SPACE NORTH™

SPACE NORTH EAST ENGLAND | SPACE HUB YORKSHIRE | UKRI Science and Technology Facilities Council Innovation Clusters | North West Space | UK SPACE AGENCY

RESILIENT COMMUNICATIONS

A Gateway to Innovation and Opportunity

RESONANCE

This brochure was created together with Resonance, a global provider of data & market intelligence on emerging technology industries. This has been designed as an extension of ***Resilient Communications: Globally Leading Expertise***, providing you with more information about specific opportunities for investment within Space North's Resilient Communications sector.

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Follow this QR code to learn more about the Resilient Communications ecosystem in Space North.

SPACE NORTH

Space Innovation for Global Challenges

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EXECUTIVE SUMMARY

This report, developed alongside the Resilient Communications: Globally Leading Expertise as part of a new series, highlights the North of England's emergence as a thriving hub for resilient communications, showcasing its potential for continued growth and investment.

Resilient communications are critical across numerous industries, ensuring seamless connectivity and reliable data exchange in situations where failure is not an option. From life-saving operations during emergencies, where secure and uninterrupted communication can mean the difference between life and death, to ensuring robust connectivity in critical infrastructure such as energy grids, transportation networks, and healthcare systems, resilient communication systems play a pivotal role.

> **With the accelerating advances in satellite communications, increased data throughput requirements, and shifting global political landscapes, the demand for robust, secure, and scalable communication systems has never been greater.**

Strategically positioned at the heart of the UK and boasting a **£490 billion economy** and the **UK's largest R&D hub outside London**, The North of England is home to a diverse array of industries - including aerospace, biomedical, chemical, digital, energy, transportation, and nuclear - and a growing network of public-private partnerships, academic collaborations, and funding opportunities.

> **The North of England has established itself as a resilient communications powerhouse, with nearly 160 companies involved in end-to-end supply chain solutions across the sector - 30% of which are carrying the torch of the region's rich manufacturing heritage - and over 60% of businesses with a global presence.**

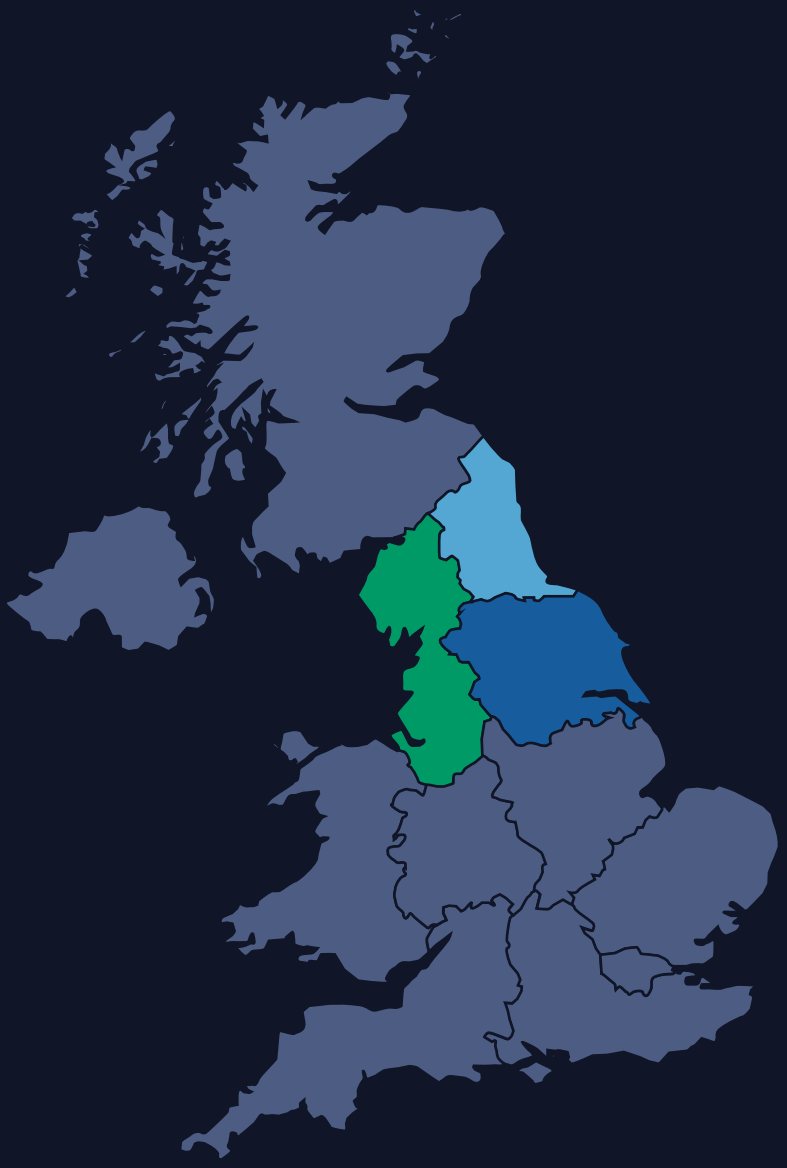
Bolstered by numerous national programs and commitments aimed at fostering innovation across the space domain and national infrastructure, the ecosystem is also home to the UK's largest defence manufacturing ecosystem, the National Cyber Force, and GCHQ operations, as well as the world's first commercial nuclear power station, the UK's first and largest offshore wind farms, and the Lighthouse Green Fuels (LGF) project, the nation's first sustainable aviation fuel terminal.

This environment has fostered success for local innovators such as Agemaspark, Aegiq, BSC Filters (part of MPG), and Filtronic, who continue to leverage the region's resources and opportunities for partnerships and funding to produce significant advances from leading-edge electronics and photonics to novel quantum communication protocols and cybersecurity solutions.

To better unite and accelerate further progress in the region, **Space North** brings together Space Hub Yorkshire, Space North East England, and the North West Space Cluster, representing over **400 space-related organisations and 85 higher education institutions.**

Will you become part of this thriving ecosystem?

SPACE NORTH



SPACE NORTH EAST ENGLAND

2.7M
POPULATION

8,600 km²
AREA

71
SPACE ORGANISATIONS

27
RESILIENT COMMS ORGS

1,300+
PEOPLE EMPLOYED

26
RESILIENT RESEARCH ORGS

SPACE HUB YORKSHIRE

5.5M
POPULATION

15,600 km²
AREA

87
SPACE ORGANISATIONS

54
RESILIENT COMMS ORGS

1,800+
PEOPLE EMPLOYED

27
RESILIENT RESEARCH ORGS

THE NORTH WEST SPACE CLUSTER

7.5M
POPULATION

14,100 km²
AREA

124
SPACE ORGANISATIONS

29
RESILIENT COMMS ORGS

2,800+
PEOPLE EMPLOYED

31
RESILIENT RESEARCH ORGS

WHY RESILIENT COMMUNICATIONS

A PROTECTIVE BACKBONE FOR INDUSTRIAL ADVANCEMENT

Resilient Communications refer to the capacity of a communication system to maintain its functionality, adapt, and recover quickly in the face of disruptions, challenges, or adverse conditions. The goal is to ensure that communication networks and infrastructure can operate effectively, even when faced with unexpected events, such as natural disasters, cyberattacks, equipment failures, or other forms of interference.

The following figures provide a glimpse into the vast market potential within resilient communications, additionally spanning terrestrial and mobile network infrastructure, management, and monitoring, transport and logistics, and much more.

