



Sound - reinvented.

Acoustic Solutions.

The sound of the future. Here today.

Ac2ated Sound System

Why we are rethinking sound.
The vehicle becomes an instrument. 6|7

Ac2ated Sound System.
The vehicle as an instrument. 8|9

The actuators are there.
Exciting sound and new design freedom. 10|11

Noise Vibration Harshness (NVH) Architecture

Architects of vehicle acoustics.
Part by part in harmony. 12|13

Good job listening!
So that sheet metal doesn't sound like sheet metal. 14

Acoustic Vehicle Alerting System (AVAS)

Sound design for electric vehicles.
Continental AVAS actuators.

15

Only hear what is important.
Safer driving thanks to targeted sounds.

16|17

Active Noise Cancellation (ANC)

We have something against noise.
Active Noise Cancellation (ANC).

18|19

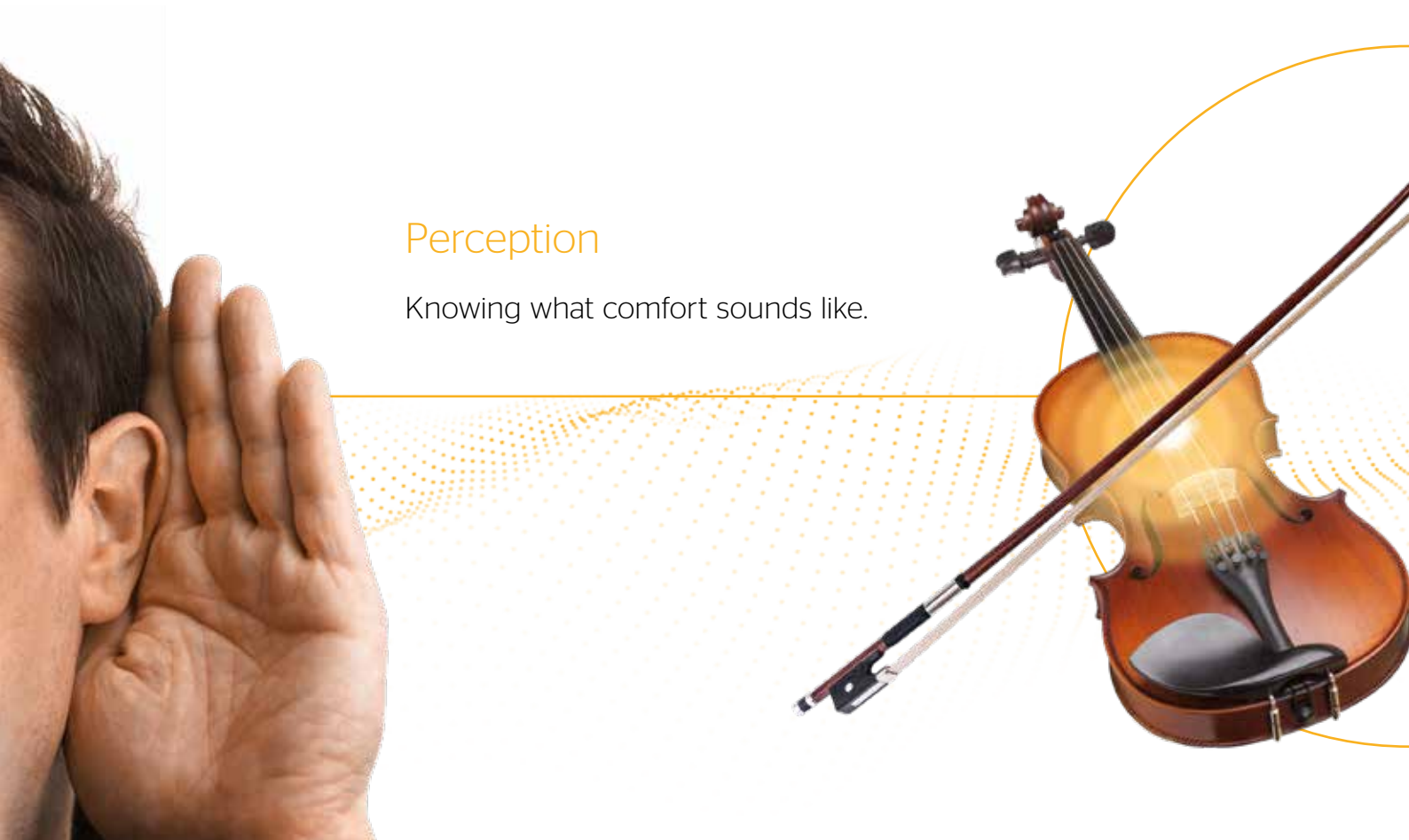
The art of engineering.

