

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – missions current and future (3A)

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DEVELOPMENT OF JAPANESE MARS AIRPLANE

Abstract

Mars is the next milestone in our exploration of the solar system. The presence of an atmosphere on Mars signifies that an airplane could travel in its atmosphere using the aerodynamic forces of flight. The airplane allows for a platform that can cover a larger area of exploration than is currently available. A reconnaissance airplane offers the possibility to obtain high-resolution data on a regional scale of several hundreds to thousands of kilometers, which cannot be achieved with rovers or satellites. There is an extremely high demand for the exploration of Mars using an airplane that can fly in its atmosphere. One of the big problems for a Mars Airplane is the very low atmospheric density on Mars. So, it is difficult to obtain the required lift, as the wing area required to generate enough lift is inversely proportional to the density. So in order to reduce the required lift, thorough weight reduction is needed. Even so, a Mars Airplane needs a large wing area, which leads to another problem. To transport to Mars, a Mars Airplane must be small and compact. As a way to solve this conflicting problem, the Mars Airplane needs some deployment mechanisms. Various hurdles, including those described above, must be overcome in order to realize the flight exploration of Mars and all of them require innovative technological solutions. Hence, the Mars Airplane Working Group was established in 2010 with the aim of conducting flight technology validations for the MELOS1 mission using a compact airplane in JAXA/ISAS. The working group aims to realize Mars exploration using an airplane for the first time ever. At present, the mission being considered for the Mars exploration plane is “flying over a range of about 100 km to capture ground surface images and observing high-resolution images of residual magnetic fields.” Cameras and magnetic field observation equipment are mounted as payloads on the airplane, which is expected to fly over a range of 100 km at a speed of 60 m/s. In the conceptual design, the weight of the airplane is about 4.0 kg, the span length is about 2.5 m, and the total length is about 2.0 m. This paper provides a summary of the Mars airplane development being considered by the working group in Japan and discusses the technical issues addressed in order to realize a Mars airplane.