SYNERGETIC AUDIO CONCEPTS

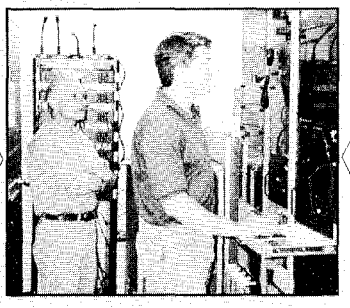
SYN AUD CON

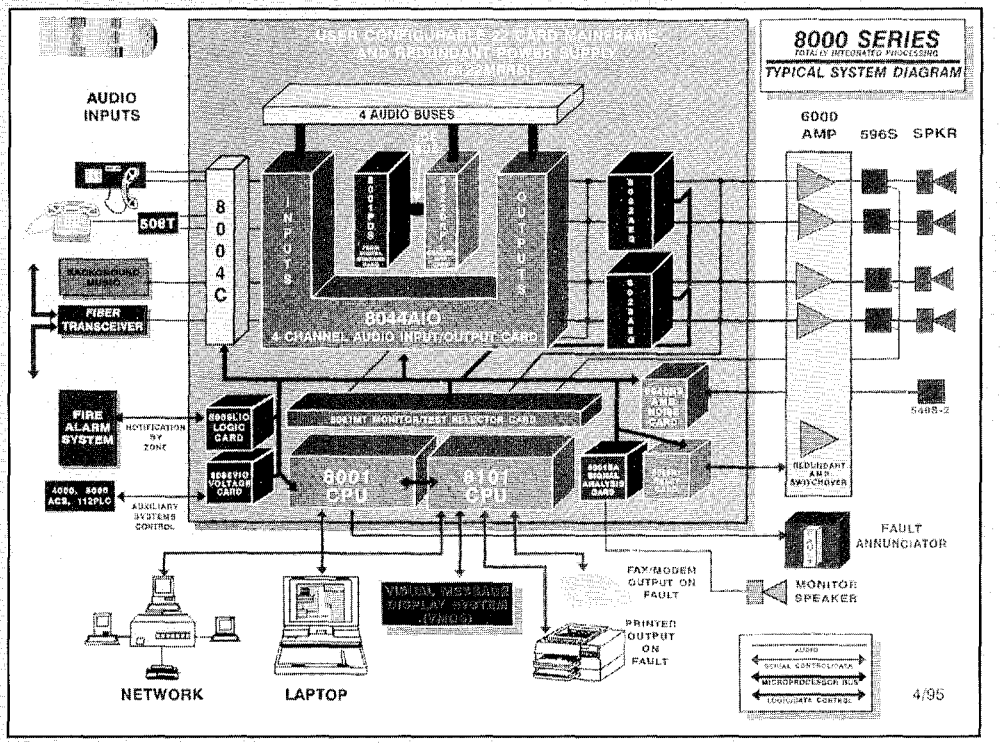
newsletter

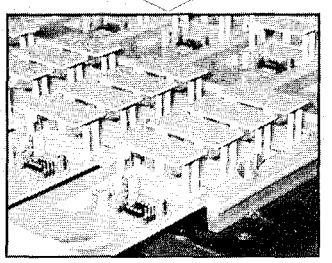
Volume 22, Number 4
Summer 1995

Don & Carolyn Davis

Intelligent Sound Systems







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 - Horns Workshop II

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

About the Cover

IED - Electronic Innovators of Intelligent Sound Systems

It is becoming apparent to all in this industry that the wave of the future is intelligent sound systems. The audio needs of today's complex public facilities can no longer be served by the methods of the past, but require a level of technology equal to or exceeding that used elsewhere in the venue.

Just over a decade ago, a group of individuals in the Louisville, Kentucky area recognized this need and pulled together the talent and resources to meet it. The result was Innovative Electronic Designs, or IED. Company founder Hardy Martin envisioned a building block approach to system design, which

would free the designer to construct a needed system component from an assortment of task-specific modules. The modular approach would allow the custom design of the signal processing chain for virtually any application.

The company's first project was an automatic mixer for JBL. With the success of this project, Martin's facility in Louisville began its transformation from a renovated house to a state-of-the-art manufacturing facility. The JBL project was followed by a contract to build a digital audio recorder for Columbus Airport, something which had never been attempted for this purpose.

With the implementation of a custom IED system, the Hoosier Dome (now the RCA Dome) of Indianapolis became the first sports arena in the nation with a computer-controlled sound system. The system could be completely reconfigured for any purpose from a computer keyboard, which saved countless hours of setup and calibration. As word of IED's innovative abilities spread, the company soon became the vendor of choice for airports, convention centers, arenas and other large venues worldwide.

Driven by research and development, the company found many ways to expand the capabilities of it's systems through intelligent electronics. Their automatic mixers can discriminate between program material and background noise, a capability which has alluded most others. The UDAPS system brought computer control to a new level, allowing the design and implementation of the entire system to be carried out on the computer screen.

The company's success in a market that it virtually created has led to many additions and expansions to the Louisville facility, including the recent purchase of the office building next door. Few passers by would believe that the historic home and landscape viewed from the street houses a modern electronic manufacturing facility.

IED Vice President of Marketing Tom Roseberry is quick to point out that it is the simple things that have built the company. Reliability is a key concern for airports and sports arenas, and the company has devised extensive methods to test it's products prior to installation at a site. This extensive and redundant testing has led to a failure rate that is one of the industry's lowest. Another factor is training, which IED promotes and requires for its designers and installers. Their modern in-house training facility is the site of regular seminars designed to equip the dealer structure for the proper implementation of IED products.

Hardy Martin, Don, and Ed Young at NSCA

IED has established itself as a world leader in sophisticated sound systems. The company's commitment to R&D, testing and training will assure its position in the market for well into the next millenium. *PB*

"On the Road" SEMINARS 1995

Sept. 20-22, 1995
The Central Complex
Fall River, Massachusetts

Located about 40 minutes from Boston, the Central Complex is a turn-of-the-century cathedral that has been renovated into a conference center. Syn-Aud-Con has chosen this historic facility as the site of a fall sound engineering seminar in an effort to respond to requests from audio practitioners for more "hands-on" training. In addition to our regular cirriculum, the Central seminar will include:

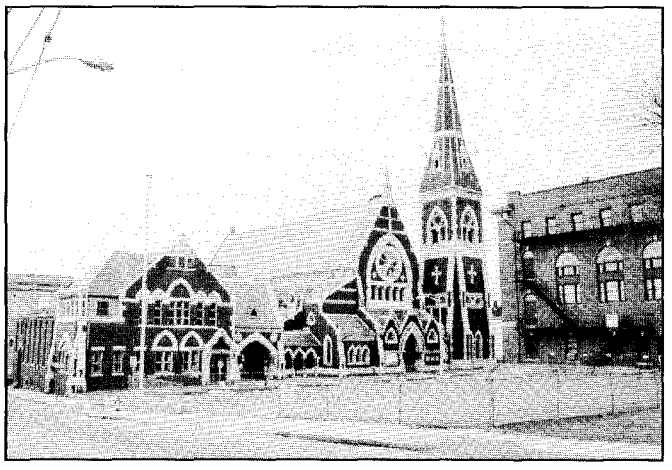
Teaching and demonstration of acoustic fundamentals using both our auditorium simulator and the very reverberant cathedral.

Participation in the setup and calibration of a sound system in the cathedral that will include both single-source and distributed loudspeaker systems.

Instruction on sound system calibration featuring our new "gain structure" workstations. Attendees will learn system calibration using basic instruments and listening techniques, and how to document their work using the decibel.

Instruction and demonstration of proper synchronization and equalization techniques to enhance system performance.

The Central seminar will be a "roll up your sleeves" approach to learning audio and acoustic basics, so come prepared to be involved. A continental breakfast is provided, as well as lunch each day. A block of rooms has been reserved at the nearby Days Inn for seminar attendees. Don't miss the opportunity to participate in this special Syn-Aud-Con "On the Road" seminar.



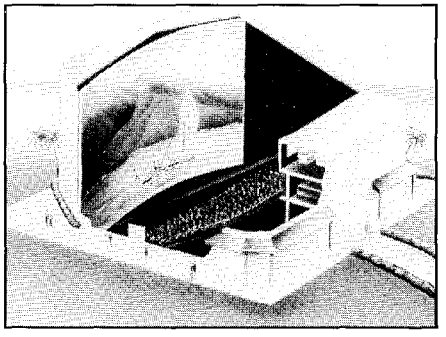
Nov. 27-Dec. 1 , 1995
Polynesian Cultural Center
Laie, Oahu Hawaii

How about a chance to combine a sound engineering seminar with a vacation in paradise? The Polynesian Cultural Center will serve as the site for a winter "On the Road" seminar, allowing attendees to learn audio and acoustics while relaxing in the beautiful setting of the island of Oahu. Two class schedules will be available, which will include a 5-day "morning only" format, and a two and one-half day format. Classes will be held in the Omnimax theater at the Center.

Regardless of which format that you choose, you will receive a thorough exposure to the principles sound system design, and plenty of "hands-on" training in design, installation and calibration practices.

A Syn-Aud-Con seminar serves as an introduction to a lifetime of study in audio engineering. Over 9000 "grads" in 23 years have helped place Syn-Aud-Con at the forefront of audio education.

There will be plenty of free time to allow attendees to enjoy the islands.



Classes will be held at the Omnimax Theater at the Polynesian Culteral Center

SEMINARS AT THE FARM
SEMINAR CENTER

3-Day Seminars - $550
"The Farm" - Norman, IN

☐ ***Sept. 14-16, 1995***

☐ ***October 12-14, 1995***

Only a few openings left!

Classes at "The Farm" are limited to 12 attendees; An experience you will never forget!

SEMINARS ON-THE-ROAD

3-Day Seminars - $550

☐ **Sept. 20-22 Fall River, MA (Near Boston)**
This special 3-day seminar will be held in a newly renovated century-old cathedral/conference center, and will include an entire day of "hands-on" training.

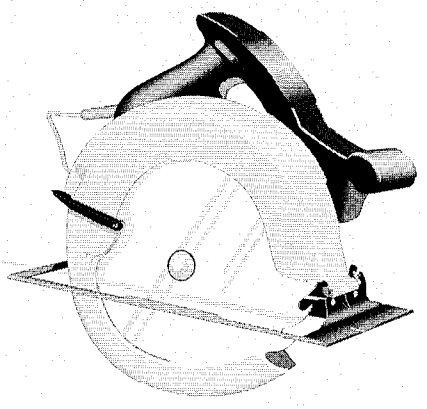
☐ **Nov. 27-Dec. 1 Laie, Oahu Hawaii**
Hosted by the Polynesian Culteral Center, this seminar will be held in an Omnimax Theater, and will conclude early each day to allow the attendees to enjoy the islands.

Our 1996 Seminar Schedule is Under Construction...

1996 will be another active year for Synergetic Audio Concepts, both "On the Road" and in Southern Indiana. Next years class schedule will include:

3-Day "On the Road" Classes

San Francisco, CA
Lansing, MI
Atlanta, GA
Boston, MA



3-Day Southern Indiana Classes

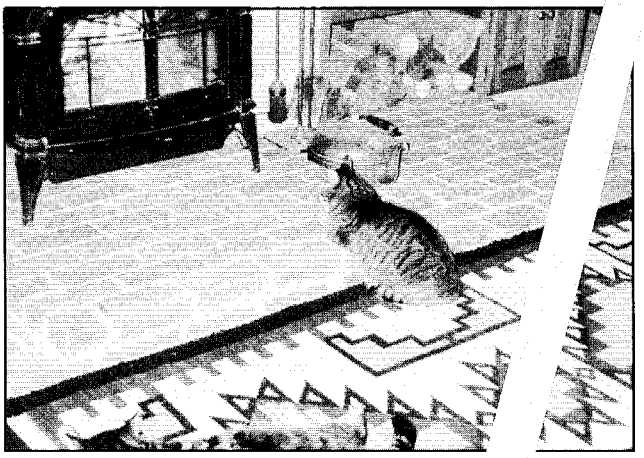
March
May
July
October

Whether you need a full overview of the art and science of audio, or just a "refresher" course, a 1996 Syn-Aud-Con seminar will give you the theory, application, and "hands-on" training that you need to excel in today's marketplace.

