SYNERGETIC
SYN AUD CON
AUDIO CONCEPTS

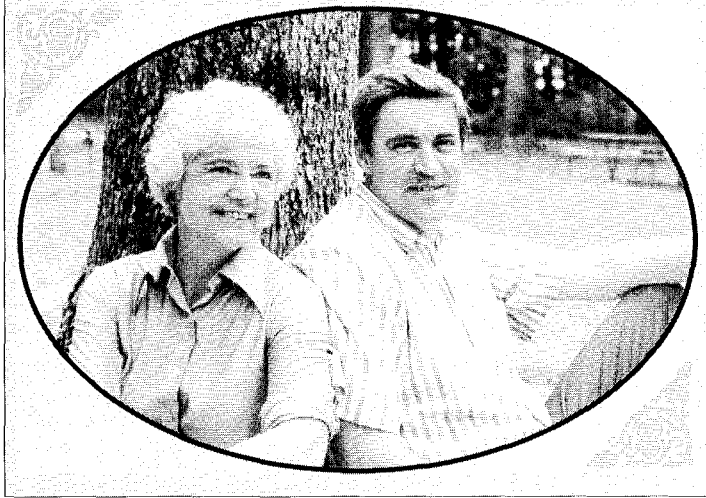
newsletter

Volume 23, Number 1
Fall 1995

Don & Carolyn Davis

Don and Carolyn at Syn-Aud-Con

1972
to
1995



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; cooperating, cooperative

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

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Design and Layout: Pat Brown, Carolyn Davis

Syn-Aud-Con Newsletter (ISSN-07397518) is published quarterly for $35 per year (U.S. and Canada) and $40.00 per year outside the U.S. by Synergetic Audio Concepts, 8780 Rufing Rd. Greenville, IN 47124. Second class postage paid at Norman, IN 47264 and additional mailing offices.

If you attend a Syn-Aud-Con Seminar during the year, your subscription will be extended one year. (Your registration fee includes a one year subscription to our Newsletter and Tech Topics.) For additional information contact:

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No. 1 - Tech Topic "Theory and Design of Professional Loudspeaker Workshop

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 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, 8780 Rufing Rd. Greenville, IN 47124

Retirement From Audio

Carolyn and I have spent 45 of our 47 married years in various areas of audio and acoustics business. We started the "Golden Ear" custom high fidelity stores in Indiana in 1951, "repped" for Klipsch & Assoc., Marantz, Grado, Nunn Audiophile Recordings in New England, was "president in charge of vice" for Klipsch and Associates in the late 50s, then our marvelous learning years at Altec Lansing starting in 1960; and finally our twenty-three years at Syn-Aud-Con. We have fully and enjoyably supped at industry's table.

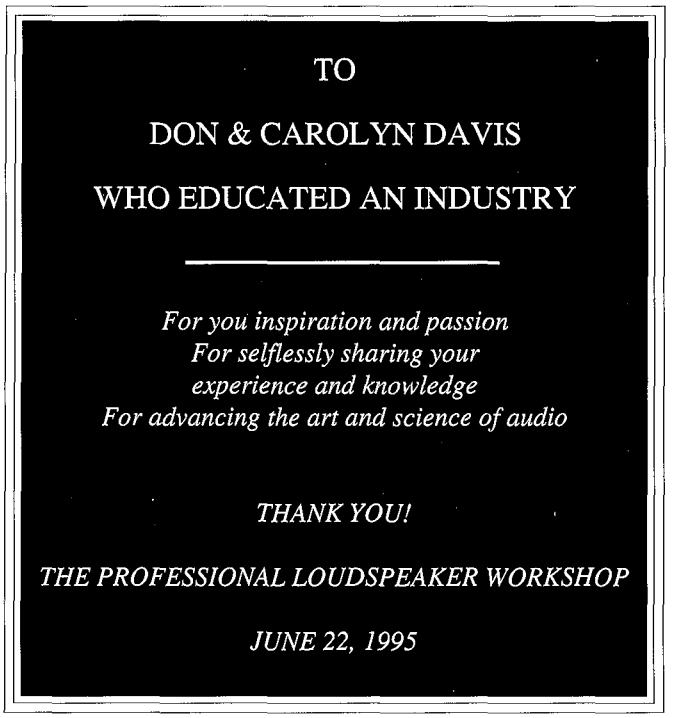
We have been privileged to work with the giants of our industry and to witness true genius at its best. The era we spanned allowed us to know the pioneers who made "the motion pictures talk" and the digital whizzes of today. Our sponsors were remarkable men and women who early on chose to support a struggling new idea because they loved the industry they were in enough to encourage education. They will remain in our thought as proof that great companies come from great men and women and not the other way around.

With such a "read only" memory of people, ideas add their interactions, the history of audio is a personal living treasure to us. So what really are we retiring from? Certainly none of the above — just from the active interface with new classes, heavy travel, and structured demand on our time.

The meaning of life is in its living and we intend to savor it to the fullest. We have overflowing gratitude for our good fortune in having the opportunity, time and resources to seek the adventures of the next twenty years.

Our blessing goes with Pat and Brenda Brown with the fervent desire that God blesses them with the cornucopia of remarkable individuals in the same manner as we have been privileged to know and experience.

Don and Carolyn Davis



The plaque was presented to Don and Carolyn by Bruce Howze and Fred Ampel at the conclusion of The Professional Loudspeaker Workshop in Nashville in June on behalf of the members of the workshop

If I cannot be free,
To do such work as pleases me
Near woodland pools and under trees,
You'll get no work at all;

For I would rather live this life
and die a begger or a thief,
Than be a working slave
with no days free.

William H Davies
(1871-1940)

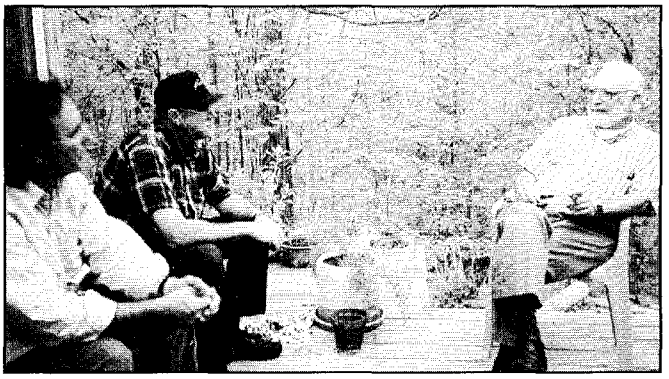
On Retirement

When Don and Sylvia Eger and their children, Tim and Heather, said they wanted to come for a weekend at the farm we were delighted. Viv and Ernie Pence, upon hearing they were coming, said they'd drive up to meet with them here. We all agreed to meet at the nearby Larry's Roadhouse for breakfast (biscuits and gravy, country sausage and eggs over easy). The Egers and the Davises were just starting breakfast when Viv and Ernie walked in carrying a small two-way radio. Ernie handed it to me and said "Say hello to Gene Patronis." I did, and back came Gene's voice. Pat Brown had just recently shown me a solid state device you could talk into that recorded your voice so I assumed that that's what Ernie had done with Gene's voice. "When did you record that?" I asked. Ernie grinned and said "Say hello to Russ Berger." I again did so and once again heard a familiar voice, Russ, answer. "Ernie where did you buy this thing?" The Egers and the Pences cracked up. As I looked up, coming in the front door at Larry's Roadhouse was Russ and Lisa Berger and their daughter Dana, Gene and Charlotte Patronis, Mary Gruszka, Peter D'Antonio and Elizabeth with their son Michael. They all announced that they had come to help us celebrate our decision to retire.

Once again, our dearest friends, had caught us in total con-

dition "white" which means flat-footed surprise. For the next two glorious days both weather-wise and spiritually, we shared the farm with a group of kindred souls, all of whom have enriched and continue to enrich our lives. I know of few more moving moments than the expression of love from your peers.

Poncho kissed them all, Russ demonstrated resurrected biking skills and transmitted new skills to his daughter, we all went swimming and exhausted ourselves tossing beach balls around, and several new inductees at the shooting range shoot great targets. Elizabeth D'Antonio is a super whiz basketball player flinging them in from any angle including back over her head at a basket she couldn't see but couldn't miss.



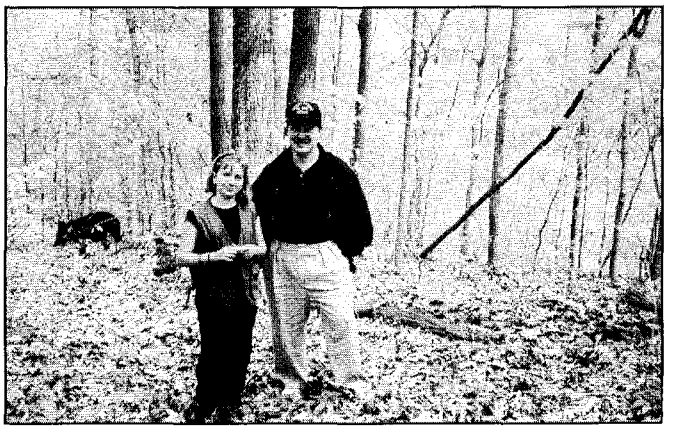
Carolyn, Viv, Charlotte, Lisa, Elizabeth, Dana and Mary saw to it that we were well fed, and provided the gentler side of life. I'll always be grateful to Mary Gruszka for her defense of the proper use of the VU in the standards committee meetings.

A memorable weekend that brought a flood of gratitude to our thought for the very tangible support these, and our many other friends who couldn't attend, have given us over the years and for the love they have expressed toward us and our efforts.

We trucked everyone over to the far woods and Carolyn found a set of really large mushrooms.

Little girls met new cats, dogs and goats as well as horses and llamas.

Elder statesmen D'Antonio, Eger, and Patronis sat out on the deck and had conversations only the privileged of this world get to take part in. Certainly Berger, D'Antonio, Eger and Patronis represent, at the very least, a critical mass of intelligence and in our opinion have already demonstrated their might in explosions of creative products and techniques. Just think how much of contemporary recording room design, loudspeaker advancements, measurement breakthroughs and acoustic improvements have radiated from this quartet.



The Light People...

Don and Carolyn who? The Davises?
Oh, yes, of course. I know who you mean.
The Light People. Yes, The Light People.
You don't know them by that name?
Well then, let me elucidate.

Don is a light tower of awesome stature
whose multicolored effulgence,
a manifestation of continual learning from diverse sources
by a consummate student,
illuminates the throng perpetually gathered at his base.
The searchlight of his knowledge and concern
frequently focuses on the needs and interests of individuals
within the multitude of the recognized.

Spaced in scattered locations around the world
are allied towers.
Their beams, though not as strong nor as far-reaching and
colorful,
likewise shine down upon the crowds at their bases.

A rare characteristic of these towers
is their ability to flash information direct to each other,
an international community of interactive radiants.

Carolyn is not at all like that.
Instead, she is a firework
in magically continuous display of constantly changing
design, color and location.
The illusion of her being in more than one place at once
is the result of a visual echo created by the intensity
of the fast-changing scene.

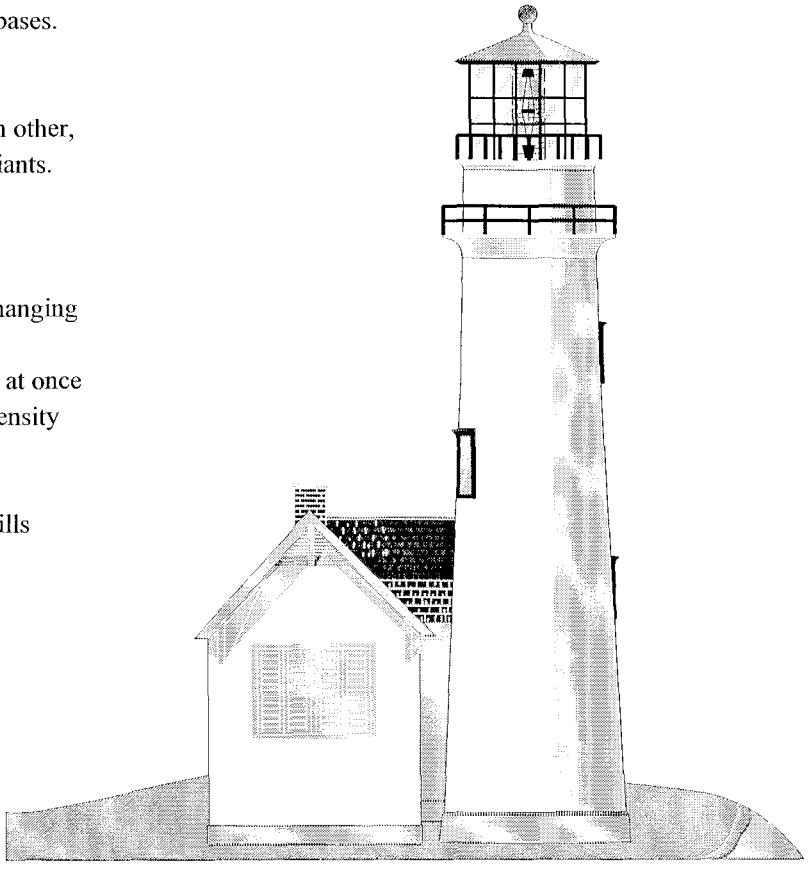
This effect is amplified by her advanced skills
in administrative legerdemain,
perfected through years of practice.

