SYNERGETIC

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AUDIO CONCEPTS

# newsletter

Volume 22, Number 1
Fall 1994
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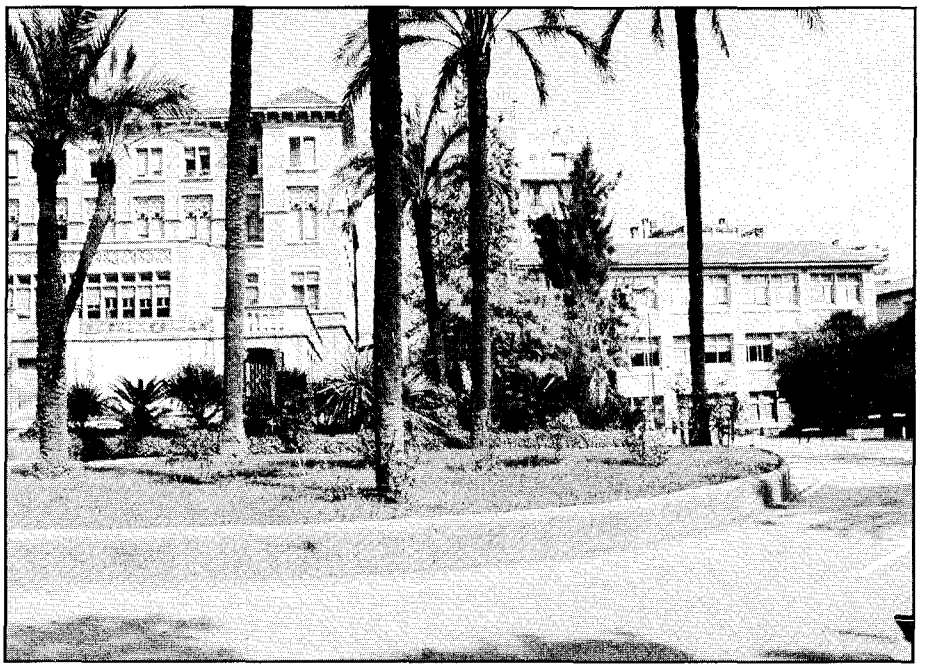
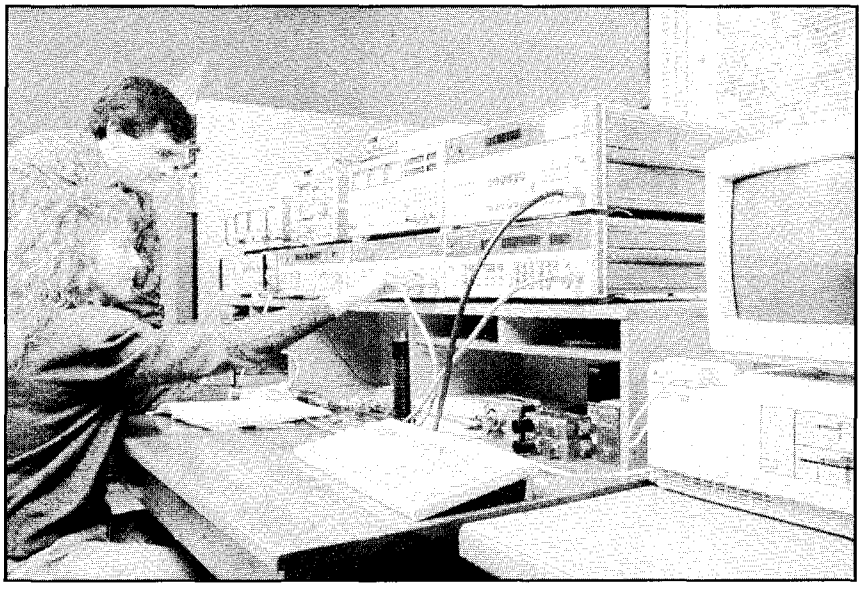
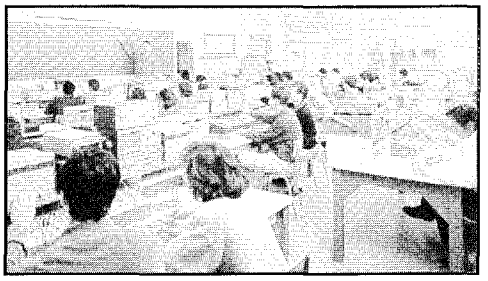
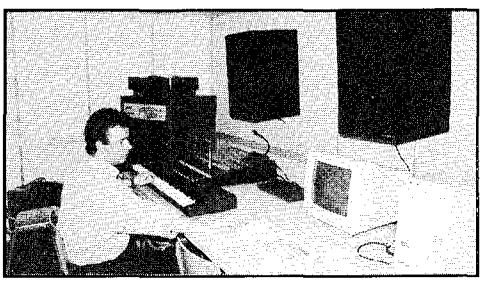
Pat Brown

## *Universitat Ramon Llull Barcelona, Spain*









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## 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; cooperating, cooperative

Synergism: Cooperative action of discrete agencies such that the total effect is greater than the sum of the two effects taken independently.

Editors: Don Davis
Carolyn Davis

Design & Layout: Dashia Meadows
Betty Branaman
Pat Brown

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For additional information contact:
**Synergetic Audio Concepts**
**12370 W. CR 100 N**
**Norman, IN 47264**
**Ph: (812) 995-8212**
**Fax: (812) 995-2110**

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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., 7-94). This means that you will receive your last issue with that quarter's mailing unless you renew. Renewal notices will be sent one month prior to your last issue being mailed. 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, 12370 W. CR 100 N, Norman, IN 47264

# Universitat Ramon Llull Barcelona, Spain

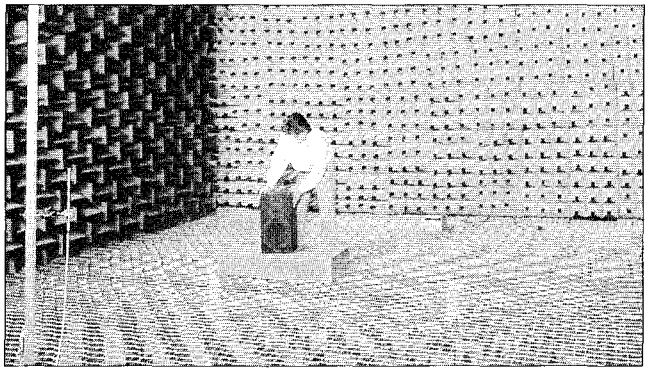
Professor Joan Anton Torello and four of his students attended the two day Mark IV/Auprosa Audio Professional sponsored conference in Barcelona. Pat Brown and I were on the program.

Following our presentation, Professor Torello invited us to see La Salle Engineering Center. Beautifully situated amid flowering trees and shrubs is an engineering school devoted to video, information systems, electronics, acoustics and telecommunications.

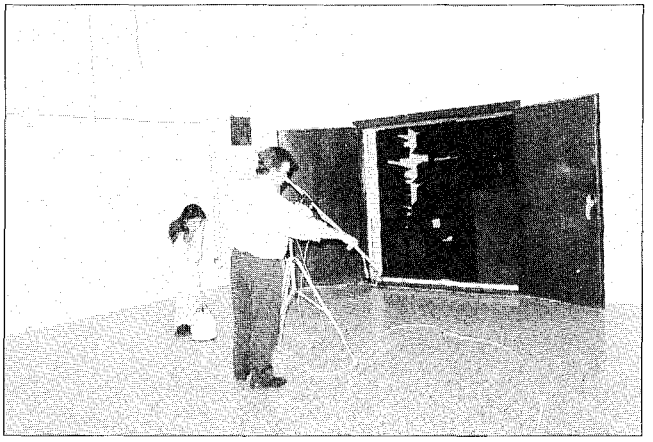
The acoustics classes have 300 students enrolled. One remarkable fact about enrollment is that 30% are women.

Taught by a very competent staff and at a ratio of 16 students per instructor. The students we observed were highly motivated young people.

The anechoic chamber is 500 $M^3$ (14,158 $ft^3$) with available space free of wedges of 250 $M^3$ (7,079 $ft^3$). The depth of the wedges are 80 cm (31.5") with 20 cm (8") of air behind them. The reverberation room is 200 $M^3$ (5,663 $ft^3$) with hard tile surfaces.



Instrumentation included the very latest in Bruel & Kjaer, Hewlett Packard, and other well-known equipment.



The school was deeply involved in the acoustics and electroacoustics for the Olympics in Barcelona and have been in operation for forty years.

When we returned to the United States following our visit to the La Salle Engineering Center of the University of Marmon Llull in Barcelona, Spain, we called Dr. Patronis. We described what we saw and heard at the University and ask if he knew any university facility in the United States that would compare with what we described. He said possibly the acoustics lab at Penn State.

We spent a delightful morning with Josep Marti, head of the Acoustics Department and four of his staff. Delightful is not the right word, stunning would better describe the morning.

***Professor Torello (R) with four of his students. The bulge under Dani Pujol's shirt is a broken arm (from playing basketball!).***

# 1995 Syn-Aud-Con Seminar & Workshop Schedule

## Live Sound '95 Workshop

**When:** **January 16-18, 1995**
**Where:** **Chapman University, Orange, CA**
**Fee:** **$650**
**Staff:** **Will Parry, Workshop Chairman**

Some of you may have noticed in the brochure that there is a subtle change from previous years. Syn-Aud-Con is not a co-sponsor of the Live Sound Workshop. Not because we don't completely support the workshop, but because we continue to cut our travel schedule as much as possible. So this year we are doing everything for the workshop we have done previously except be present in January.

## Special Seminar on AutoSound May 22-24, 1995

Richard Clark and his partner, David Navone, conducted 23 seminars last year on AutoSound in the United States and abroad. We would like to work with Richard Clark. He is a dynamo with a burning need to do it right. The AutoSound seminars are geared toward manufacturers and installers who specialize in high-end, after-market systems. They would like to hold a seminar that would mix engineers from the professional audio field and the OEM manufacturers with the after-market specialists. Car audio is one of the fastest growing segments of the audio industry, and should prove to be an interesting and challenging future for those involved. If you are interested in attending such a seminar, let us know.

### ❖2-Day On-the-Road—$550❖ Sound Engineering Seminars

**January 18-19, 1995**
**Anaheim, CA**

**February 15-16, 1995**
**Orlando, FL**

**March 22-23, 1995**
**Bellevue, WA**

**April 18-19, 1995**
**McLean,VA**

Pat Brown will conduct the two-day On-The-Road classes, teaching one per month from January through April. He will then be co-instructor for the 3-day classes at the farm in S. Indiana.

If you would like a Syn-Aud-Con seminar in your area, let us know and we'll study the possibility.

## Arraying Horns & Boxed Loudspeaker Systems

**When:** **March 29-31, 1995**
**Where:** **The Ohio Theatre, Columbus, OH**
**Fee:** **$650**
**Staff:** **John Murray, Workshop Chairman**
**Craig Janssen, Acoustic Dimensions**
**Kurt Graffy, Paoletti Associates**
**Dave Gunness, Electro-Voice**
**Mark Ureda, Mark IV Audio**

The Horns II Workshop will continue to explore constant coverage horn parameters and their effect on multiple-unit arrays. The staff is very pleased to add a very important subject to the workshop—arraying boxed loudspeaker systems. The Ohio Theatre has a mid-high cabinet coupled with custom low frequency directivity controlled cabinets. The concepts of array design for broadband directivity control will be an important subject in this portion of the workshop.

### ❖1995 3-Day Rigging Seminars

**Instructors: Harry Donovan & Jay Glerum**

**February 27-March 1, 1995**
**Las Vegas, NV**

**March 27-29, 1995**
**Orlando, FL**

**April 24-26, 1995**
**San Francisco, CA**

Again, a change. We have turned over the organization and promotion of the Harry Donovan Rigging Seminars to Dashia Meadows, the young woman that has worked in our office since we moved to Indiana, and whom we have known since she was a little girl. She has two little preschoolers now and wants to work from her new home. We suggested to Harry Donovan that Dashia would do an outstanding job for the seminars. Rigging Seminars has a new address and phone number.

**Rigging Seminars**
**Rt. 18, Box 541 ♦ Bedford, IN 47421**
**Ph: 812-278-3123 or Fax 812-278-3141**

### ❖3-Day Seminars—$550❖ Farm—Norman, IN 1995 Sound Engineering Seminars

**May 17-19, 1995**

**July 20-22, 1995**

**Sept. 21-23, 1995**

**October 24-26, 1995**

# Dr. Wokka and the MD's

Hope you enjoy the picture as much as we did when Greg Hockman showed it to us. I told him that I had to share it in the Newsletter. Anyone who has been around our audio industry for a few years, will recognize this group of musicians who performed together while they all were at EV.

*L to R: Dr. Basso Profundo - Alan Shirley, Shure Brothers; Dr. Wokka - Cliff Henricksen, Bose Corp.; Dr. DeConsolo - Greg Hockman, EAW; Dr. Bang-Bing - David Hoath (no longer in audio); Dr. Stratospherus - Mike Solomon - Beyer Dynamics*

# *Sabine Centennial Symposium*

June 5 to 7, 1994 saw the celebration of the Wallace Clement Sabine Centennial Symposium in Cambridge, MA. This was held in conjunction with the 127th meeting of the Acoustical Society of America.

Sabine, the true founder of the science of architectural acoustics, was so remembered at this symposium. We also remember Sabine as the man who sacrificed his health and life to aid the United States war effort in WWI and literally became the one man scientific research agency of the war.

