Written Evidence submitted by Fujitsu Ltd

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1. Input Approach and Why Fujitsu

Fujitsu is pleased to contribute and provide input to this timely UK Parliament Call for Evidence on the UK space strategy and UK satellite infrastructure. We are responding to the call for evidence as an organisation with a strong UK heritage working with government and across different UK industry sectors. We also have an extensive heritage in the Japan Space sector, having worked with the Japan Aerospace Exploration Agency (JAXA) and the Japanese Government for over 40 years across a wide variety of areas such as Space exploration, Space Situational Awareness, Ground Station Systems, Earth Observation Systems, Radar and Monitoring Systems.

We therefore come from a position of significant experience in the Japanese space sector, and are looking to actively work with the UK to create new opportunities for the UK Space market that align with the government's desires to restore Britain's place as a scientific superpower. This includes a particular focus on where we can apply ground-breaking technology. Our beachhead engagement over this last year has been a Grant funded innovation project with the UK Space Agency, using our industry-leading Digital Annealer/ Quantum Inspired technology, in conjunction with Artificial Intelligence to see how Space Debris Removal could be made more commercially viable; the first time Quantum-related technology and AI have been brought together in a Space context.

Fujitsu has therefore approached this call for evidence very much with an "objective" viewpoint. This means that, while other organisations and entities more steeped in the legacy of the UK Space market will have better in-depth historical perspectives, we hope to bring a fresh and "outside-in" point of view. A view that also sees a huge opportunity for the UK in Space and is keen to actively support the UK's strategic goals on research, skills, AI and net zero.

We recognise the increasing criticality that Space has to the UK, both for the imperative protection of our strategic assets, and the significant economic opportunities that all major nations are chasing. We believe that the UK is at an inflection point with Space, and if successful, with the right strategy, activity, support and partnerships, Space has the opportunity to not only be an even greater innovation and commercial centre for the UK, but also an economic and technological catalyst across multiple sectors.

Within the areas requested for commentary, our focus for this response to the UK Parliament's call for evidence will be on the following:

- Learnings from experience with Japan's Space Programme
- New Technology, what it can generate and how the UK should engage with it
- Our approach to innovation and collaborative ecosystems, and what this enables
- Where we believe there are untapped value streams for the UK
- How the UK can exploit them and create advantage

2. What are the prospects for the UK's global position as a space nation, individually and through international partnerships?

The UK "Space Industry Act", enacted on 15 March 2018, rightly anticipated the coming new age of space. This legislation is set to contribute to improving the status of UK space activities by demonstrating international initiatives for Space Traffic Management (STM).

The British aerospace industry is the second largest in Europe and the third largest in the world. We have a high level of engineering expertise, investment in R&D, human resource development, and the development of small satellites. We are actively investing in start-ups, and exports account for most of the GDP generated by the aerospace industry. Above all, the UK is a key node in the global space sector, and one that stands to gain far more through collaboration than isolation.

2.1 International Co-operation

Japan is actively looking to strengthen its cooperation with the UK, alongside the US and other European partners. This is based on the principle that by sharing work – rather than solely developing systems in single countries – financial and risk burdens are significantly reduced.

In the future, as international space activities become more active and accessible, efforts to secure space domain security will become increasingly important. The UK has the opportunity to work with international partners in this area of Space safety and sustainability, including cleaning up space debris, reducing such risks and growing our space sector. This can capitalise on the UK's strengths in robotics by building new spacecraft to remove, repair or extend the life of satellites in space, or working with partners to track space debris. This has significant future commercial potential, with the global market for debris removal and in-orbit servicing missions anticipated to be worth over £2bn over the next 15 years.

We believe that the UK will be able to establish its position in the field of Space safety by promoting international collaboration on joint security for the space domain in its R&D investment.

JAXA's international cooperation between Europe and Japan started in 1972 with an exchange of information under official notes concluded with the European Space Agency (ESA) on cooperation in space exploration. Since that time, further international partnerships have been established with many of the European based space agencies, including CNES (France), SSC (Sweden), ASI (Italy), DLR (Germany), NSC (Norway), NSO (Netherlands) and SNSB (Sweden). In this vein, Fujitsu welcomes the Memorandum of Cooperation signed this month by the UK Space Agency and JAXA, which not only renews and strengthens the relationship between both countries, but shall also enable future export opportunities, knowledge exchange and investment opportunities across the international space sectors.

