SYNERGETIC AUDIO CONCEPTS

SYN AUD CON

newsletter

Volume 19, Number 2
Winter 1992

klipsch®

A Legend in Sound

SYNERGETIC

SYN AUD CON

AUDIO CONCEPTS

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

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.

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The information conveyed in this NEWSLETTER has been carefully reviewed and believed to be accurate and reliable; however, no responsibility is assumed for inaccuracies in calculations or statements.

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If you attend a Syn-Aud-Con Seminar during the year, your subscription will be extended one year. ($35 of your registration fee to our classes includes a subscription for one year to our Newsletter and Tech Topics).

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When Do I Renew?

You can check to see when your subscription will expire by checking the mailing label on the envelope in which your newsletter was mailed. In the upper righthand corner, beside the name, a date will appear (i.e. 4-90). This means that you will receive this issue and it will be the last issue sent unless you renew. Renewal notices will be sent at this time. You must renew before the next quarter's newsletter is mailed or your subscription will become inactive.

POSTMASTER: Send address changes to Synergetic Audio Concepts, R.R. 1, Box 267, Norman, IN 47264.

klipsch®

Paul Wilbur Klipsch is "a legend in sound". That title is also applied to the company that he founded. Mr. Klipsch is now retired and his company is owned by others, including his nephew also named Klipsch. The spirit of the man remains as a component in the product design at Klipsch & Associates.

At $20,000,000 per year in a targeted professional market, some 80,000 Klipsch units leave the factory at Hope, Arkansas each year.

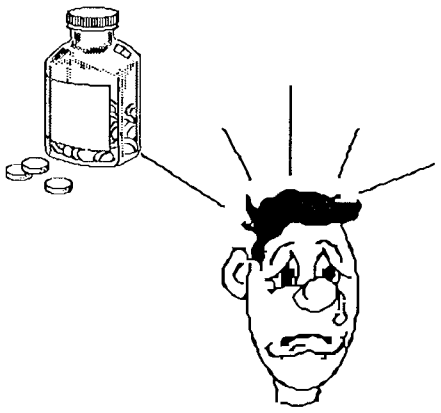
The KP-650 speaker system is one of the few devices available today that has complete structural tests of its performance certified by Wyle Laboratories' Huntsville facility. Wyle's rigorous testing exceeded any humanly conceivable normal event for these units, making them perhaps the best documented devices for hanging in public places - which, for obvious reasons, is becoming extremely important.

For those of you who haven't kept up with the Klipsch product line, it has become a leading successful effort, fielding some of today's outstanding loudspeaker systems. They are one of the top three contenders in motion picture theater sound. Their TRACTRIX TECHNOLOGY™ is one of the few new innovative approaches to horn design.

Over one-third of Klipsch & Associates' sales are from overseas, once again illustrating that where real American talent manifests itself, it's the other guy who feels like he needs trade protection.

We hope all our readers will look into what could become for each of them a profitable experience. You will meet Tom Gallagher who left Electro Voice a couple of years ago to join Klipsch & Associates, P.O. Box 688, Hope, AR 71801 (Ph: 501-777-6751 or fax 501-777-6753) as their Marketing Specialist, Professional Products Division.

Perhaps because of our past association with the man and our knowledge of the early path trod, we are especially respectful and appreciative of having Klipsch & Associates as the latest Syn-Aud-Con sponsor. Our association with Paul Klipsch started in 1951 when we opened our first hifi store in Lafayette, IN, called The Golden Ear, with two Klipschorns as part of our demo system.



Mistakes are Painful

I have spent the last 15 years trying to understand the Hilbert transform, so when I get a letter from Dr. Bertram which says, *"Don, I am amazed over your references to the Hilbert transform....I suggest you omit all references to the transform"* I am ready to put down my pen in disgust and never write another word on the subject. ("Fiber Optics Polarity", Newsletter Vol 19N1, P5)

That feeling is soon replaced with the deepest gratitude. The strength of Syn-Aud-Con, and its continuing attraction to us, is the privilege of having the Dr. Bertrams of this world straighten us out. Mentors, who are themselves distinguished men, and who care enough about us to not leave us in error, are the real wealth of this world.

There are those who don't like correction. May God have pity on them. To come a little closer every day to knowing more than you knew the day before, not memorized facts but fundamental understandings, is what life is all about. One can grow in understanding by reason or by revelation. In audio and acoustics both modes of thought can operate, but for those of us less gifted, reason is the argument that guides us towards the revelation of comprehension.

Excerpts from Dr. Bertram's letter after having read Newsletter Vol 19N1 and the accompanying Tech Topics.

"Don, I was amazed over the references you make to the Hilbert transform. On page 5 your relating the electric and magnetic fields of an electromagnetic wave by a Hilbert transform is nonsense...its like relating the voltage and current in an electric light by the transform. If E and H are the magnitudes of the electric and magnetic fields, then H =E/η where η is the impedance of the media (377Ω for space). While *H is at right angles to E with respect to the direction of propagation, there is no imaginary involved and it certainly would not be useful to concoct one. I suggest that you avoid all references to the transform...it is a useful theoretical tool but not very useful in applications. As I wrote in my paper, the Fourier transform can supply the imaginary component for a finite time sample and the FFT provides a very efficient way to do it.*

Mentors, who are themselves distinguished men, and who care enough about us to not leave us in error, are the real wealth of this world.

"The linearly polarized figure from Advanced Digital Audio makes sense, but the circularly polarized figure does not...a circularly polarized E&M wave is like two linearly polarized waves at right angles to each other with the phase of one shifted 90° with respect to the other. If the two waves shown represented the two components of the electric field, it would make sense (dropping the reference to the magnetic field would correct it). Similarly with the elliptic wave..it is like the circular wave but its two electric components have unequal amplitudes or are not 90° out of phase (or both). The spirals could represent either the electric or magnetic fields.

"I don't believe it is useful to suggest a 180° (or 90°) polarization for an acoustic wave...after all, it is a longitudinal wave. A rope could transmit two independent signals as transverse waves..as can an electromagnetic wave and the two waves could be complementary component in the Hilbert sense, but in general they would not be. Heyser's complementary component isn't realizable except for a two pass operation."

Referring now to Page 7 of the same Newsletter,

"The first of your Digital Filter Questions is confused. Quoting Rabiner & Schafer in their book, Digital Processing of Speech Signals, 'The possibility of exactly linear phase is often very useful in speech processing applications...This is property of FIR filters..." end of quote from the book, but continuing Dr. Bertram's letter,

"A linear phase shift means there is only a delay (no phase distortion); this can be accomplished with an FIR filter but not with an IIR filter. Incidentally, FIR filters can be implemented in the analog domain using charge coupled devices."

On a more positive note, Dr. Bertram complimented Ed Lethert on his Tech Topic Vol 19, No 1, "Harmonic Distortion and Crest Factor in Audio Equipment"

"I found your Tech Topic on the ac mains problem interesting. I had occasion recently to consult with a pair of EEs who were to give a lecture on the fields produced by power lines as a contributions to their biological effects. While they advanced the idea that the ground currents could produce the dominant fields, I am reasonably certain that they never thought of the contribution of non-linear devices to the ground currents. It is hard to imagine the non-linear ground currents being so large except in regions where there is a lot of electrolytic work, for example, going on. Even there it should be possible to distribute the loads between the phase..if anyone takes the responsibility for it."

Answer to Dr. Bertram's Comments On

"Cancellation of harmonics utilizing three phase, four wire electrical power distribution"

From Ed Lethert:

Thank you for sending me Dr. Bertram's comments.

Historically, it has been assumed that phase currents cancel in the neutral of three phase, four wire electrical power distribution systems. This assumption still exists (almost universally unfortunately) and is based on the fact that the only frequency of concern is 60 Hertz.

Electrical power distribution systems must now be considered broadband in nature with a bandwidth of 60 to 900 Hertz. In some cases the upper limit will be 3,000 Hertz or more. Harmonics of the 60 Hertz fundamental frequency are now found in almost all electrical distribution systems, and they exhibit diverse behaviors in three phase, four wire electrical distribution systems.

Positive sequence harmonics including the fundamental (1st, 4th, 7th, 10th, 13th, etc. - frequencies of 60, 240, 420, 720, 900 Hertz) cancel in the neutral conductor. Negative sequence harmonics (2nd, 5th, 8th, 11th, 14th, etc - frequencies of 120, 300, 480, 660, 840 Hertz) also cancel in the neutral conductor. Zero sequence harmonics (3rd, 6th, 9th, 15th, etc. - frequencies of 180, 360, 540, 720, 900 Hertz) add in the neutral conductor. These zero sequence currents are often termed triplen harmonics.

Triplen Harmonics

Even numbered triplens (6th. 12th, etc.) are not prevalent if the waveforms are symmetrical (and they usually are so). The third harmonic is the prevalent harmonic generated by diode-capacitor power supplies and has been found to be powerfully evident in many of the measurements made in our field studies.

Questions About Acoustic Origin

The latest TEF 20 software now includes the Heyser Spiral plus a cursor display that remembers its positioning on both the spiral and the ETC or TDS display as you switch back and forth.

I decided to use this capability to examine the acoustic origin. Using the Heyser spiral in the time domain (something never before available even to Dick Heyser except in his mind), we first looked at the impulse response to confirm polarity (consider that the ETC does not allow you to see polarity).

The first peak, though small, was positive so we were in polarity. This peak occurred at 3.29 ms (3290 µsecs). We then returned to the ETC display and found that our cursor set at 3.29 ms was only part way up the magnitude of the first arrival.

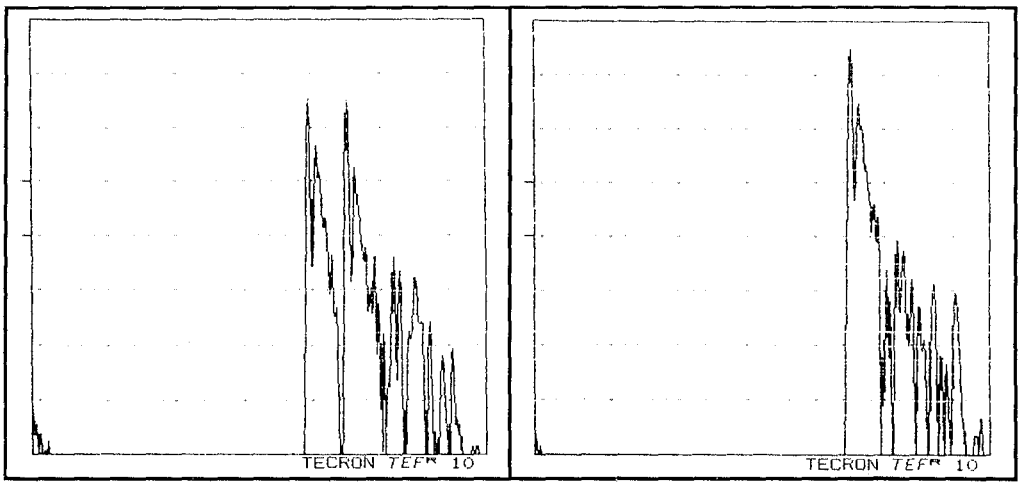
We then placed the cursor on the peak magnitude of the ETC at 3.44 msecs (3440 µsecs) and then recalled the spiral display and saw that the cursor was on the maximum negative peak (real part) and the maximum positive peak (imaginary part).

Since this is a free field measurement (no reflecting surfaces were nearby), the real part is proportional to potential energy and the imaginary part is proportional to kinetic energy. The spiral magnitude does depict the energy level and the phase angle between the potential and kinetic energy.

This brings up the question, "which signal arrival actually depicts the "time-distance" value of the acoustic origin?"

Can you defend your choice?

Early Microsecond Delay History
or
Were We There and Didn't Recognize It?



Our workshops provide an opportunity to try new ideas and concepts. We don't know where we are going so we often don't know if we have succeeded or failed in our efforts - so we try again. Such was the case with microsecond signal delay.

Sunn Music build a prototype microsecond signal delay for Don as a personal favor - not as a product that they planned to market.

We first tried it at the Loudspeaker Array Workshop in Nashville, TN in 1984. Our conclusion was that we failed - because we couldn't hear a difference between in synchronization and out. We blamed it on the horns that we were trying to align.

New Evidence

Recently we were searching for an article we knew was filed away and we came across the following measurements from the Nashville workshop.

Maybe we were there and didn't know it. Maybe we didn't know how to listen for the effect of missynchronization. We clearly got the 6 dB add that shows that we were in alignment. We didn't have the good sense to make a frequency response which would have been an enormous help in determining if the obvious early reflections around the direct sound were causing sufficient comb filters, thus lobing, to mess up the helpful effect of synchronization.

We often say it takes three workshops on a given subject to get a good handle on what the potential is for a new idea. We succeeded in the third workshop that we used the microsecond signal delay (Anaheim at St Boniface in 1986)—(we failed the second time in 1985 at the Loudspeaker Workshop in Pasadena).

New Ideas & Concepts to Explore in 1992

At the start of a new year it is natural to review the past year(s) and to think about what we want to accomplish in the coming year. Of course motivation is a key word when one thinks about accomplishment.

What Motivates Don?

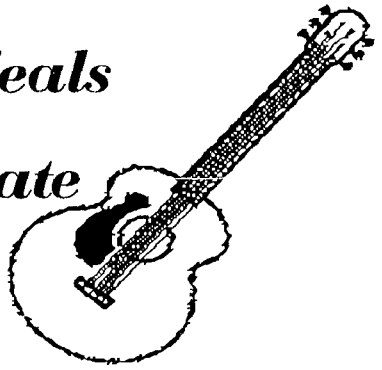
Not money, not fame and glory, not power! So what does? The quest TO KNOW and to share what he knows. That will shape our activities for the coming year.

We have held one workshop on auralization, one on ITE microphones so we know that we have a lot to learn about these subjects in the coming year.

In addition to auralization, Don is working on a new equalization project with Sam Berkow, Dr. Patronis and Don Eger, which is sure to be the subject of a workshop in the coming year.

