

Challenge prizes in space

Olivier Usher and Sam Adlen
August 2020

New technologies are transforming space and disrupting incumbents. Challenge prizes could help Britain seize the opportunity and build technology and services that change the world.

- The space sector is in flux, with disruptive technologies and new business models making their mark.
- Britain has strengths to build on, but needs to make strategic investments to make the most of the new environment.
- Challenge prizes could help support innovators to take advantage of the opportunities of this growing market.

Our vision

The space sector is being transformed by innovations, from small satellites to microlaunchers, robotics and constellations. These serve basic needs from earth observation to broadband communications, and serve commerce and society alike. As the space economy grows and changes, we want to use challenge prizes to secure a place for Britain's space industry in these exciting new markets.

The challenges and their context

The UK has fared well out of commercial space so far. Pragmatic government decisions and a strong engineering base mean the UK has specialised in relatively lucrative parts of the value chain: in space services (including Inmarsat and Sky Television) and in satellite construction, particularly of smallsats.

But we could do more, and our current advantage is at risk as the space sector changes.

What successes the UK has had have frequently been concentrated in a small number of companies, many foreign-owned.

Large parts of the value chain, including launchers and spaceports, have historically been neglected. Emerging companies such as SpaceX and a range of new innovators are challenging the way things have been done and reimagining nearly every aspect of existing supply chains.

With huge changes in the global market the UK cannot focus on incremental gains. Opportunities are arising with disruptions including microlaunchers, miniaturisation, robotics and constellations, and growing demand for satellite communications and Earth observation data from new AI-driven industries.

Against this, the policy environment is evolving in a more ambitious direction.

The UK announced last year the creation of the National Space Council and has promised strategic investment in British spaceports. The Industrial Strategy Challenge Fund is investing £99m for RALspace to create the National Satellite Test Facility, as well as strategic funding for aerospace through the Future Flight Challenge. And the government's plans for greater funding (through a target of 2.4 per cent of GDP being spent on R&D) and new institutions (like the UK ARPA announced in the Queen's Speech) signal a general appetite for greater ambition in technology.

The role of innovation

There is clearly an opportunity to take the UK space sector to the next level.

A range of new technologies are potentially enablers for new satellite applications. Precision robotics and AI in particular mean that new designs and new applications for satellites, and other infrastructure in space, are suddenly possible. There is an opportunity to create a new breed of innovative British companies with technologies and services that meet the needs of the future - such as assembly or servicing of satellites in orbit, or clearing space debris.

To keep up with the changing market and policy environment, and to make the most of the opportunities that these bring, the UK space sector must innovate.

Challenge prizes are potentially a valuable tool for supporting these breakthroughs, offering financial incentives for teams to develop technologies and services that meet specific goals.

In high-tech sectors like space, our research shows that challenge prizes have effects far beyond the incentive alone. We have found that they:

- Help galvanise action around a shared vision: by setting strategic objectives for the UK space sector they could help focus attention on particular gaps or opportunities.
- Help give credibility and visibility to teams working on them: by signalling government support and independent validation, they could help attract publicity and investment to teams taking part.
- Help demonstrate the benefits of technologies developed: by building in demonstrations in the judging of the prize, as well as providing access to facilities (such as UK spaceports or labs), prizes could help demonstrate and drive adoption of the innovations created.

Opportunities for challenge prizes

Challenge prizes in space should focus on developing strategically important technologies, where there is significant international opportunity, and where UK innovation is currently lacking. They should be linked to access to testing, facilities or demonstrations, as well as the cash reward of a prize. And they should be designed to help teams access private funding as well as the prize purse.

Space debris prize

Create and demonstrate a technology for removing space debris and failed satellites from orbit.

As low earth orbit becomes more crowded, risks to satellites increase. The prize would incentivise the development of technology that can remove satellites and debris from orbit once they have reached the end of their useful life, providing a list of known objects of space debris, and challenging innovators to safely remove one of them from orbit.

Orbital assembly prize

Demonstrate the robotic, in-orbit assembly of a satellite, including at minimum, securely attaching and connecting four solar panels together.

The prize would incentivise breakthroughs in robotic self-assembly, a key enabling technology for satellite technology of the future; one which is complementary to UK strength in the smallsat sector.

Space power prize

Build and launch an orbital solar power plant that is capable of safely beaming power to another satellite.

One promising long-term satellite application could be capturing solar power in space and beaming it to earth. This prize would incentivise an important incremental

step towards this end, and would create an useful technology that could provide additional power to satellites in orbit, particularly useful for the emerging field of large constellations of small satellites.

Micropropulsion prize

Design, develop and test the smallest possible propulsion source, suitable for use on cubesats.

Propulsion systems take up space and weight on satellites. The smallest satellites - such as cubesats, which are just 10cm across - have extremely limited space and often do not have propulsion capabilities onboard. This prize would incentivise the creation of miniaturised propulsion systems that would allow these satellites to gain manoeuvrability.

Space manufacturing prize

Demonstrate the manufacture of a product in space and safely return it to earth.

The microgravity environment in orbit is unique, and allows the manufacture of materials that cannot be easily produced on Earth. Competitors in this prize would have to develop and demonstrate the manufacture of a product (e.g. creating an alloy or growing a crystal), and developing the technology to safely and legally return it to Earth's surface.

Further information

Nesta Challenges

Nesta Challenges exists to design and run challenge prizes that help solve pressing problems that lack solutions. We shine a spotlight where it matters and incentivise people to solve these issues. We are independent supporters of change to help communities thrive and inspire the best placed, most diverse groups of people around the world to take action. We support the boldest and bravest ideas to become real, and seed long term change to advance society and build a better future for everyone. We are part of the innovation foundation, Nesta. A full list of our current challenge prizes is available on our website at www.challenges.org

The Satellite Applications Catapult

The Satellite Applications Catapult is one of a network of UK technology and innovation companies which aim to drive economic growth through the commercialisation of research. Our aim is to support UK industry by accelerating the growth of space and satellite applications and to contribute to capturing a 10 per cent share of the global space market predicted by 2030. We achieve this by exploiting the innovation potential in the UK industrial and academic communities, by being a focal point where small and medium enterprises, large industry and end users can work together with researchers to challenge barriers, explore and develop new ideas, and bring these to commercial reality.

UKspace

UKspace is the trade association of the British space industry representing a diverse membership across the industry and promoting the interests of industry with the UK government, parliament and national and international stakeholders.

To discuss the content of this challenge brief, contact:

Olivier Usher, Lead, Research and Impact, Nesta Challenges
olivier.usher@nesta.org.uk

Sam Adlen, Chief Strategy Officer, Satellite Applications Catapult
sam.adlen@sa.catapult.org.uk



58 Victoria Embankment, London EC4Y 0DS

+44 (0)20 7438 2500

challenges@nesta.org.uk

 @NestaChallenges

www.challenges.org