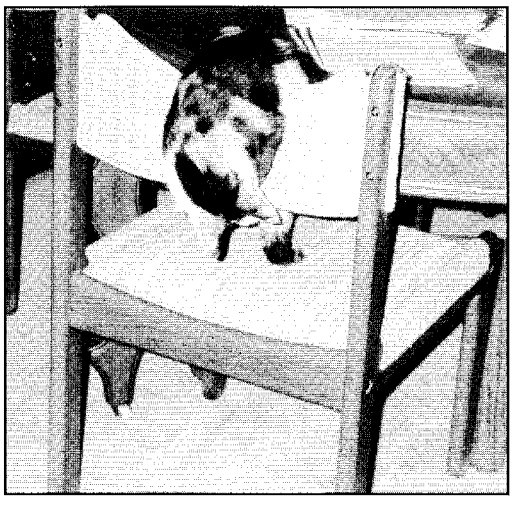
Syn-Aud-Con Seminar Information 1-800-796-2831

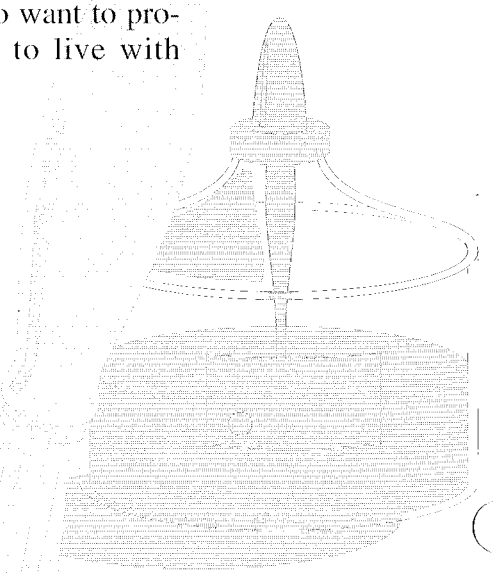
The 1995 Farm Environment

Farm Walks and Talks...



I was recently asked if what I wrote about walks around the farm was really true or was it poetic license. Let me assure one and all that what I write about those walks, the creatures we encounter, and the scenes we witness are all true and accurately recorded. Have you ever seen a cat that chases its tail vertically instead of horizontally? Our new Callie does. She loops completely around the back of the dining room chair in pursuit of her own tail. While she's engaged in this hectic activity, Rascal says prayers in front of the wood stove. No doubt prayers for fat feeble birds on warm summer days. Our deer population is exploding and will need cropping in the coming years. Neighbors call them "rats with ears." Driving home recently we saw two coyotes hunting in full daylight just a few miles north of us. We earnestly pray that those who want to protect predators get to live with them. *dbd*





Scenes from NSCA 1995

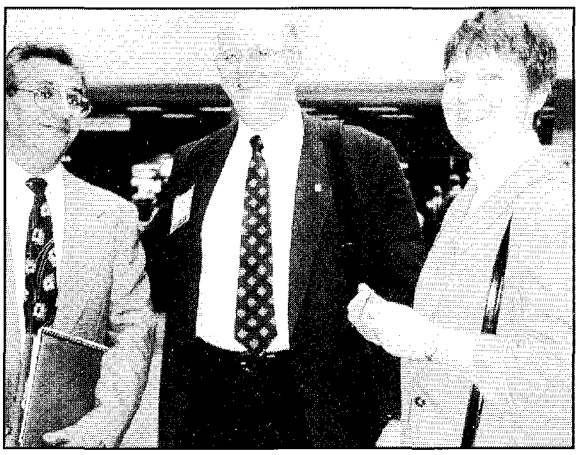
The NSCA provides the sound engineer and consultant with the best exhibits and information flow of any of the shows we are aware of. Technical societies suffer from what Babbage described as "Occasionally a few simply honest men are to be found upon a committee, they are useful as adjuncts to give a high moral tone to the cause, but the rest of the committee usually thinks of them as bores, and when they differ from the worldly members, it is usually whispered that they are crotchety fellows, and further that 'an abject worship of Princes and an unaccountable appetite for Knighthood are probably unavoidable results of placing second-rate men in prominent positions."

The NSCA has avoided technical papers, awards, and much other nonsense that attend large industry organizations and have concentrated on being a show where equipment can be seen and sold.

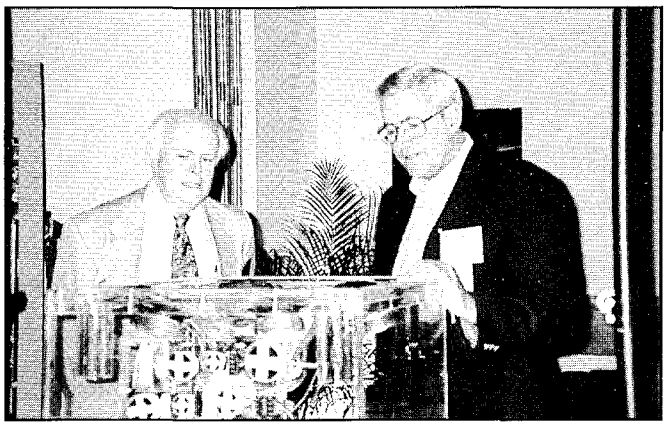
To Carolyn and I the NSCA has an even more important function - people. The NSCA is the meeting place where the manufacturers that are moving and shaking our industry come together with the consultant, planners and the men and women who will do the installations. *dbd*

Don and Carolyn were honored at a luncheon hosted by TOA Japan.

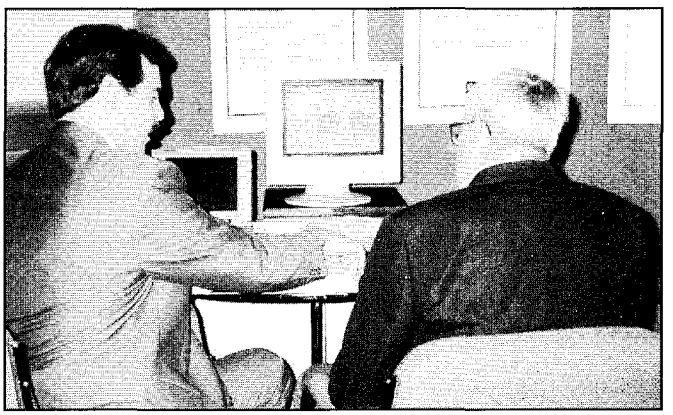
The backbone of Renkus-Heinz, Inc., Harro and Ralph Heinz.



Vinnie Macri and Don and Sylvia Eger stop to pose.



Kenton Forsythe and Don discuss loudspeaker design



Community's Todd Rockwell gives Don an overview of a current project.

Auralization

Dr. Ahnert at Indianapolis

Day three of our Indianapolis Syn-Aud-Con seminar was conducted by Dr. Wolfgang Ahnert of Germany. As well as being one of the leading acousticians in Europe, Dr. Ahnert is well known as the developer of the EASE room/sound system modeling program and the EARS auralization program. The attendees were able to experience the current state of his work in these two areas, and what an experience it was! EASE has undergone a major revision, adding to its already vast array of capabilites. EARS gives the designer the ability to listen to the room models created with EASE. The required intense mathematical calculations once required hours of computation time, but the attendees of the seminar were able to listen to the room models in real time! DSP technology has evolved to the point where the convolution of dry signal and room response can be carried out in a very short interval of time. This means that any sound source can be played through the room model and evaluated.

Hardware requirements for real-time convolution is extensive at this point. Dr. Ahnert used two pentium computers and DSP boards from Lake Engineering. If this seems inaccessible to most users, keep in mind that only a few years ago this type of setup was needed to perform TEF measurements, which we now do with a notebook computer and a one rack space processor. In fact, some of the attendees were present at the early TEF demos and commented that we were seeing in the EARS setup the birth of another giant of a sound system tool.

My advice to all of our seminar attendees is to prepare for the next age of design tools. This means becoming familiar with drawing in Autocad and becoming proficient with computers. There is a respectable crop of system design programs in existence today, most of which have demo disks available at no charge. Todays esoteric devices will be tomorrows tools.

We watch with great interest the work of people like Dr. Ahnert, knowing that their advancement is our advancement.

pb

David Kennedy, Dr. Ahnert and Don Wesner examine the EASE program.

THE FORREST GUMP OF AUDIO?

A recent letter from Dr. Sidney Bertram, a man I have immense respect for as a mathematician as well as a friend, left me feeling like the Forrest Gump of audio. He wrote:

In your "Point-Wave Duality," first paragraph: "A single point in time" is a single point in time, period.

Further on he corrected me on the interpretation of the analytic signal with:

You still show confusion over particle pressure and particle velocity. In a propagating wave these are in phase. The pressure gradient is proportional to the acceleration, not the velocity. The pressure and the velocity are 90 degrees apart in a standing wave.

Finally, I end up in august company as he also corrects Richard Feynman on mirrors:

To me, Feynman was not at his best when he described mirror images.... his explanation is far too complicated. The following is, I think, simpler (it is certainly less wordy.)

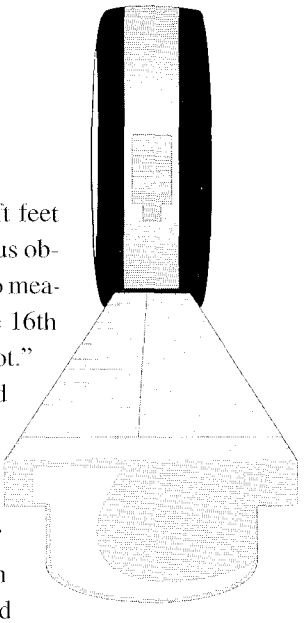
Mirrors show up/down and left/right as they are (left on the left and up above) but show the front to back reversed. The image therefore faces the wrong way with respect to its left-right characteristics, so they are not on their expected sides.

Pat, Carolyn and I encountered a multiple mirror display at the "Residence" in Wursburg, Germany where we saw our left/right, up/down and our front/back in proper perspective (i.e., we saw ourselves from the rear in spite of facing the first mirror.)

The Heysers, Patronis' and Bertrams of this world are truly marvelous to associate with. It's akin to being with Fangio, Moss, Clark and other world champion level race drivers, or with a Bill Gates in software. Two things happen. One, you stay humble; two, you learn a lot. *dbd*

Weights and Measures

Furlongs per Fortnight...



It is not the measurement system that is important, but the proper selection and application of a system based on the problem at hand. The U.S. (English) system has a unique advantage over the S. I. (metric) system in that we have the identity of the speed of sound being about 1 foot per millisecond. I have often heard Don say that it doesn't matter if you choose "furlongs per fortnight" as long as you know what you are doing with it.

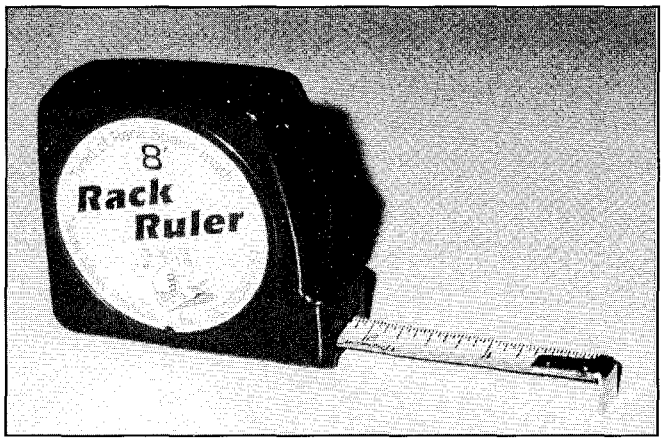
Each period of history has produced a measurement system that worked for the problems of that age. The ancient Babylonians gave us the cubit, which was defined as the distance from the elbow to the fingertips.

The Romans made important contributions to the development of weights and measures. They used a base-12 system and divided both the foot and the pound into 12 unciae ("parts," from which were derived the words inches and ounces).

During the Middle Ages, after the fall of the Roman Empire, many variations in weights and measures developed in Europe. Different standards, and sometimes different units, were used in the various regions, towns, and guilds. An example of the lack of uniformity can be seen in the directions for establishing the length of a rod ("rood") as given in a 16th-century German treatise on surveying: "Stand at the door of a church on Sunday and bid 16 men to stop, tall ones and small ones, as they happen to pass out when the service is finished; then make them put their left feet one behind the other, and the length thus obtained shall be a right and lawful rood to measure and survey the land with, and the 16th part of it shall be a right and lawful foot."

Many units of measurement and their English names can be traced to the Middle Ages. The word acre developed from a word for "field." The furlong was originally a "furrow long," the length of a plowed strip of land in the division of medieval manors. The rod originated from the length of the pole used by a plowman to measure a furrow. The yard (from gierd, meaning "twig" or "measure") represented the length of a man's arm.

As devised by the Academy, the basic unit of the metric system was the meter (a name taken from the Greek metron, meaning "a measure"). The meter was defined as one ten-millionth of the length of the meridian that passed through Paris from the North Pole to the equator. Other units, including those of capacity (volume) and mass (weight), were defined in terms of the meter. The gram was defined as the mass of one cubic centimeter of water at the temperature of its maximum density (4 C). The cubic decimeter, commonly called the liter, was the unit of capacity. The metric system was established as a base-10 system, with prefixes to indicate multiples and divisions of the basic units.



It is fitting, as we near the advent of the 21st century, that this age makes a contribution to the measurement systems used by mankind. Middle Atlantic Products, an innovative supplier and manufacturer of rackmounting products, has sealed their place in history by making official a unit familiar to the sound industry, the rack space. Their retractable tape measure is calibrated in inches on one edge and rack spaces on the other. No longer must you try to divide by 1.75 to size up a needed rack. This is sure to become standard equipment for audio people everywhere. You can get a "rack ruler" from Middle Atlantic Products, or from Syn-Aud-Con (see attached brochure *Resources for Sound People*). *pb*

Did you know...

