

P.O. Box 1239 Bedford, IN 47421 Ph: 812-275-3853 Volume 14, Number 2 Winter 1987 ©Don & Carolyn Davis



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TECH TOPICS:

VOLUME 14, NUMBER 3 - SOUND SYSTEM DESIGN SPREADSHEETS **By Mario Maltese & David Marsh** VOLUME 14, NUMBER 4 - MEASUREMENT OF % AL_{CONS} By Carolyn Davis

1987 - A YEAR OF GREAT POTENTIAL

Intelligibility Measurements

1986 saw the establishment of a solid foundation underlying the objective measurement of speech intelligibility. In fact, we are not hesitant to state that in our opinion the objective measurements presently available are as accurate and reliable as subjective testing and vastly easier to perform. What's even more exciting are the number of individuals who are becoming "calibrated" so that they can label what they hear as a given percent articulation loss of consonants.

Current Syn-Aud-Con classes include live demonstrations of intelligibility measurements plus sharing of data taken during the Intelligibility Workshop. If you haven't been to a Syn-Aud-Con class during the last two years, we can honestly suggest that 1987 is a profitable time to do so again.

New Edition of Sound System Engineering

The new edition of the Textbook is now being used in the classes. The second edition is 665 pages packed with up-to-date engineering detail.

Array Alignment

Array alignment is an area of neglect in sound system work whose time has come. With the truly remarkable

tools for its detection (TEF) and the equally remarkable tools for its correction (microsecond signal delay units), the audio world will divide into those who buy previously aligned packages and those who are capable of designing their own. We've also learned clearly during the past year that many who claim aligned packages can do only that -- claim it.

Syn-Aud-Con Future

Carolyn and I are more excited about 1987 than any of our previous 14 years at Syn-Aud-Con. 1987 is our fifteenth year of service to the audio industry and we have arrived at its threshold with all these fabulous tools and the enthusiasm to go with it. That Syn-Aud-Con is in its 15th year is thanks to the grads, our sponsors, and innumerable consulting clients who have made all this possible.

We are particularly pleased with our current sponsors. Their active participation in our various workshops has led to significant breakthroughs in audio.

We are now teaching the sons and daughters of earlier grads. It's a genuine thrill to interface with the second generation. You can be sure we'll not plan to lay on our laurels but will use this marvelous base to serve all of you better than ever.

MASTER SOUND ASTORIA DESIGNERS WORKSHOP THE KAUFMAN ASTORIA FILM COMPLEX NEW YORK CITY

CHARLES BILELLO and PETER D'ANTONIO

will be our staff for the Studio Designers Workshop, June 12-14, 1987.

We asked Charles and Peter to supply us material to prepare the brochure and we got back two typed pages of measurements that they are planning for the Workshop. I commented that the outline would imply that the Workshop was going to concentrate on measurements. They replied in the affirmative. Charles and Peter are professionals. We have never had such a Workshop and we are looking forward to it.

They have added other features to the Workshop.

(1) A group will perform in the studio during the listening/ear calibration time in the control room.

(2) A Designer's Forum in which qualified designers will present a 10-20 minute talk on their work.

(3) The Workshop held on a weekend. Their thinking is that it will allow more busy studio people to attend.

(4) The entire 3 days will be in the control room/studio at Master Sound. (One negative aspect of this is that we are using our meal money to pay for studio time. More on this in the Workshop brochure)

They have retained one format that we are very pleased with and that is to break the members of the Workshop into small groups for informal discussions. The workshop will be a sharing time. We hope you will join us.

COMMENTS ON CONTROL ROOM DESIGN

While there are many not ready to accept the use of the trademark LEDE[®] there is no shortage of persons willing to use the technology. We are pleased to see the creative extensions of the basic concepts and their translation into actual construction techniques. There is an increasing understanding that if you have the proper tools the front end can indeed by made architecturally hard while being made acoustically non-reflective. Quadratic residue diffusors are increasingly being applied.

The vital role of specular reflective surfaces is misunderstood by many and consequently misapplied in many cases. When absorption is used its frequency dependent behavior must be clearly understood in terms of level reductions, not statistical percentages.

In order to successfully design an acoustically neutral control room so the mixer can actually hear what's going on in the studio over his monitors, requires an understanding of the four major frequency dependent acoustic zones in the control room - the pressure zone, the modal zone, the diffusion zone, and the specular reflection zone.

During the past year some misleading articles have appeared that reveal major misunderstanding of the entire LEDE[®] concept. This is unfortunate because the correct concept is simple, elegant, and easily applied. The psychoacoustic considerations of accurate spatial imaging, the correct use of the Haas effect, the role of polar directivity of specular returns and their frequency dependency are all factors that need to be heard to be fully appreciated.

One of the most frequently overlooked parameters is a full directivity plot of the monitors in use both before and after mounting. Our new capability to make polar ETC's allows startling views of the action of the confining boundaries in terms of directional returns of signals and their relative levels.

Statistical absorption coefficents have no meaning in small room acoustics nor does reverberation. These are fundamental errors that need to be overcome if one is to progress in small room design. The specific specular absorption value and the critical nature of the interception angles need to be understood in order to be applied.

The differences between diffusion and specular scattering is important. A chance to calibrate one's ears, via direct comparison with live music, between the difference in QRD and a covered QRD is an illuminating experiment. In talking to Ben Rizzi, co-owner of Master Sound Astoria we asked if he had a non-LEDE[®] room in the complex so that we could let the class hear the differences between the two concepts. He replied, "That's easy. I'll arrange for a reflector panels to be placed at different places in our control room."

RICHARD C HEYSER

Many Syn-Aud-Con grads have been privileged to attend Workshops where Richard C Heyser was present. Few individuals we have known can approach the mental dynamic range Heyser brings to any event he participates in either as a main speaker or as a guest.

Dick was hospitalized in early October in Pasadena

with a spinal growth(successfully removed) and is physically immobilized while the bone damage restores itself. He is mentally as active as ever.

Dick was discharged from the hospital in early January to recuperate at home. We are pleased to report this progress and to assure his friends that he is on his way to a full recovery.