GLOBAL MARKET SIZE

CRITICAL COMMUNICATIONS	17BN IN 2023	7% CAGR →	29BN IN 2031[1]
SATELLITE COMMUNICATIONS	82BN IN 2023	10% CAGR →	162BN IN 2030[2]

[1] *AS ESTIMATED BY DATA BRIDGE MARKET RESEARCH.*
[2] *AS ESTIMATED BY GRAND VIEW RESEARCH.*

DEFINITION OF THE RESILIENT COMMUNICATIONS SECTOR

Primary classification	Manufacturing	Ground	Connectivity	Software	Services
Secondary classification	Laser/optical SATCOM Materials Manufacture (e.g. semiconductors, metal alloys, ceramics) Payload manufacturer (e.g. measurement & comms systems) Satellite integrator Satellite manufacturer Satellite subsystem or component manufacturer (e.g. RF chips / sensors) Testing and development facilities	Ground equipment manufacturer (e.g. antennas, tracking systems, control centres) Ground station / data warehousing (e.g. manage reception, processing, storage, and distribution of data collected from Space) Ground station operations (e.g. mobile vs. static) Space weather monitoring	HAPS / stratospheric Managed services providers QKD providers Vertically integrated satellite connectivity providers - By operating frequency - By type (e.g. satellite / hybrid / terrestrial) - By use-case (e.g. broadband / IoT / military) Virtual network operators	Data analytics software (incl. AI/ML) Network management Other software e.g. satellite control systems, data processing, simulation tools	Engineering IT & Cybersecurity GPS and location services Network integration and monitoring Regulatory Satellite operations Software development Training

Satellite networks today increasingly offer exceptional performance, flexibility, and reach, extending high-capacity and low-latency connections to even the most remote and challenging environments.

As one of the UK's thirteen critical national infrastructures, space technologies help protect critical functions across many sectors including energy, transportation, healthcare, and finance, even during unexpected disruptions - whether accidental or intentional - that could have cascading effects on the economy.

It is estimated that *~16% (£364bn)* of the national GDP is dependent on satellites, with the negative financial impact of a five-day outage amounting to *~£5.2 billion*.

A NEXUS OF TECHNOLOGICAL PROGRESS

Governments and businesses are taking a proactive stance by integrating satellite solutions into their resilience strategies. For instance, the interoperability between satellite networks and existing ground infrastructure continues to improve with standards like the 3GPP Release 17, which enables direct satellite communication with mobile and IoT devices. This approach helps ensure that communications can either be quickly restored or remain uninterrupted in the event of traditional network challenges.

Resilient Communications are a major part of the UK space industry, with income from satellite communications estimated to be at least *£3.9bn in the 2021/22* financial year, representing around 20% of the national space revenue.

The satellite communications (SATCOM) market relies on an extensive ecosystem of technologies that enable and manage the flow of information between Earth and orbit, from manufacturing supply chains and launch providers delivering satellites to their designated specifications and positions, to intricate ground segments collecting, storing, and distributing the relayed information, as well as subsequent processing capabilities.

Over the last decade in particular, this ecosystem has continued to innovate across both upstream and downstream sectors, with key recent and upcoming technological advancements ranging from:

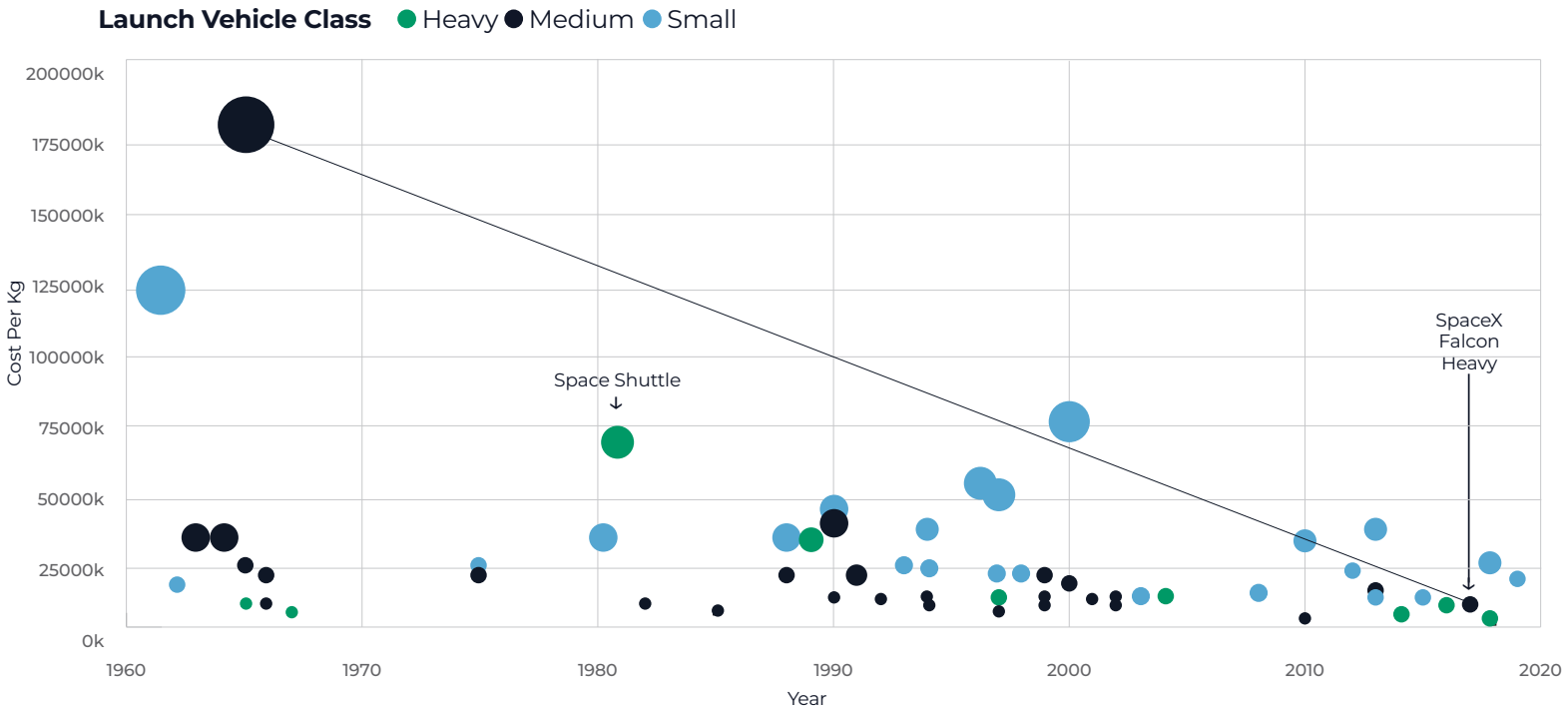
<table>
<tr><th> 
ON GROUND</th><th colspan="2"> 
IN SPACE</th></tr>
<tr><td>Advanced antenna systems, including electronically steered antennas for faster and more precise tracking of satellites and phased array antennas allow for multi-beam capabilities.</td><td>Improved satellite designs, including via miniaturisation, high aspect ratios, and advanced hardware. In particular, SATCOM designers pushing through to higher frequencies in the Ka and V bands to increase capacities with High Throughput Satellite (HTS) and Very High Throughput Satellite (VHTS), with ~75% of the 50+ active satellite operators having invested in HTS systems.</td><td>Optical terminals for space-to-space relay systems and Direct-to-Eart (DTE) transmission are set to exceed current data throughput rates and enable Quantum Key Distribution (QKD), a market estimated to be worth up to $8.9bn by 2031. While in-space laser communications are currently being developed by constellation operators, DTE is expected to be commercially available towards the end of the decade.</td></tr>
<tr><td>Software-defined ground stations that can be reconfigured to support different satellite constellations and communication protocols.</td><td>Software-enabled satellites which can dynamically respond to user demand, allowing in-orbit reconfiguration to adapt to changing needs, eliminating the need for costly replacements.</td><td>Expanding LEO constellations, including Starlink, Kuiper, G60, and GuoWang, will provide redundancy to networks alongside lower latencies and higher signal strengths. Over the next decade, an average of 10 satellites are expected to be launched per day.</td></tr>
<tr><td colspan="3">Artificial Intelligence (AI) and Machine Learning (ML) processing are being used both on ground and onboard satellites to increase data analysis efficiency as well as optimise network operations and predict failures.</td></tr>
<tr><td colspan="3">Roll-out of 5G and future 6G networks, designed to enable seamless handovers between terrestrial and satellite networks across connectivity use cases.</td></tr>
</table>