The ASA has published the invited and contributed papers as a proceedings for the fee of $35 + $3 postage (the price that a non-member would pay ordering from ASA). Our price on our order form is $38. It would be difficult to imagine a better spent $38.

Contained within this proceedings is the universe of egos, talents, pretensions and politics of the field of architectural acoustics.

Two papers are vital, necessary, yea mandatory reading if you want to understand what a TEF 20's ETCs are actually showing you about reverberation. One paper is Robert W. Young's "Sound Absorption Coefficients of Two Kinds per Wallace Clement Sabine" wherein

$$T=60\ dB/d$$

where 'd' is the decay rate in dB/sec, and Mr. Young goes on to show the metric sabine as $(dB)m^2$ and the sabine as $(dB)ft^2$ and he points out that the unit of Sabine Absorption Coefficient in one decibel (usually omitted).

The second paper "Reverberation: Theory and Measurement" by Manfred Schroeder, has the references to the truly pertinent literature such as Peutz, Joyce, Gilbert, D'Antonio, etc., whose work is not included in some proceedings. Schroeder disposes of the older perspectives on reverberation theory with, "Psychophysical comparisons have shown that the first 150 or so milliseconds really determine the subjective impression of reverberancy" and further that, "For running music, any reverberation 5 or 10 dB below the ongoing music is masked by it and therefore, inaudible."

The 394 page Proceedings is a must buy for anyone with a pretense of interest in Architectural Acoustics. Our discussion of the two papers is in no way intended to suggest that there are not dozens of equally worthwhile papers but, only to show where this writer turned first.

# LaGuardia Airport Authority Police Case # 4424

This is a story of some good news and some bad news. The bad news is that David Klepper had his measurement equipment stolen at LaGuardia Airport and the good news is the people who moved very quickly to help him.

After we received the letter from David we called to ask if there was anything we could do to help and mentioned that we wanted to put his letter in the Newsletter. He said that he wanted to thank the people that made it possible for him to be on the job the next day making measurements: Joe Davidson of Long Engineering in Virginia, David Andrews of Andrews Audio Consultants and Michael Hesse, Posthorn Recording, both of New York.

Anyone with any information about the equipment, be sure to contact David.

KLEPPER consultants
MARSHALL in
KING acoustics

7 Holland Avenue
White Plains, NY 10603
914-761-8595

18 July, 1994

Donald and Carolyn Davis
SYNERGETIC AUDIO CONCEPTS
12370 West Co. Rd. 100 N.
Norman, IN 47264

Subject: LaGuardia Apt Port Authority Police Case No. 4424

Dear Don and Carolyn:

I am writing with the sad news that two thieves (plus possibly a third and fourth in get-away car) stole valuable KMK equipment as I waited on the sidewalk in front of a terminal at LaGuardia airport on 13 July 1994 at 11:15pm returning early from the American Guild of Organist's Convention in Dallas and consultation on the acoustics of two churches in the Dallas-Fort Worth area. One thief was solidly-build, about 5'-11", blond hair long at back (to below neck) and short in front, the other about 5'-7" with black hair. They were on the plane arriving at LaGuardia and distracted me with direction questions. I believe I saw the shorter one in one of worship spaces visited in Dallas. Stolen were one "Presidential" maroon oversize briefcase, with black and silver band around the lock, one grey and black Crown Techron TEF-20, Ser. No 010158, with internal dip switch No. 5 obviously well-used, and one rubber foot nonstandard; black and chrome Bruel and Kjaer 4230 calibrator in black leather case, one long yellow 3-wire AC extension cord, several black audio cables of various types, one 100-foot XLR 3-wire black flexible audio cable, power supplies for Ivie IE-30 (black), Ivie IE-21B (black) and for Tandy 3950 laptop (grey with green pilot light), and the Ivie IE-21B pink noise generator. If this equipment is located, please let me know immediately.

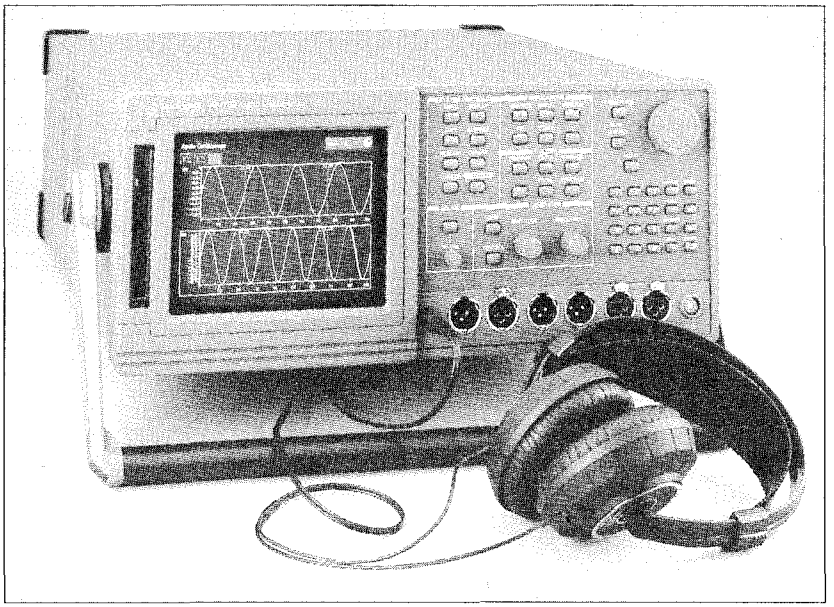
Fortunately for all concerned data from the two church consultations was already reduced to writing and/or already recorded on floppy disk in my pocket, and/or in the computer hard drive. Of course this terrible tragedy did not remove my memory of the pleasure of participation in many of the events.

**Thanks for your help.**

**Very best wishes,**

**David L. Klepper**

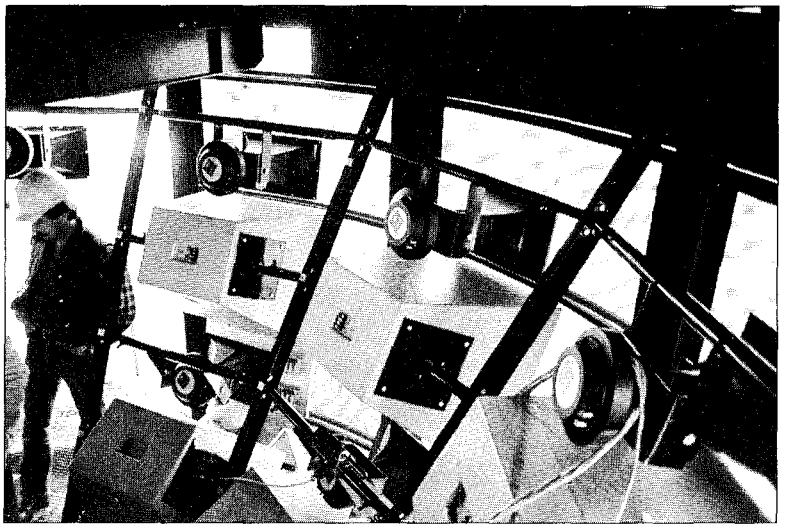
# The Tektronix AM700 - High Performance Mixed Signal Audio Tester



We note with interest that Tektronix is advertising a "mixed signal" audio tester (i.e., analog and digital) called the AM700 audio measurement set. It has a digital input and output (test signal) as well as two-channel analog input and output terminals.

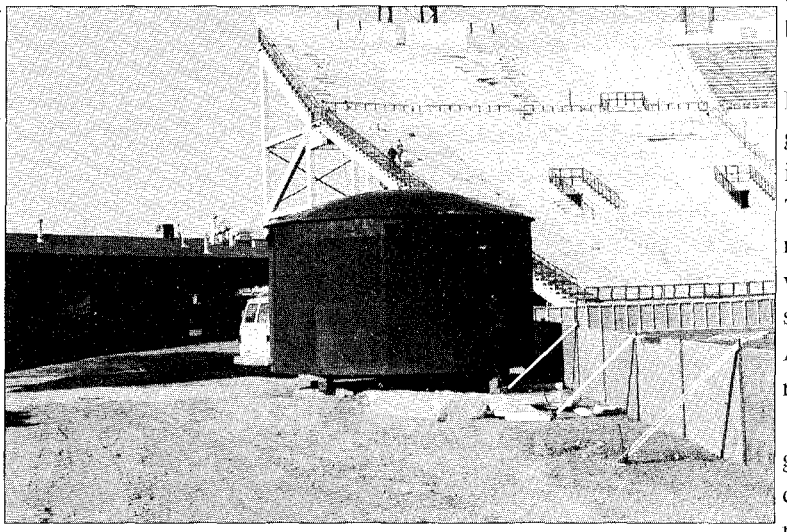
Few of us in the audio world have accepted the challenge of learning to analyze digital circuitry. We'd better because the need to do so is inevitable. For more information, write or call Tektronix Television, P.O. Box 500 MS 58-699, Beaverton, OR 97077. Ph. 503-627-3124 or fax 503-627-5801.

# The Proper Way to Do a Stadium

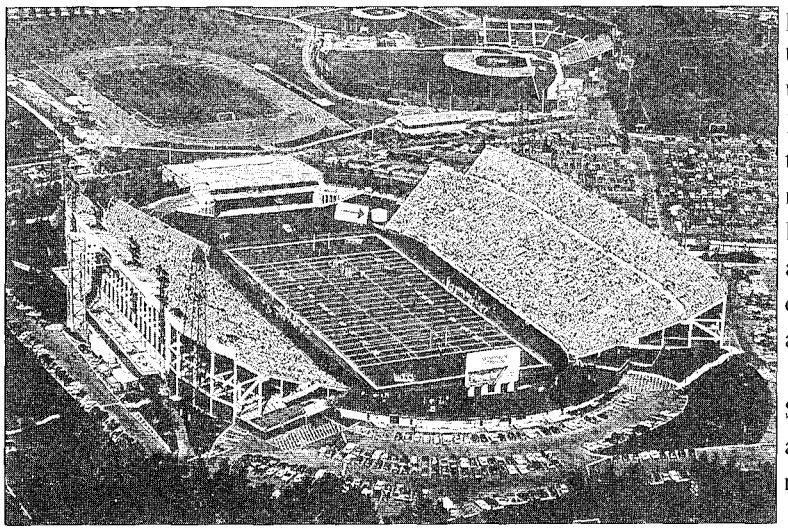


So far as we are aware, no one in the continental United States has a single source central sound system in their stadium. Canada has at least two and we know of one in Italy.

Here are pictures of one installed in McMahon Stadium in Calgary. You can tell the size of the 2-1/2 ton JBL loudspeaker array by the van parked next to it. This is the elegant way to do the job. Until we have one in the USA we have to consider us a backward nation so far as stadium sound is concerned. Bravo to the engineers in Canada who really do have to engineer their arrays.



We met the sound system designer Dan Moran, while employed by Morgan, Dowhan Engineering in Edmonton.



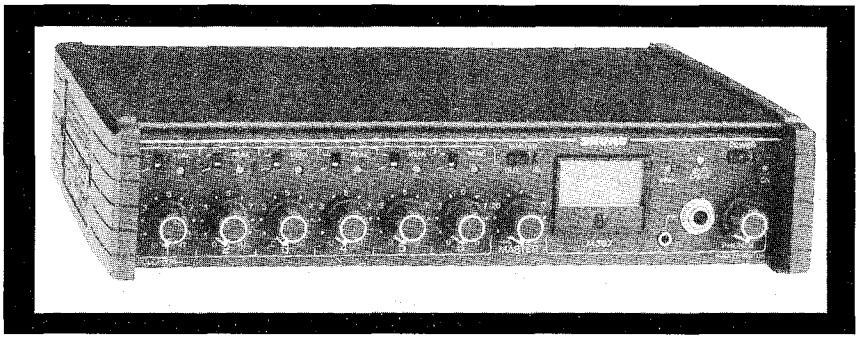
We met Dan again at the Community program in Las Vegas prior to NSCA. He now works for Genesis Communications in Edmonton Alberta.

Structural engineers, Lamb McManus of Calgary, were obviously an integral part of the team. Two-thirds of the $1.1 million sound system went towards structural steel and its installation by AGT (Alberta Government Telephone).

Clay Johnson of Morgan, Dowhan Engineering designed a similar suspended cluster in 1978 for the Edmonton's Commonwealth Stadium. (We published pictures at the time because members of his firm attended one of our Canadian classes and gave as pictures of suspended cluster.) The ten years between the two systems allowed many advancements, especially the use of constant directivity horns and the TEF analyzer. The cluster was signal aligned using electronic signal delays. Moran said, "In Calgary we got rid of a whole lot of cancellations (in comparison to Edmonton's older system) and have actually been able to increase the output of the cluster by about 5 dB just through phase alignment and not with any additional amps."

Mr. Moran has invited Syn-Aud-Con to hold a Sound Engineering seminar in Alberta next spring and we're looking forward to seeing the great northern lights again.

# New Shure Mixer



**SHURE — M367 PORTABLE MIXER**

Those who attend farm classes know that we use a Shure two-channel mixer as part of our instrumentation setup. We also carry a Shure mixer with us when we check out large systems because we know its integrity and we can substitute it for the large consoles often present when we want to know exactly what is driving the system.