NEWSLETTER SUBSCRIPTIONS

Moving our office to Indiana, starting up with a new office staff, means that we have taken a very active part in the office, something which is generally not true. The office usually runs without our entering it for months at a time.

When the word got out to the business community that we were moving our office, our office manager, Pat Carlson, was approached with a job offer that she could not refuse and we couldn't ask her to. We were on tour in the East and it meant that she left 6 weeks before we returned. Two part-time girls made tremendous sacrifices in their personal lives to work full time to get our Fall Newsletter put together and mailed, anticipate and provide all the necessary materials for our Fall classes as well as a myriad of other things that needed to be done. The girls said that they would wake in the middle of the night in a cold sweat realizing that something hadn't been done that had to be done for the next class.

Hard Disk Failure

There were glitches. To add to the work load, a hard disk failed -- a hard disk that contained our Newsletter subscriptions and which had not been backed up for several weeks.

Therein lies the main reason for this message. If you or anyone you know have any irregularies in your subscription, please let us know. We save all our renewal forms for a year after they are put in the computer, and we have records of all checks received for 10 years, so we can put check any record if we know there is a problem with a particular subscription. We have received calls so we know there are problems. If you did not receive a renewal, or any irregularity, PLEASE LET US HEAR FROM YOU IF YOU HAVE ANY PROBLEM WITH YOUR SUBSCRIPTION.

Gratitude

Working so closely with mailing list during the past few weeks and sending out renewals has caused us to have great waves of gratitude. We see names on the mailing list that have been there since Day 1. More recent grads have had their subscriptions active since their first class.

We received a letter from Ellis Guy who wrote that he started his own sound business. "To brush up on system design techniques, I started searching through some of the my old newsletters and found one that prompted me to write this letter," and further on in the letter, "Isn't it strange to realize that a newsletter that you wrote almost 8 years ago would perhaps lay dormant until now. It has been read again with new vigor and meaning. I would like to subscribe to the newsletters again..."

Our Mail is Late

If you renewed your subscription and we sent you another renewal it is because our California post office is holding our postpaid mail to send in large bundles. The last bundle contained renewals almost a month old. So bear with us during this change over.

CHICAGO SEPTEMBER 17-18, 1986



SYN-AUD-CON NEWSLETTER WINTER 1987

JBL 4406 STUDIO MONITOR

Last summer we held a class in Syracuse. Bernie and Sue Darmstedter invited us to their home for a marvelous barbecue. As we walked through his house we were



stopped cold by the sound from a pair of little loudspeakers. We asked Bernie about them and he told us they were the JBL 4406s. We were so impressed that we asked him if he could bring in a pair for us to test during the class. (Bernie is a rep for JBL in Upstate New York, as well as for Syn-Aud-Con).

The measurements were outstanding. Our tests confirmed the JBL data sheet. It is refreshingly accurate, frank and useful. Full directivity data including DI and Q plus TEF measurements of the EFC, PFC, 3D and ETC are presented. One of the most impressive measurements is the off-axis response. We couldn't help writing JBL that they really should include the measurement. We also ordered a pair for our house in Indiana.

There are few thrills that correspond to hearing a new and better loudspeaker. The JBL 4406 Studio monitor is the smallest in a new series of four monitors. This units, only 15-3/8"H, 9-3/8"W and 8-1/2"D, and weighs 35 lbs **per pair**. We have listened to this truly phase coherent monitor in our home in Indiana for the past week on everything from our oldest opera and folk recordings to new ones we have purchased recently. The imagining, balance and musicality (for want of a better engineering word) is phenomenal.

We did direct A-B comparisons of the 4406 against a four times larger coherent system. On the 4406 listening to an old record of Bing Crosby and Rosemary Clooney singing western folk songs their intelligibility became razor sharp as their voice range hit the 3000Hz region where the vertical directivity narrows. Their voices sliding from below this range into this range were instantly, though not annoyingly, apparent. Since the human voice also varies in directivity through this range, the effect was relatively natural.

We sincerely believe that JBL is the finest reproducer of sound available in a loudspeaker anywhere near its size. Except for its limited dynamic range (Max Lp - 105 dB), it is an excellent professional monitoring tool.

CHILDREN AND TV

The Christian Science Monitor in its December 27, 1986 edition, page 19, had an interview with Neil Postman, author of "Amusing Ourselves to Death". Mr. Postman is a NYU Professor of Media Ecology.

Mr. Postman states

TV today is no longer simply a benign distraction, but something actually hostile to learning.

He further points out

The great educators - from Cicero on down - have all taught that the purpose of education and schooling is to free children from the tyranny of the present; to help them see beyond the immediate. TV works just the other way. Professor Postman and educator Charles Weingartner in their book, **Teaching as a Subversive Activity**" argued that American public schools had become a wasteland of bureaucracy and standardized curricula."

They added

Teachers must learn how to show children that TV is not reality, but only one way of looking at reality.

It is refreshing to us to see the current revolution going on in the media. Every pendulum has its return swing and it just could be that two generations of TV saturated watchers are finally beginning to revolt against what is revolting.

SYN-AUD-CON SCHEDULE 1987

ANAHEIM, CA.

Holiday Inn February 3-4, 1987

STUDIO CITY, CA. Sportsmen's Lodge March 3-4, 1987

ATLANTA, GA. The Presidental Hotel April 22-23, 1987 OAKLAND, CA. Holiday Inn-Airport February 11-12, 1987

NEW ORLEANS, LA. Sheraton Inn-Airport April 2-3, 1987

LOUISVILLE, KY. Holiday Inn Southwest May 19-20, 1987 PHOENIX, AZ. Granada Camelhead February 18-19, 1987

DALLAS, TX. The Summit Hotel April 14-15, 1987

LANSING, MI. Ramada Inn June 2-3, 1987

FRAMINGHAM, MA. Holiday Inn June 17-18, 1987

SYN-AUD-CON WORKSHOPS

STUDIO DESIGNERS WORKSHOP Mastersound/Astoria, New York June 12-14, 1987 FUNDAMENTALS OF LOUDSPEAKER DESIGN July 1987 (tentative)

SOUND SYSTEM ENGINEERING ERRATA

We are submitting a list of corrections to our publisher for the next printing of the 2nd edition of **Sound System Engineering.** If you have the book we would like for you to have an errata sheet. Please call or write and we will send you one.

