

Written evidence submitted by the Ministry of Defence

Space Defence

1. How should the UK Government seek to further develop its strategic relationships and interoperability with allies?

We are actively engaged with a number of partners to determine how we may best meet our military requirements through Space. This includes working with Allies to improve alignment, transparency and interoperability from a policy, capability and operations perspective. Our strategic relationship with Allies and partners on Space matters is crucial if we are to maintain military advantage, share risk, build resilience, promote responsible use of Space and ensure Space remains safe and secure for all.

A key multilateral forum for this is the Combined Space Operations (CSpO) Initiative, which comprises the 5 Eyes nations, plus France and Germany. It seeks to improve space collaboration across policy, capability and operations. It considers individual and collective space capabilities to help enhance our collaboration, thereby expanding overall military effectiveness across all domains. In addition, the UK has military personnel stationed at the US-led Combined Space Operations Center (CSpOC), in the US, for combined planning and operations with several nations. Part of its function is to coordinate and share Space Domain Awareness and enable force support. Furthermore, the UK joined Operation OLYMPIC DEFENDER, a US-led operation, in 2019 to enable the centralised planning and synchronisation of combined space operations across several nations.

We work closely with NATO on space policy and operations, and have staff embedded in key roles within the organisation. Our presence within the alliance will continue to grow as they implement Space as the fifth operational domain. We continue to engage bilaterally with a range of nations, furthering and deepening our relationships through the provision of key capability for countries such as the US, Norway and others such as the Skynet Military Satellite Communications constellation. We continue to explore new opportunities with other nations on a bilateral basis, focusing on areas of cooperation such as intelligence sharing. The UK's relationships with international allies and partners in Research and Development (R&D) is one of our key strengths and is a growth area. The Defence Science and Technology Laboratory undertakes a significant amount of R&D with a range of partners, particularly the US, but wider Five Eyes and European nations as well. This helps to ensure future capabilities can be made complementary or interoperable from initiation.

- #### 2. Where can the UK most effectively develop and deploy its own sovereign defence capabilities, with particular regard to
- a. **Space Situational Awareness**
 - b. **PNT (Positioning, Navigation, Timing) services, in the context of the UK's exit from the EU's Galileo and EGNOS programmes**
 - c. **Intelligence, Surveillance and Reconnaissance**
 - d. **Communications**

Overview

Space will underpin the delivery of the Integrated Operating Concept for 2025, ensuring our ability to compete in the integrated and digitally connected battlespace of the future. The UK's prioritised ambitions within the Space Domain will be delivered through the establishment of a balanced Defence Space Portfolio. It will integrate current and planned capability management activities, combining existing core programmes with new initiatives to ensure the UK has capabilities to support military operations in the modern age. Defence is investing around £5 billion over the next decade to enhance our satellite communication

capabilities (Skynet) and a further £1.4 billion in the acquisition and development of new initiatives in: Space Domain Awareness; Intelligence, Surveillance and Reconnaissance; Command and Control; and other new capabilities for protect and defend activities. We will use flexible and innovative procurement to transition from design to on-orbit output more quickly and efficiently. We will develop secure, assured and resilient systems and infrastructure, exploiting the very best from the UK Space and Defence sectors to modernise platforms and capabilities, as well as using Space services to enhance our operations in other Domains.

As the UK seeks to develop its own small satellite capabilities, we will continue to explore the Defence benefits offered by this emerging market and consider potential exploitation opportunities in Defence. Further detail on the Defence Space Portfolio will be provided in the Defence Space Strategy, due to be published later this year.

Space Situational Awareness (SSA)

Space Situational Awareness (SSA) is now referred to doctrinally as Space Domain Awareness (SDA), to reflect the characterisation of space as an operational domain. The detection, tracking and characterisation of Space systems provides an increased understanding of the Space Domain and enables attribution of threats to our critical systems. It is a fundamental enabler of all other Space capabilities, combining data from a variety of capabilities with intelligence source outputs.

The Defence SDA programme, which will be boosted by additional funding, will augment and contribute to existing allied and commercial data sources with the addition of assured sensor capabilities for national object classification and attribution, critical to our ability to protect our interests in Space in the years to come. This will include coordination with other Domains to leverage and develop opportunities and capabilities with current and emerging technology to enhance SDA, as well as seeking opportunities for civil-military dual use. The requirement for SDA is critical to the success of all space functions, and therefore it is envisaged that we will continue to benefit from our international partnerships that allow us access to the widest range of data possible.

