



Capability Management Plan

Version 1.0

Oct 2022



UK Space Command

Foreword



Air Vice-Marshal Paul Godfrey OBE
Commander
UK Space Command

The UK has been operating in space routinely since 1969 and continuously since 1988. Daily lives around the world rely on the information provided by satellites and systems in space, and they also underpin multi-domain military operations. Disruption to the space domain could lead to significant consequences for civilian, commercial, and economic activity, as well as the Armed Forces' ability to undertake many Defence tasks.

The UK's first National Space Strategy and Defence Space Strategy has emphasised the importance of Space for UK plc and Defence. The purpose of the Space Capability Management Plan is to communicate our value proposition to Defence. UK Space Command is a new organisation on a journey and this Capability Management Plan will be iterative as we align to meet the needs of our stakeholders, focus on delivery and place our people at the core of what we do.

UK Space Command has a critical role to play in exploiting capability synergies across Defence, within Government and with our Allies to develop and deliver space capabilities and missions. We will also

champion space by growing and training Defence's space workforce and capitalising on the rich pedigree of expertise that exists within the UK.

We cannot do this alone, so working closely with cutting edge academia and resilient supply chains, underpinned by a diverse, competitive and globally leading industrial base, we will catalyse investment to deliver the outputs in the Defence Space Strategy. These vital partnerships create resilience; going it alone will only result in failure. Working alongside our allies and partners towards the outputs in this Capability Management Plan is the only way to ensure UK Space Command is at the forefront of activity to make space safe, secure, and sustainable for all generations.



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Section 01

Capability Management Overview



Importance of Space in the UK

Space has a vital role in our daily lives and ensures military operations can deliver across the spectrum of national security tasks.

Secretary of State for Defence 2022

The importance of space to Defence is irrefutable. It affords us operational advantage against potential adversaries and, as a nation, we depend on it for resilience and our way of life.



Satellite enabled global command & control, communications, intelligence and precise navigation to the Carrier Strike Group deployment.



Locating and pinpointing hostile targets with precision guided weapons that critically depend on real-time GPS satellite updates.



Satellite communications to engage across the Enterprise and move large volumes of data to support global Defence, humanitarian and wider Government operations.



Ability to maintain real-time eyes on the ground from space, to detect and monitor activities of Allied Forces and adversaries, night and through all weather conditions.



Deterring, protecting and responding to the growing threats and hazards to space based services which underpin our daily lives, from global communications, secure banking transactions, transport, navigation and weather services.

UK Space Command Ambitions

Building on the UK's first National Space Strategy, the publication of the Defence Space Strategy in February 2022 set the UK Defence Space Vision *"to be a meaningful actor in the space domain, securing UK interests alongside our allies and partners to ensure operational freedom in space"*.

The establishment of a UK Space Command in April 2021 was a fundamental step in achieving this ambition and to develop and cohere resilient capabilities and services.

UK Space Command Mission

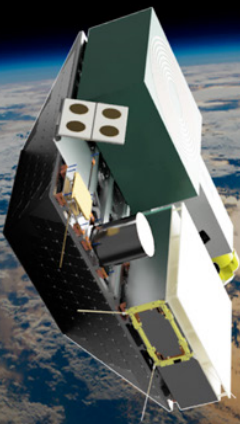
To protect and defend the UK and allies' interest in, from and to space, delivering decisive space power, enabling operational independence and contributing to global security.

UK Space Command reached Initial Operating Capability in April 2022, and will play a key role in developing, delivering and cohering resilient capabilities and services for Defence. This includes for day-to-day space operations as well as for future requirements through the exploitation of innovation.

UK Space Command will work closely across Defence Domains, with wider Government, international partners as well as the commercial, research and scientific communities.

Besides an investment of more than £5bn over the next 10 years to recapitalise and enhance our satellite communications capabilities, Defence will invest a further £1.4bn in this period through UK Space Command across wider space capabilities.

This will enable the UK to maintain its position as a leading military power and to support UK prosperity through a safer and more secure operating environment.



Capability Headmarks

Seven critical capabilities spanning the Space domain have been identified to support UK national security and the needs of Defence.



