

# CASE STUDY

## Commercial Vehicle Group uses a Desktop NVH Simulator

USA  
Automotive  
Desktop NVH Simulator

*A Desktop NVH Simulator has vastly improved Commercial Vehicle Group's customer relations and jury testing capabilities. The simulator was the latest addition to their range of Brüel & Kjær products that began when their R&D facility was commissioned in 2008. Back then, when it came to setting up a new lab, the combined experience of their commercial and construction vehicle experts led them to choose Brüel & Kjær to provide the equipment they need for world-leading NVH development of their automotive solutions.*

*Photos courtesy of Commercial Vehicle Group*



## The company

---

Commercial Vehicle Group is a public company traded on the NASDAQ stock exchange that has been experiencing exciting growth in the areas of commercial trucking, buses, construction, mining, agricultural, military, recreation and specialty vehicles. The group contains a total of seventeen well-known companies with their own R&D operations. These include internationally recognised product brands such as National Seating, KAB Seating, Bostrom Seating, Sprague Devices, Moto Mirror, Prutsman, Roadwatch, Roadscan and Comfortek.



Together, the group covers an extensive product line that incorporates everything found in the cab of a modern truck, which can even extend to complete interiors with beds and the necessary acoustic and thermal insulation. More specifically, current products include:

**Seating systems** — seats, seat suspension, in-seat products (such as heaters CVG's unique BackCycler™ system that helps reduce back pain and fatigue).

**Interior trim systems** — dashboards, headliners, carpets, insulation material, cabinets, moulded products and flooring.

**Electrical systems** — components and electrical systems including mirrors, wiper systems, electronic wiring harness assemblies, controls and switches.

**Structures** — truck cabs and complete body shells, for example, for Ford's GT40 high-speed supercar.

One of the first commercial vehicle suppliers to establish Chinese operations, Commercial Vehicle Group has a global presence with operations in Asia, Australia, Europe, and North America. In addition to direct sales all over the world, they enjoy a growing aftermarket supply business.

## History

---

The history of Commercial Vehicle Group (CVG) began with the formation of Trim Systems in 1997, which grew through the acquisition of National Seating, KAB Seating and Sprague Devices in 2000. Recognising the need for a unified company that could more fully support the increasing demands of original equipment manufacturers and provide custom solutions to them, Trim Systems set out to be an integrated company that could offer comprehensive product lines, reputable brand names and leading edge technology in diverse markets and locations.

Then in August of 2004, the management team changed the name from Trim Systems to the Commercial Vehicle Group Inc., and went public on August 4, 2004, trading on the NASDAQ with the stock symbol of CVGI.

Over the last 10 years, continuing growth has been achieved both organically and through additional global acquisitions such as Monona Wire in the US and Mexico, C.I.E.B. and PEKM in the Czech Republic, Boston Seating in the US, and Stratos Seating in Australia.

In that time, CVG has evolved into a recognised world-leader in the development, manufacture and fulfilment of fully integrated system solutions for the commercial vehicle market, covering heavy trucks, construction, military, agriculture and specialty market areas. Its latest addition is a new manufacturing plant in Mexico.



**“The Desktop NVH Simulator has been a terrific investment, as both an R&D and as a sales tool”**

*Logan Mullnix, Technical Fellow*

## Industry partnerships

As a comprehensive, single-source supplier, CVG enjoys working closely with industry leaders. According to Paul Bennett, Vice President of Engineering, Research & Development, "We have very tight relations with manufacturers such as Freightliner, Mack, Volvo, Kenworth, John Deere, Caterpillar, and Komatsu. We are involved with trucks, the construction and agricultural industries, and also work extensively with the US military authorities."

*The lightweight bodyshells for Ford's GT40 were made by CVG*



As well as performing R&D on new trucks that use their trim and components, CVG designed, engineered and manufactured the Ford GT Supercar, in which strength and weight are key factors. These use a finely tuned blend of carbon fibre, aluminium and fibreglass, the development of which provided valuable transferable knowledge.