This is how melodious innovations are created.

The development of innovative technological solutions for acoustic and infotainment systems in vehicles requires an understanding of the systems and technical interdependencies in the overall vehicle, a great deal of experience and a keen musical ear.

Perception

Knowing what comfort sounds like.





“As engineers, we understand the physics of the vehicle, but at the same time we’re focusing on people and auditory perception.”

Dimitrios Patsouras, director of the Continental Acoustic Solutions Competence Center

This is one reason why everyone in our Continental Acoustic Solutions team - from electrical, mechanical and environmental engineers to sound designers and sound technicians - has extensive expertise in auditory physiology and psychology. And because we consider engineering and musical expertise in this

area to be closely interwoven, many of our colleagues practice their acoustic skills and tone perception through their own musical activities, including outside work. Our passion for music is the connecting element, and this connection gives rise to innovative developments in vehicle acoustics.

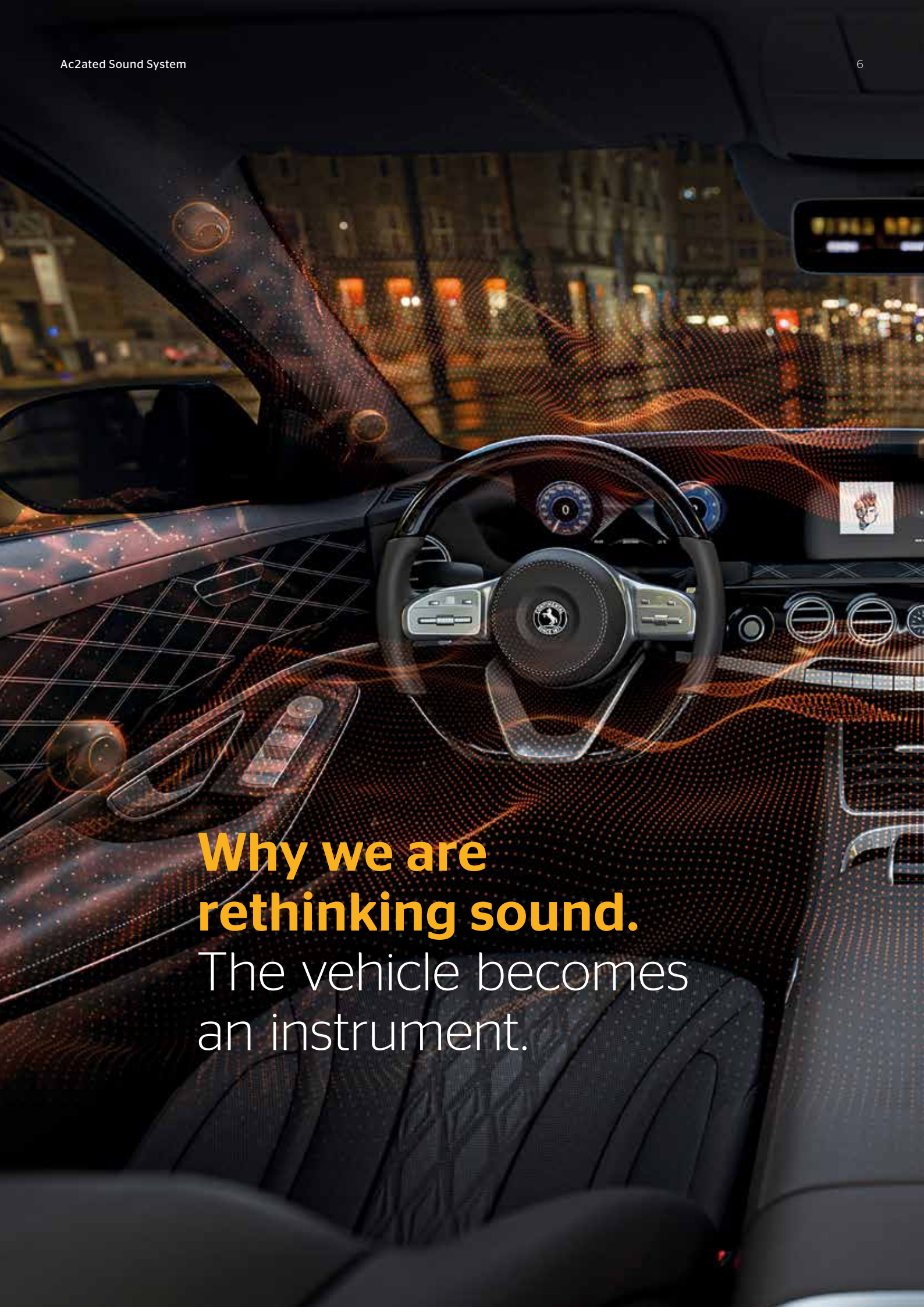
Sound

Corresponding physical properties.

Technology

Understanding of physics.





**Why we are
rethinking sound.**
The vehicle becomes
an instrument.



ac2ated  **sound**®

In the world of cars, slowly but surely, modern audio systems are taking the driver's seat. But many cars are still lugging around heavy sound systems and subwoofers. Speakers and cables alone can weigh up to 40 kilograms in a premium vehicle - impacting energy consumption and the environment along with it. This is why Continental has set out on a new, forward-looking path and developed a speakerless technology.



Ac2ated Sound System. The vehicle as an instrument.

With the Ac2ated Sound System, the sound is created by vibrating surfaces that are already in the vehicle, using specially developed actuators.

Dimitrios Patsouras, director of the Continental Acoustic Solutions Competence Center, explains what exactly lies behind this:

“We can see the entire car as an instrument – just like string instruments, which use their wooden bodies as a resonance chamber. Every part of the car – body panels, door trims, roof trim, hat rack – has its own specific acoustic characteristics.

“We’ve tried to use this constructively for our purposes. We asked ourselves: do I still need speakers if the car itself has what it needs to generate sound? Obviously not. And this is how the idea for the Ac2ated Sound System came about. For this, you have to think of the car as an orchestra. The column panels are the violins, the door trims are the cellos, while other parts of the vehicle are the double bass.”

