

Strategic Space Sector Growth Plan

SOUTH OF SCOTLAND

August, 2024





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Foreword

As Scotland's Natural Capital Innovation Zone, the South of Scotland possesses an abundance and diversity of natural resources that support and shape the region's businesses and communities.

The region's DNA is intertwined with a passion to deliver a Just Transition to Net Zero and a nature positive future which will help build the UK's first Wellbeing Economy.

The region boasts a complimentary range of traditional sectors such as agriculture, forestry, and food & drink.

Yet, it also has several new sectors such as carbon capture, storage and utilisation, and emerging sectors that include hydrogen businesses.

The link between the traditional and future sectors is that they are all constantly innovating, and this exciting space sector strategy will enable new approaches that can accelerate our region's overarching ambitions.

The strategy describes how South of Scotland Enterprise (SOSE) will harness the significant opportunities that will arise, by focusing on how growing our space activity and leveraging space technology.

It will also enable the South of Scotland to consider exciting new opportunities such as agri-tech – and nature-based solutions, made possible through the region's commitment to being green, fair, and flourishing and the collaboration of our partners in pursuit of this goal.

The strategy identifies opportunities for the region to become a more significant beneficiary of space-sourced insights, blending the region's significant traditional strengths in areas such as natural capital and renewable energy with new space services and technologies.

We want to use our region's geographical position to act as a link between space clusters to the north and south, embedding space into all development strategies.

This in turn will help raise awareness of space, awakening entrepreneurial potential, inspiring new thinking, and creating space jobs in the region, while recommending a sustainable and economically robust plan of action.

Jane Morrison-Ross
Chief Executive
South of Scotland Enterprise

1. Introduction

The South of Scotland contains one fifth of Scotland's land mass, generates more than 16% of Scotland's energy and hosts almost 10% of the UK's onshore wind production. The region is leading by example in delivering on climate change targets and biodiversity goals, with its values-centred approach to leveraging natural capital for carbon sequestration and climate change adaptation, to develop a Wellbeing Economy.

SOSE's vision is to help South of Scotland be a carbon neutral (ideally negative) region by 2045, and to enhance its natural capital through meeting the 30x30 goals (protecting 30% of the region's land, inland water, coastal and marine areas by 2030). Now, to strengthen and accelerate this vision, SOSE is looking to space.

SOSE is undertaking a strategic exercise to identify concrete actions and practical "quick wins" that will enhance the region's unique selling points by leveraging space technology and data for economic benefit, while aligning with the broader goal of addressing the climate and nature crises and creating a more sustainable region. Longer term areas of space technology development that can benefit the region economically are also considered.

Space-enabled technologies and services such as Earth Observation satellite data can help enhance the South of Scotland's understanding and monitoring of its abundant natural capital resources, thereby increasing the pace of development around a circular, sustainable ecosystem of activity in Scotland's Natural Capital Innovation Zone (NCIZ).

This strategy identifies opportunities for the region to become a more significant beneficiary of space-sourced insights, blending the region's significant traditional strengths in areas such as natural capital and renewable energy with new space services and technologies, using the region's geographical position to act as a space link between space clusters to the North and South, embedding space into all economic development strategies, raising awareness of space to awaken entrepreneurial potential, inspiring new thinking, and creating space jobs in the region, while recommending a sustainable and economically robust plan of action.

The strategy lays out the range of space related activity that could be undertaken in the South of Scotland, to provide an overview of what can be achieved. The action plan then focuses on specific space related activities where the South of Scotland can leverage its existing strengths to develop new space enterprises and expand the Wellbeing Economy.

This big picture strategy proposes to connect local industries and communities with external space expertise through a combination of space brokerage events and pilot programmes to enable the South of Scotland to gain traction and benefit in the short term from the space sector, whilst leveraging Innovation Hubs across the region. This will help generate new skills and offer new economic development opportunities, whilst seeking entrepreneurial approaches that deliver the Wellbeing Economy. Transitioning to a Wellbeing Economy is a national and regional priority.

2. Space-related challenges and opportunities

2.1 The UK and Scotland

Space presents significant opportunities; the global space economy is projected to grow from an estimated £270 billion in 2019 to £490 billion by 2030. The space sector is characterised by space data and services (known as the space “downstream”), and manufacturing and technology (known as the space “upstream”)

Across the UK as a whole, the applications derived from space data potentially offer greater opportunities than any other space related market. The applications using space information are effectively limitless given the vast number of areas touched by data.

A 2018 economic study for the UK government estimated an average annualised benefit for the UK of £1bn from Satellite- derived Earth Observation across nine key civilian use areas (agriculture, atmosphere, built environment, coastal, flooding, forestry, maritime, meteorology and transport). The study identified 125 UK public sector organisations that were current or potential users of EO data, with 131 active use cases, 62 of which were categorised as operational and 74 as exploratory. These include organisations such as the Rural Payments Agency, DEFRA and the Meteorological Office (Investigating UK public sector demand for Earth Observation technology - Geospatial Commission and the Satellite Applications Catapult, June 2022).

The number of companies within this space data downstream market will grow and produce considerable opportunities with space-enhanced solutions in areas ranging from smart cities, agriculture and transportation to medical, health, cybersecurity and maritime.

In November 2022, the Department for Business Energy and Industrial Strategy announced nearly £200 millions of funding investment to support the UK Earth Observation sector.

The space infrastructure market is also growing due to the need for more ground stations and terminals, as recently highlighted in analysis on this sector by commentators such as Euroconsult. The space situational awareness market, enhanced by the 2023 Astra Carta accords and growing investment from UK Space Command, is less well developed but now growing rapidly, and the increasing use of navigational satellites for not only transport and logistics, but even precision agriculture, has led to an increased awareness of space weather impacts.

Scotland itself is rapidly becoming the best place on Earth to build a Space Business. **Scotland’s space industry is currently home to almost one-fifth of all UK space sector jobs (twice as many by proportion to the rest of the UK). More than 130 space-related companies are estimated to**

have generated £ 880M GVA in 2017/18, with a sustained annual growth rate of 12% and increased employment of almost 10% since 2016 (source: "A Strategy for Space in Scotland 2021").

Companies located in Glasgow build more satellites than any other location in Europe – and are second only to California worldwide. Edinburgh's reputation as a capital for space data is now well established.

In October 2021, the Scottish Government released a strategy to mobilise Scotland's space community and become Europe's leading space nation. The Aim published under the name of the Scottish Space Minister, Ivan McKee was; "Our aims are clear – we want to achieve a £4 billion share of the global space market, deliver a dedicated launch capability as early as next year and create 20,000 jobs in the sector by 2030."

2.2 The South of Scotland

In the South of Scotland there are regional challenges which include an ageing population, industrial decline, lack of economic opportunities and motivation for relocation, workforce skills gaps and productivity challenges, as well as areas of deprivation and the growing occurrences of climate change-related issues.

How can the region harness the potential of space technology, navigate existing challenges, and accelerate the move towards becoming Net Zero and nature positive while driving inward investment and upskilling its citizens?

The South of Scotland has an opportunity to augment Scotland's booming space industry through adding in greater focus on Net Zero and natural capital opportunities. Whether using space data from satellites, or applying space technology to solve problems on Earth, the South of Scotland can lead the way in terms of innovative uses of space to make a cleaner, greener and more sustainable planet.

The region is Scotland's Natural Capital Innovation Zone (NCIZ). SOSE's vision is to help South of Scotland be a carbon neutral and nature positive region by 2045, and to enhance the region's natural capital through meeting the 30x30 goals (protecting 30% of the region's land, inland water, coastal and marine areas by 2030). SOSE wishes to help the region leverage space sector capabilities and data to enhance these existing strengths and ambitions.

The space sector can help through widespread use of monitoring, reporting, and verification data gathered from Earth Observation, navigation and communications satellites. The capability



to verify terrestrial and maritime activities from space enables informed decisions to be made based on robust data, avoiding greenwashing, addressing sustainability in a meaningful way.

The South of Scotland's route maps on Net Zero (Invest in South of Scotland – Net Zero Investment Guide), Renewable Energy (Powering Change – Calling the South of Scotland to Action) and five-year plan (SOSE – Our Five-Year Plan) can leverage space data to address climate impacts and to enhance the Natural Capital Innovation Zone, through working with local stakeholders, developing innovative enterprise solutions in conjunction with the space sector.

The South of Scotland region has the opportunity to:

- Leverage the flourishing Scottish space sector and the Scottish Government's strategic ambitions for space
- Combine the South of Scotland's natural capital with space-based Earth Observation data to accelerate the region's net zero and 30x30 ambitions, using space to validate and verify the potency of nature-based solutions. Trialling space use in the South of Scotland for these purposes, can drive economic export potential of new services, knowledge and IP.
- Lead the UK in terms of using space data to deliver the Wellbeing Economy through application to agriculture, forestry, habitat restoration, the maritime environment and renewable energy, generating new skills and new economic opportunities for the South of Scotland, through requiring data analysis and interpretation skills, and improving efficiency in various processes.
- Infuse net zero and natural capital thinking and strategies in the UK space sector, leading to new opportunities to support not only the UK space strategy, but the UN's sustainable development goals, and to export the experience developed as services, knowledge and IP
- Capitalise on the South of Scotland's exceptional location as a "link" between so many other UK space clusters, and collaborate with other regions on space related activities. The South of Scotland can differentiate itself from other regions through capitalising on its Natural Capital Innovation Zone status, and leading on the use of space data to support nature-based solutions that deliver community, economic, and environmental opportunities.
- Accelerate the use of space data and technology for the South of Scotland's goals in specific use cases such as the following:
 - Addressing biodiversity loss
 - Improving the effective management and monitoring of natural capital assets so that decisions on the allocation of finite resources are based on real time and robust intelligence, to address the climate and nature crises.
 - Increasing Return On Investment (ROI) / production, carbon reduction and efficiency for agriculture by working towards precision farming.

- Increasing resilience of businesses and communities in their adaptation to and mitigation of climate change impacts.
- Improving the South of Scotland's ability to deliver sustainable forest management principles.
- Assess water flow and storage to provide better water management and flood warning for businesses and communities.

All of the challenges could be countered in part through the wider provision of space-enabled services, spurring local ambitions to solve climate and nature challenges and build new business opportunities, with the additional benefit of raising awareness of new career opportunities. Space data services combined with other advanced technologies, such as satellite connected Internet of Things sensors, could provide comprehensive and robust data to help plan ways to increase resilience of businesses, communities and natural capital assets.



3. The strategy

3.1 Strategic Approach

The South of Scotland space strategy is focused on the development of a Wellbeing Economy enhanced by Space, which aligns with the SOSE route maps and strategies to be Net Zero by 2045 and which supports other targets such as 30x30 for biodiversity enhancement.

