

## IAF SPACE SYSTEMS SYMPOSIUM (D1)

Lessons Learned in Space Systems: Achievements, Challenges, Best Practices, Standards. (5)

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JAXA'S SYSTEMS ENGINEERING/PROJECT MANAGEMENT REFORMS AND BEST PRACTICES  
IN HAYABUSA2 MISSION**Abstract**

JAXA's systems engineering/project management (SE/PM) capability was significantly strengthened through an improvement for mission success that involved an organizational overhaul considering a series of mission failures that occurred from the late 1990s to the early 2000s. The establishment of a Systems Engineering Organization (SEO), clarification/standardization of rules and processes for SE/PM, the establishment of pre-project teams to strengthen front-loading, strengthening of independent evaluations for project activities, and enhancement of SE/PM training and education were included in the measures. Since 2005, the occurrence rate of mission failures has decreased significantly for a while.

Following the loss of a flagship mission during its initial phase in orbit in 2016, an overall inspection of project operations was conducted, resulting in another significant revision of SE/PM in 2017. At that time, the ambiguity in the division of responsibility and jurisdiction between the prime manufacturer and JAXA was identified as one of the significant background factors of the accident. As a result, enhancement of the front loading before the project's implementation phase, and a principle of contracting the procurement of launch vehicles and satellites to the prime manufacturer in the implementation phase were established. Five years have passed since this revision, and the issues are becoming apparent little by little.

Within this context, the development of a Japanese asteroid sample return probe "Hayabusa2" began in 2012 and launched on December 3rd, 2014. It arrived at asteroid 162173 Ryugu on June 27th, 2018. Overcoming the asteroid's extremely rough terrain, the probe achieved two successful touchdowns to collect the asteroid's soil on February 21st and July 11th, 2019. The probe departed from the asteroid in late 2019 and returned to the Earth on December 5th, 2020. The re-entry capsule was safely retrieved in

South Australia, and the unexpected amount of asteroid soil samples was confirmed inside. The probe is now on another journey targeting a fast-rotating near-Earth asteroid 1998KY26 arriving in 2031.

The success of Hayabusa2 left many positive lessons learned in terms of SE/PM (e.g., system design and SE management plans that maximized the use of heritage, real-time operation training, and hybrid development process of operation procedures). In this paper, the history of SE/PM at JAXA will be reviewed at the beginning, and the issues that have emerged since the 2017 revision will be introduced. Then Hayabusa2's best practices will be presented in detail, and the paper will be concluded.