Space4Health: A Place for Satellite Applications and Technology in the UK COVID-19 Governance Framework

J. Lauren Napier

Northumbria University and Centre for a Spacefaring Civilization

Alessandra Vernile

Centre for a Spacefaring Civilization

Abstract

The COVID-19 pandemic has changed the whole world in how governments and society respond to global health issues. Within the UK it is essential to implement strategies that call for a cross-sectoral approach in order to strengthen the work that is done to combat the virus and make society safe and secure. This future thought piece discusses how the UK could, and should, incorporate space-enabled technologies and data into the UK COVID strategies. Satellites observing the Earth have a role to play in aiding other technological and scientific initiatives focused on supporting COVID health. Additionally, this article gives recommendations on what to include in a UK COVID governance strategy that would include space-enabled technologies and data. Calling on international space governance that focuses on global health as well as initiatives on global health utilised by the UK space sector as well as the European Space Agency and others, there are many examples and existing programmes that use space data which could be included into a UK COVID governance strategy. Lastly, a risk governance model will be assessed as a potential model for the UK COVID strategy.

Keywords: COVID, governance, satellites, data, Earth Observation

Introduction

Now that society is firmly planted within the 'new normal' of the COVID-19 pandemic[1], it is time for the United Kingdom to assess where it stands regarding the juxtaposition between technology and governance. As COVID-19 continues to be a critical issue within the UK, it is essential to implement strategies that call for a cross-sectoral approach in order to strengthen the work that is done to combat the virus and make society safe and secure. One way this can be achieved is through the continued and more substantial use of space-enabled technologies and their data-driven outputs. Space-enabled technologies refer to activities of satellite communication, satellite navigation, remote sensing, and Earth Observation (EO). One facet already under consideration by the UK government refers to tele-medicine and remote monitoring for healthcare. The UK Government's COVID-19 Recovery Strategy includes space-enabled technologies and data as part of the National Health Service (NHS) and care capacity and operating model. As mentioned in the *Our Plan to Rebuild: the UK Government's COVID-19 Recovery Strategy*:

> "The Government will seek innovative operating models for the UK's health and care settings, to strengthen them for the long term and make them safer for patients and staff in a world where COVID-19 continues to be a risk. For example, this might include using more tele-medicine and remote monitoring to give patients hospital-level care from the comfort and safety of their own homes."[2]

According to the World Health Organization, tele-medicine, and by extension remote monitoring, is:

> "the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interest of advancing the health of individuals and their communities"[3].

Additionally, satellite communication can include many advantages to telemedicine by bringing

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[1] Within this article the COVID-19 pandemic will be referred to as COVID, COVID-19, or the pandemic interchangeably.

[2] UK Government, 'Our Plan to Rebuild: The UK Government's COVID-19 Recovery Strategy' (May 2020) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/884760/Our_plan_to_rebuild_The_UK_Government_s_COVID-19_recovery_strategy.pdf> accessed 16 July 2020, pg. 34.

[3] World Health Organization, 'Telemedicine: Opportunities and Developments in Member States' Report on the Second Global Survey on eHealth, Global Observatory for eHealth series Vol 2, (2009, WHO) 9.

> "… instant access to broadband services, particularly in remote areas where telecommunications are poor or non-existent, and swift response in disaster situations where speed is vital. Satellites also provide a powerful and relatively inexpensive tool, particularly for video links between multiple users. Plus, costs are constantly decreasing, and satellites are a tried, tested and extremely reliable means of telecommunication"[4].

As can be seen from these statements, the UK framework for COVID-19 should be inclusive of the use of satellites and the UK space industry in order to support the reference to telemedicine and remote monitoring in the current UK COVID-19 Recovery Strategy. Currently the United Kingdom Space Agency (UKSA) is working with the European Space Agency (ESA) as well as the NHS in order to provide incentives for businesses to support society throughout the pandemic. However, there is more that could be done to support and include space-enabled technologies and data toward a COVID-19 governance framework.

The present discussion aims to examine what is being done through space-enabled technologies and data to support the 'new normal' that the COVID-19 pandemic has brought forth, as well as to examine whether the UK governance framework for COVID-19 includes the space sector as a viable support system for this endeavour. Further, additional governance recommendations will be made where UK laws, policies, and strategies could include a more robust inclusion of space-enabled technologies and data that could support a post-pandemic recovery system within the COVID-19 governance framework. This piece will conclude by examining how using UK and ESA space-enabled technologies and data for COVID-19 related initiatives could foster a model for a UK governance framework for health more generally. An inclusion of space-enabled technologies and data would showcase the UK as a leader in 'Space4Health' applications domestically, as well as internationally through the UKSA International Partnership Programme (IPP).