A RESPONSE TO GLOBAL NEEDS

The technological progress in resilient communications is set to be driven by a combination of factors, including:

- **Rapidly increasing demand for data and connectivity worldwide**, with the ***2023 global satellite capacity supply reaching 27 Tbps, a number expected to reach 260 Tbps before the end of the decade***, driven by factors such as:
  · increasing cloud-computing adoption
  · space-based communications becoming an increasingly integral part of Internet of Things (IoT) applications such as transportation and logistics, smart cities, and personal devices like smartwatches, with a forecasted addressable market of ***10.6 billion IoT devices by 2032***
  · maritime and aviation steadily equipping their fleets with SATCOM and broadband capabilities, with ***90,000 vessels*** and ***72,000*** aircraft expected to have access to satellite connectivity by 2033;

- **Decreasing launch costs** allowing for cheaper satellite launches and reduced service costs. Advancements in launch system technology and the entry of private enterprises into the launch service landscape have dramatically reduced the cost of launching and placing payloads in Low Earth Orbit (LEO). For example – historically, the space shuttle programme cost $65,400 per kg of payload, whereas with SpaceX - the current leading launch service provider and their Falcon Heavy launch vehicle – this has reduced by 97% to $1500.



SOURCE: SPACE INSIDER

- Consolidation and diversification approaches such as **multi-orbit strategies and fleet rationalisation** being employed by satellite operators, such as Avanti, to remain competitive against recently successful mergers and acquisitions like Viasat – Inmarsat and Eutelsat – OneWeb (with ongoing negotiations between others like SES and Intelsat);

- **Increased demand for secure and reliable communications and satellite-based ISR capabilities due to increasing geopolitical tensions**, with military and government sectors increasingly partnering with commercial providers to meet connectivity demands. For example, the UK Space Command has partnered with Surrey Satellite Technology Ltd (SSTL) and successfully launched TYCHE, the MoD's first sovereign Intelligence Surveillance and Reconnaissance (ISR) satellite;

- **Connectivity for all becoming back on the agenda for governments across the world** - especially in developing and remote regions where terrestrial connectivity is not a viable solution - with initiatives like Internet Para Todos in Latin America and BharatNet in India. Similarly, there is increasing adoption of satellite-based internet services like Starlink, including in Malaysia, the Philippines, and Indonesia.

In today's increasingly digital landscape, investing in resilient communications - particularly those enabled by space technologies - is not just a strategic choice but a necessity for governments, businesses, and organisations worldwide.

As Space North, we are committed to remaining at the forefront of the UK's efforts to ensure that our nations' industries, services, and communities remain functional, connected, and secure.

THE UK'S NORTH STAR IN RESILIENT COMMUNICATIONS

SPACE NORTH™

THE NORTH IS HOME TO

1.1M
BUSINESSES

24%
OF THE UK'S POPULATION

£490BN
ECONOMY

7.7M
JOBS

6.5%
POPULATION GROWTH

19.5%
OF THE UK'S TOTAL

Space North represents a groundbreaking partnership between Space Hub Yorkshire, Space North East England, and the North West Space Cluster. Born in 2023 as a visionary collaboration that unites the North of England's complementary capabilities and shared ambition, Space North brings together over **400 space-related organisations**, including private companies, research institutions, and government bodies. Employing nearly 6,000 people, these entities collectively contribute **£660 million in income**, putting on display the region's growing significance in the UK's space economy.

The partnership is working to catalyse further growth by uniting private industry, academia, and government organisations to enhance resilient communication technologies and other space-related advancements that are key strengths within the region.

> *"The UK Space Agency is investing in the UK's network of space clusters to accelerate the development of a thriving, strong, and national space ecosystem that drives sector growth and resilience. Through a series of targeted interventions, leveraging regional, national and international opportunities, and addressing local issues, we are building an environment where the UK space sector is more than the sum of its parts. In doing so, the UK is better placed to realise its ambitions as a world-leading space economy and place to do business internationally."*
>
> UK SPACE AGENCY

This collaboration is critical to the UK's wider space industry, which employs over ***52,000 people across 1,765 organisations, generates £18.9 billion in income, and boasts a £6 billion export market***. With support from the Department for Business and Trade (DBT) and dedicated international export offices in almost every country across the globe, the national space sector has seen an impressive average growth of **21% YOY** since 2012.

The UK is a key player in civil and defence satellite communications, combining a globally trusted reputation with a forward-looking commitment to sustainability, economic stability, and innovation-centric policies. This includes ample support for innovation through R&D tax credits and a Patent Box that lowers tax on income derived from the commercial exploitation of patents developed in the country.

The UK also actively works with Ofcom, the International Telecommunications Union (ITU), and the European Conference of Postal and Telecommunications Administrations to ensure the allocation, regulation and licensing of the frequency spectrum meets the needs of all UK space sectors and technologies.

Space North is at the forefront of the UK's ambitions to advance resilient communications, offering:

1. **A Highly Accessible and Vibrant Research & Development Ecosystem**
2. **World Leading Talent**
3. **Integrated Access to Key Infrastructure and an Outstanding Quality of Life**
4. **Dynamic National and International Partnerships**
5. **Robust Supply Chain Synergies**
6. **Diverse Access to Capital**

Supported by a national drive to address global connectivity challenges, the North of England offers a seamlessly integrated ecosystem for businesses advancing satellite technologies and cutting-edge communication systems with a rich industrial heritage, bolstered by world-class research institutions and academic expertise.

01

A HIGHLY ACCESSIBLE AND VIBRANT RESEARCH AND DEVELOPMENT ECOSYSTEM

Space North benefits from the presence of over 96 research organisations that significantly contribute to the advancement of resilient communications.

These institutions serve as hubs of innovation, providing access to pioneering research, specialised training programs, and a skilled talent pipeline that meets the demands of a rapidly evolving industry. The region is also empowered by several partnerships across the R&D landscape, such as the **N8 Research Partnership** between the region's most research-intensive universities: Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield, and York.[3]

More recently, the **UK Engineering and Physical Sciences Research Council (EPSRC)** has awarded £2.5 million towards the founding of a new group between the universities of Durham, Newcastle, and Northumbria - the **North East Space Communications Accelerator (NESCA)** - aimed at the development of new resilient space communications technologies from proof of concept and feasibility towards the market.

In 2022, the North of England had the *largest higher education R&D expenditure outside of London* - nearly 25% of England's respective spending - counting towards a total of nearly £11.3bn across the North's total R&D outgoings.

The region's R&D ecosystem is also further strengthened by the UK's strong performance in intellectual property in partnership with academia. Notably, 281 UK startups filed a remarkable 853 patent applications related to university-generated inventions between 2015- 2019 - more than any other European country examined in a study performed by ***Mathys & Squire***.

> ***The UK ranks third among countries in Europe for the number of academic patent applications filed, with the North of England leading the UK's overall applications at the European Patent Organisation (EPO) outside of London in 2022.***

Manchester and Leeds ranked as the 2nd and 3rd most innovative cities in the UK in 2022, based on the ratio of new startups and the regional populations across the year.

An extensive overview of the resilient communications R&D landscape within Space North can be found in Volume I of this resource series, **Resilient Communications: Globally Leading Expertise**, with a summary of recent developments and key relevant infrastructure outlined below.

