Written evidence submitted by Viasat UK

Introduction

We are in an era of unrestricted and highly competitive warfare. Our Defence and Security communityfaces relentless and demanding challenges and is under growing pressures to act and move faster than ourevolving adversaries.

In combating this environment, the Ministry of Defence (MoD) has a vision and desire to reach a future resilient. assured, integrated battlespace. This means delivering more value and capability from platforms and service personnel across all the domains. It requires both effective and efficient information networks and speed in handling decisions and intelligence down to the tactical edge.

MoD and Government mission directives must ensure that our space strategy establishes us as a leader in what is emerging as a new 'Space and Digitisation Race' with the:

i) Defence Mission, delivering national security and protecting our values and prosperity by combating this diverse adversarial competitive threat by using unrestricted warfare. Success must focus on 'problems to be solved' to empower mission success at speed of relevance. That digital solutions delivering information advantage in support of multi-domain integration can, as will more expansively, be designed, funded and delivered through private sector capabilities; and

ii) Government Mission, focusing on delivering a growing industrial base that places the UK as one of the leaders in this race. Driving international policy for the use of space, its safety and ecology. If done correctly, it will drive the prosperity agenda, the sovereignty agenda and levelling up. It will alsosupport delivering the digital economy (IoT, 5G autonomous, smart cities, etc..) and grow a country rich in talent with highly exportable solutions.

To deliver a space strategy that delivers both these mission needs requires MoD to share its vulnerabilitieswith industry and to become a demanding customer with a coherent flexible commercial approach. This underpins a paradigm shift that combines strategy and partnership with mission needs to achieve defence and security objectives, rather than becoming drawn into the technology trap. Modern digitisations offer experimentation abilities, try-before-you-buy and bite-sized investment opportunities that deliver sustainable solutions and a prosperous industrial base.

It is anticipated - pending release of the space strategy - that to deliver modern space power requires the MoD to have:

i) assured space capabilities, resilient network(s), freedom of sovereign action, integration with allies, maximum benefit from the private sector, development of talent to be the best 'competitor' (against threats), forming of deep understanding of the total space networks - much of which is in the ground

- data management, applications, sharing of spectra, space policy and safety and adaptability; and

ii) integration and usage of the space network to deliver force multipliers from harmonising defence, security and government needs; matching those of allied integration and maximising shared investment; ensuring use of commercial and industrial road maps. Progress starts with trust(couched by appropriate security concerns), which is driven by open dialogues about vulnerabilities,

solved through collegiate team engagement and not contract models or industrial abuse. Thisunderpins the evolution of the New Industrial Defence Base and hybrid acquisition models.

Q1: How should the UK Government seek to further develop its strategic relationships andinteroperability with allies?

It is important for the Government and MoD to establish, within its space strategy, those elements (bothinfrastructure and services) of the space network and the space mission that need to be:

i) sovereign (whole or part that is UK secure eyes-only-for-solution, service and network control);

ii) UK-controlled; or

iii) co-shared/sourced with appropriate governance from allies.

From these separate space network elements, the UK can overlay gradients of potential interoperabilityacross an ambit of opportunities regarding:

iv) Integrating allied capabilities as part of our space network;

v) augmenting UK capabilities with allied network service provisions; and

vi) exporting UK space network capabilities.

To maximise each of these, interoperability needs to be designed into the space network at the outset. Ashared approach (open architecture) to the space network allows the infrastructure, data and services tobe shared as well as for a common framework to cross-share and integrate intel and situational awarenessor commercial terms. This design activity empowers a series of integration and relationship considerations:

i) use of each allies' satellites to support UK missions;

ii) shared usage/access of ground networks;

iii) cross-funding of R&D to produce common effects;

iv) cross-border procurement and incentives (trade deals and other government vehicles);

v) more freedom of movement for often scarce specialists to support allied missions; and

vi) a common standard at the tactical edge to share data.

