Conceptual Design and Development Plan of Sample Return Capsule for CAESAR (Comet Astrobiology Exploration Sample Return)

*Kazuhiko Yamada[1], Shun Okazaki[1], Yasutaka Satou[1], Yusuke Maru[1], Tatsuro Nakao[1], Akio Kukita[1], Toshihiko Yamawaki[1], Takayuki Shimoda[1]

1. Japan Aerospace Exploration Agency

NASA selected two finalist missions for next new frontiers program in December 2017. One of these is CAESAR (Comet Astrobiology Exploration Sample Return) mission, which will return nonvolatile and volatile material from comet 67P/Churyumov-Gerasimenko. JAXA's researchers, engineers and Japanese scientists also collaborate on the concept study and the preparation of proposal documents for CAESAR mission. JAXA is responsible for the development of the sample return capsule (SRC) subsystem in CAESAR mission. CAESAR requires the SRC to survive a severe aerodynamic and aerothermal environment during a direct reentry form interplanetary orbit. Additionally, CAESAR's SRC has to keep the comet's sample in low temperature and to carry a large payload system. The conceptual design of SRC was already conducted to fulfill these mission and system requirements. The CAESAR SRC is designed based on the Hayabusa SRC, which succeeded in returning the samples from asteroid Itokawa. The Hayabusa SRC can survive in the severe aerodynamic heating condition with a reentry speed of 12km/s and jettison the heated heat shield in descent phase. These technical achievements are desirable for the CAESAR mission. Especially, the jettison of the front heat shield is indispensable to prevent the heating the payload due to heat soak back. However, CAESAR's SRC has to be scaled up from Hayabusa SRC in order to install the large payload. Additionally, two-stage parachute system is necessary for the CAESAR SRC to decelerate the large SRC efficiently. Development of CAESAR's SRC to return a large payload and keep it in low temperature is a significant technical challenge. However, these capabilities will enable a wide range of future sample return missions. In this paper, the concept design and development plan of the CAESAR SRC is introduced.

Keywords: CAESAR, Comet sample return, Sample return capsule

