

# The 21<sup>st</sup> Century Space Race: Can the UK Keep Up?

**Q: How will the importance of Space in the military evolve over the next 20 years and can the UK effectively compete for its interests in this domain?**

With the official formation of UK Space Command, standing up on the 1<sup>st</sup> of April 2021, all eyes are looking towards the stars, for the vast potential that the space domain can offer. The United Kingdom has a number of notable projects in the pipeline, set to support both civil and defence applications, with the government having pledged billions of pounds worth of investment in the sector. However, can the UK keep up with some of the space domain's key players? US Space Command has already been in operation for over a year, and China and Russia, arguably the other two biggest competitors for dominance in space, have had dedicated 'space forces' since 2015.<sup>1</sup> As space becomes more congested and contested, the 'War in Space' is becoming an ever-increasing reality. This essay will first discuss how the space environment will evolve as an operational domain over the next 20 years, by considering how advancements in satellite technology will support the land, sea, air, and cyber domains as well as influence control in space itself. It will then discuss why the UK could be an effective contributor and competitor in space, focussing on the UK's experience with small satellite developments, the Ministry of Defence's relationship with industry and the UK's alliance with the United States of America.

The future of the space domain will revolve around the advancement of satellite technology which can support operations in the land, sea, air, and cyber domains; as well as anti-satellite technology which has the ability to deter, deny or destroy these space assets. The UK's ability to command control in space will directly affect how operations in all domains can be carried out effectively. Space infrastructure is a key part of military operations, providing communications, surveillance, navigational aids, and weather forecasting. This poses a notable vulnerability for the UK armed forces – a loss of any space-based capabilities could impede almost any military operation. China and Russia have already carried out successful anti-satellite missile testing in recent years which would have the capacity to carry out a kinetic attack on an opponent's satellite. However, kinetic satellite attacks pose a very high danger of creating an explosion of uncontrollable debris that could remain in orbit indefinitely. It could potentially cause a chain reaction of collisions which could see Earth orbit completely covered in debris, rendering the space domain practically useless. Due to the risks involved to all actors in space warfare associated with kinetic attacks, it is likely that the majority of offensive space operations will occur in the form of electronic warfare, whilst the ownership of kinetic missiles remains a deterrent or 'show of power'.<sup>2</sup>

In 2021, a number of governments and commercial companies are launching Low Earth Orbit (LEO) satellite constellations that will provide internet connections to compete with current wired providers. SpaceX have been given approval to launch 12,000 satellites for their Starlink programme and is just one of many similar

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<sup>1</sup> ANI (2020)

<sup>2</sup> Stickings (2020)

programmes currently launching satellites into LEO. It is expected that the number of satellites will increase by an order of magnitude in as little as 5 years, driven by these increased investments.<sup>3</sup> In 20 years, it is difficult to imagine the sheer number of satellites that could be launched. Combine this with the ESA's current estimate of 900,000 pieces of space debris (a number that will only rise with an increase in satellites) the need for effective and thorough space monitoring to prevent collisions which could damage key infrastructure is becoming increasingly important. An increase in debris will also pave the way for advancements in 'space clean-up' technology, however, as pointed out by the UK's new head of Space Command, AVM Paul Godfrey, this technology could also be used for malicious means to snatch an enemy satellite out of orbit: 'One person's debris clean up and old satellite clean up could be another person's nefarious anti-satellite instrument...'.<sup>4</sup> During a public discussion in March 2021 with Space Director AVM Harvey Smyth, AVM Godfrey highlighted the need for more transparency in the space domain, to de-classify information about space events and to ensure that space becomes more regulated. AVM Smyth discussed the commercialisation of space saying: 'there is as much of a role to play for commercial as there is for military or governments...' emphasising the importance of industry in the future of the space domain.<sup>5</sup>

The UK is already a world leader in the production of small satellites which can only serve to benefit the potential of its space programmes in the future. In 2018, the RAF launched a small cube-satellite to test the ability of small satellites to provide HD video of small areas of the Earth's surface. The prototype, the Carbonite-2, has proved the tactical capability of small cube-satellites in supporting other domains by becoming the first satellite of its kind in the world to record HD colour video.<sup>6</sup> It is hoped the video from these satellites could soon be streamed directly to pilots in the cockpit to improve situational awareness. This application, is just one of many uses for small satellites, including electronic communications, meteorology, and Earth monitoring and Intelligence, Surveillance and Reconnaissance. Small satellites have many advantages, due to their size, they are harder to detect – a particular advantage for defence applications; they can be manufactured at a low cost and can provide effective uses with relatively straightforward technology – the Carbonite-2 contains an off-the-shelf HD camera and telescope.<sup>7</sup>

The MoD's close relationship with industry will serve to ensure the most experienced minds are developing technology specific to the military's needs. The successful Carbonite-2 programme was run in partnership with Surrey Satellite Technology Ltd, owned by Airbus Defence and Space, a company with more than 30 years' experience in small satellite production. The project was completed in only 8 months, highlighting the ability of the combined efforts of the military and industry to carry out and launch high quality products quickly and efficiently. Currently in 2021, the UK must rely on other states to launch their satellites, an option that will likely incur