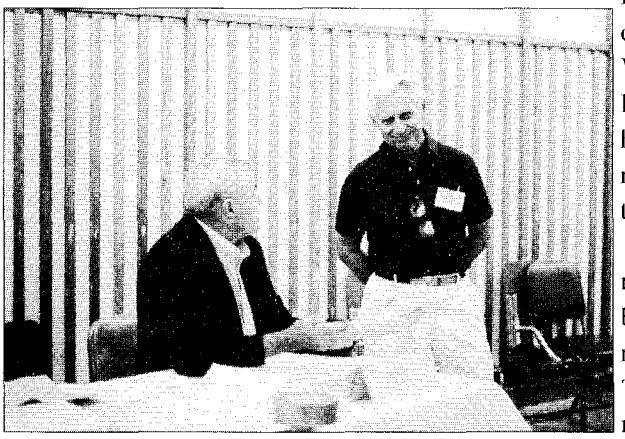
The new Shure M367 six input system is an ideal successor to the M267s we have been using. One of the reasons we carry a Shure mixer with us when we're checking out strange systems is that it provides us with a calibrated known true audio level in dBm because it has a self contained audio oscillator and its V.I. is correctly installed (i.e., the load doesn't affect its indication of available power). It's also a very low distortion microphone amplifier allowing us to voice test all circuits the other side of large consoles.

We also always carry a test power amplifier because it allows us to test arrays without having to power up massive amplification systems in arenas, ball parks etc.

Finally, we always have a speech microphone that we know the polarity of and are familiar with its voice quality on good systems.

It is also the opinion of this writer that if more operators were confined to six inputs we'd hear a lot higher quality sound in our churches.

Jim Kogen, president of Shure, attended our recent "What We Know About Hearing" workshop and I had a chance to visit with him. We have known each other for nearly thirty years having served on the AES board of Governors back in the 1960s. Jim is an outstanding manager as well as an exceptional engineer. One of the miracles in the audio industry is Mr. Shure and the men he has chosen over the years to run his company. They are in their 70th year (one owner). In 1995 they start their 76th year. Mr. Shure is in his 90s and still comes to his office several times a week. We'll repeat once again a timeless truth that especially applies here, "First rate men hire first rate men; Second rate men hire third rate men."



*Don Davis (L) and Jim Kogen, President of Shure Brothers (R)*

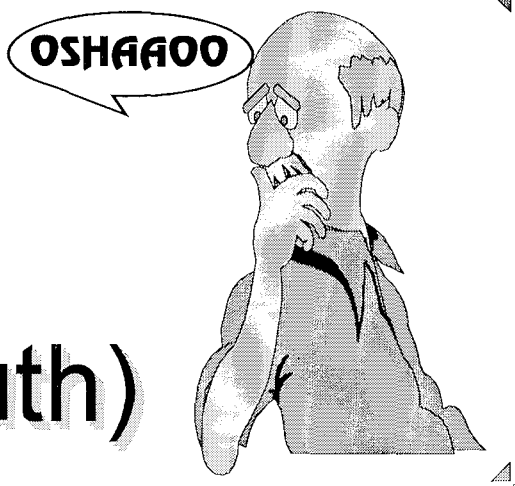
Well managed companies making engineered products benefit enormously from continuity of effort and direction. The results are products that maintain their predominance in the market place.

# Theory and Design of Loudspeaker Enclosures
## by Dr. J. E. Benson

We are very pleased that we have distributed sufficient number of copies of the book to pay our cost of printing. We are very pleased that we have been able to make the book available. We are in regular contact with Mrs. Benson and she has expressed great pleasure in knowing that Dr. Benson's work is receiving recognition. And we have received very gratifying letters from A. N. Thiele.

"There would have been no Thiele and Small Parameters without Dr. Benson." I am not sure where I read it; probably in a book review. But it expresses the debt every user of the Thiele/Small Parameters owes to Dr. Benson.

# OSHA (Cover Your Mouth)




California OSHA representative Rick Rice cited A&M Recording Studios in Los Angeles on July 20th for not having a hearing conservation program for employees, not ensuring that employees use proper hearing protection, and not providing training in hearing conservation. These were initially cited as serious violations, but as state policy provides for discussion with the employer, the severity was reduced. Rice said that A&M studios has been extremely cooperative and has already begun measures to abate the problem.

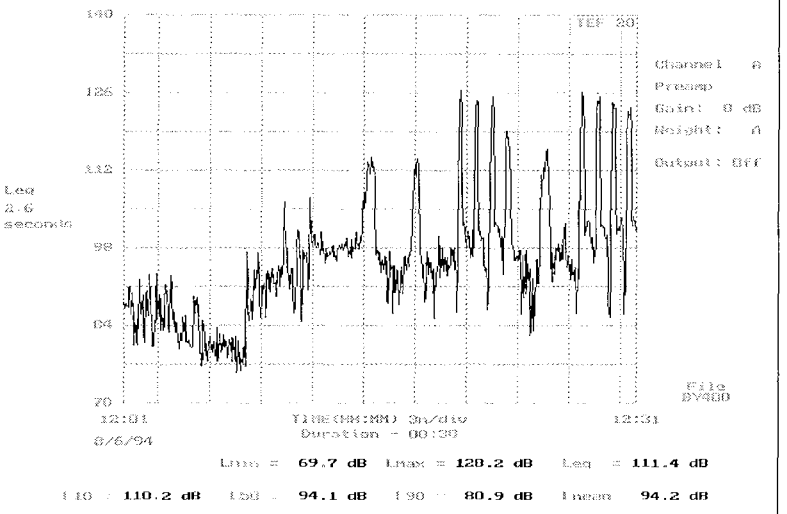
For further details see the October 1994 *Mix Magazine*, page 12.

Often government officials are ignorant of the real nature of the problem they are supposed to investigate, forcing on those uninformed of their right to resist, expensive and often less than relevant remedies for the problems.

OSHA has to obtain a search warrant to force their way onto your property. Usually a judge won't issue a warrant unless probable cause exists.

Once OSHA is on your property, they usually do not have the proper tools to evaluate hearing loss in the first place.

Any studio really interested in this kind of exposure to high levels needs a TEF 20 with its Noise Level Analyzer NLA program. When approached about possible hazardous sound levels, responsibility for employee safety is established when it can be shown that continuous $L_{EQ}$ is being monitored and all maximums, minimums and percentages are recorded. This is a winning hand against a plain vanilla sound level meter.




The Noise Level Analysis program as run on the TEF 20 provides the operator with a powerful tool for examining the fine structure of noise in difficult environments. The above example is an actual measurement from a stock car race, from opening ceremonies through the first laps of the race. Notice that the peak levels exceed 120 dB, yet the $L_{EQ}$ for the test period is 111 dB. The $L_{EQ}$ is the equivalent "one shot" exposure for all of the energy recorded during the measurement interval, and provides a useful indicator as to the actual amount of energy that the worker is exposed to. When mixing a live musical performance, the continous $L_{EQ}$ provides the mixing engineer with the information needed to exercise creativity while keeping track of the amount of energy to which the audience is exposed, providing documentation of the entire event.

# Efficient Sound Reinforcement

A totally efficient speech sound system would deliver approximately 35 microwatts to each and every listener's eardrum. In a perfect world, only the listener's eardrums would receive this signal and there would be no spurious signals going anywhere else. The $L_P$ at the eardrum would be approximately 65 dB.

If we could achieve such efficiency all we would have to do would be count heads and buy our power amplifier accordingly.

$$35\mu W \times (\#\ listeners) = required\ acoustic\ power$$

Every watt that does not go to the listener's eardrums goes to the surrounding environment. The acoustic power that encounters absorption is reduced in level in proportion to the percent absorption. The remainder of the acoustic power, in enclosed spaces, undergoes reflection at the boundary surfaces until the power level becomes inaudible.

A truly skilled sound reinforcement design engineer attempts to minimize spurious power radiation while maximizing the power per unit of area delivered to the listener's ears.

A definitive measurement of the performance of a sound system is the ratio of direct sound to reflected sound at the listener's location. The sound engineer has three tools available to help him. Increased absorption in the room will lower the level of the reverberant sound (usually only possible at the drawing board stage - hence the circumstance of being in contact with the job at that point in time). Increasing the directivity of the sound source (raising it's Q when possible) will allow an increase in direct sound level without increasing the reverberant sound level. Finally, shortening the distance between sound source and the listener will increase the direct sound level. When shortening the distance, the increase in sources must be accounted for, as increasing the number of sources that are not supplying direct sound, does increase the reverberant sound.

Activating the listener's eardrums without undue heating of the boundary surfaces is the design goal of a sound system engineer.

| | |
|---|---|
| **Desired $L_P$ at Listener** | **65 dB** |
| **Loudspeaker Sensitivity (1W/1M)** | **85 dB** |
| **Loudspeaker EIA Rating (.001W/30ft)** | **36 dBm** |
| **Required Electrical Power (36 dBm + P = 65 dB)** | **29 dBm** |
| **Amplifier Headroom** | **10 dB** |
| **Actual Amplifier Power Needed** | **39 dBm** |
| **Available Amplifier Size** | **40 dBm (10 Watts)** |

### Where does all the power go?

An amplifier capable of producing 10 watts continuous would be required to produce an $L_P$ of 65 dB to a listener 30 feet away through a loudspeaker rated at 85 dB 1W/1M. The generation of acoustic power is not an efficient process.

$$10W - 35\mu W = 9.999965 Watts\ wasted$$

## JW Davis

That's Glen Ballou, *(Handbook for Sound Engineers - The New Audio Cyclopedia)* with M. H. Earp, Jr., Eric Simonson, and Sandra Broadmax of the J.W. Davis Company. Glen was inquiring into their amplifier line for one of his consulting jobs. We have mentioned it numerous times in these Newsletters but for those who didn't hear it the first time, everyone needs a J.W. Davis catalog. Where else can you get Pataxial loudspeakers, Dick Heyser's signal biased amplification, and all the hard-to-find hardware that makes everyday jobs easier?

The J.W. Davis people are good to work with and are alert to their customer's needs.

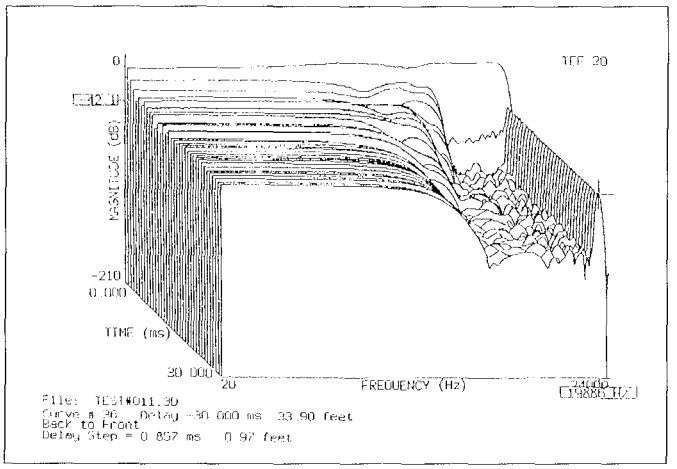
# "The Measurements Tell the Story"

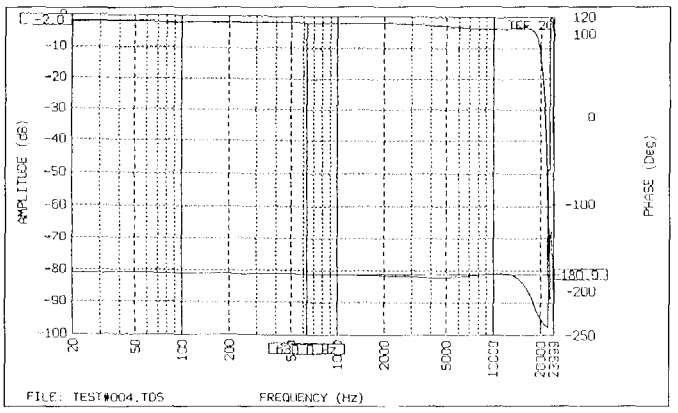
Don Washburn of the Audio Bug, in N. Miami Beach, FL, recently sent us a series of TEF measurements of a Sabine FBX-900 "Feedback Eliminator". Don wrote about his measurements: "The search for the repeal of the laws of physics continues."

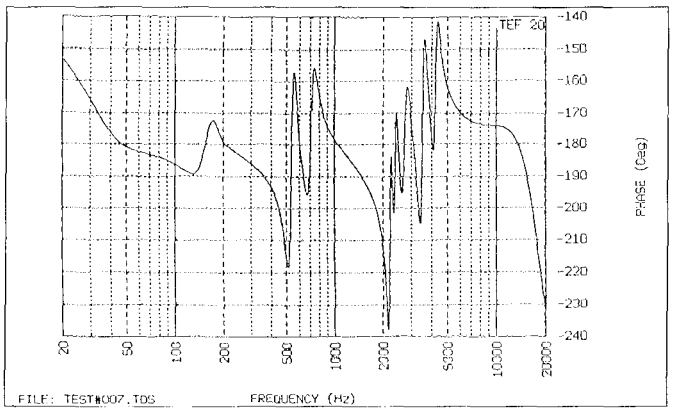
Pat Brown tells me a sound contractor in this area could make a good living just selling Sound Spheres and Feedback Eliminators—and we thought all these people were in Washington, DC.

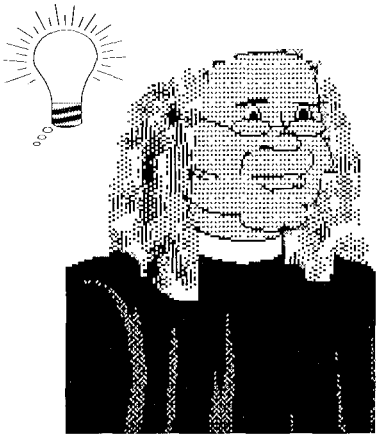
What started Don Washburn on his measurement journey was a statement from Sabine's literature, "Digital filters can be made much narrower, they lock on the chosen frequency with NO PHASE SHIFTING, and they will not shift with changes in temperature or humidity." (Caps added for emphasis.)

