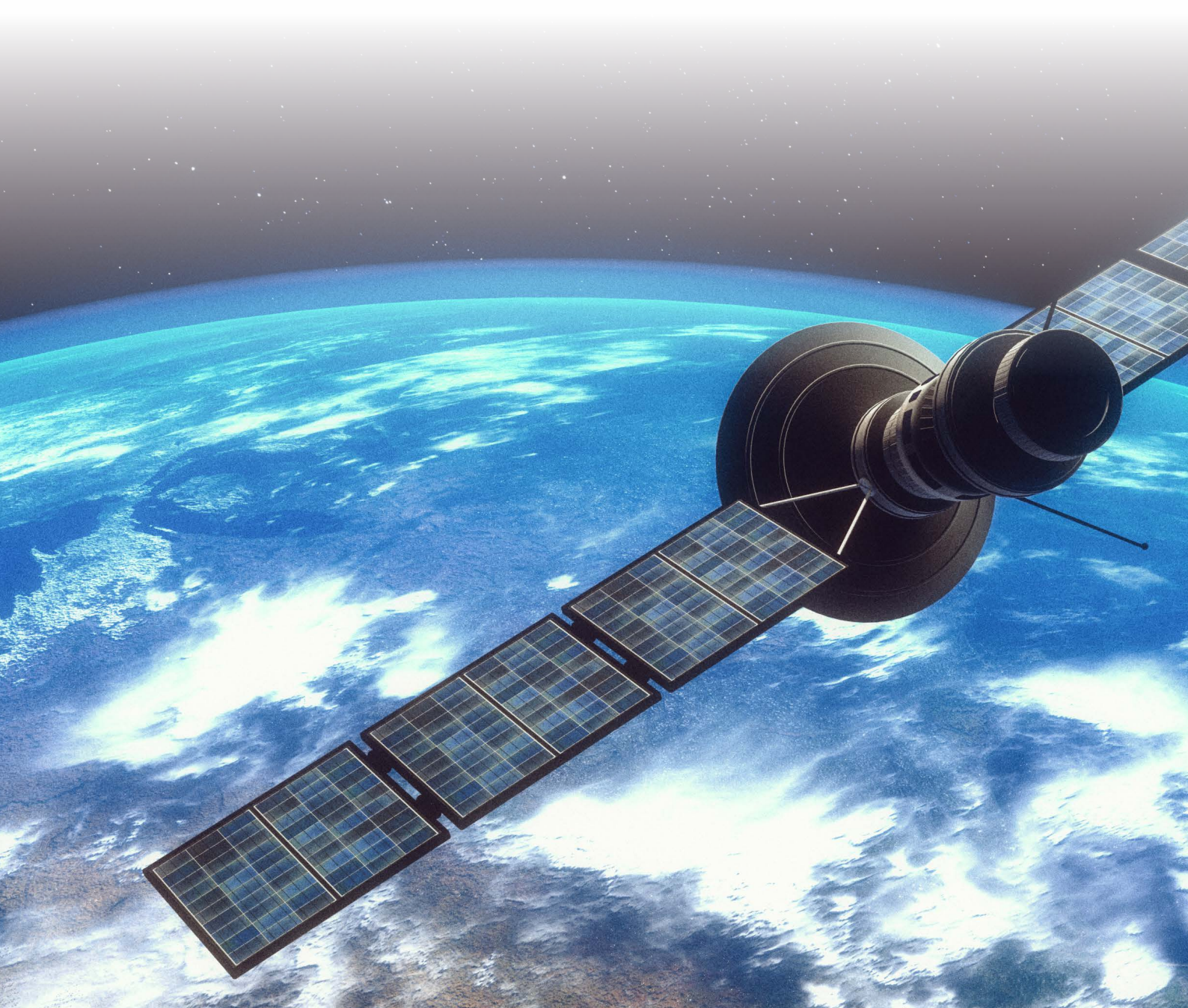


Copernican Revolution



A space policy reform agenda for transforming the UK space enterprise outside the EU's Copernicus programme

By Gabriel Elefteriu FRAeS



Copernican Revolution

A space policy reform agenda for transforming the UK space enterprise outside the EU's Copernicus programme

By Gabriel Elefteriu FRAeS



Policy Exchange is the UK's leading think tank. We are an independent, non-partisan educational charity whose mission is to develop and promote new policy ideas that will deliver better public services, a stronger society and a more dynamic economy.

Policy Exchange is committed to an evidence-based approach to policy development and retains copyright and full editorial control over all its written research. We work in partnership with academics and other experts and commission major studies involving thorough empirical research of alternative policy outcomes. We believe that the policy experience of other countries offers important lessons for government in the UK. We also believe that government has much to learn from business and the voluntary sector.

Registered charity no: 1096300.

Trustees

Alexander Downer, Pamela Dow, Andrew Feldman, David Harding, Patricia Hodgson, Greta Jones, Andrew Law, Charlotte Metcalf, David Ord, Roger Orf, Andrew Roberts, Robert Rosenkranz, William Salomon, Peter Wall, Simon Wolfson, Nigel Wright.

About the Author

Gabriel Elefteriu FRAeS is Director of Strategy and Space Policy, serving on the Senior Management Team of Policy Exchange, where he founded and still leads the first Space Policy Research Unit of any think tank in the UK. In his policy and advocacy work, Gabriel operates at the intersection between 10 Downing Street, Whitehall departments, Parliament and the space industry, as well as international entities such as the European Space Agency. His background expertise is in space affairs, defence, foreign policy and strategy, with a particular emphasis on net assessment, the framework for strategic analysis developed at the Pentagon by Andrew Marshall. Gabriel is also an Associate of King's College and an elected Fellow of the Royal Aeronautical Society, the world's largest learned society in the field, where he also serves on the Space Specialist Group's Steering Committee.

About the Space Unit

Launched in April 2019 by the then US Secretary of the Air Force, Hon Heather Wilson, and then UK Science Minister Rt Hon Chris Skidmore MP, Policy Exchange's Space Policy Unit – founded and led by Gabriel Elefteriu FRAeS – is the first of its kind at any UK think tank. The Unit's mission is to champion a comprehensive development of UK "space power" as a critical component of the UK national interest in the 21st century. Our goal is to help lift Britain's space ambitions to the next level, and help build a strong, exciting vision for UK in space that can be taken up by Government and Parliament in the years ahead.

Acknowledgements

The author would like to express his special thanks to Professor David Southwood CBE and to Andy Shaw for their insights, assistance, and guidance on some of the key issues discussed in this paper, and for their review of the final draft – including constructive criticism and dissent from certain points and arguments. Further thanks are due to several other reviewers of the report whose feedback has been extremely helpful, including Stephanie Ayres, Dr Alice Bunn OBE, Stuart Martin, Leyton Wells, and three anonymous figures. All opinions and recommendations expressed in the text, along with any remaining errors and inaccuracies, are the author's own.

© Policy Exchange 2022

Published by
Policy Exchange, 1 Old Queen Street, Westminster, London SW1H 9JA

www.policyexchange.org.uk

ISBN: 978-1-913459-92-5

Contents

| | |
|---|----|
| About the Author | 2 |
| About the Space Unit | 2 |
| Acknowledgements | 3 |
| Abbreviations | 5 |
| Executive summary | 7 |
| Recommendations | 11 |
| Key messages | 12 |
| Introduction | 14 |
| Chapter 1 - The Copernicus problem | 17 |
| The underlying issue: EU space autonomy | 17 |
| What is Copernicus | 18 |
| Copernicus dead-end | 23 |
| Chapter 2 - UK's choices | 26 |
| Integrated National Space Programme | 26 |
| Sovereign EO System built at home | 29 |
| UK-led EO via ESA | 30 |
| Big bet on ESA | 32 |
| Chapter 3 - The way forward | 35 |
| A framework for decision | 35 |
| The optimal solution: a "Plan B" policy package | 47 |
| The UK Space Enterprise in 2025: a vision | 57 |
| Conclusion: A question of political will | 59 |

Abbreviations

| | | | |
|--------------|--|----------------|--|
| ADR | Active Debris Removal | LEO | Low Earth Orbit |
| AI | Artificial Intelligence | LSI | Large System Integrator |
| ARTES | Advanced Research in Telecommunications Systems | MFF | EU's Multiannual Financial Framework |
| BEIS | Department for Business, Energy and Industrial Strategy | ML | Machine Learning |
| CAA | Civil Aviation Authority | MoD | Ministry of Defence |
| CDR | Critical Design Review | NEODTP | National Earth Observation Data and Technology Programme |
| CMIN | ESA Council of Ministers / meeting of ESA's Council at Ministerial level | NSL | National Space Laboratory |
| CNES | National Centre for Space Studies (France's space agency) | NSP | National Space Programme |
| CSC | Copernicus Space Component | NSpC | National Space Council |
| CSR | Comprehensive Spending Review | NSS | National Space Strategy |
| DCMS | Department for Digital, Culture, Media and Sport | PDR | Preliminary Design Review |
| DEFRA | Department for Environment, Food and Rural Affairs | PNT | Positioning, Navigation and Timing |
| DIAS | Data Information and Access Services | PRS | Galileo Public Regulated Service |
| DLR | German Aerospace Center | R&D | Research and Development |
| DSS | Defence Space Strategy | S&T | Science and Technology |
| Dstl | Defence Science and Technology Laboratory | SABRE | Synergetic Air Breathing Rocket Engine |
| EC | European Commission | SDA | Space Domain Awareness |
| EO | Earth Observation | SME | Small and medium-sized enterprises |

| | | | |
|---------------|--|---------------|--|
| ESA | European Space Agency | SR | Spending Review |
| FCDO | Foreign, Commonwealth & Development Office | SSA | Space Situational Awareness |
| FDI | Foreign Direct Investment | SST | Space Surveillance and Tracking |
| GEOINT | Geospatial Intelligence | STFC | Science and Technology Facilities Council |
| GMES | Global Monitoring for Environment and Security | STM | Space Traffic Management |
| GNSS | Global Navigation Satellite System | TCA | UK-EU Trade and Cooperation Agreement |
| HMG | Her Majesty's Government | TCFD | Taskforce on Climate-Related Financial Disclosures |
| HMT | Her Majesty's Treasury | TNFD | Taskforce on Nature-Related Financial Disclosures |
| IOSM | In-orbit Servicing and Manufacturing | TRUTHS | Traceable Radiometry Underpinning Terrestrial- and Helio-Studies space mission |
| ISR | Intelligence, Surveillance and Reconnaissance | UKSA | UK Space Agency |
| ISTARI | Ministry of Defence ISR space programme | WTO | World Trade Organisation |

Executive summary

- **Britain’s Copernicus problem has become intolerable: we must exit the programme as soon as possible.** Copernicus is the EU’s flagship Earth Observation (EO) programme. UK’s continued participation in Copernicus is governed by the “Brexit Deal” but is being held up by the wider political crisis over the Northern Ireland Protocol. In the meantime, British industry has already lost the most technologically-interesting and valuable Copernicus contracts to European companies. Re-joining the programme now – at a cost of £750m – would represent a net financial loss to the UK and would effectively result in British taxpayers subsidising EU’s space capabilities. Additionally, at this stage, our “third country” status would not confer any voice in the evolution or management of the programme.
- **The Copernicus money together with the next European Space Agency (ESA) budget are a golden opportunity to radically transform our space policy and build UK space power.** This is a once-in-a-generation opportunity to fund a major new direction of development for UK’s space ambitions, centred around **international collaboration** especially with **Five Eyes and Indo-Pacific Partners**. It can be a game-changer, but without clear thinking and a strategic vision this opportunity can all too easily fall victim to familiar pet agendas, vested interests, half-baked ideas, competing claims and – most damaging – exceedingly slow and ineffectual implementation and delivery.
- **The “Copernican Revolution” we need requires a package of measures: focusing on a single solution would be a missed opportunity.** There has already been some thinking in Government on a “Plan B” about what to do in case the UK does exit Copernicus. The solutions being floated are, however, extensions of the status-quo and not ambitious enough, with the main idea being to simply transfer the entire Copernicus money into a similar (but scaled-down) national Earth Observation programme. This like-for-like replacement plan – whether delivered via ESA or attempted through national means – is not only unimaginative, but it cannot in fact replicate our previous role in Copernicus and would privilege the EO community at the expense of wider national space interests.
- **With a number of options on the table, Government’s policy choice must be guided by a clear decision framework and criteria.** The decision-matrix should include six categories of questions:

1. **Speed.** How quickly and easily can the chosen policy option be implemented in reality?
 2. **Delivery.** How will the chosen policy option will improve HMG's space project management capacity?
 3. **Politics.** How politically attractive and realistic is the chosen policy option, domestically and internationally – including for non-European partners in **Five Eyes** and beyond?
 4. **Dual-use.** How will the chosen policy option advance UK's vital need for civil-military space integration?
 5. **Capability.** How will the chosen policy option benefit UK's long-term space capability and space power?
 6. **Industry.** How will the chosen policy option strengthen UK's space industrial base and global competitiveness?
- **Against this framework, the optimal “Plan B” policy package to replace Copernicus, remove the EO budget ringfence, and execute a wider transformation of UK space has four main components** (at a total net cost of only £173m/year in new funds over what is currently projected for the UK space enterprise until 2025):
 - **A short-term UK-owned Earth Observation programme set up via ESA**, which can be fast-tracked to delivery using ESA technical expertise and facilities that we pay to have access to through our core membership. Upon transfer to UK Space Agency (UKSA) control, this programme would provide the basis for an operational British EO capability, benefitting our space industrial sector and providing extra **resilience** to existing allied capabilities across the space EO/ISR mission sets from a source that is neither US nor EU.
 - **A dual-use national Earth Observation data and technology R&D programme set up at home**, and with HMG acting as an **anchor customer** for data to drive up FDI and support expansion of existing manufacturing capability in the UK, especially in areas like small satellites where we already lead. This is a chance for Britain to develop an innovative, market-driven approach to EO data services, providing novel information products to meet surging global demand.
 - **A new National Space Lab (NSL)**, consolidating Britain's space research facilities and institutions, and Government's space tech skills, under a single authority with new capabilities, to support programme delivery and R&D for UK-flagged space missions. The NSL should be capable of acting as the **technical wing** of the UK Space Agency for national programmes undertaken through UK industry and institutions, as well as providing advice and oversight of UK spend through ESA.
 - **A conditional major increase in UK's contribution and role in ESA** in programmes which support British space technology development objectives as well as an **increasing**

diversification of UK space industry, and which would bring practical and political benefits for UK national interests. This extra investment should only proceed once appropriate guarantees and safeguards mitigating specific UK concerns are obtained from ESA. Conversely, if the UK cannot obtain satisfactory guarantees from ESA, **HMG should be prepared to cut UK's contribution to ESA** and redirect those savings into domestic and bilateral space projects with close friends and allies.

- **In addition, a significant reform of UK space governance is needed.** As Policy Exchange has argued since 2019, the key task for HMG in this area is to consolidate national space policy decision-making across government departments and bring it closer to the centre of government. One of the most urgent requirements for a new government intent on opening a new era for the UK in the space domain is, therefore, the comprehensive overhaul of the top-level decision-making structures for UK space policy. The National Space Council would be one step towards greater rationalisation of space governance arrangements, if backed by a Space Secretariat functioning as UK's "central brain" on space policy; and this must be followed by a complete restructuring of the UKSA and its urgent move out of BEIS, to be placed under a dedicated Space Minister sitting in the Cabinet Office.
- **The long-term focus of this policy package must be to build national assets so that the UK has strategic operational (not just R&D) capability** which it can deploy into new **international partnerships** outside of Europe. We have a fragmented, under-funded set of R&D activities in the UK, but no civil operational capability, not even as anchor customer: that is the stand out difference and major strategic shortcoming for the UK compared to other countries. It is therefore important to keep the bottom-line in view: the ultimate objective is to achieve a form of "UK space autonomy" where Britain is not *dependent* on ESA as at present but can choose either to continue working through ESA, or directly with other space powers through wider international partnerships because we will have something to offer in return.
- **More broadly, despite progress on certain aspects of space policy in recent years, we are falling further behind our global peers.** Britain has great strengths in science and technology, and our space sector has been thriving in recent years, on its own terms. But the global space environment is changing fast and the UK is losing ground: we are falling behind in the space race, losing global market share. Britain's light-touch, low-cost space policy model is showing its limits. Other countries are taking a much more hands-on approach backed by significant investment. They – and in particular the EU – have also long understood the vital strategic and political importance of space as a component of

their national power and have elevated it to the very top of their strategic agenda. It is time for Britain to do the same: outside the EU, the UK needs to act to establish its space independence and also to use space power to underpin its own interests and its global alliances.

