

SYNERGETIC



AUDIO CONCEPTS

# newsletter

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## SYNERGETIC

Working together; co-operating, co-operative

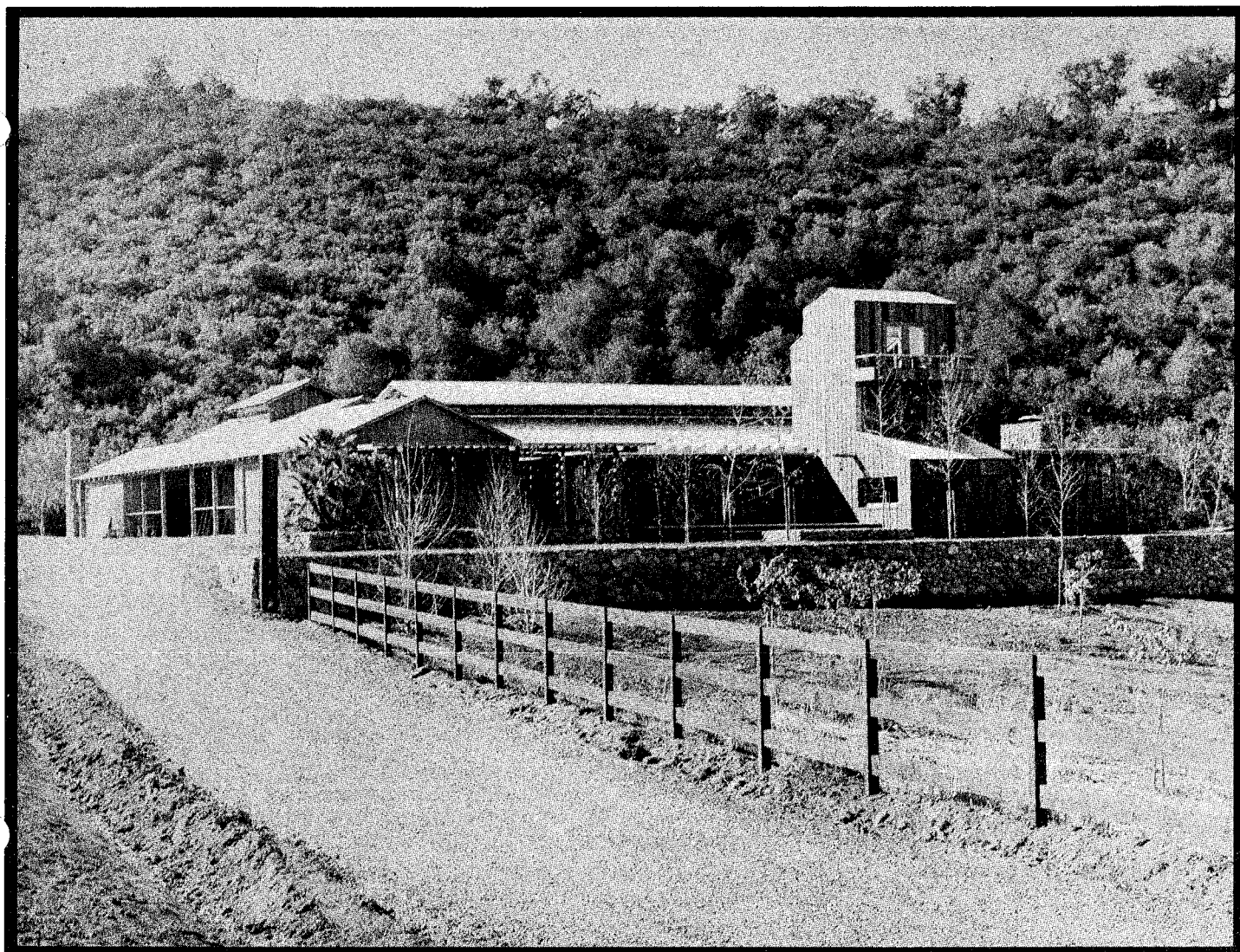
## SYNERGISM

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

## EXCHANGE OF IDEAS

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

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



**SYN-AUD-CON AUDIO INDUSTRY SEMINAR CENTER**

# TABLE OF CONTENTS

PAGE		PAGE	
2	EDITORIAL	19	SYN-AUD-CON SEMINAR STAFF
3	IF THE MGM GRAND HAD SBA	19	"THE JAPANESE BRAIN: BRAIN FUNCTION"...
3	NOTE ON HP41C CALCULATORS	20	SOUND SYSTEM DESIGN DOCUMENTATION AVAILABLE
4	RUSS BERGER'S LEDE™ CONTROL ROOM	20	THE PHON AND THE SONE
4	DESIGN EQUATIONS FOR "IN LINE" CEILING ARRAYS	21	HOW MANY OCTAVES IN A GIVEN BANDWIDTH?
5	THE ROLE OF Q, M, & N IN THE CHOICE OF D <sub>2</sub>	22	BASIC DEFINITIONS AND THE DECIBEL
6	TEF™ LICENSEES	23	VIEW FROM THE SEMINAR CENTER
7	PROGRESS REPORT ON TEF™ MEASUREMENTS	23	TV'S DISASTROUS IMPACT ON CHILDREN
8	DIGITAL TIME DELAY	23	POTPOURRI
9	DIRECTIONAL PARAMETERS FOR LOUDSPEAKERS	24	DR DIAMOND & THE NYC AES CONVENTION
9	COMPUTER WORSHIP	25	SAN DIEGO AES SECTION MEETING THE THE DELTOID
10	OVERLOOKED PZM™ ADVANTAGE	25	SUGGESTION FORMS
11	INTERESTING PEOPLE	26	"RF RADIATION: BIOLOGICAL EFFECTS"
11	%ALcons HP41C DOCUMENTATION	27	CROWN PZM™ APPLICATION NOTES
12	COLLAPSIBLE MIC STAND	27	COMPENDIUM OF MATERIALS
12	THE GENERAL CASE LOGARITHM CALCULATION	27	TERMINATING A PASSIVE EQUALIZER
13	NEW PRODUCTS FROM RAULAND BORG	28	"DIGITAL MUSIC MAKES ME WEAK"
13	HP 41C GAIN & LOSS PROGRAM IMPROVED	28	HOW MANY CUBIC FEET IN A CUBIC METER?
14	DAVID CLARK COMPANY	28	USING THE Y <sup>x</sup> KEY ON AN HP CALCULATOR
14	JAPANESE MANAGEMENT "QUALITY CIRCLES"	28	A REQUESTED CLARIFICATION
15	SPECIAL WORKSHOPS BEING PLANNED	28	HAAS EFFECT VIA INCREASED REVERBERATION
15	RPN	28	SMILE
16	NOVEMBER 1980 CLASS	29	BOOKS OF INTEREST
17	NOVEMBER 1980 CLASS MONTAGE	30	ARTICLES OF INTEREST
18	SONEX FOAM	31	CLASSIFIED
18	"THANK YOU" TO NEWSLETTER SUBSCRIBERS	31	ERATTA
		32	SPONSORS OF SYN-AUD-CON

TECH TOPICS: VOLUME 8, No. 3 - THE THIRTY YEARS OF SOUND SYSTEM PROGRESS by DAVID KLEPPER  
VOLUME 8, No. 4 - ESTABLISHMENT OF INTERNATIONAL RE-RECORDING STANDARDS by WILLIAM B. STORM

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## EDITORIAL

1981 begins a new Syn-Aud-Con era. When you receive this Newsletter, we will have had three Syn-Aud-Con classes in our West Coast Seminar Center.

The pioneer class was in November, 1980. They helped us sort out many exciting improvements such as going to Vans rather than stationwagons for local transportation, having dinners catered at the ranch rather than going to the downtown restaurants, and longer lunches so you can have time to get out in the warm California sun and take home a midwinter tan.

Our building was not quite completed in November but is finished for the January, 1981, class. All participants, so far, have agreed that the new Syn-Aud-Con experience is exceptional. Indeed, a standard comment is that we charge too little for what we provide. Even the President of the United States likes California ranch country identical to ours - same elevation, flora and fauna, wildlife, and, most of all, a mind-cleansing atmosphere.

Our own reaction to these new classes has been an outburst of activity in developing new and better ways to look at and understand audio fundamentals, the construction of new "hands on" experiences, and the day by day acquisition of exciting demonstration materials. We can now demonstrate full size clusters using very high Q directional devices. We have an extremely exciting demonstration that lets *you* hear what a change in initial time delay gap sounds like in a "live" room.

Note the relaxed informal atmosphere the pictures of the November class (elsewhere in this Newsletter) reveal. Real learning can happen in such an environment. Syn-Aud-Con, by its dedication to basic audio facts and overlooked audio opportunities, fills a unique gap in our industry. No manufacturer can fill this void no matter how hard he tries - his hardware handicaps his impartiality. No academic group can do what Syn-Aud-Con does for they stumble over their lack of experience on the firing line of everyday audio installations.

Syn-Aud-Con, as it begins its ninth year of service to professional audio men and women, has gratitude for the myriad of experiences that have proceeded from our adherence to our basic philosophy of sharing accurately the fundamentals relevant to success in our business. We are grateful for the success of our graduates. We respect and appreciate the loyal, unselfish support of our sponsors, and we are satisfied to know that we are spoken well of in the right places. If our first eight years seem miraculous, imagine what the next eight years are likely to accomplish from our present launching platform.

It is our heartfelt desire that all of you who have shared a Syn-Aud-Con class with us in the past will have the opportunity to do so again at our Seminar Center ranch. After all, you helped bring it all about.

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

## IF THE MGM GRAND HOTEL HAD SBA

The MGM Grand Hotel fire in Las Vegas, Nevada, will no doubt be analyzed from many angles as to how to prevent such disasters in the future. With the exception of workers on the lower floors and those in the casino who were caught by the rapid spread of the fire near its source, a majority of the casualties were the result of no communication to any of the rooms or hallways. The hotel paging system was one of the first things the fire destroyed.

When it is realized that, even in major cities, fire truck ladders can't reach above approximately the seventh floor, the concept of "Life-Safety" sound systems in high rise buildings is not a foolish or wasteful idea.

Just suppose the MGM Grand Hotel had installed loudspeakers in every room, all hallways, and stairwells. Would it have saved lives? Of course not because the *amplification* equipment in the basement was one of the first things destroyed by the fire. People on upper floors, fearful of the suffocating smoke, tried to use elevators, stairwells, and other doomed pathways. Some, in panic, jumped from upper story windows to their death. Those who stayed in their rooms and used wet towels to reduce smoke coming under and around the room doors or who went up the stairwells to the roof were rescued.

### WHAT IF SBA WERE USED?

Now let's suppose again the hotel had installed a small loudspeaker in each room, all hallways, and stairwells. Only in this case let's have it be an SBA system from J. W. Davis & Company. Now the amplification is spread throughout the building - there is no amplifier room to be destroyed. In such a life-safety system there would be the inexpensive master modules on each floor so the system could be controlled from *any* location in the hotel. Even more important, when the firemen arrive they not only can talk to all areas and each other over the system, but they can selectively *listen* to areas they feel might be critical. They can now direct room occupants as to the safest course of action, quiet panicky individuals, locate injured persons, and a myriad of other possibilities.

### COST OF SBA

What would such capabilities cost? Roughly about \$15 per room plus less than \$100 per floor for master modules. In a three thousand room, twenty story hotel that comes to \$47,000 worth of equipment hooked together with inexpensive four wire cable.

We can easily understand the traditional resistance to life-safety systems using 70 volt, 25 volt or other obsolete modes of operation. Not only are they really expensive, but they *can't be accessed from any point in the system*.

### DEMONSTRATE SBA SYSTEMS

We do believe that the SBA system is uniquely adaptable to this very real need. If I were in the contracting business, I'd be out breaking down doors - and resistance - to "Life-Safety" systems with effective, dramatic, forceful demonstrations of the *exclusive* benefits available from the SBA system.

There is no more pleasant profit than the one gained from meeting a real need with an honest effective solution. FARREL BECKER, a trained firefighter and thoroughly competent audio professional, has already undertaken a master design with many spectacular features that only an experienced firefighter would think of. We plan to publish his concepts in the near future.

## A QUICK NOTE ON HP41 CALCULATORS

Hewlett Packard continue their dominance of the hand held scientific calculator market with a number of new products.

1. A plug in memory module for the HP41C that puts *four* of their original modules *in one plug in unit*.
2. A new HP41CV calculator that has the four memory modules built in internally so that all four plug in ports are available for accessories such as card reader, printer, wand, and a pre-programed ROM all at the same time.

The original HP41C's are currently being sold new for as little as \$209.95 at:

Standard Typewriter Company  
1528 K Street, N.W.  
Washington, D.C. 20005  
Tel: 202-628-4940

Extra regular memory modules are \$34.88 from this source according to FARREL BECKER.

It is Syn-Aud-Con's opinion that the best programs likely to be available in the next two to three years will be those written for the HP41 series. The alpha capability makes an enormous difference when you are running programs in front of a customer or client.

# RUSS BERGER'S NEW LEDE™ CONTROL ROOM

When some talented engineers begin to make inroads into the mysticism, hype, and animal matter by actually producing better results, it's time for general rejoicing.

All this is to say that when someone with skill does an LEDE™ control room in a given city, the contrast between it and the products of the muddled-minded manglers of contemporary control rooms is both audible and profitable.

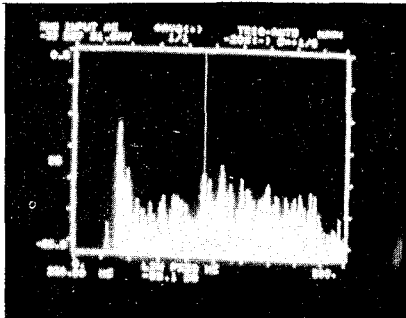
One such quote from the engineer-designer, RUSS BERGER, of a new LEDE™ control room in Texas:

"From the sound of this room, I have been contracted to design three other LEDE rooms. ..People beating the door down to lay down hard cash for a LEDE design is the best validation of the concept I know of."

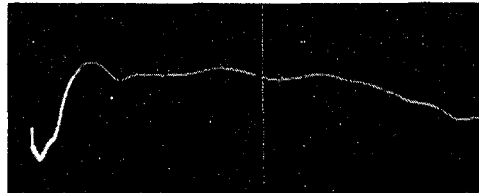
We couldn't have stated it as well as Russ has. What genuine excitement belongs to those who are the first to tread in new areas.



