

Prequel_1972-1995

I have been interested in music my entire life growing up in Brooklyn, NY with a musical family. I played in local bands during my college and graduate studies at St. John's University, Queens, NY and Brooklyn Polytechnic, NY, respectively. In 1967, I received a Ph.D. degree in Infrared Spectroscopy and Crystallography and took a position as a diffraction physicist at the Naval Research Laboratory's Laboratory for the Structure of Matter in Washington DC, headed by Noble laureate Dr. Jerome Karle. After a few years, my interest in music resurfaced and I



Figure 1. Sony TC355



Figure 2. Seated at the vertical console

As the music evolved and the band grew from two to 4 and from acoustic to electric, noise levels increased. So, we decided to build a recording studio to keep peace with the neighbors and allow my young son to sleep. Living in a split level home in Kettering, MD, I explored the idea of building a recording studio in the unfinished basement. Never having done this before, we consulted with a local company called SSI, founded by Neil Muncy. Neil was a gifted analog designer and pioneered the application of operational amplifier technology in custom-built multichannel recording consoles and related equipment. I purchased an SS3 8x2 mixer and an MXM 8x8 switcher along with ancillary electronics and we built our first vertical console, Figure 2, and upgraded to a Revox A771/2 tape recorder, with built in Sound on Sound, as seen in Figure 3.

As the picture shows, I am monitoring with headphones, since the basement area was not divided into separate recording and live areas. In addition to our own recording, we opened the studio, appropriately called Underground Sound, to commercial business. As commercial projects increased and our understanding about recording technology grew, we decided to partition the 25' x 25' area into an acoustically isolated control room, isolation booth and live area. This was the first time I thought about acoustics! I

began collaborating with Jerry Ressler writing and recording original songs, with a Sony TC355 reel-to-reel which was outfitted with sound on sound.

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Figure 3. Revox A77

began studying sound isolation theory and finalized a design in which we constructed three completely isolated rooms, with the walls floating on neoprene isolators, Figure 4, and the ceilings resting on the floated walls. All surfaces consisted of multiple layers of 5/8" drywall. Being a sub-basement, the floor was not isolated.



Figure 4. Walls shown floating on neoprene isolators

This turned out to be a much larger challenge than ever imagined. Not only were we acoustically isolating the new 3 room studio, we also designed and installed the HVAC system, the AC wiring, plumbing, lighting, etc. In Figure 5 we show an in-progress photo of the construction, while beginning to dismantle the old vertical console.



Figure 5. New studio construction and dismantling the old vertical console

patch bay routing, etc. In Figure 5, we see a photo with the new console in-progress, along with the wiring, Fig. 6, feeding our new patch bay. To complete the new control room, we purchased a Scully 100 1" 8 track, Fig. 7, and Scully 280B 2 track, Fig. 8, recorders. With the addition of UREI vintage 1970 speakers we were operational.

When construction was completed, the next challenge was the new console. We worked with Jay Kingery of RCI in Silver Spring Maryland to design and build the new console furniture. Electrically outfitting the new console required learning about grounding, wiring, 600 ohm termination, signal flow and



Figure 6. New horizontal console in-progress, with wiring to the new patch



Figure 7. Scully 100 8 track recorder



Figure 8. Scully 280B 2 track recorder

1 2 3 4 5 6 7 8 9 10 11
 U N O E R G R O U N O
 << < - S O U N O - >>
 12 13 14 15 16

16 TRACK PROFESSIONAL RECORDING

Control Room

12003 Wimbledon St., Largo, Md. 20772
 (301) 249-5647



Figure 9. New Underground Sound

In Figure 9, we show the brochure of the new and improved Underground Sound Recording Studio, along with photos of the new control room, iso booth and live room.

While the new isolated rooms were extremely useful, I began focusing on the acoustics or sound quality of the new control room, which I was not happy with. I carried out a search of the scientific literature and to my surprise, there were no published articles describing control room design research. I did find one magazine article by Don and Carolyn Davis of Synergetic Audio Concepts, describing a new approach called Live End Dead End (LEDE), using a new diagnostic tool called Time Delay Spectrometry (TDS), invented by Richard Heyser. After studying LEDE principles, I needed to implement a sound diffusing, as opposed to a sound absorbing, surface for the rear wall of the room and a broad bandwidth absorbing front. This design was 180 degrees from what current control rooms were using. Further research on diffusion led to the work of