Elsewhere, the recently signed agreement to develop a 'Space bridge' between the UK and Australia is a great example of developing international partnerships, and the UK should invest in creating further Space bridges with international allies such as Japan, if it is to fulfil the ambition of becoming a globally-competitive Space power.

2.2 UK average CAGR is 3.49% (from 2014-2020)

The UK's current ambition is to grow the UK Space sector to account for 10% of the global space sector value in 2030 (10% was estimated to be £40bn when the target was selected in 2014. Estimates from Morgan Stanley indicate a value in excess of $1,000bn by 2040, meaning at current estimates a value closer to £50bn will be needed to reach a 10% market share in 2030).

The Trajectory for growth in the UK Space Sector is indicating a different outcome for 2030, the current Average CAGR for 2014 to 2020 is 3.49%, (and meaning a CAGR of 10.69% from 2022 onwards is needed to get to a sector size of £40bn in 2030. This is 3 times the current rate of growth for the UK space sector. In order to achieve this ambition, the UK Space Sector will need to maintain the gains and growth that it is currently undertaking and will also need to expand in scope to include areas that it is not currently actively pursuing.

Investments in Launch, Internet and Consumer Broadband are already in place with OneWeb, and additional opportunities are available in Robotics, Automation, Artificial Intelligence, Quantum-related Technologies, In Orbit manufacturing (Including asteroid mining and fuel manufacturing) and other in orbit services

- In Orbit manufacturing offers the best long term outcome for the UK, but is likely to be significantly important in the 2030 to 2040 range, and will not directly help with the 2030 goal, although the research and development needed to create capable in orbit manufacturing will be economically viable in time to contribute to the 2030 goal (up to £1bn in 2030 and 10's of £billions 2040+).
- Data exploitation, applications and security are the best options for the 10%+ CAGR growth in the timescales the UK needs. Once the data platform /infrastructure is established new services and applications can be continuously developed and delivered to consumers. Policy and investments in lowering cost of entry to the space sector and exposing the basic services and infrastructure elements as pay as you go services will enable rapid exploitation and economic value creation for new developments (E.g. ensuring launch vehicles have ride share capabilities, or communications constellations are architected to allow virtual network operators to participate too).
- Other areas that are underserved in our current activities: General Launch, Deep Space Exploration, Lunar Landing.

3. What lessons can be learned from the successes and failures of previous space strategies for the UK and the space strategies of other countries?

3.1 Japan's Successes and Lessons Learned

Since the latter half of the 20th century, Japan has significantly improved its international standing in space policy - this has been achieved by following a government aim to become a "space-developed country". As a result, its greatest success is its ability to exert a global presence in rocket development, exploration, and manned activities. This is something Fujitsu believes the UK can achieve too.

On the other hand, there remain fewer government-driven projects than in the United States and other countries, and Japan's space industry has not grown as much relative to the United States, China, and Europe. In particular, Japan lags behind these major players in the field of low-earth orbit control systems. It has been recognised in Japan that it is important for the government to act as an anchor tenant to stimulate demand in areas where investment should be made in the future, not by focusing on solely on present day needs but on seed funding initiative to stimulate demand.

3.2 Japan's current Space Strategy

Japan is refocusing its Space strategy on growth areas to support its ambition of doubling the size of its space industry (approximately Y1.2 trillion / £8 billion to Y2.4 trillion / £16 billion) by the early 2030s, as highlighted in its 2020 Outline Plan on Space Policy by the Japan Cabinet Office. Government accounts for 90% of demand in Japan but is looking to increase participation from the private sector.