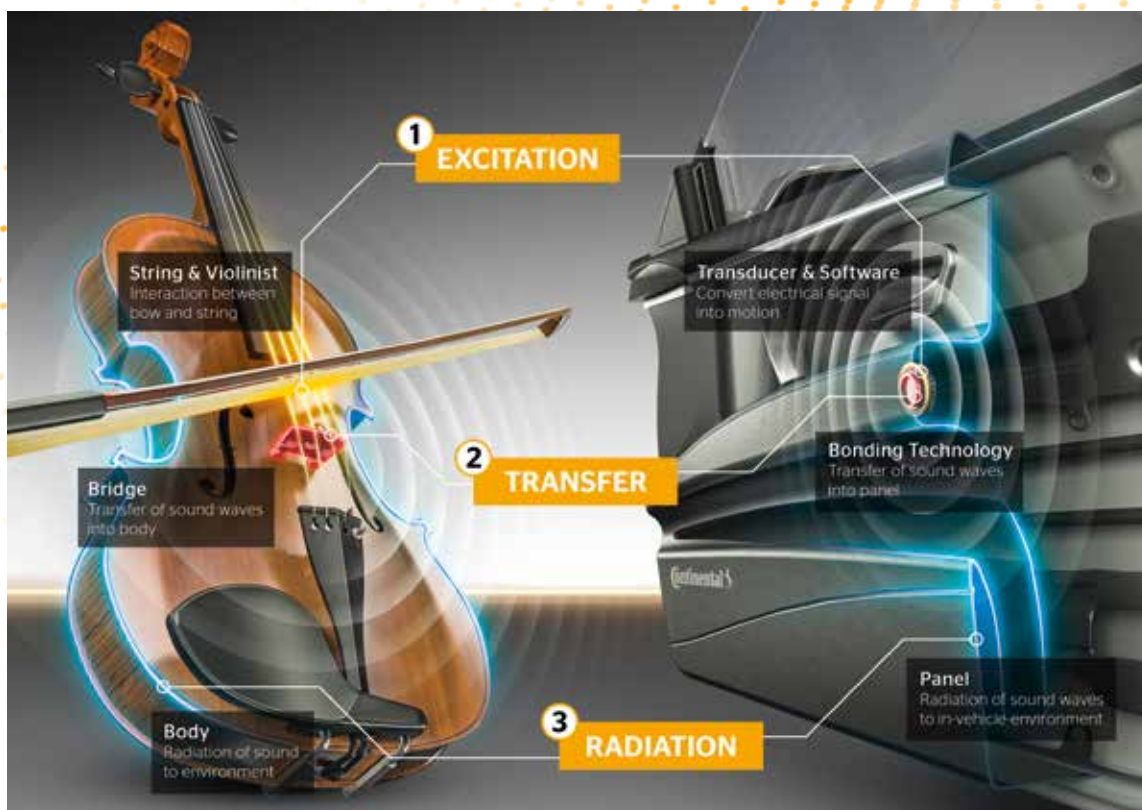


No sooner thought than done

However, the actual trigger for the idea was not the issue of sound as such, but the potential for saving vehicle weight.

An idea comes true

When wide speaker fronts no longer have to be planned for and integrated, this not only benefits the environment, but also makes carmakers and designers happy. Compared with conventional sound systems, this means a reduction in weight and space of 75 to 90 percent.



The functional principle of Ac2ated Sound Technology.

The actuators are there.

Exciting sound and new design freedom.

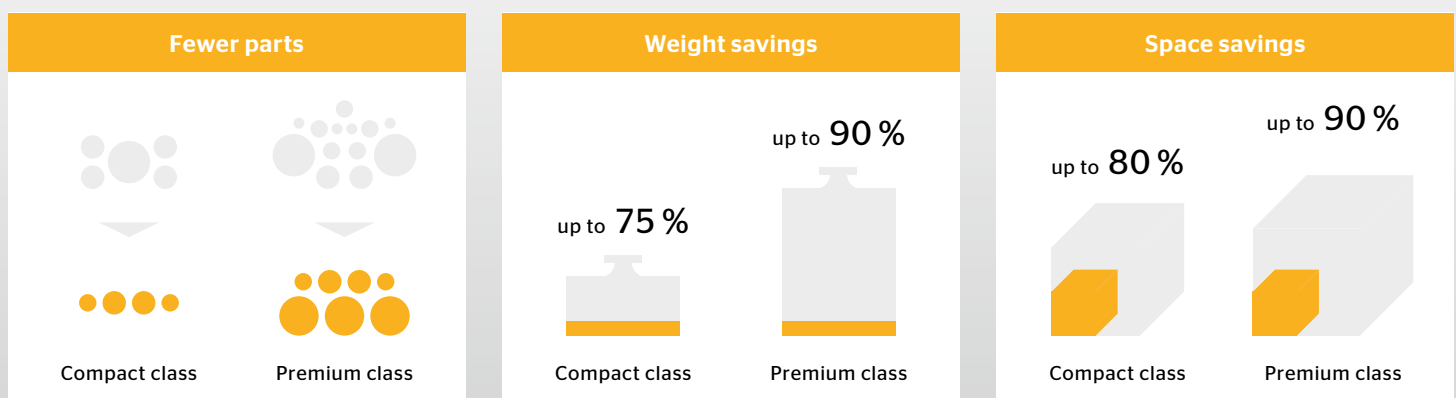
Inspired by the way string instruments work, Continental has reinvented audio technology for vehicles from the ground up. Conventional speakers are replaced by actuators that generate sound by vibrating specific surfaces in the vehicle. This technical innovation will give designers more freedom to design and make possible completely new shapes.