That one mile equals 3.62×10^4 rack spaces?

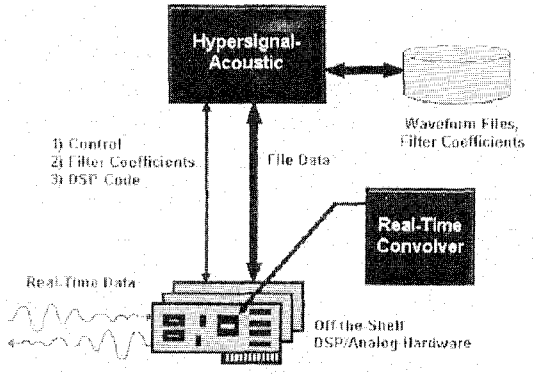
The distance around the earth is approximately 8.68×10^8 rack spaces?

That Indy cars travel in excess of 7.2 million rsph (rack spaces per hour)?

That the deer tick measures a mere 69 mrs (millirackspaces)?

Real-Time Convolver Uses Off-The-Shelf DSP Hardware

Signalogic has announced the release of version 1.6 of the Real-Time Convolver, an add-on to the company's Hypersignal-Acoustic software package that allows long impulse responses (filters) to be applied to sound inputs in real-time. Depending on the DSP/analog hardware used, real-time sampling rates range from 8 kHz to 48 kHz, and filter lengths from 500 to 25,000 points. For example, a pre-packaged system offered by the company, based on the National Instruments AT-DSP2200 board, is capable of applying a 10,000 point filter to stereo 44.1 kHz sound data in real-time. The Real-Time Convolver allows either mono or stereo operation with one or two different filters. A mode is also available that processes .WAV or .TIM files. Filters can be supplied from outside sources or created with Hypersignal-Acoustic's built-in Difference Equations, FIR/IIR Filter Design, or Equalization functions.



Real-Time Convolver is a software produce that works with a DSP card in your PC.

Typical applications include 3-D sound, various real-time sound simulators, precise real-time equalization, and impulse responses gathered from on-site or scale-model acoustic measurements or created by architectural "imaging" programs.

When combined with Signalogic's convolution algorithms, off-the-shelf DSP boards offer performance comparable to dedicated convolution instruments, but at a fraction of the cost. An excellent example of the value now available in off-the-shelf DSP/analog hardware suitable for acoustic/audio applications is the National Instruments AT-DSP2200 analog I/O with 92 dB typical dynamic range, and 384k x 32 of zero wait-state SRAM. With the AT-DSP2200, a 10,000 point filter can be applied in real-time to stereo sound data at 44.1 kHz. At lower rates, or with mono operation, filter lengths up to 25,000 points are possible. The Real-Time Convolver also supports a range of other off-the-shelf DSP/analog hardware which offer a variety of cost-performance trade-offs, including Ariel, CAC, and Signalogic boards. In all cases, a higher amount of DSP chip external memory (SRAM or DRAM) on the board translates to longer filter lengths.

The Real-Time Convolver package requires Hypersignal-Acoustic software, a supported DSP/analog hardware type, DOS 5.0 or higher, and at least a 33 Mhz 80386 machine with 4 Mb or more of memory. Single-unit Real-Time Convolver price is $495. Single-unit Hypersignal-Acoustic price is $1489. Single-unit National Instruments DSP/analog board (including 384k x 32 SRAM) price is $3095.

Technological Terrorism

The news has been full of the misuse of fertilizer in Oklahoma. Our hearts go out to the victims of such a crime.

Recently in the *Wall Street Journal* some journalistic fertilizer made the claim that Bose developed auralization. Dr. Ahnert has pointed out hat the word "auralization" was first employed in Germany in 1935.

Syn-Aud-Con demonstrated auralization at the Cincinnati NSCA back in 1990. Our demonstration was of work done by Sam Berkow and others at that time. We witnessed auralization of 1/10 scale models during our early European visits as well.

Kudos to Bose for another marketing victory, but the major length article in the *Wall Street Journal* does shake my faith in the accuracy of their reporting. *dbd*

The Complaint Department

From the desk of Tom Roseberry of IED.

From the pen of
Don Davis

Lessons Learned from Age...

Older people can look back at what they believed and what they did when they were young. The young have no way to look forward to their future. It seems that God programmed the young to ignore their elders, perhaps in order to allow a few new ideas to actually come to fruition now and then. Age teaches that in spite of the nearly unquenchable enthusiasm of youth, few are chosen to innovate and those few more often suffer than succeed in their own lifetime.

The material minded scientist often is convinced God does not exist and consequently fences him or herself out of the healing that intelligent belief in a beneficent first cause can generate in the human mind and body. The emotional, non rigorous, approach to life misses a great deal of the underlying order that disciplined thinking generates.

Age teaches that specialization is necessary to achieve difficult goals but that generalization is prerequisite to living a totally harmonious life.

Age teaches that what men and women label as God and so poorly define does intervene in individual lives if sought sincerely. It's a case of "Speak God, your servant listeneth" not "Listen God, you servant speaketh."

Dick Heyser used to say that nature has no preferred frame of reference, but is expressible in all of them. So too spiritual things have no preferred frame of reference, but are accessible to all who learn to listen.

Age teaches that youth is largely a "send circuit" whereas age is more likely to be a "receive circuit." Age teaches that living to be older is a miracle of just missing event after event that could have terminated you. Youth teaches us that we dared everything and still survived, so age knows that there is really nothing to fear except ridged thinking, unwillingness to learn, self righteousness, and failure "to keep on keeping on." *dbd*

A Truly Reverberant Field

The Sabine equation and its derivatives—critical radius, critical distance, critical frequency, the Hopkins Stryker equations and myriad of other useful equations all depend, for real accuracy, on a truly reverberant sound field. A truly reverberant sound field is one that is homogenous, mixing, ergodic, with equal probability for sound curving from all directions at an observers position. Such sound fields can occur in ancient huge cathedrals, very large arenas and other very large, hard surfaced but diffusing spaces.

The majority of acoustic spaces where sound systems are installed, do not generate such reverberant sound fields at levels significantly higher than the ambient noise level. Therefore, the classic, quite accurate equations, when used correctly, become less and less accurate in proportion to the missing reverberation.

A Word About Levels

When a sound source, be it talker, sound system, or noise maker, emits energy into an acoustic space, the following levels are generated:

1. Direct Sound Level L_D
2. Early reflected level L_{RE}
3. Reverberation Level L_R
4. Ambient noise level L_N

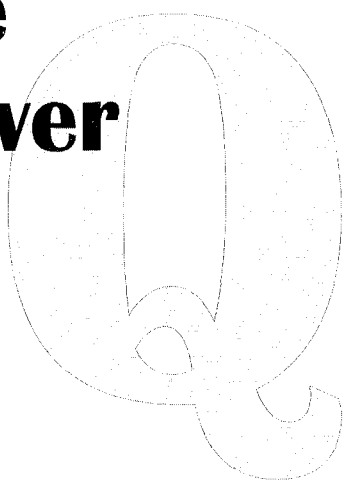
In sound system design we are rarely interested in reverberation time (i.e., RT_{60} - the time, in seconds, it takes sound to decay in level by 60 dB), but in the level of the reveberant sound field L_R. *dbd*

Did you know...

That one square rack space equals 33.25 inches?

That a 14" pizza contains 4.67 srs (square rack spaces)?

The Power of Q



Directivity factors are useful in establishing the needed direct-to-reverberant ratio at a listener position

Directivity control is one of the most powerful tools available to the system designer. While we readily employ directional control techniques in many areas of everyday life, this valuable tool is often overlooked in sound system design work. Life as we know it would not be possible without pattern control. Just imagine what your bathroom would look like if the shower head were omnidirectional. Can you imagine any uses for an omnidirectional paint spray gun? How would your car headlights work if all directivity control were removed?

Now that you have had some food for thought, let us consider the value of this tool for sound system work. When dealing with directivity in the field of acoustics, it is useful to consider as a device of reference a perfectly omnidirectional radiator. If such a device could exist, it would radiate sound in all directions equally, regardless of frequency. It is common practice to refer to a device's directivity in terms of a directivity factor, often called "Q." An omni device would have a Q of unity. If we placed our omnidirectional radiator against a large boundary (size exceeds lowest wavelength of interest), we could limit its dispersion to half of a sphere, or a hemisphere. Such an implementation would yield a Q of 2. The result is that the same energy is confined to one-half the area, which effectively doubles the energy per unit area. Placed at the junction of floor and wall, the Q is increased to 4 (same energy confined to one-fourth the area resulting in a 4 to 1 increase). If the device were placed in a trihedral corner (for instance, where the floor and two walls meet), the radiation pattern is limited to one-eighth sphere, for a Q of 8. It becomes apparent that as we confine the radiation of a give amount of acoustic energy, the intensity (sound per unit area) increases.

With this groundwork laid, the axial Q of a device can be described as the increase in on-axis intensity that results from confining the radiation of sound from a transducer, when compared to omnidirectional radiation of the same acoustic power. Normal practice is to convert these values to decibels, allowing comparisons to be made via addition and subtraction rather than multiplication and division. This also yields the resultant increase in loudness at a listener position afforded by controlling the radiation pattern.

Sound System Engineering provides us with a formula for Q factors of ideal devices, given the angles of coverage. The formula is as follows:

$$Q = \frac{180}{\arcsin[(\sin\frac{\theta}{2})(\sin\frac{\phi}{2})]}$$

where θ is the horizontal coverage angle

and ϕ is the verticle coverage angle

For instance, for a 90 x 40 horn:

$$Q = \frac{180}{\arcsin[(\sin\frac{90}{2})(\sin\frac{40}{2})]}$$

$$Q = 12.8$$

The formula yields the highest possible *average* Q for a device. Q is always for a single point in space, even though many points can have the same Q. The perfect device described by the formula has the same Q at every angle that lies inside of its coverage pattern. Measurements on real-world devices will typically be higher than the ideal on-axis (where the most energy is focused), and lower than the ideal at the limits of coverage (-6dB points) by a factor of four. If one were to average the Q across the entire area of coverage (the area included within the -6dB angles), the resultant average Q for a real-world device will *always* be less than the ideal number indicated by the formula. We like to use the PHD program to examine the Q for a given radiation angle. For speech systems, it is desirous to have a positive direct-to-reverberant ratio at all seats. This can be achieved by loudspeaker proximity (distributed systems),

or by directivity (single-source systems) or some combination of both.

Axial directivity factor (Q)	**15.36**
Directivity index (DI)	**11.86 dB**
Energy Distribution:	
3 dB Horn Contour	**57.5 %**
6 dB Horn Contour	**17.4 %**
9 dB Horn Contour	**10.0 %**
12 dB Horn Contour	**6.1 %**
15 dB Horn Contour	**3.4 %**
Approximate 20 dB Contour	**2.6 %**
Remaining energy	**3.0 %**
(To 180 degree 40 dB Contour)	

Figure 1 - Axial Q value from measured data, as calculated by the Q-Plus module of PHD. Data is for an Electro-Voice HP9040 horn.

Q's of real-world devices

Directivity factors are useful to the system designer because they allow control over the energy ratios that will exist at specific listener seats. We find that the Q factors of many devices are well defined and very consistent over the angles of coverage. By consistent, we mean that the highest Q is on-axis and the Q drops predictably as one moves off-axis. Some devices have very random radiation patterns, and therefore do not lend themselves to meaningful Q ratings. While such devices can produce acceptable results in some applications, it is not advisable to attempt application of statistically based formulas or computerized system design methods to devices that lack consistent and uniform coverage patterns. Such attempts tend to make one angry at the computer rather than the device, to the point of abandoning computer modeling as a useful design tool.

Directivity at Low-Frequencies

Directivity control is a wavelength-dependent parameter, meaning that as the sound gets larger (lower in frequency), it requires bigger and bigger waveguides (horns) to control where it goes. If we look at a the audible passband as stretching from 20 Hz to 20000 Hz, it divides nicely into three decades. Figure 2 shows the approximate waveguide dimensions required to control each of these decades. It becomes apparent that most commercially available devices do not attempt to control directivity at low frequencies with waveguides. An exception is the Leviathan II from Community, a coaxial full-range system with pattern control approaching 100 Hz (the mouth of the large horn is nearly 8 feet across). At low frequencies, some directivity control can be accomplished with arraying techniques, such as stacking multiple devices. Figures 3 through 5 show some coverage simulations done with the EASE program from Renkus-Heinz. Notice that directivity is increased as low-frequency devices are stacked.

