Space Partnership Capability Roadmaps

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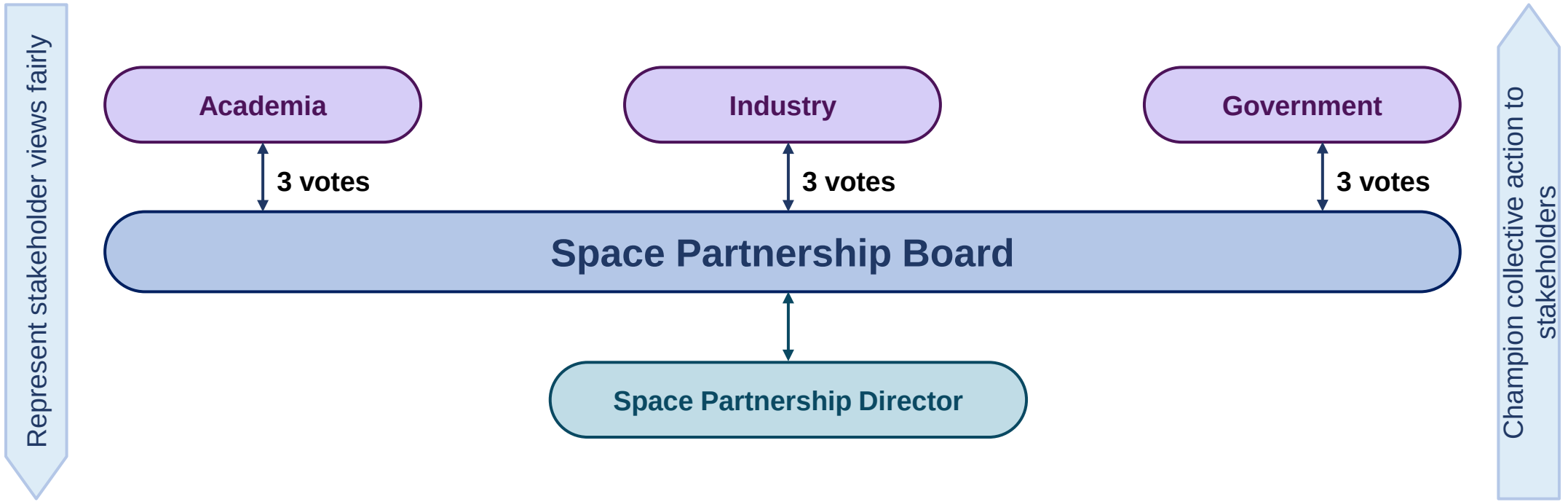
Space Partnership Director

Space Partnership

brings together industry, academia and government to work on *shared priorities* and *identify collective action* that delivers the ambition in the National Space Strategy



Space Partnership Projects

Space Capabilities

- Sequenced 22 Capability Goals
- Facilitated sector to develop 22 roadmaps to deliver the goals

Space Skills

Supported development of the Space Workforce Action Plan

UK's ESA Priorities

Facilitated a cross-sector discussion about the UK's long-term priorities for its relationship with ESA

Small sat manufacturing

Considering the importance to delivery of the NSS

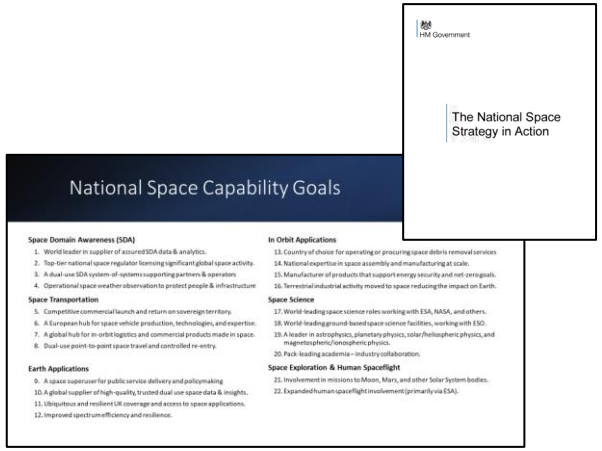
Dual-use

Supporting dual-use skills and considering dual-use opportunities

SME classifications

How to define space SME's when considering potential interventions

Space Capability Roadmaps



- 5 capability areas for accelerated plans
- Goal to have a complete set of roadmaps

Sep 21 **Jul 23** **Mar 24** **Oct 24**

Space Partnership

Confirmed a comprehensive list of UK space activity

Industry, academia & government developed 10 roadmaps facilitated by the Space Partnership which informed the Space Industrial Plan

22 Space Capability Roadmaps

Space Domain Awareness:
1. UK is an anchor partner on SDA for Allies
2. UK remains a global leader in operational space weather prediction, mitigation, response and its underpinning science

