



newsletter

P.O. BOX 1134, TUSTIN, CALIFORNIA 92680

VOLUME 4, NUMBER 3

April, 1977

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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

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 Volume 4, No. 8 - Grounding Procedures by Reg Parsons
 Volume 4, No. 9 - The Multi-Use Dilemma by H. Chaudiere & D. Klepper
 Volume 4, No. 10 - Comparison Method of Measuring "Q" by Alan Lubell

SYN-AUD-CON SPECIAL CLASS FOR COMMUNICATIONS COMPANY IN SAN DIEGO

In the past 4 years, Syn-Aud-Con has conducted special in-house seminars for:

Griffith Air Force Base Communications Group - 2 classes, Rome, NY
 United Recording Equipment Industries (UREI), N. Hollywood, CA.
 United Technologies, Hartford, Conn.
 Sunn Musical Equipment Co., Tualatin, OR
 Hollywood Sound Systems, Hollywood, CA.
 Crown International, Inc., Elkhart, IN
 Disney World, Orlando, FL
 Disneyland, Anaheim, CA
 Shure Brothers Inc.

and the latest, COMMUNICATIONS COMPANY of San Diego, CA.

COMMUNICATIONS COMPANY and President, VIC HALL, are well known to Syn-Aud-Con graduates because of their work in developing the ARA 412 real time analyzer and the RT₆₀ reverberation time meter. (By the way, COMMUNICATIONS CO. has a streamlined rack-mounted version of the ARA 412 available now.)

Vic Hall is also the developer of the table for rapid estimation of the number of overhead distributed loudspeakers needed (Table 6-2, page 102 of *Sound System Engineering*.)

Vic arranged for 21 of his employees and selected guests to attend the 3-day Syn-Aud-Con class.

This was a particularly interesting class to Carolyn and me inasmuch as Vic and his key personnel have extensive experience in advanced design projects, equalization, and real time analyzers. Because of the highly skilled engineering personnel at COMMUNICATIONS COMPANY, they perform many of the modifications to the equipment we use in classes.

Of particular interest to Vic's people is the design problem of predicting in advance of assembly the effective Q of arrays. They had many interesting insights regarding this problem. When we hold our special Syn-Aud-Con graduate class to explore this subject, COMMUNICATIONS COMPANY will be represented.

A complete sound systems installer's manual could be put together illustrated by sound systems designed and installed by COMMUNICATIONS COMPANY during the past 30 years. The same integrity, intelligence, intuitiveness and innovativeness that brought the RT₆₀ and ARA 412 into being has been brought to bear on the design of sound systems.

These special classes such as held for COMMUNICATIONS COMPANY must of necessity be limited to the larger companies with sizable staffs. To those companies able to support such special classes, the rewards are many.

WOMEN IN AUDIO

We ran our first "Women in Audio" in 1974 when MARY GRUSZKA and MARY LOU FRANTZ joined our Syracuse class. Since then we have had many women graduates, not as many as we would like but enough to indicate a trend. Our very youngest Syn-Aud-Con graduate is Pye Clark (14 in 1975). We take a special interest in having women in our classes because of Carolyn's interest which goes back to 1951 when we started our high fidelity store together.

Women & Engineering

Here's something that might be of interest to you. It's something that at first I thought I was probably imagining, but every day becomes more evident... that is, the lack of women interested in practically any facet of stereo knowledge—much less recording.

I find that I can rap for hours with people at work—providing they are male—about equipment, developments in engineering—practically anything, and be fully entertained—and yet, if I mention the subject to any of my women friends—I either draw a complete blank or a yawn.

Maybe it's only the Detroit area, but I think it's a shame that such an interesting field should be overlooked by most women—if it's not in *Glamour* or *Seventeen* it's just not important to them.

—Helen Michals
 Detroit, Mich.

Equalized Women

In coming across a copy of your magazine in Electric Lady Studio last month, I thought, what a pretty interesting magazine, except one thing—Ms. Helen Michaels, from Detroit, Michigan, in your letter section.

I would just like to say one thing. Obviously Ms. Michaels is talking to the wrong person(s). I am a sound engineer (or to be pointfully specific, a female sound engineer!). I mix and sound trouble shoot for Arista recording artists Gil Scott-Heron, on all road gigs and help with their recordings. I've become respected by my male counterparts with many sound companies, and I am looking forward to working with other artists on the road as well as in the studio (my current move).

But I am not alone. There is a female sound engineer at Paul's Mall in Boston, Mass. She handles (mixes and repairs) all sound problems (and is damn good too, I might add), in both club rooms. There is also a sound company (Audio Unlimited) in Greensboro, N.C., that has two good experienced women working with them. So in short, it's a matter of who your friends are. I'm sure that Trish Russel of 'Unlimited' would be glad to talk with you further on this important subject, as well as I. You just have to dig sometimes if it's important enough.

Oh, by the way, I read *Glamour* too!

—Ms. Nyia F. Lark
 1927 Marthas Rd.
 Alexandria, Va.

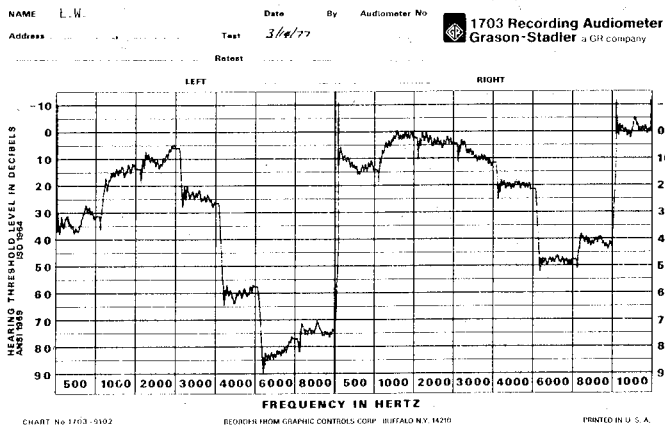
When Carolyn became a member of the AES it was a rarity to see women in the technical sessions. (Carolyn sent in her application for membership in 1968 they returned it with an invitation to become an Associate Member to which she replied that she wanted to be a full member, feeling that her knowledge and years in the industry justified full membership. And she backed up her request with reference signatures from Dr. Leo Beranek, Dr. John Hilliard and Arthur C. Davis.

All this is being written because of a couple of Letters to the Editor in MODERN RECORDING -- one from our beautiful two-time graduate, NYIA LARK

SYNERGETIC AUDIO CONCEPTS

AUDIOMETER TESTS

We have been using a GR Grason-Stadler 1703B Recording Audiometer in Syn-Aud-Con classes since early Fall, 1976. While we are not trained interpreters of the hearing tests, we have observed that exposure to certain kinds of noise typically results in a predictable hearing loss. The most noticeable and dramatic example is the users of firearms.



In this case, about 15 years ago L.W. was out hunting with his younger brother who abruptly rested his 30-06 on L.W.'s shoulder and fired. L.W. said that he suffered intense pain for weeks and was aware of a hearing loss from that time.

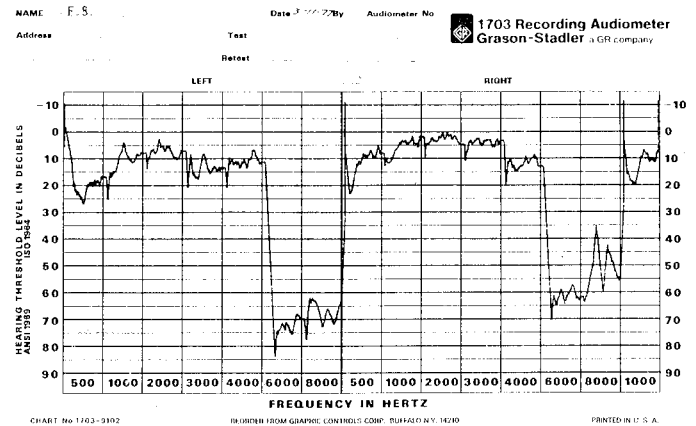
We have heard some real horror stories, such as a very young man in our Nashville class told of being on reserve duty this summer on aircraft carrier. He was assigned to do some service work right under jets as they lifted off. He said that his ears bled. His hearing loss was 50-60 dB from high to low frequencies in both ears.

During our class at COMMUNICATIONS COMPANY in San Diego, Robert Gales from the Naval Underwater Research in San Diego was able to spend some time with us. He remarked that one urgent research project needed is to find a way to determine who has "sensitive" ears and who does not; that is, who will be able to listen to sonar beeps at loud levels and not suffer damage to the hearing. In other words, who has stainless steel eardrums.

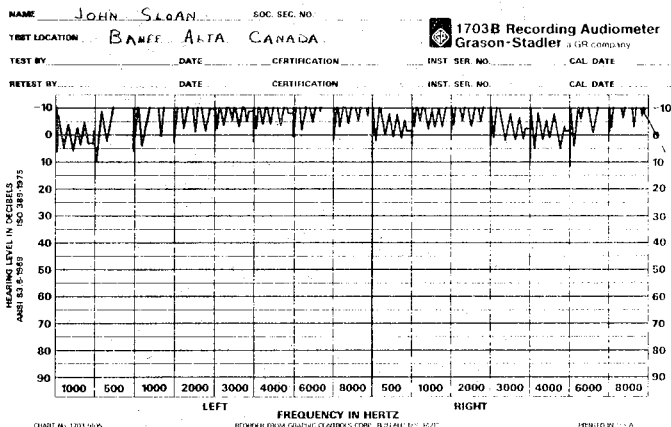
We think we met a man. MAX HALL, who runs Meeting Services at COMMUNICATIONS COMPANY is in his 50s. By looking at his hearing test you would not be able to perceive that:

1. He had scarlet fever when he was 7 and completely lost his hearing for several weeks.
2. Served in World War II, firing 90mm anti-aircraft guns
3. Starting in 1963, worked rock-rentals for Jimmy Hendrix, Janis Joplin, The Doors, Jefferson Airplanes, bowing out of rock rentals in 1973.

Max has to have the stainless steel eardrums. In his mid-50s he has less hearing damage than F.S. who is in his mid-20s and L.W. both of whom are aware of only one incident that resulted in their hearing damage.



F.S., now active in audio and a young man, is an ex-policeman. F.S. was in an indoor firing range when the man next to him unexpectedly fired a 45 revolver several times. He had an immediate loss of hearing in both ears and on duty that night was not able to hear radio communications. F.S. said the pain was almost unbearable.



JOHN SLOAN in our class at the Banff Fine Arts Center in Alberta represents the other end of the scale -- someone who has protected his hearing and is 5 to 10 dB better than normal. In fact, our class in Banff (42) tested on the average much better than other classes as a whole, which says something for the quiet of the Canadian prairies and mountains.

SYNERGETIC AUDIO CONCEPTS

NEW CALCULATING WRIST WATCH

National Semiconductor has brought out the first calculating wrist watch that has offered scientific capabilities.

