NUS takes the quantum leap into space

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Two satellites designed and built by students, researchers and faculty from the National University of Singapore (NUS) have been successfully launched from the Satish Dhawan Space Centre in Andhra Pradesh, India, on Wednesday, 16 December 2015. These are the University's first satellites in space, and they are part of six Singapore satellites that were launched in the same operation.

The Singapore satellites were deployed by the polar satellite launch vehicle of the Indian Space Research Organisation into a near-equatorial orbit.

Galassia, a two-kilogramme nanosatellite, was developed by students and researchers from the Faculty of Engineering; Centre for Remote Imaging, Sensing & Processing (CRISP); and Centre for Quantum Technologies (CQT). Kent Ridge 1, a 77.2-kilogramme microsatellite, was developed jointly by the Department of Electrical and Computer Engineering and CRISP, together with partners including Berlin Space Technologies, Nanyang Polytechnic and ST Electronics (Satcom and Sensors Systems) Private Limited. Both satellites are flying 550 kilometres above the Earth, on an orbital plane that has an inclination of about 15 degrees. The near-equatorial orbit that these two satellites will be orbiting will provide high revisit rates for its ground operations.

Professor Chua Kee Chaing, Dean of the NUS Faculty of Engineering, said, "The successful deployment of NUS' first two satellites - Galassia and Kent Ridge 1 - in space is a proud moment for all of us and a remarkable endeavour by NUS faculty, researchers and students.

Achieving this quantum leap in space R&D is an excellent demonstration of NUS' strong capabilities in engineering and satellite technologies. The joint launch of six Singapore satellites into space is also a great celebration of Singapore's Golden Jubilee, marking the significant progress of Singapore's nascent space industry."

Galassia: NUS engineering students taking on the space challenge

Galassia, an experimental cube-satellite, was developed by a team of 30 final-year engineering students pursuing the Satellite System Design track under the Design-Centric Programme of the NUS Faculty of Engineering, together with six research engineers over a period of about four years beginning in 2012.

This satellite will carry two payloads. The first is a quantum science payload developed and flown in a satellite for the first time by NUS' Centre for Quantum Technologies (CQT). It will test out a quantum-based communication concept using Small Photon-Entangling Quantum System (SPEQS). The second is a Total Electron Content (TEC) electronic payload designed by NUS Engineering students. This payload will measure the total number of electrons above Singapore in the ionosphere, knowledge of which can be used to improve GPS navigation as well as radio communication.

The operational mission life of this satellite is expected to be between six to 12 months, during which payload data will be collected and analysed.

Professor Goh Cher Hiang, Project Director of the NUS Satellite Programme at the NUS Faculty of Engineering, said, "Creating a space-ready engineering system goes beyond nuts and bolts. The Galassia

project brings together students from various engineering disciplines to apply what they have learnt in a real-life setting, and challenges them to innovate and push boundaries. The successful launch of Galassia is a strong endorsement of NUS' space engineering education and we hope that this will also inspire more talented students who are passionate about space R&D to pursue their interest in this field."

Kent Ridge 1: The "eyes" in space

Kent Ridge 1 is a hyper-spectral imaging micro-satellite designed to conduct scientific experimentation and analysis of Earth's surface characteristics. With the capability to break down colour into its constituent components, this satellite is able to collect information on what is happening to the planet when sunlight is decomposed into its constituent wavelengths. This is useful for detecting changes in soil, vegetation, volcanoes, water temperatures and fire.

Most hyper-spectral cameras flown in space are large, bulky, complex and expensive. They are usually carried in big spacecrafts with mass of about one tonne. In comparison, Kent Ridge 1 is a micro-satellite with a mass of 77.2-kilogramme, much smaller than conventional hyper-spectral satellites.

The operational mission life of this satellite is expected to be two years, during which scientific experiments will be carried out.

Breaking new grounds in satellite technology and education

Not resting on their laurels, NUS faculty and researchers are already planning to develop the second generation of Galassia and Kent Ridge 2, with the aim of achieving new technological breakthroughs with these

projects.

The follow-on project for Galassia will involve the development of a six-unit nano-satellite with enhanced capability such as propulsion and attitude control together with an optical mission for high resolution imaging. The propulsion feature being considered also has the potential to undertake an interplanetary mission, such as flying a nano-satellite to explore the Moon.

For Kent Ridge 2, the NUS team would explore incorporating high resolution multi-spectral imaging.

Provided by National University of Singapore