Mission possible

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Private enterprises have taken over students' pet project: CubeSat, a pico-satellite that promises convenient low-cost launch interface, that has found believers in established space agencies

With the confirmed launch of over 100 new nano-spacecraft into orbit by a San Francisco startup within the next 12 months, the question is how have these spacecrafts evolved from the classroom into the entrepreneurial mainstream?

Towards the end of the 1990's a number of university groups were developing student-built satellites. Based on this experience, academics at Stanford University and California Polytechnic State University developed and proposed to the community the concept of a 'CubeSat' "as a collaborative effort to continue developing the pico-satellite, provide a convenient low-cost launch interface and coordinate launch activities."

Key to the CubeSat concept is simplicity, standardisation and conformity. A CubeSat is a 10 cm cube, and is scalable along a single axis in steps of 10 cm, hence the most commercially valuable CubeSats tend to be approximately as large as a box for a whisky bottle; 30 × 10 × 10 cm.

The first CubeSats were launched in June 2003; these were 10 cm cubes and were all built by students, from Denmark, Japan, Canada and the US. Since then, innumerable CubeSats have been launched, and the growth in CubeSat developments and launches has been dramatic. In 2013, over 90 were launched, amongst these was TJ3Sat from Thomas Jefferson High School for Science and Technology in Virginia, USA, the first spacecraft designed, built and flown by school pupils.

In addition to the original 'educational' rationale, a spectrum has emerged to span a 'professional' rationale, with organisations such as the US Air Force, Nasa, and Boeing launching CubeSats, and others working with local universities, such as the UK company SSTL who worked with the University of Surrey to launch 'STRaND-1'.

The developer's spectrum for these spacecraft now spans high schools to professional engineers and space agencies. With companies such as Pumpkin, Innovative Solutions In Space, Netherlands, and Clyde Space, Scotland, having emerged to service this complete spectrum of developers with sub-systems, launch services and even complete platform solutions.

This year even more CubeSats will be launched than in last, and for the first time it is likely that the majority of these will not have been built by students or university groups, and instead will have been built by private enterprise.

An example of this is the UKs first commercial CubeSat, UKube-1, developed by a consortium led by Clyde Space and due for launch in June. UKube-1 is a technology demonstration activity and emerged from a knowledge transfer partnership with the University of Strathclyde, also located in Glasgow. UKube-1 is seen by the UK Space Agency as a pathfinder for the Agency's proposed national CubeSat programme, which would see a similar technology demonstration every 12 – 24 months.

The UK space agency envisage a national programme increasing the UK's ability to market new technologies while providing training and research opportunities for the next generation of engineers and scientists. UKube-1

is an example of innovation and knowledge transfer from academia in Scotland delivering real commercial value in the private sector. Based on the experience of UKube-1, Clyde Space recently received a $200k order from the National University of Singapore's Centre for Quantum Technologies to build another spacecraft.

The first major CubeSat commercial deployment, Flock 1, by the San Francisco start up Planet Labs, has already launched thirty-two nano-spacecraft, and they recently confirmed plans to launch a further one-hundred within the next twelve months. Planet Labs seek to bring the mentality of Silicon Valley to the space sector, and aims to operate the largest Earth observation constellation in the world, adapting our disposable approach to consumer electronics to space technology, and applying a continual evolution and replenishment to the system, enabling it to benefit from the most advanced available technology at any given time.

Planet Labs aim to use their spacecraft to generate a daily mosaic of the earth, and have according to Will Marshall, the company's co-founder and chief executive, contracts in place to exploit this service that value more than the $65-million in private equity that they have raised to-date.

That a start-up like Planet Labs can undertake development of over 130 spacecraft with $65-million of venture capital funding highlights the value of the innovation pipeline that starts in universities and continues through their staff, students, graduates and collaborators.

(Malcolm Macdonald is associate director of the Advanced Space Concepts Laboratory at the University of Strathclyde in Glasgow, Scotland.)