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## The U.K.'s 'Appetite' for Space: An Increased Craving!

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**THE U.K.'S 'APPETITE' FOR SPACE:  
AN INCREASED CRAVING!**

DR. SARAH JANE FOX\*

ABSTRACT

Launching into space was once the pursuit of super-power nations, who, during a period of international tensions, competed to be the *first*—the first into space and the first to the Moon. While the United Kingdom (U.K.) had a similar appetite it never achieved a space launch from its national soils, often thwarted by political and economic constraints. This said, the U.K. has played a key role, working alongside other nations in technological advancements related to space. This paper revisits the historical legacy of the U.K.'s space ventures and its space policies before comment is made to the current strategy and future vision. The approach is interdisciplinary and factors in semi-quasi case studies, particularly factoring in the European Space Agency. The findings are that the U.K. is returning to its original goal, with a renewed appetite to be a global leader in space launches, while also aiming to protect national interests which have necessitated closer alignment of the civil and defense space strategies.

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## I. INTRODUCTION

THERE IS NO DOUBT THAT space ventures are big business<sup>1</sup> in terms of financial investments and associated risks, which could ultimately result in huge successes down the way, but will also likely result in a number of failures before any form of success is ever achieved. Certainly that was humanity's earlier experience of space explorations, at the very least.<sup>2</sup> The early pioneers were motivated by several reasons—an *appetite* to be the first into space<sup>3</sup> and, arguably, to achieve supremacy of this new frontier.<sup>4</sup>

<sup>1</sup> See Steven Cherry, *Space Is Big Business*, IEEE SPECTRUM (June 18, 2009), <https://spectrum.ieee.org/space-is-big-business#toggle-gdpr> [<https://perma.cc/55UX-AZKE>].

<sup>2</sup> See, e.g., Freddie Wilkinson, *The History of Space Exploration*, NAT'L GEOGRAPHIC (Oct. 24, 2022), <https://education.nationalgeographic.org/resource/history-space-exploration/> [<https://perma.cc/YP8A-MN6F>].

<sup>3</sup> Peter L. Hays & Charles D. Lutes, *Towards a Theory of Superpower*, 23 SPACE POL'Y 206, 206–07 (2007).

<sup>4</sup> Sarah Jane Fox, *'Exploiting—Land, Sea and Space: Mineral superpower' In the name of peace: A Critical Race to Protect the Depths and Heights*, 79 RES. POL'Y no. 103066, 2022, at 1, 9.

Defining risk appetite<sup>5</sup> can be open to interpretation, but it is more broadly understood as the level of risk that an *entity* can tolerate.<sup>6</sup> In the formative years of space ventures, this *entity* was normally understood as a nation, such as the United States (U.S.) or the then-Union of Soviet Socialist Republics (USSR or Soviet Union), which in the 1950s and 1960s was regarded as the most powerful and competitive country in the area of space.<sup>7</sup> Certainly, these two nations invested heavily in space exploration at the outset.<sup>8</sup>

This said, the U.K.<sup>9</sup> also had a keen appetite to be a player, and even a leader, in developing this new frontier and the related opportunities that space endeavors would bring—no doubt, an extension of its earlier sea-faring ventures across the Earth.<sup>10</sup> Yet, despite this craving for space adventure, the U.K.'s policy in this area has notably consisted of varying levels of commitments whereby a restrictive, “*dietary*” approach has often been applied.<sup>11</sup> The U.K.'s early appetite for direct launches has most noticeably been constrained due to political and economic curtailment.<sup>12</sup>

Fast forward to today, and there is no denying the fact that the U.K. has been positively impacted by space exploration and associated space technologies.<sup>13</sup> Space remains a part of everyday life in the U.K. (as it is across the world), perhaps more than society appreciates.<sup>14</sup> The global ambition for space exploration

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<sup>5</sup> DAVID HILLSON & RUTH MURRAY-WEBSTER, A SHORT GUIDE TO RISK APPETITE 35–36, 43 (2017).

<sup>6</sup> HEAD OF THE GOV'T RISK PRO. & THE RISK CTR. OF EXCELLENCE, THE ORANGE BOOK: MANAGEMENT OF RISK – PRINCIPALS AND CONCEPTS 43 (2023).

<sup>7</sup> See Bailey DeSimone, *How the Antarctic Treaty of 1959 Influenced the Outer Space Treaty of 1967*, IN CUSTODIA LEGIS: LIBRARY OF CONGRESS BLOGS (Jan. 28, 2022), <https://blogs.loc.gov/law/2022/01/how-the-antarctic-treaty-of-1959-influenced-the-outer-space-treaty-of-1967/> [<https://perma.cc/NFK2-CSJR>] (implying that governments were at one time thought to be “the only entities capable of going into space”).

<sup>8</sup> See Hays & Lutes, *supra* note 3, at 207; Fox, *supra* note 4, at 9.

<sup>9</sup> United Kingdom of Great Britain and Northern Ireland—herein abbreviated as the UK.

<sup>10</sup> See Fox, *supra* note 4, at 9, n. 68.

<sup>11</sup> See Douglas Milliard, *An Overview of United Kingdom Space Activity 1957-1987*, EUROPEAN SPACE AGENCY (Apr. 2005), [https://www.esa.int/esapub/hsr/HSR\\_36.pdf](https://www.esa.int/esapub/hsr/HSR_36.pdf) [<https://perma.cc/G4SJ-LNRK>].

<sup>12</sup> See *id.*

<sup>13</sup> See, e.g., *World Space Week*, UNITED NATIONS, <https://www.un.org/en/observances/world-space-week> [<https://perma.cc/Z9XS-JU6T>] (discussing the United Nations, of which the UK is a member, recognizing “the unique benefits of outer space for the betterment of all humankind”).

<sup>14</sup> UK Space Agency, *The Wider Benefits of Space Investments for the UK Economy*, GOV.UK (Mar. 22, 2019), <https://www.gov.uk/government/news/the-wider-benefits-of-space-investments-for-the-uk-economy> [<https://perma.cc/W3WH-ZGWK>].

was always advocated as a means to both unite nations and advance humanity, even when a nation has not directly contributed to space pursuits.<sup>15</sup>

Space science continues to provide valuable and critical data, developing knowledge and understanding.<sup>16</sup> It allows society to address global challenges, such as climate change, while direct missions in space have continued to explore our solar system.<sup>17</sup> The U.K., in particular, has undertaken a lead role in communications while, debatably, often hiding key achievements under a bushel.<sup>18</sup> Evidencing this, a leading figure in the Moon landing of 1969 was in fact a Welsh engineer, Tecwyn Roberts, who played a role in designing the Mission Control Center at the National Aeronautics and Space Administration (NASA) Johnson Space Center in Houston, Texas, and creating NASA's worldwide tracking and communications network.<sup>19</sup> "Tecwyn created the Deep Space Communications Network,"<sup>20</sup> which was a network of satellites "that finally made Moon missions possible."<sup>21</sup> He was "one of the great unsung heroes of the space age."<sup>22</sup> Since this time, the U.K. has gone on to establish itself as a leading player in satellite technology,<sup>23</sup> which is a key enabler of national and global economies in advancing transport modes and systems, such as aviation, shipping and road modes, to saving lives at sea, on the

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<sup>15</sup> See *Marking World Space Week, UN Stresses Power of Space to 'Unite the World'*, UNITED NATIONS: UNNEWS (Oct. 4, 2018), <https://news.un.org/en/story/2018/10/1022292> [<https://perma.cc/JV7Y-X2SS>].

<sup>16</sup> See Phillip A. Slann, *Anticipating Uncertainty: The Security of European Critical Outer Space Infrastructure*, 35 SPACE POL'Y 6, 7 (2016).

<sup>17</sup> See *id.* at 6, 10, 12.

<sup>18</sup> See Douglas Millard, *A Review of UK Space Activity and Historiography, 1957–2007*, 66 ACTA ASTRONAUTICA 1291, 1293 (2010).

<sup>19</sup> *Rocket Man: Welsh Hero of NASA's Moon Landings*, UNIV. SOUTHAMPTON (July 17, 2019), <https://www.southampton.ac.uk/news/2019/07/tecwyn-roberts-nasa.page> [<https://perma.cc/844W-VJ2X>].

<sup>20</sup> *Id.*

<sup>21</sup> *Id.*

<sup>22</sup> Christina Mitchell, *NASA Goddard Honors an Apollo-era Pioneer, His Legacy*, NASA GODDARD (Nov. 15, 2019), <https://www.nasa.gov/feature/goddard/2019/honors-an-apollo-era-pioneer> [<https://perma.cc/SPL3-ZUCT>].

<sup>23</sup> See, e.g., *Working Collaboratively with the Space Sector for a More Sustainable Future*, MFG. TECH. CTR., <https://www.the-mtc.org/markets/space/> [<https://perma.cc/7A4X-AWBQ>]; *About Us*, SURREY SATELLITE TECH. LTD., <https://www.sstl.co.uk/about-us> [<https://perma.cc/DX57-VUHM>].

land, and in the air.<sup>24</sup> It has aided agriculture<sup>25</sup> and banking/financial transactions,<sup>26</sup> while of course, it remains an integral part of national security, which was inevitably an early and continuous driver for further space ventures.<sup>27</sup>

This said, very little has been written about the U.K.'s space policy; hence, this paper aims to explore the U.K.'s (past, present, and future) policy and involvement in space, including international cooperation, with particular commentary given to the aspirations of flight launches which is seeing a resurgence in the current National Space Strategy.

#### A. RESEARCH DESIGN—THE APPROACH

The research methodology is conducted through an interdisciplinary route, as is befitting for space—namely, a historical, socio-legal/political, law and policy approach—and it is primarily structured using a stepped and layered method. It is predominately a qualitative study, albeit with phenomenological undertones that show the causal linkage of today's civil space programs to a military and defense background. This includes discussions on international relationships and semi-quasi case studies (particularly in terms of the U.K.'s involvement with the European Space Agency) as part of the research design. The research commences by visiting the early years and the U.K.'s space-relations with other nations, before discussing the current position and policies, and the U.K.'s future aspirations in space. In essence, this takes a circular journey before returning to a key goal of space launches and protecting assets, whether in space or on the Earth.

The starting point for this goes back some ninety years (this year) to 1933 and the formation of a group made up of space enthusiasts, many with extensive engineering knowledge, who had

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<sup>24</sup> See, e.g., Global Future Council on Space Technologies 2019-2020, *Six Ways Space Technologies Benefit Life on Earth*, WORLD ECONOMIC FORUM 7 (Sept. 2020), [https://www3.weforum.org/docs/WEF\\_GFC\\_Six\\_ways\\_space\\_technologies\\_2020.pdf](https://www3.weforum.org/docs/WEF_GFC_Six_ways_space_technologies_2020.pdf) [<https://perma.cc/T3UY-RECG>]; *EU Space 4 Green and Digital Transition*, EUSPA (July 30, 2021), <https://www.euspa.europa.eu/newsroom/news/eu-space-4-green-and-digital-transition> [<https://perma.cc/9WSW-XGBD>].

<sup>25</sup> See, e.g., Global Future Council on Space Technologies, *supra* note 24, at 13.

<sup>26</sup> See, e.g., *UK Space Agency International Partnership Programme: Space for Finance in Developing Countries*, UK SPACE AGENCY (Jan. 2020), [https://www.spacefordevelopment.org/wp-content/uploads/2020/01/118601\\_UKSA\\_Finance-Report-2019\\_EL\\_v9.pdf](https://www.spacefordevelopment.org/wp-content/uploads/2020/01/118601_UKSA_Finance-Report-2019_EL_v9.pdf) [<https://perma.cc/X2RW-YM7Y>].

<sup>27</sup> See, e.g., *National Space Strategy in Action*, GOV.UK (July 19, 2023), <https://www.gov.uk/government/publications/national-space-strategy-in-action/national-space-strategy-in-action> [<https://perma.cc/9DHC-WV55>].

the hunger for seeing human spaceflight.<sup>28</sup> Since this time, there have been noticeable challenges and achievements, far too many to identify in one paper. Nevertheless, commentary is provided to key events at the start, so as to contextualize the journey and the current position.

Today, there is little doubt that the new race to space is shifting in terms of national players and private partnerships (and even private-public<sup>29</sup>) that transcend borders and boundaries of national jurisdiction, much in the same way that space also does. Space, once only the preserve of superpowers, is becoming increasingly commercialized and therefore is opening up further to new and evolving partnerships.<sup>30</sup> This said, space policies and national investments into space still sit at a State level.<sup>31</sup> Thus, despite the globally collaborative and cooperative approach transpiring amongst commercial entities, there will invariably continue to be global competitiveness.<sup>32</sup> Unvaryingly, this thirst to conquer space is a perpetual cycle—one of discovery and betterment; albeit, while it is postured at aiming to advance ‘all humankind,’ there, nevertheless, remains the constant risk of history repeating itself in terms of sovereign supremacy and protectionism, not only on Earth but also in space.<sup>33</sup>

Invariably, alongside the good use of space, in a civil context, there remains the potential for the misuse of space and space-related technologies.<sup>34</sup> There is little forgetting that the first space race was linked to a period of State mistrust and the threat of warfare, which could have easily escalated into the realms of space and space warfare.<sup>35</sup> Such is the legacy of space and the foundations for the present twenty-first century space race,<sup>36</sup> and while this is not the primary scope of this paper, comment is made at

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<sup>28</sup> See *History of the BIS*, BRITISH INTERPLANETARY SOCIETY, <https://www.bis-space.com/bis-history/> [https://perma.cc/Y4DL-YMZH].

<sup>29</sup> Cherry, *supra* note 1.

<sup>30</sup> See Chad Anderson, *Rethinking Public–Private Space Travel*, 29 SPACE POL’Y 266, 267 (2013).

<sup>31</sup> See Fox, *supra* note 4, at 10.

<sup>32</sup> See, e.g., *id.* at 12.

<sup>33</sup> See *id.* at 11.

<sup>34</sup> See, e.g., BLEDDYN E. BOWEN, *WAR IN SPACE: STRATEGY, SPACEPOWER, GEOPOLITICS* 1 (2020) (explaining the “realistic prospect” of space warfare).

