

Many thanks to the NCAC for publishing a “Diffuse Reflections of My 40th Anniversary” article in the Spring 2023 issue of their Newsletter.



The history of every company is a captivating narrative. The role played by the acoustical community in my career in acoustics, which began four decades ago, is an essential part of that story. My formal education was in chemistry and diffraction physics, not acoustics, however this prior background proved immensely valuable in my passion for music performance and recording.



My story began in 1983, but its roots can be traced back to 1972 when I completed a personal recording space for my musical compositions. Over time, this space evolved into Underground Sound Recording Studio, with separate control, isolation, and live rooms. As I ventured into designing a control room, I scoured the scientific literature, but found no prior research. However, I stumbled upon an article by Don and Carolyn Davis of Syn-Aud-Con that introduced me to the Live End Dead End approach to control room design. Inspired by this concept, I aimed to create a design that combined the acoustical characteristics of both an anechoic chamber and a reverberant space within a small room, replicating the experience of a larger performance venue. After creating a temporal and spatial reflection free zone, RFZ, to create the Dead End, which minimized interfering early reflections, the challenge lay in introducing a diffuse reverberant Live End. Fortunately, my search led me to an article by Manfred Schroeder in Physics Today's October 1980 issue. It described reflection phase grating (RPG) diffusors that were capable of uniformly scattering sound. Delving deeper, I discovered that these diffusors remarkably were 2-dimensional periodic versions of the 3-dimensional periodic crystal lattices I had been studying as a diffraction physicist at the Naval Research Lab, using x-ray crystallography. My familiarity and interest in these designable and quantifiable uniformly scattering diffusors, led me to further research and my first acoustical presentation at the 74th AES Studio Design Session C in October of 1983 in New York. To my surprise, Manfred Schroeder presented the leadoff invited presentation.

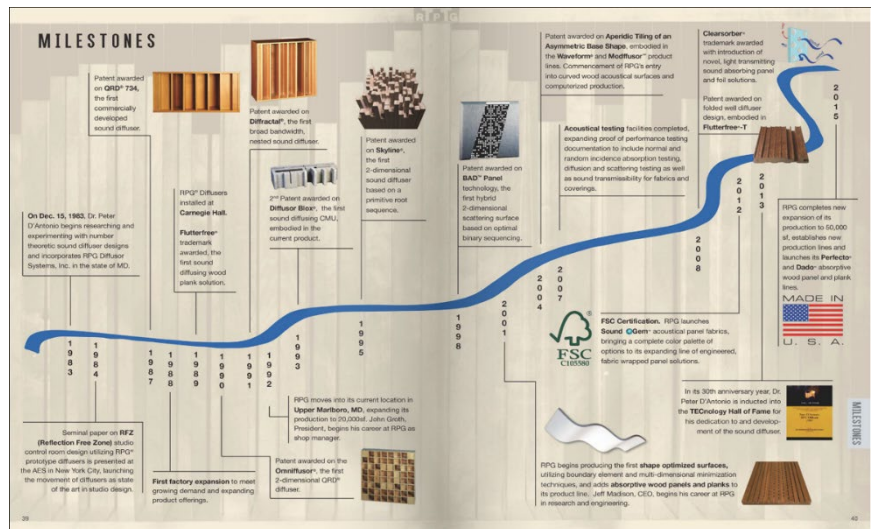
Following my presentation in a Studio Design session, I met several people in the audio community including Syn-Aud-Con founders Don and Carolyn Davis and Bob Todrank, owner of Valley Audio. Don and Carolyn Davis invited me to the first LEDE studio design workshop, where the first TEF measurements were made with a TEF analyzer by Crown. Bob Todrank and I discussed the application of these new diffusors in a studio he was designing, and our collaboration led to the first RPG installation on the rear wall of the Oak Ridge Boys' Acorn Sound Recorders, in Henderson, TN. My involvement with Syn-Aud-Con led to my meeting many of the present and future recording studio designers, who enthusiastically incorporated the RFZ/RPG control room design in recording studios around the world. As with my future collaboration with members of the NCAC, each played a key role in embracing and employing my research. The level of excitement and interest in these diffusors essentially forced me to form RPG Diffusor Systems, Inc. (RPGD) in December 1983 and set up manufacturing in my car port to meet the demand. Like my entry into the field of acoustics, starting a manufacturing company was completely foreign to me.

While we had the capability to simulate the performance of the RPGs, I needed to develop an experimental method to measure and document their performance, so they could be specified by acousticians and added to the acoustical palette. I began a systematic program of experimental measurements, using the TEF analyzer. Full scale experiments began in large sports facilities, then my son's high school gymnasium and when we outlived our welcome in these spaces, we developed a new scale-model measurement system called a Goniometer, which was another example of how my experience in crystallography led to a development in acoustics. This research eventually led to the current ISO 17497-2 diffusion coefficient measurement standard published in 2012.