Our publisher, Howard W. Sams, we feel did a good job with the new edition. We have our complaints, as I am sure they do with us. Our major complaint was that **all** our corrections for Chapter 13 were ignored. Of course this has made us very unhappy because it is one of our favorite chapters in the book.

The last thing we saw in galley form was the captions. Sometimes authors don't get to see the figures and captions at all before printing. Sams had a publishing date that was cast in stone. We tried to get the publishing date delayed. "Fix it in the mix" was the general attitude. We were told we could correct any errors in the next printing. So we have Figure 13-8 of a Patronis Pataxial, courtesy of JBL (instead of J W Davis); Figure 13-14. A pew-back system designed by David Klepper and installed by Industrial Community (instead of Industrial Communications). In fact, we have three pages of corrections just picking up what should have been corrected before the printing.

We would like you to let us know if you find any corrections that should be added to the errata sheet. We have always felt that our work has been immeasurably improved because of the input we get from the readers of our Newsletters, articles, **Sound System Engineering**, and most of all, in our classes.

Keep the information flowing. We feel very much that knowledge is a two way street.

SYN-AUD-CON NEWSLETTER WINTER 1987

THE PZM AND KEN WAHRENBROCK



In our Man of La Mancha, Don Quixote is the Dick Heysers, Ken Wahrenbrocks, D'Antonios of the world who don't count the costs, obstacles, or fears that stop ordinary men from using their God given talents. The "well meaning family" in Man of La Mancha are the bottom liners - hard headed business men - and general haters of the enthusiastic creator. With these definitions in mind our interpretation of the following letter will not be misunderstood.

We had a letter from Ken Wahrenbrock recently and we would like to quote a few excerpts:

I spent two hours with Gary Pillon yesterday and my PZM juices are flowing again.

I would like to set up PZMUG (Pressure Zone Microphone Users Group). It will maintain contact with and between users. There are so many creative users out there and no one knows about them and what they are doing.

Ken in a familiar mode-helping and sharing

Gary has made a stereo PZM shotgun for remote video use that is excellent. He indicated that he won an OSCAR from whom I don't know but will find out) for its use. He won 4 PZMs for his entry to Crown's contest. There are many innovative modifications still to be made and I am getting interested again. My old problem solving philosophy has climbed out of its temporary tomb.

When we read Ken's letter we felt like we were living a scene from Man of La Mancha where Don Quixote calls for his sword and his armor and Sancho cries Marvelous Adventure. Ken Wahrenbrock's life has been full of dreams and marvelous adventure. We are pleased that Ken will be traveling with us in the west for our Anaheim, Oakland, Phoenix and Studio City classes.



VOLUME 14, NUMBER 2

KEN JACOB ON INTELLIGIBILITY

We recently received the letter shown here from Ken Jacob of Bose with his post Intelligibility Workshop notes. We agree with Ken regarding his first paragraph that it was not a contest between the various loudspeakers and nobody won or lost but great knowledge was obtained as the result of our combined efforts.

We continue to believe, 1) the basic Peutz equation is very accurate when correctly applied and in the use of Q it is correctly applied only in the case of a well controlled devices, and 2) wrong answers from using the equation lie entirely in misapplication, not in mis-formulation. We are pleased to see that Ken recognizes with us that we now have the tools at hand to study this subject in much greater detail.

__B05E*

BOSE CORPORATION THE MOUNTAIN FRAMINGHAM MASSACHUSETTS 01701 • TELEX 948311 • TEL AREA CODE (817) 879-7330

November 21, 1986

Don and Carolyn Davis Synergetic Audio Concepts P.O. Box 669 San Juan Capistrano, CA 92693

Dear Don and Carolyn:

Thank you for a memorable experience last September at the Intelligibility Workshop in Chicago. I believe that every attendee learned about the rigors of subjective experimentation.

While I agree with most of the conclusions drawn by you and by others in the weeks following the Workshop, there are a few things which need to be clarified.

1. One primary objective of the experiment was to better understand the relationship between Q and speech intelligibility. Loudspeakers were chosen which had a wide range of directivities. The objective was not for each manufacturer to set up systems which would be most intelligible in the rooms we worked in. Of course, no attempt was made to design complete systems for these rooms but rather to use the rooms as real-world laboratories. Unfortunately, several people have called, written, and otherwise let it be known that "BOSE and BES lost the intelligibility contest." This kind of commentary goes against the grain of what we are trying to accomplish.

2. There was a correlation between actual subjective intelligibility scores and intelligibility as predicted by the following measures: a) XAlcons using an ETC as input, b) RASTI using ETC as input, and c) RASTI using the B & K meter. There was no attempt (other than my own) to test XAlcons as predicted by the simple formula which uses Q, source-to-listener distance, room volume, and reverberation time as input. This is the formula whose accuracy I have questioned and which remains unproven. Alas, it is commonly used in situations where the room and/or the sound system exist only on paper. We need to separate the real value of the results of our workshop--that results indicate that either a), b), or c) above can be used in specifications for sound systems but only as measured on TEF and the B & K meter using the actual sound system in the actual room--from other methods until they are proven accurate.

3. In my remarks to the attendees on the last day of the Workshop, I outlined the basic requirements for scientific testing of intelligibility. I did not state, nor did I mean to imply, that there was either little value in our exercise or that "perfect" listeners were required for serious work. In a scientific setting, subjects must not know the nature of the experiment, they should not be given any "clues" during the testing, and they certainly must not have predispositions about the outcome, among other things. We knowingly violated these principles in the interest of learning.

I hope that these concerns will be addressed either in personal communication or through Tech Topics. In any case, the Workshop was a valuable experience, and I look forward to repeating the effort.

