JJR ACOUSTICS, LLC

EXCELLENCE IN AUDIO

Company Profile

JJR ACOUSTICS

www.jjracoustics.com

Company Profile

General Info.

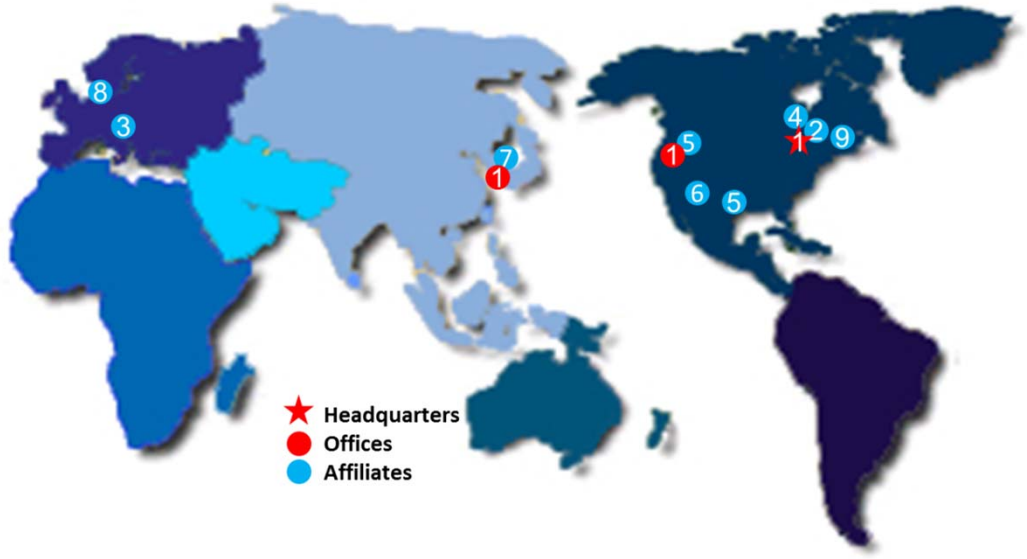
- ✓ Founded in 2011….
  Expertise established in 1986.
- ✓ 60+ years of World Wide OEM experience
- ✓ Co-Founders:
  - Jeff Bailey, Managing Director, Engineering
  - Roger Shively, Managing Director, R&D

Business

- ✓ Business Areas:
  - Personal Audio
  - Consumer Audio
  - OEM Automotive

Locations

- ✓ Headquarters & Engineering: Martinsville, IN
- ✓ R&D Center: Seattle, WA
- ✓ Business Development & Engineering Support: Seoul, Korea



1	JJR Acoustics
2	Fort Wayne, Indiana (DSP and Amplifier Development)
3	Karlsruhe, Germany (Simulation and Design Support)
4	Burton, Michigan (Power Amplifier Testing Facility)
5	Seattle, Washington (DSP Development)
6	Arroyo Seco, New Mexico (Loudspeaker Test Facility)
7	Seoul, Korea (Business Development and Engineering Support)
8	Herning, Denmark (Loudspeaker Development and Test)
9	Boston, Massachusetts (Market Research; Marketing Support)

Executive Management

Co-Founders	OEM Experience	Title
Jeff Bailey	30+ yrs	Managing Director, Engineering
Roger Shively	30+ yrs	Managing Director, Research & Development

Automotive OEM Customers

Consumer Customers

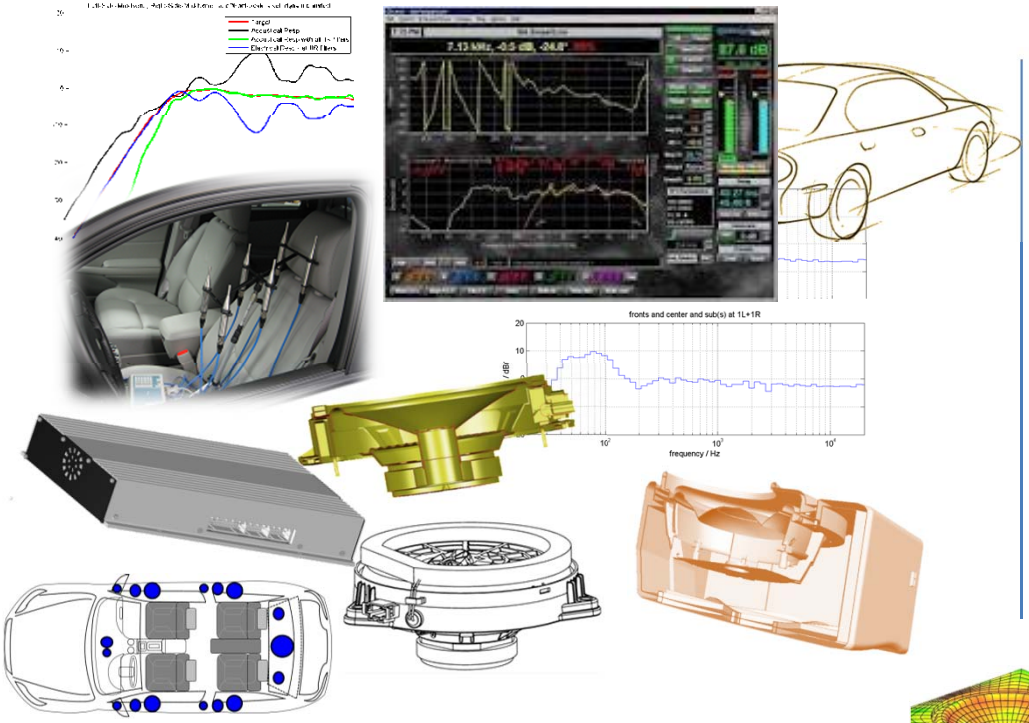
Samsung

Phaz Music

Materion

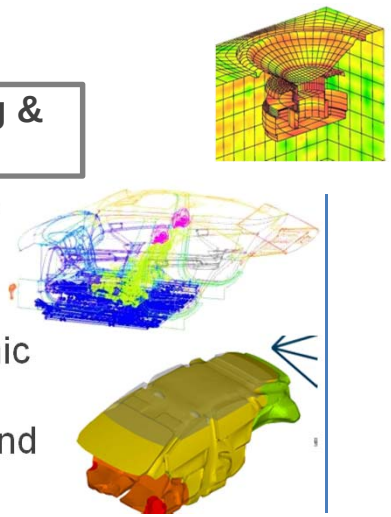
BDA

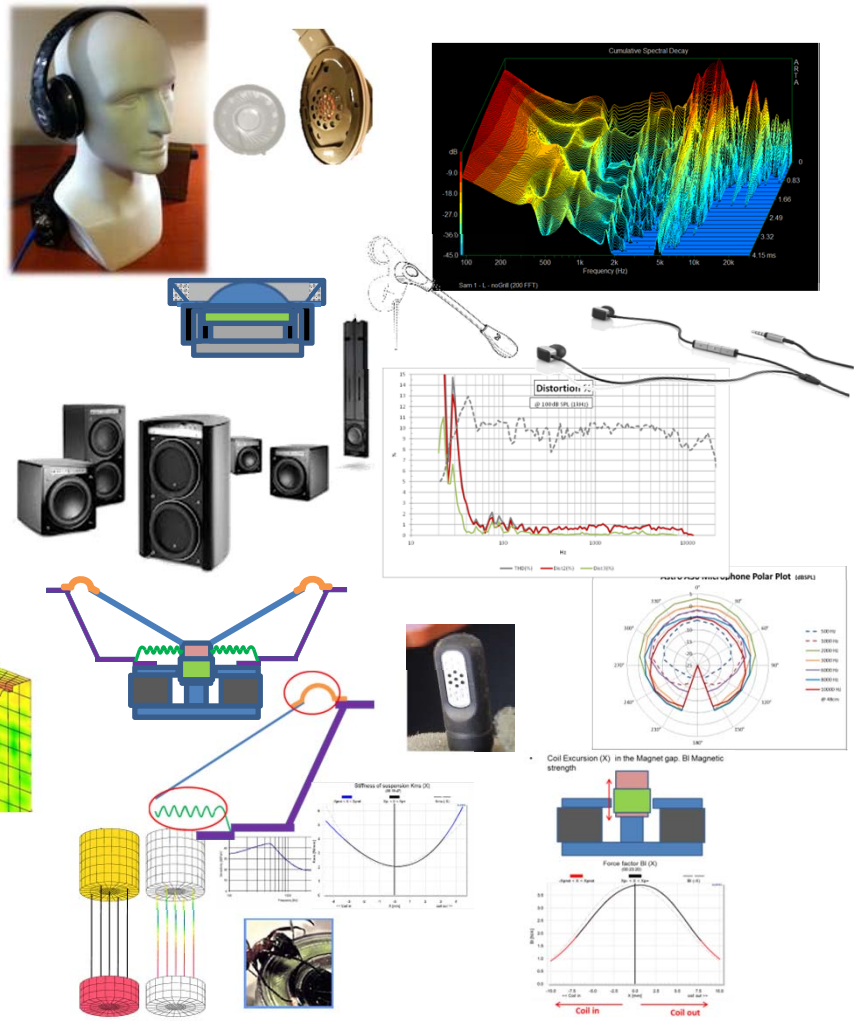
Zeikos



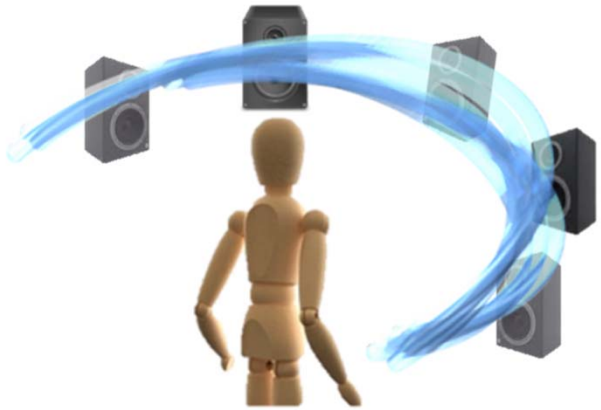
OEM Auto System Design and Tuning & Simulations

- Speaker Design & Placement, Amp Design
- Bass Optimization, Resonance Removal, Spectral Balance, Dynamic Level Capability, Spatial Balance; Listening Evaluations: Perception and Measured



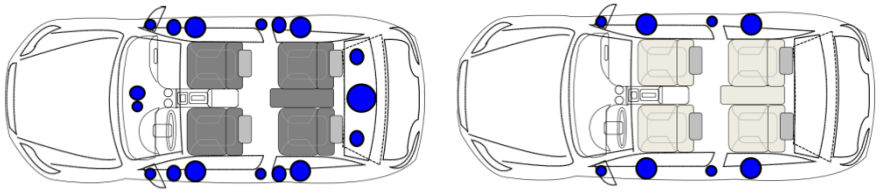


Consumer / Personal Audio Component Design, Tuning, & Simulations



DSP Development

- Next Generation Spatial Algorithms for 2ch, 5.1, or 7.1 channels signal sources and architectures.
- Signal Decomposition into “streams” of individual instruments, voices, or ambience
- Placed precisely in the sound stage
- Greater Stability and Clarity



Algorithms for 7 ch. Architecture or Simple 2 ch.