This strategy proposes a pragmatic approach whereby SOSE can help South of Scotland region to:

- become a significant link in the UK Space Cluster Chain
- develop a Wellbeing economy enhanced by space capabilities and data
- define strategic focus areas to leverage space capabilities and data
- setup Innovation Hubs
- incubate and attract space businesses, workforce, and investors
- nurture strategic partnerships to unlock the value of space

3.2 Become a significant link in the UK Space Cluster Chain

The South of Scotland region benefits from occupying a geographically central location between numerous neighbouring space clusters to the north (Space Scotland and two newly developing regional space clusters in Scotland), south (the North West Space Cluster and North East Space Cluster) and west (the Northern Irish cluster). This facilitates strategic collaboration.

SOSE has begun work on a UK Space Agency-supported project with Space Scotland in conjunction with AstroAgency and the Space East space cluster (which covers East Anglia). This represents the first of many potential cross-regional engagements which can promote the use of space technology- and data-related knowledge sharing, networking, capability and capacity building.

SOSE can help the region use this central position to amplify requirements and initiatives, whether they be focused on using space observation for natural capital enhancement, space technology or Net Zero projects leveraging space technologies.

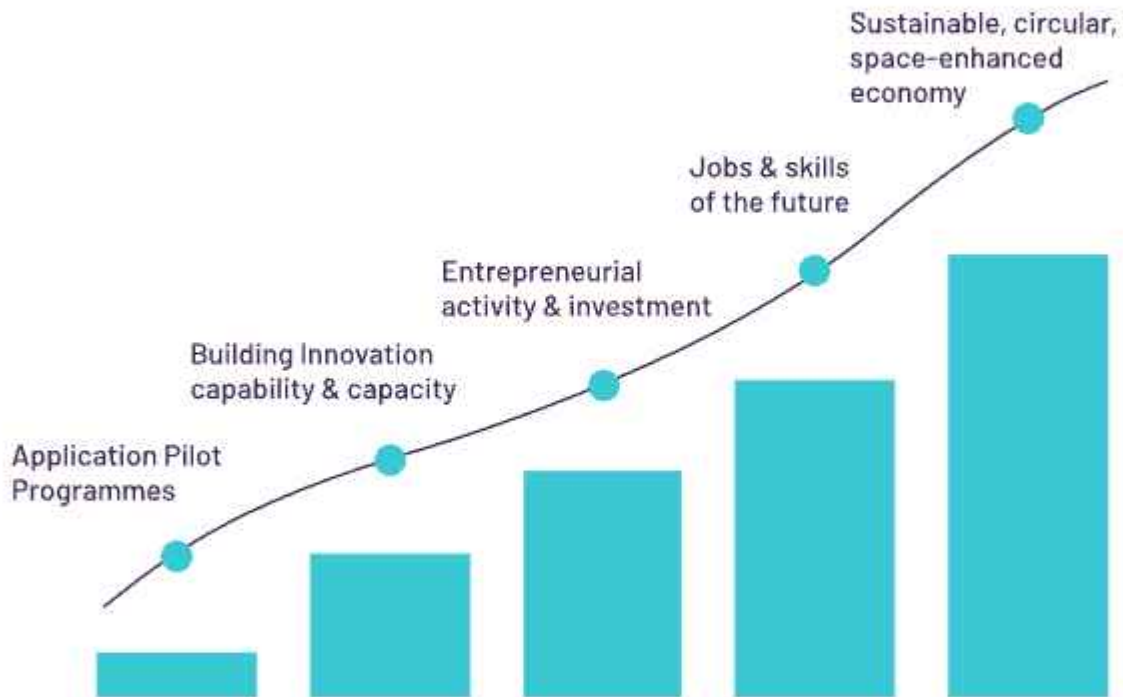


3.3 Develop a Wellbeing Economy Enhanced by Space Capabilities and Data

This strategy aims to increase space capabilities and data, while strengthening economic development in alignment with the SOSE Five Year Plan (2023), and the South of Scotland Regional Economic Strategy Delivery Plan (2021).

As well, by leveraging the case study approaches outlined in the “Invest in South of Scotland – Net Zero Investment Guide”, the strategy aims to create a space sector innovation flywheel for the South of Scotland, acting as a companion piece for various regional initiatives.

Improving the region’s space enhanced natural capital programme places the region at the forefront of global efforts to adapt and mitigate the climate emergency and reverse biodiversity loss.



The anticipated strategic progression would begin with setting up Innovation Hubs and conducting Application Pilot Programmes. These help build innovation capability and capacity, leading to increased entrepreneurial activity and investment. This in turn will create a demand for employment, and foster skills development through education or retraining and retention programmes in jobs and skills of the future. This is ultimately intended to lead towards a regional economy which is sustainable, circular, and space-enhanced.



3.4 Define Strategic Focus Areas to Leverage Space Capabilities and Data

In order to streamline the approach, this strategy organises many opportunities into broad areas of strategic focus. These are:

1. Natural Capital
2. Manufacturing and Supply Chain
3. Observing Earth and Space
4. Energy

The focus areas would be developed via Innovation Hub-centred activities which in turn help support and deliver pilot applications.

3.4.1 Focus Area - Natural Capital

“Natural capital is the renewable and non-renewable stocks of natural assets, including geology, soils, air, water and plants and animals that combine to yield a flow of benefits to people. Adopting a natural capital approach enables us to understand the role of our natural environment, alongside its intrinsic value, as an asset that underpins our economy and society.” *(excerpted from “Scotland’s National Strategy for Economic Transformation”).*

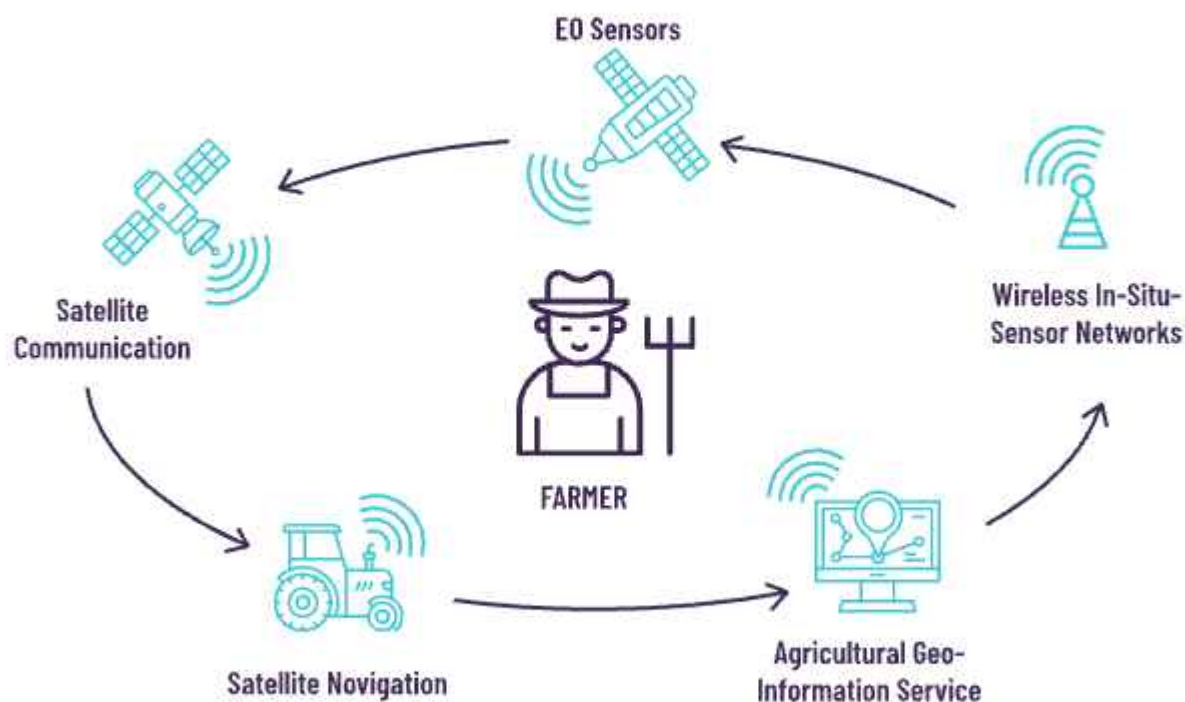
To effectively deliver climate change targets, biodiversity goals and wider land use objectives requires a transformational cultural shift to deliver a natural capital focused approach. Rebuilding Scotland’s natural capital is key to the long-term productivity of the many sectors of our economy which rely on the resources and services nature provides. **Space data enables robust and time sensitive natural capital information to be analysed and interpreted in a wide variety of creative ways, to transform and build resilience in our communities and economy.**

Agriculture

Earth Observation space data is a key tool for measuring and monitoring natural capital assets and the shift in agricultural practices required to achieve climate change targets and biodiversity goals.

With the increasing importance of sustainable food security, DEFRA and the Scottish Government have demonstrated interest in using Earth Observation for various agricultural initiatives, because of its value in performing Observation Monitoring and Reporting and supporting Verification (OMRV) of agricultural land. This then helps setting practical performance and efficiency metrics to support Environmental Social and Governance (ESG) goals.

Earth Observation can provide multi-layered remote observation for crop monitoring and soil health through moisture, water stress and irrigation. It can also demonstrate how small satellite constellations can monitor current and forecast future crop yields through more rapid assessment of an area.



Soil quality and health are paramount for agricultural productivity. Precision agriculture techniques can use space data to improve ploughing and fertilisation efforts. It can also enhance soil health through more precise inputs and soil conservation practices, ensuring that each part of a field is treated according to its specific needs, through variable ploughing, seeding and spraying.

Earth Observation data and satellite navigation data can also help determine optimum herbicide doses and fertiliser requirements. This increases efficiency and crop yield, saves money and reduces negative environmental impacts like pollution run-off.

Satellite data is integral to precision agriculture by enabling soil property mapping, including moisture levels, texture, and organic matter content. Earth Observation supports the management of spatial variability in soils, guiding precision application of resources. Additionally, remote sensing can monitor crop health and soil readiness for planting or harvesting, leading to more efficient and sustainable farming practices.

Earth Observation data is not only of use for crops however, since the ability to observe, monitor and report on vegetation health from space, can support more cost-effective and efficient rotation of fields for grazing for cattle - an important benefit in the region since Dumfries & Galloway supports a quarter of Scotland's cattle and half of Scotland's dairy herd.

Farmers can also use satellite data to help adapt to and mitigate climate change impacts. Temporal satellite data can be used to demonstrate more rapid changes than on a 30-year timescale, The value of space data is in providing hard scientific data to facilitate robust evidence-based decision making for the South of Scotland agricultural sector, and there is a business opportunity in the analysis and translation of that data into decision-grade data and actionable insights.