<sup>35</sup> See Sarah Jane Fox, *Policing Mining: In outer-space Greed and Domination vs. Peace and Equity a Governance for Humanity!*, 64 RES. POL’Y 1, 5 (2019); Sarah Jane Fox, *Securing the “Space” Above Us: Reflections on the Past – to Consider Tomorrow’s Challenges . . . Today*, 22 ISSUES IN AVIATION L. AND POL’Y 35, 41–43 (2022).

<sup>36</sup> See Colin S. Gray, *The Influence of Space Power upon History*, 15 COMPAR. STRATEGY. 293, 294–96 (1996).

the commencement of this paper in terms of the linkage to the U.K.'s earlier pioneering days into space.<sup>37</sup> The reality being argued, that ultimately, there will never be a complete separation of space for purely a civil development purpose—certainly, that is, from a State perspective. And, as will be seen in the latter part of this paper, the U.K.'s current space strategy reflects, once more, this overlap.

Summarized, the flight path for this commentary is as follows:

*Section II:* Considers the U.K.'s early involvement and aspirations in space ventures. As part of this (*Part A*), the early linkage to defense is critically discussed, while *Part B* and *Part C* factor in the early collaborative years of the U.K. and the early policy approaches. *Part D*, then considers post-2010 and the establishment of the U.K. Space Agency.

*Section III:* Further discusses the relations of the U.K. with the European Space Agency (ESA), providing a *quasi*-case-study relating to ESA. This includes the history (*Part A*) and the operation of ESA (*Part B*).

*Section IV:* Considers the U.K. space sector today, with evidenced discussions given to the value of space to the U.K. economy (*Part A*) and to the present U.K. National Space Strategy. This section analyzes the linkage to defense and the arguably circular journey being taken by the U.K. in terms of aspirations and goals (*Part B*). Discussion is then given to the U.K. space launches and the intention to realize the past, current and future vision (*Part C*).

*Section V:* Serves to conclude this research paper.

## II. THE U.K.'S INVOLVEMENT IN SPACE

The U.K.'s aspiration in space far precedes man's ventures into space. As far back as 1933, the U.K. established what is recognized as the "world's longest established organisation" in the form of the British Interplanetary Society (BIS), which was "devoted solely to supporting and promoting the exploration of space and astronautics."<sup>38</sup> While the group had ambitions "of using rocket propulsion to fly to the Moon and other planets," it

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<sup>37</sup> Research and paper scope: the aspect of warfare and defense largely sits outside the scope of this paper, although some reference is made where necessitated (particularly relating to the early years of space development). See *infra* Part II.

<sup>38</sup> *Who We Are*, THE BRITISH INTERPLANETARY SOCIETY, <https://www.bis-space.com/about/> [https://perma.cc/QD2E-VVNT].



was interpreted that the word ‘interplanetary’ reflected the even longer vision, which was in interstellar space travel and hence, developments beyond our galaxy.<sup>39</sup>

#### A. THE IMPACT OF DEFENSE TO SPACE: THE U.K.’S EARLY YEARS

The war years were to scupper some of the aspirations of the U.K., even starving it of some of its pioneering and innovative goals, with the “[f]irst proposal to fund a British-manned suborbital space flight submitted to the government . . . [being] rejected due to limited funds following the Second World War.”<sup>40</sup> The BIS’s vision had been for a passenger carrying rocket called *Megaroc*, which was inspired by the German V2-rockets.<sup>41</sup> Had this plan been supported, it would have resulted in the U.K. playing much more than a supportive role in space travel, with predictions being that the rocket could have become a reality by the mid-1950s, and therefore could have led the space race.<sup>42</sup> Arguably, across a number of years there have been a number of missed opportunities for the U.K. to take more of a principal role in terms of space launches.<sup>43</sup> Nonetheless, it was the German V-2 rockets,<sup>44</sup> which were seized by the Allies, that served as the basis for the early American and Soviet rocket designs.<sup>45</sup>

The U.K.’s original space program later commenced in 1952.<sup>46</sup> This Program had the goal of developing the country’s economic potential linked to space, against the backdrop of the space-race between the USSR and the U.S.<sup>47</sup> This said, given the global uncertainties due to warfare and related threats, much of the British government’s initial interest in space was primarily

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<sup>39</sup> See *History of the BIS*, *supra* note 28.

<sup>40</sup> Kirstie Chambers Ros Moore, *Reaching for the Stars: The UK’s History in Space*, FORCES (July 18, 2019, 11:20 AM), <https://www.forces.net/news/reaching-stars-uks-history-space> [<https://perma.cc/DJ5E-45S2>].

<sup>41</sup> See *Megaroc*, THE BRITISH INTERPLANETARY SOCIETY, <https://www.bis-space.com/megaroc/> [<https://perma.cc/7QG5-ZM43>].

<sup>42</sup> See Hannah Baker, *Britain’s Space Race*, NAT’L SPACE CTR.: SPACE NOW BLOG (Apr. 17, 2019), <https://spacecentre.co.uk/blog-post/britains-space-race/> [<https://perma.cc/9ANY-X5CZ>].

<sup>43</sup> See, e.g., *id.*

<sup>44</sup> *Id.*; See generally *V-2 Missile*, NAT’L AIR AND SPACE MUSEUM, [https://airandspace.si.edu/collection-objects/missile-surface-surface-v-2-4/nasm\\_A19600342000](https://airandspace.si.edu/collection-objects/missile-surface-surface-v-2-4/nasm_A19600342000) [<https://perma.cc/3AK5-WFVZ>].

<sup>45</sup> Richard Hollingham, *V2: The Nazi Rocket That Launched the Space Age*, BBC FUTURE (Sept. 7, 2014), <https://www.bbc.com/future/article/20140905-the-nazis-space-age-rocket> [<https://perma.cc/MAJ6-MVYV>].

<sup>46</sup> Moore, *supra* note 40.

<sup>47</sup> *Id.*

military focused.<sup>48</sup> The U.K. was in fact the pioneer of “the world’s first geostationary defence communications satellite,” Skynet 1A, which was launched from Florida, on November 22, 1969.<sup>49</sup> Although it only operated successfully for a few years,<sup>50</sup> it “provided secure and encrypted facilities for the British armed forces and Government Communications Headquarters (GCHQ).”<sup>51</sup> Hence, from the early onset of space utilization defense was a primary motivator of investment.<sup>52</sup> Today, Skynet is arguably one of the most (if not the most) expensive British space projects, although as a military initiative it remains outside the civil space program.<sup>53</sup>

However, the first U.K. satellite to enter orbit occurred several years before, when on April 26, 1962, Ariel 1 was launched courtesy of the U.S., via NASA.<sup>54</sup> This established the U.K. as the third satellite-operating nation after the U.S. and USSR, and set the scene for the U.K. to become a leading nation in satellite development.<sup>55</sup> It also marked the successful and proactive U.K.-U.S. relationship in space.<sup>56</sup> However, Ariel 1 was short-lived, as on July 9th the satellite was accidentally destroyed by the U.S.<sup>57</sup> This incident showed the might of technologies emanating from warfare and the potential for misuse of not only the sky but, invariably, space.<sup>58</sup> The demise of Ariel 1 was due to Starfish Prime, which was a U.S. nuclear warhead detonated 250 miles above the Johnston Atoll, an island about 750 nautical miles southwest of Hawai’i in the

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<sup>48</sup> See *On This Day 22 November*, ROYAL SIGNALS MUSEUM, <https://www.royalsignalsmuseum.co.uk/on-this-day-22-november/> [<https://perma.cc/S875-33ZK>].

<sup>49</sup> *Id.*

<sup>50</sup> According to various reports, it was active/operational for a period of between 18–36 months. See *Skynet 1A, 1B*, GUNTER’S SPACE PAGE, [https://space.skyrocket.de/doc\\_sdat/skynet-1.htm](https://space.skyrocket.de/doc_sdat/skynet-1.htm) [<https://perma.cc/K4QL-KMTH>].

<sup>51</sup> ROYAL SIGNALS MUSEUM, *supra* note 48.

<sup>52</sup> *See id.*

<sup>53</sup> *British Space Programme*, ACAD. ACCELERATOR, <https://academic-accelerator.com/encyclopedia/british-space-programme> [<https://perma.cc/X5MR-K97N>].

<sup>54</sup> See *UK in Space: Ariel 1*, NAT’L SPACE CTR.: SPACE NOW BLOG (Apr. 26, 2022), <https://spacecentre.co.uk/blog-post/ariel-1/> [<https://perma.cc/UY6B-TTA4>].

<sup>55</sup> *See id.*

<sup>56</sup> Mai’a K. Davis Cross, *Space Security and the Transatlantic Relationship*, 10 POL. AND GOVERNANCE 134, 137 (2022). See generally Martin Machay & Vladimír Hajko, *Transatlantic Space Cooperation: An Empirical Evidence*, 32 SPACE POL’Y 37, 40 (2015).

<sup>57</sup> See *Ariel 1*, NASA SPACE SCIENCE DATA COORDINATED ARCHIVE, <https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1962-015A#:~:text=Ariel%201%20was%20launched%20from,at%2012%20to%2036%20rpm> [<https://perma.cc/7DLW-HU9F>].

<sup>58</sup> *See id.*

Pacific Ocean.<sup>59</sup> This correlates to approximately the same height as the International Space Station (ISS) orbits today, and it was one of the last and biggest high-altitude nuclear tests.<sup>60</sup> As well as destroying the U.K. satellite, the electromagnetic pulse also caused blackouts in Hawai'i and created a new artificial radiation belt.<sup>61</sup> This unexpected "Starfish belt" remained for at least ten years and was stronger than the scientists had anticipated.<sup>62</sup> As a consequence, it is said to have "destroyed Telstar 1, the first satellite to broadcast a live television signal."<sup>63</sup> Starfish Prime was in fact, "a 1.4 megaton bomb, [that was] 500 times as powerful as the one that fell on Hiroshima."<sup>64</sup> Such was the effect, that the next year the U.S., the U.K., and the USSR, signed the Limited Nuclear Test Ban Treaty.<sup>65</sup>

The Treaty:

- prohibited nuclear weapons tests or other nuclear explosions under water, in the atmosphere, or in outer space;
- allowed underground nuclear tests as long as no radioactive debris falls outside the boundaries of the nation conducting the test; and
- pledged signatories to work towards complete disarmament, an end to the armaments race, and an end to the contamination of the environment by radioactive substances.<sup>66</sup>

Internationally, it was thirty-three years before the United Nations General Assembly adopted the Comprehensive Nuclear Test Ban Treaty (CTBT), which extended the prohibition of all

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<sup>59</sup> *Id.*

<sup>60</sup> Brian Gutierrez, *Why the US Once Set off a Nuclear Bomb in Space*, NAT'L GEOGRAPHIC (July 16, 2021, 14:30 BST), <https://www.nationalgeographic.com/science/article/why-the-us-once-set-off-a-nuclear-bomb-in-space-called-starfish-prime> [<https://perma.cc/ME93-4ZS2>].

<sup>61</sup> *Id.*

<sup>62</sup> *Id.*

<sup>63</sup> *Id.* Telstar 1, launched on 10 July, 1962, was developed by the American Telephone and Telegraph Company (AT&T), who used the satellite to test basic features of communications via space. *Telstar*, SMITHSONIAN NAT'L AIR AND SPACE MUSEUM, [https://airandspace.si.edu/collection-objects/communications-satellite-telstar/nasm\\_A20070113000](https://airandspace.si.edu/collection-objects/communications-satellite-telstar/nasm_A20070113000) [<https://perma.cc/B2ZE-KWMX>].

<sup>64</sup> Gutierrez, *supra* note 60.

<sup>65</sup> This treaty was signed on August 5, 1963, in Moscow by U.S. Secretary Dean Rusk, Soviet Foreign Minister Andrei Gromyko, and British Foreign Secretary Lord Home—just one day short of the eighteenth anniversary of the dropping of an atomic bomb on Hiroshima. President Kennedy later signed the ratified the treaty on October 7, 1963. *See Nuclear Test Ban Treaty*, JOHN F. KENNEDY PRESIDENTIAL LIBRARY AND MUSEUM: JFK IN HISTORY, <https://www.jfklibrary.org/learn/about-jfk/jfk-in-history/nuclear-test-ban-treaty> [<https://perma.cc/N5NH-PLTC>].

<sup>66</sup> *Id.*

nuclear test explosions, including those conducted underground.<sup>67</sup> Though it was signed by U.S. President Bill Clinton, the Senate later rejected the CTBT by a vote of fifty-one to forty-eight.<sup>68</sup> This said, both the U.K. and the Russian Federation did ratify it.<sup>69</sup> Twenty-five years after the U.K. signed it,<sup>70</sup> it still has never entered into force, as it was not ratified by the forty-four nations specifically stated to be required.<sup>71</sup> Regardless, despite the failure to ratify, nuclear testing has *virtually* become unthinkable, both across the globe and in space, so arguably while the CTBT has not formally entered into force, the Treaty's primary goal of ending nuclear weapon test explosions had largely been achieved.<sup>72</sup> This said, in reality, there remains no guarantees of stopping future warfare, nuclear or otherwise, either on the Earth, or in space.

Against the backdrop of the fear of global and space warfare, international (United Nations) treaties relating to space started to emerge,<sup>73</sup> commencing with the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial bodies.<sup>74</sup> The U.K.

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<sup>67</sup> See Comprehensive Nuclear Test Ban Treaty, *opened for signature* Sept. 24, 1996, S. TREATY DOC. NO. 105-28 (1997).

<sup>68</sup> Bureau of Arms Control, *Comprehensive Nuclear Test Ban Treaty Signatories/Ratifiers Fact Sheet*, U.S. DEPT. OF STATE (Nov. 15, 2000), <https://1997-2001.state.gov/global/arms/factsheets/wmd/nuclear/ctbt/ctbtsigs.html> [<https://perma.cc/BGN5-M56W>]; *Senate Rejects Comprehensive Test Ban Treaty; Clinton Vows to Continue Moratorium*, ARMS CONTROL ASSOCIATION: ARMS CONTROL TODAY, <https://www.armscontrol.org/act/1999-09/press-releases/senate-rejects-comprehensive-test-ban-treaty-clinton-vows-continue> [<https://perma.cc/G8TW-TVYP>].

