



# JAXA and Toyota Reach Agreement on Consideration Towards International Space Exploration

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The Japan Aerospace Exploration Agency (JAXA) and Toyota Motor Corporation (Toyota) announced their agreement today to consider the possibility of collaborating on international space exploration.

As a first step, JAXA and Toyota have reached agreement to further co-operate on and accelerate their ongoing joint study<sup>1</sup> of a manned, pressurised rover<sup>2</sup> that employs fuel cell electric vehicle technologies. Such a form of mobility is deemed necessary for human exploration activities on the surface of the moon. Even with the limited amount of energy that can be transported to the moon, the pressurised rover would have a total lunar surface cruising range of more than 10,000km.

International space exploration, aiming to achieve sustainable prosperity for humankind by expanding the domain of human activity and giving rise to intellectual properties, has its sights set on the moon and Mars. To achieve these exploration goals, it is essential to have co-ordination between robotic missions, such as the recent successful touchdown by the Hayabusa2 probe on the asteroid Ryugu, and human missions, such as those using pressurised rovers for activities on the moon. When it comes to challenging missions, such as lunar or Martian exploration, various countries are competing in advancing their technologies, and also their co-operative efforts.

JAXA President Hiroshi Yamakawa said: "At JAXA we are pursuing international co-ordination and technological studies towards Japan's participation in international space exploration. We aim to contribute through leading Japanese technologies which can potentially generate spin-off benefits. Having Toyota join us in the challenge of international space exploration greatly strengthens our confidence.

"Manned rovers with pressurised cabins are an element that will play an important role in fully fledged exploration and use of the lunar surface. For this, we would like to concentrate our country's technological abilities and conduct technological studies. Through our joint studies, we would like to put Toyota's excellent technological abilities related to mobility to use. We look forward to the acceleration of our technological studies for the realisation of a manned, pressurised rover."

Toyota President Akio Toyoda said: "The automotive industry has long done business with concepts of 'hometown' and 'home country' largely in mind. However, from now on, in responding to such matters as environmental issues of global scale, the concept of 'home planet' from which all of us come will become a very important concept.

“Going beyond the frameworks of countries or regions, I believe that our industry, which is constantly thinking about the role it should fulfil, shares the same aspirations as international space exploration. Furthermore, cars are used in all of Earth’s regions; and in some regions, cars play active roles as partners for making sure that people come back alive. And I think that coming back alive is exactly what is needed in this project. I am extremely happy that, for this project, expectations have been placed on the thus-far developed durability and driving performance of Toyota vehicles and on our fuel cell environmental technologies.”

At a symposium held today in Tokyo, JAXA Vice President Koichi Wakata and Toyota Executive Vice President Shigeki Terashi held a talk session, excerpts from which are given below.

1 A conceptual study for a manned, pressurised rover, jointly pursued by Toyota and JAXA since May 2018, based on a co-operation agreement.

2 As envisioned in this project, a vehicle that has an enclosed body equipped with functions and space that enable astronauts to live in the vehicle for fixed periods without wearing spacesuits, that allows ingress and egress while wearing spacesuits, and that makes sustainable mobility on the surface of a moon or planet possible by way of astronaut operation, remote operation or autonomous driving.

### **Comments by JAXA Vice President Koichi Wakata**

"At JAXA, we are studying various scenarios as well as technologies that will be applied to specific space missions. Manned, pressurised rovers will be an important element supporting human lunar exploration, which we envision will take place in the 2030s. We aim at launching such a rover into space in 2029.

"Lunar gravity is one-sixth of that on Earth. The moon has a complex terrain with craters, cliffs, and hills. Moreover, it is exposed to radiation and temperature conditions that are much harsher than those on Earth, as well as an ultra-high vacuum environment. For wide-ranging human exploration of the moon, a pressurised rover that can travel more than 10,000km in such environments is a necessity. Toyota's 'space mobility' concept meets such mission requirements. Toyota and JAXA have been jointly studying the concept of a manned, pressurised rover since May 2018.

"Thus far, our joint study, has examined a preliminary concept for a manned, pressurised rover system, and we have identified the technological issues that have to be solved. Going forward, we want to use Toyota’s and JAXA's technologies, human resources, and knowledge, among others, to solve those issues.

"International space exploration is a challenge to conquer the unknown. To take up such a challenge, we believe it is important to gather our country's technological capabilities and engage as 'Team Japan'. Through our collaboration with Toyota as the starting point, we can further expand the resources of 'Team Japan' in the continued pursuit of international space exploration."

### **Comment by Toyota Executive Vice President Shigeki Terashi**

"As an engineer, there is no greater joy than being able to participate in such a lunar project by way of Toyota's car-making and, furthermore, by way of our technologies related to electrified vehicles, such as fuel cell batteries and our technologies related to autonomous and automated driving. I am filled with great excitement.

"Fuel cells, which use clean power-generation methods, emit only water, and, because of their high energy density, can provide a lot of energy, making them especially suited for the project being

discussed with JAXA.

"Toyota believes that achieving a sustainable mobility society on Earth will involve the co-existence and widespread use of electrified vehicles, such as hybrid electric vehicles, plug-in hybrid electric vehicles, battery electric vehicles, and fuel cell electric vehicles. For electrification, fuel cell batteries represent an indispensable technology.

"Fuel cell electric vehicles have the ability to emit reduced amounts of harmful substances, such as particulate matter, that are found in the air they take in. As such, they are characterised by having so-called 'minus emissions'<sup>3</sup>. We want to further improve on this characteristic.

"Contributing to Earth's environment cannot be achieved without the widespread use of electrified vehicles. As a full-line manufacturer of electrified vehicles, and aiming for the widespread use of such vehicles, Toyota – going beyond only making complete vehicles – wants to provide electrification to its customers in various forms, such as through systems and technologies.

"Our joint studies with JAXA are a part of this effort. Being allowed to be a member of 'Team Japan', we would like to take up the challenge of space."

3 Fuel cell electric vehicles reduce particulate matter in the air they take in by way of a filter and supply the resulting cleaner air to their fuel cell batteries, emitting only water and surplus air.

### **Pressurised rover concept proposal**

- Length 6.0m, width 5.2m, height 3.8m (about the size of two minibuses/small coaches)
- Living space 13m<sup>3</sup>
- Capable of accommodating two people (four in an emergency).

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