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MISSION PLAN OF STARS-X MICRO SATELLITE FOR DEMONSTRATION OF SPACE TETHER
TECHNOLOGY FOR DEBRIS CAPTURE

Abstract

The microsatellite STARS-X is the demonstration theme of “Innovative satellite technology demonstration -3” by the Japan Aerospace Exploration Agency (JAXA). The adopted theme is “Technical demonstration of debris capture using space tether technology”. STARS-X is a 50kg class satellite, which is a large satellite compared to the previous STARS project satellites. Three main missions are planned for STARS-X. The first is to extend the tether for 1km based on our experienced tether extension technology. Tethered satellites are expected to have many applications, such as approaching space debris, space transportation, orbit altitude change, and electrical power generation. Second, the tether system is controlled by moving the robot (climber) on the tether. It is possible to control the position of the tethered satellites and the climber, and it is expected to be a technology for approaching space debris with low fuel consumption and high precision, and also it can also be applied to technology to avoid collisions with another spacecraft. The third is a debris capture experiment using a net. The tether extension uses the method of stabilizing in the direction of the earth by using the gravitational gradient force due to the gravity and orbital motion. The tether extension mechanism adopts the one that can be extended and retracted by the drum reel. Considering recent debris problems and to expand the use of tethers under such current debris condition, winding an extended tether is very important. After the tether system is stabilized by gravity gradient, the robot (climber) is moved along the tether. As the mass (climber) moves on the tether in a stable condition of the gravity gradient, forces other than the extension direction of the tether acting on the mass is generated due to orbital motion and Coriolis act on the mass. As a result, the state of the entire tether system is expected to be changed, that is, the positions of the mother, daughter and grandchild (climber) satellites. Our objective is to control the entire tether system by climbers moving on tether. And then, a debris (space junk) capture demonstration experiment is performed using a net. Dummy debris is released from its own satellite and captured by a net deployed from its own satellite. Ground microgravity experiments have been carried out for debris capture missions using a net. In this report, the above missions, including the details of ground experiments have been described.