[3] PLEASE REFER TO VOL 1 OF THIS SERIES FOR MORE INFO, PG. 44

The region has long been at the forefront of satellite communications research and international collaboration, with the University of Bradford being one of the three founding members of the European virtual centre of excellence in SATCOMs, **SatNEx**, in 2004. The programme, now in its 5th stage, aims to study the early directions for space and satellite telecommunications systems for any applications identified as not yet mature enough for initiating dedicated industry or ESA R&D activities, based on ESA Member States' priorities.

Another example of Space North's cutting-edge contributions includes **Filtronic**'s ***£3.1 million contract with the ESA's ARTES*** (Advanced Research and Telecommunications Systems) program to develop mm-Wave space 5G/6G technologies for low Earth orbit (LEO) satellite payloads and gateway links from satellite to ground stations. This project aims to keep Europe at the leading edge of the fiercely competitive global satellite communications market by further advancing ubiquitous broadband connectivity capabilities.

> *"We are currently working to develop a self-sustaining 6G ecosystem within the North of England, including the unification of terrestrial and non-terrestrial networks. This will be underpinned by advancements in softwarisation and open networking frameworks like O-RAN, creating unique opportunities across both specialist hardware and software."*
>
> **David Grace**
> Professor (Research), Head of Communication Technologies Research Group
> University of York

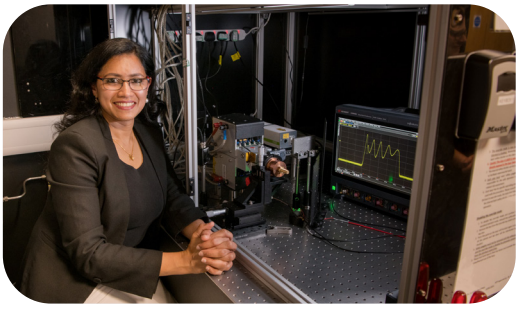
PHOTONICS

The North of England has a long history of innovation in optical technologies, such as the invention of Liquid Crystal technology at the University of Hull. This legacy continues today, with the region leading advancements in photonics for resilient communications.

Building on this heritage, **Northumbria University** has emerged as a leader in space-enabled photonics innovation. In 2023, it secured £5 million from the UK Space Agency to spearhead the UK's first university-led multi-satellite mission. In collaboration with **Lockheed Martin, Durham University, e2E Group (now part of Telespazio), and SMS Electronics**, the project focuses on designing and deploying CubeSats equipped with laser-based optical communications. This system will transform satellite communication by leveraging lasers for secure, high-capacity data transmission - up to 1,000 times faster than traditional radio frequencies. Similarly, at the end of 2024, **aXenic** started working as part of a consortium supported by the Swiss Space Office in partnership with ESA to help develop novel optical space-to-ground link and intersatellite links under the Advanced Innovative Data Access Network (AIDAN) Next project.

Meanwhile, **Durham University** is advancing free-space optical communication through a number of collaborations with companies such as Viasat. By developing a software-controlled telescope and predictive modelling tools, the team is addressing challenges posed by atmospheric turbulence to turn free-space optical technology more commercially viable. This state-of-the-art forecasting tool is set to optimise Viasat's ground station design, as well as support operational decision-making such as network switching between ground stations based on atmospheric conditions.

> *"We're excited to collaborate with Durham University and their leading work on free space optics. We are committed to investing in key research and development for satellite technology, and Durham University was a clear choice, given their leading-edge work on free space optics. The results of their innovative research will be influential in the satellite communications industry, as we collaborate and bring their work from the lab to the marketplace."*
>
> **Dr. Anton Monk**
> Former Vice President & CTO for Wireless Initiatives
> Viasat



ROOM-TEMPERATURE MASER SETUP, EXPLORING MICROWAVE PHOTONICS FOR QUANTUM SENSING AND COMMUNICATIONS (NORTHUMBRIA UNIVERSITY).

LUMINESCENT CONCENTRATORS USED AS EFFICIENT PUMP SYSTEMS FOR LASERS AND MASERS, AND TO ENHANCE LED BRIGHTNESS IN PHOTONIC APPLICATIONS (NORTHUMBRIA UNIVERSITY).

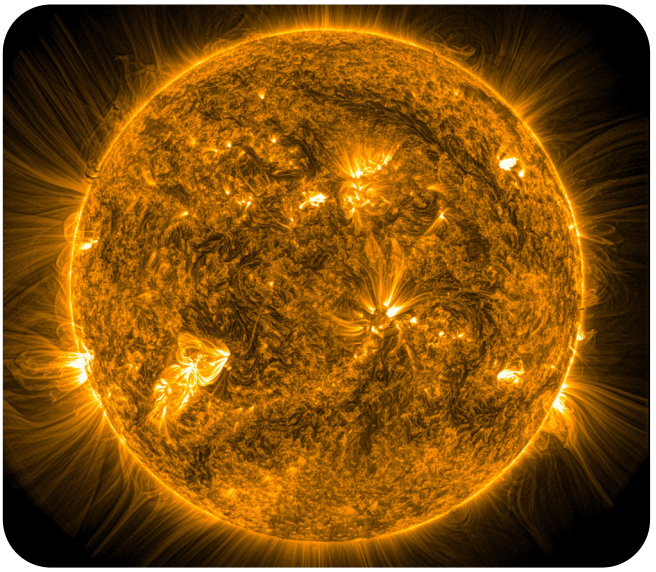
SPACE WEATHER

Space weather, driven by solar activity such as flares and geomagnetic storms, poses significant challenges to communication networks.

These disturbances can disrupt satellite operations, damage electronic infrastructure, and compromise critical services. Understanding and mitigating the effects of space weather are crucial to ensuring the resilience and reliability of modern communication systems.

Researchers at **Northumbria University** recently secured a £1.3 million grant from the STFC to investigate particle movement from solar flares, solar wind dynamics, heating processes in the Sun's outer atmosphere, and the behaviour of Earth's radiation belts to better predict and manage the impact of solar events on communication infrastructure.

Similarly, University of Central Lancashire's **Jeremiah Horrocks Institute for Mathematics, Physics and Astronomy** is the UK's only university to be a part of NASA's sounding rocket program, launching a rocket-borne camera in 2018 that aimed to study the corona of the Sun.



DO/AIA 17.1 NM IMAGE OF THE SOLAR CORONA.

REFERENCE: MORTON, WEBERG & MCLAUGHLIN (2019) NATURE ASTRONOMY, 3, 223

NORTHUMBRIA UNIVERSITY'S SOLAR AND SPACE PHYSICS RESEARCH TEAM, INCLUDING (FROM LEFT TO RIGHT) PROFESSOR JAMES MCLAUGHLIN, PROFESSOR CLARE WATT, DR. NATASHA JEFFREY, AND PROFESSOR JONATHAN RAE

REFERENCE: NORTHUMBRIA UNIVERSITY
HTTPS://WWW.NORTHUMBRIA.AC.UK/ABOUT-US/NEWS-EVENTS/NEWS/STFC-CONSOLIDATED-GRANT/

COMPUTING

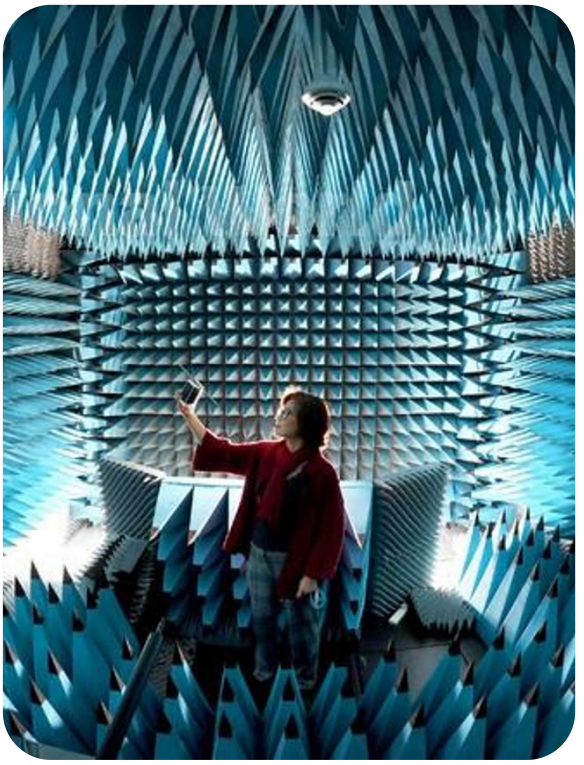
DATA PROCESSING

In the 1940s and 50s, Manchester University paved the way towards the development of modern computing with one of the earliest devices worldwide that could store and execute programs electronically - the Manchester Mark 1. The North of England continues to excel and innovate in data processing, recently having established:

The Bradford-Renduchintala Centre for Space AI in 2022 via a £2 million donation, is designed to continue the region's commitment to cutting-edge research in satellite communications and navigation, earth observation, network security and reliability, distributed systems, signal processing, and wireless communications.

