

LEE SOUND DESIGN



THE NATURE OF CREATIVE ENGINEERING

## **SERVICES AND QUALIFICATIONS**

*Member Firm - National Council of Acoustical Consultants*

Consulting Engineers in Audio, Acoustics and Video

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## **INTRODUCTION**

**LEE SOUND DESIGN, Inc.**, is a full service consulting engineering firm specializing in technologies of the art and science of aural and visual communication. Applications include professional, commercial and residential environments where critical listening, entertainment viewing and general communication occurs. Complete design and project management services are provided.

In 1993, **Lee Sound Design, Inc.** was founded to provide full time consulting engineering and construction management services to the industry. The mission of the firm is to provide quality consulting services for a fair price, to maintain a level of professionalism that elevates the respect and recognition of acoustical and specialty consultants in the general engineering community; and to educate architects, engineers and the general public in these technologies. Hearing and seeing are the oldest forms of communication, while at the same time aural and visual technologies remain one of the least understood technologies in today's world.

## **PROFESSIONAL SERVICES**

- Registered Professional Engineering in Georgia and Florida
- Member of the National Council of Acoustical Consultants
- Sponsor of the National Systems Contractors Association
- Member of the International Communications Industries Association
- Sound System Design and Analysis
- Audio Visual Facility Design and Analysis
- Acoustical Design and Analysis of Rooms for Speech, Music, and Noise Control
- Audio and Video Teleconferencing System Design
- General Communication System Design
- Laboratory and Field Measurements according to ASTM Standards
- Time Delay Spectrometry (TEF Method), FFT Analysis and MLS Analysis
- Pre-construction Performance Predictions and Computer Modeling
- Contract Administration and Construction Observation
- Seminars, Presentations and Training Workshops
- Professional Liability Insurance for Errors and Omissions

## **FACILITY TYPES**

Performing Arts Facilities  
Convention Centers and Hotels  
Worship Spaces  
Arena, Stadia, and Sports Facilities  
Government and Educational Rooms  
Corporate Conference Rooms  
Computer Presentation Rooms

Training Rooms  
Video Production Studios  
Audio Recording Studios  
Band & Choral Rehearsal Rooms  
Museums and Exhibit Spaces  
Courtrooms and Law Schools  
Auditoria, Theaters and Concert Halls

**D. Wayne Lee, P.E.** offers over 19 years of proven experience in various aspects of the industry. A graduate of the Georgia Institute of Technology, he studied under Dr. W. Marshall Leach, Jr., School of Electrical Engineering and performed *extensive* studies under Dr. Eugene T. Patronis, Jr., School of Physics. Georgia Tech studies included audio engineering, acoustical engineering, electronic instrumentation, loudspeaker design, fiber optics and noise reduction techniques.

Industry experience started in 1981 with Western Electric, Co. where Mr. Lee was a Field Engineer supporting submarine sonar systems and designing test sets for the Navy's ballistic submarine fleet. Responsibilities included field support of the existing analog system and prototype testing of the all digital system under development at Bell Laboratories. Then a move to Altec Lansing, Corp. as a Senior Development Engineer brought the establishment of the Electronics R. & D. Department in Oklahoma City. As the group leader Mr. Lee was involved in new product development and existing product support. Projects included development of power amplifiers, automatic microphone mixers, equalizers, and signal processors.

Starting in 1986, Mr. Lee spent nearly eight years as the Engineering Manager for Baker Audio/Telecom, an established design/build contracting firm in Atlanta that specializes in acoustics, sound systems and audio visual systems. There he pioneered computer assisted sound system design and acoustical measurements utilizing the Techron TEF Analyzer. System performance was predicted prior to installation and field verified with site measurements after installation. This background in design/build contracting offers practical experience many consultants may not be able to provide. During this period Mr. Lee began to offer part-time consulting services to those who did not desire design/build services. In 1993, Mr. Lee founded Lee Sound Design, Inc.

## **EDUCATION**

Bachelor of Electrical Engineering - Georgia Institute of Technology - 1981  
Broward Community College - Architecture Studies - 1976-1978  
SYN-AUD-CON Electro-acoustic Seminar Graduate - 1987  
SYN-AUD-CON Loudspeaker Designer's Workshop Staff Assistant - 1988  
SYN-AUD-CON Sponsored Intelligibility II Workshop, Indiana University - 1990  
ASTM Training on Acoustics and Noise Control for Office,  
Architectural and Industrial Applications - 1991  
Crown International, Inc. Factory Training for Computer Control of  
Sound Systems using the Crown IQ System - 1992  
Professional Liability Education Program for Architects and Engineers - 1997, 1999  
TEF Level II Training Class - Advanced Acoustical Analysis Workshop - 2000  
Extron Electronics, Inc. - Consultants Workshop - Emerging Technologies - 2000

## **PROFESSIONAL SOCIETIES**

Member - Audio Engineering Society (AES), Chairman - Atlanta Chapter - 1994, 1995  
Member - Acoustical Society of America (ASA)

In 1997, **Michael E. Cooper, CTS** joined Lee Sound Design, Inc. as Principal Consultant. Mr. Cooper brings extensive experience in design and project management for several aspects of our industry including, video systems, audio visual facilities, computer control systems and sound reinforcement systems. Additionally, he worked in video production and engineering for several Universities and hospitals.

Mr. Cooper started his career in video and audio technology as the Chief Television Engineer for Baptist Memorial Hospital in Memphis, Tennessee. Then, during the late nineteen eighties, Mr. Cooper was Director of Technology Planning for Georgetown University. During that period he designed the television studio, production and editing suites on-campus. As well he was responsible for technical direction, editing and production work.

Most recently Mr. Cooper was Engineering Manager for Baker Audio/Telecom. Prior to that he worked with Mr. Lee as a Senior Systems Design Engineer. Responsibilities included consulting, design, project management and installation management for all forms of audio and visual related projects. One specific area of expertise is computer control system design and programming.

