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Designing Britain's Future-Oriented Space Strategy

NEW DIPLOMACY PROJECT

TOP LINES

- The UK should leverage its comparative advantages, including strong diplomatic ties and data analytics, to more quickly develop research and industrial leadership for the emerging areas in space outlined in the NSS. Further investments, clear regulations, and more contributions to allied systems are all essential to gaining increased recognition as a leader in the space domain.
- Advancing its goal to 'inspire the nation' described in the National Space Strategy, further attention should be paid to space programmes that inspire younger generations, as well as education and upskilling opportunities to develop a stronger space sector workforce.
- The UK has established itself as a leader in space governance through a United Nations resolution on reducing space threats that opened up new forums for dialogue on space norms. It should continue to uphold its commitment to the sustainable and secure use of space through further diplomatic efforts and domestic actions that demonstrate a commitment to responsible space behaviours.
- The UK could advance its 'Protect and defend' strategy emphasised in its Defence Space Strategy by strengthening its space domain awareness in collaboration with the international community to be able to properly attribute and respond to attacks on space assets.
- Space should become a main research and collaboration priority of the AUKUS alliance to improve information-sharing mechanisms and collaboration on advanced space-related technologies for both military and civil programmes.
- Building upon its 'own-collaborate-access' framework outlined in the Integrated Review, Labour should ensure the UK prioritises creating redundancies and mitigating risks to space assets by pursuing wider international and private

sector collaboration on space-related programmes and strengthening its domestic capabilities.

- **China is an increasingly competitive actor in space both technologically and economically. The UK should ensure its critical technologies are protected and its commercial actors are not harmed by Chinese subsidies for state firms and other unfair trade practices.**
- **The UK should place more emphasis on integrating its space capabilities with its diplomatic efforts to boost its space sector and its diplomatic credibility, including making its space services more accessible globally.**

BACKGROUND

Emerging and future space activities are rendering outer space increasingly important for long-term security and economic prosperity, and the UK Government has already recognized this. In September 2021, the National Space Strategy (NSS) outlined the UK's plans to become a meaningful space power.[1] This was followed by the Defence Space Strategy (DSS) in February 2022 that outlined a £1.4bn Defence Space Portfolio to be carried out over the next ten years.[2] The UK's DSS is part of an emerging global trend, coming two years after the United States released its Defense Space Strategy in 2020 and a month before Australia's Defence Space Strategy in March 2022.[3] However, successfully achieving its goals in outer space will require significant continuous diplomatic efforts and strategic planning.

For example, international norms in outer space struggle to keep up with evolving space activities, and existing norms are not always upheld.[4] In 2021, Russia conducted a kinetic anti-satellite (ASAT) test which created potentially dangerous space debris and demonstrated a threat to the International Space Station (ISS) and UK assets.[5] Although the United States and India had conducted ASAT tests prior, these tests were conducted at lower altitudes to avoid producing large quantities of space debris in orbit—the Russian test created debris which threatened astronauts at the ISS.[6] Russia is also suspected of cyberattacks on space broadband communications in Ukraine. China has demonstrated advanced space capabilities, including rendezvous and proximity operations (RPOs) which allow its satellites to interfere with enemy satellites on-orbit.[7] International norms to regulate in-space activities and promote transparency are currently limited.

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[1] National Space Strategy (publishing.service.gov.uk)
[2] Defence Space Strategy (publishing.service.gov.uk)
[3] Revitalizing Canada's Visions for Space (cgai.ca)
[4] Integrated Review 2021 (gov.uk)
[5] Counterspace Timeline (aerospace.csis.org)
[6] Russian anti-satellite missile test was the first of its kind (space.com)
[7] Space Threat Assessment 2022 (csis.org)

The commercial space sector is also growing, primarily driven by decreasing launch costs, greater production of small satellites, and increased satellite computing power and AI usage.[8] The space economy opens up a wide array of new business opportunities, and the UK has a chance to capture a larger market share. Between 2019 and 2030, the space industry is projected to grow from £270 billion to £490 billion, creating opportunities to expand the UK space sector which already employs about 45,000 people.[9]

The NSS and DSS outline comprehensive plans to turn the UK into a global space power by leveraging its advantages in academic research, diplomacy, and technology. The space domain presents a pressing opportunity for the UK to follow through on its plans and assert itself as a technological and diplomatic leader.