It supports several Innovate UK, ESA, and EU-funded programmes - H2020, Marie Skłodowska-Curie initiatives, and SatNex V - to deliver projects across next-generation aeronautical data links, remote monitoring for e-Health, smart energy applications, border control, and antenna and signal security improvements.

Notably, the Centre also includes a cleanroom for picosatellite platform development and is currently working on SECRET (SEcure Network Coding for Reduced Energy nexT generation Mobile Small cells) to narrow the gap between current networking technologies and the foreseen requirements of future 5G and 5G+ networking.



BRADFORD-RENDUCHINTALA CENTRE: ANECHOIC CHAMBER

Northumbria University NEWCASTLE

NUdata Centre for Doctoral Training, constructed in 2022 and run by Northumbria and Newcastle Universities - following a £1.3 million investment from the Science and Technology Facilities Council (STFC). The hub is training dozens of PhD students in AI and data science, working with over 40 industrial partners including Amazon, BBC, Met Office, National Audit Office, Ordnance Survey, Procter & Gamble, Tesco and the World Food Programme.

DATA PROCESSING

A new **Defence Science and Technology Laboratory (Dstl)** site in Newcastle - set up in 2023 and tasked with carrying out AI and data science-related research to help defence turn data into information advantage and accelerate the responsible and ethical adoption of AI across defence. The new site is actively supporting the UK MoD and wider government whilst working collaboratively with external partners in industry and academia worldwide.

Furthermore, **Hartree National Centre for Digital Innovation**, built in 2012 as part of Sci-Tech Daresbury, helps UK businesses and organisations of any size to upskill their teams and explore and adopt supercomputing, data science, and AI technologies to tackle individual and industry-wide challenges for societal and economic benefit.

Created as a result of a £210 million investment from the UK government and several strategic partners including IBM Research, Atos, and the University of Liverpool, the Hartree Centre continues to be a hub for collaboration across several industries. This includes a recent project with BAE, Advanced Manufacturing Catapult, and IBM to explore the use of 5G manufacturing technologies in developing new digital manufacturing processes such as robotic assembly and VR/AR applications.

QUANTUM COMMUNICATIONS

Recognising the potential of quantum technologies for enhanced signal processing, network security, and optimisation across the field of communications, the North of England is putting great efforts into securing a leading position in related capabilities. This includes several quantum-focused research groups at universities within the region, including Durham, Newcastle, and Northumbria, as well as companies like **Aegiq**. The latter, based in Sheffield. is developing solutions to enable wide-scale adoption of quantum technologies towards the second quantum revolution, having recently partnered with Luxmoore Lab from the University of Exeter on 'Project U-Quant' to improve the space communication capability of true quantum light sources and develop novel materials for single-photon generation.

QUANTUM COMMUNICATIONS HUB

£1BN

the projected total of the UKNQTP investment thus far from government and private stakeholders

OVER £9M

the sum of in-kind industry contributions to Hub projects thus far

£49.5M

the total sum of money awarded to the Quantum Communications Hub consortium since its inception in 2014

OVER £3.5M

the total value of 52 PhD studentships awarded to date by the Hub, through partner university contributions and EPSRC doctoral training partnership grants

£6.7M

the total sum available in the Hub's Partnership Resource Fund to date for investment into projects aligned with the Hub's strategic vision and expanding its capability base

OVER £21M

awarded thus far to industry-led quantum communications commercialisation projects through the Industrial Strategy Challenege Fund (ISCF)

In 2014, the UK National Quantum Technologies Programme (NQTP) - a ten-year £1 billion public and private investment underpinned by the UK government - also funded the creation of the **Quantum Communications Hub** in York.

The Hub brings together ten UK universities alongside several partners (including **BT, ID Quantique, Teledyne e2v, RAL Space, and the National Physical Laboratory**) to develop satellite quantum communication systems; build new quantum sources, detectors, and protocols; advance miniaturisation of quantum key distribution (QKD) technologies onto chips, evolve and commercialise QKD-reliant applications.

CYBERSECURITY

The North is also a hub for cutting-edge R&D activities spanning 5G connectivity, network security, and advanced AI-driven defence systems, driven by several university centres such as the **Cyber Security Research Centre (CSRC)** at Lancaster University and the **Greater Manchester Cyber Foundry**, which have also, in part, attracted over a third of **GCHQ's** workforce to the region to support their activities alongside the **National Cyber Force** in the area.

Simultaneously, research groups such as **York St John University's Cybersecurity Research Group (CRG)** and **Northumbria University's CyberNets** are advancing network and embedded system security, intrusion detection, intelligent penetration testing, and privacy preservation; incorporating AI, machine learning, and optimisation techniques to address modern cybersecurity challenges.

ELECTRONICS & SEMICONDUCTORS

The region boasts a strong compound semiconductor heritage with several major past investors such as Siemens, Atmel, and Fujitsu, alongside over 30 companies working on next-generation electronics as part of the **North East Advanced Material Electronics (NEAME)** alone, a cluster expected to employ a total of nearly 5,250 people by 2030.

Complementing this ecosystem, facilities like the **ElecTech Innovation Cluster (ETIC)** in Morecambe Bay serve as catalysts for growth, providing state-of-the-art infrastructure and expertise to accelerate the development and commercialisation of cutting-edge electronics and semiconductor technologies.

Similarly, the national **Compound Semiconductor Applications (CSA) Catapult** is currently building a new base at NETPark in Sedgefield, already working closely with NEAME in supporting businesses and academia in the North in developing compound semiconductor technologies for telecoms, satellite communications, and defence industries from their other sites. This includes a £2.4m project named ORanGaN, in partnership with Inex Microtechnology and Viper RF, to develop a sovereign UK supply chain, manufacturing processes, and packaging solutions for radio frequency gallium nitride (RF-GaN) devices which are critical to 5G communications systems electronics hardware.

MATERIALS

The **National Epitaxy Facility** at the University of Sheffield directly supports the development of electronics across the UK via the provision of world-class expertise and facilities for III-V materials and devices, IV epitaxy, and hybrid III-V/ Group IV epitaxy. This follows on from the University of Sheffield's already well-established history of support to the semiconductor research community since 1979.

HENRY ROYCE INSTITUTE

Similarly, the **Henry Royce Institute**, located at the University of Manchester, supports world-recognised excellence in UK materials research for accelerating commercial exploitation of innovations across numerous industries by offering industry and academia the capability to make, test and characterise materials, components and systems. For example, researchers at the **University of Leeds' Bragg Centre** are currently benefiting from Royce's pioneering film deposition equipment to produce more efficient memory devices using superconductors, as well new technologies for applications ranging from photonics, imaging, and sensors, through to energy storage, biomedical materials, and quantum technologies.

The Institute provides access to over £200 million of facilities and nine collaborators - the universities of Cambridge, Imperial College London, Liverpool, Leeds, Oxford, Sheffield, the National Nuclear Laboratory (NNL), and the UK Atomic Energy Authority (UKAEA) - alongside several national partners.