Interest in recording facilities naturally spread to broadcast facilities and significant involvement in international residential high-end audio listening rooms. In 1989, my collaboration with Telarc Records led to a position as adjunct professor of acoustics at the Cleveland Institute of Music and stage acoustics measurements and an RPG shell at the Meyerhoff Symphony Hall, where Telarc was recording the Baltimore Symphony Orchestra. The success at the Meyerhoff led to a re-design of the rear wall in Carnegie Hall. This installation, along with development of the new Variable Acoustical Modular Performance Shell (VAMPS), launched RPGD's involvement into performing arts applications, as well as contemporary into worship spaces.

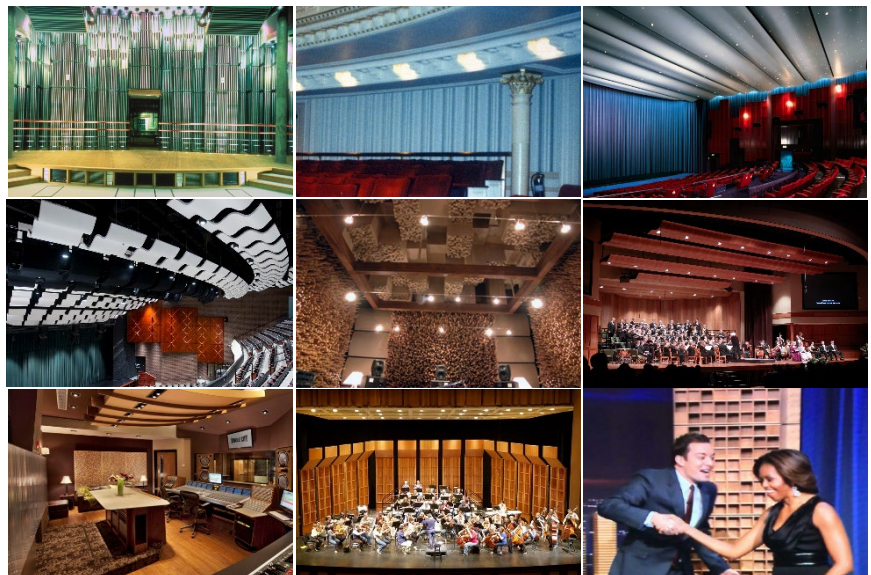
In 1993, I refereed a paper by Dr. Trevor Cox for JASA, which led to a collaboration and friendship that produced three editions of our reference textbook entitled "Acoustic Absorbers and Diffusers: Theory, Design and Application", as well as a significant number of innovative Milestone absorptive and diffusive acoustical products.

Things began falling into place and all of the relevant diffusion research was collected into a special edition of *Applied Acoustics*, entitled 'Surface Diffusion in Room Acoustics', guest edited by Yiu Wai Lam and published in June of 2000. In September of 2001, a special structured session on scattering in room acoustics was organized by Michael Vorlander at the 17th ICA in Rome. It was personally very gratifying to be part of a session dedicated to a topic that started as an intellectual curiosity and has now turned into a diffuser industry and a field of research actively being studied by the leading acousticians of our time. A short sample of Milestone Projects is also presented.



There have been many significant accomplishments over the past 40 years. We now know how to design, predict, optimize, measure, characterize, and standardize the performance of scattering surfaces. While there is still much to do, there is a general consensus in the architectural acoustics community that a solid theoretical and experimental foundation has been laid, that diffuser performance can now be quantified and standardized, and that diffusers can now be integrated into contemporary architecture, taking their rightful place along with absorbers and reflectors in the acoustical palette. The future holds many exciting possibilities.

In 2017, a new entity known as RPG Acoustical Systems, LLC (RPGA) (www.rpgacoustic.com) was established to manufacture the products designed prior by RPGD and begin research and development anew. We added the Acoustical Research Center (ARC) with a 285 m³ rev room, a new Goniometer and a 7 ton, 25' long impedance



Top row left to right: Real World Studios, Box, England, Harris Grant Associates; Carnegie Hall, Kirkegaard; Cinerama Theater, Seattle, WA, Harris Grant Associates; Middle row: Northridge High School, Middlebury, IN, dBA Acoustics; Blackbird Studio C, Nashville, George Massenburg; First Baptist Church, Eugene, OR, AGI, Inc.; Bottom row: Jungle City, NY, WSDG; Sacramento Philharmonic Orchestra, McKay, Conant Hoover; Jimmy Fallon Show, NY, Jaffe Holden.

tube. We invite you to join the ARC Associates Alliance to share this facility. By adding new milestones and expanding its product range to meet the ever-changing requirements of the architectural acoustics and pro audio industries, we are looking forward to the next 40 years. A detailed history of RPG product's evolution can be found on my web site www.peterdantonio.com.