<sup>69</sup> *Comprehensive Nuclear Test Ban Treaty (CTBT)*, UNITED NATIONS: OFFICE FOR DISARMAMENT AFFAIRS, <https://disarmament.unoda.org/wmd/nuclear/ctbt/> [<https://perma.cc/K9RY-8EWM>].

<sup>70</sup> The treaty was signed by both the U.K. and France when the Treaty first opened for signature on September 26, 1996. Twenty-five years later, both nations came together again and issued a statement during the anniversary year. Foreign, Commonwealth, & Dev. Off., *Comprehensive Nuclear Test Ban Treaty 25<sup>th</sup> Anniversary: UK and France Statement*, UK.GOV (Apr. 6, 2023), <https://www.gov.uk/government/news/uk-france-statement-on-25th-anniversary-of-the-comprehensive-nuclear-test-ban-treaty> [<https://perma.cc/87SE-Y2KB>].

<sup>71</sup> See UNITED NATIONS: OFFICE FOR DISARMAMENT AFFAIRS, *supra* note 69.

<sup>72</sup> See *Treaty on the Prohibition of Nuclear Weapons*, UNITED NATIONS: OFFICE FOR DISARMAMENT AFFAIRS, <https://www.un.org/disarmament/wmd/nuclear/tpnw/> [<https://perma.cc/6GY4-LAH5>].

<sup>73</sup> See Fox, *supra* note 35, at 3; Fox, *supra* note 4, at 10; Mai'a K. Davis Cross, *Outer Space and the Idea of the Global Commons*, 35 INT. RELATIONS, 3, 384–402 (2021).

<sup>74</sup> Adoption by the General Assembly 19 December 1966. Opened for signature: January 27, 1967, in London, Moscow and Washington. Entry into force October 10, 1967. See Vladimír Kopal (Chairman, Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space), *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies* (2008).

became an early signatory of this Treaty and in total has gone on to ratify four of the five core treaties (with the exception of the 1979 Agreement Governing the Activities of States on the Moon and other Celestial Bodies), and, in essence, this served as the foundation for national developments.<sup>75</sup>

#### B. U.K.—INTERNATIONAL COLLABORATION

The U.K. continued to have no launch capability of its own in the country, and in the period of 1962–1980, while the U.K. launched a further five satellites, this was facilitated by NASA as part of the earlier mentioned Ariel program.<sup>76</sup>

Alongside the U.K.'s successful working relationship with the U.S. in space, it also had early collaborative ventures with Australia as part of its SKYLARK project.<sup>77</sup> “Skylark originated in 1955 when the Royal Society embarked on a programme of upper atmosphere research associated with the International Geophysical Year of 1957/58.”<sup>78</sup> The Skylarks were later produced in Britain and flown to Australia for final assembly, testing, and launching, with launch facilities being established at the existing Woomera missile range in Australia.<sup>79</sup> It was the Skylark space rocket, in fact, that is said to have “really laid the foundations for everything the U.K. does in space” today.<sup>80</sup> Though, again, it also showed the clear connect of civil and military use of space, while also aiding the development of the U.K.'s Blue Streak nuclear missile program.<sup>81</sup> While Blue Streak started as a top-secret

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<sup>75</sup> See *Participants in Disarmament Treaties: United Kingdom of Great Britain and Northern Ireland*, UNITED NATIONS OFFICE OF DISARMAMENT AFFAIRS TREATIES DATABASE, <https://treaties.unoda.org/a/npt/unitedkingdomofgreatbritainandnorthernireland/RAT/london> [<https://perma.cc/9DVY-6AYL>].

<sup>76</sup> See *U.K. in Space: Ariel 1*, *supra* note 54.

<sup>77</sup> See Kaye Dee, [January 8, 1965] *The Skylark of Space (Britain's Skylark Sounding Rocket)*, GALACTIC JOURNEY (Jan. 8, 2020) <http://galacticjourney.org/january-8-1965-the-skylark-of-space-britains-skylark-sounding-rocket/> [<https://perma.cc/9XPZ-8FQ2>].

<sup>78</sup> Physics&Astronomy, *Introducing Skylark*, PHYSICS&ASTRONOMYBLOG (Oct. 26, 2020), <https://staffblogs.le.ac.uk/physicsastronomy/2020/10/26/introducing-skylark/> [<https://perma.cc/G999-Y9ES>].

<sup>79</sup> Kerry Dougherty, *Australia's Unique Space History*, ROOM (2017), <https://room.eu.com/article/australias-unique-space-history> [<https://perma.cc/JXW7-LMM4>].

<sup>80</sup> Jonathan Amos, *Skylark: The Unsung Hero of British Space*, BBC NEWS (Nov. 13, 2017), <https://www.bbc.co.uk/news/science-environment-41945654> [<https://perma.cc/836J-9NPU>]; See also CHARLES, N. HILL, *A VERTICAL EMPIRE: THE HISTORY OF THE UK ROCKET AND SPACE PROGRAMME, 1950–1970* 14 (2011).

<sup>81</sup> See The Cent. Off. of Info., *The Blue Streak Rocket*, NAT'L ARCHIVES (May 10, 2006), <https://media.nationalarchives.gov.uk/index.php/the-blue-streak-rocket/> [<https://perma.cc/932T-XZ72>].

military program, whereby Britain and the U.S. forged a plan to develop missiles that could reach targets within the Soviet Union, it was later successfully adapted as a means to launch satellites from Woomera.<sup>82</sup> In fact, Blue Streak turned out to be a highly successful rocket program, performing as planned for eleven successful launches.<sup>83</sup> Few rockets had achieved such successes during the early stages of development, and Blue Streak's record was comparable to the success rate of the more well-known Saturn V rocket.<sup>84</sup> Despite these accomplishments, history has tended to minimize the achievements of Blue Streak.<sup>85</sup>

Woomera also served as the location for the 1971 launch of a British rocket, under the auspices of the Black Arrow Program (also the name of the rocket), which successfully put a satellite, 'Prospero,' into orbit.<sup>86</sup> Although this launch marked Britain's first successful satellite launch by its own system, it also arguably marked the end of the country's ambitions to be a major player in the space industry, certainly in terms of a launch capability.<sup>87</sup> There is little doubt that the decision was both politically and economically motivated, and this subsequent loss of appetite arguably resulted in another opportunity being missed.<sup>88</sup>

However, the 1970s also saw the U.K. teaming up with nine other nations to form the European Space Agency (ESA),<sup>89</sup> which marked the next era of State collaboration. As part of these joint-collaborative ventures, the U.K. was able to utilize much of its earlier launch (rocket) technologies.<sup>90</sup> Hence in many ways, the U.K. has always managed to keep a foot in many geographical

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<sup>82</sup> Hannah Baker, *Blue Streak – Success, Failure and . . . Extraterrestrials?*, NATIONAL SPACE CENTRE: NOW BLOG (May, 24, 2017), <https://www.spacecentre.co.uk/news/space-now-blog/blue-streak-success-failure-and-extraterrestrials/> [https://perma.cc/QH48-YCF7].

<sup>83</sup> *Id.*

<sup>84</sup> *Id.*

<sup>85</sup> *Id.*

<sup>86</sup> Deploying Prospero was the last in a series of four missions for the Black Arrow program. This included two suborbital tests and a failed orbital launch attempt before the successful launch, which took place at 04:09 UTC on October 28, 1971. William Graham, *On the 50<sup>th</sup> Anniversary of Black Arrow, British Space Industry is on the Verge of a Return*, NASA SPACE FLIGHT (Oct. 28, 2021), <https://www.nasaspacesflight.com/2021/10/50th-anniversary-black-arrow/> [https://perma.cc/7FCY-CHVY].

<sup>87</sup> *See id.*

<sup>88</sup> *See id.*

<sup>89</sup> *History of Europe in Space*, THE EUR. SPACE AGENCY, [https://www.esa.int/About\\_Us/ESA\\_history/History\\_of\\_Europe\\_in\\_space#:~:text=1975%20ESA%20is%20created%20in,%2C%20Sweden%2C%20Switzerland%20and%20Spain](https://www.esa.int/About_Us/ESA_history/History_of_Europe_in_space#:~:text=1975%20ESA%20is%20created%20in,%2C%20Sweden%2C%20Switzerland%20and%20Spain) [https://perma.cc/CYV2-LPFN].

<sup>90</sup> *See, e.g., id.*

camp in order to advance its aspirations and pursuits into space, and to use the resources of other nations for space launches of its own evolving technologies.<sup>91</sup> The early U.K. strategies also clearly reinforced the fact that space development necessitates closer working between nations and demands the financial means beyond any single entity.<sup>92</sup>

### C. THE 1980S AND BEYOND—THE NEXT GENERATION

In the early 1980s, the Space Division of the Department of Trade and Industry were tasked by the government to establish an ad hoc committee to assess how U.K. space activities should be organized, and to make recommendations for structuring it.<sup>93</sup> By 1985, this served to form the British National Space Centre (BNSC) which continued to coordinate national and international space activities.<sup>94</sup> However, the formulation was different to other space agencies, the obvious being NASA, inasmuch as it had a number of rotational staff from other government departments.<sup>95</sup> Thus, BNSC worked in partnerships with various British government departments and agencies, which also aided in illustrating the cross-over of policies and platforms that space is ultimately concerned with or connected to—including defense.<sup>96</sup> The civil portion of the space program was centered around space science, Earth observation, satellite telecommunications, and global navigation.<sup>97</sup> However, this structure also resulted in a number of failings and invariably served as a disabler for rapid advancement.<sup>98</sup>

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<sup>91</sup> See, e.g., *id.*

<sup>92</sup> See, e.g., *id.*

<sup>93</sup> Millard, *supra* note 11.

<sup>94</sup> *Id.*

<sup>95</sup> However, others existed, such as Canada (CSA), Germany (DLR), Japan (JAXA) and India (ISRO). See SELECT COMM. ON SCI. AND TECH., SEVENTH REPORT, THE BNSC, 2006–07, ¶ 47.

<sup>96</sup> Initially beginning with four partners, DTI, MoD, NERC, and the Science and Engineering Research Council, by 2003, its membership had grown to ten partners who were interested in various aspects of space: The Science and Technology Research Council (STFC), the Natural Environment Research Council (NERC), the Department for Innovation, Universities and Skills (DIUS), the Met Office, the Ministry of Defence (MoD), the Department for Transport (DfT), the Foreign and Commonwealth Office (FCO), and the Department for Environment, Food and Rural Affairs (Defra). *Id.* ¶ 35.

<sup>97</sup> See *id.* ¶¶ 65, 83.

<sup>98</sup> See SELECT COMM. ON SCI. AND TECH., SEVENTH REPORT, INTRODUCTION, 2006–07 ¶ 13.

Following an inquiry into space, a report to the House of Commons (HoC) (Science and Technology Committee<sup>99</sup>) in 2007 levied criticism at the organization or, rather, partnership structure of the BNSC, and the issues that (i) it failed to have a budget of its own, and (ii) lacked an obvious domestic program.

While the inquiry focused on the civil rather than military uses of space, there was an increasing overlap between the uses of space for civil and military purposes, and many spacecraft technologies and applications were capable of being used in both sectors.<sup>100</sup> Reinforcement was also made to the fact that “[s]pace matters. Year by year, it forms an ever-greater part of everyone’s life.”<sup>101</sup>

There was also evidence presented of growing support by the U.K. public for more involvement in direct space endeavors.<sup>102</sup> Particularly referred to was the BBC’s<sup>103</sup> findings from June 2005, which captured the population’s views on human exploration to the Moon and Mars.<sup>104</sup> Of the 20,000 responses with comments, 61% confirmed that they were in favor of such ventures, while 26% identified that there were against.<sup>105</sup> For those expressing a negative stance, their views related to the investment needed for space pursuits, which was argued could be spent on the National Health Service (NHS) and tackling poverty in Africa.<sup>106</sup> At the time, indications were that the government spent just 0.038% of its overall budget on space.<sup>107</sup> In 2005–06 this equated to approximately £207.61 million being spent on space activities<sup>108</sup> (Table 1: investment in space – 1992–2006).

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<sup>99</sup> See *id.* ¶ 14.

<sup>100</sup> *Id.* ¶ 6.

<sup>101</sup> *Id.* ¶ 12; BRIT. NAT’L SPACE CTR., *A Consultation on the UK Civil Space Strategy 2007-2010*, at 2 (foreword by Malcolm Wicks, Minister for Science and Innovation).

<sup>102</sup> See SELECT COMM. ON SCI. AND TECH., *supra* note 98, ¶ 13.

<sup>103</sup> A television channel in the U.K.

<sup>104</sup> SELECT COMM. ON SCI. AND TECH., *supra* note 98, ¶ 13.

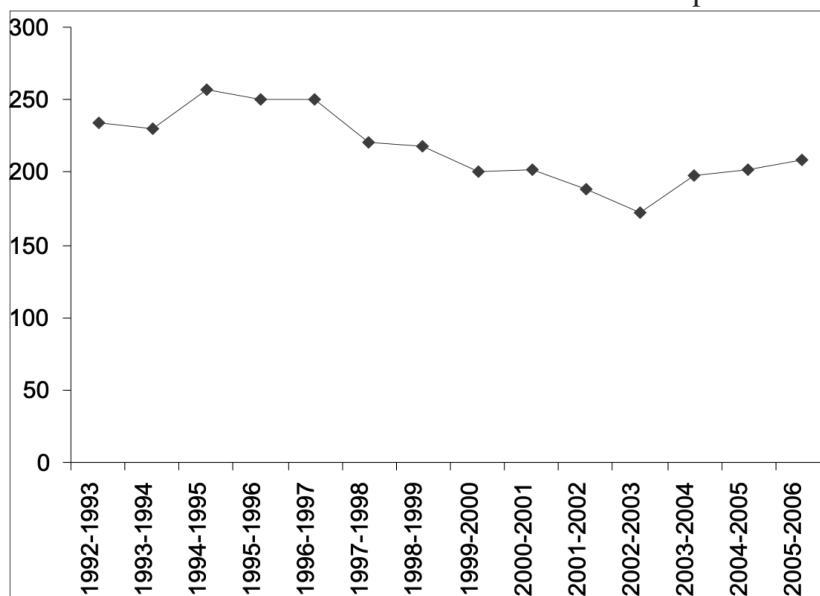
<sup>105</sup> *Id.*

<sup>106</sup> *Id.*

<sup>107</sup> *Id.* ¶ 14.

