Paper ID: 30705
oral

66th International Astronautical Congress 2015

22nd IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Satellite Operations (3)

Author: Prof. Masahiro Nohmi
Shizuoka University, Japan, nomi.masahiro@shizuoka.ac.jp

MISSION PAST RESULTS AND FUTURE PLANS OF SPACE TETHERED AUTONOMOUS ROBOTIC SATELLITE STARS

Abstract

STARS (Space Tethered Autonomous Robotic Satellite) project purposes to evaluate and to verify a space mechanical control system by a university satellite, whose characteristics are: it consists of a mother and a daughter (and grandchildren in future) satellites; it becomes a large scale space system using tether; and also robotic mechanical system performs dynamic motion on orbit. The project developed and launched two satellites and one sounding rocket, and is now developing a 2U cubesat. The first satellite of the project was "STARS," which was launched by the H-IIA rocket on 23, January, 2009. It was a mother-daughter satellite, a tethered satellite, and also a robotic satellite. These three main characteristics have been evaluated and verified successfully on orbit, though attitude control for a tethered space robot could not be performed due to shorter tether extension than expected. On 31, August, 2010, TSR-S (Tethered Space Robot -S) was launched by the sounding rocket S-520-25 from Uchinoura Space Centre. One of S-520-25 experiments is for a tethered space robot. The proposed attitude control approach for disturbances suppression and change of the desired attitude for a tethered space robot have been evaluated and verified. The second satellite of the project was "STARS-II," which was launched by the H-IIA rocket on 28, February, 2014. It was also a mother-daughter satellite, a tethered satellite, and a robotic satellite as well as STARS. However, tether was 300m long (5m long on STARS) and Electro Dynamic Tether (EDT). 300m tether deployment was evaluated by orbital altitude change, though telemetry data from the satellites was not sufficient. Currently, the project is developing "STARS-C", which will be deployed into orbit from ISS (International Space Station) in 2016. It is a 2U Cubesat, and one is a mother and the other is a daughter satellite. They are connected by 100m long Kevlar tether. Its primary purpose is to analyze basic tether dynamics motion on orbit experimentally. The goal of the project is to perform two kinds of missions. One is space debris removal as following scenario: a tethered space robot captures a space debris, and the captured debris is transferred to re-entry orbit by Lorentz force using EDT. The other is orbital space elevator, which can be applied to orbital transportation, transfer, and the first step for space elevator to Geo Situational orbit. This paper describes past mission results, future mission plans, and also future practical missions.