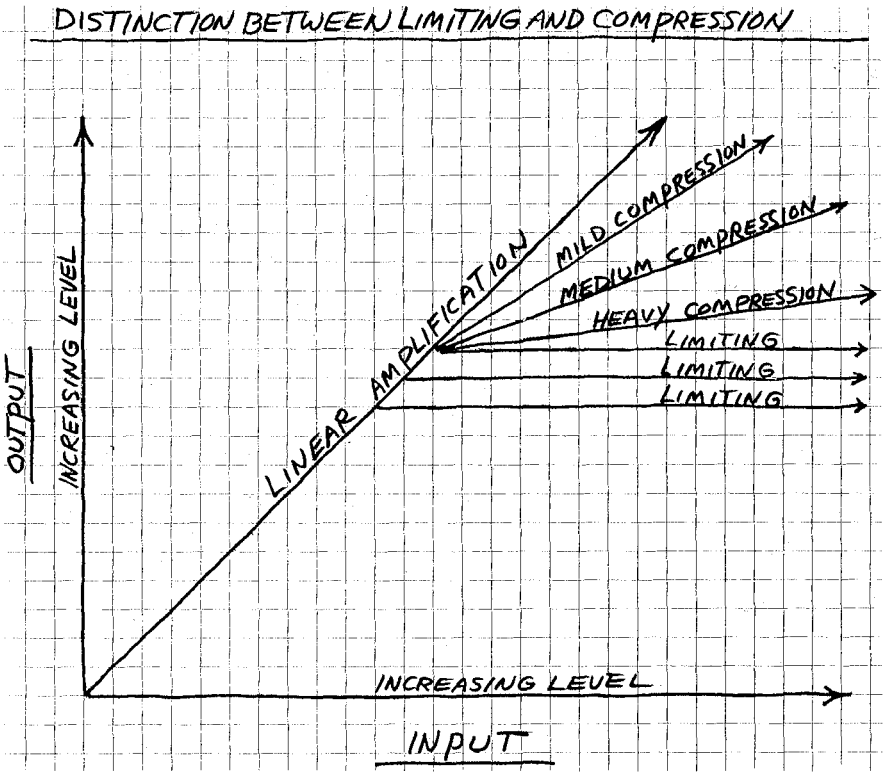
COMPRESSORS AND LIMITERS

The IEEE dictionary defines a compressor as: "A transducer that for a given input amplitude range produces a smaller output range." Under limiter in the same source we find: "Limiter (General) - a device in which some characteristic of the output is automatically prevented from exceeding a predetermined value."

Subtleties in "attack" and release times, range of initial onset in addition to the usual care for S/N, distortion, output levels, etc., make the choice of a suitable compressor or limiter more difficult than might be thought at first.

Compressors are often used in speech systems where you have a loud, strong talker and a weak talker. The system is set for no compression on the weak talker and for the needed compression on the strong talker that allows a sensation of near equal loudness from them both without feedback.

Limiters are used in disc recording work as an absolute level barrier so that the cutter does not cut into the adjacent groove when driven by an unexpected voltage swing from the power amplifier.



YOUR FRIENDS AT SYN-AUD-CON

Syn-Aud-Con, like all companies, depends upon the people associated with it. We feel particularly fortunate to have Jan Kreitz as our office manager and any of you that have met her or talked to her on the telphone know why.

Recently, those of you calling in may have been greeted by a new voice, Pat Carlson, Jan's new assistant. Pat also is a resident of Rancho Carrillo, the mother of a beautiful candy bar sales-woman daughter (for the 4-H) and a young son.

Pictured with Pat is Larry, who broke his arm, cranking the horse. Actually, Larry is not only a horseman, but a Karate expert as well and he zigged when he should have zagged. In case you think he's not a fearless horseman, you try riding several miles with your arm in a cast.

Without the skilled help of Jan and Pat, Syn-Aud-Con would truly be a disorganized company. Those of you who have been to the Seminar Center have first hand information on their effectiveness in helping and their devotion to the classes.

DIFFERENTIAL INPUT AMPLIFIERS

Syn-Aud-Con graduate ALLEN BURDICK of Dallas, Texas has developed a line of "Differential Input Amplifiers" for inclusion in existing power amplifiers that are without balanced inputs. These modules will, no doubt, find extensive use among Syn-Aud-Con graduates. We'd welcome hearing from those of you that try them.

