On the cutting edge technology enabling the challenging missions to asteroids and comets, our primitive neighbors

J. Kawaguchi[1]

[1]Japan Aerospace Exploration Agency (JAXA)

The world's first sample-and-return mission from an object orbiting outside the sphere of influence of the Earth was successfully performed through Hayabusa in 2010, an engineering demonstration mission of JAXA. And it was followed by another technology demonstrator, Ikaros, the world's first solar-sail mission launched in 2010, the same year of the Hayabusa return. These two demonstrations represent the significance of the technology development that shall precede the real science missions that will follow. The space-exploration community focuses its attention on the use of asteroids and comets as one of the most immediate destinations. Humans will perform voyages to those objects sooner or later. And we will initiate a kind of research as scientific activity for those objects. The missions may include even sample-and-return missions to those bodies for assessing the chance of possible resource utilization in future. The first step for it is, needless to say, science. Combining the sample-and-return technology using the ultra-high-speed reentry for sample recovery with the new propulsion system using both electric and photon force will be the direct conclusion from Hayabusa and Ikaros. And key elements such as autonomy are also among the essential factors in making the sophisticated operation possible around asteroids and comets avoiding the communication difficulty. This presentation will comprehensively touch on what those technology skills are, and how they are applicable to the subsequent new missions, from the mission leader's point of view. They are probably real requisites for planning brand-new innovative challenges in the ACM community.

Figure: Cutting-edge technology, capsule and sail, represented by Hayabusa and Ikaros – and their successors.