



# **Space Technology and Satellite Applications**

## **A Global Leadership Opportunity for Scotland**

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The Scottish space sector has a distinctive profile, delivering leadership in microsatellites, space science and satellite applications. As a measure of success, in 2016 on average six flight-ready microsatellites were manufactured each month in Scotland. There are now key opportunities for Scotland to capitalise on these strengths, develop a clear space strategy and capture a share of the rapidly growing global space economy.

# 1. Background

The UK space industry is estimated to be worth over £13B to the UK economy and has grown at an average of 8.1% per annum since 2010<sup>1</sup>. Looking forward, the joint industry/government Space Innovation and Growth Strategy (IGS) sets an overarching ambition to see the UK sector grow from 6% of the £160 billion world space economy in 2008 to 10% of a space economy likely to be worth £400 billion by 2030<sup>2</sup>. As one of the UK government's 'Eight Great Technologies' the space sector is clearly set to grow significantly over the coming years, supported by the creation of a new UK Space Agency (UKSA) in 2010 and investment in a Satellite Applications Catapult, established in May 2013.

Future growth of the UK space economy is expected in both upstream (satellite) and downstream (application) businesses, where there is currently a gearing of 10:1 between the downstream and upstream sectors. The large downstream satellite applications sector forms the bulk of industry turnover and includes direct broadcast satellite television, satellite navigation services, machine-to-machine networks and a growing commercial Earth observation business. This anticipated growth in downstream satellites applications provides new opportunities for Scotland to capitalise on expertise in sectors such as offshore renewable energy, agriculture, digital healthcare and financial services.

Aside from satellite applications, the UK government has recently announced its intention to support a licensing framework for UK spaceports to enable space access and support commercial space tourism. Several locations in Scotland have been positioning to deliver such space access services.



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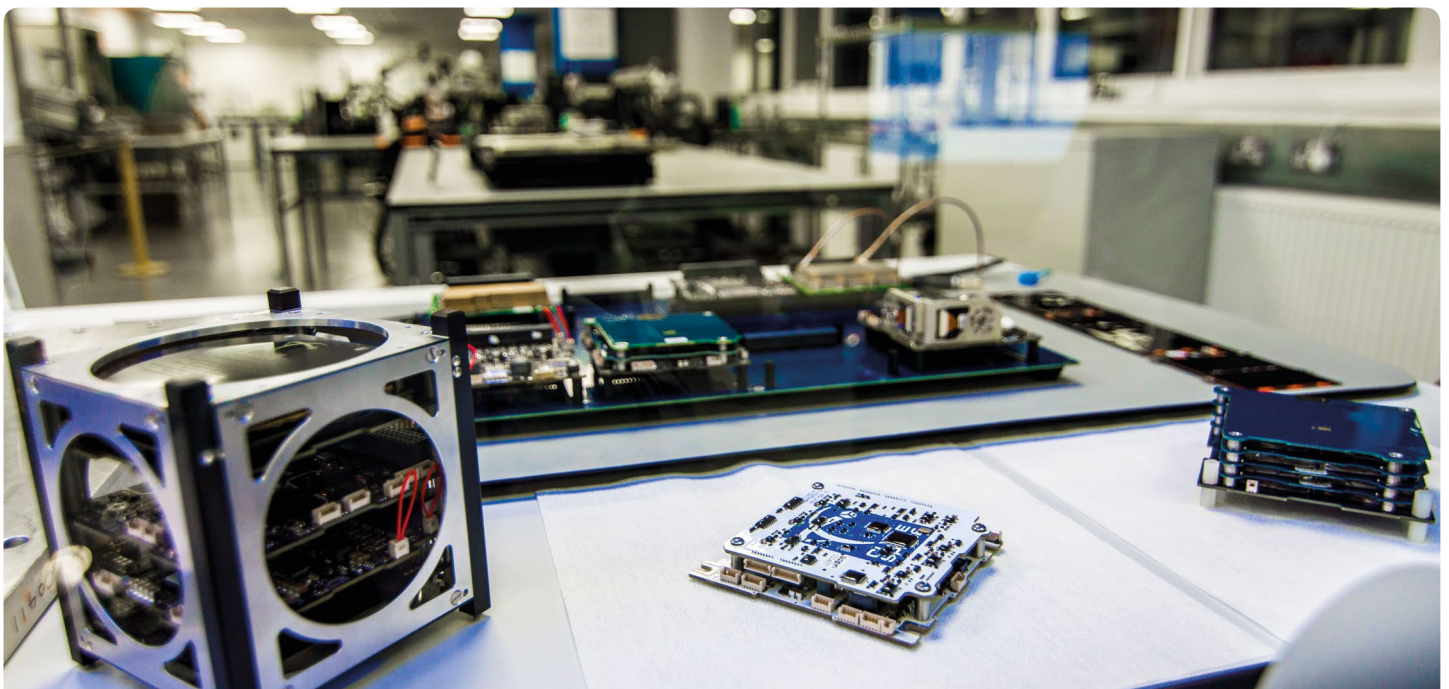