The Use of Space to Support Global Health

Space-enabled technologies and data can support global, regional, and local health initiatives – especially now in response to COVID-19. Such space-enabled technologies include Earth Observation (EO), remote sensing, satellite navigation with geospatial data, and satellite communication. To better understand what is meant by each of these space technologies, each will be defined here and examples that pertain to global health and the COVID-19 pandemic will be provided. However, it should be noted that these technologies do not have legally binding definitions, instead these are working definitions that allow for an understanding of what is meant by each utilisation.

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[4] European Space Agency, 'Satellite's Role in Telemedicine' (29 May 2003) <https://www.esa.int/Applications/Telecommunications_Integrated_Applications/Satellite_s_role_in_te lemedicine> accessed 18 September 2020.

Looking first at Earth Observation, according to the United Kingdom Space Agency (UKSA):

> "EO is the collection, analysis and presentation of data in order to better understand the planet Earth. Satellite EO is the use of satellites to collect information about the Earth."[5]

Earth observation is predominantly utilised for understanding and supporting initiatives on climate change and Sustainable Development Goals (SDGs). As an example, the Climate Change Initiative, is an ESA initiative supported by the UKSA, where various climate variables such as ocean surface temperatures and land surface temperatures are measured and assessed. With the rise of the COVID-19 pandemic, Earth Observation is also being used to support health initiatives within the UK, Europe, and globally. For example, ESA[6], the United States National Aeronautics and Space Administration (NASA), and the Japanese Aerospace Exploration Agency (JAXA) have teamed up to create the Earth Observing Dashboard in order to combine "… the resources, technical knowledge and expertise of the three partner agencies to strengthen our global understanding of the environmental and economic effects of the COVID-19 pandemic"[7].

Remote sensing, as part of the larger Earth Observation overarching initiative, as understood by the United Nations General Assembly (UNGA) *Principles Relating to Remote Sensing of the Earth from Outer Space*,

> "… means the sensing of the Earth's surface from space by making use of the properties of electromagnetic waves emitted, reflected or diffracted by the sensed objects, for the purpose of improving natural resources management, land use and the protection of the environment"[8].

Essentially, remote sensing is another way of referring to Earth Observation. The remote sensing principles were created in the 1980s, however the term Earth Observation is more encompassing and is currently used more frequently when discussing satellites that are collecting data from Earth. Earth Observation, holistically speaking, can provide ancillary capabilities in order to better understand the impact the COVID-19 pandemic has had on environmental and economic considerations at the local, regional, and global levels, such as what is being tracked by the Earth Observing Dashboard mentioned above.

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[5] United Kingdom Space Agency, 'Earth Observation (EO)' (Gov.uk, published 20 September 2017, last updated 18 December 2018) < https://www.gov.uk/government/collections/earth-observation-eo#history > accessed 8 September 2020.

[6] The UK is a major investor for ESA Earth Observation, contributing £200m in 2019.

[7] ESA, NASA, JAXA, 'Earth Observing Dashboard' < https://eodashboard.org/> accessed 8 September 2020.

[8] United Nations General Assembly Principles Relating to Remote Sensing of the Earth from Outer Space (1986) UN Doc A/41/20 and Corr. 1.

Satellite navigation, which includes geospatial data, generates positioning information of a person or a set location through tracking locations and movements[9]. The most well-known is the US Global Positioning System (GPS). Regarding COVID-19, "location information is essential in detecting and managing the spread of the virus, mainly by tracking the movement of people and observing compliance with social distancing measures"[10]. For example, Lanterne, "… a UK-based business, has developed, through the ESA Business Incubation Centre UK (ESA BIC) and other funders, their Crowdless app to support individuals who want to avoid crowds and are concerned with social distancing"[11].

One example that showcases the use of satellite communication, satellite navigation, and Earth Observation data is the UK space company Skyports and their space-enabled drones. The UKSA and ESA are supporting this initiative for Skyports to work with NHS Highland (part of NHS Scotland) in order for the "… drones to deliver medical supplies and samples from a hospital on the Argyll and Bute mainland"[12] to remote Scottish locations through a hospital-to-hospital drone delivery trial.

Overall, space-enabled technologies and data can support response and recovery from the COVID-19 pandemic, as well as support ancillary initiatives that have started to occur in connection to the pandemic. Essentially, "satellites can be used to monitor how the disease spreads, provide support for telemedicine, and support relief efforts"[13]. Additionally, data from satellites "… can help locate where help is needed, find hospitals, count houses to know how many vaccines are needed, monitor the effects of COVID-19 on air pollution"[14] and provide tele-education now that students are resuming their studies, as well as support work from home initiatives as employees are continuing to work remotely.

