ASTRODYNAMICS SYMPOSIUM (C1)
Interactive Presentations (IP)

Author: Mr. Kazuki Yokota
NEC Corporation Space Systems Div., Japan

Dr. Toshio Kamiya
NEC Corporation Space Systems Div., Japan
Mr. Kazuhisa Tanaka
NEC Corporation Space Systems Div., Japan
Mr. Yasuhiro Kusakawa
NEC Corporation Space Systems Div., Japan
Mr. Atsushi Hori
NEC Corporation Space Systems Div., Japan
Dr. Shin-ichiro Sakai
Japan Aerospace Exploration Agency (JAXA), ISAS, Japan
Mr. Yusuke Ota
University of Tokyo, Japan

AOCS DESIGN AND ON-ORBIT PERFORMANCE OF ARASE/ERG SATELLITE

Abstract

This paper presents the outline of attitude and orbit control system (AOCS) of ARASE (ERG: Exploration of energization and Radiation in Geospace) satellite and on-orbit performances of the initial critical phases.

ARASE is a spin-stabilized scientific satellite of JAXA. This project aims at elucidating how highly charged electrons have been born while they generate and vanish repeatedly along with space storms caused by the disturbance of solar wind caused by space storms, and how space storms are developed. ARASE has been launched by Epsilon-2 on December 20 2016 and successfully completed the initial critical operational phases including sun acquisition, perigee-up maneuvers, and extension of its wire and mast antennae. NEC Corporation has conducted development of the satellite bus system and integration as prime contractor. Also we have supported its flight operation and evaluation.

We developed the bus system of ARASE based on a standard satellite bus platform which is applicable to various missions such as earth observation and astronomy. ARASE was required a lot of specific functions to realize the spin-stabilized satellite configuration, therefore we optimized the standard bus architecture and the basic functions of the standard bus platform. Regarding the AOCS design of ARASE, spin nutation is controlled by either active nutation control (ANC) by thruster or passive nutation control by silicon damper, and the direction of the spin-axis is controlled by Rhumb line method. Firstly, we introduce the outline of AOCS design including configuration, operation modes, and operation sequences. Next, we present the design and simulation results of main functions which are sun acquisition (including flat-spin recovery algorithm), perigee-up maneuvers, and extension of wire and mast antennae, as well as their on-orbit performances. Also we present the major development issues such as MOI management and space qualification of commercial off-the-shelf (COTS) MEMS gyros.