It is rumored that H.P. and others are working on precision wrist watch calculators. As far as we are concerned National Semiconductor is way out in front with this unit. Anything less isn't worth the trouble. Naturally we would like to see it work first, but the promise is surely there.



WRIST CALCULATOR: A scientific calculator is included in this continuous display digital watch carrying a \$350 retail price from National Semiconductor. As a dual backlighted watch it displays time of day with seconds counting, and on command, will display AM or PM, month, day and date. And, also on command, it becomes a six-digit calculator providing algebraic logic, logarithmic and trigonometric functions, exchange reciprocal, scientific notation and storage/recall memory.

ENIAC COMPARED TO H.P. 97

To really appreciate the speed at which the digital revolution is happening, here are a few facts about ENIAC (Electronic Numerical Integrator and Computer) that MIKE JORDAN from Communications Company shared with us from a book he was reading. ENIAC, the first all electronic computer, was first turned on in December 1945 and was used until 11:45 p.m. October 2, 1955 when it was placed in the Smithsonian Institute.

ENIAC had 18,000 tubes (19,000 tubes were replaced during the first year's operation) 70,000 resistors, 10,000 capacitors, and 6,000 switches.

ENIAC was 100' long, 3' deep, and 10' high. It weighed 30 tons. ENIAC was housed in 40' rack cabinets and had 15,000 relays. Its power consumption was 140,000 watts.

The first problem presented to it was successfully solved for Los Alamos and it is so far as we know, still classified.

The H.P. 97 weighs 2.5 lbs, works off a 5 volt battery pack and consumes 2 watts; it is 2.5" high, 9" wide and 8" deep. It contains well in excess of 100,000 equivalent transistor circuits. My H.P. 97 was placed in operation in November 1976 and has had no service since. The H.P. 97 has a larger data memory capacity than the ENIAC with a larger program memory as well.

Just 31 years resulted in a battery operated 2.5 lb. ENIAC. Any speculations as to what we will be using in 2008? ENIAC in a wrist watch??

SYN-AUD-CON VISITS SUNN MUSICAL EQUIPMENT COMPANY

On our way to the very fine Seattle class we stopped by Tualatin, Oregon for our annual visit to the Sunn plant. LARRY LYNN, their new president, formerly vice president, marketing, and GREGG HILDEBRANDT met with us just before leaving for the European music show in Frankfurt, Germany. Chief Engineer, ROD GOLDDHAMMER, went over the new 2000 series Magna Mixers with us in some detail as we are now using them as one of the Mixers in our Syn-Aud-Con classes.

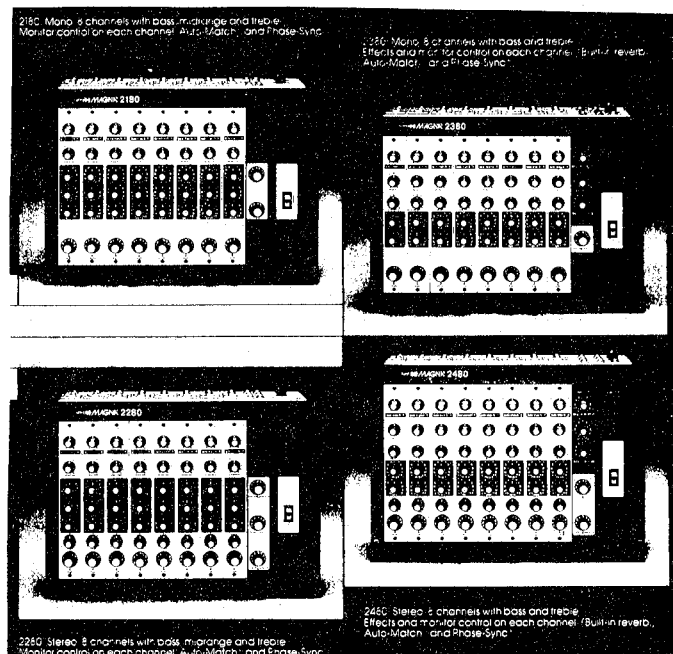
Sunn's Auto-Match^R control is one of the most interesting approaches to handling input overload and, subsequent level matching, through the remainder of the system that we have encountered. An LED tells you when you have overloaded, either at the front end or elsewhere in the Mixer. The Auto-Match^R control is then adjusted until the light goes out.

The new Magna Mixers are totally modular in construction and one of the units we are using includes 8 inputs, two outputs plus monitors, reverberation, pan pots and full tone controls for each input (featuring Phase-Sync^R for better phase relationships in the tone control interaction).

The pricing is really right on the new Magna Mixers. Gregg Hildebrandt can give you more information about them.

We'll be reporting further on these units as we gain experience with them in subsequent classes.

We were pleased to see Sunn, now in their 4th year of Syn-Aud-Con sponsorship, very busy with many new ideas and products such as the Series 2000.



SOUND REINFORCEMENT PAPERS AT AES IN LOS ANGELES

There were so many papers submitted to Carolyn's Sound Reinforcement session at the Los Angeles AES that the session was divided into a morning and afternoon session with CECIL CABLE of Edmonton, Canada taking the morning session (Sound Reinforcement: Applications) and Carolyn taking the afternoon session (Sound Reinforcement: Equalization and Instrumentation).

The Morning session: (not in correct order)

1. The "Wurst" Sound System, Kenneth R. Dickensheets, Boner Associates, Austin, TX
2. Discotheque Sound Systems: Design and Development, Paul D. Colvin & Gregory Long, Audio Specialists, San Diego
3. A Multi-Source Digital Delayed Sound Reinforcement System for a Large Gothic Cathedral by Keith Worsley, Lectrik ProMedia, Oakland, CA
4. A Rational Approach to the Design of Stage Monitor Systems, Dave Hadler, Boulder, CO
5. Ground & Shielding Techniques for Portable Concert Reinforcement Systems, Kevin Cousineau, SmokeRider's Sounds, Lompoc, CA
6. Innovations in a Stadium Sound System Design, Edward S. Seeley, Consultant, Los Angeles, CA
7. Reverberance for Organ and Clarity for Speech, Charles Catania, Consultant, San Raphael, CA
8. Modular Designs for Portable Mixing Consoles, Robert Heil, Heil Sound, Marissa, IL

Afternoon Session:

1. Electronic Detection of Acoustic Feedback and Automatic Sound System Gain Control, Dr. Eugene Patronis, Georgia Tech, GA
2. Envelope Method of Equalization, RALPH H. GIBSON, Consultant, New Hartford, CT
3. Time Delay Spectrometry Investigation of Regenerative Sound Systems, CECIL R. CABLE, Consultant, Edmonton, Alta
4. Use of a Continuously Variable Logarithmic Sweep Function Generator in the Regenerative Response Equalization of Sound Systems, Don Davis
5. Utilization of a New Time-Gated Spectrum Analyzer to Measure Sound System Effectiveness, JOHN PROHS, Audio Video Dept., Ambassador College
6. A Simplified Equalization Analyzer, BILL BEVAN, Shure Brothers Inc., Evanston, IL
7. Low Cost 1/3-octave Real Time Analyzer, Robert Thurmond, Consultant, Austin, TX.

While we have not seen the preprints, we know enough about many of the papers, particularly the afternoon session, to know that it will be a day well spent for the audio professional.

USE OF A SWEEP FUNCTION GENERATOR IN EQUALIZATION

In several of the recent classes we have been experimenting with a new form of the regenerative response method of equalizing a sound system. This new technique consists of obtaining a general shape of the house curve desired, followed by the introduction of an Interstate Electronics Type F47 function generator adjusted to give a rapid repeated logarithmic sweep over a wide frequency range. The sweep is adjusted to repeat at a rate close to that of the RT_{60} at mid-range (at least in well damped rooms this has been the case in the spaces we have worked in.)

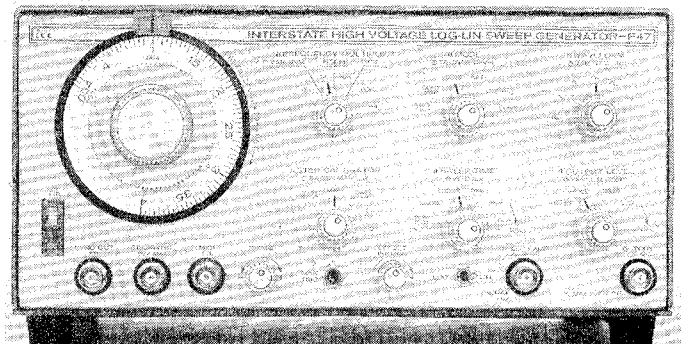
As the sound system gain control is raised towards regeneration and the level of the sweep is adjusted proportionally in several cases a distinct "gong-like" sound is heard as the sweep shock excites a frequency that wishes to "ring" longer than adjacent frequencies. This type of signal appears to excite this particular non-linearity in the system with much greater precision than any of our previous methods.

We will be reporting on this technique in much greater detail as the year progresses and we experiment with it on many systems in differing acoustic environments. In some rooms such instabilities in the system do not appear as markedly as in others; therefore, the technique is easily overlooked if tried in the wrong set of circumstances. Once the "gong-like" sound has been heard and the clarity of its being removed by filter adjustment is also heard, the function generator is likely to become a standard auxiliary source for tuning work.

Normally the frequency that near regeneration becomes non-linear under the excitation of this rapid sweep *will not* in the absence of the sweep be the next frequency to feedback if the overall gain is raised. The effect as described by Cecil Cable is the result of a *coherent* addition of a cluster of room modes and an early reflection from a nearby surface with the sweep signal and thus may or may not occur when excited by either ambient noise or program material.

THE INTERSTATE ELECTRONICS CORP. F47 FUNCTION GENERATOR

The function generator we have been using to experiment with in the new method of sinewave rapid logarithmic sweep regenerative equalization is the Model F47 high voltage Log-Lin sweep generator. This unit works well for such equalization by allowing the sweep to be set to begin and stop anywhere between 20 and 20,000 Hz, have its sweep rate varied from 10 microseconds to 100 seconds, and allowing either continuous sweeps or manually triggered sweeps. Output levels are fully adjustable from well below -60 dB/1 volt to 20 volts into 50 Ω (8 watts) or 40 volts open circuit. There are a wealth of other features that make this one of the most versatile signal sources we have used. If interested in pursuing further, you can write Interstate Electronics Corp., Dept. 7000, Box 3117, Anaheim, CA 92803 and ask for their detail-packed brochure on the Series 40 function generators.

