# CASE STUDY

**GHSP Testing Laboratories**
**A2LA Accredited Testing Laboratory**

United States of America

Automotive Components, NVH Consultancy

PULSE, Sound Quality Software, Transducers

*GHSP is a world leader in the design and manufacture of manual and automatic gear shift mechanisms. Its customer base is worldwide and includes major automotive manufacturers.*

*GHSP's Noise Vibration Harshness laboratory also provides a wide range of testing services for external customers. Brüel & Kjær's PULSE™ analyzer is the NVH analysis platform.*

## History


Founded over 75 years ago, GHSP (formerly Grand Haven Stamped Products) originally manufactured kitchen appliances and tractor components but, early in its history, there was a shift towards the automotive industry. Now part of the J.S.J. Corporation, GHSP is based in Grand Haven, Michigan, and employs approximately 800 people in the USA at three production and assembly plants.

The company has a strong engineering base that is renowned for ingenuity, quality and reliability. GHSP still manufactures a vast range of metal stampings and components for the furniture industry. In the automotive industry, it is a world leader in the design and manufacture of plastic/metal manual and automatic transmission shift mechanisms, including electronic shifters with built-in hysteresis or "feel".

GHSP's automotive customer base is worldwide with production and assembly plants in the USA and Europe. Additionally, GHSP manufactures fixed and adjustable pedals and electronic throttle controls for automotive manufacturers around the world. Its customers include General Motors, Ford, DaimlerChrysler, Honda, Nissan, Audi and Porsche and GHSP operates a "just-in-time" delivery system. GHSP is a very proactive company with fresh and unique ideas, continually investing heavily in R&D and constantly seeking to improve the quality, reliability, and "customer benefit" of its products.

## Testing Laboratories

GHSP Testing Laboratories, accredited by A2LA to ISO/IEC 17025, is not only used in the design and development of GHSP's own products. It also provides a wide range of testing services for external customers including other automotive and non-automotive component manufacturers.

The company is committed to providing world-class testing services using state-of-the-art test equipment. The goal is to combine its testing expertise with rapid response systems to minimise lead times, and thus completely fulfil the testing needs of its customers. The facilities are used about 50% on testing GHSP's own products and 50% for external customers. GHSP Testing Laboratories contributes profit to the company and its services are marketed proactively.

### Sound and Vibration

The testing facilities are extensive. There's a focus on sound and vibration testing and GHSP has invested in analysis systems and software, anechoic, hemi-anechoic and climatic chambers. For example, GHSP's new hemi-anechoic chamber is ANSI tested – it has a 180 Hz cut-off with a background sound pressure level of 32 dB(A). One of the climatic chambers is large enough to accommodate one full-size vehicle or two mid-sized vehicles.

***Fig. 1***
*Left: Part of one of the test lab areas at the Grand Haven facility*
*Right: One of GHSP's electro-mechanical shifters*

## NVH Expertise

***Fig. 2***
*Matt Millard is a GHSP Test Engineer*

Kirk Craymer is the Test Lab Manager – he has been with GHSP for 11 years. Kirk holds a Masters degree in Engineering Management and a Bachelors degree in Automotive Engineering. Kirk also has ASQ qualifications as a Reliability Engineer (CRE), Quality Engineer (CQE) and Quality Auditor (CQA). Prior to joining GHSP, Kirk held senior positions with large and small companies – always close to testing functions. His vast experience and extensive qualifications in testing and in the automotive industry are a unique asset.

Matt Millard is a Test Engineer at GHSP. He holds a degree in Mechanical Engineering from Michigan Technological University where he specialised in sound and vibration. Matt has worked at GHSP for nearly four years. Matt says, "I love what I do and I get to play with really cool equipment".

## PULSE

Kirk Craymer says, "We bought an 8-channel PULSE multi-analyzer about four years ago. We wanted the best available equipment. Quality is important – we must get repeatable results. So is reliability as we cannot afford downtime and must keep commitments to our customers – I don't want to have to worry about our equipment. Other key factors for us include the ease of equipment calibration and Brüel & Kjær's A2LA calibration services which help us in satisfying our A2LA calibration requirements".