SOSE could help farmers in the region adopt these various uses of space technology, for instance by organising a physical pilot programme that adopts more sustainable practices for agriculture while making use of Earth Observation data and insights.

Biodiversity Goals and 30x30

Using Earth Observation data to assess the quantity and quality of the region's natural capital assets will be a critical methodology for achieving biodiversity goals, 30x30 and establishing nature networks as outlined in the Scottish Biodiversity Strategy. Understanding the changes in the asset baseline, due to climate change and land management practises, will help the region enhance and monitor both habitats and species so that it can take effective and timely action.

In the South of Scotland, Earth Observation satellite data has already been used to track deer herds from space. This has value for estate management (see section 3.3.5), and sustainable forestry management, since deer have a negative impact on tree growth. Being able to locate and track a deer herd in the vicinity of an area designated for woodland creation helps to manage the woodland effectively and prevent tree damage or loss.

Smart rural technologies are already being developed, with applications as specialised as measuring birdsong with ground-based Internet of Things sensors to help determine diversity of bird population. From a space perspective, such sensors can be placed in more remote locations whilst still being able to send data to a central location, using satellite modems.

Earth Observation data provides temporal, spatial and spectral data to provide useful insights into a variety of habitats, such as hedgerow and grassland management. Earth Observation data can be used to provide an effective way to measure field health and grazing quality, so that rotation of grazing land for use by livestock can be planned more effectively and cost efficiently.

Applications such as these provide opportunities for Scottish Earth Observation space data companies and land managers in the South of Scotland to develop new initiatives which could set sustainability benchmarks globally.

30x30 may be regarded as an ambitious objective, however Earth Observation space data makes it more achievable. Being able to observe, monitor and record natural habitats from space, provides a "birds eye" view of habitat restoration and planning of additional areas of habitat regeneration. Harnessing the talents of Scottish space data companies, local stakeholders can gain new insights into the habitats and more responsively and more accurately take actions that could accelerate the goal of 30x30.

The biodiversity goals and enhancement would also be able to extend to coastal and maritime environments, critical habitats for the Borderlands Natural Capital Programme and the Galloway and Southern Ayrshire UNESCO Biosphere. The physical location of these habitats makes management extremely complex and there would be immense value in leveraging the power of satellite data to explore opportunities such as carbon sequestration.

Forestry

Sustainable forestry management acknowledges the value of forestry for achieving the 30x30 goals, carbon sequestration to address climate change and the range of community impacts to deliver the Wellbeing Economy that sits alongside the economic and social impact of the timber industry. Significant targets have been set for woodland creation and it is crucial that new planting is established in the most effective location to deliver multiple benefits.

Earth Observation data enables the quantification and monitoring of forest biomass over large areas and changes over time. Using spectral data from satellites, vegetation density and health can be inferred, which correlates with biomass. LiDAR and radar technology from satellites can provide three-dimensional structures of forests, giving insights into biomass volume. This data is essential for tracking changes in biomass due to forestry practices, natural growth, deforestation and fauna diversification or disturbances like logging, which could provide benefits to the monitoring and verification of woodland expansion initiatives such as the Wild Heart of Southern Scotland Project.

Forestry assets for carbon valuation in the South of Scotland are at a far smaller scale than the vast forests in North and South America for example. **However, there is also potential value using forestry in the South of Scotland as a "proving ground" for observing, monitoring, reporting and verifying carbon assets.** The data analytics for Environmental, Social and Governance (ESG) reporting through carbon offset applications is dependent on observing, monitoring, reporting and verification, and the monitoring aspect, when undertaken using Earth Observation space data enables verifiable analysis of climate change impacts over time, a critical element for effective carbon accounting and trading.

Upland monitoring using satellite data fits well with forestry and woodland creation, since Earth Observation from satellites can not only differentiate between different species of trees, but can also show changes in land use over time, similar to the verifiable analysis of climate change impacts, providing a method to show a historical record of land changes.

To support habitat restoration in the South of Scotland, satellite data also offers an opportunity to monitor and verify remnant temperate rainforest pockets that still exist in the Dumfries and Galloway region, to support enhancement activity.

Peatland

The relationship between Paludiculture (peatlands/wetlands) and hydrology is inherently interconnected. These ecosystems play a significant role in regulating the hydrological cycle by storing and slowly releasing water, thus influencing groundwater levels and surface water flow. Changes in hydrology can affect the integrity and functioning of peatlands and wetlands. An ecologically functioning peatland acts as a carbon store locking up carbon for future generations and is also able to sequester carbon, although this is a slow, multi century process. Unfortunately, historic land practices have resulted in much of our peat assets being damaged, resulting in the peat becoming a carbon emitter rather than a carbon store. Using Earth Observation data to observe, monitor and report on peatland conditions from space such as moisture content, to provide advance warning of areas that may be drying out, would be a

powerful management tool. Earth Observation of peatlands is also valuable for observing, monitoring, reporting and verifying the extent of peatlands, for carbon market trading under the Peatland Code.

Earth Observation data is also used to identify and manage invasive species in peatlands. High-resolution imagery can detect changes in vegetation patterns indicative of invasive species.

The opportunity for the South of Scotland would be in demonstrating initiatives that combine the ground based physical restoration of peat, with the monitoring via satellite, especially since carbon restoration expertise has the potential to be exported globally.

This is an area of development in which the South of Scotland could also run pilot programmes to draw in interest from the Scottish Earth Observation community as well as from the wider UK Earth Observation community. This work could link with bodies focused on peatland restoration such as the IUCN UK Peatland Programme, which promotes peatland restoration in the UK to help develop initiatives to support the Peatland Code and the Crichton Carbon Centre, based in Dumfries and Galloway and specialising in peatland restoration, carbon management, sustainable land-use and environmental education.

Land Use

With a fifth of Scotland's land mass within the South of Scotland, Earth Observation data also offers opportunities to support land and estate management and valuation, a topic of considerable interest to the South of Scotland with the large estates across the region.

Scottish Earth Observation data company EOLAS has already demonstrated how EO data can identify the location of animal herds (such as deer or sheep) within a specific land boundary, helping to preserve and manage them more cost effectively.

Space data can also identify areas which may benefit from habitat restoration and thereby increase biodiversity. It can help map and measure land boundaries, identifying potential opportunities to combine adjacent habitats or expand the area of coverage for habitat restoration. This information can help landowners unlock funding opportunities to perform such biodiversity and habitat improvements.

SOSE can help local landowners and estate managers understand how Earth Observation space data can provide cost effective and more rapid decision-making capability on land use, monitoring the extent and impact of managed and unmanaged fires and use of Earth Observation data to measure estate and land management health indicators, and importantly, aid in land valuation of natural capital and insurance.

A February 2024 COSS paper notes that "The Regional Land Use Partnership pilot (RLUP) has carried out extensive stakeholder engagement to evidence the challenges and opportunities of land use change in addressing the climate and biodiversity crises", and goes on to indicate that "coupling space data insights with ground truth data can further strengthens decision making and aids community engagement through greater objectivity and transparency".

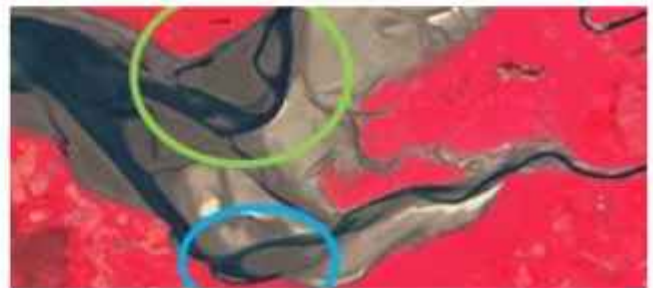
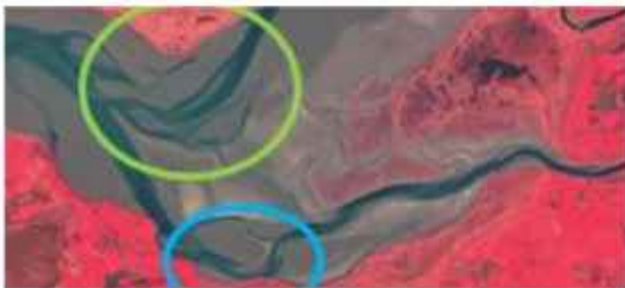
Water Management

Water management is a key factor in the delivery of the Wellbeing Economy, since it has a direct impact on biodiversity, businesses and communities.

Marine

Earth Observation satellite data is used for analysing coastal flora and fauna such as seagrass extent, saltwater marshes, marine mammals and fish, as well as algal blooms and marine pollution. Understanding the health of marine and coastal flora and fauna is critical in managing offshore environment which impacts on our communities and economy. Using space data can help identify critical impacts due to climate change that can be observed over time, or where applicable, over a more rapid timeframe.

The South of Scotland has a multiple award winning Earth Observation start-up headquartered in Dumfries & Galloway that are world leaders in using Satellite-based Synthetic Aperture Radar (SAR) data to chart the uncharted by mapping mud and sand flats to detect navigable paths through tidal channels in all weather conditions. Creative Help Ltd working in partnership with the University of Strathclyde and Nith Inshore Rescue, has developed Safe Passage, a solution to save lives from space through automated marine navigation channel mapping, a solution that has supported operations of Nith Inshore Rescue an independent lifeboat service to attend call-outs in the Solway Firth, from their base in Glencaple, UK. This expertise can be exported globally to areas facing similar challenges.



Water Quality and Water Stress

Water quality is vital since it has a direct impact on biodiversity, businesses and communities, all of which need clean, safe water. Climate change is increasingly impacting water quality and water stress, causing negative impacts to South of Scotland's businesses, communities and environment.

Degradation of water quality is caused by a myriad of reasons, many of which can be monitored using Earth Observation satellites, providing rapid reporting of reductions in water quality to allow timely and appropriate remedial action. Similarly, water stress can have the same level of impacts and climate change is already affecting the seasonal changes in weather patterns with increasing water shortages expected to occur. As the degree of water stress increases so does the value of Earth Observation space data in providing near real time insights without the delays inherent in sampling and test processes.

Flood and Disaster Management

Better disaster management (particularly for flooding) could have a significant impact on the region's economy.

Flood warning and monitoring capabilities already exist, but improvements are needed. While SEPA provides disaster warnings at the regional or local level, more information is needed to assess the actual exposure, vulnerability, mitigation and adaptation efforts of South of Scotland individual businesses.

For example, upland water run-off is a key factor in the flooding potential for lower lying areas. In upland areas rainfall can be heavy and the ground can become rapidly saturated. It can be challenging to place sufficient sensors to monitor the ground condition, due to the rough terrain. Earth Observation satellites can remotely monitor ground saturation, especially when combined with the existing river sensor network. This network can be expanded to include Internet-of-Things (IoT) networks which would monitor the assets and premises of local businesses. These IoT networks would be integrated with satellite and 5G cellular networks to improve network communication resilience during a disaster. Evaluating temporal changes from archival satellite imagery will also improve the understanding of changes to flood risk over time. Space derived data can also help analyse the extent and impact of flood damage to regional businesses, communities, and infrastructure.