Market Research

- Consumer Preference
- Benchmarking and targets

Business Area Details….

- *OEM Automotive*
- *Personal Audio*
- *Consumer Audio*

OEM Automotive

3 Factors That Affect Auto Consumers' Purchase Decisions:

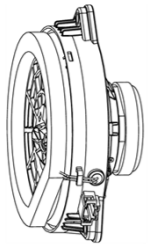
- *Prestige*
- *Performance*
- *Refined Audio*

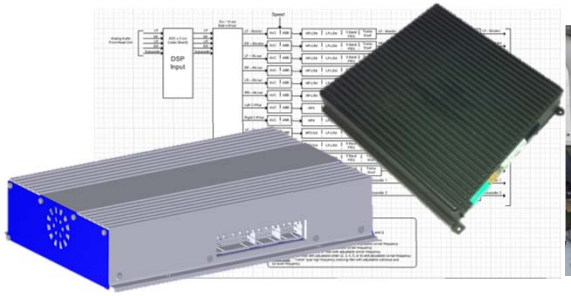
Auto Dealer Monthly: http://www.autodealermonthly.com/channel/dps-office/article/story/2008/02/the-three-factors-that-affect-consumers-purchase-decisions.aspx

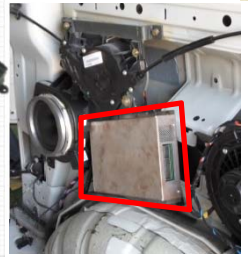
OEM Automotive Development

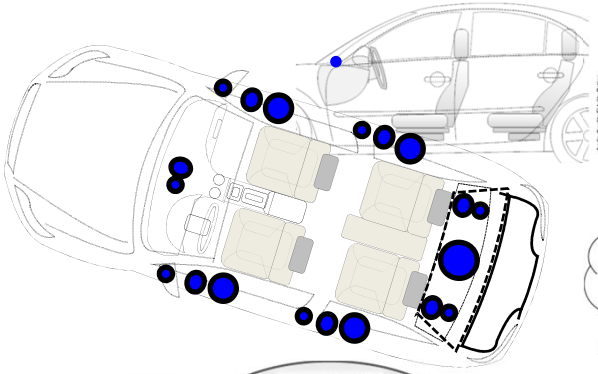
Highlights

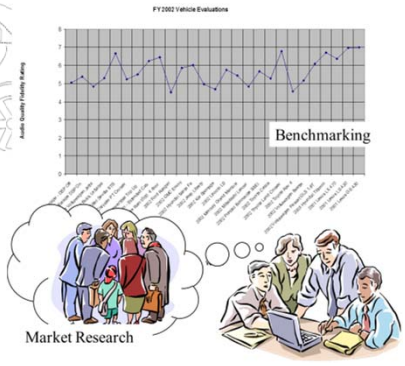
	Concept Cars	Mass Prod
Speakers *Design & Spec Prototype / Integration*	☑	☑
Amplifiers *Design & Spec Prototype / Integration*	☑	☑
Architectures *Benchmarking: - Best-In-Class - Competitive market placement*	☑	☑
Brand Development *OEM Brand Alliances*	☑	☑

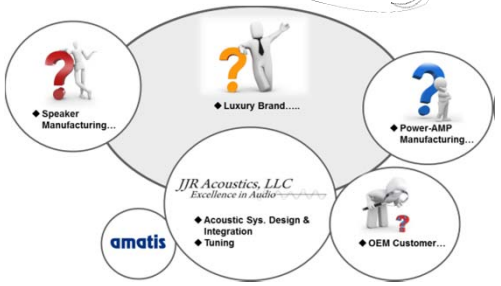






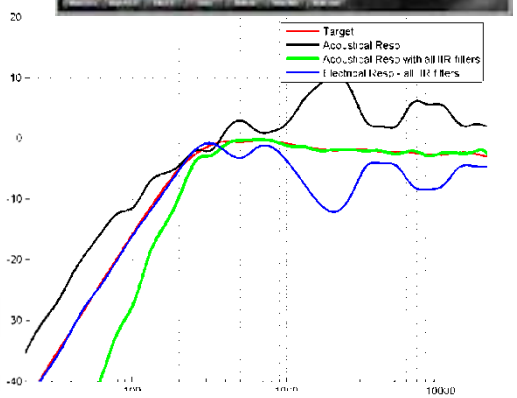


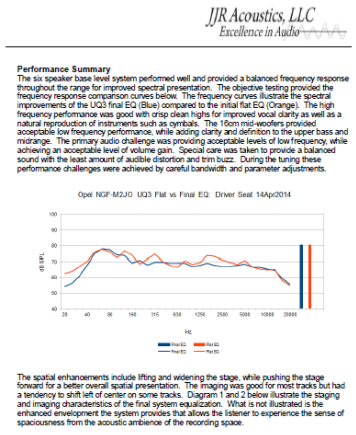


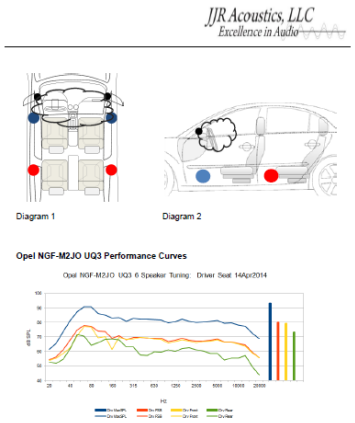


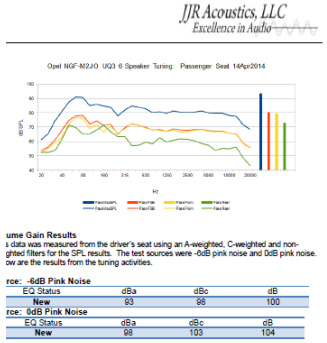
Example: Korean Auto OEM: Kia/KRELL

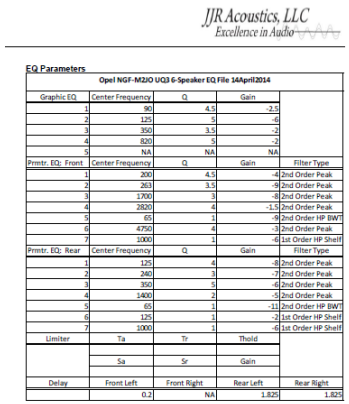
Vehicle Tuning





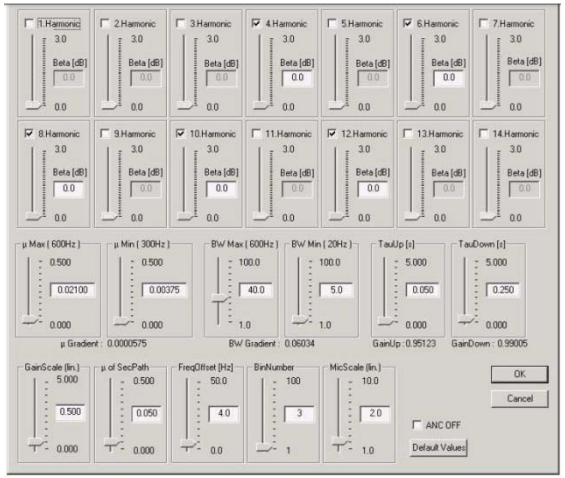


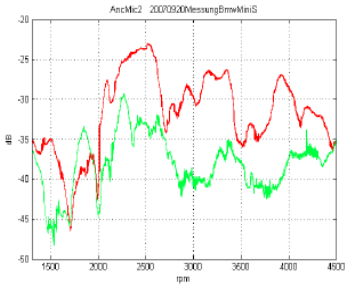




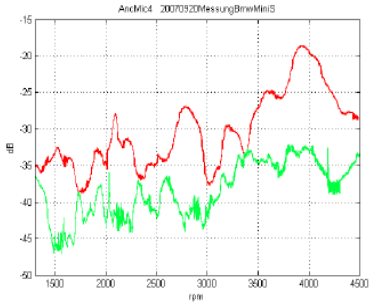
- Bass Optimization
  - Woofer Time and Phase Alignment for Front and Back Seat
- Resonance Removal
  - Equalization
- Spectral Balance
  - Gain and Shelving
- Dynamic Level Capability
  - Distortion, Limiting, Compression
- Spatial Balance
  - Alignment, EQ, Gain, Spatial Algorithm
- Listening Evaluations: Perception and Measured
- System Analysis & Tuning Reports

ANC Tuning



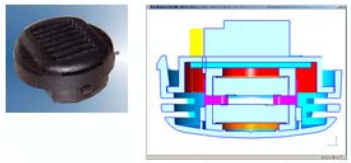


Front left seat



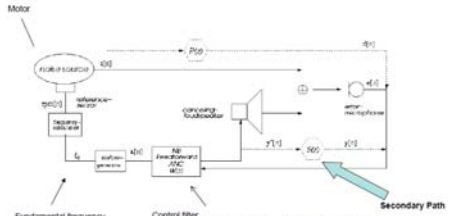
Back right seat

- Engine Order Cancellation Tuning
- Road Noise Cancellation Tuning
- ANC Tuning with regard to music quality
- Algorithm Reviews & Recommendation
- Consulting on Algorithm Design
- Microphone Performance Specification
- Microphone Number and Placement Specification



