East meets west

Toyota's new US$187 million engineering, design and safety testing facility is its first ever built outside Japan

WORDS BY JIM MCCRAW

Not many engineers and technicians have the opportunity to launch a brand new, world-class facility, and R. Scott Miller and his 843 colleagues at the sparkling new Toyota Technical Center (TTC) facility in York Township, Michigan, realize that.

Miller is general manager of half of the beautifully wooded 700-acre facility, which was planned in 2004, started in late 2006, and opened for business in June 2008 with its first crash test. The center has since carried out 10 validation development tests and 14 production tests.

Miller's half is a US$37 million, 180,000ft² component and full-vehicle crash test center housing state-of-the-art facilities and equipment. The mission of the 60 or so staff working with Miller is to prepare, crash test, and analyze the results for every model produced in North America, localizing the effort and taking a huge load off the original and only other Toyota crash facility, near Nagoya, Japan.

Miller's group works hand-in-hand with the engineering and design staff that do the upper-body design, engineering and development of Toyota's North American products in the other half of the new center, which comprises 350,000ft² of office and laboratory space.

"In the entire world of development, we do around 88% of the upper-body evaluations for our products, and 40% of the underbody evaluations, including chassis and vehicle dynamics," says Miller.

Toyota's facilities in Ann Arbor, Michigan, include a branch of Calty Design and an emissions lab. The team has been doing safety performance development work since the launch of the Solara coupe and convertible in 2004, but all of that work and most that followed was done at outside labs in the Detroit area, such as Autoliv, and TRC in Ohio.

Because of its immense size and complexity, the Tundra pickup program was done by Toyota Japan, the Hino truck subsidiary, and the Toyota Technical Center in Michigan.

Miller says the staff took a stepped approach. He says the first 10 tests were done to assure the accuracy of the impact speed, the accuracy of the impact point, the time-zero synchronization of all the systems, and verifying the

CLOCKWISE FROM TOP LEFT: The lighting system is mounted on rails; the sight that greets the center's 843 staff every morning; tuning work in the emissions lab; physical test results are very close to the CAE predictions; seat evaluation

Toyota's Michigan roots

The Japanese giant has been selling cars in the USA for 51 years, and building cars in the USA since the GM/Toyota venture, New United Motor Manufacturing Inc (NUMMI), was founded in 1982. Toyota has had a presence in Michigan since 1977, starting with a tiny garage that served as an emissions laboratory with liaison to the EPA lab in Ann Arbor.

In 1991, the North American engineering and design activity, covering 560,000ft² of space on 106 acres, was built in Ann Arbor Township, and later the Toyota Research Institute was added.

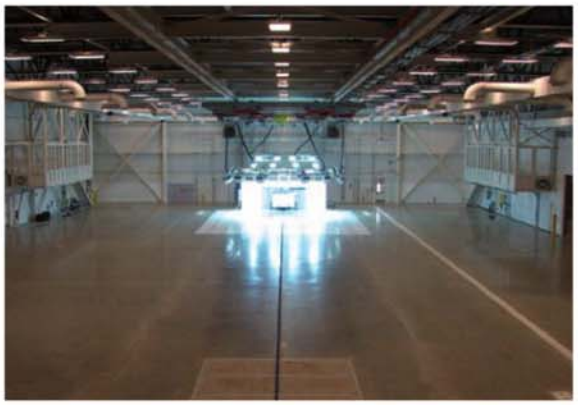
The first product partly developed in the USA was the Camry coupé in 1994, and the first vehicle fully developed here was the Solara coupé and convertible (below left), using the rapid-prototyping facility in nearby Plymouth.

The US$350 million, 800-employee engineering and design facility at the newly opened York Township site is now fully capable of designing, engineering, developing, and testing all the North American products. Those products are now built at Toyota plants at NUMMI in Fremont, California; in San Antonio, Texas; and in Georgetown, Kentucky.

different modes, including head-on, offset, and deformable barriers. The staff started by "taking the low-hanging fruit first", according to Miller. "We knew we could hit a wall, so we did the full frontal first, and are now bringing other test modes online. We will soon do all frontal testing in house, and by next spring we'll have full capability, including side impact, rear, and rear offset. The only thing we will not do is rollover testing. We made the building a little wider so we could do rear impact, but rollovers will remain outside."

The team that designed and built the facility tried to anticipate future technology and regulations as much as possible, says Miller. "I went to Toyota City, I visited the Higashi-Fuji test facility, I went to Hino, and then visited the North American outside test labs. I wanted to get a snapshot of what everybody else has, so we could incorporate the best of those facilities into ours. We have the capability to expand to a full car-to-car facility behind our building."

Most of the components in the York Township facility are off-the-shelf equipment customized or fitted to Toyota's standards, including a big KHS lighting system (28 4,000W units – the equivalent of 1,120 100W light bulbs – mounted



LEFT: The KHS lighting system boasts 28 4,000W units, which are rail-mounted for easy transition from frontal to side crash scenarios

ABOVE: Pre-testing a Tundra pickup truck prior to crash testing

on rails so that it can be converted quickly from frontal to side crash scenarios). The vehicle propulsion system is new from Messring and has a narrow micro-track that opens up the viewing area in the pit. The GX-1 camera system by NAC is capable of 50,000-200,000 frames per second, with the highest light sensitivity and video quality available. The G-5 DAS was built by DTS, and is a smaller, lighter system that offers more flexibility in ballasting the vehicles.

Although there is a crash-test HQ in Japan, and Michigan does report its findings frequently, Miller says that TTC Michigan has full responsibility for testing, investigation, root cause analysis, setting of targets, and full vehicle development for Toyota's North American products. "Our capability level is getting close to Toyota Japan's in terms of experience and countermeasure development," he adds.

Most of Miller's staff are either brought up through the company's co-op work/education program, or from the Big Three. "The physics and the language are the same, but the development styles are different."

He says that in less than a year the crash test facility will grow from one test per day to two, the rate for which it was designed, and the center's responsibilities will grow along with the staffing levels and vice versa, with training having a slight lead on testing. But Miller admits that they could not plan for every eventuality. The new federal NCAP procedure, announced in July 2008, is a good example.

"NHTSA is normalizing the distribution so that you'll have as many four- and five-star cars as you will two- and three-star cars," he explains. "They've taken the whole protocol and combined it into one vehicle rating, including rollover. It's much more complicated, and it's going to take a huge effort to re-educate the consumer.

"I think NHTSA is trying to moderate its enthusiasm for the new NCAP because of the economic hardship that some of the companies are going to face trying to develop to this new standard. Right now, it's supposed to go into effect in 2010, but I don't know what NHTSA is thinking now. It's a sea change in how the consumer is going to have to think."

When asked about the most difficult obstacle in getting the new center designed and built, Miller says, "In Toyota culture, it's the *nemawashi*, the Japanese word for consensus, getting everybody to agree on the look of the building, the staffing levels, the training plans, all the things that go on before the groundbreaking work. The planning at Toyota is the big step. After that, it's easy. Laying down the budget is more difficult than constructing the building." ❮