This combination of space and terrestrial data and technologies would provide predictive as well as real-time water level detection and prediction at a far more granular level in a way that South of Scotland businesses can understand and act on. Better risk management leads to adoption of more effective mitigation and adaptation actions, including via nature-based solutions for flood prevention and mitigation.

Having very detailed advanced warning of the likelihood, potential location timings and impact, of disasters such as floods will help increase individual business resilience, as well as that of the region's overall economy.

3.4.2 Focus Area - Manufacturing and Supply Chain

The space supply chain in Scotland is well established, with manufacturing undertaken in house for the satellite manufacturing companies. Manufacturing capabilities for the space industry are led by Plexus in Kelso, and precision machining capabilities have been used for the launch industry, with Galashiels based Thistle Rocketry having built a small supply chain within the local area, using companies such as Ceta Precision Engineering and Stewart Technology demonstrating how space development is already having a beneficial economic impact in the region, for engineering and electronics.

Opportunity also lies with future space development, providing the South of Scotland with niche areas in which it can provide demonstrable capability before other regions show interest, and more importantly, areas in which there are benefits for using space technologies to support the Carbon negative by 2045 goal.

Space textiles and sustainability

Collaborative research around textiles (which the region has existing strengths) for space suits and space stations - for instance, research into recyclable / reusable materials for space textiles, use of textiles in water purification for space life support systems, presents a new opportunity for the South of Scotland to become engaged in a key space technology that has benefits back on Earth. This would be an area where collaboration with existing human spaceflight initiatives as well as Mars analogue stations would be a route into this area of space activity.

Water reuse from the textile industry has potential benefits for closed loop life support for spacecraft, space stations and lunar bases, where the need to conserve all water is critical. Not only would this benefit space life support techniques, but in turn, it feeds back into improving industry water usage and water conservation on Earth, leading to new opportunities for sustainability.

Regenerative agriculture is a prime example of how resources can be used sustainably, and the South of Scotland can provide the focal point for drawing together sustainable technologies in agriculture and textile sectors to provide innovation in space life-support.

Textile technology also contributes to water purification systems in space life support systems (see below). Innovations include antimicrobial textiles that can prevent the growth of bacteria in water storage and filtration systems, which are critical for closed-loop life support systems in spacecraft and habitats.

In-Space Supply Chain

The in-space supply chain receives little attention in the UK, however with the increase in space development, and the advent of Lunar, and even Mars bases in the near to mid-future, there is an opportunity to capitalise on the strengths of the South of Scotland region in textiles and sustainability, to provide a UK lead in these areas.

Space suits keep astronauts alive when outside a space station or a lunar base. Textile manufacturing for space suits applies materials designed to withstand the harsh conditions of space such as extreme temperatures, micro-meteoroid strikes, and radiation exposure.

Space suit and space clothing using advanced sensors represents an underdeveloped area of the market in the UK. The South of Scotland has an existing textile industry and related academic capabilities which could develop these, perhaps in collaboration with US space suit manufacturers.

Space Stations and inflatable habitats

Inflatable space stations can be built using layers of woven materials such as Kevlar and Mylar. An inflatable module is attached to the International Space Station. Functional prototypes of much larger inflatable space stations have been built, and there are government and private sector plans for inflatable modules for space stations, lunar bases and spacecraft.

Inflatable space stations and habitats can complement and extend the space suit research and development described above, and could provide new market opportunities for the textile industry in the South of Scotland. Again, there is research collaboration potential with US manufacturers.

Life Support Systems

Living in space requires large quantities of food, water and oxygen. It also generates waste. In space habitation, waste is actually a valuable commodity that should be harvested. Space is, in essence, the most challenging environment for sustainability.

Solving this challenge for space helps solve sustainability challenges on Earth. Managing and recycling waste, optimising nutrition and diet and even reducing disease impacts can be addressed through addressing space solutions, and arguably, could accelerate the likelihood of solutions due to the systems approach needed for space applications.

Space life support requires technologies where the South of Scotland has existing strengths: agritech and textiles. Through collaboration with academic research departments in Scottish Universities, together with companies active in textile manufacturing and precision engineering, an initiative could be developed that would be of interest to space agencies and potentially space companies active in this area of activity.



3.4.3 Focus Area - Earth to Space

Space data, most notably Earth Observation space data, is the catalyst to accelerate the drive to Net Zero in the region, however there is more that can be achieved. An analysis of the region's strengths and opportunities from a space industry perspective highlights additional areas which could thrive in the South of Scotland.

Ground Stations

The existing Earth Station at West Freugh is well established and already has considerable capability, being used as a ground station for first ESA's ERS, and then Canada's RADARSAT. It would seem logical to use this site as the locus of a ground station cluster, possibly catering for commercial operators such as Starlink, OneWeb, etc. and various smallsat constellations, possibly including ground stations for Scottish satellite companies such as Spire Global, ClydeSpace as well as micro satellite constellations.

A cluster of ground station antennae for a range of satellite providers would also be a natural fit for establishing a data centre to deal with the data streaming down from space, especially with undersea cable connectivity in the vicinity. This then naturally expands the capabilities of such a site, drawing in additional operators, associated data services and leading to the organic formation of a space cluster.

This aligns with the SOSE five-year plan objectives of "Advancing Innovation and Improving Productivity", as well as aligning with the SOSE Digital Strategy, and through the nature of the data received, monitors natural resources, thus being of benefit to the SOSE objective of "Accelerating Net Zero and Nature Positive Solutions".

Defence ground station related activity at West Freugh would benefit from the existing Earth Station facilities, and could fit well with the new generation of UK MoD satellite constellations that are being developed, and leveraging future commercial ground station infrastructure developments.

Dark Skies and Space Tourists

The Galloway International Dark Sky Park is the first in the country. As the "South of Scotland Proposal for Innovative Forestry and Woodland Creation" (COSS February 2024) notes, "Dark Skies and Astro-tourism are becoming increasingly popular, opening new opportunities for tourism offers, from the science of astronomy to wellness products...and [the park] connects with the SOS's emerging Space Strategy aspirations. [The park] sits within the Galloway and Southern Ayrshire Biosphere...recently established as the Dumfries and Galloway Climate Hub...Biosphere Dark Sky Rangers [act as] ambassadors for the Dark Sky Park [and] are a key resource in celebrating and increasing residents and visitors understanding of the intrinsic value of our natural capital assets."

Langholm is also the ancestral home of fabled first moon-walker Neil Armstrong and a focus on "ground to sky" provides an opportunity to build on this local history and relate it to other Scottish space achievements and tourism opportunities.

Space Sustainability and Situational Awareness

Space sustainability covers a wide remit, ranging from development of sustainable practices for ground-based operations, to ensuring that Earth Orbit remains accessible by reducing uncontrolled space objects such as inert satellites, space debris formed by collisions in space, and expended rockets. Space situational awareness refers to being able to locate and track orbiting space debris, and requires an area free from light pollution, in which to site space tracking telescopes.

The Galloway International Dark Sky Park mentioned above can support space sustainability efforts and align with initiatives such as the Scottish Space Sustainability Strategy and the Astra Carta, signed by King Charles III in 2023. Locating a space situational awareness telescope in the Galloway Dark Sky Park would be ideal given the lack of light pollution, and could integrate with existing Astronomical sites.

Space situational awareness (SSA) is an area of importance for UK defence through UK Space Command, for tracking potentially hostile spacecraft, and for tracking space debris that could damage UK defence space assets, an area of military activity that has become increasingly important with strategic geopolitical events. The facility in the Galloway Deep Sky Park offers benefits for test and evaluation in a true dark sky environment.

Space Weather

An additional area of opportunity focused around ground station facilities is space weather monitoring. The National Severe Space Weather Preparedness Strategy outlines a series of commitments by government to work with industry, academia, and international partners to increase the country's understanding and preparedness for a severe space weather event, while tapping into UK expertise already in place, such as the 24 hour Met Office Space Weather Operations Centre - space weather monitoring facilities such as the Eskdalemuir Magnetic Observatory also align well with space situational awareness facilities and observatories, such as the Galloway dark skies sites.

Space weather has impacts on being able to undertake precise agriculture as well as wider digital infrastructure, transportation, electricity distribution and defence impacts, resulting in errors in location accuracy, loss of satellite navigation signals and data outages. The effect of space weather is highlighted as a risk in the UK National Risk register (2020), and could be considered for a future potential future pilot programme in the South of Scotland in conjunction with Scottish Universities, evaluating the impact of space weather on agriculture, as well as the impact on digital infrastructure such as the next generation 5G mobile as part of the Borderlands Digital Infrastructure, and/or the Ministry of Defence to evaluate the responsiveness of Defence infrastructure in the event of adverse space weather impacts. Such initiatives would provide an opportunity for the South of Scotland to demonstrate national leadership over this domain.

SOSE can help establish low-cost space weather stations, satellite downstations and satellite connected Internet of Things sensor systems for remote monitoring, at educational establishments such as Dumfries & Galloway College and Borders College, as well as the Marine Innovation Centres at St Abbs and Stranraer and the Advanced Manufacturing in the South of Scotland (AIMS) Project at Hawick.

Simple space weather stations and satellite downstations require IT skills, installation skills for antennae – skills that exist already in the South of Scotland. A satellite TV installation only differs from a weather satellite downstation by installing a different antenna and aligning it in a different direction. Therefore, space weather stations would provide a very low cost “shop window” to demonstrate how space technology can touch a wide range of disciplines, and show how skills from many other sectors can be used to build space knowledge and expertise.

Space Supported Communications

Under the Borderlands NC Programme, a Marine Innovation Centre is being established at Stranraer, investigating saltmarsh, seagrass and native oyster restoration. These are all potential opportunities for using space-based Earth Observation data. Additionally, the UK Government’s Department for Science, Innovation and Technology is providing £3.8 million, shared between the associated Borderlands Stranraer Marina and 4 other projects, feeding into the Borderlands’ Digital Infrastructure Strategy. Stranraer Marina will be one of ten new 5G Innovation Regions to lead on delivering the UK Government’s vision for communities across the UK to take full advantage of the transformative effect that advanced wireless connectivity and digital technologies can provide, and this can build on satellite infrastructure for both broadband resilience in rural and remote areas, and narrowband use of satellite enhanced Internet of Things sensors for distributed monitoring networks.