In addition to these physical access and integration areas, there are several other supporting operationalareas that can be accelerated and strengthened against adversary activity in the space network:

vii) space situational awareness; and

viii) cyber security.

Finally, relationships are critical for the agreement of space policy and standards. These include:

ix) rules for managing the usage of space orbits (currently no rules for LEO);

x) environmental standards and expectations (eg. quantity of aluminium to be burnt in atmosphere);

xi) safety standards expected for spacecraft and launch; and

xii) spectrum availability for space networks and frequencies across all countries.

Q2: Where can the UK most effectively develop and deploy its own sovereign defence capabilities?

It is extremely important to separate the notion of sovereignty (solutions we build and operate with no sharing of IP or access by others) from that of sovereign control (ability to use third party supplies andservices that remain under UK control).

When considering sovereignty, applications to the space networks should be limited to those capabilities that are an absolute in providing the critical defence and national infrastructure requirements. Whilst seemingly a very limited scope, this is due to the extreme economic impact of a broad global space networkrelative to its life and limited data used, together with the exponential change of technology and capabilitybeing deployed in the private sector. This critical minimal approach is extremely sustainable and secure, asboth allied and, more importantly, the private sector, secure capacity and capability augmentation are readily available and maintain speed of relevance. Collectively, sovereign and private sector augmentation combine to provide resilience and assurance within the space network ahead of adversarial activities. The sovereign critical minimal approach should:

i) ensure UK orbital slot rights across all orbit levels (currently the UK has no specific rights at LEO or MEO. This seems to be on a first-come-first-served basis);

ii) guarantee spectrum rights for space bandwidth;

iii) provide critical secure communications bandwidth for defence. There remain further considerations to such bandwidth:

   a) the scope should be sized to the sovereign data size-demand and the specific mission outcomes, rather than generic broadband statements;

   b) the bands should support such specific mission drivers, including Link16 for fires and C2, UHFand Ka for high data rates and X band for legacy systems;

   c) dedicated satellites should provide these critical defence and national infrastructure network services, given the extensive investment for dedicated space. These need careful planning on life expectancy, orbital parameters and thorough consideration given to threat environment risks, including items, such as orbital policy infrastructure;

   d) there should be co-purchased satellites or hosted payloads with allies/industry where neitherparty can remove or establish control of the other party's element. Consideration includes: (i) for GEO satellites, assertion rights to control position in orbit or control data; (ii) co-funded LEO satellites where the orbital control risk is much lower, as they are on dedicated pre-orbitalpaths; and (iii) ground infrastructure and network management that can be segregated and controlled;

   e) there should be commercial augmentation where sovereign control can be asserted over the data network (eg concept of black-core virtual private networks in space);

iv) establishment and management of network operations and cyber centres for dedicated or shared space network services. Where dedicated satellites are built, such management needs to be expanded to Telemetry Tracking and Control (TT&C) centres;

v) space Situational Awareness infrastructure and associate control centres. These must facilitate integration of allied and commercial data;

vi) PNT (Position, Navigation, Timing) services are critical for an effective space network capable of delivering space and battlefield missions. This type of solution could be offered through an architecture of hosted small payloads, signals of opportunity and integrated ground networks in order to accelerate availability and reduce cost substantially. It needs sovereign support as many aspects of the space network and defence capabilities are negated without PNT capabilities; and

vii) Intelligence Surveillance and Reconnaissance (ISR) for specific limited sensors along with associated operational and analytics centres. Again, such operations centres should provide for external feeds from allies and even commercially available sources. It should be considered that substantive ISR is

provided through commercial augmentation today and this situation will expand, as open-source datais providing substantive overlay and exponential growth.

Q3: 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)?

Direct kinetic attack of satellites appears possible by those adversaries that have their own satellites. Given the catastrophic impact of space debris and that such kinetic acts can be tracked, it is thought that such actions would be an absolute breakdown in country relations or a declaration of war. Given the other potential actions, this is thought to be a last resort approach.