Satellite Communications (SATCOM)

Assured, secure and high-capacity communications and the exchange of information anywhere in the world via satellite, at a variety of classifications, resilient to interference and external influence whether environmental or adversarial. Connecting the modern battlefield and integrating the force.



Space Domain Awareness (SDA)

Effective and timely identification, characterisation and understanding of any factor associated with the space domain that could affect space operations, including hazards, threats and vulnerabilities across the ground, link and space segments.



Intelligence, Surveillance and Reconnaissance (ISR)

Secure earth-facing and space-facing observations through electronic collection over a wide area or specific point of interest anywhere on the planet, with coherent digital architecture, tasking, processing, exploitation and dissemination that enhances understanding across the spectrum of conflict, rapidly adapts to meet new threats and exploits adversary vulnerability.



Space Command And Control (C2)

Proactive and reactive risk-aware decision-making, global coordination, coherence, control and execution of operations in or through space.



Space Control

Resilient mechanisms to sustain advantage and freedom of access to, and operational independence in, space. This includes enhanced protection of all space system elements within the complex and contested space environment, and the ability to deter hostile acts from disruptive adversaries.



Position, Navigation And Timing (PNT)

Access to assured and resilient global PNT services as part of a system of systems approach, which leverages diverse space-based and terrestrial-based technologies with no single points of failure.



Launch

Freedom of action to assure appropriate and timely access to military launch, including reactively at late notice from UK soil, to ensure our assets can reach orbit when required.

Capability Management Framework

UK Space Command will leverage a clear and robust framework to manage its capabilities underpinned by requirements, innovation and value for money. Whilst capabilities may be at different maturity stages, the framework will ensure both an agile and iterative management approach.

Requirements

- Threats & hazards assessment
- Problem statements and scenarios
- Future requirements elicitation, not just what we need today
- Capability gap assessment

Review & Exploit

- Capability auditing
- Lessons identified from operations
- Identification of further operational use cases
- Prioritisation of new requirements activity



Explore & Design

- Horizon scanning to identify novel technologies
- Military and civil dual-use identification and analysis
- Own, access, collaborate considerations
- Business case and value for money assessment

Deploy & Operate

- Establishing workforce and internal environment for success
- Fast-paced capability programme delivery with continuous improvement and scalable infrastructure
- Sustainable management and disposal of space assets

Demonstrate & Refine

- Demonstrator scoping
- Outcomes-driven, iterative and agile demonstrators with a fail fast culture
- Increase TRL & skill levels
- Capability options refinement
- Final business case submission



Exploiting Capability Synergies

UK Space Command will seek to enable the value and impact of Defence Space capabilities to be greater than the sum of its parts. This will be achieved through five themes in the management of our capabilities.

Exploiting Integration and Connectivity Benefits between Space Capabilities

UK Space Command will improve the way that Defence 'connects the dots' across space capabilities. For example, using satellite communications assets to support the collection of data for space domain awareness in orbit, or improving the ground station infrastructure to support the needs of multiple capabilities. Our ambition is to integrate space capabilities where possible to support a ubiquitous, multi-modal and multi-user domain with greater resilience and redundancy.

Capitalising on Dual-Use Opportunities across Defence and Civil Space Domains

Military and civil requirements for space capabilities can often overlap, for example civil earth observation and defence intelligence, surveillance and reconnaissance have dual use at its core, as does PNT for critical national infrastructure and space situational awareness. UK Space Command will embed dual use at the heart of our capability management processes, considering how we can share Defence space capabilities and outputs with other Government and commercial users.

Ensuring Value for Money Decisions across the Enterprise when Securing Capabilities

UK Space Command will play a key role ensuring that 'own, collaborate or access' framework decisions are not taken with a siloed capability view, but rather across the capability portfolio and enterprise architecture of space and alternative options, to prioritise spend and maximise value for money. This includes exploiting scale synergies and commonality where appropriate in procurement decisions.

Coordinating Collaboration with Industry, Academia, Allies and Other Key Partners

To maintain strategic advantage, UK Space Command will look to collaborate with and support cutting-edge academia and resilient supply chains underpinned by a diverse, competitive and globally leading industrial base. We will facilitate the exchange of information where possible and deepen international collaboration on capability management. With all partners, we will ensure a coordinated approach to the exploitation of R&D to bridge the gap from research into capability delivery.