## **EDUCATION**

Vietnam Era Veteran in the United States Navy  
Associate of Science Electronics Technology - Memphis State University - 1966  
United States Navy Advanced Electronics School - MIT Curriculum - 1968  
IBM Local Area Network (LAN) Design and Maintenance - 1987  
SYN-AUD-CON Electro-acoustic Seminar Graduate - 1991  
ICIA Sponsored Audio/Visual Technical Courses - 1989-99  
Sony Corporation Display and Projection Products Technical Training - 1990-99  
BARCO, Inc. Large Display and Projection Products Technical Training - 1990  
Crown International, Inc. Factory Training for Computer Control of  
Sound Systems using the Crown IQ System - 1993 Certified  
Extron Electronics, Inc. - Consultants Workshop - Improving Tour Image - 1999  
Atlanta Signal Processing, Inc. (ASPI Digital) - Conference Room Design - 1999  
Communication Technology Specialist (CTS) Designation - 1999  
Professional Liability Education Program for Architects and Engineers - 2000

## **PROFESSIONAL SOCIETIES**

Member - Society of Motion Picture and Television Engineers (SMPTE)  
Member - ICIA's Independent Consultants in Audiovisual Technologies (ICAT)

## **DESCRIPTION OF PROFESSIONAL SERVICES**

### **Sound System Design and Analysis**

Complete design and specification services for sound reinforcement, amplification, playback and recording systems. Designs are specific to the size, shape, acoustics and use of the environment. Performance predictions and evaluations include speech intelligibility, music quality, ease of use and aesthetics. Analysis of systems includes on-site electrical and acoustical measurements.

### **Audio Visual Facility Design and Analysis**

Complete design and specification services for large screen projection, computer interfacing, video recording and playback, audio systems, remote control systems and facility lighting control systems. Recommendations for lighting designs, interior color selection, acoustical materials and seating layout. Performance predictions and evaluations include viewing distances, viewing angles, and image resolution.

### **Acoustical Design and Analysis of Rooms for Speech Reinforcement**

Large and small room acoustical considerations for speech intelligibility, signal-to-noise problems, and application specific requirements. Designs for room size, shape, finish materials selection and electro-acoustic systems. Applications include voice amplification, speech privacy (noise masking), industrial communications, and high noise level environments. Predictions and on-site measurements of the percentage of loss in articulation of consonants (%ALCons) and Speech Transmission Index (STI), two common figures of merit.

### **Acoustical Design and Analysis of Rooms for Music Quality**

Large and small room acoustical considerations for reverberation characteristics, early-to-late energy ratio, Initial-Time-Delay Gap (ITDG), sound reflections, room modes, and noise levels. Evaluation of relationships between sound energy levels, arrival times, and direction of arrival. Comparison of musical acoustical relationships such as warmth, texture, intimacy, etc. Applications include, among others, rehearsal band rooms, recording studios, concert halls, and worship spaces.

### **Acoustical Design and Analysis of Rooms for Noise Control**

Considerations for sound isolation, sound transmission, sound absorption and vibration control. Recommendations for industrial applications, critical listening spaces, mechanical system isolation, and ambient noise level control. Predictions and on-site measurements include Sound Transmission Loss (TL), Sound Transmission Class (STC), Noise Reduction Coefficient (NRC), and sound pressure levels.

### **Audio and Video Teleconferencing System Design**

Complete design and specification services for room acoustics, microphone/loudspeaker placement, video systems, lighting systems, control systems and telecommunications systems. Applications of two-way audio, full motion video, and high resolution graphics transmission.

### **General Communication System Design**

Complete design and specification services for general communications. Commercial applications include telephone/voice paging, emergency warning, and visual message systems, satellite antenna systems, RF television distribution systems, Closed Circuit Television (CCTV) systems and fiber optic communication systems.

### **Laboratory and Field Measurements**

Complete electronic device and electronic system measurement capability including distortion, stability, and waveform analysis. Acoustical measurement capability includes Time Delay Spectrometry analysis using the TEF System, frequency response, energy time arrivals, reverberation characteristics, Noise Criteria Measurements, environmental noise, and weighted/filtered sound pressure levels. Projection system measurements include incident light (illumination) and reflected light (luminance), scan rate and color balance. Complete capability for of measurement loudspeakers, audio electronics, electronic systems, electro-acoustic systems, rooms, and environments.

### **Pre-construction Performance Predictions**

Computer generated and analytical based performance predictions for sound systems include speech intelligibility, acoustic gain, sound pressure levels, reflection problems, and acoustic coverage by loudspeaker mapping. Acoustical design predictions include reverberation times in octave bands, absorption characteristics, geometric problems, reflection problems, noise transmission levels, and music quality. Auralization is a new technology that allows listening to room acoustics when the room exists only in the computer. Projection system predictions include brightness, seating arrangement, image size, image resolution, viewing distance and viewing angle. Many human ergonomic issues such as task performance fatigue and physical comfort are evaluated and considered. Calculations of AC Power requirements and heat generating levels (in BTU/Hr) for all electrical equipment rooms and projection rooms.

### **Contract Administration and Construction Observation**

Complete management of all project phases including contract compliance, construction monitoring, installation supervision, final system adjustments and documentation. Tasks include periodic design related project meetings, documented communication between architects, engineers and contractors, review of submitted documents, periodic construction progress meetings and final performance verifications.

### **Seminars, Presentations and Training Workshops**

Training to familiarize personnel in system operations, maintenance and basic understanding. Seminars for architects, engineers and contractors in areas of design, engineering and installation of systems. Small business operating topics such as cost estimating, labor studies, and profit estimation. Seminars on the related technologies to create a basic understanding of the fundamentals to benefit the non-technical person. Presentations of system designs and concepts to assist committees and groups involved in decision making roles related to these areas.