A more indirect, and somewhat more deniable, approach is the positioning of space assets that disrupt, disturb or block the satellite beams to nullify the communications capability of such beams. Some of the efforts in debris removal vehicles could also be re-purposed for such satellite disruption activities and is a further example of the need for policy and space safety international regulations.

The current limited number of MoD space ground stations, which are also generally very well known, present a much softer kinetic target for adversary activities, both in terms of using proxy forces and exposures to direct attack or indirect action by disturbing infrastructure services, such as power.

Cyberattacks and activity appear to offer the current largest exposure for adversary activity. Such effects can be actioned remotely, through proxies and with simple targeted attacks creating very harmful andwidespread impacts.

Finally, for mission operations there are jamming activities from within the beam at the tactical edge.

Resilience to all these adversarial activities could be reduced through a number of PACE (primary alternate contingent and emergency) actions:

i) any sovereign infrastructure solutions must be built with a more resilient architecture – multiple ground networks and operations centres, small beams, high-capacity satellites, beam steering, multi-band multi-mode terminals;

ii) integration of ground elements within private sector ground infrastructure and networks must be understood as vital for resilience, given the extreme risk of disruption to such limited and exposed MoD ground stations;

iii) space network services must be augmented with allied and private sector provided services (beams, cybersecurity, terminals, ground stations);

iv) implement virtual private networks with commercial and private networks that are sovereign-controlled and managed (ie a “black-core VPN”);

v) a focus on spiral development and bite-sized implementation of new solutions must remain aheadof the threat vector, rather than on significant long term programme investments, which remove flexibility in the modern conflict arena;

vi) dedicated cybersecurity centres, importing and using commercial operations and cyber data andanalytics must strengthen our threat vector understanding and awareness; and

vii) allied and partner nations information exchange mechanisms must be implemented.

Q4; How can defence industrial policy ensure that investment and innovation in in the private space sector is harnessed to align with the UK's defence requirements?

The MoD must start by defining the mission outcome(s) that it requires from the space sector, rather than focusing on technology. The private sector must be included from the outset of the network design. MoDmust also tailor such outcomes against the network elements that really matter for direct investment, giventhat several of our adversaries have substantially greater GDPs and resources. A direct pound for pound
- or capability for capability - struggle is a contest we cannot win.

A new industrial defence base strategy formed from an eco-system of suppliers and partners, with a trust-based approach, will create a partnership that offers the force multipliers to stay ahead in an age of heavy investment, spiral technology and continuous warfare (below and above threshold of kinetic activity). Thesepartnerships facilitate the sharing of vulnerabilities and an outcome-focus to provide MoD with solutions, not technology. It will allow early sharing of the rapidly advancing commercial markets and shapeinvestments being made in space technology roadmaps to augment defence needs.

A close, trust-based approach would embrace a new paradigm of experimentation and delivery, based on proof and integrated development needs from mission/operational understanding. The process offers advantages in that:

i) MoD acquires an understanding of what technology is available today, instead of estimating what they believe will be available in the future;

ii) MoD teams, commanders and users acquire 'hands-on' experience of the potential solutions and, indoing so, find new uses and advantages that otherwise would not have been known to them or industry, until well after deployment;

iii) industry understands the constant competition and threat activities to spiral investments andcapability developments;

iv) operational effects and doctrine and modified-at-speed of relevance stays ahead of the changing adversarial threat; and

v) changing threat vectors and operational effects spiral back into the next series of innovation developments that shape private-sector investment targets to deliver next-generation solutions for the space and battlespace network.

Q5: 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?

There seems to be a more coherent approach within the published new structures. It is difficult to commentin detail as the space strategy has yet to be released. It is hoped that an outcome focus for the Defence

and Government strategy will specifically set space objectives and targets, given the above conversation on the growing adversaries' economic and resource position. The strategy must weigh the economic investment or risk reduction against the critical outcomes needed to avoid the space strategy being so broad that it endeavours to deliver every aspect of the space environment equally. We also need to increase direct UK funding into space. Confidence comes from Government spending and a suggested minimum should be multiples larger than that which we currently we spend in ESA.