Don concluded his letter with, "Let's let the measurements tell the story."



# Early ITE Experiment

ITE stands for "In-The-Ear" and the following sent to us by Sidney Bertram suggests that once again, "The Ancients are Stealing our Inventions."

"Benjamin Franklin, in 1751, is said to have been the first to suggest that electricity could produce hearing sensation in people who are deaf.

"Volta, in 1790, inserted metal rods in both of his ears and connected them to a source of electricity. He described a sensation of a blow to the head, followed by the sound of bubbling liquid, and then lost consciousness. Needless to say, this experiment was not widely copied, and interest in electrical stimulation of the brain languished."

I continue to be amazed at new things I learn about Ben's doings! I wonder what energy Volta received.

# Precision Synchronization and the Overlap Zone

Some individuals, who haven't thought it out, question why we are using lasers, TEFs, and extreme care to synchronize loudspeakers in their overlap zones when just inches away such synchronization doesn't seem to count.

The answer is that we are not terribly concerned with the overlap zone in the audience area but rather within three feet of the loudspeakers. True we can and do make the audience overlap zone sound better but our objective is to insure synchronization at the loudspeakers so that their polar responses remain the same as when they are used individually. When really precision synchronization is achieved at the minus six decibel down points between two loudspeakers their polar responses retain their integrity.

For those without instrumentation, total missynchronization is suggested (i.e., 10 to 20 msecs apart in the overlap area). Real precision synchronization sounds better to our ears but we also know that end users are not calibrated or particularly sensitive to total missynchronization and therefore, both techniques are viable to the workaday sound man. The artist in us prefers the elegant solution.

The use of the PoGO™ Laser, the TEF, and careful component selection in terms of directional characteristics compatibility should be mandatory in the design of "arrayable boxes".

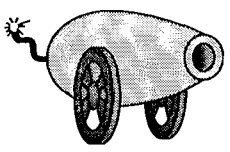
# Medications and Hearing

A recent issue of Newsweek had an article in a "Special Advertising Section" on hearing by Michael Holthouser, M.D. It is an interesting article, and it has one paragraph that is worth quoting here. We are all aware of the danger of high noise levels and especially impact noise, but we often are ignorant of the effect of medicine on our hearing.

"The prolonged or high dosage-level use of some medications can also damage hearing. They can also act in synergy with noise to damage hearing more than either noise or medications would do individually. So people working in high-noise areas should ask if their medications pose such a risk."

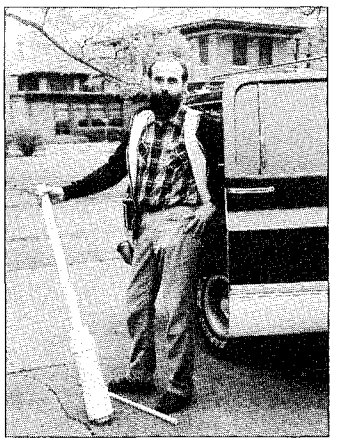
It is too bad that so little is written on this subject. If you are prescribed a drug ending in micyn, for example, streptomycin, ask your doctor if he can prescribe an alternate. I was with a relative in a doctor's office once that was prescribed a micyn drug and I asked if there was an alternative and he said, of course. Don't fail to ask. These drugs work on the nerve and therefore cause permanent damage.

Recreational drugs, alcohol, aspirin, and fatigue all enhance the possibility of hearing damage in a noisy environment.



# The Potato Cannon

That "thing" in Jim Hunter's hand is a potato cannon. Fueled with hair spray and ignited by a sparker, it hurls potatoes jammed on the end of it completely out of sight. Truly a terrorist's tuber tube.



***Jim Hunter, Chief Engineer at Klipsch and Assoc. with his potato cannon.***

# Point-Wave Duality

A single point in the frequency domain is a sine wave in the time domain. A single point in time is a spectrum in frequency.

**The Dirac Impulse**

An impulse that was instantaneous in time and infinite in amplitude in the time domain would be an infinite spectrum in the frequency domain.

**The Analytic Signal**

The Heyser spiral allows us to see our signals from the key perspectives used at the present time.

In examining the real and imaginary parts of the impulse response, we find that the real part is proportional to particle pressure while the imaginary part should be proportional to particle velocity. If one obtains the instantaneous sound pressure at two points (close by each other in space) the difference in pressure divided by the separation distance of the two microphones yields the pressure gradieant which is proportional to the particle velocity.

Our current time domain Heyser spiral shows the Hilbert Transform of the real part as the imaginary part. At this time, it does not give us a view of the particle velocity, but it does allow us to see the pseudo value for future display purposes.

# The Acoustic Response

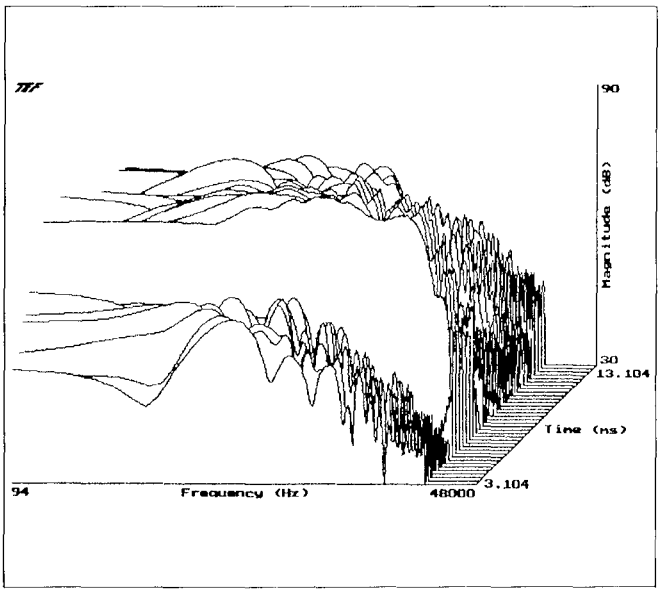
Frequency response, transfer function, amplitude vs frequency etc., all describe the idea of a signal's energy distributed over frequency.

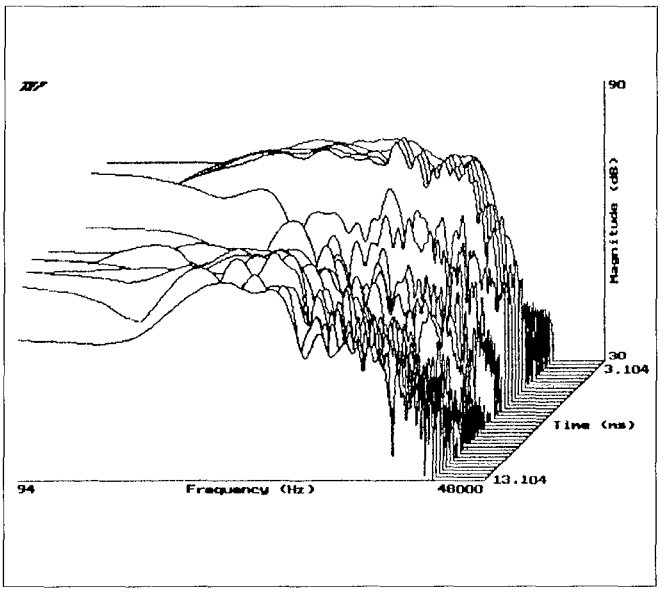
The actual system response is also distributed over time. We are allowed to see the time distribution with accuracy when we use impulse or energy time curve measurements. We are allowed to see the frequency distribution with the classic "frequency response" curve.

The use of 3D plots of frequency vs time vs amplitude force the choice of smearing the data in order to view the approximation of frequency vs time behavior of the system being tested.

Accompanying these remarks are two 3-D plots showing the onset of a signal that rises out of the noise floor and then the decay of the same signal as viewed from the rear of the first plot's perspective. These plots are made using the new MLS program from Techron. Once the impulse response has been obtained, the 3Ds are instantly available via post processing.

It is said that a picture is worth a thousand words and these two plots do indeed provide the viewer with a book full of insight into the 'frequency response' terrain.



# More on Wavelength

We regularly point out to Syn-Aud-Con classes at the farm and on the road that studying an acoustic problem in terms of wavelength "λ" rather than frequency is quite helpful in visualizing solutions.

$$\lambda = \frac{c}{f}$$

where λ is in feet or meters
c is in feet / sec or m / sec
f is in Hertz

Wavelength in phase terms can be either

$$\lambda = 360^\circ$$
or $\lambda = 2\pi$ radians

$$\frac{\lambda}{360^\circ} =$$ ft or m per degree
(i.e. phase wavelength θλ)

θλ times the phase difference gives the phase difference wavelength.

Wavelength per degree can be thought of as a phase resolution where the two signals of zero degrees and equal amplitude add to 6.02 dB, two signals of 90 degrees phase difference and equal amplitude add to 3.01 dB, and two signals of 180 degrees phase difference and equal amplitude sum to zero. For a 1000 Hz signal of 1.13 feet in wavelength, zero feet equals 6.02 dB, a wavelength of 0.283 feet equals 90 degrees and a wavelength of 0.565 feet equals 180 degrees.

For 100 Hz the distances are 2.825 feet for 90 degrees and 5.65 feet for 180 degrees.

A 40 degrees phase difference still sums to 5.5 dB, hence is essentially coherent addition of two signals. This would suggest that at 100 Hz (wavelength = 11.3 feet) that a phase difference of would be $\frac{11.3\,\text{ft}}{360^\circ}(40^\circ) = 1.25$ feet sufficient alignment for signal synchronization purposes whereas at 1000 Hz physical alignment should be on the order of 0.125 feet or 1.5 inches and at 10,000 Hz 0.0125 feet or 0.15 inch (i.e. 1/7 of an inch).

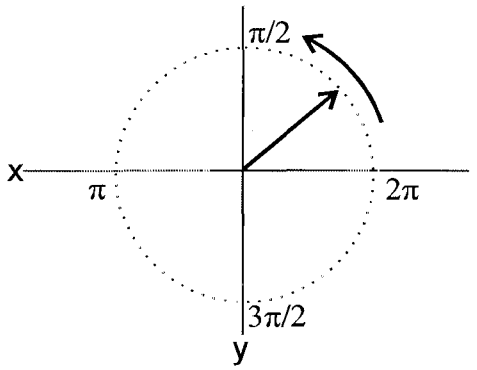
As can be seen from the above, phase wavelength is a very useful parameter for determining the required physical resolution necessary in aligning alike sources.

**Some Comments on Crossovers**

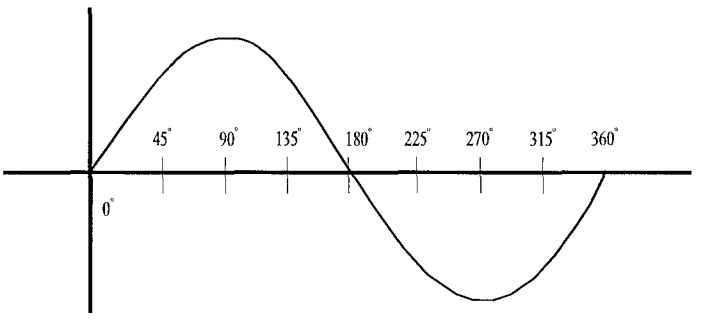
Similar thinking can be of use when contemplating crossover networks. The phase wavelength θλ for 500 Hz is 0.006 feet and 40 degrees = 0.25 feet (3 inches). A first order network (-6dB/octave) is electronically 90 degrees at crossover (3.01 dB summing) and so long as the devices are within 3 inches of physical alignment the crossover area should be relatively anomaly-free. Second order networks end up 180 degrees at crossover and many have chosen to invert polarity at crossover in order to obtain signal summing. Syn-Aud-Con feels that the inaudible deep notch is preferable to an inverted driver and consequent transient problems generated. Gradual changes in phase are normally not too noticeable but a sudden complete discontinuity in a relatively narrow region does have audibility on certain transient signals.

Of course, the phase behavior at crossover is frequency dependent and when the frequency dependent phase behavior of the chosen drivers are the conjugate of the chosen network true signal synchronization is achieved for disparate sources.

Magnitude measurements are what we all were raised with but they are seldom as informative as using wavelength and phase.




A 1000 Hz signal requires 1ms to go through 360 deg (2π radians). Therefore one period of a 1000 Hz signal = 1ms.




This 1 ms period can be further subdivided into 360 one-degree increments of 2.8 μsec each. This time interval can be converted into distance: 2.6 μsec * 1130 = .038 in. per deg.

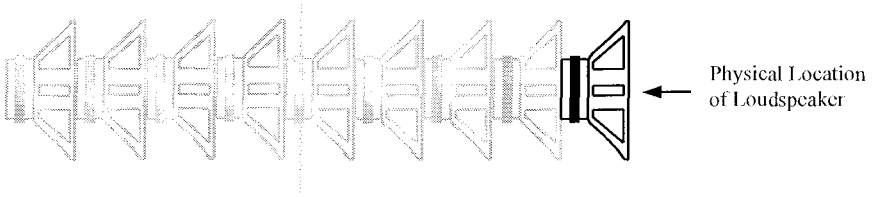
# What Do Phase Measurements Really Show Us?