- **Space power is a critical force shaping 21st century geopolitics.** The projected expansion of the global space market to over \$1.25tn by 2030 – and its structural integration with the wider digital economy – means that space is becoming much more than just another economic proposition. Rather, it is becoming a strategic centre of gravity in its own right. Countries such as China and the US are already using space as an instrument of state policy in order to advance their geopolitical agendas. Combined with the evolving role of military space capabilities in warfare – **as witnessed in the Ukraine war**, including with Starlink – these trends are turning space power into a key component of national influence in global affairs. No responsible long-term strategy for a major country like Britain can ignore the requirements of space power over the coming decades, any more than it can ignore the long-term challenge of climate change.
- **Space is a huge opportunity for UK global leadership & influence – if we act now.** Embracing an ambitious agenda for UK space development comes with disproportionate rewards. The clearest and most often cited are the practical benefits of space for economic prosperity – across a wide range of applications – and for national security. In addition, as we are now outside of the EU, a more substantive space pivot to the world can become an important driver of the Global Britain concept. Diversifying UK's space industrial interests from its current over-integration with Europe is also essential in order to grow the British space economy. This will inaugurate a new approach in UK space policy where industrial interests are subordinated to national strategic interests as determined by the National Space Council, not the other way around as has historically been the case in this country. Finally, boosting UK space power would give the British government the requisite influence to play a leading role in the shaping the international regime governing space affairs.
- **Unlocking the UK's full space potential is primarily a question of political will, not of means.** We find ourselves at a crossroads in the space domain. The Copernicus challenge and the ESA question are overlapping with the fundamental transformation happening in the global space environment as part of the New Space Age. A comprehensive reform of the national approach to space is required if Britain is to not only avoid a reversal of its space fortunes, but to positively launch itself on a trajectory to becoming a leading space power. It is clear what policy changes are required, while the costs are comparatively low – considering the level of public

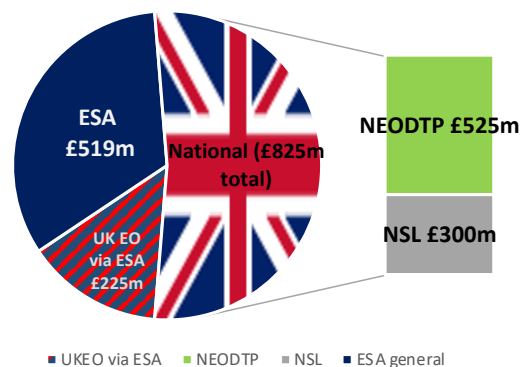
investment we are starting from. But this programme of reform would need to be delivered with energy and despatch. More than anything, it requires political will and top-level leadership from the Prime Minister.

Recommendations

1. **Exit Copernicus as soon as possible.** Depending on how the Horizon situation progresses, a political-legal solution might be required to decouple Copernicus from Horizon and Euratom under the terms of the EU-UK Trade and Cooperation Agreement (TCA) Protocol.
2. Transfer budgetary and programme mission ownership of EO from DEFRA to BEIS, currently the UK's principal civil space management structure. **Remove the EO ringfence** around the UK's Copernicus budget.
3. Create a **new three-year UK-led EO programme within ESA**, using up to **30% (£225m)** of the funds previously earmarked by HMT for Copernicus, as a temporary R&D and capacity-building "bridge" solution to Britain's immediate need to build operational capability and delivery capacity. This programme, which would ideally be transferred over to UKSA (and joined with NEODTP, below) by 2025, should be complementary to Copernicus and it should be structured so as to allow collaboration, via ESA, with non-European space partners particularly from the Indo-Pacific Region. Evidently, the **UK should not continue in the ESA side of Copernicus** beyond the current ESA budgetary period, allocating that funding to this new EO programme instead.
4. Create a new dual-use civil-military **National EO Data & Technology Programme (NEODTP)** at home, jointly under the UK Space Agency and Dstl, funded partly with up to **30% (£225m)** of UK's Copernicus money and partly with resources (equivalent to 40% of Copernicus, i.e. **£300m**) from the MoD's ISTARI space-based ISR programme. The programme, which should be **open to Five Eyes and other close allies**, could also be expanded beyond strictly civil or defence applications, into new commercial markets where there are safety-critical applications with a security component.
5. Create a new **National Space Lab (NSL)** funded with the remaining **40% (£300m)** of Copernicus money, as a UKSA in-house end-to-end R&D centre, covering all space science and technology areas – including, in particular, Science and Exploration, PNT and IOSM – but fully integrated with UK's long-term national strategic space interests. Budget-wise, £150m would be deployed directly via UKSA, £150m via ESA.

6. Consolidate all civil UK space activities under a reformed and more autonomous UK Space Agency with its own separate budget line and new powers.
7. Review TRUTHS and mothball the project until or unless other partner nations are found to shoulder a significant element of its cost and share of risk. Redirect TRUTHS savings into the UK EO programme.
8. **Subject to strict conditions and guarantees from ESA, increase UK's annual contribution to ESA's next budget (2023-2027) at the November CMIN from €1.6bn (£1.36bn) today (11.5%)¹ to €3.04bn, or £2.6bn (19% of the planned £16bn next ESA budget). Deploy the extra £1.24bn² investment into ESA's programmes for Launch, Exploration and the new UK EO programme proposed here. The assurances and guarantees required by the UK prior to making this extra investment should be set by **an ESA Policy Group** of officials, with expert support, to be convened by the UK National Space Council at the earliest opportunity.**

Total costs 2022-2025 = **£1.57bn***
 (£519m new money i.e. £173m/year)
 *over UKSA's £1.7bn SR21 settlement; incl Copernicus budget and £300m from ISTAR1



Key messages

Now is the time for Britain to take major decisions about its space future that will impact our collective destiny for decades to come. We cannot delay, else we will never catch up with the world's space powers as they surge forward at ever higher pace. But nor can we compete in this race without a strategic plan, without space leadership skills, or without a shrewd understanding of how space affairs are shaping up – and where our interests lie.

There are three areas where Britain needs to focus its space efforts.

1. European Space Agency, *Space 19 Plus: total subscriptions*, 28 November 2019; available at: https://esamultimedia.esa.int/docs/corporate/Space19plus_charts.pdf
2. The £1.24bn figure would comprise of the £225m for the UK EO programme; £150m for NSL spent via ESA; and £865m new funds from HMG spread over the five years (2023-2027) of the next ESA budget, i.e. £173m/year, or a total of £519m over current SR period of 2022-2025.

I. Ethos: Building the Vision and Skills Required for UK Space Leadership

Space is not just “new” as a domain of human activity, but it has no real analogy in our past experience. The rules are completely different – starting with the basics of astrophysics – and the challenges are on a completely different scale. Moreover, technological progress keeps altering the strategic reality of space – the limits of the possible. In this context, space success requires not just a clear vision of Britain’s interests and a roadmap for UK space development: we also need to develop a new “**space-power mindset**” along with the political leadership that can turn space into a truly national endeavour.

II. Technology: Expanding the UK Space Scientific and Industrial Base

Winning a front-rank place among the world’s leading space nations of tomorrow requires a completely different order of space-industrial capabilities than we have now. Britain has so far had a very “lightweight” space policy model, with the government acting more as a convener for industry and with innovation overwhelmingly driven by private sector purely on commercial grounds. This approach, while economically successful, has not been strategic. Scaling-up Britain’s space-industrial base, which is necessary to compete in building the great space infrastructures of tomorrow, requires a more integrated, long-term technology strategy.

III. Delivery: Managing the UK Space Enterprise

The Apollo Programme that put US astronauts on the Moon was a managerial wonder even more than it was a technological one. As a unique operating environment, unlike anything known in human history, space comes with unique programme and policy delivery requirements. Effective and efficient management of the national space enterprise is absolutely key to space leadership.

Introduction

“European decision-makers have demonstrated their readiness to use space as a geopolitical tool . . . Consequently, interdependencies in the space sector can be used by states to exert pressure and push forward their own strategic interests.”³

– European Space Policy Institute, May 2022

The controversy over UK’s continued participation in EU’s Copernicus space programme – as well as Horizon – comes at a critical juncture as global space competition sharpens and as the Government seeks to define the space dimension of Global Britain. With its vital role in the functioning of modern economies, militaries and many other critical services, space has quietly become a strategic component of national power writ large. To take just the recent example of Ukraine, its heroic defence against Russian attack has already benefited hugely from space connectivity provided by Elon Musk’s Starlink satellites. We have been warned, and we need to learn the right lesson: space will be decisive to the UK’s fortunes in the decades ahead, both for our prosperity and security – and for Britain’s place and standing in the world.

Countries like China, the US, France or India understand this, and have the financial resources and strategies in place to compete and secure their own space interests effectively. In this context, a lot is riding on the next UK Prime Minister’s vision for lifting Britain up the space power rankings.

This timing is all the more important because no UK government has so far acknowledged **space power** as a core dimension of UK national power (alongside military or economic power for instance) and as a component of the national interest. Space has traditionally been a vast blind spot in the government’s strategic thinking at the highest levels. It accounts for the many gaps and weaknesses in UK space policy and posture, and for the deficit of relevant space expertise across government. The end result is that Britain lags far behind the competition in the space domain.

The economic value of space

Without space modern society would simply stop working. Space-enabled services underpin large chunks of the economy, from the precise time-stamping of financial transactions to the satnav people’s cars or mobile communications worldwide. Climate monitoring, banking, transport, insurance, telecoms and so on – space is everywhere, and the industry is booming.

3. European Space Policy Institute, *ESPI Executive Brief No. 57: The War in Ukraine and the European Space Sector*, 5 May 2022; available at: <https://www.espi.or.at/briefs/the-war-in-ukraine-and-the-european-space-sector/>

Most importantly, space is fundamental to our defence. From precision strikes to command and control – the modern army cannot fight effectively without space.

Space development is about money, innovation, and the cutting edge of technology. And in the end it translates into national advantage for those who do it well.

The global space market is expected to grow to £1.25tn⁴ by 2030⁵ (it is around \$470bn today). The precise figures matter less than the underlying drivers, which are similar to the growth of the Internet economy itself and are here to stay. They are based on a virtuous cycle of strong innovation creating (and integrating) new solutions and technologies, in turn leading to new services which in turn are creating new markets. In the highly digitalised economy of the future boosted by a 5G-enabled Internet-of-Things, the appetite for space-derived Big Data will be boundless. And then there are new markets awaiting beyond Earth orbit, such as Lunar settlements or asteroid mining. Purely in economic terms, then, space is a key domain of future competition in which Britain must be a leading player in order to ensure its economic security and prosperity. In other words, we need to be able to secure a good share of this market not just because it is profitable, but because it is a strategic imperative to do so.

But now, whether we like it or not, the scene is set for a major transformation of UK space policy over the next few months of 2022. Two slow-burning policymaking issues with long-ranging strategic implications are about to come to a head.

The first and most important is the question of UK's continued participation in the EU's Copernicus space programme, the largest earth observation system in the world. At the moment UK's participation is suspended pending the adoption of a separate Protocol negotiated as part of the UK-EU Trade and Cooperation Agreement (TCA). The Protocol's enactment (which also governs UK's participation in the EU's Horizon programme) is being held up by the ongoing political dispute over the Northern Ireland Protocol.

Britain's participation in Copernicus is worth £750 million (on a GDP share basis): money that the UK Government will automatically pay into the current EU budget for this programme which runs to 2027. Normally, this money would come back into the UK space industry in the form of major contracts; which is why Copernicus has been an important driver of growth in the UK space sector.

But while UK has been suspended from participating for political reasons, the programme has moved forward and many industrial aspects of Copernicus's next phase have been already decided without British involvement. **The value to the UK of getting back in the programme at this late stage, at a price of £750m, is therefore severely in doubt.**

There are a number of political, legal and economic issues that need to be considered as part of this equation, starting with exactly how, when or if the UK-EU dispute over the Northern Ireland Protocol is solved. For example, one complicating factor is that **Copernicus is bound together with the fate of Horizon** under the TCA, yet the policy – and political – issues are somewhat different for each of them.

4. See Northern Sky Research, *NSR's global space economy report projects \$1.25 trillion in revenues by 2030*, 27 January 2022; available at: <https://www.nsr.com/nsr-global-space-economy-report-projects-1-25-trillion-in-revenue-by-2030/>

5. See the Space Foundation, 27 July 2022; available at: <https://www.spacefoundation.org/2022/07/27/the-space-report-2022-q2/>

In any case, the fundamental question which this paper focuses on is: what happens *after Copernicus*? If the UK exits the programme, as it should, the £750m earmarked for Copernicus should be available for a **UK national space programme**. But what should that include – and, more importantly, **how to get there**? At the moment, Britain lacks critical delivery and operational capacity to run such a programme: any such goal requires a **phased approach**.

Overall, this is a once-in-a-generation opportunity to fund a major new direction of development for UK's space ambitions. It can be a **game-changer**, but without clear thinking and a strategic vision this opportunity can all too easily fall victim to familiar pet agendas, vested interests, half-baked ideas, competing claims and – most damaging – exceedingly slow and ineffectual implementation and delivery.

This is where **the second** potential driver of change this year comes in: the European Space Agency (ESA) ministerial meeting in November 2022. Held every three years, this key forum sees each ESA member country committing certain amounts of money to certain projects and programme lines, according to their national space policy and interests.

With the overwhelming majority of UK's civil space spending going directly into ESA, the choices made at the November ministerial will be essential to the next stage of Britain's space development – particularly in conjunction with the Government's response to the Copernicus situation.

But this unique moment and opportunity in the history of UK space is about more than just cracking a policy dilemma: that is just a means to an end. **The real prize, now, for a new Prime Minister, is to open a new path for Britain in space.**

Turning Britain into a leading space nation of the 21st century, therefore, ultimately requires a higher vision: it is about adding a new dimension – a further identity element – to the country's *self-image*. To be sustainable – and space is now a never-ending proposition – this must be more than just another “growth” or “innovation” project aiming to simply augment UK power in the name of prosperity and security. In this sense, it would be a historic initiative.

Becoming a space nation implies a sense of national endeavour. Curiously for a country with such a distinguished history of Earth exploration, the ambition to play a national role in the exploration of space passed Britain by.⁶ This is likely a result of circumstance (and perhaps of a misplaced declinist mindset at elite level) rather than a genuine popular disinterest. On the contrary, space is hugely popular with the public as demonstrated by the widespread enthusiasm generated by Tim Peake's *Principia* mission to the International Space Station in 2015. Therefore, if properly couched in a broader message about a new “space chapter” for the UK, an ambitious space vision can galvanise public imagination and become a self-fulfilling prophecy. And that must be our goal.

6. We closed our rocket programme in the 1970s, and to date only two UK astronauts even visited a space station – both times via non-national space programmes. World-class UK-made instruments regularly feature on some of the most advanced space probes built by man, but there are no UK-only missions; even countries like India and Israel are sending their own spacecraft to Mars and the Moon.

Chapter 1 - The Copernicus problem

The underlying issue: EU space autonomy

Understanding the nature and trajectory of EU's relationship with ESA is absolutely critical to UK space policy-making. The two organisations have a long history of collaboration, with ESA building flagship EU-owned space systems such as Galileo. But with the arrival of ESA's new Director General, Josef Aschbacher, there has been a renewed attempt to clarify the relationship, leading to a new agreement signed in December 2020 that also seeks to prevent the duplication of ESA activities by the EU itself.⁷

At the same time, we should be clear-eyed about the interests at play here, and the direction of travel. It is a well-known fact that France's long-term goal is to turn ESA into a delivery agency for the EU on "strategic autonomy" grounds. French industry represents, very roughly, some 30% of West European space-industrial capability, which would give it a major built-in advantage in a consolidated European space market where public procurement followed EU competition rules rather than ESA *juste retour*. President Macron's speech in Toulouse is instructive in this regard,⁸ and the strong French push for European strategic autonomy is being reinforced by lessons already being learned from the Ukraine war about the critical value of space power.

But there is no preordained conclusion here. Despite EU ambitions, ESA's space budget is still some three times larger than that of the EU, which should give it a strong bargaining power. ESA support is essential to the delivery of the EU space programme, which is a strategic interest for Brussels. Secondly, UK membership – both in terms of financial contribution and of capabilities – strengthens ESA's position relative to the EU. In the constant power-struggle between ESA and EU, the UK is an important asset to ESA.

The Copernicus programme is also likely to develop new security dimensions, with some already calling for adding a military-grade service to it similar to Galileo's PRS. Even a partial "securitisation" of Copernicus will inevitably come with new authorities for the European Commission (EC) to control participant countries' access to various elements of the programme.

Next year's European Space Security and Defence Strategy is expected to further impact the rules around how EU space programmes interact with third countries.

7. Council of the European Union, *EU Space Programme: Council presidency reaches political agreement with the European Parliament*, 16 December 2020; available at: <https://www.consilium.europa.eu/en/press/press-releases/2020/12/16/eu-space-programme-council-presidency-reaches-political-agreement-with-the-european-parliament/>

8. Council of the European Union, *European Space Strategy: President Macron's Speech in Toulouse*, 17 February 2022; available at: <https://presidence-francaise.consilium.europa.eu/en/news/european-space-strategy-president-macron-s-speech-in-toulouse/>

Another clear indication of the direction of travel in Europe was EU Commissioner Thierry Breton's speech in January 2022⁹ which did not mention NATO once, yet talked about a future "EU Space Command". It was a reminder of France's bid for space leadership in Europe, but this runs against the familiar set of concerns by East European countries who see their security guaranteed primarily by NATO.

One key priority for Mr Breton and the European Commission is an EU LEO satcom constellation. Given the budgetary pressures, the EC will be keen to have the early stages of this constellation developed by ESA, with a promise of big EU "build" contracts later.

