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DEVELOPMENT PHILOSOPHY AND FLIGHT RESULTS OF ARC EVENT GENERATOR AND INVESTIGATION SATELLITE HORYU-IV

Abstract

HORYU-IV satellite is the fourth satellite in the HORYU series to be developed at Kyushu Institute of Technology and the second satellite of the series to be piggy-back launched on H-IIA. The first to be launched was HORYU-II in May 2012, which successfully demonstrated the feasibility of generating 350V in low Earth orbit. HORYU series are categorized as lean satellites. A lean satellite is a satellite that utilizes non-traditional, risk-taking development and management approaches – with the aim to provide value of some kind to the customer at low-cost and without taking much time to realize the satellite mission. HORYU series satellites are dedicated to spacecraft charging and high voltage experiments which are not always welcomed as payloads on a shared platform due to concern over disturbance caused by discharge. Lean satellites are ideal testing platforms for those risky experiments. HORYU-IV is a cubic satellite within an envelop of 450mm x 420mm x 430mm and weighs approximately 10kg. Its structure and bus are mainly inherited from HORYU-II with various improvements in functionality and reliability. Especially, many layers of power cycle reset against single event effects were implemented. HORYU-IV implements HORYU-II high voltage photovoltaic power generation technology and uses it to study discharge phenomena. HORYU-IV's main mission is to acquire an arc current waveform by an onboard oscilloscope and capture its image by a camera triggered by the oscilloscope. In addition, HORYU-IV plans to carry out scientific experiments on arc-mitigation high voltage solar array, plasma measurement using a double Langmuir probe, vacuum arc thruster, photoelectron current measurement, and polymer material degradation. HORYU-IV project started in Mary 2013 and the flight model was delivered to JAXA in January 2016. On February 17, 2016, it was successfully launched by a H-IIA rocket to an orbit of 575 km altitude with 31o inclination as a piggyback satellite. The operation strategy was to carry out the main mission as soon as possible after the launch considering the high infant mortality rate of lean satellites. After initial check of the satellite house keeping data, the main mission was executed and the preliminary result indicates the mission was successfully conducted. It is planned to operate the satellite for at least two years in orbit. At the time of symposium, overview of the satellite, especially its development philosophy as a lean satellite, will be given along with some preliminary flight results obtained during the eight months in orbit.