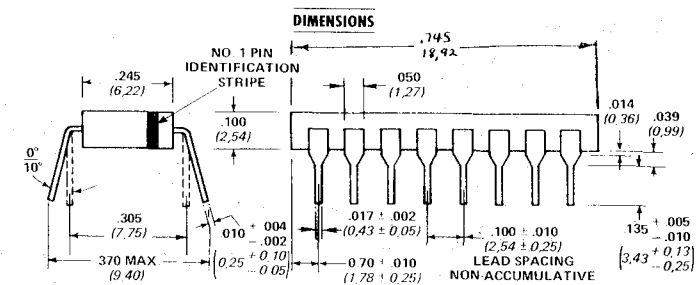
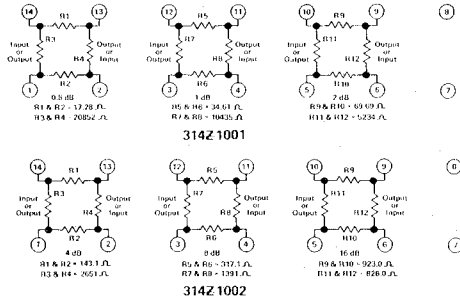
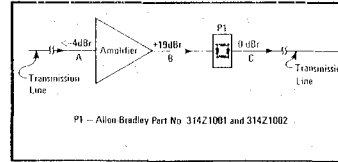


SYNERGETIC AUDIO CONCEPTS NEW PACKAGED PADS FROM ALLEN BRADLEY

MIKE HOOVER, Audio Technical Services, Vienna, VA (D.C. 1975 and Nashville 1976) told us about a new product from Allen Bradley, so we wrote for samples and literature. They have introduced a most useful balanced attenuator for adjusting levels in link circuits. The convenient D.I.P. packaging and the electrical versatility combine to make an extremely useful component for professional sound system work. See your nearest Allen Bradley distributor, or write Allen Bradley, Electronics Division, 1201 South Second St., Milwaukee, Wisconsin 53204.

Network	Resistor Tolerance	Temperature Coefficient of Resistance (ppm/°C)	Power Dissipation Rating (Up to 70°C Ambient)	Operating Temperature Range	Characteristic Impedance	Attenuation Tolerance (dB)	Attenuation Change Due to Temperature	Frequency Response
314Z	±1%	±200	150 mW/attenuator at 70°C +21dBm	0°C to +70°C	600 ohms	±1%	±1% Additional	Flat to 1 MHz

At 70°C power derates linearly from full rated power to 0 wattage at 130°C



THROW AWAY EAR PLUGS

BOB HATHAWAY, Walt Disney Productions (special Disneyland class 1976) gave us some throw-away ear plugs which he used during his private flying. They are made of a "unique formed polymer" which is rolled down to a very small size, put in the ear and it expands to fill the ear. Can be used several times (I pour boiling water over a pair to clean them). We wrote the manufacturer: E.A.R. Corp. and they sent sent us the name of a local distributor who, in this case, sold a pair, in quantity, for 11¢ each. An audio man would have a lot of uses for such ear protection where it was not feasible or diplomatic to be seen wearing a set of DAVID CLARK hearing protectors.

E.A.R. Corporation
A subsidiary of E.A.R. Corporation
376 university ave. • westwood, ma 02090
telephone 617/329-3950



THE WORLD'S SMALLEST MICROPHONE

Knowles Electronics has announced the world's smallest microphone, the EA series. The sheet they announced it on has the world's smallest print. Dimensions (as best we could tell under a good magnifying glass) are: 0.090" x 0.220" x 0.157".

Believe it or not, they utilize an improved electret film and integral FET amplifier to provide an acoustic sensitivity and impedance that ease application. Hiding these microphones in olives should be easy. Where to find cable as small may be hard. Send for EA series data sheets to Knowles Electronics, 3100 N. Mannheim Rd. Franklin Park, ILL 60131.

EMILAR MOVES TO A NEW PLANT

Good News for those who have Emilar drivers on backorder. Emilar has moved into a new plant where they will be able to produce 500 drivers a month. Their new address is: 2837 Coronado St., Anaheim, CA 92806. Phone 714-632-8500.

OSHA AND AIR BAGS

OSHA needs to hear about what the Dept. of Transportation plans to do to us. The current airbag undergoing tests in some car fleets generate 167 dBA (duration 300 ms) while expanding.

While this is not the only air bag supported by the government, it's obvious that we need protection from federal wind bags, literally and figuratively.

TABLE II
COMPARISON OF INFLATED-BALLOON AND
BREATHING AIR CUSHIONS (WINDOWS CLOSED)

	A-duration ms	A-peak dB (psi)	B-duration ms	B-peak dB(psi)
Inflated- balloon air cushion	300	167 (0.64)	60	159 (0.25)
Breathing air cushion	300	160 (0.30)	75	151 (0.10)

**It should be noted that air-cushion systems currently being installed reduce the overall risk of auditory damage by varying the rate of inflation of the cushion according to the impact velocity

SYNERGETIC AUDIO CONCEPTS
TIME-ALIGN™ TECHNIQUE BY ED M. LONG

It is our opinion that a significant advance in the quality of monitor loudspeakers has been achieved during the past year. The developer of the basic idea is Edward M. Long of Oakland, CA who demonstrated his technique, TIME-ALIGN™ to our San Francisco class in mid-February (with RON WICKERSHAM's help.)

One aspect of the demonstration was particularly dramatic: the coherence established during the switching of polarity of a single channel system. The difference in polarity was readily detectible when the program material was the human voice. The difference heard was due to the non symmetrical nature of the acoustic wave form of speech. Failure to polarize a single channel so that the waveform was correctly reproduced was clearly audible on the TIME-ALIGN™ system.

TIME-ALIGN™ TECHNIQUE is a real time design method, utilizing proprietary instrumentation, which allows the driver placement and network parameters to be adjusted simultaneously to achieve near perfect alignment of the frequency components of a complex waveform as heard by a listener.

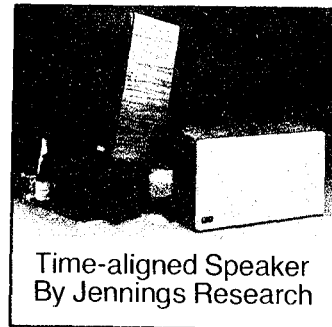
Ed has requested that any of us discussing his technique help him protect it by calling it by its proper name and indicating in any of our writings that it is trademarked by E. M. Long Associates.

UREI is licensed by E. M. Long Associates and will demonstrate this improvement in coaxial monitor loudspeakers during the West Coast AES Convention in Los Angeles in May.

A "New Products" release by Jennings Research indicates why Ed Long is asking for help to protect his name and invention.

"A two-way system with the woofer and tweeter voice coils lying in the same mounting plane to eliminate differences in arrival time of their outputs" has NOTHING to do with the TIME-ALIGN™ TECHNIQUE, nor does "the woofer and tweeter voice coils lying in the same mounting plane" eliminate differences in arrival times of their outputs. It is far more complex than that!

Since the ad by Jennings Research appeared Mr. Jennings has expressed his apology to Ed Long indicating that he was unaware he was using a Trademarked name.



□ Jennings Research has announced its first "time-aligned" product, the Contrara Vector One, a two-way speaker system with the woofer and tweeter voice coils lying in the same mounting plane to eliminate differences in arrival times of their outputs. In addition, the recessed tweeter (a 1-inch dome design) is housed within a hollow of acoustically absorbent plastic foam intended to control diffraction effects and other reflections of its acoustic output

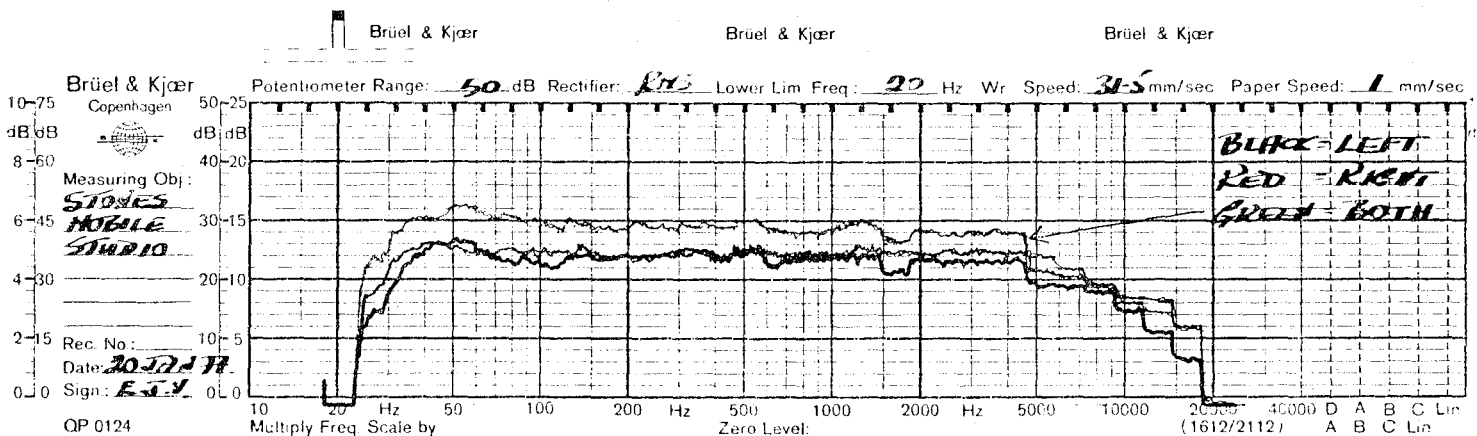
LETTER FROM EDDIE VEALE

Eddie Veale is a noted acoustical consultant in England.

"Dear Don,

"My work with monitor systems still progresses and I have six London studios who engage me on a permanent basis to check and align their systems. All except one, who uses JBL 4350's have hybrid or modified systems; all are equalized...

"I recently concluded the refurbishment of the Rolling Stones Mobile and recorded the monitor performance.



"The monitors are the Altec enclosure with 604G, Amcron DC500 (Crown) and Dolby equalizers. The engineers are very pleased with the results, and as the summation indicates, the sound picture and centre image are clearly defined. I have now standardized on an equalization curve where I equalize flat to 3K15Hz and then roll off at 3 dB/octave.

"In control room designs, I am now using a mixture of acoustic absorption techniques and geometric shapes with considerable success. The methods are enabling us to produce designs to accommodate almost any requirement the client may have, size of room and layout. The best part is that we waste the minimum amount of space in the room and provide the client with maximum floor area (vital in this age when goodies in heaps are lumped into the control room)."

Sincerely,

SYNERGETIC AUDIO CONCEPTS

H.P. 97 & 67 PROGRAMS AVAILABLE

The H.P. 97-67 seems to have been received with open arms by Syn-Aud-Con graduates. Since so many have found their way into your hands, we have printed up a complete format and program detail of our Sound System Design Program.

Even though so many Syn-Aud-Con graduates have notified us that they have purchased the new H.P. 97 or 67, we didn't feel we could justify printing 1500 copies and making a general mailing. Send \$2 to cover printing and postage, and we will send you printed program.

For those of you who do not write programs yet this limited printing Tech Topic can serve as a good introduction to the simpler straightforward programming techniques available in such a machine.

JULY NEWSLETTER WILL BE LATE

Our Spring "tour" which starts in Los Angeles May 18, then Dallas, Indianapolis, Chicago and Minneapolis which ends June 24 leaves us just enough time to rush back to Tustin to prepare a celebration for our Uncle Roy's 100th birthday during the 4th of July weekend; therefore, it will be early August before we are able to mail out the next Newsletter.