STRENGTHENING DOMESTIC SPACE CAPABILITIES

The UK should leverage its comparative advantages, including strong diplomatic ties and data analytics, to more quickly develop research and industrial leadership for the emerging areas in space outlined in the NSS. Further investments, clear regulations, and more contributions to allied systems are all essential to gaining increased recognition as a leader in the space domain. The UK has recognised strengths in data analytics, artificial intelligence and data processing.[10] These are all of significant importance as the proliferation of small satellites results in more data to be analysed. Improvements in data analytics for satellite data would have many civil, commercial, and military applications. For example, improvements in military weapons systems, such as hypersonic weapons, are decreasing acceptable data processing rates to effectively detect and respond to threats against assets. The UK can be a leader in developing advanced computing systems to support space infrastructure, including United States and NATO defence architectures.

Space development is happening quickly, and Labour should ensure that more horizon scanning is conducted to identify and respond to emerging threats and commercial trends.[11] Responsive regulations and investments can ensure the UK remains protected, operationally relevant, and well-positioned to capture a growing share of the emerging space economy. For example, the UK does not have domestic legislation regulating commercial space resource use that has been enacted in four nations thus far (United

[8] Small satellites: The implications for national security (atlanticcouncil.org)
[9] National Space Strategy (publishing.service.gov.uk)
[10] UK's Defence Space Strategy in Context (policyexchange.org.uk)
[11] Realising the Ambitions of the UK's Defence Space Strategy (rand.org)

States, Luxembourg, Japan, and United Arab Emirates).[12] However, the UK has signed the U.S.-led Artemis Accords which allows for in-situ space resource utilisation. The UK can become a favourable place for space startups by creating regulations to keep up with emerging space technologies such as in-orbit servicing, human spaceflight and space tourism. Clusters of space activities, such as the Harwell Campus, are already attracting innovative startups, and responsive regulations would help to maintain this trend.[13] By establishing itself as a leader in creating such legislation and regulatory procedures, the UK can ensure that it attracts talent by clarifying rules while also promoting sustainable space usage.

Although small satellites and emerging space technologies will have a huge impact on the future, current commercial organisations are often not viable without government contracts because of the relatively nascent space economy. Labour should ensure proper investment in advanced technologies such as in-space manufacturing, space-based energy, and space resource utilisation to enhance its knowledge capacity and ensure it plays a significant role in these emerging areas. Attracting high-tech companies to the UK's space clusters creates good jobs for both technical experts and blue-collar workers.

Advancing its goal to 'inspire the nation' described in the National Space Strategy, further attention should be paid to space programs that inspire younger generations, as well as education and upskilling opportunities to develop a stronger space sector workforce. The lack of sufficiently qualified and experienced personnel (SQEP) for space-related projects is a major bottleneck for Britain's defence strategy.[14] The new Space Academy being established by the Ministry of Defence is a good start, but it will only be effective if it can attract talent from academia and the private sector and keep up with trends in commercial space. Labour should ensure sufficient investments are made in space-related education and upskilling for long-term benefits, including opportunities for participation throughout the entire nation.

The UK Satellite Applications Catapult effectively connects the UK commercial space industry to cutting-edge research, resulting in a more integrated UK space sector.[15] However, the Ministry of Defence (MoD) is a crucial end user which supports the entire sector, and Labour should ensure that the MoD is utilising the cutting edge academic and industry knowledge being developed wherever there are dual-use applications. Labour should support outreach efforts to ensure the space sector is responsive to Defence's

[12] Japan passes space resources law (spacenews.com)
[13] Space Cluster (harwellcampus.com)
[14] Realising the Ambitions of the UK's Defence Space Strategy (rand.org)
[15] https://sa.catapult.org.uk/

needs. Actively sharing government priorities, investment opportunities, and acquisition processes with the sector through industry days and assistance for commercial organisations can enhance public-private partnerships, supporting important jobs.