Cohering Learning, Development and Knowledge Spillovers across the Enterprise

UK Space Command will lead the activation and continuous improvement of a coherent Whole Force training and education plan, for both space professionals and wider Defence. We will take early strategic workforce planning decisions and support a range of space career paths to retain expertise in the Enterprise. UK Space Command will also facilitate the exploitation of knowledge spillovers and lessons learned feedback mechanisms across space related capability initiatives.










High Level Capability Plan

Space capability management plans will deliver short and longer term goals for Defence, whilst ensuring the integration and connectivity between capabilities throughout their development.

Exploiting Capability Synergies

Short-Term Focus (2022-2025)

Ambitions Beyond (2026-2030)

 <p>Satellite Communications</p>	<ul style="list-style-type: none"> • Sustainment of SatCom capabilities and establishment of MOD as the operational duty holder and intelligent customer. • Maturing future technologies and assessing opportunities for cross-government (dual-use) and international collaboration. 	<ul style="list-style-type: none"> • Introduction of new terminals and satellites to the SKYNET constellation, with greater integration to national and international architectures.
 <p>Space Domain Awareness</p>	<ul style="list-style-type: none"> • Collaboration with industry to test new software, computing power, sensors, commercial data sources and connectivity. • Working with defence decision-makers and capability programmes to elicit future requirements and progress business case development. 	<ul style="list-style-type: none"> • Robust SDA system of systems, with diverse mix of assured data sources from the UK, allies and commercial sources.
 <p>Intelligence Surveillance & Reconnaissance</p>	<ul style="list-style-type: none"> • Intensive R&D period working with partners on technology demonstrators including novel methods of data transfer, satellites, sensors, ground architecture and digital architecture. • Focus on maturing requirements and capability options, and supporting business case development between 2022-2025 development. 	<ul style="list-style-type: none"> • Fully functional, assured and resilient ISR and digital backbone, integrated with key partners.
 <p>Command & Control</p>	<ul style="list-style-type: none"> • Explore the need and options for Command and Control on the full range of space capabilities. • Upgrade enabling technology software and data management to improve flexibility and resilience of capability. 	<ul style="list-style-type: none"> • Fully operational Space Command and Space Operations Centre, with the right skills to Command and Control all Defence space assets.
 <p>Space Control</p>	<ul style="list-style-type: none"> • Wargaming and collaborating with international allies to elicit requirements and explore capabilities gaps. • Working with academia and industry to explore technology options and demonstrators. 	<ul style="list-style-type: none"> • Appropriate Space Control systems and processes in place, with a twin-track approach, looking both up at space and down to Earth, with clarity of responsible behaviours and norms.
 <p>Position, Navigation & Timing</p>	<ul style="list-style-type: none"> • Developing alternative terrestrial and space based PNT technologies to build upon resilience afforded by existing GNSS. • Collaborating across government and with allies to strengthen partnerships to existing and new PNT capability programmes. 	<ul style="list-style-type: none"> • Assured and resilient System of Systems securing access to PNT through a diverse range of sources.
 <p>Launch</p>	<ul style="list-style-type: none"> • Evaluate options for assured reactive launch capabilities. • Close collaboration with a range of partners in the development and testing of launch systems. 	<ul style="list-style-type: none"> • Secured partnerships and freedom of action to safeguard assured launch of assets into orbit at a moment's notice.

Working with Stakeholders



UK Space Command will work closely with a range of key stakeholders who will all play a role in delivering an integrated approach to capability management.



Ministry of Defence (MOD)

Directing and enabling space strategy, policy and funding, whilst supporting collaboration across Strategic and Front Line Commands to elicit clear requirements.



International Allies

Collaborating closely to lead scientific technology development, broaden capabilities, deepen resilience, and prevent conflict in space.



Defence Science and Technology Laboratory (DSTL)

Exploiting novel technologies and maturing technology readiness levels, to translate innovation into functional space capability.