An exclusive focus on UK's position in Copernicus can obscure the wider and more fundamental questions as to the future of the whole programme from an EU standpoint. There are some who wonder whether the sheer number of new satellite missions funded under Copernicus will see the whole programme collapse under its own weight.

At the moment, ESA designs, builds and operates the satellites on EU's behalf. There is currently no entity in place to take on operational responsibility in the way that the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) does for meteorological missions. The conclusion must be that the new EU Space Agency will eventually take on this role; if this happens, this will be a watershed moment in European space policy. It is therefore essential that ESA maintains sufficient autonomy to be able to develop and deliver secure programmes for its member states, especially where there are new commercial markets opening up enabled by assured EO, navigation or communications services from space.

What is Copernicus

Overview

The Copernicus programme is the European Union's Earth observation programme.¹⁰ It is delivered in partnership with the ESA and other European agencies including EUMETSAT. The programme is funded and managed by the European Commission and cost around €7bn between 1998-2020. A large proportion of this total has been spent in the last decade alone, with €4.3bn for the 2014-2020 period, and €5.4bn more recently marked for 2021-2027.

Copernicus' objective is to provide accurate, timely and easily accessible information to improve the management of the environment and to understand and mitigate the effects of climate change and ensure civil security. Copernicus' data is made openly available, free of charge, to all users and the public, which allows third parties to develop their own services. This free and open data is accessible through dedicated infrastructures operated by ESA and EUMETSAT.

Copernicus Components

Copernicus is built upon three main components: measurements from space, in-situ measurements, and services built upon the gathered datasets:

9. European Commission, *Speech by Commissioner Thierry Breton at the 14th EU Space Conference*, 25 January 2022; available at: https://ec.europa.eu/commission/presscorner/detail/en/speech_22_561

10. Official Journal of the European Union, *REGULATION (EU) No 377/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 3 April 2014 establishing the Copernicus Programme and repealing Regulation (EU) No 911/2010*, April 2014. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0377&rid=9>. Also see: European Commission, *Copernicus: 20 years of History*, June 2018; available at: https://www.copernicus.eu/sites/default/files/2018-10/History_Factsheet_vf.pdf

- **The space component** involves the space-based observation satellites and the associated ground segments. Missions observe land, atmospheric and oceanographic parameters. The space component is comprised of ESA's families of dedicated Sentinel satellites; and missions from other space agencies called Contributing Missions (including weather data from EUMETSAT satellites).
- **The in-situ component** includes ground, sea, and airborne measurements. These provide data at smaller scales than satellites and help validate satellite data. In-situ networks (e.g., weather stations) are managed by member states.
- **The services component** delivers managed services which are freely accessible to users, operating under six main themes: Atmospheric Monitoring; Marine Environmental Monitoring; Land Monitoring; Climate Change; Emergency Management; and Security.

Space Component Missions

The space component is managed by ESA, who develops the fleet of dedicated Copernicus satellites called Sentinels. Sentinels are developed in batches or missions (Sentinel-1 to 6), with each batch being made to fulfil specific needs. The in-situ component is managed by the European Environment Agency and individual EU countries.

Looking forward to the next generation of Copernicus (Copernicus 2.0), on July 1, 2020, ESA awarded contracts for the construction and development of six new Copernicus satellites,¹¹ the so-called “expansion missions”. These six new high-priority candidate missions¹² are intended to meet EU policy goals, fill gaps in Copernicus user needs, and to expand current Copernicus space component capabilities:

1. **Sentinel-7:** Anthropogenic CO₂ emissions monitoring (CO₂M)
2. **Sentinel-8:** High Spatio-temporal Land Surface Temperature (LSTM)
3. **Sentinel-9:** Copernicus Polar Ice and Snow Topography Altimeter (CRISTAL)
4. **Sentinel-10:** Copernicus Hyperspectral Imaging Mission for the Environment (CHIME)
5. **Sentinel-11:** Copernicus Imaging Microwave Radiometer (CIMR)
6. **Sentinel-12:** Radar Observing System for Europe - L-band SAR (ROSE-L)

British prime contractors were left out of the 2020 contract awards.¹³ In the not too distant past, the UK would have had leadership on at least some of them – especially in radar and high-fidelity radiometry, areas of distinct UK strength.

Between 2017 and 2035 Copernicus is expected to generate €67bn to €131bn in benefits to Europe. This is ten to twenty times the cost of the

11. European Space Agency, *Contracts awarded for development of six new Copernicus missions*, 3 July 2020; available at: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Contracts_awarded_for_development_of_six_new_Copernicus_missions

12. See European Commission, *Copernicus Expansion Missions*, available at: <https://sentinels.copernicus.eu/web/sentinel/missions/copernicus-expansion-missions>

13. Space News, *ESA selects prime contractors for six new Copernicus missions*, 1 July 2020; available at: <https://spacenews.com/esa-selects-prime-contractors-for-six-new-copernicus-missions/>

programme. Interestingly, more than 80% of the benefits are expected to be generated outside of the space sector, through the use of Copernicus data in other parts of the economy (such as agriculture, fisheries, insurance or air quality).

Data

The data aspect of Copernicus, provided by its Services Component, represents the heart of the programme; for many stakeholders – certainly the scientific community – Copernicus is all about the environmental data it provides. While Copernicus data is open and free to access by anyone in the world, Copernicus member countries have privileged access that allows for fast downloads of vast datasets. Additionally, other 3rd party countries such as US and Australia have negotiated Copernicus data access through offering reciprocal data access to their own national EO programmes. But the UK cannot do that: **at the moment we have nothing to barter with.**

Even if UK were promised privileged data access as part of some (unlikely) breakthrough in negotiations with Brussels over Horizon and Copernicus, it must be kept in mind that after Brexit no kind of UK access to Copernicus data will ever be risk-free. The EU can switch Copernicus datastreams off to third parties like Britain for “security reasons” that will always be the European Commission’s prerogative to (re)define as it sees fit. Ironclad guarantees under international law against this kind of future behaviour might be possible in theory, but they are effectively impossible in practice for the foreseeable future.

Budgetary aspects of Copernicus

There are two main budgets at play in Copernicus:

(A) The Copernicus Satellites, in turn broken down in two parts:

1. **The Copernicus Space Component (CSC), or ESA “technology development”** part, managed by ESA. This is governed by *juste retour* rules and a strong position in CSC normally helps UK industry to access longer term, larger EU Copernicus budgets managed by ESA. It is also worth pointing out that CSC is separate from other ESA EO budget lines that UK has been subscribing to, including FutureEO (Science) and Earth Watch (data, commercial etc).
2. **The “operational” or EU part of Copernicus**, owned directly by the European Commission as an EU programme. This pays for building and deploying the actual satellites that enter service on orbit as part of the Copernicus system. This is where the big industrial contracts are, and where countries recoup their R&D investments into the ESA-managed CSC. Since it is an EU programme, industrial build contracts are awarded on EU competition rules rather than on *juste retour*, even though the procurement process is technically managed by ESA.

(B) The Copernicus Services Component, with six elements¹⁴:

1. Atmosphere
2. Land
3. Marine
4. Climate Change
5. Security
6. Emergency Response

This Component is again governed by EU competition-based procurement rules, rather than ESA's *juste retour*. The UK contributes funding to the Services Component but it is not clear how much of our investment returns to UK entities.

None of the services is led by or has a substantial contribution from any UK organisation. Most of them are run by "European" entities such as European Centre for Medium-Range Weather Forecasts (on Atmosphere and Climate Change), and in practice the major contractors delivering land, marine, security and emergency services are all continental. This is not a new problem: it stems from the fact that at the very beginning of Copernicus (when it was called GMES) the UK largely failed to secure leadership on any of the precursor GMES service programmes, with the issue perpetuating to this day.

Similarly, in 2018 the EU funded four contracts to build what they call **DIAS systems** – Data Information and Access Services – from the six Copernicus services.¹⁵ Again, no UK entity was successful in winning or leading any of these contracts. UK had a role in the ESA Collaborative Ground Segment (sited in Wales) but that has been wound down in recent years.

Many UK research institutions and companies that contract via the Copernicus services element are now gone or at risk. Industry sources estimate upwards of £10m lost revenue across 90-100 research contracts – a significant sum in a UK market context; but there is no publicly available collation of industrial impact.

Copernicus Services are not expanding but are generating a wider user base. Some view the services as rather lame and lacking in relevance or quality. It appears the DIAS range will be consolidated but that would still see little or no UK participation.

14. See a summary here: Copernicus, *Copernicus Services*; available at: <https://www.copernicus.eu/en/copernicus-services>

15. See Copernicus, *Data and Information Access Services*; available at: <https://www.copernicus.eu/en/access-data/dias>; and European Space Agency, *Accessing Copernicus data made easier*, 14 December 2017; available at: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Accessing_Copernicus_data_made_easier

Timelines

One complicating factor from a policy perspective is the **different funding timelines** on EU's and ESA's side, despite Copernicus being a joint programme. For example, the ESA subscriptions for Copernicus agreed in Seville in 2019 run to 2028, a year later than the EU's Copernicus budget under MFF which ends in 2027.

This makes it more difficult to track budget execution, given that spending and industrial return figures break across budgetary settlements.¹⁶ This is illustrated by the fudge earlier this year involving the extension of the Copernicus development programme from Preliminary Design Review (PDR) to Critical Design Review (CDR) in 2024 with UK work funded by ESA. This took advantage of the formal contractual breakpoints that occur at various dates in 2022 (the respective project PDRs).

But more importantly, the non-synchronised budgets allow decision-makers to play the differences for political effect, if necessary. The entire byzantine set-up is a bureaucrat's paradise, which puts a premium on quality information and political coordination when it comes to key policy choices.

For example, the EU side can easily play the terms of the current MFF – which extends until 2027 – against UK interests, by making the case that, as a third country, UK's presence in any EU programmes beyond 2027 could not be guaranteed. Framed in this way, doubt over UK's future commitments can thus be used to undermine others' commitments to partnering with UK companies.

Value to the UK

As a member state of ESA, and formerly of the EU, the UK had been involved in the establishment and development of Copernicus. The UK policy lead for Copernicus is DEFRA,¹⁷ with the UK Space Agency leading on the Copernicus Space Component. Britain spends somewhere in the region of £200m per year on the CSC and supporting science through the various EU/ESA channels. This includes resources covering the Copernicus Services component, which a number of UK institutions have contracts to develop and deliver.

UK science organisations (e.g. STFC, or RAL Space with Sentinel-3) and businesses (e.g. Airbus UK) have been involved in various aspects of the design and deployment of Sentinels on a secondary level. It is important to note, however, that the **UK has not played a major role** in any of the Copernicus Sentinel satellite missions – either the core ones or the newly announced expansion missions. Part of the reason for this is the **lack of a UK national programme** to develop the technologies that go into EO missions, not least because the British science community has focused on being good users of other people's data rather than supporting investment into upstream and instrument technology at home. The result is that UK industry is less competitive than it could be in this area, and therefore it has fewer chances to win important operational contracts against European competition.

Finally, UK scientists play important individual roles on various Mission Advisory Boards but that is not industrial support. It is hard to see how, going forward, in terms of the UK subscriptions to Copernicus via ESA or

17. It can be argued that at least one of the roots of the problem, in the early days, lies in asking DEFRA and NERC to manage UK's EO policy with a focus on scientific outcomes and no real regard to industrial return or holding ESA to account. Whether UKSA could and should have done better over the past few years is another matter.

16. For example, the November 2021 deadline had nothing to do with the UK. It was a political/management decision deadline for the EC to instruct ESA on what to do in terms of building the next stage of Copernicus (Copernicus 2.0, from 2022) if the UK situation had been sorted out (this completing the full Copernicus budget) or, alternatively, to instruct ESA to reshape Copernicus without the UK's £750m. The latter option is already being considered, with the Contribution Agreement (CA) between ESA and EC (as a supporting document of the FPPA), having now been placed under revision and the ESA DG having received a mandate in March 2022 to amend the CA. See: ESPI Brief no. 28, "The urgent need for sustainable EU-UK relations in space", European Space Policy Institute, 30 June 2022, available at: <https://www.espi.or.at/briefs/the-urgent-need-for-sustainable-eu-uk-relations-in-space/>

EU, this country would manage to soak up or recoup these investments of taxpayer funds.

| Benefits of Copernicus | | |
|-----------------------------|---|--|
| Industry | Science | Socio-Political |
| Contracts for UK industry | Data access for scientific applications | Together with Horizon, Copernicus is seen by some as an important bridge between the UK and the EU after Brexit. |
| High-tech R&D participation | Scientific collaboration with European counterparts on instrumentation, data etc. | |

Copernicus dead-end

The legal position

As Copernicus is an EU programme, Britain's continued participation in it is governed by the EU-UK Trade and Cooperation Agreement (TCA), i.e. the Brexit deal. Part Five of the TCA outlines the general terms of UK participation in EU programmes, with Article 7.10 specifying that the actual programmes open to the UK, and the "conditions for participation" will be listed in a separate Protocol.¹⁸ The final text has not yet been adopted due to the ongoing EU-UK political stand-off over the Northern Ireland issue,¹⁹ but a draft of the Protocol, agreed in principle, was published alongside a Joint Declaration on UK participation.²⁰ The draft Protocol (at page 16 of the Joint Declaration) states that:

"Should such an agreement [on security cooperation] be substantially delayed or prove impossible, the **Specialised Committee on Participation on Union Programmes** shall examine how to adjust the participation of the United Kingdom in Copernicus and its financing taking into account this situation."

The financial terms of UK's participation in these programmes would be similar to those before Brexit: the main contribution is calculated on a GDP share basis (i.e. the ratio of UK's GDP to EU's GDP). At the time when the current EU MFF 2021-2027 was drawn up, UK's GDP share, applicable to all these programmes, was around 15.6%. This effectively means that continuing in Copernicus would **cost the UK £750m** out to 2027.

Until the Protocol is formally adopted, UK representatives will be able to attend EU committees that manage specific programmes, but they are excluded from decision-making and will not have voting rights.

Copernicus operates under an open data policy for most of its data, and therefore UK users retain access to this data. However, until the agreement is finalised UK users will not have access to Copernicus data deemed security sensitive and may lose the right to high-bandwidth access.²¹

There are two key **legal** implications for the UK:

18. Trade and Cooperation Agreement, Part Five, Chapter 1, Section 1, *General Conditions for Participation in Union Programmes and Activities*, 30 December 2020; available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/982648/TS_8.2021_UK_EU_EAEC_Trade_and_Cooperation_Agreement.pdf

19. The European Commissioner for Research and Innovation, Mariya Gabriel, has suggested that other wider political issues between the UK and EU would need to be settled before UK association to EU programmes could be formalised. She referred specifically to differences over UK implementation of the Northern Ireland Protocol of the Withdrawal Agreement. See Business Science, *Gabriel confirms UK can't join Horizon Europe until row over Northern Ireland Protocol is settled*, 14 October 2021; available at: <https://science-business.net/news/gabriel-confirms-uk-cant-join-horizon-europe-until-row-over-northern-ireland-protocol-settled>

20. UK Government, *EU-UK Declarations*, 24 December 2020; available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/948105/EU-UK_Declarations_24.12.2020.pdf

21. See Department for Business Energy, & Industrial Strategy, *UK involvement in the EU Space Programme*, 31 December 2020; available at: <https://www.gov.uk/guidance/uk-involvement-in-the-eu-space-programme>

22. The new Horizon programme is worth approximately £14bn to the UK, under the current MFF. This is 20 times more than the Copernicus element of just £750m. This vast cash difference also accounts for some of the corresponding political *indifference* towards the space dimension of the UK-EU crisis over the NI Protocol.
23. Speaking to the Committee in October, the then Brexit Minister Lord Frost said the EU could be in breach of the TCA by not moving to adopt the protocol on UK participation. He cited Article 710 of the TCA that the protocol “shall” be agreed and adopted. He said that there could come a point where the “value-for-money case” for UK participation in the programmes became less compelling than in was at the outset. See House of Commons European Scrutiny Committee, *Oral Evidence: The UK’s new relationship with the EU*, 25 October 2021; available at: <https://committees.parliament.uk/oralevidence/2867/html/>
24. “Until the agreement on UK participation in Copernicus is finalised, the UK will not be able to participate in the parts of the Copernicus programme that are open only to EU member states. For example, UK-based businesses, academics and researchers will not be able to bid for Copernicus contracts tendered through the EU, funded through the EU’s Multi-annual Financial Framework or through any process using EU procurement rules after December 2020.” See Department for Business, Energy & Industrial Strategy, *UK involvement in the EU Space Programme*, 31 December 2020; available at: <https://www.gov.uk/guidance/uk-involvement-in-the-eu-space-programme>
25. For the UK, in formal terms the terminal crisis is likely to occur in 2024 if the Northern Ireland issue is not solved, because that is when the ESA funding for Copernicus (i.e. the ESA component of the programme) runs out and the EU funding should kick in. At the ESA Council in March 2022 it was decided that a reset of the Copernicus budget in the case of a UK exit from the programme should be postponed to the Critical Design Review (CDR) of the 6 Copernicus Sentinel Expansion missions (Q2 2024).
26. The current UK subscription amounts to €170m to the ESA part of the CSC-4 programme for the current stage of Copernicus under the ESA budget agreed at Seville in 2019. As of January 2022 total industrial return to the UK from this investment – for activities on PFM (first model) and FM2 (second model) satellites – stood at €119m, i.e. 70%. See ESA/IPC(2021)32 for details.