*Note the decorative console hood. The back is hard but because of the angle, the reflections are put back into the soft front. The sound that hits the console face is not audible in a seating position but can be heard standing up. (The highs have a sharp chirping sound when no effort is made to shield the console face from the monitors.)*



The ETC picture reveals an excellent initial time delay gap and a series of well spaced early reflections that provide the "acoustic disappearance" of the rear wall via the Haas Effect. The energy vs frequency curve is of the "raw" response of the UREI 811s.



Russ said that he had to "eat" two UREI 539 1/3-octave sets because they were not needed.

Some items of interest to us in Russ's work are his thoughtful pioneering work in developing a practical "crossover"

between the inner and outer walls of the control room, (you have to know your basics thoroughly to do an efficient predictable job on the mass, rigidity and mounting of inner wall materials), his handling of the TEF™ measuring tools, and his careful use of the new Sonex material,

## DESIGN EQUATIONS FOR "IN LINE" CEILING ARRAYS

$$I. N^* = \left( \frac{Q_{min}}{Q_{avail}} \right)$$

$$II. D_{2max} = D_{2SS} \left\{ 10^{(.5 \text{LOG}(1/N))} \right\} \left\{ 10^{(.5 \text{LOG} \left( \frac{Q_{avail}}{Q_{min}} \right))} \right\}$$

$$III. Q_{avail} = Q_{min} \times 10^{\left\{ 2 \text{LOG} \left( \frac{D_{2max}}{D_{2SS} \left( 10^{(.5 \text{LOG}(1/N))} \right)} \right) \right\}}$$

IV.  $Q_{min}$  by definition is always found through the use of the Peutz %AL<sub>cons</sub> equations

### EXAMPLES

Given:  $Q_{min} = 12$ ,  $Q_{avail} = 3$ ,  $D_{2SS} = 100'$

$$N^* = \frac{12}{3} = 4$$

$$D_{2max} = 100' \left\{ 10^{(.5 \text{LOG}(1/4))} \right\} \left\{ 10^{(.5 \text{LOG} \left( \frac{3}{12} \right))} \right\} = 25'$$

$$Q_{avail} = 12 \times 10^{\left\{ 2 \text{LOG} \left( \frac{25'}{100' \left( 10^{(.5 \text{LOG}(1/4))} \right)} \right) \right\}} = 3$$

\* This  $N^*$  applies only when all loudspeakers are identical (same sensi, Q,  $C_L$ , etc.).

## THE ROLE OF "Q", "M", AND "N" IN THE CHOICE OF D<sub>2</sub>

1. Increasing N raises the reverberant sound field by 10 LOG (N) decibels.
2. For every D<sub>2SS</sub> distance there is a minimum Q that allows 15% AL<sub>CONS</sub> with a single source. 10 LOG of this (Q<sub>min</sub>) divided by the actual Q available to the designer (Q<sub>avail</sub>) provides the number of decibels the direct sound field will lower if the same D<sub>2SS</sub> is retained.

$$10 \text{ LOG} \left( \frac{Q_{\min}}{Q_{\text{avail}}} \right) = \text{decibels}$$

3. Inverse square law level change with varying D<sub>2SS</sub> follows:  $20 \text{ LOG} \left( \frac{D_{2SS}}{D_x} \right) = \text{decibels}$

4. To observe the effect of either a change in Q or a change in N or the role of both in their effects on D<sub>2</sub> distances, the following rules are most helpful:

$$\text{New } D_{2\text{max}} = \text{old } D_{2SS} \left( 10^{\left( \frac{10 \text{ LOG} \left( \frac{1}{N} \right)}{20} \right)} \right) \left( \frac{10 \text{ LOG} \left( \frac{Q_{\text{avail}}}{Q_{\min}} \right)}{20} \right)$$

### AN EXAMPLE

Suppose that you have a situation wherein D<sub>2SS</sub> = 100' and the calculated Q<sub>min</sub> = 12. Upon looking at what's available in the rental stock you find you only have loudspeakers with a Q = 3.

$$100 \left( 10^{\left( \frac{10 \text{ LOG} \left( \frac{3}{12} \right)}{20} \right)} \right) = 50'$$

Now we need to go 100' but our lowered Q<sub>avail</sub> only allows a throw of 50' for a single sound source with a Q = 3.

If we raise N to N = 2 then D<sub>2</sub> equals  $50' \times \left( 10^{\left( \frac{10 \text{ LOG} \left( \frac{1}{2} \right)}{20} \right)} \right) = 35.36'$

and 2 X 35.36 = 70.71' which is still short of 100'  $50' \times \left( 10^{\left( \frac{10 \text{ LOG} \left( \frac{1}{3} \right)}{20} \right)} \right) = 28.87'$

and 3 X 28.87' = 86.60' which is closer but still not 100'  $50' \times \left( 10^{\left( \frac{10 \text{ LOG} \left( \frac{1}{4} \right)}{20} \right)} \right) = 25'$

now 4 X 25' = 100' and we have a useable design *provided* the coverage angle C<sub>L</sub> of the four units covers our audience. Usually, these four loudspeakers would be used in a line overhead spread out so that each one's D<sub>2max</sub> = 25' and each of the four areas would have their coverage determined by creative use of the -6 dB C<sub>LC</sub> of the individual sources.

It is of further interest to note that we could have saved a series of steps by using N\* =  $\left( \frac{Q_{\min}}{Q_{\text{avail}}} \right) = \frac{12}{3} = 4$

\*N in this case is the number of *identical* sources of the same Q, sensitivity, C<sub>L</sub>s, etc. This N simply tells you the number of units necessary to maintain a 15% AL<sub>CONS</sub>. The general case N equation in Tech Topic Vol. 5, #5, is used when large cluster arrays are involved or widely distributed overhead systems are employed. N\* is a simplification useful in the specific instance of a line of identical sources using digital time delay to overcome the impasse where Q<sub>min</sub> for a D<sub>2SS</sub> is excessive.

The electroacoustic modifier, M<sub>e</sub>, is the divisor that adjusts the D<sub>2SS</sub> to fit the circumstances dictated by Q and N

$$M_e = \sqrt{\frac{NQ_{\min}}{Q_{\text{avail}}}} \quad D_{2\text{max}} = \frac{D_{2SS}}{M_e} \quad \text{and remembering that} \quad N^* = \frac{Q_{\min}}{Q_{\text{avail}}}$$

we could have used our data at the beginning in the following manner:

$$N^* = \frac{12}{3} = 4 \quad M_e = \sqrt{\frac{4(12)}{3}} \quad D_{2\text{max}} = \frac{100}{4} = 25$$

and 4 X 25 = 100 as a check.

# PROGRESS REPORT ON TEF™ MEASUREMENTS & USERS

The list of authorized TEF™ licensees continues to grow. We will continue to issue these licenses until the arrival of the Crown "dedicated" TEF™ analyzer in the market place (latest estimates indicate late 1981 or early 1982)

Mr. Robert Todrank  
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23715 Haynes Street  
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Downey, CA 90242

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Schaumburg, IL 60194

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Howard M. Schwartz Record.  
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24227 Edgemont  
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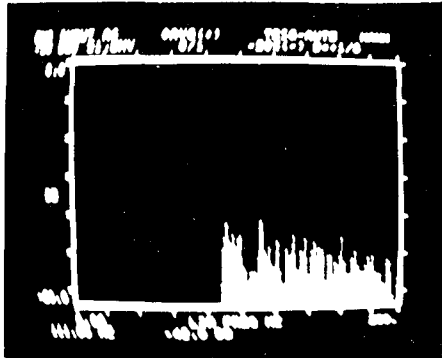
Mr. William Danner  
Nat'l Bureau of Standards  
Bldg. Acoustics & Comm. Noise  
Sound Bldg., Room A105  
Washington, D.C. 20234

PROGRESS REPORT ON TEF™ MEASUREMENTS, continued

The growing number of LEDE™ control rooms and the enthusiasm that accompanies their use is rapidly turning access to TEF™ measurements into a vital necessity for serious studio control room designers (see elsewhere in this issue some results of this work).

ETC AND TIME DELAY SETTINGS

Syn-Aud-Con recently was employed to verify and adjust a new \$600,000 auditorium system employing six digital delay systems.



The photograph shows how distinctly we were able to view the arrival time, the relative delay times, and the level differences in a single sweep of the ETC display. The horizontal scale is 200 msec with each mark 20 msec. The vertical scale is 60 dB with each mark 10 dB. Note in the photograph that it is the delayed channel that is providing the strong direct sound level and that the first channel at this position is badly time-smearred. In other words, here's living proof that a delayed system is doing its job.

We called down to the control room on an intercom provided to us at each location and had the operator adjust the time delay (UREI units) and the level in real time as we watched. The results were startling. Areas were brought into precise adjustment for the widest coverage possible for the maximum Precedence Effect and meaningful experimentation became unbelievably easy with such a tool at our disposal. I wouldn't want to adjust any complex delay system without ETC.

ETC IS TO TIME DELAY WHAT THE REAL TIME ANALYZER IS TO EQUALIZATION

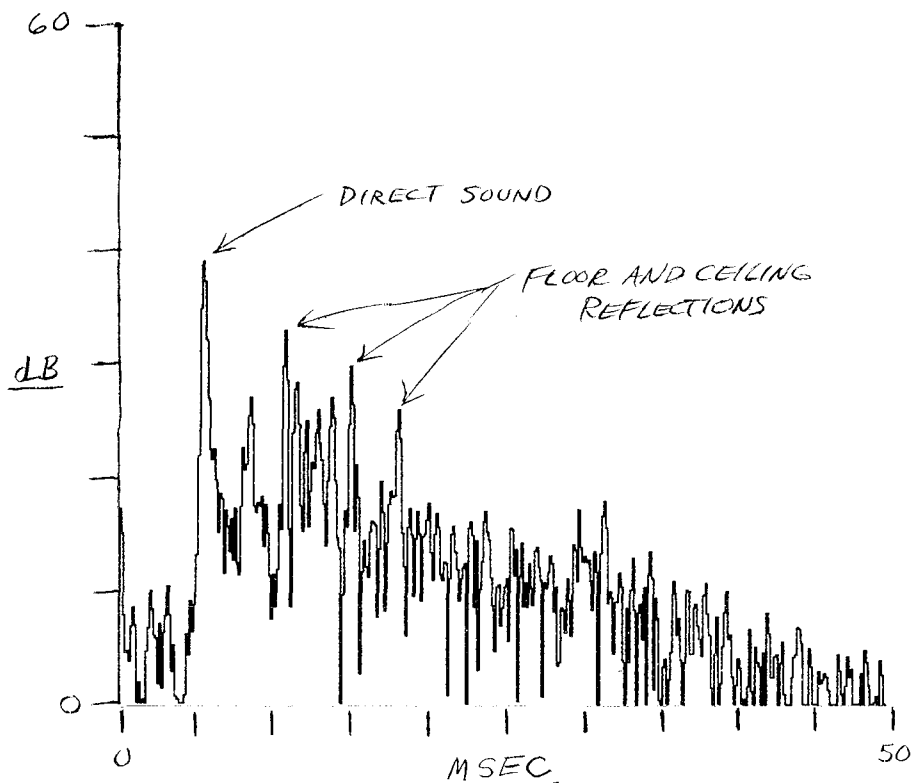
When we first acquired 1/3 octave real time analyzers back in the early days of equalization, we were able to accurately equalize a system in minutes. Before real time analyzers the job took days to do it inaccurately. We can see on the ETC display what we are doing right by using digital delay systems and the unsuspected flaws that can creep in when the adjustment is done by ear, especially in the setting of relative levels.

UREI LEVEL RECORDER

Still another extremely valuable tool is the use of the UREI level recorder with the *x/y* plot module in place to allow permanent hard copy of the ETC displays. The UREI recorder, when attached to our GenRad 2512 FFT analyzer yields the type of display shown in Figure 2.

We also had a chance to use the Crown RTA and the Badap on this job, both of which are proving to be reliable, accurate, and rugged instruments for use in either the field or the laboratory.

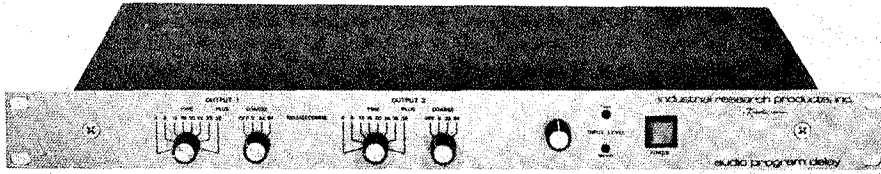
While all phases of TEF™ measurements are invaluable as research, teaching, consulting, and troubleshooting tools, it has been our experience thus far that the ETC measurements have provided us with remarkable new insights we wouldn't have obtained without it.



GLENN MEEKS of Sound Investments in Indianapolis and ED BANNON of Las Vegas Recording worked out the of using the UREI level recorder with the GenRad FFT.

# DIGITAL TIME DELAY

It has been Syn-Aud-Con's observation over the past eight years that sound contractors do not normally employ digital time delay devices in their sound system designs. The majority of digital time delay devices end up in specifications via the independent acoustic consultant.



This is a pity because digital time delay devices offer a number of advantages that are very costly to ignore.

For example:

1. You can use several lower Q loudspeakers of exceptionally smooth coverage in place of one high Q device. This allows you to match the ratios of direct-to-reverberant sound achieved by the high Q loudspeaker by adjusting the N factor and  $D_2$  distance of the multiple speaker system and aligning them with digital delay.
2. This results in being able to do a vastly wider range of sound system design with a significantly lower inventory of directional control devices.
3. In churches, school auditoriums and gymnasiums where the currently employed sound system is a central cluster which failed to have a sufficiently high Q for good intelligibility, the *demonstration* of digital time delay attached to a correctly positioned loudspeaker is an instant solution, sale, and satisfaction to the customer.

What holds most contracting firms from really running with this moneymaking, customer satisfying, improved design concept? Probably the reasons are (1) a failure to realize that the investment in money for a digital delay device is minimal; (2) time to experiment with it until familiarity develops; and, due to the other two reasons, (3) no experience to date on how easy it is to design, install and adjust in a sound system.

