CASE STUDY

MIRA Ltd
Warwickshire
EU Noise Directive Testing

UK
Automotive
PULSE™, Transducers

MIRA is a leading automotive design, development and certification consultancy providing a wide range of European certification and homologation services for automotive and non-automotive customers, as well as conducting tests which are accepted for national approval in many countries worldwide. MIRA provides Automotive Type Approval services for automotive legislation ("e" marking) and also Certification services for industry-relevant CE marking directives.

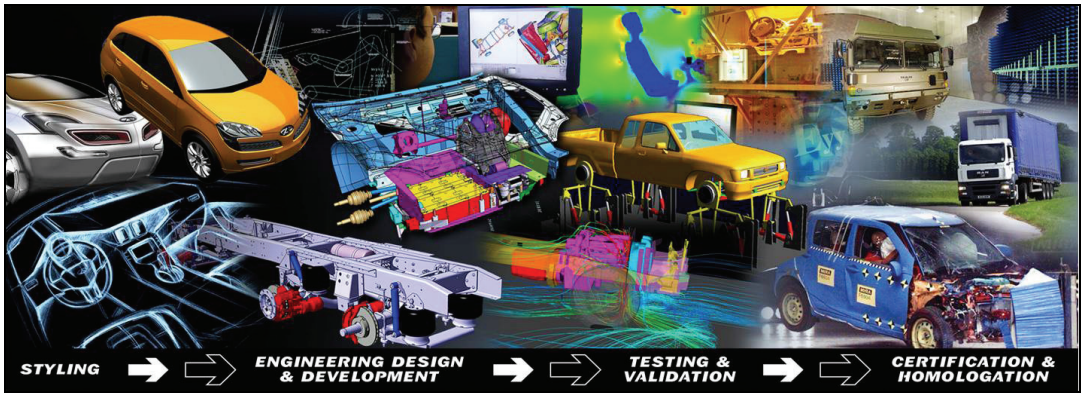
MIRA uses a Brüel & Kjær PULSE data acquisition and analysis system with Sound Power software to test whether customers' products comply with, for example, EU Noise Emission Directive 2000/14/EC.

Photographs by kind permission of MIRA

Vehicle engineering specialist, MIRA, is a leading design, development and certification consultancy delivering engineering solutions from individual tests to turnkey vehicle design programmes. MIRA's customers include vehicle manufacturers and equipment suppliers across the automotive, defence, aerospace and rail sectors.

Around 400 dedicated employees, including some of the world's leading engineers, are based at MIRA's UK headquarters in Nuneaton – a secure 760-acre site featuring 32 major development facilities.

MIRA's multi-disciplinary project teams combine expertise in active and passive vehicle safety, aerodynamics, thermal management, NVH (Noise, Vibration and Harshness), vehicle dynamics, electrical/electronic systems, EMC engineering, powertrain integration and all aspects of durability. Typical projects include integration of Intelligent Transport Systems (ITS), developing low carbon vehicles and research into autonomous vehicle technologies.