## 2. Scottish Space Sector

The Scottish space sector has demonstrated a strong and sustained record of achievement in recent years, with a growing UK-wide and international profile. For example, the launch of the UKube-1 CubeSat in July 2014 represented the first microsatellite to be designed and manufactured in Scotland, led by Clyde Space Ltd. More recently, the University of Glasgow delivered the optical bench for the European Space Agency (ESA) Lisa Pathfinder mission, launched in December 2015, while the UK Astronomy Technology Centre in Edinburgh delivered the MIRI instrument for the NASA/ESA James Webb Space Telescope, scheduled for launch in October 2018.

Aside from specific missions, Scotland now has its own regional downstream applications centre, the Scottish Centre of Excellence in Satellite Applications, supported by the Satellite Applications Catapult in Harwell since April 2014 (and now a delivery partner with Scottish Enterprise and Highlands and Islands Enterprise). Moreover, funded by the Science and Technology Facilities Council (STFC) and supported by ESA, the forthcoming Higgs Centre for Innovation in Edinburgh will provide business incubation services for start-up space companies and access to the facilities of the UK Astronomy Technology Centre from 2017. This is complemented by the NERC-supported Dundee Satellite Receiving Station which has been down-linking and archiving high-resolution Earth observation and weather satellite imagery since 1978. Scottish Enterprise have also recently supported a second phase of Space Network Scotland, tasked with developing greater integration across the sector and improving links to the UK and European space agencies.

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1U CubeSat in build alongside subsystems

## 2.1 Commercial Space

The sector has seen the growth of a number of Scottish businesses both upstream and downstream, covering platforms, subsystems and satellite applications including:

- **Astrosat:** space services and management business developing novel satellite applications including global disaster relief, urban energy efficiency and coastal monitoring.
- **Bright Ascension:** developer of on-board satellite software (for UKube-1) and ground station mission control software, including operator interfaces.
- **Clyde Space:** supplier of CubeSat microsattellites and satellite subsystems, delivering a large export sales base with an average of six CubeSats manufactured each month in 2016.
- **Ecometrica:** supplier of sustainability and carbon mapping tools delivered using a range of data sets, including high-resolution Earth observation satellite imagery.
- **Leonardo-Finmeccanica:** supplier of novel MEMS rate sensors for satellite attitude control subsystems with a long heritage from the Ariane launcher series inertial navigation system.
- **Orbital Access:** developer of low cost payload launch services using a horizontal take-off, air-launched vehicle delivered to altitude from a large wide-body carrier aircraft.
- **Spire Global:** Inward investment in Glasgow from US-based space data company to develop a constellation of CubeSats for next-generation weather forecasting.
- **STAR-Dundee:** specialist in SpaceWire, an international standard for on-board satellite data handling and processing with customers including all major global space agencies.

