

Written evidence submitted by CGI

1. Founded in 1976, CGI is among the largest IT and business consulting services firms in the world. For over 45 years, we have worked in the Space industry delivering complex, mission-critical space systems. Our solutions are secure, often in complex technical environments, proven to work first time, every time, ultra-reliable and delivered on time to avoid costly delays. We work on the major European navigation, communication and earth observation programmes and are specialists in space security and ground control systems. Indeed, CGI has held critical roles on programmes such as the ground management and software integration for Skynet 5 satcom services, and its ongoing comprehensive support wrap, as well as Galileo, Meteosat (Third Generation) and EGNOS. Over the last 5 years, CGI has continued to develop cutting-edge solutions including:

- developing a Global Network Operations Centre for a nascent LEO mega-constellation satellite communications network;
- created exploitation platforms for increasing the uptake of earth observation data;
- built the software for Europe's Mars Rover programme;
- used space data to help achieve a number of UN Sustainable Development Goals.

We are also currently at the cutting edge between space and terrestrial technology, through the integration of current satellite communications into future 5G networks, as well as developing new partnerships as space increasingly becomes a greater part of our everyday lives.

2. CGI is pleased to offer this response, however, we would wish to highlight that, through our Athena partnership and membership of UKSpace (Security & Defence Committee), we have contributed to both of these inputs to the Defence Select Committee Inquiry.

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

3. As one of the four internationally recognised global commons, i.e., resource domains that do not fall within the jurisdiction of any one particular nation state or country, outer space needs international cooperation, through strategic relationship building and interoperability, more than ever before. The UK Government should therefore further develop its strategic relationships and interoperability with its key Allies by establishing and clearly communicating its principles, policies, frameworks, standards and ambitions for the UK's role in the Space domain, through the publication of its National Space Strategy, including the contribution Defence makes in this arena. It should also continue to build on its long-established relationships, such as the enduring 5-Eyes partnership and NATO, as well as collaboration with like-minded nations such as India and Japan. It could also look to reinvigorate the Commonwealth nations through a new Commonwealth Space Alliance, opening up access to new sensors, geographies and data feeds to support the attribution of non-aligned space behaviours and norms. For example, a first pilot project could be the use of the UK/Australia Space Bridge initiative to further develop CGI's new Aurora platform (see below), which went live in the UK Space Operations Centre (UKSpOC) recently, to extend the ambition and reach of the current national dual-use Space Domain Awareness (SDA) vision to provide a truly global view.

Where can the UK most effectively develop and deploy its own sovereign defence capabilities, with particular regard to SSA, PNT, ISR & Communications?

4. 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. Indeed, developing a multi-spectral, multi-purpose, space and terrestrial-based sensor network capability, capable of feeding trusted data into both a national SDA capability and wider Allied/federated SDA network, would be mutually reinforcing and highly beneficial.

5. With the ever-increasing threat from hostile states and their desire to exploit vulnerabilities in space, CGI strongly suggests that the development of alternative, assured and available, PNT, ISR and Communications services, **not** reliant on Space, should be explored. Indeed, any resilient system needs to employ multiple/alternative systems whether that is through terrestrial means, use of commercial and/or Allies, the answer need not be solely 'sovereign'. One of the areas that the UK has traditionally invested heavily in, has been in the field of satellite communications, due to the UK armed forces' reliance on being able to operate anywhere in the world. This makes satellite communications a critical enabler, whereby, resilience of both the space and ground-based assets becomes paramount and, with it, the use of sovereign-based capabilities and expertise. Moreover, with the advent of high speed wireless communications and a clear need to 'diversify' our sovereign assets, the UK should look to explore the benefits that hybrid satellite/5G networking can bring to provide resilience and diversity to this much relied upon capability. From an ISR perspective, Defence should explore how it can better task future sovereign collection assets in order to process and exploit the information alongside that which is already available from other sources of data, be that open source or provided by our Allies (i.e., via National Technical Means).

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)?

6. Space is part of the UK's Critical National Infrastructure (CNI) and space-based services form an integral part of the nation's everyday life. The competition and congestion in Earth orbit, increasing threat from debris and the space environment, the behaviours of other space actors and emerging capabilities all highlight the need for substantially enhanced awareness of the space domain. The UK needs to understand this rapidly evolving and dynamic landscape in order to protect, defend and regulate the UK's space interests, mitigate threats posed to the UK's assets and CNI, and play its part in assuring safe and responsible behaviour in space. To that end, CGI has worked closely with both the Royal Air Force and UKSA to enhance the safety of UK assets in space; hence, the introduction of our new AURORA software package, into the UKSpOC at High Wycombe, will form a crucial part of the UK's Space Surveillance and Tracking capability and be used by analysts to monitor the increasing hazard of orbital debris.

Of course, the degree of vulnerability from physical and/or cyber-attack is somewhat difficult to quantify. However, we can assert that, currently, the UK's in-orbit space assets do not have robust defensive aids suites, either physical or through electro-magnetic spectrum protection, nor do they have unlimited fuel to constantly manoeuvre to avoid threats. The telemetry links and ground segment control facilities should, of course, be built upon 'secure-by-design' architectures that meet not only current physical and cyber security principles and standards, but have some measure of 'future-proofing'. Overall, therefore, UK Space capability resilience is questionable. Hence, the impact of a deliberate attack - depending on intent, intensity and duration, i.e. whether below or above a particular threshold - and the harm created, would sit on a spectrum from catastrophic destruction/instant denial to an insidious, longer-term manipulation and degradation of UK space capability (across the space, link and ground segments). Ultimately, it could severely affect all military domains, UK CNI and how UK society lives, works and plays.