MATERIALS

The **PuMA2 laboratory** - located at Sellafield in Cumbria and operated by the **NNL** - is poised to become the UK's national facility for extracting nuclear materials intended for use in Radioisotope Power Systems (RPS) in deep space applications.

Commissioned and funded by the UK Space Agency with an investment of £19 million and access to the ***world's largest supply of Americium-241***, this facility will enable the development of ***the world's first space battery powered by Americium-241***. This is expected to be deployed on ESA's Argonaut mission to the Moon in the early 2030s, as well as in future deep space missions, with the facility aiming to dedicate around 50% of its capacity to additional R&D projects and skills development.

This initiative follows the UK's record investment in ESA programs including £22 million allocated to ENDURE (European Devices Using Radioisotope Energy), aiming to further solidify the UK's leadership in sustainable space power solutions.

The thriving R&D ecosystem in the North of England is integral to the growth of resilient communications and space technologies, providing a fertile environment for innovation, collaboration, and commercialisation. Continued investment in cutting-edge research areas mentioned above and beyond will be crucial to maintaining the region's leadership in these high-growth sectors.

This robust ecosystem not only fosters groundbreaking advancements but also ensures the development of a skilled workforce to support long-term industry needs. To complement this thriving R&D landscape, the sections below explore how companies are accessing the capital needed to drive their ambitions forward - including via skills, supply chain, funding, infrastructure, and partnerships - unlocking even greater potential for growth and innovation.

02

WORLD LEADING TALENT

> *"We initially came because of the printable electronics centre but access to a highly skilled semiconductor workforce in the North East has been a key factor in us staying and growing here [... as well as the value for money office space and the access to funding...]."*
>
> **Ken Williamson**
> COO, PragmatIC

The North of England is a powerhouse for cultivating world-class talent. Building on the region's strong foundation in R&D, its universities, training programs, and collaborative initiatives produce highly skilled professionals who drive advancements across the space and resilient communications sectors.

For example, Durham University has recently announced that it has partnered with ESA and the Satellite Application Catapult to create a **£5m Space Research Centre** to provide world-leading research and training to address the technical and digital skills needs of the sector.

Meanwhile, **Hartree National Centre for Digital Innovation** has already upskilled ***2,033 individuals from 446 organisations*** so far through free courses on how to take advantage of digital technologies like supercomputing, data science, AI, and quantum computing.

Similarly, the **Yorkshire Cyber Security Cluster** is collaborating closely with the **UK Cyber Cluster Collaboration (UKC3)** skills working group to nurture expertise in the cyber security sector, while conducting national research and surveys to better understand and address the industry's evolving needs.

There are also ongoing activities to establish further innovation and skills development centres in the region, such as **NESST (North East Space Skills and Technology Centre)** being developed by **Northumbria University** in partnership with **Lockheed Martin**, further outlined in more detail later in this brochure.

> *"We've been delighted to welcome Lockheed Martin Space to the North East and to collaborate with them on the development of the North East Space Skills and Technology Centre (NESST). This partnership highlights not only the strengths of Northumbria University but also the region's exceptional capabilities in space and satellite technologies, high-value manufacturing, optical communications, cyber security, and beyond. We look forward to working together to grow the regional space economy and deliver the workforce of the future."*
>
> **Professor John Woodward**
> Pro Vice-Chancellor
> Northumbria University

40,000+[4]
EMPLOYEES
IN COMPANIES WORKING IN THE RESILIENT COMMS SECTOR

THE NORTH OF ENGLAND ANNUALLY PRODUCES

220,000+
GRADUATES

25,000+[5]
RESEARCH PUBLICATIONS &
130+ PATENTS[6]

85+
HIGHER EDUCATION INSTITUTIONS
25% of which have ongoing research, dedicated facilities, and courses directly relevant to resilient comms, with most other offering courses for adjacent supportive skills like manufacturing and software development.

88,000+
STUDENTS YEARLY ENROLLED
across engineering, technology, computing, and physical and mathematical sciences at the region's universities.

The North of England has an extensive legacy in manufacturing innovation, with Sheffield-born Harry Brearley revolutionising the steel industry in 1913 when he added chromium to molten iron to create stainless steel, and the invention of graphene by Andre Geim and Kostya Novoselov at the University of Manchester in 2004, for which they won a Nobel prize.

> ***Today, manufacturing remains a cornerstone of the North's economy - with notable expertise in aerospace, automotive, and chemicals - employing over 725,000 people and contributing towards more than 20% of the UK's manufacturing output. The North West, in particular, stands out as the country's largest manufacturing region, generating £29.5 billion annually.***

Beyond traditional manufacturing, the North has a strong presence in adjacent sectors like life sciences, med-tech, and digital health. Yorkshire and the Humber and the North West are nationally recognised hubs for these industries, offering expertise in data dissemination, processing, and analytics, communication provision, and other digital health sub-sectors that have a high demand for space and resilient communication technologies.

Furthermore, the region fosters a dynamic business environment, supported by a network of ***15 business schools*** accredited with the prestigious Small Business Charter. These institutions act as hubs of knowledge and best practices, equipping entrepreneurs with the tools and insights needed to thrive in competitive markets.

Northumbria University's Newcastle Business School further exemplifies this commitment to enterprise, winning the Outstanding Commitment to Encouraging Student Enterprise and Entrepreneurship award in 2024.

NEARLY
875
SPIN-OFFS, STARTUPS, AND SOCIAL ENTERPRISES IN THE ACADEMIC YEAR 2022/23 FROM UNIVERSITIES ACROSS THE NORTH OF ENGLAND.

[4] ESTIMATED BASED ON PUBLICLY AVAILABLE DATA ON COMPANIES IDENTIFIED TO BE PART OF THE RESILIENT COMMUNICATIONS SECTOR AND THEIR FOOTPRINT IN THE REGION.
[5] NUMBER OF RESEARCH PUBLICATIONS OVER THE LAST FIVE YEARS - OBTAINED BY QUERYING NORTHERN ENGLAND UNIVERSITY NAMES, AND GREAT BRITAIN FILTER CONSIDERING JOURNALS, BOOKS, AND REPORTS ON THE LENS.
[6] AVERAGE NUMBER OF PATENTS OVER THE LAST FIVE YEARS - OBTAINED BY QUERYING NORTHERN ENGLAND UNIVERSITY NAMES, AND GREAT BRITAIN AS FILTER FOR INVENTOR AND OWNER COUNTRY ON EUROPEAN PATENT OFFICE.

03

INTEGRATED ACCESS TO KEY INFRASTRUCTURE AND AN OUTSTANDING QUALITY OF LIFE

> *"The North offers a vast opportunity landscape, combining its strategic central location, a rich legacy of manufacturing excellence, continuous scientific innovation emanating from the region's world-class universities, and thriving national and international collaborations."*
>
> **Duncan Johnson**
> CEO, Northern Gritstone

Standing as the beating heart of the UK industrial revolution for its dominance in textiles, mining, manufacturing, and global transportation networks, the North of England continues to stand at the forefront of transformative industries.

This Space North alliance harnesses each region's strengths to form a cohesive network that supports end-to-end solutions for resilient communication systems and beyond, leveraging Yorkshire and the Humber's excellence in materials manufacturing and ground equipment production, the North East's leadership in satellite component and subsystem manufacturing, and the North West's advanced IT and cybersecurity capabilities.

The result: a seamless ecosystem of innovation and expertise across upstream, downstream, and midstream space verticals, as well as in communications and digital technologies.

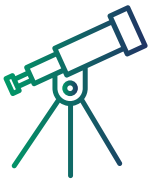
With significant investments in state-of-the-art facilities, the region offers a thriving ecosystem where research, innovation, and industry converge to develop world-leading technologies. From pioneering science parks to specialised research centres, this infrastructure underpins the North's growing reputation as a powerhouse for the space and communications sectors.