The UK has made great progress towards developing a launch capability, and the first commercial launch from Virgin Orbit is expected this summer from Spaceport Cornwall. Further launches from SaxaVord Spaceport in Scotland are expected in 2023.[16] A survey found that sixteen percent of UK space organisations have already experienced significant benefits from a sovereign launch capability, driven by factors such as increased investment opportunities and demand from the launch sector.[17] Beyond enhancing space infrastructure, a launch capability can create greater public interest in the space sector. For example, student groups can observe launches and design small satellites at universities that are launched from UK spaceports. These activities would support the goal stated in the NSS of delivering one million space-related engagement activities annually to younger generations.[18] Plans outlined in the NSS to develop a rover to return samples from Mars to Earth and return UK astronauts to the ISS can also inspire the public, and Labour should consider these as priorities for their impact on public opinion of spacefaring. Further investments in scientific missions would result in more collaboration with the academic sector, improvements in space knowledge, and opportunities to involve and inspire younger generations with space activities. Commercial opportunities with the potential to inspire future generations may also benefit from more government attention, including space tourism and entertainment.[19] Labour should ensure that these emerging areas are not neglected.

MAINTAINING DIPLOMATIC LEADERSHIP

The UK has established itself as a leader in space governance through a United Nations resolution on reducing space threats that opened up new forums for dialogue on space norms.[20] It should continue to uphold its commitment to the sustainable and secure use of space through further diplomatic efforts and domestic actions that demonstrate a commitment to responsible space behaviours. Although national regulations are necessary to clarify rules and ensure space safety and sustainability, other countries lacking such regulations can attract commercial space in the short- to medium-term by allowing more commercial risk-taking and quicker development speeds. For example, since there is no legislation in the Philippines which makes domestic commercial space

[16] Orbex unveils prototype of rocket preparing for UK's first vertical launch (spacenews.com)
[17] Size & Health of the UK Space Industry 2021 (brycetech.com)
[18] National Space Strategy (publishing.service.gov.uk)
[19] Future Uses of Space Out to 2050 (rand.org)
[20] UN Resolution 76/231 (ny.un.org)

operators liable for accidents, the government is responsible for damages because of a provision in the Outer Space Treaty.[21] Labour should ensure that the UK collaborates internationally to enforce commercial responsibility to prevent a 'race to the bottom', avoiding a scenario where there are trade-offs between space sustainability and promoting commerce.

The UK can capitalise on its goal of promoting the values of Global Britain in its NSS by continuing its leadership on space regulation at the United Nations (UN). In late 2021, a UK-led resolution at the UN titled 'Reducing space threats through norms, rules and principles of responsible behaviours' was passed, which convened an open-ended working group to meet throughout 2022 and 2023 to discuss further space norms.[22] As it continues its leadership at the UN, the UK can enhance its diplomatic credibility by following up with domestic and bilateral actions which reflect the concerns of other nations regarding space threats and promote a spirit of cooperation. For example, the United States and Canada recently banned direct-ascent anti-satellite (ASAT) weapons testing, and the UK can follow suit.[23] The UK can also require commercial operators to meet industry standards for on-orbit servicing and RPOs, which have been developed by the Consortium for Execution of Rendezvous and Servicing Operations (CONFERS), an industry-led initiative.[24] Enacting domestic laws to enforce the non-binding agreements that result from international discussions would ensure the UK is taken seriously as a leader of negotiations. Creating fair rules and standards for in-space activities may further attract space startups by clarifying the regulatory environment, reducing uncertainties of legal challenges for the commercial sector. Labour should also ensure that diplomatic efforts at the UN level continue, particularly to promote strong behavioural norms to deter emerging threats. Transparency and confidence building measures (TCBMs) may be an effective way to promote international cooperation to reduce threats surrounding ASAT weapons testing, RPOs, and more long-term space activities like operations on celestial bodies.[25]

The UK could advance its 'Protect and defend' strategy emphasised in its Defence Space Strategy by strengthening its space domain awareness in collaboration with the international community to be able to properly attribute and respond to attacks on space assets. The UK makes important contributions to space domain awareness networks, including its radar installation located at RAF Fylingdales which is part of the U.S.-led

[21] Key Governance Issues in Space (aerospace.csis.org)
[22] UN Resolution 76/231 (ny.un.org)
[23] Canada joins U.S. in ASAT testing ban (spacenews.com)
[24] CONFERS establishing international standards for satellite operations
[25] Responsible Space Behavior for the New Space Era (rand.org)

Space Surveillance Network.[26] However, network analysis shows that the UK is not presently a central actor in global space domain awareness.[27] Since space domain awareness (SDA) and space traffic management (STM) are essential to ensuring space safety and sustainability, a lack of network centrality and space awareness can inhibit the UK's credibility in global space regulation as well as its space control for Defence.

