

The Audio System Design Seminar

offered by
Stroud Audio Inc. (SAI)

Introduction

Excellent sound helps make OEM's proud of the vehicles they sell, and helps them sell those vehicles. It also gives them a competitive advantage, as many competing vehicles do not enjoy high-quality sound.

With high fuel prices and growing traffic jams, listening to a great audio system can make one feel happy about just being in their car. Even a low-cost system that is properly designed, installed and equalized can produce a pleased, perhaps surprised, customer.

In order to produce great systems, designers must have the skills necessary to demand proper speaker and installation parameters. This designer must know how to specify suitable electronics: proper equalization, correct loudness compensation, and good signal processing (delay, clip management, compression, phase compensation, etc.) and power.

Our two-day Audio Systems Design Seminar helps vehicle designers understand what sound properties satisfy customers. It helps designers gain needed system design skills. It helps them understand how to optimize the

performance-value tradeoffs of their car audio systems.

This class can be useful for vehicle design engineers, and for audio system suppliers. The first part of this class speaks to subjects that are perhaps even interesting to your marketing department.

This seminar consists of more than 280 PowerPoint slides packed with essential information about how to design a quality automotive audio system from setting performance goals to execution and evaluation.

The Audio System Design Seminar is divided into seven parts, including six more formal learning elements and one informal vehicle evaluation element. Many picture slides and demonstrations help keep the class lively and interesting.

When your employees have completed this course, they will be better equipped to develop high-performance, high-value system designs, select better components and help you build better sounding vehicles.

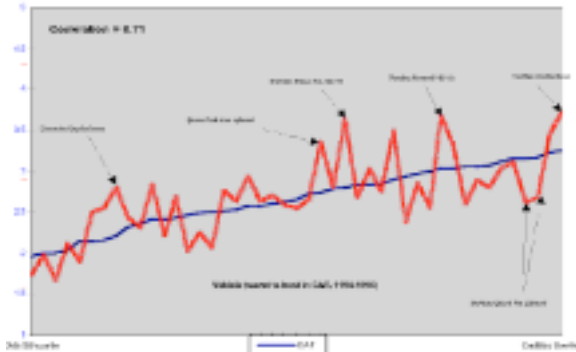
Audio Systems Design Seminar Outline

The following outline shows the key elements covered.

Part 1. Customer Expectation and System Evaluation

- What do customers want from their audio system?

- What kind of music are they playing?
- Theory of "correctness perception"
- The US vs. Europe, Asia
- The Audio System Design Target: frequency response, power, envelopment, etc.
- Is brand important to a luxury car customer?

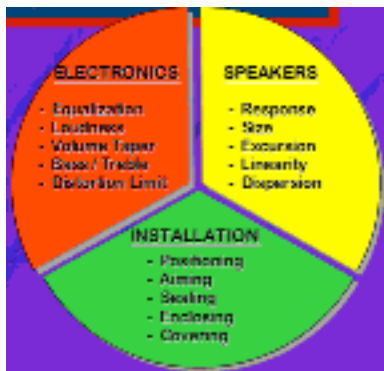


Customer Data vs. Evaluation Data

- Subjective and objective audio evaluation methods used in the industry.
- SAI's subjective and objective evaluation recommendations

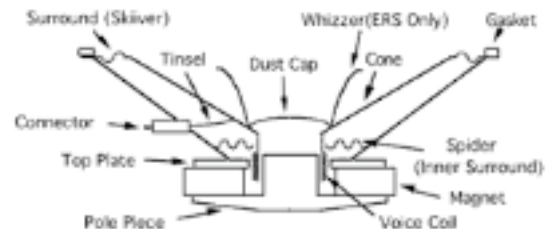
Part 2. Loudspeaker Choice, Specification & Measurement

- The Audio System Design "Pie"



The Audio Performance "Pie"

- Choosing speaker sizes and types
- Loudspeaker basics, and tradeoffs
- Why not flat speakers?
- Specifying a loudspeaker
- Relevant loudspeaker measurements
 - Frequency response, on and off axis
 - Power compression
 - Intermodulation distortion (2 kinds)
 - Loudspeaker power handling
 - High-excursion weighted distortion
 - Rattle/Buzz testing
 - Theile-Small and large signal parameters



