Space Experiment of Bare Tape-Tether Technology on the Sounding Rocket S520 the 25th

By Hironori A. FUJII[1),2)], Takeo WATANABE[3)], Tairo KUSAGAYA[2)], Hirohisa KOJIMA[3)], Koh-Ichiro OYAMA[4)], Susumu SASAKI[4)], Kohji TANAKA[4)], Takumi Abe[4)], Manabu SHIMOYAMA[4)], Yoshiki YAMAGIWA[5)], Hirotaka OHTSU[5)], Mengu CHO[6)], Koki KASHIHARA[6)], Toru HADA[7)], Juan R. Sanmartin[8)], M. Charro[8)], Alain Hilgers[9)], Jean-Pierre Lebreton[9)], Erick J. van der Heide[10)], Michiel Kruijff[10)], Fabio De Pascale[10)], John Williams[11)], Binyamin Rubin[11)], Charles Les Johnson[12)], George V. Khazanov[12)], and Pavel M. Trivailo[13)]

Keywords - *Sounding Rocket, Tether technology, Space experiment, Hollow cathode*

Two projects are introduced to verify the performance of space tether technology. The sounding rocket S520 the 25th will be launched on the summer of 2009 to deploy a bare electro-dynamic tape tether with length 300m. The other project to verify the space tether technology is a small satellite to deploy bare electro-dynamic tape tether with 25km in length and is expected to be launched on 2013. These verifications of tether technology will lead a large numbers of applications of space tether technology. The space tether technology is indispensable in constructing and also maintaining large space structures, which are designed for future space development including the solar power satellite and deep space exploitation.

A verification of tether technology will be conducted on a sounding rocket, S520-25 to be launched on August of 2009 by ISAS/JAXA. The object of the projects is to verify the bare electro-dynamic space tether technology, which is believed to be useful in our future space development from both of the scientific and engineering aspects. The tether will be deployed in its length through 300m in a few minutes (Fig.1).

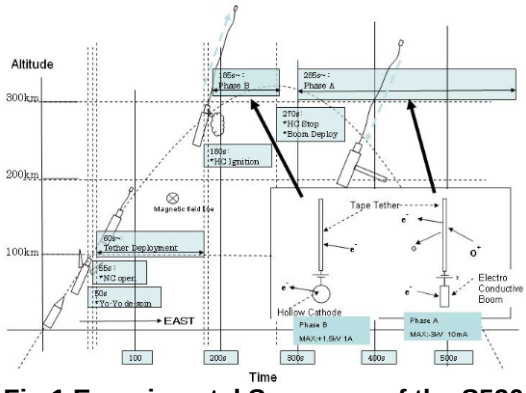

Fig.1 Experimental Sequence of the S520-25

[1)]Kanagawa Institute of Technology/Nihon University, Japan, [2)]TMIT & Co., Ltd, Japan; [3)]Tokyo Metropolitan University, Japan; [4)] ISAS/JAXA, Japan, [5)] Shizuoka University, Japan; [6)]Kyusyu Institute of Technology, Japan; [7)]Kyusyu University, Japan; [8)]Unversidad Politecnica de Madrid; [9)]ESA, Europe; [10)]Dealta-Utec,SRC, Netherlands; [11)]Cololado State University, USA; [12)]NASA/MSFC, USA, [13)]Royal Melbourne Institute of Technology, Australia.

The two object studied in this proposal are apparently two major indispensable technologies both in the scientific and engineering aspects and will play important roles in the course of the space development. The present proposal is to verify the fundamental technology for such important tether technology as deployment and use of bare conductive tether in space. The other of the two objectives of the present proposal is the scientific study to incorporate the conductive tether by employing an Aluminum bare tape tether. A conductive tether opens unique opportunities for science that are not limited to testing OML collection under orbital conditions and generating convenient electron beams. The project is a European/ American/ Australian/ Japanese International Sun-Tower Campaign.

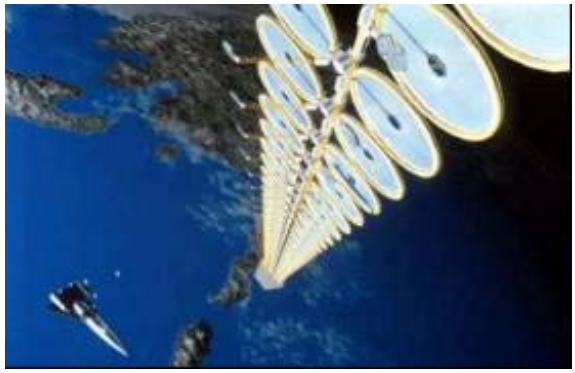

Fig.2 Solar power satellite

The sounding rocket experiment could be extended to a low cost LEO mission of a small satellite with an electro-dynamic tether. These demonstrations will extend many useful methods of employment of the bare electro-dynamic tether including engine to increase/decrease orbit, supplier of electricity, spring-shot, and lifter for payloads. The objective is to verify the two fundamental and important aspects of the tether technology: One is the orbit elevation without using fuel, and the other is the Alfven wave experiment. A tether could generate controllable nonlinear Alfven wave fronts in space that are of interest as regards fronts of the solar wind with Earth, Jupiter, or comets. In the engineering mission, thrust or drag could be applied by the electro-dynamic tether on space structures without using fuel mass and the orbit elevation without any fuel is an object of interest for persons in the space Institutions.

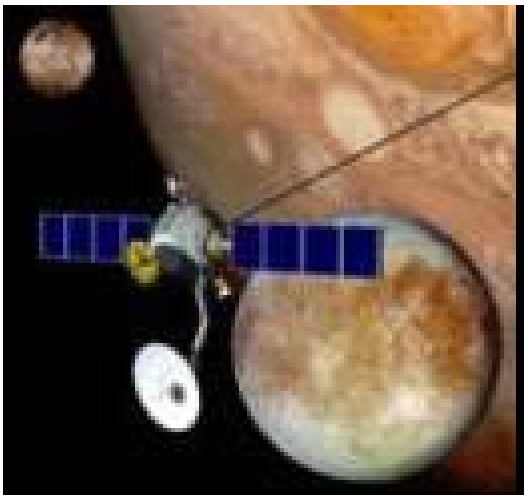

Fig.3 lunch free tour satellites

The drivers for the electro-dynamic tether underlie in the low cost, simple mission concept, and fast realization possibility. The application includes a number of interesting and useful operation of space tether technology including, elevation of orbit of the International Space Station without consuming fuel and the solar power satellite (Fig.2). The demonstration will also be very effective to examine the possibility of the rotating electro-dynamic tether to Jupiter mission application to enable simple entry into the atmosphere of the Jupiter, or lunch free tour to Saturn satellites (Fig.3). It may be noted that de-orbiting of defunct satellites is indispensable for our future space to reduce the numbers of debris indicating one of the commercial applications. These demonstrations will extend many useful employment of the bare electro-dynamic tether. The success of two international campaigns by Europe, United States, Australia and Japan on space tether experimental projects presented will bring new era of the electro-dynamic tether technology to a number of useful space applications in our near future.