

Japanese Mars Airplane

-Creation of new vehicles for planetary exploration-

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Mars is a significant milestone in our exploration of the solar system. An atmosphere on Mars indicates that an aircraft could navigate its atmosphere using aerodynamic forces. The airplane offers a platform that enables exploration over a larger area than is currently feasible. The airplane provides the opportunity to gather high-resolution data on a regional scale spanning hundreds to thousands of kilometers, surpassing the capabilities of rovers or satellites. The demand for Mars exploration utilizing an airplane capable of flight in its atmosphere is exceptionally high.

One major challenge for a Mars airplane is the extremely low atmospheric density on Mars. This poses difficulties in achieving the necessary lift, as the wing area required for generating sufficient lift is inversely proportional to the density. For this reason, significant weight reduction measures are essential. However, a Mars airplane still requires a large wing area, leading to another predicament. The Mars airplane must be small and compact to facilitate transportation to Mars. Deployable mechanisms are necessary to resolve this conflicting issue for the Mars airplane.

Overcoming various challenges, including those mentioned above, necessitates innovative technological solutions to realize Mars flight exploration. Therefore, in 2010, the Mars airplane Working Group was established by JAXA/ISAS and Tohoku University with the participation of various universities, with the main objective of realizing the first airplane-based Mars exploration.

Currently, the mission under consideration for the Mars exploration plane involves flying over an approximately 100 km range to capture ground surface images and observe high-resolution images of residual magnetic fields. Cameras and magnetic field observation equipment will be installed as payloads on the airplane, which is expected to fly at 60 m/s over the designated range. In the conceptual design, the airplane's weight is estimated to be around 4.0 kg, with a span length of approximately 2.5 m and a total length of about 2.0 m.

This presentation will provide an overview of the Mars airplane development contemplated by the Japanese working group, the technical challenges to be addressed for realizing the Mars airplane, and the planned demonstration flight test to be conducted at high-altitude on Earth.