Frequency Span	Wavelength Range	Required Waveguide Size
2000 to 20000 Hz	6.8 to 0.68 inches (17.2 to 1.7 cm)	7" 17 cm
200 to 2000 Hz	5.65 to .565 feet (1.72 to 17 m)	5.6' 1.7 m
20 to 200 Hz	56.5 to 5.65 feet (17.2 to 1.72 m)	56' 17 m

Figure 2 - Approximate waveguide size for each decade of frequency

Prudent control of directivity leads to better coverage, higher intelligibility, and vastly improved gain-before-feedback in sound systems. *pb*

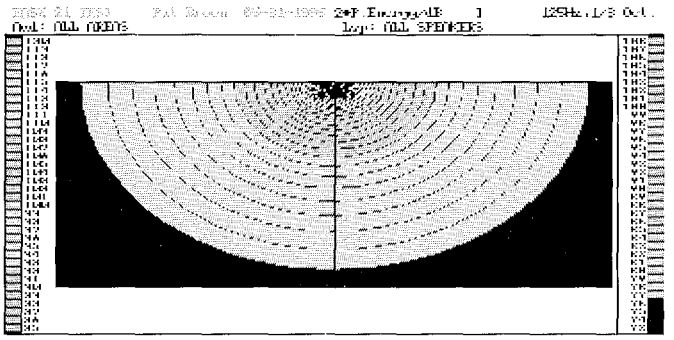


Figure 3 - Top view of the horizontal radiation from a single low frequency cabinet at 125 Hz

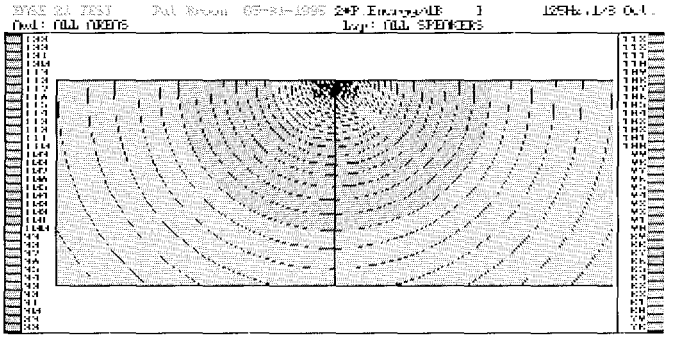


Figure 2 - Top view of the horizontal radiation of two low frequency enclosures placed side-by-side 2' apart.

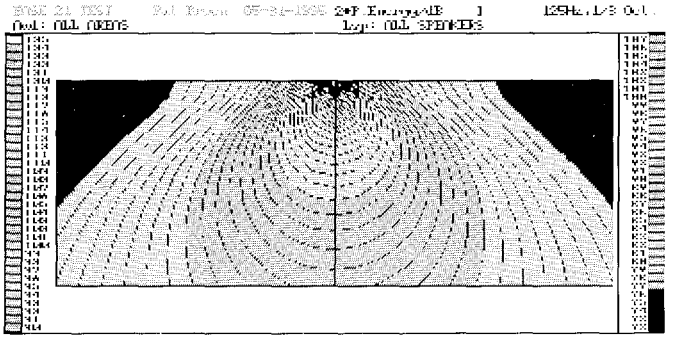


Figure 3 - Top view of the horizontal radiation of four low frequency enclosures placed side-by-side 2' apart.

20th Century Problems

Magnetic Fields

What you don't know can hurt you.

We have a high tension power line on our farm which runs about 300 feet from the farm house where I grew up (installed in the late 40's by the power company.) Recently we were informed that crews with very heavy machinery would "rebuild the 138 KV line which crosses your property."

Red flags began to wave as to whether they were planning to increase the voltage of the line, especially since reading *Today's View of Magnetic Fields* in the December 1994 issue of IEEE Spectrum. We sent the article to PSI and asked them to measure the line before and after the "rebuilding" of the line.

It is a 12 page article and worthy of reading. It changed a few of my habits. The subject is controversial:

Critics of the biological work claim that it makes no sense for biological effects, admittedly present in the laboratory, to show up in the human body, since many of the field levels studied are below the body's own internal level of electromagnetic noise. However, it may be that the body can detect the coherent pulses of power-frequency fields in the midst of random noise, (underline mine -cd) *and laboratory work to test the concept of noise is underway....Some biologists say the body's ways of sorting signals from noise are not fully understood...*

The article has a checklist of prudent avoidance of field exposure:

*Replacing electric bedding (blankets, mattress pads, or waterbed heaters) with down comforters....

*Moving electric clocks or answering machines from the night stand to a dresser at least 1.5 meters from the bed. Look for other appliances with small motors that may be near at hand for extended periods of time and keep them at a distance.

*Moving beds from walls with major appliances on the other side and from measured hot spots. (The article mentions later of the head of his son's bed touched a wall where the electric wiring entered the home, an electromagnetic hot spot.)

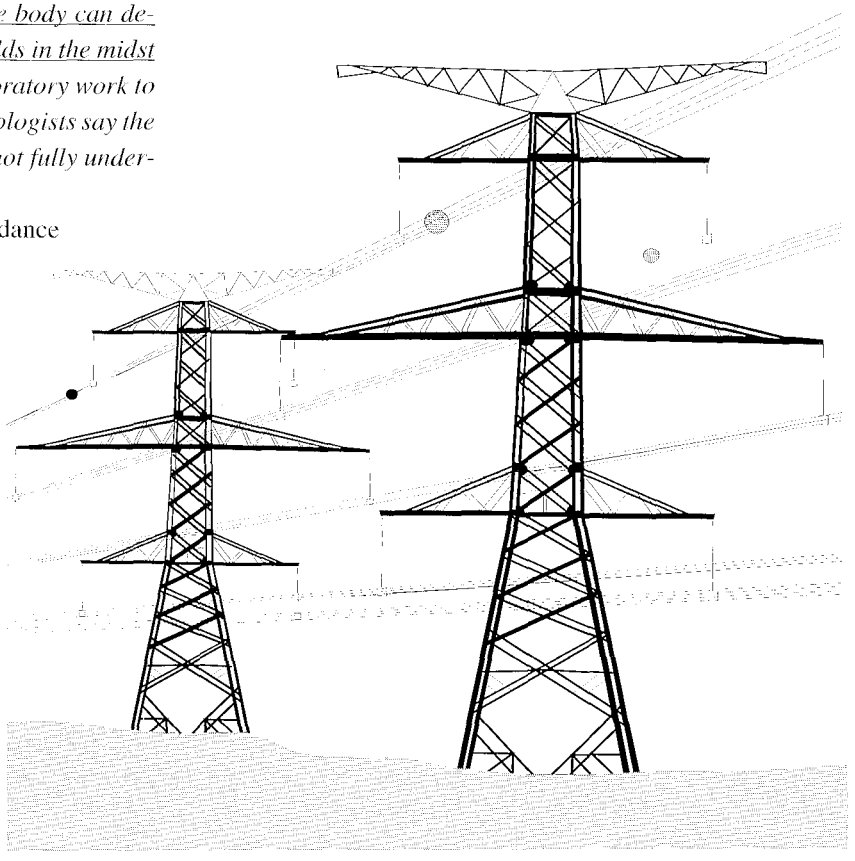
*Sitting at least an arm's length away from VDTs. (When you need to replace a VDT, consider a monitor that meets the Swedish standards for low fields.) Editor's note. I turn off my monitor now when I am not using it. And I am extra careful to keep my cats from sleeping on the monitor, though backs and sides are worse.

*Sitting at least two meters away from large television screens.

*Checking the background field at your home. Most U.S. utilities will provide this service free upon request.

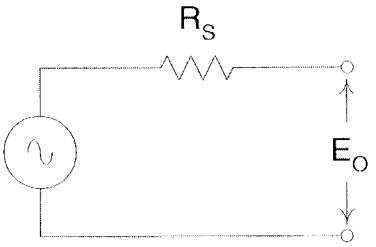
The article goes on to mention that *incorrect grounding and shunting of neutral current allows current to get out of balance and generate high fields. Grounding connections to water pipes, depending on their placement, can produce significant fields, especially if the return current loops around the house instead of going directly in from the street.*

I could go on for 12 pages. We can wish that the IEEE Spectrum would issue a CD-ROM. It is one of Don's favorite magazines. *cpd*

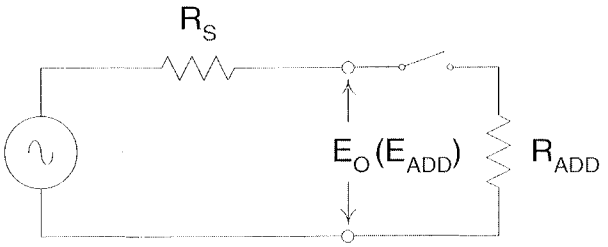


Finding R_S from Voltage Measurements

In evaluating an amplifier we would like to know its source impedance value at its output. (i.e., what kind of a source is it to the following device.)



If we have an impedance bridge, we can simply connect it to the amplifier output (all level controls zeroed) and read it directly. If we have only a voltage reading device, we can do the following:



By adding a known resistance value to the output and measuring the change in voltage. Because the following is true:

$$E_{ADD} = \frac{E_O \cdot R_{ADD}}{R_S + R_{ADD}}$$

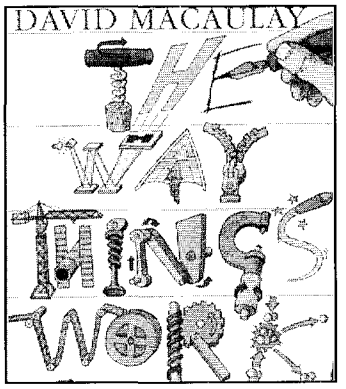
we can simplify it to read:

$$R_S = R_{ADD}\left(\frac{E_O}{E_{ADD}} - 1\right)$$

This technique is useful with all types of amplifiers including the extremely low impedance power amplifiers outputs.

Multimedia Education

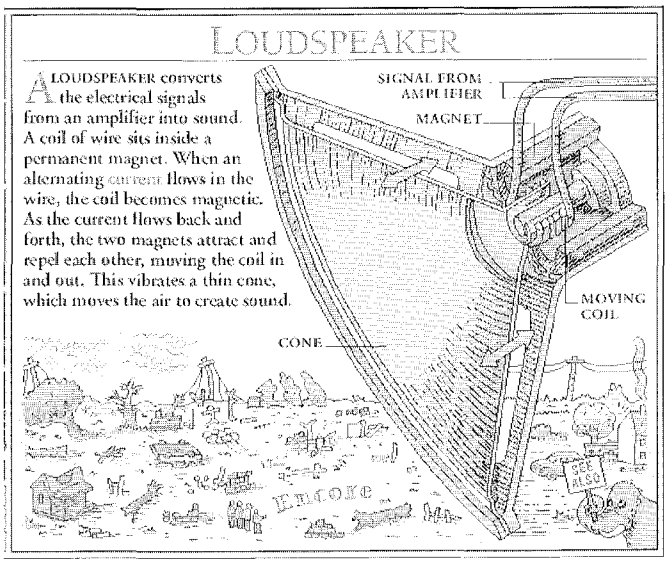
Yes, Learning Can Be Fun!



Have you ever had the desire to learn more about the gadgetry that surrounds us, but didn't know where to begin or where to look? A long-time favorite book of mine is called The Way Things Work by David McCaulay. The book takes a light, practical approach to explaining the physical workings of many of the things that we have made ourselves dependent upon in this age of instant gratification.

As sometimes happens in life, something good just got better. The book is now an interactive, multimedia CD Rom, and this learning adventure is now full of sights and sounds that will make learning even the most mundane subject an experience. I highly recommend this for your CD Rom library (You *do* have a CD Rom library, don't you?). If not, this is a good choice to begin one with. Major topics include: History, the Principles of Science, Inventors, and Machines.

The CD contains over 1,500 screens and pop-ups, more than 1000 illustrations, more than 300 animations, 60 minutes of audio, and 70,000 words. Available from most software vendors, The Way Things Work sells for about $45.00.



An excerpt from David McCaulay's The Way Things Work

Clarification of %Alcons

Last issue I made an attempt at clarifying the %Alcons formula published in Sound System Engineering, and correlating it with the algorithm used by the TEF 20 to calculate %Alcons from measured values. My apologies for the obvious typo in the TEF 20 formula. Here again is the Sound System Engineering formula (from Mr. Peutz) and the TEF 20 formula (also from Mr. Peutz). The graphs display the results of the formulas for various direct to reverberant ratios. Thanks to Bruce Olson for his excellent graphing routines for Mathcad.

Also pictured are some measurements made at various relationships to critical distance. The graph at the bottom is from Mathcad, and represents the solutions to both %Alcons formulas solved and plotted simultaneously. Note the excellent correlation between the measured values and the Mathcad values. What remains is to score a live listener group under these conditions to see if the results correlate with the measured and calculated values.

Special thanks to George Augspurger for initiating this entire discussion, bringing the errors in the formula to my attention, and for his interest in "clearing the fog" on this controversial subject.