The mechanism which powers this dynamo
is a mental conveyor belt
that flows through her consciousness
nonstop, day and night,
loaded with myriad faces and histories,
details, requirements, agendas and goals.

This system has directed
all Syn-Aud-Con events and personal plans,
and also continues to keep the animals fed,
the vegetables growing
and the butterfly flowers in bloom.

Now do you recognize The Light People?
Good. I knew you would.

Arline Wahrenbrock



Dr. Wolfgang Ahnert

Wolfgang Ahnert, the father of EASE, EARS, and the leading European textbook on sound reinforcement, is a truly brilliant man. I like these pictures of him because it reveals his genuine gentleness and joy in life. That he spent his first forty-plus years in the midst of one of the most repressive regimes in history without it touching him in any way, but to enhance his total inner freedom and harmony is a testament to the power of mind-over-matter and the spiritual over the material. I know that the seed was planted by a good Christian mother and her seed fell on extremely fertile ground. Only God makes such a natural gentleman. *dbd*

From Potential Foe to Kinetic Friend

One of the few times I've ever seen Carolyn stand and look at someone speechless with mouth open was upon learning, on our recent trip to Germany, that these two men were the TEF representatives in Germany.

Go back six years, the Wall is still up and we are at a Cultural Center in East Berlin. Our host for the tour of the Cultural Center was Bernhard Hamm, on the right. He showed us an exhibit dedicated to another Davis—Angelia Davis. Our tour was video taped. We were very uncomfortable and have carried that distress with us all these years.

Imagine our surprise to meet Mr. Hamm, an entrepreneaur in a united Germany. What a change a few years can make. *dbd*

"To An Honest to God Man"

When Col. Cooper is asked to autograph a book, he signs his name in it. We now know of an exception to that policy. After meeting John Royer at the Indy 500 race and hearing of John's Vietnam record and witnessing how John, like the Colonel, is the man in charge, Col. Cooper wrote in John's copy of *Fireworks*, "To an honest-to-God man." The picture shows John seeing the autograph for the first time, as it was done after the race rather than in his presence. Needless to say, we concur with Col. Cooper. *dbd*

CO-SPONSORED BY PRO SOUND NEWS AND SYN-AUD-CON

LIVE SOUND REINFORCEMENT WORKSHOP

JANUARY 15-17, 1996

Pro Sound News, in cooperation with Synergetic Audio Concepts, announces the seventh in a series of Live Sound Reinforcement Workshops, to be held on January 15-17, 1996. The Workshop will be held at Chapman University in Orange County, CA.

These workshops have made history by bringing together the leaders in the live and concert sound industry in a cooperative joint effort to share the best in their business philosophies and technical expertise.

The event will be hosted by Paul Gallo of Pro Sound News. The Workshop Chairman will be Will Parry of Signal Perfection, Ltd. (SPL) who has assembled a staff from the major touring sound companies and from world-renowned audio professionals. The staff will include:

Albert Lecesse from Audio Analysts

Howard Page from Showco

David Scheirman from Lone Wolf

Mick Whelan from JBL

David Robb from Jaffe Holden Scarbrough

...as well as a number of prominent guest speakers and presenters.

The focus of this year's workshop will be hands-on mixing techniques, making this an excellent opportunity to gain experience and expertise at operating some of the finest sound equipment available.

For more information, please contact Syn-Aud-Con at:

1-800-796-2831

For up-to-the-minute Syn-Aud-Con Schedule information, visit our World Wide Website at

http://wl.iglou.com/synaud

Syn-Aud-Con Synergetic Audio Concepts

Upcoming Seminars

The following seminars have been scheduled for the remainder of 1995 and the first half of 1996. All seminars are three days, and will feature extensive hands-on training in system design and calibration. Additional 1996 seminars and workshops are pending, and will be added to the schedule on an ongoing basis.

Hands-on Training in:
Room Evaluation
Gain Structure
Loudspeaker Arrays
Synchronization
Equalization
and more...

Three & Five-Day Seminar
Nov. 27-Dec. 1, 1995
Laie, Oahu

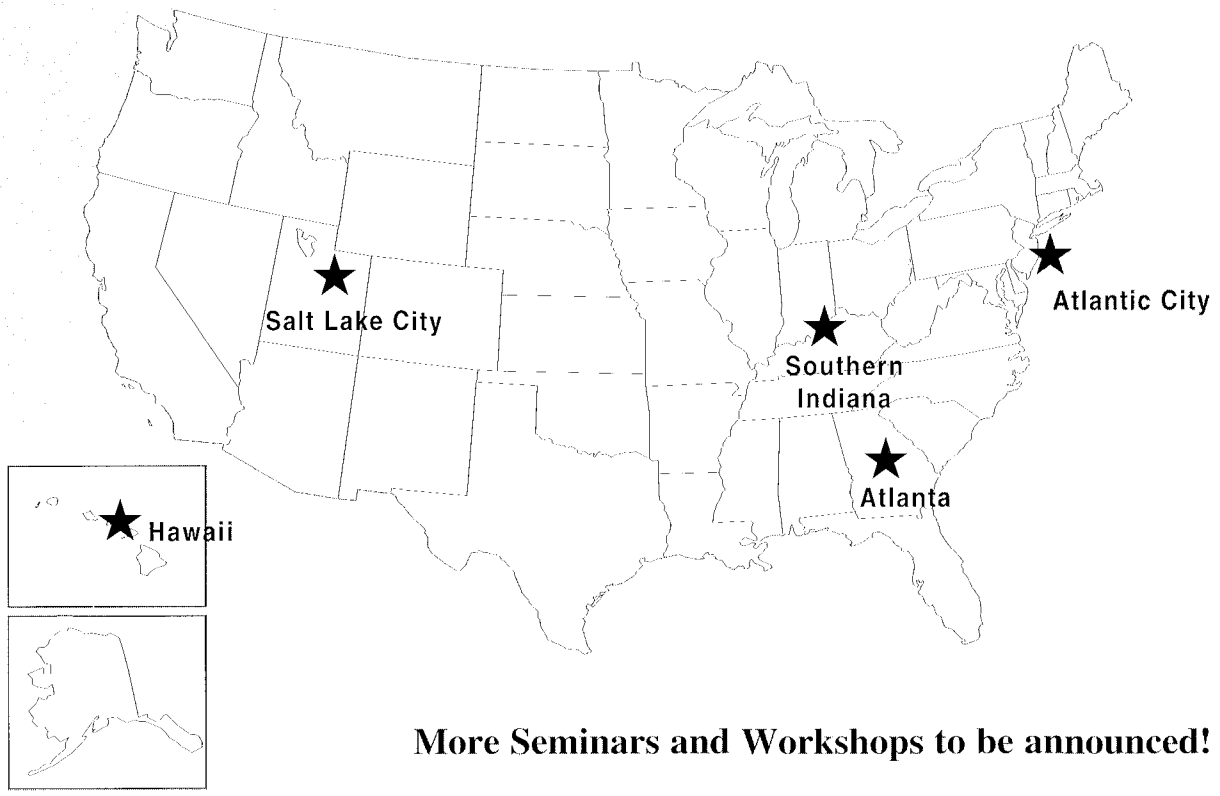
Three-Day Seminar
February 19-21, 1996
Atlanta, GA

Three-Day Seminar
March 25-27, 1996
Southern Indiana

Three-Day Seminar
April of 1996
Atlantic City, NJ

Three-Day Advanced Seminar
April 29-May 1, 1996
Southern Indiana

Three-Day Seminar
June 10-12, 1996
Salt Lake City, UT



More Seminars and Workshops to be announced!

Site Selected for 1996 Indiana Seminars

Our popular Syn-Aud-Con "At the Farm" seminars will continue in 1996. The reluctant search for a new site has yielded one that we hope will preserve the quaintness of the farm, yet offer good accessibility and excellent services.

Joe Huber Family Farm and Restaurant has been a popular midwest tourist attraction for many years. This well-known facility lies nestled in the hills of southern Indiana, just north of Louisville, KY. Surrounded by woods and farmlands, Joe Huber's offers the solitude and "laid back" setting that people have come to the farm seminars to experience.

Joe Huber's Family Farm has much to offer, including:

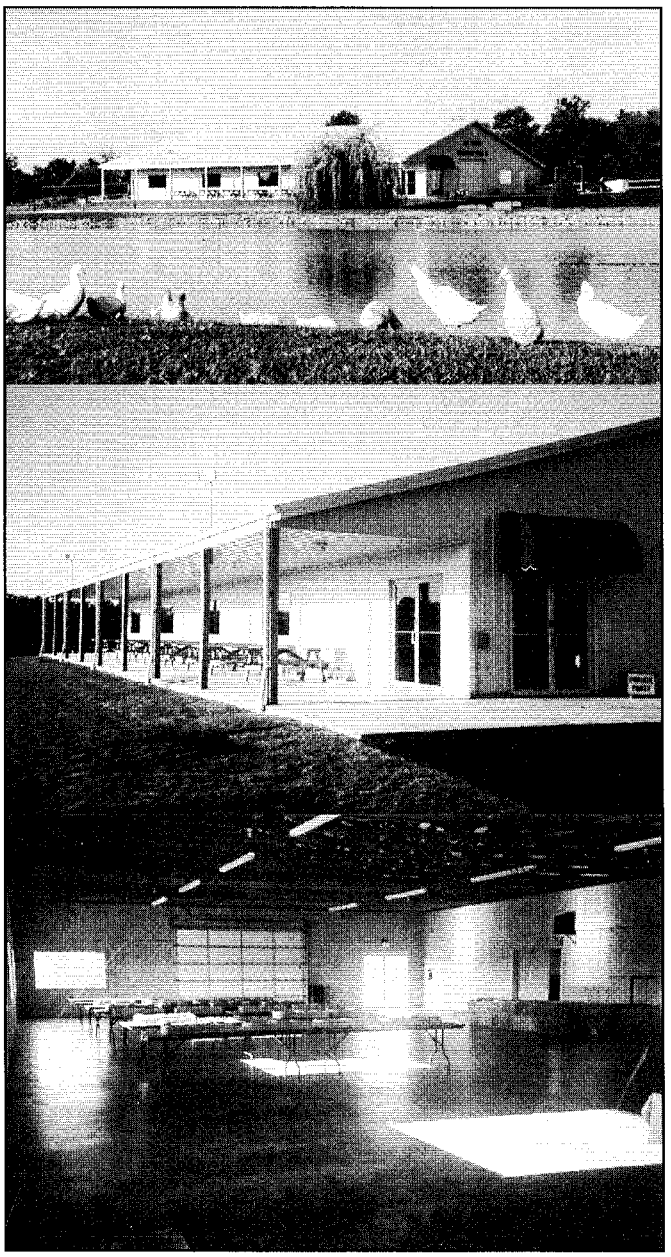
A five-star restaurant
A gift shop
A playground that your kids won't believe
Basketball, volleyball, and horseshoes
Several lakes with plenty of ducks and geese
Good accessibility. Just 20 minutes from the hotel.
Five-minutes from an award winning winery, petting zoo, and horse stables.

Our main reason for choosing Joe Huber's Farm are the large conference buildings where the classes will be held. Over 10,000 square feet of floor space will provide us with the space needed for plenty of demonstrations and hands-on work. For outdoor demos, the large exterior doors can be raised and the loudspeaker arrays aimed across a large open field.

Meals will be from the Joe Huber Restaurant and will be served in the seminar facility. Fresh-baked cinnamon rolls will be served each morning during the seminar, and a fully equipped beverage bar is right in the room where the classes will be held. You may choose to stay after the seminar for a dinner at the restaurant. Just a short walk from the seminar building, the restaurant is one of the areas finest, with a menu that will suit anyone's appetite.