Sincerely yours,

BOSE CORPORATION ant en

. Ken Jacob Acoustic Research Engineer

We totally support Ken's statement:

We need to separate the real value of the results of our workshop -- that results indicate that either a), b), or c) above can be used in specifications for sound systems but only as measured on TEF and the B&K meter using the actual sound system in the actual room from other methods until they are proven accurate.

What pleased us the most out of this very difficult workshop was the unbelievable cooperation of the sponsoring manufacturers that were involved: B&K, BES, Bose, EV, JBL, and Techron. we have had many comments regarding this aspect of the Workshop.

One fact that was demonstrated by this Workshop was that **intelligibility is related to Q**. It should be noted, however, that often high Q well controlled devices may not at the same time provide the coverage required. One of the next problems to study is the "N" factors role in intelligibility. We believe that John Carter of Bose gave us the best solution to this problem in the late 1970s when he attended a Syn-Aud-Con class in New York. He provided us with:

$N = \frac{QMIN(SS)}{QAVAIL} AND D2MAX = \frac{D2(SS)}{N}$

Ken Jacob also gave invaluable assistance in the processing of the new data when he provided one of the three Macintoshes that made the processing possible at the workshop.

Intelligibility is a major on-going project. The workshop made it possible to measure objectively, with confidence, real systems in real rooms. That's major motion in the right direction.

NEW TEF OWNERS

George Weber 619 Hungry Ford Dr Rockville, MD 20050

Edward D. Burquez 303 N. Highway 47 Columbiana, AL 35051

Iemke Roos Kuiperberqweg 20 1101Amsterdam Holland

Tery Remy AT&T 1120 20th St., N.W. Washington, DC 20036

Art Noxon Acoustic Sciences Corp 385 Lawrence Eugene, OR 97440

Robert F Ancha Ancha Electronics 189 Gordon St Elk Grove Village IL 60007

Rick Zwiebel Audible Visions 31620 Navajo Trails Dr Franklin Lakes, NJ 07417

Audio Command Anodeweg 4 1627 LJ Hoorn Netherlands

N. Podgorski Chrysler Corp 1250 Eng-Prod Develop 12800 Oakland Ave Highland Park, MI 48023 Cliff Sroka Cliff Sroka Acoustical P.O. Box 3413 Portland, OR 97204

Uli Mall D & B Audiotechnik Steinstrable 40 7054 Korb West Germany

Graham Thirkell Editron USA 748 Seward St Hollywood, CA 90038

Brock Adamson Mordor Investment 2851 Simpson Rd Richmond, BC V6S-2R2

Musik Productiv Gildestrasse 60 4530 Ibbenburen West Germany

Don R Foerster S.D. Warren 89 Cumberland St Westbrook, ME 04092

SCV Audio Cedex France 186 Allee Des Erables Paris Nord II 95947 Roissey CDG France

SVC Audio BF50056 Paris Nord II 186 AlleeDes Erables 95947 Roissey, CDG

Sennheiser Electronic 3002 Wedemark 2 West Germany Steven Paul Steven Paul Audio 3750 Vineland Ave Studio City, CA. 91604

Cy Stewart Stewart Company 2 Richey Ave Collinswood, NJ 08107

Bob McCarthey Teleconnect Long Distance 500 2nd Ave SE Cedar Rapids, IA 52406

Jay Paul Trump Casino Entertainment Dept Atlantic City, NJ 08401

Brad Albers University of S. Fl/Sycom 115 Hopeman Hall River Campus Tampa, FL 22620

Ian Jones Unit F, New Crescent Works Nicoll Rd London N2109AX England

Avidan A/S Udlejrevej 3650 Olstykke Denmark

George Smith Smithall Electronics 2001 Vince St Cincinnati, OH 45210

SOUND SYSTEM ENGINEERING 2ND EDITION

We would like to make the 2nd Edition of **Sound System Engineering** available to Syn-Aud-Con grads for \$30 plus \$1 handling charge, or \$31, shipped book rate parcel post. If you purchase the book and attend a Syn-Aud-Con seminar we will allow you \$25 refund.

We are very pleased with the new edition. Howard W.

Sams allowed us to add new material as late as October for a late November printing. So while we complain about minor embarrassing errors in the printing, we are happy with the trade off of being able to make the book completely up-to-date. Far more distressing to an author than minor typos is to submit material for a book and wait two years for the printed edition - some material outdated at publication.

GRAFFY AND McKAY ASA PAPERS

While attending the December meeting of the Acoustical Society of America convention in Anaheim we were privileged to hear two outstanding papers. The first was by Kurt M. Graffy and Dennis A. Paoletti of Paoletti and Lewitz Associates in San Francisco. His paper was entitled "In Situ Auditorium Measurements of Quadratic Residue Diffusors." The second paper was by Ron McKay of BB&N in Canago Park, CA.

Both men used TEF analysis in remarkably innovative ways to illustrate complex relationships in the simplest possible manner.

After two days of ASA sessions discussing theoretical measurements without any kind of actual measurements, we came to have a certain distrust of all the talk and no data. The McKay and Graffy papers were welcome evidence of what can be done by real professionals.

Ron McKay's Paper

Ron's paper was not available in printed form and our program from the ASA is still waiting to be unpacked from our move. We don't have the title of the paper. His visual overheads of ETCs were beautifully annotated and presented. Some of the data included before and after ETCs of the early sound in the stage area for no equipment on stage and then normal equipment such as chairs and music stands. Excellent views of the use and effect of variable acoustic treatment in the hall in its various configurations provided interesting insights into how late in time the operation of the absorption actually is.

Kurt Graffy's Paper

The Graffy paper was available in printed form and we would like to share just a few of the remarkable polar measurements of quadratic residue diffusors. See Figure 1 through 3. Kurt's firm was hired to do an acoustic study for the renovation of a performing arts building in Moscow, Idaho. The figures reproduced here show only one facet of the study: a computer study of the effect of QRDs and actual on-site TEF measurements of the QRDs in use. The correlation is remarkable.