With the inclusion of data from satellites, there is some concern over data protection and what this means for citizens, as well as the government. In a time of track-and-trace utilisation, it is relevant to consider data protection policies and what they mean for a COVID-19 governance framework – as will be discussed below.

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[9] The caveat to using geospatial data is what this means vis-à-vis data protection policies – such as the UK Data Protection Act 2018 and the General Data Protection Regulation (GDPR) – more of which will be discussed below.

[10] Dimitra Stefoudi, 'Space Data in the Fight Against Pandemics: Privacy Concerns and Sharing of Benefits from the Use of Space Technology for Decision-Making' (2020) Air & Space Law, 45, Special Issue, 107-122, 109.

[11] University of Northumbria Law School and Centre for a Spacefaring Civilization, 'Written Evidence on House of Commons Science and Technology Committee UK Science, Research and Technology Capability and Influence in Global Disease Outbreaks' (2020).

[12] UK Space Agency, 'Space Agency Backs Space-Enabled Drones to Deliver Covid-19 Testing Kits' Gov.uk press release (10 July 2020) < https://www.gov.uk/government/news/space-agency-backs-space-enabled-drones-to-deliver-covid-19-testing-kits > accessed 8 September 2020.

[13] Tanja Masson-Zwaan, 'Combating COVID-19: The Role of Space Law and Technology' (2020) Air & Space Law, 45, Special Issue, 39-60, 40.

[14] Tanja Masson-Zwaan, 'Combating COVID-19: The Role of Space Law and Technology' (2020) Air & Space Law, 45, Special Issue, 39-60, 40.

Data Protection and COVID-19

Having examined the use of space to support global health initiatives – COVID-19 in particular – the present section of the article will discuss data protection. The data collected from satellites is vast and can contain sensitive or private information, therefore, looking at the UK data protection strategy in conjunction with the COVID-19 strategy is essential. The relevance that new technologies, especially the space-based ones, developed during the first peak of the pandemic in March, has been translated into the adoption of solutions that aim at tracing the population. In the context of these solutions, a series of ethical and privacy related issues were raised, especially concerning citizens[15]. In general terms, all across Europe and the UK, extraordinary powers were introduced by governments and were imposed to allow the governments to use data as a tool to make fast decisions, creating the basis for an ethical discussion and a review of the General Data Protection Regulation (GDPR), a legal framework that sets guidelines for the collection and processing of personal information from individuals who live in the EU[16]. in this exceptional case.[17] Specifically within the UK, GDPR is implemented, at this time, through the Data Protection Act 2018.[18]

With the introduction of GDPR in 2018, individuals gained major control over their personal information and how said data is stored and treated.[19] As has been argued, satellite data is crucial to tackling the pandemic, but depending on the satellite technology adopted, the use of such data could conflict with GDPR privacy and data protection, as per satellite location data and-in some case- Earth Observation. The importance of having control of personal data has been strongly reaffirmed during COVID-19, where sharing personal data for public health is important to preserve the citizens' health and well-being. Among the different solutions proposed by European and UK governments to allow citizens to come back to their normal lives, location-based mobile applications to trace potential COVID-19 cases are considered highly relevant. But several doubts arose around the actual relevance of the apps and their impact on the pace of the pandemic, especially around the issue of being traced while reducing their right to privacy[20]. As a consequence, the governments started to support and advertise tracing apps that rely exclusively on Bluetooth, considered safer

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[15] eHealth Network, Mobile applications to support contact tracing in the EU's fight against COVID-19 Common EU Toolbox for Member States. (15.04.2020). https://ec.europa.eu/health/sites/health/files/ehealth/docs/covid-19_apps_en.pdf

[16] Morgan Lewis&Bockius LLP, Data Privacy Issues in COVID-19 Contact Tracing Apps. (03.09.2020) https://www.lexology.com/library/detail.aspx?g=5f45b116-9287-4c5d-9974-849aafcbe106

[17] Tanja Masson-Zwaan, 'Combating COVID-19: The Role of Space Law and Technology' (2020) Air & Space Law, 45, Special Issue, 39-60, 40.

[18] At the time of writing the UK Data Protection Act 2018 implements the General Data Protection Regulation (GDPR), however post-BREXIT plans are still unclear if the GDPR implementation will stand within the 2018 Act or if the 2018 Act will be updated.

[19] Adrienne Harebottle, "GDPR is Here But, What Does it Really Mean for Satellite?" (30 May 2018) Via Satellite.