Defence Equipment and Support (DE&S)

Continuously striving to provide capability to the user faster than traditional procurement methods, through rapid, incremental and agile capability acquisition and development.



Defence Digital

Delivering underpinning capabilities that integrate space systems across the digital backbone, connecting sensors, driving information advantage, supporting decision-makers, and enabling multi-domain integration.



Cross-Civil Government

Aligning on the development of dual-use capability areas, sector policy objectives and collaborating on driving UK prosperity, innovation, levelling up and other policy directives through space.



UK Space Agency (UKSA)

Collaborating closely on space operations and programme delivery in dual-use capability areas such as the National Space Operations Centre, as well as the exchange of information and development of space skills.



Industry

Generating and maintaining leading capabilities for Defence, from design and experimentation through to programme delivery and service provision, both proactively and reactively to our requirements.



Academia

Exchanging cutting-edge thinking and collaborating on scientific research and development which could have benefit for Defence.

Section 02

Capability Plan



Satellite Communications (SATCOM)



Headmark

Assured, secure and high-capacity communications and exchanging of information anywhere in the world via satellite, at a variety of classifications, resilient to interference and external influence whether environmental or adversarial. Connecting the modern battlefield and integrating the force.

Overview of Capability Development

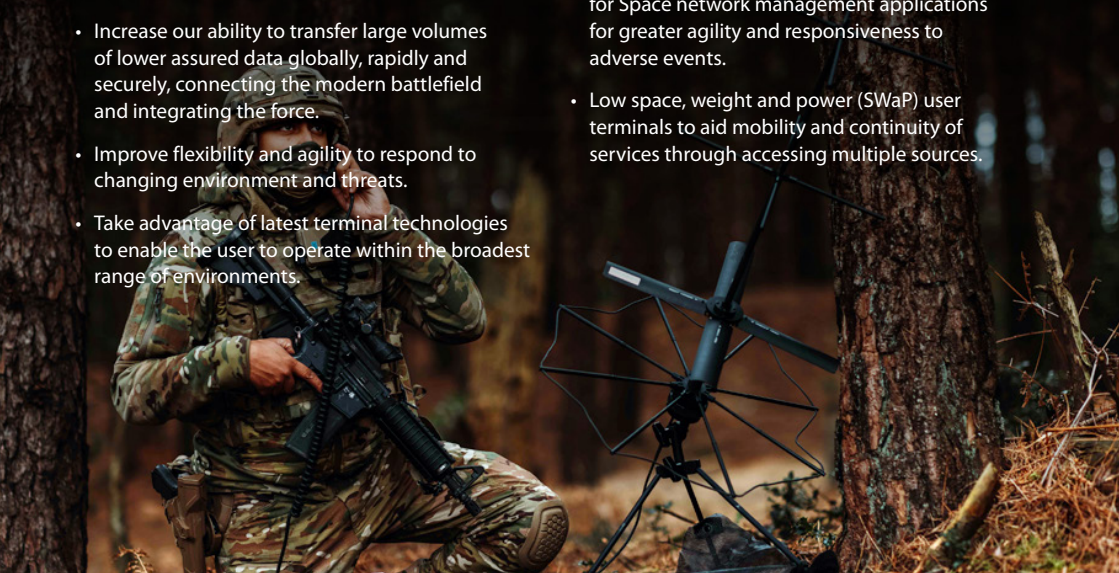
We will oversee a blended approach to future SATCOM service provision based on both military and civilian systems and Partner exchanges.

UK Space Command will support UK Strategic Command in the development of the Skynet ecosystem to:

- Promote greater integration with complementary allied capabilities to extend coverage, increase interoperability and resilience through redundancy and diversity of supply for highly protected services.
- Support wider UK Government with civilian applications (dual-use).
- Increase contribution to (and benefit from) wider space capabilities to 'Protect & Defend' UK space assets.
- Evolve and integrate the SatCom architecture into the wider space architecture.
- Increase our ability to transfer large volumes of lower assured data globally, rapidly and securely, connecting the modern battlefield and integrating the force.
- Improve flexibility and agility to respond to changing environment and threats.
- Take advantage of latest terminal technologies to enable the user to operate within the broadest range of environments.