Space Transportation
3. UK has the leading launch ecosystem in Europe

Earth Applications:
4. UK is a country of choice for space data assurance
5. UK is an important contributor to global environmental early warning systems
6. UK strengthens climate change and NetZero knowledge base to reduce long-term national risk
7. UK strengthens its position as a significant player in the global satcoms market
8. UK develops differentiated space-enabled PNT systems to enable assured and resilient services
9. UK ensures that there is sufficient spectrum to support current and future space services

In-Orbit Applications:
10. UK is a European leader for In-orbit Servicing & Manufacturing
11. UK shapes the future of space sustainably through improved understanding, regulation and influence
12. UK unlocks the circular in orbit economy through transforming the industrial base
13. UK pioneers Space Based Solar Power to support Net Zero and Energy Security

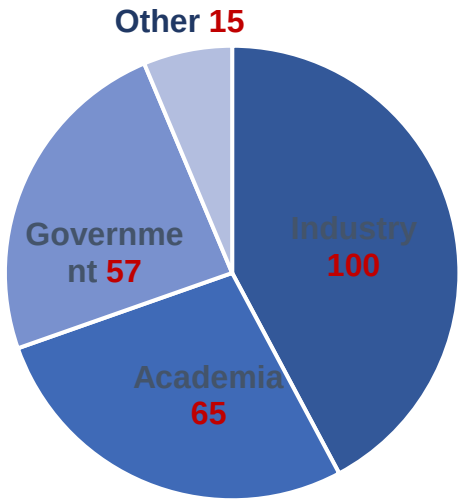
Space Science
14. Enhance the UK's role and influence to be a senior partner on a large international mission
15. Be the bilateral partner of choice for space science and instrumentation outside of ESA
16. Create a national across-class mission & facility framework enabled by science-industry ecosystem
17. UK drives the ESA Space Science programme from proposal to exploitation, particularly around small sat
18. The UK remains a world-leader in ground-based astronomy and space physics

Space Exploration & Human Spaceflight
19. UK leverages world leading Mars science to secure significant role in Mars exploration
20. UK capitalises on lunar science and a lunar economy in a responsible manner
21. UK exploits LEO opportunities to maximise scientific and industrial return
22. UK secures leading position in nuclear energy technologies to enable advanced global space missions

Developing the Roadmaps

Space Partnership facilitated the process to bring the sector together:

237 Representatives from **109** Organisations



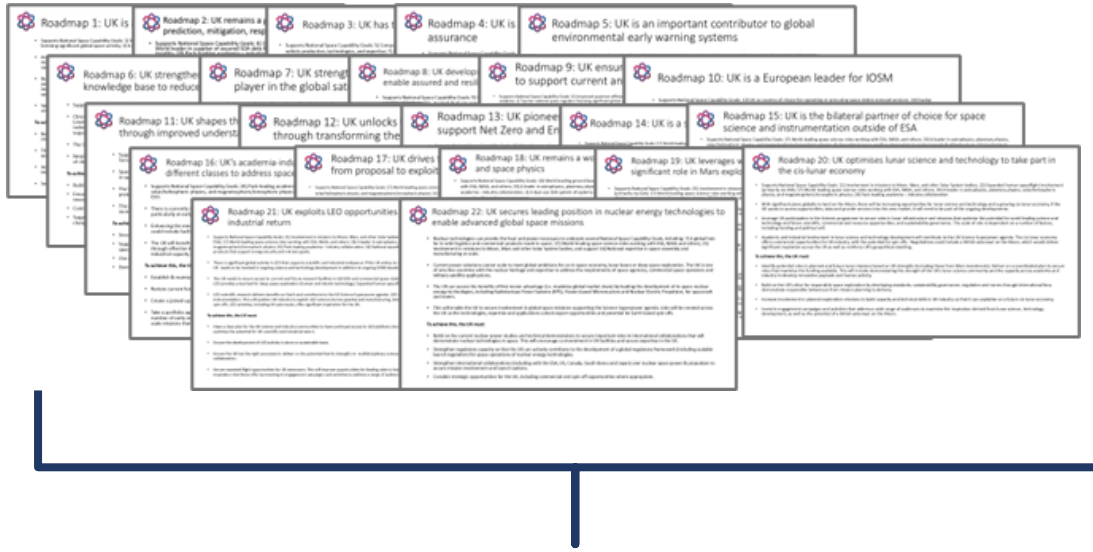
14 Workshops

50 Calls

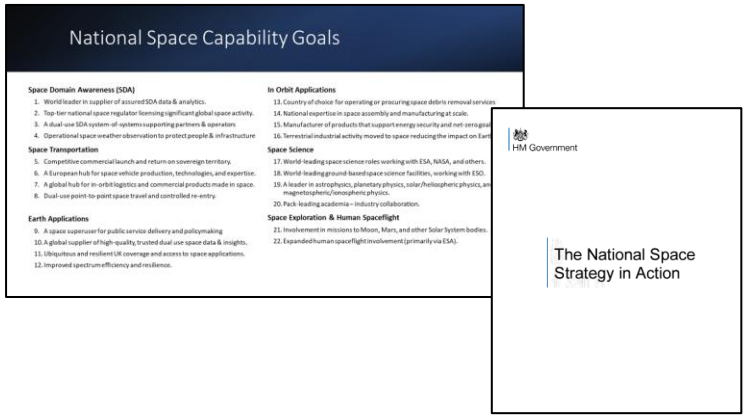
+

34 UKspace & SPAN meetings

NOW: Complete set of 22 Roadmaps



Cover all 22 Space Capability Goals



Form a common platform for discussion for:

- ***D-SIT*** *including Cross Government Capabilities Group*
- ***Space Partnership Board***
- ***EVERYONE***

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8. UK develops differentiated space-enabled PNT systems to enable assured and resilient services
9. **UK ensures that there is sufficient spectrum to support current and future space services**

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Top-Level, Narrative Roadmaps

Long-term vision: in 4 statements addressing the:

- Importance of this capability
- Inherent challenge to address
- Capability the UK will develop
- Benefits this will bring the UK

Summary title

4 key things that are needed to achieve the vision

Looks at the 'what' needs to happen through 4 lenses:

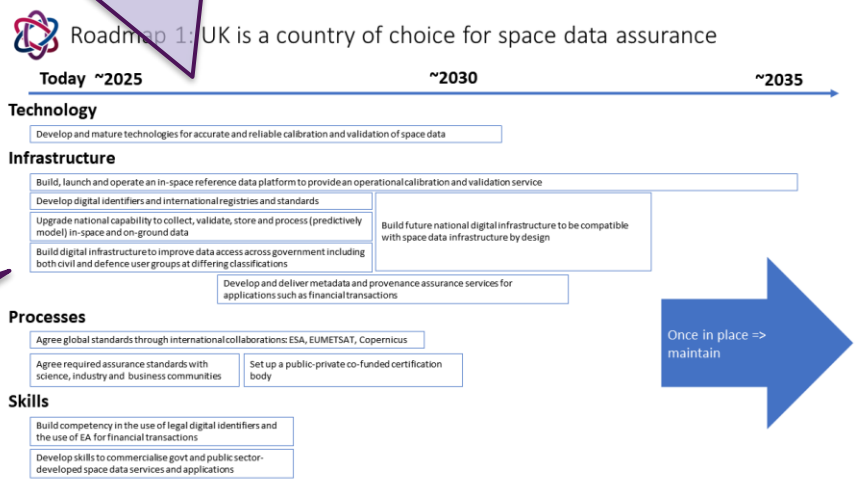
- **Technology**: lower TRL, know-how & IP development required
- **Infrastructure**: Physical, Human and Digital assets deployed to deliver services
- **Processes**: Operating procedures, policies, guidelines, standards, regulations, legislation, organisational frameworks, partnerships and alliances
- **Skills**: Individual and organisational knowledge, experience and competences

Roadmap 1: UK is a country of choice for space data assurance

- Supports National Space Capability Goals: 10) a global supplier of high-quality, trusted dual use space data & insights; 11) Ubiquitous and resilient UK coverage and access to space applications
- There is an increasing need to assure space data to guarantee that it is precise, accurate, and auditable before it is used for policy making, business decisions, and to regulate behaviours. The data needs to be of "decision-quality" (and often "litigation-quality").
- The UK should retain and build on its position as a globally recognised provider of reference standards and trusted satellite derived information, through national organisations such as the Met Office, Ordnance Survey and NATS.
- By increasing its capability to deliver trust in space-derived insight to underpin decision making capability in the UK & abroad, the UK will support its economic and societal goals and increase its global influence.

To achieve this the UK must:

- Lead the coordination of key international science-industry-market initiatives to establish agreed standards.
- Have national infrastructure to calibrate and validate the quality of UK and others' data at a market-acceptable pace, service, and cost.
- Strengthen national & global public and commercial adoption of UK space data assurance services
- Provide an intuitive service to Government challenge holders and public service operators to access assured data.



Against time, so gives an indication of the **length of intervention**: a short box horizontally implies a one-off short-term intervention, a long box indicates continued investment into perpetuity.

