

# Toyota Mirai Fuel Cell Sedan Global Media Preview - Satoshi Ogiso

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*As prepared for:*

**Toyota Mirai LLPP**  
**Newport Beach, CA**  
**Monday, November 17, 2014**  
**Satoshi Ogiso, Managing Officer, Toyota Motor Corporation**

Thank you John, good morning everyone.

As John pointed out in his introductions of me and Chairman Uchiyamada, we have worked together for many years on this vision of future mobility... involving first the hybrid Prius... and now the fuel cell Mirai.

I cannot help but think that to some people, our collaboration-our adventurous road trip, must seem quixotic; idealism without regard for practicality.

I, of course, would not agree with that... but at least I know... who is Don Quixote and who is Sancho Panza.

Uchiyamada san said earlier that Hydrogen, and Hydrogen fuel cell technology will be a societal and economic game changer... and that it will be the fuel for the next century.

Frankly speaking, I think I feel a little more optimistic than that.

I believe this technology... is going to change our world; and sooner... rather than later.

That, in fact, is why we named this car Mirai.

We see it as the vehicle that will open the door to future for Toyota.

Of course not everyone agrees.

For many years, the use of hydrogen gas to power automobiles has been seen by many smart people as a foolish quest.

That point of view is much like opinions 20 years ago of how the Prius hybrid was nothing more than a science project... and economically unfeasible.

Sometimes change can happen quickly; a disruption of convention for the better.

Other times, change takes persistence.

And a long view.

For more than 20 years, Toyota has taken a broad portfolio approach to advanced powertrain R&D, including a continued strong focus on all types of electric motor-driven or electric motor-assisted designs.

For that entire 20 years...and more...we have been turning wheels, with electricity...by combining hydrogen and oxygen in an onboard fuel cell system.

Our investment in fuel cell R&D over that time... has been...very large.

Since 2002, we've been testing and developing a series of more than 100 fuel cell vehicles in North America.

In those years, and more than a million miles... we have found ways to dramatically reduce the cost of building a fuel cell powertrain.

In fact, we estimate a 95-percent cost reduction in the powertrain and fuel tanks in the Mirai compared to what it cost to build the Highlander fuel cell back in 2008.

How this is accomplished is due largely to 20 years of experience with hybrid technology... starting with the Prius.

Here's an example.

During development of the second-generation Prius hybrid engineers reduced the size, weight and cost of the expensive main battery by using an advanced boost convertor to raise overall system voltage.

The same thinking was carried over to fuel cells... where a new convertor multiplies the system voltage from the fuel cell... to the electric motor.

This saves weight and space, and considerable cost.

The fuel cell sits under the front driver and passenger seats; the two tanks under and behind the rear seats.

The stack, will have a total output of more than 114kW... and a output density of 3.1 kW per liter... both are among the world's highest outputs.

The process of producing electricity onboard and on-demand is simple in theory... but took two decades in practice.

Proton-exchange membranes inside fuel cell stacks need moisture to produce electricity.

Most fuel cell stacks use a humidifier.

Mirai's fuel cell stack is designed to circulate the water produced during the production of electricity and requires no humidifier; a world's first.

Mirai has two high-pressure – 70 megapascals fuel tanks, 62.4 and 60 liters in size ... with a tank storage weight density of 5.7 % .... and a maximum filling pressure of 87.5 megapascals.

By the way, the 70 megapascal number is equal to 10,000 psi, which many people find both easier to remember and to pronounce.

The carbon fiber-wrapped resin composite tanks are also the first in Japan to meet the international standard for compressed hydrogen storage containers for vehicle fuel systems.

The process for wrapping these bullet-proof tanks uses a machine that looks and acts like a modern-day version of the fabric loom that was the beginning of the company started by Sakichi Toyoda in 1926.

I like the symmetry that 88 years ago tomorrow was the beginning of a new company.

And today, we begin a new chapter in our history.

With fully fueled tanks, the system will not only power the Mirai for 300 miles; it is capable of supplying enough energy to power home essentials in an average house for up to a week in an emergency.

Which is why we have also developed an optional external power take-off device or “PTO”... to enable this whole-house energy delivery.

The fuel cell stack, tanks and boost convertor are all developed by Toyota in-house.

Current-generation hybrid components were used extensively in the fuel cell powertrain, including the electric motor, power control and main battery.