Examples of key activities and demonstrators expected to be run in the next 3 years include:

- Integration of regenerative payloads to provide greater capacity and resilience.
- New waveforms and encryption methods to maintain highly protective communications in an increasing threat environment.
- Inter-satellite links (within and between orbits) to extend coverage without need for additional ground stations.
- Communication payloads operating in alternative, lower congested, parts of the spectrum.
- Artificial intelligence and machine learning for Space network management applications for greater agility and responsiveness to adverse events.
- Low space, weight and power (SWaP) user terminals to aid mobility and continuity of services through accessing multiple sources.



Space Domain Awareness (SDA)



Headmark

Effective and timely identification, characterisation and understanding of any factor associated with the space domain that could affect space operations, including hazards, threats and vulnerabilities across the ground, link and space segments.

Overview of Capability Development

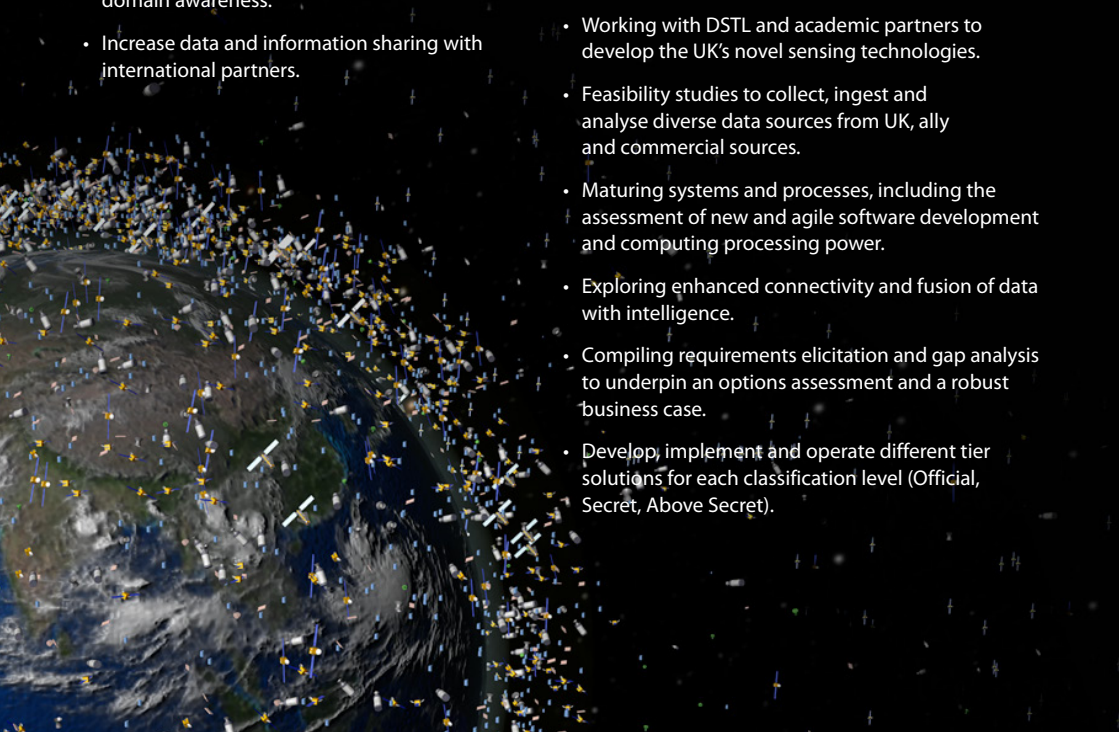
As a key pillar of the National Space Strategy, we will continue to upgrade and deliver leading SDA capabilities to enable a safe, secure and sustainable space domain that we can continue to benefit from, now and in the future.

We will take an R&D approach in the coming years which will see UK Space Command working closely with the UK Space Agency to:

- Protect and defend space systems from relevant threats and hazards.
- Monitor spacecraft for compliance with regulatory and international agreements.
- Provide coherent civil and military space domain awareness.
- Increase data and information sharing with international partners.