<sup>108</sup> *Id.*



**Table 1: U.K. Government Investment in Space<sup>109</sup>**

1987. Decisions at the ESA Ministerial Council in The Hague in November 1987 meant the U.K. did not join the programmes to develop Ariane 5 (as a manned launcher) and Hermes (a human-rated spaceplane).<sup>110</sup> Of note, “The 1987 House of Lords Science and Technology Select Committee report stated that the ‘Committee’s view [was] that for the foreseeable future space could offer enough opportunity to telecontrolled craft to make the involvement of man an expensive as well as a hazardous diversion.’”<sup>111</sup>

This said, in 1991 Helen Sharman<sup>112</sup> made history for a number of reasons when she became the first British astronaut and first Western European woman to enter space, spending eight days orbiting the Earth, her ventures into space being facilitated by a Russian Soyuz spacecraft.<sup>113</sup> However, this was not due to a

<sup>109</sup> See SELECT COMM. ON SCI. AND TECH., SEVENTH REPORT, CIVIL SPACE POLICY IN THE UK, 2006–07, ¶ 16.

<sup>110</sup> Rupert C. Wilmouth & Raj Sivalingam, *The New UK Civil Space Strategy, 2008–2012*, 24 SPACE POL’Y 90, 92 (2008).

<sup>111</sup> *Id.*

<sup>112</sup> See generally *Welcome*, HELEN SHARMAN CMG OBE: THE FIRST BRITISH ASTRONAUT, <https://www.helensharman.uk> [<https://perma.cc/W72V-R36K>].

<sup>113</sup> Tamela Maciel, *Helen Sharman – Britain’s First Astronaut*, NAT’L SPACE CTR.: SPACE NOW BLOG (May 17, 2017), <https://spacecentre.co.uk/blog-post/helen-sharman-britains-first-astronaut/> [<https://perma.cc/WB55-U92C>].

national program, rather, it was due to private funding.<sup>114</sup> Project Juno was the name given to this cooperative Soviet-British mission co-sponsored by a group of British companies.<sup>115</sup> In many ways, this marked, for the U.K., a significant turning point in terms of further collaboration and private space partnerships.<sup>116</sup>

The final version of the U.K. civil space strategy, under the auspices of the BNSC, was published in 2008, and ironically, it outlined the goals of BNSC by providing clarity as to its vision and ambition for space.<sup>117</sup> Wilmouth and Sivalingam, writing on the implications of the then “*new strategy*,” identified that space contributed “around £7 billion a year and 70,000 jobs to the U.K. economy” at that time.<sup>118</sup> This said, it was increasingly voiced that reconstruction for space activities was needed in the U.K., with advocates arguing for the creation of an ‘agency’ instead of the inefficient BNSC partnership approach.<sup>119</sup>

Significantly, it was identified that an agency, alongside structural revisions, was needed in order to ensure that the U.K. remained, or more accurately became, a leading player in space moving forward.<sup>120</sup> The call for a re-think was premised largely on the ability of an agency to have increased power; greater visibility; a centralized budget; the capability to make longer term investments centered around a single strategy; and ultimately, control with decision-making.<sup>121</sup> The agency would therefore also serve as a hub for national and international activities, providing a strengthened presence and carrying greater sway at the international negotiating table.<sup>122</sup>

Some three years later, in 2010, follow-on discussions at the House of Commons (Science and Technology Committee) identified the progress that had been made across the previous few years.<sup>123</sup> This included ESA stationing activities at Harwell, Oxfordshire, and the development of the new agency for space in the form of the *U.K. Space Agency*.<sup>124</sup> This said, despite this pro-

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<sup>114</sup> *See id.*

<sup>115</sup> *Id.*

<sup>116</sup> *See id.*

<sup>117</sup> *See* Wilmouth & Sivalingam, *supra* note 111, at 90.

<sup>118</sup> *Id.* at 91.

<sup>119</sup> *See* SELECT COMM. ON SCI. AND TECH., *supra* note 95, ¶¶ 47–48.

<sup>120</sup> *See* Sci. and Tech. Comm., Memorandum Submitted by the Dept. For Business, Innovation, and Skills (UKSA 00), 2010, ¶¶ Key Points, 1.

<sup>121</sup> *See id.* ¶¶ Key Points, 1, 13.

<sup>122</sup> *See id.* ¶¶ 4, 7.

<sup>123</sup> *See id.* ¶ 7.

<sup>124</sup> *See infra* Part III. B.

gression, the earlier 2008–2012 approach still remained in place, which perhaps served as an inhibitor in terms of taking this new, (U.K.) Space Agency forward.

#### D. THE U.K. SPACE AGENCY

The U.K. Space Agency<sup>125</sup> was officially launched on March 23, 2010 and became a full executive agency of the then-Department of Business, Innovation and Skills on April 1, 2011.<sup>126</sup> From then on, the responsibility for all space activities was transferred away from the former departments and bodies to the U.K. Space Agency.<sup>127</sup> This policy shift served to reinforce the U.K.'s interest in playing a further, and more significant, role within Europe.<sup>128</sup> It was therefore, not viewed as an isolated step, but was taken in parallel to the increased commitment of the U.K. to the ESA programs, in particular, regarding the exploration plans to Mars (as stated at the 2008 Ministerial Council).<sup>129</sup> Alongside this, the U.K. additionally reiterated its strong support to the public-private collaborative approach in space telecommunications, which related also to the U.K.-ESA partnership in the Harwell Centre.<sup>130</sup>

There is no denying that the U.K. space sector was re-energized, with a clearer vision being established around the time of the launch of the U.K. Space Agency.<sup>131</sup> No doubt, the fact that Tim Peake, from the U.K., joined ESA in 2009 and commenced his training to become an astronaut, also provided an added incentive to do so.<sup>132</sup> This said, his voyage into space was far from guaranteed at that point—as Tim explained in his recent autobiography—due to the political implications of the U.K., not (at that time) contributing to the ISS.<sup>133</sup> In effect, Tim actively pursued an ambassador role, encouraging the U.K. to increase its activities in optional programs.<sup>134</sup> In November 2012, David Willetts, the then Minister for Universities and Science, finally announced, at

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<sup>125</sup> See generally U.K. SPACE AGENCY, <https://www.gov.uk/government/organisations/uk-space-agency> [<https://perma.cc/HC6L-3SZY>].

<sup>126</sup> *United Kingdom Space Agency (UK Space Agency)*, ESA: ENABLING & SUPPORT, [https://www.esa.int/Enabling\\_Support/Space\\_Engineering\\_Technology/United\\_Kingdom\\_Space\\_Agency\\_UK\\_Space\\_Agency](https://www.esa.int/Enabling_Support/Space_Engineering_Technology/United_Kingdom_Space_Agency_UK_Space_Agency) [<https://perma.cc/FZ3U-FAK6>].

<sup>127</sup> *Id.*

<sup>128</sup> *See id.*

<sup>129</sup> *See* INT'L SPACE EXPL. COORDINATION GRP., 2008 ANNUAL REPORT 28 (Mar. 2009).

<sup>130</sup> *See infra* Part III. B.

<sup>131</sup> *See, e.g.*, Sci. and Tech. Comm., *supra* note 121, ¶¶ Key Points, 1, 5.

<sup>132</sup> *See generally* Tim Peake, *LIMITLESS* (2020).

<sup>133</sup> *Id.*

<sup>134</sup> *Id.*

the European Space Agency's (ESA) Ministerial Council in Naples, the outcome of negotiations and the U.K.'s commitment to space endeavors.<sup>135</sup> This included the U.K. strengthening its role in a number of areas, including telecommunications and Earth observation satellites.<sup>136</sup> In fact, what this translated to was £240 million per year over the next five years, which was split between ESA's mandatory program and 10 other optional programs, including a one-off contribution to the ISS (a £16 million investment) as part of the negotiations on the Orion Multi-Purpose Crew Vehicle (MPCV).<sup>137</sup>

It was identified that the optional programs selected were specifically chosen as a means to maximize the economic growth to the U.K., allowing for significant business expansion through future orders and thus creating a stronger space sector—which included exports overseas.<sup>138</sup> Other linked factors identified related to increase opportunities (and ideally a lead role) in economic services development, aspects of robotic exploration—such as space nuclear power and robotics—and climate studies using space data.<sup>139</sup> There was also the belief that this investment would “secure around £1 billion of orders per year for British businesses and lay the foundations for the U.K. to deliver its ambition to have a £30 billion space industry by 2030.”<sup>140</sup> However, when the U.K. ultimately decided to further invest in space, the relationship with its European neighbors was noticeably different, and it remains questionable just how much the decision to leave the European Union (EU) has affected the U.K.'s vision for space, particularly its ability to trade with partners.<sup>141</sup> While the U.K. Space Agency continues to have responsibility for managing the U.K.-ESA relationship, the U.K.-EU relationship—across space and allied activities—has arguably been impacted by Brexit (the UK's withdrawal from the European Union).<sup>142</sup>

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<sup>135</sup> Dept. for Bus., Innovation, & Skills, *UK Secures £1.2 Billion Package of Space Investment*, Gov.UK (Nov. 21, 2012), <https://www.gov.uk/government/news/uk-secures-1-2-billion-package-of-space-investment> [<https://perma.cc/L7PN-HJ3W>].

<sup>136</sup> *Id.*

<sup>137</sup> *Id.*

<sup>138</sup> See *infra* Part III. B.

<sup>139</sup> See Dept. for Bus., Innovation, & Skills, *supra* note 137.

<sup>140</sup> *Id.*

<sup>141</sup> See *id.*

<sup>142</sup> *Id.*; Jill Lawless & Raf Casert, *Britain Leaves the European Union, Leaps into the Unknown*, AP News (Jan. 31, 2020, 5:36 PM), <https://apnews.com/article/brexit-ap-top-news-london-boris-johnson-international-news-e48bf51838ced94e2d92ad-ba189b4944> [<https://perma.cc/SP9G-YC8E>]. The U.K. public voted, in a referendum on June 23, 2016, to leave the European Union and, as a consequence, the United Kingdom withdrew from the European Union at 23:00 GMT on January 31, 2020. *Id.*

### III. RELATIONS: THE EUROPEAN SPACE AGENCY AND THE U.K.

#### (A QUASI-CASE-STUDY)

Despite no longer being a member of the EU, the U.K. remains a member of ESA.<sup>143</sup> This is because the ESA is not a body of the EU, but is in fact independent of it, although the EU does contribute to the ESA.<sup>144</sup>

#### A. HISTORY

The ESA remains a significant element of the U.K.'s commercial space program.<sup>145</sup> The foundations of the ESA are traceable back to the 1960s—prior to the U.K. and many other European countries joining the EU.<sup>146</sup> In effect, the ESA was formed from the merger of the earlier created European Launcher Development Organization (ELDO) and the European Space Research Organization (ESRO).<sup>147</sup> This was in accordance with the “Resolution adopted by the European Space Conference on 20 December 1972 and confirmed by the European Space Conference on 31 July 1973.”<sup>148</sup> The Resolution ensured “that a new organisation, called the ‘European Space Agency’, would be formed out of the European Space Research Organisation [ESRO] and the European Organisation for the Development and Construction of Space Vehicle Launchers,” with the aim of integrating the European national space programs into a European space program.<sup>149</sup> However, this did not mean that nations with their own space programs would cease activities, instead it was seen as a complementary means for closer collaboration.<sup>150</sup>

This said, even before the formation of the ESA, the U.K. had worked collaboratively with several European Nations—including Germany and Italy—as well as Australia on a project

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<sup>143</sup> *Current ESA Member States*, ESA, [https://www.esa.int/Education/Current\\_ESA\\_Member\\_States](https://www.esa.int/Education/Current_ESA_Member_States) [<https://perma.cc/V2BE-BAMZ>].

<sup>144</sup> *See ESA and the EU*, EUROPEAN SPACE AGENCY, [https://www.esa.int/About\\_Us/Corporate\\_news/ESA\\_and\\_the\\_EU](https://www.esa.int/About_Us/Corporate_news/ESA_and_the_EU) [<https://perma.cc/Z2XE-4EDH>].

<sup>145</sup> *See, e.g., Launch UK: Leading the Commercial Space Age*, LAUNCH UK, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1151020/LaunchUK\\_18.4.23v2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1151020/LaunchUK_18.4.23v2.pdf) [<https://perma.cc/W7P9-X5MD>].

<sup>146</sup> *See History of Europe in Space*, *supra* note 89.

<sup>147</sup> *Id.*

<sup>148</sup> Convention for the Establishment of a European Space Agency, *opened for signature* May 30, 1975, 1297 U.N.T.S. 343, 11 (entered into force Oct. 30, 1980).