The low UK return on CSC-4 had no precedent in the recent past for UK involvement in ESA EO programmes. The immediate cause is the fact that UK companies were not included – or, rather, were purposefully excluded – from European industry consortia formed to bid for the big Copernicus contracts. Exactly *how* this happened i.e. at what stage and in what circumstances, during the ESA-run assessment process, is not entirely clear and merits further investigation.

Also see: Department for Business, Energy & Industrial Strategy, *UK involvement in the EU Space Programme*, 31 December 2020; available at: <https://www.gov.uk/guidance/uk-involvement-in-the-eu-space-programme>

- **Britain’s Copernicus future is now tied to Horizon** (and also Euratom). They are grouped together as a single entry in the TCA. In other words, as things stand, we cannot get out of Copernicus only,²² except if Government finds a legal solution. The other option is to leave all three EU programmes at the same time. Conversely, UK exclusion from the Horizon Europe programme is among options reportedly being considered by the EU as retaliation if the UK uses the Article 16 provision to suspend aspects of the Northern Ireland Protocol.²³
- **British entities cannot currently bid for Copernicus contracts** tendered through the EU, though it can bid on those tendered by ESA. More specifically, at the moment the UK’s status in Copernicus is that of a future 3rd country.²⁴ Thus, in theory, bids are allowed under WTO rules but the clauses are punitive. If a UK company bids for an EU Copernicus contract before UK participation is formalised, that company would be required to indemnify the EU in full if the UK ends up withdrawing from Copernicus with the company unable to continue in the programme. This indemnity would be excessively expensive, creating an unacceptable risk to any company, acting as a practical deterrent to UK industrial bids.

Damage to UK industry

Even if the UK-EU stand-off over the Northern Ireland Protocol was resolved right now, thus unblocking the Copernicus situation and allowing the UK to resume its full participation in the programme, it will all be too late. The damage to industry is already done and there is little benefit to going back into Copernicus at this stage.

The first consortia to bid for the ESA side of Copernicus were formed in 2019/2020. They largely condition who can win the big “build” contracts in the EU phase of the programme which is tendered under EU competition rules rather than ESA geo-return principles. At the moment, each of the six new Copernicus missions is going through PDR – Preliminary Design Review, where engineers check if the different components would work together properly. The PDR is a long process, starting in February 2022, and lasting until around November 2022. It effectively decides what things need to be procured by what dates. But there are many components what are long-lead items that can be procured in advance (before the PDR concludes in November), which means that major procurement on Copernicus (invitations to tender) would have already started in the summer of 2022.²⁵

When the overall consortium contracts were awarded in August 2020, the UK remained involved in only one of six Copernicus missions (in the ESA side of the programme), CSC-4, and even in this one we are under-returned on investment.²⁶ These consortia are now effectively fixed for the duration of the entire Copernicus 2.0 programme. The essential problem for the UK is that the big Copernicus contracts are already being tendered while UK industry cannot bid.

Essentially, British industry has now missed the boat: it is only for CSC-4 that UK companies can really hope to win significant EU Copernicus work. The value of these contracts is virtually guaranteed to be much below (less than half, at best²⁷) the programme “re-entry” fee of £750m, meaning that in effect **the UK would end up subsidising EU’s Copernicus programme** to the tune of hundreds of millions of pounds until at least 2027.

While the present situation persists, British industry will be left in the **worst of both worlds**: unable to bid on Copernicus but also unable to receive that Copernicus funding as government support, because HMT is obliged to hold on to the £750m as long as UK participation is technically still on the cards.

Objectively speaking, the great beneficiary of this status quo is the European space industry which, without making any effort at all, is seeing its British rival’s competitiveness being quickly eroded.

The Exit imperative

The long-running uncertainty around UK’s future in Copernicus has now clearly passed the point of no return. Re-joining the programme at this stage would represent a net financial loss to the UK, compounded by the fact that most of the technologically-interesting and valuable work has already been apportioned to European companies.

It must also be remembered that even if Government does decide to sign off our Copernicus money to the EU – which would happen without conditions as far as the programme itself is concerned – the EC can change the rules for procurement down the line. The UK would effectively be at the mercy of Brussels for the rest of the current MFF.²⁸ On this point, it may be argued that the risk to the UK in Copernicus in the very next few years (until 2027) is likely low. However, the real problem is that the EU’s behaviour so far indicates that it will be very difficult to get a good deal on Copernicus at the next MFF negotiations (for the post-2027 period), which again calls into question the value of struggling to get into what is left of the current MFF to begin with.

Whichever way the question is examined, whether in terms of financial return to industry, available high-tech R&D opportunities, or long-term UK interests in the programme, the same conclusion emerges in every instance: **Britain must leave Copernicus as soon as possible**. Not only it does not make any sense, anymore, to seek “third country” participation; but the present “limbo” situation, is clearly intolerable and destructive to UK space industry.

27. Government officials have argued, informally, that around £350m might come back in contracts to UK industry (some 46% return) but considering the CSC-4 limitations and the fact that other downstream contracts are already being lost, some sources indicate the return to UK could be as low as 32%.

28. Switzerland’s experience in 2014 is a cautionary example. The Swiss had paid to join Horizon 2020, but in 2014 the cantons adopted a law on immigration which caused a political crisis with the EU. Brussels then availed itself of this situation to remove Switzerland from full participation in the Horizon programme. See Swiss Government, *Horizon 2020 and Euratom Swiss Participation*; available at: <https://www.sbf.admin.ch/sbf/en/home/research-and-innovation/international-cooperation-r-and-i/eu-framework-programmes-for-research/horizon-2020/ch-status-horizon-2020.html>

Chapter 2 - UK's choices

British space policy is now at a major crossroads. Leaving Copernicus and thus obtaining a windfall space budget for the national interest is a once-in-a-generation opportunity to open a new era for UK space development – particularly in conjunction with the pivotal ESA meeting in November. This is Britain's chance to build capability to transition to the “next level” in the space domain: to a position where we are masters of our space destiny and have options in dealing with international partners – from Five Eyes countries to new friends and allies in the Indo-Pacific and beyond.

So what are the main categories of policy choices in front of the Government at the present moment? Four different pathways, or “strategic options” lie open in front of this country at the present moment. In summary:

- **Build a comprehensive UK National Space Programme, with an important EO component.** There would be a number of subsidiary options available here, as to what the programme should emphasise and how it should be delivered; OR:
- **Use ESA to deliver a UK EO Project to complement Copernicus;** OR:
- **Sovereign EO System built at home, as a National solution;** OR:
- **Big bet on ESA.** To transform UK's space relations in Europe.

These four individual options are presented here in a “pure form” for analytical purposes, to tease out where each might lead us if *one became the single preferred policy solution going forward*. In practice, as the next Chapter of this report explains, the **optimal choice for HMG** will be a **mix of elements from each of these four pathways**.

Taking each individual option in turn:

Integrated National Space Programme

Unlike other peer nations the UK does not have an actual National Space Programme (NSP), even though this term is sometimes used to describe the totality of UK space activities in general. A proper NSP²⁹ requires its own long-term technological roadmap, management and delivery arrangements – and proper funding. With over 75% or more of UK's civil space spending going directly to ESA for multilateral projects, and parts of the remainder going to other non-R&D commitments, only a fraction of Britain's space money (usually well under £100m at any given time³⁰) has been left for “national” space-related tech projects here at home in recent

29. Called for by Policy Exchange since before the start of the Johnson administration in 2019. See Gabriel Elefteriu, *What do we want from the next Prime Minister? Policy ideas for new leadership: Space*, Policy Exchange, 16 July 2019; available at: <https://policyexchange.org.uk/publication/space-what-do-we-want-from-the-next-prime-minister/>

30. See the latest UKSA Annual Report for 2021/2022; available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1091945/5903_UKSA_AR_21-22_CB_V17_Cc.pdf

years. In comparison, France and Germany spend around €1.2bn³¹ and €800m³² respectively on national space activities, separately from what they devote to ESA.

In addition, even the very limited resources that the UKSA does invest in “national activities” are mostly deployed in the form of *grants*, not Agency-owned projects. In effect, as far as its core national mission goes, the UK Space Agency is a grant-making body that organises “calls to industry” and oversees the disbursement of its comparatively meagre resources to the wider UK space community. In recent years this has been done under a number of spending headlines including:

- A. Academic Grants
- B. National Space Technology Programme
- C. National Space Innovation Programme
- D. International Partnership Programme (now being closed down)
- E. Spaceflight Programme
- F. Other programmes (SABRE, Spectrum etc)

The fact is that HMG has no mechanism – and so far no clearly expressed intention – to develop and manage a proper NSP that can deliver sovereign UK space capabilities in response to the national interests of this country. The best that the 2021 National Space Strategy could offer was this vague formulation, carefully worded by government officials for maximum flexibility and to avoid any clear commitments:

*Government will regularly map and fully understand its capability needs from space as technology advances and new opportunities emerge. We will increase our space expertise and build greater control over a larger range of space capabilities. We will need a flexible approach to determining where space capabilities can be most useful and where dual-use capabilities can best meet civil and defence needs.*³³

There is no question that, if it wants to graduate into the ranks of real space powers and bring its standing in this domain into some kind of alignment with its economic or military status internationally, the UK needs to set up a proper National Space Programme of its own, to build a national operational capability – like every serious space nation has done.

The rock-paper-scissors problem that needs to be overcome here is that:

- A. An NSP requires clarity on national requirements, and funding to match.
- B. To clarify national requirements and make the funding case to HMT, you need a centralised, authoritative Decision & Planning function in government with the specialist expertise.
- C. You cannot develop that expertise and space power-centre in government without an NSP to anchor both.

31. Centre National D'études Spatiales, *Annual Report 2020*; available at: https://cnes.fr/sites/default/files/drupal/202108/default/is_rapport-activite-2020.pdf

32. German Aerospace Center, *Facts and figures (DLR)*; available at: <https://www.dlr.de/EN/organisation-dlr/media-and-documents/facts/facts-and-figures.html>

33. HM Government, *National Space Strategy*, 27 September 2021; available at: <https://www.gov.uk/government/publications/national-space-strategy>

UK space policy is caught – partly by design, mostly by political ignorance – in this failure loop that cycles continuously from A to B to C and back to A with hardly any substantive results over the years. The nettle must be grasped and the vicious circle broken once and for all. But is it feasible to do it at this particular point in time? If not, then what is the best way to advance towards this goal?

Implementation

This can now be done in one fell swoop at no extra cost by a Prime Ministerial decision within the National Space Council to establish a UK National Space Programme funded 100% with the £750m budget currently earmarked for Copernicus (in addition to UKSA's current budget). UK would exit EU's Copernicus and at the same time gain a domestic programme that would catapult it into the front ranks of the world's space nations. Of course, HMG would have to commit to maintaining the same level of investment in the future as well, after this initial £750m resource runs out.

To give it full effect, four key provisions would have to be embedded in the Council's decision:

- HMT to remove the EO ringfence from the Copernicus money, ensuring that the newly released funds can be deployed across all types of UK space technology projects, over the current Spending Review period.
- UKSA to be upgraded and reformed into a more autonomous body with new authorities and spending powers, and given direct management and delivery responsibility for the NSP.
- The remit of the NSP would include all key space technology areas already mentioned in the National Space Strategy (EO, SATCOM, PNT, Launch, SDA, IOSM, ADR) plus an explicit instruction to develop end-to-end capabilities for supporting fully UK-built space science and exploration missions.
- An HMG commitment to continue funding the NSP at the end of the first budgetary period under a similar multiannual settlement at least at the same level.

The Council would also give UKSA up to six months to produce a detailed and costed **Ten-Year UK Space Technology Roadmap** which will guide its activities. It would be expected that an important share of the new NSP's resources would be devoted to a UK EO system that would continue the country's contribution to global climate research and related commercial applications – albeit at reduced scale.

The Council may or may not also choose to intervene, at this stage, in the sensitive but critical question of truly “integrating” UK's civil and military space efforts, but it should be aware of the hugely important efficiencies and cost-reductions available to the taxpayer if integration is properly taken forward.

The final form of the NSP would have to reflect **a new approach** in UK space policy where industrial interests are subordinated to national strategic interests as determined by the National Space Council, not the other way around as has historically been the case in this country.

Concerns

This maximalistic solution to UK's Copernicus dilemma would be the ideal outcome from a national interest point of view. It would send a powerful, positive signal to the world market and very likely lead to significant inward investment if it looks like Britain is finally getting its space enterprise in order.

But legitimate questions will be raised with respect to its feasibility, given that this route combines bureaucratic reform and high-stakes, multi-stakeholder planning – both, the kinds of tasks that today's British state seems effectively incapable of executing quickly. In the space domain this problem is particularly acute given the widely acknowledged space project management skills deficit within government. In other words, as things stand, HMG would simply not be able to muster the expertise necessary to run a fully-fledged NSP anytime soon.

On the other hand, as the Vaccine Task Force showed, with the right leadership, authorities and political backing even the most daunting challenges can be overcome. In the end it is a question of political will.

Sovereign EO System built at home

Under this option the UK would use the full £750m to create its own domestic version of Copernicus through a dedicated EO procurement programme (which could well include a Data component). It may be argued that the chronic issue of a lack of HMG space delivery capability could be avoided by effectively “buying” the entire system from industry with support from private-sector contractors, on the PPP model used for Skynet 5, buying into existing projects such as OneWeb as HMG did in 2020, or buying services as an “**anchor tenant**” from existing commercial providers (e.g. methane data from GHGSat) on a “**space-as-a-service**” model.

More creative solutions could also be possible, such as, for example, a co-funded government-industry initiative aimed at creating an **open-system architecture** (as opposed to the closed Skynet model) that allows other global partners (commercial and/or governmental) to join in at a later stage.

The costs could well be higher, and the capability outcomes likely not fully optimised for UK's national requirements given the need to balance commercial interests as well. However, the entire process would be quicker and easier to implement by BEIS/UKSA with not much extra hassle – in theory – compared to a full-fledged national programme. But in the end, whether even this kind of effort is within UKSA's skill-set and capacity at present, is severely in doubt.

A sovereign UK EO System would arguably be the most straightforward

and politically attractive choice: HMT's EO ringfence would not have to be challenged; the like-for-like replacement of Copernicus (difference in scale aside) is a simple, clear "sell", demonstrating that the UK can easily pivot away from Copernicus to a national solution; and all the money would be invested directly at home into the UK space industry. Additionally, a purely "national" EO project would give HMG maximum flexibility in terms of offering collaboration opportunities to other **friends and allies around the world**.

The EO ringfence

An essential political question is whether the £750m that would have been invested into Copernicus should now be reserved, entirely, for an equivalent UK programme – i.e. whether it should be ringfenced for the EO mission – or whether it should be deployed where it can to boost UK's space programme to the best overall effect.

Removing the EO ringfence will inevitably mean a reduction in UK's EO budget. But most importantly, it runs the risk of seeing the overall £750m becoming "fair game" for Treasury officials looking for resources to plug other public spending gaps.

The argument for keeping the £750m focused entirely on EO further divides on the balance between downstream and upstream investment. There is a strong case for boosting UK capabilities in the area of EO data exploitation, from cloud platforms to AI/ML and blockchain applications – given the surging demand driven by TCFD/TNFD³⁴, climate risk, supply chain risk, food security, energy costs etc.

Of course, any new national EO industrial policy should be matched with a Government strategy to maximise exploitation and applications.

As regards the upstream, or the space component, there are a variety of high quality mission concepts that would serve science, policy and/or commercial needs. Some would be similar to what exists, adding further innovation. Others would introduce cutting edge instrument technology such as reconfigurable SAR technology, spaceborne LiDARs and numerous atmospheric and oceanography missions that scientists have struggled to get funding for via ESA. Additionally, many of the innovations here are in line with the UK lead on smaller/affordable mission platforms that would align well to the UK Launch agenda.

This option leaves the UK with most control in the EO area but also most responsibility. With a long-term interest in reducing British dependence on ESA, it could be a good way to go. However, parallel investment in infrastructure and people should also be part of the plan, in order to replace skills and facilities that what we currently rely on ESA to provide.

UK-led EO via ESA

Under this option, a new UK-owned programme structured on UK terms would be included in the ESA DG's proposal to the triennial Council of Ministers, the next of which is scheduled for November this year. This is the normal way of creating new ESA programmes, and this is how it was done for TRUTHS in 2019.³⁵ In our scenario, ESA would undertake

35. More classic general examples here include the French-led Ariane and the Italian-led Vega programmes.

34. The G7-endorsed Taskforce on Nature-Related Financial Disclosures is an international initiative that will recommend new disclosures for financial services firms and corporates (organisations) that capture nature-related risks from 2023. TNFD expands on previous recommendations by the Taskforce on Climate-Related Financial Disclosures (TCFD).

programme development on behalf of the UK (who will be ultimate owner of all IP rights and infrastructure created),³⁶ with British personnel embedded in the project so as to help grow a UK capacity to deliver such a programme in the long term.