SYN-AUD-CON CLASS AT BANFF

Each Syn-Aud-Con class is different because the people attending the class are different. Our Syn-Aud-Con class at the Banff Fine Arts Center in Alberta (sponsored by the University of Alberta in conjunction with the Alberta Contractor Association) was tremendously enjoyable for many reasons. One, the diversity of the class -- 42 members of the class from every province in Canada - from universities, telephone companies, Governmental agencies, sound contractorships and consulting firms, as well as operating and management personnel from theaters, arenas and stadiums.

And the class had an enormous sense of humor with DON PETRO of Estron Industries and BOB GIBSON of the Calgary Exhib. & Stampede, being the King of Puns: "Plant marijuana with potatoes and get hash browns". "A log table is made from a tree with square roots".

JOHN STANFEL of North Bay, Ontario gave us the following "contract" which we think you will appreciate:

The Plans and Specifications are to be taken together. Anything shown on the Plans and not mentioned in the Specifications and not shown on the Plans is to be considered as both shown and specified. Anything wanted by the Architect, or any of his friends, or anybody else, except the contractor, shall be considered as shown and specified, implied and required, and shall be provided by the contractor without expense to anybody but himself.

If the work has been done without expense to the contractor, the work shall be taken down and done over again, until it costs enough to satisfy the Architect. The plans are to be considered diagrammatic and in some instances disgraceful, and are to be followed only where space conditions make it impossible to avoid doing otherwise.

Anything that is forgotten or left out of the Plans and Specifications, but which is necessary and required for the comfort and convenience of the Owner, whether he thought of it before or after the execution of the contract, shall be provided by the contractor to the satisfaction of the Architect, Owner and everybody else - except the contractor - and in full accord with evident intent and meaning of the specifications and without extra cost to the Owner or anybody else but the contractor.

Anything that is right on the plans is to be considered right, anything that is wrong shall be discovered by the contractor, and shall be made right without telling the Architect or Owner or indicating it on the bills. The work shall comply with all rules and regulations, caprices and whims of all City, Provincial, and National and International Departments, bureaus, and officials, having or not having jurisdiction over same.

All materials shall be the best of their respective kinds and the contractor is expected to know and provide the best, irrespective of what is stated in the Plans and Specifications.

The Architect reserves the right to change his mind about what is best. Any change necessary to make the work and materials fit the mind of the Architect, shall be made by the contractor without extra cost.

The contractor shall obtain all Permits and shall pay all Fees, Dues, Assessments, Subscriptions to Masked Ball organizations, outings and all Hat and Dinner checks.

Any damage done by the contractor, shall be paid for by the contractor as liquidated damages and not as penalty.

The contractor shall guarantee, and does hereby guarantee, that he will keep in complete and perfect working order, anything that the Architect asks him to, as long as there is no more work in sight in the Architect's office.

In case of dispute arising, as to the nature, character or extent of the work done, specified or implied, the matter shall be decided by referendum and recall after which the Architect may set aside and reserve the decision. The Architect's decision shall be final.

Payments, if any, shall be made as the work progresses in the amount of 85% of the value of the work done, as judged by the Architect. In any case, the judgement of the Architect shall not be more than enough to cover the payroll every Friday night. The material men must take their customary chances.

The final payment, if at all, shall be made only when everybody is satisfied, except the contractor; any evidence of satisfaction on the part of the contractor shall be considered just and sufficient cause for withholding Final Payment.

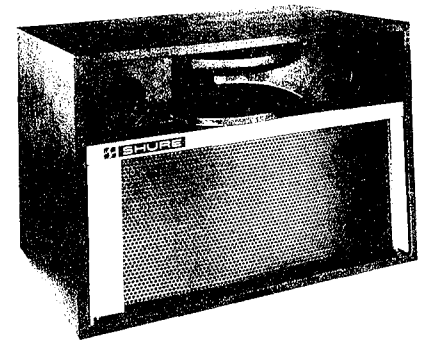
THE CONTRACTOR SHALL ACCEPT AND DOES HEREBY ACCEPT THE CONDITIONS FOR HIMSELF, HIS ANCESTORS, HIS FAMILY, HIS HEIRS, EXECUTORS, HIS OX AND HIS ASS, AND ANY STRANGER THAT IS WITHIN HIS GATES.

SYNERGETIC AUDIO CONCEPTS

NEW PRODUCT FROM SHURE BROTHERS INC

Shure Brothers has brought out a new loudspeaker system. It is available in two models - SR 112 and SR 116 (the 116 has a handle and a vinyl cover for the grill).

The instruction sheet that comes with these units is comprehensive and lacks only a Q figure; however, horizontal polar plots are shown for 250 Hz, 2000 Hz and 8000 Hz. We would guesstimate a Q of approximately 10 at 2,000 Hz. See Q program data which assumed same polar response for both horizontal and vertical. Only horizontal was given.



MODEL SR112 SPEAKER SYSTEM

Q PROG

100.0	*** 0°
95.0	*** 10
97.0	*** 20
95.0	*** 30
92.0	*** 40
90.0	*** 50
87.0	*** 60
85.0	*** 70
86.0	*** 80
77.0	*** 90
77.0	*** 100
77.0	*** 110
77.0	*** 120
77.0	*** 130
77.0	*** 140
75.0	*** 150
75.0	*** 160
75.0	*** 170
75.0	*** 180

HORIZ
DATA

VERT.
DATA

100.0	*** 10
99.0	*** 20
97.0	*** 30
95.0	*** 40
92.0	*** 50
90.0	*** 60
87.0	*** 70
85.0	*** 80
86.0	*** 90
77.0	*** 100
77.0	*** 110
77.0	*** 120
77.0	*** 130
77.0	*** 140
77.0	*** 150
75.0	*** 160
75.0	*** 170

AVER. LEVEL 89.9 ***

ON AXIS LEVEL 100.0 ***

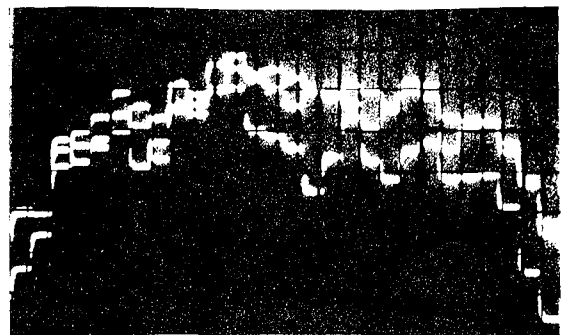
Q = 10.1 ***

There is a complete impedance by frequency curve (confirmed in class using both the ZP-2 with external oscillator and the RTA method). The calibration of the impedance curve is the reverse we normally encounter but is accurate. The 4'-1 watt sensitivity rating is 95.5 dB-SPL. Thus its efficiency has to be approximately 1 to 1.5% at 2000 Hz, just barely bringing it into the medium efficiency classification.

Our impression of the unit is highly favorable. It is attractive in appearance, light in weight, has a smooth coverage angle. In the Seattle class we ran a response curve at 0°, 60° and 120° off horizontal axis. Note that the 0° and 60° are for all practical cases identical, with the 120° response essentially affected only by the side-by-side woofer as frequency increased.

It will handle lots of electrical power with ease. It is not a high fidelity unit but will easily be accepted as such by listeners who do not have an immediate A-B available with a standard high fidelity unit.

For its intended purpose, we believe it is an extremely well balanced choice of conflicting parameters. Reaction in three Svn-Aud-Con classes has been that it fills a real need in the marketplace.



AN UNUSUAL TELEPHONE SERVICE CALL

On occasion graduates can contribute some astounding problems and how they were solved. PAT ROUTLEDGE of Protek Electronics in Winnipeg, while attending our class in Banff related the following telephone Co. service call he handled while living in England.

It is common practice in England to signal a subscriber by signaling with 90 volts across one side of the two wire circuit and ground (earth in England). When the subscriber answers the phone, it switches to the two wire circuit for the conversation. This method allows two parties on the line to be signalled without disturbing each other.

This particular subscriber, an elderly lady with several pets called to say that her telephone failed to ring when her friends called and that on the few occasions when it did manage to ring her dog always barked first. Torn between curiosity to see this psychic dog and a realization that standard service techniques might not suffice in this case, Pat proceeded to the scene. Climbing a nearby telephone pole and hooking in his test set he dialed the subscriber's house. The phone didn't ring. He tried again. The dog barked loudly, followed by a ringing telephone. Climbing down from the pole, Pat found:

- Dog was tied to the telephone system's ground post via an iron chain and collar
- Dog was receiving 90 volts of signaling current
- After several jolts dog was urinating on ground and barking
- Wet ground now conducted and phone rang.

Which goes to prove that some grounding problems can be passed on.

SYNERGETIC AUDIO CONCEPTS

HARDWARE "COOKBOOK"

HOOKERS[®]

FOR
HANGING
YOUR SNAKES
AND WIRES FROM
SUSPENDED CEILINGS



RANDY VAUGHAN sent in an item for the Cookbook: Hookers "easy to install and remove, made of strong pliable plastic, will not damage ceiling, fits any standard ceiling channel, light color blends with any ceiling."

Hookers come 5 hooks per bag: \$4.98 plus 22¢ postage.

We ordered a bag to see how well they work, and they are great.

Storey Systems, P.O. Box 8284, Dallas, Texas 75205

Randy Vaughan (Disco Scene in the Norfolk, VA area) reports that he has used the Hookers with great success.

DAVID M. ANDREWS of Gary & Timmy Harris Inc. in New York shared several items:

The Lafayette Radio Electronics Catalogue has some interesting tools and accessories such as the Adel Nibbling Tool (a must for anyone who does black boxes) which I have not found anywhere else:

Lafayette Radio Electronics
Syosset, LI, New York 11791

"Hard to Find Tools and other fine things"

Brookstone Company
121 Vose Farm Road
Peterborough, New Hampshire 03458

Many interesting "devices" are available in the catalogue from

Edmund Scientific Co.
Edscorp Building
Barrington, N.J. 08007

One of our Syn-Aud-Con graduates sent us, and I'm sorry we let the name get separated from the literature, information on a Loudspeaker Mounting Kit (\$6.95) which looks like it would be very useful. (\$4.00 dealer net)

We are very grateful for this "sharing of ideas" and will look forward to more sharing so that we can print our Hardware "Cookbook".

L'IC Audio

PRESENTS

LOUDSPEAKER MOUNTING KITS

KITS INCLUDE:

- 4 Die Cast Clamps
- 4 Tee Nuts
- 4 Screws
- 1 Gasket Assembly

\$4.00 EA. DEALER NET (PPD)

KITS ARE ATTRACTIVELY
PACKAGED FOR DISPLAY.



L'IC Audio
P.O. Box 184
Van Nuys, CA 91405

STAGE MONITORS VS. HOUSE SYSTEM

We often talk in class about the importance of supplying good monitors for the artist on stage vs. the attention given to the audience during a rental concert.