Unfortunately, it is not possible to self-teach the "how to adjust them." This is best done through a series of careful listening experiences wherein you hear the Haas effect level adjustments with and without the Haas effect and, most helpful when available, undergoing the experiences where TEF™ measurements can be viewed. ETC measurements are a genuine ear and eye opener, especially when you can watch the time and level adjustments occur on the analyzer's screen; then you sit and *listen* to the same adjustments with your ear and brain. (See Figure #1)

Ear and brain, when ruled by your mind, can be powerful, practical tools so long as they are calibrated and not just being fooled by the various psychoacoustic effects.

Industrial Research Products, Inc., has achieved an enviable position in the digital delay market. IRPI has an excellent reliability record and they push on the "outer envelope" of what is possible. Industrial Research has recently issued a little calling card size set of notes on digital time delay design basics. We feel they are useful rules worthy of your attention.

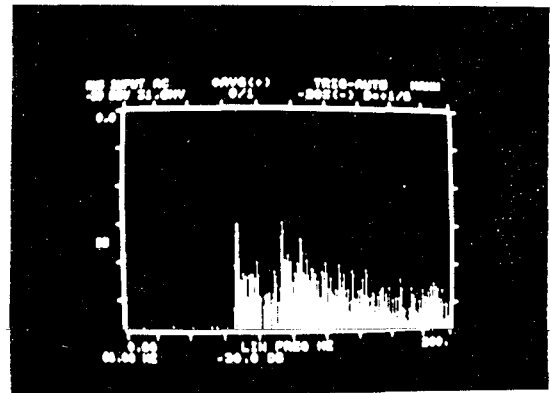


FIGURE #1: Cursor on direct sound. Two time delays visible plus early reflected energy.

## SOUND PATH DIFFERENCE

DELAY MSEC	DISTANCE	
	FEET	METERS
4	3.5	1.4
8	7.1	2.7
12	10.6	4.1
16	14.2	5.5
20	17.7	6.9
24	21.3	8.3
28	24.8	9.6
32	28.3	11.0
64	56.6	22.0
96	85.0	33.0
128	113.3	44.0
160	170.0	66.0

## PATH DIFFERENCES AND DELAYS ADD

**EXAMPLE:**  
IF DELAY IS 56 = 32 + 24 MSEC.  
DISTANCE IS 49.6 = 28.3 + 21.3 FT.  
OR 19.3 = 11.0 + 8.3 METERS

INDUSTRIAL RESEARCH PRODUCTS, INC.  
*Research comes*

## RULES FOR DELAY IN SOUND SYSTEMS

- Sound from desired direction must arrive 5 to 15 msec before reinforcement.
- Keep delayed sound and direct sound spectra similar.
- Level of delayed sound may be up to 10 dB higher than sound from desired direction.
- Keep maximum arrival time differences to 40 msec or less for signals that are not down by 20 dB or more.
- Expect to add extra delay in proportion to reverberation time.

INDUSTRIAL RESEARCH PRODUCTS, INC.  
*Research comes*

321 Bond Street  
Eli Grove Village, IL 60007  
Telephone: (312) 439-3600



## DIRECTIONAL PARAMETERS FOR LOUDSPEAKERS FOR LISTENING TO RECORDED MUSIC

Back in the late 1960's I wrote an article for a popular electronics journal of the day in which I laid out the arguments for the need of a directive loudspeaker rather than an omnidirectional loudspeaker for listening to recorded music. The directional characteristics of conventional musical instruments was examined in the article, as well as ratios of direct-to-reflected sound, and the role of directivity in producing the largest possible listening area between two reproducing channels. The article was, in general, totally ignored with the exception of a letter from a man at MIT stating that: "Any fool knows the perfect source is a point source and point sources are omnidirectional." I never answered this letter, feeling that the writer was a "pointed head" source.

Thus, it was with great interest that we read in the *JAES* of November, 1980, Volume 28, No. 11, pp 787-794, an article by James M. Kates entitled "Optimum Loudspeaker Directional Patterns." Mr. Kates suggests ideal -3 dB pattern widths of 30° by 90° (which, in a perfect loudspeaker, becomes a Q of 17 -- see Figures 3 through 7 on page 44 of *Sound System Engineering*).

He further remarks that the main axis of the loudspeakers should be aimed at the *opposite ends* of the desired listening area. (He apparently assumes that the person doing this will consider the realistic patterns of the loudspeaker before placing the opposite ends of the listening area a mile from each other.)

Syn-Aud-Con certainly agrees with both of the above ideas and has for nearly twenty years.

Mr. Kates' final sentence in the paper is music to our ears but I'm sure he'll get a nasty letter from MIT. "An ideal spherical source has traditionally been the goal of many loudspeaker designers. We have shown, however, that a consideration of auditory perception leads to a different goal. Loudspeakers that are directional over a wide frequency range are required to give the best localization performance."

The article's bibliography fails to mention Steinberg and Snow's paper on auditory perspective, Paul Klipsch's papers on the same subject, my papers on the subject, or, indeed, a wealth of earlier work. Nevertheless, Mr. Kates does a workmanlike job of presenting these well-founded ideas in this decade's preferred form (lots of math to confuse the masses). He may invent LEDE™ next as this paper has the following tantalizing line:

"A similar argument would suggest that the *rear radiation* from a dipole loudspeaker *should be absorbed* if the best possible localization is the design goal."

## COMPUTER WORSHIP

There is the story of a programmer asking the first really large computer the following question, "Is there a God?". The computer whirled, buzzed, blinked and out came the typed answer, "There is now!"

Many a physical scientist in his arrogance has twisted the biblical Samuel's words around to: "Listen Lord, thy servant speaketh", and it is humorous if taken for what it's worth.

Math is as much a "graven image" as any ancient gold, silver, wooden, or clay idol. The idea behind it is closer to something useful.

Physical scientist working their way back to the original "Big Bang" (if there ever was such a thing) find that sitting just over the ridge on the far side of the magnificent view at the top are centuries of religious philosophers and thinkers. Humbling it should be - but rarely is, for the materialist undone.

The equation reproduced here is one man's view of the conflict.

Richard Heyser expressed it best when he said in our graduate meeting in 1978:

*Most of us think of mathematics as those chicken tracks - little wiggle signs. That isn't math. - that's the fossil remnants of a thought.*

*The thought is the math. It is the structured reasoning that is the math. And when you start taking things we refer to as common sense and observation and you begin to structure that in a reasoning mode - that's math.*

*The axioms and postulates of that which most of us would call common sense - that's math. When it's dried up and withered and appears as little chicken tracks on a piece of paper - that isn't math -- that's just the residue of it -- just a shorthand that lets people know that a mind went past here on this page.*

## And God said...

$$\frac{mv^2}{r} = \frac{Ze^2}{r^2}$$

$$mvr = \frac{h}{2\pi}$$

$$r = \frac{r^2 h^2}{(2\pi)^2 m Z e^2}$$

$$E = \frac{1}{2} mv^2 - \frac{Ze^2}{r}$$

$$E = \frac{2\pi^2 m Z^2 e^4}{n^2 h^2} = Ry$$

## ...and there was Light.

## AN OFTEN OVERLOOKED PZM™ ADVANTAGE

Just how deep (in inches or cm) is the so-called "in phase" pressure zone near a broad highly reflective boundary surface?

If we start with the assumption that it *might be* as deep as the molecular amplitude at the frequency of interest, we could then calculate from readily available equations:

$$A_m = \frac{P_{RMS}}{2\pi f \rho c}$$

where:  $A_m$  is the RMS amplitude of the air molecule in M

pc is the acoustic characteristic resistance in Rayls (406 Rayls for air at sea level)

f is the frequency in Hz

$P_{RMS}$  is the sound pressure in pascals (pa)

$$P_{RMS} = .00002 \left[ 10^{\left( \frac{L_p}{20} \right)} \right]$$

Using this equation, we can find for a tone with a frequency of 2000 Hz and a level ( $L_p$ ) of 96 dB an amplitude of:

$$A_m = \frac{.00002 \left[ 10^{\left( \frac{96}{20} \right)} \right]}{2\pi (2000) (406)} = .000000247 \text{ m}$$

or  $\frac{.000000247 \text{ m}}{1} \cdot \frac{100 \text{ cm}}{1 \text{ m}} = .0000247 \text{ cm}$

or  $\frac{.0000247 \text{ cm}}{1} \cdot \frac{1 \text{ in}}{2.54 \text{ cm}} = .0000097''$

or approximately  $\frac{1}{100,000}$ th of an inch

These equations can be simplified into:

$$A_{cm} = \frac{7.8 \times 10^{-7} \left[ 10^{\left( \frac{L_p}{20} \right)} \right]}{f}$$

and:

$$A_{in} = \frac{3 \times 10^{-7} \left[ 10^{\left( \frac{L_p}{20} \right)} \right]}{f}$$

At low frequencies, a greater amplitude would occur as seen by trying the same  $L_p$  of 96 at a frequency of 30 Hz.

$$A_{in} = \frac{3 \times 10^{-7} \left[ 10^{\left( \frac{96}{20} \right)} \right]}{30} = .00063''$$

or approximately  $\frac{1}{1500}$ th of an inch

### SIZE OF PRESSURE ZONE

These calculations would indicate that the "pressure zone" near a boundary surface is quite "thin." Pressure fields are developed successfully in enclosed cavities such as calibration couplers. A PZM™ system, when correctly done, provides a "coupler-like" environment for the microphone diaphragm. (The viscosity of the air for gaps measured in thousandths of an inch can provide a semblance of an enclosure.) Thus, it can be seen that significant differences occur between a microphone diaphragm mounted flush in a large boundary surface and the same diaphragm mounted on a surface of its own opposed to the large boundary surface. The physics involved offer an interesting opportunity for original research.

### AN IMPORTANT PZM™ ADVANTAGE

The practical importance of the observations made here is *the fact* that a "flush mounted" microphone, though free of anomalies at low and mid frequencies with regard to sound sources located close to the surface of the boundary, is *extremely sensitive to the anomalies caused by raising the sound source above the boundary surface*. For instance, when the entertainer moves about the microphone, a PZM™ system *does not* display any sensitivity to such sound source relocations.

DIAPHRAGM SIZE

Another consideration is the diaphragm size. One wave length at

<u>2,000 Hz</u>	<u>10,000 Hz</u>	<u>20,000 Hz</u>
$\lambda = \frac{1130}{2000} = .57''$	$\frac{1130}{10,000} = .11''$	$\frac{1130}{20,000} = .057''$

We believe this suggests that distances and angles to the varying parts of a large diaphragm from a sound source are a much more operative factor than is the spacing of the diaphragm from the boundary surface.

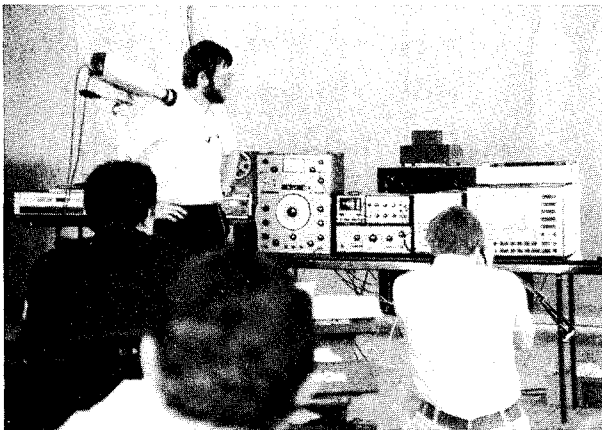
These distinctions are noteworthy not only for the increased freedom it gives the users of PZM™ systems but also for the insights into the basic physics of "pressure zones" and their optimum utilization.

For the practical user, it means that a flush mounted microphone is not and does not behave like a PZM™ system in the presence of a moving sound source.

Art, as usual, precedes science and we eagerly await the sharing of scientific insights this discussion hopefully will trigger.

### INTERESTING PEOPLE

Two extremely interesting men from Europe attended the November, 1980, class.



The first of these is Paul Ladegaard of B&K Instruments in Denmark. He brought along the \$50,000 B&K version of Heyser's TDS. The class found his discussions very interesting and his equipment demonstrations were fascinating.

The second man is Hellmuth Kolbe of Zurich, Switzerland. Hellmuth is the engineer who did all the E. Power Biggs, Furtwangler, etc., recordings in Europe over a twenty year period. We hope to have Hellmuth back for a special recording class where he can share his wealth of microphone techniques for recordings.

We can't promise such classmates in every class but their attendance at this class is indicative of the regard highly qualified professionals have for the Syn-Aud-Con experience.

### %ALcons HP41 DOCUMENTATION

RANDY GAWTRY of Minneapolis, Minnesota, took the time during the NYC November, 1980, AES to extract the equations used in a computer program for %ALcons written for the H.P. 41C. We received the magnetic cards minus documentation. We had our H.P. printer list the program and a day later Randy returned with these equations:

$$A = -0.32 \text{LOG} \left( \frac{L_R + L_N}{10L_D + L_R + L_N} \right); \text{ for } A \geq 1, \text{ let } A = 1$$

$$B = -0.32 \text{LOG} \left( \frac{L_N}{10L_R + L_N} \right); \text{ for } B \geq 1, \text{ let } B = 1$$

$$C = -0.5 \text{LOG} \left( \frac{RT_{60}}{12} \right)$$

$$AL = 100 \left( 10^{-5(A+BC)-ABC} \right) + 0.15$$

Our thanks to Randy for valuable documentation.

# COLLAPSIBLE MIC STAND

**Do you want a good high . . .**

. . . place to put your microphones? AEA offers a series of collapsible aluminum microphone stands. Available in three sizes (7', 12' and 15' models), these stands provide a sturdy, lightweight means of placing mics high in the air—without the problems inherent in "flying" them.

Model	Height collapsed/extended	Weight	Price
AEA/4707	18"/ 7-ft.	1¾ lbs.	\$40 <sup>00</sup> \$50 <sup>00</sup>
AEA/428	28"/12-ft.	3½ lbs.	\$60 <sup>00</sup> \$70 <sup>00</sup>
AEA/532	32"/15-ft.	4½ lbs.	\$85 <sup>00</sup> \$98 <sup>00</sup>

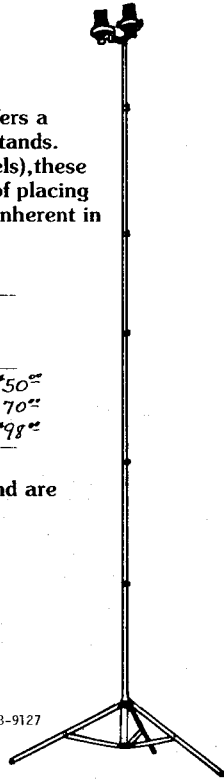
All stands are in brushed aluminum finish and are capped with a plated brass 5/8 -27 mic stud.