The beauty of having as your goal - the Quest to know - you never feel like you can stop now, you never feel you have accumulated enough. With the Quest the excitement is always there to find out what is on the other side of the mountain.

Dan Seals Update



In May 1988 we were invited by Morning Star Productions to conduct an in-house seminar. Much to our surprise and delight Dan Seals attended the seminar the first day.

We wrote about it in the Summer 1988 Newsletter, "We have met the enemy and they is us!?

Dan Seals had a problem which he wanted solved. Once the problem was measured, the explanation was easy but not necessarily the solution.

Dan is a left-handed guitar player and was having trouble with acoustic feedback whenever he turned to his left at the microphone. He demonstrated it to us and we made the measurement reproduced in Figure 1. The upper trace

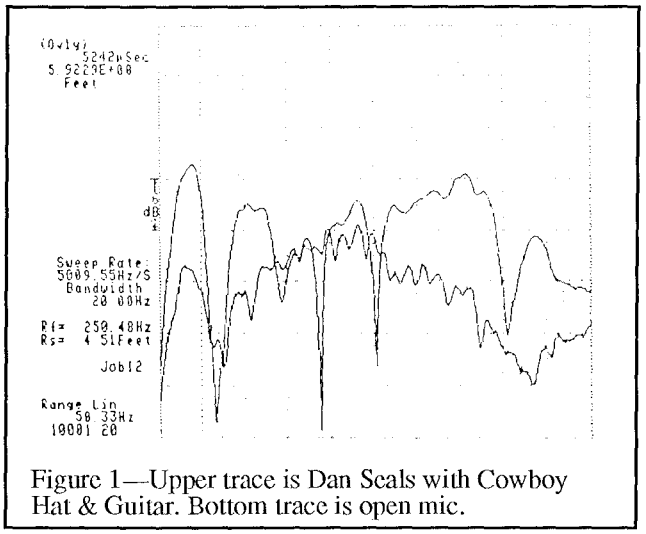


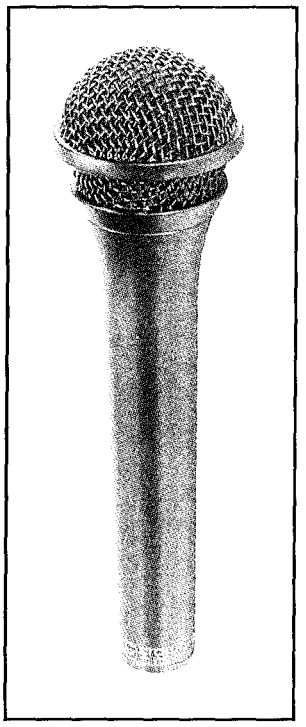
Figure 1—Upper trace is Dan Seals with Cowboy Hat & Guitar. Bottom trace is open mic.

shows how the combined guitar reflection and the hat brim reflection combine acoustically at the microphone to cause a genuine excess gain problem. When he turned to the left, the body of his guitar reflected the left monitor towards the

microphone and his hat brim reflected the right monitor to the same place.

When Dan saw the measurement he turned to his crew and said, "We have met the enemy and they is us."

We suggested alternatives, like putting the monitors at different distances from Dan, but that didn't make him comfortable.



Now Using the Crown.....

Recently John Windham of Morningstar Productions was in our October 17-19 class at the farm. John tours with Dan Seals and we asked him how Dan was handling the feedback problem. John said,

"We no longer have the problem. We are now using the Crown CM-310 Differoid. It has completely solved our feedback problem."

The CM-310 is perfect for the monitor feedback problems. It does require that the performer be disciplined to not move his head - if he wants to be picked up.

Another excellent use of the CM-310 is for sporting events where the announcer is in the open in front of a noisy crowd. It works!

Politics & Audio Share One Trait in Common

The Law of the Conservation of Ignorance:

"A false conclusion once arrived at and widely accepted is not easily dislodged and the less it is understood the more tenaciously it is held"

and

"The most fertile source of insight is hindsight".

Syn-Aud-Con 1992
Seminar & Workshop Schedule

❖ 3—Day Seminars—$525
Farm—Norman, IN

Sound Engineering Seminars

May 21-23	***August 20-22***
June 18-20	***September 17-19***
July 16-18	***October 5--7***

An Assistant Instructor will be present at each of the seminars at the farm. Our staff includes:

Farrel Becker, Rick Brehm, Fred Fredericks, Kurt Graffy, Mary Gruszka, Don Heavener, Dr. Patronis, John Prohs, Don Van Oort, and Randy Vaughan. Dr. Wolfgang Ahnert will be an assistant instructor for the May Seminar

❖ 3—Day Workshops—$650
The Farm & Medora, IN
May 14-16, 1992

Dr. Wolfgang Ahnert of Berlin, Germany and his family will be spending a vacation with us at the farm during the month of May. Dr. Ahnert tells us he has a massive amount of new material to share with us on:

Advanced auralization
Greatly advanced EASE program
The Moscow Congress Hall
A new book which he has written on sound reinforcement systems detailing new European discussions of acoustic & audio fundamentals

Dr. Ahnert is a remarkable, likable, world citizen who also is a very talented acoustical designer.

We are planning to have a special workshop of three days at the farm and the Medora gym. Dr. Ahnert will be the main instructor as well as helping us teach the regular May 21-23 class. The workshop with Dr. Ahnert will be May 14-16 and will be limited.

This is a very special opportunity to spend three days with a very special man.

A short story about Dr. Ahnert will give you some insight into the sort of person he is: Dr. Ahnert developed the EASE program in East Germany on a Sinclair. Later he was able to finish the program on a PC 8088. When he showed me his EASE program on my 386-33 in 1990, one of the measurements took 2 minutes to process. Dr. Ahnert exclaimed, "It took me 8 hours to process that measurement." Dr. Ahnert, who was raised in a village only a few kilometers from Harro Heinz, president of Renkus Heinz, took the program to RH for distribution. When he went back to E. Germany he took a 486 with him!

Dr. Ahnert is a remarkable man who survived a cruel system with his intellect, wit and charm in tact.

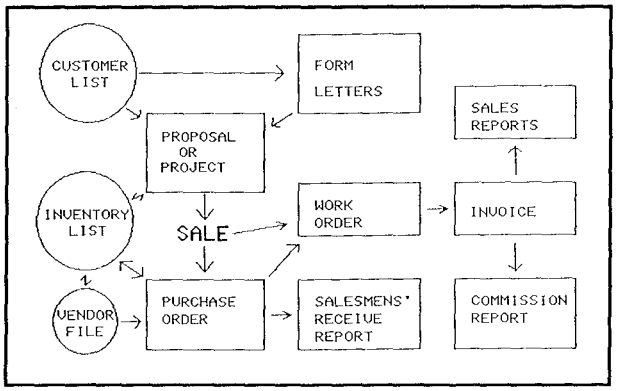
The Project System™
A Sales & Service Management System
For the Large and Small Audio-Visual Dealers and Sound Contractors

Ron Steinberg of RentCom in Chicago told Tony Nasca that we should know about his product and he sent us literature and followed up with a phone call. We asked him to send us the names of 4 sound contractors using his system and hopefully we would know one whom we could select from the list and discuss Nasca Systems before we went any further.

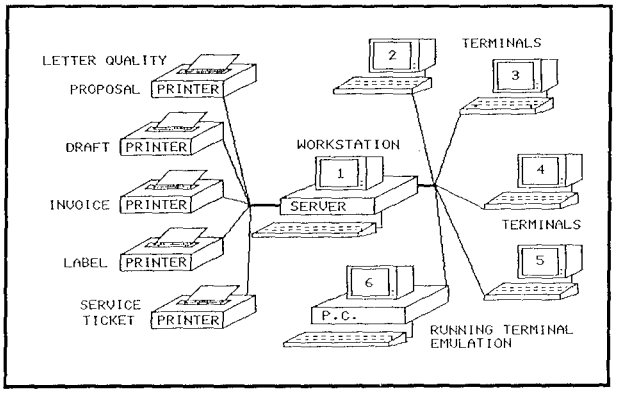
Craig Thompson of Thompson Electronics Co. in Peoria, IL was on the list. I trusted Craig to give a straight story. Craig couldn't say enough good. I realized that Tony Nasca was doing what Don has said that our audio manufacturers should be doing for their sound contractors instead of spending hundreds of thousands on loudspeaker coverage programs. (He has programs under development that he isn't discussing here.)

Tony Nasca, before starting Nasca Automated Systems, owned and operated an Audio-Visual/Sound Contracting business for 12 years.

We asked Mr. Nasca to write about his programs for sound contractors. He sent us enough text for two pages and I told him that I would rather use one page now, get feedback from other users of the Nasca system or other systems that we should know about, then share that information. We would like to hear from anyone who has worked with Nasca Automated Systems or anyone who has worked with programs they particularly find useful.



This is a general line drawing of some of the relationships between the different databases within system.



This drawing shows a typical configuration when using The Project System™ in a multi terminal environment. All processing is done by the "server". This type of system can be very fast and the cost/ workstation is low.

From Tony Nasca:

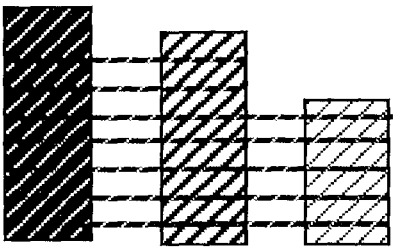
"THE PROJECT SYSTEM™ is an integrated and multi functional automated software system. Among it's many capabilities, the system creates and prints letter quality Proposals or Quotes, tracks Projects, and has an Inventory System with allocation capability. The system does Billing and Purchase Orders; has a Customer List, does Shipping Labels, merges letters, and much more. It runs on a variety of hardware platforms including stand alone PCs, Networks (Novell, Lantastic) and Multi-User Systems (Xenix, CCDOS).

"At the onset, you might say that we are already doing these functions using several independent systems. The key word is 'independent'." THE PROJECT SYSTEM is different because it combines all of these functions into one program. Current users of the system perform both sales and service tasks; from a very large hospital Nurse Call System to tracking the repair of a VCR.

"Without going into the particulars, you can start from a single TOP MENU selection, add a customer, write a proposal or quote, add inventory items and manufacturers, print and re-edit, all before sending out the final copy and all within 15 minutes. Now, for most users this would be pretty good. Normally this process is slowed down to include site surveys, engineering if needed and other company processes. After the Proposal is accepted, the system can check STOCK to see if the items are available and /or create Purchase Orders. When the items are received, the system allocates the items to the calling project. The system can also notify the salesperson that items have come in. The system supports Progress Billing and Complete Billing. Inventory is automatically depleted. Sales Commissions and Sales Taxes are tracked.

"The system is easy to use and follows the normal flow of doing business. The system has many built in functions to save you time and make you money. Current users of The Project System will recommend and encourage anyone interested in improving his business through computerization to begin using and incorporating The Project System into their business. The Project System is a marvelous tool to help the Audio-Visual and Sound Contractor, do and run their business. It still takes a lot of work, but this system can make it easier."

For more details, contact Nasca Automated Systems, Inc., 3901 Peppertree Lane, Silver Spring, MD 20906 or phone 301-460-6842.



Acoustical Engineering

by

Harry Olson —A Classic Returns

There are rare out-of-print texts that any serious audio engineer endeavors to collect because the fundamentals they discuss are timeless and not subject to product life or current fad. Olson's **Acoustical Engineering** is such a text. (Harry Olson has been called "one of the world's greatest acoustical scientists and engineers.")

Professional Audio Journals (Jesse and Hannah Klapholz's publishing company) is making the reprint available. The hard-bound book is 736 pages with 567 illustrations. While the book is mostly known for its coverage of loudspeakers and microphones, it also includes chapters on measurements; speech music and hearing; sound reproduction; communication systems; underwater sound; and ultrasonics.

Books by Olson, Massa, Hilliard, Sabine, Hunt, Strutt (Lord Rayleigh) and Frayne, to name but a few, contain the seeds of many future products that were apparent to these men as problems not solvable then, but able to be manifested in this digital age.

Syn-Aud-Con can sincerely say that this book should be in the hands of any serious electroacoustic amateur or professional.

You can order **Acoustical Engineering** from Professional Audio Journals, P O Box 31718, Philadelphia, PA 19147-7718. PH 215-465-1975 or FAX 336-7743. Cost is $49.95 + 4.00 shipping (U.S.). Foreign orders must be in U.S. dollars on U.S. bank + $8.00 for surface mail.

Avalanche of Technology

The TEF 20 HI with its high speed DSP interface prepared to work with the Hypersignal software in addition to its own software opens acoustic simulation (auralization) plus new measuring techniques for equalization that we can't discuss at this time, but that will appear in 1992.

Ariel SYSid is engaged in equally intriguing new approaches to the creative uses of DSP interface technology. Its hard to imagine how individuals can keep up - it is going to take teams of skilled dedicated personnel.

When desirable programs alone exceed 100 megabytes on a hard disc you begin to suspect that those who wait are wasted.

New Simplified Programs from Altec and Renkus Heinz

Both AcoustaCADD™ and EASE have announced less expensive, easier- to-use programs to help beginners get up to speed. AcoustaQWIK has just been announced by Altec and EASE Jr by Renkus Heinz. JBL has a new Windows based program. PHD remains a consultant's mainstay.

We don't want to say "the sky is falling" but we will say that the nineties will prove those who can't compute, can't compete.

More on AcoustaQWIK

Altec is working on an easy-to - use version of AcoustaCADD. They recognize the need for a fast and easy design assistance software package that can handle the majority of their design projects. AcoustaQWIK will provide a very fast room model construction function linked to an extensive library of pre-defined prototype room shapes.

Quoting from a recent letter from Altec:

"It is so simple that a room model can be created in one or two minutes even when balconies or multiple floor sections are required.

"The loudspeaker location and aiming angles are specified on a graphic screen by "pointing and clicking" with the mouse. Coverage and SPL maps are automatically generated by AcoustaQWIK and are ready for immediate presentation to the client."