The legal basis for this option is Art 9.2 of the ESA convention³⁷ which states that ESA can provide technical assistance to an ESA member state. The most recent examples of the use of this provision include assistance given to Italy (approx. €1.3bn) and Greece (approx. €200m). Both countries are similar to the UK in not having an adequate procurement capability within their national agency able to handle projects of this size and complexity.

In Italy's recent case, an EO constellation is being developed and will be handed over to Italian operators for exploitation. The Italian agreement was negotiated within a few months in 2021 and is not necessarily linked to an ESA Ministerial Council. Approval is needed at the regular ESA Council (a 2/3 majority required and meetings take place quarterly).

ESA is often seen as the best solution to the problem of delivery. The ESA route is available now, it has a track record in assisting other member states in the same way – as mentioned, Greece and more recently Italy – and, most importantly, there are important incentives at play that work in UK's favour. In the all-important balance of power between ESA and the EU, keeping the UK inside the ESA tent – particularly if it involves a new, well funded British space programme – can have political, not just technical benefits for the Agency.

On the other hand, there is an unavoidable question of trust involved, as well. Handing Britain's £750m "golden egg" over to ESA to incubate can be seen as stretching the bounds of prudence at this point in time, considering the political context. For example TRUTHS – essentially a UK mission managed by ESA – might yet become a cautionary tale if, at the end of the day, we will discover that much of the work has gone to entities outside of the UK.

It is an unavoidable fact of life, let alone politics, that no one can be expected to look after your interests better or with more diligence than yourself. In order to mitigate these risks, there would have to be a UK capacity to supervise ESA's management of our UK-funded programme; but the lack of this kind of capacity is the reason why we are considering the ESA route in the first place!

The main issue with this option is the lack of time. A new such programme would require rapid communication with the ESA Earth Observation Director to ensure it was ready by November. UK's influence would be proportional to its subscription and the general principle of geographical return – or *juste retour* – would ensure that attention was paid to UK industrial bids. (Although, as discussed above, the returns on UK's investment in the ESA side of Copernicus have been low in recent years.)

36. Any ESA member state can subscribe to a programme established in this manner. Legal requirements providing the framework of the programme (enabling resolution, programme declaration, implementing rules) need be agreed between member states before the Council.

37. ESA Convention and Council Rules of Procedure, SP-1337/EN Pocket Edition, November 2019; available at: https://esamultimedia.esa.int/multimedia/publications/SP-1337/SP-1337_EN.pdf

Big bet on ESA

A counterintuitive but strategically-relevant option for the UK at this stage, that has to be considered, is to put in a very large subscription to ESA this November, for example taking our share of the optional programmes from 11.5% to about 19%: an **increase of £1.24bn**³⁸ (over five years) on our current £1.36bn level of spending under ESA's 2020-2024 budget. In this scenario, the additional £1.24bn would be paid with the already-available £750m of Copernicus money, meaning that the net cost of this radical ESA option to Government would be £490m over five years. For just **£98m more per year**, therefore, the UK could **completely transform** its standing within the European Space Agency, opening up radically new possibilities in UK's space relations with Europe, with important geopolitical and strategic benefits.

This would be a *game-changer* and make Britain the second-largest ESA contributor, therefore boosting our political influence in the world's second-largest space Agency. It would also mean that:

- **ESA's independence from the EU would be strengthened** as the balance of power between the two organisations would be significantly altered by UK's scaled-up input. This, however, would not happen *automatically*: it will require hands-on management and political focus from British officials.
- **Germany would very much welcome** Britain stepping up in ESA – to the extent where this could launch a new UK-German partnership on space and tech more broadly.
- **East European members of ESA would likewise back Britain's** renewed leadership in the Agency, building on the strong impact made by UK's support for Ukraine in the face of Russian aggression – as opposed to the more nuanced response of other Western EU members.
- The UK will be in a position to support a more **global orientation of ESA**, towards greater cooperation with non-European partners – including in the Indo-Pacific.

The main practical advantage of this course of action is that, compared to all three other major options described in this paper, it is both the simplest to implement and, because of ESA's georeturn rule, it almost guarantees that the UK's investment would flow back into the UK industry. Every other option – including a UK-led EO programme within ESA – involves various new management tasks for UKSA, and therefore likely translates into more delays, bureaucratic wrangling and a degree of wasted resources.

There are important risks and concerns that need to be taken into account if we do go down this route. This new UK funding package will have to be negotiated very carefully with ESA and the other member states in order to ensure that it does deliver an effect commensurate with our investment. The main issue is that we need to find ways to ensure that UK money will allow UK industry to play into the most valuable ESA

38. Assuming a that ESA's next multiannual budget will be around €16bn, as expected.

programmes. It will be up to ESA to make sure the architecture of ESA programmes is such that UK interests cannot be squeezed out. One part of the deal would have to be a **new ESA EO programme** where UK entities would play a leading part, in order to compensate for lost Copernicus work.

Considering present EU hostility, it must be recognised that reaching a good deal in ESA is a difficult mission, especially on a tight schedule before the November CMIN.

On the other hand, the major UK financial uplift would provide British negotiators with real leverage that could perhaps be combined with an effective exploitation by HMG of its “golden share” in OneWeb which is now being pursued by Eutelsat.³⁹ The broader geostrategic context also favours UK’s negotiating position in ESA, considering the increasing crossover between space technology and military affairs as evidenced in Ukraine by Elon Musk’s Starlink.

39. OneWeb could provide an avenue for a UK involvement in EU’s secure satcom programme which is a top priority for the EC and especially France. The EU Space Regulation specifies restrictions on third country companies being involved in security EU programmes. (see Regulation (EU) 2021/696 of the European Parliament and of the Council of 28 April 2021; available at:<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R0696&from=EN>). This provision is similar in fact to the standard practice in the UK MoD. It follows that the way around the EU restrictions could be similar to the arrangements that allow Airbus (a French company) to build and run UK’s highest-grade military satellite system. I.e. OneWeb could establish an EU-based operation, with an EU board, “independent” of the mother-company which is based in London, thus allowing it to pass as an “EU” enterprise. One problem with this solution is that the EU will want to own the associated spectrum, and the filings are currently owned by OneWeb as a UK-based company. However, it may be possible to transfer the filings to an EU-based subsidiary of OneWeb, perhaps the existing OneWeb Luxembourg.

| But if the UK is to “go big” on ESA, where should it deploy its increased contribution? ESA runs a wide range of programmes and projects, but a few options stand out in particular for the UK from a strategic point of view: | |
|--|---|
| Communications | Advanced Research in Telecom Systems (ARTES) is the easiest and most straightforward ESA programme to boost. But the money would go straight to UK industry – because our strong pre-existing expertise there – so it would not deliver much political leverage and influence with other countries. |
| Launch | <p>It is easy to put money in (i.e. there is demand). But the UK has always stayed out of ESA Launch because has been historically dominated by the French Ariane and Italian Vega. However, the programme is diversifying: there is now a <i>RIDER</i> spaceplane demonstrator project, for example, that would be of interest to the UK.</p> <p>Furthermore, the UK could attract other European companies such as TAS, Leonardo and others to develop and manufacture ESA-funded launch projects in the UK. This would create more high-quality manufacturing jobs in UK space industry, and Britain would get a strategic foothold in this key European area.</p> <p>This move can also benefit UK launch companies, if they can do some ESA work on launch technology relevant to their field. ESA also runs <i>Boost</i>, the small-launch programme in which the UK already participates.</p> <p>With Launch as one of the principal points of focus in the UK’s NSS, and with ESA diversifying somewhat from Ariane and Vega, there is a case for re-assessing the value to British industry from engaging with ESA in this area.</p> |
| Safety | This programme which includes in-orbit servicing and technologies related to debris monitoring and clearing. This has a security dimension, which could help advance the “cause” of dual-use in UK space policy. Additionally, the UK has been clear in its ambitions to be a global leader in space sustainability. |
| EO | Copernicus aside, there are several ESA EO programmes already in the works for bringing to the November meeting (FutureEO, InCubed, etc). These could be a vehicle for UK but the programme would not be framed around UK needs specifically. However, money talks and UK’s influence (and industrial benefit) would be proportional to the scale of its subscription. |

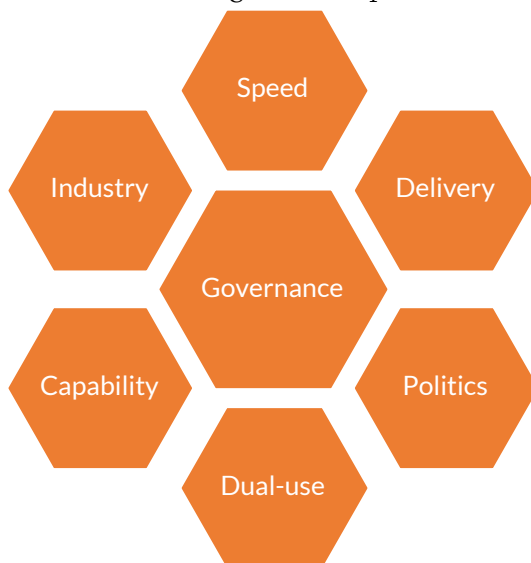
Chapter 3 - The way forward

A framework for decision

With a number of different space development pathways open to it at this pivotal time, HMG needs some kind of framework and criteria to guide its decision – especially if this is to be a mix of the best elements available. There are advantages and disadvantages to all the policy options on the table, and without a balanced and fair assessment of the issues involved any final call is more likely to reflect narrow institutional or factional preferences rather than the national space interest.

A decision matrix for UK's post-Copernicus future should be guided by six key questions, all underpinned, in the background, by the common imperative of improving UK space governance:

1. **Speed.** How quickly and easily can the chosen policy option be implemented in reality?
2. **Delivery.** How will the chosen policy option will improve HMG's space project management capacity?
3. **Politics.** How politically attractive and realistic is the chosen policy option, domestically and internationally?
4. **Dual-use.** How will the chosen policy option advance UK's vital need for civil-military space integration?
5. **Capability.** How will the chosen policy option benefit UK's long-term space capability and space power?
6. **Industry.** How will the chosen policy option strengthen UK's space industrial base and global competitiveness?



Speed of implementation

The number one problem with UK space today is that we are falling behind our peers, and UK space governance – and mindset – is not set up for speed. It is not that HMG is getting worse at “doing” space, or slowing down; on the contrary. The system is actually improving: UKSA/BEIS and MoD have gripped the policy issue in an unprecedented way over the past few years, there are new plans, strategies, structures, and even some new funding.

But the issue is that these improvements are taking *too long*, meaningful progress comes too slowly and in the meantime the global competition is accelerating. Other countries are investing even more in their space industries and national programmes, and *executing* their strategies at a faster pace. The latest example is Italy, which this year has decided to invest an extra €1.3bn in space (via ESA) on top of its existing space budget.⁴⁰

While the global space market is booming quickly, the growth rate of UK’s global share has been stagnating or even declining recently. Even though the UK space industry continues to grow (£16.5bn for 2021, an insignificant improvement from £16.4bn previously⁴¹), its share of the global space economy is *falling* (4.2% now⁴², down from 5.1% in 2020⁴³, which in turn was down from 6.5% in 2018/19). In other words, we are not keeping up with global space market expansion.

Against this background of intense international activity and surging space investments, UK’s performance is a cause for concern. Nothing illustrates the problem better than the (comparatively small) Spaceflight Programme, which has not only been UK’s national flagship programme since 2018,⁴⁴ but has been the outgoing Prime Minister’s chief priority on the space agenda. It has taken years to get the regulations right, get industry players aligned, and advance a number of spaceport projects in the face of complex bureaucratic challenges. All the while, the date for the much-vaunted “first launch from UK soil” has been delayed over and over again.

As regards the policy-making process, it is a great achievement that the UK now has both a National Space Strategy and a Defence Space Strategy published in 2021 and 2022 respectively – but again, they took several years to develop, with the DSS first announced back in 2018. The all-important Space Industrial Policy, which has been in the works since early 2022 and is supposed to be the key “implementation” document for the NSS, is not expected to arrive in its final version before early 2023.

The UK has a great opportunity now to use the Copernicus money to boost its space enterprise. But the *speed* with which this is done will make the difference between success and failure – and is therefore a strategic element in this decision. The record shows that, faced with the responsibility of running even minuscule space initiatives directly – such as the Spaceflight Programme, worth around £10m/year – the existing machinery is very slow. Asking UKSA/BEIS, at this point, to plan a new £750m programme will likely only result in a very long delay before anything actually gets agreed and any clear directions and commitments

40. European Space Agency, *Investing recovery and resilience funds in space projects*, 17 December 2021; available at: https://www.esa.int/About_Us/Corporate_news/Investing_recovery_and_resilience_funds_in_space_projects

41. See UK Space Agency, *Size & Health of the UK Space Industry 2021*, 12 April 2022; available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1068861/20220412_BryceTech_UKSA_S_H_Summary_Report.pdf

42. Of a total global space economy of \$469bn in 2021 according to the Space Foundation; see Space Foundation, *Space Foundation releases the Space report 2022 Q2 showing growth of global space economy*, 27 July 2022; available at: <https://www.spacefoundation.org/2022/07/27/the-space-report-2022-q2/>

43. UK Space Agency, *Size & Health of the UK Space Industry 2020*, 5 May 2020; available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/987498/know.space-Size_Health2020-Infographic-FINAL_May21.pdf

44. UK Launch started under then Science Minister Jo Johnson, with initial funding provided in 2017. UK Government, *Government announces boost for UK commercial space sector*, 9 February 2017; available at: <https://www.gov.uk/government/news/government-announces-boost-for-uk-commercial-space-sector>

are presented to industry.

It is therefore imperative that the option chosen by decision-makers takes account of these realities and optimises for speed of implementation, even at the expense of value-for-money. Speed is of the essence.

Delivery capacity

The policy option chosen by HMG to deal with the Copernicus situation cuts across the perennial question of “Delivery” in two different ways:

- Delivery capacity as a limiting factor in the Government’s decision-making.
- The opportunity to build up UK technical space delivery capacity on the back of whichever mix of programmes or policy solution that results from this decision-making process.

The success of any new, scaled-up British space programme – whether focused on EO or a wider range of capabilities – will depend entirely on the delivery arrangements,⁴⁵ i.e. specialist government capacity to manage significant space acquisition pipelines.

The importance of delivery cannot be understated; it is currently the principal chokepoint on UK’s space development because it pre-judges what is deemed to be “possible” and “realistic” in terms of national space ambitions.

This problem is central to the decision-making over UK’s post-Copernicus future. HM Treasury as well as a great many members of the space community are not convinced that UKSA could deliver a proper National Space Programme established with the help of the £750m, or even a smaller version of this. The Agency has never done so – operating instead as largely a grant-making organisation – and its flagship Spaceflight programme, likewise run mainly through grants, has been beset by problems and delays. UKSA’s only other major effort in recent years that *could* have incentivised the creation of a delivery function, the GNSS Programme, was progressively “reset” and downgraded until it was effectively closed down with no practical capability outputs delivered.

There is no getting away from the fact that Government space procurement expertise – vital for UK’s future space development – can only be built around major UK space programmes. A wider debate is required here as to the exact way this expertise should be built and integrated across government – the creation of a dedicated space career stream within the Civil Service should be part of it. But the main point is that the post-Copernicus policy options facing HMG should be assessed with an eye to this critical requirement.

ESA technical support may be an option in the short term, but it should only be used as a stepping stone towards a proper UK space project management capability within HMG. Ultimately, for a sovereign Global Britain looking to confirm its status as a pillar of world order and as a key G7, NATO, Five Eyes and UNSC member, the ability to independently

45. Policy Exchange has repeatedly called for this since 2019. See Gabriel Elefteriu, *What do we want from the next Prime Minister? Policy ideas for new leadership: Space*, Policy Exchange, 16 July 2019; available at: <https://policyexchange.org.uk/publication/space-what-do-we-want-from-the-next-prime-minister/>; or *The First Hundred Days: How the Government can implement the pledges in its 2019 election manifesto*, Policy Exchange, 15 December 2019; available at: <https://policyexchange.org.uk/wp-content/uploads/2019/12/The-First-Hundred-Days.pdf>

run its own national space programme is certainly the only mature and responsible solution that must be made to work one way or another.

In its 2020 CSR proposal,⁴⁶ the UKSpace trade association outlined the “Functions of a UK Space Delivery Capability reporting to the NSpC”. The list is still broadly relevant and bears repeating:

- Establish a National Space Programme covering both military and civil requirements ensuring best leverage of tax payers’ monies and of academic spin-off;
- Manage both the National Space Innovation Fund and the National Space Procurement Fund;
- Ensure review of export policies to ensure such policies are fit for purpose as the UK develops new international trade agreements where Space will feature significantly;
- Create a nationally accessible, technical body of space knowledge and expertise equipped to guide Government decision making in the procurement of space products and services;
- Ensure full transparency through effective project management of a portfolio of projects defined by the National Space Programme;
- Ensure the UK has the technology and capabilities needed to anchor high-value work and downstream services as a result of a large shift in the execution of R&D invested by industry and government into required space systems;
- Advise government and industry on capability requirements and developments ensuring the UK space offering is as holistic and rounded as possible;
- Work directly with UKSA and ESA to ensure UK ESA investments are “returned” effectively to UK companies and universities;
- Provide better alignment of space requirements across government departments;
- Work with the UKSA and the Department for International Trade in the development of international partnerships and strategic space missions

Politics of space, at home and abroad

Such a pivotal moment in UK’s space fortunes must take full account of the “art of the possible” when it comes to the domestic political situation and how the next Downing Street administration will approach its overall policy agenda.