Examples of key activities and demonstrators expected to be run in the next 3 years include:

- Developing cross-Government SDA requirements, as well as those of Defence commands and other space capability areas.
- Establishing a Civil and Defence National Space Operations Centre, capable of meeting future challenges of the space domain, and supporting key decision-makers.
- Working with DSTL and academic partners to develop the UK's novel sensing technologies.
- Feasibility studies to collect, ingest and analyse diverse data sources from UK, ally and commercial sources.
- Maturing systems and processes, including the assessment of new and agile software development and computing processing power.
- Exploring enhanced connectivity and fusion of data with intelligence.
- Compiling requirements elicitation and gap analysis to underpin an options assessment and a robust business case.
- Develop, implement and operate different tier solutions for each classification level (Official, Secret, Above Secret).



Intelligence, Surveillance & Reconnaissance (ISR)



Headmark

Secure earth-facing and space-facing observations through electronic collection over a wide area or specific point of interest anywhere on the planet, with coherent digital architecture, tasking, processing, exploitation and dissemination that enhances understanding across the spectrum of conflict, rapidly adapts to meet new threats and exploits adversary vulnerability.

Overview of Capability Development

Our ambition is to provide a constellation of assured and resilient multi-sensor satellites with an enabling mission system and digital backbone to collect, process and disseminate space based ISR data.

We will take an R&D approach in the coming years which will see UK Space Command:

- Working across Defence and Government to refine user requirements that reflects Defence's current and future priorities, and dual-use opportunities.
- Delivering and cohering demonstrators to test new technologies, ramp up the TRL and ensure the right skills are in place to deliver success.
- Exploiting innovation that could meaningfully enhance existing capabilities and provide the UK with a strategic advantage.

Examples of key activities and demonstrators expected to be run in the next 3 years include:

- Collaborating with DSTL and industrial partners to develop novel sensor types and synchronised monitoring in difficult conditions.
- Exploring on-orbit sensors and autonomous processing technologies.
- Scoping a digital architecture that enables data transfer, cloud storage and AI-driven insights, including novel and secure ground architecture.
- Enhancing pattern analysis to reduce intelligence collection and processing time.
- Disseminating timely intelligence, at different classification levels, from space to the right person on the ground.
- Identifying integration opportunities with assured architecture from allies and commercial partners, for both the space component and ground components.
- Identifying integration opportunities with other UK space capabilities including Command & Control.
- Development of a robust evidence base and business case for a planned architecture, which would set the roadmap for a fully operational capability from 2025 to deliver tangible benefit.



Command and Control (C2)



Headmark

Proactive and reactive risk-aware decision-making, global coordination, coherence, control and execution of operations in or through space.

Overview of Capability Development

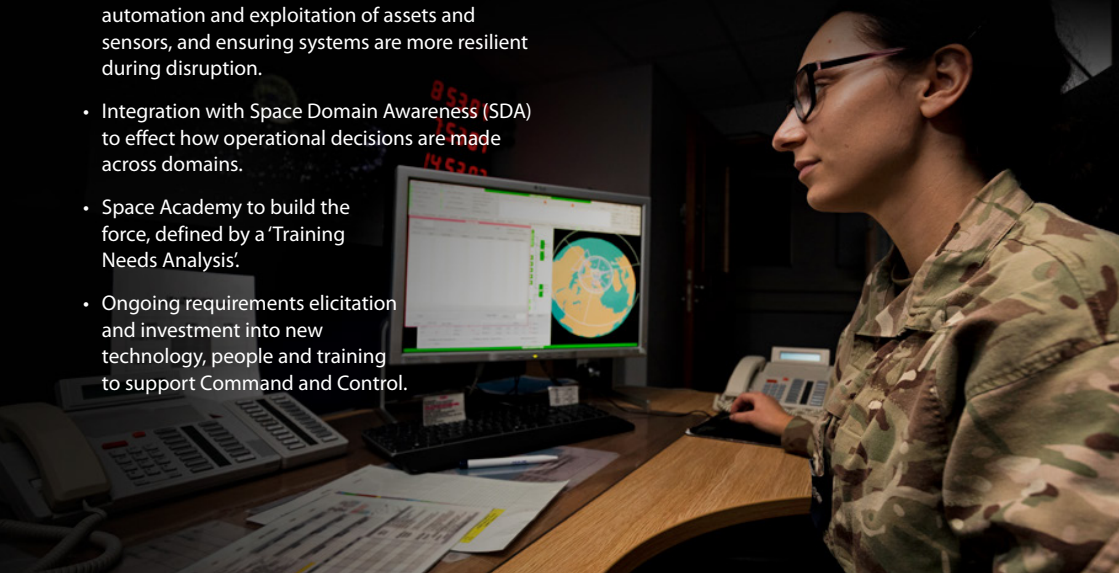
Fundamental to UK Space Command's purpose is to 'deliver the UK's command and control of space', and we will ensure this through a system of systems approach, capturing evolving requirements and exploiting new innovation.