Rooms have been blocked at the Holiday Inn Lakeview in Clarksville, Indiana. The Holiday Inn has indoor and outdoor pools, and is just minutes from one of the largest shopping and dining areas in Kentuckiana (that's Hoosier-eese for Indiana and Kentucky!). Just 10 minutes from the Louisville International Airport, the hotel offers a free shuttle service for guests.

The Farm seminars are alive and well, and we hope that you will have the opportunity to experience Southern Indiana hospitality during 1996. *pb*



Computers and Audio...

New Advanced Training Seminar Offers Continued Education for Grads

We have found it increasingly difficult to cover all of the necessary audio topics in our standard Syn-Aud-Con seminar. Three days simply is not enough, given the quantity of information needed to be proficient in today's marketplace. The solution to this has been to develop an advanced training seminar that picks up where the standard seminar leaves off. The advanced seminar will focus on implementing the modern tools available to the system designer. In addition, this will allow the standard seminar to be better focused at the basic principles of system design. Here is an overview of what will be covered in the each seminar:

The Standard Training Seminar

Day One (Includes a site visit to an auditorium)

The Ear/Brain System - Learning to quantify what you are hearing

Basic Acoustics - Getting clues from the acoustic environment on the type of system that will work

Critical Distance, **Critical Frequency** and **Wavelengths**

Establishing the **Needed Acoustic Gain** of the system

Designing for **Speech Intelligibility**

Noise Measurements in Auditoriums

Upon completion of Day One, the attendee will understand how to fully evaluate a room on the basis of noise, reverberation and reflections. In turn this information will be utilized during the course of the seminar to design a working sound system.

Day Two

The Basics of **Gain Structure**

Using the **Decibel** as a system design tool

How to measure and calibrate the **Signal Processing Chain**

Hands-On **Equipment Set-up** and **Calibration**

Upon completion of Day Two, the attendee will be able to work from the talker to the listener (and all the way through the sound system) using the decibel. This will include the hands-on calibration of three different types of signal processing chains.

Day Three

The basics of **Loudspeakers** and **Loudspeaker Arrays**

Using **Directivity Factor (Q)** to your advantage

Achieving **Acoustic Gain**

How to properly **Synchronize** and **Equalize** the system

Instrumentation (Sound Level Meter, Real-Time Analyzer and Computer-controlled Analyzers)

Upon completion of Day Three, the attendee will understand what Q is and how to use it. Three different types of loudspeaker systems will be setup and calibrated by the attendees, including a point source, a box array, and a distributed system with delay.

These three days of intense training will equip the attendee to logically approach the design of the sound system, and recognize the trade-offs of various approaches. The hands-on, practical nature of the standard seminar will assure that the information presented will be utilized on the job, resulting in better working systems.

The Advanced Training Seminar

The Advanced Seminar will be aimed at familiarizing the system designer/operator with the technological tools available today. The computer has found a permanent place in the audio world, and this seminar will be focused toward using computers and microprocessor-based instrumentation and equipment to design sound systems with advanced capabilities. Here is an overview of what will be covered.

Day One - Computer-aided System Design

Day One will be an intensive introduction to using computers to aid in system design. Various software packages will be covered, including PHD, EASE/EARS, and CADP2.

Day Two - The Computer and System Control

Day Two will cover the use of computer-controlled sound systems, and the advanced capabilities that they can offer. Hands-on work with the major systems available in the marketplace will be featured.

Day Three - Microprocessor-based Analyzers

Day Three will examine the role of the computer in audio and acoustic measurements. Both stand-alone and computer-controlled instrumentation will be discussed. Attendees will do hands-on work with TEF analyzers, the Ariel SYSid system, and others, learning how to select and apply the proper instrument for the application.

This seminar will begin where the standard seminar leaves off, so it is important that the attendee be familiar with the topics covered during the standard seminar.

The Advanced Training Seminar will provide an "upgrade path" for audio professionals to continue their education and stay on top of the technology available in today's marketplace.

pb

HAPPINESS IS HEARING FROM AUDIO FRIENDS

Dr. Don Creevy, San Francisco area, attended our Syn-Aud-Con seminars and workshops for many years. Since Don and I quit traveling for on-the-road classes, we haven't seen much of Dr. Creevy, but we do hear from him occasionally. We so enjoyed his last letter and thought you would also:

As always, I enjoyed the latest (Fall) newsletter. I especially enjoyed the reference to the air coupler. High Fidelity was first published in 1951, as I recall. I have all the issues ever published.... My dad, a surgeon, was a music lover who appreciated good sound but he was not a "hi fi hobbyist". He did, however support my hi fi hobby.....by directing me to an electronics wholesaler who had a hi fi room upstairs, and by helping me with many construction projects.

One of the most memorable projects was the construction of an air coupler and the necessary crossover network to supplement the Altec 603B mounted in my closet door. It was the later version that had internal partitions that created two resonant pipes rather than one. It was an easy project because we had a table saw and a large array of hand tools. We built a winder and wound our own air core coils from #16 magnet wire, and used motor starting capacitors. The driver was a 600B. I screwed the air coupler directly to the floor of my bedroom with angle irons and lag screws, and on low organ tones it would shake the entire house. It created the illusion of having better and lower bass than my dad's 604B in a corner bass reflex enclosure in the living room (it didn't). Later I built an electronic crossover from a plan in High Fidelity and built the air coupler its own amplifier. I soon tired of its boomy bass and gave it to a friend. My favorite demo record was one of Paul Klipsch's favorites, Columbia 7356M, a 78 rpm organ recording of Lehar selections played by Sidney Torch on a theater organ. According to Dr. Klipsch, it was one of the very few recordings he knew of at the time with relatively unlimited bass response. I still have it and it is still impressive!

Harold Lindsay of Ampex fame and Dr. Creevy

Incidentally, I attended the afternoon of reminiscences by Dr. Klipsch at the San Francisco AES recently. Although he is quite hard of hearing, his sense of humor was intact and his memory was impressive. As always, he was wearing at least two watches. He mentioned in response to a question from the audience about whom he had worked with who had made major contributions to audio that he was proud to be able to call Don Davis a good friend. I don't believe that he mentioned anyone else.

Best regards to you both.. One of these days I'll visit you at the farm at a seminar.

Dr. Creevy is a doctor of some renown. Sometimes Dr. Creevy would be called out of class to deliver a baby. We would return and announce that it was a boy or a girl, much to the delight of the class. Often Harold Lindsay of Ampex fame would attend our San Francisco seminars and I have burned in my memory a picture of Dr. Creevy and Harold Lindsay with their heads close together at lunch talking about audio. *cpd*

Ear/Brain Education

Steve Cassavant and Wayne Varner, in our July Farm class, are not inspecting our crab grass, trying to get out of the sun, or playing jungle gym. They are listening to the tremendous bass lobe out of the 25 loudspeakers in parallel vs its total absence when connected as a Bessel Array. Listening experiences like this replace hundreds of polar plots and theoretical discussions about signal synchronization. *dbd*

IMAX 3D PROCESS

A Significant Spacial Accomplishment

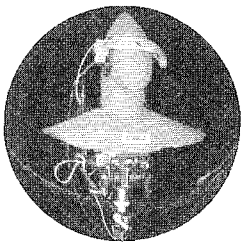
When Steve Saunders called to register for the Loudspeaker workshop in Nashville, we asked if they could bring with them their headsets used in the new IMAX 3D Sony theater in New York. We had read reviews that were enthused about the process - reviewers that had no technical knowledge of how the effect was created. For instance, this excerpt from National Review,

"It is hard to describe the exact technical achievement. But this is what it feels like: because the image stretches into a virtually real, three-dimensional infinity before you, you get to feel that its infinity is also behind you. Something more than the screen becomes three-dimensional - something around you or, perhaps more precisely, inside you. You are not only immersed in the third dimension, you are also invaded by it. When a piece of monstrous rock jumps up at you just in front, you can sense where, from behind your back, it came. It is not only the screen but the auditorium, too, that becomes three-dimensional; and with the auditorium, too, that becomes three-dimensional; and with the auditorium, your way of thinking and, for the duration of the movie, this whole threatening world."

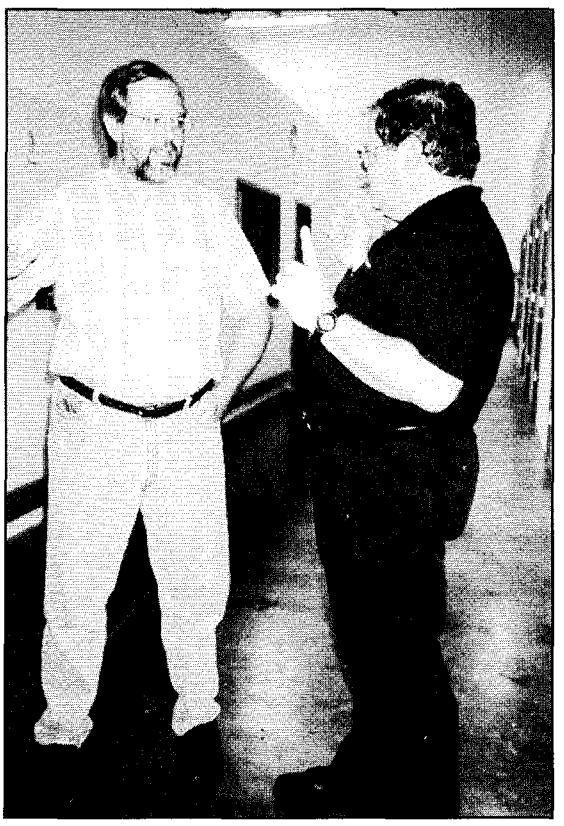
Bill Schofield and Steve Saunders of Sonics Associates in Alabama brought their industry-leading exploration of the use of head transfer function HRT recording. Their system records using the Aachen Head, marketed by Sonic Perceptions in Connecticut and plays back utilizing full range theater systems supplemented by pinnae clues generated by small transducers in the ear piece of the special liquid crystal shutter glasses. They achieve startling geometric and spatial realism.

Currently the system can be heard by the public at the Sony Theatre in New York, which means that most of the audio world has little opportunity to hear it; therefore, you can imagine what a thrill it was for the members of the Loudspeaker Workshop to each have the opportunity to put on the headsets and enter the world of Virtual Reality! It was thrilling. The next theatre to have the system will be in the Edwards Theatre in Irvine, CA.

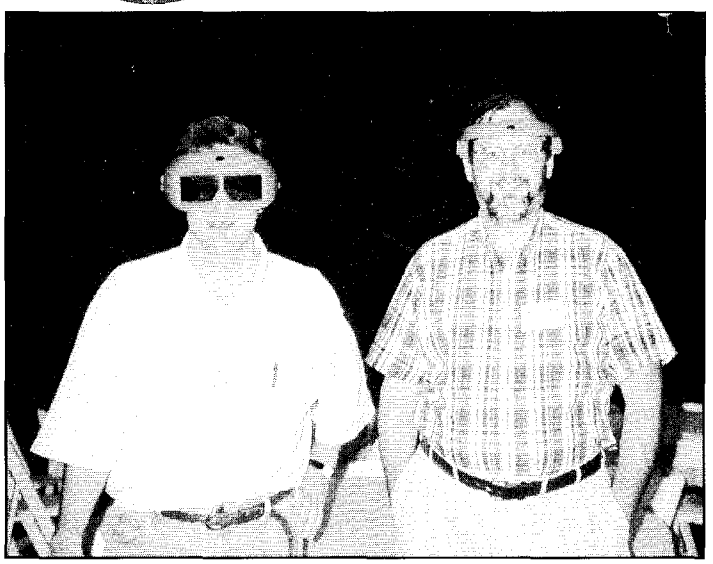
Bill Schofield brought along a book to share with the members of the workshop which we highly recommend to anyone interested in the subject: *3-D Sound for Virtual Reality and Multimedia* by Begault. ISBN - 0-12-084735-3. It is available from Opamp Technical Books, 1-800-468-4322.

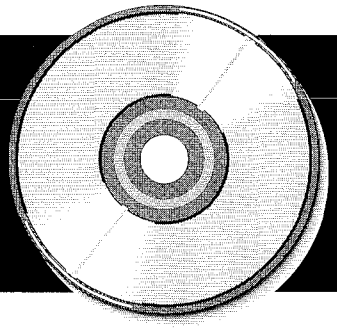


Fred Ampel telling Steve Saunders that he has been to the Sony Theatre in New York and how very impressed he is with the IMAX 3-D process.