The combination allows for re-generative braking... an extra boost of power when accelerating... and optimized electrical flow to the motor from either the battery, or fuel stack, or both.

The result is a car that will have a cabin as quiet as a Lexus hybrid... zero-to-sixty acceleration of 9 seconds and a passing time of about 3 seconds from 25 to 45 mph...from a system output of 153 –hp.

As we learned with Prius, the introduction of game-changing technology poses new challenges that must be fully tested and confirmed in both lab and on-highway environments; which is where Frankenstein comes in.

Frankenstein is a very rough prototype test vehicle, where a platform and powertrain and borrowed parts are stuffed into an existing car so that critical testing can be accomplished.

For the past two years...Frankenstein and three others like it, have been subjected to critical on-road testing in North America.

It has involved more than a week in Yellowknife Canada confirming early morning start-ups at minus-30 degrees Centigrade.

High altitude testing was done in the Rockies, while the notorious Streets of San Francisco were used to test steep, low-speed hill climb from a standing start.

This last summer in Death Valley... system cooling and cabin air conditioning were severely tested.

While on-road testing is being done in the U.S., hundreds of thousands of miles are being logged in Japan where complete powertrain systems are bench-tested in extreme conditions.

Not far away at the Higashifuji R&D Center extensive crash testing has been on-going for months.

Safety is always a top priority.

Measures to specifically address frontal, side and rear impacts have been taken for superior protection of vehicle occupants.

At the same time, a high level of collision safety has been achieved to protect the fuel cell stack and high-pressure tanks against body deformation.

The FC stack frame uses lightweight and easily processed carbon fiber-reinforced plastic.

This protects the stack by absorbing impact from vehicle-road interference.

All primary components are positioned under the floor and near the center of the vehicle.

Since fuel cell vehicles do not emit high-temperature exhaust, the components are further protected by a complete underbody cover, which also improves aerodynamics and reduces road noise.

Positioning the stack, tanks and other components under the floor and near the center of the vehicle has also resulted in a low center of gravity and good front-to-rear weight balance.

I think you will be surprised tomorrow by Mirai's overall dynamic performance, combining the refinements of an ultra-quiet cabin and comfortable ride, with excellent handling and stability and agile cornering performance.

It's a blend not easily achieved and I look forward to hearing your comments tomorrow after your drive.

One thing I am sure you all will have an opinion about is Mirai's styling, inside and out.

It's no secret that when we launched Prius we decided that making it look different from any other car on the road was a risk that needed to be taken.

Prius styling was distinctive then and still is today.

We think Mirai will be as well.

If the name of your car means "the future"...it better look futuristic.

Most definitely, we wanted to make such a statement with Mirai, and many of its exterior elements are thematic.

If the front-end looks like its main purpose is to induce air flow under the hood...you would be correct.

A large flow of air is required to draw heat from Mirai's three radiators.

Not only are the intakes critical to system cooling they are part of an air management system that will deliver excellent aerodynamics of 0.29 Cd.

The phrase "*Oxygen in...water out,*" in fact, was an important part of the styling theme; of form... based on function.

The sides of the car are meant to convey the transformation of air into water, with flowing door profiles.

The rear uses a catamaran shape representing water flowing under and through the body.

On profile, the roof and the front hood are meant to be floating above the belt line.

If the exterior was meant to provoke the question "what's that?" the interior was meant to incite a "wow."

The design is meant to convey uncluttered, open and seamless space, soft-touch and contrasting textures and surprising refinements

Recessed surfaces of the front seats envelop the entire body and provide excellent fit-and-hold performance, thanks to cushion covers and cushions being produced as a single component.

Standard in both the driver's seat and front-passenger seat is eight-way power control for optimum seat positioning and electronic lumbar support.

I think the interior also conveys something a bit more profound.

The Mirai represents the first step in a new era in mobility. It is the future.

But the interior of the car is where the owner will live and the Mirai will need to deliver on many levels to be a success.

Perhaps most importantly, for any product to revolutionize a market... it must *fit* neatly and comfortably and conveniently... into the everyday lives of the consumer...accomplishing more, without asking for more, of the owner.

For all of its technical wizardry, its zero emissions and its bold styling, it needs to be, at the end of the day... a regular car.

That's what made Prius a success.

We hope that is what makes Mirai a success as well.