A Commercial Integration Cell at the UK National Space Operations Centre (SpOC) will help to embed private sector practices within our national requirements through integrating commercial entities that provide services to HMG, ensuring they have the most current data. The Defence SDA programme will also continue to be combined with the civil Space Surveillance and tracking programme, led by the UK Space Agency (UKSA), to bring together the best possible data and analysis from civil, commercial and classified sources.

Positioning, Navigation and Timing (PNT)

PNT signals underpin almost every military activity, delivering critical Defence capabilities, including precise navigation and targeting across the globe. Defence, like most sectors across Critical National Infrastructure (CNI) and commercial, relies heavily upon the US Global Positioning System (GPS) for our PNT requirements. We have access to encrypted signals which provide us a degree of additional resilience. PNT systems are inherently vulnerable to interference and nefarious activity, whether through jamming or spoofing (Electronic Warfare) or the natural hazards of the space environment. These threats were outlined in the 2018 Blackett Review into Satellite-derived Time and Position.

The Integrated Review stated that we would “strengthen the resilience of the PNT services on which our CNI and economy depend; and use Space assets to solve shared problems, supporting development efforts and disaster response.” We will continue to develop our relationship with the Five Eyes community regarding Navigation Warfare, and the protection and resilience of PNT capabilities such as GPS.

Following the UK's exit from the EU, HMG could not ensure that we would have the required level of access to the security protocols of Galileo to be able to continue using it for Defence and Security purposes. The UK therefore withdrew from the Galileo programme. UKSA, with support from other government departments, is now considering concepts for a UK Space-based PNT solution.

The UK no longer participates in the European Geostationary Navigation Overlay Service (EGNOS), including the Safety of Life (SoL) service which aids aircraft landing, and the EGNOS Data Access Service (EDAS), which permits access to EGNOS data through the Internet. The UK still has access to both EGNOS and Galileo's open signals.

Intelligence, Surveillance and Reconnaissance (ISR)

ISR comprises those elements of Earth Observation (EO) primarily utilised by the Defence and Intelligence community. EO provides imagery over a wide area or a specific point of interest, anywhere on the planet. EO has many civil purposes, such as weather forecasting, natural disaster monitoring, assessing the effects of climate change and tracking wildlife trends. Military and civil requirements for EO frequently overlap; as such, EO/ISR lends itself particularly to dual civilian-military use.

Defence will invest in the development and coherence of a range of cutting-edge technologies to generate a flexible, resilient ISR capability, underpinned by a novel and secure ground architecture. We will deliver a combined series of on-orbit and ground-based operational capability demonstrators over the next four years that provide the foundation for a Space-based ISR constellation. It will be coherent with Defence's wider cross-domain ISR and interoperable for the benefit of both the UK and our Allies and Partners.

Satellite Communications (SATCOM)

Global SATCOM that is secure and resilient, exchanging information via satellite to enable enhanced strategic capabilities, is essential for our operational independence. We maintain a non-discretionary sovereign requirement for global SATCOM that is secure and resilient, exchanging information via satellite to enable enhanced strategic capabilities. It enables global operations and discreet passage of information at a variety of sensitivities and classifications. The existing investment in the UK's world-renowned SATCOM capability, Skynet, will be bolstered with additional science and technology research to enhance and support our capabilities further.

3. How vulnerable are our space assets to deliberate attack, both physical and otherwise, and what steps can be taken to improve their resilience (with regard both to defence capabilities and other critical national infrastructure)?

Space is an increasingly contested and congested domain. As the cost of entry to Space has gone down, the number of actors in Space has increased along with the technologies those actors may employ. We have seen nations test anti-satellite technology in Low-Earth Orbit, one of the most congested areas of near-Earth Space. Although these tests have not been directed against specific nations, this behaviour risks inadvertently damaging satellites in orbit which could cause a Kessler event¹ as the debris created causes further damage throughout the domain.

¹ Kessler syndrome, proposed by Donald J. Kessler in 1978, is a theoretical scenario in which the density of objects in Low Earth Orbit (LEO) is high enough that collisions between objects could cause a cascade in which each collision generates space debris that in turn increases the likelihood of further collisions.

