Written evidence submitted by UKspace

Space Defence

Introduction

UKspace is the trade association of the UK space industry representing the interests of over 90% of companies involved in the space sector across the country. It works closely with UK Government, Parliament, and other national and international stakeholders. Working with trade body partners ADS and techUK, UKspace is dedicated to representing the interests of a diverse membership across industry and supporting them to grow and develop their business. UKspace works closely with key government agencies and departments such as the UK Space Agency, the Ministry of Defence and InnovateUK, as well as organisations who support the commercial growth of the sector such as the Satellite Applications Catapult and the Satellite Finance Network.

The largest of the UKspace sub-committees is the Security and Defence Committee (SDC) which represents those companies that have services or products associated with defence and security needs. Many are suppliers to UK MOD.

The SDC led on the drafting of this submission with views provided from its members. Membership of the SDC is diverse and consequently so are the views held by its members. This submission by no means captures all views and we would encourage continued engagement with the sector. To ensure fair representation from our members, the views are presented without prioritisation, trade-off or analysis (although some editing has been made to meet formatting requirements). Thus, a broad spectrum of opinions is deliberately apparent, but divergence tends to be in the detail and individual experiences inform opinion.

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

The space sector is international and global by nature and often characterised by collaboration in both R&D and commercial endeavours. But it should be recognised that there is competition in space for commercial and military advantage, therefore tensions can escalate by either design or accident. The lack of space domain awareness can make it difficult to identify or attribute intentional aggressive action.

To enable interoperability with allies, future UK space capability needs to be "International by design", enabling the UK to seamlessly support its allies in key missions and hence achieve both operational advantage and strategic influence, whilst also being best placed to utilise allied capabilities. But, where appropriate, these should be UK operated systems to retain freedom of action. The scale of the space mission (many orbits, threats and missions) lends itself to burden-sharing with allies to achieve mutual benefit in cost and performance and also sending strong messages to potential aggressors

Although it has been declared that the US is a key ally, there has been significant benefit from relationships with European allies and institutions (EU, ESA). There is also clear benefit in Franco-British cooperation; both have sovereign Satcom capability (Skynet, Syracuse), which are complemented with different commercial Satcom services. This needs to be maintained but there would be merit in being clear on the objectives and priorities for those international relationships so industry can respond. Further, working through alliances such as the 5EYES and NATO for space missions is a deterrent. Working together in space-based capabilities could also enhance interoperability and operational effectiveness of combined forces, such as US-UK task forces (notably special forces and global response forces), the multi-nation Combined Joint Expeditionary Force (CJEF) and of course NATO.

The work the UK has done at the UN to agree norms of behaviour in space has demonstrated global leadership in the sector. This endeavour is imperative to agree standards for the sustainable and safe use of space and to ensure commercial operators can have confidence in the domain. It will also enable defence and security agencies to recognise behaviours that may be malicious. This enables the exchange of data supporting identification and attribution of unacceptable space behaviour (and using space for attribution of other domain behaviours).

The UK should leverage its expertise in certain technology areas to galvanise relationships with allies such as PNT, EO/ISR and Satcom where allies can interoperate. Or build on world-leading technologies (such as quantum) to secure strategic advantage in the sector. Success will be dependent on engaging in cross-party dialogue with Allies to fully understand the UK national defence space landscape. This should involve mapping existing capabilities, identifying future capabilities required, and completing a gap analysis.

Defence should leverage key strengths in new and emerging technologies including Quantum Technology which has applicability across a variety of space domains including PNT, sensing, secure communications and data analytics.

Many UK space companies are subsidiaries of multinationals. This global reach offers opportunity. Major space programmes ebb and flow on a cycle, therefore we cannot rely on home grown companies and national opportunities alone to sustain capability. Adopting a collaborative approach should be a key tenant of future planning, reflecting our desire to work with our key allies. So future UK space capabilities should be planned not just for sovereign needs but for supporting exchange of benefits with allies and realising export potential. Strong international industrial links underpin strong diplomatic relationships.

We should look to significantly increase commitment to collaborative R&D projects between the UK and other nations, particularly the US. This will allow the UK to lead in areas where we have a strong capability heritage and to influence export markets at an early stage.

Champion standardisation with converging commercial technologies might be adopted. This is most germane in the telecoms area: including. co-operation with the US and German Defence departments on satcom and LTE/5G which could provide standardisation for high bandwidth military communications on the move.

