REXUS / BEXUS

Experiment Proposal Form

Full experiment title	reel.SMRT - Experimental Gravity Research Platform for High Altitude Balloons *by the SpaceMaster Robotics Team*

☐ **REXUS**

- ☐ spinning with 4 Hz
- ☐ despun with Yo-Yo

☒ **BEXUS**

Science & Organisation

What is the scientific and / or technical objective of your experiment?	The team aims to develop a platform, which can be used in the future to allow more diverse experiments on-board BEXUS launches. We propose to achieve this by creating a payload which carries a secondary payload for safely reeling down from the gondola. Our experiment will measure gravitational acceleration during the operation of the balloon as well as the gravitational acceleration in a secondary payload which will be reeled down and up from the balloon. The technique, if used in a dropping mode, will generate some lower gravity forces on the secondary payload. The payload would also allow for the option of slow reeling for atmospheric data sampling across a broader height range than is normally possible.
Why do you need a rocket / a balloon?	This technology is being investigated specifically to expand payload possibilities on board high-altitude balloons.
Where did you get the idea from?	The SpaceMaster robotics team develeoped a smaller similar experiment which was flown on a smaller balloon flight in Reno, NV (H.A.L.E. project). This previous experiment was developed by the SMRT team in Kiruna. The idea initially came from Mark Fittock to combat some of the limitations of experiments on-board high altitude balloon systems.

Describe your experiment	The experiment we propose will use 2 payloads, the main payload, which includes the micro-controller some motors and the main mechanical structure, as well as a reference accelerometer, and the secondary payload. The main box will receive the measurements from the secondary box via either a wired or

	preferably a wireless connection link. This link will have to use a frequency, which does not interfere with other experiments or the BEXUS communication links. Systems to use for wireless communication could be Bluetooth and RF chips that have been used for CanSat applications before. The measurements are to be taken with a 3-axis accelerometer. The data will provide a rough gravitational model and will be used to evaluate the future uses of such a platform. The main experiment will be to measure generated low gravity environments inside the secondary payload. While the secondary payload will be reeled down the acceleration is measured and stored on-chip in the secondary pay-load and also transmitted to the main payload where it is also stored on a micro-chip together with the data from the reference accelerometer. The secondary payload is then reeled back in and the experiment would be repeated over the course of the flight in several modes to get more data for post processing, future research and analysis.
Which data do you want to measure?	Main point is to the measure the acceleration in the secondary payload and to figure out how to control it due to tests at different altitudes.
How do you want to take measurements?	On the secondary payload a 3-axis-accelerometer will be installed. The data will then either be transferred over a wire or wirelessly to the main payload in the gondola.
Describe the process flow of your experiment?	During ascent: the experiment waits whilst recording and sending data about status During Float: the secondary payload will be reeled down and up to take data about performance in different modes The secondary payload will be reeled in and docked before descent begins.
What do you plan to do with your data after the flight?	Post flight we will analyse the data to gain a better understanding of the change of environment of the reeled payload. We will monitor temperature and acceleration within the scope of our experiment as they are both very important. This data can also be used to investigate how the payload travels and this will be useful for future experimenters wishing to do testing with this module.

Organisation of your project	Project Management: Katherine Bennell Outreach, Science: Mark Fittock Electronics: David Leal Martínez, Mikulas Jandak Software: Jürgen Leitner, Jan Speidel Mechanical: Campbell Pegg
Are you supported by an Institute or a professor?	All team members are currently participating in the SpaceMaster programme, so far we have talked and got positive feedback from the Institute of Space Sciences (IRV) in Kiruna, Sweden and the Helsinki University of Technology (TKK - Finland).
Do you have a workshop or a laboratory to work?	The before mentioned institutions will support us with a workshop and laboratory facilities (e.g. cooling chamber, shake testing…)

Do you have all the material and equipment which is needed for your experiment? If not, how do you plan to obtain it?	Some materials are available at IRV and also at TKK, other major components would need to be purchased
How do you plan to finance your expenses?	The project will receive funding from IRV for the students participating in the project from there. Further funds will need to be acquired though.
Who else will support you (sponsors, others)?	We intend to find sponsors to help cover the cost of components.