A widespread threat to our space assets is electronic warfare delivered from the ground against our assets that operate using space signals. Activities such as jamming or spoofing are relatively easy, cheap and have significant impact on capability. Examples of this are outlined in the 2018 Blackett Review which sets out the threats and vulnerabilities faced by the UK's dependency on US GPS. Measures we are taking to increase resilience are outlined in the section on PNT above.

The MOD tests its own dependence on space-based assets through capability audits and wargaming, which we conduct with partners. The results of these efforts are classified. Responsibility for the security of space-based assets underpinning CNI sectors that are not Defence-specific falls to the UK Space Agency's Space Security team. The MOD's intelligence community works very closely with the team to share information where possible. SDA is key to understanding activity and is foundational to both military and National space operations. There are an increasing range of threats and hazards that pose a threat to military and civil space assets, and in 2008, UK Defence established the SpOC to provide Command and Control to Military Space assets. The MOD has been collaborating with the UK Space Agency on space operations since 2016 including embedding UKSA analysts. The UK SpOC enhancement started in 2018 and we are now set to establish a UK National SpOC.

4. How can defence industrial policy ensure that investment and innovation in the private sector is harnessed to align with the UK's defence requirements?

The Defence & Security Industrial Strategy was published in March 2021. It outlines the need to embrace the growing UK space innovation environment and support wider sector growth aspirations through targeted projects. We need to exploit novel technologies and provide capability to the user faster than before, keeping pace with the burgeoning space sector and the speed of technology development to ensure we maintain cutting edge capability. The consideration of dual civilian-military use of technology at all stages of development and procurement will ensure maximum benefit is derived, both for capability and value for money. This principle will be embedded in Defence's approach to capability development.

The publication of the National Space Strategy later this year will set out opportunities for industry, and Defence will work with the civil sector to ensure that there is a clear implementation plan that is communicated with industry.

5. Have recent machinery of government changes ensured a joined-up and coherent approach to defence space policy both across Whitehall and within the MoD? What further improvements could be made?

In 2020, No 10 and the Cabinet Office commissioned BEIS and MOD officials to lead a review of space governance and structures across Whitehall (the Space Landscape Review). This has informed key changes which are now underway, notably the movement of high-level policy and strategy functions from the UKSA to BEIS by autumn 2021. The Agency will focus on programme delivery and technical expertise and will retain responsibility for programme-level policy. The review will also result in closer working between BEIS and the MOD on policy issues where this makes sense.

6. What should be the priorities of the new Space Command, and how will its structures facilitate integration across all military domains and co-operation with commercial space operations?

UK Space Command is a Joint Command, staffed from the Royal Navy, British Army and Royal Air Force, the Civil Service and key members of the commercial sector. It brings together 3 functions under a single 2-Star military commander: space operations; space workforce training and growth; and space capability (developing and delivering space equipment programmes).

Space Command is prioritising delivery of Defence's element of the Integrated Review, including the development of a civil / military National SpOC and the enhancement of UK space capabilities. This will allow us to support the Government's ambition to monitor, protect and defend UK interests in and through space. Space Command continues to work closely with UK Strategic Command which will retain sponsorship of capabilities such as ISR and Communications. Space Command is also focussed on deepening our cooperation with international partners and NATO, while also increasing our collaboration with industrial partners to identify and exploit mutually beneficial opportunities to work together.

Retaining a wide workforce mix within Space Command will remain a priority as the organisation continues to grow. Integration across Defence is further enhanced through Liaison Officers from Space Command who are employed in other single service and joint headquarters to act as a conduit between the two organisations. This is complemented by measures to improve the level of space-specific training and education provided to all members of the Armed Forces.

7. How can the Ministry of Defence ensure that it attracts, develops and retains high calibre space specialists in both policy and operational roles?

The military space workforce has traditionally been made up predominantly of Royal Air Force personnel from a number of branches and trades. These personnel are career managed into space posts on a routine basis, undertaking additional space specific training prior to and during their postings.

The establishment of UK Space Command as a joint organisation with responsibility for space workforce training, will drive the expansion of the space workforce across the other Services, the civil service and industry partners. This will grow the pool of experts from which we can draw.

Work will be undertaken to establish whether a specific space career specialisation or career management is required in the future. A Defence Space Workforce Training Needs Analysis is being conducted and will report its findings in 2022. It will be used to inform the correct training and management structures to ensure a viable, sustainable Defence Space Workforce for military and civilian personnel.

15 July 2021