At the heart of this effort lies **NETPark** - opened in 2004 by then Prime Minister Tony Blair - serves as a focal hub for the commercialisation of cutting-edge R&D for international organisations, universities, and entrepreneurial ventures in key areas like fintech, data science, low-carbon energy, and healthcare. Currently housing over 32 innovative companies and providing more than 550 highly skilled jobs, the nationally leading science park is set to be imminently expanded with an additional 285,650 square feet of laboratory, office, production, and storage space via £100 million in funding approved by Durham County Council.

> *"Filtronic chose NETPark for a number of reasons including the modern infrastructure and facilities, the established, innovative and like-minded businesses located there and finally the flexibility it offers to enable us to scale our business."*
>
> **Michael Tyerman**
> CFO, Filtronic

Space North East England supports the regions' space ecosystem from NETPark. Originally set up as the North East Satellite Applications Centre of Excellence by the Satellite Applications Catapult and funded by the UK Space Agency, they foster national collaboration and provide direct assistance to organisations to help harness satellite technologies and gain a competitive advantage in the global market. To date, it has facilitated the entry and expansion of over 350 businesses into the space sector, with 84% originating from other industries, and has delivered an impressive return on investment, with every £1 of funding generating £18 in business value for the North East alone.

> *"Since establishing a Centre of Excellence in the North in 2014, we have witnessed the region's remarkable growth, evolving into dynamic and innovative clusters specialising in RF, optics, and antennas - all rooted in its rich heritage of electronics and industrial development."*
>
> **Matthew Child**
> Chief Architect of Future Satellite Systems
> Satellite Applications Catapult



The Centre for Advanced Instrumentation (CfAI), also based at NETPark, collaborates with international observatories to design and commission high-tech instruments for optical and infrared astronomy, driving advancements in imaging and analysis critical to space exploration and satellite technology. Commissioned by Durham University as part of the first building opened at NETPark, CfAI has helped the university achieve the rank of top university in Europe and 4th globally for the impact of its space science research.

Complementing these efforts is the **Centre for Process Innovation (CPI)**, part of the **High Value Manufacturing Catapult**. The CPI provides businesses with access to technology innovation expertise, enabling them to translate early-stage research into commercial applications across agri-food-tech, energy, health-tech, materials, and pharma.

Located in Yorkshire, the AMP anchored by the world-renowned **University of Sheffield Advanced Manufacturing Research Centre (AMRC)** and is is home to some of the world's biggest employers and renowned institutions including Rolls-Royce, Boeing, McLaren Automotive, UK Atomic Energy Authority, Insight and Danieli, advancing technologies across aerospace, automotive, nuclear, and renewable energy.

The region is also home to pioneering manufacturing and innovation facilities like the **3M Buckley Innovation Centre (3M BIC)**, which supports additive manufacturing, design, and prototyping. The Centre drives advancements in materials science and product development, equipped with cutting-edge tools such as virtual and augmented reality, photogrammetry, and advanced prototyping technologies including Selective Laser Sintering (SLS), Stereo Litography Apparatus (SLA), Filament Deposition Method (FDM), and Direct Metal Powder Bed Fusion (DMPF).

These efforts are complemented by sites like the **Liverpool City Region (LCR), Humber, and Teesside Freeports**, which are driving economic growth in the North by fostering public-private partnerships and enabling key investments across adjacent sectors. This also includes **Manchester's Atom Valley**, which aims to create 20,000 jobs in advanced manufacturing and machining while building 7,000 zero-carbon homes, as well as host a new Sustainable Materials and Manufacturing Centre that supports the existing Centre of Expertise in Advanced Materials and Sustainability.

CASE STUDY

Lockheed Martin recognised the potential of the North of England by investing in a new **North East Space Skills and Technology Centre (NESST)**, jointly putting forward a total of £50 million together with the UK Space Agency and Northumbria University towards the new Centre.

Expected to open in 2026, NESST will offer world-class laboratories, testing facilities, teaching spaces, and collaborative environments. It aims to create over 350 jobs and inject £260 million into the local economy over the next 30 years, aligning with the government's levelling-up agenda.

LOCKHEED MARTIN UK SPACE AGENCY Funded by UK Government

NESST's facilities will also help companies across adjacent markets take their technologies into space while acting as a catalyst for the broader UK space industry. Lockheed Martin's previous collaborations with Northumbria University—such as the development of machine learning algorithms to detect nanojets and projects in space-based solar power—underscore the potential impact of this new centre.

Lockheed Martin has also previously invested £630,000 into collaborations with Northumbria University on a number of trailblazing projects, including working together to create machine learning algorithms to detect and record nanojets, as well as joining forces to accelerate the use of space-based solar power.

> *"Our decision to invest in the North of England was strongly supported by HMG's regional growth agenda and the incentives and guidance provided by local regional entities. The region's robust training infrastructure, highly skilled advanced manufacturing workforce, and world-class academic institutions present immense growth potential. The strong tradition of collaboration between industry and academia also aligns perfectly with our proven success model for innovation and our ambitions for NESST and future endeavours in the region."*
>
> **Benjamin Shaw**
> Head of Operations & Capture
> Lockheed Martin

Home to the largest defence manufacturing ecosystem in the UK, the North of England is also home to the National Cyber Force, a significant GCHQ presence, and the nation's most powerful industry-accessible supercomputer, located at the Hartree Centre.

The region additionally hosts an extensive array of communications infrastructure with great potential for testing defensive and ground-to-space technologies. This includes facilities like **RAF Spadeadam**, historically used for testing Britain's Blue Streak missile and Europa launch vehicles, now hosting Europe's only **Electronic Warfare Tactics Range** where aircrews can practise manoeuvres and tactics for contemporary combat. Similarly, **RAF Menwith Hill** is home to the world's largest electronic monitoring station, acting as communications and intelligence support service to the UK and USA as well as a missile warning site and extensive satellite ground station.

Furthermore, sites like **RAF Spadeadam** and the **Kielder Dark Skies Observatory** provide infrastructure ideal for advancing ground-to-space communications technologies, while the **Centre for Polar Observation and Modelling (CPOM)** provides UK national capability in satellite observations and numerical modelling of Earth's polar regions.

The North's strategic position also offers proximity to the UK's rapidly developing spaceports, both in the Highlands and Islands and in the South in Cornwall, facilitating accessibility to launch activities and further cementing its role as a critical hub for space-related innovation and operations.

The North of England combines cutting-edge facilities with affordability and connectivity to create an ideal environment for businesses and professionals in the space and communications sectors.

On average, house prices in the North East are 73% less than in London, whilst ***79% of indoor premises across the North have 4G coverage***.

Office spaces are also ample at a fraction of the cost compared to other parts of the UK. For example, Space Enterprise Labs, provide state-of-the-art offices and resources in strategic locations such as Daresbury, Leeds, Leicester, and NETPark, acting as hubs for innovation and collaboration. For example, the ***North East offers***:

GRADE A OFFICE SPACES COST

75% AND

40% LESS THAN PRICES IN

LONDON & SCOTLAND

2ND LOWEST COSTS

FOR HIRING SPACE-RELATED EMPLOYEES IN THE UK

30% LOWER

OPERATING COSTS THAN LONDON

The region's cities are also thriving and evolving to meet the demands of the 21st century. Manchester, for instance, has been recognised as the fastest-growing city in Europe economically, drawing investment and talent from across the globe, with over 80 of the FTSE 100 firms having offices in the city.

Furthermore, the North of England is celebrated for its outstanding natural beauty, offering a picturesque and serene environment that enhances the quality of life for residents. From the dramatic landscapes of its five national parks - including Lake District National Park, a UNESCO World Heritage Site - to the sprawling wilderness of the Pennines, the region provides idyllic settings for hiking, cycling, and exploring quaint villages steeped in history.

