T0083-S Design and Development of a Microsatellite Attitude Control System (MSACS)

Problem Statement

- MSACS project aims at advancing the state of the art in attitude control systems by developing a novel momentum management system.
- Flight opportunity provides a critical mechanism for technology maturation by demonstration of prototype MSACS components.
- Potential users include, NASA, Air Force and Commercial Aerospace Corporations for Attitude Control, Robotics and Precision Pointing.

Technology Development Team

- Manoranjan Majji, Assistant Professor, University at Buffalo – State University of New York, mmajji@buffalo.edu.
- NASA Langley Research Center (Program Officer: Dr. Ron Litchford) is currently funding this effort under an NRA.
- Potential future collaborators include: Virgin Galactic and U.S. Air Force.

Proposed Flight Experiment

Experiment Readiness:

- March 2014

Test Vehicles:

- Vehicles of the class of Virgin Galactic's Space Ship Two (SS2) or XCOR Aerospace's Lynx vehicle.

Test Environment:

- A test article consisting of a constrained spacecraft system is employed to demonstrate the attitude in a zero gravity environment.

Test Apparatus Description:

- The test article consists of a microsatellite structure suspended about a point by using a rigid aluminium rod, making it act as a spherical pendulum. Suspension point is equipped with two encoders that measure the azimuth and elevation degrees of freedom of the article.
- The rigid rod reduces the degrees of freedom of the spacecraft and we require only one momentum wheel mounted on the Canfield joint to control the azimuth and elevation of the spacecraft. Successful demonstration of the control of azimuth and elevation shows the effectiveness of the novel momentum exchange device developed by the PI's team..
- A CAD model of the test article is shown in Fig 1.

Technology Maturation

- Flight test of a single Canfield Gimbal is important to demonstrate the utility of the MSACS technology.
- To achieve TRL > 6, it is anticipated that .
- State the deadline, if any, to mature the technology to TRL 6 or higher.

Objective of Proposed Experiment

- Use flight tests to advance TRL of the MSACS technology.
- Flight data will be used to evaluate the performance of the control system and induce design changes for advancement of the TRL.

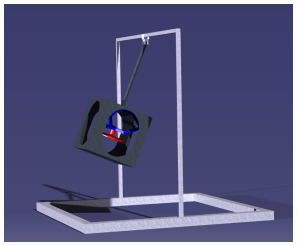

Fig. 1 CAD model of the test article

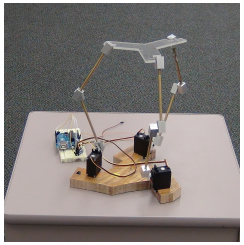

Fig. 2 Prototype Canfield Joint

Applicable Technology Areas: TA03, TA04, TA08 and TA12

7/2013