SMILE

In a 1938 Shirley Temple movie, "Little Miss Broadway," an older gentleman, a member of a singing group, walked with Shirley into the large lobby of a hotel. He asked, "How are the acoustics here?" Shirley replied, "Oh, we don't have any here.....we use Flit."

John Lanphere

PHASE PAPER by DR. PREIS

Professor Douglas Preis of Tufts University is rapidly becoming one of our favorite AES authors for his really splendid tutorial papers on phase and phase related subjects. His latest paper appears in the Nov. 1982 JAES Vol. 30, No. 11, pp. 774-794. You would be hard pressed to find a comparably thorough, accurate, beautifully illustrated, and rigorous discussion of the fundamentals we will be *forced* to become totally familiar with in the coming decade. We'll quote first one sample to whet your appetite.

> *A minimum-phase system is also a minimum-delay system since it has the least amount of phase change for a given magnitude response. (The group delay equals the negative rate of change of phase with respect to frequency.) Thus the signal energy is released as fast as is physically possible without violating causality. However, in doing so, certain frequency components are released sooner than others, and thus constitutes a form of phase distortion, sometimes called dispersion. Its presence is indicated by deviations of the group delay from a constant value. A linear-phase system necessarily introduces greater delay than a minimum phase system with the same magnitude response. However, it has the advantage that there is no dispersion.... An equalization strategy to minimize linear distortion must strike a balance between magnitude-response flatness and phase-response linearity. For audio engineering applications this balance should depend on and be derived from perceptual tolerances."*

It would be difficult to find a more succinct verbal description describing what we are seeing on our TEF® screens every time we use the analyzer. The title of this paper is "Phase Distortion and Phase Equalization in Audio Signal Processing-A Tutorial Review." We're pleased when the AES finds a genuine authority to handle such subjects.

ARTICLES OF INTEREST

We recently read an exceptional article entitled "How to Handle Confrontation Successfully" by Sam R. Lloyd in *Consulting Engineer* magazine.

The crux of the article is contained in the following quotation:

> The belief that people or events cause others to have certain feelings is a myth. No person or event *makes* you feel and you cannot *make* any other person feel. What really happens is that people are "*invited*" *(italics mine)* to feel and the result of that invitation is up to the person who receives it. We each choose our own feelings.

We believe a second quotation to be accurate:

> Successful people usually are those who are good at inviting others to feel cared about, respected, and trusted. They also are those who choose to feel okay much more of the time than most people, even though others around them may be trying to get them to feel bad.

His classification of basic styles of behavior is useful.

> The basic styles of behavior that everyone uses are:
>
> *Nonassertive. When you are being nonassertive you are failing to stand up for your rights and are not communicating your wants, needs, thoughts, and feelings. You are being quiet, passive, inhibited, and self-effacing, and are inviting disregard from others.
>
> *Aggressive. When you are being aggressive you are standing up for your rights but are violating someone else's rights in the process. You are being inappropriate, demanding, controlling, exaggerated, and are attempting to win by forcing someone else to lose.
>
> *Assertive. When you are being assertive you are standing up for your rights while demonstrating a respect for the rights of others. You are communicating your thoughts, feelings, wants, and needs in a direct, honest, appropriate, and respectful manner which invites cooperation from others.

Finally, the realization that the temptation to believe that most human problems are the fault of a person, place, or thing rather than recognizing it might just as likely be a mode of thought about the *perceived* situation that needs changing and not the person, the environment, or the tool. Lloyd again sums it up in direct terms.

> Most of us think of the other person as the problem and approach confrontation *with the goal of changing the person or some aspect of his personality. You cannot do it. (Italics mine.)* When you use blameful, judgmental words you invite the other person to feel bad and violate his right to be treated with respect. You will either fail to get what you want, or you will get it, only to have him looking for a way to get even. But you can get a person to change a specific behavior if it is described in nonblameful terms.

For those of you with access to recent issues of *Consulting Engineer* magazine, we recommend you read the entire article. It's a pleasure to encounter such totally practical and realistic advice from academia.

