

Technology Development and Solar System Exploration Strategy at JAXA

Junichiro Kawaguchi[1]

[1] JAXA/ISAS

What the Hayabusa spacecraft successfully demonstrated the touching down and landing for sample collection at Itokawa last November, it begged and intrigued the Japan's planetary scientists' enthusiasm to have a next mission. Japan now has its own technology for acquiring the extra terrestrial sample in its hand. This presentation briefly looks and gives a perspective on how Japan's solar exploration is pursued and will elaborate the author's view about what JAXA and Japan should work out for it.

The objective of the solar system exploration is simply to understand the Earth itself. It also includes the expansion of our knowledge on the origin of life and on the resources potentially available in future. Since the human being acquired the transportation means making artificial probes fly directly to the intended celestial objects, the planetary exploration immediately started, when it was even in 1950s. The planetary flight is categorized into several distinct steps, among which the last step is the most difficult one, in which the spacecraft collects some sample of the surface and returns it back to Earth. This is a round trip flight designated 'Sample & Return'. What Hayabusa demonstrated is this last step and put JAXA at the front line of the world's deep space exploration race.

Japan's planetary exploration began by Sakigake and Suisei launched in 1985 toward the comet Halley, participating the international fleet for it. It was not intended but inevitable that Japan targeted primitive small objects such as comets and asteroids, since larger neighboring objects represented by Venus, Mars and others had been already explored by many probes of US and USSR. However, in other words, the most important scientific theme that discloses the clues on the early solar system was left unanswered. In parallel with this approach, Japan has distilled the magnetosphere physics study around the Earth and attempted to extend the skill to the Mars via Nozomi launched in 1998. Unfortunately Nozomi failed to be on orbit around Mars, but it did contribute to brushing the planetary spacecraft design skill, which was applied to Hayabusa. As this history indicates, and also in view of the complementary space development status, Japan's solar system exploration may well concentrate to both primitive bodies and aeronomy / magnetosphere observation. This strategy at the same time is recognized as comprehensively viewing neighboring region around the Earth mostly.

The solar system exploration will expand and a new era is sure to come soon. Sample and return from main asteroids belt and outer solar system exploration will be envisioned, when the Propulsion and Power Revolution occurs. Solar power is available probably within asteroids main belt or Jupiter's distance, however, setting sail beyond Jupiter must make use of nuclear reactor power instead. This revolution does come some day and a new grand voyage era surely comes soon.

JAXA is currently building a new strategy to conduct the solar system exploration along with the Moon. The strategy combines the missions based on the established schemes with the challenging missions that may result in ultra-high scientific return while the risk mitigation is not complete owing to highly sophisticated functions. JAXA may build another Hayabusa for the completion of the Sample and Return from an asteroid. As for the aeronomy, JAXA schedules to launch the PLANET-C to Venus several years ahead. Those are run together with the missions to the Moon as the established missions. In addition to these, JAXA plans to have a Mercury orbiter in Bepi-Colombo program and is presently figuring out a Jupiter orbiter mission transported by its cutting-edge technology, the Solar Electric Sail spacecraft that uses combined hybrid propulsion of solar photon and electric propulsion.