**CALL OR WRITE FOR INFORMATION**



AUDIO ENGINEERING ASSOCIATES

1029 North Allen Avenue, Pasadena, CA 91104 (213) 798-9127



Ron Streicher is an experienced recording engineer who was one of the first to creatively use PZM's in his work. Among his varied interests is an extremely useful mike stand (out of lighting stands) that allows useful heights to be safely accessed. We use Ron's AEA/532 for our precision measuring microphones and have found them completely satisfactory.

Price for the mike stands is:

7 ft.....\$50.00  
12 ft..... 70.00  
15 ft..... 98.00

## THE GENERAL CASE LOGARITHMS CALCULATION

The most common equations widely used in decibel calculations today are:

$$a/c = b^{\left(\frac{NM}{M}\right)} \quad \text{and} \quad M \text{ LOG}_b(a/c) = NM$$

These same relationships can be expressed using natural logarithms (base e) as:

$$\ln a/c = \ln b^{\left(\frac{NM}{M}\right)}$$

$$M \left( \frac{\ln a/c}{\ln b} \right) = NM \quad \text{or} \quad \frac{\ln a/c}{\ln b} = \left( \frac{NM}{M} \right)$$

The inverse operation becomes:

$$a/c = e^{\left( \ln b^{\left(\frac{NM}{M}\right)} \right)}$$

### SUMMARY

This general case form allows the generation of logarithms to any base and the discovery of uncommon multipliers when only the ratio and end results are given.

For example, if we were presented with:  $X \text{ LOG}_{10} 4 = 9.5 \text{ dB}$  we could quickly solve for the unknown

multiplier X using the general case technique. Remembering that:  $M \left( \frac{\ln a/c}{\ln b} \right) = NM$

then:  $M = \frac{NM(\ln b)}{\ln a/c}$  which in this case is:  $M = \frac{9.5(\ln 10)}{\ln 4} = 15.8$

Proof:  $15.8 \text{ LOG}_{10} 4 = 9.5$

## NEW PRODUCTS FROM RAULAND BORG

Rauland Borg Corp. has started 1981 with a flare of new products, special training classes, and total commitment to the TEF™ program by Heyser in February at our new West Coast Seminar Center.

At the conclusion of the upcoming February class they will have five engineers that have received Heyser training (more than double that of any other manufacturer). Rauland has Bruel & Kjaer equipment for this work and they are engaged in some very worthwhile novel investigations.



Rauland has an industry first in their Spectrum Master 3507 and 3511 automatic mixer amplifier.

All other manufacturers can just groan and say, "Why didn't I think of that?" The 3507 (70 watt) and 3511 (110 watt) Mixer/Amplifiers feature professional performance and optional automatic microphone mixing. Each provides 4 microphone inputs (expandable to 6), plus auxiliary and bridging inputs. Distortion is less than 0.5% at full output from 20 Hz to 20 KHz into 8 ohm load. Optional accessories include compressor and magnetic cartridge input cards, Voice Entree modules, and output matching transformers.

### Training for Rauland Dealers

The months of January and February will see both extensive and intensive week-long training schools run by Rauland for their distribution. The size of the staff, the extent of product, and the scope of subjects covered is large by any standard and show that Rauland is committed to really helping their distributors.

## HP41C GAIN & LOSS PROGRAM IMPROVED

JIM NULLE in Gillette, Wyoming revised our Gain & Loss program for the HP 41C published in Newsletter Volume 7 # 4, page 6. Jim writes:

This is the Gain and Loss Program that was in the summer '80 Newsletter. I have deleted and added a few statements for those who wish to use this program with a printer for printing the input data and the results. The program contains a subroutine for printing and with the changes is only 4 lines longer but requires 3 sides of cards. These are relatively simple changes but they give a hard copy of input and output data.

```

GAIN/PR
01 *LBL "GAIN/PR"
02 *INPUT R=? "
03 PROMPT
04 STO 01
Add 05 XEQ 01
06 *SOURCE =? "
07 PROMPT
08 STO 02
Add 09 XEQ 01
10 *LOAD R=? "
11 PROMPT
12 STO 03
Add 13 XEQ 01
14 *INPUT V=? "
15 PROMPT
16 STO 04
Add 17 XEQ 01
18 *OUTPUT V=? "
19 PROMPT
20 STO 05
Add 21 XEQ 01
" 22 ADV -Used to space
" 23 RCL 05 inputs +
" 24 *12 results
25 .001
26 RCL 03
27 *
28 /
29 LOG
30 10
31 *
32 STO 06
33 RCL 04
34 RCL 02
35 RCL 01
36 +
37 RCL 07
38 /
39 +
40 STO 06
41 *12
42 .001
43 /
44 RCL 02
45 /
46 LOG
47 10
48 *
49 6.02
50 -
51 STO 08
52 RCL 06
53 X<>Y
54 -
55 STO 09
56 *dB GAIN ="
Add 57 XEQ 01
58 RCL 07
59 *SOURCE V="
60 XEQ 01
61 RCL 06
62 *dBm OUT ="
Add 63 *LBL 01
" 64 ARCL X
" 65 AVIEW
" 66 RTH
67 .END.
} Sub routine

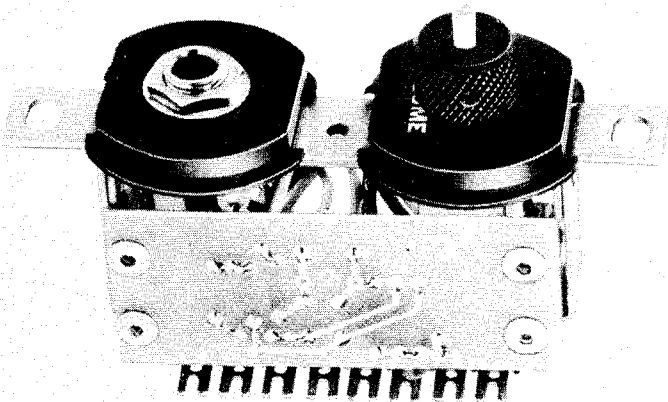
INPUT R=? 10.000.0000
SOURCE =? 150.0000
LOAD R=? 0.0000
INPUT V=? 1.0000
OUTPUT V=? 0.5000

dB GAIN =12.6001
SOURCE V=1.0150
dBm OUT =14.9485
    
```

## DAVID CLARK CO.

David Clark Company is a very familiar name to current Syn-Aud-Con graduates. They have used our special Syn-Aud-Con hearing protectors made for us by this long time Syn-Aud-Con sponsor. We have no reserve whatsoever in naming their protectors the best available.

One facet of this excellence that Syn-Aud-Con graduates do, on occasion, overlook is the use of this superior protection capability in the construction of David Clark Company noise attenuating headsets. We see many intercoms chosen on the basis of the ease of using microphone cables for the interconnection. Such units *do not*, however, provide the exceptional noise attenuation that the David Clark units have. We realize that many of you don't have continually noisy environments to work in, but we also have observed that your intercoms are usually wiped out when you do. Syn-Aud-Con prefers to specify systems like the David Clark's for any quality long term system and that includes almost all test facilities, industrial plants, sporting events, and "live" entertainment facilities.



The David Clark M3142 headset station is a good example of some of the engineering offered by this company.

The M3142 is an integral part of their 3100 communications system and it combines push to page, volume control, and preamplifier in a module small enough to fit into a standard electrical wiring box.

The M3142 allows you to plug in one of their noise attenuating headsets and to page throughout the entire system simply by pressing the page button.

If you are not familiar with this portion of the products offered by the David Clark Company, we suggest you write or telephone

Mr. George Conlon  
David Clark Company, Inc.  
370 Franklin Street  
Worcester, MA 01604  
Tel: 617-756-6216

and ask for the relevant literature on this most useful product line.

## JAPANESE MANAGEMENT "QUALITY CIRCLES"

Many American companies are adopting the Japanese management tool called "Quality Circles" (QC). A "quality circle" is a group of from 5 to 13 employees doing similar work who meet regularly with their supervisor to investigate quality problems *and try to solve them*. A key aspect is the voluntary nature of the relationship.

In Japan this leads to a "bottom up" path to management's ear and is essentially a manifestation of the worker's loyalty to their company and a desire to contribute their skills to the common good.

Japanese executives with experience in both Japan and the U. S. caution that "People in the United States are very individualistic; they largely come from Europe and are self-reliant. The advantage is creativity and originality; the disadvantage is a lack of faith in each other and distrust."

Japanese companies, we are told, judge an employee's attitudes as most important, coming before even performance in salary reviews. Again, to quote Japanese management - "Everything comes from unity and harmony. What we work for is not just putting the individual ahead but a common cause, a company that will support us."

Americans during wartime battles achieve such goals - but then who wants a permanent lifestyle from the battlefield.

We suspect that, as is usually the case in our remarkably mixed American society, Japanese quality circles will be discussed, cussed, tried, tripped over, and gradually there will emerge individualistic original variations on the theme such as can only come from a Mexican wetback being introduced to a new idea by a Hungarian foreman reporting to a Vietnamese supervisor working for a Quaker owner. There's just naturally going to be some variations on the theme when tried in the good ole U. S. of A.

## SPECIAL WORKSHOPS BEING PLANNED

Our limited attendance classes the past year have been successful. Many problems that can't be handled in large classes are easy in smaller classes where increased face-to-face communication can take place between ourselves and class attendees.

One problem that is more difficult to resolve is the balance between the amount of basic fundamentals and more involved audio problems that can be touched upon. This has led us to think about a special type of Workshop where we would sit down with say only 5-6 people for five days and cover subject-by-subject in total detail the basic fundamentals of audio.

We discussed in the Fall Newsletter (Vol 8 #1) a number of Workshops that we are considering. We failed to include the extra copy of the "Are you interested in a special Workshop?" which was printed in the Newsletter. In spite of that many people photocopied the page and returned it, enough that we know that there is real interest in special Workshops. As we talked with people about what they would like we are seriously considering the very limited attendance for 5 days to accomplish what we want.

Rather than advertise a special Workshop at a given time, when we have several who have indicated their interest in a certain Workshop, we will contact them to set a time convenient to each. We think that we will hold Workshops on Church and Auditorium sound system design; Studio Designers Workshop; Microphones for Recording and Sound Reinforcement; Sound Installers Workshop; Contractor Financial and Management Workshop; and the Fundamentals of Audio Workshop.

The Fundamentals of Audio Workshop would be spent working as a group on Ohms Law, the dB, waveform measurements, analyzers and how to use them, the sound level meter, basic logarithms, and other subjects of this type.

Such a class would be conducted in the relaxing atmosphere of our Seminar Center Ranch with all meals, lodging and local transportation covered. Housing would be at the Ranch with wholesome ranch cooking to support the mind stretching work to be done. Adequate time would be available for recreation and the entire five days would be devoted to working in detail on your questions about audio fundamentals.



A couple of the recreational activities at the Ranch

Each Workshop would be conducted by Syn-Aud-Con staff plus noted authorities in a given field. One of the earliest Workshops that we would like to plan is with CHIPS DAVIS and ED BANNON - truly men of outstanding talent in Studio and Control Room design. We want to share as soon as possible the work that Chips and Ed have been doing since they formed a team.

If you are interested in our planned mini-group Workshops, please fill out the enclosed form and send it to us. We expect the fee to be approximately \$1,000. When the Workshop of your interest is formed, you will be notified in time to make a final decision as to your participation in it.

### RPN

A fascinating write-up on Jan Lukasiewicz (WookashAYveech), the developer of "Polish Notation" from which H.P. developed Reverse Polish Notation (RPN), was included in the most recent edition of H.P. Digest. His was a distinguished career in mathematics and modern "truth" tables are a by-product of his conception of a three valued propositional calculus. (Propositional calculus is literally a method for calculating the truth value of a sentence, just as algebra is a method of calculating the truth value of a numerical equation.)

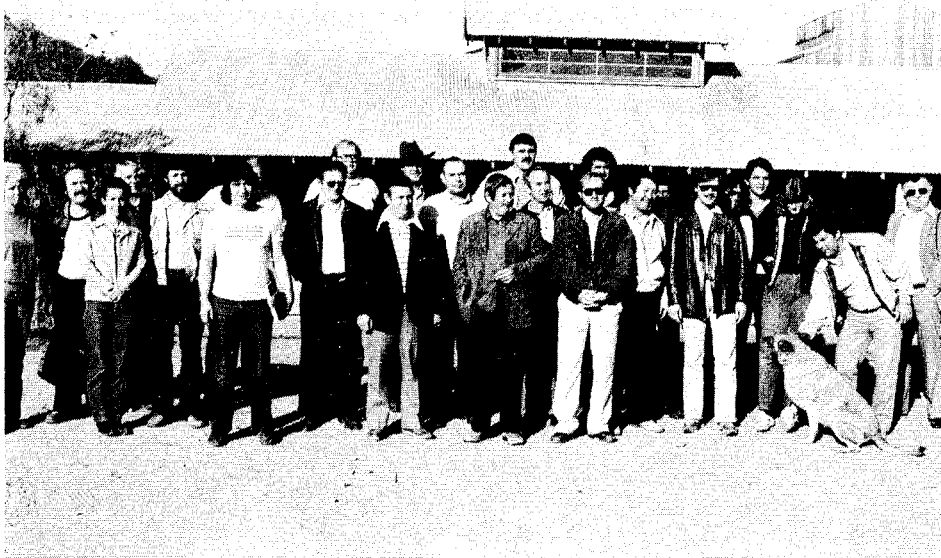
Lukasiewicz's statement about the philosophy of science and mathematics is:

"Just as art grew out of the craving for beauty, science was created by the urge for knowledge. Seeking the goals of science outside the intellectual sphere is as great a mistake as cramping art by considerations of usefulness. The saying 'art for art's sake' and 'science for science's sake' are equally valid."