Specific targets of Japan's Space Policy include:

1. Contributing to a wide range of national interests
   - Ensuring space security
   - Contributing to disaster management, national resilience, and solving global issues
   - Creation of new knowledge through space science and exploration
   - Realizing economic growth and innovation for which Space is the driving force

2. Strengthening the comprehensive foundations of Japan's space activities including industrial, scientific and technological bases
   - Recreation of an ecosystem for Japan's space industry by proactively promoting international cooperation where necessary
   - While aiming to become self-sufficient in areas where necessary and incorporating new entrants

3.3 UK - Japan similarities

From the above, one of the strategies the UK may use to achieve space leadership in the world is to invest with the aim of improving its international status, while carefully assessing strategic investment areas, where it can collaborate, and where it needs to create autonomy.

There are a number of similarities between the UK and Japan in the Space arena. Both are medium-sized space nations that have historically followed non-militarised space policies. Both have strong ambitions in Space and recognise its criticality to their national security and their wider economies.

They also face common challenges as identified in the Chatham House 31 March Paper[1]:

1. The increase in Counterspace capabilities in China and Russia, and the potential for militarisation of Space, and
2. The expansion in the number of space actors, active satellites and pieces of space debris

However, in addition, both nations have a dependency on government funding, without the accessible budgets of the size of the US or China. Both also have a challenge on fulfilling their growth ambitions, with the danger of growth stalling without central demand stimulation.

3.4 UK and Japan Strengths and Weaknesses

Both the UK and Japan are medium-sized space powers, compared to large powers of USA, Russia, and China. Both individually lack the ability and resources to match the number of satellites and launch capability of the larger powers, and more focus will be given to diplomatic and soft-power activities as a way to increase the UK's international standing as a space power (ref. Chatham House).

Both the UK and Japan have been relatively early entrants into space, with the first launch of a satellite in 1970 for Japan and for the UK in 1971. Unfortunately, they have both suffered from not having had enough progress or priority on space until more recently, although fortunately this is being remedied. Above all, their similarities suggest the UK and Japan would benefit from further cooperation and partnerships, as set out below.

3.4.1 Comparative UK strengths

- Commercialisation. UK industry has pioneered small satellites, which has had a large effect on the space sector. This has been a success story for the UK and its economy.
- Science and technology. For examples, quantum technology for secure communication and navigation, technology required for close approach and rendezvous and the recent initiative to explore the uses of nuclear energy for space exploration.
- Diplomatic and soft-power activities. In the international arena, the UK is leading multilateral discussions around behaviours and norms. For example, on 7 December 2020 the UN General Assembly adopted an energy resolution led by the UK and backed by Japan.

[1] https://www.chathamhouse.org/2021/03/security-frontier/outer-space-uk-japan-responses

3.4.2 Comparative UK weaknesses

- The UK has struggled to find its identity as a space actor, when compared to other space powers.
- Lacks hardware e.g. launch vehicle and platform.

3.4.3 Comparative Japan strengths

- Exploration. Since the formation of JAXA in 2003, it has become one of the leaders in space exploration. Recent successful missions, including its Hayabusa2 asteroid sample-return mission, have shown Japan to be at the forefront of technology in this area.
- Focus areas. Japan has identified specific areas where they can add value to particular projects and team up with other countries such as the US to spread the cost, such as the recent Artemis lunar landing mission.
- Japan is an internationally well-respected space actor and active in multilateral discussions regarding the space environment.

3.4.4 Comparative Japan weaknesses

- Commercialisation. Space activities are largely driven by government, and only recently has there been a more co-ordinated approach to public/ private collaboration.
- Diplomatic and Soft Power International leadership.

3.5 UK – Japan opportunities for co-operation

There are also obvious areas for co-operation:

1. Multilateral discussions in particular in the area of Space Safety and behaviours in Space, taking place through UN mechanisms
2. Space Situational Awareness (SSA) or Space Domain Awareness (SDA), which has been a strength of Fujitsu Japan, built through its work with JAXA
3. Science and Exploration, noting that Japan is well established in the field of space exploration and orbit determination. Fujitsu has been responsible for the development and operation of orbit determination systems in all of Japan's solar system exploration projects for more than 30 years, including supporting the orbital dynamics in the recent Hayabusa 2 mission to the Ryuga Asteroid. In addition, Fujitsu provides cutting-edge information and communication technologies that allow satellites, probes and orbiters to reliably carry out their missions as they travel through space. Our high-performance platforms are used to build the ground-based systems that receive data transmitted from space, track control operations and process observational data.