Finding %Alcons from Acoustic Parameters

$E_D := 80$ Direct sound energy level

$E_R := 75$ Reverberant sound energy level

$E_N := 45$ Ambient noise energy level

$i := 1 \dots 60$ $j := 18$ index to RT60 index to RT60 table

$RT60_i := \frac{i}{4}$ Reverberation Time or Early Decay Time

Conversion to acoustic watts

$E_{D2} := 10^{\frac{E_D}{10}} \cdot 10^{-12}$ $E_{R2} := 10^{\frac{E_R}{10}} \cdot 10^{-12}$ $E_{N2} := 10^{\frac{E_R}{10}} \cdot 10^{-12}$

$E_{D2} = 1 \cdot 10^{-4}$ $E_{R2} = 3.162 \cdot 10^{-5}$ $E_{N2} = 3.162 \cdot 10^{-8}$

Conversion to power ratio

$I_D := 10^{\frac{E_D}{10}}$ $I_R := 10^{\frac{E_R}{10}}$ $I_N := 10^{\frac{E_N}{10}}$

Long Form of Peutz Equation ... SSE p 643

$A := -0.32 \log\left(\frac{I_R + I_N}{10 \cdot I_D + I_R + I_N}\right)$ $B := -0.32 \log\left(\frac{I_N}{10 \cdot I_R + I_N}\right)$ $C_i := -0.50 \log\left(\frac{RT60_i}{12}\right)$

$A = 0.484$ $B = 1.28$ $C_j = 0.213$

$A_X := \text{if}(A \geq 1.1, 1, A)$ $B_X := \text{if}(B \geq 1.1, 1, B)$

$IPart_i := \left(A_X + B_X \cdot C_i\right) \cdot \left(A_X \cdot B_X \cdot C_i\right)$ Information index for parallel paths

$IPart_j = 0.594$

$\%Alcons_i := 100 \left(10^{-2 \cdot IPart_i} + .01\right)$ %Alcons

$\%Alcons_j = 7.485$

TEF20 RT60 cursor Equation ... Farrel Becker

$ISN := -\log\left[\sqrt{\left[\frac{0.9}{1 + \left(10 \cdot \frac{E_{D2}}{E_{R2}}\right)}\right]^2} + 0.1\right]$ Information index due to signal to reverberation

$ISN = 0.589$

$TI_i := -\log\left[\sqrt{\left[\frac{0.9}{1 + \left[\frac{50}{(RT60_i)^2}\right]}\right]^2} + 0.1\right]$ Information index due to Reverberation Time

$TI_j = 0.234$

$IPart2_i := (ISN + TI_j) \cdot (ISN \cdot TI_j)$ Information index for parallel paths

$IPart2_j = 0.685$

$\%Alcons2_i := 100 \cdot 10^{-1.7 \cdot IPart2_i}$ %Alcons $\%Alcons2_j = 6.838$

i	$RT60_i$
1	0.25
2	0.5
3	0.75
4	1
5	1.25
6	1.5
7	1.75
8	2
9	2.25
10	2.5
11	2.75
12	3
13	3.25
14	3.5
15	3.75
16	4
17	4.25
18	4.5
19	4.75
20	5
21	5.25
22	5.5
23	5.75
24	6
25	6.25
26	6.5
27	6.75
28	7
29	7.25
30	7.5
31	7.75
32	8
33	8.25
34	8.5
35	8.75
36	9
37	9.25
38	9.5
39	9.75
40	10
41	10.25

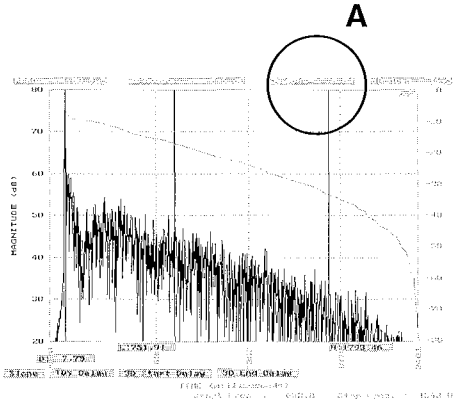


Figure 1 - TEF 20 %Alcons measurement well within critical distance.

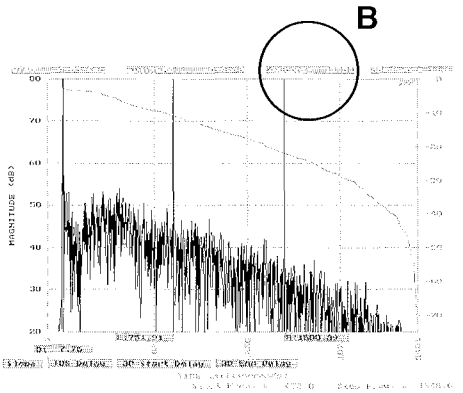


Figure 2 - TEF 20 %Alcons measurement near critical distance.

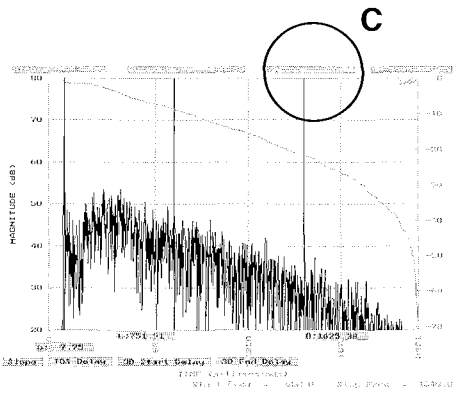
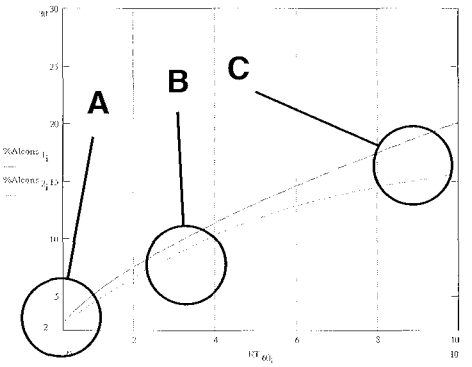


Figure 3 - TEF 20 %Alcons measurement beyond critical distance.



Solutions to both formulas plotted simultaneously in Mathcad.

The Disc Project

Quantifying the process of diffusion will increase the accuracy of computer room simulations

To provide a fast and accurate measurement of the directional properties of scattering surfaces, RPG Acoustics Research has developed a new high angular resolution, fixed multi-microphone polar measurement system using a Maximum-Length Sequence fast Hadamard approach, which offers 70 dB of dynamic range. The measurement hardware is based on Techron's TEF 20 DSP, which samples at 48 KHz. Fig. 1 shows the 486/50MHz computer, 48 channel Audio Precision audio switchers, TEF 20, and Crown Macro Reference power amplifier. The photo shows the 1/5 scale setup at RPG with the B&K source loudspeaker with Kimber Kable, QRDX scattering surface and 37 fixed Crown GLM-100 microphones, with Wireworks cabling, in place. The measurement system is networked to a rewritable magneto-optical storage system using 128 MB optical disks for unlimited storage.

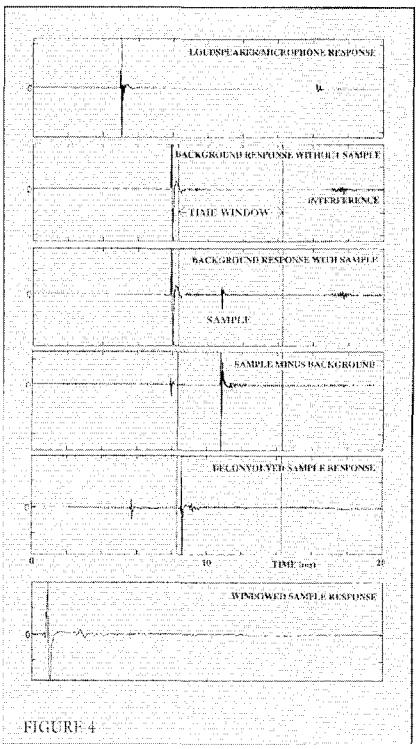


FIGURE 4

To obtain the impulse response of a sample under test, we must deconvolve the loudspeaker/microphone response at each scattering angle and minimize any room interference within the time window of interest. To obtain the response of the loudspeaker/microphone at each scattering angle, the loudspeaker is placed at the sample position and rotated so its on-axis response is coincident with the on-axis response of each microphone for each angle. The speaker is then placed in its normal source position, without any sample present, and the background response at each angle is automatically measured. The sample under test is then placed in position and the scattered sound is automatically measured. Data are collected at 5° intervals. 2.5° resolution is possible by combining another data set with the sample rotated 2.5°. The measurement system selects a microphone, emits a selected (normally 131K point) MLS stimulus, records the data, selects the next microphone position, etc. Since the microphones are stationary and the measurement process is rapid, the respective background response can be subtracted from each microphone position, prior to deconvolution. The data are post processed to provide impulse response, frequency response, polar response and a new and important parameter which we will call the diffusion response, along with a single parameter called the Diffusion Coefficient.

The new Diffusion Coefficient is based on the standard deviation of the polar responses at each frequency, and is zero for a perfect diffusor. Fig. 4 illustrates the sequence of events in determining the scattered impulse response at a particular observation angle, for a given angle of incidence.

from Diffuse Reflections Vol. 1 Issue 2, Spring 1994
An RPG Publication

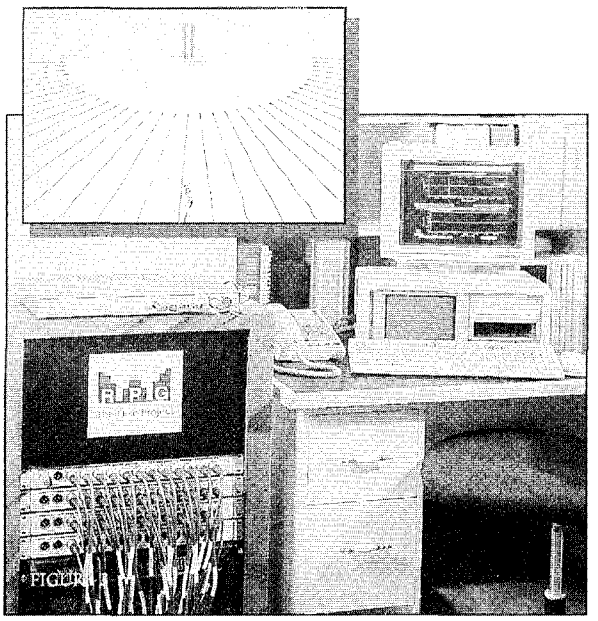


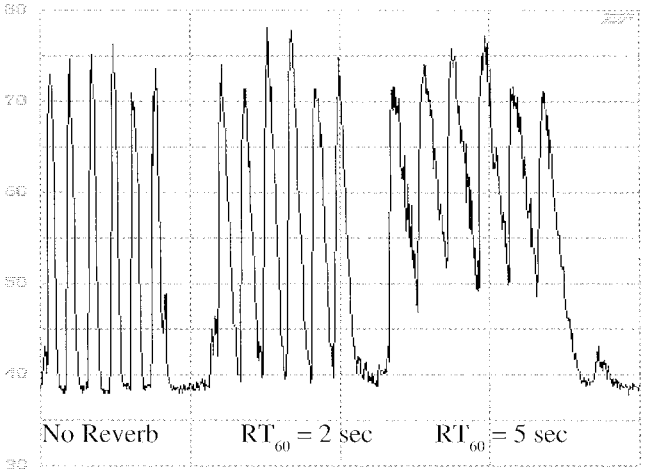
FIGURE 1

Innovative Uses for Noise Level Analysis

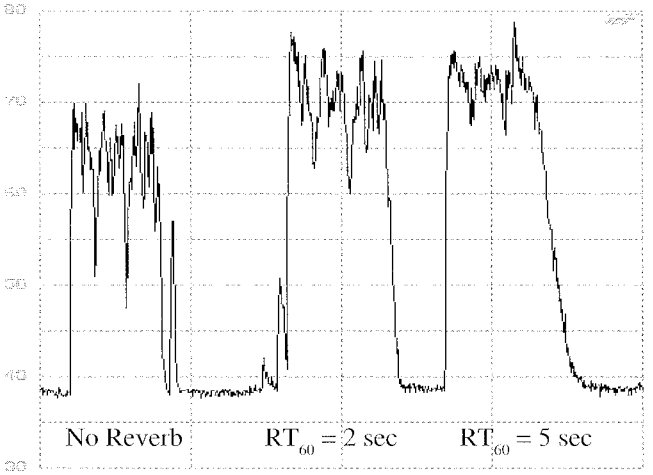
Good audio measurement tools seem to find their way into about every project that one gets involved with. The Noise Level Analysis software for the TEF 20 is just such a tool. The use of NLA for calibration of our speech intelligibility simulator has opened our eyes to a new application for this valuable tool.

