The MTS Vehicle Dynamics Simulator (VDS) is a next-generation driving simulator designed by McLaren Applied Technologies to provide automotive OEMs, Tier 1 suppliers and motorsports teams a revolutionary tool for transforming vehicle development. Born of Formula 1 vehicle modeling, development and simulation innovation, the VDS employs a “driver-in-the-loop” approach that allows engineers to gain subjective evaluations of component and full-vehicle performance well in advance of the availability of physical prototypes.

The VDS combines a proven McLaren dynamic motion platform and control algorithms with an rFpro virtual environment to immerse test drivers in an exceptionally low-latency driving experience. A Concurrent iHawk™ computing platform orchestrates the real-time synchronization of vehicle and terrain models with the 6DOF motion platform and virtual environment, enabling conceptual vehicle designs to be “driven” through a diverse array of adaptable scenarios. McLaren MIDAS and ATLAS software provides state-of-the-art simulation definition, execution and analysis capabilities.

The resulting high-fidelity driver-in-the-loop simulation and feedback provides designers with early, deep insight into handling issues and the impact of design changes, minimizing validation-stage rework and accelerating overall vehicle development.

The VDS offers other advantages over conventional driving simulators. Its compact, all-electric motion platform makes it easy to deploy in existing facilities. Also, the VDS is designed to integrate seamlessly with advanced mechanical Hardware-in-the-Loop (mHIL) technology, and is adaptable for evaluating a wide variety of emerging automotive technologies, such as Advanced Driver Assistance Systems (ADAS).
Low Latency Sensory Cueing

The VDS leverages sophisticated low latency sensory cueing technologies to immerse test drivers in high-fidelity driving scenarios. The McLaren dynamic motion platform and high-speed controls provide haptic and vestibular sensory cueing, while an adaptable rFpro virtual environment contributes both visual and audio sensory inputs. Concurrent iHawk real-time computing is used to integrate and synchronize the motion platform and virtual environment with complex vehicle and terrain models, quickly closing the simulation loop through the human driver in the extremely short time interval required to achieve meaningful subjective evaluation.
Proven Dynamic Motion Platform Design

The VDS employs a highly dynamic motion platform design born of years of McLaren Formula 1 vehicle modeling and simulation and proven through over half a million kilometers of simulated driving. It features a lightweight cockpit and low-friction, 6 degree-of-freedom (6DOF) mechanical scheme that integrates linear electric motors and the latest in high-speed industrial controls to deliver the superior performance needed for high-fidelity subjective evaluation.

This proven design offers operational advantages over simulators equipped with conventional hexapods, including the elimination of complex, cross-coupling phenomena endemic to hexapod platforms. The all-electric VDS motion platform is also more compact than simulators that utilize hexapod-on-rail systems; it requires no seismic mass; and its relatively low power and cooling requirements make it possible to locate and maintain the system very close to a typical office environment. The VDS platform is engineered to provide the highest levels of safety to drivers and operators. Its control system is CE compliant, making it readily deployable anywhere in the world.

MIDAS (McLaren Integrated Data Analysis and Simulation) Software

MIDAS software has been developed and refined over the last two decades by McLaren as a platform for engineers to manage and analyze simulation and test data. It comprises an array of tools to make configuring experiments, interrogating results, comparing data sets and the automation of post processing scripts both consistent and repeatable.

MIDAS is included as part of the fully integrated software solution for the VDS, providing the ability to manipulate specific cueing parameters in order to deliver the best environment immersion for a driver-in-the-loop simulation. It features a user interface for editing configuration data that automatically mirrors its underlying structure. It is also version-controlled for full traceability.

Additionally, the modular, extensible MIDAS structure facilitates rapid and consistent collaboration across multi-discipline engineering teams by allowing different departments to share common tools and processes, while maintaining customized content for different roles.
Next-Generation Simulation Capabilities

Mechanical Hardware-in-the-Loop (mHIL)

The VDS is engineered to integrate seamlessly with leading-edge mHIL solutions from MTS. Mechanical Hardware-in-the-Loop is a hybrid simulation technique that enables the real-time integration of difficult-to-model hardware – tires, dampers, hybrid transient powertrains and steering systems – directly into virtual simulations. The mHIL technique can be used for replicating real-world handling maneuvers and events; evaluating, calibrating and tuning suspension components or mechatronic control systems; and evaluating system behavior (or feel) for EPS or ABS systems. These capabilities enable “true” driver-in-the-loop simulation and improve development efficiency by delivering accurate, repeatable test results earlier in the process, minimizing rework in the validation phase. To date, MTS has pursued a variety of mHIL solutions, integrating a diverse array physical hardware from dampers and steering systems to suspension and chassis systems.

Adaptable Vehicle Environment & ADAS Development

The adaptable, low latency environment of the VDS provides an ideal platform for initial subjective evaluation of Advanced Driver Assistance Systems (ADAS). The simulator’s flexible Concurrent hardware interface allows for rapid integration of custom software and hardware components for testing on-board aids such as ABS and ESC. Optional components of the adaptable rFpro environment also enhance ADAS testing capabilities. The rFpro SENSOR_IG plug-in (a variant of its standard Image Generator) allows rendered buffers (32-bit colour, depth, etc.) to be accessed in real-time for use by custom image-processing tools and sensor models. Combining the rFpro TRAFFIC module and a third party software, such as open-source Simulation of Urban MObilility (SUMO), provides a fully customizable traffic simulation solution. The rFpro ReplayServer provides the ability to build up and replay exact scenarios to confirm control strategies with multiple vehicles created within the environment.

Learn More

Contact MTS today to explore how the MTS Vehicle Dynamics Simulator (VDS) can serve to accelerate and streamline your vehicle development processes. To experience next-generation VDS technology today, contact Patrick Lane-Nott, R&D Vehicle Dynamics Simulator Engineer, at patrick.lane-nott@mts.com.