The UK and Japan could also co-operate in supporting each other's growth ambitions, including how they engage with the private sector and act as a catalyst to stimulate international collaboration between the two countries. Setting up business incubators and accelerators between the two countries, similar to the UK and Australia Space Bridge initiative would be a positive step. Fujitsu, potentially along with partners such as Astroscale, could help to support the facilitation of such an initiative.

4. What should be the aims and focus of a new UK Space Strategy?

Including considerations of:

- technology;
- skills and diversity;
- research funding, investment and economic growth;
- industry;
- civil and defence applications;
- international considerations and partnerships;
- place;
- current regulatory and legislative frameworks and impact on UK launch potential; and
- impacts of low Earth orbit satellites on research activities.

4.1 Emerging Technologies

To support its ambition to become a scientific superpower in Space, the UK must fully embrace and attain a leadership position in key technologies such as 5G, IoT, AI, Big Data, Blockchain, Cloud, Cyber Security, Robotics, 3D Printing and Quantum Technology. These technologies are at different stages of maturity, but it is their practical application and mutual conjunction that will drive differentiated capabilities in UK Space.

In assessing these new technologies and how they could benefit UK Space, the following observations could be considered:

- **5G/ 6G offer ubiquitous connectivity.** Connecting everything from physical world with IoT and edge devices to the virtual world on the cloud for big data storage, processing, simulation, and management, for real-time digital twin. With global connectivity becoming a very real prospect, trust in IoT data will be vital, and there is an opportunity for the UK to lead the way in verifiable services where trust is required such observation data.

- **Explainable AI.** Whilst AI is already the potential for significant benefit to UK Space, it must be recognised that the majority of AI software algorithms are black boxes. The progress of data-driven AI has encountered some undesirable outcomes, for example, biasness when data is incomplete and/or not well balanced. Repeatability and explainability are other issues for decision-making and traceability processes. Given the UK's strength in regulation and history in civil and military aerospace, the UK could play a leading role for setting the standards for explainable AI in Space.

- **Blockchain.** As an emerging technology within the Space sector, Blockchain has a number of applicable use cases that should be explored further to fully understand the art of the possible. Existing use cases range from smart contract negotiations through to deep space exploration but other areas for use include end to end supply chain, decentralised networks and in particular securing the provenance of data.

  The volume of Earth observation data continues to increase at rates faster than ever previously experienced. The sheer amount of data poses a challenge to the data providers, and there is a need for advanced data management solutions to address this.

A method of securely tracking data from source, though distribution and processing to the end user application is required. The quality of the data needs to be assured and protected from data altering techniques such as spoofing. The ability to certify the integrity of data is required in many applications, and especially within legal cases where a dispute over data authenticity is involved.

- **Miniaturisation and advanced materials.** There are gains in weight reduction and efficiency performance. For example:
  1. Composites use in aircraft (fuselage and wings) and spacecraft enable lighter weight, lower cost structure with fewer parts. In NASA's space launch system, trade studies show that all composite structures could decrease the mass by 40% and increase the payload to Low Earth Orbit (LEO) by 25 metric tons (NASA presentation at NDT in aerospace 2019).
  2. A crystal structure that has increased both current and voltage GaN HEMT (gallium-nitride high-electron-mobility transistor) effectively tripling the output power of transistors used for transmitters in the microwave band. And growing a diamond film with highly efficient heat dissipation on the surface of GaN HEMTs by 40%, for both front and back sides expects approximately 77% (Fujitsu press release).

The UK could play a role in the R&D and commercialisation of these technologies.

- **In-orbit manufacturing**, assembly, and repair requires advanced robotics with autonomous capability. The fabrication of parts with 3D printing technology, automation, and remote operation supervision are some key drivers.

In-orbit manufacturing is the only expansion area that has the potential to unlock access to resources that do not need to be launched from Earth. Any country that can manufacture in space, will unlock enormous economic advantages for their space programme and provide a significant multiplication factor to the development of the space sector.