This kind of work, done in the field leads to real understanding. The correlation between accurate measurements and experienced listening results in the ability to design effectively with foreknowledge of the end results.



Figure 1

Figure 2

Figure 3

These illustrations are vivid evidence of how rapidly conventional computers can be interwoven with TEF programs so both design and measurement data can be accurately compared.

SYN-AUD-CON MOVES TO INDIANA

It seems that our move to the old family farm in Indiana has surprised many people who find it difficult to believe that anyone leaves Southern California. Those who visited us on our little mountain top (2600' elevation. To appreciate the elevation one has to realize that the surrounding area is at sea level) know that we loved the hundred mile vistas, the 40,000 acres of wilderness, and the small community with whom we shared the mountain valley.

We love our farm in Indiana too. There are 500 acres in the family farm in Southern Indiana just south of Brown County. Half the farm is in woods and the other half harboring cattle, horses, goats, fields of wheat, corn, soybeans and green pastures; deep ravines with shale bottomed creeks, tall oak, walnut, hickory, dogwood and popular trees; an old family homestead built in 1883 and refurbished in the 1970's; two barns, one of which we helped build when we were younger.

Today I took my 1895 Winchester and walked the deep woods, beautiful in a light snow mantle. Deer tracks crossed, crisscrossed and recrossed my path. Coyote and cat tracks along with coon, rabbit and other small forest beasts left their signature.

Electricity is a luxury easy to take for granted and at Rancho Carrillo in California we had to generate our own for the past 20 years. In Indiana we have 200 amp service to the new house a quarter of a mile in back of the old house which is itself a quarter of a mile from the gravel county road. A few miles away we have a new office in a Bedford limestone house with space to develop a full service office.

One look at our yearly schedule reveals that the vast majority of our classes are in the East (defined as East of the Rockies). Typically we hold 3 to 4 classes in the West. This meant that when our headquarters were at Rancho Carrillo we were there only three months out of the year. When we are in the West, we like most persons who have spent 20 or more years in California, would like to explore Oregon, Washington, Idaho, Nevada, Utah and especially Arizona. We will now be free to do that between our Winter classes in the West. This year we are working out of the Phoenix area.

Rancho Carrillo twenty years ago was a private paradise. Today nearly sixty wonderful families live there. My ancestors moved when they could see the smoke from the nearest neighbor's fire. That luxury is no longer possible but a large farm is its nearest approximation.

We have a very full schedule for 1987 and we are looking forward to it with great joy.



NEW YORK (SECAUCUS NJ) OCTOBER 22-23, 1986

CREATIVE DESIGN



Peter Ames of Sport and Games Ltd in Trinidad sent us the picture of a very creative installation of lighting, sound system, and air conditioning at the pool terrace at the Trinidad Hilton Hotel.

The total system was designed by architects Warner, Burns, Toan and Lunde of New York. Sports and Games did the loudspeaker installation.

Lights, air conditioning and loudspeakers are always in competition for ceiling space. This shows that they can be harmoniously integrated.

A REFRIGERATOR DOOR

We were sitting at our dining room table and listening to a radio that was in the kitchen (see diagram).

We found that by opening and closing the refrigerator door we could generate images that went from wall to wall in the dining room. The location of the sound could be made to originate from the corner of the kitchen or the living room. Anyone who doubts the effect of short term reflections should try to duplicate this setup and play with the door at differing angles.



ROCK MUSIC

At long last we have heard "Rock Music" that we totally enjoy. Shown here is a picture of the "Rock" on our measuring turntable in the New York class. That's Sam Helms and Vinnie Macri flanking it. Believe me, it takes two huskies to lift the rock.



This loudspeaker system housed in a rock measures well and sounds great. It sounded so great that Carolyn and I ordered a pair for use at our Indiana farm where they'll greet arriving guests in stereo. In the Fall they will be used to talk to poachers as they come up the trail in the woods. Something like, "You have the right to an attorney and anything you say may be held against you". It should be a first "Hunter arrested by a rock".

You too can be the first in your community to have a talking rock. These are easily the most practical outdoor loudspeaker system we have encountered that really

sounds good on music and speech. They are heavy but they are good. Dealer cost is approximately \$200 for the Rocky Jr. Other models include The Hillside and Stonehenge. For more information contact Rockustics, Inc., 41Main St., Bayshore, Ny 11706. 516-665-6497.



PC'S FOR ACOUSTIC ANALYSIS

During our demonstration of room acoustic measurements in the Washington DC class we turned our loudspeaker towards the wall and placed our microphone behind the loudspeaker. See Figure 1. The ETC produced from this arrangement is shown in Figure 2. As would be expected the signal from the rear of the loudspeaker is lower in level than the reflection off the wall from the signal from the front of the loudspeaker.



We then placed some Sonex on the wall and remeasured the ETC and obtained a good 12 dB reduction (i.e., about 94% absorption). See Figure 3.

Finally, we removed the Sonex so the wall was again hard and reflective and we measured the impulse response displaying the "real parts" squared log magnitude. See Figure 4.

Since this last approach is the one most frequently taken by the "whiz kids" programming personal computers for acoustic analysis, we'd recommend caution in the use of such software. What you see may not be what you get.

Farrel Becker's Measurements

The following four figures (5 through 8) further illustrate the differences we are seeing between TEF-ETC measurements and impulse squared log magnitude measurements. These were made by Farrel Becker during the Intelligibility Workshop in the reverberant cathedral in Joliet.

An ETC measurement is the square root of the sum of the real part squared plus the imaginary (doublet) part squared. With this information it becomes apparent in Farrel's measurement that the reflection is hiding the doublet.

"Do We Hear Only the Real Part?"

We believe the argument, "We only hear the real part" is specious. Consider a seat in an auditorium where a listener is seated. The listener's head occupies a not insignificant space. Additionally, the listener's head moves about in the space it occupies as it listens. Now place a microphone in that same seat. Does the microphone hear what the ears heard? The answer is, we believe, yes, if the microphone signal is converted into an ETC. The answer may well be no if the microphone signal is converted into a log magnitude of the impulse squared--unless one of two things is also done.