[20] Hannah van Kolfschooten & Anniek de Ruijter (2020) COVID-19 and privacy in the European Union: A legal perspective on contact tracing, Contemporary Security Policy, 41:3, 478-491, DOI: 10.1080/13523260.2020.1771509

in terms of data protection, but less precise than the Global Navigation Satellite System (GNSS). Nevertheless, a series of hybrid apps were created and launched on the market that merge GNSS technology with Bluetooth. In such cases, the users deliberately gave consent on the use of data collected without feeling their privacy was violated.[21]

As pointed out during a webinar organised by Eurisy- a European NGO with a mission to connect space and society and to raise awareness on the socio-economic benefits derived from the uptake of space applications for societal needs- on "Tracing apps and COVID-19 containment. Legal threats and cyber challenges"[22], the challenge for governments and GNSS service providers is, and still will be, the need to reconcile tracing apps with the European and UK standards for privacy. EO-based solutions developers face different challenges, not directly related to privacy. Indeed, specific to Earth Observation, privacy concerns are limited: except for some cases where images have 5cm resolution, in general, satellite imagery tends to have smaller centimetre resolution in order to produce better image quality. This means that the majority of satellites sensing Earth are not jeopardizing the privacy of global citizenry.[23]

Relevant Space Governance Toward Global Health

Within the outer space governance framework, there is nothing explicitly stated, or legally binding, on the use of space for pandemics or global health. However, it can be inferred through the use of relevant general international law using language referring to the Sustainable Development Goals or socio-economic issues, specifically in-line with SDG 3: Good Health and Well-Being.[24] However, it is up to States to implement as they see fit -- within their national global health policies and strategies -- any principles and other non-binding international law or UN initiatives on global health. The *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*[25] is the foundational treaty of the outer space governance framework and allows under Article I; "… use by all States without discrimination of any kind, on a basis of equality and in accordance with international law …"[26]. Article I lays down the accepted principle, in

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[21] Hannah van Kolfschooten, *in ibid.*

[22] Eurisy, "COVID-19 Tracing Data and Protection"- Summary of the Eurisy-SGAC Webinar "Tracing apps and COVID-19 containment. Legal threats and cyber challenges. (5 June 2020) <https://www.eurisy.org/data_files/publications-documents/56/publications_document-56.pdf?t=1592477688> accessed 19 September 2020.

[23] Shelby Brown, 'Satellite surveillance may be less of a privacy concern than you think -- for now' (29 October 2020) CNET <https://www.cnet.com/how-to/turns-out-satellite-surveillance-only-sounds-like-a-major-privacy-concern/> accessed 19 September 2020.

[24] Learn more about SDG 3: Good Health and Well-Being here: https://www.un.org/sustainabledevelopment/health/

[25] Herein after referred to as the Outer Space Treaty.

[26] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (open for signature 27 January 1967, entered into force 10 October 1967) 610 UNTS 205.

treaty form, that space utilisation is open to all and has paved the way for uses which include Earth Observation, remote sensing, satellite navigation, and satellite communication. There is also a UN Resolution, the *Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries*[27] (also known as the 1996 Declaration on Space Benefits) which encourages States – when cooperating internationally – to use space for peaceful purposes and to take into account the needs of developing countries. International cooperation "… shall be carried out for the benefit and in the interest of all States, irrespective of their degree of economic, social, or scientific and technological development …"[28]. However, as non-binding international law, it is up to States to support this idea of international cooperation at the national regulatory level and to decide on whether to include global health initiatives.

The Space2030 Agenda

The only international space governance text specifically referring to global health and the Sustainable Development Goals is the draft Space2030 Agenda[29]. The draft Space2030 Agenda outlines a different framework than the Outer Space Treaty; mainly because the Space2030 Agenda is a broad policy framework with a voluntary, non-binding status within international space law, while the Outer Space Treaty is binding international law. In response to the UN framework of the 2030 Agenda for Sustainable Development[30], the impact of space-based services and applications to respond to societal needs and to socio-economic development is now assessed through the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) Member States' involvement in drafting the Space2030 Agenda. In particular, the draft Space2030[31] Agenda provides a long-term plan to integrate space as a development tool to policy-oriented implementation at the national level in order to support society, not exclusively in emerging and developing countries, but through adoption on a more global scale. The objective is to fulfil the 17 Sustainable

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[27] UNGA, 'Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries' (1996) UNGA Resolution 51/122 13 December 1996.

[28] UNGA, 'Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries' (1996) UNGA Resolution 51/122 13 December 1996.

[29] At time of writing the Space2030 Agenda is only in a revised draft format and has not yet been finalised through the work of the UN Committee on the Peaceful Uses of Outer Space, partly because of the pandemic and committee meetings being cancelled.