Manufacturing components and fuel for spacecraft in space will alter the fundamental economics of space exploration and should be strongly considered as a vital building block for medium and long term strategies in UK Space development. The capability would benefit from helio-centric orbits (for easy access to power /heat) and undermine the reliance on launch capabilities that currently determine much of the success of space operations at the moment.

- **Quantum computing** has a high propensity for benefit in space in the future due to its promise of high speeds and improved calculations for materials development, for example, but it is one of the least mature technologies; it will take at least 5-10 years for a quantum computer to be capable enough for real world calculations. However, work can be done now to upskill a workforce, understand where quantum computers will have an impact and start to build solutions for when quantum computers are ready, to become a Quantum-ready economy.

One way to make a practical start on this journey is using Fujitsu's Digital Annealer as a bridging technology towards realising quantum-like optimisation ahead of the quantum horizon. These solutions are addressed using the same algorithms that quantum computers will use so that you can lift and shift them to quantum whenever it becomes available. Another approach is to "match-make" technologies, pairing the DA's optimisation capabilities with AI's prediction capabilities to allow for a faster and better solution as a whole.

Quantum technology examples include:

1. Quantum computer for general real-world application is about 5-10 years away. For quantum annealing problem, Fujitsu Digital Annealer is available today for combinatorial optimisation solutions, such as network optimisation and mission planning.
2. Quantum key distribution for secure communication and services e.g. authentication, digital signatures.
3. Quantum compass for navigation e.g. navigation in the absence of GPS such as underwater or in space.

4.2 Impact on Innovation and Economic Growth

- **Satcoms.** The satellite communication sector is by far the largest satellite services market globally. New business models such as LEO and mega-constellations for mobility markets e.g. inflight online entertainment and wi-fi, and 5G/ 6G enabled markets with low latency and high throughput applications, offer new opportunities and new entrants in the applications space. The UK Government's investment in OneWeb has not only enabled a UK satellite communication player, but has attracted further investment globally from Eutelsat and SoftBank. This investment funding model for Satcoms that has acted as catalyst for global interest can be replicated in other research and high growth areas.

- **Digital and data** are key drivers for data-driven innovation and decision support. Scale-up is frequently more straightforward starting from a pure digital base, where knowhow can also be transferred from the ICT sector. This enables reduced costs, enhanced process efficiency and diversification of business models. Organisational and process resilience are improved and more enduring with digital technology, as experienced with the COVID-19 crisis. Trust in the data can be enhanced by Blockchain technology to keep a record of transactions with all stakeholders.

- **Space security** is vital to both increase activity and overall safety in space. Space situational awareness e.g. space debris and space traffic management, is key, with the amount of space activities and launches increasing rapidly, especially in LEO mega-constellations. There is a need to conceive and implement a global network of space traffic management systems in order to sustain the space environment.

- **Sustainability** on societal impacts and role of the space sector. Earth observation such as climate monitoring, needs to be supported by science-based decision-making to enable action against potential violation and bad actors. There is an urgent need to apply emerging technologies such as green propellants, space debris removal, in-orbit serving to extend satellite lifetime, to help drive a more climate resilient space economy.

- **Space sovereignty and governance** requires space law, regulations, and procedures moving forward for commercial operators. The UK has a strong legacy of policy-making and setting global governance standards in numerous sectors. Compared to existing regulatory and compliance processes in sectors such as the financial industry, where there is a challenge of moving from analogue to digital, space has no such baggage, and the UK could be an innovator by starting off on a digital footing. Space-assets insurance is a challenge for UK insurers such as Lloyd's of London, but working in alignment with policy makers and regulators could present them with an innovative opportunity, especially when requisite data with provenance that could create proactive insurance services.

Note: Lloyd's of London gained global commercial supremacy over 300 years ago due to its collective risk expertise, a syndicated commercial model, cost efficient services and risk premium pricing, as well a wide-reaching global agency network that provided the market with unparalleled sovereignty of information and insight. This provided a bedrock for commercial and service innovation. The sovereignty of information has been eroded, but data from Space could become a key enabler for commercial advantage again, and a basis for new, innovative, preventative versus reactive insurance and risk services.