A properly measured loudspeaker phase response is the acoustical equivalent of the doctor's microscope. Phase measurements provide a view of many of the subtleties of loudspeaker behavior, and allow anomalies to be viewed which can go completely unnoticed by traditional "frequency response" measurements. With this much resolution at our command, proper test setup is vital for meaningful measurements.

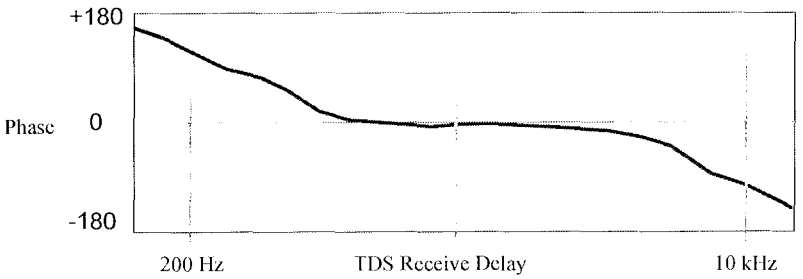
When a loudspeaker is hit with an impulse of electrical current, it does not "speak" immediately. The physical and electrical properties, present in its construction, work to defy the electrical current's request for movement. As a result, the loudspeaker exhibits a time "smear" that is both frequency and level dependent. One way to visualize this is to view the imperfect loudspeaker as an infinite group of "perfect" loudspeakers displaced in distance behind the actual one. Each of these "phantom" loudspeakers produces a single frequency. As such, our acoustical signal is emmitted from many points in space, resulting in a packet of energy propagating towards our test mic. This phenomenom is not readily apparent when viewing an amplitude response curve, but it becomes immediately apparent when viewing phase. The longer that it takes for a given frequency to depart from the surface of the loudspeaker cone, the farther behind the cone it is in time. When fine tuning a TEF analyzer to view the loudspeaker's phase, the receive delay is adjusted so that the phase curve has the same slope as the amplitude curve. This is typically done in the middle of the loudspeaker's pass band, where it should be fairly flat.

When choosing a receive time on the TEF analyzer, we are allowed to "slice through" this packet of energy at only one instant in time, hence some of the energy will arrive at the test mic before we look and some will arrive after we look. The frequencies that arrive at our mic at the receive delay setting will show a phase response near zero. Those frequencies that arrive later than the receive delay setting will have a positive phase angle, and those arriving prior to the receive delay setting will have a negative phase angle. Thus, the phase response curve presents a picture of how the loudspeaker's energy is smeared in time and space, providing a map to the location of the acoustic origin on a Hertz by Hertz basis.

A system is termed "minimum phase" when the phase response is the Hilbert Transform of the amplitude response. Stated another way, a minumum phase system in general will not exhibit the sharp discontinuities in phase response that are indicative of sound sources that are arriving at sharply different times at the measurement mic. The repeat offenders in this category are non-synchronized overlapping sources and very early reflections. Such anomalies must be corrected outside of the domain of the electronic equalizer.




Acoustic Origin is Frequency Dependent




Phase ∠ at 200 Hz = 60°

$$\frac{1}{200 \times 360} = 13.8\,\mu \text{ sec/ deg}$$

$$55.6 \times 10^{-6} \times 1130 \times 12 = .188 \text{ in / deg}$$

$$.188 \times 60° = 11.3 \text{ in}$$

Phase ∠ at 10kHz = -110°

$$\frac{1}{10{,}000 \times 360°} = 278 \text{ nano seconds}$$

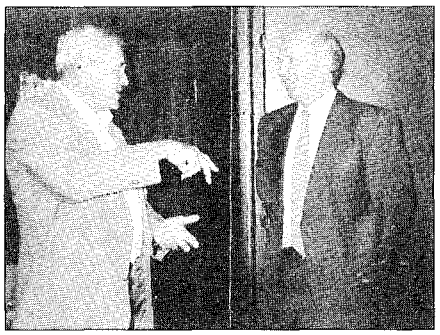
$$278(10^{-9}) \times 1130 \times 12 = .0037 \text{ in/deg}$$

$$.0037 \times 110° = .407 \text{ inches}$$

Deviation in Acoustic Origin = 11.3-.407
= 10.9 in

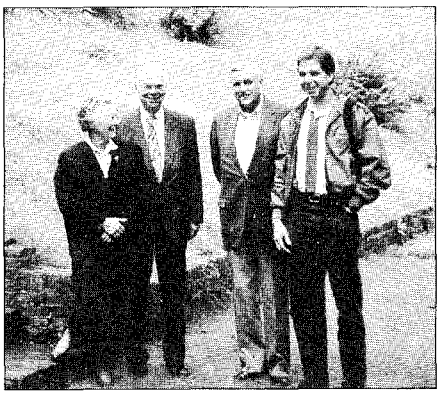
# Europe '94

Syn-Aud-Con travelled to the other side of the Atlantic to conduct classes for our host, Larry Frandsen of Mark IV Audio, Switzerland, for distributors and consultants. We flew



***Our host, Larry Frandsen of Mark IV Audio***

into Amsterdam so that we could drive over to Nimegen to visit with Mr. & Mrs. Peutz. We hadn't seen them for four years and they had not changed. It was as though we had seen them yesterday. Mr. Peutz is retired now. The Consulting firm that Mr. Peutz founded is celebrating their 50th year!



***Mr. and Mrs. Peutz with Don and Pat***

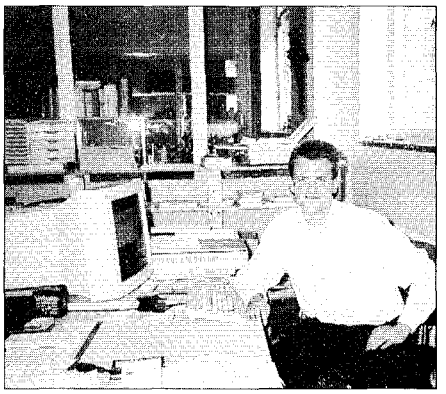
We needed a couple of days to adjust to the time change before starting our participation in the Mark IV programs, so after leaving the Peutz's, we drove to Bochum to see Deiter Michel. Dirk Wedell, Dieter and one other person on the staff (three people) publish a magnificant magazine, *ProAudio,* devoted entirely to sound reinforcement. It is slick, it is accurate, it is professional! Dieter and Dirk write almost all the material for the publication; take all the photographs; keep the mailing lists updated—it goes on and on. I guess we appreciate their accomplishment so much because we have some idea of how much of their life blood goes into the magazine. We had another motive, we felt that Dieter was beautifully equipped to bring us to date on the progress of sound reinforcement in Germany.

**Darmstadt**

Rudolph Carracciola in 1938, on the Frankfurt-Darmstadt Autobahn, drove a Mercedes car to 437 kph (271 mph) average. Caracciola described the sensation of driving that fast on the autobahn as, "I cannot get it into my mind that my brain should be slower than the speed of my car. Always there is the strange impression of having to aim to get through." Just hours later the Great AutoUnion driver Bernd Rosemeyer, only 25 year old, crashed at kilometer 9.2 when a gust of wind caught him at over 250 mph as he attempted to wrest the record away from Caracciola.

Hearing about this as a young boy was one of the motivating factors in travelling to Germany after WWII. So Darmstadt didn't seem like a foreign destination. To initiate Pat Brown we travelled the same stretch as fast as our new Mundao could travel (just under 200 kph or 120 mph).

The Darmstadt meeting had 200 in attendance and the technical level of the audience was uniformity high. Precision equalization drew a sizeable group up front after the



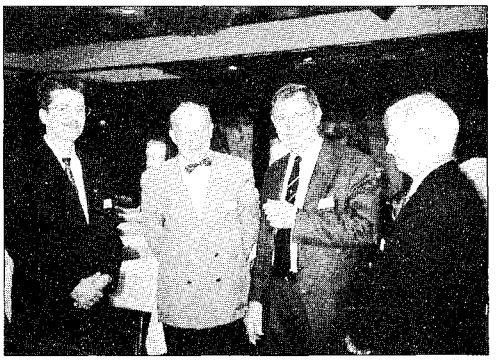
***Deiter Michel***

demos to talk with Pat Brown and see the TEF features built into this program.

Maximum length sequences MLS also drew extra interest especially when we described how it can use old data gathered by other analyzers using this technique.

Germany is a beehive of audio activity and many former East German engineers and technicians are now enjoying the freedom to apply their skills to the abundance of what had been to them impossible to audio equipment.

The day after the meeting, Carolyn, Pat and I drove to Wursburg



to see the "Residency" and court gardens. This is a mammoth monument to the arrogance of men with too much temporal power. As I've said before, "I'm willing to live in a 'class' system only if I can be the king."

From Wurzburg we travelled on the back roads of Germany over to the Necker river and up it to Heidleberg. German back road drivers still use their cars to the full and a mischosen gear quickly leads to being left in the dust.

**England**

The next day we left for merry old England, from the Frankfort airport, and arrived in Birmingham in the midlands. We got in early enough for Jasper Whitaker of Shuttle Sound to take us to see Mick Lown at the new symphony hall which is part of their new international convention center.

***Our host in England, Mark Burgin with Larry Frandsen.***

Mick is a very competent sound man willing and able to show us the virtues of his hall and its sound system. A Spanish Flamingo group was rehearsing (complete with large local choir). Much foot stamping and other useful excitation allowed us a chance to evaluate this well thought of hall (very much like the Myerson Hall in Dallas). We've not seen other than first rank halls from Russel Johnson who designed this hall.

Having a day prior to the meeting we hired a car and driver to take us around the area. Highly trained "muscle memory" for left hand cars forbids me messing with right hand cars. Yes, you can do well in one, but let an emergency happen and your reflex will be for a left sided driving world.

Our driver was an absolute jewel. He took us to Warick Castle, Stratford-on-Avon and then the Cotswolds. He knew every back path in the Cotswold and we saw fields full of grouse, pheasants, rabbits and other game. The villages in this remarkable 90 by 70 mile area are hard to believe for their absolutely classic beauty.

The Shuttle Sound sponsored meeting was with approximately 60 people from a wide diversity of backgrounds. Mark Burgin of Shuttle Cad fame put together a good program. The English rigid adherence to RASTI reminded me of how long the English handicapped themselves with Newton's notation while the continent advanced mathematics by using Leibniz's notation. Chris Beale

presented an outstanding discussion of a new road system approach to loudspeakers by SSE.

**Barcelona**

From England we flew to Barcelona, Spain. The last time we had been in Barcelona was forty years ago. Culture shock was complete. The old Spain is gone except as museum displays. They are a modern bustling major European entity. The hotel we stayed in was entirely marble—walls, floors, etc., everything but the ceilings, and it overlooked the Mediterranean from the bluff it was perched on. Spanish food! What can we say? The seafood was absolutely marvellous. Course after course led to feeling like we might never need to eat again. For those of you who think of Mexican food as Spanish let me say that food in Spain is more like French and Italian than anything else.

Antoni Carrion, Professor of Acoustics, gave a talk that indicated the degree of professionalism that is in Spain today. Professor Torello provided us a big surprise. He invited us to visit his school. Wow!! 300 students taking serious acoustic courses. More on page 3 of the Newsletter.

**Home**

The flight home—Barcelona, Amsterdam, Atlanta, Louisville let us sample three different kinds of aircraft and we were up for 27 hours before again going to bed.

Driving from Louisville to home at 55 & 65 mph reminded us that the worth of our dollar abroad and our speed limits put us in a "third world" nation classification.

# *Yotta, Zetta, Yocto, and Zepto*

Sounds like the three stooges just became the four stooges. $10^{24}$ candy bars are "yotta" bars. After I eat them, what's left is $10^{-24}$ candy bars or Yocto bars. If moderation prevails, then I'd only eat $10^{21}$ candy bars or Zetta bars and the remainder would be $10^{-21}$ candy bars or Zepto bars.

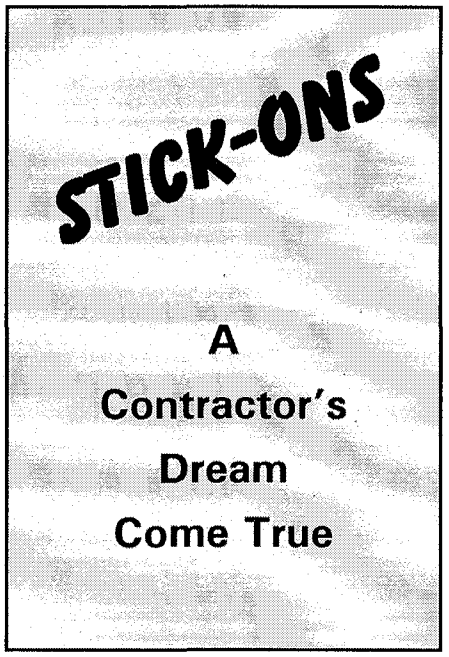
To this writer this is Zepto dismal. All this plus "Because the definitions of the S.I. electrical units are given in terms that are impossible to realize in the laboratory (infinitely long conductors of zero diameter), standards laboratories—maintain practical realizations to serve the purposes of science and industry."

Scientific idiocy S.I. fits in well with much else the enlightened are attempting to bring to the great unwashed.

NASA has the "pyramid" dimension which is defined as the number of zeros in the funds spent by NASA to date.