 Spatial averaging over the whole area.
Correct signal processing (i.e., the log magnitude of square root of the real part squared plus

the Hilbert Transform of the real part squared (the



Figure 2



Figure 3

With Sonex blocking reflection



Continued next page

doublet).

PC'S for Acoustic Analysis, Continued



TRANSVERSAL EQUALIZER

Mahlon Burkhard sent me a paper he and R. W. Peters had written for **Sound and Video Contractor** on Transversal Equalization.

This superb description of what a transversal equalizer is and does should be required reading for anyone who intends to equalize any kind of sound system.

Often when we encounter a transversal in the field it is operated by persons who have not read the

operated by persons who have not read the instructions and have tried to use the equalizer as though they were conventional cut-boost filters.

The Industrial Research Products Inc equalizers consists of non-recursive analog all-pass phase shift networks. The time response of the desired frequency characteristics is synthesized directly in the transversal structure. So far as the user is concerned this translates into "uncolored" transient response.

A great deal of nonsense has been written this past year by various equalizer manufacturers who we believe know better but adhere to "any distortion for a buck" philosophy. Burkhard and Peters are thoroughly qualified engineers who have developed a notable "first" and have described it with real engineering accuracy.

We have utilized these equalizers in a number of our classes and workshops and found them to be extremely effective. Be sure you read the instructions first.



MORE POLAR PLOTS FROM BECKER

Farrel Becker has sent us a detailed study of the concert hall used during the Intelligibility Workshop. These polar plot of energy versus direction include front FD, right RT, rear RR, and left LT plus a set of returns from above UP, below DN, Forward FD, and rear RR as well as UP, DN, RT and LT.

The frequencies that were swept to obtain this data was from 250H2 to 2500H2. The time scale (Horizontal scale on ETC) was 24-201 msec for a total time span of 177 msec.

Notice carefully, on the polar displays the "initial" and "final" value below maximum (i.e. the peak of LD). These values tell you where the floor was set on the ETC for the particularly polar display you are viewing. This use of a floor allows a judgement to be made about which directions are returning higher levels of early sound. We have rarely seen an entirely new view of something in audio that proved as useful and easy to understand. We now have:

Energy vs frequency Energy vs time Energy vs direction Frequency vs time Speech Intelligibility Frequency vs direction Frequency vs distribution Phase vs frequency Frequency vs energy vs direction

Frequency vs group delay RT60 vs frequency Schroeder integration Ld vs Lre or Lr Real vs imaginery Frequency vs energy vs time Forward energy integration Impulse response Doublet response

And there's much much more to come. For those of us raised on level vs frequency and simple oscilloscope views all of this seems miraculous -- and it is! These new viewpoints will quickly lead to better understanding of what now seem to be complex -psychoacoustic phenomena by allowing the remeasurement of older data that did not have such tools available when it was originally done. Anyone who attended the AES meeting in Los Angeles know that they are still talking about redoing conventional level vs frequency measurements with level recorders and FFTs. Somewhere in the wide world of audio we need a new forum for the coordination and exploration of all of these new tools done by qualified personnel who are enthused with the possibilities presented. Perhaps an audio measurement society or some similar format. We'd be pleased to hear from our readers what their thoughts are on this subject. Should we arrange a special workshop just on audio measurement?



On 9/24/86 At DEFALS





First data point = 1 Last data point = 400



SOMETHING OLD & SOMETHING NEW

While at the farm this summer we received a reminder from the past. Ron Steinberg of RentCom in Chicago replaced an old Boner tuning done back in the 1960's and sent us the handwired equalizer. As you can see from the photos we now have a good supply of 16, 160 and 640 mh coils plus a few tuned circuits for shelving. It's always fun to reconstruct various filter circuits used in the past for analysis by the TEF analyzer.

The second item received came from heaven and we've name him Pete. He arrived small, hungry and at least a mile from the nearest other habitation. We were instantly adopted and that brings to a total of four cats



WASHINGTON D C

in the Davis household. (We had two office cats in California, which have joined us in Indiana now that we have moved.) Punch is our oldest citizen and is a petite female calico. Francine is a totally black, even her whiskers, completely paranoid cat that tells us she is being held against her will but she doesn't know were else to go. Tillie, or more formally, Tillard is our largest male cat and passes through each day with immense dignity.



OCTOBER 28-29, 1986



VOLUME 14, NUMBER 2

WHAT'S IN A WORD

We understand that SIM (Source Independent Measurement tm) is trademarked by Meyer Sound Labs. We had originally thought it stood for "simply invisible measurements" because none were ever published. We have nothing against autocorrelation and though Meyer denies that is what SIM is, we'd like to see him do it without autocorrelation.

It is not source independent but uses the performance as a source instead of an analyzer generated test signal. I would call it PIMTM, Performer Initiated Measurement, or PCMTM, Performer Correlated Measurement.

Now, with that settled, how does one go about such a measurement? You simply sample what's coming electrically out of the output of your system (console output, power amplifier output, wherever it is convenient), signal delay it and compare it to what's received by your measuring microphone placed at some magic spot totally representative of your entire venue. The difference between what you electrically sent and what you acoustically received will appear on the screen. Adjust your equalizer until there is no difference.

Compensate for the Presence of an Audience?

We are told that all of this is done to compensate for the presence of an audience. Let's consider that proposition. The direct sound emits from the loudspeaker and travels to the listener. Let's say it is a dead hall with an RT 60 equal to 1.5 secs. That's 1500 msecs. Let's further say that the natural time of the space is one half that or 750 msec (i.e., the time to the maximum level of the integrated late energy). The effect, if any, of the audience now arrives 750 msec later. But, according to an article by Chris Miche, formerly of Meyer Sound Labs, written for Sound and Communications, they can compensate for "frequency response modifications caused by delayed reflections up to 40 msec". Even if they misplaced the decimal point, they can't do anything about the audience.