DENNIS BADKE told us during our special class at CROWN that for the last "Wings" concert tour by Paul McCartney there were 90 Crown amplifiers in use: 78 on the stage monitors and 12 for the house!!



This is the sole type of acoustic research on cats that has Syn-Aud-Con's approval. With the modern computer, 99.99% of the experimentation on animals is without rational justification.

Landis Bennett, professional photographer in our Orlando class and a member of a church building committee to oversee the installation of a sound system for their very large and beautiful church in Raleigh, N.C., caught this picture during class when Punch (our Calico cat) and Judy (our German Shepherd) joined the class in Orlando.

DISNEYWORLD TOUR

Our Orlando '76 class got a special treat. We had 13 present at the class from DisneyWorld. They arranged for the class to have a "behind the scenes" tour of DisneyWorld, which was tremendously interesting.

As you can see from the picture taken by Landis Bennett, the class enjoyed an "above ground" tour also.

Michael Iseberg knew that he had an unusually appreciative audience and gave the class the full treatment.

Michael Iseberg and his Iseberg Machine --five synthesizers; organ; electronic piano; 12-input mixer; echo and reverberation units; frequency shifter and pitch-to-voltage converter -- assembled seven years ago as a PhD project. Iseberg was doing 5 shows daily at the time of the tour at DisneyWorld. He commented that the Disney organization because of its resources and its willingness to experiment *will be a leader in the electronic music field (italics mine)*.



FERROFLUIDICS SPEAKER DAMPING KIT

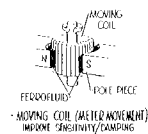
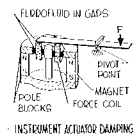
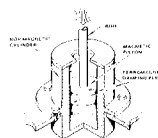
Last year at AES we saw demonstrated a product from Ferrofluidics Corp., K-72 Speaker Damping Kit. It looked good but we waited until we talked to someone that had tried it:

TOM WALTON, Alpha Audio in Santa Cruz, has used the product and verifies that it is excellent.

For more information write
Ferrofluidics Corporation,
144 Middlesex Turnpike
Burlington, MA 01803

DAMPING KITS

A new engineering kit to help the design engineer take advantage of the damping characteristics of ferrofluids, as well as the cost savings, increased product life and greater reliability. Investigate applications for inductors, actuators, loudspeakers, stepping motors wherever "stictionless" operation is required. Special benefits are: hysteresis free operation; permanent lubrication; self-centering forces; hermetic sealing of gap preventing dirt accumulation; dramatic heat sink qualities and positive prevention of creep.



\$100.00 K-71 GENERAL PURPOSE DAMPING KIT

30cc Diester	100 gauss	100 cps viscosity
30cc Diester	100 gauss	1000 cps viscosity
30cc Diester	100 gauss	10,000 cps viscosity

\$35.00 K-72 LOUDSPEAKER DAMPING KIT

10cc Diester (woofer)	350 gauss	250 cps
10cc Diester (Mid-Range)	100 gauss	1000 cps
10cc Diester (Tweeter)	100 gauss	2000 cps

SYNERGETIC AUDIO CONCEPTS

CECIL CABLE TO CONSULT FOR SYN-AUD-CON

Mr. & Mrs. CECIL CABLE of Edmonton, Canada, well known consultants in electroacoustics and time delay spectrometry research are to travel with Syn-Aud-Con during the following classes in May-June 1977: Los Angeles, Dallas, Indianapolis, Chicago and Minneapolis.

The Cables' time delay Spectrometry equipment will be demonstrated in each of the classes along with several new insights into room-sound system equalization.

Press Release MAC 77 TOPIC: SOUND REINFORCEMENT

The Midwest Acoustics Conference will hold its tenth annual conference on Saturday, May 7, 1977, from 8:30 a.m. to 6:30 p.m. at the Norris Center of Northwestern University, Evanston, Illinois.

"Sound Reinforcement" is this year's conference topic. Speakers will address the problems inherent in the design and application of sound systems, with special emphasis on the purposes and objectives of sound reinforcement.

The keynote address by PETER TAPPAN of R. Lawrence Kirkegaard Associates will feature demonstrations showing correct and incorrect methods in sound system design and usage. The morning session will focus on equipment aspect and state-of-the-art technology in the field of acoustics. ROBERT SCHULEIN of Shure Brothers will discuss Microphone Use, and JUERGEN WAHL of U.R.E.I. will review Sound System Electronics, Don Keele, Jr., of Klipsch Associates will end the morning session with an Overview of Loudspeaker Systems.

Sound Reinforcement System Applications is the subject of the afternoon sessions. Presentations will be made by Stan Miller of Stanal Sound who will speak on Sound Systems for the Performing Artist; Mahlon Burkhard of Industrial Research Products, Inc., whose subject will be Creating the Concert Hall Outdoors with Sound Delay; and David Klepper of Klepper, Marshall, King will speak on Sound Reinforcement for the Theater.

Don Davis of Synergetic Audio Concepts will discuss the relationships among various industry and service segments that work to create quality sound reinforcement and what they can learn to improve the satisfaction of the system user. After his presentation, Davis will moderate an audience participation panel discussion on Future Aspects of Sound System Design. Featured speakers at the conference will serve as panel members. Further information on attendance at the conference or participation as an exhibitor may be obtained from Harry O. Saunders, 225 W. Randolph 24A, Chicago, Illinois 60606, 312-727-4331.

GENERAL "MASS LAW" EQUATION

$$TL = 20 \log_{10} (MF) - 34 \text{ dB}$$

Where: TL is the transmission loss in dB
M is the panel area density in lbs/sq ft*
F is the sound frequency in Hz

This equation is valid for $MF > 100$ which covers most practical situations.

$$NR = TL - 10 \log_{10} \left(\frac{1}{4} + \frac{S_w}{S_{a2}} \right) \quad *S_a \text{ or } R$$

Where: NR is the noise reduction in dB
TL is the transmission loss in dB
 S_w is the area in ft^2 of the partition separating rooms
 S_{a2} is the sound absorption in the receiving room

Where $S_w = S_{a2}$, then $NR = TL$

Where $S_{a2} = S_w$, then $NR = TL + 6 \text{ dB}$ (outdoor receiving area)

The reduction of SPL in a room where absorptive material is added is found by:

$$\text{dB-SPL}_R = 10 \log_{10} \frac{A_0 + A}{A_0}$$

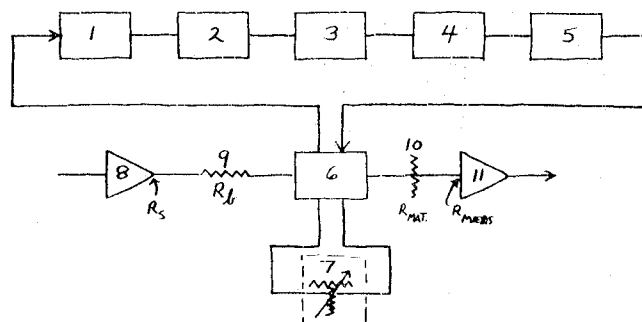
Where: dB-SPL_R is the reduction in SPL in dB

A_0 is the absorption originally present
A is the absorption added.

*See Newsletter Vol 2, # 2, Page 19 for density of common materials or, INDUSTRIAL NOISE - A Guide to its Evaluation and Control. Pub.# 1572, U.S. Government Printing Office, Washington, D.C. 20402 - Price \$1.75

SUGGESTED MASTER TEST SET FOR EQUALIZATION

1. Rauland 6200 test set
2. Shure SR 107 octave band equalizer
3. UREI 529 or 539 1/3-octave band equalizer
4. UREI 529 or 539 1/3-octave band equalizer
5. UREI 560 tunable notch filter or Rauland 7205 tunable notch filter or Rauland 7205 tunable notch filter
6. A 4-pole 3-position switch
7. A precision Bridged "T" attenuator with 1 dB/step to 45 dB total attenuation. 600Ω
8. Sound system mixer or line amplifier
9. Build out resistor $R_s + R_b = 600\Omega$
10. Shunt resistor $\frac{1}{600} - \frac{1}{R_{meas}} = \frac{1}{R_{mat}}$
11. Sound system power or line amplifier



NEW ACOUSTICAL FACILITY IN CANADA

KEN H. HEWITT, who attended our Syn-Aud-Con class in April 1976 in Edmonton, Canada (under the auspices of the University of Alberta), recently sent us a special report on the new acoustical facility constructed by his firm, Bolstad Engineering Associates, Ltd.

The 40-page report entitled "A New Acoustical Facility in Western Canada" is profusely illustrated with photographs of the facilities, diagrams of test spaces, and details of some of the novel testing devices developed especially for this facility.

The report consists of two parts:

1. The Facility and its Justification
2. Technical Evaluation of the Facility, co-authored by Dr. Gary Faulkner and DONALD OLYNYK, P.E. (also a graduate of the '76 class)

This is the first full scale acoustical test facility in Western Canada.

The report constitutes a valuable reference for anyone undertaking either the construction or testing of such a facility. It would also seem worthwhile for any of Syn-Aud-Con's Canadian graduates to consider having this facility measure the sound power from loudspeakers which do not presently have Q ratings so that the on-axis sound levels made at the same electrical input power level as the sound power measurement can be compared to the sound power level to obtain very usable Q ratings:

$$Q = 10 \left(\frac{\text{dB-SPL} - \text{dB-PWL} + 20 \log \left(\frac{\text{meas. dist.}^*}{0.282\text{m}} \right) + 0.2}{10} \right) \quad \text{*the measured distance is in meters}$$

The dB-SPL measurement is taken in a free field at the same electrical input power to the loudspeaker used for the dB-PWL measurement.

To obtain a copy of this excellent, complete, and informative report write:

Bolstad Engineering Associates Ltd.
PO Box 5768, Station L
Edmonton, Alberta T6C 4G2

CALCULATING THE EQUIVALENT ACOUSTIC DISTANCE

In *Sound System Engineering* we use a nomograph for finding the EAD (see Fig. 5-1, P 77). The necessary parameters are:

1. The ambient noise level in dBA
2. The talker's level in dBA
3. The reference distance in feet or meters at which the talker's level was obtained

$$\text{EAD} = \text{ref. dist.} \times 10^{\left(\frac{\text{Talker's level} - (\text{amb. N.L.} + 25 \text{ dB S/N})}{20} \right)}$$

*In rooms with an $RT_{60} < 1.6$ seconds lower S/N figures can be used (See Fig. 4-22 p 71 of SSE).
The S/N value is for the octave band centered on 2000 Hz.

Example

Talker's level = 65 dBA

Ambient Noise Level = 32 dBA

Reference distance at which talker's level was obtained = 2'

$$\text{EAD} = 2' \times 10^{\left(\frac{65 - (32 + 25)}{20} \right)} = 5'$$

This simple equation allows the use of the separate parameters within a computer program to calculate EAD directly without the need of the chart.