[30] United Nations, 'The Sustainable Development Agenda' <https://www.un.org/sustainabledevelopment/development-agenda/> accessed 21 September 2020.

[31] United Nations Office of Outer Space Affairs, 'Space2030: Space as a Driver for Peace' (25 September 2018) <https://www.unoosa.org/oosa/en/outreach/events/2018/spacetrust.html> accessed 21 September 2020.

Development Goals[32], which in light of the pandemic means a focus on Sustainable Development Goal 3: Good Health and Well-Being.

During the past months space-based technologies have provided a valuable contribution to respond to the challenges posed by the pandemic and the lockdown measures. In the context of the draft Space2030 Agenda, the adoption of such space solutions meant the reaffirmation of the importance of including space-based technologies in the policy making process and to build around it a legal framework that would allow institutional space actors and commercial ones to have the same toolboxes and principles.

Other UN Instruments Relating to Space and Global Health

As per the UNGA report on *Coordination of Space-Related Activities within the United Nations System: Directions and Anticipated Results for the Period 200-2021 – Megatrends and Realization of the Sustainable Development Goals*[33] (A/AC.105/1230)[34], space applications are used to tackle COVID-19 related challenges and to address the virus in the very long-term. Space-based applications together with digital technologies are supporting governments and the population. In particular, the report referenced the United Nations Economic and Social Council Commission for Asia-Pacific (ESCAP) that is facilitating the regional sharing of georeferenced data, geospatial and temporal data analysis to create a pattern for local and national authorities to understand how the virus is impacting on different sectors, such as health, finance, or the economy. ESCAP is also planning to leverage on regional coordination mechanisms available in the Asia-Pacific Region to promote and favour the take up of geospatial data for global health, including in extraordinary cases such as pandemics. The objective is to support health authorities in mapping risks and integrating space technology for a better evidence-based decision-making process.[35] This case study of ESCAP exemplified within the UN report, showcases how regions can implement data-sharing in order to support pandemic related initiatives – which could be used as a model for UK data-sharing and implementation as well.

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[32] Luigi Scatteia, Alyssa Frayling, and Tala Atie, 'The Role of Emerging Space Nations in Supporting Sustainable Development and Economic Growth' (February 2020, PwC). <https://www.pwc.fr/fr/assets/files/pdf/2020/03/en-france-pwc-space-practice-emerging-space-nations-paper.pdf> accessed 21 September 2020.

[33] Herein referred to as the Report.

[34] United Nations Office of Outer Space Affairs, Coordination of space-related activities within the United Nations system: directions and anticipated results for the period 2020–2021 – megatrends and realization of the Sustainable Development Goals (2020) A/AC.105/1230 <https://www.unoosa.org/oosa/en/oosadoc/data/documents/2020/aac.105/aac.1051230_0.html> accessed 21 September 2020.

[35] United Nations Economic and Social Council, Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018-2030) (21 January 2019) ESCAP/75/10/Add.2 <https://www.unescap.org/commission/75/document/E75_10A2E.pdf> accessed 21 September 2020.

Space4Health

Through the Space2030 Agenda, the United Nations Office for Outer Space Affairs (UNOOSA) supports countries all over the world to have equal access to space science and applications. Health is one of the fields where space technologies are having a relevant impact. In particular, UNOOSA is supporting capacity building activities in this field, and in the areas of telehealth and tele-epidemiology. [36]

In 2018, the UN Committee on the Peaceful Uses of Outer Space established a Working Group on Space and Global Health that is working on collecting information from Member States about their use of satellite applications for global health. The platform that has been created within the Working Group allows the sharing of information, best practices, tools, and capacity building activities. [37] Currently, the UK is not part of the Working Group on Space and Global Health, which is egregious given the importance that is placed on global health at the national level. This self-exclusion from the working group means that the UK is limiting its exchange of best practices and know-how on the space and global health topic. This seems counter-intuitive to the UK rhetoric for implementation and knowledge-sharing which the UK supports in the context of the Long-Term Sustainability Guidelines (LTSG) –voluntary non-binding international law guidelines -- as will be seen below.