## **RECORDING STUDIO AND PRODUCTION FACILITIES**

**Hawk's Ridge Recording Complex**, Atlanta, GA - Complete consultation, acoustical design and construction administration of a 2000 square foot professional recording studio. Spaces include an 825 square foot large main room, auxiliary room, isolation booth and pseudo LEDE control room. Noise control design includes dual, multi-leave walls, hardwood floating floors, isolation hanger suspended ceilings, rated acoustical doors and windows. Interior acoustical design includes RPG, Inc. DiffRACTAL® diffusers, Omnifusor™ 2-D diffusers, Corner BASS Traps and BAD™ Absorptive Panels. Technical AC power system, grounding and conduit system design provided. Review and assistance on audio system implementation. Acoustical testing, adjustments and evaluation performed after completion.  
Client: Housing Trends, Inc., Norcross, GA 1999, 2000, 2001

**Georgia State University Digital Arts & Entertainment Lab Video Routing and Production Facility**, Atlanta, GA - The existing Core Video and Audio Editing Facility will be upgraded and expanded to include automated routing of multiple signals for transfer, capture, recording, sync, and machine control of mixed analog and digital formats between systems. Signals to be considered are composite video, S-video, component video, serial digital video, analog audio, digital audio, time code, sync, and RS-422 machine control. Areas of concern include; Onyx Machine Room , High Definition Editing Suite , Pro Tools Editing Suite, AVID Editing Suite, Digital Post Production Classroom and Audience Response Theater.  
Client: Georgia State University, Atlanta, GA - 2000, 2001

**The Renaissance Center**, Dickson, TN - Acoustical and system design for the 1500 square foot audio recording studio located in the educational foundation facility. Room layout includes a 700 square feet main room and adjacent voice booth. Acoustical consultation with facility wide project acoustician on noise control issues in the studio. Technical AC power system, grounding and conduit system design provided. Contract Administration on audio system implementation.  
Client: Everton Ogelsby Askew Architects, Nashville, TN  
The Media Resource Group, Nashville, TN - 1997, 1998, 1999

**Georgia State University Instructional Technology Center Production Studio**, Atlanta, GA - Consultation, system design and project management of a Video Production Studio Project. Areas include a complete production studio, control room, and edit suites. The studio will interface to the Video Training Systems and be the heart of all recording and production work related to the center. There will be live to air production, as well as taped material for Georgia Public Television (GPTV). There will be several distance learning and video teleconferencing sessions per quarter associated with the Georgia State Academic and Medical Systems (GSAMS).  
Client: Georgia State University, Atlanta, GA - 1997, 1998

**Crash Bang Wallop Studio**, Stone Mountain, GA  
Sound isolation and noise control design recommendations for a residential professional production and recording studio.  
Client: Crash Bang Wallop Studio, Stone Mountain, GA - 1993

## **THEATER AND AUDITORIUM PROJECTS**

**New Wando High School**, Charleston, SC - Acoustical design for a 1000 seat Auditorium. The design includes audience chamber acoustical panels and clouds as well as a stage house acoustic shell. Acoustical enhancement design was provided for the Band/Strings Classroom and the Chorus Classroom. Sound control design was provided for the Gymnasium, Cafeteria and Commons Area.

Client: LS3P Associates, Charleston, SC - 2000, 2001

**Boiling Springs Junior High School**, Boiling Springs, SC - Acoustical design, sound system design and audio visual projection system design for a 1000 seat Auditorium. Extensive use of diffusion products including RPG, Inc. DiffusorBlox<sup>R</sup> specialty concrete masonry units. Room size and geometry designed for improved acoustic music performance. Left Center Right theatrical loudspeaker system with two mix positions; house mix position and projection booth position.

Client: McGarity Gilmore Forrester Architects, Spartanburg, SC - 1999, 2000, 2001

**The Renaissance Center**, Dickson, TN - Sound system design for several spaces in a private educational foundation. Included are a 450 seat Performing Arts Theater, 75 seat Lecture Hall, public Rotunda assembly area for 150 to 300 people, small audio recording studio & control room, and a MIDI classroom. Acoustical consultation with project acoustician on the theater and studio.

Client: Everton Ogelsby Askew Architects, Nashville, TN

The Media Resource Group, Nashville, TN - 1997, 1998, 1999

**Statesville Civic Center**, Statesville, NC - Acoustical consulting and sound system design for a 12,000 square foot divisible Multi-Purpose Auditorium, 2800 square foot Break-out Room and a 35 person Special Meeting Room. Sound control and interior acoustics design including a Video-teleconference application in the Special Meeting Room. Sound reinforcement system design includes a combining audio system that follows the configuration of the Multi-Purpose and Break-out spaces and a specialized mix-minus sound system in the Special Meeting Room.

Client: J. N. Pease Associates, Charlotte, NC - 1998

**West Ashley High School**, Charleston, SC - Acoustical design for an 835 seat Auditorium. The design includes audience chamber acoustical panels and clouds as well as a stage house acoustic shell. Acoustical enhancement design was provided for the Band/Strings Classroom and the Chorus Classroom. Sound control design was provided for the Gymnasium, Cafeteria and Commons Area.

Client: LS3P Associates, Charleston, SC - 1997, 1998

**Dutch Fork High School**, Irmo, SC - Acoustical enhancement design was provided for the Band Rehearsal Room, Orchestra Rehearsal Room and the Chorus Rehearsal Room. Sound control design was provided for Cafeteria. Design drawings, details and specifications, as well as architectural sound isolation recommendations.

Client: LS3P Associates, Charleston, SC - 1998



**South Carolina State University**, Orangeburg, SC - Sound system design, drawings and specifications for several rooms in a University Music Department. Sound reinforcement systems and recording systems for a Recital Hall and six classrooms. Audio playback and remote control systems for an on-demand Music Library.  
Client: James S. Brawley & Associates, Inc., Clemson SC - 1998

**Southeast Middle School**, Richland County, SC

- Acoustical design for 250 seat Lecture Hall/Auditorium. Includes audience chamber acoustical panels and clouds as well as a stage house acoustic shell.
- Client: Liollo Architecture, Charleston, SC - 1998

**Rock Hill Middle School**, Rock Hill, SC

- Acoustical consulting and noise control on 500 seat auditorium, Gallery and typical Classroom.
- Client: LS3P Architects, Charleston, SC - 1996, 1997

**Chester Middle School**, Chester, SC

- Acoustical consulting and noise control on 1000 seat auditorium, Band Rehearsal Room, Choral Practice Room, Drama Rehearsal Room.
- Client: LS3P Architects, Charleston, SC - 1996, 1997

