

F R O S T & S U L L I V A N

2024

TECHNOLOGY
INNOVATION LEADER

*IN THE GLOBAL
AUTOMOTIVE ACOUSTICS
INDUSTRY*

F R O S T & S U L L I V A N

BEST

2024 PRACTICES

AWARD



Continental
Engineering
Services

Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Continental Engineering Services excels in many of the criteria in the automotive acoustics space.

AWARD CRITERIA	
<i>Technology Leverage</i>	<i>Business Impact</i>
Commitment to Innovation	Financial Performance
Commitment to Creativity	Customer Acquisition
Stage Gate Efficiency	Operational Efficiency
Commercialization Success	Growth Potential
Application Diversity	Human Capital

Focus on Customer-centric Development

As vehicles get lighter and more powerful, car manufacturers are constantly looking to deliver an exceptional acoustic experience with lightweight and lower volume speakers. The Ac2ated Sound

“With its customer-led strategy, CES provides cutting-edge acoustic solutions that offer efficiency, comfort, and versatility. These solutions allow companies to immerse car users in a natural three-dimensional (3D) soundscape.”

Kamalesh Mohanaragam
 – Head of Connected and Autonomous Vehicles Research

technology from Continental Engineering Services (CES) dispenses entirely with traditional loudspeakers, instead using tiny actuators which vibrate to produce an immersive output, turning the vehicle body itself into a speaker. Along with improved sound quality, this innovative technology reduces weight and uses less energy than traditional speakers.¹

Continental Engineering Services (CES) has been providing automotive acoustics solutions and audio applications to the world’s leading car producers. These solutions combine light and compact properties with substantially

lower weight and installation volume, contributing to carbon dioxide reduction. The company’s solutions reproduce high-fidelity speech and music, immersing car passengers in a lifelike sound world.

¹ <https://www.rollingstone.com/culture/culture-lists/future-entertainment-technology-music-tv-movies-760659/cars-as-traveling-speakers-760684/>

CES outpaces its competitors by leveraging its advanced automotive acoustic expertise and maintaining an excellent standing among its users in the automotive industry.

Bringing Innovative Solutions to the Market

There is an increasing consumer inclination toward an entertaining driving experience, with growing demand among users (especially millennials) for vehicle customization and an immersive user experience. Car manufacturers invest heavily in technological innovation, incorporating the most advanced customer-oriented car entertainment systems (e.g., immersive audio like Dolby Atmos, Active Noise Cancellation, active enhancement of the driving experience via auditory and tactile feedback, brand-specific sound design, seat-based Sound Zones, exterior safety features like an Acoustic Vehicle Alerting System (AVAS), as well as exterior sound infotainment and entertainment) to meet versatile customer needs. Customers look for audio systems that ensure an immersive audio experience and overcome or actively enhance engine (particularly internal combustion engines) and road noise.² They also require support from audio engineers who can help ensure control over the car's soundscape setup and finetune acoustics.

With its customer-led strategy, CES provides cutting-edge acoustic solutions that offer efficiency, comfort, and versatility. These solutions allow companies to immerse car users in a natural three-dimensional (3D) soundscape. Specifically, they provide the following benefits:

Efficiency

Unlike standard audio systems, the company's solutions (e.g., Ac2ated Sound) replace traditional loudspeakers with compact actuators that excite trim parts to generate sound. The dashboard, A-pillars, and rear window all become parts of the sound system.³ This approach allows car companies to cut the weight and required volume for integration of audio systems by up to 90%, making a system volume 10 times smaller than traditional speaker-based solutions.⁴ They produce the highest audio quality with a broad frequency range and homogenous sound radiation while using only two types exciter (AS Wide Range and AS Bass).

Additionally, an Ac2ated Sound based system requires fewer parts and OEMs can customize them depending on design plans. CES allows car designers and manufacturers to overcome cars' interior constraints. They do not have to work with large speaker areas that occupy a vast chunk of vehicle space, and their solution is highly modular and scalable. Manufacturers can integrate them across all vehicle models, from entry-level to premium models, without significant expenditure.

Quality

Car manufacturers can also finetune the company's solutions to achieve perfect sound quality in the vehicle by adjusting preferable sound characteristics to vehicle-specific parameters to achieve an immersive audio experience. CES's solutions provide them with tools to assign particular acoustic

² <https://professional.dolby.com/siteassets/music/cars/your-roadmap-to-the-future-of-in-car-entertainment/your-roadmap-to-the-future-of-in-car-entertainment-dolby-december-2023.pdf>

³ <https://www.nytimes.com/2018/03/22/business/car-audio-speakers.html>

⁴ https://conti-engineering.com/wp-content/uploads/2022/07/CES_Acoustic-Solutions-Broschure_EN_WEB.pdf

properties to each car part (e.g., door trims, body panels, and roof trim), making the car one holistic orchestra that immerses car occupants in a concert-like environment.