NVH Capability

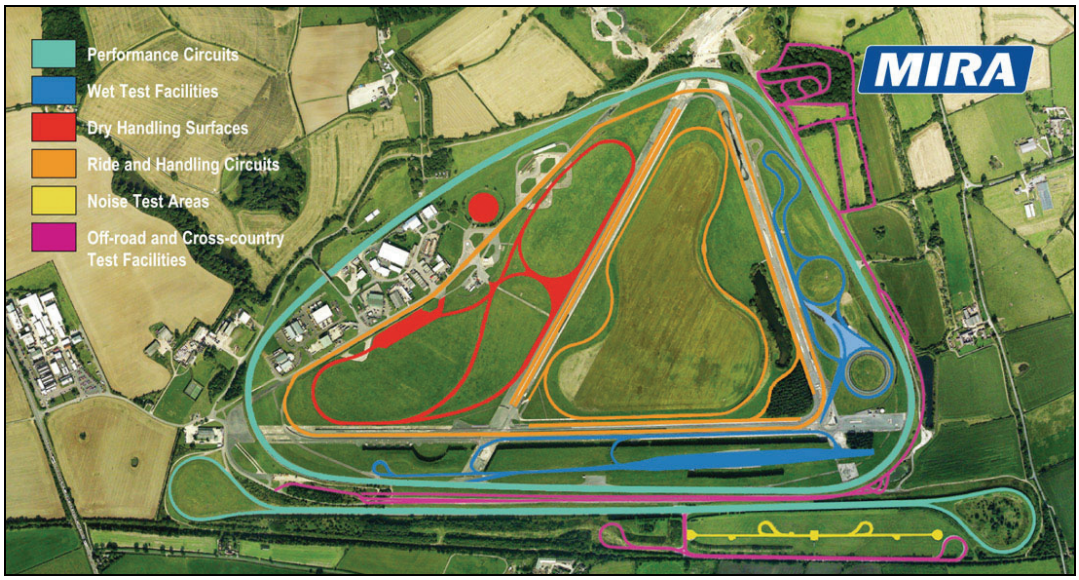
MIRA's team of highly-qualified scientists, engineers and technicians, with their diverse and extensive experience in vehicle NVH, address a wide range of NVH-related issues including:

- Idle refinement
- Sound branding
- Aero-acoustic performance
- Ride comfort

To support this, MIRA's NVH development facilities include:

- Anechoic Chamber
- Semi-anechoic Chassis Dynamometer
- Semi-anechoic Engine Chamber
- Sub-System Refinement Centre
- Sound Quality Listening Suite
- Various multi-channel Data Acquisition Systems
- Modal Test Lab
- Aero-acoustic Analysis in Full-scale Wind Tunnel
- Modelling and Simulation
- 760-acre Proving Ground (noise surfaces and pass-by)

The proving ground, which forms the largest area of MIRA, is built on 760 acres of the former RAF Lindley airfield



Noise Labelling with PULSE Sound Power

MIRA offers a range of customer services pertaining to the EU Noise Directive. As well as advisory services to help clients understand the directive, MIRA also offers approval and testing services for equipment subject to noise limits and noise marking.

EU Noise Emission Directive 2000/14/EC

Directive 2000/14/EC relating to the noise emission in the environment by equipment for use outdoors was adopted by the European Parliament and the Council and first published in May 2000.

The label indicating compliance with the Directive

The Directive aims to protect the health and well-being of citizens, protect the environment and provide the public with information on the noise emitted by equipment ranging from powered gardening tools to construction and waste-management plant. Such products must bear a CE-mark and the indication of their guaranteed sound-power level and be accompanied by an EC declaration of conformity before they can be placed on the market.

The Directive involves 57 types of equipment for use outdoors. Product sound-power levels have to be declared, and quality-control procedures established, to ensure continued compliance with the new legislation.

On 3 January, 2002, the Directive became mandatory. Failure to comply with its regulations can result in products being prohibited from the EU marketplace.

PULSE Sound Power

PULSE Sound Power software determines noise emission quantities of machinery, equipment and their sub-assemblies, and includes the determination of sound power levels as described in international standards, as well as the measurement of emission sound pressure levels at specified positions in the vicinity of a machine.

Paul Delderfield, NVH Technical Leader, Vehicle Dynamics & NVH, MIRA

Paul Delderfield is the NVH Technical Leader, Vehicle Dynamics & NVH at MIRA. A graduate of Loughborough University, he has a degree in Automotive Engineering. Following five years at Rover, he joined MIRA in 1992 and has worked with NVH-related issues for the past 17 years. “Most of the current legislative work is noise labelling,” he explains. “Customers come to us and ask us to verify that the sound power of their products complies with legislation. Some products do fail, and in such cases, the engineering development team is sometimes asked to help troubleshoot, make modifications and improve the noise. This was the case with Caterpillar who, as a result of our collaboration, were awarded the Blue Angel Mark for Low-noise Construction Machinery.”