Three aspects should be considered here. The first is the immediate **future of UK-EU relations** – in particular flowing from the next Prime Minister’s approach to the Northern Ireland issue. This can range in theory from the more conciliatory to the more confrontational, with a major crisis distinctly possible.

With respect to the former, a carefully balanced UK policy with respect to ESA can be presented as part of “rebuilding bridges” with Europe in a safe and predictable manner. But if the crisis scenario obtains, there will be extra political pressure for more of a “national” UK solution to the post-Copernicus dilemma.

Since much of the work on UK’s post-Copernicus options is likely to take place *before* these UK-EU political matters are settled,⁴⁷ it would be wise to **build as much flexibility into the final decision as possible.**

47. The all-important ESA Council of Ministers meeting takes place in November.

46. UKSpace, *Creating a Modern Space Power: A plan for action to double Britain’s Space Sector by 2030*, September 2020.

Whatever policy course is adopted, it should not foreclose either the ESA or the UK-national route; a mix of both would reduce the political risk to the resulting programme.

At the same time, at CMIN22 in November, UK decision-makers will need to be careful about proposed ESA programmes that are designed to be taken over by the EU at a later stage. The risk is that – as on previous occasions – British money will fund R&D for programmes that serve EU's interests and that our industry cannot access. But there is enough realism at ESA HQ as regards Britain's constraints, and there is likely to be a willingness to find acceptable solutions to UK concerns. This could well include, for example, new ESA programmes designed for non-EU members like Switzerland, Canada or the UK, which would be of particular interest to British decision-makers. (What might require more clarification for ESA's benefit, however, is UK's specific interest in **secure commercial systems** development rather than government/defence security technology.)

Furthermore, on the European question, there must be a clearer realisation within UK Government that Britain has a direct strategic interest in the future of EU-ESA relations. It is unquestionably in Britain's interest that ESA retains its independence as a non-EU organisation and avoids being subsumed, in the long run, to Brussels' control. Apart from the inherent value to its members including the UK, a **strong ESA would continue to act as a brake on France's hegemonic space ambitions** and would help prevent the consolidation of EU into a much more powerful space rival to Britain. The political division that the Ukraine war has generated across the continent, coupled with the surge in UK's political prestige especially in the Eastern half of Europe, presents an opportunity to transfer some of that political realignment into new political alliances within ESA, helping to boost UK's position within the Agency and enable the UK to continue playing a role in European space – on equitable terms.

Beyond the European question, the space politics around Britain's post-Copernicus future will also encompass our **space relations with the US** as well as the wider, Global Britain angle. It is in Britain's long-term interest to diversify its space industrial base away from Europe and, in the first instance, towards the US as the first and most natural partner. This approach, which would build in particular on the existing close military **space dimension of the Special Relationship**, would also match the geopolitics of our times, especially in the context of close UK-US cooperation on Ukraine and of the threat posed by China.

But this political intention must be built into the very structure – the policy DNA – of Britain's preferred space option after Copernicus. This will require provisions to be made, in the policy mix, for procurement pathways that are open and attractive to major American companies, not just European ones, and that can result in more UK-US industrial as well as scientific space cooperation.

Apart from the US, the UK needs to think about its **long-term global posture as a space actor**, and ensure that the development of UK space

power supports a wider international agenda and alliances. UKSA is already increasing funding for bilateral space projects with allies like Australia or Japan – but is this enough? The real opportunity, after Copernicus, is to set up a new programme in such a way that it can attract not just private investment but even sovereign government involvement from such close Indo-Pacific allies.⁴⁸

Dual use and civil-military integration

As explained in Policy Exchange’s analysis of the 2021 UK Defence Space Strategy (DSS)⁴⁹, the question of civil-military space integration is central to this country’s space fortunes. And a major part of that question is the policy approach to **dual-use technologies**.

As mandated by the DSS, the MoD’s main space capability spending line, worth about £1bn over the next ten years, is in the ISR area through Project ISTARI. This will certainly include the deployment of SAR technology but also other EO domains such as thermal, hyperspectral and video from orbit (already tested via the Carbonite satellite). The MoD has already ordered a new satellite from SSTL for the Minerva precursor programme of ISTARI.⁵⁰

Most of these technologies and novel imaging techniques would have significant dual-use potential, and would therefore provide ample opportunities for smarter project design, jointly, by the MoD and the civil side of UK space. The challenges would be around mission design and upstream access arrangements.

As well as space segment, dual-use issues extend to data management and service delivery. Should one entity be responsible for all national mission data management? It might not be effective or needed.

It is worth noting that ESA can also provide at least an interim platform for progressing UK’s dual-use aspirations. The Agency already has considerable experience in hosting or supporting dual-use military-civil projects for or involving its member states such as Galileo PRS. There is no reason why the MoD’s ISTARI could not be linked with a UK civil EO project through or with ESA assistance, and offered as a complementary capability to Copernicus.

But simply adopting more dual-use technology into UK space capabilities does not constitute, by itself, a pathway to true integration between British civil and military space domains. Such integration requires top-level political direction seconded by practical policies designed to achieve that institutional effect. The civil/defence National Space Operations Centre is already a step in that direction. But the real integration will happen on the Delivery front.

In this sense, the key building block of UK’s integrated space future would be a new **Systems and Services Acquisition & Procurement capability** that would address all government space needs on both levels – system acquisition and service procurement – within a single **joint civil-defence organisation**, with appropriate internal protocols and protections in place for sensitive national security space projects. Delivering this mission from a central point, especially in connection with developing

48. In 2020, Policy Exchange proposed the development of a UK-led, ESA-type Space Technology Alliance with Commonwealth, Five Eyes and other close allies in the Indo-Pacific. See *A Very British Tilt: Towards a New UK Strategy in the Indo-Pacific Region*, 22 November 2020; available at: <https://policyexchange.org.uk/publication/a-very-british-tilt/>

49. Ministry of Defence, *Defence Space Strategy: Operationalising the Space Domain*, 1 February 2022; available at: <https://www.gov.uk/government/publications/defence-space-strategy-operationalising-the-space-domain>

50. Ministry of Defence, *First £22 million MIN-ERVA satellite supports 100 UK jobs*, 4 April 2022; available at: <https://www.gov.uk/government/news/first-22-million-minerva-satellite-supports-100-uk-jobs>

large space infrastructure projects such as a civil-military UK EO/ISR system, would also lead to new synergies and reduced costs.

This joint model would represent a key step towards overcoming the deep separation currently prevailing in government between the civil and defence areas of space policy. The long-term integrated vision and institutional base that Britain needs in order to flourish into a leading space power cannot be achieved unless silos are broken down (without prejudice to essential national security interests) and a more integrated civil-defence space partnership becomes the foundation for a restructured UK space enterprise.

Space power in the 21st century

As the application of space technology in the **Ukraine** conflict by Elon Musk's Starlink and other Earth Observation systems has already shown, much more is at stake when it comes to the space domain than simply "prosperity" or even incremental additions to national security. No prudent long-term vision for UK grand strategy over the coming decades can ignore the role of space power in global affairs and its relation to the national interest.

It is essential to understand that a true *Revolution in Space Affairs* is now underway. This is bringing qualitative changes to the military-economic space environment.⁵¹ These changes are opening a truly new chapter in this domain. This transformation is driven by new technologies enabling cheap launch and ultra-small, ultra-capable satellites that in a few short years have unlocked the field for a wide range of commercial actors.

Impact on geopolitical affairs

The dependency of advanced economies and armed forces on space-enabled services and capabilities is well established; and it will only grow with time. There is also an emergence of "space blocs" (the US-led West vs Russia and China), each with their own missions including to the Moon, and with competing supply chains as well as diverging regulatory/standards perspectives. In addition, something qualitatively new is happening. Space capability is no longer only vertically integrated along national lines. Powered by this new generation of commercial space enterprises, it is set to become thoroughly enmeshed with the global economy and security considerations in a similar manner to the Internet and digital technology. A self-reinforcing evolutionary feedback loop has emerged between human activity on earth and in space: they drive each other both in terms of economic value and in terms of mutual dependency. Whereas space has hitherto been an enabler and *adjunct* to the institutions and functioning of societies, it is now morphing into a core infrastructure and a centre of gravity in its own right. This is a strategic convergence with far-reaching consequences. While its pace, sequencing and impact across the world remains a matter of debate, the point is that this process is now in motion and will roll on over the next decades and beyond.

An instrument of national power

One important conclusion follows from all of the above: space power will become, within our lifetime, as significant in shaping human affairs as classic geopolitical power. Conceiving of national strategy purely on a geopolitical basis (in the traditional manner) will become an incomplete and erroneous approach as space and "terran" affairs proceed to merge into a single strategic continuum.

In this context, the early adoption of a national "**space-power mindset**" (and the means to bring it into effect) is a prudent response to the disruptive challenges of the coming decades – and indeed this is what all other major nations are doing.

Views on the future course of space affairs are hardening on all sides, as evidenced by the creation of the US Space Force and numerous Space Commands across the world in recent years. This is a key trend. We have seen not only a change in political rhetoric around this subject, but actual policy and doctrine documents coming out in recent years (from various countries) that, for example, define space as a warfighting domain, talk about space control, talk about the strategic imperative of the high ground.

51. On a conceptual level, a narrower equivalent notion is the Revolution in Military Affairs which marked the advent of precision warfare. The Pentagon's views on what later became known as the RMA were shaped by a seminal study undertaken by the Office of Net Assessment: Andrew F Krepinevich, *The Military-Technical Revolution: A Preliminary Assessment*, July 1992; available at: <https://csbaonline.org/research/publications/the-military-technical-revolution-a-preliminary-assessment>

This is coming not just from the US, but France, Britain and NATO.⁵² All of this is a result of geopolitical tensions which are driving new strategic concepts as states seek to work out how to deploy their power to best effect – including space power.

The impact of space power in the military field will outstrip anything we have experienced so far. The present paper is not the place to examine this matter in any depth. But it is worth noting the actions of countries like France, India or the US over the past three years or so: large increases in military space budgets, creation of dedicated military space organisations, new space doctrines. All this speaks to an increasing recognition that future wars could be won or lost in space – a new departure in strategic affairs.

53. Policy Exchange, *Britain's industry-led space policy "model" has been a resounding success. But can it survive the fierce competition of the new space race?*, 30 May 2018; available at: <https://policyexchange.org.uk/britains-industry-led-space-policy-model-has-been-a-resounding-success-but-can-it-survive-the-fierce-competition-of-the-new-space-race/>

52. This strategic "gear-shift" in space affairs took place in 2017-2018. Testifying to the US Senate Armed Services Committee in May 2017, then Secretary of the US Air Force Heather Wilson affirmed that "space is now a warfighting domain" and that "the DoD must begin shifting its organizational and training structures to normalize warfighting concepts for the space domain". This formal doctrinal shift was subsequently adopted in the *US National Defence Strategy 2018*. Department of the Air Force, *Presentation to the subcommittee on strategic forces to the United States Senates*, 17 May 2017; available at: https://www.armed-services.senate.gov/imo/media/doc/Wilson-Goldfein-Raymond-Greaves_05-17-17.pdf; and Department of Defence, *Summary of the 2018 National Defence Strategy of the United States of America*, 17 January 2018; available at: <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>

Similarly, the latest UK Air and Space Power doctrine JDP 0-30, published in December 2017 noted that "the space domain should ... be considered as routinely as the other operating domains, and must be included in military planning processes"; and in May 2018 then Defence Secretary, Gavin Williamson, said that "We must make sure we are primed and ready to deter and counter the intensifying threats to our everyday life that are emerging in space." Ministry of Defence, *Joint Doctrine Publication 0-30 UK Air and Space Power*, 13 December 2017; available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/668710/doctrine_uk_air_space_power_jdp_0_30.pdf; and Royal Air Force, *UK Defence Space Conference*, 23 May 2018; available at: <https://www.raf.mod.uk/news/articles/uk-defence-space-conference/>

In France, it was on the eve of Bastille Day in July 2019 that President Macron declared that space had become "a key question of national security". He also announced a new military space doctrine geared towards space defence, and the formation of a dedicated French Space Command. French President, *Discours aux armées à l'Hôtel de Brienne*, 13 July 2019; available at: <https://www.elysee.fr/emmanuel-macron/2019/07/13/discours-aux-armees-a-lhotel-de-brienne>

Capability and space power development

HMG is not used to having a serious space capability conversation because historically the only sovereign UK Government space system has been Skynet. This is a major reason why UK space policy debates, especially when it comes to ESA, are in effect industrial or science policy discussions about rates of return, value for money, or scientific achievement. These conversations have rarely been about actual hard national capabilities that can support UK space power – whether in a civil-scientific, economic or indeed military sense.

The purpose of UK space spending has effectively been seen mainly as a way to keep space scientists funded and a cottage industry of small space companies going – or indeed growing – as an end in itself. That has certainly resulted in a thriving and exciting UK space sector with some world-class strengths in particular areas. What it has not done has been to position Britain as a front-ranking space nation in terms of the strength of its own operational capabilities, space companies or indeed major space missions. We have also not recognised that having sovereign, national operational capability will enable us to deliver on a much broader range of foreign policy objectives.

As argued elsewhere,⁵³ this approach is showing its limits in an increasingly competitive global environment where the "space race" is really being contested by major primes and well-funded national space programmes or rival states. A new model is needed now, one where HMG looks at its space activities as a means to an end, striving to go beyond UK's historic role as a technology provider to others and to become a space power in its own right. The policy options chosen by Government at this Copernicus inflexion point should reflect and give ample room to accommodate this kind of a new, more ambitious turn in UK's approach to space.

A comprehensive and specific UK space capability plan should be framed with a long-term *strategic intent* in mind, so as to assure British technological and scientific competitiveness over the coming decades. Certainly not all technology research and scientific endeavour is dependent upon space, but a great deal of it is. Everything from excellence in geophysics and environmental science through to advances in Artificial Intelligence and 3D printing crosscuts with a robust space industrial base and assured access to space.

Both the NSS and the DSS have outlined, to different degrees of detail, the areas of capability that the UK is looking to pursue over the next decade:

| NSS | Civil programme | Defence programme |
|---|----------------------------------|----------------------------------|
| Satellite Communications | ARTES (via ESA) | Skynet 6 |
| Earth Observation and ISR | Copernicus | ISTARI |
| Command-and-Control and Space Capability Management | National Space Operations Centre | National Space Operations Centre |
| Space Control | - | Space Control |
| PNT | n/a | n/a |
| Spaceflight | Spaceflight Programme | - |
| IOSM | Debris removal | - |
| SDA | Various | Various |

This generalist list covers all major categories of space capabilities and activity, with the notable exception of human spaceflight and with a question mark over PNT given that the SBPP⁵⁴ has been terminated. It remains vague and does not offer any kind of detailed commitments to particular capability requirements or development timeframes. The all-important procurement decisions and approaches will be guided by the **Own-Collaborate-Access** framework first laid out in the 2021 Integrated Review. As Policy Exchange’s analysis has shown, the way this will be used – particularly by the MoD – can make or break UK’s space-industrial future.⁵⁵

If the UK’s “Copernican moment” is to be truly transformational to UK space power, then the final policy decision will have to explicitly authorize and enable the development of concrete UK space capabilities that support UK industrial, science, defence and foreign policy – as opposed to allocating further significant resources to more grant programmes, vanity science projects, unproven start-ups, or indiscriminate “growth initiatives” and “space hubs” up and down the country.

Turning Britain into a space nation and a serious partner to big international space players requires a concentration of effort and major hard capability programmes that can generate jobs, skills and FDI on a large scale.

Industry and investment

Britain has one of the lowest rates of public investment in space in the OECD. HMG’s space policy model partly compensates for this by leveraging UK’s world-class S&T base and wider commercial and entrepreneurial strengths. This allows the UK to have a much stronger and competitive space sector than what other countries could expect to achieve with similar public levels of investment.

Nonetheless, there is only so much that smarter policies can achieve with limited resources. Especially in the context of an increasingly-sharp global competition, government spending matters greatly. The British

54. Space Based PNT Programme, the successor to the UK GNSS Programme.

55. See Gabriel Elefteriu, *UK’s Defence Space Strategy in Context: An Analysis*, Policy Exchange, 10 February 2022, page 10; available at: <https://policyexchange.org.uk/publication/uks-defence-space-strategy-in-context/>

space industry is already falling behind: our growth rate has slowed in recent years as other nations have started to put much more money into their space programmes.

The government must therefore be clear about the unavoidable need to invest more in the UK space sector if we are to stay in the race – let alone get ahead. The industry has already lost an important source of funding as a result of Britain leaving Galileo. UK's annual spend on Galileo (which was done through our overall EU contribution, separately from ESA or UKSA) used to flow back into the UK industry, but after Brexit it simply ceased – depriving the sector of some £200m/year in contracts.

It is vital, therefore, that at this point the UK Government does not just retain the planned Copernicus spend for the UK industry, but indeed looks to upscale public investment into space in a significant way.

