Written evidence submitted by Dr Adam Bower (DIS0043)

Scottish Affairs Committee, United Kingdom Parliament
Inquiry regarding Defence in Scotland – the North Atlantic and the High North

Written evidence submitted by Dr Adam Bower, University of St Andrews

Introduction

Dr Adam Bower is a Senior Lecturer in International Relations and co-director of the Centre for Global Law and Governance at the University of St Andrews.[1] His research examines the development, implementation, and transformation of international law and norms regulating the use of armed violence. He is currently studying the international governance of military space activities (initially funded by a Research Fellowship from The Leverhulme Trust). Dr Bower is a Fellow of the Outer Space Institute (OSI), a global network of transdisciplinary space experts committed to promoting safe and sustainable space operations. He is involved in OSI research and advocacy initiatives including an international open letter calling for a kinetic anti-satellite weapon test ban treaty[2] and a submission to the United Nations Open-Ended Working Group on Reducing Space Threats meeting in January-February 2023.[3] He is also part of a collaborative research program on High North security supported by the Scottish Council on Global Affairs.

Summary

Scotland is a High North country which by extension implicates the United Kingdom as a whole. There is growing recognition that the High North represents a key area of geopolitical competition as global warming has accelerated efforts to exploit natural resources including fisheries, oil and gas fields, rare metals and minerals, and sea lanes. While these developments raise national security issues of their own, they are exacerbated by renewed tensions with another Arctic state, Russia. The UK government has recognized the strategic importance of the High North.[4] The new Scottish Council on Global Affairs has also adopted the High North as one of its inaugural research themes.[5]

This submission focuses on role of outer space technologies in defence of the High North and Scotland's vital role in realising the UK government's ambitions to be a leading player in space.[6] Earth-orbiting satellites mediate all aspects of modern life, from weather forecasting and global supply chains to human rights monitoring and advanced warfare. Ensuring access to, and use of, outer (Earth orbital) space is therefore a key component of national defence and prosperity including in the High North. This is reflected in the publication of the UK *National Space Strategy*, *Defence Space Strategy*,[7] and *Space Power* Joint Doctrine[8] and creation of UK Space Command.

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[1] https://adam-bower.wp.st-andrews.ac.uk/
[2] Outer Space Institute. 2021. *Open Letter Re. Kinetic ASAT Test Ban Treaty*. 2 September. http://outerspaceinstitute.ca/docs/OSI_International_Open_Letter_ASATs_PUBLIC.pdf.
[3] Outer Space Institute Working Group on Space Security. 2023. *Non-Kinetic Anti-Satellite Weapons (ASATs)*. 13 January. A/AC.294/2023/NGO/1. https://meetings.unoda.org/meeting/57866/documents.
[4] Polar Regions Department, Foreign, Commonwealth & Development Office. 2018. *Beyond the Ice: UK Policy Towards the Arctic*. https://www.gov.uk/government/publications/beyond-the-ice-uk-policy-towards-the-arctic and Ministry of Defence. 2022. *The UK's Defence Contribution in the High North*. https://www.gov.uk/government/publications/the-uks-defence-contribution-in-the-high-north.
[5] https://scga.scot/
[6] Department for Business, Energy & Industrial Strategy; Ministry of Defence; and UK Space Agency. 2021. *National Space Strategy*. https://www.gov.uk/government/publications/national-space-strategy
[7] Ministry of Defence. 2022. *Defence Space Strategy: Operationalising the Space Domain*. https://www.gov.uk/government/publications/defence-space-strategy-operationalising-the-space-domain.
[8] Ministry of Defence. 2022. *UK Space Power (JDP 0-40)*. https://www.gov.uk/government/publications/uk-

This submission draws attention to the nexus of space technologies and UK defence in Scotland by briefly addressing three themes: (i) space launch; (ii) satellite technologies; and (iii) public-private entanglement. More than 130 space companies operate in Scotland, representing 18% of the UK labour force in this growing sector.[9]

Space launch

Scotland's northernly location provides distinct advantages for accessing highly desirable segments of low-Earth orbit (LEO), known as polar orbits, which are inclined more than 60° relative to the equator.[10] Launch sites at higher latitudes provide a more efficient base for rockets targeting polar orbits, reducing fuel consumption and cost. Scottish spaceports also benefit from open ocean to the north-northeast of their locations (the direction of launch), with safe launch corridors along a rocket's trajectory to jettison spent rocket stages containing toxic fuel or in the event of an accident.