Reverberation in enclosed spaces causes a sound field to buildup and sustain as energy is continually introduced into the space. The level of this reverberant sound field is of prime concern when considering the intelligibility of speech. NLA allows an interesting look at the reverberant sound level as well as providing a graphical picture of how sound decays in the space. Operating much like a traditional graphic level recorder, NLA allows continual monitoring of both the direct sound energy and the resultant reverberant level. As speech is continually introduced into the system/room under test, we can now view graphically the level to which the energy decays to during pauses in the talker's voice. The computer display becomes the Hopkins-Stryker equation in motion, as one observes the level increase due to the presence of reverberation.

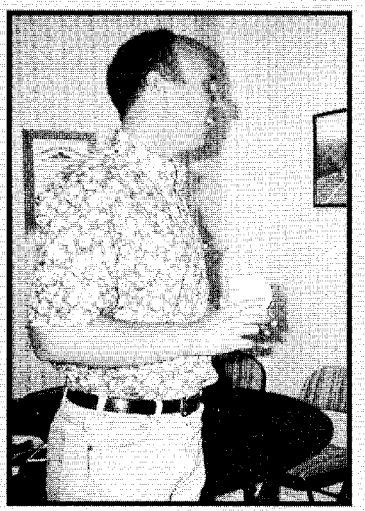
Our goal in system design is to leave the reverberant sound field "unexcited" by the sound system. This will allow the speech to decay between words, resulting in improved intelligibility. *pb*



A slow 1, 2, 3, 4 etc. count as viewed with the NLA software. The amount of decay between words is a good indicator of speech intelligibility.



The same test repeated with "Joe took father's shoebench out...". Note that as reverberation increases, the individual words become less defined (both to the eye and ear).



Andrew Rutkin

Eastern Acoustic Works is a sponsor and supporter of Syn-Aud-Con. We are pleased each year to have several EAW personnel in our classes, and we are always impressed at their intensity and interest in improving their product. Also apparent is the willingness to provide support for new ideas. Andrew Rutkin is (position) at EAW, and has been a tremendous support for getting new ideas implemented in our seminars. We are grateful for such support, as it allows the classes to showcase the latest in technology, and provide an improved learning experience.

"Joe Took Father's Shoebench Out"

Why is it that when you see someone approaches a stage mic during an audio system setup, that you can predict in advance what they will say? There are only two possible choices, the well known "Test 1,2,3" and the infamous "Check, ch-ch-ch-check". There do exist some alternatives, and if you are looking to expand your repetoire of system check-out stimuli, please read on.

Our favorite test phrase dates back to Harvey Fletcher of Bell Labs, circa 1930. Fletcher was a genius by the standards of any age, and his research into speech and hearing laid the groundwork for the next generations of researchers. His test phrase "Joe took father's shoebench out" is a carefully constructed phrase with a purpose. From his 1930 paper Some Physical Characteristics of Speech and Music Fletcher states:

This silly sentence was chosen because it is used in our laboratory for making tests on the efficiency of telephone transmitters. This sentence together with its mate "She was waiting at my lawn" contains all of the fundamental sounds in the English language that contribute toward the loudness of speech.

Try the phrase the next time you check out a system, and be prepared for some funny looks from passers by. Perhaps we need a modern version, such as:

"Should Sally buy cable, or a satellite dish?"

From a Recent Issue of the *ASA Journal*

The Journal of the Acoustical Society is huge, monthly issues as much as 700 pages. There is usually one or two articles each issue that require reading, and always the patent reviews by George Augspurger. The January 1995 issue contained a two-part article on the evaluation of suspended baffle arrays, prediction and scale model measurements, funded by a government agency. I thought you would enjoy the final paragraph to the Predication article, which could have been succinctly summed up in seven words.

The results depend on the choice of the non-baffle parameters. There is considerable uncertainty as to how to make this choice. Further work is necessary to determine the non-baffle parameter values and thence the baffle parameters, with greater confidence. Since the effective baffle-array performance usually did not vary monotonically with the room and baffle-array parameters studied, the development of empirical models is not feasible at this time.

Translated: We learned nothing; give us another grant.

Patents

5,307,417 - Sound System with Howling-Prevention Function, Pioneer Electronic Corp.

The late C.P. Boner at one time experimented with a varying phase shift device to suppress feedback in sound reinforcement systems. Commercial frequency shifters later appeared and are still sometimes used. This Pioneer patent describes a more sophisticated, DSP-based circuit which, " ...comprises an all-pass filter having group delay characteristics which vary with the elapse of time." The goal is to prevent howling without degrading sound quality. — GLA

We get at least a call a year asking about the value of the phase shifter. We usually say, "yes, the phase shifter gives you 3 dB more gain but don't use it on music." Maybe Pioneer has developed something useful for both speech and music. *cpd*

Give Your Clients Multi-System Capability with Crown IQ

It's the same old story, having to choose the best type of sound system to present to a client. But which is best? Should the system be single-source to articulate speech, stereo to provide spaciousness for music, or a distributed system, which can do both pretty well. The answer may be all three! Today's technology allows several types of systems to work together seemlessly. With the push of a single button, the system operator can go from point-source to multi-channel. While the possible configurations are endless, here is one way that it might be done for a church or theater.

First, design a full-range single-source system for the center of the stage. This array should provide coverage for all seats, as though it were the only loudspeaker system.

Second, add a full-range cabinet on both the left and right sides. Cover as many seats as possible with each.

Third, implement a high-density distributed system for overhead, zoned from front to back.

Once in place, these three loudspeaker systems can provide an amazing amount of versatility for the client, with all switching and patching done by the Crown IQ system. Capable of many system functions, in this application the IQ System can be envisioned as a completely automated patchbay, and is used to select the most appropriate system configuration for the program source. In our example system, all speech reinforcement is done through the center array. For contemporary music, the system uses a left-center-right configuration. An excellent processor for this is the Miles Technologies MT-1, which creates a spacious sound stage between three loudspeakers from a stereo mix. Once the song is over, the system can be returned to single-source with the press of a button.

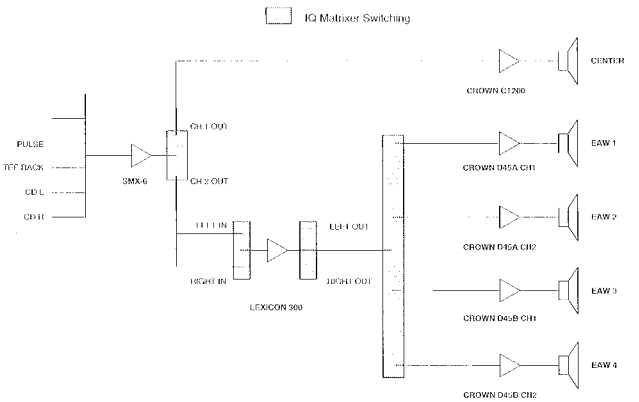
The distributed system can serve several roles. First, using a reverberation processor (we like the Lexicon 300 and LARES systems), the overhead system can be used to simulate a multitude of acoustic environments. Your client can have a 5-second reverberation time for the opening organ solo, and immediately go to a 2-second reverberation time for a piano with vocal arrangement. The system can even be switched back to single-source for narration between songs! When distant stage miking is required, a 1 x 4 delay line is substituted for the reverberation processor. You now have a multi-zone distributed system, with Haas-effect delay used to shift localization back to the stage array, which in this configuration is acting as a precedence loudspeaker.

If all of this sounds expensive, you may be surprised. Most venues end up purchasing several sound systems before they end up with the right compromises, a process which can be totally eliminated. The forward-thinking contractor/consultant will implement the system in phases, beginning with the single-source or distributed system. This will create an ongoing relationship with the client. It also helps the customer to understand that no single system can meet all of their needs, so you will get less complaints.

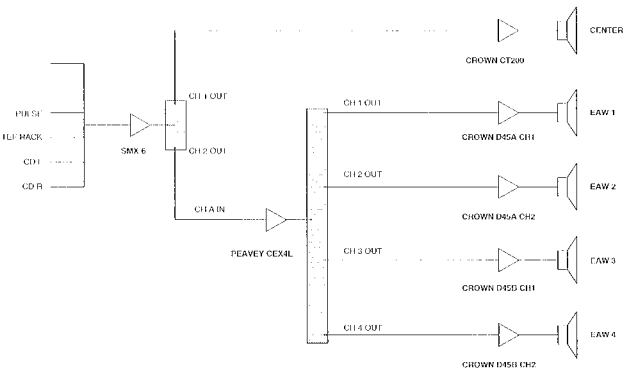
We are currently using this same setup for Syn-Aud-Con classes, and are consistently pleased with the versatility and control that we can have over our setups. With the IQ System, we can even perform a mix, and monitor the amplifier operation. In fact, we are constantly discovering new ways to set things up, all of which can be implemented through software.

I have often wondered how many sales possibilities are lost each day because the contractor/consultant is timid about cost when designing a system. Your role is to present the possibilities, and the clients role is to decide if and when they can afford them. Too expensive? You may be surprised! *pb*

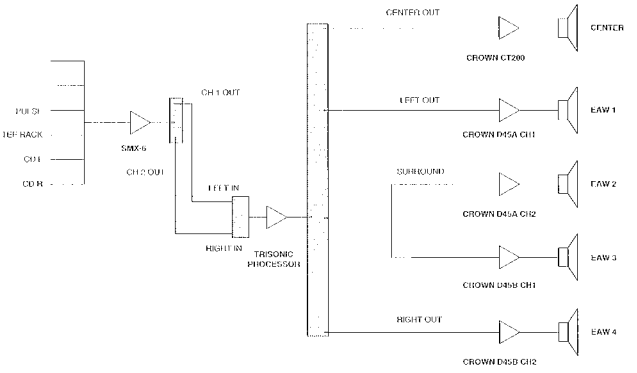
SYN-AUD-CON SYSTEM LAYOUT
LEXICON 300 PROCESSOR



SYN-AUD-CON SYSTEM LAYOUT
PEAVEY CEX4L PROCESSOR



SYN-AUD-CON SYSTEM LAYOUT
TRISONIC PROCESSOR



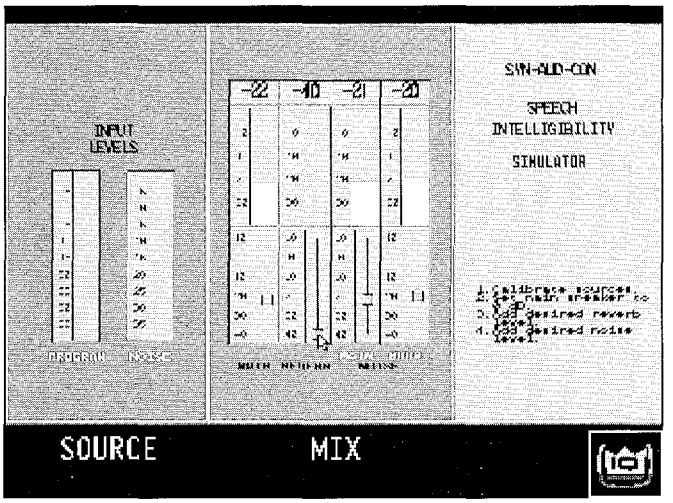
Speech Intelligibility Simulator

During our last visit to Europe, we had the honor and pleasure of visiting with V.M.A. Peutz and Associates in the Netherlands. At their office we were introduced to a method that they developed to simulate various room parameters for intelligibility evaluations. The listener could control the direct sound level, noise level and reverberation level and evaluate the resultant intelligibility. We knew immediately that we must have this capability, since it is a real eye-opener for the client and designer alike. Fortunately, we discovered that we had all of the tools for this process already in-house.

The heart of our simulator is the Crown IQ system. Utilizing the SMX6 mixer, we created a custom screen for controlling the system. This provides full control of the simulation via a mouse. The program sources include anechoic recordings accessed via CD. The acoustics are supplied with a Lexicon 300 processor, and the noise source is either CD (band-limited pink noise) or DAT (real-world noise recordings). Each source is calibrated using the TEF 20 Noise Level Analysis software module. The loudspeaker system includes one loudspeaker for direct sound and four surround speakers for the room and noise. It can also be done through headphones. A strong direct sound level is made the reference, and then noise and reverberation can be mixed in at various ratios. The Lexicon can be used to simulate an endless variety of acoustic fields, which can be evaluated with or without noise. The IQ System allows the substitution of a 1x4 delay line (Peavey CEX4L) so that the effects of reflections can be evaluated. Each reflection can be bandwidth limited as desired.

A measurement microphone can replace the listener's head and TEF measurements made. This gives us the ability to evaluate the measurement algorithms (both %Alcons and STI) and their application to a variety of acoustic situations. It has already proved an invaluable tool for optimizing intelligibility measurements on the TEF 20.

Our thanks to Peutz and Associates, Lexicon, Crown, and Peavey for this valuable tool.



Syn-Aud-Con classes use the intelligibility simulator to learn more about designing sound systems.