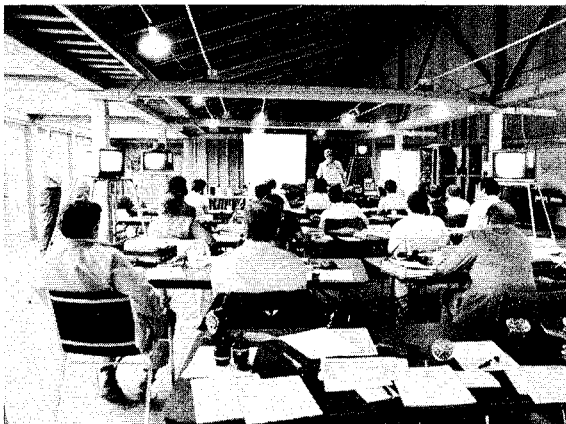
CONCLUSION

With the advent of extremely high quality digital time delay and some very smooth constant directivity devices (some in very handy sizes like the Emilar units), it is increasingly attractive to adjust  $D_2$  rather than  $Q$  in order to maintain the desired %ALcons at each seat. Uniform coverage is usually easier to achieve through uniform devices than it is with devices that, in a multiple unit, single point array, vary in  $Q$  by ratios of four and even 16 to 1 (in the case of a three horn array with a far throw and medium throw and a short throw). It is instructive to calculate the interaction of changing  $Q$ 's and  $N$ 's in various systems in the search for optimum design techniques.

## NOVEMBER 1980 CLASS



Pictured here is a unique and privileged group of audio pioneers. Each distinguished in his own right, they came together to form the pioneer class at the new Syn-Aud-Con West Coast Audio Industry Seminar Center.



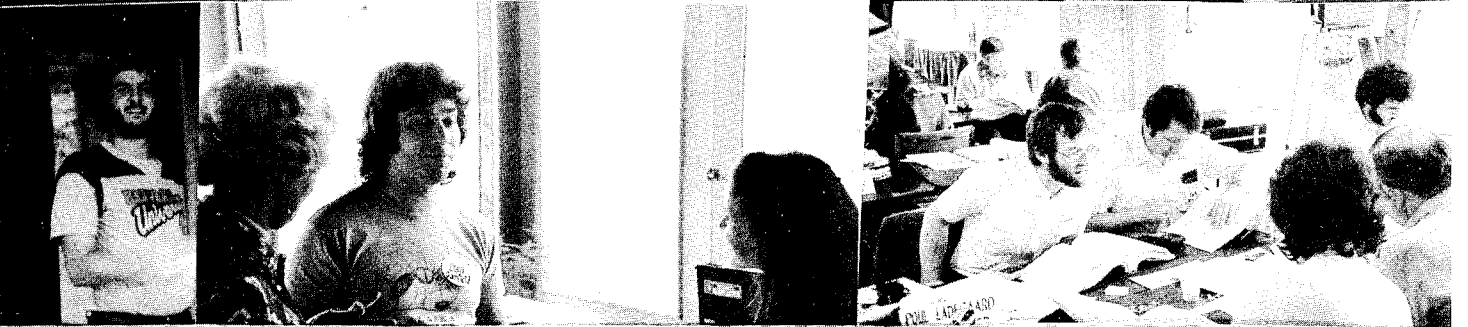
As the photographs show, we spread out in the new Center, we ate out on the broad patios under the Pepper tree, we relaxed and solved problems, and most of all, we shared a memorable environment all too rare in this hurried age.

Many of the class found the drive up the mountain, through the large cattle ranch below us, and the passage through the forest made the extensive facilities on the Ranch seem truly unique.

We're looking forward to having you come to the class of your choice in 1981. You'll agree with this class that pictures can't do justice to the area.



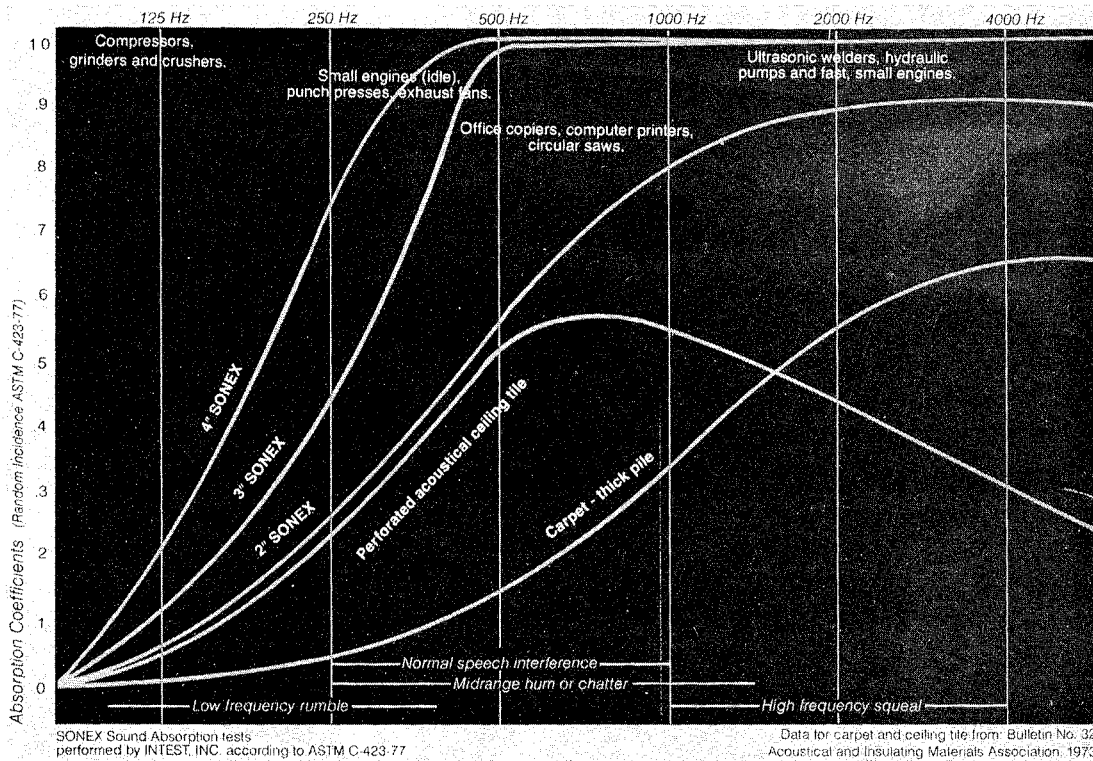
NOVEMBER 1980 CLASS



# SONEX FOAM

Illbruck/USA of Minneapolis is the manufacturer/distributor of a material called Sonex. (Alpha Audio in Richmond, Virginia has signed an agreement with Illbruck to become the United States distributor for the audio industry.) We originally reported on this unusual material in our Volume 7 # 1 Newsletter of the Fall 1979 issue, pp 22-23.

The graph below tells their story well (and confirms our original TDS measurements).



## LEDE Control Rooms

As can be seen, the 4" Sonex material operates beautifully from about 250Hz up or, put another way, it crosses over right at the typical frequency point, in most control rooms, between wave acoustics and geometric acoustics. This characteristic makes Sonex the very first choice functionally for the absorptive material in an LEDE™ control room (See its use in this Newsletter in RUSS BERGER's new LEDE control room.) Bert Whyte of Audio Magazine has turned his living room into an LEDE listening space and reports spectacular results.

The present Sonex meets rigid fire-safety requirements and now offers a multiple choice of colors -- at least 5 colors presently available.

Syn-Aud-Con recommends Sonex for the "dead end" of any LEDE control room because the design problem is reduced to obtaining proper diffusion with the rear wall and constituting a good transfer from wave to geometric acoustics in the inner walls.

Rooms with extremely tight budgets can and do eliminate the outer shell and build the inner wall as massively as possible. This is a compromise but not a major one in the design of a budget LEDE control room. When carefully done it is not readily apparent to even trained ears.

A good source of Sonex is KEN WAHRENBROCK, Wahrenbrock Sound Associates in Downey, CA, primarily because he has full TEF™ capability to maintain quality control of the shipments he sends to you. Also, Ken has had the opportunity to witness and measure a number of rooms employing Sonex and is in a position to give authoritative advice and counsel: Wahrenbrock Sound Associates, 12115-A Woodruff Blvd, Downey, CA 90242. Phone: 213-861-0397. Ken's distributor agreement is with Alpha Audio.

## "THANK YOU" TO NEWSLETTER SUBSCRIBERS

Each quarter of the year when a Renewal Notice is being prepared for the Newsletter subscribers we take time to study the list. And it makes us humbly grateful to see the old friends that have been subscribers to the Newsletter since they attended a Syn-Aud-Con class -- a remarkable number since 1973 when we held our first classes. THANK YOU for the support each of you has given to Syn-Aud-Con for so many years.

## SYN-AUD-CON SEMINAR STAFF

The November, 1980, class was chauffeured in by Kitty Purvis, Jan Kreitz, and Jeanie Garcie (left to right in the photograph). Jan is our office manager and one of the pleasant voices encountered when you call Syn-Aud-Con. Jeanie is Jan's assistant in the office. Kitty aids our regulars during the seminars. When the Syn-Aud-Con Vans pull up in front of the Marina Inn in Dana Point to bring you up to the Seminar Center, one of these girls will be there to welcome you aboard.



### “THE JAPANESE BRAIN: BRAIN FUNCTION AND EAST-WEST CULTURE”

"The Japanese Brain: Brain Function and East-West Culture," by Tadanobu Tsunoda, has yet to be translated into English but information as to its contents is traveling fast and far.

Written in 1978, Tsunoda asserted that *language* shapes the neurophysiological pathways of the brain. This complex academic work has surprisingly become a bestseller in Japan. If Tsunoda's thesis turns out to be correct, and it is based on extensive scientific testing of the highest order, it may be that the language we learn alters the physical operation of our brains. The patterns of hemispherical dominance that he has plotted look much like this:

JAPANESE		WESTERN	
Vowels Consonants Non-verbal Human Sounds Japanese Instrumental Music Animal Sounds Calculation	Mechanical Sounds Western Instrumental Music	Consonants Language Calculation	Non-verbal Human Sounds Animal Sounds Western and Japanese Instrumental Music Mechanical Sounds
Left Hemisphere	Right Hemisphere	Left Hemisphere	Right Hemisphere

If Tsunoda is correct, and we believe he is from the evidence we have seen, then it's no surprise that the Japanese do not hear with the emotional side of the brain the disturbing characteristics sensitive Western listeners claim is in digital recordings. "One recent study has shown that left-handers (they reverse the use of the cerebral hemispheres) who process language in both hemispheres do better than other groups on tests of tonal pitch recognition." Another study has found that a higher than normal percentage of musicians are ambidextrous.

"Researchers have been unable to show whether this is cause or effect; it is an open question whether or not people who are less lateralized tend to be more gifted musically, or whether playing music develops both hands - or possibly both sides of the brain."

These intriguing quotes are all from "The Japanese Brain," by Atuhiro Sibatani in the December, 1980, issue of Science. Syn-Aud-Con highly recommends a trip to the library to read the entire article.

# SOUND SYSTEM DESIGN DOCUMENTATION AVAILABLE FOR SALE

TOM BOULIANE has produced what we feel is the finest example, to date, of thorough documentation for our Sound System Design program. Tom is offering copies of his package to the readers of the Newsletter for \$15 per copy. It is an 11-page package and would make an excellent model for any documentation you might wish to do with other programs you use.

Write to: Mr. Thomas G. Bouliane, Audio Contractors Inc., 18 Trinity Place, Buffalo, NY 14201

We particularly recommend this package to anyone wishing to program an Apple, Commodore, Radio Shack or other home computer in a language other than RPN since all the essentials are available in this package.

Tom says anyone ordering his package, which covers cost of duplicating, postage, and a contribution to his fund to buy a card reader and printer, will be kept abreast of future revisions.

## THE PHON AND THE SONE

The Phon scale (See Figure #1) is of equal *loudness* level contours. At 1000 Hz every decibel is the equivalent loudness of a Phon unit. In 1947 ISO adopted a new subjective scale called the Sone scale. One Sone is the loudness of a 1000 Hz tone of 40 dB intensity level. It is also the *loudness* of any sound having a 40 Phon level. Expressed mathematically:

$$S = 2^{\left(\frac{P-40}{10}\right)}$$

where: S is the Sone level  
P is the Phon level

and:

$$P = 10 \left( \frac{\ln S}{\ln 2} \right) + 40$$

These equations are for single tones or critical bands of broadband sounds.

For two different sounds *within* a critical band (for most practical purposes, using 1/3 octave bands suffices) they are added in the same manner as decibel readings. For example, suppose that within the same critical band we have two tones each at 70 Phon.

$$P_T = 10 \text{ LOG} \left( 10^{\left(\frac{70}{10}\right)} + 10^{\left(\frac{70}{10}\right)} \right) = 73 \text{ Phon}$$

Loudness Index, Annoyance, and Perceived Noise Level

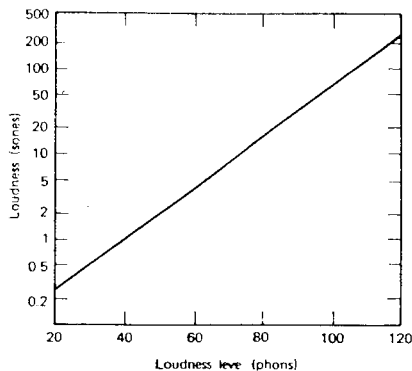


Figure 2 Graph showing the relation between sones and phons

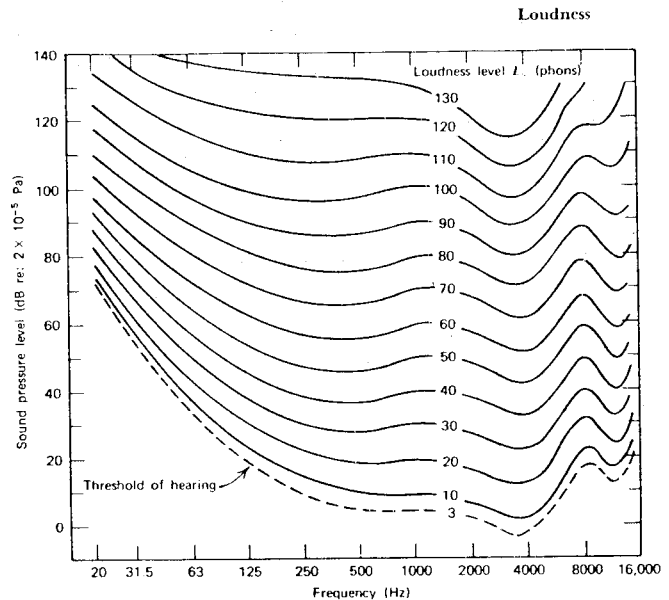


Figure 1 Equal loudness level contours (phons) expressed in decibels relative to  $2 \times 10^{-5}$  Pa for average listeners for narrow band or pure tones (International Standards Organization).