4.3 Research Funding

The UK currently has no identified or central national research facility. In comparison to other countries, along with no current national Satcom provider, this is a gap in its capabilities. To remedy this would admittedly require significant centralised funding, however, what the UK does have is recognised excellence in Space in our universities, such as Glasgow, Surrey, Southampton, Leicester and Aberystwyth – with the likes of Leicester and Surry considered research centres in their own right. An alternative model to a single national research centre is a well-funded, integrated and co-ordinated research programme across our key universities that supports targeted and specialised activity aligned to UK national goals. This will also tie in with the Government's ambitious levelling-up programme.

An observation from our recent work with the University of Glasgow (UoG), Astroscale and AWS is that there is real excellence in orbital dynamics in UoG, that when combined with both SME and large-scale industry capability, collectively became a very positive dynamic. The more that research can have a practical application, and the more extensive the partnering between academia and industry (promoted by UK Government), the better this co-ordinated UK capability can be leveraged for the development of innovative Space services and the UK Space economy as a whole. Any research programme therefore must include strong links to industry.

By comparison, on 26 March Japan's Cabinet approved five-year funding of Y120 trillion (£800Bn) for Science, Technology, and Innovation (STI) in the 6th Basic Plan for Science and Technology. This comprises a 20% increase in target public STI budget to Y30 trillion (£200bn), and a private sector target of Y90 trillion (£600Bn). The plan includes potentially transformative structural reforms for Japanese Science and Universities – performance-based funding and institutional autonomy. It was also intended to encourage and support international collaboration.

4.4 Space Industry Ecosystems

The UK's most creative and successful sectors have built highly effective ecosystems that attract global talent, investment and trade. For the UK Space Industry to grow and proliferate and it needs to continue to build a sustainable ecosystem with a new level of collaboration between not only government agencies and bodies, but also the cross-spectrum of industry, both large and small, as well as academia and researchers. Creating this collaborative federation of policy setters, investors, academia, innovators, buyers and vendors will enable the UK Space Industry to take a step towards establishing a common basis for industry development that is efficient and resilient enough to provide a solid foundation for future investment while not compromising the participants.

Space is a highly innovative and data rich industry that lends itself to the potential of new creative services and SME providers. However, for sustained resilience there is a need for sustained funding, as well as integrated access to partners and collaborators, to ensure that SMEs survive the initial phases of their organisational lifetime. The UK's small and medium sized firms have in general been weakened considerably by Covid-19 and business conditions over the past 18 months, and an integrated ecosystem with the requisite funding will be necessary to ensure that these creative entities come through this difficult period in strong health.

Currently government funding agencies distribute funds independently, with one-off competitions. Short-term funding, while positive for kick-starting innovative ideas, needs a continuation of both funding, observation, and guidance to ensure that these ideas reach an enterprise service level of outcome that can both impact the UK economy, but also the long-term health of the sector vendors. Innovation only becomes material if it has practical application and is industrialised. Large and small organisations working together can ensure that SME services become enterprise ready.

Other considerations for Parliament to ensure a dynamic and sustainable integrated ecosystem include the need for match-making capabilities in this federation of UK Space participants around key strategic goals and challenges, to drive positive collaboration. In addition, in other sectors, it has been recognised that access to high quality data upon which innovative services can be created is critical. Currently much of the data is too raw for this and creates an expense for SMEs and slows down the speed of innovation and change (see section 5.2 on UK Data Refinery).

4.5 Commercial Models

To enable companies to innovate on their commercial models for space sector operations there are two primary challenges:

1. The high capital costs to operate in the sector

2. The payback periods on investments are very long

Policy responses from government can therefore focus on these two challenges to deliver improvements

1. Lower the cost of entry /operation in the space sector.
    i. Encourage and support further industry collaboration and international partnerships
    ii. Share infrastructure costs by providing a framework to present them as services, for example as with Openreach
    iii. Establish data service platforms to allow development of data driven services /applications (these would both lower the cost and reduce the time to generate economic impact from the additional services. Examples could include correlation of satellite imagery over time to drive insights (Rainfall in April predicts crop performance in September) or be automated to flag up potentially interesting insights over time (E.g. insurance company flags a sea front property, and gets alerts when erosion occurs)
2. Provide financial support for investors and operators for the long-term investments needed. It can take 10+ years for investments in space applications to generate a reasonable revenue return, taking equity stakes and access to low interest long term loans or other supporting mechanisms could improve the access to funding.