Equalizer Operates on Direct Sound Only

We would hope that it is fundamentally obvious that an electrical equalizer is not going to operate on anything but the direct sound level from the loudspeaker. This leaves us with the question, What then does PCM do? Suppose you put a dip in the direct sound to compensate for a bump caused by a first reflection less than 40 mecs away (i,e., 45 feet). If, and that's a big IF, the ear-brain integrates for 40 msec, then you might get away with this mixture of direct and first reflection energy. We personally doubt it.

To be fair, what might PCM do? Anyone who has attended a recent Syn-Aud-Con class has observed the dramatic changes in response of a system where the performer's face reflects sound into the handheld microphone. Indeed, you might want to compensate for the difference ways the performer uses the microphone during different parts of the performance. These effects can be compensated for in the direct sound level and can be seen with a 40 msec time window.

Because so few people use a test loudspeaker into the microphone when they equalize, but rather the majority inject their test signal into the system electrically, someone using a PCM technique will then observe these effects for the first time.

We suggest that PCM techniques be looked at in terms of exactly where the variation in response actually came from. Farrel Becker's excellent analysis of audience effects at Wolftrap is a splendid example of how to do so (Newsletter V14Np8-9). We believe that when this is done we'll find that PCM techniques will have no relation to the audience's presence.

ORIGIN OF WOOFER AND TWEETER

In **Electroacoustics** by Frederick V. Hunt on page 84, describing work done by Robert D. Parry for a patent issued in 1928, the following paragraph is found:

"Parry's disclosure went somewhat further than others by proposing that a separate voice coil be provided for driving each of the three annular segments into which the conical diaphragm was to be divided. A paraphrase of the Goldilocks legend is almost irresistible suggested by such a neat array of voice coils nicely graded as to size. The little central cone had a little voice coil and it would go Tweet, Tweet; the middle size conical section had a middle size voice coil, and it would speak with a middle pitched voice; but the big conical section on the outside had a great big voice coil, and it would go Woof, Woof."

Hunt's book was published in 1954 right in the middle of the high fidelity craze after the war. A generation of his students heard the tale from his own lips.

STANDARDS

There is a tremendous force in a standard whether set by law or custom. The "QWERTY" keyboard layout designed a century ago to slow typists so the primitive machines of the day didn't jam survives on modern computers because it's standard.'

So much for standards. They entomb the dead.

FIBER OPTICS

Fiber optics will be an important factor in acoustics before this decade ends. The prices, technology and availability will have vectored by 1990 to make fiber optics the preferred choice in a large number of transmission line usages.

In the Fall 1986 class in Clearwater, Richard Downes was in our class. He was starting a new career after having been very successfully involved in fiber optics with Litton Industries. I mentioned my desire to learn more about the subject and he recommended a magazine, Photonics Spectra. (See the sample extract from the July issue).

Their summer 1986 Photonics Product Portfolio is a major resource of information relative to this field: lasers, cables, splicers, lens design software, research radiometers, optical pulse generators and all kinds of measuring and computing tools for fiber optic systems.

We are told in one of their reports that computers in grocery stores connected to touch operated video displays will allow customers to

- 1. See where they are at in the store
- 2. See where what they want is in the store

3. Provide an optimum path on the screen from the customer to the product.

I'd say putting these in, maintaining them and helping

program them could provide some sound contractors a real extra activity in any of the larger cities.

Photonics magazine is available free to qualified people. Their address is Berkshire Common, Pittsfield, MA 01202.

Copper to the Rescue

Putting fiber optic cable in the ground posed no problems for Illinois Bell. It was afterward, when someone decided to dig in the vicinity of the cables, that trouble arose. Cable technicians had difficulty pinpointing the cable's location and tracing its path. They also had difficulty communicating with each other during maintenance operations. The problems stemmed from the fact that the fiber optic cable, including the splices, was buried two feet deep and ran for miles without surfacing. After examining a list of options, including bringing the cable to the surface at frequent intervals and burying a conductive warning tape a few inches above the cable, the company decided to lay a separate cable containing two pairs of 19-gauge copper wire along with the fiber optic one. Access to the copper cable is provided by bringing it to the surface every 2000 to 3000 feet. In this way the fiber optic cable is easily located and technicians can communicate over the copper circuits.



MINNEAPOLIS OCTOBER 1-2, 1986

AURATONE MEASUREMENTS

Charles Bilello's life has changed with the advent of TEF analysis. From school teacher to LEDE designer is quite a step especially when you take it on yourself to lead the way with workers like D'Antonio, Mary Gruszka, and Dave Andrews. This quartet has literally innudated us with TEF data. We've been innudated before but the quality of this material and the new insights it is providing is marvellous. Real technical breakthroughs take dogged determination and stamina. That's why innovation is not a nine-to-five job. If anybody has earned their MMMTIT* button this quartet certainly has. (*Measure, measure, measure, think, think)



Here's a set of measurements that Charlie sent with a note saying "I love doing this".

Here are 3-D and FTC polar responses in log frequency scaling for the omnipresent Auratone monitor.

MEASUREMENT PARAMENTERS FOR FIGURES 1 through 3:

Vertical: 6dB/div Horizontal: 100.12Hz to 19998.10Hz Resolution: 2.2557E+00 Feet & 5.0096E+02Hz



IMPORTANT DEFINITIONS

- 1. VI Volume Indicating Instrument.
- 2. VU Volume Units (what a VI is calibrated in).
- 3. On a sine wave only: OVU = O dBm.

4. On program material (speech or music) O VU = + 10 dBm (by universal agreement).

5. What is read on a VI scale is called the instrument indication. The *level* is the instrument indication plus the *attenuator* setting \pm any impedance corrections if required.

6. O dBm is one milliwatt (0.001w) period! Any voltage across any resistance that results in a power of 0.001w is a power *level* of O dBm.

7. There is output power level L_{OUT} and available input power level L_{AIP} . L_{OUT} is actually developed at the output of the system. L_{AIP} is what is *theoretically* available from the output of one device at the input of the following device.

8. Gain or loss is the difference in level between the input of a device and the output of a device. The input will be the L_{AIP} of the previous device. The output will be the L_{AIP} of the device itself relative to the next device. When the device is the final electronic device in the chain, then the L_{OUT} is *measured* and used.