Bill Scofield and Steve Saunders of Sonic Associates





The Syn-Aud-Con Test CD for Sound Reinforcement Systems

We are pleased to announce the release of our first CD publishing project, the Syn-Aud-Con Test CD for Sound Reinforcement Systems. There are many excellent test CD's in the audio marketplace, but we felt that a useful disk would be one aimed at room and loudspeaker system evaluation. Such a disk would include some useful ideas already in existence, as well as introduce some new ways to quickly evaluate rooms and sound systems.

The disk starts out with some standard test stimuli that we have found useful:

400 Hz and 1 kHz sine waves for gain structure use
Broadband Pink Noise (6dB Crest factor)
Band-Limited Pink Noise (200 - 5000Hz) for evaluation of the vocal range.
Polarity pulses for reflection identification and polarity tests (you need a receive unit)

The next section contains some speech intelligibility evaluation tests. John Royer was kind enough to lend us his vocal skills (extensive background in broadcast and announcing events) and a recording session at Crown International yielded the following tracks:

Counting from 1 to 50
A list of one syllable words
The same list of words, with each embedded in a carrier sentence. The carrier sentence was recorded one time and then duplicated with a wave editor. Each word from the word list was then embedded into the sentence twice.
A 3-minute reading from Chapter One of Sound System Engineering.

The next section provides octave band-limited pink noise. Each of the ten octaves from 31Hz to 16kHz are provided. The 6 dB crest factor pink noise was provided by Altec Lansing, and then band-limited using the TOA DACsys DSP processor.

Next on the disk are some noise burst tests useful for estimating reverberation time of rooms. The octave band limited pink noise is segmented into repetitive bursts at 1, 2, 3, 4, and 5 second intervals. In each test, the noise is "on" for the same amount of time that it is "off," allowing the reverberant field to fully develop prior to the silent interval. The user begins with the one second interval, walking the space and listening. If the reverberation does not decay to inaudibility during the silent period, the two second interval is selected and the test repeated. One eventually arrives at a pretty good estimate of the RT_{60}, without the use of analyzers, meters, stop watches, etc. One advantage of this method is that the user is free to walk the room during the test, checking for the uniformity of the reverberation. The noise bursts are provided on the octave bands centered at 125Hz, 250Hz, 500Hz, 1Khz, 2kHz, 4kHz, and 8kHz. An additional set of bursts are provided that use the vocal band-limited pink noise described earlier. These tests will allow the user to quickly and accurately estimate the RT_{60}'s of the eight one-octave bands of interest to system designers, and will provide a great deal of insight into whether the room can be analyzed with the statistical design equations.

The next group of tracks were produced using Don Keele's stimulus for Shaped Tone-Burst Peak Power measurements. This test method was introduced a The Theory and Design of Professional Loudspeakers Workshop in Nashville earlier this summer. Please see the overview of the test stimulus on the opposite page.

The tone-bursts are provided on one-third octave centers beginning at 20 Hz and extending to 20 kHz. The left channel has the bursts at 1 second intervals, and the right channel at 2 second intervals. I have found the burst quite useful for evaluating both loudspeakers and rooms.

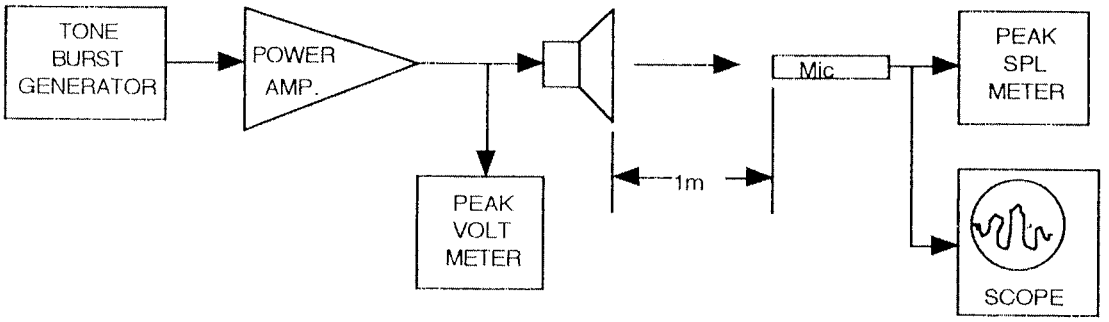
The Test CD for Sound Reinforcement Systems is available from Syn-Aud-Con at $40.00 plus shipping.

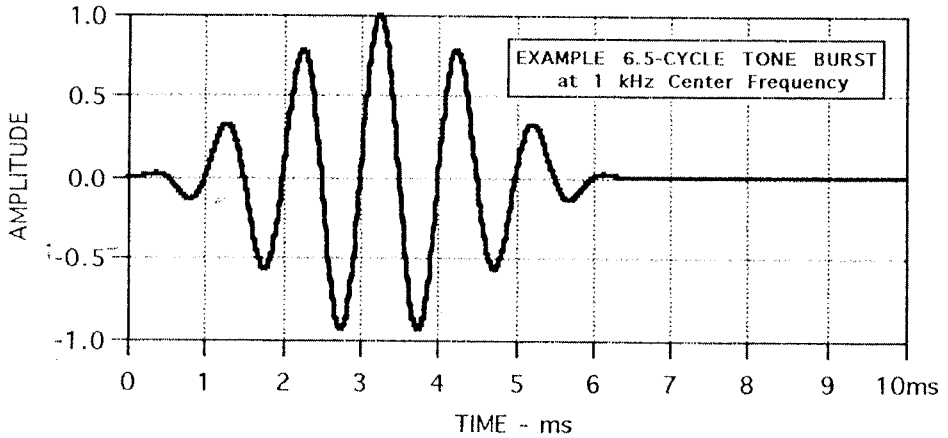
SHAPED TONE-BURST PEAK POWER MEASUREMENTS

Don Keele is widely known for his loudspeaker reviews for Audio magazine. He utilizes a barrage of tests to evaluate loudspeakers, many of which require sophisticated analyzers, such as the TEF 20. It was for this reason that Don was an instructor at our Loudspeaker Workshop in Nashville this summer. During the workshop, Don demonstrated a tone-burst test that is useful in determining the peak power handling characteristics of loudspeakers.

In this test, a very large amplifier is connected to the loudspeaker. Don uses a Crown Macro Reference amplifier, which can produce short duration pulses at over 5 kW (37 dBW, ± 200V swing). The peak input power is calculated by assuming that the measured voltage is applied across the loudspeaker's rated impedance.

The amplifier is driven with a tone burst at each one-third octave center frequency. The duty cycle of the tone burst should be such that transducer heating does not become a factor. A reasonable value is one second. The output of the transducer can be observed on an oscilloscope, or just listened to. Excursion-produced nonlinearities become readily apparent with this technique, and it should be used with caution to prevent driver damage. The test stimulus, on one-third octave center frequencies, is available on the Syn-Aud-Con Test CD for Sound Reinforcement Systems. *pb*

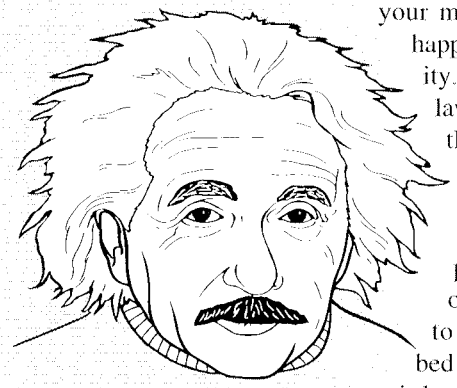




$$f(t) = \begin{cases} \left(1 - \cos\frac{2\pi f_0 t}{6.5}\right)\frac{\sin 2\pi f_0 t}{2} & \text{for } 0 \le t \le \frac{6.5}{f_0} \\ 0 & \text{otherwise} \end{cases}$$

Only You Can Govern Your Thinking

When one has had a good look at death face-to-face, and been fortunate enough to survive, life's priorities take on a different order.



At such times it's between you and your maker, however you happen to perceive Deity. The material rules, laws, relationships of the everyday world seem foolishness. What usually emerges is the appreciation of the gift of life. One has only to stand at the death bed of a loved one who is hooked to all the scientific machinery known to man, and realize that what's breathing and producing signals is not alive, merely activated.

Eugene Wigner, who just passed on at age 92, had as his last great inquiry the effort to define consciousness. Consciousness, like electricity, is something we know a lot about the effects it can cause but not what it actually is. Einstein's consciousness could conceive of a single unifying force, but we have been unable to find it in physics.

In teaching technical subjects you have some hard won, proven-to-work, truths you'd like to share. To do so you can take two paths. One is to force a "graded learning" of a series of "facts". The other is to expose, whoever you would like to share your knowledge with, to thinking about whatever subject is at hand from whatever basics he or she has already made their own.

Thinking about life can be approached in a similar manner. Rather than allowing others to program our consciousness, submit what is presented to our best self-won knowledge that we are convinced works and see if what is being presented really makes sense in our lives. Many times even terrible programs have something useful buried somewhere in the midst. What we can do, if we make the genuine effort to think, is to construct our own conscious understanding of the world around us. *dbd*

The Purdue Class Was a Nice Surprise

Rick Thomas, a professor in the Theater Department at Purdue University was on the program at International Congress of Acoustics in Vancouver in 1988. We attended the program because it was a dream come true, all the "greats" of our acoustic world in one place: Peutz, Blauert, Kuttruff, Barron, Meyer, Nagata. But what was Rick Thomas doing there — a young professor at Purdue? Obviously the program chairman saw a spark of genius there and wanted to encourage Rick.

Seven years later I understand better why Rick was at ICA in Vancouver. We worked with Rick on the Theater Sound Design Workshop in 1993.

Rick called this year to ask if he could have a special 2-day class at the farm for his students who had just finished a semester in learning to design sound systems for theaters. Their term paper was to design a sound system for a theater with a $100,000 budget.

We expected to treat the subject a little superficially without formulas, etc. We were 2 hours into the class when we knew that these young people were here for raw meat. They had used EASE/EARS, TEF - to work on their project. Rick Thomas is a special breed.

Note the perverseness of Pat Brown wearing his IU T-Shirt for the Purdue Class. *cpd*

V.M.A. Peutz

The very first workshop Syn-Aud-Con ever held was in Los Angeles just prior to the AES convention in 1969.

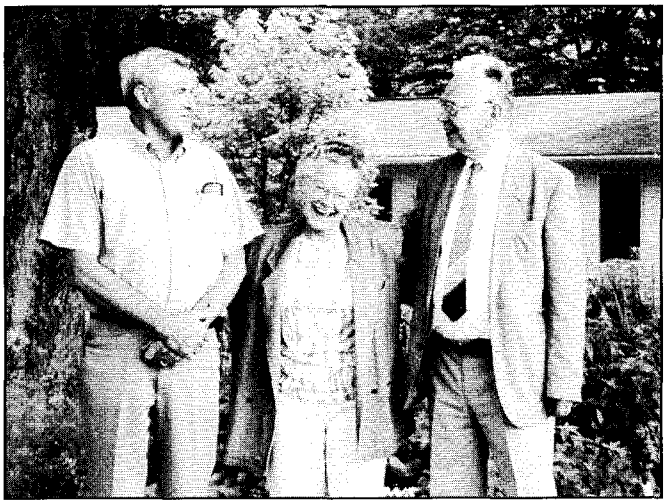
The staff for that workshop was Richard C. Heyser, James Moir, John Hilliard, and Victor Peutz with myself being the moderator. This was an era without personal computers, speech intelligibility measurements, TEF analysis, LEDE control rooms, PZM microphones, constant directivity horns, and digital electronics, other than a few signal delays, and a host of other gleams in the eye of the innovator.

Out of that original staff V. M. A. Peutz and myself remain and as we have visited Mr. and Mrs. Peutz at our respective homes in the Netherlands and Indiana during this past year, our memories of our accomplishments are the rewards of active and productive lives.