It is worth returning to the question of space policy and rules. In order to deliver the MoD mission, the UKmust establish rules for allocation of orbital slots at all layers (LEO/MEO/GEO), rules around safety (standards and % of failure), environmental standards, flight operational rules and spectrum availability for space. Whilst there is much focus on areas such as launch, should policy not be prioritised and agreed upon promptly, then access to space will be monopolised by those with the economic power to insertsatellites into orbit very quickly (without any current demand to meet standards for environmental or failurerates).

Q6: 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?

They should be the focus on the delivery of an assured and resilient integrated space network to meet theMoD space defence strategy, including:

i) to support space directorate and Government in feedback on standards and policies
ii) to work with space directorate and deliver the open architecture
iii) to manage and deliver:
    a) launch;
    b) satellite flight;
    c) the space network infrastructure;
    d) data management;
    e) space situational awareness; and
    f) integration of private sector and allies' services and networks.

In essence, the Space Command needs to manage and deliver the entire vertically integrated space network that provides the secure data to enable the missions. Today, the defence space operational landscape is siloed and fragmented across the front-line commands, defence digital and DE&S, which must be orchestrated into a single-focus domain group, delivering the network demand to the other four domains in an integrated platform and services manner.

Q7: How can the Ministry of Defence ensure that it attracts, develops and retains high calibre spacespecialists in both policy and operational roles?

It should participate in and facilitate thought leadership in investment circles around the delivery ofoutcomes in space that are required for UK prosperity and sovereignty. This means we must:

i) invest in the sector directly and increase national programmes, whether or not this comes from re- directing existing funding, finding new channels or creating cross-pollinated demands across defence and commercial. This initial spending delivers confidence from a change in approach, which will accelerate the space sector. Direct UK investment should be multiples larger than that which we currently we spend in ESA; and

ii) up our game with international and rest-of-world investments. Whether inward or outward, we must become attractive to foreign investment and use offset and prosperity as elements to drive future continued UK sustainability. When considering the remit of the space network, this includes exporting our network services, ground infrastructures and cyber information, not just physical satellites and terminals.

Dedicated STEM investment programmes are essential. If we are to develop the talent for today and for tomorrow's space demands:

i) demographics in the space sector must support graduate schemes and university placements for the industry to prosper in the future;

ii) these programmes must encourage diversity in the workforce, which thrives on developing its full potential across the entire space eco-system;

iii) they must advertise the exceptionally broad and multi-faceted space environment to excite the talents of the required workforce;

iv) they must look to highlight and promote rare skills items, such as space operations; but

v) most importantly – they must allow this new young talent, growing in the digital era, to teach and expand the art of what is possible.

Finally, there must be a career strategy for space within MoD. Space Directorate and Space Command have dedicated space experts coming through the system from all levels, with a career structure which means that the head of these Space Domain roles in the future will come from a background of space flight, space situation awareness, orbital mechanics, space management, space environmental, policy awareness and basic space communications principles.

In Conclusion

The space industrial footprint is a massively broad opportunity that pollinates across society, encompassing software, applications, terminals, ground infrastructure, launch and satellites. It is integral to 5G, IoT, Cyber, Artificial Intelligence and Machine Learning.

Space is a critical resource and requires agreed international orbital and environmental policy, safety rules and freedom of spectra. As a resource, it delivers the networks that allows all the other domains to compete in the modern battlespace. Today, space offers multi-domain integration to work smarter, faster and more securely across the defence, security and allied footprints.

Ultimately, supporting MoD to become a demanding customer allows a mission solution-focused industry that will create the space innovation necessary to win the space and digitisation race against evolving adversarial threats in an era of unrestricted warfare.

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