Labour should encourage the Government to take measures to increase its relevance to global SDA, utilising the UK's technical and geographical advantages. Sensor installations in the Falkland or Ascension Islands can address coverage gaps in current SDA, and UK capabilities in artificial intelligence and data processing can enhance the detection capability and speed of SDA networks.[28]

Even though space assets in earth's orbit are visible to all actors with the proper detection capabilities, there is not presently a unified, open, international SDA network. The United States is the current leader in cataloguing space objects, and it plans to make this data more open by transferring responsibility from the Air Force to its Department of Commerce.[29] However, there is no space catalogue which captures nearly all space objects in orbit, and some commercial actors such as the Space Data Association have strong detection capabilities.[30] Labour should consider how the UK can enhance its relevance and credibility as a leader in space regulation by guiding an effort to integrate space object data from various providers, including nations and commercial organisations, into a single, accessible platform. Such a transparent solution would leverage existing UK comparative advantages in data analytics and diplomatic credibility to enhance transparency and safety when operating in space.

Space should become a main research and collaboration priority of the AUKUS alliance to improve information-sharing mechanisms and collaboration on advanced space-related technologies for both military and civil programmes. Space is deeply connected to other high priority areas for collaboration on advanced technologies by the AUKUS alliance. Hypersonic weapons are tracked by space-based systems, artificial intelligence is used for processing and analysing satellite data, and quantum encryption technologies are becoming necessary to secure satellite links. In 2016, China launched the first quantum communications satellite, known as Micius.[31] Labour can emphasise outer space

[26] Realising the Ambitions of the UK's Defence Space Strategy (rand.org)
[27] Examining the Growth of the Global Space Situational Awareness Sector: A Network Analysis Approach (sciencedirect.com)
[28] Towards a UK space surveillance policy (kcl.ac.uk)
[29] Towards a UK space surveillance policy (kcl.ac.uk)
[30] Responsible Space Behavior for the New Space Era (rand.org)
[31] China's quantum satellite enables first totally secure long-range messages (theconversation.com)

cooperation within the alliance to ensure that collaborations on developments of advanced technologies are not siloed and that they will be actively applied to space development. Such an emphasis would help ensure AUKUS nations sustain technological leadership in the space domain.

ANALYSING POTENTIAL RISKS

Building upon its 'own-collaborate-access' framework outlined in the Integrated Review, Labour should ensure the UK prioritises creating redundancies and mitigating risks to space assets by pursuing wider international and private sector collaboration on space-related programmes and strengthening its domestic capabilities. After Brexit caused the UK to lose access to the European Union's Galileo PNT system, the lack of a sovereign PNT capability has made the UK an outlier among permanent members of the Security Council.[32] In 2020, the UK took a 20 percent stake in OneWeb, a broadband internet satellite network. OneWeb may also be able to provide some PNT capabilities, but this is not its primary focus, and there are some technical uncertainties.[33] Labour should ensure that the UK government is making adequate progress towards a PNT system that can serve as a redundancy to the United States-owned GPS, and promoting development of a fully sovereign PNT system may be an effective way to ensure access, build knowledge, and create jobs.[34] Labour should also hold the government accountable for continued participation in the Copernicus programme within the European Union Space Programme. Copernicus is integral to the earth observation (EO) capabilities of the UK, and it supports contracts for UK-based organisations.[35]

Labour should also ensure proper risk assessments are conducted before determining where the UK can rely upon access or collaboration rather than ownership of space assets and services. In particular, Labour should be cognizant of the use of commercial off-the-shelf components for critical infrastructure or inclusion of Chinese parts in supply chains which may be prone to government interference.[36] Recent analysis shows that over half of manufacturing inputs used within the UK space industry are currently sourced from abroad.[37] While utilising commercial services is necessary in some cases to have access to the most advanced technologies, the UK should balance the need to stay technologically ahead through private-public partnerships with maintaining strict standards for quality assurance, risk mitigation, and supply chain management. For

[32] Realising the Ambitions of the UK's Defence Space Strategy (rand.org)
[33] The UK government to acquire satellite company OneWeb in deal funded in part by India's Bharti Global (techcrunch.com)
[34] What do we want from the next Prime Minister? (policyexchange.org.uk)
[35] UK Involvement in the EU Space Programme (gov.uk)
[36] Britain and the Geopolitics of Space Technology (policyexchange.org.uk)
[37] Size & Health of the UK Space Industry 2021 (brycetech.com)

example, redundancies for space systems should be created through multiple providers or backup sovereign capabilities to ensure continuous space access. Surveyed commercial space organisations also suggested greater investments in space hardware and research and development for new intellectual property in the space sector.[38] These initiatives would reduce dependencies on imports for space sector manufacturing and increase the share of modern commercial space technologies that are owned by UK firms.