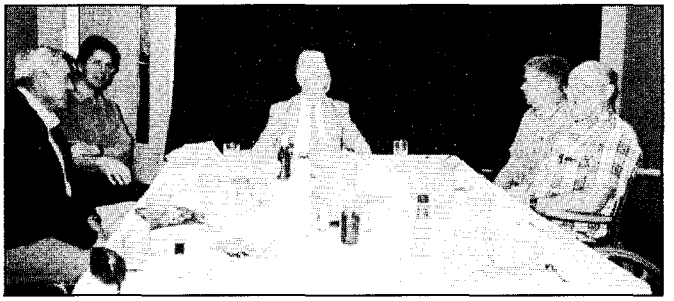
A Special Visit, A Special Meeting

We were honored with the visit of Mr. and Mrs. V.M.A. Peutz of the Netherlands recently at the farm. Mr. Peutz is a world-renowned authority on speech intelligibility, as well as a gentleman and friend. We had the honor of visiting the Peutz's last year on our European trip, and were glad to have the honor of reciprocating their hospitality.

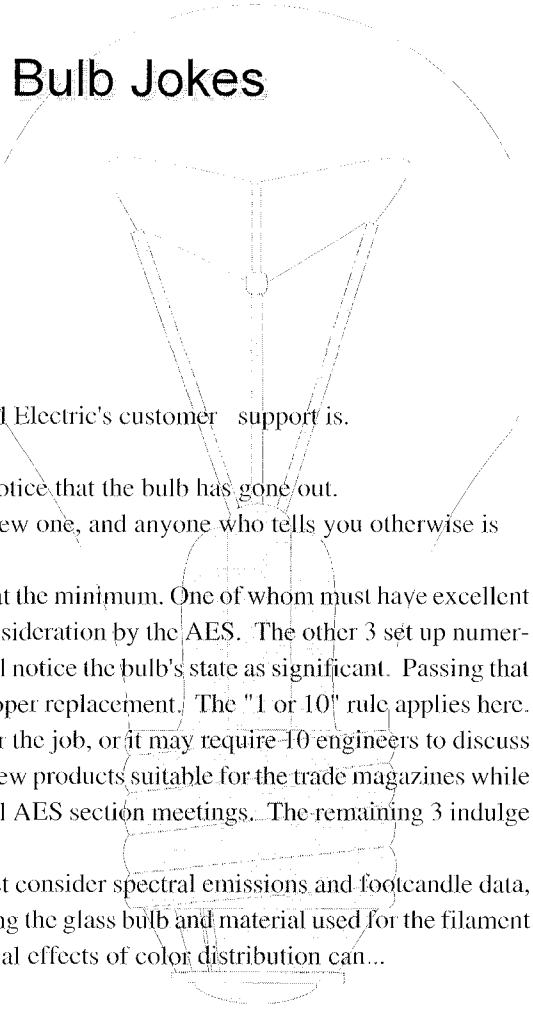
Just prior to their departure for Nova Scotia to visit one of their daughters, the Peutz's met with some key people from the field of acoustic measurements to share ideas and insights. Ron Bennett (Techron) and Don Eger (Eger and Associates) shared insights and discussions on the work of Dick Heyser with Mr. Peutz and Don Davis. This is a group of people interested in seeing that the late Mr. Heyser's insights are fully realized and appreciated by the audio world.

All agreed that there is much yet to be discovered about the realm of acoustics, and we wait eagerly for the next Dick Heyser to blaze the path.

From left to right are Mr. and Mrs. Victor Peutz, Don and Carolyn Davis, Mr. and Mrs. Don Eger, and Mr. and Mrs. Ron Bennett.



The Professional Audio List of Light Bulb Jokes



Q: How many audio engineers does it take to change a lightbulb?

1. What's a lightbulb?
2. It's in the manual. Didn't you READ the manual?
3. Three. One to change it, and two to complain about how bad General Electric's customer support is.
4. None. That's what interns are for.
5. If you just turn the other dimmers down a bit, the client won't even notice that the bulb has gone out.
6. There is *NO* scientific difference between your old bulb and the new one, and anyone who tells you otherwise is peddling snake oil.
7. First, the decision as to whether the bulb should be changed. It takes 4 at the minimum. One of whom must have excellent communication skills and will present a paper on the subject for consideration by the AES. The other 3 set up numerous blind looking tests to determine whether or not anyone really will notice the bulb's state as significant. Passing that part of the process, we find that it may be necessary to select the proper replacement. The "1 or 10" rule applies here. Either the engineer is experienced enough to select the right bulb for the job, or it may require 10 engineers to discuss the various options available. No fewer than 3 of these will then review products suitable for the trade magazines while 4 others present discussions of the subject to such venues as regional AES section meetings. The remaining 3 indulge in Internet flame wars blasting the reviews of the first 3.
   Ideally, a side by side comparison of bulbs will take place. One must consider spectral emissions and footcandle data, measuring all to confirm manufacturers' claims. The type of gas filling the glass bulb and material used for the filament can influence the quality of lamp performance, and the psychological effects of color distribution can...
   What was the question?
8. Two. One to operate the dimmer and one to say "a little too bright. Turn it down."
9. If you use 110-ohm balanced line in your lamps, you can go for dozens of generations without changing.
10. One, so long as he replaces it with an oxygen-free bulb.
11. First we have to decide if the bulb is wired base-hot, or thread-hot.
12. Well, first we need to evaluate how it will affect the artistic integrity of the piece to be played in the dark or in the light....
13. Three, if the bulb has poor off-axis response.
14. Lightbulb...??? You're still using those?
15. One, two, one, two...is this thing on?
16. None. That's a job for a video engineer.
17. I don't know, how many engineers did it take at [competitor's company]?
18. None. Since it's analog, leave it broken and replace it with the latest digital bulb from Alesis.
19. None. They'll just fix it in the mix.

Thanks to Brad Nelson for the list. If you have any, send them in.

Even a broken clock tells the right time twice a day.

Dan Davis - Columbus, IN

Top Ten Part II

You Know You're in Trouble With Church Sound When...

Last issue's Top Ten stirred some response, possibly giving a whole new meaning to the phrase "Been there, done that". This issues top ten builds upon the foundation laid, taking the saga of church sound to new heights (or depths!) and comes to us from George Pfisterer, of Pfisterer Sound Engineering - Huntingdon Valley, PA

1. You are told that several of the sound committee members are "in electronics" or "into that sound stuff".
2. The committee member with the hearing aid has the most complaints about the current sound system. He also has a book about sound systems which he frequently quotes.
3. You are told that the minister started out in college studying electrical engineering.
4. One of the committee tells you he wants "high impotence" microphones that will pick up all around - not those "unilateral" ones. He also speaks with much authority about "70 Ohm speaker lines". Worst of all, he has prepared a "block diagram" of the new system which you are supposed to be designing.
5. One of the committee begins every other sentence with "I don't know anything about sound, but ..."
6. The minister tells you they have a sensitive situation with the church member who has taken care of the sound system for the past 40 years. They also have a sensitive situation with a member's relative who owns a music store.
7. You observe literature and quotations from your competitors in the church office. There is also every church mail order catalog that exists.
8. Several church members ("ex-telephone people") want to help with the installation.
9. You discover that the sanctuary thermostats and the men's room hot water faucets are "locked out" during the week.
10. The room where the sound equipment will go has tins of rat poison on the floor.

East Meets West

We had many friends drop-in to chat at the JW Davis/Syn-Aud-Con hospitality suite at NSCA. As always, much discussion and synergy occurred between visitors. Here we see Jerry Clements of Radio Design Labs and Dieter Michel of Pro Sound Magazine (Germany) getting acquainted. It is this type of meeting that lays the groundwork for future alliances and business relationships.

"Don't fear failure, don't crave success. Just immerse yourself in the problem and work hard. The true reward is not in the results but in the doing."

Wilson Greatbatch - inventor of pacemaker

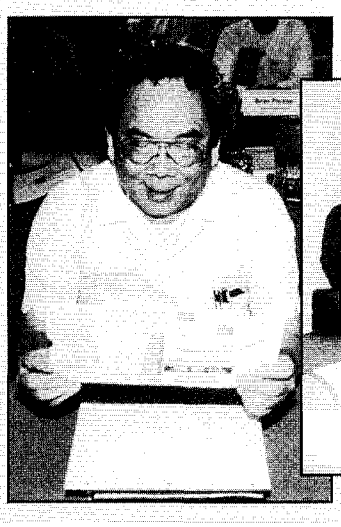
Spring 1995

Thanks for the Memories...

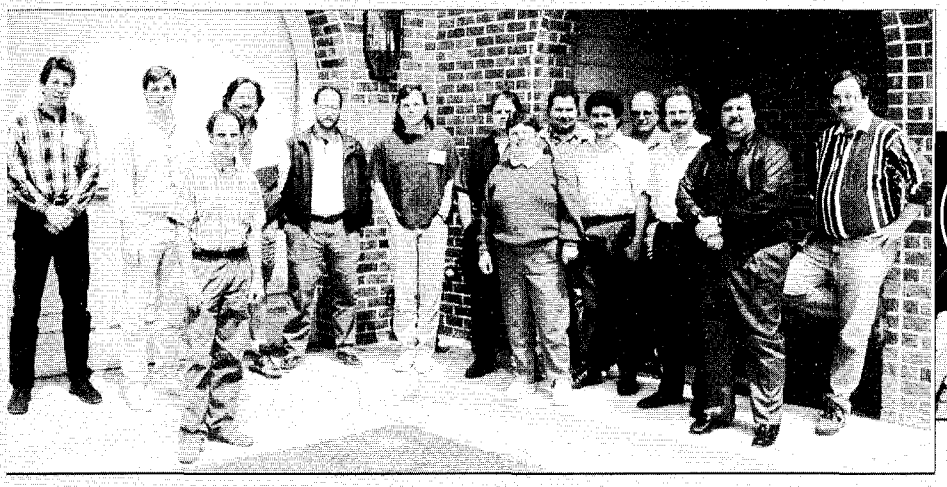
Purdue University Farm Class

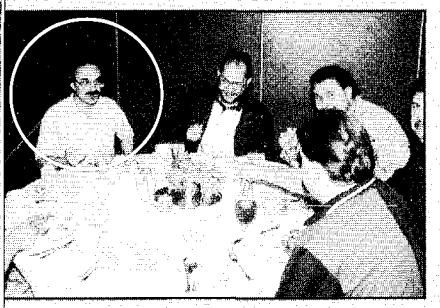
May Farm Class

Seattle "On the Road" Class



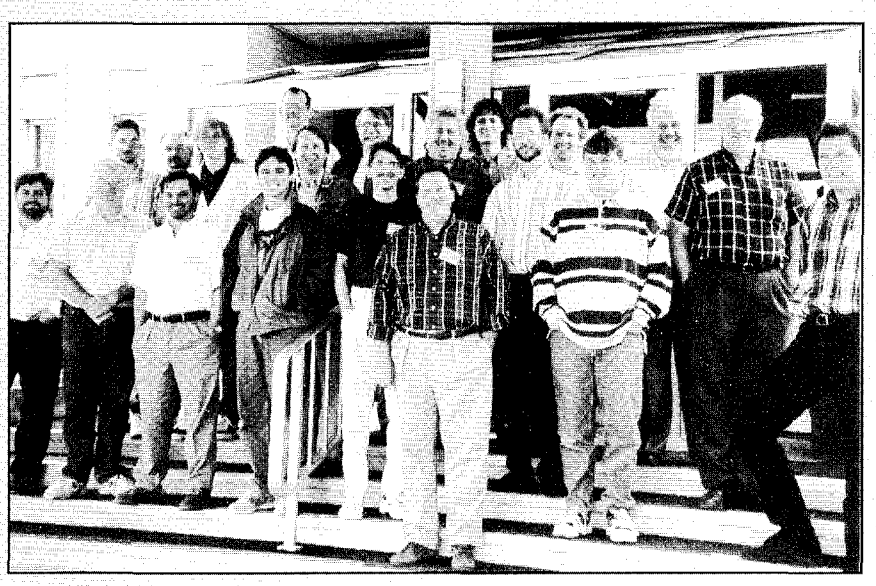
Washington DC "On the Road" Class

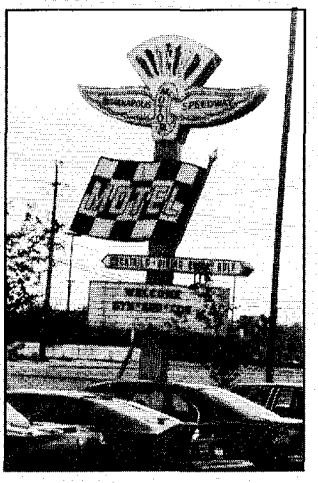




Farrel Becker of Techron was co-instructor of the DC class.