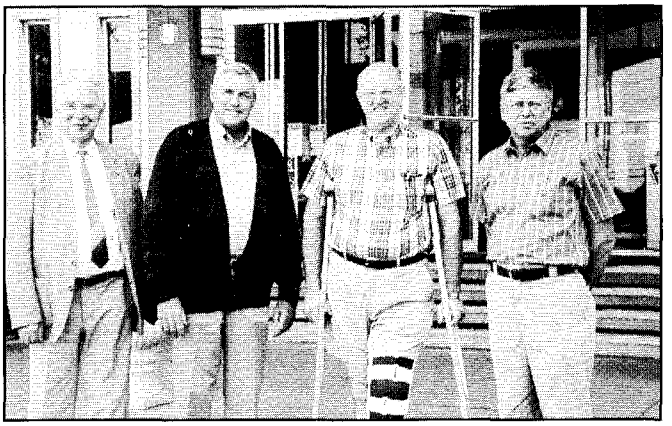
Societies hand out awards and we have received a few, but the highest recognition to me is the lasting friendship of remarkable men like V. M. A. Peutz.

While Mr. & Mrs. Peutz were here we arranged to meet with Don Eger and Ron Bennett to discuss Richard Heyser's last papers, many unpublished, which have been given to Don Eger and Ron Bennett. Richard Heyser respected Mr. Peutz and shared many insights with him, many that were not shared with others, to our knowledge.

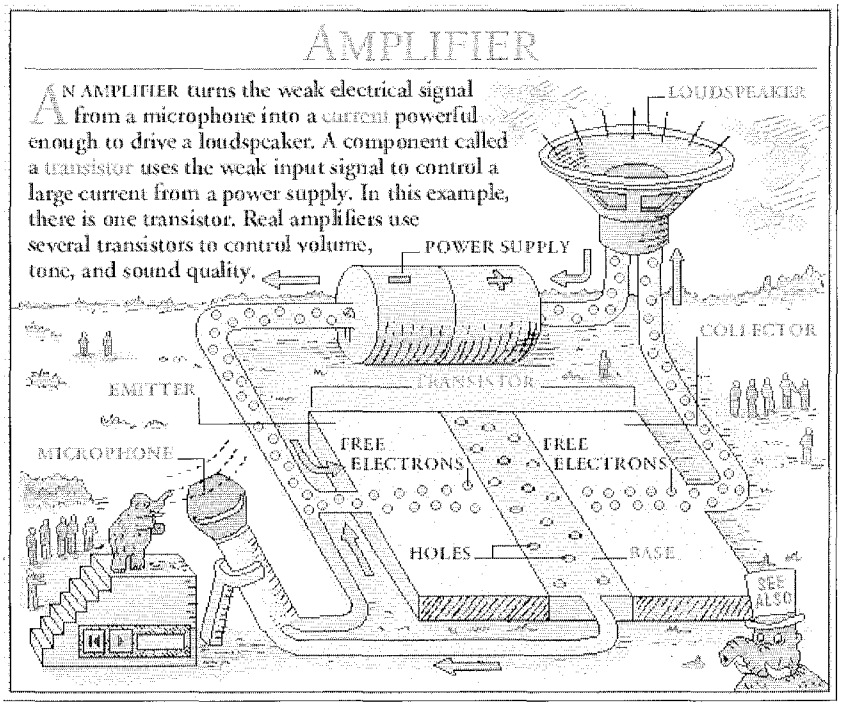
dbd



Don with Nelly and Victor Peutz



Victor Peutz, Don Davis, Don Eger, and Ron Bennett at the conclusion of a meeting to discuss Richard Heyser's work.



"If I have been able to see farther than others, it was because I stood on the shoulders of giants."

Sir Isaac Newton

"Learned men are the cisterns of knowledge, not the fountainheads."

James Northcote

from "The Way Things Work"

Marvin Camras - Magnetic Tape Recorder Pioneer Dies at Age 79

Quoted from DOS Orchestra, an electronic publication of the International Conference of Symphony and Opera Musicians (ICSOM), edited by Robert Levine:

Marvin Camras, generally credited as the inventor of magnetic tape recording, died on June 23 in Evanston (IL) of kidney failure. He was 79.

Camras built a magnetic wire recording in the late 1930's for a relative who was a singer. He joined the Armour Research Foundation to develop his invention and, after refining the process to record on magnetic tape rather than wire, received a patent in 1944 on "method and means of magnetic recording," one of 500 patents he received during his career. His patents were licensed by over 100 manufacturers. He was awarded the National Medal of Technology in 1990.

Ray Dolby, inventor of the Dolby noise reduction system, told the New York Times that "Marvin Camras is a legend, and we are all grateful for what he did... the basic principles he explored and designed are used in the tapes and recorder designs in our machines today."

Camras was also an accomplished luthier. One of his violas is played by his son-in-law Charles Piklar, principal violist of the Chicago Symphony.

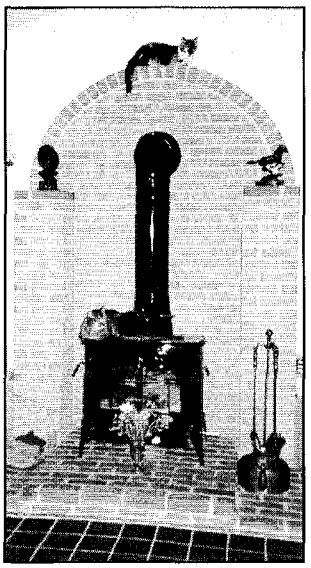
Camras is survived by his wife, Isabelle Pollak Camras, four sons, a daughter, and six grandchildren.

From Ron Steinerg of Rentcom

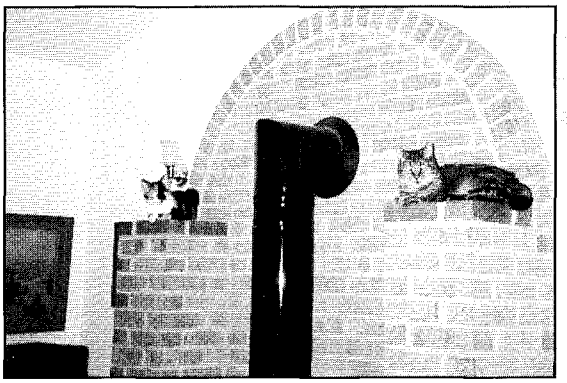
It's Not All Work at a Farm Class!

I wanted to especially mention Susan Johnson, an architect from Ball State University in Muncie. Susan attended the class because she designs facilities at the college and she wants to understand how the acoustics of the space interacts with the sound system. Susan was not a passive student. She is seriously interested. I wish we could clone Susan so that there would be at least one Susan Johnson in every architectural firm. *cpd*

Feline Everest



During the fall, winter and spring, our wood stove is a focal point of warmth and light. During the summer, our alpine cats treat the area as their personal Matterhorn. So far only Callie has mastered the summit while Rascal waits at the various base camps. While Callie can walk up the arch she has not yet figured out how to walk down. Knowing that she would have to jump, we removed our sculpture by Ken Payne and one we affectionately call our Charlie Russell sculpture. (Actually the Charlie Russell bust was done by Earle Heikke, a protege of Charlie Russell.) Rascal couldn't resist joining Callie on the newly cleared pedestal. ***dbd***



Listen Before You Measure...

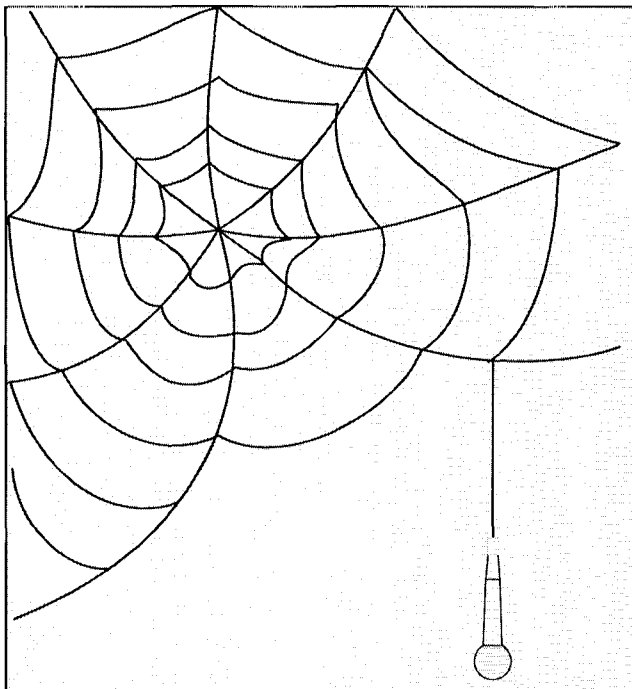
Can meters tell you what something sounds like?

Acoustic measurements are but one way to evaluate the dissipation of energy in an enclosed space.

An example from everyday life is in order. We shall consider something that everyone reading this will have in common, your body weight. How can you tell if it is increasing or decreasing? There are several possibilities, but the first indicator is often the fit of a favorite belt. When the usual notch is a little hard to reach, the conclusion drawn is that I have gained weight. If there is some slack when the usual notch is reached, then have another piece of pie. The tightness of the belt is an indicator of the condition of the entire body, for the waist does not expand or contract independent of the other parts. A possibly more accurate indicator is the fit of a favorite pair of jeans. Now the test includes more data points, since the jeans cover about half of the body. If they are too tight (and your spouse has not shrunk them), we know what has happened (no pie for supper)! When the bathroom scale is used to quantify the situation, the clues provided by the belt and jeans are confirmed. How does this work? When you stand on the scales, your body places pressure on a mechanism. The amount of pressure is proportional to the weight of your body. This pressure is converted, via another mechanism, into a force that causes the deflection of a shaft, to which a pointer is affixed. The process is complete when an appropriate scale (lbs or kgs) is placed beneath the pointer. Once calibrated, the accurate body weight is read directly from the position of the pointer on the scale. Although an indirect method, a bathroom scale is calibrated and consistent, and is used to verify the clues provided by the belt and jeans.

Acoustic measurements work essentially the same way. The combined response of the room and loudspeaker give us many audible clues as to what is going on, much like the belt in the previous example. The ear is neither calibrated nor consistent, but one should always listen prior to acquiring data. Listening to the loudspeaker on axis is a useful endeavor. A more desired approach is to walk the entire seating area. This yields a better idea of system performance, much like the jeans of the previous example. When you have decided what you would like to measure, it is time to place the microphone at the desired position and acquire some data. As in our bodyweight analogy, we will actually be measuring a pressure and converting it into a quantity via a calibrated scale. In TEF measurements, this will be a voltage converted to a sound pressure- squared level in decibels. The dB reading will either confirm and quantify what our ears have already told us, or it will reveal that we didn't hear what we thought we did.

The moral of the story? Listen before you measure. Nature provides many clues to our senses concerning events of interest. Attempts to fully evaluate this data with pressure deflections and calibrated scales is to overlook other meaningful and valid observations. *pb*



Syn-Aud-Con's

WORLD WIDE WEBSITE

Up-to-the-minute Syn-Aud-Con information is just a mouse click away

It has been a long time coming, but the Syn-Aud-Con World Wide Website is now on-line. With the advent of Windows 95 making access to the Internet even more widespread, our Website will play an important role in keeping our readers informed about Syn-Aud-Con activities.

Of course the list is growing, but here is what you will find on our Website:

Current Syn-Aud-Con Schedule - This is the up-to-the-minute list of the events that we have scheduled. New events will appear on this list before you will ever see anything in print about them.

Syn-Aud-Con Sponsor Information - Each of our valued sponsors has a page on our Website, filled with the information that you need to access them. If they have Websites (and the list of those who do is growing) there will be a link to their site from ours in this space.

Downloadable files - Our newsletter often reviews shareware, or offers audio utilities at no charge, such as our Mathcad Quarterly. Those files, as well as others, will be downloadable from the Website. Now you can wake up at 3 A.M. and have a bowl of cereal and a computer session.

Links to Other Audio Websites - There are many audio sites on the Web, and you can get to some of them by visiting our site. Whether you need the latest information about the Audio Engineering Society (AES), a used equipment list from RentCom in Chicago, or would like to check out the European audio scene (Bahnoff in Sweden), the Syn-Aud-Con Website can be your place of departure.

Used Test Equipment - If you are a current newsletter subscriber, you may place an ad for used test equipment on the Website at no charge.

Positions Available - Syn-Aud-Con subscribers and sponsors may place "help wanted" or "personnel available" notices on the Website at no charge. These should be valuable in keeping people abreast of employment opportunities, as well as informing our sponsors about individuals who are looking for a position.

Notices for the Website should be emailed or faxed to:

Syn-Aud-Con 1-812-923-3610 (Fax)
or
patb@synaudcon.com (Internet)
74032.1356 (Compuserve)

To use this service, we ask that you have a current Newsletter subscription, and that you write the ad, keeping it as brief as possible. *pb*

Temporary URL:	*Permanent URL:*
http://wl.iglou.com/synaud	http://wl.synaudcon.com/synaud

What is the World Wide Web?

