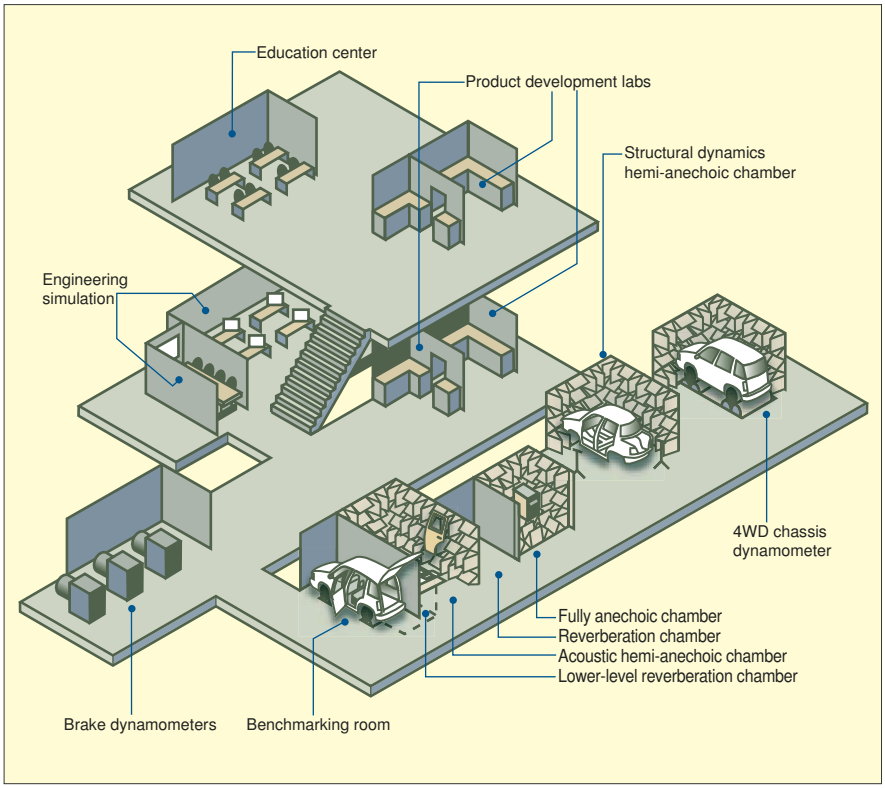
Triad of Companies Launch State-of-the-Art Noise, Vibration, and Harshness Research Center

The Material Sciences Corporation (MSC) Application Research Center (ARC), in Canton, MI, is a state-of-the-art noise and vibration solution center which houses not only a wide array of NVH testing capabilities, but also advanced computer simulation capability, complete materials development and testing capability, as well as the commercial personnel for all of MSC's acoustical materials, including Quiet Steel®.

What makes the facility unique is the partnership between MSC, Brüel & Kjær, and Link Engineering. These three companies have combined their resources to create a facility that is truly state of the art with high capacity. Brüel & Kjær has provided 100% of the NVH measurement capability to the ARC, including transducers, PULSE measurement systems, and NVH test/analysis software. Link has provided the test systems needed to replicate real world test conditions for automotive applications including three shaft dynamometers for brake noise testing and one 4WD NVH chassis dynamometer for full vehicle noise testing. In exchange, B&K and Link have been able to locate a significant number of their personnel in the ARC, and each has guaranteed access to the various NVH testing facilities to conduct NVH test services and NVH consulting projects for their own customers.

Testing is conducted within five acoustical chambers provided by Eckel Industries (the three brake dynamometers have their own acoustical/environmental chambers and are from Link). The sound transmission loss (STL) suite is comprised of one hemi-anechoic chamber with two attached reverberation chambers (one under ground and one adjacent to the hemi-anechoic room) and one fully anechoic chamber. The hemi-anechoic chamber is large enough to accommodate a dual-wheel, rear-axle, full-size pickup truck with a GVWR of 10,000 lbs. The chamber includes an overhead crane system with two, 3-ton electric hoists. There are openings (14 × 7 ft) to both reverberation chambers with reconfigurable plugs that allow for a wide variety of STL panels of different size and shape to be tested. Adjacent to the main reverberation chamber is a full anechoic chamber with a 4 × 4 ft opening to the reverberation chamber for SAE J1400 testing. The main reverberation chamber and the full anechoic chamber provide capability for NVH testing of many consumer and industrial products such as disk drives, appliances, etc. All three main chambers are built on fully isolated floor systems.



Material Sciences Corporation, Brüel & Kjær, and Link Engineering have combined resources to create the Application Research Center in Canton, MI. It is a state-of-the-art noise and vibration solution center housisng a wide array of NVH testing capabilities, advanced computer simulation, and complete materials development and testing capability.