Then the Sone level becomes:

$$S = 2^{\left(\frac{73-40}{10}\right)} = 9.85 \text{ Sones}$$

Now suppose we again have two tones - one at a low frequency of 70 Phon and one at a high frequency (many critical bands from the low frequency) of 70 Phon. In this case they are first calculated as Sones *then added together*:

$$2^{\left(\frac{70-40}{10}\right)} + 2^{\left(\frac{70-40}{10}\right)} = 16 \text{ Sones}$$

or converting them back into Phons for comparison with the two tones within the same critical bandwidth

$$10 \left( \frac{\ln 16}{\ln 2} \right) + 40 = 80 \text{ Phon}$$

An interesting experiment in this regard is to start with two equal level signals 10 Hz apart at 1000 Hz and gradually separate them in frequency while *maintaining their Phon level*. They will increase in apparent loudness as they separate. This is one of the reasons a distorted system sounds louder than an undistorted system at equal power levels. One final factor worthy of storage in your own mental "read only memory" is that in the 1000 Hz region most listeners judge a change in level of + 10 dB as twice or half the loudness of the original tone.

Using 1/1 octave analysis the total loudness level of complex sounds can be obtained by

1. Using the 1/1 octave analyzer, record the  $L_p$  in each octave band from 63 Hz to 8000 Hz.
2. Convert each  $L_p$  reading to a Phon level. (See Figure #3)
3. Convert each Phon level to a Sone level. (Use equations)
4. The total loudness in Sones  $S_T$  then becomes

$$S_T = S_L + 0.3*(S_S - S_L)$$

where:  $S_T$  is the total Sone level

$S_S$  is the sum of the individual bands in Sones

$S_L$  is the largest Sone value in the individual bands

\* For 1/3 octave analysis use 0.15 as a constant.

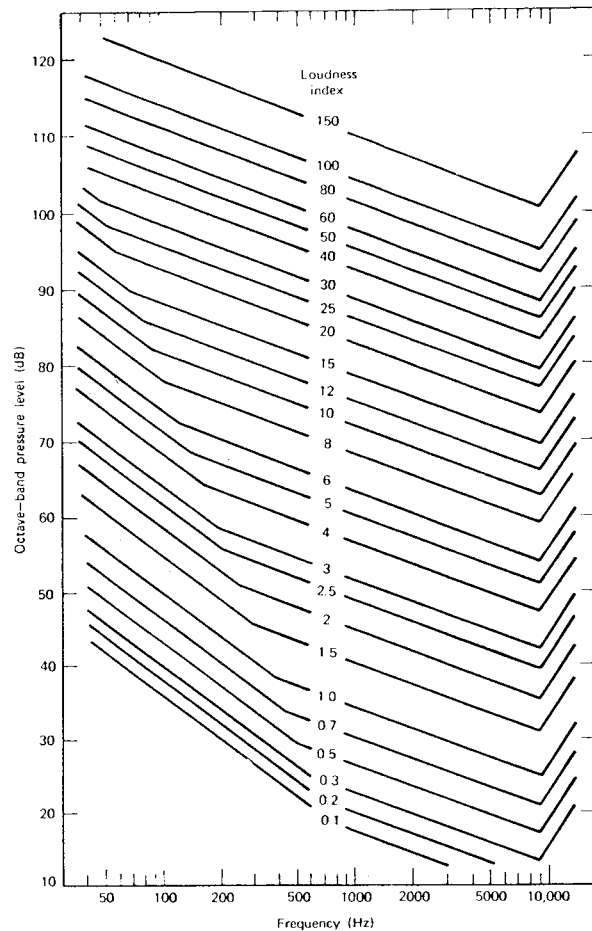


Figure 3 Contours developed by Stevens. A loudness level index in sones can be determined by measuring the sound pressure level of eight octave bands having center frequencies of 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz. [From S. S. Stevens, *J. Acoustic Soc. Am.* 33, 1577 (1961)]

## HOW MANY OCTAVES IN A GIVEN BANDWIDTH?

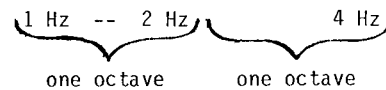
What is an octave? One octave is a 2 to 1 change in frequency such that from 1 Hz to 2 Hz is one octave. So is 1000 Hz to 2000 Hz or 10,000 Hz to 20,000 Hz.

This can be written mathematically as:

$$\frac{f_H}{f_L} = 2^N$$

where:  $f_H$  is the higher frequency  
 $f_L$  is the lower frequency  
 $N$  is the number of octaves

$$\frac{4\text{Hz}}{1\text{Hz}} = 2^{(2)} \text{ or } 2 \text{ octaves}$$



Using natural logarithms, we can easily formulate this relationship into a general case equation:

$$\ln\left(\frac{f_H}{f_L}\right) = \ln 2 \times N$$

$$\text{thus: } N = \frac{\ln\left(\frac{f_H}{f_L}\right)}{\ln 2}$$

### AN EXAMPLE

How many octaves are there between 30 Hz and 1500 Hz?

$$N = \frac{\ln\left(\frac{15,000}{30}\right)}{\ln 2} = 8.97 \text{ octaves}$$

This is a very wide range high fidelity system (measured not advertised). Very few technological systems are asked to span such a range. All of visible light is but one octave. Audio is more complex than is often realized.

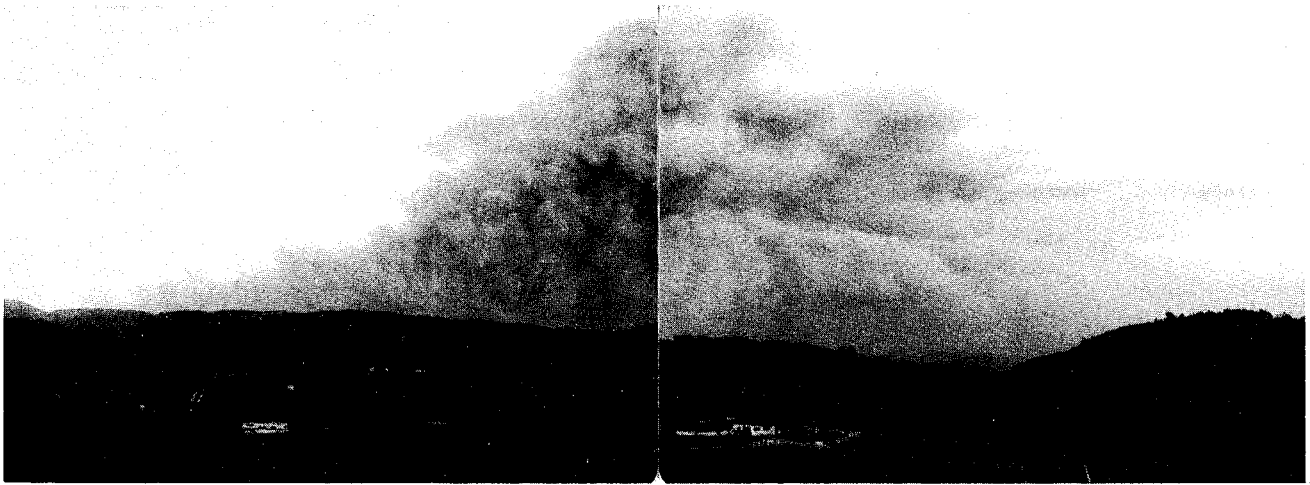
## BASIC DEFINITIONS AND THE DECIBEL

In current Syn-Aud-Con classes we develop the mathematical foundation of the decibel much as we have in the past but with some refinements we feel help increase insight into the use of this marvelous tool. Here is our present approach in the form of numbered notes.

1. Any *power* ratio (a/c) can be expressed as:  $a/c = b^N$   
 where:  $b$  is any base except 1 or 0  
 $N$  is the exponent
2. Thus, the *power* ratio (10/1) can be written as:  $10/1 = 10^1$
3. This relationship can also be expressed logarithmically as:  $\text{LOG}_b a/c = \text{LOG}_b b \cdot N$   
 and since the  $\text{LOG}_b b = 1$  (the LOG of any number identical to its base is equal to one)  
 Therefore:  $\text{LOG}_b a/c = N$
4. In electrical terminology this becomes:  $\text{LOG}_{10} (10/1) = 1 \text{ BEL}$
5. The term "deci" in the S.I. (metric system) means "one tenth of." Therefore, a decibel (dB) is 0.1 BEL or dimensionally there are 10 dB to 1 BEL:  
 $\frac{1\text{dB}}{1} \cdot \frac{1\text{BEL}}{10\text{dB}} = 0.1 \text{ BEL}$   
 $10 \left( \frac{1\text{BEL}}{10} \right) = 10 \left( \frac{\text{LOG}_{10} 10}{10} \right) = 10^{1/10} =$   
 $\sqrt[10]{10} = 1.25893\dots$
6. Expressed as a *power* ratio 1 dB becomes:  $\text{LOG}_{10} (10)^{10} = 10 \text{ dB}$
7. Decibels may be obtained from BEL's by:  $10\text{LOG}_{10} 10/1 = 10 \text{ dB}$
8. More commonly, rather than using the exponent ten we can first take the logarithm of the power ratio *and then multiply* by ten:
9. The general case equation in algebra becomes:  $M\text{LOG}_b a/c = NM$  and  $a/c = b^{\left(\frac{NM}{M}\right)}$   
 where:  $M$  is called the multiplier  
 $b$  is called the base  
 $a/c$  is now any ratio  
 $N$  is the logarithm of the ratio
10. When, as is so often the case today, *non* power ratios are to be used to obtain the *power ratio in decibels*, they must first be converted into the equivalent power ratios.  
 For example, a voltage change from 1 volt to 2 volts across the same impedance can be written as:  $10\text{LOG}_{10} (2/1)^2 = 6.02 \text{ dB}$   
 where:  $(2/1)^2$  turns the voltage ratio into a power ratio (note that 6.02 dB is a 4/1 power change by definition, not a 2/1 voltage change)  
 $20\text{LOG}_{10} (2/1) = 6.02 \text{ dB}$   
 The multiplier 20 is found by 2 X 10 in place of squaring the voltage.

The simplicity of this approach belies the complexity of arriving at what we feel is the most logical presentation of the subject. We hope you find it helpful as a review of what we all need to know to be efficient with our scientific calculators.

## THE VIEW FROM THE SEMINAR CENTER



The view from our seminar center 7:00 AM Sunday morning - two days after our first class in the Santa Ana Mountains in November. Fortunately, the strong (75 mph) wind carried the fire down canyon rather than over the canyon wall. The next week, when the fires were started again, we had thirty fire trucks in our little community of fifty houses. This is one year we'll pay our county taxes with gratitude.

### TV's DISASTROUS IMPACT ON CHILDREN

The above title comes from an article in the January 19, 1981, issue of U. S. News and World Report. We all have seen the "disastrous" effect it has on adults so we're not totally surprised to find it's harmful to children.

What does interest us is the convincing evidence that "TV appears to be shortening the attention span of the young as well as eroding, to a considerable extent, their linguistic powers and *their ability to handle mathematical symbolism.*" (Italics mine)

Anyone who has attended a Syn-Aud-Con class knows that we can write equations on the overhead projector but it's only when *you* pick up a calculator or slide rule and *think* through the problem that learning takes place.

To quote again - "Television can *never* teach what a medium like a book can teach, and yet educators are always trying to pretend that they can use television to promote the cognitive habits and the intellectual discipline that print promotes. In this respect they are *doomed* to failure. Television is not a suitable medium for conveying ideas, *because an idea is essentially language--words and sentences.*" (Italics mine)

Professor Postman, the author of the article, presents a persuasive argument that reveals TV as the Ayatollah of America.

### POTPOURRI

\*GLEN BALLOU reports making a helicopter noise tape (he works for Sikorsky Aircraft) of a take off, fly by, and landing using a Crown PZM™. He states that the recording was done in 20°F weather with 20 knot winds. Even when the helicopter flew directly overhead at 50' altitude, the wind noise was minimal. He concludes "Another good use of PZMs."

Have you tried Crown's PZMs with their phenomenal freedom from vibration pickup, wind noise, and shock? You'll be pleasantly surprised when you do.

\*\*Emilar (Tom McMahon, corporate vice president) tells us about a new ECH diaphragm that they are manufacturing for some of their excellent drivers. By eliminating an upward fold in their original diaphragm they gain about 2000 Hz more high frequency response.

One more proof that Emilar is not resting on its laurels.

\*\*\*Richard Heyser says that rather than saying "digital" and "analog" we could better describe the processes by saying "quantization" and "continuous".

\*\*\*\*HMElectronics and Swintek, leading manufacturers of excellent wireless microphones, will both use the PZM™ capsule in their systems this year.

## DR. JOHN DIAMOND AND THE N.Y.C. AES CONVENTION

The approach being adopted by the ad hoc digital community within the AES relative to Dr. John Diamond parallels the famous Senator McCarthy's tactics. Persons who get into public discussions relative to Dr. Diamond's work, through innuendo and inference, are left with the feeling that if they wish to avoid having influential enemies they'll forget all about Dr. Diamond and his investigation into digital recording.

Syn-Aud-Con was delighted, therefore, to have Dr. Diamond and his son as our guests at our suite in the Waldorf Astoria (the AES Convention hotel). Many of our graduates and others had the opportunity to meet Dr. Diamond, watch him demonstrate his "deltoid muscle" test with digital and analog recordings on many volunteer subjects, and to hear him discuss what he feels his demonstrations prove.

One of the effects (which he attributes to R.F. radiation - microwaves??) was the fascinating fact that everyone in our suite, except Ken Wahrenbrock, tested "weak" facing a certain window but as soon as a ring of other bodies interposed between the test subject and the window, they would again test "strong." Dr. Diamond suggests that the environment where the tests are conducted must first be tested to see that deleterious effects are not inherent in them.

Some test subjects are in a "state of reversal." By reversal, Dr. Diamond means that influences that should make you test "strong" make you test "weak" and influences that should make you test "weak" actually make you test "strong." To illustrate this interesting effect Dr. Diamond selected a test subject who had already tested "normal" on the digital-analog test. He then asked this individual to think of someone he loved. The subject tested quite strong. Dr. Diamond then asked him to think of someone he hated. The test subjects response was now jelly-like.