<sup>149</sup> *Id.*

<sup>150</sup> *See History of Europe in Space*, *supra* note 89.

which stemmed back to 1961 and had seen Blue Streak (later Black Arrow) technology being utilized in the 'Europa' rocket initiative undertaken by the European Launcher Development Organization (ELDO).<sup>151</sup>

The ESA provides an innovative structure for nations to coordinate, and it reinforces the value and need for cooperative civil ventures in space.<sup>152</sup> It was, "[o]n 30 May 1975, that the [ESA] Convention was signed by: the Federal Republic of Germany, the Kingdom of Belgium, the Kingdom of Denmark, Spain, the French Republic, the Italian Republic, the Kingdom of the Netherlands, the United Kingdom of Great Britain and Northern Ireland, the Kingdom of Sweden, and the Swiss Confederation," with it entering into force on October 30, 1980.<sup>153</sup> The ESA was established with the overarching goal of promoting the peaceful exploration and use of space for the benefit of humankind, while today, the focus is on pushing the frontiers of science and technology and promoting economic growth in Europe.<sup>154</sup>

Over the course of time, new countries became involved in ESA activities either as members or via other agreements (Table 2).<sup>155</sup> Predominately, these remain European countries, although not necessarily full members of the EU.<sup>156</sup> Currently, the ESA has twenty-two Member States (MS) with the national bodies responsible for space in each of these countries sitting on the ESA's governing Council.<sup>157</sup> These being, "Austria, Belgium,

<sup>151</sup> See Jean-Jacques Serra, *Europa Launchers*, [http://www.sat-net.com/serra/europa\\_e.htm](http://www.sat-net.com/serra/europa_e.htm) [<https://perma.cc/XKN3-R56C>].

<sup>152</sup> See Convention for the Establishment of a European Space Agency, *supra* note 150, at 11–12.

<sup>153</sup> Along with these countries, the Convention was signed by Ireland, later that year, on December 31, 1975. Eur. Space Agency, *ESA Convention*, ESA: LAW AT ESA, [https://www.esa.int/About\\_Us/Law\\_at\\_ESA/ESA\\_Convention](https://www.esa.int/About_Us/Law_at_ESA/ESA_Convention) [<https://perma.cc/YD4Y-EL47>].

<sup>154</sup> *This is ESA*, EUROPEAN SPACE AGENCY, [https://www.esa.int/About\\_Us/ESA\\_Publications/This\\_is\\_ESA](https://www.esa.int/About_Us/ESA_Publications/This_is_ESA) [<https://perma.cc/PCJ2-SRYT>].

<sup>155</sup> See, e.g., *Member States and Cooperating States*, EUROPEAN SPACE AGENCY, [https://www.esa.int/About\\_Us/Corporate\\_news/Member\\_States\\_Cooperating\\_States](https://www.esa.int/About_Us/Corporate_news/Member_States_Cooperating_States) [<https://perma.cc/T9FR-JNDZ>].

<sup>156</sup> See, e.g., *The European Economic Area (EEA), Switzerland and the North*, EUR. PARLIAMENT, <https://www.europarl.europa.eu/factsheets/en/sheet/169/the-european-economic-area-eea-switzerland-and-the-north> [<https://perma.cc/R8AF-T4GP>] ("The European Economic Area (EEA) was set up in 1994 to extend the EU's provisions on its internal market to the European Free Trade Area (EFTA) countries. The EEA's parties are Norway, Iceland, and Liechtenstein. Switzerland is a member of EFTA but does not take part in the EEA.")

<sup>157</sup> *ESA Astronaut Patch in Space*, EUROPEAN SPACE AGENCY (Sept. 21, 2017), [https://www.esa.int/ESA\\_Multimedia/Images/2022/10/ESA\\_astronaut\\_patch\\_in\\_space](https://www.esa.int/ESA_Multimedia/Images/2022/10/ESA_astronaut_patch_in_space) [<https://perma.cc/R96N-2BRG>].

Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland and the United Kingdom.”<sup>158</sup>

**Table 2:** The current members of ESA<sup>159</sup>

Country	Date of deposit of instruments of ratification
Sweden	April 6, 1976
Switzerland	November 19, 1976
Germany	July 26, 1977
Denmark	September 15, 1977
Italy	February 20, 1978
United Kingdom	March 28, 1978
Belgium	October 3, 1978
Netherlands	February 6, 1979
Spain	February 7, 1979
France	October 30, 1980
Ireland	December 10, 1980
Austria	December 30, 1986
Norway	December 30, 1986
Finland	January 1, 1995
Portugal	November 14, 2000
Greece	March 9, 2005
Luxembourg	June 30, 2005
Czech Republic	November 12, 2008
Romania	December 22, 2011
Poland	November 19, 2012
Estonia	September 1, 2015
Hungary	November 4, 2015

Noticeably, outside of the European countries, “Canada also sits on the Council and takes part in some projects under a Cooperation Agreement.”<sup>160</sup> In addition to this, four other EU states have Cooperation Agreements with the ESA—these being, Bulgaria, Croatia, Cyprus and Malta.<sup>161</sup> While Slovakia,

<sup>158</sup> *Id.*

<sup>159</sup> *ESA Convention, supra* note 155 (Current as of Jan. 2023).

<sup>160</sup> *Member States and Cooperating States*, EUROPEAN SPACE AGENCY, [https://www.esa.int/About\\_Us/Corporate\\_news/Member\\_States\\_Cooperating\\_States](https://www.esa.int/About_Us/Corporate_news/Member_States_Cooperating_States) [<https://perma.cc/ST9M-7G9J>].

<sup>161</sup> *Id.*

Slovenia, Latvia, and Lithuania are regarded as Associate Members.<sup>162</sup> Hence, the ESA has also “established formal cooperation with all Member States of the European Union that are not ESA members,” and has extended this further outside of the European continent.<sup>163</sup> In this way, the U.K.’s space relationship with other nations is extended and also leads to various nations coordinating more closely on projects under the auspices of the ESA umbrella, as well as aside to it.<sup>164</sup>

## B. HOW ESA OPERATES

The ESA’s foundations were based on its peaceful use of space and its collaborative approach, and related projects have historically typified this in terms of civilian perspective.<sup>165</sup> This said, the newly launched (2022) *Civil Security for Space* approach, which is aimed at supporting efforts to “monitor, mitigate and resolve civil security and crisis events from space to keep people, infrastructures and resources safe on Earth,” reflects some of the challenges both on Earth and in space.<sup>166</sup> Invariably, it once again identifies some of the difficulties of separating space into two distinct areas—namely, as a space for (i) civil and (ii) defense purposes.<sup>167</sup>

The ESA’s headquarters are located in Paris,<sup>168</sup> where it decides its policies and programs, while the ESA also has sites in a number of European countries, each of which has different responsibilities such as ECSAT, the European Centre for Space Applications and Telecommunications, in Harwell, Oxfordshire, (U.K.).<sup>169</sup> Additionally, the ESA also has liaison offices in Belgium (Europe) and further afield in the U.S. and Russia.<sup>170</sup> It also has a launch base in French Guiana and ground/tracking stations in various parts of the world.<sup>171</sup>

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<sup>162</sup> *Id.*

<sup>163</sup> *See id.*

<sup>164</sup> *See id.*

<sup>165</sup> *See id.*

<sup>166</sup> *See* Eur. Space Agency, *Civil Security for Space, CONNECTIVITY & SECURE COMMUNICATIONS*, <https://artes.esa.int/civil-security-space> [<https://perma.cc/D5WP-7945>].

<sup>167</sup> *See id.*

<sup>168</sup> *ESA’s New Headquarters*, EUROPEAN SPACE AGENCY (Mar. 22, 2023), [https://www.esa.int/ESA\\_Multimedia/Videos/2023/03/ESA\\_s\\_new\\_headquarters#:~:text=After%20five%20years%20of%20intensive,Mario%20Niki%20in%20Paris%2C%20France](https://www.esa.int/ESA_Multimedia/Videos/2023/03/ESA_s_new_headquarters#:~:text=After%20five%20years%20of%20intensive,Mario%20Niki%20in%20Paris%2C%20France) [<https://perma.cc/6HGE-9SKV>].

<sup>169</sup> *ESA ECSAT*, EUROPEAN SPACE AGENCY, [https://www.esa.int/About\\_Us/Corporate\\_news/ESA\\_ECSAT](https://www.esa.int/About_Us/Corporate_news/ESA_ECSAT) [<https://perma.cc/C6HV-V6PY>].

<sup>170</sup> *ESA Facts*, EUROPEAN SPACE AGENCY, [https://www.esa.int/About\\_Us/Corporate\\_news/ESA\\_facts](https://www.esa.int/About_Us/Corporate_news/ESA_facts) [<https://perma.cc/JQF2-QBPE>].

<sup>171</sup> *Id.*



Working with its MS's, the ESA coordinates "the financial and intellectual resources of its members."<sup>172</sup> The ESA clearly accords recognition to the fact, that it is advantageous and necessary to directly lead coordinated programs and activities which extend beyond the scope of any one European country or entity.<sup>173</sup> As was recognized since its inception, and stated within the Preamble to the Convention, it is appreciated that, "the magnitude of the human, technical and financial resources required for activities in the space field is such that these resources lie beyond the means of any single European country."<sup>174</sup>

The ESA's governing body is the "Council" which "provides the basic policy guidelines within which ESA develops the European space programme."<sup>175</sup> Additionally, "[e]ach Member State is represented on the Council and has one vote," regardless of the size of the nation or the financial contribution.<sup>176</sup> Furthermore, "ESA is headed by a Director General who is elected by the Council every four years," with "[e]ach individual research sector having its own Directorate" that reports directly to the Director General.<sup>177</sup>

In 2021 the ESA's budget was €6.49 billion, and in 2022 it was €7.15 billion.<sup>178</sup> As mentioned earlier, "ESA's activities fall into two categories – 'mandatory' and 'optional'."<sup>179</sup> Programmes carried out under the General Budget and the Space Science programme budget are 'mandatory.'<sup>180</sup> "They include the agency's basic activities (studies on future projects, technology research, shared technical investments, information systems and training programmes)."<sup>181</sup> The mandatory activities are "funded through financial contribution from all the Agency's Member States."<sup>182</sup> This is based on a calculation relating to each country's gross national product.<sup>183</sup>

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<sup>172</sup> *Id.*

<sup>173</sup> *Id.*

<sup>174</sup> See Convention For the Establishment of a European Space Agency, *supra* note 150, at 11.

<sup>175</sup> *ESA Facts*, *supra* note 172.

<sup>176</sup> *Id.*

<sup>177</sup> *Id.*

<sup>178</sup> *The European Space Agency (ESA)*, EU FUNDING OVERVIEW, <https://eufundingoverview.be/funding/the-european-space-agency-esa> [<https://perma.cc/N4EF-SQVD>].

<sup>179</sup> *Id.*

<sup>180</sup> *Id.*

<sup>181</sup> *Id.*

<sup>182</sup> *Id.*

<sup>183</sup> *Id.*

In addition to this, each Member State is able to decide whether, and how much, they wish to further contribute to optional programs.<sup>184</sup> “Optional programmes cover areas such as Earth observation, telecommunications, satellite navigation and space transportation.”<sup>185</sup> Similarly, “the International Space Station and microgravity research are financed by optional contributions.”<sup>186</sup> As was commented previously, the U.K.’s involvement with these optional programs has tended to fluctuate in terms of investment and commitment, but the U.K.’s appetite to engage—particularly for the areas identified above—has become greater and more embedded in the U.K.’s space policy since the formulation of the U.K.’s Space Agency.<sup>187</sup>

In addition, “ESA operates on the basis of geographical return, i.e. it invests in each Member State, through industrial contracts for space programmes, an amount which is more or less equivalent to each country’s contribution.”<sup>188</sup> Historically, the biggest investors into the ESA are Germany and France.<sup>189</sup> In 2022, based on the percentage contributed to the ESA across all activities, Germany contributed 21.1% and France 24.5%—this equating to €1017.5 million and €1178.2 million respectively.<sup>190</sup> In contrast, the U.K.’s investment was €437.9 million, or 9.1% of the total contributions.<sup>191</sup> Other than Germany and France, the only other investor above the U.K. was Italy, which contributed 14.1% of the budget (€680.2 million).<sup>192</sup> In total, the contributions made by MS’s was €4.81 billion which equates to 64.3%; hence, the remainder of the budget comes from various other sources<sup>193</sup> (Figure 1).

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<sup>184</sup> *The European Space Agency (ESA)*, EU FUNDING OVERVIEW, <https://eufundingoverview.be/funding/the-european-space-agency-esa> [<https://perma.cc/N4EF-SQVD>].

<sup>185</sup> *Id.*

<sup>186</sup> *Id.*

<sup>187</sup> See, e.g., UK Space Agency, *ESA Council of Ministers: Decision Time for Shaping the Future of Space*, GOV.UK: UK SPACE AGENCY BLOG (Nov. 17, 2022), <https://space.blog.gov.uk/2022/11/17/esa-council-of-ministers-decision-time-for-shaping-the-future-of-space/> [<https://perma.cc/H7PK-M2NR>].

<sup>188</sup> *ESA Facts*, *supra* note 172.

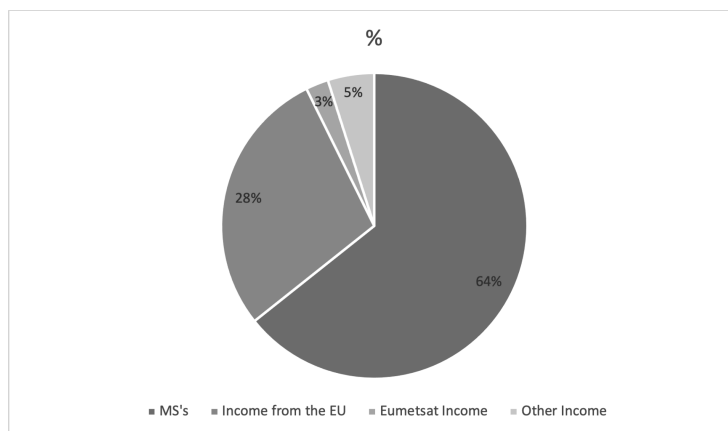
<sup>189</sup> See EU FUNDING OVERVIEW, *supra* note 180.