## Committed investment

Most R&D activities take place at the group headquarters in New Albany, Ohio, while other R&D is performed locally at some of the 20 manufacturing facilities. R&D is both proactive (suggesting and developing innovations), and reactive (building to customers' specific needs).

*CVG's headquarters includes the Acoustics and Thermal Lab, reflecting the importance of these dimensions in modern truck design*



The group headquarters in Ohio is a dedicated 39,500 sq. ft building. Within the R&D wing, the Acoustics and Thermal Lab was set up when the building was commissioned in 2008, in order to rank acoustic and thermal properties. Most of the experimental equipment is supplied by Brüel & Kjær.

Three secure bays for R&D work allow the NVH team to optimise such components and modules as seat trim, seats and dashboards, sound barriers and absorption materials. A rapid prototyping lab allows them to produce parts very quickly.

Both the corporate headquarters and the R&D facilities inside it were significant investments, in keeping with CVG's ambitious strategy to rapidly become a major player. As Paul Bennett says, "Driver comfort and ergonomics are highly important factors in our business."

## Setting up the Acoustics and Thermal Laboratory



**“There is a significant image benefit in Brüel & Kjær. Equipping our lab with their systems shows that CVG is investing in quality, advanced technology.”**

*Jim Haylett, NVH Engineer*

The significant investment in the new headquarters clearly showed that they were ready to meet the demands of the world’s customers. As Jim Haylett, an NVH Engineer and the group’s NVH expert says, “It is clear that our customers are increasingly concerned about acoustics, and this is a major factor when developing new products.”

The Acoustics and Thermal Lab’s objective is to test systems and components such as barrier, interior trim, headliners and flooring products, where they investigate new materials’ insulation and absorption properties.

Just as the investment showed a clear commitment to quality, choosing Brüel & Kjær was an obvious choice to show the world that they meant business. As Jim Haylett says, “There is a significant image benefit in Brüel & Kjær. Equipping our lab with their systems shows that CVG is investing in quality, advanced technology. We also needed flexibility, and Brüel & Kjær is great in this area.”

CVG’s initial investment equipped the new R&D lab with Brüel & Kjær microphones, accelerometers, a 53-channel PULSE system, a material testing solution, and a spherical beamforming array. Then in 2010 they further advanced their lab capabilities with a Desktop NVH Simulator and Source Path Contribution software.

In addition to years of working with Brüel & Kjær equipment, Jim Haylett’s choice to go with Brüel & Kjær’s solutions was based on reputation and product quality. According to him, “Brüel & Kjær offers a wide range of solutions and state-of-the-art technology.”

## Desktop NVH Simulator

Logan Mullnix, a Technical Fellow at CVG, was involved in buying the Desktop NVH Simulator, and has been working for CVG and its predecessors for 19 years, and with Brüel & Kjær equipment for 27. According to him, “The Desktop NVH Simulator has been a terrific investment, as both an R&D and as a sales tool.”

*The NVH simulator is combined with a truck cab on a Moog six-degree of freedom driving simulator for a highly realistic driving experience*

The NVH team uses the simulator for troubleshooting and performing diagnostics, as it gives greatly improved context to the testing environment, and a fuller experience. For analysing their NVH development and displaying it to customers and their own staff, CVG use the desktop unit either alone, or incorporated into a whole truck simulator that is linked to a six-degree-of-freedom driving simulator made by MOOG. With it they can simulate hills, snow and ice, and benchmark competitor products. The NVH Simulator adds sound and interior cabin vibration to give a totally realistic driving experience.



Typically, CVG uses a Brüel & Kjær SoNoScout binaural sound and vibration recorder to benchmark complete trucks, and then uses the input for the simulator. According to Jim Haylett, “SoNoScout is very simple and easy to use.”

