Flight Analysis of a Suborbital Space Probe: the Light Airbag-Protected Lander.

Flight Analysis of a Suborbital Space Probe: the Light Airbag-Protected Lander

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2010 (English)Independent thesis Advanced level (degree of Master (Two Years)), 20 credits / 30 HE creditsStudent thesis

Abstract [en]

A novel Inatable Aerodynamic Decelerator (IAD) and platform for multi-pointmeasurements in the ionosphere, has been evaluated in the REXUS (Rocket-bourneEXperiments for University Students) program. The experiment, named LAPLander(Light Airbag-Protected Lander), was launched from Esrange 4th of March 2010 to analtitude of 88 km. LAPLander is a 3.043 kg right-circular cylinder with a diameter of24 cm and a length of 8.4 cm when the IAD is folded inside. At ejection LAPLanderis spin stabilized around its polar axis with 3.5-4 Hz. Contact was lost after ejectionwhich points to an electrical failure.This thesis presents an evaluation of the LAPLander IAD and a 6 Degrees-Of-Freedom (6-DOF) ight analysis. The 6-DOF simulation indicates that LAPLanderwould start to wobble, but if the rotation around its polar axis is decreased morethan estimated, it will start to autorotate. Perhaps with high enough angular rate todemand special precautions if a parachute is to be used as a mean of recovery. TheLAPLander IAD is designed to deploy at 6 km altitude. If the IAD was inated inspace instead, the resulting reduction in the ballistic factor at reentry would save masson the heat protection system, and thus save mass on the overall recovery system. AnIAD derived from the LAPLander IAD capable of a 250 km apogee reentry will beprovided.The IAD incorporate CO2 cartridges to inate the system, these do each containa CO2 valve. A pre-launch valve failure resulted in that LAPLander ew without aworking IAD. The valves are based on the principle that resistors heat Field's metalabove 62C (the melting temperature). The main mechanism of the

valve failure seemsto be brittle creep in the Field's metal at this point. Some IAD ination-problematicshave been detected and this report provides a few recommendations.

Place, publisher, year, edition, pages

2010. , p. 122

Series

EES Examensarbete / Master Thesis ; XR-EE-SPP 2010:007

National Category

Aerospace Engineering

Identifiers

URN: urn:nbn:se:kth:diva-92526OAI: oai:DiVA.org:kth-92526DiVA, id: diva2:513480

Educational program

Master of Science in Engineering - Vehicle Engineering

Uppsok

Technology

Supervisors

- Ivchenko, Nickolay

Examiners

- Blomberg, Lars

Available from: 2012-04-10 Created: 2012-04-02 Last updated: 2012-04-10Bibliographically approved

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