Satellite-Enhanced Remote Health Monitoring

The pioneering “Hospital at Home” project operating in the Central Borders, as well as the Digital Health & Care Centre provide a good fit with the use of satellite enhanced health monitoring in rural areas, as is already being explored in pilot programmes in England by the Satellite Applications Catapult “Space Enterprise Lab”. The other advantage to remote telecare initiatives such as this is in reduction of the need to travel, which is easier for the patient.

There is an increasing risk of severe weather events which can impact not only public health but also interrupt terrestrial communications networks. Satellite communications can offer a lifeline for more resilient and robust communications for remote rural areas, helping to ensure continuity of care. Resilient phone and internet communications will be increasingly important as more digital healthcare services become available, such as those mentioned above.

Expanding remote telecare initiatives through leveraging satellite-based services, represents an area where the South of Scotland could lead on space based rural healthcare monitoring, providing insights for other regions of the UK, and potentially provide export potential of both IP accumulated, and in expert opportunities. Bodies such as the Scottish Digital Health and Care Innovation Centre (DHI) and the Satellite Applications Catapult “Space Enterprise Lab” could offer potential partnership opportunities, enabling a faster pace of development of this growing area of the healthcare sector.

3.4.4 Focus Area - Energy

The South of Scotland's success in developing strong renewable energy opportunities for the energy sector, can be enhanced using space data.

Hydrogen production for space fuel cell research

Fuel Cells were adapted for NASA's Apollo lunar programme in the 1960s, and have provided a practical power source in space ever since. These could then be incorporated into terrestrial hydrogen fuel cells for clean energy. This could be achieved in the South of Scotland by hydrolysing Hydrogen using Wind and Solar energy, or through processing forestry or agriculture biomass using anaerobic digesters, presenting an opportunity for international collaboration.

Governments and the private sector are making plans to return to the moon and create permanent settlements. Hydrogen fuel cells offer a compact and effective power source that in the future, will enable safe lunar living as well as many terrestrial applications for clean energy storage and distribution.

Power Generation

Wind power can be used to produce hydrogen via electrolyzers that split water into hydrogen and oxygen. Hydrogen production can contribute to a sustainable hydrogen economy, and hydroelectric power can also generate hydrogen by providing a clean source of electricity for water electrolysis. The outcome of such clean growth is an acceleration of decarbonisation of the energy sector in the South of Scotland, moving the region ever closer to Net Zero, on the way to becoming carbon negative.

Clean energy aligns with the UN Sustainable Development Goal #7 "Ensure access to affordable, reliable, sustainable and modern energy for all", and Goal #12 "Ensure sustainable consumption and production patterns".

Earth Observation Satellites can support clean energy growth. Wind farm site selection is undertaken by mapping wind patterns and assessing the wind energy potential of different regions. For the South of Scotland, Earth Observation data can support energy companies in the planning and management of wind energy projects tied to hydrogen production.

Earth Observation data can additionally help manage hydroelectric resources by monitoring water levels in reservoirs, precipitation patterns, and overall watershed health, which are important for the reliable generation of hydroelectric power for hydrogen production.

The European Space Agency (ESA) recently established an Innovation in Energy through Space task force (November 2022) to address the key challenges faced by the sector through the use of space solutions.

Applying space data to energy reduction and conservation

The SOSE report, "Powering Change - Calling the South of Scotland to Action", poses a question regarding the impact of wholesale conversion of the off-gas grid housing stock to electric heating. Earth Observation satellite data provides the means to observe, monitor, report and verify progress towards such a decarbonisation programme, not only for housing stock, but for commercial and public sector infrastructure - all using existing Earth Observation satellites.

The data is available from satellites which observe and monitor thermal emissions, the capabilities exist within Scotland to analyse the data, and provide key insights to all stakeholders regarding progress, and enabling faster progress of strategies such as the Scottish Government's £33 billion "Heat in Buildings" strategy, through analysing the satellite data. The same space thermal data used to decarbonise heat generation and supply can also be used in the monitoring of travel, and addressing the decarbonisation of travel.

Renewable Energy Monitoring

Generating three times more electricity from renewable energy than the total electricity usage in the region, the South of Scotland leads the way in demonstrating how a transition to Net Zero can be achieved in terms of switching to clean energy, and furthermore, through exporting electricity outside of the region, how this can result in a positive economic success.

Measuring the extent to which wind farms impact the local environment, and minimising environmental changes as a result of this, can be supported by using Earth Observation data from satellites, where changes to the land over time can be observed and monitored.

From the perspectives of both energy generation and distribution in the South of Scotland, this satellite data is of use to companies across the energy supply chain, since lower resolution data can provide a good overall perspective for planning of energy generation and distribution infrastructure such as electricity pylon routes, and then high resolution Earth Observation data can ensure precise siting of resources such as onshore wind turbine pylons, access roads, electricity pylons, substations, and potentially in the future, battery megapacks and Hydrogen fuel cell power generators.

Satellite connected Internet of Things sensors can be used onboard offshore wind turbines to monitor turbine health, with the internet of things applications being supported by satellites manufactured in Glasgow by companies such as Spire Global. Earth Observation data also has a role to play in supporting offshore wind turbines. In areas such as South of the Mull of Galloway, there is a need to monitor the marine environment effects due to the interaction between the wind pylons and the surrounding water. Water mixing due to the pylons interacting with water flows can be monitored using thermal monitoring Earth Observation satellites.

The use of Earth Observation data for solar energy generation is of benefit at high inclinations such as the UK, where maximising solar illumination is critical. This becomes even more important in a region with considerable variations in the height of terrain such as the South of Scotland, because in a similar way to microclimate effects varying over distances of less than 100 metres, solar insolation can be considerably impacted by obstacles in the line of site to solar

panels, especially at lower Sun angles in the Winter. Low resolution Earth Observation data can indicate the most appropriate locations to maximise solar illumination, and higher resolution Earth Observation data can help optimise solar energy systems, through providing data that can be used to determine the most efficient orientation and angle of solar panel placement, to maximise the capture of solar energy for solar farms and smaller solar arrays on commercial, government and domestic infrastructure.

Energy generation, transmission and distribution

In addition to using data from Earth Observation satellites for planning infrastructure, the data can also be used to detect excessive vegetation growth, where it could present an impact on the land-based power distribution network, where smaller pylons and substations in more remote areas may require additional inspection. Advance warning of encroaching vegetation via satellite data can then enable resources on the ground to be dispatched to mitigate any adverse impacts.



3.5 Setup Innovation Hubs

3.5.1 Overview

To help achieve SOSE's space strategy goals and objectives, it should establish a regional network of Innovation Hubs.

The hubs are small "centres of excellence" which help participants leverage space data and technology in one or more of the focus areas described above. They are geographically situated in appropriate locations across the region, and support virtual and physical participation and collaboration.

The South of Scotland Innovation Hubs are intended to cooperate with each other and are likely to form the nuclei of an eventual South of Scotland Space Cluster. They can also explore and facilitate collaborative opportunities between other UK organisations and clusters. Examples of potential collaborative opportunities in the South of Scotland would be with the 5G Hub, AIMS and the Marine Innovation Centres, with the innovation hubs also providing an opportunity for collaboration with Scottish wide organisations such as the Data Lab and CENSIS. This "cluster of clusters" model has been adopted by the Scottish Space Cluster, and is advocated by the UK Space Agency and Satellite Applications Catapult.

Individual hubs should focus on a relatively "narrow" set of industries/sectors for participants and it should be clear to interested parties what the Hub does and why it would benefit them to participate. A Hub will facilitate holding topically-focused events such as hackathons, brokerages, and conferences; it will encourage innovation and knowledge sharing around a set of products/services/research areas; help develop skills, jobs, careers, make it easier to engage regional and external stakeholders, and attract investment.

3.5.2 Establishing Hubs

Innovation Hubs help nurture community building and research and development activities. Where possible, they should be established at existing locations such as academic institutions or in shared hosting spaces, which can flexibly accommodate on-site and virtual events and collaboration. The Hubs should be inclusive and accessible, balance diverse interests, stay relevant and focused on supporting the SOSE space strategy and demonstrably show how they are helping increase innovation in the region, through measurable objectives, especially in alignment with the strategic direction of SOSE and the South of Scotland Regional Economic Strategy Delivery Plan. A framework should be developed to identify and address likely or potential issues such as those around data privacy and security, and Intellectual Property (IP) issues.

SOSE should consider hosting Satellite Applications Catapult "Space Enterprise Lab" (SEL) within at least one of its Innovation Hubs. SELs are "a UK-wide network of local places for space innovation that are free-to-use and digitally inclusive. As physical anchors for the UK Space Ecosystem and complementing the Space Enterprise Community platform, the Space Enterprise Labs (SELs) bring communities together, both locally and nationally. They include free access to resources, virtual demonstrations and expertise, as well as technology".

The SEL helps organise space strategy sessions, business engagement and support, run local events, host demonstrations and project meetings. so is aligned with the purposes and needs of the Innovation Hubs.

3.5.3 Stakeholders and Governance

Innovation Hubs should invite and involve a wide variety of participants:

- Government entities can provide policy support, funding, and regulatory guidance, facilitating the implementation of projects and solutions developed within the region. They can offer resources and support for scaling and integrating innovative solutions into regional planning and development.
- Academic Institutions are vital for research and development, offering expertise, resources, and a pipeline of skilled individuals. Collaborations can include joint research projects, internships for students, guest lectures, and the utilisation of university facilities for hub activities. Academic institutions can also play a key role in measuring and evaluating the impact of innovation hub activities.
- Local communities should be engaged to ensure that the hub's activities are grounded in real-world needs and can foster public support. Community members can participate in citizen science projects, co-design activities through participatory and workshops, and provide valuable feedback on local issues and needs.
- Businesses can offer practical insights into market needs and the commercial viability of technologies. They can participate in mentorship programs, provide funding or resources for projects, and collaborate on research and development. Local technology companies and start-ups can offer technical expertise, access to cutting-edge tools and platforms, and potential pathways for commercialising innovations. They will also attract investors and Venture Capitalists to provide funding and guidance for start-ups and entrepreneurs emerging from the hubs.
- Non-Governmental Organisations (NGOs) can bring in grassroots perspectives, contribute to policy discussions, and assist in mobilising community actions.
- National and international organisations can offer wider perspectives, funding opportunities, and networking connections.