At the same time, the company leverages exciters instead of speakers in the interior design to generate preferable synthetic vehicle noise based on car vibrations depending on car parameters (e.g., speed) and environmental conditions (e.g., rain/wet conditions). These exciters are more flexible and durable due to their small dimensions, low weight, and resistance to various impacts (e.g., water and dust).

CES ensures efficient body and cavity sealing in cars to prevent noise transmission through the vehicle components to create the best possible acoustic comfort. The company provides various sound absorbers (e.g., fleece and foam) in cavities between sheet metal and cladding (e.g., under the hood). The company also leverages mass-spring systems to ensure acoustic insulation for the vehicle cabin from unpleasant distracting exterior noises. CES Acoustic Solutions has highly experienced acoustic engineers who have play a leading role in developing worldclass vehicle acoustics and weight optimized insulation packages for their customers.

Optimization

At the company's acoustic center, engineers acoustically evaluate car components and materials to elevate the overall acoustics quality to a new level. CES leverages the most advanced testing equipment (e.g., artificial heads, laser scanning vibrometers, and test benches) to assess vehicle acoustics holistically under real-life conditions (e.g., tires' noise). The company's experts examine each car component to understand acoustic characteristics and produce a harmonious acoustic picture. CES's engineers support clients by helping them to utilize its solutions better and enhance overall acoustic performance across their vehicles. This team of engineers also consults on optimizing vehicle architecture to accommodate its solution and achieve desirable acoustic performance outcomes. To this end, the company conducts holistic acoustic assessments to identify potential problems and understand which specific materials manufacturers can utilize to eradicate structure-borne and engine noise. The team also consults on all the damping elements and appropriate sealing measures for cable bushing and the car's bulkhead.

Frost & Sullivan believes the company provides industry-leading, highly compact solutions that ensure unparalleled audio quality for vehicle occupants.

Excelling in Growth to Support Innovation

CES has invested in an acoustics center with an all-wheel acoustic chassis dyno in Markgröningen, Germany, to implement complex commercial projects in general vehicle acoustics to aid customers worldwide.⁵ These efforts help CES to drive innovation in the automotive acoustics industry for its end-users.

CES employs around 2,800 highly skilled engineers and strongly emphasizes research and development (R&D) activities. In 2024, the company plans to increase efficiency and pool its R&D activities to shorten

⁵ <https://www.continental.com/en/press/press-releases/continental-engineering-services-is-expanding-three-new-branch-locations-inaugurated/>

product development times and focus on critical technologies (e.g., acoustics) to meet versatile customer needs.⁶

Frost & Sullivan recognizes that CES meets customers' needs and exceeds their expectations as multiple customers and partners value the top performance and business impact of its solutions:

"We are delighted to bring our audio expertise and AMBEO Mobility software into the pioneering Ac2ated Sound system from CES, calibrating and finetuning the sound quality to deliver a completely immersive and natural sound experience that opens new audio perspectives and realities."

- Dr. Andreas Sennheiser, co-CEO of Sennheiser⁷

Ensuring Strong Partnerships

Since its inception, CES's sterling reputation and customer-oriented framework have led to its preferred partner status. For example, the company partners with Sennheiser, a German-based audio specialist focusing on revolutionizing the audio experience of vehicles.⁸ Jointly, the partners developed a speakerless audio solution providing an immersive sound experience inside the car.⁹ The companies integrated Sennheiser's patented AMBEO 3D audio technology with CES's Ac2ated Sound system as part of this partnership. As a result, a newly developed solution ensures a natural 3D sound reproduction that creates an immersive landscape for car passengers to enjoy proper in-car entertainment fully. This joint

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Maksym Beznosiuk
– Best Practices Research Analyst

solution is highly compact compared to traditional speaker systems and makes car occupants feel like they are sitting in a concert hall.

Frost & Sullivan believes CES is firmly positioned to fill market gaps and address challenges, enabling companies in the automotive industry to enhance acoustic experiences for end-users worldwide. This approach will help the company drive its next growth phase by stepping into 2024 with an increased customer base and maintaining its leadership in the coming years.

Positioned for Success

Frost & Sullivan recognizes that many contributing factors make a company successful; having a customer-centric strategy is paramount. However, successfully implementing a plan is different. Thus, it is crucial to have aligned leadership and staff to implement and operationalize a strategy cohesively.