4.6 Policy, Standards and Regulation

International collaboration, security and interoperability are key challenges for space applications. The UK government has a great track record in creating useful international standards. A standards organisation working to address the key concerns would be a clear enabling factor in UK growth in the space sector, and would allow the UK's knowledge economy to influence the entire industry.

There is a need for strong action on reducing new derelict objects and capturing the large debris objects that are specifically owned by specific nations. The remaining debris is very numerous, too small to justify a specific mission and has no liability ownership or revenue associated with capture. Policy action to provide revenue to justify missions to collect small debris would be vital to managing the long-term risks from space debris. This debris is also an obvious source for materials for future in-orbit manufacturing operations.

5. What needs to be done to ensure the UK has appropriate, resilient and future-proofed space and satellite infrastructure for applications?

Including:

- navigation systems;
- weather forecasting;
- earth observation including climate change; and
- communication (including broadband)

5.1 Space Safety Services and Data

Space Safety in the UK has historically had the primary ambition of Surveillance and Tracking. This is a vital pillar of Space Safety, but in order for the UK to become a mature Space nation it needs to broaden its vision and ambition firstly to Space Situational Awareness, then to Space Traffic Management and finally Space Safety Leadership, driving a co-ordinate and integrated framework, including policy, regulation and standards, for the future of global Space sustainability.

If the UK wants to follow this path, it needs to build out a more ambitious and sovereign SSA capability that allows Space Debris to be tracked in more detail, but also the ability to investigate future incidents. Activity in space is dramatically increasing, and the amount of Space Debris is substantial with over 120m items, of which only 27,000 are tracked by the US Department of Defence.

There is an ever-increasing likelihood of incident, unintended or otherwise. Although there is undoubtedly a close and beneficial relationship with the US, there is a national and global reliance on this data. Working in partnership with the US and allies, but also with its own Space data strategy and assets, the UK can move from a passive position to a more active and proactive one, building in resiliency and taking advantage of inevitable future commercial opportunities derived from Space safety data.

5.2 Earth Observation Data

The vast amount of Earth observation satellite data available today enables us to develop applications that have the ability to change how we currently live and protect our futures. However, in many cases it is not a simple task for end user communities to efficiently access the required data sets, process them to a usable format and develop innovative applications.

The influx of new data sets are very much welcomed by the sector. However, data access issues still remain, with many providers hosting their data within independent environments. An end user has to be knowledgeable and have the ability to access, search and download the required data from source. In the majority of cases, the data is then received in a format that requires further intensive processing to create what is known as Analyst Ready Data (ARD). ARD is the required format when creating many Earth observation applications.

Analysis Ready Data is satellite data that has been processed to a minimum set of requirements and organised into a form that allows immediate analysis with a minimum of additional user effort and interoperability both through time and with other datasets (CEOS).

The processing of data into a usable state is resource intensive, both computational and human, requiring extensive expertise in ICT and data processing techniques.

If we are to fully realise the true benefits of satellite data, and the innovative services that can be derived from it, the process of accessing and processing it needs to be more efficient, and accessible for all.

The current collaborative ground segments and European DIAS facilities don't fully fulfil the requirement of the end user communities; the data is limited and the infrastructure services are outdated. A combination of elements now exist that together provide an opportunity to build on the UK's heritage of EO exploitation platforms and create a unique, state of the art cloud based facility, that not only provides access to almost endless infrastructure and services, but also provides access to unprecedented volumes of Analyst Ready Data.