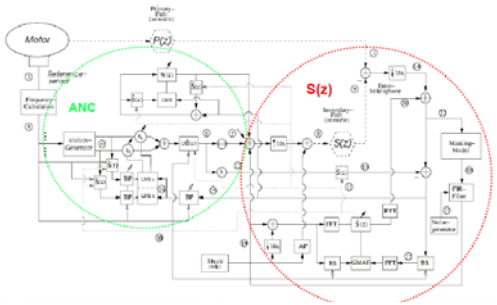
Anc Music Concept

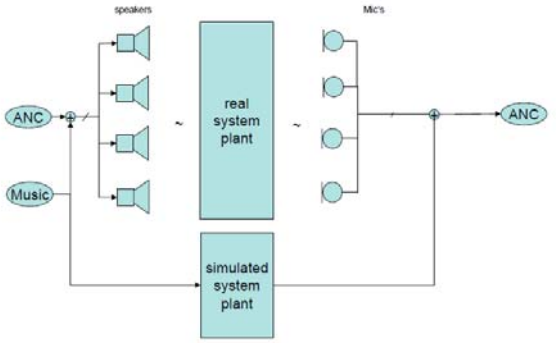
Principle of the Narrowband Feedforward-ANC



→ For an application in a car the information of a nonacoustic RPM sensor is used, and K harmonic canceling sines are generated (22)

Whole ANC System





System Development History (2011+)







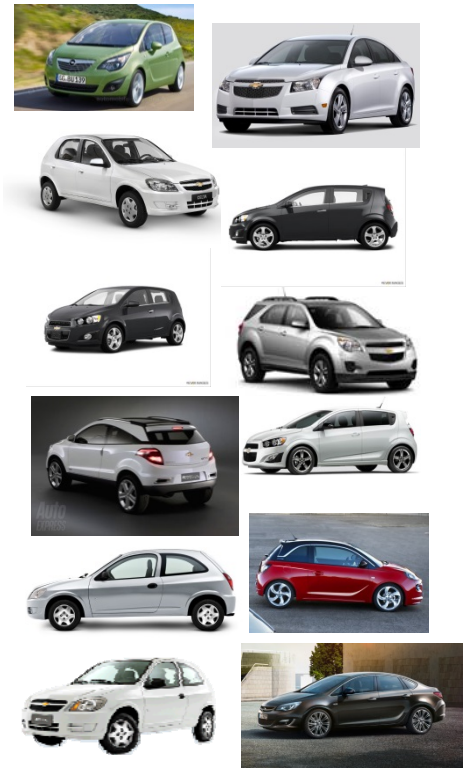






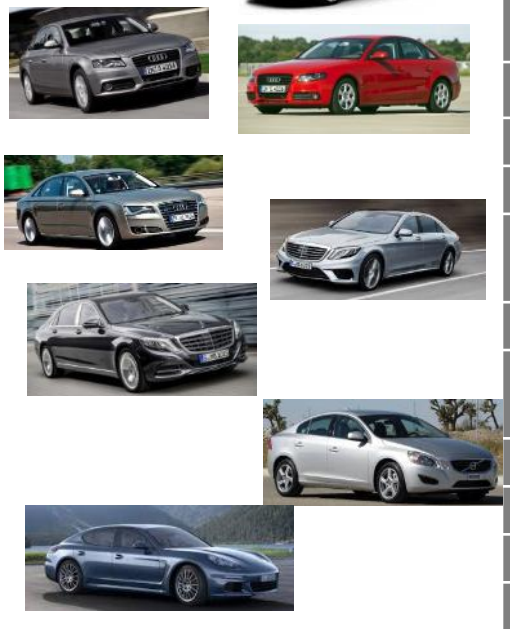

Highlight scope of work (overview): •Acoustic Design and Analysis •Audio System Tuning			•Product Design and Development •Research and Development
Customer	**Program**	**Schedule**	**Short Description**
Ssangyong	Chairman W200(2008)	harman/kardon Branded audio system design and tunings	
	Rexton C200 (2010)	harman/kardon Branded audio system design and tunings	
GM Korea	J300 (6 Speaker)	Sept. 5-9th, 2011	Audio System Tuning and Design Analysis
	T300	Sept. 7th, 2011	Listening Evaluation
	J300 (6 Speaker)	Sept. 16-20th 2011	Audio System Tuning and Design Analysis
	T300 (4 Speaker)	Oct. 24-28th, 2011	Audio System Tuning (Gain Change)
	J308 (4-6 Speaker)	Nov. 3-17th, 2011	Audio System Tuning and Design Analysis
	J300 (4 Speaker)	Nov. 17-24th, 2011	Audio System Tuning and Design Analysis
	Chevy gSUV (4-6 Spkr)	Nov. 28-Dec. 8, 2011	Audio System Tuning, and Design Analysis
GMNA	M300 (6 Speaker)	Dec. 14-16th, 2011	Audio System Tuning, and Design Analysis
GM Korea	J308 (4-6 Speaker)	Jan. 9-16th, 2012	Audio System Tuning and Design Analysis Cloth vs Leather
	J300-J308 (4 Speaker)	Jan. 17-19th, 2012	Audio System Tuning and Design Analysis Cloth Comparison
	J300-J308 (6 Speaker)	Jan. 26-30th, 2012	Audio System Tuning and Design Analysis Cloth Comparison
	T300 (6-Speaker)	Jan. 31-Feb. 7,2012	Audio System Tuning and Design Analysis
	Opel gSUV (6 Speaker)	Feb. 13-16, 2012	Audio System Tuning and Design Analysis
GMNA	Chevy gSUV (4-6 Spkr)	Apr. 16-25, 2012	Audio System Tuning and Design Analysis

System Development History



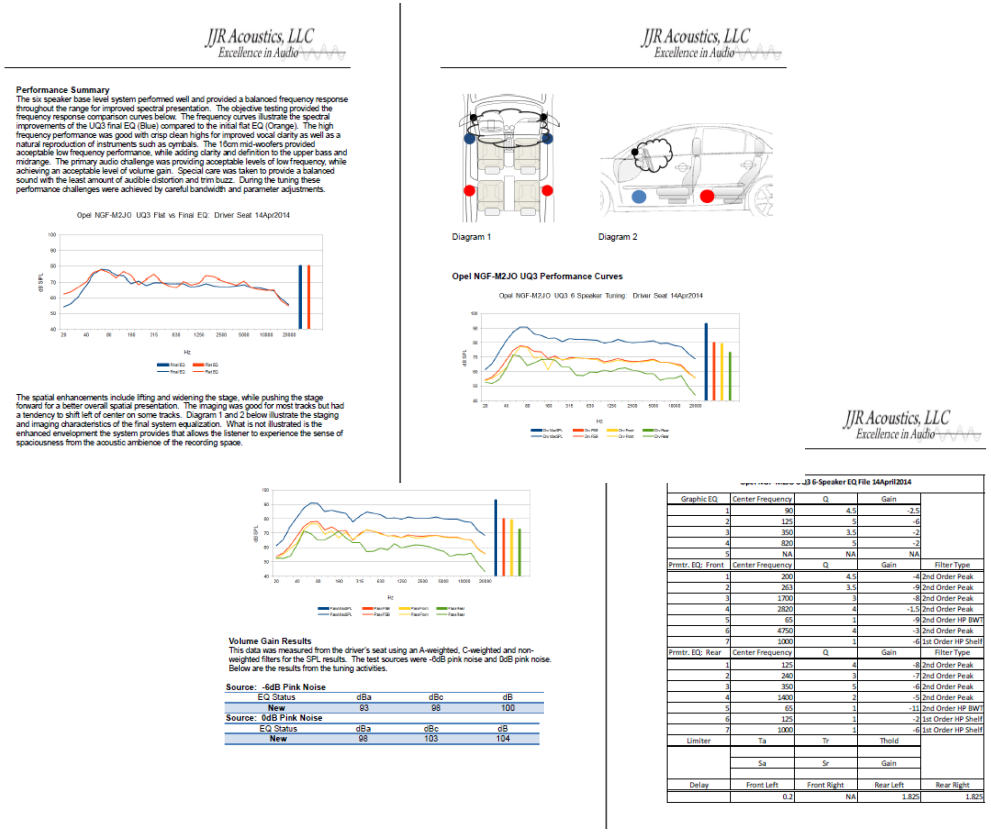
Highlight scope of work (overview): •Audio System Tuning			•Product Design and Development
Customer	**Program**	**Schedule**	**Short Description**
GM Korea	C140 (6-8 Speaker)	May 13-30th, 2013	Audio System Tuning and Design Analysis
	Opel NGF (4-6 Speaker)	Apr. 8-17th, 2014	Audio System Tuning and Design Analysis
	Chevy NGF (2-4-6 Spkr)	Apr. 18-May 8, 2014	Audio System Tuning and Design Analysis
	Opel NGF (4-6 Speaker)	Aug. 12-20th, 2014	Audio System Tuning and Design Analysis
	E2SC (6 Speaker)	Sept. 8-12th, 2014	Audio System Tuning and Design Analysis
	Chevy NGF (4-6 Spkr)	Nov. 17-24th, 2014	Audio System Tuning and Design Analysis
	Chevy gSUV (2-4-6 Spkr)	Dec. 8-18th, 2014	Audio System Tuning, and Design Analysis
	T250 (2-4 Speaker)	Jan. 12-22nd, 2015	Audio System Tuning, and Design Analysis
GMNA	E2SC-N	Apr. 27-30th, 2015	Audio System Tuning and Design Analysis
GM Korea	J200 (4-6 Speaker)	May 19-29th, 2015	Audio System Tuning and Design Analysis
GM Brazil	GMI 700 (2-4 Speakers)	Jul. 27-Aug. 11th, 2015	Audio System Tuning and Design Analysis 4 Speaker Systems with 2 Suppliers
GM Korea	Opel MCM (6 Speaker)	Sept. 1-4th, 2015	Audio System Tuning and Design Analysis
	T300 (6 Speaker)	Oct. 20-23rd, 2015	Audio System Tuning and Design Analysis
	Chevy gSUV (4-6 Spkr)	Nov. 2-16th, 2015	Audio System Tuning and Design Analysis

System Development History (cont)