Suppose that you finally got a much needed vacation, and elected to take a ski trip in the Rocky Mountains. This being your first ski trip, you would naturally want to do some research to find out how to enjoy it to the fullest. Maybe your first step would be to write the Chamber of Commerce of the ski town for some information on resorts. Once that information came, you could then proceed to check out some places for your trip. After finding one that seems just perfect, you are reading through their literature and you find an article on ski boots. This prompts you to investigate further. After talking to the local sporting goods store about boots, they ask you what kind of outfit you are going to wear. Not realizing that there many choices, you set out to find out more about ski wear. This in turn leads to several other searches, including skis, goggles, and first aid kits. Finally exhausted from your search, you decide to go to the beach instead.

The World Wide Web is a part of the Internet, and is made up of many "sites" often referred to as Web pages. "Browsing" through these pages is somewhat like paging through the Sears catalog, each page having something different to offer. You can begin your "webwalk" with a search on a topic, such as ski's. The search returns several Websites that offer information on the subject. As you visit the sites (with a click of the mouse) you find all kinds of articles on skiing. Some of the main words are highlighted in blue, and clicking on them sends you off to another Website and more information. The interesting part is that the sites may be in the same city or on opposite sides of the planet. It really doesn't matter, because at the speed of light there is little difference.

Websites are plentiful (literally hundreds of thousands), each being a page in a master book of who is out there in the world. The World Wide Web is just a part of the Internet, but it is a friendly part that is an endless resource of knowledge and information.

You can gain access to the Web with about any on-line service, or with a direct dial-up connection to the Internet. *pb*

The Road to Connection...

If you are new to the world of the Internet, here is a quick walk-through of what you can do to get up and running:

1. Get a computer - Of course, you already knew that.

2. Buy a modem - A 14.4 bps will get the job done, but a 28.8 is much better for Internet exploration.

3. Decide on an On-line Service - There are a variety of choices out there, but the major players are

America On-Line (superior Internet access)
CompuServe (Extensive worldwide network of local access numbers, and the most popular with Syn-Aud-Con grads)
Prodigy, Genie, and others.

These services offer their own array of features, plus access to the Internet. Beware that the "meter will be running" when using the service, and that low monthly fee can escalate into a larger bill. Sign-up kits are available at most of the large office products stores for less than $30.00, or you can contact the services directly for a free demo disk.

Dial-up Internet Connection

You can also elect to establish a dial-up account with an Internet provider. While this may not offer some of the frills that the on-line services do, it is probably the cheapest and most versatile in the long-run. Many providers have toll-free dial-up numbers, so you can use them anywhere you go. This type of connection is also necessary if you anticipate establishing a Website in the future. Internet kits can be obtained from all of the software supply houses and range in price from $30 to $100. If you live near a larger town, you can check the local phone book for a supplier,. They will provide you with all of the software that you need to use the Internet.

Once you have the start-up pack, just follow the directions. You will be up and running in no time and ready to explore the Information Super Highway. Learning to navigate the 'Net is like learning to read, just do it often and you will get the hang of it. *pb*

Ray Tracing

Is What You See, What You Get?

A nagging question in our industry is whether computer modeling programs can accurately predict the acoustic performance of an enclosed space. Are these useful design tools or just slick sales tools to be used to impress the client? Let us examine what the current technology can and cannot do with regard to acoustic simulation.

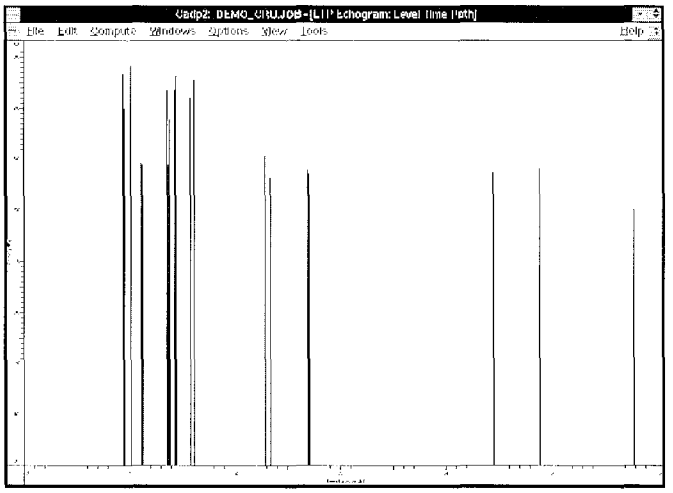
Wallace Sabine quantified the relationships for statistical reverberation nearly 100 years ago. Armed with a stopwatch and a good set of ears, his formula is still the best available for true statistical spaces. Unfortunately, it tells us little about the early energy decay in a space, and it is this sound field that is often of major concern in most halls. Since the early-reflected sound field (I_{RE}) is different at every seat, there are no one-number predictors that allow it to be examined at the drawing board stage of a system design. What is really needed is the ability to generate a plot of energy vs. time for any desired seat, which means that the geometry of the space must be fully considered. This data is readily accessible for an existing space with TDS or FFT measurements.

Reflectograms

The energy-time curve (ETC) is one of the most valuable measurement tools that we possess. The display represents the total acoustic energy (including potential and kinetic) as it distributes over time, and is useful for viewing what we hear in a space. The microphone is placed at the desired point of observation and a test stimulus is introduced into the environment. As the acoustic energy encounters the microphone, the pressure is recorded (as a voltage from the microphone) and stored in memory as an impulse response. This impulse response represents only one part of the energy present (just as the position of a falling object represents only one part of the energy possessed by that object, the other part being its energy due to motion). Heyser showed us that if we acquire one part, (normally the real part or impulse response) the doublet, or imaginary energy, can be derived from it via the Hilbert Transform.

This mathematically intensive task is handled nicely by the computer or a DSP chip. The ETC represents the total energy from these two parts. With this data, it is possible to identify the various sound fields that develop within the space, i.e. early reflections, reverberation, etc. Once identified, these sound fields can be modified via absorption, diffusion and/or reflection in order to improve the acoustical performance of the space. Ignoring this valuable tool is analogous to the doctor ignoring the X-Ray department and proceeding on intuition alone.

Imagine for a moment, that you could have an ETC prior to the installation of a loudspeaker system, or even the construction of the room. This is what computer modeling is all about. The space is constructed on the computer screen by entering coordinates (or vertices) for the corner points of plane surfaces. These vertices can be connected together to create the planes. If enough planes are created and connected, the model takes on the shape of the room.



Reflectograms at the drawing board stage can help guide the design by influencing loudspeaker choice and placement.

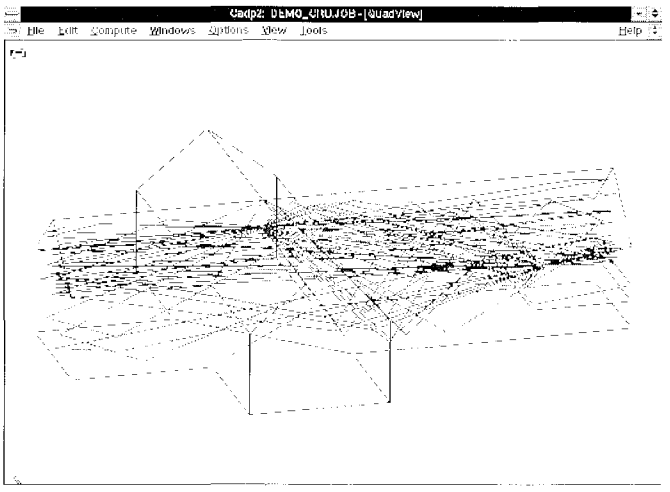
When Wallace Sabine entered the Fogg Lecture Hall to begin his ground breaking work in architectural acoustics, he

was armed only with a stopwatch, a tone generator and some moveable absorbers. With these basic tools he empirically derived the relationship between volume and absorption in an enclosed space. Since a reverberant sound field is statistical (uniform throughout the space) and involves only the volume and absorption present, computer modeling techniques are not essential in predicting it. When attention is shifted from the reverberant field to the early reflected sound field, the mathematical approach must shift from a statistical acoustics approach to a specific acoustics approach. This means that the energy must be considered on a seat-by-seat basis, since the early reflection intervals are a function of the physical distances between the seat under investigation and the reflective surfaces of the space. Computer programs use ray tracing to model the sound emitted from a loudspeaker as though it behaved as rays of light, and trace its path through the space as a series of reflections. Sound behaves in this manner at frequencies whose wavelengths are much smaller than the space being modeled. The lowest frequency for which this applies, often called the critical frequency, can be estimated from this simple formula:

$$\lambda = \frac{3390}{D_x}$$

Where D_X is the room's smallest dimension in feet.

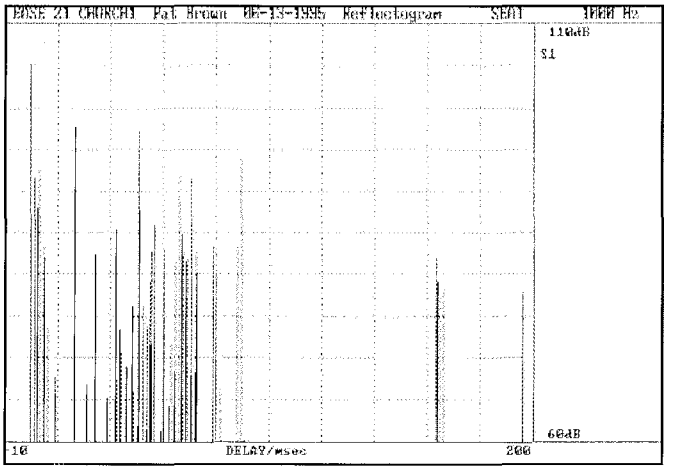
In the model, as the wavefront encounters a room boundary, energy is removed from it in accordance with the absorption coefficient assigned to that surface. The wave will continue to propagate until it dissipates sufficiently in level, or falls outside of the specified time interval being investigated.



IBL's CADP2 works within a Windows environment

It would seem then, that the current ray tracing routines can provide a believable reflectogram above the critical frequency of the space, when room surfaces are fairly large when compared to the wavelength of the frequency of interest.

Below critical frequency, the ratio between wave size and room dimensions prevent the sound from behaving as rays of light. A modal acoustics approach must be used, which none of the current programs presently implement. This is why critical frequency should always be considered when modeling indoor spaces.



EASE from Renkus-Heinz supports two ray tracing algorithms

At the risk of oversimplifying the problem, we might view the room response as we do a sound system design problem. The audible passband (20 Hz to 20 kHz) divides nicely into three decades. Let us consider each from a simulation perspective:

20 to 200 Hz - Many spaces exhibit modal behavior in this region, and in such spaces it should be ignored for ray tracing studies.

200 to 2000 Hz - Ray tracing works well when surfaces are flat and large compared to the frequency of interest. Diffusion characteristics cannot be modeled by the programs at their current state of development. It can be pointed out that one reason for modeling most rooms to begin with is to determine where diffusion should be applied, and ray tracing works well for this purpose. We encourage software developers to work toward the inclusion of Peter D'Antonio's work in their products so that the effects of diffusors can be accurately predicted.

2000 to 20000 Hz - Sound behaves most like light at these frequencies, so the models should be most accurate here. Unfortunately, a large amount of detail must be included in the model, since even a pitcher of water becomes an acoustic obstacle in this decade.

In conclusion, ray tracing studies can yield useful information about an auditorium, and should be performed when the effects of significant specific reflections or loudspeaker arrival times need to be considered at the drawing board stage.

pb

Model For Approximating Diaphragm Excursion for Horn Loudspeakers

Our Fall Mathcad Quarterly comes from Bruce Marlin. Bruce is an engineer for Atlas Soundolier, with years of experience in horn and driver design. During the Loudspeaker Design workshop, Bruce made his very useful Mathcad template available to the attendees. Based on the work of Harry Olson, the template allows the maximum excursion of a driver to be predicted. Bruce was generous enough to share it with Syn-Aud-Con readers at no charge.

Try changing the diameter of the diaphragm to larger numbers and note the increase in excursion available. This is an excellent way to visualize why drivers become larger as their bandpass extends lower.