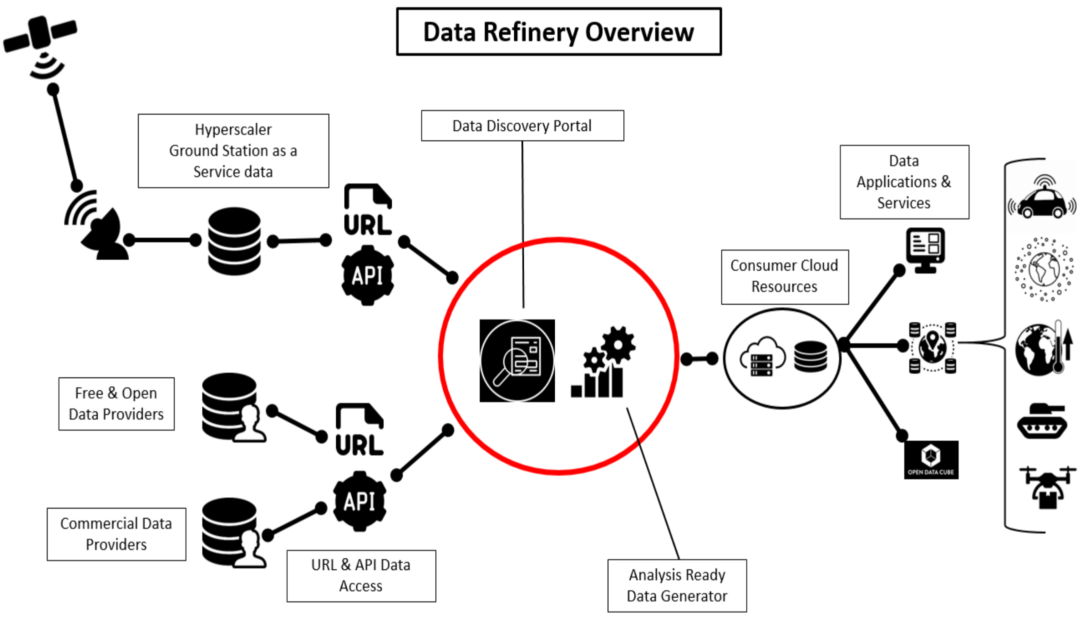

Figure 1.0 UK Data Refinery Concept

The UK should consider both developing a new data access and processing facility or invest and build on existing facilities to put the UK back at the forefront of EO data exploitation. A critical piece of national infrastructure such as this would support and enable growth within the space sector, and the downstream sectors that Earth observation supports.

Collectively these capabilities could act as cornerstones of a future Space Data Market, supported by private/ public sector collaboration. Interconnected with other sectors (see Section 4.2), this could create a value multiplier for Space Data services and the wider UK economy.

5.3 Infrastructure Resiliency

Two recent experiences have uncovered different tales of resiliency. The operational resiliency that the UK witnessed through Covid-19, as technology enabled a distributed workforce to retain its effectiveness and productivity was a clear success that few would have anticipated. Technology innovation can enable significant operational and infrastructure resiliency that would have been unimaginable a decade ago.

With the proliferation of cloud and infrastructure hyper-scalers there have been significant benefits of service agility and lowering costs of entry. However, a second recent example highlights the care that needs to be taken around the end-to-end supply chain of critical national infrastructure and UK assets; the “Fastly” outage had a drastic and proliferated impact on a vast number of services, due to the wide usage of its edge computing services.

There is an increasing danger of a ‘network of networks’ scenario, where simplification from the consolidation of services into monolithic providers obfuscates a range of supporting service providers but also downstream potential single points of failure.

Attention needs to be paid to the service supply chain for critical assets, as the ever-evolving innovation in the network of service providers can in turn come to rely on common elements.

6. Conclusion

The Space sector will be of increasing importance to the long-term success of the UK. It contains the opportunity and promise of large and sustainable economic gains and will be a foundational aspect of the power dynamic between nations in the coming years. The UK space industry has many strengths, including its commercialisation efforts, its scientific research and its enviable diplomatic reach, but it has thus far struggled to define itself as a major international player.

Fujitsu believes that with the right strategy, activity, support and partnerships, Space has the opportunity to be a great innovation and commercial sector for the UK in the years ahead. Above all else, this means forging new and ambitious partnerships, with industry and with foreign allies such as Japan, to share research, pool expertise, and effectively manage risk. Through international collaboration the UK will be able to extend its influence far further than it could on its own, while at all times maintaining its capabilities to protect its national interests.

This is the approach that Fujitsu is pleased to champion and support, and we are delighted to have the opportunity to share our thoughts with Parliament.

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