More on EASE Jr

EASE Jr is a simpler, lower cost version of EASE developed for the user who has no need for all the advanced acoustical analysis features of EASE. It retains the high degree of accuracy that characterizes EASE, has the same extensive speaker and wall materials database, and features a greatly simplified method of room entry. Articulation loss and RASTI predictions are shown in isoline form.

EASE Jr, like EASE, will be handled as an open data base program and offered without restriction to anyone engaged in the design or installation of electro-acoustic systems. The price has been established at $595.

It will be formally introduced to Sound Contractors for the NSCA show the end of April.

EASE has achieved "Registered Developer" status with Autodesk, Inc (AutoCAD). As a registered AutoCAD developer, RH is in a position to work closely with them on EASE/AutoCAD data exchange and further refine this important function.

Crown's Macro-Tech 3600VZ

Featuring 4.8 horsepower in 3.5 inches of rack space, and costing about the same as a Porsche Speedster bought at the Stuttgart Zuffenhausen plant in 1958, Crown's Macro-Tech 3600VZ is a remarkable package.

Operable in stereo, bridged-mono, and parallel-mono modes, the 3600VZ has a frequency response of ± 0.1 dB from 20 Hz to 20kHz at 1 watt. The S/N ratio is 105 dB (A-weighted) at full output and 26 dB gain, while total harmonic distortion (THD) is <0.05% from 20Hz to 1kHz and increases linearly to 0.1% at 20kHz at full output.

Roland Sound Space (RSS)

We got a four page Christmas message from Bob and Sheila Todrank. They had moved from Nashville, TN to Los Angeles this summer so that Bob could take over as National Sales/Marketing Manager of the ProAudio/Video Group at Roland Corp, and specifically the sales and marketing of the RSS processor.

I would expect Bob to be in on the new and exciting as he is a true pioneer. It was Bob that hand-built the first D'Antonio RPG Diffusors, before they were a product, for an LEDE control room in a facility he was building for the Oak Ridge Boys in Hendersonville, TN.

I talked with Bob on the phone and he said he would send us a CD Sampler of the Roland Sound Space Process. I told him that I felt that the systems that I had heard to date produced interesting effects, but I didn't have the feeling of being in the space, as I do when I listen to an In-the-Ear recording - and that was my reference.

We Listened on our Home Music System

Bob said, "listen". We did - on our music system in our home - and we were not impressed. It sounded good but not what the text on the jacket said I would hear, nor did it rate the $44,000 investment for the Processor.

Excerpt from Text on CD

I would like to reproduce an excerpt here from the CD outlining Features of the RSS Process.

"The Roland Sound Space System consists of two processors, a Binaural Processor, and a Transaural Processor. The Binaural Processor processes the input signal to simulate the effect of a binaural (dummy head) recording. Binaural recordings provide a good reproduction of sound locations when played back on headphones, but does not recreate the sensation of the sound being in front of the listener. The effect is reduced when played back on stereo speakers due to crosstalk. The Transaural Processor eliminates crosstalk and as a result, sounds can be placed anywhere in the 360 degree listening field, and at any elevation. The effect is accurately reproduced when played back on conventional stereo speakers."

We Listened on the Frazier CATS

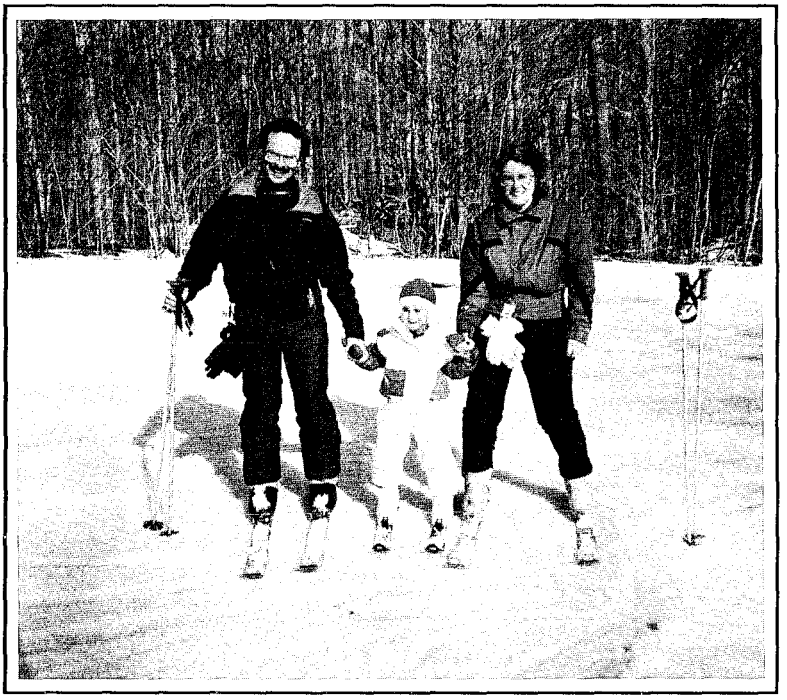
Knowing that perfect signal alignment in a loudspeaker system is critical for localization, which is not the usual attribute of the typical esoteric loudspeaker system, we took the RSS Sampler to the Lab to listen on our playback system for the ITE recordings: Frazier CAT speakers with perfect signal alignment.

I was startled. It seemed impossible to believe that I was listening to the same recording. The effect was stunning. I was sitting in the sound field. Sounds were up, down, front, back and around.

Now, having said that, I am going to qualify my enthusiasm by saying that I don't trust my hearing to make a quality judgment. If Chips Davis or Hellmuth Kolbe said, that's good, I would believe it, or if they said, listen, you can hear.... I would hear it once pointed out, but I don't really know how to listen.

The music was mostly synthesized music. Everything abounded with percussive sounds, which are much easier to localize than other musical instruments. I would like to hear a classical orchestra. Don thought he heard "phasiness" at times. I don't know. What I do know is that Roland does have a product worth $44,000 and the listener better have signal aligned speakers for the playback system.

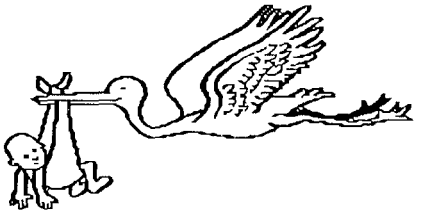
The Family that Skis Together....



Members of the Syn-Aud-Con family - Farrel and Gina Becker with 5-year old daughter, Liz, skiing together last winter.

There will be no skiing this winter for the Beckers. By the time you receive the Newsletter there will be a Becker son.

Liz is as good at the computer as she is on skis. She has her very own computer and works at her computer while her dad programs for the TEF 20 all the exciting things that Techron has planned for us.



Coincidentally, I received a call from Farrel while I was working on the final layout of this page- with very special news. Kevin Michael Becker was born on January 6, 1992 and weighed 7 lbs 7 oz. Family and baby are all doing well.

—Dashia Meadows

Acoustic Power From Loudspeaker

Glen Ballou wrote that something was wrong with "Acoustic Power from Loudspeaker" NSL 18N4 P19. Kurt Graffy made the same observation with suggested changes. I have re-written the explanation, corrected the typos and hope that it is easier to read now.

In order to find the acoustic power output, in watts, for a loudspeaker given the loudspeakers sensitivity rating and directivity factor we first need to compute the sound power level L_W.

$$L_W = L_P(\text{Sensi}) + \left(20 \log \frac{\text{Measure Dist.}}{\text{Ref. Dist}}\right) + \left(10 \log \frac{1}{Q}\right)$$

This equation is valid when the REF.DIST. is 0.283m or 0.928 ft. because for a Q= 1.0 at that distance $L_P = L_W$.

The basic equation for L_W is:

$$L_W = 10 \log \left(\frac{\text{Measured power}}{\text{Referencepower}}\right)$$

The reference power is 10^{-12} watt (one picowatt). Solving for measured power results in:

$$\text{Measured power} = \left[10^{\left(\frac{L_w}{10}\right)}\right]$$

We can by combination, construct an equation to go directly to the acoustic power in watts from sensi (L_P) and directivity factor (Q)

$$W = \frac{10^{\left[\frac{L_P + \left(20 \log \frac{\text{DIST}}{\text{REF}}\right) + \left(10 \log \left(\frac{1}{Q}\right)\right)}{10}\right]}}{10^{12}} =$$

Example: A loudspeaker produces 99 dB at 4' and has a Q = 7.0 at the frequency of interest.

$$W = \frac{10^{\left[\frac{99 + \left(20 \log \frac{4}{0.928}\right) + \left(10 \log \left(\frac{1}{7}\right)\right)}{10}\right]}}{10^{12}} = 0.0208\text{w}$$

If in this case, the L_P = 99 dB was the result of one watt electrical input then:

$$\%\text{EFFIC} = \frac{0.0208 \text{ watt}}{1 \text{ watt}} \times 100 = 2\%$$

Audience Dependent Acoustic Changes

Audience dependent acoustic changes ADAC do occur in listening environments. But first we must ask an important question. Can the LD be affected by the audience? The answer, of course, is no! If not LD, then what? The major influence will be on LR with a second order affect on LRE. What about the path LFD travels over? Well, an audience can cause temperature differentials that can bend the path. Is that correctible with an equalizer? No! It is not. You have to physically re-orient the device's directivity.

Questionable Equalization Practices

The only parameter that can be equalized and should be equalized is the direct sound level from the loudspeaker. Conventional fractional bandwidth analyzers (i.e., 1/1, 1/3, 1/6, 1/10-octave units) and conventional FFT constant bandwidth analyzers have looked at either total sound level LT or a very wide "time window" that includes all of LRE and a good portion of LR. When an operator equalizes a sound system in an empty hall by watching LT he or she may inadvertently misshape the LD spectrum by lowering it at some frequencies to compensate for the LRE (i.e., floor, wall or ceiling reflections that raise LRE inordinately.) When an audience arrives and covers the floor, wall reflections are grounded in the audience and the ceiling and floor can no longer support each other; therefore, the sound changes. The operator then readjusts the signal to a smoother LD. If LD had been adjusted in the first place, there would have been no reason to readjust it when the audience arrived.

We don't deprecate the SDM approach. Far from it. But we do advocate that its use be based upon acoustic facts, not fancy, and that its wide use with its limitations clearly identified, could be a helpful equalization tool.

"Abe Jacob explains"

- an excerpt from an article in Theater Crafts, August/September 1991, P76 written by John Huntington:

"One surprising aspect of these (SIM) systems is that apparently much of the actual alignment is of the system to itself and its relationship to the stage set, rather than to the room. 'What we have found,' explains Abe Jacob, "is that if we maintain speaker towers and speaker mounting positions that are the same relative to the width of the stage opening, and that your speakers are permanently mounted and aimed (within the towers), that a preliminary SIM adjustment to those speakers as well as time delay maintains itself relatively well from theatre to theatre. You do have to make some adjustments, of course, with respect to the room size, but it has been amazing for the majority of the shows that we've had on the road in the last year or two, that the original SIM EQ settings seem to be maintained.' Tony Meola has found this situation on the ***Les Miserables*** *third national company. 'We SIMmed in Tampa, where we opened, and then we SIMmed in Tampa, where we opened, and then we SIMmed again in Miami, which was the second stop. We just tweaked it a little bit. We have speaker towers on that show that are actually part of the scenery, and the towers are almost always at the same place relative to each other, and the speaker within the tower are always in the same place relative to each other. It's always the same pair of speakers, with the same EQ, the same cable, and the same amplifier, so I think that has a lot to do with it."*

Put another way I will repeat my statement at the beginning, "The only parameter that can be equalized and should be equalized is the direct sound level from the loudspeaker. "

"Stupidity is not recognizing that you are ignorant"

I often ask Dr. Patronis to let me know when I have made a technical error, but outside the classroom, Dr. Patronis is very reticent about correcting anyone on a technical point.

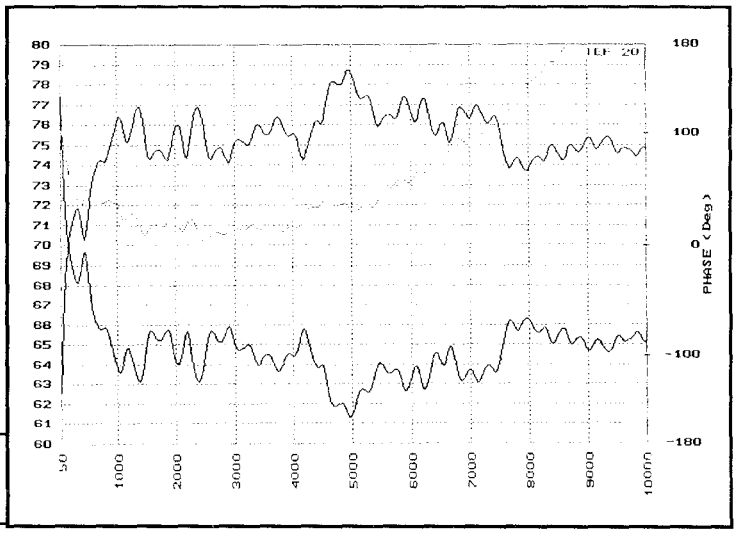
Recently we held a two day meeting with 8 people at the farm. It was an important meeting and Dr. Patronis was convinced that one of the participants was in error. At one point, the young man with whom Dr. Patronis disagreed, said, "I'm not stupid," to which Dr. Patronis said, "no you are not; stupidity is not recognizing that you are ignorant on a given subject."

Mirror Images
—A New Tool—

As we show in our Syn-Aud-Con classes, the way to check an equalizer is to look at its electronic response "upside down and backwards."

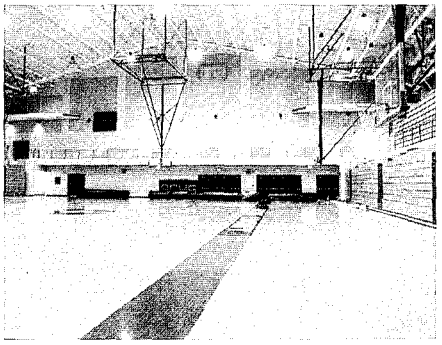
Ron Bennett of Techron has now provided that capability at a key stroke. If you use the correct resolution for your "house curves" and overlay the inverted electronic response of your equalizer, then the "fine tuning" details become a "match" to the curves.