***Fig. 3***
*GHSP's new hemi-anechoic sound chamber. It has a 180 Hz cut-off with a background sound pressure level of 32 dB(A)*

Kirk continues, "Using Brüel & Kjær gives us, and our customers, complete confidence. In fact, Brüel & Kjær products and solutions are used exclusively – PULSE, sound quality software, transducers, calibration equipment and sound level meters".

"Our external customers often say 'Oh you've got Brüel & Kjær – you know what you're doing'. It's a real advantage for us" says Matt Millard.

PULSE is extensively used for testing GHSP's own automotive products. For example, on electro-mechanical transmission shifters, tests are made on solenoid noise, shifter noise and button noise. Brüel & Kjær Sound Quality software is frequently used for objective and subjective tests, both on GHSP's own products and when testing for external customers.

## Testing

***Fig. 4***
*GHSP has a range of facilities for climatic tests. A complete vehicle can be tested in this chamber*

Matt Millard explains, "We have made a huge investment in equipment. Apart from the new hemi-anechoic chamber, we have bought a very large shaker for shock, random and sine testing. We can test up to 50 or 60 g and can subject products to millions of operation cycles. We are able to test as many as six gear shifters at a time. Our intention is to put a permanent magnet shaker in the sound room".

The range of tests carried out by GHSP's NVH laboratory is extensive. Here are just a few examples.

### NVH Road Data

NVH road-load data is recorded inside a vehicle on a customers test track. Sometimes GHSP records the data on a DAT recorder. On other occasions, the external customer will record the data. GHSP plays the recorded data back through a shaker to replicate the test track conditions and this excites the component to be tested, and then carries out the analysis.

Another practical example is recording the sound, using one or two microphones, directed towards a gear shifter installed in a car that runs on the test track. The sound is played back through PULSE and the vibro-acoustic characteristics are analysed in the NVH lab.

Matt says, "We calibrate the microphones both before and after a test using a Brüel & Kjær Type 4231 Calibrator – it's a very quick process and gives us confidence that the measurements are totally accurate".

### R & D Testing

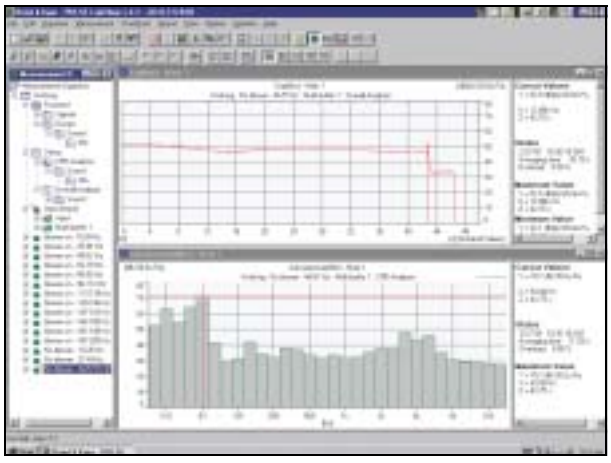

*Fig. 5*
*1/3-octave CPB analysis. A shaker was used to apply 2 g and swept across defined frequency bands. The NVH characteristics were measured using one microphone*

As an essential part of product development, real-time NVH testing is performed in GHSP's laboratory using a wide range of equipment. Matt says, "For example, an automotive manufacturer asked us to test the effect of shock on an in-car DVD player and screen to check the buzz, squeak or rattle (BSR) that might emanate from the player or screen under road conditions. We used a shaker to apply 2 g sweeping across defined frequency bands and used a microphone and 1/3-octave CPB PULSE analyzer to monitor the noise". Fig. 5 shows the PULSE display.