Status Quo of UK COVID-19 Governance Framework

As it stands, the UK COVID-19 governance framework consists of a two-document strategy entitled *Our Plan to Rebuild: the UK Government's COVID-19 Recovery Strategy*[38] and *The Next Chapter in Our Plan to Rebuild: the UK Government's COVID-19 Recovery Strategy*[39]. After review of both strategies, there is no direct reference to the use of space-enabled technologies and data to support the recovery

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[36] United Nations Office of Outer Space Affairs, 'Working Group on Space and Global Health' <https://www.unoosa.org/oosa/en/ourwork/copuos/stsc/gh/index.html> accessed 21 September 2020.
[37] United Nations Office of Outer Space Affairs First Meeting of the Expert Group on Space and Global Health (6 February 2015) A/AC.105/C.1/2015/CRP.29 <https://www.unoosa.org/pdf/limited/c1/AC105_C1_2015_CRP29E.pdf> accessed 21 September 2020.
[38] UK Government, 'Our Plan to Rebuild: The UK Government's COVID-19 Recovery Strategy' [May 2020] < https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/884760/Our_plan_to_rebuild_The_UK_Government_s_COVID-19_recovery_strategy.pdf> accessed 16 July 2020, pg. 34.
[39] UK Government, 'The Next Chapter in Our Plan to Rebuild: the UK Government's COVID-19 Recovery Strategy' [May 2020] < https://www.gov.uk/government/publications/our-plan-to-rebuild-the-uk-governments-covid-19-recovery-strategy/the-next-chapter-in-our-plan-to-rebuild-the-uk-governments-covid-19-recovery-strategy--2> accessed 16 July 2020.

strategy. There is one indirect reference to space technologies in the *Our Plan to Rebuild* strategy as was mentioned above:

> "… this might include using more tele-medicine and remote monitoring to give patients hospital-level care from the comfort and safety of their own homes."[40]

The concepts of tele-medicine and remote monitoring for patients rely on space-enabled technologies and data, however, nothing concrete is mentioned, nor is there any further understanding on how satellites will be utilised for these endeavours.

Disjointed and not referenced in the above mentioned two-document strategy are the UK space sector strategies for supporting the COVID-19 pandemic. Further, within the UK space sector there is no formal UK Space Agency COVID-19 strategy, nor are UK initiatives adequately connected. Some UK space COVID-19 initiatives are even embedded into regional frameworks within the European Space Agency. Currently, any mention of the pandemic and outer space within the UK are funnelled through Satellite Applications Catapult[41] which supports UK space innovations and through UKspace[42], the trade association for the UK space industry. One angle that is adopted in the UK is how to support the UK space economy through the pandemic. If there were more initiatives and funding to support space businesses to tackle pandemic issues, then the UK space economy would also benefit in return.

When searching for information about the UK space sector and the pandemic, most information is from April or May 2020 and has not been updated since. Additionally, a search on the UKSA government website does not feature any mention of supporting the pandemic through the space agency. What is known on how the UK space sector is supporting the pandemic comes from news sources, ESA, the UKspace, or Satellite Applications Catapult. The fact that information must be found on a varied number of online sources and through doing an extensive search suggests that no clear UKSA COVID-19 strategy has been created.

Nonetheless, there are some positive aspects, even without a clear strategy in place. The UKSA and ESA have announced a £2.6 million fund for projects that would support the NHS in responding to the pandemic.[43] These projects, some of which were mentioned above – such as the Crowdless app – are already underway. The information on how to apply for funding and further details are housed within the ESA website as a 'Space for UK on COVID-19' initiative.[44]

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[40] UK Government, 'Our Plan to Rebuild: The UK Government's COVID-19 Recovery Strategy' [July 2020] < https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/884760/Our_plan_to_rebuild_The_UK_Government_s_COVID-19_recovery_strategy.pdf> accessed 16 July 2020, pg. 34.

[41] Satellite Applications Catapult: https://sa.catapult.org.uk/

[42] UKspace: https://www.ukspace.org/

[43] UK Space Trade Association, 'UK Space Technologies to Boost NHS Coronavirus Response' <https://www.ukspace.org/uk-space-tech-to-boosy-nhs-coronavirus-response/ > accessed 21 September 2020.

[44] European Space Agency, 'Space for UK on COVID-19' (updated 15 May 2020) <https://business.esa.int/cv19-uk#LatestInfo> accessed 21 September 2020.

What this analysis of the status quo of the UK COVID-19 governance framework and the case for space supporting global health initiatives demonstrates is that there is a disjointed approach to handling the pandemic. The fact that the UK financially supports ESA and national space applications toward the SDGs and Earth Observation, yet does not utilise the expertise across sectors, strikes a chord of disconnection and, perhaps, miscommunication. There is room for improvement and synergising across sectors at the UK level, as well as room for communication of initiatives at the ESA level to be brought to the UK governmental departments. Use of space is risky and expensive, therefore, it behoves the UK to get the most out of the UK financial contributions in space especially if these contributions connect with non-space related national healthcare initiatives. Therefore, the next section aims to give recommendations on how the UK COVID-19 governance framework could further utilise space-enabled technologies and data to create a more robust COVID-19 strategy now and in the post-COVID phase.