Highlight scope of work (overview):			
• Acoustic Design and Analysis • Audio System Tuning		• Product Design and Development • Research and Development	
Customer	**Model**	**Short Description**	
GM Korea	T300 (4 Speaker)	Nov. 16-17th, 2015	Audio System Tuning and Design Analysis
	INFO 3.0 (4-6 Speaker)	Apr. 25-May 4th, 2016	Audio System Tuning and Design Analysis
	INFO 3.0 (4-6 Speaker)	Jun. 7-9th , 2016	Audio System Tuning and Design Analysis Distortion Reduction
	T250 (6 Speaker)	Jul. 11-15th, 2016	Audio System Tuning and Design Analysis
Mano Motor (Korea)	Starex (2013)	Luxury Van Conversion Audio Systems Design and Tuning Audio System Design and Tuning (for Hyundai Car & Life division)	
Hyundai	For use in all car models, systems, speaker and amplifier components (2011 - present)	Research and Development (Benchmarking and Design), Product Design and Development, Component and System Specifications. 2 KRELL brand Systems launched 2016 ; additional systems in development	
Audi	AU360 2013	System Design Analysis	
	AU495 2014	System Design Analysis	
	AU651 2014	System Design Analysis	
Daimler Mercedes	JCI 2013	System Design Analysis	
	S-Class (V222) 2014	System Design Analysis	
	MB 223 2014	System Design Analysis	
	ANC R&D 2014	Research and Development, System Design Analysis	
Volvo	2015 (In Development)	System Design Analysis	
Porsche	XXX 2017	System Design Analysis, Virtual Tuning	

Vehicle Tuning & Analysis Reports



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Performance Summary

The six speaker base level system performed well and provided a balanced frequency response throughout the range for improved spectral presentation. The objective testing provided the frequency response comparison curves below. The frequency curves illustrate the spectral improvements of the UQ3 final EQ (Blue) compared to the initial flat EQ (Orange). The high frequency performance was good with crisp clean highs for improved vocal clarity as well as a natural reproduction of instruments such as cymbals. The 16cm mid-woofers provided acceptable low frequency performance, while adding clarity and definition to the upper bass and midrange. The primary audio challenge was providing acceptable levels of low frequency, while achieving an acceptable level of volume gain. Special care was taken to provide a balanced sound with the least amount of audible distortion and trim buzz. During the tuning these performance challenges were achieved by careful bandwidth and parameter adjustments.

Opel NGF-M2JO UQ3 Flat vs Final EQ: Driver Seat 14Apr2014

The spatial enhancements include lifting and widening the stage, while pushing the stage forward for a better overall spatial presentation. The imaging was good for most tracks but had a tendency to shift left of center on some tracks. Diagram 1 and 2 below illustrate the staging and imaging characteristics of the final system equalization. What is not illustrated is the enhanced envelopment the system provides that allows the listener to experience the sense of spaciousness from the acoustic ambience of the recording space.

JJR Acoustics, LLC
Excellence in Audio

Diagram 1 Diagram 2

Opel NGF-M2JO UQ3 Performance Curves

Opel NGF-M2JO UQ3 6 Speaker Tuning: Driver Seat 14Apr2014

JJR Acoustics, LLC
Excellence in Audio

Volume Gain Results

This data was measured from the driver's seat using an A-weighted, C-weighted and non-weighted filters for the SPL results. The test sources were -6dB pink noise and 0dB pink noise. Below are the results from the tuning activities.

Source: -6dB Pink Noise

EQ Status	dBa	dBc	dB
New	93	98	100

Source: 0dB Pink Noise

EQ Status	dBa	dBc	dB
New	98	103	104

J3 6-Speaker EQ File 14April2014

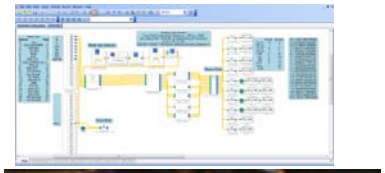
Graphic EQ	Center Frequency	Q	Gain	
1	90	4.5	-2.5	
2	125	5	-6	
3	350	3.5	-2	
4	820	5	-2	
5	NA	NA	NA	
Prmtr. EQ: Front	Center Frequency	Q	Gain	Filter Type
1	200	4.5	-4	2nd Order Peak
2	263	3.5	-9	2nd Order Peak
3	1700	3	-8	2nd Order Peak
4	2820	4	-1.5	2nd Order Peak
5	65	1	-9	2nd Order HP BWT
6	4750	4	-3	2nd Order Peak
7	1000	1	-6	1st Order HP Shelf
Prmtr. EQ: Rear	Center Frequency	Q	Gain	Filter Type
1	125	4	-8	2nd Order Peak
2	240	3	-7	2nd Order Peak
3	350	5	-6	2nd Order Peak
4	1400	2	-5	2nd Order Peak
5	65	1	-11	2nd Order HP BWT
6	125	1	-2	1st Order HP Shelf
7	1000	1	-6	1st Order HP Shelf
Limiter	Ta	Tr	Thold	
	Sa	Sr	Gain	
Delay	Front Left	Front Right	Rear Left	Rear Right
	0.2	NA	1.825	1.825

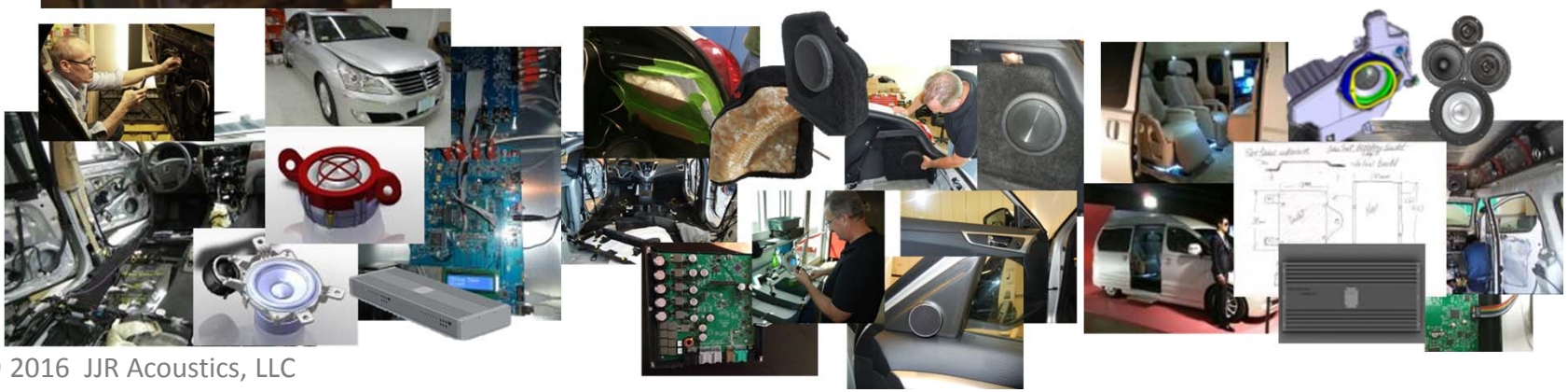
Concept Car Development Summary

Highlight scope of work (overview):

- Concept Fabrication & Interior Mockup
- System Installation
- System Tuning
- Component and System Specification
- Acoustic Design and Analysis
- Product Design and Development
- Research and Development (Benchmarking & Design)

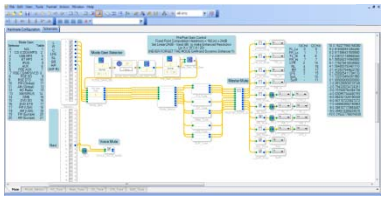
Customer	Model	Short Description
Hyundai	2011-2012 Luxury Platform	New Luxury Brand System Concept. 17 speakers, 14 channels, 20/35V, 50W/150W
	2012 Limousine Van Platform	New Premium Brand System Concept. 21 speakers (15 locations), 16 channels, 20/35V, 50W/150W
	2013-2014 Large Sedan Platform	New Luxury Brand System Concept. 12 speakers, 10 channels, Class-D 600 W
	2014 Midsize Platform	Advanced System Concept and HMI interface. 13 speakers, 12 channels. Configurable amp channels, rails, and wattage. Variable input control bus.
	2014 T-car Concept	Hyundai 2014 Tech Show – Signature EQ Mobile App. 11 speakers, 12 channels.
	2016 Reference Benchmark	Existing Luxury Audio System. 17 speakers, 12 channels. Speaker location benchmark





*Timeline (History) of New Luxury Brand (Equus) – **From Demo Car to Production Development !***

- **2011 December** – Brand & HMC Concept Meeting
- **2012 January – February**
  - JJR Acoustics Equus Vehicle
    - System Specification Requirements
    - Prototype Amplifier Creation
    - DSP
    - Speaker samples
    - Demo build and install, tuning (Seoul)
- **2012 February** – 1st Demo Exec. VP (Electronic Development Center)
- **2012 March** – May Director, Electronics Development Team listening
- **2012 May** – Exec VP (2nd Listen) & Audio Team listening
- **2012 July 19** – HMC Headquarters Brand Show and Reception (HMC Design Team)
- **2012 July 26** – HMC Headquarters Brand Sound Presentation w/ Marketing and Product Planning
- **2012 September** – Co-development Meeting with electronic supplier
- **2013 October** – HMC request to JJR to Discuss project with HMA; Use of Competitive Vehicle Brand Comparison
- **2014 February** – July – HMC Brand Selection
- **2014 October** – New Branded System Project Kickoff
- **2015 January** – Final Competitive Vehicle Comparison (Closing the Loop)
- **2016 January** – First Production in Kia K7



KRELL
THE LEADER IN AUDIO ENGINEERING

KRELL Launches in Kia K7 (2016) …

KRELL Sound Arrives in the Kia K7 (January 11, 2016 @ 18:43)

Posted on January 11, 2016 by Roger Shively

The Korea Herald

[Photo News] KIA Motors unveils all-new K7

2016-01-11 21:45

Technicians check the KRELL audio system in Kia's new K7 sedan at the carmaker's R & D center in Hwaseong, Gyeonggi Province, on Monday. The automakers' new flagship sedan with eight-speed transmission boasts enhanced fuel efficiency and driving performance. The new K7's price tag ranges from 30.8 million won ($ 24,940) to 39.4 million won depending on power trains and options. Kia Motors

The K7 tuning provides system performance that reflects KRELL's three performance goals:

- Musical Detail
- Three-dimensional sound presentation
- Extreme volume dynamic capability

KRELL sound is lively and unconstrained, evoking a live performance and the true instrumental sound, recreating the recording the way the musicians intended listeners to experience.