You will be hearing more about this feature this year with respect to a new equalization technique.



Mirror image of a response curve. The very faint curve in the middle is the phase.

October 17-19, 1992 Farm Seminar



NC Curves Should be a Specification Requirement

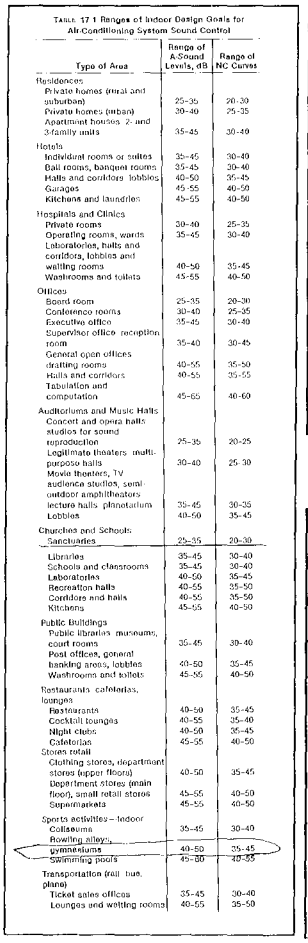


Table 17.1 Ranges of Indoor Design Goals for Air-Conditioning System Sound Control

Type of Area	Range of A-Sound Levels, dB	Range of NC Curves
Residences		
Private homes (rural and suburban)	25–35	20–30
Private homes (urban)	30–40	25–35
Apartment houses, 2- and 3-family units	35–45	30–40
Hotels		
Individual rooms or suites	35–45	30–40
Ball rooms, banquet rooms	35–45	30–40
Halls and corridors, lobbies	40–50	35–45
Garages	45–55	40–50
Kitchens and laundries	45–55	40–50
Hospitals and Clinics		
Private rooms	30–40	25–35
Operating rooms, wards	35–45	30–40
Laboratories, halls and corridors, lobbies and waiting rooms	40–50	35–45
Washrooms and toilets	45–55	40–50
Offices		
Board room	25–35	20–30
Conference rooms	30–40	25–35
Executive office	35–45	30–40
Supervisor office, reception room	35–40	30–45
General open offices		
drafting rooms	40–55	35–50
Halls and corridors	40–55	35–55
Tabulation and computation	45–65	40–60
Auditoriums and Music Halls		
Concert and opera halls, studios for sound reproduction	25–35	20–25
Legitimate theaters, multi-purpose halls	30–40	25–30
Movie theaters, TV audience studios, semi-outdoor amphitheaters		
lecture halls, planetarium	35–45	30–35
Lobbies	40–50	35–45
Churches and Schools		
Sanctuaries	25–35	20–30
Libraries	35–45	30–40
Schools and classrooms	35–45	30–40
Laboratories	40–50	35–45
Recreation halls	40–55	35–50
Corridors and halls	40–55	35–50
Kitchens	45–55	40–50
Public Buildings		
Public libraries, museums, court rooms	35–45	30–40
Post offices, general banking areas, lobbies	40–50	35–45
Washrooms and toilets	45–55	40–50
Restaurants, cafeterias, lounges		
Restaurants	40–50	35–45
Cocktail lounges	40–55	35–40
Night clubs	40–50	35–45
Cafeterias	45–55	40–50
Stores (retail)		
Clothing stores, department stores (upper floors)	40–50	35–45
Department stores (main floor), small retail stores	45–55	40–50
Supermarkets	45–55	40–50
Sports activities – indoor		
Coliseums	35–45	30–40
Bowling alleys, gymnasiums	40–50	35–45
Swimming pools	45–55	40–55
Transportation (rail, bus, plane)		
Ticket sales offices	35–45	30–40
Lounges and waiting rooms	40–55	35–50

Figure 4—Excerpt from a table listing acceptable NC curves for sporting activities (indoors).

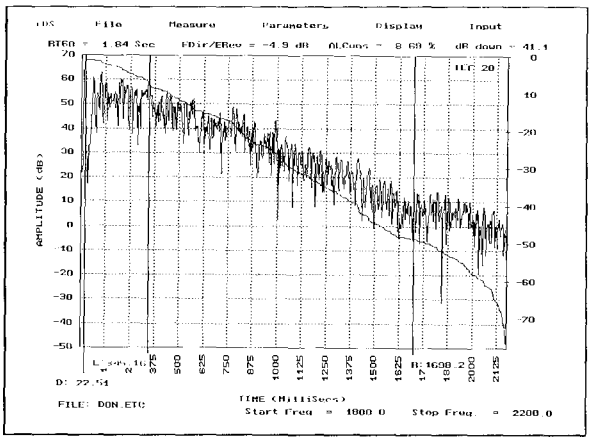


Figure 1—Reverberation of 1.8 secs 2 kHz.

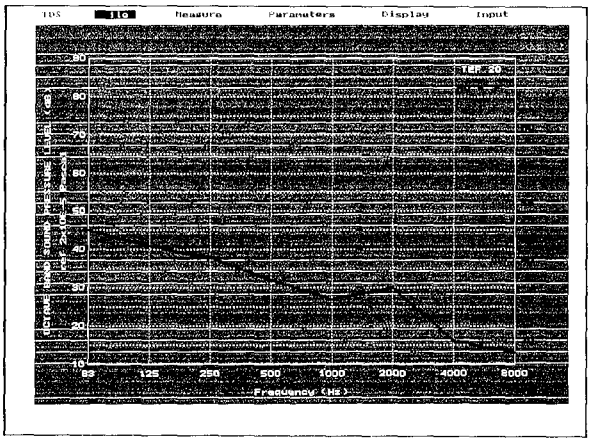


Figure 2—NC of 35 with noise handlers off.

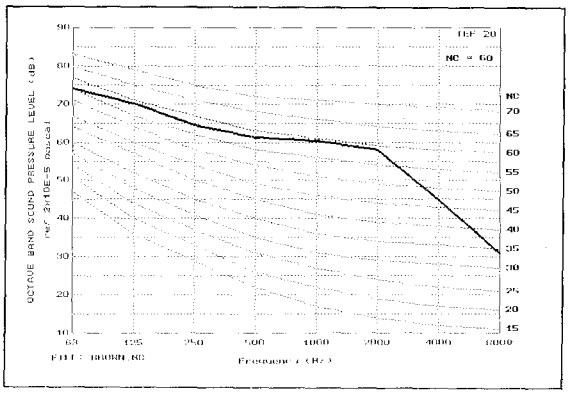


Figure 3—NC of 60 with noise handlers on.

It seems so obvious that an NC curve should be a requirement in a specification for any building - but it isn't. In fact, a goodly number of architects don't even know what an NC curve is.

We were hired to make measurements in a new high school gymnasium in which an exceptional acoustician was retained to design the acoustics and the sound system, but nothing to do with the HVAC - "the electrical engineers that we have worked with for years will take care of that."

The Acoustics are Wonderful

The gym was a delight. One could communicate from one side of the bleachers to the other without a sound system, which is the case when practice is going on. See Figure 1 for the reverberation measurement. The sound system is exceptional.

With HVAC On - NC 60!

With an NC 60 you can't communicate 10 feet in this outstanding gymnasium. Let no Syn-Aud-Con grad work on a job in which he has not done everything possible to get an NC curve in the specification and if he can't, get a letter on file of the possible consequence.

Speech Intelligibility Workshop II

In October 1990 a second speech intelligibility workshop was convened at Indiana University under the auspices of Syn-Aud-Con. Dr. Larry Humes of the I.U. Speech and Hearing Department and Peter Mapp, prominent British acoustic consultant, helped conduct new research into the use of the existing algorithms.

TEF-12 plus and TEF-20 analyzers were the primary tools with Modified Rhyme test tapes from Dynastat again used with the live listeners.

We also were fortunate to have Sonic Perception's Aachen Head and their all digital BAS (Binaural Analysis System). Mahlon Burkhard and Ed Wolfrum from Sonic Perceptions were distinguished additional staff assistants.

Improved tools available that did not exist for the first workshop were:

1. In-the-Ear (ITE) microphones. These special silicon probe microphones from Etymotic Research allow measurements and recordings to be made in the pressure zone of the live human eardrum.

2. Sony Pro DAT 10 professional digital recorders.

Dr. Humes arranged for complete audiometric testing of all thirty participants including complete ear molds of the pinnae-ear canal. A majority of those attending were professionally involved in the design and installation of sound systems and possessed significant experience listening to typical field conditions that can be encountered.

The Intelligibility II Workshop demonstrated the remarkable variety in human listeners.

Five positions in the large hall chosen for the tests progressed from good speech intelligibility to poor speech intelligibility.

Generated as part of this workshop was a digital tape recording of the audible difference between different "live" listeners with In-the-Ear microphones in the pressure zone of the ear drums, microphones installed at the entrance to the ear canal designed by Hellmuth Kolbe, and The Head from Sonic Perceptions.

Some New Insights

Because ITE microphony showed important data to the listeners' perception that omni microphones could not see in small dead rooms, it was also tried in this large diffuse reverberant test room. The measured differences on the analyzers between ITE and omni microphones were negligible at Alumni Hall. The difference in perception when listening to recorded playback was very discernible.

Like all workshops exploring the unexplored, advance hypothesis existed to be proven or disproven. Since human listeners vary by approximately 5%ALCons and scores above 30%ALcons are basically meaningless, we can use these limits to pick test spaces. In order to test up to the 30%ALcons value, you must have an RT60 of

$$RT_{60} = \frac{\%ALcons}{9} = \frac{30}{9} = 3.33 \text{ secs}$$

at 2kHz if you are to test for the affect of reverberation on speech intelligibility.

In terms of S/N, we find that a perfect score requires at the very minimum 30 (RASTI) - 15 = 30(1.0) - 15 = 15 dB in a non-reverberant space.

Further, the maximum score of 30% ALcons (RASTI 0.32) can be achieved by noise alone when the S/N is 30 (0.32) - 15 = -5.4 dB

Alumni Hall at Indiana University came close. It's 2kHz RT60 = 2 secs and we could control the HVAC ambient noise generators. To exceed the required 3.3 secs one position in the hall was provided with a controlled artificial reverberation system.

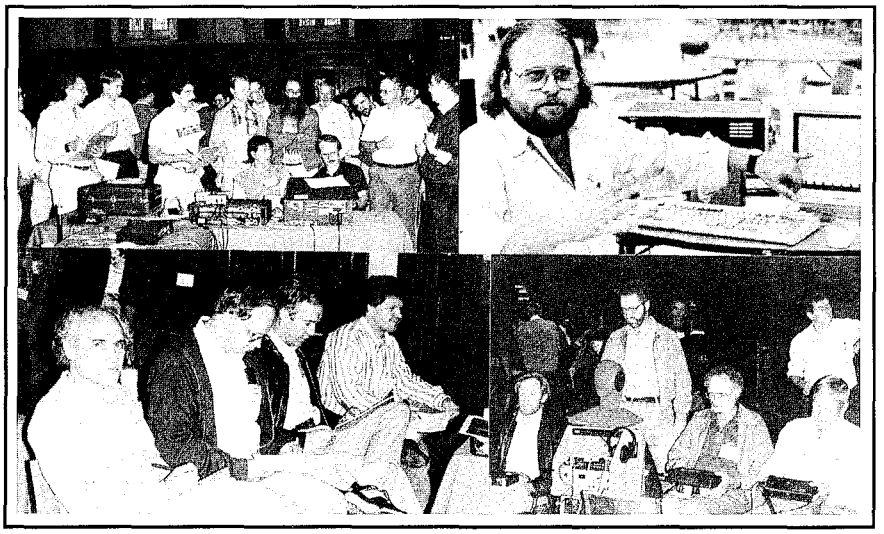
The Role of High Level Specular Reflections

We have learned to better appreciate and evaluate the role of high level specular reflections particularly from side walls.

The anomalies observed in the data taken in this workshop were frustrating. There were positions where

which way a listener's head was turned produced significant scoring differences. In several positions the "information" the listener was using could be clearly heard subjectively to come from the walls rather than from the loudspeaker.

The December 1991 Journal of the Acoustical Society of America Vol 90 No 6 has an outstanding article that address some of the major anomalies we experienced. "Effects of a single reflection with varied horizontal angle and time (signal) delay on speech intelligibility" by Tatsumi Nakajima and Joichi Ando represents a key missing link in the intelligibility equations.



The Big Surprise

We had several people with perfect hearing (no loss in the frequency response) yet would have low intelligibility scores on the MRT as compared to people with definite loss - who would often score much better than those without loss. Of course, if the frequency response loss was great (45 dB or more), the MRT test scores would be low.

We made pinnae response measurements and ear canal molds on each person attending. We did not find the magic key hoped for in pinnae shape, size, or configuration. Nor did we find an intelligibility correlation between ear canal resonance and intelligibility scores though both play a significant role in detecting the direction of the source. I feel sure that the answer is in studying and understanding the measurements.

Auralization

Speech Intelligibility II was the maiden voyage for the TEF 20 and for Sam Berkow's demonstrations of auralization to Syn-Aud-Con. I think I can speak for all members of the workshop when I say it left no doubt in anyone's mind that auralization was the tool of the future - and so it is proving. The Renkus-Heinz EASE program will demonstrate binaural auralization with their program at NSCA in late April in Anaheim. Altec has their best talent working on auralization and I would expect to hear a demonstration at NSCA.

Sound Quality vs. Speech Intelligibility

A good speech intelligibility score does not mean that the system will necessarily sound "good" to the listener; it just means that a majority of the words spoken will be understood. Sound system design almost always dictates a careful compromise between the extended frequency range desired for naturalness and the frequency shaping in the 500 to 3000 Hz region that can aid intelligibility.

Some Comments on Available Measurement Systems

For evaluating sound systems the %ALcons technique, as exemplified in the Techron analyzers, is without a peer. Since the same analyzers also incorporate the full STI and the RASTI techniques, the preference for %ALcons springs from:

1. %ALcons tracks the live listener scores more closely than others.