The Mathcad Quarterly is available for download from Syn-Aud-Con's World Wide Website. *pb*

MODEL FOR APPROXIMATING DIAPHRAGM EXCURSION FOR HORN LOUDSPEAKERS

Only compression ratio and power are used to approximate theoretical diaphragm excursion for horn driven loudspeakers. The user is required to know the efficiency of the driver, in percent, which can be obtained from a plane wave tube measurement. Input the electrical power and the efficiency to calculate the acoustic power. The user must also enter the diaphragm diameter in centimeters, Dd, and the horn throat diameter in centimeters, Dt. This routine assumes that the mechanical compliance is linear and has infinite excursion capabilities. It is also assumed that the diaphragm is terminated in an acoustic resistance. This routine is based on Olson's equation 7-23 from his text Acoustical Engineering.

$\eta := 25$ Driver efficiency [%]

$P := 200$ Electrical input power [Watts]

$Pacoustic := \frac{\eta}{100} P$ Acoustic power [Watts]

$Pacoustic = 50$

$Dd := 10\ 16$ Diameter of diaphragm [cm]

$Ad := \left(\frac{Dd}{2}\right)^2 \pi$ Area of diaphragm [cm^2]

$Dt := 3\ 175$ Diameter of horn throat [cm]

$At := \left(\frac{Dt}{2}\right)^2 \pi$ Area of horn throat [cm^2]

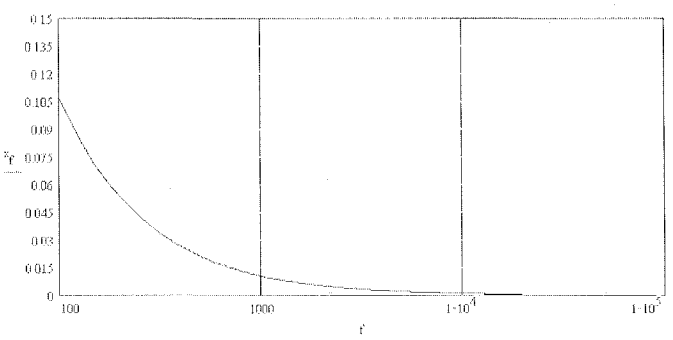
$f := 100, 125 .. 20000$ Frequency vector [Hz]

$\omega_f := 2 \pi f$ Radian frequency [rad/sec]

$\rho c := 41\ 4$ Specific resistance of air @ 25 [degrees C] [gm/sec-cm^2]

$x(f) := \sqrt{\frac{2 \cdot At \cdot Pacoustic}{\rho c \left(\omega_f\right)^2 \cdot Ad^2} \cdot 10^7}$ Diaphragm excursion [cm]

$x_f := \frac{x(f)}{2\ 54}$ Diaphragm excursion [in]



The "Barron" Direct-Plus-Early/Late vs. Time Curve

L. Gerald Marshall
Klepper Marshall King Associates, Ltd

The TEF 20 ELR program displays for comparative purposes a theoretical early/late vs. time curve labeled C_X. This curve is the theoretical equivalent of the measured without direct signal curve, C_{to}, and comes from the equation

$$C_X = 10\log(e^{13.82t/RT_{60}} - 1)$$

From traditional room acoustics theory, the equation for a theoretical curve which includes the direct signal (that is, the theoretical equivalent of C_t) is,

$$C_{TR} = 10\log(\frac{Ve^{13.82t/RT_{60}}}{1024RT_{60}r^2} + e^{13.82t/RT_{60}} - 1)$$

Where V is the room volume in ft^3, r is the source-receive distance in feet, t is the ratio dividing time in seconds, and RT_{60} is the reverberation time in seconds.

In this equation, the first term within the bracket represents the ratio of direct-to-late sound energy, while the remainder, of course, is the ratio of early-to-late given above.

Michael Barron produced a revised theory to better represent the change in sound level experienced with distance from the source, and this is discussed in his recent book, Auditorium Acoustics and Architectural Design. The revised theory was presented earlier in a paper he co-authored with L.J. Lee, published in JASA, Volume 84, Pages 618-28 (1988). The associated direct-plus-early/late curve - labeled "Barron curve", C_B - comes from the equation (again with English units),

$$C_B = 10\log(\frac{Ve^{(.0122r+13.82t)/RT_{60}}}{1024RTr^2} + e^{13.82t/RT} - 1)$$

which differs from the traditional theory equation only by the distance factor, r, included in the exponent of the direct/late term. For omnidirectional sources, C_{TR} and C_B generally differ only slightly (speaking only about early/late ratios here, not about the change in sound level with distance). However, as the directivity of the source increases, greater emphasis accrues to the direct signal and the "r" factor in the exponent of the first term in C_B becomes significant.

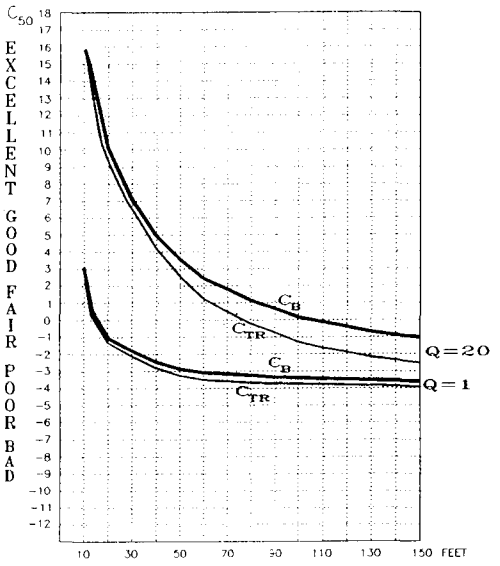
Using source directivity factor, Q, as a multiplier on the direct signal term in each equation, an illustration is provided for C50 using the following parameters,

V = 250,000 cubic feet
RT_{60} = 2 seconds
Q = 1 and
Q = 20

My hope is that the next version of the ELR program will add the Barron curve as a graphing option to the user. Of course, room volume must be known so it can be entered when this option is toggled on.

There are advantages to adding Barron values to the ELR display. Since the relative strength of the direct signal in relation to subsequent reflected energy is indicated by the separation between C_t and C_{to}, that separation can be compared with theoretical behavior by observing the separation between C_B and C_X.. Another advantage is that source loudspeaker "Q" can be readily determined. By assuming that, except for the effect of Q on the direct signal (which comes from the sound system), the differences between with and without-direct-signal ratio values would be similar for the measured and theoretical ELR's.

$$Q_{DS} = \frac{\log^{-1}(C_t/10) - \log^{-1}(C_{to}/10)}{\log^{-1}(C_B/10) - \log^{-1}(C_X/10)}$$



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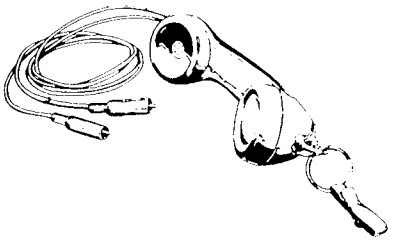
submitted by Neil Thompson Shade Acoustical Design Collaborative, Ltd

The Contractor's Survival Kit

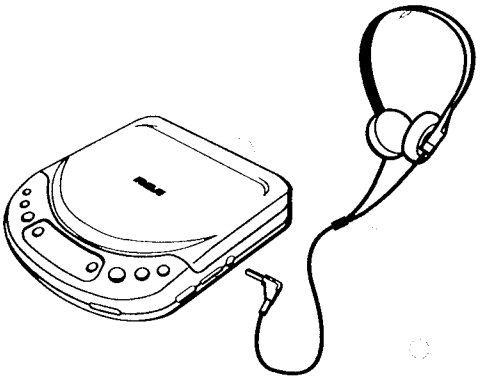
For "In the trenches" audio work, there are some things that you just can't live without

When it comes to test equipment, it is not difficult to find a place to spend lots of money very quickly. With all of the high-tech analyzers and meters on the market, one could go to the "poor house" very quickly trying to stay up-to-date. That's what wives are for. They were put here to "balance the scales" so that there is money available for food and clothing. Someone asked me once what I would do if given a budget of a few hundred dollars to get equipped for day-to-day audio work. Fortunately, in the audio profession, a few hundred dollars goes a long way.

Here are my picks for an "nuts and bolts/get it done" audio equipment kit.

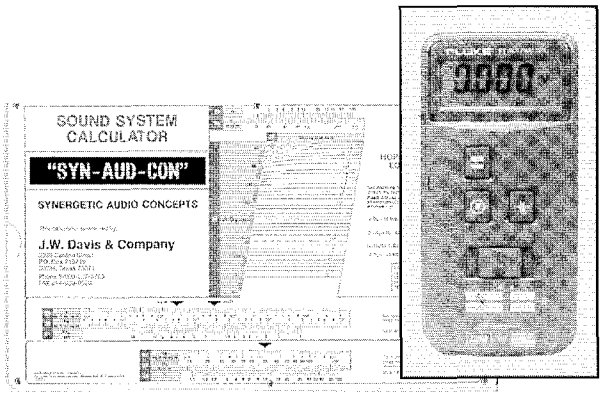


First on the list is the TS-1A TESTSET from Music Supply Company, Inc. or from J.W. Davis Company. This versatile handset allows signals of all levels to be monitored. It consists of a transducer (2000 ohms) in a "bullet-proof" molded handset with a couple of test leads attached, and is excellent for finding where the signal stops, checking the DC supply of a power amp, determining if lines are balanced or unbalanced, and a host of other applications. Cost? $104.50. Put it at the top of the list.



Next on the list might be a personal CD player with and active direct box. Used in conjunction with a good test CD (Of course, the new Syn-Aud-Con test CD is a good choice!) one of these devices makes an excellent signal generator for all levels of inputs. Use the headphone output so that you can vary the level, and the direct box for interfacing with balanced mic inputs. Cost? Under $100, and about the same for a decent active direct box. Make sure that you get a model with Electronic Skip Protection and 8-hours of play time from two AA batteries.

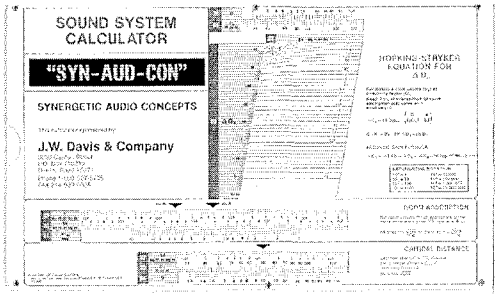
A multimeter is indispensable for doing gain structure. An inexpensive one works fine, as long as you can measure voltages up to about 200 V. And for turning those measurements into decibels, a pocket calculator or the Syn-Aud-Con Slide Rule should be in the bag. Cost? $50-$100 for the voltmeter and $7 for the slide rule.



If there is still some money left, get a test loudspeaker with built-in power amplifier and tripod stand. Try to find one with a five-inch cone transducer and no tweeter. This can be used with the CD player to simulate a human talker for calibrating mixers, estimating RT_{60}'s, and general room evaluation prior to system design. Used with the Radio Shack Sound Level Meter, you can also determine the Equivalent Acoustic Distance and Critical Distance for an auditorium. Measure the test loudspeaker's Q and you have a good number to drop into the statistical formulas for determining the needed Q for a system design.

Don't overlook the simple tools and the ear/brain system. Properly applied, they can provide a wealth of knowledge about the space (and make you lots of money!)

pb



Using N Factor to Modify Critical Distance

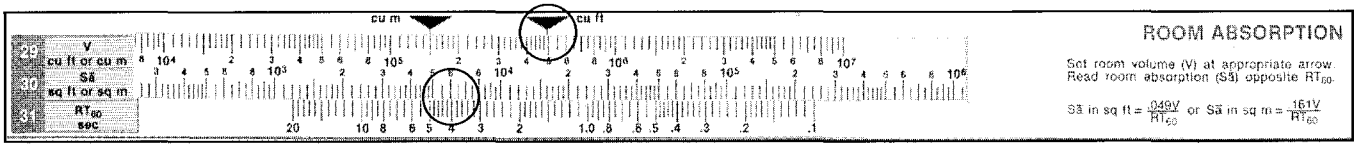
The critical distance of a reverberant space (with a given sound source) can be found by the equation

$$D_C = 0.141\sqrt{\frac{QS\bar{a}}{N}}$$

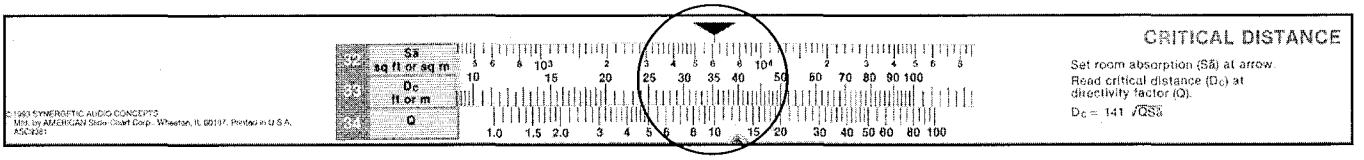
Where Q is the directivity factor of the device
Sa is the absorption in Sabins of the space
N is the sound power ratio of all devices to the device aimed at the seat under investigation

The term "N" is not accounted for on our Syn-Aud-Con slide rule, but the effects of N can be easily accounted for by a simple additional step.