Where can the UK most effectively develop and deploy its own sovereign defence capabilities

General Points

There needs to be a clear definition of 'sovereign' so that industry can understand how to deliver to those requirements. Freedom of action and operational advantage do not necessarily mean 'UK-built', but relates more to ownership and operation of those systems.

There are security and economic benefits from pursuing as much 'on-shoring' as possible. Sovereign control of assets extends to appropriate assurance in the design, supply chain, integration and test. However, the government needs to guard against making this definition prohibitive for inward investment or adding unnecessary cost to systems. The MOD "Assured Capability" (AC) approach provides some useful guidance to define this more intelligently.

By definition, both space and many parts of a ground segment or ground-based Space Domain Awareness / space surveillance and tracking (SDA/SST) capability are outside "the UK", sometimes on UK territories – a global advantage that we should use more. Previous discussions with UK government in this area have struggled with a workable definition of "sovereign" that takes account of these issues.

Defence should be looking at platforms and architectures that support multiple and different missions through life and capabilities such as reprogrammable, multi-purpose systems (satellites and infrastructure). With a focus on rapid technology refresh, lower unit price with shorter life expectancy and lower risk (security, system, and operational), easy prototyping, lower cost components, etc.

Space Situational Awareness

The UK already plays a part here, and has obligations to monitor UK operated and licenced systems. There is a need to maintain links to allies' capability to support, burden share, enhance and increase mutual resilience. Commercial capability is evolving very quickly and that needs to be drawn into a coherent UK 'space picture'.

The UK can most effectively develop and deploy its own sovereign defence capabilities by treating space-related information and data as both a strategic asset and a powerful tool to mitigate both natural and man-made threats in the space environment. In so doing it can support not only the Defence perspective but also the wider national space sustainability agenda (which should in our view be a key tenet of the nascent National Space Strategy). Treating space-related information in this way requires a deep understanding of the origin and characteristics of the data (including its fidelity and quality) as well as a strong commitment to share the understanding derived from it with other like-minded nations to provide a means for ensuring security and prosperity in space.

Furthermore, the introduction of specific UK capabilities, for example in ground and space based sensors (ideally established in collaboration with commonwealth partners) as well as enhanced understanding through data processing and analysis, could lend great weight and credibility to both our own sovereign aspirations and the role we aspire to play with our Allies and partners.

Enabling the safe of use space is a cross-government endeavour. Some members suggest that Space Command should provide the security element (Space Domain Awareness - SDA) and a civil organisation such as the UKSA should be the SSA (Space Situational Awareness). A partnership akin to the Air Command - CAA relationship.

We should focus on the need to develop the infrastructure and skillsets for an independent (yet collaborative) civil space surveillance capability to provide SSA for space sustainability and the foundation on which Defence can develop SDA as part of the Defence Space Strategy.

PNT (Position, Navigation, Timing) services, in the context of the UK's exit from the EU's Galileo and EGNOS programmes

PNT information is vital in transport, communications, energy distribution, finance and emergency response.

There are many alternative solutions to meet the UK's PNT needs. Existing systems will continue to be used where applicable. There is huge potential to collaborate with allies and/or utilise other GNSS systems to: aggregate for resilience, leverage comms systems with multi-band antennas, link into ground-based systems. In addition, the next generation of US GPS programme is underway and the UK could seek a role in that capability.

UK should approach PNT in terms of CNI resilience first. Resilient PNT needs the ability to utilise multiple systems and resilience solutions to assure technical and commercial choice and real resilience. The answer may not just be a "sovereign" constellation but considered use of commercial, EU and allied assets.

Access to PNT services is fundamental to enabling military operations. With growing threats exploiting obvious weaknesses in current GNSS, there is a clear need for alternative options. Ownership or access to global alternatives (space and terrestrial) are needed with these integrated to deliver an assured service to military users.

Even a temporary loss of GNSS could have serious consequences for critical national infrastructure and Defence operations. Quantum technology can mitigate the jamming and space weather threat through new optical or quantum clocks. On the ground, these can provide backup timing. In space, they may be used to upgrade satellite navigation systems, improving the resilience of our GNSS systems.