### Troubleshooting

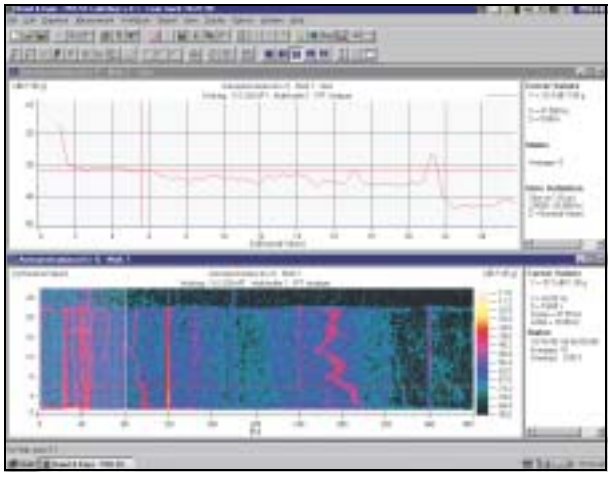

*Fig. 6*
*A typical PULSE display using FFT analysis. Here, an electrically operated car seat is being tested*

An automotive sub-supplier had problems with vibration from an electrically operated seat while it was moving. An accelerometer was mounted on the seat track and the vibration was examined using PULSE running an FFT analyzer. Frequencies from 2.5 to 80.5 Hz are of special interest. Fig. 6 shows the PULSE display.

PULSE currently runs on Windows NT®. Test data is archived on CD-ROM – in the future data will also be stored on GHSP's network database.

## A2LA Accreditation

"Of course we are also ISO 9001 accredited but we are one of only about 20 companies in the USA with A2LA accreditation for Acoustics and Vibration and we believe that this is more valuable to our external customers", says Matt.

### Reports

GHSP can either print reports straight from the PC screen and combine these with its A2LA accreditation documentation, or the data can be exported to Microsoft® Word using the reporting function in the PULSE software.

## The Future

***Fig. 7***
*Colin Eden, Test Engineer, works with PULSE*

Kirk Craymer, GHSP's Test Lab Manager says, "We intend to expand our NVH consultancy work and we'll invest in further Brüel & Kjær solutions – in fact, we would never consider any other supplier. We get top-notch training, backup, support and service from their office in Detroit".

Kirk continues, "We are interested in the WorkFlow Manager. This would be an ideal solution for repetitive testing and we are evaluating this now. We are also considering the purchase of a further portable PULSE system which, together with a laptop PC, would be ideal for in-car measurements on test tracks."

Kirk concludes, "A binaural head and torso simulator would also be a great tool, and the Modal Analysis software and Modal Test Consultant software enables us to expand our testing services, not only on our own products, but also for our external customers".

## Key Facts

- GHSP focuses on two industries – automotive and furniture
- The company has three production sites in the USA and one in Europe, employing about 800 people
- GHSP has a strong engineering base and is renowned for its ingenuity, quality and reliability
- The company is a world market leader in the production of electro-mechanical transmission shifters for the automotive industry.
- Automotive component production and assembly plants are located in the USA and Europe with sales offices in the USA, Europe and Japan – GHSP operates a "just-in-time" delivery strategy
- GHSP Testing Laboratories provides testing facilities for GHSP (about 50%) and external customers (about 50%) – external customers include other automotive and non-automotive component manufacturers
- PULSE is GHSP's chosen analyzer platform.
- All NVH test equipment has been supplied by Brüel & Kjær
- GHSP Testing Laboratories are A2LA and ISO 9001 accredited
- The company is seeking to extend its NVH testing with external customers
- GHSP will invest in further Brüel & Kjær products – it will not consider other suppliers of NVH testing solutions
- GHSP gets excellent support, training, backup and service from Brüel & Kjær's Detroit office
- GHSP gets all of its Brüel & Kjær equipment calibrated by Brüel & Kjær's A2LA accredited calibration division in Norcross, Georgia

02/09
BO 0496 – 11