**Clayton County Schools Performing Arts Center**, Jonesboro, GA

- Sound reinforcement system testing and evaluation for a 2500 seat performing arts auditorium, recital hall and lecture hall.
- Client: Clayton County Schools Performing Arts Center, Jonesboro, GA - 1996

**Walhalla High School Auditorium**, Oconee Co, SC

- Acoustical architecture and sound system design on a 500 seat multi-purpose auditorium.
- Client: LS3P Arch's, Charleston, SC and Buford Goff & Assoc., Columbia, SC - 1995

**Seneca High School Auditoriums**, Oconee Co, SC

- Acoustical architecture and sound system design on a 500 seat multi-purpose auditorium.
- Client: LS3P Arch's, Charleston, SC and Buford Goff & Assoc., Columbia, SC - 1995

**Horry County Schools**, Horry Co., SC

- Acoustical consulting on a 500 seat multi-purpose auditorium, 150 seat Lecture Hall, rehearsal rooms, and several small single person practice rooms.
- Client: LS3P Arch's, Charleston, SC and Buford Goff & Assoc., Columbia, SC - 1995

**University of South Carolina at Aiken**, Aiken, SC

- Production sound system design for a 1000 seat performing arts center Auditorium and Experimental Theatre.
- Client: James S. Brawley & Associates, Inc., Clemson SC - 1994, 1995

**United Arab Emirates Faculty of Medicine**, Al Ain, UAE

- Acoustical consulting on 1000 seat auditorium, classroom, lecture halls, A/V studio and teleconferencing room.

Client: Suidan & Associates, Abu Dhabi, UAE - 1994, 1995

**Gatlin Brothers Theater**, Myrtle Beach, SC

- Analysis and signal alignment of large loudspeaker clusters for a 2500 seat music theater.

Client: James S. Brawley & Associates, Inc., Clemson SC - 1994

**South Carolina Employment Security Commission**, Columbia, SC

- 150 seat multi-purpose conference room/auditorium

Client: Buford Goff & Associates, Columbia, SC - 1993

**Midlands Technical College Harbison Campus**, Columbia, SC

- 125 seat multi-purpose campus auditorium

Client: Buford Goff & Associates, Columbia, SC - 1993

**Midlands Technical College Airport Campus**, Columbia,

- 100 seat multi-purpose campus auditorium

Client: Buford Goff & Associates, Columbia, SC - 1992

**Evergreen Conference Center**, Stone Mountain, GA

- 150 seat multi-use theater style auditorium

Client: Baker Audio/Telecom and Hardin Construction Co., Atlanta, GA - 1991

## **AUDIO/VISUAL, VIDEO AND TELECONFERENCING SYSTEM PROJECTS**

**Georgia Southern University School of Information Technology**, Statesboro, GA - Feasibility Studies, planning and programming for A/V technologies and acoustics in the new complex. Facilities include multiple classrooms, Distance Learning Rooms, Labs, Interactive Learning Rooms, 125 seat Lecture Hall, 500 seat Auditorium and Professional Learning Center. Tasks include; technical planning, A/V system development, infrastructure impact and budgets.  
Client: Georgia Southern University and Sizemore Floyd Architects, LLC, Atlanta, GA - 2000, 2001

**Georgia State University Sparks Hall**, Atlanta, GA - Pre-design and Programming Services for the traditional and computer classrooms. The intent is to define project concepts or and create documents to support these, as associated with the physical parameters of the facilities. Technologies include; acoustics, lighting, classroom layout, computer training classrooms (Networking), audio-video cabling, audio-visual equipment, and smart furniture.  
Client: Tippetts Clepper Associates, Atlanta, GA - 2000, 2001

**Macon State College Nursing, Health Science & Outreach Complex**, Macon, GA - Feasibility Studies, planning and programming for A/V technologies and acoustics in the new complex. Facilities include basic classrooms, computer labs and auditorium style classrooms. Tasks include; technical planning, A/V system development, infrastructure impact and budgets.  
Client: The Woodhurst Partnership, Augusta, GA - 2000, 2001

**Georgia State University Digital Arts & Entertainment Lab Video Routing and Production Facility**, Atlanta, GA - The existing Core Video and Audio Editing Facility will be upgraded and expanded to include automated routing of multiple signals for transfer, capture, recording, sync, and machine control of mixed analog and digital formats between systems. Signals to be considered are composite video, S-video, component video, serial digital video, analog audio, digital audio, time code, sync, and RS-422 machine control. Areas of concern include; Onyx Machine Room , High Definition Editing Suite , Pro Tools Editing Suite, AVID Editing Suite, Digital Post Production Classroom and Audience Response Theater.  
Client: Georgia State University, Atlanta, GA - 2000, 2001

**Georgia State University School of Health Sciences - Kell Hall**, Atlanta, GA - Consultation, system design and project management of a Technical Classroom and Laboratory Video System Project. Designed to allow complete camera control and distributed monitor video display of training and instruction on technical props, manikins and physical objects. System allows large screen data projection, video/audio recording and integrated touch screen panel remote control.  
Client: Georgia State University, Atlanta, GA - 2000, 2001

**Cobb County Superior Courts Courtroom of the Future**, Marietta, GA - The purpose of the courtroom is to integrate the latest video, audio, and computer technologies to accelerate and improve the flow of cases for the court. The heavily computer based facility integrates several systems including; speech reinforcement, video/computer display, media (press) feeds, assistive listening, language translation, and remote control systems. Services include construction administration.  
Client: Cobb County Superior Courts, Marietta, GA - 1999, 2000

**Georgia State University Andrew Young School of Policy Studies**, Atlanta GA - Acoustical consulting and audio visual system design for a 100 seat Auditorium, Smart Seminar Room, and Conference Rooms. Services include acoustical recommendations, audio-visual, sound and integrated control systems design.  
Client: Smallwood, Reynolds, Stewart, Stewart and Ass., Atlanta, GA - 1999, 2000