Then Dr. Diamond had this individual listen to one minute of a rock recording with an anapestic beat on a small portable tape cassette (two unstressed beats followed by one stressed). After listening for a minute, Dr. Diamond again asked the test subject to think of someone he loved. Now he tested "weak." Dr. Diamond then suggested he think of someone he hated again. Now the subject tested "strong." A complete reversal to the stimuli had occurred.

Dr. Diamond's comments on this were tempting to believe. He suggests that rock music causes a reversal in the body's signals that warn us of what is good for us and what is bad for us and, once the reversal occurs, drugs and other abhorrent behavior don't trigger the warning signs in the body in the normal manner. Just for a moment, suppose Dr. Diamond is correct. Frightening, isn't it!

Dr. Diamond made several medical diagnoses by having the test subject touch differing parts of their bodies while he tested their deltoid muscle response. He correctly called out ulcers, prostrate, and other disorders which in each case were confirmed by the test subject as medical problems they were dealing with.

### ACUPUNCTURE AND DELTOID TESTING

Dr. Diamond maintains that there is a close association between acupuncture and the deltoid muscle test. It is put forth that the network whose reaction time is degraded by these various "adverse" influences are along the acupuncture meridians. Obviously, Syn-Aud-Con is totally unequipped to make *any* kind of judgment about this part of the discussion and we would prefer to leave the medical implications of Dr. Diamond's work to others.

### SYN-AUD-CON'S PRESENT ATTITUDE

By becoming involved in even the simplest way with Dr. Diamond's demonstrations we have become convinced of the following:

1. There is so much money on the digital table (mostly still just out of sight residing in products about to be introduced) that if it were found to cause your sexual organs to atrophy the ad hoc digital community would accept that hazard as more to their liking than the potential financial loss of owning up.
2. There is *something* to Dr. Diamond's demonstration. Just *what* remains to be found out. We do know we can easily duplicate his claims with consistency (see article on San Diego AES Section meeting). We also are finding the deltoid muscle a very sensitive indicator of "which noise annoys rather than just which noise is loudest".
3. We hope that Syn-Aud-Con graduates will begin a verbal and letter writing campaign to raise the question to the public if another essentially Japanese based example of audio poor judgment is assaulting the market place (remember Quad?).

Is digital really at an acceptable level of technology to entrust treasured musical performances to its "weakening" clutches?



## SAN DIEGO AES SECTION MEETING AND THE DELTOID

I was asked to address the new AES Section in San Diego, California. Vic Hall, of Communications Company, San Diego, hosted the meeting in his recently acquired facilities. An attendance of approximately 60 was present for the meeting.

I presented a general review of some of our Syn-Aud-Con work and then chose to conclude with a demonstration of digital recording versus analog recording effects on the deltoid muscle of subjects chosen at random from the audience. Before discussing who Dr. Diamond is, I asked for a show of hands from those who knew of him. Then I asked for volunteers from among the group who had never heard of Dr. Diamond or the demonstration he presented at the May, 1980, AES Convention. One of Vic Hall's engineers then flipped at random the test record we are using - Vanguard VA25000 recording of Haydn's Symphony No. 100 in G Major (The "Military") which has one side recorded digitally and the identical material on the second side recorded analog - and without anyone knowing which side was up, placed the tone arm on the record for the first test. Let me reiterate the conditions:

1. The record used has the identical performance on *both* sides - one side recorded digitally, the other side recorded analog.
2. The operator did not know which side he chose.
3. Neither I nor the subject knew which side had been chosen.
4. The subject didn't know what was being tested.

### WHAT HAPPENED?

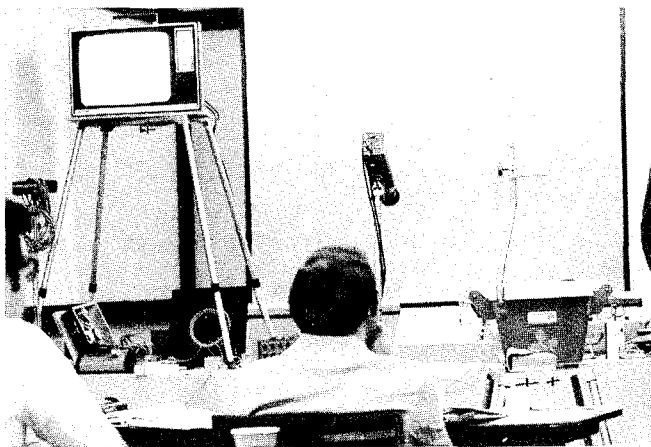
What happened was that each time we tried a subject and used Dr. Diamond's deltoid test, *as he has trained us to do*, all subjects tested "weak"\* under the influence of the digital recording and "strong"\* under the influence of the analog recording.

Those who feel that Dr. Diamond is some sort of manipulator should take note that our interest in this phenomenon is that of an interested amateur and we *are not* prejudiced toward either side of the argument. We are prepared to state that the deltoid muscle test is learnable by others and that *something*, indeed, does interfere with the deltoid muscle's reaction time capability when a so-called digital recording is played. We achieved 100% correlation during the tests performed at this meeting and our audience expressed no little surprise and concern over the logical ramifications that are obvious.

\*"Weak" in deltoid muscle testing means that when a light push on the outstretched arm is applied at a variable rate the subject is unable to "read" fast enough to counter the downward push.

\*"Strong" means that the subject is able to easily "read" faster than the variation in the pushing and the tester is unable to find a point between reactions where the arm becomes quite easy to push down. When the subject tests weak, the amount of force required to push his arm down is quite small. What happens is that his reaction time to each slight push just falls farther and farther behind the varying rate of push. A *steady* push on the arm gets the same results for either digital or analog recordings, but the rapid reaction response time seems to *disintegrate* in the subject under the digital influence.

## SUGGESTION FORMS (NO MORE TIME DELAY STORIES)



At the end of each class we ask you to fill out a Suggestion Form (unsigned) telling us what you liked about your class and what would have made it better for you. And we listen -- sometimes we act slowly, but nonetheless, we're listening. The picture shows one result of our listening. We have bigger monitors. Now we have the two large monitors plus the two smaller ones. All the class has a close monitor.

Since our very first class, Don has told his Time Delay stories. We have graduates who have attended as many as 7 classes. In a recent class, one such graduate said, "You sit down and I'll tell 'em." Don was temporarily put down, and there is one class out there that lives without the benefit of the Time Delay stories.

## "RF RADIATION: BIOLOGICAL EFFECTS" AND DR. DIAMOND

The IEEE Spectrum of December, 1980, included a special report entitled "RF Radiation: Biological Effects." Here are some quotes from the article.

"The core of the dispute has, from the start, been whether low level fields of radiation - fields too weak to cause gross heating of tissues - can cause biological effects. Most researchers in the United States worked initially from the hypothesis *that such effects did not exist* and that only thermal effects were hazardous. This led to the establishment of the U. S. exposure standards at 10mW/cm<sup>2</sup>.....standards that are now being lowered to 1mW/cm<sup>2</sup>."

Interestingly enough the Soviets have a 10uW/cm<sup>2</sup> standard or 1/1000th of the allowable U. S. exposure.

The article reveals that the "average" person in the U. S. (city dweller) is exposed on a daily basis to less than 5nW/cm<sup>2</sup> or 200 times less than the Soviet standard.

### WHAT'S NOT "AVERAGE"

1. Users of microwave ovens
2. Users of C.B. radios or other two-way radios
3. Living near a broadcasting station (FM)
4. Living near a radar installation
5. Users of R.F. sealing machines are in serious jeopardy

Some typical headings in the article:

"The Brain as an Oscillator"

This section discusses the *proof* the scientific community has gathered from carefully conducted experiments that show "that the brain functioned, in part, as a sort of exceedingly complex non-linear oscillator, producing slow electromagnetic waves and using them to integrate its own functioning *and to process sensory information.*"

Another heading states:

"Microwaves Affect Brain Function"

Several researchers have found that neurological illnesses among powerline workers may be traced to exposure to the powerlines' radiated energy. Further quotes:

"Soviet research has reported *immunological impairments* and behavioral and EEG changes at very low radiation levels especially at frequencies around 10 Hz."

"Exposure to unmodulated radiation, in U. S. research, led to similar results."

Further headings:

"ANSI Standards Criticized"

"Legal Liability Part of Issue"

And a further thought provoking quote:

"Top secret research.....in applying bio effects of R.F. radiation for "Mind Control" does seem to be going on at General Dynamics and perhaps elsewhere."

"The medical liability problem gives some insight into the radically differing approach to safety standards of the Soviet Union and the U. S. The Russians have tended to set standards very conservatively, knowing that tough standards do not add materially to the overall social costs of production and that they insure against all potential hazards.....In the U. S., however, there is a tendency to set standards as high as compatible with the avoidance of known and verified dangers, since as one ANSI sub-committee member said, 'Suits will be settled on the basis of these standards.'"

It's that kind of thinking that led to doctors at the turn of the century testing X-ray machines daily by using their hand - until their fingers fell off - then it came to the attention of the scientific community that something needed investigation.

Syn-Aud-Con strongly recommends that you go to the library and read this entire article.

Why is Syn-Aud-Con even interested in this article - are we afraid of the radiation from powerlines? No, it's not fear, rational or irrational, that motivates us but the beautifully clear example present in this article that 99.99% of those clutching the title "scientist" to their bosom are simply dogmatists and that those who first "sense" a new problem are regarded as "fools" by the establishment.

How fascinating it will be to hear the "I knew it all the time" stories, dressed in the "emperor's new suit" of "scientific" community approval, that will be broadcast when Dr. Diamond's "wild idea" is shown to the "doubting Thomases."

## CROWN PZM™ APPLICATION NOTES

Crown International is now providing PZM users with "Crown PZM Application Notes". The series currently offers (1) String Instruments, (2) Shaping the Pickup Pattern, (3) Basic Theory of PZM, (4) Piano, (5) Theater, (6) Percussion.

The format of these Application Notes is Questions and Answers. A little side note on these Application Notes states that:

"PZM Application Notes include suggestions for the placement of PZMicrophones™ in sound recording and reinforcement which have been used successfully. If you find that a different placement works better for you in a specific situation, please write us about it so we can update that particular Application Note. Thanks."

It's a good example of how to get people to "stretch the envelope."

For your set of Application Notes, write Crown International, 1718 W. Mishawaka Rd., Elkhart, IN 46517

## COMPENDIUM OF MATERIALS

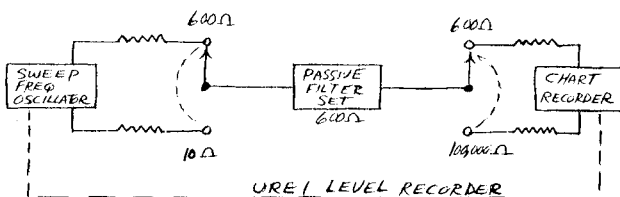
There are several books available from the government that are useful for the acoustician and the audio engineer. We have written about them in past Newsletters. The address and price have changed on the *COMPENDIUM OF MATERIALS FOR NOISE CONTROL*.

It is now available from U. S. Department of Commerce, National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22151 for \$18. (It used to cost \$4.50) If you are not familiar with this publication, we wrote the following evaluation of the publication in an earlier Newsletter:

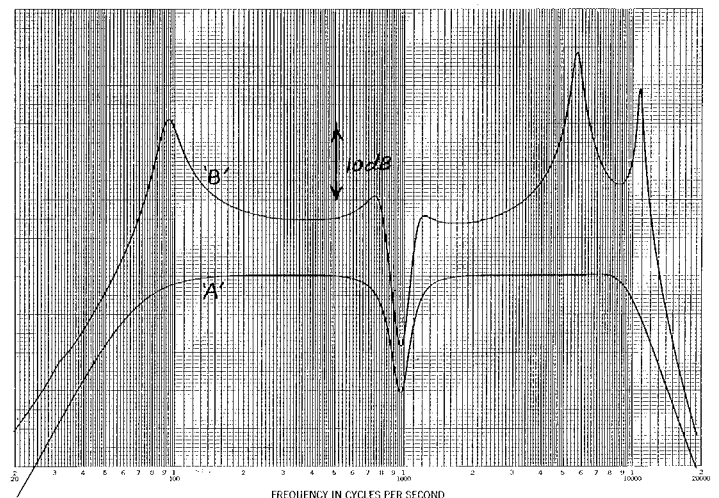
In addition to a very well written section on acoustic basics, it lists acoustical laboratories, manufacturers of acoustical materials and their addresses, all types of materials - glass, folding partitions, sound absorbing concrete blocks. There are sections of the book composed of Tables: Sound absorption materials, sound absorption systems, sound barrier materials, composite system for sound absorption and transmission reduction, sound barrier systems and specialized items. This is THE source book for everyone who ever asked "where can I get a set of absorption coefficients?". The book really meets a need of the professional sound engineer and belongs in his library.

## TERMINATING A PASSIVE EQUALIZER

### THE EFFECT OF FAILING TO BUILD OUT AND TERMINATE A PASSIVE EQUALIZER OR FILTER



1. Chart "A" made with switches in 600 Ω position.
2. Chart "B" made with switches in *non* 600 Ω position.



## "DIGITAL MUSIC MAKES ME WEAK"

Peter Sutheim offers the distinctive badge shown here as a way for those who wish to offer a silent suggestion to the digital community to clean up their act. It takes a certain strength of character to wear one of these badges as the "R&R" scientists (Rant and Rave) behave in unseemly manner on occasion. Uncouth behavior often stems from holders of "ultimate scientific truths" and Bronowski pointed out in the Ascent of Man that concentration camps are the final intellectual tool of such single mindedness.



With some of this in mind, we enjoy wearing our badge as sort of a *anti-Swastika* counterbalance to the digital Shogun group.

To obtain yours, write Peter Sutheim, 5146 Almaden Dr., Los Angeles, CA 90042. Peter has graciously agreed to make up the buttons for materials and postage. \$2 -- a small fee for such a noble effort.

## HOW MANY CUBIC FEET IN A CUBIC METER?

How many cubic feet in a cubic meter or, as the S.I. prefers, how many  $\text{ft}^3$  in a  $\text{M}^3$ ? Factor-Label to the rescue. For everything having to do with lineal measurements in the metric system and their conversion to the English system the only metric factor you need to memorize is that 2.54 cm equals one inch.

$$\frac{2.54 \text{ cm}}{\text{IN}}$$

Since there are:  $\frac{12 \text{ IN}}{\text{FT}}$  and  $\frac{100 \text{ cm}}{\text{M}}$  Factor-Label reveals:  $\left(\frac{\text{M}}{\text{I}}\right)^3 = \left(\frac{100 \text{ cm}}{\text{M}} \cdot \frac{\text{IN}}{2.54 \text{ cm}} \cdot \frac{\text{FT}}{12 \text{ IN}}\right)^3 = \frac{35.3 \text{ FT}^3}{\text{M}^3}$

What could be easier? Why stay in the English system in the first place!