## 2.2 Research and Facilities

A number of Scottish university research groups and national laboratories are actively engaged in underpinning research and space technology development with industry and agencies, including:

- **Heriot-Watt University:** development of new technologies for satellite communications through the Microwave and Antenna Engineering Group.
- **Higgs Centre for Innovation:** incubation and testing facility to translate research expertise in particle physics and astronomy into new businesses for big data and space technology.
- **Space Glasgow Research Cluster:** multi-disciplinary cluster operating across the physical sciences and engineering developing instrumentation, mission concepts and robotic tools.
- **Space Technology Centre, University of Dundee:** developer of SpaceWire technology and planetary surface simulation tools, facilities include the Dundee Satellite Ground Station.
- **Strathclyde Space Institute:** grouping of centres across space technology, access to space and space robotics, hosts the Scottish Centre of Excellence in Satellite Applications.
- **UK Astronomy Technology Centre:** national centre for astronomy technology leading the design and build of instruments for many of the world's major terrestrial and space telescopes.
- **University of Edinburgh:** largest geoscience centre in the UK with extensive research programmes on the use of satellite data for environmental monitoring.

### 3. Current Sector Issues

Scottish Enterprise-commissioned studies by London Economics estimate the turnover of the Scottish sector in 2012/13 to be £134M<sup>3</sup>. While this is below the expected per capita share of the UK space sector it indicates a potential for significant growth in targeted areas. Indeed, to meet UK-wide growth targets it is recognised that regional growth will be essential<sup>4</sup>. This was one of the key motivations for establishing both the Scottish Centre of Excellence in Satellite Applications in April 2014, supported by the Satellite Applications Catapult in Harwell, and the Higgs Centre for Innovation, supported by STFC. London Economics envisage the Scottish sector potentially growing to 10% of the UK space economy by 2030<sup>5</sup>. This represents a significant opportunity for the future.

Similarly, the UK has agreed an uplift in its contributions to the ESA and in November 2012 committed to invest £240M per year over the subsequent 5 years<sup>6</sup>. Much of this investment returns to the UK through commercial contracts via a long-standing 'juste retour' policy. While some Scottish organisations are successful in winning competitive ESA business, Scotland may not see a full return on its contribution to UK investments in ESA. Again, this represents an untapped opportunity for the future growth of the Scottish space sector, not only for space-focused businesses but across the broad technology supply chain from electronics to software.



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## 4. Future Sector Opportunities

While the Scottish space sector is currently modest in size, it has a strong UK-wide and international profile which offers significant potential for growth, both in upstream platform technologies and in downstream satellite services. In particular, given its geography, Scotland has important opportunities to benefit from downstream satellite applications including agriculture and aquaculture, digital healthcare and condition monitoring for offshore renewable energy infrastructure.

Other future opportunities include the development of a Scottish spaceport, to provide low cost access to space for small satellite launchers and to service the potential commercial market for space tourism. Fully developing such opportunities will require the coordination of activity across a range of government departments, public sector organisations, universities and industry.

Importantly, to underpin future growth in the sector Scotland will require its own distinctive space strategy to reflect its many strengths. Such a strategy would ensure that links to the growing UK Space Gateway at Harwell can be made in a coordinated fashion and that future UK investments in space have a strong regional profile.

Recommendations:

- Form a joint industry/Ministerial-led space industry group to develop a concrete plan for action and define a roadmap for the future.
- Use this action plan to strengthen links between industry, academia and the public sector to capitalise on Scotland's capabilities and prime competition for future UK and international investments.
- Use public sector bodies as anchor customers for satellite applications to stimulate downstream business growth and to showcase new satellite services in energy, agriculture and healthcare.
- Capture the excitement of the space sector to help drive STEM engagement, using case studies of Scottish High School students now following careers in Scotland's space sector.

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### References

- <sup>1</sup> UK Space Agency, *The Size and Health of the UK Space Industry*, December 2016
- <sup>2</sup> UK Space Agency, *UK Space Innovation and Growth Strategy (2015 update)*, July 2015
- <sup>3</sup> Development of the Scottish Space Industry, London Economics, January 2016
- <sup>4</sup> UK Space Agency, 2015
- <sup>5</sup> Development of the Scottish Space Industry, London Economics, January 2016
- <sup>6</sup> Macdonald, M., Smith, L-J., *Impact Assessment of Scottish Independence on the Space Sector*, University of Strathclyde Publishing, ISBN 978-1-909522-04-6, 2014



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