MB Dynamics
TECHNOLOGY, TEST PROCESSES & ENGINEERING SERVICES

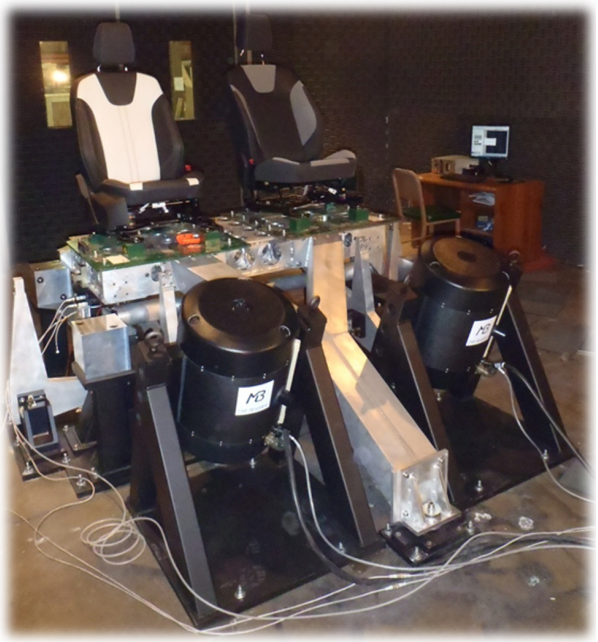
VPR+4D

Multi-Axis S&R Detection

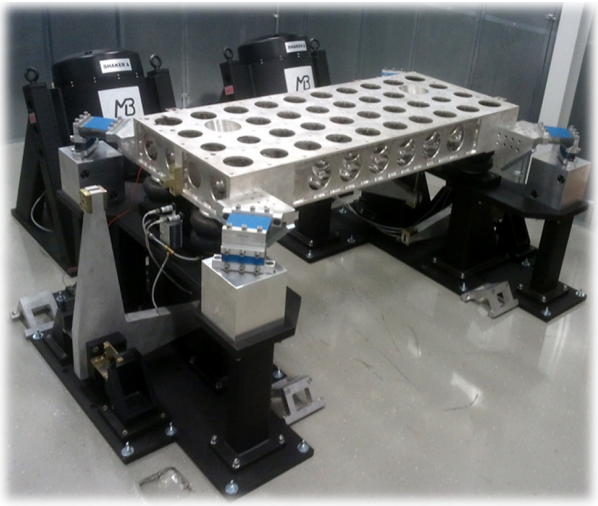
Vertical Pitch Roll (VPR) Squeak & Rattle Testing combined with Sequential 4 DOF

KEY DIFFERENTIATORS

- **Effective at Detecting S&Rs:** Stimulates & correlates to S&Rs found on roads, test tracks & road simulators
- **Effective at Detecting S&Rs:** Reproduces road-load acceleration time histories, PSD random & sine vibration
- **Quiet:** Background noise of VPR+4D running typical S&R profile without test item: <32 - 34dBA; <1.5 Sones N10 in 4 DOF Mode
- **Quiet:** Test equipment noises do not mask S&Rs
- **Quiet**: For *objective* S&R acoustic measurements and subjective S&R evaluations
- **No Hydraulics:** Uses uncooled electrodynamic Energizers
- **Multi-Axis for Realism**: 5 degree-of-freedom response in VPR mode; 2 DOF controlled and other 3 coupled
- **Multi-Axis for Realism:** Sequential vertical, fore-aft, & lateral excitation to fulfill OEM specs; drive 2 shakers in-phase provides vertical and out-of-phase yields roll
- **Versatile:** One test system helps fulfill multiple OEM test specs for different excitation directions and DOFs
- **Versatile:** Quiet enough for S&R; powerful enough for durability and S&R aging
- **Rapid Changeover:** Convert from VPR Mode to 4 DOF < 1 hour
- **MIMO Control:** Improves test productivity and realism, compared to MISO
- **Simple to Operate:** By plant quality people and/or test lab personnel
- **High Uptime and Low Maintenance:** No wear parts, no hydraulics
- **Nominal Facility Requirements:** No special foundation; 220 VAC, 1 phase, 50/60 Hz, 50 Amps
- **Multiple Test Items:** Evaluate seats, cockpits, sunroofs, door modules, other modules – and components
- **Cost Effective:** Less expensive than hydraulic MAST
- **Reasonably Portable:** Relocate equipment from lab to pilot plant – site to site
- **Operate Inside Environmental Chamber as well as Quiet Room**
- **Frequency Range:** 2 – 200 Hz
- **Mounting Table:** 1500mm x 635mm; magnesium honeycomb structure



Vertical Pitch Roll (VPR) Mode



Vertical & Roll Excitation, 4 DOF Mode

Buzzes, squeaks and rattles (S&Rs) in vehicles are a major source of customer dissatisfaction, complaints in J.D. Power surveys, and warranty claims and costs. MB Dynamics delivers affordable turnkey systems to help OEMs & their suppliers develop and produce vehicles free of squeaks & rattles, with measurable quality. VPR+4D can be used for product validation during design/development as well as for production verification, launch support, and in-plant quality audits.