Recommendations to UK COVID-19 Governance Framework: Space Data is Key

Overall there is progress being made to include the UK space sector in the fight against COVID-19. However, the UK governance framework for the pandemic does not have a structured inclusion of the UK space sector within the current COVID-19 strategy. This section aims to give recommendations on how the current UK pandemic governance framework, which includes a UK COVID-19 Strategy, should be inclusive of the use of space technologies as was mentioned above. This inclusion of space technologies and data would create a more robust governance framework for the UK to combat COVID-19.

A Risk Governance Framework Model: Inclusive of Technology

It is clear that although society would like to say that it is closer to a time of post-COVID, with the rise in lockdowns across the UK and Europe and the seasonal effects on health, it would be prudent to continue with a COVID-19 governance framework that allows for flexibility and agility as the numbers fluctuate and a vaccine is underway. The fact that today's society is an interconnected, globalised one only exacerbates the fact that any national COVID-19 strategy must accept that there may be setbacks in order to take one small step forward. Additionally, not all States were fully prepared within their health sectors to have the capacity or the resources to manage a pandemic. Furthermore, the pandemic has taken a serious toll on the economic stability of States and does not just affect the health care systems. Therefore, thinking about COVID-19 as being managed by a risk governance framework can support the way forward. Within the UK this has been done however, in a disjointed way and often lagging behind the rise in numbers. Risk management in a risk governance framework "… begins with taking decisions about the measures needed to deal with the risks evaluated as tolerable. It involves designing, selecting, and implementing strategies

to reduce the adverse consequences associated with the risk"[45]. Therefore, it is reasonable to say that any UK COVID-19 strategy going forward should still consider the risks given that the numbers of those infected are low enough to confidently say the UK is in a post-COVID recovery stage.

A risk governance framework would support looking at lessons learned from previous risks, such as SARS or Ebola, to better understand the ups and downs of a health risk and what that can mean for individuals and the society as a whole. It is important to respond quickly to rises in numbers across counties and cities – such as was done in Leicester and the North East of England. What is key is utilising technology – such as satellite technology as is argued in this research – in order to "… predict, identify and help respond to infectious disease outbreaks and other emergencies"[46]. Collins, Florin, and Renn suggest "this is the first 'smartphone pandemic'"[47] and therefore discussions on tracing while considering privacy is a key component. Additionally, this use of smartphone technology can include the use of satellite technology, which means including the space sector in strategic discussions could create added benefits of how best to utilise these technologies.

Cross-Collaboration: UK Space Sector

Another step forward for the government is to strengthen capacity building activities of technology-related institutions. This would be the case for the UKSA. The UKSA should encourage capacity building mechanisms with the European Space Agency and with satellite experts, such as Satellite Applications Catapult, UKspace, and Eurisy of which the UK Space Agency is a member. This capacity building would include engaging and communicating with the healthcare sector and other relevant sectors in order to discuss why and how space-enabled technologies can support COVID-19 strategies.

In the first case, UKSA-CATAPULT would have the possibility of developing solutions to fight any pandemic by relying on satellite-based solutions and technology and favour their scalability on the commercial market. If the product is scalable, the UKSA with the UK government should support the company for the first year to allow the

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[45] Aengus Collins, Marie-Valentine Florin, and Ortwin Renn, 'COVID-19 Risk Governance: Drivers, Responses and Lessons to be Learned' (2020) Journal of Risk Research <https://www.tandfonline.com/doi/full/10.1080/13669877.2020.1760332> accessed 21 September 2020.
[46] Aengus Collins, Marie-Valentine Florin, and Ortwin Renn, 'COVID-19 Risk Governance: Drivers, Responses and Lessons to be Learned' (2020) Journal of Risk Research <https://www.tandfonline.com/doi/full/10.1080/13669877.2020.1760332> accessed 21 September 2020.
[47] Aengus Collins, Marie-Valentine Florin, and Ortwin Renn, 'COVID-19 Risk Governance: Drivers, Responses and Lessons to be Learned' (2020) Journal of Risk Research <https://www.tandfonline.com/doi/full/10.1080/13669877.2020.1760332> accessed 21 September 2020.

developers and/or entrepreneurs to cope with the financial difficulties many agencies are facing. With Eurisy, UKSA can work together to bridge the UK space sector with the end-users and to access local authorities to support the take-up of satellite-based solutions.