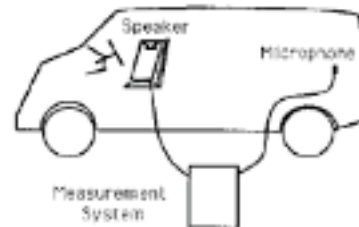
LOUDSPEAKER CROSS-SECTION FIGURE 3

Loudspeaker Cross Section

- Listening to loudspeakers vs. measuring them; LQ analysis

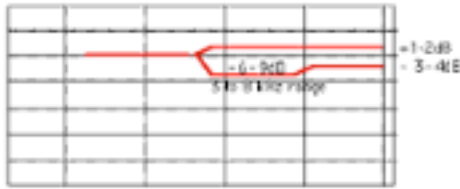
Part 3. System Installation

- Purpose of each speaker location
- Placement of loudspeakers
- Bass and the transfer function



Transfer Function Testing

- Polar patterns and aiming
 - The target curve
 - Stereo vs. Multichannel

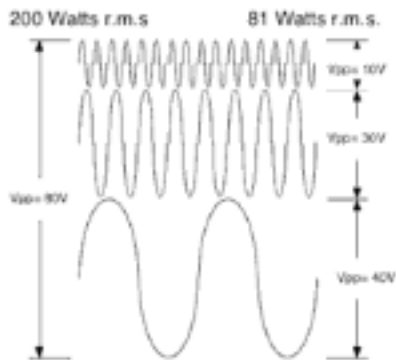


Target Response Curves

- Speaker mounting and vibration
- Sealing, covering and enclosures
- The door as an enclosure
- Fixing radiation resistance issues
- Passive crossovers / passive EQ
- Wiring considerations

Part 4. Audio Electronics

- Equalization
- Amplifier requirements: power, clip management
- Benefits of bi and tri- amplification



Results of Tri-Amplification

- Switching amplifiers
- Loudness compensation and sound processing
- Correct speed/noise compensation
- Time delay for rear speakers
- Phase-shifting for image control

- Bass management for control of loudspeaker distortion and clipping
 - Avoiding "MORE" and listening like a professional
 - Other sources: satellite, MP3, iPod
- #### Part 5. Multichannel in Automobiles

- Is multichannel important to customers?
- Are customer needs modified?
- Why are consumers disappointed with multichannel?
- Surrounding ambiance and the center speaker
- Types of multichannel
- Stereo / multichannel switching
- Making multichannel sound better



Multichannel Enhancement System
(SAI all rights reserved)

Part 6. Design Selections and Tuning

- Determine performance goals and system attributes
- Understand cost, mass and space constraints
- Performing the concept installation
- Tuning the system with efficient and capable tools like Ableton Live



Ableton Live Screenshot

- Measuring the interim and final results with objective and subjective measurement

Part 7. Vehicle Evaluation

Following the technical training part of the course, usually on the following day, the class performs a series of listening evaluations of employee and/or company and competitive vehicles.

For this evaluation section, class participants are divided into two or three groups. They are quickly taught an abbreviated listening evaluation method (similar to that used in Stroud Audio's "Skilled Listening" Seminar), and their evaluation results are compared with that of a trained listener. Some group's listening evaluations achieve very surprising and quite good results.

Specific Attributes we will listen for include:

- Tonal balance
- Spatial presentation
- System S.P.L. capability
- Distractions: distortion or noises

Objective frequency response

measurement data will also be obtained.

Miscellaneous Seminar Details

The SAI Audio Systems Design Seminar can be held at any location from Kokomo, Indiana to most anywhere in the world. We do not limit class size, but perhaps 5-15 people would be about right.

Handouts with course slide material will be made available, and a Certificate of Completion will be provided for each deserving participant.

If the training is outside of Kokomo, we would prefer to utilize your slide projector with VGA inputs.

Thank You!

Thank you most kindly for considering Stroud Audio Inc. for your audio system design training needs.

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