Examples of key activities and demonstrators expected to be run in the next 3 years include:

- Maturing the UK Space Command HQ beyond its initial operating capability in April 2022, towards full operating capability.
- Working with the UK Space Agency (UKSA) to establish a combined Defence and Civilian National Space Operations Centre that will be fully integrated with our allies and partners, as well as across Government.
- Ongoing requirements elicitation, with enhancements to our command, control and coordination of major Defence space assets.
- Investing in new technology software to improve automation and exploitation of assets and sensors, and ensuring systems are more resilient during disruption.
- Integration with Space Domain Awareness (SDA) to effect how operational decisions are made across domains.
- Space Academy to build the force, defined by a 'Training Needs Analysis'.
- Ongoing requirements elicitation and investment into new technology, people and training to support Command and Control.

Additionally, UK Space Command will continue to strengthen UK participation in international initiatives:

- Controlling the UK's participation in the US-led space coalition under Operation Olympic Defender, a multinational coalition formed to deter hostile actors in space and reduce the spread of debris in orbit.
- Continuing the UK's commitment to the Combined Space Operations initiative with Australia, Canada, France, Germany, New Zealand, and the US, to ensure a safe, secure and stable space domain.
- Supporting the growth of the NATO space enterprise.



Space Control



Headmark

Resilient mechanisms to sustain advantage and freedom of access to, and operational independence in, space, including enhanced protection of all space system elements within the complex and contested space environment, and the ability to deter hostile acts from disruptive adversaries.

Overview of Capability Development

The international security context is characterised by persistent and aggressive state competition where adversaries understand our reliance on space services; Major powers are increasingly able to exploit the vulnerability of our satellites and degrade the UK's access to space, threatening our strategic stability and security.

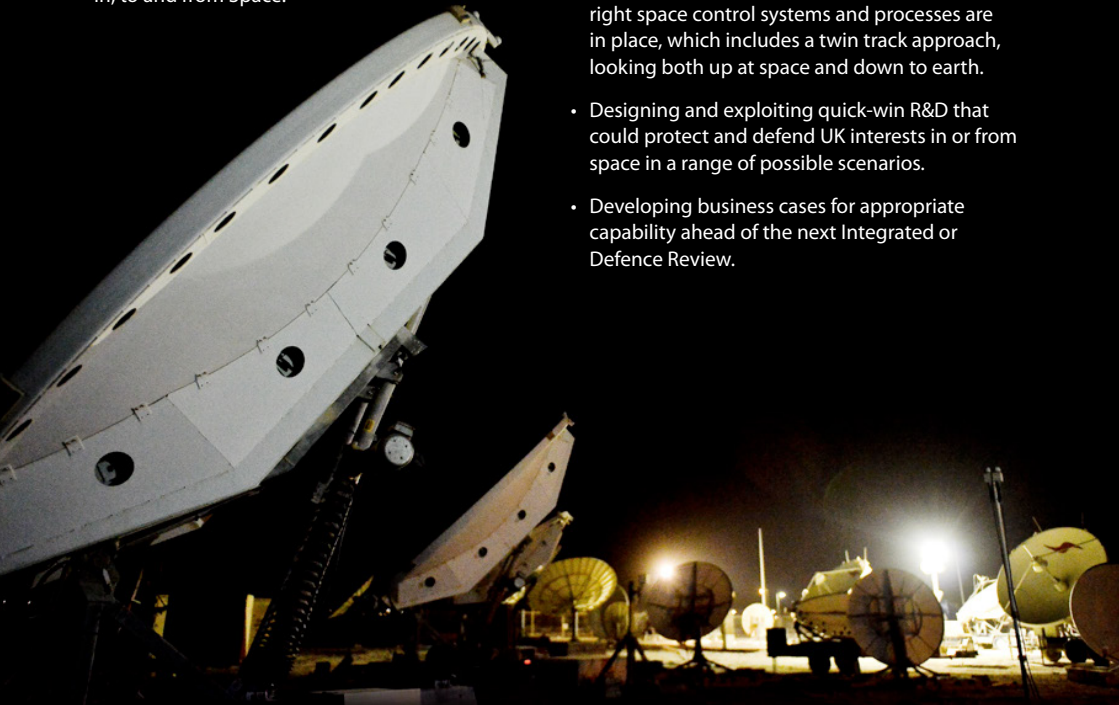
As part of this, the Space Domain could be disrupted either temporarily or long-term, and potentially at critical moments, and targeted by a range of threats or electronic warfare.