ENERGY DATA

1. Total muscle-power output of the human race estimated to be about: 3×10^9 megawatt-hours per year.
2. Worldwide power usage under human direction is of the order of 7×10^{10} megawatt-hours per year.
3. Energy-amplification ratio currently is about 25 to 1 on a worldwide basis.
4. The U.S. has an energy-amplification ratio of approximately 250 to 1.
5. If all of the thermodynamically available solar energy were used, an amplification ratio of 500,000 to 1 is theoretically possible.

Reference: "Energy and Information" by Myron Tribus and Edward C. McIrvine. Scientific American

CALCULATOR CATALOG

If you are looking for a catalog listing many of the scientific calculators available (very good delivery at some of the lowest prices) write Olympic Sales Co., 212 S. Oxford Ave, P O Box 74545, Los Angeles, CA 90004. 213-381-3911.

CALCULATING THE SOUND LEVEL TO BE EXPECTED AT A GIVEN DISTANCE FROM A NOISE SOURCE WITH A KNOWN ACOUSTIC OUTPUT IN A GIVEN ACOUSTIC ENVIRONMENT

Increasingly manufacturers in the HVAC field are providing the power level (dB-PWL) of their equipment and associated devices. With the advent of James Moir's calibrated sound source from B&K obtaining the dB-PWL will be much easier. The following equations show how to use the power level to predict the broadband sound pressure level (dB-SPL) at any point in an enclosed space.

$$\text{dB-SPL} = \text{dB-PWL}_{-12} + 10 \log \left(\frac{Q}{4\pi D^2} + \frac{4}{S\bar{a}} \right) + 10.5 - \left(\left(0.734 \frac{\sqrt{V}}{H \cdot RT_{60}} \right) \log \left(\frac{D_c \gg D_c}{D_c} \right) \right)^*$$

Where: dB-SPL is the sound pressure level in dB above 20 uPa

dB-PWL₋₁₂ is the acoustic power in dB above 1 picowatt

Q is the directivity factor - dimensionless

D_x is the distance in ft. from the noise source

S \bar{a} is the total acoustic absorption in the environment expressed in sabins (1 s \bar{a} = 1 ft² of open window).

V is the internal volume of the environment in ft³

H is the average ceiling height in ft.

RT₆₀ is the time in seconds for the sound level to decay 60 dB

$$RT_{60} = \frac{0.049V}{S\bar{a}}$$

D_c is the critical distance in ft.

$$D_c = 0.141 \sqrt{0.5 S\bar{a}}$$

*The part of the equation in $\left(\right)$ is the Peutz "add on" equation for environments that do not establish a true reverberant sound field. The add-on value is limited to D_x > D_c and ΔdB > 6 dB = 6.02 dB.

The program for the H.P. 97 is reproduced below.

001	*LBLA	21 11	046	=	-24	091	*	-35
002	1	01	047	4	04	092	STOD	35 14
003	R/S	51	048	RCL8	36 08	093	RCLB	36 12
004	ST01	35 01	049	=	-24	094	LOG	16 32
005	2	02	050	+	-55	095	RCLB	36 14
006	R/S	51	051	LOG	16 32	096	*	-35
007	ST02	35 02	052	1	01	097	RCLA	36 11
008	3	03	053	0	00	098	WZY	-41
009	R/S	51	054	*	-35	099	-	-45
010	ST03	35 03	055	1	01	100	STOC	35 13
011	4	04	056	0	00	101	R/S	51
012	R/S	51	057	.	-62	102	RTH	24
013	ST04	35 04	058	5	05	103	*LBL1	21 01
014	5	05	059	+	-55	104	RCLA	36 11
015	R/S	51	060	RCL1	36 01	105	STOC	35 13
016	ST05	35 05	061	+	-55	106	R/S	51
017	6	06	062	STOA	35 11	107	RTH	24
018	R/S	51	063	R/S	51	108	*LBL2	21 02
019	ST06	35 06	064	*LBLB	21 12	109	RCLA	36 11
020	R/S	51	065	RCL6	36 06	110	6	06
021	ST07	35 07	066	RCL9	36 09	111	.	-62
022	.	-62	067	WZY?	16-34	112	0	00
023	0	00	068	ST01	22 01	113	2	02
024	4	04	069	=	-24	114	-	-45
025	9	09	070	STOB	35 12	115	STOC	35 13
026	RCL3	36 03	071	RCL3	36 03	116	R/S	51
027	*	-35	072	JM	54	117	RTH	24
028	RCL4	36 04	073	RCL5	36 05	118	*LBLC	21 13
029	=	-24	074	=	-24	119	RCLA	36 11
030	ST08	35 08	075	RCL4	36 04	120	PRTH	-14
031	RCL2	36 02	076	=	-24	121	RCLC	36 13
032	*	-35	077	.	-62	122	PRTH	-14
033	JM	54	078	2	02	123	-	-45
034	.	-62	079	2	02	124	PRTH	-14
035	1	01	080	1	01	125	RTH	24
036	4	04	081	*	-35	126	R/S	51
037	1	01	082	6	06			
038	*	-35	083	WZY?	16-35			
039	ST09	35 09	084	ST02	22 02			
040	RCL2	36 02	085	WZY	-41			
041	Pi	16-24	086	3	03			
042	4	04	087	.	-62			
043	*	-35	088	3	03			
044	RCL7	36 07	089	2	02			
045	*	-35	090	2	02			

REGISTER PRINTOUT

dB-PWL	0.00	0
Q	5.00	2
V	500000.00	3
RT ₆₀	2.50	4
H	45.00	5
D _x	125.00	6
D _c	15625.00	7
S \bar{a}	9800.00	8
D _c	31.21	9
H.S. dB-SPL	96.87	A
P _r	4.00	B
H.S. + P dB-SPL	94.09	C
DIFFERENCE	4.61	D
	0.00	E
	0.00	I

dB-SPL (H.S.)	96.87	***
dB-SPL (H.S.+P)	94.09	***
DIFF.	2.78	***

CALCULATING 'BUILDOUT' AND 'TERMINATING' RESISTOR VALUES

A typical use of both buildout and termination resistors in today's audio systems is when a link circuit between two active components needs to be adjusted so that a passive component (such as an equalizer) may be inserted into the link circuit and see a specified source and load impedance.

The active source is normally a lower impedance than the passive device and the passive device becomes a lower impedance source to the active component acting as the load. See Figure 1.

Normally the active source is not critical about its load so long as it exceeds some minimum value. Again, normally, the active load is not critical about the impedance driving it so long as it doesn't exceed some specified value.

In the case illustrated if we use a buildout resistor of

$$600 - 120 = 480\Omega$$

which is an acceptable value as it exceeds the specified output impedance.

Looking at the active load we find a terminating resistor value of

$$\frac{1}{600} - \frac{1}{2800} = \frac{1}{764\Omega}$$

Therefore, a 764Ω terminating resistor would allow the passive component to see 600Ω while the active load would "see" approximately

$$\frac{1}{\frac{1}{600} + \frac{1}{764}} = 336\Omega$$

which again is perfectly acceptable as it does not exceed the specified input impedance.

Calculating the Losses Incurred

Inserting these resistors in the link circuit will cause losses in addition to those that might be due to the passive component.

The derivation of these losses as relative voltages and as relative powers is illustrated in Figure 2.

THUS IF E_s IS MADE EQUAL TO ONE THEN:

THE LOSS IN dB CAUSED BY INSERTING R_b IS:

$$R_b \text{ LOSS IN dB} = 20 \text{ LOG } \left(\frac{R_s + R_L}{R_s + R_b + R_L} \right)$$

$$R_T \text{ LOSS IN dB} = 20 \text{ LOG } \left(\frac{R_T (R_s + R_L)}{R_T (R_s + R_L) + R_s R_L} \right)$$

$$R_b \text{ LOSS IN dB} = 10 \text{ LOG } \left(\frac{P_L \text{ WITH } R_b}{P_L \text{ WITHOUT } R_b} \right)$$

$$R_T \text{ LOSS IN dB} = 10 \text{ LOG } \left(\frac{P_L \text{ WITH } R_T}{P_L \text{ WITHOUT } R_T} \right)$$

LIMITATIONS ON USE OF R_b AND R_T

USING R_b THE 'LOAD' SEES AN IMPEDANCE MATCH BUT THE SOURCE DOES NOT.

USING R_T THE SOURCE SEES AN IMPEDANCE MATCH BUT THE LOAD DOES NOT.

IF BOTH SOURCE AND LOAD MUST SEE AN IMPEDANCE MATCH THEN THE USE OF AN IMPEDANCE CORRECTING PAD IS REQUIRED (SEE P-125, S.S.E.)

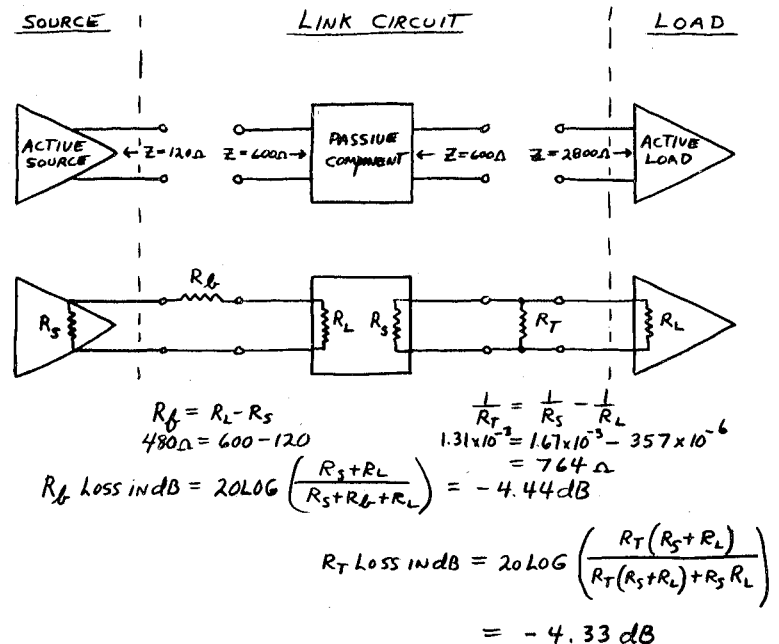


Figure 1. Calculation and Placement of R_b and R_T Resistors

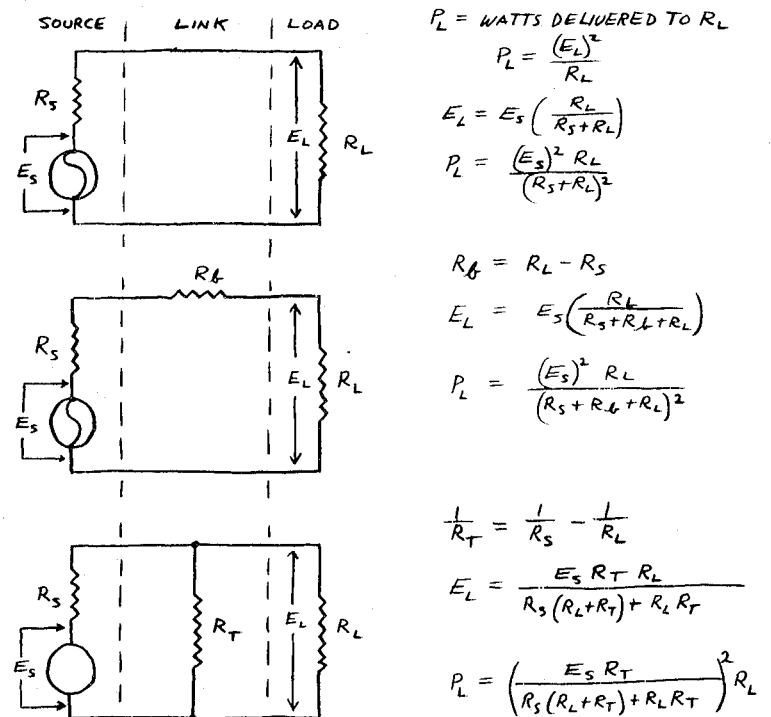


Figure 2. Calculating Buildout and Terminating Resistor Values

continued next page

SYNERGETIC AUDIO CONCEPTS

Calculating 'Buildout' and 'Terminating' Resistor Values, cont.