**HBO & Company Headquarters**, Alpharetta, GA - Acoustical sound control design and audio visual system design for 32 conference & training rooms, 2 Video-teleconference rooms and one 200 seat classroom. The premiere space is a high technology Presentation Theater with 10' x 16' image projection, dual 6' x 8' image projection, an interactive electronic smart board system, surround sound audio system and other features. Recommendations and design for wall construction and interior acoustical treatments were provided.  
Client: Holder Construction Company, Atlanta, GA - 1998, 1999, 2000

**Georgia State University Digital Arts & Entertainment Lab Audience Response Theater**, Atlanta, GA - Sound and Video System design, as well as, construction administration for a 25 person screening room and audience response suite. Surround sound, DTS and AC3-F capability is designed into the system. Video projection systems include capability for HDTV, DTV and DVD.  
Client: Duckett & Associates Architects/GSU, Atlanta, GA - 1998, 1999, 2000, 2001

**American Red Cross**, Atlanta, GA - Facility design, acoustical consultation and audio visual system design for the Georgia Training & Disaster Operations Center. Training systems and command control type systems are provided for the 520 sq. ft. Disaster Command Center, 1560 sq. ft. Board Room, and 1250 sq. ft. Large Training Room. Traditional training systems provided in a 750 sq. ft. Mid-size meeting room and two 400 sq. ft. small training rooms. Audio visual systems based on a centralized media retrieval design with multiple sources of satellite, DSS, cable TV, and other equipment, available for each room. There is computer based scheduling and maintenance included in the system.  
Client: American Red Cross, Atlanta, GA - 1997, 1998, 1999, 2000

**Medical University of South Carolina Storm Eye Institute**, Charleston, SC - Audio visual consultation and system design for an 8000 square foot, 150 person conference room and medical classroom. Multi-projector rear screen system for video/data/graphics display, 35mm slide presentations and front screen transparency projection. Fully integrated audio, video, and remote control systems for technical training and instruction. Contract administration and project management included.  
Client: Medical University of South Carolina, Charleston, SC - 1997, 1998

**Georgia State University Instructional Technology Center Production Studio,** Atlanta, GA - Consultation, system design and project management of a Video Production Studio Project. Areas include a complete production studio, control room, and edit suites. The studio will interface to the Video Training Systems and be the heart of all recording and production work related to the center. There will be live to air production, as well as taped material for Georgia Public Television (GPTV). There will be several distance learning and video teleconferencing sessions per quarter associated with the Georgia State Academic and Medical Systems (GSAMS).  
Client: Georgia State University, Atlanta, GA - 1997, 1998

**Woodruff Arts Center Circle Room,** Atlanta, GA

- Large multi-use meeting facility renovation

Client: TVS Interiors, Inc., Atlanta, GA - 1999

**Medical University of South Carolina Gazes Cardiac Research Ctr,** Charleston, SC

- 1500 square foot, 52 person conference room and medical classroom
- Interface to Silicon Graphics Workstations for critical medical research displays

Client: Medical University of South Carolina, Charleston, SC - 1996, 1997, 1998

**Georgia State University Student Center,** Atlanta, GA

- 440 seat Auditorium, Ballroom and Board Room

Client: Georgia State University, Atlanta, GA - 1997, 1998

**Spartanburg Regional Medical Center,** Spartanburg, SC

- 100 person Family Practice Conference Room
- 150 person Executive Dining Room

Client: Spartanburg Regional Healthcare System, Spartanburg, SC - 1997, 1998

**Georgia State University Instructional Technology Center,** Atlanta, GA

- 3 Seminar Rooms with 1-CCD Camera Systems w/Pan/Tilt/Zoom Control
- 1 Seminar Room with 3-CCD Camera Systems w/Pan/Tilt/Zoom Control

Client: Georgia State University, Atlanta, GA - 1996, 1997

**Visioneering International Inc.,** Atlanta, GA

- Engineering assistance on the design and construction management of several large Video Wall Systems and Surround Sound Theaters for hospitals and marketing centers

Client: Visioneering International Inc., Atlanta, GA - 1995, 1996

**Arthritis Foundation National Office,** Atlanta, GA

- 200 person, 3000 square feet Meeting Room

Client: Arthritis Foundation, Atlanta, GA - 1995, 1996

**High Museum of Art**, Atlanta, GA

- Technical consultation and engineering services for art exhibits using video, audio and control system technology. Exhibits include: Jem Cohen "Buried In Light" and Pepon Osorio "Social Turf".

Client: High Museum of Art, Atlanta, GA - 1994, 1995

**Bullfoot Audio-Video Resources, Inc.**, Alpharetta, GA

- Demo room for large screen video projection and THX Surround Sound home theater systems.

Client: Bullfoot Audio-Video Resources, Inc., Alpharetta, GA - 1994

**Georgia State Academic and Medical System (GSAMS)**

- Evaluation of multiple Distance Learning Sites in association with the video CODEC supplier, Compression Labs, Inc. (CLI)

Client: Baker Audio/Telecom, Atlanta, GA - 1994

**South Carolina Employment Security Commission**, Columbia, SC

- 150 seat multi-purpose conference room/auditorium

Client: Buford Goff & Associates, Columbia, SC - 1993

**Midlands Technical College Harbison Campus**, Columbia, SC

- 125 seat multi-purpose campus auditorium

Client: Buford Goff & Associates, Columbia, SC - 1993

**Evergreen Conference Center**, Stone Mountain, GA

- 150 seat multi-use theater style auditorium

Client: Baker Audio/Telecom and Hardin Construction Co., Atlanta, GA - 1991

**Georgia Power Efficiency Store**, Northlake Mall, Atlanta, GA

- Interactive video and audio systems for home efficiency education.

Client: Georgia Power Company, Atlanta, GA - 1993

**Evergreen Conference Center**, Stone Mountain, GA

- 150 seat theater style auditorium

Client: Baker Audio/Telecom and Hardin Construction Co., Atlanta, GA - 1991

## **ROOM ACOUSTICS AND SOUND SYSTEM PROJECTS**

**Riverside Military Academy**, Atlanta, GA - Design review, performance verification, product comparisons, and project evaluation for several sound systems in this private military school. Systems include Dining Hall/Auditorium sound system, Quad Courtyard Public Address system and a facility wide paging system. Prepare submittal documents, shop drawings and details for project contractor. Some Project Management included. Preliminary System Testing in-shop and site and Final System Testing at site.