CES' team reacts swiftly to all new technological developments and versatile customer requirements. Its vital mission is to design and deliver effective solutions while being a reliable engineering partner for the automotive and industrial environment. The company mainly tailors its automotive acoustic solutions to

⁶ <https://www.continental.com/en/press/press-releases/20240214-development/>

⁷ <https://www.continental.com/en/press/press-releases/2020-01-06-ces/>

⁸ <https://www.continental.com/en/press/press-releases/2020-01-06-ces/>

⁹ <https://www.continental.com/en/press/press-releases/2020-01-06-ces/>

unique customer requirements to achieve desired outcomes and unparalleled immersive audio experiences for end users. CES executes its customer-centric approach by providing superior engineering services tailored to customers' needs globally. The company offers various engineering services, from concept development and manufacturing to testing and product development. In 2021, the company was recognized as a CES Innovation Honoree, which included a recognition for In-Vehicle Entertainment and Safety.¹⁰

Frost & Sullivan applauds CES' commitment to helping customers ensure effective solutions. The expert team is impressed by the company's commitment to aiding companies in achieving efficiency and quality.

Conclusion

Technology is a critical success factor for the automotive acoustics and audio industry. However, with different options available, market stakeholders need to utilize the most relevant technology-based solutions to optimize their market impact. Continental Engineering Services (CES) delivers unparalleled efficiency and quality, providing outstanding acoustic solutions and audio technologies that enable immersive three-dimensional sound experiences and ensures the best possible acoustic comfort for vehicle occupants. The company stands out from competitors based on its unwavering commitment to innovation and creativity while achieving commercial success. Its commercial success comes from its customer-centered approach and determination to exceed complex customers' needs worldwide. CES' top-notch engineering team provides around-the-clock customer support while designing cutting-edge automotive acoustics solutions.

Frost & Sullivan firmly believe CES is poised to capture a large market share in the near future. For its strong overall performance, Continental Engineering Services is recognized with Frost & Sullivan's 2024 Global Technology Innovation Leadership Award in the automotive acoustics industry.

¹⁰ <https://www.continental.com/en/press/press-releases/ces-2021-innovation-awards/>

What You Need to Know about the Technology Innovation Leadership Recognition

Frost & Sullivan's Technology Innovation Leadership Award recognizes the company that has introduced the best underlying technology for achieving remarkable product and customer success while driving future business value.

Best Practices Award Analysis

For the Technology Innovation Leadership Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Technology Leverage

Commitment to Innovation: Continuous emerging technology adoption and creation enables new product development and enhances product performance

Commitment to Creativity: Company leverages technology advancements to push the limits of form and function in the pursuit of white space innovation

Stage Gate Efficiency: Technology adoption enhances the stage gate process for launching new products and solutions

Commercialization Success: Company displays a proven track record of taking new technologies to market with a high success rate

Application Diversity: Company develops and/or integrates technology that serves multiple applications and multiple environments

Business Impact

Financial Performance: Strong overall financial performance is achieved in terms of revenues, revenue growth, operating margin, and other key financial metrics

Customer Acquisition: Customer-facing processes support efficient and consistent new customer acquisition while enhancing customer retention

Operational Efficiency: Company staff performs assigned tasks productively, quickly, and to a high-quality standard

Growth Potential: Growth is fostered by a strong customer focus that strengthens the brand and reinforces customer loyalty

Human Capital: Commitment to quality and to customers characterize the company culture, which in turn enhances employee morale and retention

About Frost & Sullivan

Frost & Sullivan is the Growth Pipeline Company™. We power our clients to a future shaped by growth. Our Growth Pipeline as a Service™ provides the CEO and the CEO's growth team with a continuous and rigorous platform of growth opportunities, ensuring long-term success. To achieve positive outcomes, our team leverages over 60 years of experience, coaching organizations of all types and sizes across 6 continents with our proven best practices. To power your Growth Pipeline future, visit Frost & Sullivan at <http://www.frost.com>.

The Growth Pipeline Engine™

Frost & Sullivan’s proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fuelled by the Innovation Generator™.

[Learn more.](#)

Key Impacts:

- **Growth Pipeline:** Continuous Flow of Growth Opportunities
- **Growth Strategies:** Proven Best Practices
- **Innovation Culture:** Optimized Customer Experience
- **ROI & Margin:** Implementation Excellence
- **Transformational Growth:** Industry Leadership



The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.

Analytical Perspectives:

- **Mega Trend (MT)**
- **Business Model (BM)**
- **Technology (TE)**
- **Industries (IN)**
- **Customer (CU)**
- **Geographies (GE)**