## USING THE $y^x$ KEY ON AN H.P. CALCULATOR

The original H.P. 35 (the world's first scientific calculator) had an  $x^y$  key. All subsequent models have had a  $y^x$  key instead. The following exercise is useful in seeing why:

$$2^{12^3} = \left[ \left( 2^1 \right)^2 \right]^3 = e^{\left[ \ln \left[ \left[ \ln \left[ e^{\left( \ln 2 \times 1 \right)} \right] \times 2 \right] \right] \times 3 \right]} = 2, \uparrow, 1, y^x, 2, y^x, 3, y^x = 64$$

## A REQUESTED CLARIFICATION

PUDDIE RODGERS recently wrote us asking that we clarify a reference to her in our original letter to the AES Journal on Dr. Diamond:

"Ms. Rodgers brought to our attention the work of Wright, Hebrank, and Wilson. (Wright, Hebrank and Wilson, "Pinna Reflections as Cues to Localization," JASA, Vol. 56, No. 3, Sept. 1974, pp 957-962.) These authors found that when provided with adequate stimuli, the auditing system can mono-aurally detect delays as short as 20 usecs. When subjects were asked to discriminate between two delays, the average delay discrimination ranged from 5 to 8 usecs."

## HAAS EFFECT VIA INCREASED REVERBERATION

Dr. Hartmann, a professor of acoustics at Michigan State University, in a surprise paper at the Fall Acoustic Society of America convention in Los Angeles gave us all something to think about. He duplicated the Haas Effect on a two channel system using increased reverberation on one channel rather than increased delay -- Interesting!!

Dr. Hartmann says he will send us additional material so that we can duplicate the experiment in our classes, and also publish in our Newsletter.

## SMILE

You know you are dealing with a pro when:

His cassette deck costs more than his two mixers...

His mix location is one foot in front of the stage loudspeakers, and the sound man sings from that location

He expects one monitor to be loud enough for the whole band...

He wants only one mic on the drums "so they won't be too loud"...

He provides exciting sound effects by inserting his live mic into a Shure A53M donut during the performance.

BRUCE THAYER assures us that this all happened at one performance.

## BOOKS OF INTEREST

*ACOUSTICAL DESIGNING IN ARCHITECTURE*, by Vern O. Knudsen and Cyril M. Harris, is now available in a soft cover edition at a very nominal price -\$15.00. It is being republished by the American Institute of Physics for the Acoustical Society of America. The surviving author, Cyril Harris, has edited this new edition so that out-of-date material is replaced by the latest data.

Syn-Aud-Con has long recommended this book as one of the best basic texts available on architectural acoustics, and this latest version is even more useful. Extensive absorption coefficient tables are included in the appendixes at the rear of the book. Your copy may be obtained by writing the Acoustical Society of America, 335 East 45th Street, New York, NY 10017.

\*\*\*\*\*

"*The Right Stuff*" is a book by Tom Wolfe and is not about audio but about the original seven astronauts. That's interesting in itself but, like the seven dwarfs, who can remember all of them correctly? *You will* if you read this book! This guy, Tom Wolfe, pulls off the nearly impossible in this remarkable book. Anyone who ever phantasized about writing a book has to read this one and you'll say, "I couldn't have done that well."

Wolfe *captures* the essence - "The Right Stuff" that test pilots, racing drivers, professional big game hunters, and Texas Ranger-types exude. This author doesn't just outline it; he constructs interconnected real life events into a net that enmeshes the reader in hopeless slavery until the book is completed. I checked with a most legitimate possessor of "the right stuff" who was at Edwards Air Force Base during the X-1 and X-15 rocket ship days and knew the principals involved. This man states that what Tom Wolfe reports is accurate and true to the men described.

One caution is necessary. You won't necessarily care for the first 43 pages but they must be read if you are to understand what is to follow. Don't be put off by the beginning. Wolfe had real integrity to risk losing his reader in order to tell the truth. Because he does so with such honesty and perception, those of us far removed from such scenes begin to catch just a glimmer of the light we need to illuminate the seven principal characters he writes about.

Starting at page 44, the chapter, "Yeager," will leave you unable to put the book down. It has been my privilege to know men similar to Chuck Yeager through my interest in auto racing and police work. I've seen "the right stuff" literally cow mobs; and any devoted fan of A. J. Foyt doesn't have to have "the right stuff" explained to him in detail.

Many men are brave; many men are skilled; many men are patriotic; and many men bow to the higher power. The men who get it all together in one well-balanced package are what this book is all about.

Wolfe likens his subjects to the "single combat warrior"; those who stepped out in front of the armies in ancient days and fought in single-handed combat the enemy's champion - Buffalo Bill Cody galloping ahead of the troops to meet Chief Yellow Hand head-on and take the first scalp for Custer; Frank Hamer walking into a courthouse full of armed murderers and telling them, "I want you and you and you and the rest of you get out of here," and they did.

Can any of us ever forget the emotional wave that swept over us when John Glenn returned from single-handedly challenging the Russian space supremacy - that's how we saw it at the time.

While each generation is positive theirs is the last to have a full share of "the right stuff," both experience and books like this says that each generation will rise to meet its challenges.

Syn-Aud-Con feels you'll miss a great deal if you fail to read this book (now available in paperback).

\*\*\*\*\*

We recently read the new *INDY: RACE AND RITUAL*, Presidio Press, P O Box 3515, San Rafael, CA 94901. By Terry Reed.

Having written stories on the Indy Race that were good enough to be reprinted in the 50th Anniversary program, I consider myself qualified to judge, at least, the authenticity of feeling the race generates.

Terry Reed has accomplished the difficult task of covering accurately the main facts that, when taken as a whole, convey the "feeling" Indianapolis can stimulate in the "faithful".

The Indianapolis 500 is a peculiarly American affair. It's of interest that the crowd's reaction at Indianapolis is about as all pervasive as was the crowds at Nurnberg in Hitler's day. What's important is the difference in events necessary to reach the subconscious of the two nationalities. We don't think it is an accidental relationship (no pun intended) but more than likely the affirmation of the right to dare all and expect to win vs the worship of mass force and death orientation.

In any case, *INDY: RACE AND RITUAL* covers a lot of subliminal ground with relevance..

## ARTICLES OF INTEREST

Researching the literature is one of the greater pleasures in life, provided one's experience has supplied an early warning mechanism tuned to when to independently verify and when to believe data as presented. For example, once we have independently confirmed in our own thought that Dr. Diamond's theories have a basis in physical science we have become sensitized to every citation in the literature that seems to correlate with our now personal experience with the subject. Thus, while reading a Journal of the Acoustical Society of America article by Manfred R. Schroeder, Vol 68, No 1, July 1980 we found the following exciting information on page 27:

Things become even more exciting when pitch and location of tones are closely interwoven, as in the astounding experiments of D. Deutsch. She puts a high note into one ear and a low note into the other ear and then alternates high and low notes. (Editor's Note: that is, the right ear hears a low note while the left ear hears a high note, then the right ear receives the high note while the left ear gets the low note. The tones appear alternately at each ear but never the same tone at the same time in both ears.)

And what does the listener hear? Well, his brain apparently acts as a switch-yard: All the high notes seem to come from the right ear and all the low notes from the left.

Fascinating! If you don't believe it, try it out on yourself. The experiment is easy to do, but you'd better be right handed.

Mentioning this reference to TED UZZLE brought forth an avalanche of references plus his copy of Ms Diana Deutsch's article, "Musical Illusions" which appeared in Scientific American.

An excerpt from a typical Uzzle casual note is reproduced here:

How co-incidental you should direct me to page 27 of the ASA \*50 papers (or actually it was Don's letter you read me over the telephone). I hadn't read Schroeder's paper in full, only the condensed version in Physics Today. Anyway, I immediately recognized Diana Deutsch's work. You will be very interested in her interaural work, described in her article, "Musical Illusions," Sci. Amer. 233(4), 92 (October 1975), which is enclosed. I am sending you the entire issue rather than a Xerox because you need to be able to see the illustrations in color to make sense of them. Please return the issue to me when you are done with it.

Ms Deutsch (who by the way works right down in San Diego) has more recently reported on her work in "Lateralizations by Frequency for Repeating Sequences of Dichotic 400 and 800 Hz tones," J. Acoust. Soc. Am. 63(1), 184 (January 1978), and in her very recent paper, "Ear Dominance and Sequential Interactions," J. Acoust. Soc. Am. 67(1), 220 (January 1980). Her hypothesis seems to be that her test signals are ticking exactly that cortical mechanism that permits us to understand speech through echoes and reverberation. Her Scientific American article might make a good Tech Topic.

By the way, in the January 1978 issue of J. Acoust. Soc. Am. cited above there is another article, " 'I/f noise' in music: Music from I/f noise" by Voss and Clarke, which was the subject of the "Mathematical Games" column in Scientific American in April of that year. Excellent, excellent work!

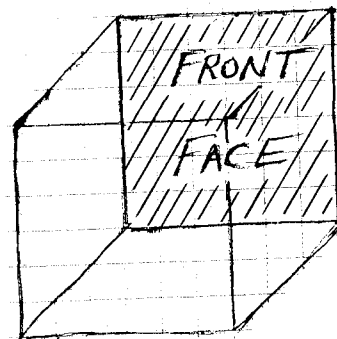
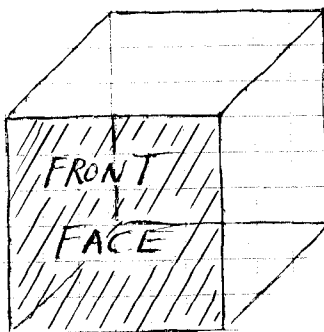
It will be quite some time before word processing manufacturers can offer an Uzzle software package for the less erudite.

In her Scientific American article Ms Deutsch offers an excellent optical example of the activation of the brain's switching mechanism by way of the "Necker Cube" in which the back face periodically becomes the front face. In both this visual illusion and the auditory one, reversals occur spontaneously.

Elsewhere in this Newsletter is a reference to Dr. Tsunodas work on the cerebral hemisphere processing of differing sounds.

Now, back to the Dr. Diamond theory. Why should it seem foolishness to any impartial observer that the rapid switching rate of digital processing might indeed manifest itself muscularly.

What, to Syn-Aud-Con, is the ultimate foolishness is to disregard such clues and wait for an audio version of Ralph Nadar to really do the job on digital after everyone has made major investments in it.



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WANTED: Used HP41C

Syn-Aud-Con will pay \$150 for used HP41C calculators in good condition. We're gradually replacing our HP21's. Call or write.

- FOR SALE: GenRad 1982 Analysis System - complete. Like new - maximum usage 8 times. Case, tripod, complete. New unit sells for approximately \$3500. Price \$2500. Contact Capital Communications, P. O. Box 481, Olympia, WA 98507. Telephone: 206/943-5378
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- FOR SALE: Ordered 2 by mistake - Radio Shack TRS-00 personal computer (pocket size) with interface and minisette-9. New. Retail for \$378.90 - yours for \$300.00. Contact: John Odum, Route 3, Elkton, KY 42220. Telephone: 502/277-9922.
- FOR SALE: 800 watt Altec 9440A (rarely used) \$475.00 - Shure, AKC, Altec mics - Sescom in-line attenuators - Barcus-Berry hot dots and guitar mixers - lots of other goodies. Send self-addressed stamped envelope for complete listing to: John Odum, Route 3, Elkton, KY 42220.

## EMPLOYMENT OPPORTUNITIES:

Position Open: Professional Sound Design and Sales. Wide open market. Good pay and company support. Contact: Bruce Thayer, WMT Music & Sound, Cedar Rapids, Iowa. Telephone: 319/395-6151.

Position Open: Audio and Sound System Design Engineer. Progressive audio company, designing, installing and testing 50 auditorium sound systems a year. Knowledge of testing methods, room acoustics and audio systems desired. Excellent opportunity in exciting field. Contact: Ford Audio and Acoustics, Inc., 4800 West I-40, Oklahoma City, OK 73108. Telephone: 405/946-9966.

## ERATTA

MARK LAFFIN, a student at Purdue University, caught a typo in Newsletter Vol 7 # 3, page 21, "Using a Voltmeter to Measure....."

Now reads: 8. Calculate Z:  $Z = \frac{V}{I}$

Should read: 8. Calculate Z:  $Z = \frac{V_Z}{I}$

\*\*\*\*\*

GLEN BALLOU pointed out another typo, Newsletter Vol 8 # 1, page 22, "Calculating Resonant Frequencies", the second formula

Now reads: .0083

Should read: .00083

\*\*\*\*\*

Glen would also like us to correct a couple of mistakes in the "Instructions for Sound System Design Worksheet", Volume 8, No 18, page 4 in the answers to Sample Design Problem. We didn't have time to check out his corrections. Would appreciate hearing from others with your thoughts on how to make the problem clearer.

If you noticed more than usual number of typos in spelling in Vol 8 # 1 Newsletter it was because we rushed it to the printers without our marvelous proofreader, Helen Range. The Newsletter always gets two proofings before it gets to Helen, and the last Newsletter was an example of how many she finds, even after two proofs.

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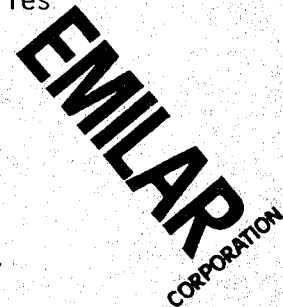
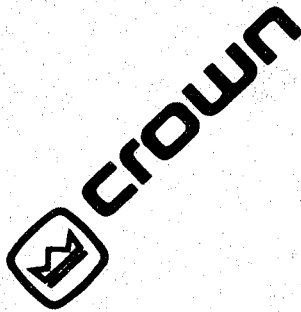
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Their presence on this list as a Syn-Aud-Con sponsor indicates their desire to work cooperatively with you in professional sound.

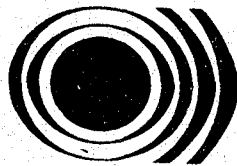
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