A KRELL system does not draw attention to itself but presents a precise, energetic presentation with an openness that demonstrates to the listener that no compromises were made during the development of the product.

To achieve these performance goals the tuning activities focused on providing a balanced spectral presentation on all channels, provide a well-defined sound stage that extends to the left and right edge of the instrument panel with a focused center image, and a level of envelopment that allows the listener a sense of the recording space, while maintaining uncompromised dynamic capability.

http://www.jjracoustics.com/blog/

And Launches in Kia Niro (Hybrid) (2016) …

KIA's Niro Premium Hybrid Launches with KRELL

Posted on March 17, 2016 by Roger Shively

The Korea Herald Published : 2016-03-16 20:00

Engineers of Kia Motors conduct a product quality inspection on Kia's all-new Niro hybrid sport utility vehicle, at a media preview event held on Wednesday at the automaker's Namyang research and development center in Hwaseong, Gyeonggi Province. Kia Motors. (Korea Herald © 2016)

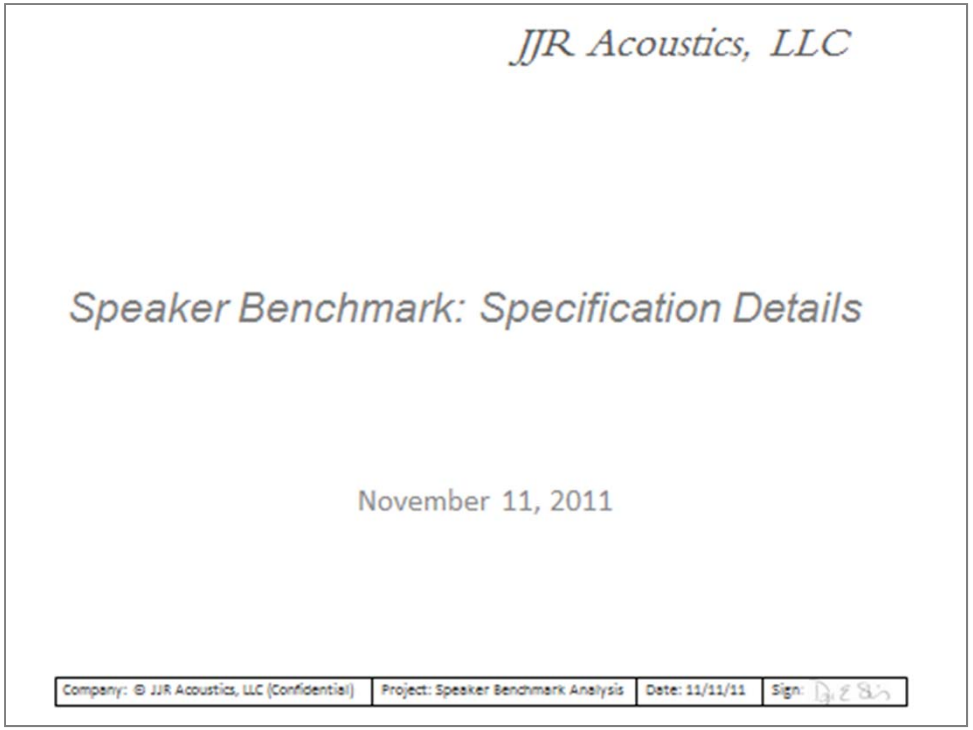
JJR ACOUSTICS

KRELL
THE LEADER IN AUDIO ENGINEERING

KIA

http://www.jjracoustics.com/blog/

Detailed Speaker and System Specification Information in "Speaker Benchmark Specifications" at:
http://www.jjracoustics.com/blog/?p=19


JJR Acoustics, LLC

Speaker Benchmark: Specification Details

November 11, 2011

Company: © JJR Acoustics, LLC (Confidential)	Project: Speaker Benchmark Analysis	Date: 11/11/11	Sign:

JJR Acoustics is affiliated with MVOID (Karlsruhe, Germany) **for large system level or lower level component Acoustic Simulation.**

http://www.jjracoustics.com/blog/?p=74
http://www.jjracoustics.com/blog/?p=212

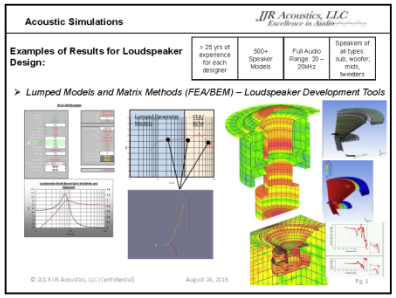
JJR Acoustics (and MVOID) **use:**

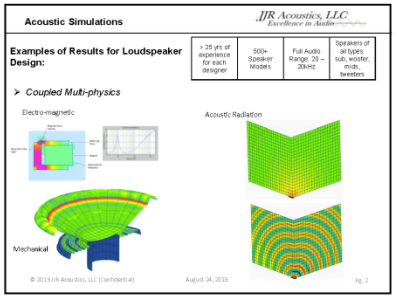
COMSOL

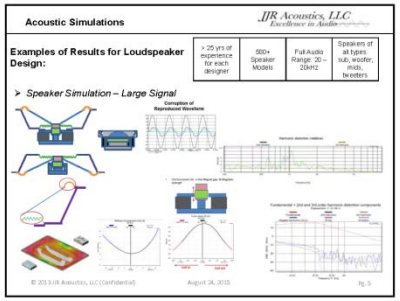
COMSOL Multiphysics
With M-VoiD add-in

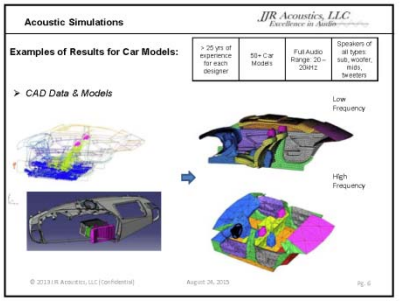
mvoid

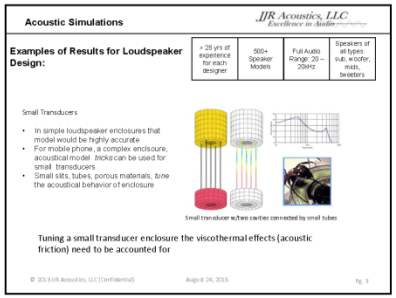
Loudspeaker Simulation Examples:

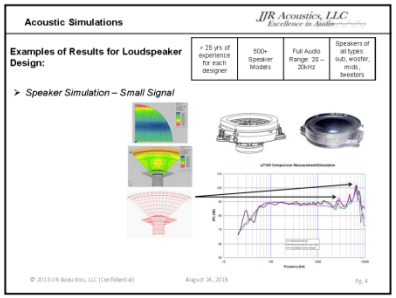


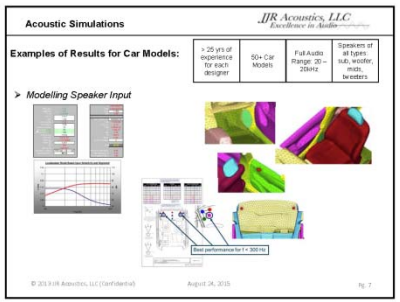


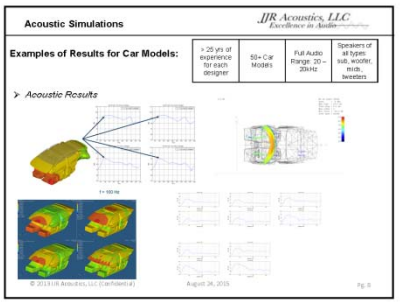












Instruments, Software, …

http://www.jjracoustics.com/blog/?p=238

Microphones

Instruments and Software:

Microphones:

- Earthworks M23: 142dBSPL max, 9Hz-23kHz, Omni-directional
- 6 mic array :
  - array more useful for sound power response of system in small rooms, e.g., cars

RTA

Measurement Software:

- Real Time Analyzer, FFT, Impulse Response
- For Frequency and Time measurements
- *SmaartLive*

Tuning Options:

- Existing on-board DSP
- Custom DSP (JJR Acoustics, LLC)
  - Speaker / Line Level
  - Parametric EQ & Gain
  - Delay
- Rack-mount DSP
  - Parametric EQ, Gain, Delay