3.5.4 Events and Activities

Consider a mix of ad-hoc/participant-led events and activities, combined with more formal and organised efforts. We recommend at least the following:

- **Hackathons and challenges:** These are time-bound events where participants collaborate intensively to solve challenges. They can focus on broad themes or specific applications, for example climate change adaptation and mitigation techniques for individual home-owners, businesses, or on data gathering and analysis challenges for precision agriculture. Relevant examples are a potential hackathon for the European Lunar Symposium as well as participating in the annual NASA International Space Apps Hackathon (described in Section 4, below).
- **Workshops and Training Sessions:** Offer hands-on training in specific technical areas such as geospatial data analysis, satellite imagery processing, or programming languages relevant to Earth Observation. Workshops on soft skills like project management or communication would also be important for communicating science concepts and developing the pilots.
- **Speaker Series and Guest Lectures:** Invite experts from academia, industry, or the nonprofit sector to speak on topics related to climate change, technology, or innovation. This provides an opportunity for community members to learn from and interact with thought leaders.
- **Unconferences:** These are participant-driven meetings where attendees decide the agenda. They can stimulate innovative thinking and cross-disciplinary collaboration. They can be particularly effective in areas where traditional conference formats may not fully explore emerging ideas or technologies. Since the pilots will require cutting edge and creative thinking across a variety of different audiences and applications, unconferences could measure and drive grassroots innovation.
- **Project Showcases:** Regular events where community members present their ongoing projects to facilitate feedback, collaboration, and peer learning.
- **Networking Events:** Social events with a thematic focus can help build a strong community. These could be informal meetups, professional networking events, job fairs, and mentorship gatherings.
- **Incubator, Mentorship, and Guidance Programs:** Provide support for early-stage projects or start-ups, including mentorship, resources, and guidance. This could be particularly impactful for initiatives focusing on climate change mitigation or adaptation technologies.
- **Policy and Advocacy Workshops:** Given the importance of policy in climate change and environmental issues, workshops that educate and empower participants to engage in policy advocacy can be highly beneficial.

3.5.5 Example of a Mature Innovation Hub Network

SOSE should identify, prioritise, and establish a handful of Innovation Hubs in the immediate term (see “Action Plan – Immediate Term” below). Over time, this network can be enhanced and expanded. A viable network of hubs could eventually look like this:

1. Natural Capital

This Innovation Hub would provide space innovation technologies, data and support for climate change adaptation and mitigation and biodiversity aspirations. The marine elements would focus on topics such as aquaculture, plant medicine, seagrass, and marine biodiversity. Terrestrial elements would focus on elements such as agriculture, forestry, and land management. It could provide collaborative opportunities to work with the SRUC on their plan to develop Land Use for Net Zero Hubs.

2. Manufacturing and Supply

This hub would help regional suppliers connect into the “upstream” side of the space industry (such as rockets/satellites/habitation). It could have specialties in Textiles and/or in services or product manufacturing.

3. Earth to Space

This hub focuses on Ground Stations and Space Weather in the West Freugh area, leveraging the presence of the existing ground station. A space situational awareness specialty could be located in the Galloway Forest (Dark Sky) Park. Space weather stations could be situated at Dumfries & Galloway College and Borders College, the Marine Innovation Centres and the Advanced Manufacturing in the South of Scotland (AIMS) Project at Hawick.

4. Energy

This hub would focus on renewable energy generation, storage, and distribution. Its initial specialty could be Hydrogen fuel cells, and location could be at a business campus, manufacturing lab, or academic institution.



3.5.6 Application Pilot Projects

In order to make the work of the Innovation Hubs more tangible, they need to be applied to real world applications. Therefore, Hubs should support application pilot projects.

The application pilot programs, to be agreed upon by SOSE and Hub participants, should all be projects with tangible goals and objectives, success metrics, and outputs including new intellectual property, enhanced local knowledge, expanded partnerships, and new data sets. Their results and outputs are expected to align with the focus areas as well as the overall space strategy. Successful outcomes will produce verifiable, beneficial results for the region and its businesses.

The pilots will provide a practical testing ground for industry and academia to help build capacity and capability while also showcasing the region's growing expertise and leadership in these areas. Their intent is to minimise costs and maximise efficiency, while drawing in space industry expertise to build on regional strengths and provide new opportunities for the region. Over a period of time, a sustained programme of pilots would build local expertise, technology and data which can then be exported outside the region as new products and services.

3.6 Incubate and Attract Space Business, Workforce, and Investors

Using compelling video or infographics to show how space is used constantly from wake up until sleep, whether through SatNav, precision agriculture or habitat conservation, would provide a means of using space to inspire the region and providing a reason for young people to remain in the region. The call to action is how the population of the South of Scotland can lead on using space technology to enable a cleaner, greener planet, through entrepreneurial space related activity, generating new skills and jobs, using this opportunity for leadership provides the reason for people to stay in a region and help improve its Net Zero credentials. SOSE could collaborate with local stakeholders through the pilot programmes to develop and shape the call of action, refining the message.

As a way to inspire the region, regional stakeholders should consider participating in the NASA International Space Apps Hackathon (<https://www.spaceappschallenge.org>) aims to "SOLVE REAL-WORLD CHALLENGES ON EARTH & IN SPACE...[and is] a hackathon for coders, scientists, designers, storytellers, makers, technologists, and innovators around the world to come together and use open data from NASA and its Space Agency Partners to create solutions to challenges we face on Earth and in space." This year's hackathon will be held the weekend of October 5 and 6. SOSE can work with partners and local organisers to use this annual event to inform, inspire, and engage Scottish citizens, academia, and enterprises to use space technology and data for regional problems. No Scottish city officially participated in 2023 (as seen on the NASA Space Apps Challenge website) so this would be a chance to literally put South of Scotland's space efforts "on the map".

3.6.1 Attracting and Incubating Space Sector Companies

There is an opportunity to attract space industry companies and talent to the South of Scotland.

SOSE can help attract and incubate space sector companies. Increased presence of space sector organisations, R&D, and capabilities would encourage inward investment, support levelling up through space related upskilling, provide new opportunities to increase economic development and job creation, drive new business start-ups in the region, and highlight new career opportunities to employ and inspire citizens.

Thirty-three Earth Observation space data companies are currently located in Scotland, with around 160 across the UK, but only one has a presence in the South of Scotland. It is time to encourage these other companies, and national bodies to the region. This can be achieved through a series of space brokerage events, proposed strategic pilot initiatives, workshops and follow-on events, engaging them in the development of solutions to help use space to provide even more natural capital innovation. Examples include using precision agriculture techniques to waste and water usage, flood protection using Earth Observation satellite data to monitor water levels and water saturation, or using Earth Observation satellite data for Observation Monitoring Reporting and Verification (OMRV) for Environmental Social Governance (ESG).

SOSE can organise and host space brokerage events and space pilot initiatives to connect these companies with regional projects and opportunities.

3.6.2 Attracting Investment

In terms of inward investment into the South of Scotland, establishing the pilot programmes detailed in the action plan would provide impetus to attracting interest in the region. By highlighting the opportunity for Earth Observation to support the high-quality natural capital resources in the South of Scotland, SOSE would be able to work with space data companies who can provide expert input into how their analysis can benefit the region.

SOSE is already actively engaged on a space project with Space Scotland, the trade body for space activities in Scotland, who have considerable knowledge and experience of the markets and potential for Scottish Earth Observation space data companies. Establishment of space activity in the South of Scotland also offers an opportunity for SOSE to engage with public sector organisations offering space industry support, such as UKSA, ESA, InnovateUK, DASA, Horizon Europe, STFC, SPRINT, NERC and the Satellite Applications Catapult and initiatives such as the Catapult Space Investor Launchpad.

The investment community, with private investment vehicles such as Seraphim Capital and E2MC has played an important part of the space funding landscape, and with sufficient success in the South of Scotland over the longer term, the potential for supporting new space enterprises through private investment capital should also be considered.

To encourage Earth Observation companies to engage, there may need to be financial incentives. As an example, SOSE could help organise a match funding drive to help fund one or more pilot programmes (e.g., a Natural Capital pilot programme). Seed funding would help pilot project participants to cover costs and prove the concept. They could then roll out the pilot-developed technology across Scotland, the UK and internationally, providing a clear incentive for Earth Observation companies through the opportunity to expand business to a larger market, and develop IP.

3.6.3 Growing the Workforce

SOSE's "Our five-year plan" notes that 89% of enterprises in the region have fewer than 10 employees. Bringing space capabilities and services to the South of Scotland presents an opportunity to build capacity for new, high skill jobs:

1. The value of the Earth Observation services results in potential for a high gross value yield per employee, which is why Scotland has developed an outsize capability for its size in the space data sector.
2. The SOSE five-year plan notes that the South of Scotland has better three-year survival rates for start-ups, and at 19%, a greater level of self-employment than the rest of Scotland. This represents an opportunity for SOSE to highlight an advantage for space industry participants to relocate to the region.

Building awareness of career pathways in the space sector can be driven effectively by practical demonstration of space applications, and this would help align with the South of Scotland Regional Economic Strategy.

To maximise use of space data in the South of Scotland, the Innovation Hubs can help coordinate and deliver training in Earth Observation data handling and data analysis skills, by bringing in external experts who could provide training and guidance for local industry and those on a skills or educational journey. By demonstrating how space applications, when used in the South of Scotland, could help address climate change through supporting the goal of 30x30 and the region becoming carbon neutral by 2045, there is a clear reason for people to engage and help make a meaningful difference.

Previous research on the opportunities for the application of Earth Observation data using software on digital hardware platforms such as laptops and tablets will require skills and training, especially for the next generation of farmers. When providing training in Earth Observation data handling and data analysis skills to agricultural practitioners, care should be taken to address diversity, and increase the involvement of women in space and data science-related work.

Earth Observation space data companies in Scotland have already demonstrated significant success in exporting knowledge across the globe, developing world leading reputations. The South of Scotland can seize the opportunity to become a leader in melding space data with actionable insights regarding natural capital for the wider community, enabling real progress in addressing the challenges of climate change.

3.7 Nurture Strategic Partnerships to Unlock the Value of Space

SOSE should cultivate and leverage strategic partnerships to advance and accelerate its activities and unlock the full value of space capabilities and data. As mentioned, the South of Scotland's enviable geographic location can facilitate this.

The immediate opportunity is to advance the Space Cluster Partnership with Space Scotland and East Anglia, as described below.

SOSE should also help ensure that space data and technology is integrated with Borderlands Natural Capital Programme.

Other potential opportunities for space-related partnership work include:

- Using the Innovation Hub activities to collaborate efficiently with Scottish, UK, and international organisations. For example, a partnership with the Edinburgh Data Lab could be explored. The hubs could leverage Earth Observation data for use in flood monitoring applications in conjunction with SEPA.
- Collaborating on space data applications that do monitoring, reporting, and verification (MRV) with organisations such as Scottish Forestry, Forestry and Land Scotland as well as NatureScot.
- Researching how space data could help provide services or monitoring for rural areas could be undertaken in collaboration with the Scottish Digital Health and Care Innovation Centre (DHI).
- Contributing to the Space Upstream in conjunction with the Scottish Centre for Sensor and Imaging Systems (CENSIS).
- Aligning to the Scottish Government's Natural Capital Market Framework which is being developed to establish responsible trading of natural capital benefits.