The sources act as voltage dividers and where $R_S = R_L$ half the power is dissipated in the load and half in the source. This condition represents the maximum power transfer but only a 50% efficiency. When the load impedance is high relative to the source impedance, then while less power is taken from the source, the efficiency is much higher.

When all components require an exact impedance match in all directions within the circuit, then simple buildout and terminating resistors should not be used. The correct solution in such a case is to use the impedance correcting pads described in *Sound System Engineering* on Page 125.

No account is taken of the mismatch loss, such as would be present between the active source and active load if the passive device were not present, because it remains essentially a constant.

Impedance matching of passive components is not done to achieve maximum power transfer but to insure that the passive network sees its design source and load impedances in order to maintain its transfer characteristic. (Pages 115-117 of *Sound System Engineering* cover this subject in some detail.)

SIMPLIFIED METRIC TO ENGLISH AND ENGLISH TO METRIC CONVERSIONS

1. M to ft.

$$\frac{\text{ft}}{\text{M}} = \frac{1 \text{ in.}}{2.54 \text{ cm}} \times \frac{100 \text{ cm}}{1 \text{ M}} \times \frac{1 \text{ ft.}}{12 \text{ in.}} \times \frac{\text{M}}{1}$$

2. M² to ft²

$$\frac{\text{ft}^2}{\text{M}^2} = \left(\frac{1 \text{ in.}}{2.54 \text{ cm}} \times \frac{100 \text{ cm}}{1 \text{ M}} \times \frac{1 \text{ ft.}}{12 \text{ in.}} \right)^2 \times \frac{\text{M}^2}{1}$$

3. M³ to ft³

$$\frac{\text{ft}^3}{\text{M}^3} = \left(\frac{1 \text{ in.}}{2.54 \text{ cm}} \times \frac{100 \text{ cm}}{1 \text{ M}} \times \frac{1 \text{ ft.}}{12 \text{ in.}} \right)^3 \times \frac{\text{M}^3}{1}$$

4. ft. to M

$$\frac{\text{M}}{\text{ft}} = \frac{2.54 \text{ cm}}{1 \text{ in.}} \times \frac{1 \text{ M}}{100 \text{ cm}} \times \frac{12 \text{ in.}}{1 \text{ ft.}} \times \frac{\text{ft}}{1}$$

5. ft² to M²

$$\frac{\text{M}^2}{\text{ft}^2} = \left(\frac{2.54 \text{ cm}}{1 \text{ in.}} \times \frac{1 \text{ M}}{100 \text{ cm}} \times \frac{12 \text{ in.}}{1 \text{ ft.}} \right)^2 \times \frac{\text{ft}^2}{1}$$

6. ft³ to M³

$$\frac{\text{M}^3}{\text{ft}^3} = \left(\frac{2.54 \text{ cm}}{1 \text{ in.}} \times \frac{1 \text{ M}}{100 \text{ cm}} \times \frac{12 \text{ in.}}{1 \text{ ft.}} \right)^3 \times \frac{\text{ft}^3}{1}$$

Example Conversion Answers

$$500,000 \text{ ft}^3 = 14,158.42 \text{ M}^3$$

$$42,500 \text{ ft}^2 = 3948.38 \text{ M}^2$$

$$125 \text{ ft.} = 38.10 \text{ M}$$

You will encounter increasing pressure in your audio work as time progresses to express quantities in *both* Metric and English equivalents. These simplified "factor-label" conversion routines work efficiently with the available handheld calculators.

A QUICK CHECK ON COVERAGE WIDTH

SAM BRIDGES of Electronic Design Co., St. Paul, sent in the following for checking speaker coverage:

When designing a sound reinforcement system, it is necessary to know the beamwidth of a speaker at the first row of seats. Or perhaps, you need to know the required dispersion angle to cover the end seats. The following simple equations make it easy:

$$W = 2D \tan \left(\frac{\theta}{2} \right)$$

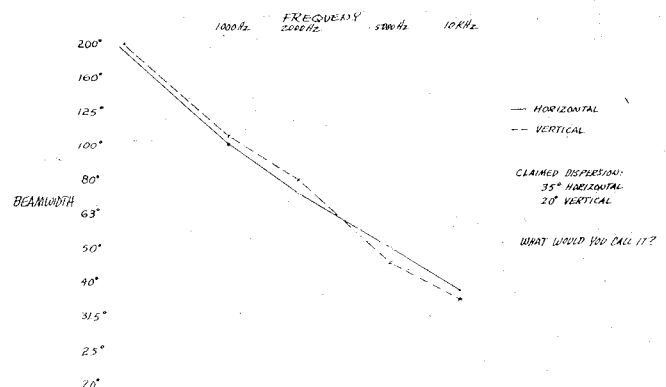
$$\theta = 2 \tan^{-1} \left(\frac{0.5W}{D} \right)$$

$$D = \frac{W}{2 \tan \left(\frac{\theta}{2} \right)}$$

Where: W = width of beam at first row

θ = speaker dispersion angle

D = distance from speaker to center of first seating row



BEAMWIDTH (-6dB) vs FREQUENCY

FIGURE 1

Some speaker manufacturers provide transparent overlays with printed speaker plots which you are to place over plans. They will work where the axis of the speaker is parallel to plane of the overlay. But speakers are rarely mounted with their axis parallel to the floor.

There are two possibly dangerous assumptions made. First, the manufacturer knows what the true beamwidth is and that it remains essentially constant at all frequencies of interest (see Figure 1). Second, that the horn actually projects through the aperture described by the angles specified (covers the corners). Even manufacturers with good performance documentation don't provide diagonal polars. We always want at least 20% wider beamwidth than required.

BOOKS OF INTEREST

During the week between the San Francisco class and the Seattle class we parked our travel trailer directly on the ocean beach near the town of DePoe Bay in Oregon. In the town itself is a really marvelous used book store such as is normally found in large cities (DePoe Bay is a few hundred). It was here that I found a book I had been looking for during the past four years. (PHIL CLARK of Diversified Concepts has the only other copy I've seen -- among his library of many thousands of books).

MATHEMATICS FOR THE MILLIONS by Lancelot Hogben, published by W. W. Norton & Co., Inc. NY. July 1943.

Hogben separates writing (sort language) and mathematics (size language). He equips those of us familiar with language about the *sort* of things the world seems to be composed of to now consider the *size* of things the world seems to be made of.

The book is replete with remarks such as "The modern man has got to learn the language of size in self defense, because no society is safe in the hands of its clever people", and in talking about political utterances of a brilliant mathematician, "It seems the fate of a revolutionary epoch to fling up live lava and dead ashes in about equal amounts."

The chapter "How Logarithms Were Discovered" is alone worth many times the price of the book (I paid \$10 for my used copy). The book will be extremely useful to those attempting to fill the void left by the typical Vertical thinking oriented conventional schooling and the possibilities offered by the computer-calculator for self-education in mathematics. Hogben, you'll find, is on your side.

EDITOR'S NOTE: There are many books out of print that would be useful to the audio engineer. There are many firms that specialize in "book search". They will find the book for you and let you know the charge for the book. And at that time you can order the book, if you wish. We are reproducing a few ads from SR. Many magazines have similar ads.

OUT OF PRINT BOOKS

NAME THE BOOK--WE'LL GET IT! Free search service Chicago Book Mart, Box 636B, Chicago Heights Ill. 60411. Est. 1948.

WE FIND BOOKS! Rare or out-of-print. Free search. Eva Davis Books, 2 Prince Charles, Williamsburg, Va. 23185.

FREE SEARCH SERVICE and every book guaranteed. You name it--we find it! International Bookfinders, Inc., Box 1-SR, Pacific Palisades, Calif. 90272

LOOKING FOR A BOOK? Free search service if not in our large stock. Write: Q. M. Dabney & Co., Box 3106-W, Washington, D. C. 20031

CURT ENERSON of Edmonton, Canada and a graduate of both Syn-Aud-Con Canadian classes, one in Edmonton and one in Banff, possesses a highly developed mathematical capability. Knowing that I share his interests if not his capabilities, he introduced me to a fascinating book on the history of computers:

THE COMPUTER FROM PASCAL TO VON NEUMANN, written by Herman H. Goldstine and published by the Princeton University Press 1972. \$14.00

Mr. Goldstine was personally involved as a professional mathematician, with the ENIAC project and later with von Neumann.

While it took slightly over 100 years from Babbage to ENIAC it took only 31 years from ENIAC to the H.P. 97. It is clearly evident that we are on still a steeper acceleration curve at the present time, so 10 years should see fantastic changes again.

Anyone interested in where computers came from, how they were developed and why, can gain valuable insights from this fine book.

"PHYSICS OF HI FI". A group of teachers at Southern Illinois University at Carbondale have developed a physics course entitled *Physics of Hi Fi*. The basic intent of the course is described by the teachers (quoting from PHYSICS TODAY):

"A preliminary survey of hi fi demonstrates that most of the traditional areas of physics must be thoroughly understood and integrated in order to elucidate the principles of its operation. A few examples follow here.

"The summation of simple sine waves via the principle of linear superposition is represented by a record groove that contains the entire audio spectrum encoded in complex undulations. The groove is composed of two independent channels cut into the orthogonal walls--each of which corresponds to the components of the stylus-displacement vector and produces two channels of stereo from what appears to be a single groove. What a beautiful way to present scalars and vectors! Other applications to mechanics would include: Linear speed (speed of magnetic tapes, sound and radio waves), angular speed, acceleration (acceleration of the stylus in record grooves, wow and flutter in records and tapes), Newton's laws (flywheel effects of turntable platters, vertical tracking forces and stylus compliance), resonance (tone arm resonance, speaker-cone resonance and acoustic resonance of listening rooms) and simple harmonic motion (record grooves and stylus motion, sound waves and speaker-diaphragm motion).