DSP

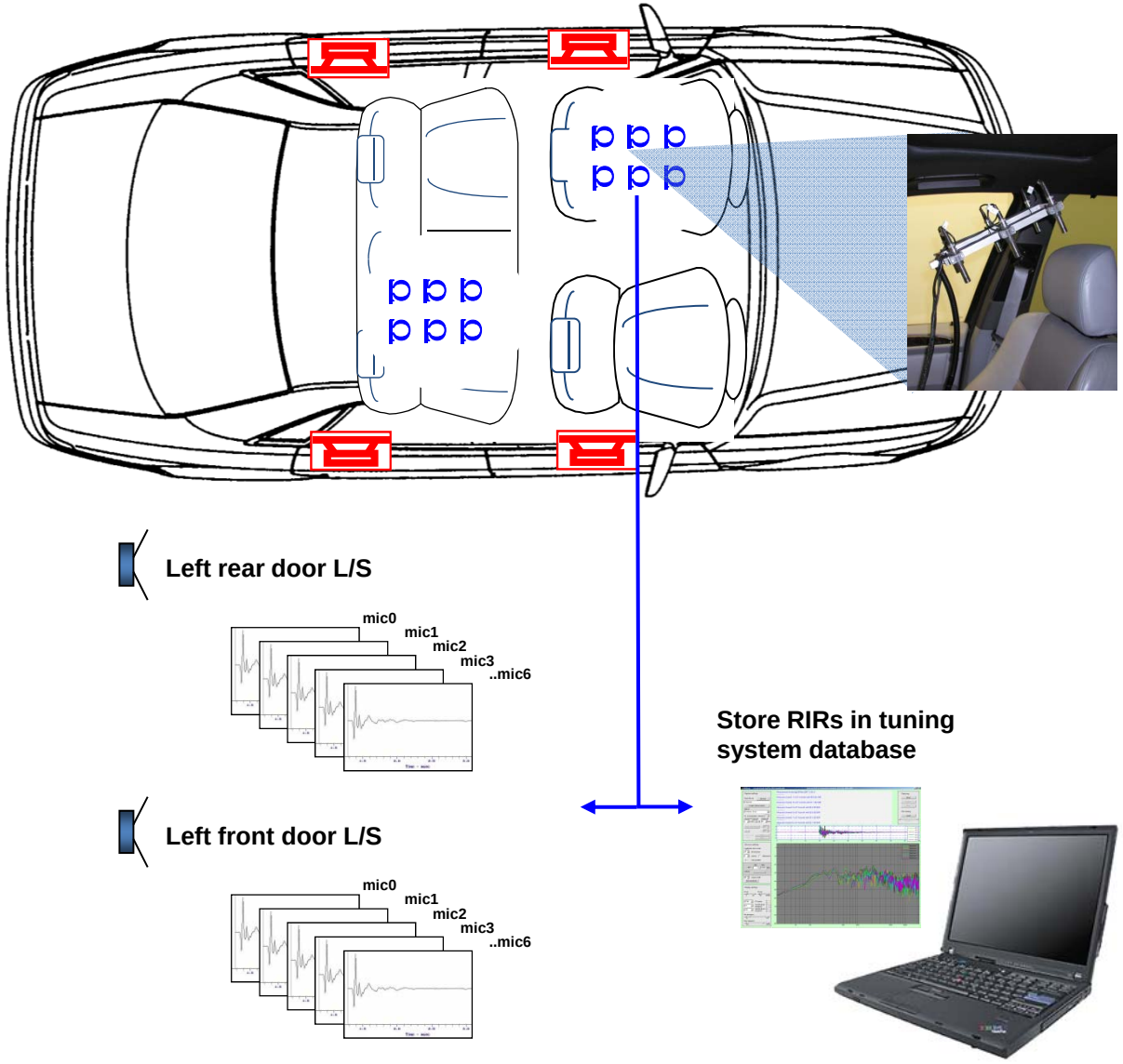
Instruments, Software, …

OEM GUI Software experience:

- Analog Devices (Sigma Studio): Hyundai MOBIS, nFuzion
- Cirrus Logic: Hyundai Equus Demo
- NXP GUI: GM
- Humax Automotive GUI: GM

Static Acquisition (Room Impulses Response RIR)

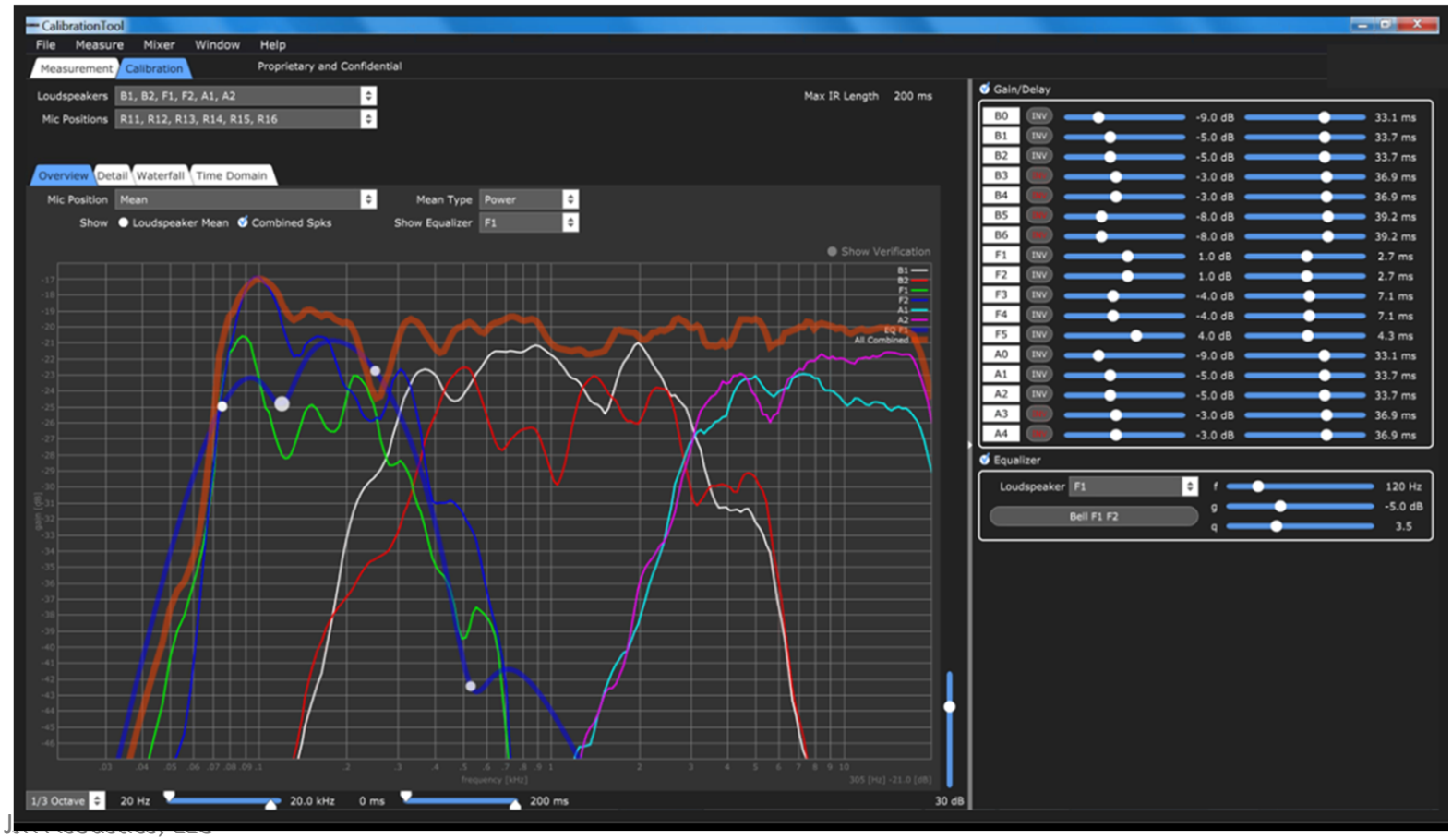
http://www.jjracoustics.com/blog/?p=298



- Automated acquisition system measuring RIR for each of the 6 mics simultaneously
- The RIR from each channel to each microphone is captured
- All RIRs from each channel to each mic are then stored in a database for virtual tuning
- This procedure is then repeated for additional seats as required

Static Acquisition (Room Impulses Response RIR)

- Systems engineer manually applies different sets of tuning parameters to virtual system depending on static acquisition to get base line tuning
  - ❖ Gain levels of each channel, Time delays between channels, Different types of filters to modify frequency response of each channel

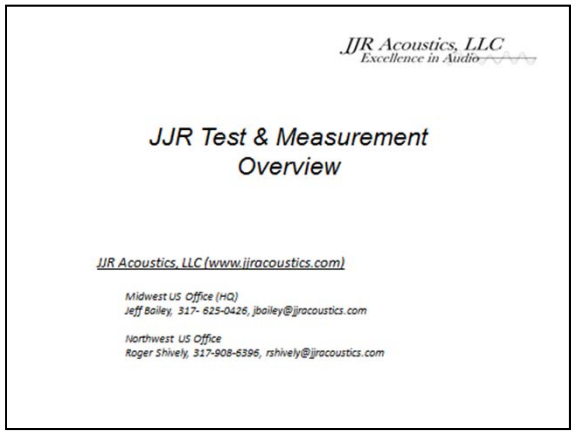


… Methodology

Spectral Management and tuning + Spatial Balance:

- Bass Optimization
- Resonance Removal
- Spectral Balance
- Dynamic Level Capability
- Spatial Balance
- Listening Evaluations: Perception and Measured

Detailed Test, Measurement, and Simulation Information in "JJR Test & Measurement" at:
http://www.jjracoustics.com/blog/?p=45


JJR Acoustics, LLC
Excellence in Audio

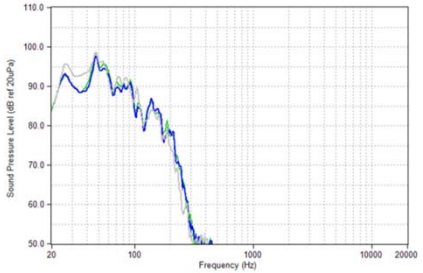
JJR Test & Measurement
Overview

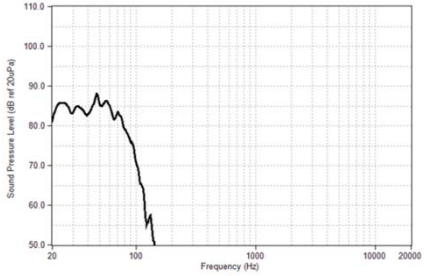
JJR Acoustics, LLC (www.jjracoustics.com)

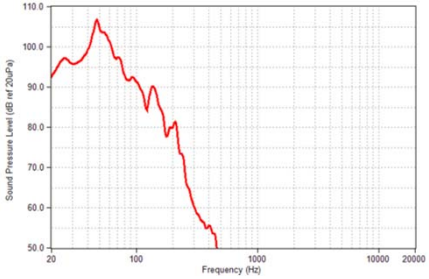
Midwest US Office (HQ)
Jeff Bailey, 317- 625-0426, jbailey@jjracoustics.com

Northwest US Office
Roger Shively, 317-908-6396, rshively@jjracoustics.com

Room Tuning



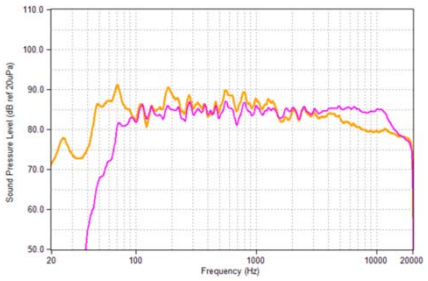




Bass Optimization of multiple woofers:

- Align Phase and Amplitude (delay)
- Equalize (parametric)