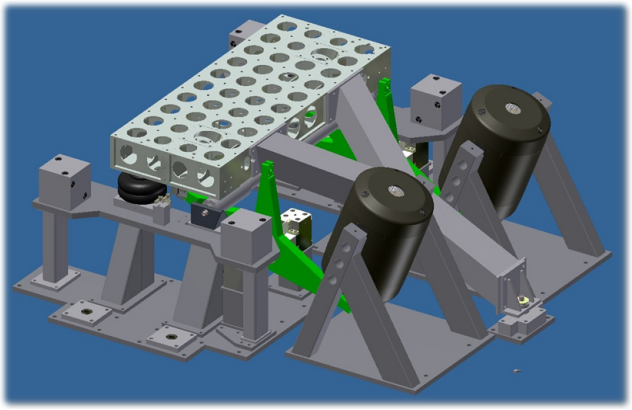
VPR+4D, *continued*

PERFORMANCE CURVES

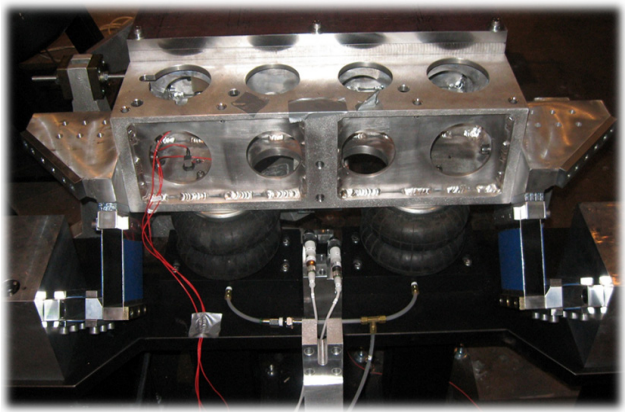
Payload, kg	Squeak & Rattle, g's RMS BLACKs Uncooled	Durability Squeak & Rattle, g's RMS BLACKs Forced-Air Cooled
Bare Table	0.7	1.0
50	0.6	0.8
100	0.4	0.7
225	0.3	0.5
315	0.2	0.4
Payload, kg	**Squeak & Rattle, g's RMS SILVERs Uncooled**	**Durability Squeak & Rattle, g's RMS SILVERs Forced-Air Cooled**
Bare Table	1.8	2.2
50	1.4	1.7
100	1.1	1.4
225	0.7	1.0
315	0.6	0.8

REFERENCE TERMINOLOGY

- **VPR:** Vertical Pitch Roll multi-axis vibration test system; 5 degrees of freedom in 1 or 2 test cycles
- **4D:** sequential 4 axis excitation (4 Degrees of Freedom), vertical, roll, pitch and lateral – one axis at a time
- **VPR+4D:** 1 test system that can perform both VPR & 4D test functions with changeover from one to the other in < 1 hour; roll excitation in vertical mode yields 4th DOF
- **MISO:** Multi-Input, Single-Output vibration control, using 4 accelerometer inputs and one output signal to drive both EnergizerS, either in-phase or out-of-phase
- **MIMO:** Multi-Input, Multi-Output vibration control, using 4 accelerometer inputs and two output signals, one for each of the 2 Energizers



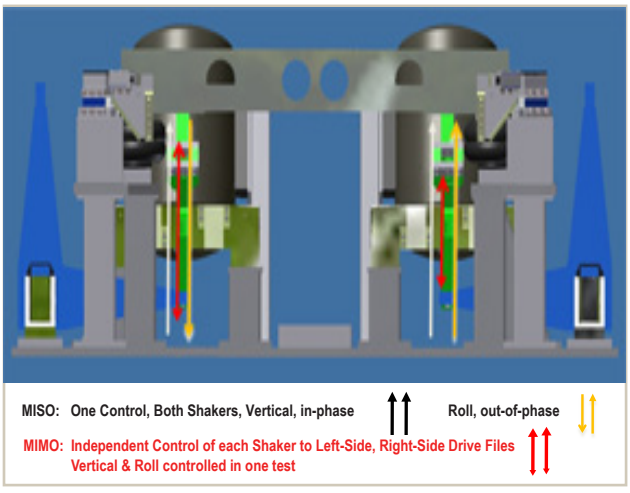
VPR Mode
Overview from Exciter Side



Mounting Table with Air Spring Load Support and Flexures for Fore-aft Excitation

FACILITY REQUIREMENTS

- **Equipment Footprint:** 2.5m wide x 2.4m deep, min. – Quiet Room inside dimensions are user selected to provide access around equipment as needed
- **Recommended Inside Height of Quiet Room:** 3m
- **Quiet Room Ambient Noise:** Preferably < 30dBA
- **Power:** 220-240VAC, 1 phase, 50/60 Hz, 50 Amp for System; 380-440VAC, 3 phase, 50/60 Hz, 32 Amp for system
- **Shop Air:** 30 liter/min @ 2 bar (1 CFM @ 30 psi)
- **Flooring:** Smooth concrete surface; no additional reinforcing is required



4D Sequential Multi-Axis Exitation, Vertical and Roll, MISO and MIMO

MB Dynamics, Inc.
25865 Richmond Road · Cleveland OH · 44146 USA
+1 (216) 292-5850 phone +1 (216) 292-5614 fax
www.mbdynamics.com