China is an increasingly competitive actor in space both technologically and economically. In May 2022, a report published by the Atlantic Council claimed that China would become the leading space power by 2030.[39] The UK should ensure its critical technologies are protected and its commercial actors are not harmed by Chinese subsidies for state firms and other unfair trade practices. Commercial space actors in China are expected to meet stringent military regulations because of close collaboration between China's civil and military space regulators.[40] In addition, private space actors are expected to share information with the Chinese government upon request. Because of the high level of government control and monitoring, Labour should be very cautious of dependence on Chinese firms in supply chains, or collaboration with Chinese firms that may result in intellectual property theft.

State subsidies in China often give its firms an unfair advantage on the international level, and many space sector firms in the UK are reliant on exports rather than government contracts.[41] Labour should advocate for greater investments and partnerships with UK-based space firms to boost the industry given the competitive international dynamics.

Following the breakdown in diplomacy created by Russia's war in Ukraine, Russian Deputy Prime Minister Yury Borisov claimed that Russia may withdraw from the ISS in 2025 to develop its own space station.[42] However, it is unlikely that Russia would withdraw until its new space station is operable. Russia's withdrawal nevertheless risks marking the end of the ISS, which is already within its last decade. The ISS has been pivotal for conducting scientific research in space, including exploring health effects and developing closed-loop life-support systems.[43] Access to research facilities in space may be essential for UK-based academic and commercial organisations to achieve novel discoveries and

[38] Size & Health of the UK Space Industry 2021 (brycetech.com)
[39] Small satellites: The implications for national security (atlanticcouncil.org)
[40] The Growth of China's Non-governmental Space Sector in the Context of Government Support for Public-Private Partnerships: An Assessment of Major Legal Challenges (sciencedirect.com)
[41] Realising the Ambitions of the UK's Defence Space Strategy (rand.org)
[42] Russia mulls withdrawing from the International Space Station after 2024 (science.org)
[43] Future Uses of Space Out to 2050 (rand.org)

technologies, including revolutionary technologies such as 3D-printed organs that can only be produced in low gravity conditions. Labour should ensure that UK-based groups maintain access to research facilities in space through international or commercial collaborations. Commercial space stations are actively being considered and developed, including by Axiom Space.[44] Scenario planning and assessments should be conducted to ensure continued access to space-based research and development and determine whether there may be commercial or investment opportunities for building replacement space research facilities in the UK.

The UK should place more emphasis on integrating its space capabilities with its diplomatic efforts to boost its space sector and its diplomatic credibility, including making its space services more accessible globally. Other nations actively use space technologies for diplomatic ends and exerting soft power abroad. Japan hosts researchers from developing countries at its universities to share its technical expertise, and China actively promotes its own space technologies among participants in the Belt and Road Initiative through the Space Information Corridor, including its Beidou PNT system and Gaofen EO satellite system.[45] By providing free space services to developing countries, China's space services become more relevant abroad, potentially to the detriment of Western programmes.

The UK has made prior efforts to promote space technology for diplomacy. The UK Space Agency's (UKSA) International Partnership Programme (IPP) was a £152 million programme to deliver benefits to developing economies through UK space assets, but funding was not continued during the COVID-19 pandemic.[46] Labour should support increased funding for space diplomacy to enhance the soft power of the UK, improve its diplomatic and regulatory credibility, and deliver benefits to the global economy through UK space assets.

Space capabilities are essential to the entire economy, and they can greatly enhance developing economies. For example, EO satellites are used for environmental monitoring, PNT systems are used for timestamps on financial transactions, and communications satellites such as OneWeb are essential for broadband communications. Labour should consider that access to UK satellite technologies internationally can not only provide great benefits to emerging economies and support other diplomatic efforts, particularly

[44] Axiom Station (axiomspace.com)
[45] Britain and the Geopolitics of Space Technology (policyexchange.org.uk)
[46] Soft Power in Space - A Landscape Review of UK Influence (dgroup.co.uk)

around climate change, but international usage of UK space assets can also increase the political consequences to hostile attacks against them.[47]

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[47] Tailoring Deterrence for China in Space (rand.org)