Roadmap 9: UK ensures that there is sufficient spectrum to support current and future space services

- Supports National Space Capability Goals: 12) Improved spectrum efficiency and resilience; All goals require spectrum, particularly 1) World leader in supplier of assured SDA data & analytics; 2) Top-tier national space regulator licensing significant global space activity; 10) A global supplier of high-quality, trusted dual use space data & insights; 11) Ubiquitous and resilient UK coverage and access to space applications; 14) National expertise in space assembly and manufacturing at scale; 15) Manufacturer of products that support energy security and net-zero goals; 19) A leader in astrophysics, planetary physics, solar/heliospheric physics, and magnetospheric/ionospheric physics; 21) Involvement in missions to Moon, Mars, and other Solar System bodies.

- Providing services from space, remote sensing and controlling satellites requires spectrum whether that is for satcom, PNT, Earth Observation, SDA, In Orbit Applications or space science. Spectrum is a finite resource that supports research, innovation and also connectivity delivered through space. It is managed nationally by Ofcom and on a global basis through the International Telecommunication Union (ITU), a specialised UN agency. Securing new spectrum, especially for space applications, is achieved through global negotiations that can take many years.

- The UK is one of 193 Member States of the ITU. To ensure UK national interests are adequately represented as part of these negotiations involves understanding the sector requirements, significant planning and active international engagement with the ITU and beyond.

- The UK will retain and secure the spectrum that it needs to deliver on its national space ambition, ensuring critical space services and supporting the UK space sector (jobs & inward investment). By active involvement in the ITU and other forums, the UK will retain its strong geopolitical influence in global spectrum management.

To achieve this, the UK must:

- Build the evidence base to support negotiations. This will include working across the satellite sector to define current and long-term spectrum requirements and understand constraints.

- Work across government and through Ofcom to ensure the needs of the space sector continue to be reflected in the development of spectrum policy and regulation.

- Prepare for the ITU and other forums in a coordinated manner to ensure the best evidenced case is made and delivered for the UK space sector, including defending the interests of incumbent services and supporting new and innovative uses where appropriate.

- Ensure there are sufficient personnel with appropriate expertise in spectrum and regulation.

Roadmap 9: UK ensures that there is sufficient spectrum to support current and future space services

Today **~2025** **~2030** **~2035**

Technology (R&D to evaluate spectrum options)

Support R&D into more efficient ways to use spectrum to support space sector user needs

Infrastructure (Ensure infrastructure available to build evidence base)

Establish national infrastructure to support spectrum monitoring and management

Processes (Work nationally & internationally to secure and defend spectrum for space sector)

Build the evidence base: Understand & regularly re-evaluate UK's long-term spectrum requirements to support UK space sector ambition

Work across government and through Ofcom to ensure the needs of the space sector continue to be reflected in the development of spectrum policy and regulation

Prepare for the ITU and other forums in a coordinated manner to ensure the best evidenced case is made and delivered for the UK space sector

Actively advocate for UK space interests within international regulatory discussions

Skills (Ensure sufficient suitably qualified experienced personnel)

Recruit, retain and develop staff with appropriate expertise in spectrum and regulation

Next Steps

Roadmapping process: *Is a journey not a destination…*

- Starting to look at how we use the complete set of roadmaps
- Continue to update roadmaps as required
- Feedback to: Joanna.Hart@spacepartnership.org.uk

Dr Joanna Hart

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National Space Capability Goals

Space Domain Awareness (SDA)

1. World leader in supplier of assured SDA data & analytics.
2. Top-tier national space regulator licensing significant global space activity.
3. A dual-use SDA system-of-systems supporting partners & operators
4. Operational space weather observation to protect people & infrastructure

Space Transportation

5. Competitive commercial launch and return on sovereign territory.
6. A European hub for space vehicle production, technologies, and expertise.
7. A global hub for in-orbit logistics and commercial products made in space.
8. Dual-use point-to-point space travel and controlled re-entry.

Earth Applications

9. A space superuser for public service delivery and policymaking
10. A global supplier of high-quality, trusted dual use space data & insights.
11. Ubiquitous and resilient UK coverage and access to space applications.
12. Improved spectrum efficiency and resilience.

In Orbit Applications

13. Country of choice for operating or procuring space debris removal services
14. National expertise in space assembly and manufacturing at scale.
15. Manufacturer of products that support energy security and net-zero goals.
16. Terrestrial industrial activity moved to space reducing the impact on Earth.

Space Science

17. World-leading space science roles working with ESA, NASA, and others.
18. World-leading ground-based space science facilities, working with ESO.
19. A leader in astrophysics, planetary physics, solar/heliospheric physics, and magnetospheric/ionospheric physics.
20. Pack-leading academia – industry collaboration.

Space Exploration & Human Spaceflight

21. Involvement in missions to Moon, Mars, and other Solar System bodies.
22. Expanded human spaceflight involvement (primarily via ESA).