The key to success, however, is using that funding – and public procurement of space capabilities – in order to attract more private investment, including from abroad. This absolutely requires HMG to put together a convincing proposition for why the UK is the best place for an international space company to set up and do business.

What role for Government?

- **Government as prime.** The original model where national space agencies would project-manage and do most or all of the R&D work in-house via specialised space centres.
- **Government as an owner/operator.** Essentially the traditional public-private partnership model, where a private sector consortium gets the contract to develop and procure a space system/capability on behalf of the government which then owns and operates it. Example: Skynet 5.
- **Government as anchor tenant.** Under this model the government sets out a funded programme to meet a certain service requirement. Companies win initial public contracts towards building that capability, which they leverage to raise further R&D funds from private investors. When the new space system/technology is ready, the government contracts its services from the commercial industry to meet its needs - having avoided the majority of the R&D costs. Example: NASA's commercial cargo and crew service.
- **Government as a customer.** In this scenario government buys off-the-shelf space services from the commercial market.

We already have a compelling package to offer, business-wise: from the regulatory and legal environment, to our insurance and investment sectors, a thriving start-up scene, a world class science base and so on. But there are important shortcomings that need to be addressed from a competitiveness point of view:

- A space industry that is dominated, objectively speaking, by one major company;
- No major space procurement programmes outside MoD's Skynet;
- A majority of UK civil space spending that goes straight to ESA but returns mostly to only one part of the UK industry;
- A Government that does not play an anchor-tenant role, nor acts as a major customer for services from UK space providers.

The policy solution chosen by HMG at this moment must look to redress these problems to the maximum extent possible. In particular, it must promote **greater diversity** in the UK space sector, also with an eye on UK's changing global posture and the critical importance of the Five Eyes alliance in a fraught geopolitical environment.

Governance, policy control and institutional reform

It is vital to grasp the critical link between UK's space governance arrangements and the actual performance and ambition of UK space policy. The picture is not encouraging: the entire system acts as a drag on Britain's space development. Similarly to the problem of Delivery, the top-level question of governance has two distinct implications for how HMG should think through its post-Copernicus options:

- How would the chosen policy solution map on to a dysfunctional governance landscape: to what extent **can the current system accommodate it** with minimal bureaucratic complications, from a realistic perspective?
- What kind of institutional reforms would be needed in order to exercise **proper direction over a transformative new policy mix** (to include new programmes, as expected) and make it a success? How would the HMG's chosen policy solution drive changes in governance?

UK operates a severely inadequate space governance model that needs to be re-thought from first principles. It is not easy to make this case after several years of multiple changes and “reforms”, most recently with the creation of the BEIS and MoD Space Directorates, of the UK Space Command, and the hiving off of policy and regulatory functions away from UKSA – which was already a lowly 2* organisation with hardly any spending powers.⁵⁶ Nor are these arrangements stable: it is expected, for example, that the MoD Space Directorate will soon fold with some of its functions transferred to Space Command and, one expects, with an impact on the Space Board as well.

UK Space Governance arrangements

At present, UK space policy-making is dispersed and deeply inefficient, with several centres of decision and activity spread across government – reflecting the haphazard evolution of this area of policy over time. This landscape includes the UK Space Agency and its parent department, BEIS, with its space directorate; the MoD with its current space directorate trying to reconcile sometimes differing views on space by Air Command, Strategic Command and other elements in Main Building; the FCDO and DIT, each driven by certain wider strategic priorities which may not always fit with UK's space interests; the DfT, which sponsored the Space Industry Bill 2018 and has now taken over spaceflight regulation via the CAA; DCMS through its digital connectivity mandate; DEFRA, which leads on Earth Observation requirements; and finally, at the centre of government, the Cabinet Office which now supports the National Space Council and tends to act as a cross-departmental joint task force convener on certain space issues, such as the erstwhile PNT Strategy. In addition, the wider UK space ecosystem includes arms-length bodies such as the Satellite Applications Catapult (with a growing network of regional space hubs), the Geospatial Commission, UKRI-linked research institutions, the MOD's Dstl, as well as local enterprise partnerships and devolved administrations – with the Scottish Government, in particular, conducting its own form of industrial space policy.

UK's tangled web of institutional responsibilities for space is not only complex and confused in its own right – thereby making it all but impossible to achieve clarity, coherence and consensus on UK space priorities – but it also gives rise to bureaucratic conflicts which undermine the policy-making process.⁵⁷

56. Compare UKSA's situation with the German case where DLR's Space Administration also operates as a procurement agency, with the power to award contracts and grants for space projects under the National Space Programme (it also delivers projects for the German Ministry of Defence).

57. A case in point is that of the UK GNSS Programme which was the object of multiple “briefing wars” since it was formed in 2018, which eventually ended up shutting it down.

As Policy Exchange has argued since 2019, the key task for HMG in this area is to consolidate national space policy decision-making across government departments and **bring it closer to the centre of government**. One of the most urgent requirements for a new government intent on opening a new era for the UK in the space domain is, therefore, the comprehensive overhaul of the top-level decision-making structures for UK space policy.

All leading space nations have powerful structures driving their space policy; while different national constitutions dictate different organisational arrangements, the net effect in each case is that national space policy is concentrated largely in one place and has top-level political backing. France and Germany have powerful national space agencies with cross-government representation on their boards; the United States has a cross-government National Space Council chaired by the Vice President; while the locus of Japanese space policy is directly in the Prime Minister's Office.

Reforming the institutional framework underlying UK space policy is therefore not a trivial pursuit, but the **essential prerequisite for long-term success**. The National Space Council is one step towards greater rationalisation of space governance arrangements; it must be followed by a complete overhaul of the UKSA and its urgent move out of BEIS, to be placed under a dedicated Space Minister sitting in the Cabinet Office.

The UK should build a powerful National Space Council machinery – a **permanent Space Secretariat** – to serve as the central “brain” and authority for all UK space activities and policy. The head of this secretariat should also function as the **National Space Adviser** to the Prime Minister and provide the focal point for cross-government coordination, spanning both the civil and defence areas, as well as for industry engagement.⁵⁸ In the long term the Government should consider establishing a dedicated Space Ministry – which would have precedent in the Air Ministry formed at the end of the First World War – or transforming UKSA into a “super-agency”, with similar powers to the Submarine Delivery Agency for example.

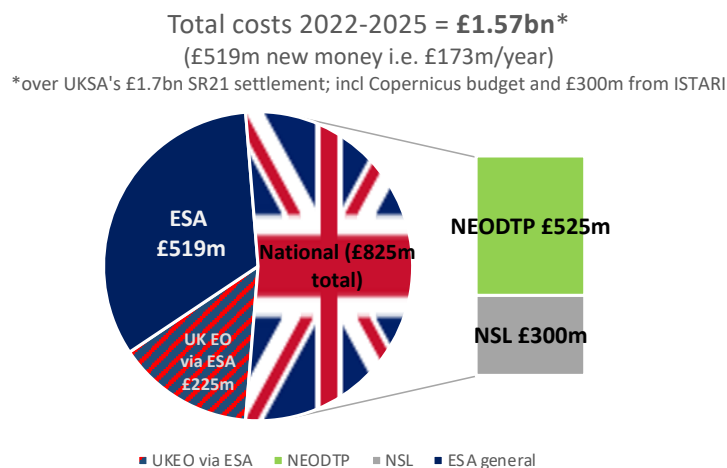
The optimal solution: a “Plan B” policy package

As the Government considers its various options for a post-Copernicus “Plan B”, it must keep the wider picture in view. It is easy to focus entirely on the short-term and the most immediately-practical. But the combination of the freed-up Copernicus funds and the ESA Ministerial in November represents an unmissable opportunity for HMG to act strategically and put the UK on a path to space power – with appropriate safeguards in place as regards ESA collaboration.

On the available evidence, and applying the decisional framework described above, the best way forward for UK space at this point in time is to **use our position in ESA to maximum effect**, and to **mix** elements from all main pathways explored in the previous Chapter of this report. Essentially this means a four-pillar solution or policy package:

58. See *The First Hundred Days: How the Government can implement the pledges in its 2019 election manifesto*, Policy Exchange, 15 December 2019; available at: <https://policyexchange.org.uk/wp-content/uploads/2019/12/The-First-Hundred-Days.pdf>

- I. A new short-term **UK-led EO** programme initially set up within ESA, what could transfer directly under UKSA control by 2024. In the meantime, this programme would also help build up project management and delivery capacity in the UK.
- II. A national **EO R&D** programme (NEODTP – National EO Data & Tech Programme) to run in parallel with the ESA one and absorb it in due course. This would be the basis for the much-discussed National Space Programme. It would also allow a novel, market-driven UK approach to EO downstream services.
- III. A consolidated **National Space Lab**, concentrating Britain’s civil space science capacity in one place and under one authority, providing the high-tech R&D component to the National Space Programme – a first step towards a future equivalent of France’s Toulouse Space Centre or NASA’s own national space labs.
- IV. A conditional strategic upgrade of UK’s investment in **ESA**.



This combination of choices presents a number of advantages that meet most “tests” laid out in the decision framework outlined above:

- ☑ Significant resources deployed quickly and effectively via existing ESA and functional UK channels, helping to support industry in the transition period from Copernicus.
- ☑ Build-up of UK space programme management capacity embedded in the plan and executed gradually in a sustainable manner in partnership with industry.
- ☑ Decisive push for dual-use and civil-military integration.
- ☑ Phased, sustainable development of a National Space Programme.
- ☑ A British Space R&D centre for the first time, to boost UK-flagged space exploration, build critical skills, and inspire the nation.
- ☑ Driving reform of UK space governance with benefits for taxpayers and UK space power.
- ☑ UK as an anchor tenant for a new range of space services, boosting UK space industry.

- ☑ Strong signal to allies and investors, leading to more FDI and a more diverse, powerful UK space sector.
- ☑ Major new opportunities for international collaboration with close allies and partners, supporting Global Britain policy.
- ☑ Acquiring sovereign space capabilities required to compete in the global space race.
- ☑ Boost for UK influence in ESA with political-strategic benefits for UK interests.
- ☑ Low cost: only an extra £173m/year to 2025 over existing/projected commitments.

1st pillar: UK EO within ESA

Summary: Create a new three-year UK-led EO programme within ESA, using up to 30% (£225m) of the funds previously earmarked by HMT for Copernicus, as a temporary R&D and capacity-building **“bridge” solution** to Britain’s immediate need as we exit Copernicus. This programme, which would be transferred over to UKSA (and joined with NEODTP, below) by 2025, should be complementary to Copernicus and it should be structured so as to allow collaboration, via ESA, with non-European space partners particularly from the Indo-Pacific Region.

Total cost: £225m over three years.

How would it work: The model is outlined in full in the previous Chapter of this report (“UK’s choices”). Under ESA management, this programme would allow the UK to grow our Large System Integrator capability. We can use ESA to develop UK operational capability – starting with EO – so that in the future the UK has genuine optionality: sometimes working with ESA, sometimes going it alone or with new strategic partners outside of Europe. Particularly when joined with the NEODTP (below) from 2024/25, this programme would ensure Britain can remain a player in provision of the class of spacecraft that form the basis of global Earth Observation space systems dedicated to weather and climate change like Copernicus.

Scored against the decision framework:

| | |
|-----------------------|--|
| Speed | Allows immediate action. |
| Delivery | Delivered by ESA. Helps grow initial UK project management skills if properly negotiated. |
| Politics | Supports Pillar 4 (ESA increase) and “fightback” strategy vs. Europe. |
| Dual-use, integration | Could provide for MoD involvement. |
| Capability | Credible new UK capability programme. |
| Industry, investment | Cushions “hard landing” for UK EO sector after Copernicus exit. The money invested comes back into the UK space industry on <i>juste retour</i> rules. |
| Governance | Need to coordinate with NEODTP creates requirement for stronger role for a more independent UKSA. |

2nd pillar: NEODTP (National EO Data & Tech Programme)

Summary: Create a new dual-use civil-military National EO Data & Technology Programme (NEODTP) at home, jointly under the **UK Space Agency and Dstl**, funded partly with up to 30% (£225m) of UK’s Copernicus money and partly with resources (equivalent to 40% of Copernicus, i.e. £300m) from the MoD’s ISTARI space-based ISR programme. NEODTP would be a stepping stone towards Britain’s future dual-use EO constellation, which would support climate research, commercial EO services, military ISR, and wider security / law enforcement GEOINT missions (e.g. monitoring Channel crossings and supporting action against human traffickers) as well as better public services.

Total cost: £525m over three years.

How would it work: In the first two years this programme would act as an industrial support programme to UK’s EO industry, with an initial focus on Data and other EO technology R&D activities already underway in various parts of the industry or within easy reach. It could be split down into **space component** and **services** lines similarly to Copernicus – but with the key difference that on downstream services NEODTP would take a different, **market-driven approach** guided by user data needs. For example, in contrast to Copernicus’s “Land” data service in which data related to a key application like Agriculture is just subset of the overall output, a UK system would be *designed* with Agriculture applications data users in mind from the outset.

With this blank EO slate, the great opportunity for the British EO industry here is therefore to avoid the **Copernicus trap** of a system designed by scientists for scientists, that is so complicated for the end-user that it often requires specialised, intermediary companies to translate raw sensor data into useable information.

Instead, the UK can develop the Service Element of the programme

to respond to global demand for information products and services that are aligned with food security, carbon, GHG mitigation, disaster risk management and so on, which would make best use of all mission data as well as stimulate applications and enable technologies such as AI, machine learning and digital twin approaches.

In this, the UK Government can act as an **anchor tenant** or main customer for services as well as raw data, in support of a range of applications from fighting climate change and supporting the Net Zero agenda to better delivery of public services across the country.

Organisations like DEFRA, Geospatial Commission and Ordnance Survey are all showing increased interest in the use of data and we should expect that they would have a good, clear idea of what they would like to achieve via the Data side of NEODTP. This data component could even be structured as a **national EO Service**, defined perhaps on the model introduced by the Scottish Government.⁵⁹

In the space component area, NEODTP would work on the initial scoping and design phase of **Britain's future dual-use civil-military EO constellation**, as previously with the UK GNSS Programme. In this early set-up, NEODTP's management requirements would be covered by UKSA working more closely with Dstl, and also drawing on industry expertise from UK and Five Eyes countries.

Infrastructure for data handling and management might indeed be different for a capability dedicated to military intelligence/reconnaissance missions rather than to global Earth system modelling, so this is not a trivial issue. But a dual-use – or, rather, dual-purpose – architecture is well within Britain's space competency to design and execute, especially with allied support.

Overall, NEODTP would develop a combination of nationally owned missions that balance innovation, industrial policy and science needs (as the "Own" element) against more operational data and service delivery ("Access").

A key mission of NEODTP would be to deploy resources to increase competition among UK NewSpace players and therefore grow the entire EO ecosystem. This includes foreign companies that have established a foothold in UK – and are therefore operating at SME level – who would be interested in expanding manufacturing and/or downstream processing in this country.

From an institutional perspective, NEODTP would lay the groundwork for the UK's much-anticipated integrated National Space Programme, setting up the mechanisms and structures required to absorb the UK EO Programme that would start within ESA, described above.

59. See Scottish Earth Observation Service (SEOS), which works in partnership with other geospatial service providers to provide a one-stop service for monitoring land assets; available at: <https://www.seos.org.uk/>. Also see: Ecometrica, *Scottish Earth Observation Service*; available at: <https://ecometrica.com/scottish-earth-observation-service>

Scored against the decision framework:

| | |
|------------------------------|---|
| Speed | Allows immediate action. |
| Delivery | Mechanisms & expertise already available especially on Data/SDA. Synergy with the UK EO Programme running within ESA. |
| Politics | Shows decisive action to start a UK National Space Programme. |
| Dual-use, integration | Key driver of dual-use; creates pressure for civil-military integration with cost benefits on both sides. |
| Capability | Builds towards a comprehensive UK EO System. |
| Industry, investment | Cushions “hard landing” for UK EO sector after Copernicus exit. Chance for UK to take a novel, market-driven approach to downstream EO services, boosting our global competitiveness. |
| Governance | Creates pressure for civil-military integration and strategic command and control of UK space activities from the centre of government. |

3rd pillar: NSL (National Space Lab)

Summary: Create a new National Space Lab (NSL) funded with the remaining 40% (£300m) of Copernicus money, as a UKSA in-house end-to-end R&D centre, covering all areas of space – in particular Science and Exploration (including human spaceflight), propulsion, PNT, and robotics and IOSM – and project management of large space systems. Budget-wise, £150m would be deployed directly via UKSA, £150m via ESA.

Total cost: £300m over three years.

How would it work: This capability, forming an *organic part* of the UK Space Agency, would serve as a national incubator for the critical technical capacity and expertise, *across civil and defence*, that will be increasingly required in the future as Britain scales up its space ambitions. Developing – gradually, starting small – a UK equivalent of NASA’s or CNES’s space centres is absolutely critical to growing that national space project management and delivery expertise and reducing Britain’s dependence on ESA.

There will likely be concerns from the various other space “hubs” and “centres” across the UK about a central NSL undercutting their own activities and interests. To the extent that a certain proportion of these activities are of marginal value to advancing core UK space interests, and instead serve as space “welfare programmes” for local organisations, these concerns would be justified. The existing landscape is too fragmented: it must be consolidated.