A second hemi-anechoic test chamber houses a 12 × 24-ft bedplate mounted to a 100,000-lb seismic mass resting on grade and completely isolated from the building foundation. This room is designed primarily for vibration measurements such as modal analysis and vehicle transfer function measurements. The hemi-anechoic design provides a very low background noise level for vibration tests of large panels, but also allows the room to be used for general purpose acoustics testing as well. This chamber also includes an overhead crane system with twin, 3-ton electric hoists. Finally, the chamber has a vehicle exhaust extraction system that allows a full vehicle to be run in the room for idle noise/vibration measurements or neutral engine run-up tests.

The 4WD NVH chassis dynamometer is housed in a third hemi-anechoic chamber. This chamber has the added capability of moving large amounts of air at very low noise levels to maintain temperature and humidity in the chamber while vehicles are running on the dynamometer. The room can move 15,000 CFM of air at noise levels below 50 dBA, while maintaining a temperature range of 50 to 110° F. The hemi-anechoic chamber is constructed on a floating isolated floor for building vibration isolation. Test vehicles can be viewed directly via a high STL viewport window and/or a closed circuit camera monitor system.

The technical specifications for these chambers are as follows (validation tests are currently underway):

☐ **Acoustics Hemi-Anechoic Chamber (STL suite)**
- 90-Hz cutoff frequency
- Background noise rating: NC20
- Room size (wedge tip to tip): 36′-4″ × 22′-4″ × 13′-2″
- Maximum vehicle weight: 10,000 lbs
- STL windows: 14′ × 7′ in floor (to reverb chamber below) and 14′ × 7′ in wall (to main reverb chamber)
- Fully Isolated Floor
- Overhead Crane with twin 3 ton hoists

☐ **Main Reverberation Chamber**
- 170-Hz cutoff frequency
- Background noise rating: NC20
- Room size: 28′-0″ × 20′-0″ × 16′-0″ (8960 ft^3)
- Maximum vehicle weight: 10,000 lbs
- STL window: 14′ × 7′ in wall (to acoustics hemi-anechoic chamber)
- 4′ × 4′ in wall (to full anechoic chamber), SAE J1400 standard
- Fully isolated floor

☐ **Full Anechoic Chamber**
- 90 Hz cutoff frequency
- Background noise rating: NC20
- Room size (wedge tip to tip): 14′-0″ × 13′-0″ x 15′-0″
- Floor grating: supports 1000 lbs

ARC's 4WD Link dynamometer is designed to simulate vehicle operating conditions in a hemi-anechoic test chamber.

- STL window: 4′ × 4′ in wall (to main reverb chamber), SAE J1400 standard
- Fully isolated floor
- Utilities: hot/cold water, natural gas, sanitary drain

☐ **Structural Dynamics Hemi-Anechoic Chamber**

- 90-Hz cutoff frequency
- Background noise rating: NC20
- Room size (wedge tip to tip): 36′-4″ × 22′-4″ × 13′-2″
- 12′ × 24′ T-slot bedplate (with inertia mass isolation)
- Overhead crane with twin 3-ton hoists
- Vehicle Exhaust Extractor System

☐ **Chassis Dynamometer Hemi-Anechoic Chamber**

- 90-Hz cutoff frequency
- Background noise rating: NC20
- Room size (wedge tip to tip): 36′-4″ × 22′-4″ × 13′-2″
- Max HVAC airflow: 15,000 CFM

Product development labs specialize in materials engineering and develop sample materials and subject them to a wide range of tests.

- Temperature range: 50-110° F
- Vehicle exhaust extractor system
- Floating floor

In addition to the NVH testing chambers, the ARC has a dedicated and specially designed "quiet room" for sound quality listening activities. The room has a special wall and ceiling design to greatly increase the STL to ensure a low-noise environment. All of the computer equipment and other electronics are housed in a small adjacent "control room," and the operator can control the listening exercises via wireless mouse and keyboard from the listening room.

Finally, the facility houses a complete materials engineering lab that allows development of various polymer materials, sample preparation, mechanical testing and environmental testing. Three separate Oberst test rigs are used for the characterization of material damping. The lab also includes an impedance tube for testing normal incidence sound absorption coefficients of materials.

To support all of the testing in the ARC, a significant amount of support infrastructure is included in the facility. There are six vehicle work bays, each with compressed air and vehicle exhaust extractors. Three of these work bays have vehicle hoists. Additionally, the facility includes a full wood and metal fabrication shop with a complete set of metal and woodworking tools including a milling machine, table saw, MIG welder, among others. The entire facility, including doorways, hallways, and testing chambers has been designed to accommodate the size and weight of a dual-wheel, rear-axle, full size pickup truck

Nowhere is there an NVH test facility that combines such a wide array of NVH testing and material development capability under one roof. But it is not just the NVH equipment in the facility that makes the Application Research Center unique – it's the combined 150 years of NVH experience that MSC, Link, and Brüel & Kjær can bring to bear on any NVH solution. This truly separates the ARC from all other NVH test centers.

For more information or to receive a testing proposal from the MSC Applications Research Center, please contact: greg.goetchius@mat sci.com.