Gain is the term used to describe the change in *level* expressed in decibels *at the listener's ears* upon the insertion of a device into the system in place of a piece of wire..

If you have these definitions solidly in mind, you should be a handy man around a sound system installation job.

-20-

EAW MEASUREMENTS

In the New York City class, Peter Russell brought in his personal EAW SD 6000 loudspeaker. EAW stands for Eastern Acoustic Works and is a firm with a knowledgeable designer, Ken Forsythe. Many times a loudspeaker brought in to be measured before the class leaves its owner a wiser but sadder person. Not so in this case. The energy time curve, ETC, is one of the cleanest we have seen. When you see an ETC this narrow and uncluttered it tells you that the device has a very wide bandpass and because more than one driver is involved, it tells you the signal alignment is exceptional. The linear energy frequency curve, EFC, and the phase vs frequency curve, PFC, reveal truly textbook uniformity. The on- and off- axis response curves show that more than one listener can hear this system perform well even if they are sitting side-by-side. The bump in the high frequency portion of the log EFC is primarily due to my half inch measuring microphone and not to the loudspeaker. This unit really does seem to be plus or minus 3 dB throughtout the audio range. Many claim it, few produce it.



SHURE SHOTGUN



We have a friend who borrowed a relatives motor home for a vacation trip to Canada. It happened to have a bumper sticker say 'This motor home insured by Smith and Wesson". When he arrived at the Canadian border he found himself being closely and persistently questioned as to where the pistol was hidden in the motor home. Canada has strict firearms laws and no sense of humor about any part of the subject.

It is with this story in mind that I received one of those yellow with black lettering diamond shaped signs for the rear window of a car from Shure stating "Protected by a Shure Shotgun". I'll be curious to see how many loyal Shure dealers get pulled over in Morton Grove, II on their way to visit the Shure factory in Evanston. I don't think I'd put it in the window in MA either.

The SM89 shotgun microphone looks interesting and the text of the release indicates that they have thought about the common problems other shotguns exhibit. Excerpting from their recent release on the SM89:

The on-axis frequency response of the SM89 is 60 to 20,000Hz. A slight presence rise in the high-frequency response compensates for high-frequency losses due to distant pickup.

The off-axis response of the SM89 is outstandingly free of comb-filter effects. This is particularly important when it is not possible to aim the microphone precisely, when it is desirable to pick up dialogue or sound from moving sources, or when it is necessary to reinforce sound from a single instrument within a group without excessively coloring the sound of nearby instruments.

As an optional accessory item for the SM89, Shure has made available the A89SM shock mount for use when exceptional freedom from mechanically transmitted noise is required.

While the SM89 is the lightest professional shotgun available it is also the most rugged. It can literally be bounced off the floor or wall without denting and still perform.

THE BOSE WAVEGUIDE

The latest Zenith TV incorporates the advanced Digit 2000 TV circuits of ITT Semiconductor, West German Intermall GMBH. But, so does all the other manufacturers so we are told. What the other manufacturers do not have is the Bose split waveguide.

The standing waves in the Bose enclosure are formed by two elongated waveguides folded back onto themselves. A single low frequency driver is precisely positioned so that one of the two waveguides is three times the length of its compliment. With the correct adjustment of driver and waveguide dimensions, standing waves are developed. The waves reflect down the opening and travel back toward the speaker cone without dampening. This produces a velocity gain in the air movement and a consistent reduction in cone motion that improves speaker efficiency. The folded waveguides also function as low pass filters that suppress distortions produced by the bass driver. Used in a three way system the first crossover is at 400 Hz. I'm not sure whether the Zenith waveguide is an outgrowth of the research done for the Bose acoustic wave portable radio or vice versa, or it all came out of research for the Delco/Bose.



TIME-FREQUENCY MEASUREMENTS

The popular audio magazines are rife with badly written inaccurate articles on modern spectrum analysis. When the occasional exception occurs we like to note it.

INTERPRETING TIME - FREQUENCY

MEASUREMENTS by E. Curtis Eichelberger in the Nov. 1986 Sound and Communications is just such an article. It addresses the virtues and problems of the three major approaches and arrives at the inevitable conclusion that TEF (called TDS in the article) is the superior technology for normal audio work in real-life systems and spaces.

TDS offers exceptional performance in situations where immunity to background noise is essential."

In discussing all three systems dual channel FFT,

scanning systems the kind most frequently adopted to PCs and TEF he states:

"Results using these systems can be formatted into three dimensional plots and the amplitudes can be scaled in units of energy. However, these results are not equivalent to TDS data - the time and frequency resolution is usually different. There is a direct tradeoff between time resolution and frequency resolution because the measurement is being done in real time. TDS does not suffer from this trade off because the measurement is essentially not in real time."

Read the whole article and remember it. It can save you from a bad investment.

COMMENTS ON MANAGEMENT

U.S. News and World Report has the services of an exceptional cartoonist who illustrates their business pages. One of our favorites is shown here. As anyone with experience in the sound contracting field knows, your best men sometimes leave to become your competitor. In fact, the better the management the greater the likelihood of such events as "first rate men hire first rate men and second rate men hire third rate men".

Competition is all too frequently viewed as conflict. To compete is to rise to the very best you can do. Conflict is

trying to interfere with what the other guy is trying to do. You can't do your best when your attention is fastened on the other guy's projects. Leaders have no peer group, competition, or worry about the other guy.

Many a talented team that comes together for a brief period to create magic in the marketplace fall apart due to their lack of moral fiber and ethical practice. Long term success is absolutely dependent upon both morals and ethics. Fortunately, just as often the ideas they generated are picked up by real businessmen who do have their act together and the idea does not die by the wayside but is brought into maturity and usefulness.



CLASSIFIED

WANTED:

Used TEF 10 or 12 Analyzer. Ken Barron, Barron & Associates, Acoustical Consultants Ltd., 3284 Heather St., Vancouver, B.C. V5Z 3KS

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

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

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





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