2. It not only correctly measures a poor seat, but reveals on the screen what is causing the problem.

We read recently where a programmer, who obviously never had to solve an intelligibility problem, preferred the STI measurement because no human judgment was required to use it.

Unfortunately, one very clear message from the Intelligibility Workshop is that great wisdom and judgment is required in both operating the measurement instrument and in interpreting the data.

More Later

Data from the workshop has been sent to each member of the workshop for their analysis. As we get comments from them both pros and cons, we will be sharing the data in greater detail.

"Fractals, Chaos, Power Laws" A New Book by Manfred Schroeder

Almost any publication by Manfred Schroeder is important to audio and acoustic engineers. His latest volume is no exception.

"Fractals, Chaos, Power Laws" is 429 pages of pure Manfred Schroeder. In discussing "Similarity and Dissimilarity" he begins with Paul Valery's "The Universe is built on a plan the profound symmetry of which is somehow present in the inner structure of our intellect. Earlier in the book, he quotes Albert Einstein, *"I want to know how God created this world. I am not interested in this or that phenomenon, in the spectrum of this or that element. I want to know his thoughts; the rest are details."*

A sub-heading in one chapter is "The clustering of Poverty and Galaxies" while yet another chapter addresses "Percolation: From Forest Fires to Epidemics" where his quotation from David Butler, *"The function of an expert is not to be more right than other people, but to be wrong for more sophisticated reasons" devastatingly applies to the Forest Service's misuse of statistical analysis that allowed the 1988 Yellowstone National Park conflagrations to set completely out of hand by exceeding the percolation threshold."*

A chapter entitled "Noises: White, Pink, Brown and Black" has to capture the interest of any audio engineer.

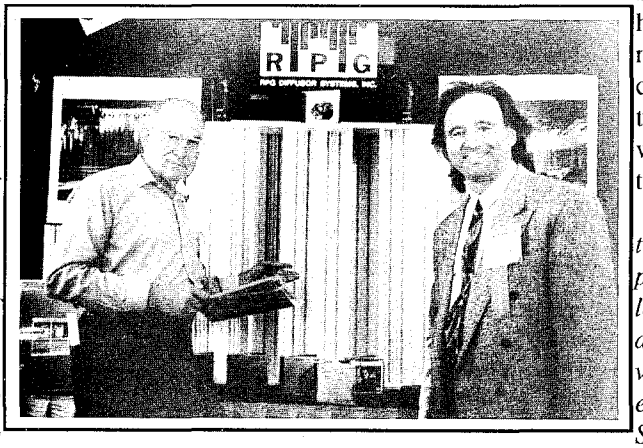
Self similarity is illustrated by pink noise which if translated on a tape recorded to one-half or twice the speed will (except for level) sound exactly the same as at the normal speed.

Chaos can be seen in watching a motionless cigarette in an ashtray as its smoke starts out as a laminar flow and ends up as turbulent chaos.

Schroeder relates Luis Alvarezs' method of confusing German U boats reading of attacking aircraft radar emissions.

"The same inverse square law that governs gravitation also describes the fall-off of radar power with distance. This simple fact was exploited by German submarines during World War II. By measuring the increase in radar intensity, they could gauge the rate of approach of an enemy plane and dive undersea for safety before the plane could attack.

"The tactic worked very well for Grand Admiral Karl Donitz until the American physicist Luis Alvarezs (1911-1988) had a foxy vision, codenamed Vixen. Alvarez suggested reducing the radar power so that it would be proportional to the third power of the range of the submarine. Thus, while the plane was approaching, the power incident on the unsuspecting U-boat was actually decreasing, giving the false impression that the radar plane was flying away. A grand idea indeed! (For the attacking plane, however, the received radar power reflected from the boat would still increase as it closed in.)"



The footnote states:

"This scheme of Alvarez is somewhat reminiscent of Genghis Khan ("Universal Ruler") and the wily Mongol tactic perfected by the horsemen of the Golden Horse. While seemingly galloping away from their pursuers, they would actually allow them to close in and then suddenly stand up in their stirrups, turn around in their saddles, and launch their arrows at the dumbfounded enemy."

Mr. Schroeder is a remarkably well read man with a genius for mathematics and, as readers of this book will find out, a sense of humor.

We recommend, without reservation this outstanding volume. It can most profitably be read sans the math or you can have the time of your life trying the relationships discussed.

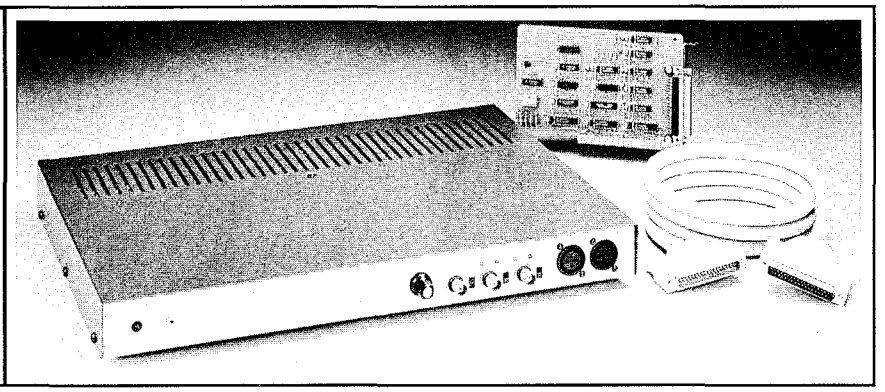
Publisher W H Freeman & Company $32.95 ISBN 0-7167-2136-8

Comments from Peter D'Antonio

We asked Peter D'Antonio if he would write the review of Mr. Schroeder's book, knowing that he might be too busy with the move of RPG to a brand new facility - as he says, a dream come true. He sent us the following fax which we found so interesting that we would like to share it:

"I wish that I had time to do the review, but the move is occupying so much time. I have looked at the book and once again the master has provided a very scientific treatise which is enjoyable and humorous. Prof. Schroeder and I had a wonderful opportunity to discuss many things including fractals and his new book during the ASA at Penn State.....He recalled his manuscript from Freeman to include a few lines about our Diffractal ™, which fascinated him, in that it integrated his work on reflection phase gratings and fractals (p.236)....Prof Schroeder's talk in NY at AES was an absolute classic. If you can get a tape of it, you will love it. He was in rare form, especially his 3-body chaos example. He explained how his life has evolved from a prominent physicist to a writer to his present embodiment of an artist. After wowing us with his scientific and literary contributions, I can't wait for the art."

The TEF 20 HI from Techron



We don't know who wrote it but the press release on the TEF 20HI is the most straightforwardly informative, free from hype, product description we have encountered in years. Usually I edit, add to, and delete press releases. In this case, you get the whole thing because I don't believe its possible to tell the necessary details in any less words.

"Equipped with the same powers as the TEF 20, Techron's TEF 20HI takes things a step further with the addition of a high-speed interface that effectively allows the device to be used as a digital audio recorder. This ability is additionally complemented via the same HI interface to permit third party software programs to utilize the DSP chip to control the entire system.

"By design, the TEF 20HI's high-speed interface provides the user with a wide variety of tools and functions not usually associated with a TEF machine. For example, while other TEF devices are dedicated measuring systems, the TEF 20HI's interface unleashes the power of the DSP chip to the extent that it can become a top-notch digital oscilloscope, real-time analyzer, filter generating unit, and data capture and display/analysis device.

"One of the most popular of the third party software programs which can be used with the TEF 20HI is Hypersignal. With Hypersignal, the aforementioned capability to turn the TEF 20HI into a digital recorder becomes a reality. Armed with this weapon, you can easily record acoustic information and do analysis later. Hypersignal can additionally manipulate any signal in virtually endless ways, including filtering in real time.

"Among the manipulations Hypersignal can perform, most useful is its capacity to convolve any signal with another. This process involves importing the characteristics of one signal directly onto another. From a user's standpoint, the appeal here is obviously quite broad-ranging, because now you can record an environment's impulse response and convolve it with an anechoic recording of music or speech to obtain an accurate model of the early sound field in a room. To better illustrate this process, think of being able to present an acoustical image of what a room's early sound field will sound like to someone who wants to know what the effects of absorption material that's being added will have. By simply manipulating the signal to reflect the changes that are being made and convolving it with an anechoic source, they will actually hear the results of the proposed change. Conversely, you may want to know how a particular room reflection effects intelligibility. With the Hypersignal controlled TEF 20HI, you can instantly create an impulse measurements representing that type of reflection and then convolve it with anechoically recorded speech to produce an accurate acoustical image.

Now you can record an environment's impulse response and convolve it with an anechoic recording of music or speech to obtain an accurate model of the early sound field in a room.

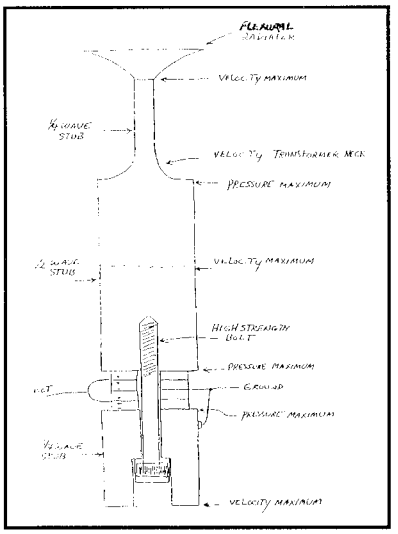
"As a tool, then, Hypersignal's convolution capabilities are extremely beneficial to both the audio professional and his or her clients. And since contractors are increasingly relying upon CAD devices for design, the ability to convolve signals provides yet one more accurate method of verifying their designs.

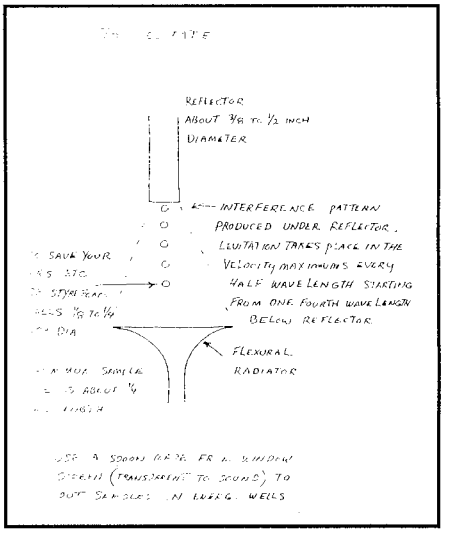
"Other features Hypersignal adds to the TEF 20HI include on-screen two-dimensional and three-dimensional spectrograph viewing of a signal. While viewing in 2-D, which manifests itself visually as a color graph with time along the X axis and frequency along the Y axis, you can additionally select any portion of the spectrograph, and with a single keystroke, listen to what's on-screen.

"The TEF 20HI will carry a price tag of under $5,000. Two versions of Hypersignal are available: the first, called Hypersignal-Workstation from Hyperception Inc., retails for $989. Called Hypersignal-Acoustic, the second version is enhanced by SignaLogic Inc. and lists for $1489. Both companies are based in Dallas, TX."

For more information, contact Techron, P O Box 1000, Elkhart, IN 46515. (219) 294-8300.

Acoustic Levitation Anyone?





Tom Danley at Intersonics is a very clever man. He sent us an interesting toy with the following letter and drawings.

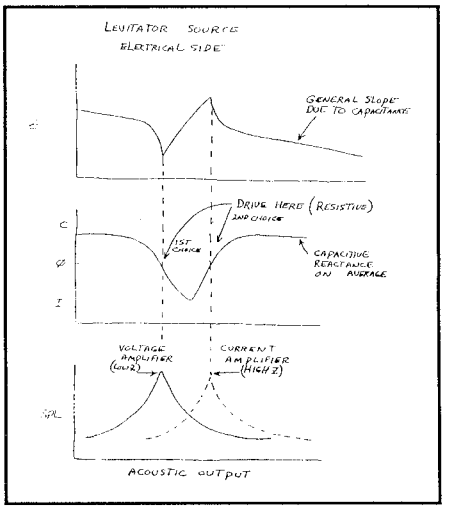
"Don, I get the impression you are a collector of neat stuff also, so I'm sending you an interesting toy. It is a levitation sound source. This one is too far off in frequency for our use (which requires matched sets), but it will still levitate things. This is an interesting device from a transducer point of view (I'm prejudiced).

"If you TEF the device with a microphone, you will see a high "Q" resonance at around 21kHz. Electrically though, because it is a piezoelectric, it is very different than a loudspeaker. You will notice the impedance curve looks like the phase curve of a dynamic speaker, while the phase curve looks like the impedance curve of a speaker.

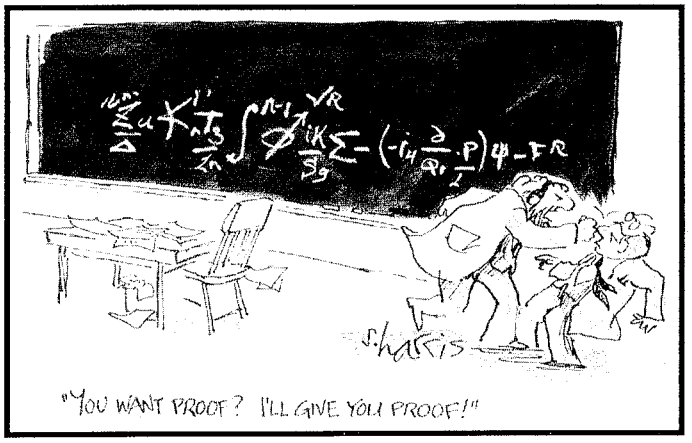
"To drive it for levitation, it should be driven at either of its two resistive points. One is at about 50 Ω impedance and the other is several hundred Ω. The resonance can be determined by connecting about 1 Ω in series on the ground side and monitoring the output voltage phase and the signal (current) which is across the resistor with an oscilloscope.