Maria Franco-Jørge, NVH Team Leader, Vehicle Dynamics & NVH, MIRA

Maria Franco-Jørge, NVH Team Leader, Vehicle Dynamics & NVH, has a Mechanical Engineering Masters Degree from the University of Madrid. She spent a year at Jaguar Land Rover, Gaydon, while working for MIRA, where she's been for the last 14 years. As well as being Team Leader for 17 engineers, she has researched and published numerous papers for Internoise and other NVH events.

"We have a specially built test area on the MIRA site for testing hydraulic hammers, lawn mowers, cranes and compactors. The automotive approval authority and technical service in the UK, VCA, is one of our main customers," says Maria. "Brüel & Kjær's PULSE Sound Power is extensively used for such customer services."

Sound Power Testing of Bell's B50D 6 × 6 Articulated Dump Truck

Bell Equipment is another MIRA customer. Founded in 1954, Bell manufactures and distributes an impressive range of equipment including Articulated Dump Trucks, Front End Loaders, Tractor Loaders, Backhoes, Tri-Wheeled Loaders (timber/sugarcane harvesting and loading machines), Haulage Tractors, Dozers, Graders, Excavators and a wide range of forestry equipment.

Bell Equipment's head office and main factory is in Richards Bay, South Africa and there are assembly plants in Eisenach in Germany and with Deere in Davenport in the USA. Today, Bell Equipment is a truly international company with more than 19 000 machines operating in over 60 countries around the world.

The company's flagship the B50D, is the world's first production 50 tonne 6 × 6 Articulated Dump Truck (ADT) and has a Mercedes Benz diesel engine.

Before commencing deliveries, the B50D ADT had to undergo tests to verify sound power compliance with EU Directive 2000/14/EC. MIRA travelled to Bell's assembly plant in East Germany to perform the required measurements. Owing to its size, the 50 tonne truck had to be tested outside in perfect weather conditions. This means no rain and a maximum wind speed of 5 m/s. As well as the weather requirements, the EU Directive specifies that there must be no reflecting material within 50 m of the test object.

For the test, MIRA used six Brüel & Kjær ½-inch Free-field Microphones Type 4190 positioned at six specified measurement points on the hemispherical measurement surface. The microphones are calibrated before and after each test using Brüel & Kjær Sound Calibrator Type 4231. "Setting up the test takes time," says Paul, "but with the PULSE system it actually takes us less than an hour". The sound measured must represent the way the machine is working normally and the sound power level is obtained by a combination of measurements and calculations the rules for which are laid down in the Directive.

The test procedure takes between one to two hours. Paul explains, "We drive this enormous vehicle through the hemisphere of microphones in forward and reverse gear at specified speeds". He continues, "A stationary test is then done in the middle of the hemisphere with the truck at full rpm raising and lowering the bucket nine times".

Once the sound power measurements conform to the ISO standards (EN ISO 3744:1995 and EN ISO 3746: 1995), they can be used to qualify for compliance with the 2000/14/EC directive for outdoor equipment.

PULSE – "One of the Best Buying Decisions Ever"

Although PULSE is primarily used to make sound power measurements on machines, MIRA also uses it for general sound and vibration analysis such as 1/3-octave CPB or FFT and to measure sound power on automotive components and smaller items in MIRA's semi-anechoic chamber.

Paul says, "PULSE Sound Power is one of the best buying decisions we've ever made. It's reliable, accurate and easy to set up. We trust it and it's one of very few products that has not needed maintenance".

Maria agrees and concludes, “It does what it’s supposed to do,” she says. “It’s proved its worth.”

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HEADQUARTERS: Brüel & Kjær Sound & Vibration Measurement A/S · DK-2850 Nærum · Denmark
Telephone: +45 7741 2000 · Fax: +45 4580 1405 · www.bksv.com · info@bksv.com