Acoustic sustainability

The speakerless audio system offers a number of advantages:

- › Besides much lighter weight, significantly reduced installation volume and lower electricity consumption, the new Continental solution delivers excellent acoustics – even for discerning ears.
- › Compared with standard high-end audio systems for vehicles, a speakerless solution makes possible a system volume that is ten times smaller or even more, and the weight of the system can be reduced to a fraction of the weight of speaker-based solutions.
- › This invisible vehicle audio technology can be integrated into all vehicle models – from a high-end sedan to a small electric vehicle.
- › At the same time, invisible audio technology gives vehicle designers and manufacturers the freedom to do more with a car's interior, as they no longer have to work with large speaker areas that take up valuable space.

We have developed a premium sound system that reduces both installation space and weight. At Continental, we call this acoustic sustainability.



Ac2ated Sound Bass

- › Ultra-compact subwoofer replacement
- › Impressive bass punch
- › Universal retrofit option for vehicles

Ac2ated Sound Bass+

- › Maximum bass performance for high-end requirements
- › Homogeneous acoustic pattern
- › Up to 85 percent lighter than conventional subwoofers



Ac2ated Sound Wide Range

- › Ultra-compact size
- › Brilliant high-frequency performance and enabler for Immersive 3D Sound and Personal Sound
- › Invisible installation in headrests, pillars, roof liner or other vehicle structures

Ac2ated Sound Wide Range+

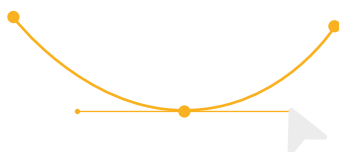
- › Broad frequency range
- › Homogeneous acoustic pattern
- › Compact and flat housing

CO₂ savings



Supports overall reduction of CO₂

Design freedom



Facilitates new designs thanks to fewer parts and less weight and volume

Safety



Offers new opportunities for implementation of “zero accidents”

Architects of vehicle acoustics.

Part by part
in harmony.



Every vehicle sounds different. And the character of the noise can often be used to identify the brand or the manufacturer – whether it’s when closing the doors or starting the engine. Bet that...?

We have an ear for it

We examine the overall acoustic impression, evaluate individual vehicle components and materials and develop specific suggestions for optimization to improve overall vehicle acoustics.

Localizing noises ...

In the first step, noise sources are localized through a subjective evaluation by our acoustic engineers, using special electronic stethoscopes and intensity probes.

Sounds good

Our goal is to create good overall acoustics, ideally by using components that are as lightweight and cost-effective as possible. This can be done by using new components or by material as well as design changes to existing components.