"You may want to use a 70.7v transformer to step up the output voltage from a conventional amplifier. You need to use some caution. However, the source can produce over 160 dB at 6" on-axis. Several of these transducers together produce about 170 dB, which is loud enough to LIGHT A CIGARETTE!! (About 65 watts/sq/ins).

"Also, the pzt element can produce a large DC voltage (thousands of volts)



if left in an open circuit condition and exposed to a temperature change or mechanical shock. I have been "snapped" many times developing these and have made it a good practice to short the leads together when not in use. The A.V.I.S. photos of sound fields I sent you were taken with this type of transducer."



Don Heavener, assistant instructor during the October 24-26 class, hooked up the levitator to the 1200 watt Altec power amplifier and we had a great deal of fun showing the class styrofoam balls suspended in mid-air by acoustic pressure. In fact we were so fascinated that after the class I realized that I stood with camera in hand during the whole demonstration and failed to take a single picture.

SMS Symphonic Mike System

A new microphone system for amplifying acoustic instruments

David Scheirman, Concert Sound Consultants in Julian CA, a consultant we have had occasion to work with a number of times and have found to know his business, recently brought to our attention a radical new approach to micing individual orchestral instruments.

As audio consultant to the tour producers and sound designer for the world tour of a full symphony orchestra and a rock group, he was asked to do the 'impossible" - to successfully present a full symphonic ensemble and a full-blown rock group on the same stage at the same time. After a lot of testing and research he found the SMS - Symphonic Mike System - a new microphone system for amplifying instruments.

Short Description

The SMS is a world-wide patented probe microphone system, developed specifically for stringed instruments.

For the first time ever, a miniature microphone capsule can be introduced into the inside of the instrument through a hollow tail-pin.

We have not seen or heard the SMS but David tells us that he used them on a tour with the 80 piece Moscow Symphony Orchestra playing live on stage with the Electric Light Orchestra (ELO) - a British Rock group.

"This new mic technology from Soundlab Electronics in Germany is the only thing that made the show possible for the violins, violas, celli, and basses."

Several initially conflicting demands had to be fulfilled in the development of the SMS:

(1) a microphone capsule with the least possible inherent noise level
(2) sufficient headroom available to handle peaks without distortion
(3) the diameter of the microphone head could not exceed 6mm in order that it fit through the hollow tail-pin
(4) the most linear and widest possible frequency range
(5) omnidirectional characteristics and insensitive to body vibrations of the instrument.

The SMS microphone was developed with the assistance of one of the world's leading microphone producers to fulfill the aforementioned criteria and to enable relevant statements concerning the acoustic of the interior of the instrument to be made.

David further told us "I'd be glad to explain these techniques in detail to any Syn-Aud-Con members who might be interested."

From David's remarks and the data sheets he sent us the SMS would appear to be a fundamental addition to useful microphone techniques and technology.

You can contact David Scheirman at 619-765-2220 or Fax 619-765-2520.

Yamaha's Guide to Sound Systems for Worship

Yamaha's "Guide to Sound Systems for Worship" edited by Jon F. Eiche is 190 pages of densely packed details on the design, installation and operation of church sound systems. It should, in a majority of cases, influence the minister to hire professional help. This book displays the myrid subjects that should be familiar ground to any person who is going to assume the role of expert.

Eiche is smart enough to avoid mathematics and sticks to fairly safe generalizations for many definitions. There's no harm in this and he keeps the main goal in mind at all times -- the goal to clearly illustrate that church sound systems are complex technical projects worthy of serious professional consultation along with building architecture and engineering.

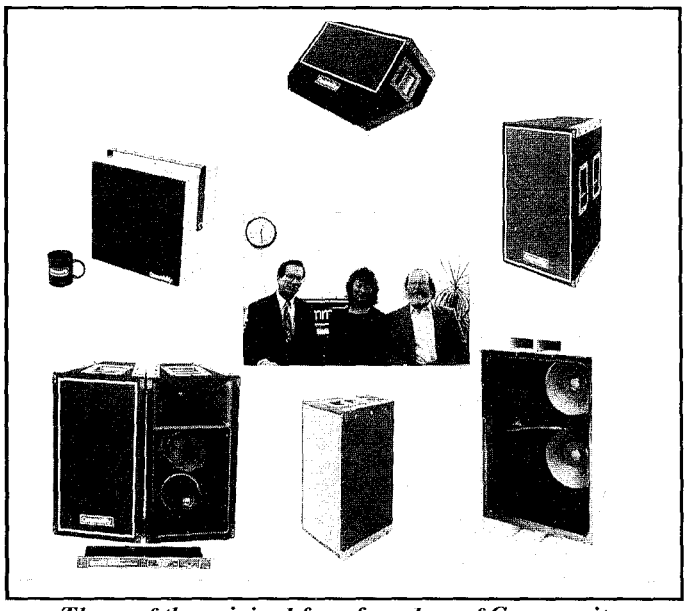
I understand the book is available from Hal Leonard Publishing, P. O. Box 12819, Milwaukee, WI 53213 for $24.95.

Community

Community's activities are evident in the awards coming their direction for their efforts in the international marketplace. Governor Mark Single of Pennsylvania commended Christine Howze for her company's "outstanding achievement in exporting" and "accomplishments and contributions to Pennsylvania's economy" in an official letter of honorable mention.

Christine Howze is Syn-Aud-Con's idea of what the "Women in Audio" group in the AES can look up to as a highly successful manager in the real world of audio manufacturers. Christine Howze, then Christine Kofoed, was one of the original four that started Community Light and Sound in 1971.

Community is still another US company that is proving that they can compete worldwide on the basis of better product design, manufacture, and customer communication. It's too bad that GM and Chrysler can't borrow some of Community's spirit and drive rather than spouting drivel to Congressmen about protectionism. When you are out front, let the other guy worry about his protection.



Three of the original four founders of Community

The montage shown here is only a portion of the flow of new ideas Community is putting forward.

We recently had the privilege of working with various RS series loudspeaker systems in a very large and reverberant venue.

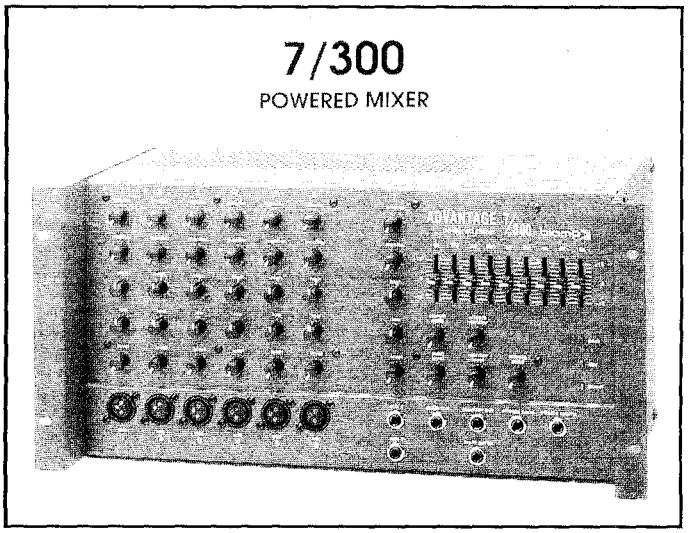
The BIAMP Powered Mixer

The BIAMP products fill real niches in a sound contractor's inventory.

The *powered* mixer is a perfect example. The Advantage 7/300 is a six microphone input mixer and 300 watt power amplifier with a built-in 1 octave graphic equalizer. There are literally thousands of small jobs where this kind of packaging solves the installation problem completely.

The second product is the Advantage CPA 650 commercial power amplifier, UL aproved and made entirely in the USA. It has many useful features such as level controls that can be mounted on either the front or the back of the amplifier, built in muted turn on, and built in ground lifts.

If you are not familiar with BIAMP, we suggest you look into their increasingly extensive line of equipment. They are an excellent source of audio input consoles, equalizers, and amplifiers.



Our Address is Changing !

Old:
Synergetic Audio Concepts
Rt. 1 Box 267
Norman, IN 47264

New:
Synergetic Audio Concepts
12370 W. Co. Rd. 100 N
Norman, IN 47264

Effective February 1, 1992

How Do We Explain the Success of the Notorious "Edison Tone Test"?

by Pat Quilter of QSC Audio

As a phonograph collector, I too was amused to see your Summer issue ad reproduction claiming "perfect fidelity" for the Edison Diamond Disc phonograph, I own a Lab Model in fair working order, considering its age of 70+ years. I would like to assure your readership that while the above claim is indeed laughable to modern ears, the machine's reproduction quality is a big step forward, compared to contemporaneous phonographs, and competes fairly closely with the famous Victor Orthophonic, which was developed over a decade later and used electrical recordings.

How Do We Explain the Success..?

How do we explain the success of the notorious "Edison Tone Test"? These were conducted for years, involving hundreds of successful demonstrations to audiences all around the country. Part of the answer is that the reproduction was, in fact, considerably improved (closing the fidelity gap by about 50%). Another reason is that Edison used a substantially anechoic recording process. This eliminated the aural cue of recorded room tone when making the live vs playback comparison. Lastly, I believe there was an implicit assumption that loudness was not expected to match the original, any more than we expect a movie or TV to be as bright as real life. If you combine this factor with the masking and concealment effects of a reverberant hall, and the expectation of a lower volume for the reproduction, it is just about conceivable that unsophisticated listeners, never hearing a modern sound system, might agree "it sounds just like the real thing". This response was apparently amplified (pun intended) by the ad writers to a claim of literal indistinguishability.

In the long run, the market decides. Edison's system takes its place among the other "technically superior" systems which did *not* win the hearts and living rooms of America. This situation is usually caused by unacknowledged defects. In addition to the fact that the anechoic recordings caused a rather sterile sound in typical living rooms, the "dirty secrets" of Edison's discs were excessive surface noise, due to the molding defects lying in the same plane as the vertically recorded signal, and a lack of artistically exciting performances. While Victor was loudly trumpeting their stable of exclusive artists, bands and entertainers, the Edison recordings largely consisted of material somewhat analogous to the "hi-fi demo discs" of yesteryear, which may have showed off the playback quality, but rarely exploited the appeal of popular artists and current hits. Perhaps this was the genesis of the modern concept that quality and availability of software counts more than the raw performance of the machine on which it plays. Above all, this stands as a lesson that even the presence of the world's foremost Audio Engineer, presiding over the greatest R&D facility in the world had yet seen, could not ensure success if the firm had weak marketing, did not correct its mistakes, and did not respond to the true needs of the customers.

Sound Levels

My $39 Radio Shack sound meter gives the following data on sound levels (sustained crescendo and peak readings, all obtained at about 1 meter in front of the horn)

Model	Large Band	Vocal
Amberola 50 cylinder	83-87 dB	85-88 dB
Victrola, inside horn	89-94	90-98 (Caruso)
Edison Diamond Disc	92-96	90-102 (Anna Case)
Orthophonic Victrola	88-93	85-95

(Note: the Orthophonic horn has a much larger mouth, so measuring SPL at the same distance gives a deceptively lower reading, since the sound waves are more dispersed. It fills the room with about the same volume as the Edison Disc player.)

Sound Quality

The Amberola cylinder player delivers a "warbly blare" with much coloration, 160 rpm flutter, much second harmonic distortion, and fairly quiet surfaces. The Victrola has a much more stable turntable, and its mica diaphragm has a bright chirpy quality which compensates somewhat for a lack of true overtones on the records, but it also emphasizes needle scratch on worn records. Both machines can reproduce intelligible voice and music, but their sonic signatures are the most obvious feature during playback. The Edison Disc player is arguably the first device to achieve a reasonably natural, non--resonant playback. The range is limited, and peaks tend to rattle somewhat, but the middle several octaves are respectably flat and the high and low frequency rolloffs are not too abrupt. For the first time it was possible to get some feeling for the actual presence of the artist. Side by side comparison reveals that the Orthophonic has slightly more bass, but is impaired by metallic overtones and high frequency resonances in the aluminum diaphragm, as well as the drawbacks of the crude steel needles, which are audibly worn by the end of a single play.

First Disc Player to Use a Permanent Stylus

The Edison Diamond Disc was the first disc player to use a precision-ground permanent stylus riding in a matching groove. While the diaphragm lacks a phase plug, its rigidity and moving mass are better than the overly complex Orthophonic reproducer. The horn is completely free of slip joints, and couples the lower registers remarkably well considering it is a small fraction of the size of the Orthophonic horn.

Bob Oliver, Stage and Sound Manager at Syracuse Performing Arts Center in Syracuse, sent us a packet of interesting information on hearing. In the packet was a brochure on an organization: H.E.A.R.—a non-profit organization whose mission is to prevent hearing loss by promoting awareness of hearing issues and educating the public about the nature of sound.

You can receive their information packet for $7 to cover their costs. Write H.E.A.R., P O Box 460847, San Francisco, CA 94146, Ph 415-773-9590.

Pete Townshend, patron and benefactor of H.E.A.R. is quoted as saying,

"The real reason that I haven't performed live for a long time is that I have very severe hearing damage. It's manifested itself as tinnitus, ringing in the ears at the frequencies that I play the guitar. It hurts, and its painful, and it's frustrating."

Co-founder of the organization is Kathy Peck, a musician who developed a hearing problem after opening for Duran Duran at the Oakland Coleseum. She wears a hearing aid to understand speech.

"A Phase Cancellation Method for Tinnitus"

M. D. Judd and A. Unal gave a paper at the April 1991 ASA Convention. The abstract was printed in the ASA Journal. I think it is of sufficient interest to reprint the abstract here.

"Tinnitus is an intrinsic feedback noise generated within the inner ear. Objective tinnitus is the kind in which a sound field does exist in the outer ear canal. Recent findings on the objective tinnitus problem strongly suggest that the signal(s) emanate from damaged sensor hairs inside the cochlea. The ringing, or noise, that the patient "hears" is most likely the firing of neighbor sensor hairs, due to the damaged sensor. Thus these neighbors comprise some signal bandwidth over which the patient detects the ringing. In the greater number of patients, this phenomenon is diagnosed as due to a single tone. Current signal methods used to mask the tone, or noise, emanating from the cochlea typically employ wide bandwidth signals that overlap more than the full bandwidth of the tone (or noise). These methods inherently create noise in themselves and do little to remove the signals being generated from the inner ear. This paper presents a simple viable method to cancel a single tone, in the local region of the damaged sensor, in the cochlea."