Intelligence, Surveillance and Reconnaissance (ISR)

The case could be made for a "UK NRO" within UK Space Command to lead on ISR from space. This must be integrated with wider defence, national and international ISR capabilities and linked to other information and intelligence sources.

The UK currently relies on OSINT (Open Source Intelligence), commercial remote sensing (from UK and global companies) and Allies (especially the US). The key sovereign element could be focussed on the analyst capability of these different information sources. There is a need for greater autonomy and intelligence processing of ISR sensor data. This should embrace AI and ML algorithms working in tandem with real-time in-orbit data processing and fusion. Enabling defence to deliver multi-domain integration and ensure resilient connectivity across defence and into wider government.

Many members support the IR's recommendation to develop a UK EO/ISR constellation, as this plays to national industrial strengths in smallsat and UK launch from a strategic perspective. We can offer this UK capability to allies as burden sharing.

Communications

The UK has invested in independent military satellite communications capability (currently delivered and managed by industry) and this continues to be a core capability. But future systems could deliver to more cross-government requirements to maximise value for money. In addition, the military communications needs cannot be met by a military system alone and will need to access commercial systems (at all orbits) and allies systems (as it does now with the UK partnership and investment in the US' AEHF capability) to meet the overall needs. The seamless integration of these capabilities into the Military mission needs to be a focus, including technical and commercial enablers.

There is some convergence between satcom and terrestrial systems so there needs to be investment in terminal technology to best leverage different space-based assets. The US SDA approach of commercial and defence integration utilising more bearers (including constellations and ground systems) improves resilience and robustness and enables freedom of action.

The UK should continue to invest in quantum cryptography. The benefits and resilience that this technology affords for Defence is potentially significant.

Command and Control

As the UK invests in multiple future space-based systems there needs to be thought given to consolidation of the ground architectures and control systems. There is an opportunity for a single, resilient, architecture capable of monitoring and controlling future space assets as well as the transmission of the information (PNT, ISR and data) they deliver. .

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)?

The UK is currently highly reliant upon other nations to provide Space surveillance data from which we develop a view of the vulnerability of our Space assets. The steps that can be taken to improve resilience should be based around developing and sustaining our sovereign (and therefore

operationally assured) Space Domain Awareness capability, focused around the strategic importance of data and the valuable understanding that can be derived from it.

Space based systems are increasingly vulnerable and there is clear intent from some adversaries to undermine or attack them. Threats to systems can include attacking the space assets (hard and soft kill), jamming and interference (optical to RF), attack of the ground system (spacecraft to ground segment), or interdiction through the supply chain and the cyber domain. Aggressor actions can be sub-threshold and justified as legitimate manoeuvres sometime utilising apparently 'commercial' systems.

To mitigate threats it is imperative that the whole of the system is defended, as the ground segment is often most vulnerable to intercept, disrupt or destroy, especially a widely dispersed LEO ground segment that is harder to protect. A robust terrestrial architecture is required similar to other parts of the UK's telecommunications CNI, with intrinsic strong cyber protection. Many allies systems design space capabilities to be less reliant on the ground architecture to improve their survivability in the case of ground attack, utilising technologies such as inter-satellite links.

Non-destructive interception of satellites remains difficult but many nations have demonstrated such capabilities and the threat alone results in a loss of manoeuvre. Political and operational strategies and capabilities are needed to counter these threats.

Protection measures could involve the permanent or temporary modification of a satellite's observable signature, or changes to a satellite's concept of operations. Other, more active options include deliberate attempts to interfere with adversaries' SSA system operations through RF countermeasures that are already a well-established feature of terrestrial military systems.

Work with allies to create operational, technical, commercial and (inter) national resilience (i.e. a national system maybe easier to target than one supporting allies and / or enterprise or consumer traffic).

Also noted:

- Training should also be a prominent strategy in developing understanding of the issues and operator resilience.
- The commercial and defence investment activities are driven by ongoing risk assessment and mitigation approaches for all assets in the wider system; commercial dual use and defence.
- Deliberate debris-creating destruction of satellites needs to be internationally banned.
- Consider legislating so that civilian spot beams can be commandeered (i.e. steered) to where defence needs them

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

Moving to a more fully-funded approach, particularly expanding the existing SME full-funding to mid-Tier UK companies would fuel more investment in the UK space supply chain.

