43rd STUDENT CONFERENCE (E2)
Student Team Competition (3-V.4)

Author: Mr. Thomas Sinn
University of Strathclyde/Advanced Space Concepts Laboratory, United Kingdom, thomas.sinn@strath.ac.uk

Mr. Tiago de Franca Queiroz
University of Strathclyde / Computer Science, United Kingdom, contato@tiago.eti.br
Mr. Frazer Brownlie
University of Strathclyde / Mechanical and Aerospace Engineering, United Kingdom, frazer.brownlie@strath.ac.uk
Mrs. Larissa Batista Leite
University of Strathclyde / Computer Science, United Kingdom, yfb13104@uni.strath.ac.uk
Mr. Darryl Black
University of Strathclyde / Electrical and Mechanical Engineering, United Kingdom, darryl.black@strath.ac.uk
Mr. Craig Hay
University of Strathclyde / Electrical and Mechanical Engineering, United Kingdom, craig.hay.100@strath.ac.uk
Mr. Andrew Allan
University of Strathclyde / Electrical and Mechanical Engineering, United Kingdom, andrew.j.allan@strath.ac.uk
Mr. Adam Rowan
University of Strathclyde / Electrical and Mechanical Engineering, United Kingdom, adam.rowan@strath.ac.uk
Mr. Jonathan Gillespie
University of Strathclyde / Electrical and Mechanical Engineering, United Kingdom, jonathan.gillespie@strath.ac.uk

ISEDE DEMONSTRATOR ON HIGH ALTITUDE BALLOON BEXUS: INFLATABLE SATELLITE ENCOMPASSING DISAGGREGATED ELECTRONICS

Abstract

The goal of this project from students of the University of Strathclyde is to design and build an initial prototype of an all-inflatable satellite with disaggregated electronics for deployment on-board a BEXUS balloon as proof of concept. The idea is to use cellular structures as support for all the subsystems composing a typical nano-satellite. Each subsystem and component is mounted on a different cell. Cells are both individually inflated and individually controlled. The aim is to design and build a prototype for this new type of satellite, demonstrating the deployment, communication among components and local control enabling structure shape adaption. Traditional satellites have a rigid structure defining the basic configuration of the satellite and holding all subsystems in place. A variation of the shape or configuration of the satellite is normally achieved through the use of deployable structures or appendices (antennas, solar arrays, booms, etc.). Although modern structural solutions are modular and multifunctional, the structure of a satellite still represents a significant portion of its mass and a limitation on the achievable configuration, extension of deployable components and packing efficiency during launch. The idea of this project is to replace classical structures with cellular ones. Cellular structures are made of a number of light-weight cells individually inflated (and possibly rigidised once inflated). When deflated, cellular structures can be packed to occupy a very small volume. Once the structure is deployed in space, it can extend to a large area with a small mass. In order to allow high packing during launch, subsystems like computers, cameras, gyroscopes and accelerometers need to be miniaturized and distributed across the cells. The required level of miniaturization is already available in smart phones. Mobile phones are de facto, complete satellites that could be potentially deployed in space. The idea is to distribute (disaggregate) components similar to those found within a smart phone over the inflatable structure, add solar arrays and make all the components communicate. The unique architecture of the inflatable structure opens the possibility of changing its shape to be adapted to various space mission stages or environmental conditions. Cells can then be individually controlled to change the overall shape of the satellite. This paper will present the design, manufacturing, testing and first results of the iSEDE experiment which will be launched on ESA/DLR/SNSB's BEXUS in September 2013. Furthermore, the project management and the outreach approach in a university environment will be outlined.