An NSL is also the only way in which Britain can ever get to build its own end-to-end, fully-owned space exploration missions – something that even countries like Israel or the UAE have been able to deploy for years – and take British space science and tech research to the next level.

One component of NSL could be a **British Astronaut Centre** providing a full astronaut qualification programme and growing UK competence in space life sciences. This centre would take advantage of existing UK capabilities in this area such as centrifuges or world-leading space medicine expertise.

A national space R&D, design, engineering and programme management capacity could be organised mainly by aggregating existing UK centres of space excellence, facilities and research institutions. The components are available already: what is lacking is the policy, authority and funding to cohere it into a single system. The foundations for NSL could be laid by combining **UKSA** technical resources with those of **Dstl** and **RAL Space**, while extending RAL's remit to delivery of a national technology and missions procurement programme. RAL brings technical expertise across the space programme domain (design, operations, budgeting, technology development etc).

The Satellite Applications Catapult could be brought into the mix if it is decided to take a more hands-on approach to services and market development.

Scored against the decision framework:

| | |
|-----------------------|--|
| Speed | Institutional drag will likely slow down implementation. But once operational, NSL will drastically improve UK's global competitiveness. |
| Delivery | Provides key route to building UK space delivery capability. |
| Politics | Enables UK-flagged space missions, demonstrates Britain as a Space Nation that can stand on its own feet in this domain. UK Space Agency joins the ranks of top-level players like NASA or the French CNES. |
| Dual-use, integration | NSL would service both civil and Defence space projects. Major driver of civil-military integration. |
| Capability | Core enabler of long-term UK space capabilities. |
| Industry, investment | Single government "front door" for all UK high-end space tech R&D, driving better coordination with industry. Major credibility boost for the UK "space enterprise" from an investor perspective. Enables development of large missions, thus attracting private sector co-investment. |
| Governance | Significant institutional shake-up; high-level political backing required. |

4th pillar: ESA increase

Summary: Subject to **strictly negotiated assurances**, increase UK's contribution to ESA's next budget (2023-2027) at the November CMIN from €1.6bn (£1.36bn) today (11.5%) to €3.04bn, or £2.6bn (19% of the planned £16bn next ESA budget, which should make the UK the second-largest contributor to ESA's optional programmes). Deploy the extra

£1.24bn⁶⁰ investment into ESA's programmes for Launch, Exploration and the new UK EO programme proposed in this report. The extra £1.24bn would be made up of: £375m combined 1st and 3rd pillar funding (£225m and £150m respectively); plus an £865m extra investment from HMG committed over 5 years, i.e. £173m per year (amounting to a total of £519m for the 2022-25 Spending Review period).

Total cost: £519m over three years.

How would it work: Since the strategic intent of this extra investment would be to effect a major – and controversial – political transformation in UK's space relations with Europe, HMG must take a very different approach to its CMIN22 preparations than is usually the case. **Conditionality is key: this ESA increase should not proceed until the UK side receives satisfactory assurances and guarantees from ESA on the conditions laid out below.**

Setting and then negotiating these assurances will be a challenging task requiring strong political direction and policy expertise on UK's part. With the November meeting fast approaching, the **UK National Space Council Secretariat** must convene as soon as possible an **ESA Policy Group** with both civil and Defence representation, and with external expert support, to outline in detail UK's medium to long term strategic goals in ESA and the negotiation objectives and mandate for the British delegation at CMIN22.

Funding-wise, since the post-Copernicus policy solution advocated here includes the three other “pillars” already mentioned (UKEO, NEODTP and NSL), the additional increase in UK's ESA contribution would be funded differently than if it were deployed as the sole British answer to exiting the EU programme. Specifically, we would be counting both the UKEO budget (as a new UK programme in ESA) and half of NSL budget (that would be deployed via ESA's Science & Exploration programme) towards the £1.24bn of additional UK funding for ESA.

However, simply raising the ceiling for UK's investment in ESA at CMIN22 would not directly guarantee the result that Britain needs. **Spending more money in ESA is not an end in itself** – despite the fact that in principle this is just another (and sometimes very effective) way of funding UK space sector growth. Rather, this extra investment would be a means to an end, i.e. growing UK domestic delivery and industrial capacity **across the sector** – thus driving diversification and being careful not to simply entrench existing players plugged into ESA contracts – so that at the next CMIN there will be true optionality in our relations with ESA.

In order to work from a UK national interest point of view and to justify this increased investment, the CMIN settlement in November this year should meet a number of **key British conditions** which should be taken up by the **No.10 ESA Policy Group** mentioned above:

60. The £1.24bn figure would comprise of the £225m for the UK EO programme; £150m for NSL spent via ESA; and £865m new funds from HMG spread over the five years (2023-2027) of the next ESA budget, i.e. £173m/year, or a total of £519m over current SR period of 2022-2025.

- **Access to high-quality ESA R&D work.** After Brexit, British industry and experts have been squeezed out from some of the most interesting and high-value R&D projects, partly through the EU's use of "security exclusions" against third-party states (focused of course on Britain). British negotiators will have to obtain **guarantees** that UK entities will have full access to all future ESA technology development done under the three "**accelerator**" workstreams outlined in the Matsuhino Manifesto. These include: (1) SST/STM/space safety; (2) disaster management and sustainability linked to climate change-related technology; and (3) secure connectivity. There is a risk that the European Commission will want to co-opt these accelerators for the purposes of the EU Space Programme. **ESA will have to credibly demonstrate that these three R&D axes remain open in the long run to non-EU countries like the UK**, and that the EU will not be able to exercise security exclusions in these areas in the future.
- **Specific protections for UK involvement in ESA secure services work.** ESA should recognise commercial markets for secure services rather than exclusively recognising the institutional requirements set by Brussels under timescales that will render capability useless by the time it matures. In other words, ESA should develop projects with commercial application, given the needs for secure communications, for example, of entities like banks. This would not be without precedent, given that Ariane, which benefits from ESA R&D, is technically a commercial company. Furthermore, there should be guarantees for continued UK involvement in Govsatcom-related technology R&D work. Fundamentally the EU only consider secure systems in the context of defence requirements. Civil society is going to increasingly rely on space capability and many of those applications will need to be increasingly secure and assured. The UK needs to protect the commercial and wider strategic advantage in being at the fore of developing this capability.
- **The new UK EO Programme.** To be set up quickly within ESA and designed to UK specifications. The programme Agreement should include explicit provisions facilitating collaboration with non-European partners such as Australia, Canada, Singapore or Japan.
- **Influence in ESA via key British appointments**, particularly at the very top in the programme directorates focused on Applications. Additionally, we will need guarantees against security exclusions being applied (formally or informally) against UK individuals working within ESA which can cut the UK Government off from certain information flows and reduce our awareness of the internal dynamics of the organisation, with detrimental effects to our interests.

There is no hiding from the fact that a major increase in UK’s ESA contribution would be a tall political order for HMG at this juncture – even if the sums involved are rather modest compared to other spending commitments on the public agenda. Secondly, the pressure of time – the need to agree a UK negotiating position and work with ESA in advance, all before November – only adds to the challenge.

If the negotiations fail and the UK cannot obtain adequate assurances from ESA along the lines mentioned above, HMG should **not proceed** with any extra investment and should in fact consider **cutting UK’s contribution to ESA** and redirecting those funds into domestic space activities and bilateral projects with close allies.

This initiative can only work, therefore, if Government exercises clear direction and political leadership. Treating this CMIN in a “business as usual” manner just with a bigger cheque on the table would be absolutely the **wrong** way to proceed. Boosting UK’s position in ESA can be a bold move to secure this country’s space future – but only if we know what we are doing.

Scored against the decision framework:

| | |
|-----------------------|---|
| Speed | Allows immediate action. |
| Delivery | Provided by ESA; system already in place. |
| Politics | Boost to UK influence in European space affairs. Ensures UK foothold to slow/prevent EU space consolidation and to protect UK national interests in short-medium term. Creates bargaining chip in wider UK-EU negotiations. |
| Dual-use, integration | Opportunities for growing UK dual-use space technology via the Space Safety and Security programme area. |
| Capability | Taking strategic positions in key ESA programmes will help support development of UK national capabilities, including in Launch. |
| Industry, investment | The money invested is “geo-returned” into the UK space industry (subject to properly negotiated terms and guarantees). But this return must be carefully managed so as to benefit a diverse set of UK companies rather than entrench the existing dominance of a single entity. |
| Governance | Step-change in UK’s position in ESA requires corresponding upgrade UK’s own ESA-related policy-making arrangements (starting with an ESA Policy Group). Britain’s mandate at CMIN22 should be framed in wider, strategic terms from a national interest perspective and decided at Cabinet level. |

The UK Space Enterprise in 2025: a vision

What would this Copernican Revolution – the policy package outlined in this paper – actually mean for UK space? It is worth sketching out a vision of where we would be and how the UK Space Enterprise would look by 2025 if this four-pillar solution is adopted.

By 2025 the UK will have expanded its capability to build big spacecraft. The higher-end of the industry would be more diversified with at least **two large scale integrator-class** (LSI) companies or consortia leading major projects under the UKEO and NEODTP programmes. As the scope for big space business in the UK increases and the market diversifies, this attracts more attention from international companies especially from the United States, allowing the UK space sector, in turn, to plug more into the US market. A **new UK-US Space Special Relationship** emerges in the commercial realm. At the same time by 2025 Britain will have strengthened and re-energised its NewSpace industry through new opportunities – particularly in EO services, through a more **market-driven** commercial approach, and data processing including under the SDA mission – as a **well funded, directed and coherent pipeline of R&D work** feeding into the UK National Programme is organised through ESA and NSL contracts.

But it is the successful adoption of **dual-use** as a core principle that will have proven to be the game-changer in UK space development by mid-decade. With strong political leadership, Britain will have taken bold and innovative steps towards integrating its civil and defence space establishments into a single **National Space Enterprise** that, at its core, designs, develops, procures and delivers capabilities, missions and services for both military and non-military HMG needs, and benefits from a new, dedicated Civil Service space career path supported by Space Fellowships (similar, for example, to No.10's Innovation Fellowship Programme⁶¹). This new British approach to institutional space integration will have become a world-leading model in its own right, being held up as an example of 21st century policy-making innovation. By bringing together civil and defence Space, HMG will have not only maximised synergies and reduced costs, but it will have created a compelling proposition for **foreign partners** looking to do business or develop joint allied capabilities with the UK.

All this will have been made possible by a major reset of UK's space governance, breaking the cycle of bit-reforms driven by the personalities of the day. The key win would be that by 2025 the all executive direction of UK space activities will have been consolidated under a reformed and more **autonomous UK Space Agency with its own separate budget line and new powers**, and with separate provision for input and representation from the MoD – preparing the way for the creation of a dedicated Ministry of Space in the latter part of the decade, similarly to the Air Ministry set up in 1919 by Winston Churchill.

Critically, the new-look **UKSA would sit outside BEIS**, reporting directly into the Cabinet Office and taking strategic and policy direction from the **National Space Council and its Secretariat**, which would

61. See UK Government, No.10 Innovation Fellowships; available at: <https://no10innovationfellows.campaign.gov.uk/>

function as the “central brain” and authority for British space.

A new National Space Laboratory will have become fully operational by 2025. Functioning under UKSA as a network of facilities plugged into a new flagship Centre, with common oversight and aligned to a single multi-year space tech R&D plan, the **NSL would become the focal point and “crown jewel” of UK’s National Space Enterprise**. It would be a world-class concentration of space scientists, technologists and programme managers, providing space expertise in support of HMG objectives but also offering a high-performance “docking platform” for commercial entities involved in advanced space R&D and innovation and for increasingly ambitious bilateral science & exploration partnerships with other nations.

With HMG getting transforming its approach to space at home while also being more assertive and ambitious within ESA, by 2025 the **UK will have mounted a strategic “comeback” on the European space scene**. This will have created a bargaining chip for wider UK political interests while also securing Britain’s “space flank” from the **threat of a completely consolidated EU space sector**. Increasing UK’s credibility and space power within Europe would lead to a reassessment of EU-UK space relations and open a way back to a relationship based on collaboration rather than hostile competition, with strategic benefits for all sides.

To sum up, through the policy interventions proposed in this paper, by the mid-2020s the UK would be on an accelerated track to becoming a front-rank **space power**. Structural, institutional and market reform, as well as a more hardnosed and strategic approach to long-term policy objectives, will have singled out the UK, by 2025, as the world’s most exciting and open place to do business: a country with a clearly defined ambition, that takes its own space power development seriously and directs it from the top, coherently and strategically in a way that benefits itself as well as its allies and partners.

Conclusion: A question of political will

The full opportunities and benefits of space for the UK – both on the domestic and international fronts – are within our reach. British space power can be unlocked relatively quickly: it can be done. It is rather clear what the main problems are and what specific steps are required to tackle them.⁶² As part of this process, the principal task is to bring coherence to UK space governance (at the moment space policy decision-making is dispersed across government), and to establish an ambitious National Space Enterprise that can develop real operational capabilities.

Potentially disruptive – and controversial – organisational and conceptual reform in the way the government “does” space is inevitable if the UK’s space problem is to be tackled with the urgency required by trends in the global competition as well as the context of Global Britain. But this will necessitate strong central direction, great energy and an occasionally-aggressive programme of action. It is for these reasons that **political will and leadership from the highest level of government is absolutely crucial** to this process. Britain’s space future cannot be secured without drastic change and vision, and these in turn depend on Prime Ministerial drive.

Most importantly, the **costs** of scaling up the UK’s space ambitions and setting it on course to becoming a leading space nation are comparatively low. The cost/benefit ratio of a major policy decision to build up UK space power is hugely advantageous.

Current public expenditure in the civil space sphere routinely involves modest sums. One risk that comes with it is that of salami slicing, as officials are afraid to pick winners and instead try to sometimes fund too many items at sub-optimal levels. As already mentioned, the annual *national* space technology grants budget is a few million pounds; development of important infrastructure projects such as the Newquay spaceport was long delayed by complex negotiations also over a few million; the Space Application Catapult (whose remit is to energise the space market across the country) has a grant of only about £11m; the Space for Smarter Government Programme, whose critical mission in a 21st century economy such as ours is to increase the take-up and integration of space-enabled solutions by local authorities, has functioned in recent years on a budget of only about £1.5m. Even with these extremely low levels of investment a great deal is being achieved; one can only imagine the impact that just a few million more in each of these cases (and others) could have.

An extra £173m/year over the next three years for space – in conjunction with integrating some of the MoD’s space budget with civil programmes – should be well within the possibilities of the 5th or 6th largest economy in

62. See Policy Exchange’s *Space Manifesto* for a full space policy programme that addresses the main issues, 11 July 2019; available at: <https://policyexchange.org.uk/wp-content/uploads/2019/07/Manifesto-Space.pdf>

the world and permanent member of the UN Security Council. It would have an absolutely **transformative** effect on the domestic space market. It is arguably a small price to pay for propelling Britain to the “big league” in global space affairs.

It is extraordinary that Britain has so far been denied a much stronger space development pathway, with all the powerful economic and strategic benefits it would have produced, by repeated failures to invest even small extra sums. And this, despite the fact that the economic return on public investment in UK space has been demonstrated to average a 4:1 ratio; in effect, in the long run **space spending pays for itself**.

Serious and explicit political backing for UK’s space ambitions is particularly important from the point of view of **international partners**. The galvanising effect of such a move cannot be overstated. It can tip the balance in what is currently a situation of international confusion and scepticism about Britain’s space future post Brexit, versus a strong appreciation for the excellent fundamentals of British industry, science, skills base and overall business environment. All this is taking place at a time of very rapid change in the global space sector: a clear political statement – indeed, a commitment to space power – will boost confidence and create a positive space business dynamic centred on the UK.

Britain has before it the option of **becoming a leading space nation of the 21st century**. The government only has to decide to act: we have what it takes to succeed. A strong vision for the UK’s space future must be articulated, but many elements of it are clear already. A major reform of how the government “does” space must be implemented, but political will can drive it through. A series of specific policy measures must be taken, but it is clear what they are and they lie within reach. Money must be committed, but the sums are comparatively low when set against the benefits. All this may be disruptive, but the UK space industry is world-class and will respond positively.

This is the **right moment** to launch Britain on a trajectory to space power. A new political impetus for post-Brexit, post-Covid Britain under a new Prime Minister provides an opportunity to rebalance our civil space relationships from a focus on Europe and define a role for the UK as a global space beacon and perhaps as the leading space nation of the Commonwealth.

An ambitious space vision can also be a unifying and **inspirational project for the country**. It will also be a powerful declaration to the world about Global Britain and its role in it.

There is a huge disconnect between Britain’s standing in the world as an economic, diplomatic and military power and its position in the space domain. Space power has already become a component of national power, whether acknowledged or not by policy-makers (it is certainly acknowledged by our peers). It must be integrated in Britain’s long-term grand strategy.

The fundamental requirement in all of this remains: **direct Prime Ministerial leadership on space**.



£10.00
ISBN: 978-1-913459-92-5

Policy Exchange
1 Old Queen Street
Westminster
London SW1H 9JA

www.policyexchange.org.uk