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MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

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RESULTS OF REXUS12'S SUAINEADH EXPERIMENT: DEPLOYMENT OF A SPINNING SPACE WEB IN MICRO GRAVITY CONDITIONS

Abstract

On the 22nd of March 2012, the Suaineadh experiment will be launched onboard the sounding rocket REXUS12 (Rocket Experiments for University Students) from the Swedish launch base ESRANGE in Kiruna. The Suaineadh experiment serves as a technology demonstrator for a space web deployed by a spinning assembly. The successful deployment of this web will be a stepping stone for the development of ever larger structures in space. Such a structure could serve as a substructure for solar arrays, transmitters and/or antennas. The team formed of the University of Strathclyde (Glasgow, UK), the University of Glasgow (Glasgow, UK) and the Royal Institute of Technology (Stockholm, Sweden) designed, manufactured and tested the experiment over the last 18 months. A fully working experiment was delivered to Eurolaunch in January 2012. Following launch, the experiment will be ejected from the ejection barrel located in the nosecone of the rocket. Centrifugal forces acting on the space webs spinning assembly will be used to stabilise the experiment's platform. A specifically designed spinning reaction wheel, with an active control method, will be used. Once the experiment's motion is controlled, a 2 m by 2 m space web will be released. Four daughter sections situated in the corners of the square web will serve as masses to stabilise the web due to the centrifugal forces acting on them. The four daughter sections contain inertial measurement units (IMUs). Each of the IMU's is providing translational accelerations in three directions and angular velocities around three axes. Through this, the positions of the four corners are found through time integration of the accelerations and rotations. Furthermore, six cameras mounted on the central hub section will capture high resolution imagery of the deployment process. The quantitative results from the experiment are compared with dynamic deployment simulations using the commercial finite element software LS-DYNA. For redundancy, the images from the cameras are of great importance

in case some of the IMUs malfunction. The measurements obtained by the four IMUs during deployment and stabilisation phase are compared to simulation results and data from on-ground tests. Furthermore, the paper presents the images of ejection, deployment and stabilisation phases taken by the six cameras on the ejectable section and the two cameras on the rocket. Visual comparison between captured images and screenshots from the LS-DYNA simulations are used to verify the IMU data.