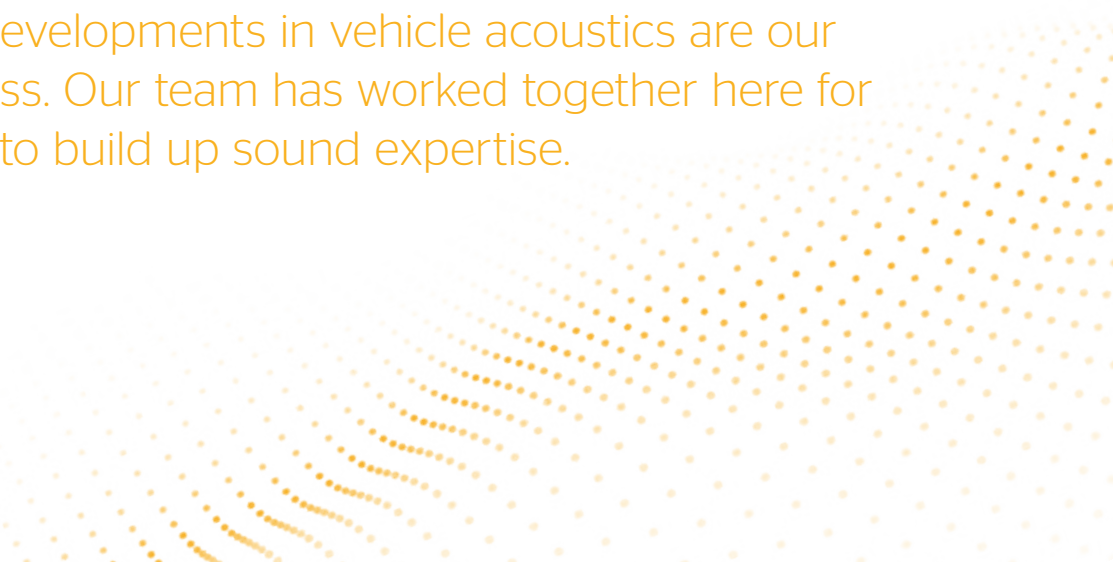
... and optimizing them

The most advanced testing and testing equipment, such as roller test benches, artificial heads and laser scanning vibrometers, can be used to analyze and evaluate a wide range of aspects of vehicle acoustics under constant and effectively real environmental conditions. This is a prerequisite for reproducible acoustic measurements where e.g. the rolling noises of the tires on different asphalt surfaces or the engine noise in a wide range of rpm under different load conditions are investigated.

The acoustic trademark

At Continental Engineering Services, we have our own acoustic center: the best condition for acoustically evaluating materials and components in accordance with automotive specifications, optimizing them and helping vehicle manufacturers improve the overall acoustics of their vehicles by changing materials or components. And this is how we meet the customer’s acoustic standards for their vehicle.

In general, developments in vehicle acoustics are our basic business. Our team has worked together here for many years to build up sound expertise.



Good job listening!

So that sheet metal doesn't sound like sheet metal.

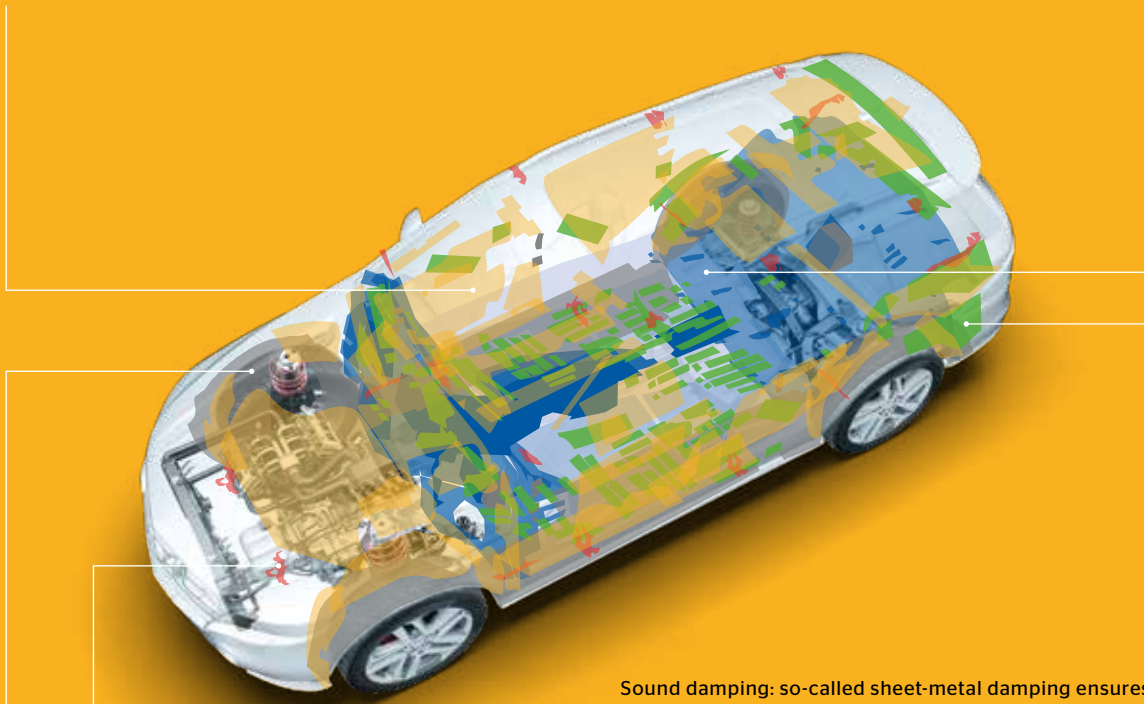
More than 200 parts of an automobile with a total weight of up to 120 kg affect the vehicle's acoustic pattern. We look at and listen to each individual component and understand its acoustic characteristics.