<sup>190</sup> *Id.*

<sup>191</sup> *Id.*

<sup>192</sup> *Id.*

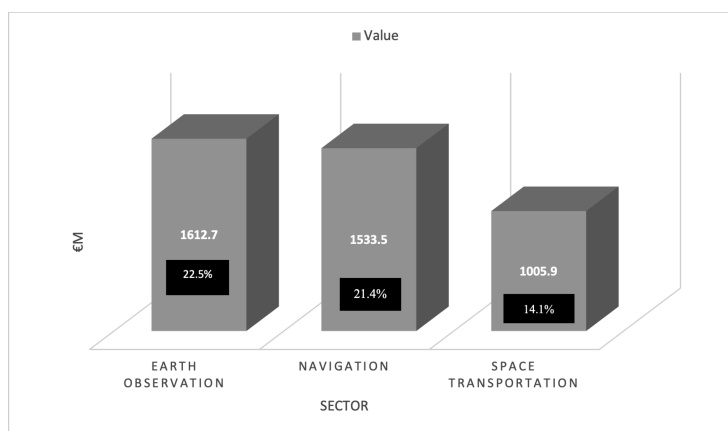
<sup>193</sup> *Id.*



**Figure 1:** Sources of finance for ESA.<sup>194</sup>

By far, the biggest area for investment relates to earth observation, navigation, and space transportation (Figure 2).<sup>195</sup> These three sectors, combined, take up 58% of the overall budget.<sup>196</sup>

Other key areas for budget allocation relate to human spaceflight (micro) and exploration (13%); the scientific program (8.1%); telecommunication and integrated applications (7.2%); what is classed as basic activities (4.1%); technology support (3.1%); space safety (1.6%); and other miscellaneous aspects account for the remaining 4.9%.<sup>197</sup>



**Figure 2:** The three highest funded sectors (by percentage and value).<sup>198</sup>

<sup>194</sup> See *id.*

<sup>195</sup> See EU FUNDING OVERVIEW, *supra* note 180.

<sup>196</sup> See *id.*

<sup>197</sup> See *id.*

<sup>198</sup> See *id.*

There is no doubt that the pooling of resources is advantageous for all members of the ESA.<sup>199</sup> Hence, the U.K. recognizes the need for international relations in space.<sup>200</sup> As part of this approach, it continues to invest in the ESA, alongside other international programs.<sup>201</sup> In terms of its early roots, it continues to maintain close historical ties with Australia and the Australian Space Agency in order to develop a 'Space Bridge' between the two countries<sup>202</sup>—while the ambition and investment into the UK's 'Spaceflight Programs' invariably involves close partnerships and investments with the U.S.<sup>203</sup> Additionally, the U.K. continues to coordinate with a number of countries and space agencies on the U.S. led Artemis program, which invariably is centered around returning humankind back to the Moon, and then using the Moon as a staging post for further galactic travel, starting with the first human to venture to Mars.<sup>204</sup> This in essence is reflected in the current U.K. Strategy for Space.<sup>205</sup>

#### IV. THE U.K. SPACE SECTOR TODAY AND HIGH ASPIRATIONS ... THE FUTURE VISION

Science and technology expertise has ensured that the U.K. has played a key role in regional and international missions, with national capabilities increasing in fast-growing space related areas.<sup>206</sup>

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<sup>199</sup> *How Much Do European Citizens Know About Space?*, EUROPEAN SPACE AGENCY (Jan. 16, 2019), [https://www.esa.int/About\\_Us/Corporate\\_news/How\\_much\\_do\\_European\\_citizens\\_know\\_about\\_space](https://www.esa.int/About_Us/Corporate_news/How_much_do_European_citizens_know_about_space) [https://perma.cc/V794-SQ5C].

<sup>200</sup> *See, e.g.*, Stewart M. Patrick, *A New Space Age Demands International Cooperation, Not Competition or 'Dominance'*, WORLD POLITICS REVIEW (May 20, 2019), <https://www.worldpoliticsreview.com/a-new-space-age-demands-international-cooperation-not-competition-or-dominance/> [https://perma.cc/EZR2-7VAA].

<sup>201</sup> *See, e.g.*, *LaunchUK: Leading the Commercial Space Age*, *supra* note 147.

<sup>202</sup> UK Space Agency & Department for International Trade, *'Space Bridge' Across the World Will Help UK and Australia Get Ahead in Global Space Race*, Gov.UK (Feb. 23, 2021), <https://www.gov.uk/government/news/space-bridge-across-the-world-will-help-uk-and-australia-get-ahead-in-global-space-race> [https://perma.cc/L98P-UKL5].

<sup>203</sup> *See, e.g.*, Department for Transport & The Rt Hon Grant Shapps MP, *Landmark Partnership Between the US and UK to Launch New Era of Space Flight*, Gov.UK (May 13, 2022), <https://www.gov.uk/government/news/landmark-partnership-between-the-us-and-uk-to-launch-new-era-of-spaceflight> [https://perma.cc/AR8M-SC6V]. This is focused on the U.K. being the first country in Europe to achieve a commercial, small satellite launch from its national territory. *See infra* part IV.B. and IV.C.

<sup>204</sup> UK Space Agency, *The UK in Artemis*, Gov.UK (Aug. 25, 2022), <https://www.gov.uk/government/case-studies/the-uk-in-artemis> [https://perma.cc/EH8N-B9H9].

<sup>205</sup> *See* George Freeman MP, *Policy Paper: National Space Strategy in Action*, Gov.UK (July 19, 2023), <https://www.gov.uk/government/publications/national-space-strategy-in-action/national-space-strategy-in-action> [https://perma.cc/87UH-VHAV].

<sup>206</sup> *See id.*

Today, the U.K. continues to have far-reaching ambitions in space, and the national Space Agency continues to remain an integral cog in realizing future aspirations.<sup>207</sup> While the executive agency of the Space Agency was renamed from the Department of Business and Industry to the Department for Business, Energy & Industrial Strategy (BEIS), it now sits within the Department for Science, Innovation and Technology.<sup>208</sup> However, there of course remains considerable overlap with other government areas, not least transport and defense.<sup>209</sup> Nevertheless, the U.K. Space Agency ultimately (from a civil perspective) lies at the heart of U.K. efforts to explore and benefit from space.<sup>210</sup> For example, “[i]t leads the UK’s civil space programme in order to win sustainable economic growth, secure new scientific knowledge” and hence, it is seen as interfacing with other departments as part of this role.<sup>211</sup> More noticeably of late, this includes security and military programs and, although it does not manage these programs directly, the Agency is kept informed and involved in decisions.<sup>212</sup>

#### A. SECTOR GROWTH—BUILDING ON PAST SUCCESSES

While the U.K. failed to maximize on its early success on space (satellite) launches, there is little doubt that for over forty years, the U.K.’s pioneering work on satellite technology (and now cube-sat—a smaller variant) has aided to revolutionize the industry.<sup>213</sup> For the U.K., space remains a big business.<sup>214</sup> It underpins £360 billion of the U.K. GDP.<sup>215</sup> Since 2012, the population of space organizations has grown by approximately 21% per annum.<sup>216</sup> In

<sup>207</sup> *See id.*

<sup>208</sup> *See* UK Space Agency, GOV.UK, <https://www.gov.uk/government/organisations/uk-space-agency> [<https://perma.cc/B6Q3-3AWM>].

<sup>209</sup> *See, e.g.,* *Spaceflight Policy*, UK CIVIL AVIATION AUTHORITY, <https://www.caa.co.uk/space/the-role-of-the-cao/policy/> [<https://perma.cc/6YK4-32QP>].

<sup>210</sup> *UK Space Agency Collaborates Through Govdelivery to Raise International Profile*, UK SPACE AGENCY, [https://granicus.com/pdfs/SS\\_UKspace.pdf](https://granicus.com/pdfs/SS_UKspace.pdf) [<https://perma.cc/4HJN-BU5H>].

<sup>211</sup> *Id.*

<sup>212</sup> *United Kingdom Space Agency (UK Space Agency)*, EUROPEAN SPACE AGENCY, [https://www.esa.int/Enabling\\_Support/Space\\_Engineering\\_Technology/United\\_Kingdom\\_Space\\_Agency\\_UK\\_Space\\_Agency](https://www.esa.int/Enabling_Support/Space_Engineering_Technology/United_Kingdom_Space_Agency_UK_Space_Agency) [<https://perma.cc/Y8QU-8B7H>].

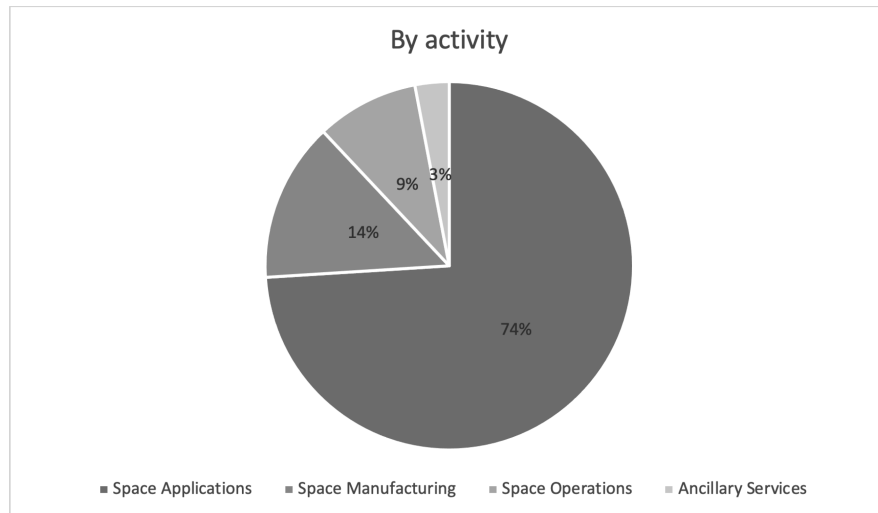
<sup>213</sup> *See, e.g.,* UK SPACE AGENCY, ANNUAL REPORT AND ACCOUNTS 2021-22 14 (2022), [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1091945/5903\\_UKSA\\_AR\\_21-22\\_CB\\_V17\\_Cc.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1091945/5903_UKSA_AR_21-22_CB_V17_Cc.pdf) [<https://perma.cc/XZ49-25PJ>].

<sup>214</sup> *See id.* at 11.

<sup>215</sup> *Id.*

<sup>216</sup> BRYCE TECH, THE SIZE & HEALTH OF THE UK SPACE INDUSTRY 2021, at ii (April 2022). In the U.K., organizations meeting the following definitions and criteria are

the period 2019–2020, space-related organizations in the U.K. were reported to have produced £16.5 billion in income (percentage breakdown Figure 3).<sup>217</sup> About a third (32%) of the income came from exports, the main markets for exports being Europe followed by North America.<sup>218</sup> An estimated £836 million was spent on space-related research and development (R&D) in the same period, equivalent to 5% of total industry income.<sup>219</sup>



**Figure 3:** Total space industry income: £16.5 billion (percentage breakdown).<sup>220</sup>

Broken down further in terms of employment, this equated to:

- (i) Direct space employment of around 47,000 jobs in 2019/20;

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considered part of the “space industry”: “Non-commercial organisations (e.g., universities, research institutes) that secure income to contribute space-specific research and expertise throughout the industry supply chain, often in partnership with commercial organisations. Non-commercial income includes government agency and institutional grant funding, core funding, research funding, tuition fees, departmental expenditures, and operating budgets. Commercial organizations (i.e., businesses, companies, firms) that earn revenue from the manufacture, launch and operation of satellites/spacecraft, and from meaningful utilisation of the signals and data supplied by satellites/spacecraft to develop value-added applications. Such organizations may also secure non-commercial income (e.g., grants) to undertake specific research and development.” *Id.* at 2.

<sup>217</sup> *Id.* at ii.

<sup>218</sup> *Id.*

<sup>219</sup> *Id.*

<sup>220</sup> *Id.* at 5.

(ii) Space activities<sup>221</sup> supported a total of approximately 190,000 jobs across the value chain; and

(iii) Space employment seeing a growth of 6.7% from 2018/19.<sup>222</sup>

However, based on limited data, it is noticeable that the majority of those employed in the space industry are male, the majority of women (employed in STEM positions) coming from other nations, with just over a quarter being British nationals.<sup>223</sup>

The U.K. space industry has shown itself to be resilient to many global challenges, such as COVID-19 and Brexit, although arguably some of the longer effects of the latter remain undetermined.<sup>224</sup> This said, in comparison to the wider economy, which shrank by 9.9% in 2020, the space economy overall only marginally showed any fluctuation.<sup>225</sup> In fact, “[t]wo of [the] space industry’s segments experienced overall growth in real terms, with space manufacturing increasing by 1% (£23 million) and ancillary services by 4% (£20 million)” (most noticeable ones being identified in Table 3).<sup>226</sup> While these growths are globally identified, the U.K. nonetheless is particularly well situated in terms

<sup>221</sup> Space Manufacturing: Design and/or manufacture of space equipment and subsystems. Includes: launch vehicles and subsystems, satellites/payloads/spacescraft and subsystems, scientific instruments (e.g., instrumentation for use in space-related experiments, astronomical instruments), ground segment systems and equipment (control centres and telemetry), suppliers of materials and components, scientific and engineering support, fundamental and applied research, space test facilities (e.g., provision of environmental testing services).

Space Operations: Launch and/or operation of satellites and/or spacecraft. Includes: launch services, launch brokerage services, proprietary satellite operation (including sale/lease of capacity . . .), third-party ground segment operation, ground station networks, in-orbit servicing, debris removal, space surveillance & tracking . . .

Space Applications: Applications of satellite signals and data. Includes: direct-to-home (DTH) broadcasting, fixed and mobile satellite communications services . . . location-based signal and connectivity service providers, supply of user devices and equipment (e.g., satellite phones), processors of satellite data, applications leveraging satellite signals (e.g., GNSS devices and location-based services) and/or data (e.g., meteorology, geographic information system (GIS) software and geospatial products), other (e.g., quantum key distribution).

Ancillary Services: Specialised support services. Includes: launch and satellite insurance (including brokerage) services, financial and legal services, software and IT services, market research and consultancy services, business incubation and development, policymaking, regulation, and oversight. *Id.* at 2–3.

<sup>222</sup> *Id.* at ii.

<sup>223</sup> Joseph Dudley & Heidi Thiemann, *Demographics of the UK Space Sector*, SPACE SKILLS ALL. (Mar. 9, 2021), <https://spaceskills.org/census-demographics#gender> [<https://perma.cc/X42V-DDLA>].