Client: Simplex Time Recorder, Norcross, GA - 1997, 1998, 1999

**The Renaissance Center**, Dickson, TN - Sound system design for several spaces in a private school. Included are a 350 seat Performing Arts Theater, 75 seat Lecture Hall, public Rotunda assembly area for 150 to 300 people, small audio recording studio & control room, and a MIDI classroom. Acoustical consultation with project acoustician on the theater and studio. Project tasks include contract administration and construction observation.

Client: Everton Ogelsby Askew Architects, Nashville, TN

The Media Resource Group, Nashville, TN - 1997, 1998, 1999

**The McKimmon Center, NC State University**, Raleigh, NC - Sound system design for a Main Ballroom and Multi-purpose Room. Meeting spaces are divisible and combinable with audio electronics automatically configuring for the application. One audio teleconferencing room/system included in Hall.

Client: James S. Brawley & Associates, Inc., Clemson SC and

Lehman Mehler Hirst Associates Architects & Engineers, Chapel Hill, NC - 1997, 1998

**Institute of Nuclear Operations, Inc**, Atlanta, GA - Sound system design for a 32 person, 16 microphone Conference Room. Low ceilings required the use of microphone mix-minus and loudspeaker muting techniques for maximum acoustic gain. Programmable electronics allowed multiple configurations for dividing the room into two meeting sections.

Client: Institute of Nuclear Operations, Inc, Atlanta, GA - 1997, 1998

**Ft. Gillem Army Distribution Center**, Atlanta, GA - Design review, performance verification, product comparisons, and project evaluation for a 500,000 square feet warehouse Paging and Announcement System. Responsible for electro-acoustics computer modeling and presentation of data for sound system performance and room acoustics. Prepare submittal documents, shop drawings and details for project contractor. Some Project Management included. Preliminary System Testing in-shop and site and Final System Testing at site.

Client: Simplex Time Recorder, Norcross, GA - 1996, 1997

**Dorchester Co. Human Services and Law Enforcement Complex**, Charleston, SC

• Sound system design for courtrooms and council chamber

Client: Dorchester County Development Department, Charleston, SC - 1994

## ACOUSTICS PROJECTS

**Trident Technical College**, Charleston, SC - Provide acoustical analysis and recommendations for the Conference Center Divisible Multi-Purpose Rooms and Pre-Function Areas. This includes surface treatment review for ceilings, walls, partitions, floors and acoustical panels.

Client: LS3P Architects, Charleston, SC - 2001

**Wood Hollow Apartment Complex**, Atlanta, GA - Provide environmental noise measurements and consultation for adjacent HVAC Chiller noise. Work with BRD Noise and Vibration on acceptable noise barrier wall design and construction. Confirming acoustical measurements after construction.

Client: Battle Law Group, LLC, Atlanta, GA - 2000, 2001

**Laurens Place Condominium/Maritime Center**, Charleston, SC - Provide environmental noise measurements and consultation for adjacent Ice Machine Cooler Tower noise. Work with architect on noise barrier wall design and potential mechanical noise control solutions.

Client: LS3P Architects, Charleston, SC - 2000, 2001

**Blast Cleaning Products of Atlanta**, Cumming, GA - Acoustical measurements and consultation on noise control for large abrasive cleaning machinery in a metal processing plant. Testing included sound pressure levels and frequency spectrum data to allow accurate selection of noise control products. Consultation on materials and application of solutions was included.

Client: Blast Cleaning Products of Atlanta, Cumming, GA - 1996

**CompDent Corporation**, Atlanta, GA - Acoustical evaluation of two 25,000 square foot open office plans. The space is designed for customer service related telephone use. The evaluation was centered on determining whether a sound masking system would benefit the environment and be a cost effective approach to increasing speech privacy in the open office areas. Complete analytical analysis of open office acoustics was performed including determining Speech Privacy Ratings.

Client: CompDent Corporation, Atlanta, GA - 1996

**Charleston Technical Center/WestVaco Facility**, Charleston, SC -

- Acoustical consulting and noise control on a large Atrium space, Research and Chemical Labs, and several Conference Rooms.

Client: LS3P Architects, Charleston, SC - 1996, 1997

**Nuclear Assurance Corporation**, Norcross, GA

- Noise control evaluation and acoustical measurements for an office complex designed as a secure area. Measurements according to ASTM Standards.

Client: HCB Contractors, Inc., Atlanta, GA - 1994

**Parkview High School Rehearsal Band Room**, Lilburn, GA

- Acoustical analysis and recommendations to solve musical quality problems.

Client: Parkview High School Music Department, Lilburn, GA - 1993



## **WORSHIP SPACE PROJECTS**

**St. Brigid Catholic Mission Church**, Alpharetta, GA - Acoustical and sound system design for a 1000 seat Sanctuary, 750 seat Parish Hall and 150 seat Chapel. Construction documents, project administration and system testing included. Client: CDH Partners Inc., Marietta, GA - 2000, 2001

**Oakhurst Baptist Church**, Decatur, GA - Architectural restoration of an historic church Sanctuary. Acoustical renovations include choir acoustics for ensemble and natural projection and Sanctuary diffusion and reflection control. Client: Culpepper, McAuliffe and Meaders Architecture, Atlanta, GA - 2000, 2001

**St. Peter Chanel Catholic Mission**, Roswell, GA - Acoustical design and recommendations for the 7000 square foot Parish Hall Nave used as an Interim Sanctuary. Review of design/build proposed sound system . Client: The Preston Phillips Partnership, Atlanta, GA - 2000, 2001

**First United Methodist Church of Anniston**, Anniston, AL - New sound system design for a traditional style, 1000 seat church sanctuary. This is an upgrade to a 32 input system with much more stage production capability for the Praise Team and Ensemble. Contract administration, construction observation and performance testing will be provided. Client: First United Methodist of Anniston, Anniston, AL - 1998, 1999

