



Orbital Design for Solar System Exploration / Space Education through CubeSat Development

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● Research Outline

Characterization of aero-gravity assisted trajectory

In the present solar system exploration, gravity assist, the so-called swing-by is an essential orbital technology. However, the magnitude of acceleration (or deceleration) obtained by gravity assist has a limit. Therefore, prior to the arrival of the age of the solar system navigation, development of orbital technology to go to a more distant object more quickly is expected.

One of the new orbital techniques is aero-gravity assisted trajectory. This is a way to increase the acceleration by daringly passing through the planetary atmosphere when carrying out gravity assist. However, atmospheric drag and attitude control accompanying atmospheric flight are a major task for realization. In order to solve this problem, it is proposed to adopt the waverider shape under study in the aviation field as the shape of the spacecraft. In this study, usefulness of aero-gravity assisted trajectory will be examined from a composite viewpoint such as astrodynamics, aircraft dynamics and aerodynamics (Fig. 1, Fig. 2).

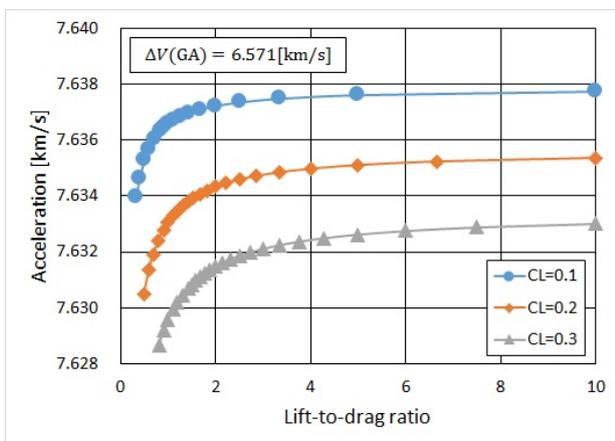


Fig. 1 The magnitude of acceleration obtained by aerogravity assist using the Earth. This result is calculated by the 3 degrees of freedom flight simulation. And the result shows the aerogravity assist has the advantage for acceleration compared with conventional gravity assist.

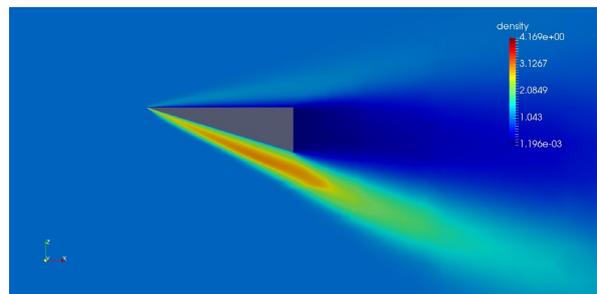


Fig. 2 Hypersonic flow around the waverider (trial calculation). This result is obtained by CFD tool FaSTAR which is developed by Japan Aerospace eXploration Agency (JAXA).

Space Education through CubeSat Development

There is KOSEN Space Collaboration composed of researchers in the space field at the National Institute of Technology. This group is developing 2U CubeSat with the goal of launching the first micro satellite by National Institute of Technology. In addition, Space education for students through CubeSat development is being carried out. Especially at National Institute of Technology, Gifu College, CubeSat models for space education are being developed with student (Fig. 3).



Fig. 3 Model rocket class in the KOSEN space camp 2017. Model rocket license can be acquired by this course.