4. The action plan – immediate term

The immediate term plan identifies key areas that SOSE should focus on over a fourteen-month period between now and the end of March 2025 (end of upcoming fiscal year). It is intended to get into action and start delivering measurable and meaningful results. It will help SOSE decide and agree on the methodology of how the plan is deployed and measured. It will also enable the development of SOSE's marketing and comms plan to key stakeholders.

The immediate term actions are:

1. Complete the "Space Action Matrix" planning;
2. Space Cluster Partnership with Space Scotland and East Anglia;
3. Establish a focus for space activity in the South of Scotland; leveraging space brokerage events;
4. Use space technology and services to inspire and enthuse the region.

4.1 Complete the "Space Action Matrix" planning

Planning work is underway at SOSE on an "Action Matrix/Process Plan" which defines key areas that it should focus on in 2024, helps decide and agree on the planning methodology, assigns roles and responsibilities, and defines how to measure the deliverables.

The immediate purpose of the planning work is to get into action and start delivering results and help enable the development and delivery of SOSE's marketing and communications plan to key stakeholders.

The higher-level purpose of the planning work is to help South of Scotland contribute to and claim value from the Scottish Space Sector, by

- developing leading practices in the use of space data to create economic opportunities derived from the region's natural capital and status as Scotland's Natural Capital Innovation Zone (NCIZ).
- demonstrating the South of Scotland's social values—diversity and inclusion, bold and striving, STEM and Schools-Youth Forum and more, Net Zero Commitment, partnerships, SRUC, Third Sector, Charities, Wellbeing, Fair Work.
- developing decision-ready datasets and evaluating the quantity and quality of regional assets including those in natural capital. This will help map the opportunities for nature-based solutions delivered through blended and private finance investment.
- Qualifying local businesses and external partners that SOSE can use to benchmark and develop best practices as it implements its strategy.

All tasks and processes in the planning work should align to one or more of SOSE's 6 A's, Regional Economic Strategy (RES) and the Scottish Government National Strategy for Economic Transformation (NSET) Themes. Fair Work should be a prerequisite as part of all interaction with supply chain and inward investors.

Identify roles and responsibilities (such as in a RACI matrix) for the action plan items and sub-tasks. This information should be included in the knowledge management portal (see "Develop SOSE Space Accelerator Framework", below).

4.2 Space Cluster Partnership with Space Scotland, Space East and AstroAgency

4.2.1 Unlocking Space-Derived Data for Agricultural Opportunities across Scotland

The Space Cluster Partnership with Space Scotland, Space East and AstroAgency is a project to empower farmers, land managers, and agricultural stakeholders with the tools, knowledge, and insights needed to harness the full potential of space technology. The first stage, the research phase, from January to May, 2024, is a discovery phase, where Earth Observation companies and agricultural organisations in the regions are identified. Once completed, this leads on to the second phase, from June 2024 to February 2025, which is a series of knowledge exchange events and collaborative workshops which will provide an opportunity to identify what areas of activity would have short term and longer-term demand for Earth Observation services.

Examples of areas of activity that could benefit from using Earth Observation data in the context of this project, would include:

- Detecting and controlling pests and disease
- Understanding water and nutrient status
- Planning crop nutrition programmes
- Informing in-season crop irrigation
- Predicting crop yields
- Estimating crop harvest timing

From August 2024 until March 2025, an ongoing programme of developing case studies and promotional activity will be planned and undertaken.

4.3 Establish a focus for space activity in the South of Scotland

Define the mode of operations for initial and longer term SOSE space activities. Establishing a focus for space activity in the South of Scotland would make it easier for directing space companies and funding opportunities to SOSE.

The main tasks (which are expected to run in parallel) are:

1. Develop SOSE "Space Accelerator" Framework
2. Run space brokerage events
3. Establish Space Innovation Hubs
4. Gather and share actionable insights and data

4.3.1 Develop SOSE “Space Accelerator” Framework

In order to achieve the strategic goals and embed space capabilities and data into SOSE and regional decision making and collaboration projects, many different space technologies, data sets, terms, and concepts will have to be learned and absorbed by SOSE leadership, stakeholders, staff, external partners, and even local businesses and organisations.

This subject matter can be complex and highly technical/scientific, context-specific, and rapidly changing. Establishing a space-focused knowledge management process is therefore vital. Accordingly, SOSE should create a knowledge management framework to accelerate the awareness, understanding, and application of space technology and data.

The framework should be a highly practical, inexpensive, organically evolving set of tools, processes, and content that can be used internally and externally. It will also serve as a data/content resource catalogue. It should start small, leveraging existing content and processes wherever possible.

Simple processes can be defined to help SOSE’s business development staff quickly find and inject relevant space data and technology topics and links into their work.

For example, sample topics can cover relevant space technology and data use cases, explain concepts and define terms, address frequently asked questions, and provide indexes to more detailed information, case studies, and policies. The information should be written to align with or respond to relevant SOSE frameworks including the 6 “A’s and other relevant formats such as the UK Government “Green Book”, NSET and RES.

Content can be created as simple web pages with clickable links. The web pages can be hosted internally and/or externally-facing wiki, websites, or knowledge management (KM) portals. The knowledge portal(s) can provide “self-help” guidance 24/7, and be used by SOSE business development staff when they meet with stakeholders and need to explain why space capabilities are relevant.

Once the relevant information is accessible, understandable, easy to consume and inject into SOSE processes, it will be easier for SOSE to accelerate the adoption of space data and technology in the region.

To get started with the framework, SOSE should prepare for and run brokerage events (described next) and capture the information (inputs and outputs) for future such events.

4.3.2 Space Brokerage Events

Run space brokerage events to identify/bring in supply chains and delivery partners together so that SOSE can identify and qualify opportunities and priorities. This enables the South of Scotland to hit the ground running, not only building networks between the Scottish space industry and local stakeholders in the South of Scotland across a range of sectors, but finding solutions to regional and sectoral challenges.

Brokerage event outcomes should tangibly unlock space/tech related business opportunities for local businesses and clearly identify other opportunities relating to SOSE's key objectives. Event outcomes should include specific deliverables, metrics, and next steps.

Space brokerage events could be run at locations such as Dumfries and Galashiels, where public transport connections offer an ability for a wider number of people to attend the events physically, but should include the option of virtual participation as well.

The brokerage events and pilot programmes should be mutually complementary, building on each other to support activities creating a more integrated approach to using space to address climate change solutions. The events will also help create and establish the South of Scotland Space Cluster (as described later in the document).

4.3.3 Establish Innovation Hubs

Define a plan for how Innovation Hubs could best stimulate entrepreneurial activity, which would then enable space solutions to be mapped to these activities. This would then create demand for employment, and improve skills development through education or retraining and retention programmes.

Examples of possible innovation hubs are:

1. Natural Capital
2. Manufacturing and Supply Chain
3. Earth to Space
4. Energy

4.3.4 Gather and Share Actionable Insights and Data

SOSE and its clients and partners will need to make many informed decisions using high quality data. Wherever possible, SOSE should share such information with partners/the public through brokerage events, storing info in the accelerator framework or via websites, web portals and micro websites.

A common factor for any analysis, presentation or publication of investment or policy and natural capital, is the importance of transparency and reporting. This is at the core of Earth Observation satellite data's value, since the data enables not only observation and monitoring and reporting, but verification of the Earth's surface and processes. This provides a measurable way to validate claims of acting for the benefit of the planet, and helps support the drive to Net Zero, through providing clearly defined metrics which support actionable insights with defensible and robust data for ESG within wider industry, including the financial and insurance industries.

Develop a set of short-, medium- and long-term data sets and measurements which can be used to track impact and progress of space technology and services in meeting South of Scotland goals.

Classify information using standardised taxonomy such as tagging technologies or companies as working “upstream” or “downstream”, sector, technology or data type, relevance to 6 A’s/NRES/RES, whether information can be shared publicly or internally only, etc. Wherever possible this metadata taxonomy should use existing standards or practices at SOSE, nationally/internationally, and in the space and other relevant industries.

Publish the content on partner portals/public websites, at brokerage events, when working with clients and partners, when working with academic institutions; and during innovation hub events.

A survey of existing data clients and potential clients in the South of Scotland could help to build a more compelling reason for establishing and growing a data analysis and support economy in the region.



4.4 Use space technology and services to inspire and enthuse the region

4.4.1 Awareness and Outreach Campaigns

There is a need to market to the South of Scotland that SOSE are engaged with the Space sector, and SOSE are very serious about their ambitions and businesses and partners need to know the SOSE story and why. This approach will enable SOSE to start seizing the opportunity to develop new space capabilities in the region (which is achievable through working with established space facilities such as ground stations). Additionally, it will also help with retention and development of new skills in the South of Scotland, through the new capabilities.

From lists of businesses in the region, compile a company level capability map to identify new business streams, more efficient existing business practices, new entrepreneurial activity and a rationale why they should enter the space market and support and resources required to do so. Use lists of the more than 100 space businesses in Scotland to match them against the businesses in the South of Scotland.

4.4.2 Space Hackathons

The European Lunar Symposium on June 24 could be used to raise awareness and enthusiasm in the region. A hackathon exercise could be organised to allow student participation to “help explore the moon”, for instance by assembling ultra-small satellites such as ambasats. Local industries can participate in sponsorships, in-kind support, and/or judging. The European Lunar Symposium hackathon could also serve as practice to involve the region in the annual NASA International Space Apps Hackathon (held this year on October 5 and 6).

SOSE and/or its partners should apply to run a local chapter of this hackathon (described earlier). Local lead applications are due by June 15. (<https://www.spaceappschallenge.org/host-an-event/>)

Once approved by the event’s Global Organizers, Scottish space companies could then be approached to aid in organising, sponsoring, mentoring, and judging the hackathon. This would serve as a kind of “brokerage event” in a well-established and supported, internationally known event. From examples in Canada and elsewhere, participants in local events have regularly gone on to work in the space industry or even form start-ups.



5. The action plan – immediate term

These actions take place over a longer period than the next fiscal year (although they can begin within it, if time and capacity allow).

The longer-term actions included (but are not limited to):

1. Harness the space industry to accelerate SoS's goals
2. Nurture space entrepreneurial activity in the South of Scotland
3. Engage stakeholders with South of Scotland's space industry

5.1 Harness the space industry to accelerate SoS goals

5.1.1 Pilot Programmes

Establish space industry pilot programmes which focus on addressing the South of Scotland regional issues and challenges described above (especially those related to Natural Capital and Climate Change). These not only support the acceleration of the South of Scotland's goals to reach its 2045 goals, but also raise the profile of the region. Whilst the pilot programmes would be defined in the Space Brokerage Event's Action Point 1, examples of pilot programmes could include:

Use of Earth observation data for observing and monitoring farmland in the region to support precision agriculture for a reduction in waste which then leads to more sustainable agricultural outcomes, potentially with bodies such as SAOS (Scottish Agricultural Organisation Society) with their practically led farm technology trials.