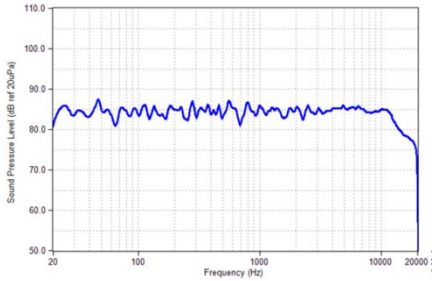
◀Studios



◀ Mid & High Frequency Speaker System/Room Optimization

Rooms ▶

System/Channel/ Room Balance ▶

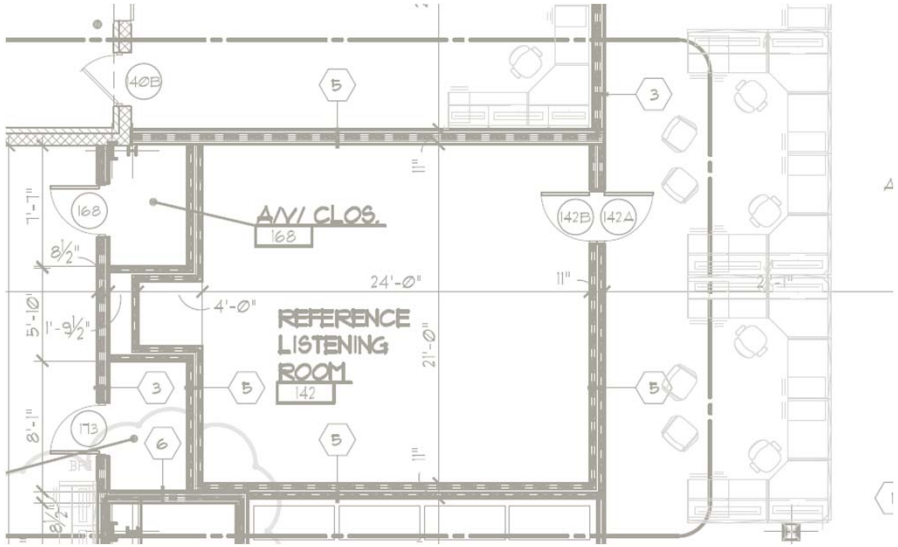


Room Tuning

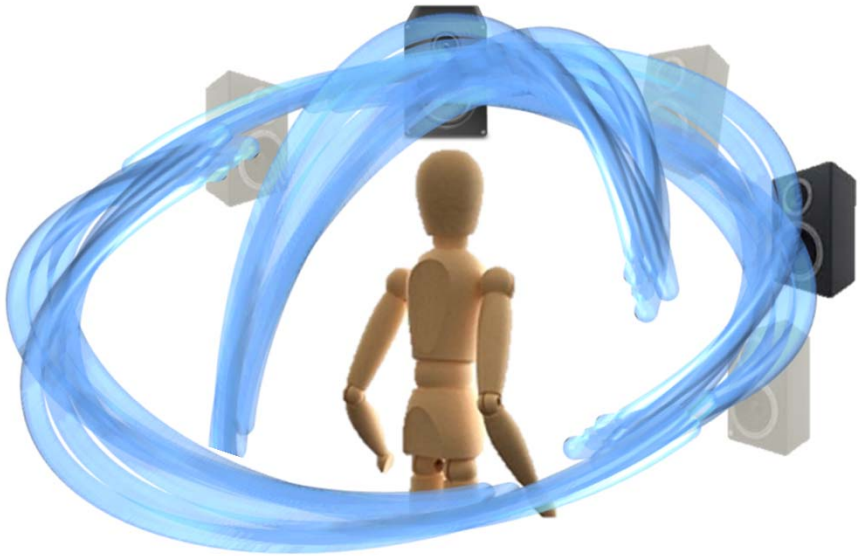
Listening & Theater Room Tuning and Design

- Harman, Martinsville (2) Tuning and Design — year: 1994 & 2004
- Toyota, Ann Arbor (1) Tuning, Redesign — year: 2003
- Harman, Nagoya (2) Tuning and Design — year: 2004
- Harman, Seoul (1) Tuning and Design — year: 2005
- Harman, Michigan (2) Tuning and Design — year: 2001 & 2008
- Harman, Suzhou (1) Design — year: 2010

- Over 15 years of room design and tuning



Spatial Enhancement DSP

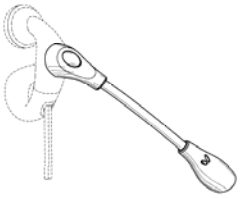


- DSP for Virtual Speaker placement from 2 or more channel input
  - Virtual Center
  - Virtual Speaker Spreader, 3D
  - Virtual Surround, 5+ channel up-mix
  - Added Height Dimension
- Fully Immersive Audio
- Enhanced Spatial Sound field, Maintaining Spectral Balance
- Passive or Real Time Processing
- Compressed Audio Enhancement
- Compatible with all legacy content, the most flexible platform in the world today
- No special hardware or room measurements needed
- Applications: Automotive, PC, Home Listening, Gaming Console

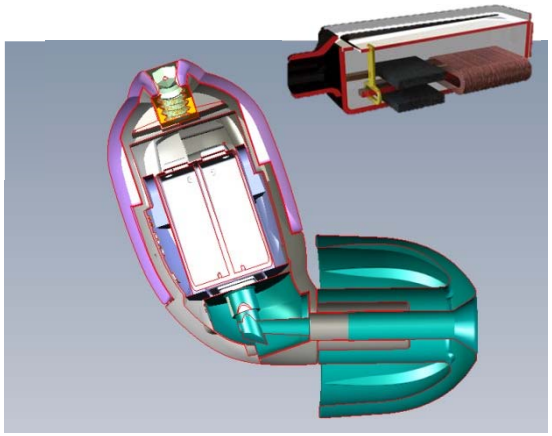
Earphone &Headphone Dynamic Transducers

(∅ 5mm – 50mm+)

BT Soundboxes



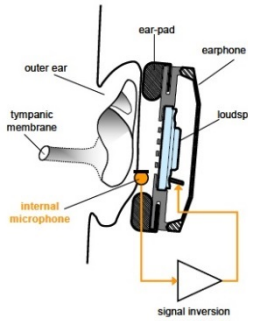
Headphone Systems

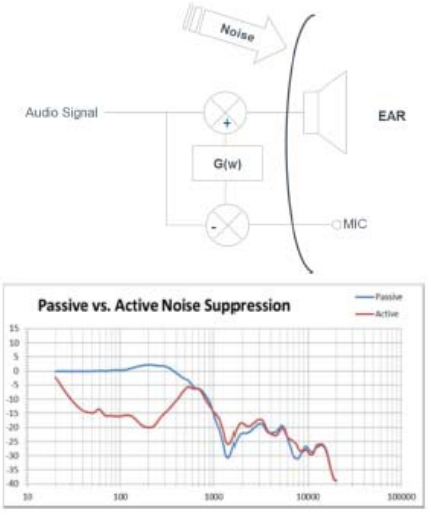


Earphone Systems

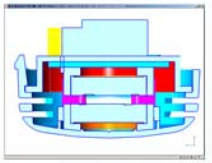
ANC Tuning

Feedback Top

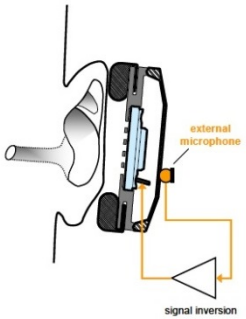


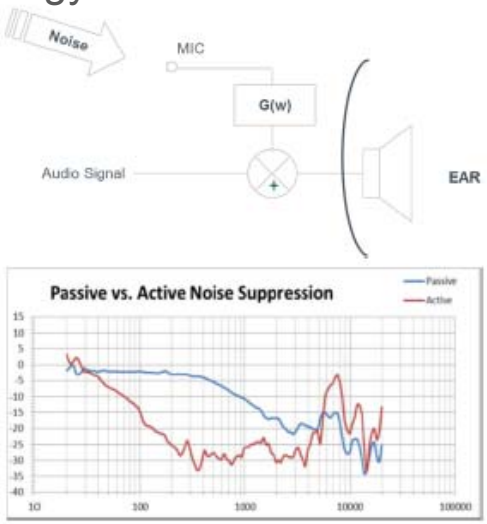


- Headphones / Earphones
- ANC Tuning with regard to music quality
- Algorithm Reviews & Recommendation
- Consulting on Algorithm Design
- Microphone Performance Specification
- Microphone Number and Placement Specification

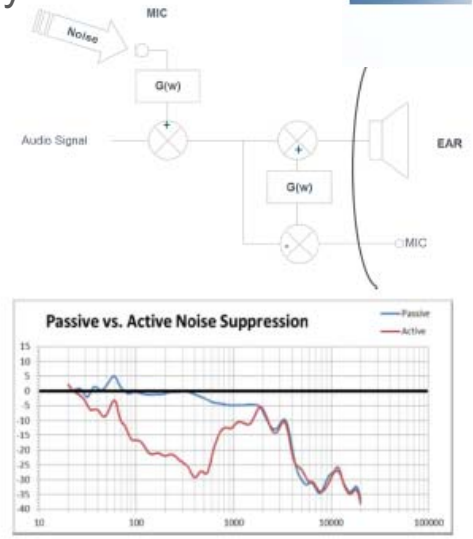


Feedforward Topology





Hybrid Topology



System Development Summary

Highlight scope of work (overview):

- Product Design and Development
- Manufacturing Process and Quality Control
- Acoustic Design and Analysis
- Research and Development
- Product Acoustic Tuning
- Electronic Design and Analysis
- Noise Reduction

Customer	Model	Short Description
BDA Inc.	Munitio Pro40's (2013)	Product Design and Development, Acoustic Design and Development, Manufacturing Process and Quality Control, and Product Acoustic Tuning for the new model headphone
	Munitio Pro30's (2013)	Product Design and Development, Acoustic Design and Development, Manufacturing Process and Quality Control, and Product Acoustic Tuning for the new model headphone
	Moga Gaming Headsets (2013)	Product Design and Development, Acoustic (mic and speakers) & Electronic Design and Development, and Product Acoustic Tuning, and Wind Noise Reduction for the new model gaming headset.
MATERION	New Material & Product Development (2013)	Acoustic Design and Analysis, Research and Development for new speaker material and headphone design
Zeikos	Elite (2012)	Acoustic Analysis and re-Design, and Product Development of new model headphone
	New Product Development iHip Brand PHAZ P2 (Jan 2015 Launch)	Product Design and Development, Acoustic & Electronic (amp and charging) Design and Development, Manufacturing Process and Quality Control, and Product Acoustic Tuning for the new model headphone
	Sound Machine, and additional new BlueTooth Speakers (2014)	Product Design and Development, Acoustic & Electronic (amp and power) Design and Development, Manufacturing Process and Quality Control, and Product Acoustic Tuning for the new model Bluetooth speakers

https://www.phazmusic.com/catalog/over-headphone-with-patented-integrated-phone-charger-p-1551.html

"Whether you're listening to a classical piano piece or today's hip hop, these headphones were engineered for the audio performance the artist intended you to hear."