With this understanding, we develop a harmonious overall picture. The vehicle noise becomes a sonorous interplay between the individual parts of the vehicle. In this process, we can influence both the acoustic character of the vehicle and its weight by using components that are as light as possible. By doing this, we meet the manufacturers' technical and acoustic requirements for their vehicles, because even the sound of the door closing can convey safety and quality, for example.

Interplay of parts

Sound absorber (foam, fleece): used in cavities between sheet metal and cladding, e.g. behind the door trim, above the roof liner, under the hood, in the trunk.

Mass spring systems provide damping within the vehicle so that distracting noises do not penetrate.



Sound damping: so-called sheet-metal damping ensures (for example) that sheet metal does not sound like sheet metal.

Body and cavity sealing so that noises are not transmitted through the components of the vehicle.

Wheel housing and underbody claddings are materials exposed to weather conditions (water, stone impact etc.).

Sound design for electric vehicles.

Continental AVAS actuators.

Modern audio systems not only offer unique musical experiences. Today's cars have a wealth of different sources of noise, but one will be particularly important in the future. The car must be heard - outside the vehicle. So that it is always recognizable in traffic.



Only hear what is important.

Safer driving thanks to targeted sounds.

Electric cars are so quiet that they're barely audible, but this poses a safety risk for pedestrians and cyclists. According to an EU regulation, Acoustic Vehicle Alerting Systems (AVAS) will be mandatory for all electric vehicles from 2021. The system warns non-protected road users acoustically of quiet vehicles.

Heard. Warned. Protected.

The sound must resemble an internal combustion engine, reach a certain volume and differ, depending on whether the vehicle is accelerating or braking. Otherwise, the sound creators are free to create any artificial engine sound they want.

Manufacturers usually use conventional speakers that are installed in the engine compartment or under the mud guards. However, these require additional protection because their resilience and resistance to dirt, moisture and impacts are naturally limited. Here, the small, lighter actuators described earlier are used again.



Electric cars must be heard in traffic to achieve the “zero accidents” vision.

Artificial revving sound

At Continental, we use the Acoustic Vehicle Alerting System (AVAS) to create artificial sounds via actuators instead of speakers based on vibrations of vehicle structural elements proportional to parameters such as speed, accelerator position and gear.

The synthetic vehicle noise is generated by and amplified on a control unit developed by Continental. The sound algorithm can be controlled by vehicle-specific parameters, making possible dynamic sound characteristics. Besides the actuators and AVAS control unit with integrated amplifier, Acoustic Solutions also offers support in creating brand-specific and vehicle-specific sound profiles (sound design).

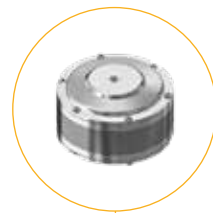
Acoustic brand management

Cars emotionalize and inspire – through design, comfort and performance. And now there's another emotional aspect: sound. And manufacturers attach particular importance to this. Here, we can use small actuators to create attractive and memorable sound worlds that represent brand and manufacturer. Factors such as psychoacoustics, statutory requirements and an understanding of sound aesthetics and acoustic brand management play a particularly important role here.