Polar orbits allow the satellite to pass over nearly all of the Earth's surface over a series of orbits, as the Earth rotates underneath. This is highly valuable for Earth observation and remote sensing applications and is increasingly being employed to provide high-speed internet access to remote locations. A sub-set of these orbits, known as "sun-synchronous orbit," is designed so a satellite passes over a specific location on the Earth at the same mean solar time each day; this allows for the collection of imagery with consistent illumination (barring cloud cover), enabling comparison across time. These characteristics have generated a rapid increase in the number of satellites in polar and sun-synchronous orbits, with demand expected to continue to grow.[11]

Several space launch facilities are currently under development or in planning within Scotland.[12] These include vertical launch facilities at SaxaVord in Shetland and SpaceHub Sutherland, and horizontal (airplane-based) launch at Prestwick (as with Spaceport Cornwall). Scottish space launch companies including Orbex and Skyrora are developing relatively small rockets that can deliver multiple small satellites to polar and sun synchronous orbits from Scottish spaceports. These operators will often serve commercial and civilian clients, but military and intelligence organisations will also increasingly rely on these services to augment or replace satellite capabilities on rapid timescales.

Satellite technologies

Satellites provide data platforms for national defence applications including intelligence and reconnaissance, networked communications, navigation, and targeting precision-guided weapons. They also enable countless civilian applications including telecommunications and the internet, mapping and geolocation, transportation and just-in-time logistics, banking, agriculture, environmental monitoring and weather forecasting, natural disaster response, and scientific exploration. As such, satellites and the ground stations that control them and collect and distribute their data are intimately implicated in forms of military, environmental, and human security. More broadly, space systems are increasingly understood to constitute a key element of national defence and economic power.

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space-power-jdp-0-40.

[9] Scottish Development International. 2023. "Space Industry in Scotland." https://www.sdi.co.uk/business-in-scotland/find-your-industry/digital-and-technology-industries/space-tech.

[10] Low-Earth orbit extends from 160 to more than 1000 kilometres above sea level. At these altitudes satellites travel very rapidly (approximately 7.8 km per second) and circle the Earth roughly every 90 minutes.

[11] As of May 2022, of the 5465 active Earth-orbit satellites, 673 were classified as polar and a further 1414 as sun-synchronous (38% of total). See https://www.ucsusa.org/resources/satellite-database.

[12] UK Government. "Delivering for Scotland: Spaceports." https://www.deliveringforscotland.gov.uk/levelling-up/spaceports/.

Satellite systems hold particular utility in the context of the High North, where movement, communication, and observation are impeded by weather, terrain, and isolation. Earth observation satellites can be used to monitor sea ice levels and animal populations or to identify military installations and the movement of units and materiel. Satellite-based sensors can capture radio frequency emissions from maritime vessels, which is especially valuable when operators (such as illicit fishing fleets or adversarial naval assets) may seek to evade detection. Satellites have long been used to detect and track ballistic missile launches; many intercontinental ballistic missiles would have attack trajectories over the Arctic. Finally, commercial broadband internet mega-constellations including SpaceX Starlink and OneWeb can partially replace expensive military satellite networks (such as the US Enhanced Polar System and Russian Meridian system) for providing communication at high latitudes.

In addition to commercial space launch described above, Scotland has emerged as a hub for the design and production of small satellites and components (e.g., AAC Clyde Space and Alba Orbital) and data services (e.g., Ecometrica and Spire).[13] As a recent Scottish Government statement noted, "Glasgow builds more small satellites than any other place in Europe."[14] The release of a Scottish space strategy illustrates the growing collaboration between government, industry, and academia in this sector.[15]

Public-private entanglement

As the above discussion demonstrates, commercial space operators are increasingly used to enhance state capabilities including in national defence. This has been most dramatically illustrated in the ongoing war in Ukraine where commercially provided satellite imagery and broadband internet have received extensive attention. The UK government has recognised the need for deliberate and sustained collaboration between public and private sources, including through the coordination of targeted investments in high-value technologies and skills.[16] To take one example, the UK government recently announced a strategic investment of up to £200 million in the UK Earth observation sector.[17]

But integrating civilian technologies into defence systems raises challenging questions concerning the status and responsibilities of commercial actors. This is especially so as most space technologies are inherently dual-use with civilian and military applications that are difficult to easily distinguish from the outside. Under the international law of armed conflict (international humanitarian law), civilian actors and assets would normally be protected from attack. However, this protection is forfeited if an actor or object "by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization… offers a definite military advantage."[18] The use of commercial space systems for critical military and intelligence capabilities thus blurs the line between combatants and non-combatants and raises the prospect that commercial operators may be targeted.