"Faraday's law of induction and simple harmonic motion combine to provide a complete picture of how the cartridge translates intricate groove motion into a replicated output voltage. The same law can be applied to playback heads of tape-recording systems and microphones (these allow for a variety of applications in magnetism and electromagnetism)" and so on.

We sent for their detailed report they prepared for interested physics teachers as well as their Lab Manual. Those of you who work with hi fi consumer classes or seminars should find the concepts presented very useful.

To obtain the Lab Manual and further information, write Prof. Kenneth W. Johnson, Department of Physics and Astronomy, Southern Illinois University, Carbondale, Ill. 62901. Cost \$5.00.

We are sometimes asked what course of study at the University level would be most applicable to a career in professional audio. We have invariably replied that, in our opinion, the study of physics gives the most useful background. It is also our opinion that a knowledge of basic physics makes for a far better informed consumer for any product as most fraudulent product claims can be exposed as a violation of basic physical laws.

SYNERGETIC AUDIO CONCEPTS

ARTICLES OF INTEREST

February was an important month for articles of interest for professional audio engineers. BROADCAST MANAGEMENT/ENGINEERING magazine (a magazine free to audio engineers. See Newsletter Vol. 4, # 2 for a complete listing) had a special section devoted to digital techniques in the broadcasting industry. Naturally a great deal of the space was devoted to digital TV devices.

The consensus is that the wave of the future in broadcasting is overwhelmingly digital.

Some interesting side notes are present -- "analog memory is still cheapest. Restating a VTR's capacity into bytes and bits (8 bits equal 1 byte) we see the cost per bit as 4.8×10^{-8} cents. For analog disc stores it is 1.3×10^{-6} cents. Computer tape, by comparison is 1.7×10^{-5} cents per bit."

Discussing the resistance to change, "However, we have learned one thing from experience in other fields: While the advent of the digital tool may seem to destroy the distinctions between certain types of labor, in reality what it does is highlight the difference between *routine* labor and *creative* labor...Machines should work, people should think."

A digital framestore synchronizer using 8-3/4" of rack space and costing \$50,000 with a power consumption of 500 watts would have in 1950 taken 10,485 racks containing 300 12AT7s per rack taking up 94,000 ft² of floor space with a power consumption of 10.66 megawatts at a cost of \$200,000,000.

Finally, the specs are given on a new digital audio recorder that has just appeared on the market:

Harmonic distortion:	Below noise floor not measurable	Frequency response	dc to 20KHz, ±0 dB
Wow and flutter	Unmeasurable - Time base established in playback by a crystal clock	Modulation noise	Unmeasurable
		Print through	None
Signal-to-noise ratio	Better than 86 dB, dc to 30KHz	Crosstalk	Unmeasurable -85 dB or better relative to clipping level to 13KHz

This series starts on Page 27 and goes through Page 65 of the February issue and is most instructive reading.

Hale J. Sabine's paper and John Hilliard's paper are part of a six paper section on the history of American Acoustics in the February 1977 JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA, Vol 61, No. 2.

"Building Acoustics in America, 1920-1940". This is the title of an informative and authoritative paper by Hale J. Sabine of Cocoa Beach, FL. Mr. Sabine, whose father was P.E. Sabine, second cousin of W.C. Sabine (same great grandparents) has, with a great deal of human interest described the early struggles and successes of experimenters, manufacturers, and academicians in exploiting W.C. Sabine's breakthroughs achieved at the turn of the century. The author's invaluable sense of how one event led to another and the interrelationship between scientific insights and the ability to manifest useful products is enlightening as well as demonstrating the role of basic research in the seeding of practical industrial growth.

In corresponding with Mr. Sabine regarding his excellent article I received a very informative letter back with some interesting information:

"Your mention of BILL PUTNAM (in the Newsletter) brought back pleasant memories of our contact in Chicago during the 1950s when I was at Celotex. I got him to make for us a special test signal record consisting of several 1/3-octave bands each having 10 pure tones combined in random phase, known as a 'multitone'. I don't remember that it worked especially well, but it had an interesting sound."

And, some further comments relative to an article in the Newsletter on Speech Privacy Systems:

"I especially noted the mention of your story of the use of masking noise to compensate for inadequate isolation between closed rooms. This was actually the first use of such systems, having been introduced and marketed for a time by the Etof Hanson Company well before open plans became popular."

The series of 7 articles on the early history of sound can be had from The Journal of the Acoustical Society, 335 E. 45th St., New York 10017, for \$7.00

"Electro Acoustics to 1940" from the JOURNAL OF THE ACOUSTICAL SOCIETY, Vol 61, No. 2. John Hilliard has been busy during the past year writing various articles on the history of electro-acoustics from his unique perspective as a key participant. This latest article touches on the key scientific developments that laid the foundation of modern electro acoustics. To quote John Hilliard's summary: "The choice of limiting this review to the period ending in 1940 was not difficult on the basis that this period included practically all the fundamental electroacoustic achievements. Since that time, it appears that most advancement has resulted from better materials and techniques of assembly."

Excellent illustrations of the Western Electric 555W compression driver, the RCA-77A and RCA 44 microphones, the WE 618 dynamic microphone, and the famous Shearer-Hilliard theater loudspeaker system are included.

Other papers in this special section are: Architectural Acoustics in America to 1930 by Robert Shankland; Acoustical Measurements and Instrumentation by Harry B. Miller; Review of Undersea Acoustics to 1950 by Marvin Lasky; Psychological and Physiological Acoustics 1920-1942 by Hallowell Davis.

See Sabine review for address of papers.

Articles of Interest, cont.

I read John Hilliard's article, "Movie Sound Reproduction" in the March AUDIO Magazine with more than usual interest. First of all, John Hilliard was Mr. Theater Loudspeaker to those of my generation. John Hilliard later became an invaluable teacher of audio to those of us fortunate to work in the same company with him, and finally he has been a friend and neighbor for many years.

When I suggested to Gene Pitts, editor of AUDIO Magazine that he contact John Hilliard it was because I knew that John knew how it all had come about in the early professional audio field.

John's article is informative, intriguing and inspiring as he weaves his personal experiences into a narrative of brilliant engineering breakthroughs, difficult business situations, and artistic triumphs.

We all need to carefully ponder the older lessons he stresses such as having enough individual horn configurations available so as to avoid the Pandora's box of complex arrays wherever possible.

Don't fail to procure, read, and study this excellent article by one of professional audio's greatest pioneers.

OF INTEREST

THE CHRISTIAN SCIENCE MONITOR: "Americans on Broadway and off are showing unprecedented enthusiasm for live theater, music, and dance. Some 772 new theaters and civic centers for the performing arts, ranging in construction costs from \$500,000 to \$10,000,000 each have recently been built in large and small cities across the United States.

The tiny town of Dothan, Alabama, for instance just completed a \$7 million civic center seating 3,000 people, according to Beatrice Handel, who publishes the National Directory for the Performing Arts."

RADIO & TELEVISION WEEKLY: "Beatrice Foods Acquired Harman International Firm" (i.e., JBL) (ED: A lawyer from Wilson Meat Packing is "running" Altec; why not Beatrice Foods for JBL? You can really start worrying when you get your speakers wrapped in Saran Wrap.)

ELECTRONICS: "Wang adds mini-diskette to product line. Wang hit upon a dual mini-diskette memory that uses 5¼-in diameter floppy disks. The disk, which stores 89,600 bytes, is roughly half the size of conventional diskettes. Wang says the mini-diskette memory package costs 60% less than a standard diskette system."

U.S. NEWS & WORLD REPORT: "Time out for OSHA. The Occupational Safety & Health Administration has suspended job-safety inspections at workplaces in Idaho. A panel of three federal judges there ruled last December 30 that OSHA inspectors violated the Fourth Amendment to the Constitution by entering a business without a search warrant. OSHA is appealing the decision to the Supreme Court, and says that inspections are continuing in other parts of the country. But pending a Supreme Court decision, OSHA is declaring Idaho off limits to its inspectors."

ROLLING STONE: "Radio mikes are the latest in a long series of mini-revolutions in the technology of rock and roll. Attached to the rear of the electric guitar, they transmit the signal to the amplifier without wire. Rock theatrics, previously hindered by musicians getting tangled up in their cords, would be bound only by gravity.

" 'The possibilities are endless,' says Ken Schaffer, of Ken Schaffer Group, *the first company to market a foolproof model that won't switch over to the nearest CB signal in the middle of a concert. (Italics mine)* 'Besides offering complete freedom from electrocution, the musicians can do their own sound checks. They can play from the soundboards at the rear of the auditorium, away from the stage, and hear what they sound like from the audience for the first time.'

"The Schaffer-Vega mikes have been out only a few weeks and will sell only to the biggest bands, as the cigarette-pack-sized devices cost \$3000 apiece. *After guitarist Ace Frehley nearly electrocuted himself in Lakeland, Florida KISS became the first purchasers - \$25,000 worth. (Italics mine.)* ED: ROLLING STONE doesn't have the greatest creditability in reporting on the technical aspects of professional audio, but Ken Schaffer does have creditability -- a name associated with Eventide Clock Works.

ELECTRONICS: "Folded-horn device has free-field output of 105 dB at 1 inch and 2.1 KHz. In designing transducers for portable pagers, the objective is to get the most sound out of the smallest volume at the lowest price. A miniature unit from Dyna Magnetic Devices, 200 Frank Rd., Hicksville, NY 11802, probably comes nearest the target than anything previously developed. Its free-field sound output at 1 inch is a minimum of 105 decibels for an input power of 80 milliwatts at 2.1 kilohertz. Despite this high output, the cube-shaped device measures only 0.64 in. on a side and weighs less than 6 grams. The price in OEM quantities is less than \$3."

ELECTRONICS: Pentagon moves slowly on metric conversion programs. Already distressed with inflated weapons-systems costs, the Department of Defense is discouraging conversion of existing weapons to the metric system, and it will push the use of metric units in new weapons only 'when there are nonsignificant technical or cost penalties.'

CLASSIFIED

FOR SALE: Communications Co. RT₆₀ Reverb Time Meter. New Condition. \$360.00 (new price is \$460.00)
Specialized Audio Inc., R.D. 5, Hutchins Road, Saratoga Springs, New York 12866 Ph (518)885-1153

LATE BULLETIN

U.R.E.I. HAS MOVED. New address: 8460 San Fernando Road, Sun Valley, CA 91352. Telephone: 213/767-1000

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

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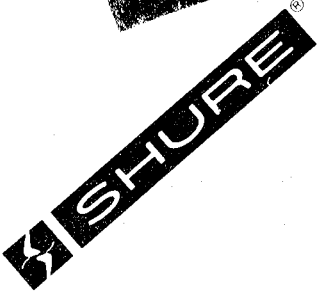
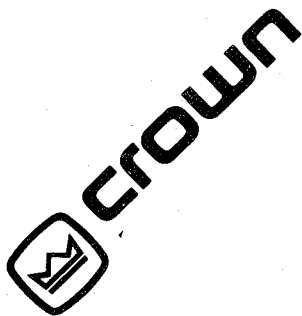
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