For Logan Mullnix it is the realism of the Desktop NVH Simulator that really brings the benefits to CVG. "We are very impressed with simulator as it creates a highly realistic environment, with a totally authentic sound," he says.

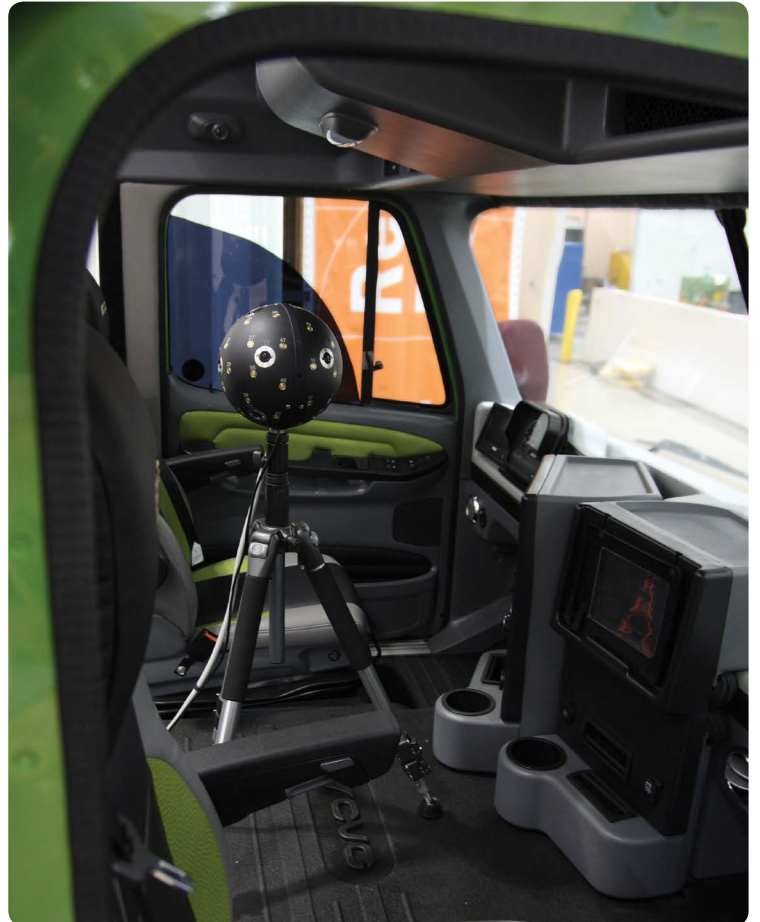
CVG has a quiet room for jury testing, as it can accommodate more people at once than the truck alone. "But" says Jim, "conventional jury testing is not as accurate as the Desktop NVH Simulator, which is more realistic and provides greater context." For jury testing they use data obtained with the SoNoS-cout, about which Logan Mullnix says, "The NVH sound quality evaluation is super."

## Marketing

*Their demonstration truck cab complete with NVH Simulator and Spherical Beamformer brings CVG a great deal of attention at shows*

The Desktop NVH Simulator is used considerably at exhibitions and shows, where the team displays a life-sized demonstration cab. Inside, the truck cab is complete with the correct seats and dashboard, and draws a huge amount of attention. They include their Brüel & Kjær Spherical Beamformer to showcase the technology.

But it is also in internal marketing and cross-departmental communication that the simulator is effective. "A big part of my whole job is transferring information and communicating with different people across the whole group," says Jim Haylett. "There are also a lot of customer tours around our R&D facility, and the simulator truck cab always creates a great deal of interest."