This is not a hypothetical matter. There are regular reports of jamming or spoofing of position, navigation, and timing (PNT) signals and efforts to jam commercial telecommunications signals to

[13] https://scottishspace.org/
[14] Scottish Government. "Space Sector." https://www.gov.scot/policies/manufacturing/space-sector/
[15] Scottish Government. 2021. "Scottish Space Strategy Launched." 20 October. https://www.gov.scot/news/scottish-space-strategy-launched/.
[16] *National Space Strategy*, p. 23
[17] Department for Business, Energy & Industrial Strategy; UK Space Agency; Natural Environment Research Council; Science and Technology Facilities Council; Met Office; and Innovate UK. 2022. "Notice: Earth Observation Investment." 23 November. https://www.gov.uk/government/publications/earth-observation-investment.
[18] Additional Protocol I to the 1949 Geneva Conventions (1977), Article 52(2). https://ihl-databases.icrc.org/en/ihl-treaties/api-1977/article-52.

prevent broadcasting in particular regions of the world. More dramatically, on 24 February 2022 commercial operator Viasat experienced a major cyberattack against its KA-SAT satellite network.[19] SpaceX has also reported regular—and apparently increasing—attempted cyberattacks against its Starlink broadband internet constellation operating over Ukrainian territory, attributed to Russia.[20] While not acknowledging specific efforts, Russia has declared that civilian and commercial space systems are legitimate targets when they effectively contribute to military operations.[21]

Conclusions and future considerations

In the context of the present Committee Inquiry, it is important to acknowledge the differing competencies and responsibilities held by the UK and Scottish governments. However, the central conclusion of this submission is that the two cannot be neatly separated: in areas of high technology, security and defence considerations invariably bleed into ostensibly civilian realms. In the case of space launch and satellite production, deliberations concerning industrial strategy, business development, rural development, or environmental protection will influence what capabilities are encouraged and prioritised and how space technologies are employed for national defence, and vice-versa.

Rapidly expanding commercial space capabilities and the challenging international environment call for innovative approaches to enhancing dialogue within the UK and globally. This submission recommends that the UK and Scottish governments, in the context of their respective competencies, carefully reflect on the legal, political, and economic implications of public-private collaboration in national security and defence space operations. This submission does not offer specific solutions but poses the following questions for consideration:

- What is the United Kingdom's position on the legal status of commercial space operators whose systems are utilised for national security missions during peacetime and/or an armed conflict?
- Assuming that an assessment is heavily context-dependent, would it be advisable for the UK to establish clear thresholds *ex ante* for what is regarded as acceptable and unacceptable? Alternatively, is constructive ambiguity more beneficial?
- Does growing public-private collaboration in national security and defence space operations require changes to UK regulatory structures? If so, what entities hold responsibility for this?
- How can UK and Scottish governments collaborate to ensure the effective development of the commercial space sector?
- How can commercial operators be better integrated into space policy deliberations both domestically and in international fora?
- Do commercial operators wish to be involved in policy discussions, and in what form?

January 2023

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[19] This attack did not target the satellites or ground stations, but instead disabled user modems connected to the company's broadband internet network in Europe. Cyber Peace Institute. 2022. "Case Study: Viasat." June. https://cyberconflicts.cyberpeaceinstitute.org/law-and-policy/cases/viasat.

[20] Elizabeth Howell. 2022. "Elon Musk says Russia is ramping up cyberattacks on SpaceX's Starlink systems in Ukraine." *Space.com*. 14 October. https://www.space.com/starlink-russian-cyberattacks-ramp-up-efforts-elon-musk.

[21] Statement by Vladimir Yermakov, Head of the Delegation of the Russian Federation, Director of the Department for Nonproliferation and Arms Control of the Ministry of Foreign Affairs of the Russian Federation, at the General Debate in the First Committee of the 77th Session of the UN General Assembly. New York, 4 October 2022. https://reachingcriticalwill.org/images/documents/Disarmament-fora/1com/1com22/statements/4Oct_Russia.pdf, p. 7.