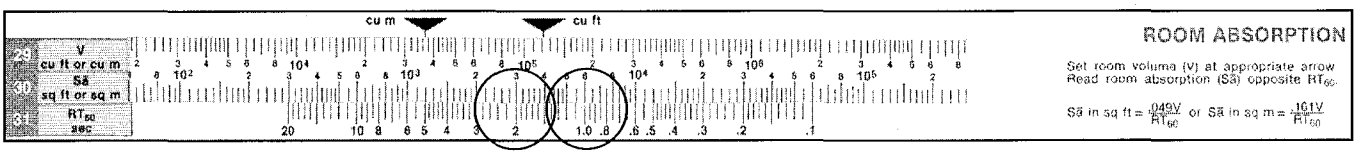
Let us assume that we have used the Room Absorption section of the slide rule to determine that there are 6000 Sabins of absorption in a large room (500,000 cubic feet), that has a reverb time (RT_{60}) of 4 seconds.



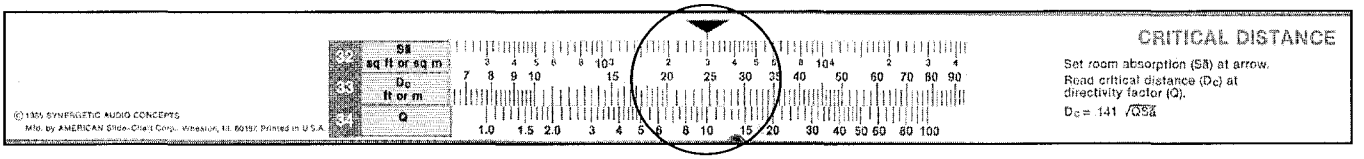
Aligning the 6000 Sabins on Scale 32 to the marker, we see that the critical distance of this space, using a device with a Directivity Factor (Q) of 10 would be about 35 feet.



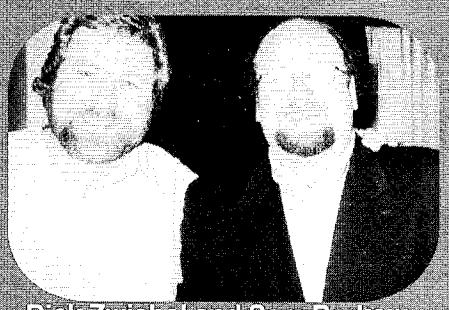
What would be the effect on critical distance of adding another identical loudspeaker to the array, to cover another area? Although N is not represented on the critical distance section, we can account for it by scaling the room absorption. Referring to the Room Absorption section of the slide rule, place the 6000 Sabins mark opposite one second on the RT_{60} scale. Instead of RT60 think of the scale as N factor, and follow it to the left to an N factor of 2, which is below 3000 Sabins on scale 30. We can say that the effect of increasing N to 2 would have the same effect on critical distance as reducing the absorption by one-half (It went from 6000 Sabins to 3000 Sabins).



Now go back to the critical distance section and use 3000 Sabins instead of 6000 Sabins. In doing so we find that the energy from the second device has caused critical distance to go from 35 feet to about 25 feet.

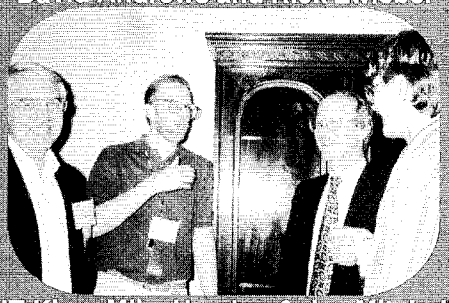


Try it again, substituting different values in each case. It is interesting to note that increasing the N factor has the same acoustical effect as reducing the absorption, and conversely. Turning off some unneeded loudspeakers is a much more economical solution to an intelligibility problem than applying acoustical treatment to the room. *PB*



Rick Zwiebel and Sam Berkow

David Andrews and Rick Zwiebel



JT King, Mike Headon & Jay Mitchell

Dieter Michel & Angie & Craig Janssen

Kathy and Deward Timothy

Scenes from the NSCA JW Davis/Syn-Aud-Con Hospitality Suite

It was again our privilege at this year's NSCA Show in Indianapolis to share a hospitality suite with our good friends from J.W. Davis Company of Dallas, TX. "Share" may not be the correct work, because they insist on doing most of the work. The suite was buzzing from opening time after the show until about 11P.M., when us Indiana folks have to retire for the day, or face the consequences the next day. We were grateful for the good times spent with audio friends from around the world, and we offer a sincere "thank you" to all who stopped to visit.

We hope to have the same privilege of "suite sharing" at future shows, and encourage all to stop and visit.

After awhile we began to wonder if there was a correlation between audio talent and facial hair. Perhaps this will be a subject for an upcoming Tech Topic. *pb*

JW Davis Company

A different perspective on sound...

Joseph Duarte

Some months ago someone called from the DC area to ask if Joseph Duarte, who is "profoundly deaf," could register for the July class. Mr. Duarte said that he would bring equipment with him to interface with our equipment. How grateful we were to have Joseph. Joseph spoke to the class to explain to us the many ramifications of providing assisted hearing devices for hearing impaired people. A single system will not assist the hearing of each hearing impaired person. Each has a special need. This was a surprise to members of the class.

I know that I personally was very touched by the magnitude of the problem. Soon after the July class, I made an appointment at a local beauty shop. The owner of the shop, in her early forties, suffers from nerve damage and is progressively losing her ability to hear. She must read lips, which means that she can't use the telephone. She commented that her children would all be in school in a couple of weeks and that she was concerned as to how she would continue her work.

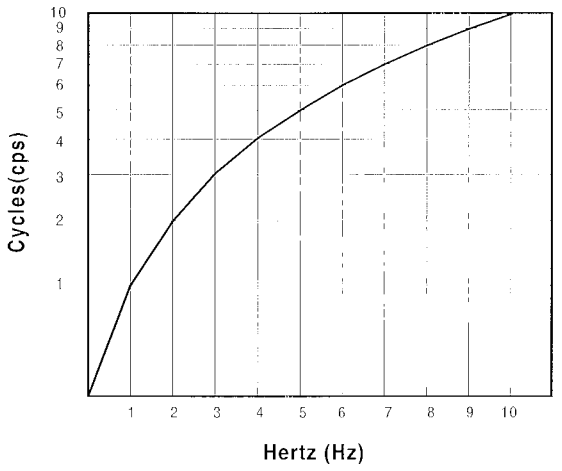
I called our friend, Larry Humes, of the Department of Speech and Hearing Sciences at Indiana University. He recommended that I call Dr. Hipsink, who is an authority in making it possible for hearing impaired or profoundly deaf people

Joseph Duarte addresses the class

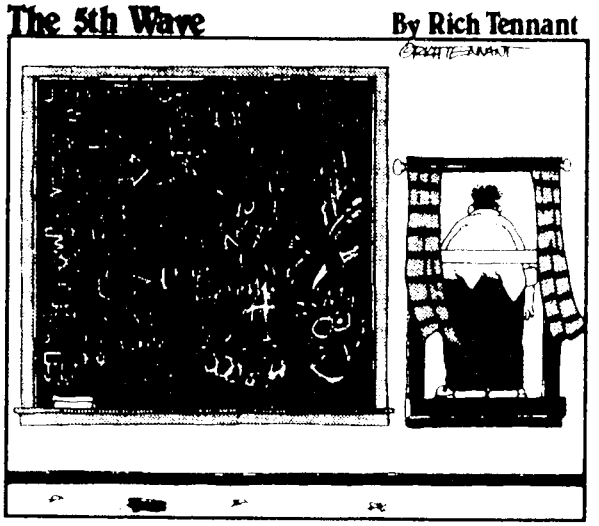
to communicate by telephone. We have an appointment later this month to test her hearing and determine what equipment would be needed to allow her to communicate. Also, we are in touch with Joseph where he has a business in Falls Church, VA to provide a host of equipment for the hearing impaired.

Had Joseph not attended the July class, I may have taken only a passing interest in my neighbor's problem. *cpd*

Converting Cycles per Second to Hertz



from Bruce Marlin



It is questionable if all the mechanical inventions yet made have lightened the day's toil any human being.

John Stuart Mill (1806 - 1873)

GLOSSARY

PRESSURE

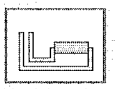
Pressure is the force produced by a liquid or a gas as it pushes against a surface. The pressure on the wall of a container full of a gas, for example, is caused by the constantly-moving gas atoms hitting the wall.

Principles of Pressure

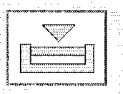
PRINCIPLES OF SCIENCE

PRESSURE

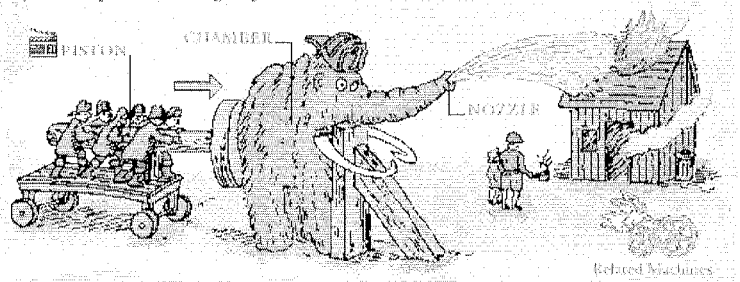
MOLECULES *in a fluid (gas or liquid) move around constantly. When a molecule collides with a surface, it pushes against it. Although the force of each individual collision is tiny, millions of molecules collide every second to create a large force, called pressure, which pushes against the surface. The weight of gas or liquid molecules also creates pressure. Atmospheric pressure, for example, is the weight of air molecules on Earth.*



Pressure Machines

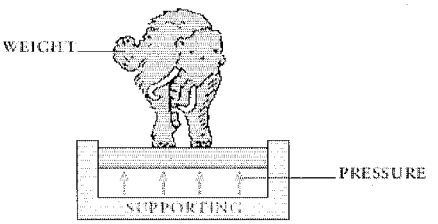


Pressure and Area



Related Machines

PRESSURE AND AREA



SUPPORTING
The weight of the mammoth is supported by the pressure of the fluid beneath it.

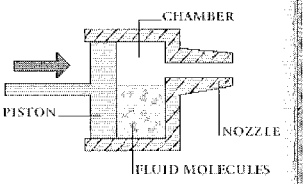
DOUBLING PRESSURE
If the area stays the same, doubling the pressure of the fluid doubles the weight it can support.

DOUBLING AREA
The same pressure of steel can also support double the weight if the weight is spread over twice the area.

From ***The Way Things Work***

by David Macaulay

PISTON



When the piston moves inward, the volume of the chamber decreases, so the pressure inside increases. The fluid therefore travels to the lower-pressure air outside. Pulling the piston reduces the pressure in the chamber to below that of the air outside. Air is then sucked into the chamber.

Professional Services

Acoustical Consultants are provided a listing in this section. 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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Norsonic Type 1230 1/2 inch pressure response microphone (equal to B&K Type 4166) $350.00

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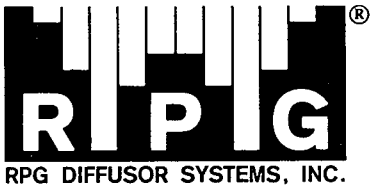

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Personnel from these manufacturers receive Syn-Aud-Con training which provides still another link in the communications circuit between the ultimate user and the designer-manufacturer of audio equipment. The are "in tune" with what a Syn-Aud-Con grad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

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Electro-Voice, Inc.
IRP- Professional Sound Products
Innovative Electronic Designs
JBL Professional/UREI Electronics
Radio Design Labs
RPG Diffusor Systems, Inc.
Renkus-Heinz, Inc.
Shure Brothers Inc.
TOA Corporation - Japan
TOA Electronics
West Penn Wire Corp.