CLASSIFIED

HP41C'S FOR SALE:

Syn-Aud-Con is selling a portion of its HP41C's. Price is $125.00 each, condition excellent, original box, manual and carrying case. First come, first served. These are the calculators you used in class. If later you want to increase the memory to equal the CV, you may purchase a Quad-memory module for about $60.00. It fits into one of the ports available. $ 125.00 each

SYN-AUD-CON ALSO HAS FOR SALE:

- H.P. 82143A Thermal printer - Retail value $385.99. Selling Price: $ 275.00
- H.P. 82161A Digital Cassette Drive - Retail value $550.00. Selling Price: $ 425.00
- H.P. 3580A Spectrum Analyzer with options 001 and 002 - Retail $5,885.00 $ 4,200.00

  ALSO: special fitted Anvil carrying case - yellow, with extra cutouts for accessories: $ 150.00
- H.P. 3325A Synthesizer/Function generator - Retail $3,000.00 $ 2,000.00

  ALSO: Anvil case that holds two such instruments $ 150.00
- H.P. 1201B rack mount dual trace oscilloscope with variable persistence and storage. This scope utilizes an aluminized P-31 phospher. The persistence capability is from less than 0.2 sec to more than 60 seconds. Complete with original manual $ 700.00.
- IE 17 Ivie analyzer processor - Retail value $1,500.00. Selling price: $ 750.00

All of the above are in "as is" condition, which to the best of our knowledge is excellent in each case.

Contact Syn-Aud-Con, San Juan Capistrano, CA. Phone: (714) 496-9599.

FOR SALE:

- Pair EV Sentry 100 Speakers, Mint . . . . . $ 225.00
- HP333A Auto-Null Distortion Analyzer . . . . . $ 995.00
- Crown IMA Intermod Analyzer . . . . . $ 350.00
- One pair Spectrasonics "Complimenters" . . . . . $ 150.00

Contact: CHRIS HOOD, P. O. Box 44110, Crafton, PA 15205. Phone (412) 921-4357.

FOR SALE:

- 2 Swintek Wireless mike systems - Model MK 1L and MK 2L, includes both lapel and handheld. Contact Bob Carter, 12400 Studabaker Rd., Norwalk, CA 90650 Ph 213-868-0072

WANTED:

For a book, and possibly a film, on Thaddeus Cahill and his Telharmonious (1892-1911), the first eletronic music synthesizer, I would appreciate any information on letters, recordings, or other materials. I would also like to hear from any digital experts interested in reconstructing the sound of the Telharmonium, using its schematics and the written descriptions of ear-witnesses. Contact Reynold Weidenaar, 5 Jones St., Apr. 4, New York, New York 10014

EMPLOYMENT WANTED:

Training includes Syn-Aud-Con 1982 Graduate, Full Sail Recording Workshop - 1980. Experience includes several "live" concerts and festivals. Experienced with computer, including word processing. Young woman EAGER to work in audio, free to travel, willing to relocate, member AES, has received national security clearance.

Contact: NANCY DYKSTRA, 1617 Gorham Dr. SE, Grand Rapids, MI. Phone: (616) 245-1938.

SYN-AUD-CON SPONSORS

Syn-Aud-Con receives tangible support from the audio industry, and ten manufacturing firms presently help underwrite the expense of providing sound engineering seminars. Such support makes it possible to provide the very latest in audio technology while maintaining reasonable prices relative to today's economy and to provide all the materials and continuing support to all graduates of Syn-Aud-Con.

Personnel from these manufacturers receive Syn-Aud-Con training which provides still another link in the communications circuit between the ultimate user and the designer-manufacturer of audio equipment. They are "in-tune" with what a Syn-Aud-Con graduate needs.

Their presence on this list as a Syn-Aud-Con sponsor indicates their desire to work cooperatively with you in professional sound.

United Recording Electronics Industries
HME
Shure Brothers, Inc.
Sunn Musical Equipment Company
Crown International, Inc.
Emilar Corporation
Rauland-Borg Corporation
Community Light & Sound, Inc.
Industrial Research Products, Inc.
TOA Electronics, Inc.
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UNITED RECORDING ELECTRONICS INDUSTRIES

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TOA ELECTRIC CO., LTD.
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SHURE BROTHERS INCORPORATED

COMMUNITY LIGHT & SOUND, INC.

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