

Toyota Motor Corporation

Better Understanding Driver Behavior

MTS helps Toyota open new vehicle development possibilities with a state-of-the-art driving simulator



The world is now a giant step closer to seeing vehicles that automatically sense and react to dangerous situations on the road.

CUSTOMER CHALLENGE

Toyota® Motor Corporation has set an aggressive long-term goal for its vehicle development: zero traffic fatalities. Achieving this objective would require Toyota to develop a thorough understanding of how different types of drivers react to actual accident situations, as well as how they respond to new safety innovations built into the vehicles themselves.

Gleaning this type of information has been difficult in the past, because doing so requires exposing drivers to dangerous situations on the expensive and essentially non-repeatable test track. Accurately simulating real-world driving conditions in the test laboratory has presented formidable challenges of its own. Such testing requires the difficult-to-achieve combination of visual, aural and physical elements, all orchestrated in precise unison.

This third element, physical motion, has historically been the most vexing to accurately build into the simulation experience. But it is also critical. When a driver slams on the brakes, for example, he or she must feel the deceleration that should accompany this action, or the phenomenon will not be authentic. This sensory disharmony between what a driver sees and feels in the inner ear can also cause motion sickness.

Toyota approached MTS Systems Corporation to provide this critical motion mechanism, control system and related software for its driving simulator. The project was ultimately awarded to MTS, based primarily on MTS' established leadership position in motion mechanics and response measurement for other vehicle development applications around the world.

MTS SOLUTION

In January 2005, MTS began its significant technology contribution to the driving simulator project at Toyota's Higashifuji Technical Center in Shizuoka, Japan. Full-scale operation of the driving simulator began in Spring 2008.

The simulator places a full vehicle prototype atop an MTS hexapod, x and y motion base, vehicle motion actuators, and a turntable, providing a system with 12 degrees of freedom. The vehicle is enclosed in a domed video screen four-and-a-half meters (14.7 feet) high and just over seven meters (23 feet) in diameter, offering a dynamic,

360-degree visual simulation of driving through the town of Gotemba, Japan. A sophisticated audio system ensures all sound cues originate from the proper direction.

Driven by industry-leading MTS control hardware and software, the simulator moves an unprecedented 35 meters (119.4 feet) on a longitudinal plane and 20 meters (65.6 feet) laterally to provide the required force cues. This results in an amazingly realistic rendition of getting behind the wheel. Drivers are unaware that the system is actually moving in space. To them, the movement lends to the perception that they are operating a moving vehicle, complete with all the forces and accelerations one actually feels while driving. It is the most realistic virtual driving environment currently in existence.



With its state-of-the-art video, audio and acceleration simulation technology, the Toyota driving simulator offers the most realistic virtual driving environment currently in existence.

CUSTOMER BENEFITS

This state-of-the-art driving simulator allows Toyota to confidently pursue its accident-reducing active safety technology. This technology is designed to sense potential accident situations and either alert the driver or take actual physical measures to avoid them. Vehicle development engineers can now conduct the necessary driving tests that were formerly either too dangerous or too difficult to conduct on the test track.

The simulator provides Toyota with significant insight into how behaviors such as fatigue, illness, inebriation and cell phone use affect driver performance. In addition, it accurately evaluates which systems should be integrated to reduce the associated risks. Now that a safe virtual experience has replaced the physical dangers of track testing, potential applications are practically endless.

The Toyota driving simulator significantly raises the bar for how thoroughly vehicle developers must understand — and respond to — driver characteristics when designing their vehicles. With the development of this advanced simulation system, the world has moved a giant step closer to seeing vehicles that automatically sense and react to dangerous situations on the road.

See the Toyota driving simulator in action.

Watch a brief video at:

http://www.toyota-future.com/EN/#/technology_library/top/synap_a6/detaila6



MTS Systems Corporation

14000 Technology Drive
Eden Prairie, MN 55344-2290 USA
Toll Free: 1-800-328-2255
Fax: 1-952-937-4515
E-mail: info@mts.com
Internet: www.mts.com

ISO 9001 CERTIFIED QMS