7. Critically, the UK does not have a sovereign, and therefore operationally assured, capability to observe, sense, understand and retain custody of its own space-based assets. This is because the UK Space Sensor 'network' is not fit for purpose in terms of coverage and availability, and the UK remains reliant upon other nations' sensor networks and data generation capabilities, to provide Space Surveillance data, from which the UKSpOC then develops its own view of the Space Domain (Space segment). The steps that can be taken to improve resilience across Defence and the other CNI capabilities are in the long-term Political/Defence commitment and investment (akin to MOD's Continuous At Sea Deterrent approach) in:

- a. Sustaining and improving the UKSpOC's Space Domain Awareness and command and control 'AURORA' digital operating system and;
- b. Developing, deploying and operating a UK/commonwealth/partner Terrestrial and Space based operationally-assured sensor network and;
- c. Publishing and implementing the recently completed Cabinet office led cross-government National PNT strategy and risk analysis work.

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?

8. Much like the Aviation sector experienced several decades ago, the Space sector is at an inflexion point, as it becomes increasingly driven by commercial operations. This is generating new revenue streams and attracting significant R&D investment and commercial exploitation. In the long-term, the UK Defence budget will not be able to compete. Therefore, Defence should look to align (or piggyback) its Space capability requirements with commercially-led Space capability R&D (both domestic and with international partners), and operational initiatives. To keep pace with technological acceleration and remain competitively relevant in the information age, Defence must shift to an agile capability procurement approach. Defence Industrial Policy should:

- a. Be directly related to/aligned with a coherent and integrated national space strategy.
- b. Drive outcome-focused and agile-procurement behaviours that secures competitive relevance and delivers UK prosperity, societal safety, security, freedom, confidence, morality, creativity and affluence.

- c. Commit to a 'whole-of-government' approach to develop a UK Space-capability 'Partnership' that together can:
- i. Generate and sustain an on-shore cadre of Space-sector competencies;
 - ii. Attract domestic and international investment;
 - iii. Create mutual support opportunities, e.g. dual-use/multi mission platforms and capabilities, enforcing good operations behaviours and mission burden-sharing;
 - iv. Reduce risk and liability and minimise costs and;
 - v. Create investment breaks (c.f. film industry) to build and operate UK-initiated space capabilities.

Furthermore, Defence Industrial Policy capability requirements, and the programmes that are generated, should recognise and be measured against the Treasury's Public Value Framework. In addition, they should use the six recognised 'Capitals' (Financial, Intellectual, Human, Social and relational, Physical, Digital and Natural) to measure actual VfM delivered, as well as wasted.

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

9. New governance around space has been established and, with it, good intent has been observed, but evidence of a joined-up, coherent, agile and decisive approach remains elusive and it also appears to have introduced or inherited systemic inertia inhibiting the pace and tempo needed to be competitive. This is hampering the UK's ability to cohere around and develop a National Space Strategy and capabilities that will make us globally relevant. Specifically the delay in deploying a clear industrial strategy that will allow industry to plan investments in future infrastructure and more importantly the retention of current space-literate engineers is beginning to resonate within the sector.

10. Further improvements should be focused around inculcating the key attributes of enterprise agility and resilience, which are key. The capacity to sense, understand, respond quickly, flexibly and decisively, and the ability to learn, adapt, anticipate, initiate and exploit or mitigate events are not being sufficiently demonstrated. Establishing the Space Directorate and Space Command is a hugely positive step, but they will benefit from adopting operating models that are relevant within the emergent bio/info tech-led economy. The risk is that Space Command follows the dogma, construct and operational style of legacy Commands. Space Command, in particular, presents a once-in-a-generation opportunity to design, from the ground-up, an agile and resilient organisation fit for the 21st century.

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?

11. The priorities for Space Command should be to stand up an organisation that is suitably resourced and funded and is seen as wholly 'Joint' in nature and outlook across the OPERATE, GENERATE and DEFEND functions. It should look to conduct a capability audit and ensure that it understands the 'demand signal', in a multi-domain integrated (MDI) manner, across all the other Commands/domains. A key aspect of standing up a new space command will be growing a space cadre with the necessary skills and expertise, this will need to be underpinned by a new space career stream into which individuals can be recruited, trained and, hopefully, retained rather than drawn

from various branches or trades which lack the skills required. It is also essential that this exercise is done in partnership with industry in order to develop the capacity to determine the ambitious strategy as well as deliver it within 10 years.

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

12. The Ministry of Defence can ensure it attracts, develops and retains high calibre space specialists in both policy and operational roles by:

- Recognising MOD is not the dominant player or indeed expert in the UK Space domain and the emergent Bio and InfoTech economy.
- Recognising that to solve complex problems the MOD needs to encapsulate cognitive diversity and representation from across the Space and InfoTech economy.
- Developing a career progression pathway that is attractive to Space-based STEM talent, which enables individuals to move between roles and organisations across a national space capability partnership.
- Provide an incentive framework that rewards agile and innovative behaviours and team working rather than results and the individual.
- Develop and commit to long-term and shared-ambition partnerships with bio and info-tech companies.

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