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<sup>3</sup> Hilborne and Presley (2020) p.3

<sup>4</sup> AVM Godfrey (2021)

<sup>5</sup> AVM Smyth (2021)

<sup>6</sup> *Defence Secretary outlines future space programme*. Royal Air Force (2019)

<sup>7</sup> *Lift-off: Satellite launched into space on RAF mission*. UK Government (2018)

delays and high costs. However, prime minister, Boris Johnson, has pledged to launch a satellite from UK soil by 2022 and an MoD contractor, QinetiQ, is involved in the development of a spaceport on the Scottish island of North Uist.<sup>8</sup> A number of other sites are also being considered for development, including a site in Cornwall to support Virgin Orbit. These launch sites could also pave the way for the UK to provide launches for other nations in the future, giving the UK a level of control over the infrastructure of other countries, solidifying beneficial alliances and an awareness of the space abilities of other states. The investment in this infrastructure will greatly support the fast development and launch of military satellites in the future as well as giving the UK the opportunity to support other nations, and the support from industry experts will enable the use of the latest technology which will keep the UK as a key competitor in space.

The UK's close relationship with the United States of America will enable effective sharing of ideas and capabilities to ensure both nations are key competitors in the space domain. The UK and USA have a unique and special relationship, identified in the Defence Command Paper as the "broadest, deepest and most advanced of any two countries in the world".<sup>9</sup> The United States' experience of space outdates most other nations and provides the UK with a wealth of knowledge to support its own research and development. In 2019, the UK became the first international state to join the US Operation Olympic Defender, which aims to strengthen allied deterrence of potentially hostile activities by opponents in space. 2019 also saw the official formation of Team Artemis, a joint UK-USA initiative made up of military and commercial members, which aims to research the military applications of small satellites. It aims to launch a constellation of small satellites utilising Virgin Orbit's launch capability. It will test Virgin's ability to launch quickly – with potentially as little as one week's notice. According to CEO of Virgin Orbit, Dan Hart, the benefit of short notice launches, in addition to getting equipment into orbit quicker and more efficiently, could act as a deterrent for kinetic attacks on satellites in orbit.<sup>10</sup> If one is destroyed, another could be launched rapidly, meaning the loss of capability felt by the loss of the satellites would only last for a very short time. The financial investment in the development and use of anti-satellite missiles would probably far outweigh the benefit of leaving an opponent without a certain capability for only a very short time.

Virgin Orbit's technology will also enable the UK to potentially launch from anywhere in the world. There is a significant geographical disadvantage with vertical launch sites as their location on the Earth will determine where a satellite can be put into orbit. As the UK is a very small island in comparison with some of its key adversaries in Russia and China, only sites in the North of Scotland are really advantageous launch locations, putting satellites into sought-after polar orbits. However, to gain a strategic advantage, the UK will need satellites in a number of different orbits and locations all over the globe. Virgin Orbit will enable this requirement, putting satellites

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<sup>8</sup> *Why is Scotland a prime rocket launch site?*. BBC (2020)

<sup>9</sup> *Defence in a Competitive Age* (2021) p.28

<sup>10</sup> Erwin (2019)

into orbit where they are most needed and supporting the rapid deployment of key infrastructure.

However, the UK will still need to invest in key space infrastructure to ensure it remains a competitor in space. Brexit has left the UK without access to the EU's Galileo navigation satellites. In order to ensure there is no reliance on another state for such an important military application, the design, manufacture and launch of a state-owned Position, Navigation and Timing (PNT) satellite capability will be an important step to ensure the military can continue to operate effectively in the land, sea, and air domains.<sup>11</sup> Although the UK has access to the US' space infrastructure, it will need to ensure its own capabilities can compete on their own to safeguard the alliance with the US and remain a worthwhile ally.

The United Kingdom must continue its investment in the space sector if it is to compete against the big space powers of China and Russia. It already has a thriving space sector with commercial companies with decades of experience. This is a great opportunity for the MoD to explore the military applications of civil technology as well as working closely with industry experts to develop infrastructure for specific operational needs. The Carbonite-2 satellite proved the MoD's ability to work closely and effectively with industry to produce ground-breaking technology. Small satellites, in particular, will enable the military to develop cost-effective and hard-to-detect satellites capable of a range of applications. The creation of UK spaceports will greatly expand the UK's launch abilities and reduce the need to rely on other nations. It will also enable the UK to provide launches for other countries, a key strategic advantage. The UK's relationship with the US will enable the sharing of ideas and infrastructure, both within the military and industry, to support research and development. Virgin Orbit's launch system will provide a notable capability for the UK to rapidly launch satellites from almost anywhere in the world. This benefits the UK's geographical launch limitations, as well as providing a deterrent for kinetic attacks on satellites, if replacements can be launched quickly. However, the UK needs to create its own PNT satellites to ensure the MoD does not have to rely on another state's infrastructure. If the UK continues to invest in space and work closely with industry experts to utilise the latest technology, it certainly has the potential to be a key player in the 21<sup>st</sup> century space race.

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<sup>11</sup> Franklin (2020)

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