Wide Range Actuator:

- › Widespread sound emission through surface excitation
- › Flexible integration thanks to small dimensions and low weight
- › Better resistance than conventional speakers (water, dust and impacts)



Bass Actuator:

- › Ultra-compact and robust bass actuator
- › Extra-low frequency generation
- › Homogeneous frequency response



While the Wide Range Actuator meets the statutory requirements, the slightly larger Bass Actuator can also add high-quality, deep and sonorous elements to the sound.

We have something against noise.

Active Noise Cancellation (ANC).

When driving, we are confronted with pleasant sounds, useful tones and distracting noises. We have declared war on these unpleasant sources of noise – with Active Noise Cancellation (ANC).

Anti-noise on the same wavelength

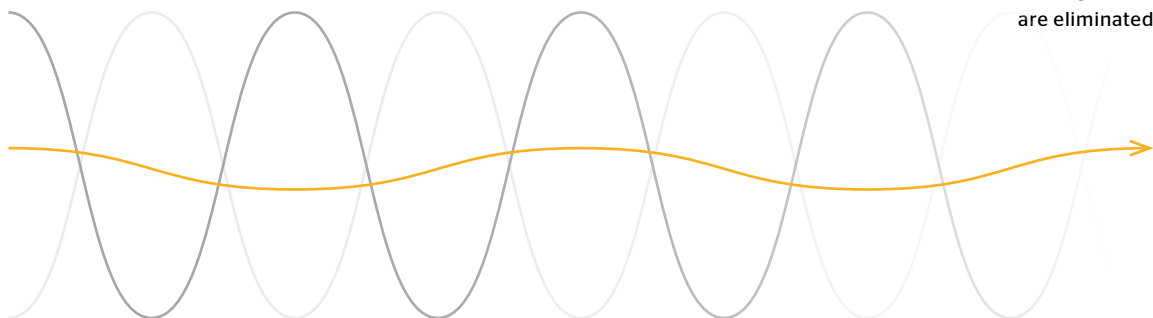
This is done by producing noises at the same frequency as the distracting noises. We take advantage of the fact that sounds that meet on the same wavelength cancel each other out. Large, heavy conventional speakers are generally used.

More frequency with actuators

This is where our specially developed actuators come into play. Their advantage is that they offer a wide usable frequency range and can be easily integrated into the headrest. This makes it possible to effectively cancel out the distracting frequencies in the immediate vicinity of the ears.

As you can hear, you can't hear anything

Anti-noise



Quietened acoustic signal

Distracting noises
are eliminated

Distracting noise



Greater freedom

Conventional speakers	Actuators in the headrest
› Sound emission is focused in one direction	› Immersive sound experience
› Perforation of the cover material required	› No perforation required
› Always visible	› Concealed solution › Design freedom
› Not easy to install	› Weight and volume reduction of 70 % › No increase in size of headrest required › Easy to integrate
› Limited frequency range	› Wider usable frequency range › Deep low corner frequency

Finale

The cars of the future will come without conventional speakers, but they will still have unprecedented sound. At the same time, modern audio systems are using every opportunity to further increase vehicle safety. Continental is driving this development forward with innovative solutions, positioning it well for the future – both audio and automotive.

Continental Engineering Services GmbH

Breitlacherstr. 94, 60489 Frankfurt a. M., Germany

Tel. +49 69 678696-0

info.CES@conti-engineering.com

www.conti-engineering.com



Legal notice

The information provided in this brochure contains only general descriptions or performance features, which, in actual use, may not always apply as described or which may change as a result of further development of the products. This information concerns only a technical description of the product. It especially does not represent any guarantee of condition or durability. This means that the desired performance features are binding only if they are expressly agreed when a contract is concluded. Subject to availability and technical changes.

© Continental Engineering Services GmbH