We will take an R&D approach in the coming years which will see UK Space Command:

- Understanding requirements and options to enable the development of Space Control capabilities over 10 years that provides the UK with a capability to deter and/or mitigate threats in, to and from Space.

Examples of key activities and demonstrators expected to be run in the next 3 years include:

- Assessing requirements from Space Control across the space portfolio, through collaboration and wargaming with allies, industry and academia.
- Exploration of potential options to ensure the right space control systems and processes are in place, which includes a twin track approach, looking both up at space and down to earth.
- Designing and exploiting quick-win R&D that could protect and defend UK interests in or from space in a range of possible scenarios.
- Developing business cases for appropriate capability ahead of the next Integrated or Defence Review.



Position, Navigation and Timing (PNT)



Headmark

Access to assured and resilient global PNT services as part of a system of systems approach, which leverages diverse space-based and terrestrial-based technologies with no single points of failure.

Overview of Capability Development

Improving the resilience of PNT was sought by the 2021 Integrated Review, and Defence will seek to do this through the development of a resilient system of systems approach.

UK Space Command will support UK Strategic Command in the potential development of space based PNT capabilities to:

- Enhance PNT resilience, exploring alternative and complementary systems to GNSS, which we are overly reliant on;
- Improving PNT situational awareness to give operators a better understanding of the quality of PNT service ;
- Explore ways to exploit space domain awareness to enhance non-GNSS alternative navigation techniques;
- Work more closely with Other Government Departments, Industry and Academia to cohere PNT capability efforts for UK national security; and
- Explore opportunity for greater coherence and interoperability with international partners under NAVWAR.

Examples of key activities and demonstrators expected to be run in the next 3 years include:

- An assessment of the MOD's most vulnerable platforms to inform the development of a System of Systems Approach.
- The development of MoD timing architecture to provide an independent (to GNSS) means to source and distribute precision time.
- Conducting R&D on innovative alternative navigation methods and timing references including signals of opportunity (including satellites), increase technology readiness levels from 4-5 today to TRL 8 by 2028.
- Exploring multiple frequencies, and anti-jamming and spoofing technologies.
- Merging and, later fusing diverse PNT data sources together to increase the likelihood of providing an assured PNT information and exploiting integrity monitoring software and advanced data analytics to support situational awareness.
- A study to understand the UK industrial base, including the identification of niche sovereign PNT-related capabilities.

Launch



Headmark

Freedom of action to assure appropriate and timely access to military launch, including reactively at late notice from UK soil, to ensure our assets can reach orbit when required.

Overview of Capability Development

Space Command will explore a range of launch capabilities for military assets to meet Defence needs.

Examples of key activities and demonstrators expected to be run in the next 3 years include:

- Ongoing assessment of requirements and military utility of responsive launch.
- Assessing options for sovereign military launch, across multiple launch sites and wider different potential partners.
- Leveraging UK launch capabilities for UK Space Command R&D demonstrators and technology programmes.
- Working with the UK Space Agency on knowledge transfer and capability support for their Launch UK Programme.





Credits:

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