**Free Chapel Worship Center**, Gainesville, GA - Acoustical and sound system evaluation and testing project. Acoustical and sound system performance measurements and recommendations for corrections in the 750 seat contemporary sanctuary. Measurements included architectural acoustics and sound system performance measurements. Loudspeaker cluster and electronic system evaluation for problems with tonal balance and quality. Client: Free Chapel Worship Center, Gainesville, GA - 1999

**Vineville Baptist Church - North**, Macon, GA - Acoustical and sound system evaluation and testing project. Acoustical and sound system performance measurements and recommendations for corrections in the 1000 seat contemporary sanctuary. Measurements included architectural acoustics and sound system performance measurements. Loudspeaker cluster and electronic system evaluation for problems with speech intelligibility. Client: Vineville Baptist Church- North, Macon, GA - 1999

**Victory Christian Center**, Charlotte, NC - Acoustical consulting for a contemporary worship center which includes a 4000 seat sanctuary, TV Studio and various edit and control suites. Unique architecture includes a 236 foot diameter geodesic domed roof structure over the sanctuary. Services include acoustical design of the sanctuary architecture for music, speech and noise control. Consulting on HVAC, mechanical systems, electrical systems and building construction for sound and vibration control. Assistance to the sound contractor on sound reinforcement system design by providing loudspeaker cluster mapping, aiming and reflection analysis using sound system design software and manual ray tracing methods. Complete project construction management and final system performance testing.

Client: Victory Christian Center, Charlotte, NC - 1995, 1998, 1999, 2000, 2001

**Forest Hill Church**, Charlotte NC - Acoustical design for a 1500 seat contemporary church sanctuary. Services include acoustical design of the sanctuary architecture for music, speech and noise control. Assistance to the sound contractor on sound reinforcement system design by providing loudspeaker cluster mapping, aiming and reflection analysis using sound system design software and ray tracing methods.

Client: Forest Hill Church, Charlotte, NC - 1998, 1999

**Warner Robins First Methodist Church**, Warner Robins, GA - Acoustical and sound system performance measurements and recommendations for corrections in the 750 seat contemporary sanctuary. Measurements included architectural acoustics and sound system performance measurements. Acoustical analysis of the Social Hall for problems in excess reverberation and noise. Engineering design intended to lower the activity noise and ambient noise of the room to allow normal conversation and less fatigue. Analysis included Noise Criteria, geometric problems and TEF analysis. Recommendations for acoustical treatments include type of panels, size of panels and locations.

Client: Warner Robins First Methodist Church, Warner Robins, GA - 1997, 1998

**Auburn United Methodist Church**, Auburn, AL - Acoustical analysis and renovation for a 1000 seat traditional Sanctuary. Working directly with the Holtkamp Organ Company to improve the acoustics for the new pipe organ. Performing reverberation studies for "livening" the room and geometric studies for improved sound projection into the congregation. The acoustical re-design will be for the enhancement of the organ and also choral and congregational singing.

Client: Auburn United Methodist Church, Auburn, AL - 1995, 1996

**St. Philip's Episcopal Church**, Charleston, SC - Sound system renovation for a 1000 seat, 150 year old cathedral in a historic downtown district. Architectural impact of the renovation was a high priority. Complete program of services provided including; sound system design, contract administration of bid documents, construction observations of installation and performance verification and testing after completion.

Client: St. Philip's Episcopal Church, Charleston, SC - 1994, 1995

**St. Mary's-On-The-Highlands Episcopal Church**, Birmingham, AL - Acoustical measurements and evaluations for a proposed acoustical re-design program in the 400 seat historic sanctuary. The primary goal was to determine whether it was feasible to increase the "liveness" of the room to improve the performance of a future pipe organ. As well, to comment on the impact of acoustical changes for choir singing and congregational singing. Measurements included extensive Reverberation Measurements using the TEF analysis techniques of Integrated Energy Time Curve (IETC) and 3-D Reverb processing.  
Client: St. Mary's-On-The-Highlands Episcopal Church, Birmingham, AL - 1994

**First Baptist Church**, Fitzgerald, GA - Acoustical Design of the Chancel and Choir walls and ceiling for improved music acoustics. Working directly with the Holtkamp Organ Company to improve the acoustics for the new pipe organ. Performing geometric studies for improved choir projection into the congregation.  
Client: First Baptist Church, Fitzgerald, GA - 1994

**Roswell United Methodist Church**, Roswell, GA

- 2200 seat contemporary sanctuary
- Acoustics and sound system evaluation for speech and music quality

Client: James S. Brawley & Associates, Inc., Clemson SC - 1994

**Unitarian Universalist Fellowship of Athens**, Athens, GA

- 250 seat sanctuary
- Acoustical analysis of room focusing problems and sound system performance

Client: Unitarian Universalist Fellowship of Athens, Athens, GA - 1994

**First United Methodist Church**, Carrollton, GA

- 500 seat sanctuary
- corrections and system adjustments including balancing electrical gain structure and performing system equalization.

Client: First United Methodist Church, Carrollton, GA - 1994

**Briarcliff United Methodist Church**, Atlanta, GA

- 500 seat sanctuary
- Room acoustical analysis for speech reinforcement and choral music quality
- Computer simulation and performance predictions with verified field results

Client: Briarcliff United Methodist Church, Atlanta, GA - 1993

**Trinity Episcopal Church**, Pinopolis, SC

- 250 seat Parish Hall
- Analysis and corrections for problems in excess reverberation and noise

Client: Trinity Episcopal Church, Pinopolis, SC - 1993

## **SPORTS ARENA AND STADIUM PROJECTS**

**American Airlines Arena**, Miami, FL - Home of the NBA Miami Heat. Assistance to Wrightson, Johnson, Hadden & Williams, Inc., of Dallas, Texas, the prime acoustical consulting firm as the Florida Professional Engineer of Record. Provided design services, construction management and final testing of the arena sound reinforcement system, television distribution system and video replay systems.