<sup>224</sup> *See id.*

<sup>225</sup> BRYCE TECH, *supra* note 218, at iii.

<sup>226</sup> *Id.*

of both upstream and downstream activities<sup>227</sup> that allow it to be able to exploit these segments, particularly when its abilities are compared to other countries.<sup>228</sup>

**Table 3:** Sector growth and loss.<sup>229</sup>

Growth sectors		Loss sectors	
Space Tourism	34%, £1 million	Space operations	- 4%, - £57 million
Launch and satellite insurance (incl. brokerage)	25%, £20 million	Space applications	- 2%, - £280 million
Launch services	18%, £1 million		
<b>Other activities</b> (e.g. such as distribution)	13%, £1 million		

There is no doubt that, overall, the sector continues to grow in the U.K. with indications that the industry increased by £0.9 billion from the previous year, to around £17.5 billion in 2021.<sup>230</sup>

### B. FUTURE PLANS: A *CIRCULAR JOURNEY!*

On September 27, 2021, the U.K. government published the current National Space Strategy (NSS).<sup>231</sup> This is a multi-layered structure, whereby the plan ultimately is for the U.K. to grow further as a space nation, while perhaps also realizing missed opportunities in terms of an overarching end-to-end solution—which includes the means and capability to launch into space.<sup>232</sup>

It is recognized that “[t]he space ecosystem is highly interconnected,” with systems and structures not only nationally but across

<sup>227</sup> Upstream refers to space manufacturing (including satellites, launch vehicles, and ground segment equipment), testing, and launching, and downstream describes services such as satellite operations, satellite service provision (broadcasting, communication, navigation, Earth Observation (EO), and weather forecasting) and data processing. SCIENCE & TECHNOLOGY COMMITTEE, UK SPACE STRATEGY AND UK SATELLITE INFRASTRUCTURE, 2022-3, HC 100, at 6.

<sup>228</sup> BRYCE TECH, *supra* note 218, at iii.

<sup>229</sup> *Id.*

<sup>230</sup> See KNOW.SPACE, SIZE & HEALTH OF THE UK SPACE INDUSTRY 2022, at 5 (Mar. 2023), [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1148037/know.space-Size\\_Health2022-SummaryReport.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1148037/know.space-Size_Health2022-SummaryReport.pdf) [<https://perma.cc/F99M-ZPGP>].

<sup>231</sup> See generally UK SPACE AGENCY, NATIONAL SPACE STRATEGY (2021), [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1034313/national-space-strategy.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1034313/national-space-strategy.pdf) [<https://perma.cc/KNV5-9X4Q>].

<sup>232</sup> See *id.* at 3.



the world affecting State goals.<sup>233</sup> As a consequence, four pillars are identified as arguably the scaffolding for the five “goals”:

Pillar 1: Unlocking growth in the space sector.

Pillar 2: Collaborating internationally.

Pillar 3: Growing the UK as a science and technology superpower.

Pillar 4: Developing resilient space capabilities and services.<sup>234</sup>

The U.K.’s five goals, as identified in the NSS, are to:

Goal 1: Grow and level up ‘our’ space economy,

Goal 2: Promote the values of Global Britain,

Goal 3: Lead pioneering scientific discovery and inspire the nation,

Goal 4: Protect and defend ‘our’ national interests in and through space,

Goal 5: Use space to deliver for U.K. citizens and the world.<sup>235</sup>

The current strategy is centered around plans covering a decade and beyond, while the linked Space Agency plans set out a shorter duration (2022–2025) in terms of priority areas to ultimately reach the longer end goals.<sup>236</sup> Within the Space Agency plans, three priority aims are identified, while it continues to stress the need for continued collaborative ‘*team*’ involvement, not only with other nations but also with the private sector.<sup>237</sup>

These priorities being to:

- **Catalyze investment**, by deploying funding and resources to multiply the value of non-Government contracts and private capital secured by UK space organizations to maximize the space sector’s long-term growth.
- **Deliver missions and capabilities**, independently and with others, that use space science, technology and applications to meet national needs and help humanity to understand our universe.
- **Champion space**, encouraging other sectors to use space to deliver better services, tackle the climate emergency, inspire STEM education and lifelong learning, and advocate for sustainable space activities.<sup>238</sup>

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<sup>233</sup> *Id.* at 23.

<sup>234</sup> *Id.*

<sup>235</sup> *Id.* at 6.

<sup>236</sup> See UK SPACE AGENCY, UK SPACE AGENCY CORPORATE PLAN 2022–25 6 (2022), [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1091933/6192\\_UKSA\\_Corporate\\_Plan\\_CB\\_v9a\\_Bb.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1091933/6192_UKSA_Corporate_Plan_CB_v9a_Bb.pdf) [<https://perma.cc/CG5S-V87P>].

<sup>237</sup> See *id.*

<sup>238</sup> *Id.*

In order to achieve this, focus is then given to eight priority approaches:

**Table 4: UKSA Priority Areas.**<sup>239</sup>

UK Space Agency Priority Areas	
Space Launches	Innovation
Earth Observation	Discovery
Low Earth Orbit Capabilities	Levelling-up
Sustainability	Inspiration

The reference to having mission capabilities in the form of space launches shows a resurgence to the U.K.'s earlier appetite in this area.<sup>240</sup> When the National Space Strategy was revealed, it was clearly identified that “[t]he days of the UK space industry idling on the launch pad are over . . . [with] this strategy mark[ing] the start of the countdown.”<sup>241</sup> This spells out a clear determination for advancement in terms of the ability to also stand alone and to bring in other nations which would utilize facilities on U.K. soil.<sup>242</sup>

However, what is also noticeable in the current NSS is the fact that this is the first ever National Space Strategy that aligns more with defense.<sup>243</sup> Indeed, it speaks of an integrated space strategy which brings together military and civil space policy.<sup>244</sup> Reference within the NSS is clearly being made for the need to “protect and defend the UK’s interests [in space],” which is being served by a dedicated goal.<sup>245</sup> While this is further elaborated upon in terms of a defense perspective, it is also suggestive of the potential for State protectionism.<sup>246</sup>

The later Defense Space Strategy, published on February 1, 2022, likewise reiterates support for the integrated NSS, while also clearly identifying concerns for the potential of an arms race in space.<sup>247</sup> Once more this is reminiscent of the historical legacy and origins of space exploration in the twentieth century.<sup>248</sup> Re-

<sup>239</sup> *Id.* at 8.

<sup>240</sup> *See infra* Part II.B.

<sup>241</sup> UK SPACE AGENCY, *supra* note 233, at 2 (then-Prime Minister Boris Johnson discussing the U.K. Space Strategy).

<sup>242</sup> *See id.*

<sup>243</sup> *See* MINISTRY OF DEFENCE, DEFENCE SPACE STRATEGY: OPERATIONALISING THE SPACE DOMAIN 5 (2022) (The publication of this report emphasizes an alignment with defense.).

<sup>244</sup> *Id.*

<sup>245</sup> UK SPACE AGENCY, *supra* note 233, at 6, 12 (emphasis added).

<sup>246</sup> *See* MINISTRY OF DEFENCE, *supra* note 245, at 4.

<sup>247</sup> *Id.*

<sup>248</sup> *See infra* Part II.A.

iterating this further perhaps, is the later published Combined Space Operations Vision–2031 which recognizes the need for international cooperation of the U.K. with its identified partners (Australia, Canada, France, Germany, New Zealand, and the U.S.) to prevent what is deemed ‘escalation’, as well as to ‘deter hostile activities’ in space.<sup>249</sup> This is being undertaken by providing combined assurance and resilience—which ultimately aids to preserve the U.K.’s strategic advantage in the space domain.<sup>250</sup>

Particularly identified, from both a civil and defense (military) perspective, is the need to upgrade the U.K.’s space capabilities.<sup>251</sup> This includes delivering the UK’s first Defense Space Portfolio, which also necessitates investment in the military’s satellite communication system.<sup>252</sup> As a consequence, defense is investing around £5 billion across the next decade to enhance the Skynet satellite communication capabilities<sup>253</sup>; and, no doubt serving as an incentive to aid realize this, is also the aspiration to, “become the first country to launch a rocket into orbit from Europe . . . with the aim of becoming a leader in commercial small-satellite launches.”<sup>254</sup>

When the NSS was published, for the latter, the date of 2022 was advocated, however, at the time of writing, this still has not been realized, although the revised year is now identified as 2023.<sup>255</sup>

### C. REALIZING A VISION

In preparation of the launches, several spaceport sites around the U.K. were proposed, including Wales, Scotland, and England.<sup>256</sup> Another preparational factor included ensuring a modern and fit-for-purpose legal framework to suit the new aspirations and the commercial era of space.<sup>257</sup>

National space law has its origins in the treaties and principles established by the UN Committee on the Peaceful Uses of Outer

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<sup>249</sup> See MINISTRY OF DEFENCE, COMBINED SPACE OPERATIONS 1 (2022), [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1055940/Combined\\_Space\\_Operations\\_Vision\\_2031.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1055940/Combined_Space_Operations_Vision_2031.pdf) [<https://perma.cc/AR3A-LSJY>].

<sup>250</sup> *Id.* at 1, 3.

<sup>251</sup> UK SPACE AGENCY, *supra* note 233, at 7.

<sup>252</sup> *Id.*

<sup>253</sup> *Id.* at 7, 29.

<sup>254</sup> *Id.* at 7.

<sup>255</sup> *Id.* at 41.

<sup>256</sup> *Id.*

<sup>257</sup> UK SPACE AGENCY, *supra* note 233, at 31, 49.

Space (COPUOS), which remains today.<sup>258</sup> It is a committee, set up following the Soviet Union's 1957 launch of the world's first ever satellite, 'Sputnik.'<sup>259</sup> Ultimately, this led to the first set of principles on outer space, adopted by the UN General Assembly as the "Declaration of Legal Principles" for space activities.<sup>260</sup> These principles were later elaborated upon in the UN Outer Space Treaty of 1967, and in subsequent UN treaties, resolutions, and principles.<sup>261</sup>

Up until 2018, the sole legislation appertaining to space activities carried out in the U.K., or by U.K. entities overseas, was governed by the Outer Space Act 1986 which has application to "(a) launching or procuring the launch of a space object; (b) operating a space object; (c) any activity in outer space."<sup>262</sup> Bearing in mind that the U.K. has never launched from its own national soil, "it required entities who procured an overseas launch and/or operated a satellite in orbit to hold a license."<sup>263</sup>

As of 2018, the U.K. supplemented this with the Space Industry Act 2018 (SIA), which, together with Regulations and Rules made under the SIA, regulates spaceflight and associated activities carried out in the U.K.<sup>264</sup> Thus, the Outer Space Act 1986 has been amended to regulate only activities carried out overseas by U.K. entities, including the procurement of the overseas launch of a space object and the operation of a satellite in orbit from an overseas facility by a U.K. entity.<sup>265</sup> The SIA (as stated

<sup>258</sup> See generally *Comm. on the Peaceful Uses of Outer Space and its Subcommittees*, UNITED NATIONS: OFFICE FOR OUTER SPACE AFFAIRS, <https://www.unoosa.org/oosa/en/ourwork/copuos/comm-subcomms.html> [<https://perma.cc/427Q-EMJ8>]; see also Fox, *Exploiting – Land, Sea and Space*, *supra* note 4, at 9; Fox, *Policing Mining*, *supra* note 35, at 3.

<sup>259</sup> UK Space Agency, *Spaceflight Legislation and Guidance*, Gov.UK (June 1, 2022), <https://www.gov.uk/guidance/spaceflight-legislation-and-guidance> [<https://perma.cc/UFM3-NKU8>].

<sup>260</sup> *Id.*

<sup>261</sup> *Id.* See also *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, U.N. OFF. FOR OUTER SPACE AFF., <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html> [<https://perma.cc/KPF8-T3HK>] (The Outer Space Treaty was considered by the Legal Subcommittee in 1966 and agreement was reached in the General Assembly in the same year (resolution 2222 (XXI)).

<sup>262</sup> See UK SPACE AGENCY, *supra* note 261; Outer Space Act, 1986, c. 38.

<sup>263</sup> UK SPACE AGENCY, *supra* note 261.

<sup>264</sup> See Space Industry Act, 2018, c. 5, § 1.

<sup>265</sup> See Outer Space Act, *supra* note 264, § 1. Specifically, it is stated (section 1(3)) that, "[t]his Act does not apply to activities carried on in the United Kingdom (and accordingly does not apply to activities requiring authorisation under section 3(1) of the Space Industry Act 2018)." *Id.*

in section 1) regulates “(a) space activities, (b) sub-orbital activities, and (c) associated activities, carried out in the United Kingdom.”<sup>266</sup>

As is realized, launching carries significant challenges and invariably risks, which must be managed and mitigated for—including in the form of insurance provisions.<sup>267</sup> The SIA also contains provisions on insurance, as it identifies that operators will not be subject to unlimited liability for actions carried out in compliance with the Space Industry Act and the respective license conditions.<sup>268</sup> A later 2021 Act, the Space Industry Regulations 2021, provided for further provisions, including information on the aspect of liabilities.<sup>269</sup> It should be identified that the Outer Space Act 1986 had already been amended in relation to indemnity through the Deregulation Act, 2015, although there remain marked differences in terms of insurance and indemnity depending on the location of the activity.<sup>270</sup>

These revisions to the U.K. regulatory landscape also resulted in the Civil Aviation Authority (CAA) taking on a new role as the space regulator as of July, 2021.<sup>271</sup> Prior to this date, space regulation sat within the U.K. Space Agency.<sup>272</sup> As of November 16, 2022, the CAA issued its first ever spaceport license to Spaceport Cornwall in anticipation of the U.K.’s first orbital space launch.<sup>273</sup> Technically, as identified in the SIA, there are various types of licenses that can be issued by the CAA covering a variety of space events, and prior to the issue of the spaceport license, the regulator had already issued a number of other licenses, in particular relating to satellite activities.<sup>274</sup>

The highly awaited first launch from U.K. soil was to be undertaken by Virgin Orbit from Spaceport Cornwall at the end

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<sup>266</sup> Space Industry Act, *supra* note 266, § 1.