Should you want to contact Mr. Judd or Mr. Unal, their address is listed as 3100 Central Expressway, Santa Clara, CA 95051

Richard Jamieson of Jamieson Associates in Minneapolis sent us an interesting article on Tinnitus written by Ty Ford in Baltimore. It is a full page article and I will excerpt only a small part of the article:

"Tinnitus (pronounced TIN-ah-tus) is a hearing disorder that affects about one in every six people in America. ...

"Tinnitus can be caused by trauma, infection, drugs and allergies or simply by wax build-up in the outer ear. Trauma, in this case, means having the ear exposed to overly loud audio for any length of time.....

"According to Dr. William Brownell of the Ear, Noise and Throat department of Johns Hopkins Hospital in Baltimore, we are born with 12,000 to 15,000 hair cells in our inner ear. Since our bodies do not regenerate new hair cells, keeping the ones we have healthy is vital."

There are a few very disturbing sentences in the article, like,

"Curiously, there was a gap of 20 to 30 years between the exposure to high SPL and the onset of tinnitus.

A friend of mine who has been an audio engineer for 10 years recently left the trade because of problems with tinnitus."

There is speculation that lack of proper blood circulation in the inner ear also seems part of the problem, which indicates that alcohol, caffeine, salt, nicotine and fats are out.

Dr. House of the House Ear Institute is quoted in an article in October 1991 MIX magazine by David Schwartz and Penny Jacob (David Schwartz along with many notables in audio are on the advisory committee at H.E.A.R.)

"Former patients who have willed us their temporal bones to study, so that we can look at the fine, delicate structures of the inner ear to determine the extent of noise-induced damage and exactly how it affects the inner ear. We are beginning to see a phenomenon that is not necessarily associated with extreme hearing loss, but with an extreme sensitivity to noise. There are certain patients whose problems stem from one rock concert or one loud gunshot. This one-time exposure to an extremely loud sound can damage the inner ear and cause these people to become so extremely sensitive to normal, loud environmental sounds--a door slam, cars going by on the freeway--that they have to wear earplugs just to survive in the normal environment."

You can contact the House Institute for more information about hearing, protection and treatment. Contact

Charlie Lahaie, House Ear Institute, 2100 W 3rd Street, Los Angeles, CA 90057; (213)483-4431.

I read a statement by Dr. Thomas Fay on stereo earphones in the H.E.A.R material that Bob Oliver sent that impressed me,

"It's like the nozzle of a fire hose has been stuck down the ear canal."

If your work requires that you work in the presence of excessively loud music, the H.E.A.R. material makes it very clear that you will want to strike up an immediate friendship with Dr. Mead Killion at Etymotic! We have written about Etymotic many times in our Newsletters but if you don't have the address handy, Etymotic Research, 61 Martin Lane, Elk Grove Village, IL 60007, Ph 312-228-0006.

Reprint from Audio Magazine Letters to the Editor from Mead Killion (excerpt)

In Your Ear

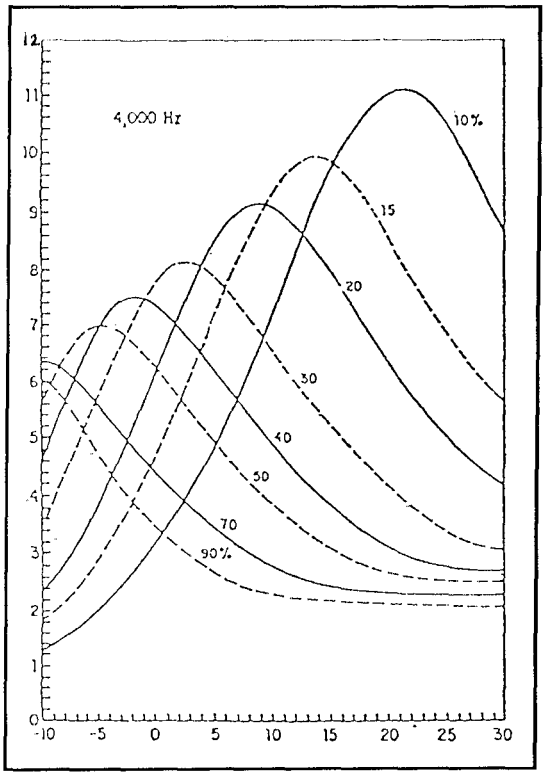
I thoroughly enjoyed Ed Long's article on headphone measurements (April 1991) and was delighted to read his comment that *"The only other earphones I would presently consider for use as references are the Etymotic Research ER-1M, which are, at least at present, not available as a production item. They are an in-the-ear type and the most accurate of any I have ever heard."*

I am happy to report that a production version of these earphones, the ER-4, is now available. It is an all-in-the-ear type with the same diffuse-field-equalized frequency response as the ER-1M but with a slightly higher undistorted output.

By providing some 20 to 30 dB of isolation from outside noise, such earphones permit enjoyment of the day dynamic range of recent recordings without requiring ear-shattering reproduction levels to overcome masking by the background noise levels of typical listening environments.

If there is any one thing that comes through loud and clear in the referenced material here: TAKE CARE OF YOUR HEARING!

Atmospheric Attenuation vs Temperature & Humidity



Atmospheric Attenuation vs. Temperature and Humidity

Barry McKinnon, of Barron Kennedy & Lyzun in Vancouver, sent in the two graphs shown here. Unfortunately the source is unknown. We would be pleased if any one could tell us where they came from.

Studying these in conjunction with Figure 7-3, Page 148 of *Sound System Engineering* leaves one with a real appreciation for the frequency dependency of atmospheric effects.

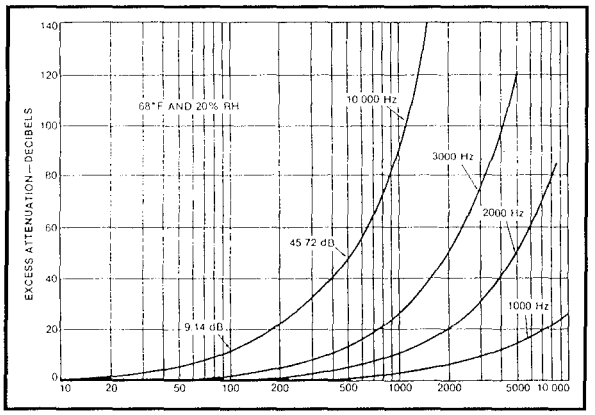
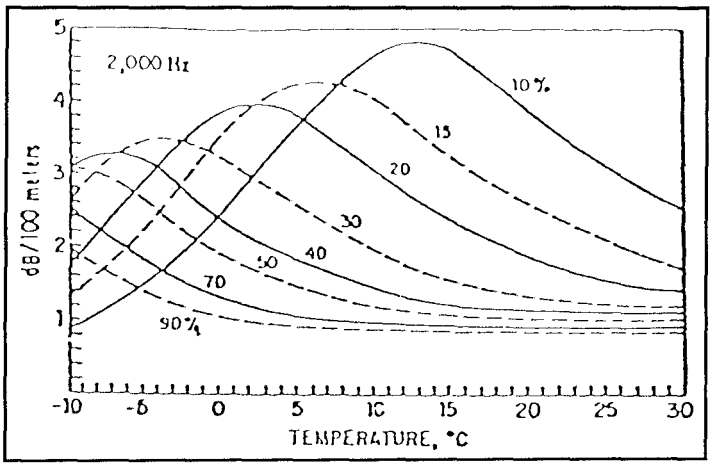


Fig. 7-3—Excess attenuation for different frequencies and distances from the source.



S. Indiana in the Fall

This is the first year in over twenty-five years that Carolyn and I have been in S. Indiana, even to visit, during the fall. Our normal travel schedule usually had us working out of Gettysburg, PA or Williamsburg, VA for our East Coast classes.

Maybe this was an exceptional year or maybe we had forgotten how beautiful the forest becomes after the first frosts. The hard maples are dark red (not the blazing reds of the North East) along with the yellows, oranges and rusts and the shimmering light and shadows of early evening and a sun low in the sky.

The deer move about in groups. I saw one herd of eleven and in our back field the biggest buck I have ever seen anywhere in the U.S. He had a rack with ten points and challenged me by stamping his front legs. He didn't appear the least perturbed by my presence other than the stamping and took his own sweet time in leaving. Every 50 yards or so he would stop and turn broadside to me. When I first saw him he, was about 25 yards away. He was so big he looked like a small elk.

Earlier that same day while out horseback riding Carolyn was in the lead on Red Reed Truckle when they stirred up four doe. Horseback ing is the way to travel S. Indiana. The view high above the low brush lets you see further and clearer and the horses don't "spook" the deer until they are quite close.

We were in Arizona for a holiday during hunting season so we invited 2 local law enforcement officers to hunt (and protect) our deer - but with the special request to preserve our 10-point buck.

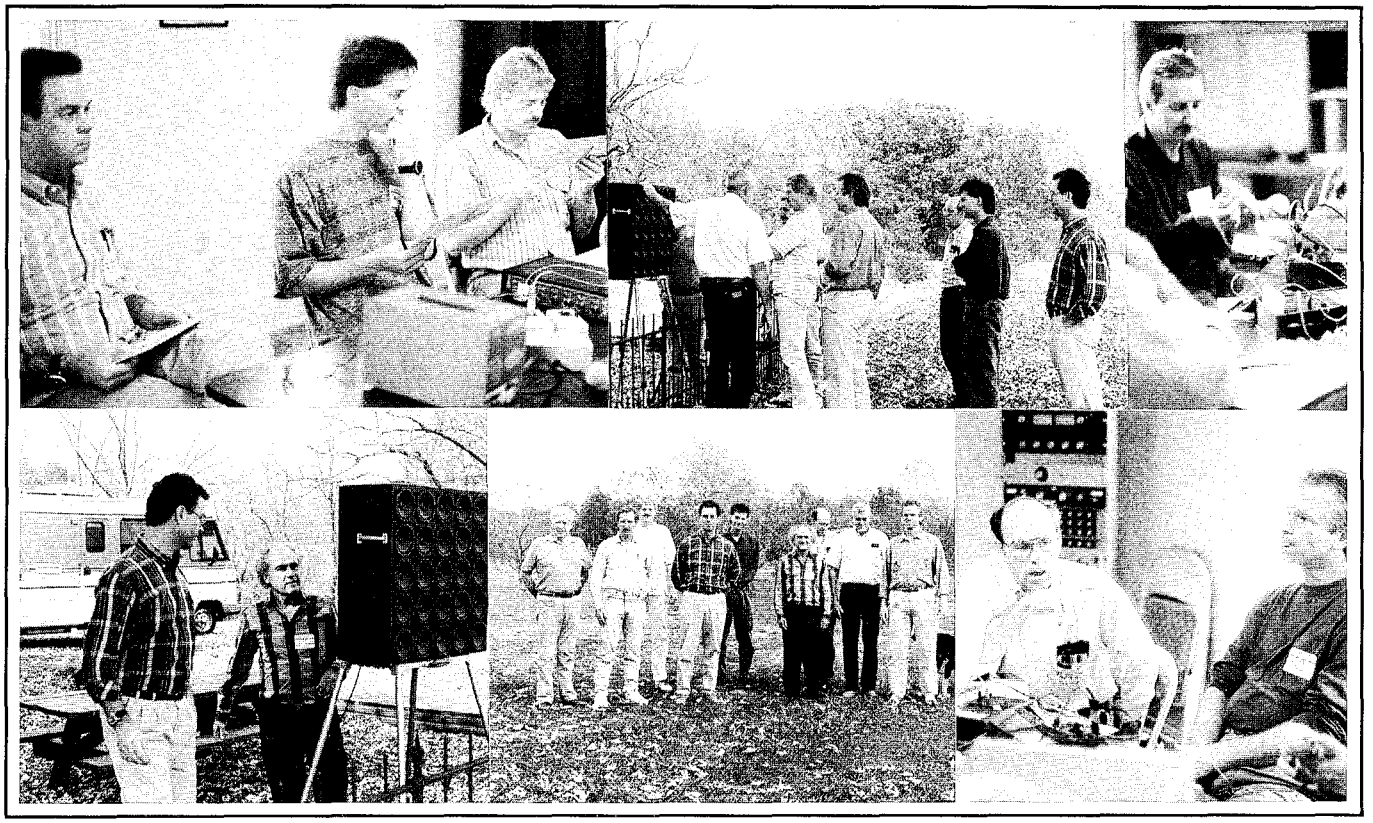
Theodore Roosevelt once said

"We loved a great many things
birds and trees and brooks
and all things beautiful
and horses and rifles and children
and hard work and the joy of life"

We could add to Theodore Roosevelt's list music, math, music, analysis, music, motorcycles, music, Porsches, music, skiing, music....

Now is our time in life to immerse ourselves in the beauty around us and savor it to the full. We are grateful to be able to do so.

October 25-27 Farm Seminar 1991



Critical Bands

(Frequenzgruppe)

The highly directional constant directivity horn aimed at a specific area was no longer aimed at the absorptive audience area, but had lobes spraying the marble walls, floor and ceiling.

In the 1960s, during the development of the 1/3-octave filter sets and the 1/3-octave real time analyzers, the Hewlett Packard engineers we were working with brought "critical bands" to our attention. (The real time analyzers were being designed in Boblingen, on the outskirts of Stuttgart, Germany.)

A critical bandwidth is one within which you can't tell the spectrum shape of complex sounds such as speech or music. The ear/brain system tends to judge the entire band as a sum of some sort. This showed us at that time, and 30 years later still holds, that equalization done on 1/3-octave increments was optimum for most purposes and program materials.