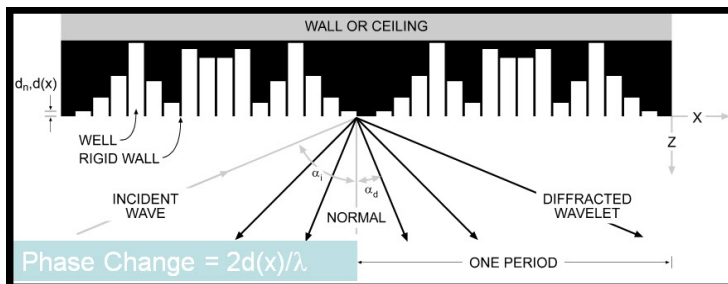


Figure 10. Quadratic Residue Diffusor (QRD®) consisting of divided wells, whose depths are based on mathematical number theory

Manfred Schroeder, related to reflection phase gratings, using quadratic residue and primitive root number theory sequences. After studying this research, I realized that these new number theoretic diffusors were actually 2-dimensional periodic surfaces. Now at the time I was studying 3-dimensional periodic

surfaces in the form of crystals, using x-ray crystallography. Therefore, I was very familiar with this theory and was able to design, model, build and test these new diffusing surfaces using the new TDS technology.

The rear wall was now solved, and I focused my attention on the “dead” end or front of the room. This led to the development of the reflection free zone (RFZ™) concept, Figure 11, which used splayed, massive and broad bandwidth absorptive surfaces on side walls and ceiling, to both absorb and reflect incident sound from the adjacent monitors to the rear of the room, where it was uniformly diffused, creating an accurate and enveloping monitoring environment and a sense of passive surround.

I presented this research at the 74th AES Convention in New York in 1980. There I met Don and Carolyn Davis and Bob Todrank, owner of Valley Audio, who used this technology for the first time to design and build Acorn Sound Recorders for the Oak Ridge Boys, Fig. 12.. Following the success of this project,

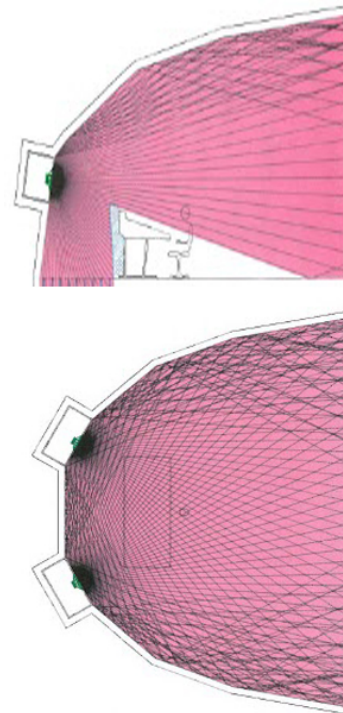


Figure 11. RFZ created by splayed ceiling and walls

the RFZ/RPG design quickly became a defacto international standard readily accepted by studio designers and launched RPG Diffusor Systems, Inc. in 1983

'Come On In'

Valley Audio invites you inside ACORN SOUND RECORDERS' new control room.

When the Oak Ridge Boys wanted a new control room for their Acorn Sound Recorders in Hendersonville, Tn., they entrusted their chief engineer, Jimmy Tarbutton, with the responsibility of contracting the best services available for the job. He chose Bob Todrank and Valley Audio.

"I wanted the latest in control room technology with a large functional space. Since we were building from the ground up, it had to be right. I chose Bob to completely design the room and oversee the construction. I wanted Valley Audio's technical services to do our equipment interface because of their more than ten years' experience in audio installations, and selected the new Harrison MR-4 32-24 console based on its flexibility and innovative designs. We then selected a long term associate, Jim Aanderud of Viking Enterprises as our contractor."



Rear wall showing diffusion reflection

Todrank says, "Since Jimmy wanted a large, open room with a very "live" feel, I designed a control room incorporating the latest *LEDE (Live End/Dead End) concepts. I chose a rear wall diffuser system designed by Peter D'Antonio of RPG Diffusor Systems, Inc., to accomplish a widely dispersed sound field around the console. We built and installed the very first of its kind anywhere and I was thrilled with the results. I also used our TECRON TEF equipment to place the final room interior treatments. The proper implementation of the LEDE design theory along with the use of on-axis monitoring, correct room geometry and accoustical equalization (selective diffusion/reflection/absorption techniques) has resulted in a room I'm very proud of."

The Oaks are proud of it too. Duane Allen's reaction... "It's like a dream come true."

*LEDE is a registered trademark of Synaptic Audio Concepts



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The Oak Ridge Boys
Circle #048 on Reader Service Card

AUGUST 1984

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Figure 12. Oak Ridge Boys' Acorn Recorders