

Preliminary design of visualization tool for Hayabusa operation and 25143 Itokawa

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Hayabusa, one of the engineering missions at ISAS (Institute of Space and Astronautical Science), was launched in May 2004. Hayabusa is now accelerated by ion engines. It will approach to the asteroid by optical navigation and obtain some samples from its surface to bring back to the Earth over the atmosphere. The main aim of the mission is to acquire and verify the technology required for a sample-return mission [1]. Another scientific objective is to find clues on primitive materials for planets or asteroids.

Hayabusa will arrive at the target asteroid (25143) Itokawa this autumn. Observation phase consists of eight periods: cruising phase (CP), approach phase (AP), gate position (GP), home position (HP), extended observational transition (XT), high phase angle observation (XO), terminator observation (TO), and touch down (TD). Remote sensing observation such as telescopic multicolor camera AMICA, near-infrared spectrometer, fluorescence X-ray spectrometer, and laser range finder, will be put into operation in each phase. Almost all of images for shape modeling will be taken in GP. In addition, we intend to get images distinguish more detailed geologic context in XO and TO.

The size of the spacecraft is about 1 meter, and solar panel is about 3 meters. It involves the risk to touch down on rough surface, whose degree of roughness is about the size of Hayabusa. Three-dimensional map is required for recognizing the roughness map in 103 m resolution on about 10 meter polygons of asteroid's shape model. The goal of this study is to develop a tool to project some data on an irregular shaped model.

The main libraries to implement the tool are SPICE toolkit [2] and glut (OpenGL Utility Toolkit) [3]. Footprint, calculated using SPICE toolkit [2], gives us the information of the border of the field of view of an instrument projected onto a surface. To calculate the footprint, relative position information will be used as an input data. This visualization tool will be implemented by expending HARMONICS (HAYabusa Remote MONItoring and Controlling System) to make a plan of operating Hayabusa.

[1] http://www.jaxa.jp/missions/projects/sat/exploration/muses_c/index_j.html

[2] <http://naif.jpl.nasa.gov/naif/pds.htm>

[3] <http://www.xmission.com/>