Client: Wrightson, Johnson, Hadden & Williams, Inc., Dallas, TX - 1998, 1999

**New Atlanta Philips Arena**, Atlanta, GA - Home of the NBA Atlanta Hawks and NHL Atlanta Thrashers. Assistance to Wrightson, Johnson, Hadden & Williams, Inc., of Dallas, Texas, the prime acoustical consulting firm as the local representative for the project. Provided construction management and final testing of the arena sound reinforcement system, television distribution system and video replay systems.

Client: Wrightson, Johnson, Hadden & Williams, Inc., Dallas, TX - 1997, 1998, 1999

**Broward County Civic Arena**, Sunrise, FL - Home of the NHL Florida Panthers. Assistance to Wrightson, Johnson, Hadden & Williams, Inc., of Dallas, Texas, the prime acoustical consulting firm as the Florida Professional Engineer of Record. Provided design services, construction management and final testing of the arena sound reinforcement system, television distribution system and video replay systems.

Client: Wrightson, Johnson, Hadden & Williams, Inc., Dallas, TX - 1997, 1998

**Centennial Olympic Stadium**, Atlanta, GA - Site of the Opening and Closing Ceremonies and Track & Field Games. Assistance to Wrightson, Johnson, Hadden & Williams, Inc., of Dallas, Texas, the prime acoustical consulting firm on the project. Assistance on project site issues and loudspeaker performance testing during installation. Assistance to the sound system installation contractor, Ancha Electronics on project issues and testing.

Client: Wrightson, Johnson, Hadden & Williams, Inc., Dallas, TX - 1996

**Olympic Tennis Center**, Stone Mountain, GA - Speech Reinforcement System design and project management for the 5000 seat center court stadium, site of Olympic Tennis competition. Small format mid-range horn design for voice announcements only during sporting events. Distributed loudspeaker system required for covered Plaza seating sections. Sound reinforcement loudspeaker mapping and system design. Limited preparation of engineering drawings and bid specifications for construction

Client: Atlanta Committee for the Olympic Games (ACOG), Atlanta, GA - 1996

**Morris Brown College Stadium**, Atlanta, GA - Full range sound reinforcement system design for speech and entertainment in the 15,000 seat stadium used for Olympic Field Hockey. Large loudspeaker array located on the scoreboard provides full range coverage to the stadium seating. Sound reinforcement loudspeaker mapping and electronic system design. Limited preparation of engineering drawings and bid specifications for construction.

Client: Atlanta Committee for the Olympic Games (ACOG), Atlanta, GA - 1996

**Clark Atlanta University Stadium**, Atlanta, GA - Full range sound reinforcement system design for speech and entertainment in the 7,000 seat stadium used for Olympic Field Hockey. Loudspeaker array located on the skybox provides full range coverage to the stadium seating. Sound reinforcement loudspeaker mapping and electronic system design. Limited preparation of engineering drawings and bid specifications for construction.

Client: Atlanta Committee for the Olympic Games (ACOG), Atlanta, GA - 1996

**Morehouse College Gymnasium**, Atlanta, GA - A 6000 seat gymnasium, the site of the Olympic Basketball Preliminary Games. Acoustical analysis of building design for excessive reverberation and noise levels. Sound reinforcement loudspeaker mapping and system design. Limited preparation of engineering drawings and bid specifications for construction.

Client: Atlanta Committee for the Olympic Games (ACOG), Atlanta, GA - 1995, 1996

**Gator Bowl Stadium**, Jacksonville, FL

- Assistance to WJHW, Inc., on final adjustments, set-up and performance testing of the stadium sound reinforcement system.

Client: Wrightson, Johnson, Hadden & Williams, Inc., Dallas, TX - 1995

**Gettysburg College**, Gettysburg, PA

- Performance specifications for a Sports Complex including; Gymnasium, Field House, Multi-purpose Activity Room and Administrative Offices.

Client: JTM Associates, Atlanta, GA - 1989

## **PUBLICATIONS AND LECTURE PRESENTATIONS**

**D. Wayne Lee, P.E.**

AN/BQR-15 Towed Array Project - "ASIM Cable Simulator CCA Design and Evaluation Report", U. S. Navy. February 1984.

"Safety Assessment of the AN/BQR-15 Thin Line Array Program".  
U. S. Navy, Accepted 1984.

"Heat Sink Design for a Class B Push Pull Amplifier". Altec Lansing Corp. Internal Engineering Report. 1985.

Association of Audio/Visual Technicians (AAVT) Reception. 1986  
Lecture/demonstrations on Power Amplifiers and Loudspeakers.

"More on Transformers and Amplifiers" published Fall, 1988 SYN-AUD-CON Technical Newsletter.

TEF Symposium, Nashville, TN. "Measurements of Electronic and Electrical Devices".  
SYN-AUD-CON Sponsored, May 23-24, 1989.

"A Basic Approach to a Small, Multipurpose Amphitheater" published July 20, 1991,  
Sound & Video Contractor Magazine.

"The Wiring Made It Do It" published September 20, 1995, Sound & Video Contractor Magazine.

INFOCOMM 1996 Philadelphia, PA, June 13-15. The industry Audio Visual and Computer Presentation Convention. Class Instructor for four audio programs. "Basic Audio Equalization", "Digital Audio Basics" and "DSP Products for Audio" presented with Fred Ampel. "Nuts and Bolts of Sound Systems" presented with Fred Ampel and Mark McLean, Editor of Live Sound magazine.

NSCA EXPO '97 Charlotte, NC, April 15-19. The National Systems Contractors Association Convention. Class Instructor for the "Audio Instrumentation" course discussing what parameters should be measured, what tools are required for measurement, and which systems are on the market today.

CEDIA EXPO '97 Atlanta, GA, September 3-7. The Custom Electronic Design & Installation Association Convention. Assistant Instructor for two courses on the fundamentals of Electrical Engineering.

AIA/ASID Chattanooga Chapter - March 2000 Monthly Meeting Cleveland, TN, March 14, 2000. American Institute of Architects and the American Society of Interior Designers, presentation on Architectural Acoustics Form and Function.

Gold-Line TEF Advanced Church Sound Measurement Workshop - October 2000.  
Host for one of two churches used for acoustical and sound system measurements.