*Customers can sit in a fully recreated truck cab*



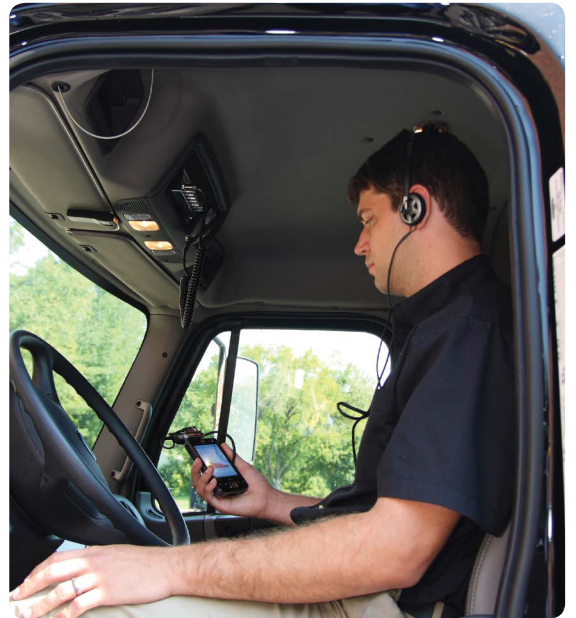
**Spherical Beamforming** can be thought of as an 'acoustical camera' and produces colour images of the various noises entering the vehicle. These are superimposed on photographic images taken by the unit, allowing CVG to pinpoint the location of noise problems – in a method not available from many other tier-one automotive suppliers.

## Other Brüel & Kjær tools

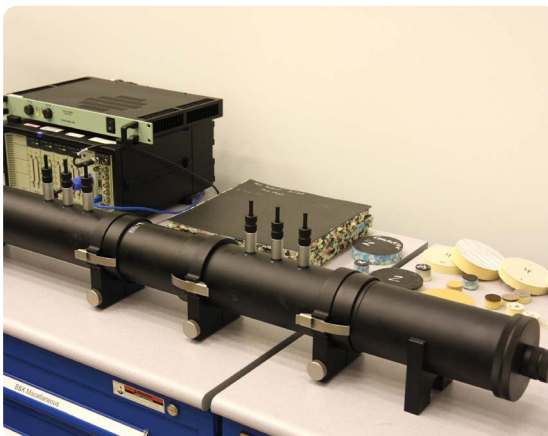
Sound recordings are used for benchmarking, target-setting, and evaluating the effectiveness of new cab interior solutions such as floor-mats, seats, headliners, and instrument panels.



*SoNo Scout Binaural Recording and Analysis System*



*Brüel & Kjær's hand-held binaural data recorder - SoNoScout - is used for simulator input and benchmarking.*



*CVG uses a PULSE system with a power amplifier, as well as impedance testing tube to optimise acoustic properties of the materials they use. Here you can see circular samples of material for testing.*



*Type 2270 at work checking the sound level of their six-axis MTS system. According to Logan Mullnix, "It is a valuable tool for benchmarking and troubleshooting industrial-type noise problems, easily providing overall levels and 1/3 octave spectra."*

As with most Brüel & Kjær systems, PULSE provides the flexible backbone for data analysis. With it, CVG tests components such as wiper motors for sound quality using a PULSE system and microphones. As Jim Haylett says, "PULSE is very intuitive and easy to use. This allows me to dedicate more time to developing new technologies and capabilities."

"We also use PULSE Reflex for post-processing," he continues. "It's very efficient and fast when using many channels. And we use Reflex modal for structural analysis." Backing up their systems is a PULSE Software Maintenance and Support Agreement (M1). "M1 brings great value and benefit, with terrific support," says Jim Haylett. To which Logan Mullnix adds, "We get great service and support from Brüel & Kjær's local office."

In addition, Source Path Contribution software helps CVG's NVH automotive engineers understand how noise and vibration are transmitted through various paths of the vehicle – both structure-borne and airborne. It provides a tool for optimising sound and vibration contributions according to engineering design parameters.

## Future

---

When asked of his opinion of the decision to set up their lab with Brüel & Kjær, Logan Mullnix wastes no words. "Our overall attitude to Brüel & Kjær is: great decision, great benefit, added value. We are very satisfied with the quality and the support."

*Logan Mullnix and Jim Haylett in front of their truck cab*