Outreach Programme	
Describe your outreach programme for before, during and after the REXUS / BEXUS flight campaign?	Before: Presentations @ Universities (EU and Australia), Schools (EU and Australia), Austrian Spaceday Newspapers Webpage During: Webpage Updates After: Presentations @ Universities (EU), Schools (EU), Spacemasters Programme Newspapers Webpage Webpage: http://smrt.name/

Experimental Set-up & Technical Information

Mechanics	
Describe your experimental set-up.	We intend to use a prefabricated motor, reel, line and assembly, which will reel the secondary payload, down and up from a docking bay. This will be supported by an electronics box housing electronics and batteries required. This will all be contained within a highly rigid structure (for vibration mitigation) with shielding to protect people from moving parts and EMC effects. The secondary payload will be a simple structure to take the required sensors and support (batteries and electronics).
Estimate the dimensions and the mass of your experiment.	400*400*500 (mm) 20 kg
Indicate the preferred position of your experiment:	The two preferred orientations would be an access hatch in the centre of the gondola floor or the experiment could be designed to drop the payload over the edge of the gondola. If the second option were taken, the experiment would need to protrude over the edge of the gondola.

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Electrics / Electronics	
Will you need (additional) batteries? What do you need for charging?	Ni-Mh battery pack (24V, 4800mAh) There is no need for charging.
Estimate the electrical consumption of your experiment.	40W
Do you use any equipment with high inrush currents?	Our motor will have a potentially high inrush current; however, this current could be limited to accaptable level and also we will use our own power supply in order to reduce EMI to other projects.
Do you need uplink and / or downlink?	Yes, both
Provide an event timeline, including the experiment actions during flight, such as timer or telecommand events.	During ascent: the payload will wait for a go signal from ground. During float: the payload will receive commands to control reeling down and time intervals between reeling, dependent on sensor feedback. Before descent: A command will be sent to stop the experiment and reel the secondary payload for stowage in the gondola payload's bay.

Environmental Questions & Safety Issues	
Does the experiment use wireless devices?	ISB Band (2.402-2.480GHz) -Bluetooth, ZigBee, output power less than 20dBm RF (~400 Mhz or ~800Mhz since 400 Mhz could interfere with the EBASS both available from funkmodul.de) output power less than 10dBm
Does the experiment create a magnetic or electrical field?	Yes we will generate both but we can mitigate this via sheilding
Could there be an electrostatic discharge from your experiment?	Between the secondary payload and the main payload
Is the experiment sensitive to light?	No

Is the experiment sensitive to vibrations?	The experiment is not sensitive to vibrations but we will evaluate the effects of such on both our payloads.
Does the experiment generate vibrations?	Yes, our motor will generate vibration, we will take measures to damp vibrations from the motor
Will you use any flammable, explosive, radioactive, corrosive, magnetic or organic products?	Magnets within motor
Will you use a laser?	No
Is your experiment airtight? Are parts of your experiment airtight?	No
Are there any hot parts (> 60°C)?	Possibility during motor operation for shaft to become hot however with a temperature sensor monitoring this we will be able to regulate this temperature by controlling use of the motor
Are there any moving parts? Are the moving parts reachable?	Yes, moving parts can be contained within a sealed module apart from the secondary payload to be reeled.
Do you need any pressure systems from Eurolaunch before launch?	No

Your text should be intelligible to scientists of various fields and engineers with a general scientific background.

Before you submit your proposal, please ensure that you have read the REXUS / BEXUS Technical Overviews available at www.rexusbexus.net You can also refer to the REXUS / BEXUS User Manuals for more detailed information.

To submit your proposal to ESA, please register at www.joinspace.org and download this application form as a Word file. The completed form must be uploaded again before the deadline of 17 November 2008.