The recent Defence Industrial Strategy (DIS) provides opportunities for better understanding of IPR and liability, along with strategic partnering possibilities. Traditionally Dstl have appeared reticent in adopting these principles, culturally more comfortable with a customer supplier relationship and control of IPR. This willingness for more of a strategic partnership approach with key industry players and custodians of important parts of the UK's CNI will be essential to leverage wider investment and innovation taking place that can be applied to Defence capabilities.

The MOD needs to better understand how commercial operators are able to provide resilient infrastructure, delivered to the MOD without the MOD defaulting to resilience being analogous to MOD sovereign ownership. A more expansive view on 'sovereignty' and 'freedom of action' is necessary, viewing resilience from a layered perspective as evident in other capability areas.

Procurement agencies need to evaluate the strategic and economic value of UK purchasing to the taxpayer. A government body to lead in the specification and procurement of the UK's civilian and military systems could take advantage of synergies. While military, civil and commercial needs can differ, the private space sector needs better briefings in order to offer effective solutions that could benefit all users.

Spend at least the equivalent of peer nations; more if the UK wants to gain advantage in the sector.

The UK should consider direct investment to ensure UK access to unique capabilities or to accelerate the availability of products/services that meet clear near-term needs. Directly investing in targeted opportunities provides capital and also creates confidence for investors, strategic partners, and customers.

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?

The governance seems to provide what was lacking previously in terms of an overall UK space approach. However, there is still a perception that there are two main agendas between the MOD and non-MOD (BEIS, UKSA, DfT) which could lead to divergence in the UK space strategic intent and capability. As the strategy and governance mature there needs to be oversight to ensure 'UK as a whole' benefits are realised.

The release of the National Space Strategy would be seen as the most important piece of tangible progress towards a clear policy.

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?

UNDERSTAND, ENABLE, PROTECT – across all space capabilities. But in concert with others (UK agencies and allies) noting the attack vectors for the ground segment. Building around the existing UK capability and growing linkages with allies and wider UK Defence.

It must be seen as a joint command and understand the wider user and provider community (military and commercial) and how operating the battlespace / domain enables and concerns them. It remains unclear how the responsibilities will mature between Space Command, Strategic Command and the Centre and exactly the portents for co-operation with the commercial space sector. We are concerned to see the sector chasing those who have influence, if not necessarily the funding, and hence risk a period of unhelpful confusion. There are analogies to the early years of the cyber journey with Defence and historic lessons should be re-examined. Communications and ISR are fundamentally capabilities space contributes to – (the "digital backbone") but a fledgling space command (and even a fully mature one) should not lead these functions. Strategic Command and enabling organisations need to set the demand on space, and integrate these capabilities for wider defence purposes. Space Command could in time deliver and operate the space elements for and on behalf of Stratcom and enable the Front Line Commands. Strategic Command and enabling organisations need to set the requirements on "space" and integrate those capabilities for wider defence purposes. This includes clarifying with the Defence Solutions Centre exactly what we mean by Space ISR and satellite communications.

There is strong hope that Space command grows rapidly in experience so that it can support delivery of space domain capability, be the intelligent customer and operator of UK military space. Strategies to help Space Command's accelerated development should be encouraged. Rapid, modest (but growing) real-world programmes will help to develop that capability and flush out conflicts.

- It is already noted that additional effort is needed on Skynet 6 to ensure the programme remains on track and that the best of breed from capabilities across industry are brought to bear in a timely and agile manner, including SMEs.

UK Space Command cannot be the same as the US, due to scale and budget realities. It needs to act as a focus, and not attempt to do everything. The balance between Stratcom C4ISR and Space Command will be key.

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

There is a strong need for Space practitioners to focus on the in-orbit assets. Whilst clearly the MOD needs to deepen expertise in this area, they should ensure space specialists retain a broad understanding of end user requirements. As with cyber, there needs to be a 'Whole Force approach, possibly with 'cross-postings' (to and from civilian organisations) to broaden experience and provide expertise at the right place (and right time for longer programmes). Such exchanges need to be career and remuneration neutral-positive for those taking part.

Space programmes are long-term and many roles are specialist; expertise comes with experience. There needs to be a career stream for MOD space personnel that includes technical acquisition.

A "Space Academy" to service government, industry and academia is noted as a route to achieving more focussed expertise, knowledge retention and transfer within a controlled setting.

6 July 2021