

NPSAT1 ACS Hardware-in-the-loop Simulation

Introduction

NPSAT1 is a low-cost, technology demonstration satellite hosting a number of experiments. Commercial, off-the-shelf (COTS)-based technology will be implemented with custom designs to offer a low-cost command and data handling (C&DH) subsystem building on commercial, desktop PC architecture and standards-based specifications. In addition to an experimental C&DH subsystem, NPSAT1 will demonstrate the use of non-volatile ferroelectric RAM which is inherently radiation-tolerant and lithium-ion polymer batteries, state-of-the-art technology that will be employed offering high energy density (Watt-hr/kg) for space applications.

Experiments on-board NPSAT1 include two Naval Research Laboratory (NRL) payloads. The coherent electromagnetic radio tomography (CERTO) experiment and a Langmuir probe. The CERTO experiment is a radio beacon which, in concert with ground station receivers, is used to measure total-electron-content (TEC) in the ionosphere. The Langmuir probe will augment CERTO data by providing on-orbit measurements. The other experiments are of NPS origin. These include a novel design for a spacecraft computer board, a COTS visual imager (VISIM), and some micro-electromechanical systems (MEMS)-based rate sensors.

Description of Thesis Topic

One of the experiments aboard NPSAT1 is the MEMS-based rate sensors. A follow-on study is needed to test and characterize the flight rate sensors. This includes modifications to the current test setup and defining the flight requirements, and performing design of the sensor operation, including error analysis.

Proposed Outline

- NPSAT1 Introduction
- MEMS Rate Sensor Description
- Test Plan and Setup
- Flight Article Design and Operation
- Conclusions & Recommendations
- Appendix of Test Results and Test Data

Suggested References

- MS Thesis by LT Seiko Okano
- *Microengineering Aerospace Systems*, H. Helvajian, editor, The Aerospace Press / and AIAA, 1999.
- Product literature (Systron-Donner QRS11 Rate Sensor)