Critical Bands and Signal Synchronization

Years later, when we began signal synchronization with precision digital delay devices, non-experimenting critics scoffed at us, saying the comb filters we were correcting were narrower than 1/3-octave and therefore inaudible. They were correct in so far as they went, but overlooked that these comb filters were not electrically generated but acoustically, and in the process they changed the polar response of the two devices generating the signal in a highly detrimental manner.

The lobes generated no longer went to the audience absorption, but now went to the ceiling and side walls. In other words, the highly directional constant directivity horn aimed at a specific area was no longer aimed at the absorptive audience area but had lobes spraying the marble walls, floor and ceiling.

On axis, in an anechoic chamber, these comb filters made only minor audible changes in the complex signal. The same setup listened to in a reverberant space was a dramatic ear opener because the out-of-control lobes excited the entire reverberant sound field.

In Syn-Aud-Con classes we teach that equalization, signal synchronization, LEDE spectral control, and ambient noise levels are critical where the majority of the sound power, speech intelligibility and hearing resolution and acuity are optimum, namely 250 to 5,000 Hz (roughly five very important octaves).

Within that frequency region you need to be alert to polar behavior, frequency aberrations and distortion components.

When we use our knowledge of these parameters in a creative way we can greatly reduce the number of listeners who listen but don't hear.

Musical Acoustics Seminar/Workshop

On March 7-9, 1992, Professor Rossing will conduct a three-day workshop on Musical Acoustics.

Thomas Rossing is a distinguished research professor in Northern Illinois University Department of Physics at DeKalb , IL (about 60 miles from Chicago.) He is the author of 200 publications, including 10 books, and the holder of 19 patents. Professor Rossing's research areas include musical acoustics, psychoacoustics, environmental noise control, magnetic levitation, and physics education.

Participants will consider certain subjective aspects of musical sound perception, such as loudness, pitch and timbre, using modern acoustics measuring equipment to analyze sound pressure, frequency, spectrum, amplitude envelope, etc. Participants spend about one-third of the course in the laboratory and take home materials for acoustics experiments. Finally, the recording and reproduction of musical sound, with special attention to digital recording will be discussed.

Obviously this workshop is a MUST for teachers of audio and acoustics courses. At $195 the workshop is a genuine bargain. It is our feeling that Syn-Aud-Con grads would benefit from Dr. Rossing's instruction. For more information call Debra Booth at the College of Continuing Education at 815-753-6913 or Prof. Rossing at 815-753-6493.

Reminisces

When Carolyn and I started Syn-Aud-Con in January 1973, we had a truck, a trailer, some test equipment, and a desire to share what we had learned up to then about audio and acoustics.

As we begin our twentieth year, January 1992, we are reminded once more that had we been allowed to plan in detail what those twenty years were to bring we would have really short-changed ourselves. We truly have been at the open end of an audio and acoustic cornucopia.

We have been privileged to witness a great deal of genuine human genius as well as experience the deep bonds that can develop between true peers. The past twenty years have been overwhelmingly filled with hard-working, productive, inventive and wholesome people eager to do the best that can be done.

Our judgment at our mid-sixties is that there are more inherently good people with valuable talents alive today than at any past period.

We have seen a small but very vocal minority generation demonstrate what dishonesty, immorality, and self deception lead to and we have rejoiced that the vast majority of that generation made it through the myriad temptations to witness the change in the mental atmosphere back to ancient but inviolable standards.

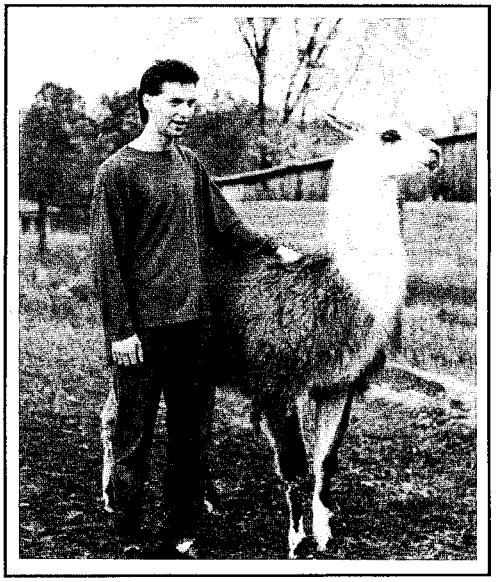
We once saw a sign in front of a church that said it well, "They are not ten suggestions."

This last decade of the 20th twentieth century promises to introduce more new developments than any previous one. The international nature of the audio and acoustic marketplaces means that only the best will survive. What we can fearlessly predict is that a very high percentage of those who do survive will be Syn-Aud-Con grads. We can hardly wait to see the year 2,000 AD and watch those grads run the show.

Poncho Has a New Personality

Poncho has been with us for 18 months (he is now 2-1/2 years old). We loved Poncho on sight when we purchased him. We asked for the "loan" of a companion to be with Poncho until he got used to our place, and we ended up purchasing our "loaner"—another male. It was a mistake as they were not at all compatible. (We can't afford a female at $10,000 up nor do we want to be in the breeding business.) We found a new home for our loaner last July and we have had six months of staying at home with our animals and being around Poncho.

Llamas don't like to be touched or handled so we have been very careful to keep our hands off. If you have noticed in the pictures of Poncho with class members in the Newsletter, hands are always out of sight. Then a breakthrough occurred with Chris Gille in our October 24-26 class. Poncho's tail curled up and he literally begged Chris to touch and handle him. Now Don and I are working with him several times a day, brushing and rubbing him. Big thrill!



Auxiliary Loudspeaker

It is often desirable to have extension or auxiliary systems driven from the same sources as your primary system, but isolated in such a way that their presence is totally undetectable when listening to the primary system.

Most modern electronics have auxiliary outputs. If your control preamp does not have such an output, generate one by bridging across the output of the one you have. Input the auxiliary amplifier from the preamps auxiliary output (the aux amplifier should have enough gain associated with its input to insure "gain overlap" between it and your primary system's preamp).

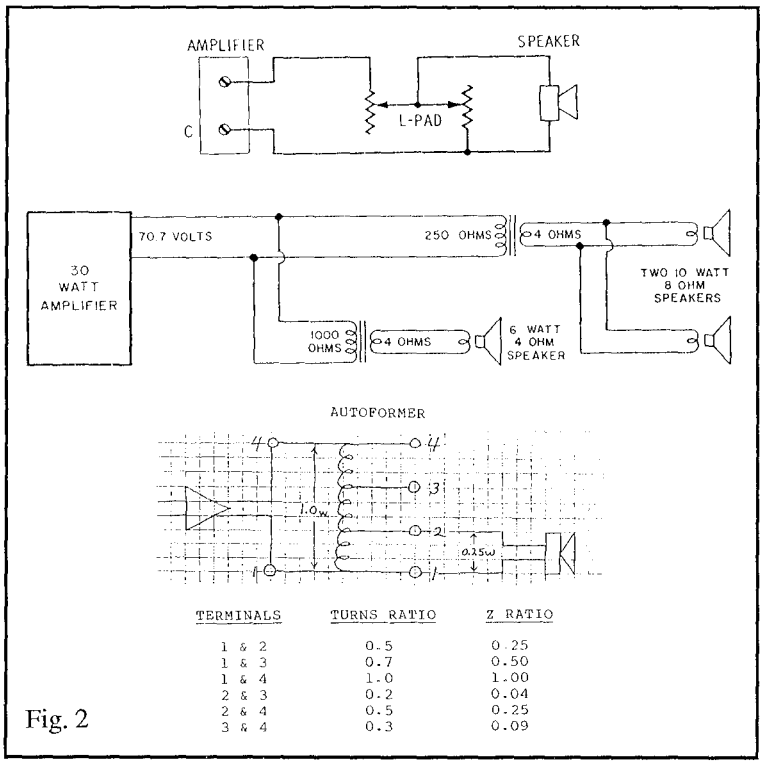


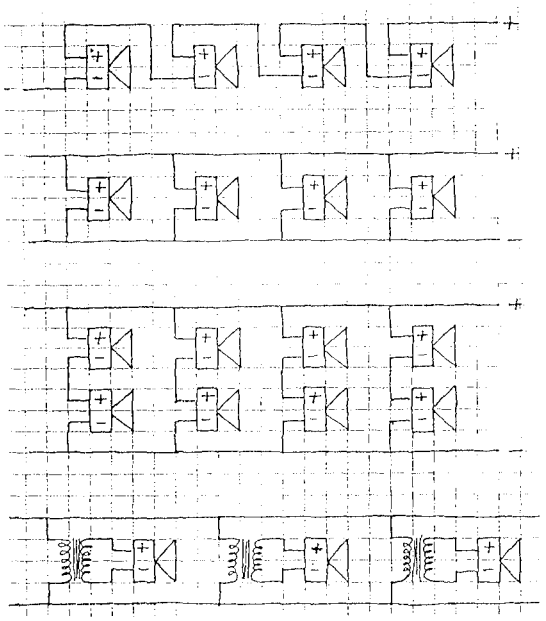
Fig. 2

AUXILIARY AMPLIFIER OUTPUTS

Loudspeakers can be wired in series, in parallel, in series parallel, or as transformer isolated. See Fig. 1.

In quality systems, series and series-parallel are not used. From suitable amplifiers it is possible to generate very low source impedances on the order of 0.5Ω without loss of stability and still draw its full power rating. Such an output would allow 32 sixteen Ω loudspeakers or 16 eight Ω loudspeakers to be connected in parallel. If only one unit is connected, the mismatch (which is in a now harmless "bridging" mode) limits the amount of power it draws and when all are connected at one, the full power of the amplifier is distributed evenly among them.

LOUDSPEAKER WIRING Fig. 1



TRANSFORMER COUPLING

The technically partially informed often council against the use of transformers. The only legitimate problem associated with transformers is cost. If you use them, they must be high quality and quality has a price. What you get if you pay the price is convenience. You can set individual levels easier and each unit is isolated from the remainder and the amplifier so that even if it were to be totally shorted, it would not cripple the others.

There are many ways to control remote level, but the three simplest are shown in Fig. 2

Mental Conditioning

"If bad sound were fatal, audio would be the leading cause of death."

Those engaged in hazardous activities attribute their success and survival to "mental conditioning" that prepared them to be able to detect escalating dangers in time to take meaningful counter action. Fortunately in audio and acoustics remaining totally unalert and unaware does not have physically fatal results. We have told many a class "If bad sound were fatal, audio would be leading cause of death."

Let's, just for the fun of it, suppose that the next auditorium you walk into has audio and acoustic problems that can kill if undetected in time. Just what sort of mental attitude would you have to have to approach the auditorium and the sound system?

You would, of course, cultivate alertness. Alertness means that you are aware of your ignorance and won't try to bluff anyone. Alertness also means that you are aware of your talents and will vigorously use them.

Since undetected faults could be fatal, you would, naturally, carefully check out as many things as possible before turning the system on, starting with the AC power right through all audio interconnections with nothing taken for granted. You would satisfy yourself as to grounding, shielding, appropriate impedances, correct polarities, gain overlaps, gain settings, and microphone-loudspeaker sensitivities.

Then, cautiously you would go out and listen to the room before turning on the sound system. You would look for deadly concave curved surfaces, excessively dangerous ambient noise levels, fiendish high level long delayed reflection possibilities. One look at the environment may dictate bringing in the SWAT team (special word lists for articulation testing) or even the heavy artillery of TEF and SYSid analysis.

Remembering that "its not the weapon but the man" that determines the outcome, you would approach the use of the tools at hand knowing that man analyzes with his mind, not his hands.

Let's say you hear something strange. How do you listen? Is it frequency dependent, time dependent, polar dependent or some strange combination of them. You have been trained to "cup your ears" for polar dependence and you might even use the shield of Sonex to determine exactly which direction the danger came from. Is it air borne or structure borne. Remaining aware of source, path, and receiver you search carefully for all offending sounds.

Having cleared the room it's now time to turn on the system. To minimize danger you operate with the gain down and bring up one loudspeaker at a time. As soon as you have one loudspeaker under control you turn it off and try the next. These guys are easiest one at a time. Once you have two loudspeakers under control, turn them both on and see if they can be handled together. Never turn your back on a comb filter. Many are harmless, but some are deadly.

Once you have all parts of the array up and working harmoniously with each other and their assigned audience areas you can turn the system over to its operator.

Just as you are leaving the control room it hits you that you have never seen the operator before. It turns out he is a last minute replacement for the operator that you have trained. The feedback screech taking out all the high frequency drivers is the last sound you'll ever hear as your lifeless ears slump to the floor.

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Acoustical Consultants may list their cards on this page. There is no charge. The only requirements are that you are a full-time consultant, that you have attended a Syn-Aud-Con seminar, and have an active subscription to the Syn-Aud-Con Newsletter. If you would like to be on our Consultants page, send in four (4) business cards for our file.

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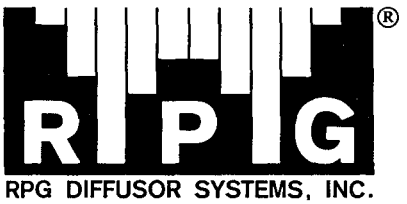

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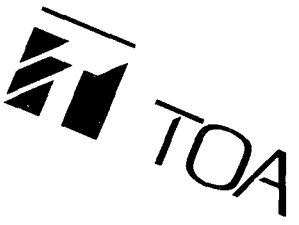

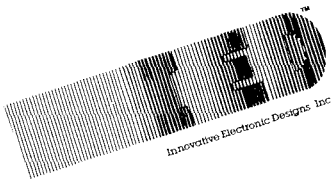

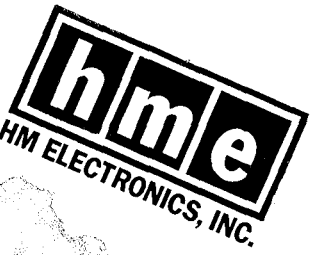

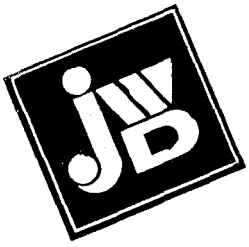

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