Indianapolis "On the Road" Class

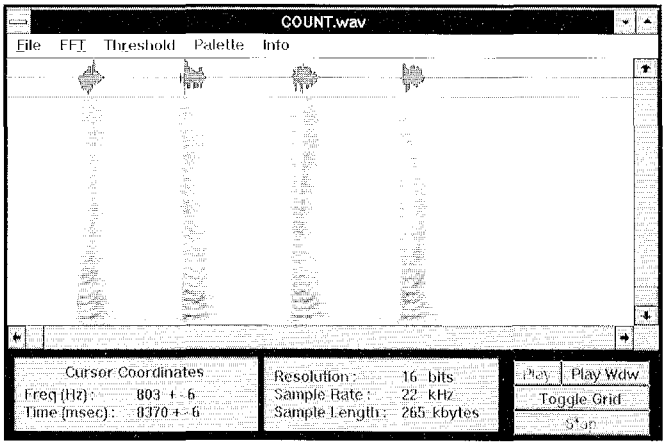




An Effective Way to Learn FFT Basics

Syn-Aud-Con grad and "email friend" Langston Holland send me an interesting program that allows the Fast Fourier Transform to be performed on .wav files from Windows.

The program is an excellent way to get a handle on the resolution trade-offs involved when making acoustic measurements.



Spectrogram runs under a Microsoft Windows environment, and is a great way to learn FFT basics without investing in expensive software programs.

The program is "freeware" and can be distributed to anyone at no charge.

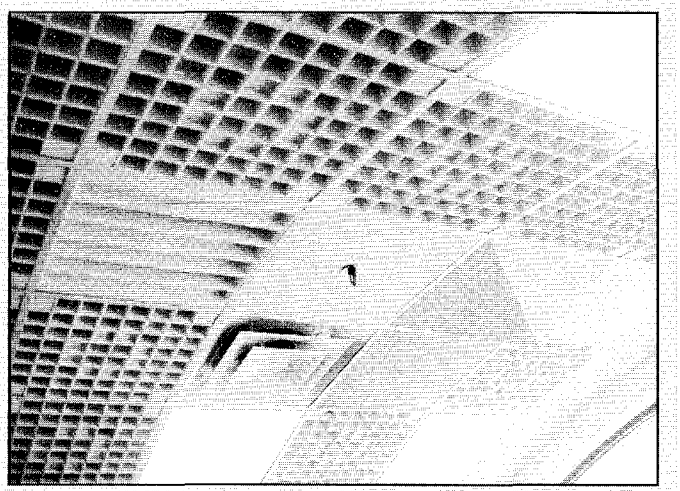
You may get a copy from Syn-Aud-Con via email if you reside on Compuserve.

From Langston's Letter:

> ...It is my understanding that you can give it to everybody in the world. I found it on a public Internet sound oriented ftp site. The included readme file indicates that it is the work of a Professor with an attitude similar to the Davis' of freely educating the public.
>
> You might want to drop a note of appreciation to the author (his address is in the readme file) and quiz him about broadcasting it to all of the Syn-Aud-Con weirdos that I am such a proud member of!
>
> God bless you! - Langston

The Proper Way to Do a Drop-Tile Ceiling

The ceiling from a meeting room at RPG Diffusors shows how to enhance the acoustics of a small meeting space with diffusion. Individuals who meet in such environments all-day long deserve more than the dry, boomy sound prevailent in such spaces.

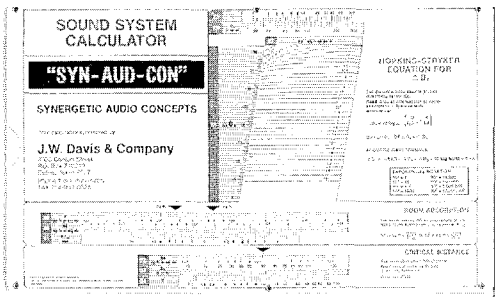


Don Keele Addresses Washington DC Class

We were fortunate enough to be holding a Washington DC "On the Road" seminar at the same time that Don Keele was to address the DC chapter of the Audio Engineering Society. The meetings were combined for a memorable evening session enjoyed by all.

Don will be a featured presenter at the Loudspeaker Designers Workshop in Nashville, and we look forward to hearing his insights in this area.

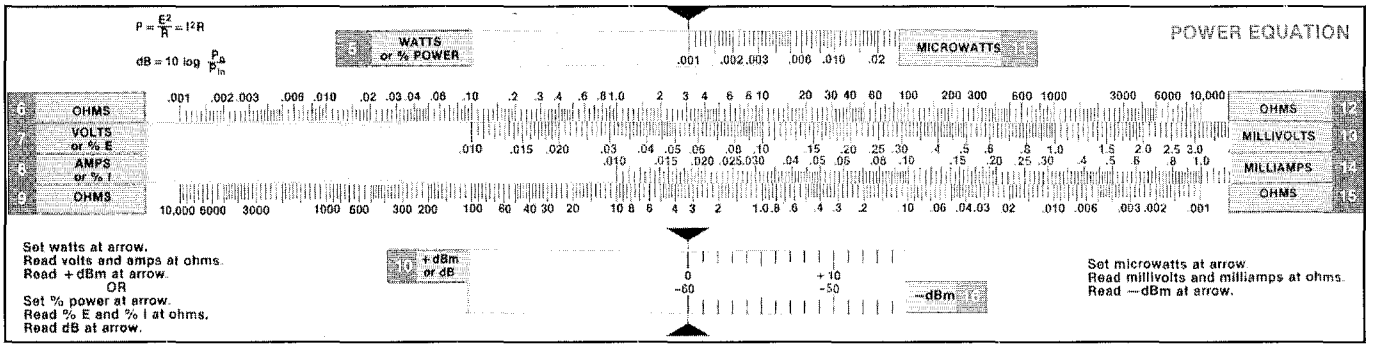
Understanding Logarithms



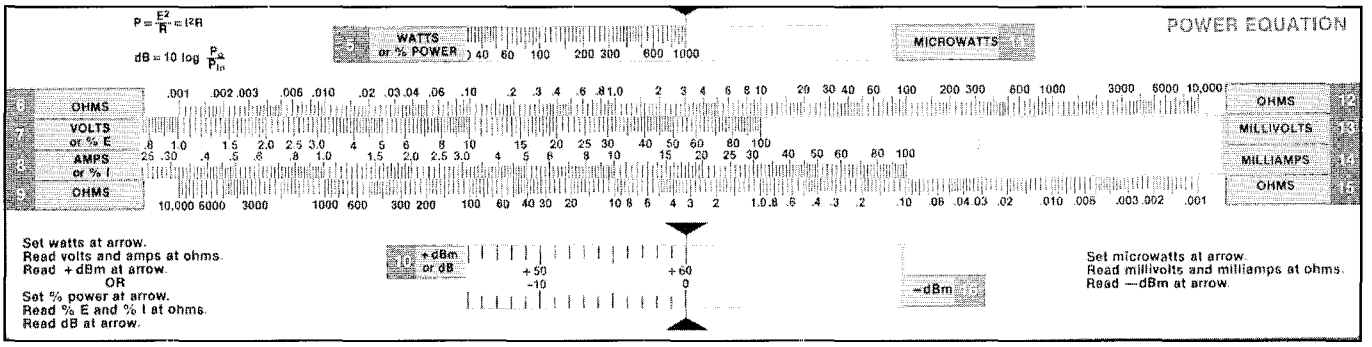
Compression is a useful tool in everyday life, and we apply it often without realizing it. When you sit on the suitcase to get it closed, you are compressing the clothing. The contents of that can of shaving cream in the bathroom would fill a garbage can if it were not compressed.

Logarithms are a convenient way to apply some mathematical compression to numbers. In audio, we are often faced with very large ranges of numbers to deal with, so some compression is in order. This issue we will explore this "number compression" with the Syn-Aud-Con slide rule.

First, find the Power Equation section of the slide rule, and line up .001 watt under the marker on scale 5. Note the reading on scale 10 (0 dB).



Now, slide the scale to the other end of scale 5 (1000 watts) observing scale 5 and 10 as you slide. Notice the numerical value that you end up with on each scale.



Note that on scale 5, you went from .001 to 1000, while on scale 10 you went from 0 to 60. Any of the numbers on scale 5 can be expressed as a number on scale 10. We have effectively taken a 1,000,000 to 1 range of numbers and expressed them as a number between 0 and 60. This is what logarithms are all about. They are used to compress large ranges of numbers into smaller ranges of numbers. The value read on scale 10 is actually 10 times the log of the number read on scale 5, and is actually a conversion from power in watts to decibels.

Is this useful? You bet, because logarithms (as decibels) are a very useful tool for describing the way that the ear/brain system processes information when concerning the loudness of sounds.

Some experimentation is urged at this point. Repeat the above procedure with the other scales of the Power Equation section of the slide rule, observing how changes in voltage, current and resistance translate into decibel changes.

If you don't have one of these marvelous tools, they are available from Syn-Aud-Con for $7.00.

Rx Your Prescription for a Sick Sound System?

One of Don Davis' famous lines is "If bad sound were fatal, audio would be the leading cause of death." Don Wesner of Audio Analysts (Georgetown, Kentucky) took him seriously, and acquired an ambulance that he has converted into his work vehicle. Complete with sirens and a public address system, this vehicle is sure to get you past the guard and to the job site.

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.

For Sale

Norsonic Type 1230 1/2 inch pressure response microphone (equal to B&K Type 4166) $350.00
Techron BAL-1 balanced to unbalanced interface box for TEF20. $150.00

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KMK
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NULL ENGINEERING COMPANY

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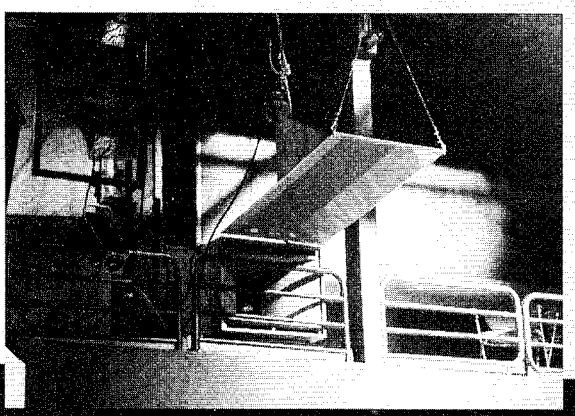
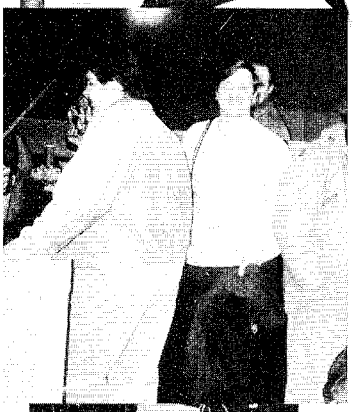
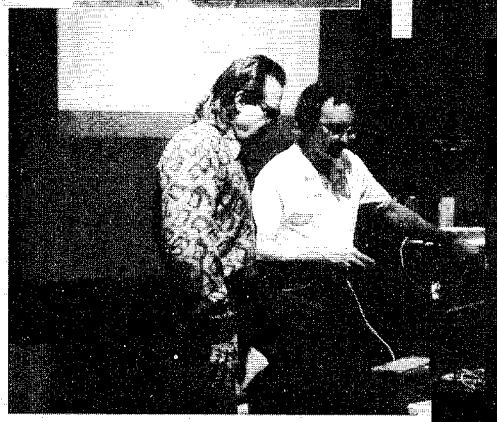
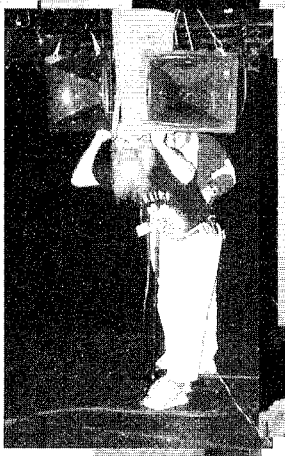
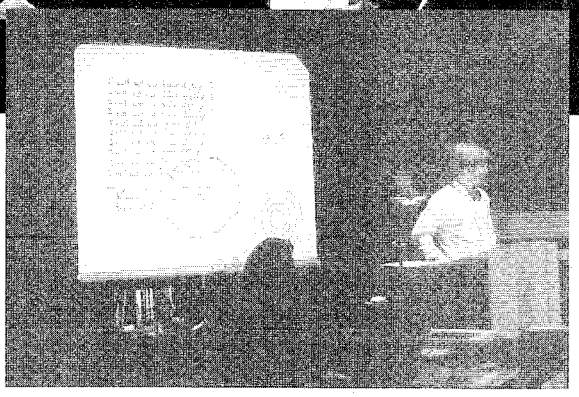
818-347-0692



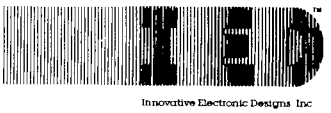




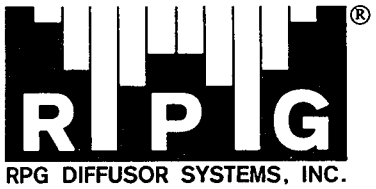

Scenes from Horns II

Scenes from Indianapolis

THE SOUND OF THE PROFESSIONALS' .. WORLDWIDE



JW Davis
Company



TOA
Corporation

SYN-AUD-CON SPONSORS

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

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

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

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