All of this to be paid for by SAP*

*Simple American Patriot




Have you ever been finishing up an installation project and found that your hardware was missing a feature or two? Perhaps you would like to turn one those extra line inputs into a mic input. Or maybe you would like to "duck" that background music when an announcement is made. Well, the answer to these and a multitude of other "hardware shortcomings" are the Stick-On modules from Radio Design Labs. Stick-Ons are designed to be affordable, high-quality solutions for the sound contractor. Each module is about credit card size and requires no tools or connectors for use. The product line includes everything from mixers, amps, and DA's to voice-activated relays and compressors.

Due to their small size and weight, Stick-Ons can be shipped about anywhere overnight, just in time to finish up that job, or provide a last minute update to an existing system. For more information, call Radio Design Labs at 800-281-2683.


***Don talking with Jerry R. Clements***

# *Audio and Acoustic Analysis (Update)*

The TEF-20 system and the new high speed PCs have resulted in measurement capabilities unimaginable even ten years ago. The three key analyzers within TEF that we use heavily are the dual-channel real time analyzer, the TDS portion of TEF and lately the very fine MLS system by Paul Kovitz.

In terms of sound system work, if you can't do it with one of these three you probably can't do it. Where the lag exists is that there are not enough skilled users out in the field. In terms of MLS this includes yours truly who is still using his notes to get by.

It's these notes we want to share with you as MLS is now being shipped to TEF owners.

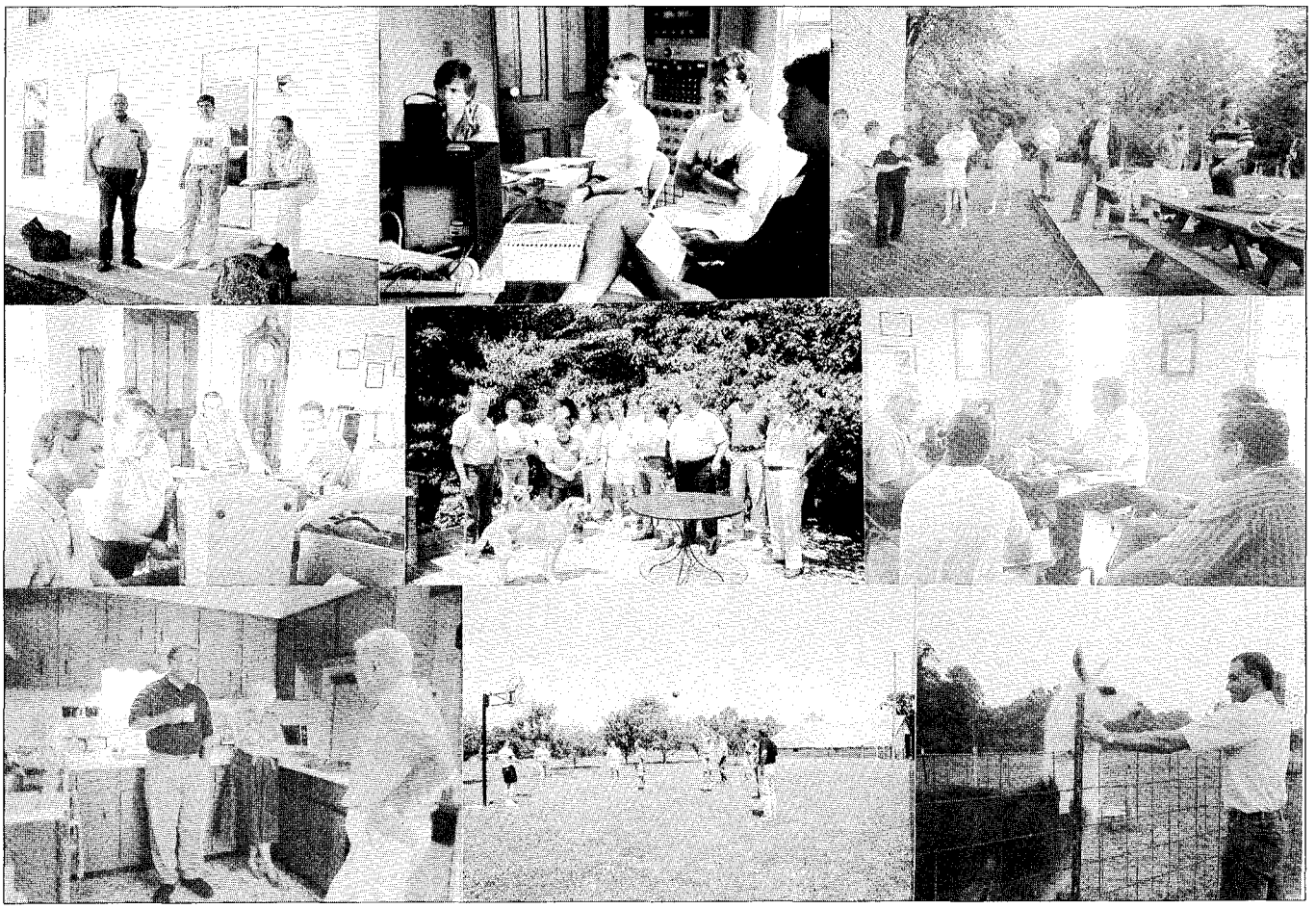
**MLS-FFT Equations**

FFT Length (N)
Sampling Freq. ($F_S$) 48 kHz?
$1/F_S$ - Time spacing
$F_S/N$ - Freq. spacing
$F_S/2N$ = Freq. points (For 24 kHz)
$R_t$ = The Length, in seconds, of the measurements time record
$R_f = 1/R_t$
$R_t f_S$ = Number of points with data
$N-(R_t f_S)$ = Number of points containing zero
$N/f_S$ = Maximum $R_t$

With a measurement system having the potential resolution capabilities of the MLS algorithm it is important to remember, that in audio, the maximum resolution is limited by the bandpass of our devices, not the time and frequency spacing on the screen.

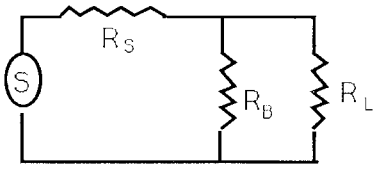
Another consideration of DSP measurements, based on using various forms of FFT processing, is that the measurement length be longer than the phenomenon being measured. (i.e., the measurement period takes in the entire impulse response of the device under test.)

## JUNE 1994 FARM CLASS



# Bridging Losses

When you "bridge" a higher impedance circuit across a lower impedance circuit it drops the level of the lower impedance circuit by some amount. The circuit looks like:




Where:

$R_S$ is the source resistance
$R_L$ is the load resistance
$R_B$ is the bridging resistance

If we were to asume a current for the circuit of 1.0 ampere (for simplicity), then: W = $I^2R$ becomes W = R and the power drawn by $R_L$ in parallel with $R_B$ equals.

$$\frac{R_B \times R_L}{R_B + R_L} = R_T$$

The power drawn by $R_B$ is $R_B$. The ratio of these two powers

$$\frac{R_T}{R_B} = \text{the bridging loss in dB}$$

**Example**

A V.I. has a bridging impedance of 7500Ω and is intended to bridge across a 600Ω line. The change in level due to the V.I. being across the 600Ω line (bridging loss) is:

$$10 \log \frac{\left(\frac{7500 \times 600}{7500 + 600}\right)}{600} = -0.33 \text{ dB}$$

Now, if it were important to maintain the 600Ω value on the main line, the problem shapes up like this:

$$\frac{1}{7500} - \frac{1}{X} = \frac{1}{600}$$

or

$$\frac{1}{600} - \frac{1}{7500} = \frac{1}{X} = 652$$

and

$$10 \log \frac{\left(\frac{7500 \cdot 652}{7500 + 652}\right)}{652} = -0.36 \text{ dB}$$

# "Back in the 1960s....."

**Mark Engebretson and John Eargle hold a tape of the 2036 steps of the sound system design program.**

Back in the 1960s "Don Davis spent most of the past weekend infusing its (HP9810A computer calculator) memory banks with more than 2,000 bits of information."

Ah, those were the good old days before DOS, color graphics, but not before advertising hype. The reverse side of the press release had two Altec employees holding the program printout of the 2036 lines of instruction for the HP 9810A.

The reason that I could do this in a weekend was because I had been researching the proper algorithms for the two previous years. Many of today's programs still can't predict acoustic gain accurately and note that even at this early date we could tell you what loudspeaker Q to use to obtain useable speech intelligibility.

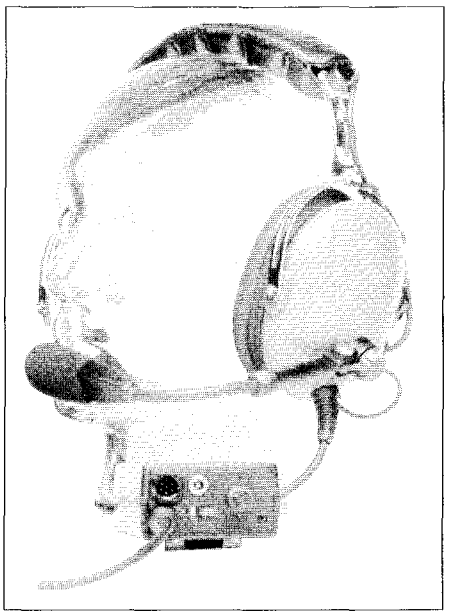
We, on occasion, find it amusing to hear about who first wrote certain algorithms or generated the ideas behind sound system design utilizing computers. We were well into our third generation of such mathematical efforts in the late 1960s.

# *Active Noise Canceling Headset*

*Richard Small trying the PA9000 Quietman.*

Bill Moseley from MNC, Inc. in Shreveport, LA, attended the workshop bringing along an active-noise-canceling headset, the PA 9001 Quietman™ Plus headsets.

The headset is very impressive. The headset is protected by four patents. The Quietman effectively reduces noise over an extended spectrum from 30 Hz to 15,000 Hz, yet the low frequency trash is gone; and the price is right—around $500. If you are interested, contact Bill Moseley, MNC, Inc., 9595 Ellerbe Rd., Shreveport, LA 71106. Phone 318-797-2610 or fax 318-798-2036.



# Thank You

**"Somehow, kind of magically, we knew that no matter what we ended up doing, our lives would forever be better because of the opportunity we had to attend one of your seminars at The Farm."**

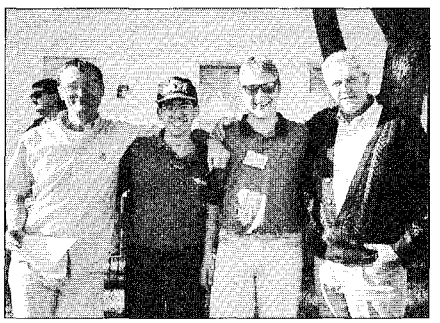
Raul Gonzalez

Raul Gonzalez wrote us following the May, 1994 seminar. We would like to share the letter with you for no other reason that it gave us a lot of pleasure:

Dear Don and Carolyn:

As I was driving back to Lafayette with my friend Brian, we were talking about what he'll be doing now that he's graduated. I think we both realized how much we had changed and grown in just a couple of days. Somehow, kind of magically, we knew that no matter what we ended up doing, our lives would forever be better because of the opportunity we had to attend one of your seminars at The Farm.

It is really hard to find an appropriate way to say Thank You. Now more than ever, I realize what Don was talking about regarding the differences between "professionals and experts" and what we should really be. I feel not only challenged, but obliged to comply to his suggestions, if I am to become a successful audio person. For the longest time I had been reading the Syn-Aud-Con Newsletters in a jealous kind of way because there were not "my" newsletters. I knew that the people who received these newsletters had been through a transformation if you will. Now I know.



*Rick Thomas, Professor of Theatre Technology at Purdue University and two grad students, Raul Gonzalez and Brian Hupke attended our seminar in May, 1994.*

...I would like to get more involved in working with you and Pat. He is one of the best presenters I have encountered. He is very good at communicating complex concepts in a very down to earth way. We are all very lucky to have him around. I hope there is something I can do. I have always believed that the only way to get is by giving....

Thanks

# Syn-Aud-Con's Position on Equalizing Reflections

The measurement of a system's transfer function by means of dual channel FFT analyzers using the program source material as the system excitation is legitimate over a range restricted by the available power of the chosen program source. At Syn-Aud-Con we call this a source dependent measurement.

While constrained by the powers of the program source, those frequencies receiving enough power to allow for accurate, repeatable measurements up to about 10,000 Hz mean that most of the useable speech-music range is covered.

So far, so good. Once you have such measurements, what can be done with them? That depends upon the inherent physical rules of measurement, namely, what time and frequency resolutions are available for analysis.

**Time Resolution = Transform length/2 max. Freq.**

| TC = | 64 | 128 | 256 | 512 | 1026 | 2048 | 4096 |
|---|---|---|---|---|---|---|---|
| Full Screen time in msec= | 1.6 | 3.2 | 6.4 | 12.8 | 25.7 | 51.2 | 102 |

(For 20 kHz max. freq.)

**The Time - Bandwidth Product**

The time bandwidth product is: $F_r \cdot T_r = 1.0$

**Freq. resolution = 2 maximum Freq./Transform length**

| TL = | 64 | 128 | 256 | 512 | 1026 | 2048 | 4096 |
|---|---|---|---|---|---|---|---|
| Fr = | 625 | 313 | 156 | 78.1 | 39 | 19.5 | 9.77HZ |

(For 20 kHz max. freq.)

How big a time sample is chosen has both acoustic and psychoacoustic parameters of importance. Time windows of from 10 msecs to 20 msecs allow useful looks at the direct sound. 100 msecs to 200 msecs allows the early reflected field to participate.