UKSA and UKspace have already met to discuss the UK space sector response to the pandemic. During the meeting it was agreed to:

> "Maintain an effective flow of information between the space sector and government during the COVID-19 crisis. Establish dedicated teams from the UK Space Agency and UKspace to direct companies towards the support available from government. Identify any further actions that the government and trade body can take to minimise the disruption of COVID-19. Broaden the engagement with space business beyond members of UKspace."[48]

However, this meeting took place in April 2020 and since then nothing else has been announced publicly, nor has any kind of UK space sector strategy for the pandemic been announced. In late April 2020 it was mentioned that as the UK started to bounce back from the COVID-19 pandemic, government and industry within the UK need to work together to ensure that, "… the strategic importance of space is recognised across Government …"[49]. While the Vice Chair of UKspace was referring to making the UK a Tier 2 space State and working past the pandemic, this line of thought should be applied now even though the UK – and many other States – are not yet clear of COVID-19.

Having a coherent UK space sector strategy for the pandemic is crucial as numbers are still high and a UK-wide lockdown has been put in place again in November 2020. It would be fruitful for the UK if synergy was found by way of a clear-cut, forward-thinking strategy on how the UK space sector could support the pandemic and not just a recovery strategy – as recovery is still some way away. This recommended strategy should call upon the UKSA to head up collaborating and communicating with ESA, UKspace, Space Applications Catapult, and perhaps other organisations such as Eurisy and the United Nations Office of Outer Space Affairs in order to provide a UK space sector strategy for the pandemic that could then be paired with the UK government COVID Recovery Strategy framework. Additionally, all of these measures should be evaluated in light of the need of the government to relaunch the economy moving into the next phase of the pandemic and to align with the 'Global Britain' initiative post-Brexit.

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[48] Melissa Maday 'UK Space Sector Working Together on Response to Coronavirus' (15 April 2020, Space Watch Global) <https://spacewatch.global/2020/04/uk-space-sector-working-together-on-response-tocoronavirus/> accessed 21 September 2020.
[49] Nick Shave, 'Urgent Need for Coherent Cross Government Space Strategy' (24 April 2020, UKspace trade association) <https://www.ukspace.org/urgent-need-for-coherent-cross-government-space-strategy/> accessed 21 September 2020.

The UK and the International Partnership Programme

To respond efficiently to the COVID-19 emergency, the UK could rely on the lessons learned from the response to previous health outbreaks. Among them, the UK should set up a plan on the basis of the "Health is Global" one that the government issued with the aim of protecting the health of the UK citizenry proactively by tackling health challenges outside the borders. Similarly, the UK should gain the same support and leading role in the discussions with the World Health Organization (WHO). Such a step could help the government in contributing to the global health effort, although standing outside the UNOOSA Global Health Working Group, the UK could still contribute to the exchange of views and know-how that would be advantageous for a proper cooperation in the field of global health within the UN system.

It is recommended that a series of long-term investment packages in the R&D sector are implemented, to favour cross-sectoral activities that would involve space technology in the fight against the spreading of the virus. Relying on the tool of the UK International Partnership Programme (IPP), a similar scheme could be put in place to support public, private entities and non-profits and NGOs to present valuable solutions to respond to the virus. The best option would be to combine public and private investments to be addressed to fund vaccinations, treatment, and diagnosis of infectious diseases such as COVID-19. To achieve this goal, the government should publish, as also proposed in the governmental plan to respond to the Ebola crisis, an "emerging infectious disease strategy", that could highlight the main threats to the citizenry and how to tackle them.[50]

Conclusion

This future-thinking research argues the importance of utilising space-enabled technologies and data toward the UK's pandemic governance framework. As COVID-19 is still a crisis within the UK, it is imperative that the government find ways to cross-collaborate and communicate amongst sectors that could support against this pandemic. Specifically, this research suggests that while the UK space sector has been working to support COVID-19 it has done so in a fragmented way and without any connection to the UK COVID-19 Strategy. To foster better solutions, it is urged that the UKSA liaise with the UK space sector and ESA in order to report back and support the overarching UK pandemic governance framework. Additionally, this framework should look to the model of risk governance to see how technology and science play a pivotal role in designing and implementing key action points toward a more robust strategy against COVID-19. Unfortunately, the UK is not in a post-COVID-19 phase and as such should reconsider how space-enabled technologies and data

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[50] UK Department of Health, 'Government response to the House of Commons Science and Technology Committee 2nd Report of Session 2015-16: Science in Emergencies: UK lessons from Ebola' (April 2016) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/516828/DH_Cm_9236_Ebola_acc.pdf> accessed 20 September 2020.

could better support the current dynamic in order to move the UK toward a post-pandemic strategy while continuing to learn lessons from the previous iterations.