Use of Earth Observation data for more responsive and predictive flood monitoring and management through observing the regional hydrology during periods of high risk with adverse weather. This will become of increasing importance with the less predictable nature of the changing climate, and addressing real time flooding, drought and water quality will help increase business resilience planning ability. Data projects underway with SAOS would align with space derived data and insights, and present an opportunity for a pilot programme.

Use of Earth Observation data for using space-based Earth Observation for monitoring river and water health, observing and monitoring water courses to identify agricultural fertiliser run-off into water courses, sewage leaks and crop stress, potentially with bodies such as SEPA and SAOS.

The Innovation Hubs would be able to assist with organising and running the pilot programme meetings in the South of Scotland.

5.2 Nurture space entrepreneurial activity in the South of Scotland

5.2.1 Continue Space Brokerage Events

Continue to run space brokerage events that build awareness within the region of what space can achieve for other sectors, and how it can help other sectors reach their Net Zero goals.

Plan a series of space workshops to maintain the moment of the space brokerage events. These would be for local businesses and space companies to solve regional challenges using space services and products, focusing on a different industry sector each time, or covering several sectors each time, and could be held at locations with good public transport connectivity such as Dumfries or Galashiels.

One area that should be highlighted could be the space funding landscape, with private investment vehicles such as Seraphim Capital and E2MC, as well as public sector organisations offering space industry support, such as UKSA, ESA, InnovateUK, DASA, Horizon Europe, STFC, SPRINT, NERC and the Satellite Applications Catapult.

5.2.2 Develop new Space Capabilities and Markets

Seizing the opportunity to develop new space capabilities in the region is achievable through working with established space facilities such as ground stations, as well as developing new capabilities that have the ability to retain and develop new skills in the South of Scotland. Areas of opportunity which present calls to action for the South of Scotland for space technology, manufacturing and the space supply chain include:

SOSE can help educate precision machining and other manufacturing companies about new and emerging market opportunities in the upstream space sector; organise and promote space brokerage events to draw in space companies with a demand for manufacturing services; and market South of Scotland manufacturing companies to the space sector.

Engage with QinetiQ to explore the possibility of adding additional ground station providers to the existing large ground station facility at West Freugh, either within the perimeter of the existing site, or beyond the perimeter.

Establishing multiple ground station providers at the West Freugh site, would form a nucleus for a space cluster focused on this essential component of the space industry, which can then expand to support data centre facilities and space weather monitoring, whilst establishing an innovation hub at West Freugh.

Engage with the Scottish Digital Health and Care Innovation Centre (DHI) and the Satellite Applications Catapult "Space Enterprise Lab" regarding developing satellite enhanced remote healthcare pilot programmes, to provide more robust and resilient telecare, whilst providing a route to reducing CO2 emissions. Coordination of satellite enhanced remote health care programmes could be coordinated through either an innovation hub in Dumfries or in Galashiels.

Connect Heriot-Watt University's School of Textiles and Design, at Galashiels with companies in the US developing space suits and inflatable space stations, such as ILC Dover and Sierra Space, as well as NASA field centres innovating with life support technologies. Build connections and partnerships to encourage research projects through initiatives such as the UKSA's International Bilateral Funding programme.

Reach out to Scottish Universities and Higher Education establishments to establish interest in Hydrogen Fuel cell research for space applications which can also be used terrestrially, as well as connect to companies engaged in work with Hydrogen in the South of Scotland.

Scotland's Rural College at the Barony Campus and the School of Social and Environmental Sustainability, University of Glasgow - based on Crichton Campus, Dumfries, may help establish industry interest and partnerships in areas such as water management.

5.2.3 Enhance/Extend the Innovation Hubs

Continue to enhance and establish innovation hubs across the region to build space entrepreneurial activity in the South of Scotland, and to provide an opportunity to build capability through providing local focal points to nurture new ideas and innovative space solutions for the region, with an emphasis on supporting the Net Zero agenda through a clear strategy to establish the innovation hubs to demonstrate how sustainable space capabilities can be developed.

Investigate the feasibility of developing regional capability in a "space cluster" (see below) focused on using Earth Observation space data to address rural climate change impacts with clear, measurable and actionable data, in conjunction with the pilot programmes.



5.2.4 Skills/Careers

Supply Chain engagement to establish where the skills gaps and opportunities are that can be addressed by the space sector - this would also enable collaboration with Scottish Universities as well as Skills Development Scotland, Space Scotland and the Scottish Government on potential solutions.

5.3 Engage Stakeholders with South of Scotland's Space Industry

5.3.1 Establish a South of Scotland Space Cluster

The Innovation Hubs are intended to occupy physical locations in the South of Scotland with a focus on specific themes. Over time, what is referred to as a "regional space cluster" should emerge from the various Innovation Hub activities.

A space cluster is a government-recognised grouping of space related companies in a geographic area, which can attract additional government funding opportunities and support.

In the United Kingdom, Harwell is the location of the first space cluster, but the various UK space clusters other than Harwell tend to represent entire regions. In Scotland there are several space clusters such as the overall Scottish space cluster, and the North Scotland space cluster.

A South of Scotland Space Cluster is likely to arise when the activity in the individual innovation hubs starts to generate similar or complementary space technology and data, application use cases, products and services, and stakeholder participation. Formal UK Space Agency recognition of a South of Scotland "regional space cluster" will likely attract entrepreneurial space ventures from the rest of the country and even internationally. South of Scotland's exceptional geographic location will serve as a centralising "link" between the other UK space clusters.

A space cluster would be a natural output of healthy and successful Innovation Hubs. This action plan involves studying and identifying the point at which space sector activity will benefit from a regional space cluster, and conducting the necessary outreach and awareness, networking, administrative, and operational activities required to make this a formal designation and to then capitalise on it.

Ultimately, SOSE will help define exactly what a South of Scotland "space cluster" will look like and how it will function.

5.3.2 Awareness and Outreach Campaigns

This extends the previous work showcasing the SOSE space strategy and activities, and the many (growing) ways that the region leverages space capabilities. The campaigns will articulate the many benefits to and from the South of Scotland's participation in the space sector, and the successes supporting new entrepreneurial activity. They should serve to attract investment opportunities in the South of Scotland for space activities.

Some suggested activities include:

- Engaging within Scotland and the UK:
 - UKSA to establish formal recognition of distinct space activity in the South of Scotland (“space cluster”, above), and to leverage funding opportunities for regional space growth.
 - Neighbouring space clusters (Space Scotland, the North West Space Cluster, North East Space Cluster and Northern Ireland Space Cluster).
 - Satellite Applications Catapult to establish one or more Satellite Applications Catapult Space Enterprise Lab (SELS).

- Engaging Internationally:
 - Working with globalScots to promote SOSE’s space strategy and regional activities and successes through Scotland’s international diaspora.
 - The regional ESA ambassador for Scotland to establish funding opportunities focused on the ESA BIC.
 - USA and Canada.
 - Explore other markets.

- Building the SOSE space brand identity and brand awareness focused on the natural capital leadership provided by SOSE, and how this can work with the space industry to drive initiatives such as 30x30.

There are also opportunities to use Earth Observation to support and research natural capital preservation and growth and the impact of climate change, especially when aligned with the 30x30 goals. There is an opportunity for the South of Scotland to engage with the Satellite Applications Catapult, NERC, and the UKSA for both funding and knowledge transfer, and for learning from mitigation methods used by other countries with regions suffering similar issues. This would then provide an opportunity for international collaboration and eventually export of knowledge and expertise internationally.



6. Conclusion

The South of Scotland is the Natural Capital Innovation Zone for Scotland and is well placed to build interest in the area from the space sector. The key is to build on such existing strengths and 'bootstrap' space development and usage across the region.

This strategy proposes a practical, actionable approach whereby SOSE can help the South of Scotland:

- become a significant link in the UK Space Cluster Chain;
- develop a Wellbeing Economy enhanced by space capabilities and data;
- define strategic focus areas to leverage space capabilities and data;
- setup Innovation Hubs;
- incubate and attract space businesses, workforce, and investors; and
- nurture strategic partnerships to unlock the value of space

The strategy focuses on thematic areas that are a natural fit for SOSE and South of Scotland and that will benefit from applying space industry technology and data:

1. Natural Capital
2. Manufacturing and Supply Chain
3. Earth to Space
4. Energy

Innovation Hubs will help support economic resiliency and growth in these focus areas, and will eventually help establish a South of Scotland "space cluster".

SOSE should develop a plan of actions to be undertaken in the immediate term (to the end of the upcoming financial year), and over the longer term.

The immediate term plan identifies key areas that SOSE should focus on over a fourteen-month period between now and the end of March 2025 (end of upcoming fiscal year):

1. Complete the "Space Action Matrix" planning
2. Space Cluster Partnership with Space Scotland and East Anglia
 - a. Unlocking space-derived data for agriculture
3. Establish a focus for space activity in the South of Scotland
 - a. Develop SOSE "Space Accelerator" framework
 - b. Run Space Brokerage events
 - c. Establish Innovation Hubs
 - d. Gather and share actionable insights and data
4. Use space technology and services to inspire and enthuse the region
 - a. Awareness and outreach campaign
 - b. Space hackathons

Longer term, recommended strategic actions should include:

1. Harness the space industry to achieve and accelerate SoS's goals
2. Nurture space entrepreneurial activity in the South of Scotland
3. Engage stakeholders with the space industry.

An effective way of growing space capability from the current level in the South of Scotland would be to put in place an activation plan, and rapidly structure a series of space brokerage events to bring together potential end users in the South of Scotland with space experts. Building on this, a series of "application" focused pilot programmes would then be established, with a focus on how space can accelerate meeting the challenges of climate and biodiversity loss. These will use the benefits of space capabilities in support of the natural capital strengths of the region, and in the process, maximise learning opportunities to refine the focus of activities, develop new skills, and showcase the sustainable space industry leadership potential of the South of Scotland.

The region would benefit from developing Innovation Hubs, which support the strategic focus areas. Hubs would help drive and support application pilot projects and together these would act as a crucible upon which to forge valuable new knowledge and skills capabilities and capacity in the region.

In conclusion, the South of Scotland region has rich natural capital and a strong leadership focus on delivering climate change targets and achieving biodiversity goals. When combined with space sector expertise, technology, and data, these provide the ingredients for economic success and a sustainable future. Nurturing South of Scotland's space capabilities will act as a beacon of inspiration and economic opportunity to current and future generations.

Whether using space data from satellites, or applying space technology to solve problems on Earth, the South of Scotland can and should lead the way in demonstrating how to create a cleaner, greener and more sustainable planet, whilst building new economic opportunities for all. Space can help realise this goal.





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