**Fraudulent Claims We Object To**

Once the measurement is at hand, what do you do with it? Herein is our objection to processes sold commercially that claim to control a parametric equalizer, signal delays and other processors, all of which can control *only the direct sound.* Echo, reflections, ambient noise, reverberation all occur after the direct sound has arrived at the listeners' ears. It is perfectly obvious that the electronic processors adjust direct sound only since they have no way to look into the future and see what might happen *if* some direct sound were released from the system. No sound system can anticipate an echo nor can it then send an anti-phase signal to cancel it. This means that correct adjustment of the direct sound is still correct after an audience arrives, before it arrives and during its entrance and exit. This leaves the adjustment of the total sound field to the tender mercies of program EQ with hopefully sensitive adjustment of distortions that might *mask* some room effects. This is best done by a trained ear.

---

# Renard Numbers to 11 Places

| Number | Label | dB |
|---|---|---|
| 1.00000000000 | 1.00 | 0 |
| 1.25892541179 | 1.25 | 1 |
| 1.58489319245 | 1.60 | 2 |
| 1.99526231495 | 2.00 | 3 |
| 2.51188643148 | 2.50 | 4 |
| 3.16227766012 | 3.16 | 5 |
| 3.98107170546 | 4.00 | 6 |
| 5.01187233616 | 5.00 | 7 |
| 6.30957344464 | 6.30 | 8 |
| 7.94328234701 | 8.00 | 9 |
| 10.00000000000 | 10.00 | 10 |

If you memorize the 1/3-octave bands from 1.0 Hz to 10 Hz you will have also memorized the decibel ratios from 1.0 dB to 10 dB.

# The EASE Seminar - Making a Great Tool Better

EASE is a serious design tool for audio professionals. It's creator, Dr. Wolfgang Ahnert, a leading acoustician in Europe, designed the program to aid him in his work. As is true of anything that someone makes for their own use, there are capabilities and procedures that require explanation for the rest of us. The EASE seminar provides this vital link between Dr. Ahnert and users of his program. The three day seminar provides an in-depth look at the program, it's capabilities, and it's ironies.

The class instructor, Ron Sauro, is a successful consultant from the Pacific Northwest. He has been using EASE in his work since it's inception, and has modelled literally hundreds of jobs. Ron's expertise with the program and with audio and acoustics in general make him a valuable asset to anyone interested in learning the in's and out's of EASE. When you put Ron in the same room with 6 "audio nuts" for three days, the results are predictable; long hours, an exhausted instructor, and a great deal accomplished. It is in this type of environment that "synergy" takes place. During the three days we managed to:

1. Take an in-depth look at the software and it's capabilities
2. Share a multitude of "war stories" about our own experiences with the program
3. Initiate a few "round table" design sessions that included "tweeking" some of the group's upcoming projects.

The good people from Renkus-Heinz provided a great learning environment, including an audition of some of Ralph Heinz' new loudspeaker concepts.

The EASE seminar is highly recommended for anyone using the program. In addition to covering the standard features, Ron also covers many new and undocumented capabilities. The cost of the seminar is $75.00. Please contact Renkus-Heinz for details at 17191 Armstrong Ave., Irvine, CA 92714. Ph. 714-250-0166 or fax 714-250-1035.


***Class members from left to right are Max Krueger, Joe Williams, Ashton Taylor, Cecelia Williams, Pat Brown, Ron Sauro, and Larry Walford.***

# Useful Shortcuts

In this age of omnipresent electronic calculators, "shortcuts" are not as in use as in the days of yore. Shown here are three classics from the days of slide rules and "in your head" solutions.

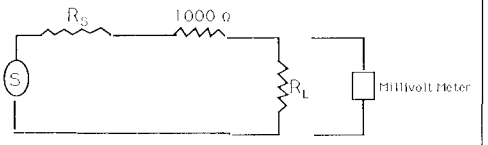
The first two are from a graduate student under Rick Thomas at Purdue. The third is from Sidney Bertram, who can never resist devising an alternative approach.

*Useful Shortcuts*

I. To read a voltmeter's millivolt scale directly in ohms.

$1=\frac{V}{Z}$ and $\left(\frac{1V}{1000+8}\right)=\frac{1}{1000}=\frac{1}{Ma}$

$Z=\frac{V_{MEAS}}{1Ma}$

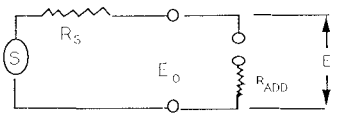



II. For 1 watt sensi measure

Because $E=\sqrt{WR}$

Then $E=\sqrt{R}$

III. Finding RS




$R_S=R_{ADD}\left(\frac{E_0}{E}-1\right)$

Because $E=\frac{E_0 R_{ADD}}{R_S+R_{ADD}}$

# THE CONIC SECTIONS

A surprising amount of the mathematics we use in audio came to us from the Greeks (who may indeed have gotten it from the Egyptians, who may have gotten it from ... and so forth).

For literally thousands of years mathematicians have been aware of the "Conic Sections". These are the curves on a plane thrust through a cone. A surface thrust through a cone parallel to the cone's base a circle appears. A plane thrust through at an angle to the base of the cone but through both sides of the cone results in an ellipse. A plane thrust through one slant side and parallel to the other slant side is a parabola. Finally, if we thrust a plane through one slant side and the base but which is not parallel to the other slant side we obtain a hyperbola curve. These curves appear in plots made from trignometric and hyperbolic equations. The H.P28C was used to plot this variety of curves using the equations shown.

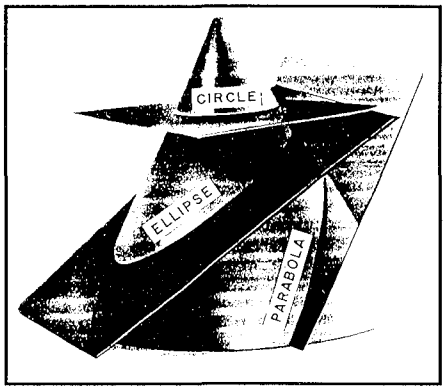



*Fig. 1—Circle, ellipse and parabolas are produced by three intersecting planes. Plane parallel to base provides circle; plane parallel to slant surface provides parabolas; plane at angle between the other two planes provides ellipse*

The best reference we have ever seen on this subject is "Physics and Mathematics in Electrical Communication" by James Owen Perrine, 1958 John F. Rider, Inc.

$$\text{COSH}(X) + \text{SINH}(X) = e^{x}$$

*and*

$$\text{COSH}(X) - \text{SINH}(X) = e^{-x}$$

Where COSH is the hyperbolic cosine SINH is the hyperbolic sine.

Then it can be realized that a knowledge of hyperbolic functions can be a real shortcut in the computation of any kind of "attenuation" problem.

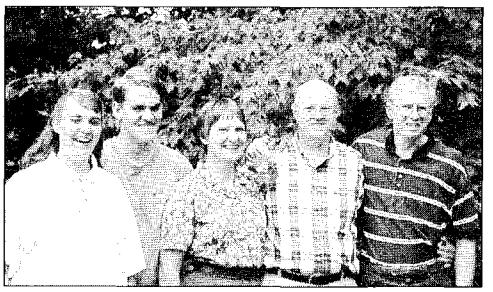
We hope this short taste of the subject will encourage some of you to explore further.

# A War Time Tale

A generation ago we were doing a consulting job for a major industrial firm in the Netherlands. One evening the talk turned to the war and how they had survived under Nazi domination. Their industrial capacity had been utilized to support the Luftwaffe by building aircraft. The method they had used to quite effectively sabotage the Nazi supervision of their work was to follow every order exactly as given, never asking questions or offering suggestions. Production was severely damaged as a result. This cartoon was a reminder.

# Summer Visitors

Anyone staying for a summer at the farm would soon discover that he or she was going to meet many of the movers and shakers in audio and acoustics. One weekend saw the Egers and John Prohs here at the same time. As we have stated many times in these newsletters, talent like this is why we keep Syn-Aud-Con going. The Egers were here to relax between their career change and John Prohs dropped in especially to share his time with both the Egers and us. John also showed Pat Brown how to solve the vibration problem of a CD player in a car. As a result, we immediately went out and bought a Tinker Toy set.



The CD player is suspended on a rubber band mounted through the slots in the Tinker Toy sticks. It works very well and is as economical as you could ask.

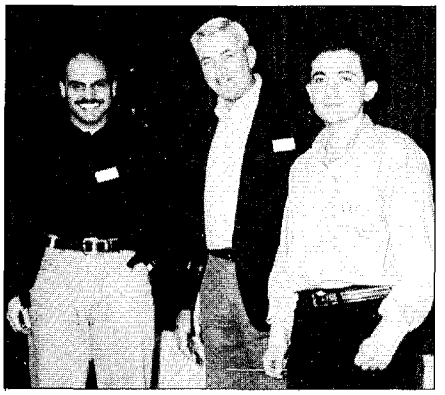
# We almost had a Grad from Saudi Arabia

Emad El-Saghir from the Zagzoog & Matbouli Company is Saudi Arabia registered for our September class here at the farm. A few days before the class he called to say that our American Embassy would not grant him a visa to come because "he was young (24), Egyptian, and unmarried; therefore, they had no assuarance that he would return to Saudi Arabia." Of course, we were disappointed too.

We mentioned to members of the September class as many of them knew that we were waitlisted for the class yet we were one short. Chris Evans of the Benedum Center in Pittsburgh said that we should have called our congressman. I felt so bad about not taking this obvious step that I faxed Mr. El-Saghir and told him that we would be in Germany, England and Spain for two-day classes for Mark IV.

So it was a real thrill to meet Mr. Matbouli (L) and Emad. In talking with them, we discovered that they had had a month long trip planned to the United States, first going to the TEF training class in Orlando (they have a TEF 20), our September class, then on to meet major sound contractors in the U.S., including Bob Reim of Acromedia who is a major force in Saudi Arabia.

They are very bright people and we look forward to meeting them in the United States next year.



## Dear Abby

I have a problem. . .I have two brothers. One brother is an audio consultant and the other one is sentenced to die in the electric chair. My mother died from insanity when I was three years old; my two sisters are prostitutes (one has Aids) and my father sells drugs. I recently met a girl who was released from a reformatory where she served time for smothering her illegitimate child to death. I love this girl very much and want to marry her. My problem is: Should I tell her about my brother, the audio consultant?

***Courtesy of Jim Carey***

## Parable for Procrastinators

This is a story about four people named Everybody, Somebody, Anybody, and Nobody. There was an important job to be done and Everybody was sure that Somebody would do it. Anybody could have done it, but Nobody did it. Somebody got angry about that because it was Everybody's job. Everybody thought Anybody could do it, but Nobody realized that Everybody wouldn't do it. It ended up that Everybody blamed Somebody when Nobody did what Anybody could have done.

***Courtesy of Bob Reim***

# *Friends of Syn-Aud-Con*

One of the many compensations of growing older is the accumulation of friends. Syn-Aud-Con has touched many individuals during its 21 years of existence as well as having had many individuals touch us with their loyal and ardent support.

All of our sponsors have individuals within their companies that have shared our vision of what Syn-Aud-Con should and could accomplish.

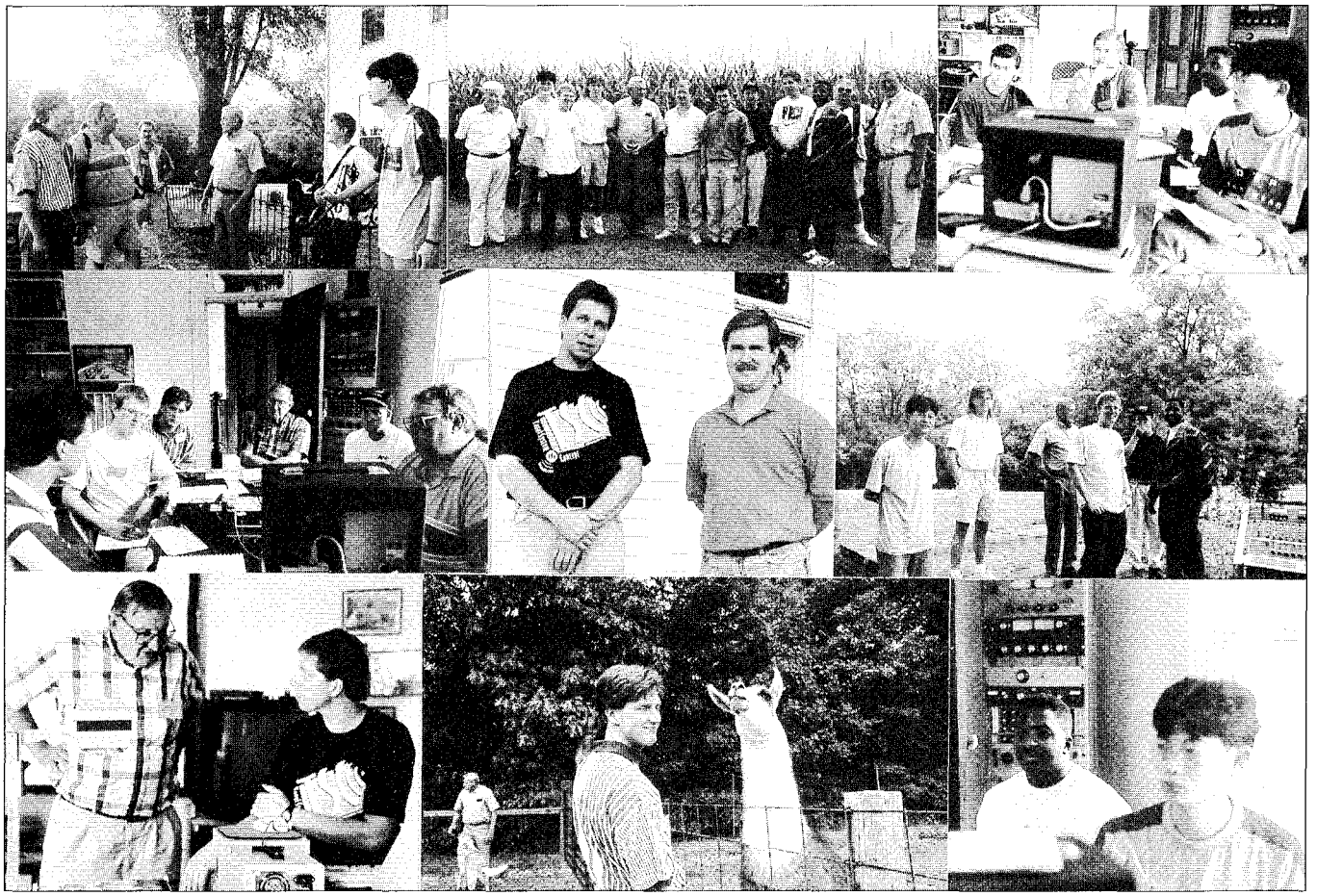
It takes decades to cement friendships because true friendship has to be tried in smooth times as well as rough times. Friends don't always agree with you, but when they don't, one of you has the opportunity to grow in both understanding and friendship. "Yes!" people are not friends but neither are "No!" people. Friends help you evaluate, like family, why you're standing where you stand—and, on occasion, having patience with you until you refind your footing.

