MICROGRAVITY SCIENCES AND PROCESSES (A2)
Microgravity Processes onboard the International Space Station and Beyond (7)

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REEL.SMRT : A FEASIBILITY ANALYSIS OF A NOVEL BALLOON-BORNE PLATFORM FOR LOW-GRAVITY EXPERIMENTATION

Abstract

A balloon-borne platform that can drop and reel back up a tethered payload and perform this multiple times may have the potential to significantly expand the scope of balloon-based experimentation and low gravity platforms. The reel.SMRT Project is a mission that was launched on a Stratospheric Balloon in October 2009 from Esrange Space Center following an 8-month development period as part of BEXUS-9 (Balloon-borne Experiments for University Students). Through this programme, reel.SMRT investigated the feasibility of such a platform, capable also of controlled lowering and raising of a payload.

The vision is that the platform may be ultimately up-scaled to provide a viable and more cost-effective alternative to parabolic flights and drop towers. It has the potential to drastically increase the maximum drop lengths and versatility of such systems, along with more frequent drops and a greater number of drops in a single mission. The reel.SMRT system also has secondary applications for balloon experimentation, such as a controlled lowering of a payload, via which it is possible to take measurements further from the gondola, increasing experimental sampling range. Other advantages of an upscaled system would include: capability for large-dimension payloads such as antenna deployment tests; multiple drops to gain more test data; and variable gravity to simulate Martian or Lunar conditions through control of the drop acceleration. Additionally, the tether has applications as a safety line for UAV experimentation, or for lowering a sensor or object to near the surface for a low-altitude mission (such as in Martian exploration). The project's simulations have shown that with minimal tension, milligravity performance is limited only by airdrag after kilometers of drop distance. Challenges to implementation included sensor sensitivity and sampling rates as well as the rate of the line coming off the spool.

For this feasibility analysis, the system had a 50m drop length (70m total reel length) and 5G braking force, to demonstrate the quality of the low gravity environment for a dropped payload without actuators,

using COTS components including standard fishing tackle and line as the reeling mechanism and on a low-budget. The reel.SMRT Team thus investigated the feasibility of their concept of a balloon-borne low gravity system.