-ROGER SHIVELY

Research & Development - JJR Acoustics

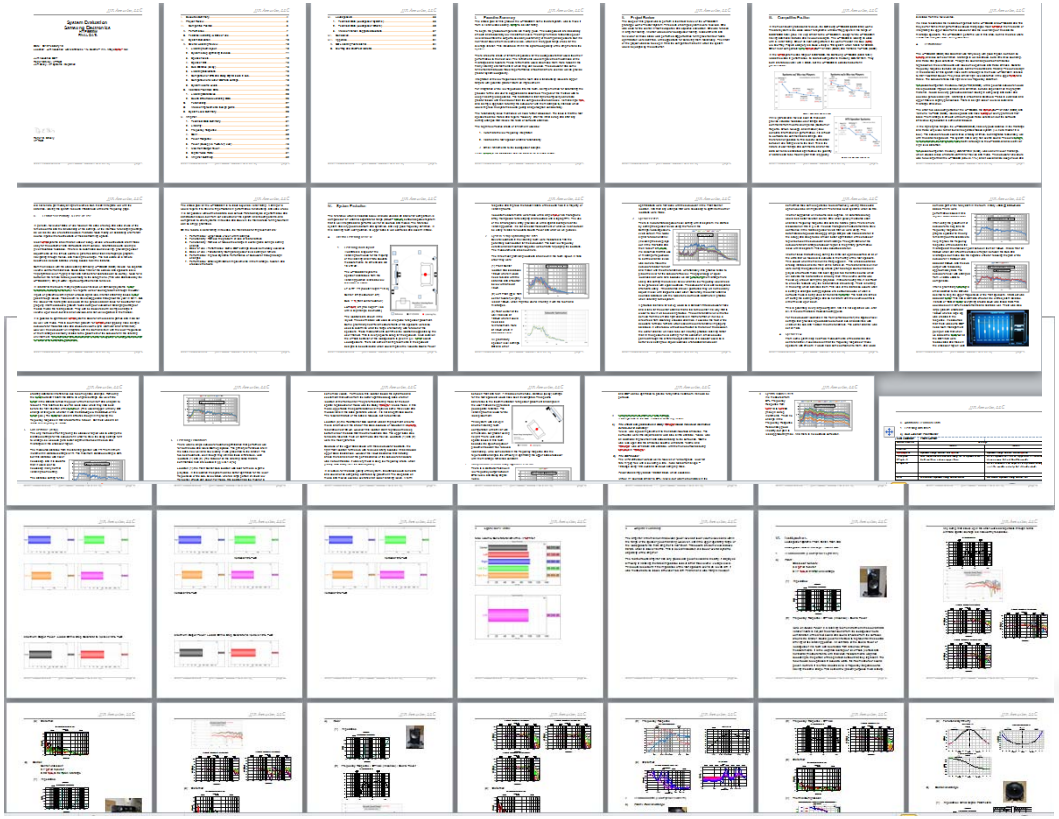
CHARGE WHILE YOU LISTEN

In today's mobile, energy-hungry world, Phaz is the first company to transfer the power from your headphone's battery to boost the power of your mobile device. And our patented technology allows this to happen without any audio performance compromise. Which means you never again need to choose between your music and your mobile device's battery run-time.

System Development Summary

Highlight scope of work (overview):	
• Acoustic Design and Analysis • Electronic Design and Analysis	• Product Design and Development • Research and Development

Customer	Model	Short Description
Samsung	HT-E5500W (2012)	Research and Development, Benchmarking. Product Evaluation and re-Design of Home Theater System speaker and electronic components. Acoustic & Electronic Analysis and re-Design.



Comprehensive Product Analysis

Jeff Bailey, Professional Biography

2011 – present	JJR Acoustics, Managing Director of Engineering, Founding Member
1998 - 2011	Harman International, Senior Systems Engineer, Electrical and Acoustic System Development, System Integration and System Voicing
1996 - 1998	Relm Communications, Senior RF Technician, Circuit and PCB Design, Validation Testing, FCC/UL Certification
1992 – 1996	Oxford Speaker Company, Instrumentation Engineer, Test System Software Development for Acoustic Laboratory, End-of Line and QC Conformance Test Systems
1986 – 1991	Harman International, Test Engineer, Test System Development for Acoustic Laboratory, End-of Line and QC Conformance Test Systems
1983	Graduated with a degree in Electrical Engineering, ITT Technical Institute

Member of the Audio Engineering Society

Published Papers in Acoustics and Test and Measurement

Roger Shively, Professional Biography

2011 – present	JJR Acoustics, Managing Director of R&D, Founding Member
1996 – 2011	Harman International, Chief Engineer, Simulation and Virtual Acoustics, Automotive Audio Multidisciplinary virtual system engineering for audio systems, Pyscho-acoustics research
1988 – 1997	Harman International Senior Engineer, Advanced Transducer Development for automotive applications, Engineering analysis with finite und boundary elements for stress analysis, dynamics und acoustics
1986 – 1988	Advanced Masters Degree study in FEM and BEM, Indiana University – Purdue at Indianapolis
1983	Graduated with the degree Bachelors of Science in Acoustics, Purdue University, West Lafayette, Indiana

Full member of the Audio Engineering Society, Acoustical Society of America, and Society of Automotive Engineers

15 Published Papers in Acoustics and Physics; 2 Patents Acoustics & Audio Processing

Roger Shively & Jeff Bailey

Publications

1. "A Reliable Method of Loudspeaker Rub and Buzz Testing Using Automated FFT Response and Distortion Techniques“, Presented at the 91st Conv. of the AES, New York, (1991 October).

2. “Perceived Boundary Effects in an Automotive Vehicle Interior”, Presented at the 100th Conv. of the AES, Copenhagen, (1996 May).

3. “Finite-Element and Boundary-Element Computer Modeling For Loudspeaker Cone Design”, Presented at the 133rd Meeting of the Acoustical Society of America, Penn State, (1997 June).

4. “Listener Training and Repeatability for Automobiles”, Presented at the 104th Conv. of the AES, Amsterdam, (1998 May).

5. “Subjective Evaluation of Reproduced Sound in Automotive Spaces”, Presented at the 15th Int’l Conf. of the AES, Denmark, (1998 Oct 31-Nov 2).

6. “Automotive Audio: System Engineering“, Presented to the AES Los Angeles Section, (1999 March).

7. “The Placebo Method, A Comparison of In-Situ Subjective Evaluation Methods for Vehicles”, Presented at the 108th Convention of the Audio Eng. Soc., Paris (2000 February).

Roger Shively & Jeff Bailey

Publications – cont

8. "Automotive Audio Design (A Tutorial)", Presented at the 109th Conv. of the AES, Los Angeles, (2000 September).

9. "Automotive Doors as Loudspeaker Enclosures", Presented at the 114th Conv. of the AES, Amsterdam, (2003 March).

10. "Update to Automotive Doors as Loudspeaker Enclosures", Presented at the 116th Conv. of the AES, Berlin, (2004 May).

11. "Automotive Doors as Loudspeaker Enclosures Modeling Considerations", Presented at the 118th Conv. of the AES, Barcelona, (2005 May).

12. "Automotive Sound System Development Method & Technology Trend", Presented at the 2nd Automotive Electronic Technology Workshop of the IEEK (Institute of Electronic Engineering Korea), Seoul, (2008 September)

13. "Considerations for the Optimal Location and Boundary Effects for Loudspeakers in an Automotive Interior", Presented at the 128th Conv. of the AES, London, (2010 May).

14. "Optimal Location and Orientation for Midrange and High Frequency Loudspeakers in the Instrument Panel of an Automotive Interior", Presented at the 129th Conv. of the AES, San Francisco, (2010 November)

Roger Shively & Jeff Bailey

Publications – cont

15. "Multiphysical Simulation Methods for Loudspeakers - Advanced CAE-based Simulations of Motor Systems", Presented at the 137th Conv. of the AES, Los Angeles, (2014 October)

16. "Multiphysical Simulation Methods for Loudspeakers - Advanced CAE-based Simulations of Vibration Systems", Presented at the 139th Conv. of the AES, New York, (2015 October-November)

17. "Multiphysical Simulation Methods for Loudspeakers – Non-Linear CAE-based Simulations", Presented at the 140th Conv. of the AES, Paris, (2016 April)

Patents:

- #5,883,961. March 16, 1999. Transaural three-dimensional sound in a multi-channel automotive sound system. (Also applied for in Europe. 2006)

- Patent Application Case No. 11336/658 (P04044US). August 12, 2004. Sound Processing System for Configuration of Audio Signals in a Vehicle. (Renewed 2009. 11336/1817)

Executive Management (Co-Founders & Principals)

Jeff Bailey – Managing Director, Engineering

- 30+ years of experience in audio design of telecommunications and automotive systems Holds a degree in Electrical Engineering Technology in 1983.
- Member of the Audio Engineering Society and has co-authored several technical papers in the area of Test and Measurements
- Worked at Harman International Industries Inc. in the Automotive Division. Was a distinguished member of the technical staff and worked as senior engineer in the Acoustic Systems Engineering group. Senior Systems Engineer for Hyundai branded audio systems

Roger Shively – Managing Director, Research & Development

- 30 + years of experience in engineering research and development.
- Acoustical design and product development for audio and acoustic components.
- 15+ scientific papers in the areas of transducers, automotive audio, psychoacoustics, and simulation.
- U.S. and International Patents related to the design of advanced acoustic systems and applications.
- Experience in product realization & launching new products at OEM manufacturers around the world.
- B.S. of Acoustics from Purdue University and completed post-graduate work in Finite Element Analysis.
- Worked as Chief Engineer of Acoustic Systems, Functional manager for North American and Asian engineering product development teams in the Automotive Division of Harman International Industries