In the case of Syn-Aud-Con's friends, our remarkable good fortune has been to attract individuals with more talent than we possess and to benefit tremendously from their largess.

Shown here are a few of this legion of friends that we encountered at the last NSCA Convention in Las Vegas.

1. *David Moore and Don*
2. *Vic Hall, Ed Burquez and Fred Fredericks*
3. *Ferd Boyce and Don*
4. *Don Eger, John Prohs, and David Andrews*
5. *Ron Baker and Don*
6. *Glen Ballou and Don*
7. *Don, Gayle Campbell,and Sam Helms*
8. *Sandy Schroeder*
9. *Lou Valente, Don, Brenda Brown and Fred Fredericks*

## JULY 1994 FARM CLASS

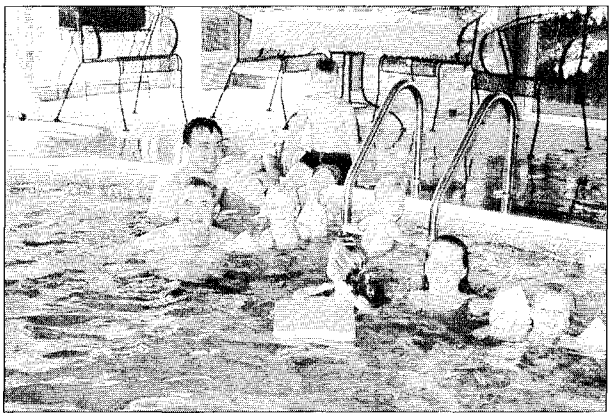


# *It's Not Audio but.....*

I want to share a couple of pictures that aren't about audio, but they give us a lot of pleasure.

**Family Values**

Church friends of ours (with Don) in the swimming pool with five of their six children (one nearby in a crib). I can't look at this picture without a glow of pleasure and thought you might share the feeling.

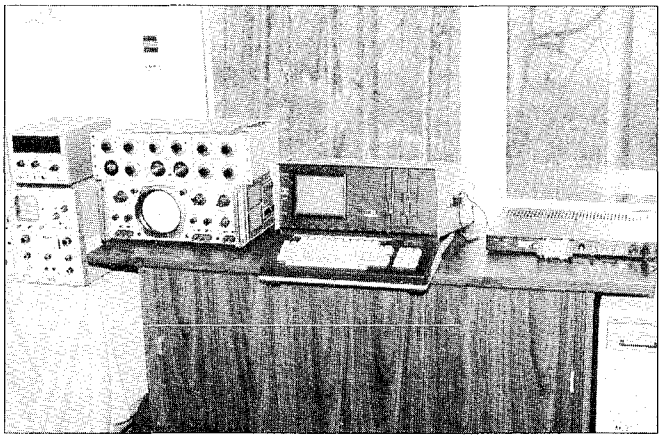


**New Kitty in the Home**

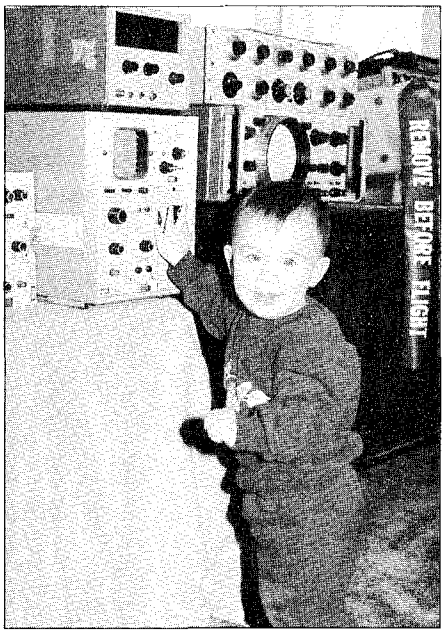
Usually new additions to our pet family are desperate for a home. Callie wasn't exactly desperate but our neighbor had to find a home for a new litter of kittens. When David Reynolds held up precious Callie, I tried to turn away and not look. I resisted for about three weeks and then gave in. We love her dearly and our attack cat, Rascal, has a true playmate.

# *Who Else but Farrel & Gina Becker's Son at the Instruments*

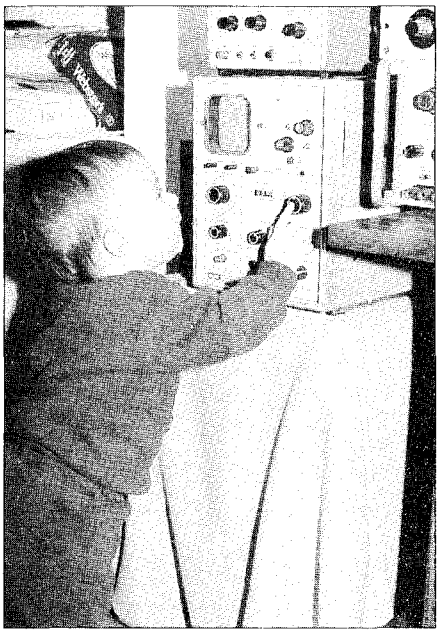
Who else but Farrel and Gina Becker's son at the instruments. The instruments here are the precious instruments from Richard Heyser's hallowed lab—given to Farrel by Mrs. Heyser.



**Farrel shows three generations of TEF analyzers here.**




**Let's make some measurements**



**Fine tune for phase**


**Look at that response!**

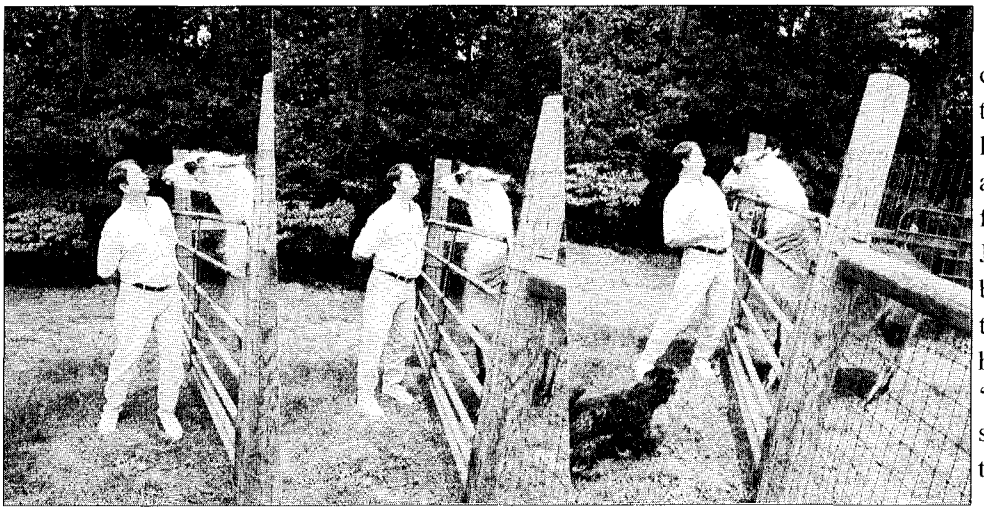
## ZIGGY


*What do you get when you cross a cantaloupe and a collie puppy? A melancholy baby.*

## *The Intensity of Learning*

***David Casper from Community***

# Poncho's Special Powers



Jim Cawthon of Sonic Associates in Birmingham, AL told us that his wife would like to have a llama so we suggested he get acquainted with Poncho. In the first picture Poncho coughed on Jim, so in the second picture Jim blew on Poncho. In the third picture, Jim has learned that Poncho has special blowing powers called 'Spitting', which comes from stomach #4. Translation, "Go take a shower."

## *"How to Achieve Full Bass Response"*

**by Charles Fowler**
**Published in Vol. 1, No. 1,**
***High Fidelity Magazine***

We have talked about this article on the Fowler/Allison/Sleeper, FAS, bass coupler for many years (published 1955).

Quoting the lead-in for the article, "Hundreds of audiophiles have tried out the FAS system and found that it provides remarkably improved bass response. This complete review of experimental and constructional details will enable you to build your own system, or adapt the FAS idea to your present installation.

"The air coupler was designed to handle frequencies below 350 Hz and to be mounted out of sight, specifically between floor joists."

The article is 13 pages. If you would like a copy, let us know. Send us a check payable to Synergetic Audio Concepts for $5 to cover our reproduction, handling and shipping costs.

# Alton Everest

Alton Everest, a well known west coast author and friend of Syn-Aud-Con has donated his collection of Newsletters and Tech Topics to our library at the Seminar Center so that those attending farm classes can use them as ready references during class.

Mr. Everest was on our staff for the second LEDE Workshop held in 1982. His writings on the LEDE concept and small room acoustics in general are among the best available. Our industry has been blessed by his presence.

Our heartfelt thanks to Alton for his generousity and thoughtfulness.

# Professional Services

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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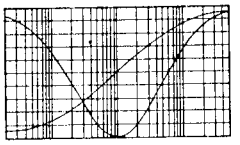

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Consultant in Acoustics

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# Looking Past the Obvious

We look in mirrors everyday—to shave, dress, etc. We feel we understand the mirror image, but do we?

We may have published part of this before when I ran across Feynman's concept, again the importance of reexamining the familiar is of such necessity if we are to improve the ideas we work with that I didn't feel it amiss to bring attention to Feynman's explanation once again. Do we examine all of our assumptions? I sincerely doubt it and the evidence is that it would be very beneficial if we did.

Where I have personally run into this problem has to do with "stage left" and "stage right" when doing stereo recordings. When I first began such recordings, I was surprised to find that following labels the playback perspective was one of sitting on the stage with the artist.

It's always worth while to reexamine critically what we think we know inside out.

Humans seem mostly symmetrical, but not perfectly so. The symmetry is "broken," as a modern physicist would say, by an off-center heart and liver and the more subtle or superficial differences. We learn to break the symmetry ourselves by internalizing an awareness of the difference between left and right, although sometimes this is not so easy. Feynman himself confessed to a group gathered around the coffee pot in a Caltech laboratory that even now he had to look for the mole on the back of his left hand when he wanted to be sure. As early as his MIT fraternity days he had puzzled over the classic teaser of mirror symmetry; why does a mirror seem to invert left and right but not top and bottom? That is, why are the letters of a book backward but not upside down, and why would Feynman's double behind the mirror appear to have a mole on this right hand? Was it possible he liked to ask, to give a *symmetrical* explanation of what a mirror does—an explanation that treats up-and-down no differently from left-and-right? Many logicians and scientists had debated this conundrum. There were many explanations, some of them correct. Feynman's was a model of clarity.

Imagine yourself standing before the mirror, he suggested, with one hand pointing east and the other west. Wave the east hand. The mirror image waves its east hand. Its head is up. Its west hand lies to the west. Its feet are down. "Everything's really all right," Feynman said. The problem is on the axis running *through* the mirror. Your nose and the back of your head are reversed: if your nose points north, your double's nose points south. The problem now is psychological. We think of our image as another person. We cannot imagine ourselves "squashed" back to front, so we imagine ourselves turned left and right, as if we had walked around a pane of glass to face the other way. It is in this psychological turnabout that left and right are switched. It is the same with a book. If the letters are reversed left and right, it is because we turned the book about a vertical axis to face the mirror. We could just as easily turned the book from bottom to top instead, in which case the letters will appear upside down.

Our own asymmetries—our blemishes, hearts, handedness—arise from contingent choices nature made in the process of building up complicated organisms. A preference for right or left appears in biology all the way down to the level of organic molecules, which can be right or left handed. Sugar molecules have this intrinsic corkscrew property. Chemists can make them with either handedness, but bacteria digest only "right-handed" sugar, and that is the kind that sugar beets produce.

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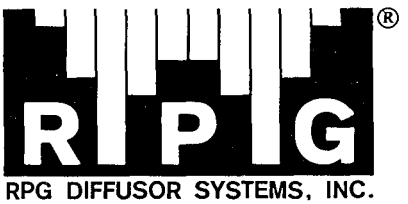



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