<sup>267</sup> *See id.* § 34.

<sup>268</sup> *Id.*

<sup>269</sup> *See* The Space Industry Regulations 2021, SI 2021/792, ¶ 218–221.

<sup>270</sup> *See* Deregulation Act, 2015, c. 20, § 12.

<sup>271</sup> *CAA Becomes UK Space Regulator and Launches Licensing Regime*, U.K. CIV. AVIATION AUTH. (July 29, 2021), <https://www.caa.co.uk/news/caa-becomes-uk-space-regulator-and-launches-licensing-regime/> [https://perma.cc/LVN3-L7HW].

<sup>272</sup> *See* Joanne Wheeler MBE, *In Review: Space Law, Regulation and Policy in the United Kingdom*, LEXOLOGY (Jan. 5, 2023), <https://www.lexology.com/library/detail.aspx?g=eaaf138-43f6-4068-ad8d-6c21abdfb055> [https://perma.cc/KR6S-KXGD].

<sup>273</sup> *Spaceport Cornwall Receives First -Ever UK Spaceport License*, U.K. CIV. AVIATION AUTH. (Nov. 16, 2022), <https://www.caa.co.uk/newsroom/news/spaceport-cornwall-receives-first-ever-uk-spaceport-licence/> [https://perma.cc/P7G5-G6BW].

<sup>274</sup> *Id.*

of 2022.<sup>275</sup> However, in December, it was announced that some technical and regulatory issues—also reported as licensing issues—meant that it would need to be pushed back until the start of 2023.<sup>276</sup> Finally, on January 9, 2023, Virgin Orbit was able to launch.<sup>277</sup> Founded in 2017, Virgin Orbit took a different approach from the more familiar vertical-rocket take-off means.<sup>278</sup> It utilized a converted Boeing 747, called ‘Cosmic Girl,’ and took off in the same manner as a traditional plane, which is deemed a horizontal launch.<sup>279</sup> In essence, the aircraft served as the LauncherOne (rocket) carrier system.<sup>280</sup> However, while the rocket successfully launched, quickly going hypersonic and successfully reaching space, the mission ended prematurely.<sup>281</sup> During the firing of the rocket’s second stage engine, and with the rocket travelling at a speed of more than 11,000 miles per hour, the system experienced an anomaly, which led to loss of the cargo.<sup>282</sup>

Four previous LauncherOne missions in the U.S., which had also carried payloads for private companies and governmental agencies, had been successful.<sup>283</sup> Inevitably, this loss no doubt served to re-emphasize the risks associated with space activities—particularly, launches and the appetite that is needed to both undertake these in the first place, and then to continue.<sup>284</sup>

This said, the U.K. launch did serve to bring “together new partnerships and integrated collaboration from a wide range of partners, including the U.K. Space Agency, the Royal Air Force,

<sup>275</sup> Jeff Foust, *Virgin Orbit Delays First U.K. Launch*, SPACENEWS (Dec. 8, 2022), <https://spacenews.com/virgin-orbit-delays-first-u-k-launch/> [<https://perma.cc/6FDG-RQV8>].

<sup>276</sup> *Id.*; Elizabeth Howell, *Virgin Orbit Delays Historic Launch from United Kingdom Over Licensing: Reports*, SPACE.COM (Dec. 8, 2022), <https://www.space.com/virgin-orbit-spaceport-cornwall-launch-licensing-delay#> [<https://perma.cc/HBZ9-E8VD>].

<sup>277</sup> Anna Cooban, Jackie Wattles, Tom Foreman, & Ross Levitt, *Virgin Orbit’s LauncherOne Rocket Suffers Failure on First Attempt from the UK*, CNN BUS. (Jan. 9, 2023), <https://www.cnn.com/2023/01/09/business/virgin-orbit-uk-satellite-launch-scen/index.html> [<https://perma.cc/B2LS-L7HH>].

<sup>278</sup> See Ed Browne, *Virgin Orbit: Facts About the Bankrupt Air-Launch Provider*, SPACE.COM (June 3, 2023), <https://www.space.com/42975-virgin-orbit.html> [<https://perma.cc/3SHV-5NEB>].

<sup>279</sup> *Id.*

<sup>280</sup> *See id.*

<sup>281</sup> *See id.*

<sup>282</sup> Luke Hurst, *Virgin Orbit: What Went Wrong With the UK’s First Satellite Launch Mission?*, EURONEWS (Oct. 1, 2023), <https://www.euronews.com/next/2023/01/10/virgin-orbits-cosmic-girl-aircraft-set-to-deliver-first-satellite-launch-from-uk#:~:text=The%20company%20said%20in%20a,%2C%20ending%20the%20mission%20prematurely%22> [<https://perma.cc/EKS8-W8EY>].

<sup>283</sup> See Browne, *supra* note 280.

<sup>284</sup> *See id.*

the Civil Aviation Authority, the U.S. Federal Aviation Administration, the National Reconnaissance Office, and more.”<sup>285</sup> It also showed that a successful launch can be achieved on U.K. soil—albeit, this did mark an overall mission failure.<sup>286</sup> The payload consisted of nine satellites, which together with the rocket, were ultimately lost, although the U.K. Space Agency identified that “the satellite load was insured and Virgin Orbit would recover its losses.”<sup>287</sup> It is known that these satellites were both for civil and military purposes, with several of the satellites being the property of the U.S. and U.K. defense communities.<sup>288</sup> Once again, this aids to reinforce the overlap between the civil and military purposes of space, and the nature of joint operations, not just by States, but related to the purpose of launches and activities.<sup>289</sup>

As a consequence of events, it was voiced that, while this was an obvious set back to the U.K.’s plans, it had not thwarted the overall ambitions or their commitment to continue with an imminent launch from the U.K.<sup>290</sup> In this respect, the U.K. continues to work within Pillar 4 in terms of developing resilience in its space capabilities and services.<sup>291</sup>

Although the mission was assumed to be a fully-U.K. mission based on the fact that ‘Virgin’ is a household name associated with the British billionaire Richard Branson, in actuality Virgin Orbit is a U.S. company.<sup>292</sup> Almost immediately after the event,

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<sup>285</sup> *Historic UK Mission Reaches Space, Falls Short of Orbit*, BUSINESSWIRE (Jan. 10, 2023), <https://www.businesswire.com/news/home/20230109005944/en/Historic-UK-Mission-Reaches-Space-Falls-Short-of-Orbit> [<https://perma.cc/C9LX-MXBG>].

<sup>286</sup> *See id.*

<sup>287</sup> *See* Nina Massey, *Virgin Orbit and Government Investigating Why First UK Rocket Launch Failed*, EVENING STANDARD (Jan. 10, 2023), <https://www.standard.co.uk/tech/science/virgin-orbit-atlantic-ocean-mod-science-europe-b1052062.html> [<https://perma.cc/T8U5-WTR3>].

<sup>288</sup> *See id.*

<sup>289</sup> *See id.*

<sup>290</sup> Jonathan Amos & Greg Brosnan, *UK Rocket Failure is a Setback, Not Roadblock*, BBC NEWS (Jan. 10, 2023), <https://www.bbc.co.uk/news/science-environment-64223882> [<https://perma.cc/6VVB-U867>].

<sup>291</sup> *See supra* Part IV.B.

<sup>292</sup> Michael Sheetz, *Here’s What Went Wrong With Virgin Orbit*, CNBC (Apr. 17, 2023, 9:09 AM), <https://www.cnbc.com/2023/03/31/virgin-orbit-what-went-wrong.html> [<https://perma.cc/AV2Z-MSLJ>]; Browne, *supra* note 280. The U.S.-U.K. Technology Safeguards Agreement (TSA), which establishes the principles under which U.S. spaceflight technology may be licensed for export by the U.S. authorities to the U.K. for use in spaceflight activities, is also implemented through the Space Industry Regulations 2021. *Spaceflight Legislation and Guidance*, *supra* note 261.

it led to Virgin Orbit dropping the value of its shares;<sup>293</sup> and, as of April 4, 2023, it was reported that Virgin Orbit Holdings, Inc. and its U.S. subsidiaries “had commenced a voluntary proceeding under Chapter 11 of the U.S. Bankruptcy Code . . . in order to effectuate a sale of the business.”<sup>294</sup> Technically, the Chapter 11 bankruptcy filing allows a company to stay in business in order to reorganize its affairs, debts, and assets.<sup>295</sup>

Presently, the U.K. is turning its attention north to possible vertical launches from a number of Spaceports in Scotland.<sup>296</sup> The most likely candidate is anticipated to be the SaxaVord spaceport on Scotland’s Shetland Islands, where hopes are for a possible launch in the latter part of 2023.<sup>297</sup> This would again be a collaborative approach between a number of players, including German counterparts.<sup>298</sup> In the meantime, lost satellites will also need to be rebuilt and replaced.<sup>299</sup>

## V. CONCLUSION

There is little doubt that the U.K. has made a significant contribution to space, which has benefitted the home nation but also wider society and humanity. But invariably, this has been somewhat of a circular journey, where history has shown a tendency to repeat itself. Early space missions were driven by nations competing to be the ‘first’—the *first* to go into space, the *first* to place a man-made satellite into space, the *first* to have man orbit the Earth, the *first* to have a man walk on the Moon, and so on. The journey and achievements continue and effectively remain unlimited, as this frontier remains in its infancy of discovery.

This inevitable goal to be the ‘first’ also coincides with another early incentive for space development, the period of uncertainty

<sup>293</sup> Igor Greenwald, *Virgin Orbit Shares Slide as First UK Space Launch Fails*, INVESTOPEDIA (Jan. 10, 2023), <https://www.investopedia.com/virgin-orbit-shares-slide-failed-space-launch-7093346> [<https://perma.cc/VV7C-NLV6>].

<sup>294</sup> *Statement Regarding Virgin Orbit*, BUSINESSWIRE (May 23, 2023, 4:26 PM), <https://www.businesswire.com/news/home/20230523006077/en/Statement-Regarding-Virgin-Orbit#:~:text=As%20previously%20announced%2C%20on%20April,a%20sale%20of%20the%20business> [<https://perma.cc/8FQD-9ZTM>].

<sup>295</sup> *Explained: The Chapter 11 Bankruptcy Process*, XCLAIM, <https://www.x-claim.com/blog/explained-the-chapter-11-bankruptcy-process> [<https://perma.cc/6ASM-6SFB>].

<sup>296</sup> See Neil Pooran, *First Orbital Rocket Launch From Scotland Could Blast Off in October*, THE SCOTSMAN (Jan. 23, 2023, 4:55 BST), <https://www.scotsman.com/lifestyle/tech/first-orbital-rocket-launch-from-scotland-could-blast-off-in-october-3996432> [<https://perma.cc/VJ92-L83P>].

<sup>297</sup> *Id.*

<sup>298</sup> *See id.*

<sup>299</sup> *See Massey, supra* note 289.



on Earth in terms of nations distrusting each other and the continued threat of warfare, this time nuclear after the Second World War had concluded. While nations realized very early that space served as another military zone and that control of space was a valuable commodity, nations did come together to look at limitations, and some agreements were reached—such as the UN Outer Space Treaty. However, while there was an early willingness to reach international agreement relating to comprehensively banning nuclear testing and use—obtaining the full commitments of nations served as a means to prevent this ever becoming a reality.

Invariably, space remains an ever-growing business, where the stakes are high, not only in terms of being the first, but the associated investments, returns, and risks, albeit, of varying nature. This investment into space has paid dividends to humankind on Earth, which has benefitted from this continuing journey, driven by and driving technological advancements. Ultimately, there is no turning back from the achievements already made and the legacy of past endeavors.

Physically venturing into space, by manned or unmanned means, remains fraught with challenges—it takes a healthy appetite to do so, alongside substantial financial resources. For the U.K., this has proved a problematic area to commit to, due to political agreement and economic restraints. There can be little doubt that some of the early ambitions of the British Interplanetary Society have been realized in terms of the exploration of space and astronautics, including manned flights to the Moon—albeit, that the U.K. were not perhaps the direct pioneers as had been desired—the nation, nevertheless, played a lead role, particularly in terms of communications, that enabled that accomplishment. In fact, alongside other technological areas, satellite advancement has been a key part in the growth and driver of the U.K. space sector. This said, it was invariably driven by military and defense reasoning in the early years. And so we return to today and the current and future aspirations of the U.K. for space advancement and increasing the growth of this sector.

The current National Space Strategy reveals a renewed appetite for space launches, this time, invariably, U.K. led and from U.K. soil. It identifies that it is able to build upon its strengths in terms of advancing cube-sat technology for satellites—with the ambition to be the first nation to launch a rocket into orbit from Europe and with the ultimate aim of becoming a leader in commercial small-satellite launches. Yet, without doubt, this is also

linked to the need for renewed reinforcement to the U.K. defense satellite system too. Hence, the current approach serves to reinforce that there can be no clear separation of civil and defense space policy.

Tellingly, the NSS has identified this, as for the first time it includes an integrated Defense Space Strategy and clear reference is made within both (the NSS and the Defense Space Strategy) of the need to '*protect and defend national interests in and through space*'—such is the value and risk of space.

Once again, this reinforces the challenges associated with space in terms of risks from other nations and players, threats and hostile actions—both directly and to the advancing technology that is continuously linked and connected to space and that serves everyday functions, as well as the critical national infrastructure of the nation and beyond. There can be no denying that there remains constant challenges both on Earth and in space, and that any acts of hostility by nations, or organized groups, will stand to attack and compromise key systems supported or delivered by space technology. Such is the time that we now currently live in that there remains this potential and/or constant threat. And so, this circular journey continues, of advancing “all” humankind and invariably risking it also; of working collaboratively with partners and allies to protect countries and space; and yet, also needing to have systems in place to protect national assets and, then perhaps, to revert to an insular protectionism stance. There can be little doubt that nations remain cognizant that supremacy of space affects Earth; and, hence why, perhaps, the U.K. now has a renewed appetite to take a prominent role.