Coastal gems like Whitby and the award-winning Northumberland Coast offer stunning Blue Flag beaches and historic landmarks, while the Kielder Water and Forest Park combine tranquillity with opportunities for stargazing under one of Europe's largest Dark Sky reserves.

Coupled with vibrant cultural scenes in cities like Manchester, Newcastle, and Leeds, the North is a highly desirable place to live, blending accessible modern amenities with the serenity of its natural surroundings and rich history.

YORK

HADRIAN'S WALL

MANCHESTER

BRIDGING NATIONAL AND INTERNATIONAL INNOVATION

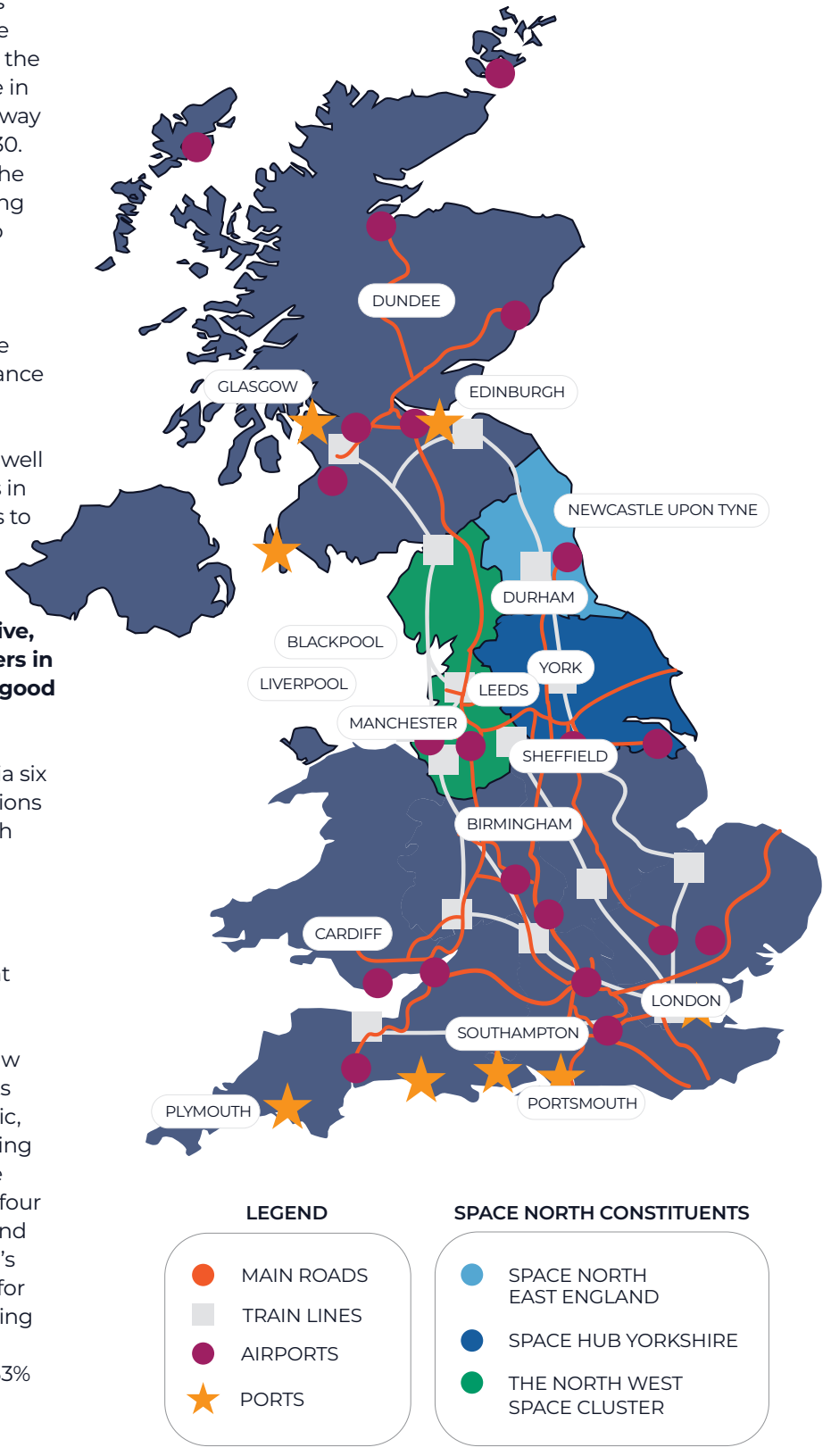
The North of England's legacy also boasts the birthplace of modern railway, with the creation of the first railroad locomotive in the world to carry passengers on a public line in 1824 and the world's first inter-city rail railway between Liverpool and Manchester in 1830. This pioneering spirit of connection laid the foundation for the region's role in powering the industrial revolution and continues to shape its infrastructure today.

Building on this foundation, Northern Powerhouse Rail (NPR) is a transformative strategic programme established to enhance connectivity between the North's major cities, accelerating economic growth and fostering collaboration. The region is also well connected to other major industrial hubs in the UK, with journeys as short as 1.5 hours to Edinburgh and 2-3 hours to London.

The North has access to 75% of UK manufacturing sites within a 4-hour drive, as well as a total of 320 million customers in mainland Europe within 24 hours via a good network of road and rail connectivity.

Internationally, the region is connected via six airports to over 210 international destinations from Airport City Manchester alone, which is currently undergoing an £800 million expansion and improvement.

The North also boasts several world-class ports, including in Liverpool (with a recent £300 million SuperPort investment), Sunderland, Hull, Tyne, Tees, Blyth, and Immingham. Specialising in importing raw materials and exporting finished products across both the North Sea and the Atlantic, they effectively support the region's thriving manufacturing sector and provide ample opportunities for global distribution. The four major ports of Hull, Goole, Immingham and Grimsby handle around 17% of the nation's trade alone and play a vital strategic role for the UK as a global trade gateway, managing materials that supply 10% of the nation's energy, 25% of the UK's fuel, and almost 33% of national timber supply.



04

DYNAMIC NATIONAL AND INTERNATIONAL PARTNERSHIPS

The North continuously cultivates robust connections across the UK, creating pathways for innovation, investment, and technological collaboration that underpin a dynamic and thriving ecosystem.

Nationally, the region is actively engaged in the **Power4Space** initiative, funded by the UK Space Agency. In partnership with the Midlands space cluster, this initiative aims to connect supply chains across the regions to seize commercial opportunities in novel power systems designed for deep space missions.
The North West and North East space clusters also play a vital role in a consortium led by Harwell Space Cluster, hosting the Satellite Applications Catapult's pilot **Connected Capabilities Network: the Autonomous and Connected Earth Network (UK-ACE)**. This initiative aims to expand the reach and impact of satellite data and space technologies across the UK, with a particular focus on autonomy and connectivity applications.

> *"Space North has been instrumental in fostering meaningful collaborations with industry, all the way from emerging players to primes, as well as serving as a vital bridge to the excellent universities we have on our doorstep and the wider public sector, enabling us to expand our networks and leverage new opportunities effectively."*
>
> **Tudor Williams**
> CTO, Filtronic

The North is also home to the UK's first Maritime Innovation Hub, located at the Port of Tyne. This hub unites major industry players, including Drax, Nissan, and Royal Haskoning DHV. The **2050 Maritime Innovation Hub** serves as a vibrant platform for collaboration, advancing innovation across the maritime and broader logistics sectors, welcoming hundreds of businesses and academics from diverse industries - including space, defence, renewable energy, rail, the RAF, data science, and artificial intelligence - to share ideas, concepts, and strategies. It also operates as a clean energy testbed, recently having focused on the rapidly expanding offshore wind sector in the North Sea, further solidifying the region's leadership in renewable energy and maritime innovation.

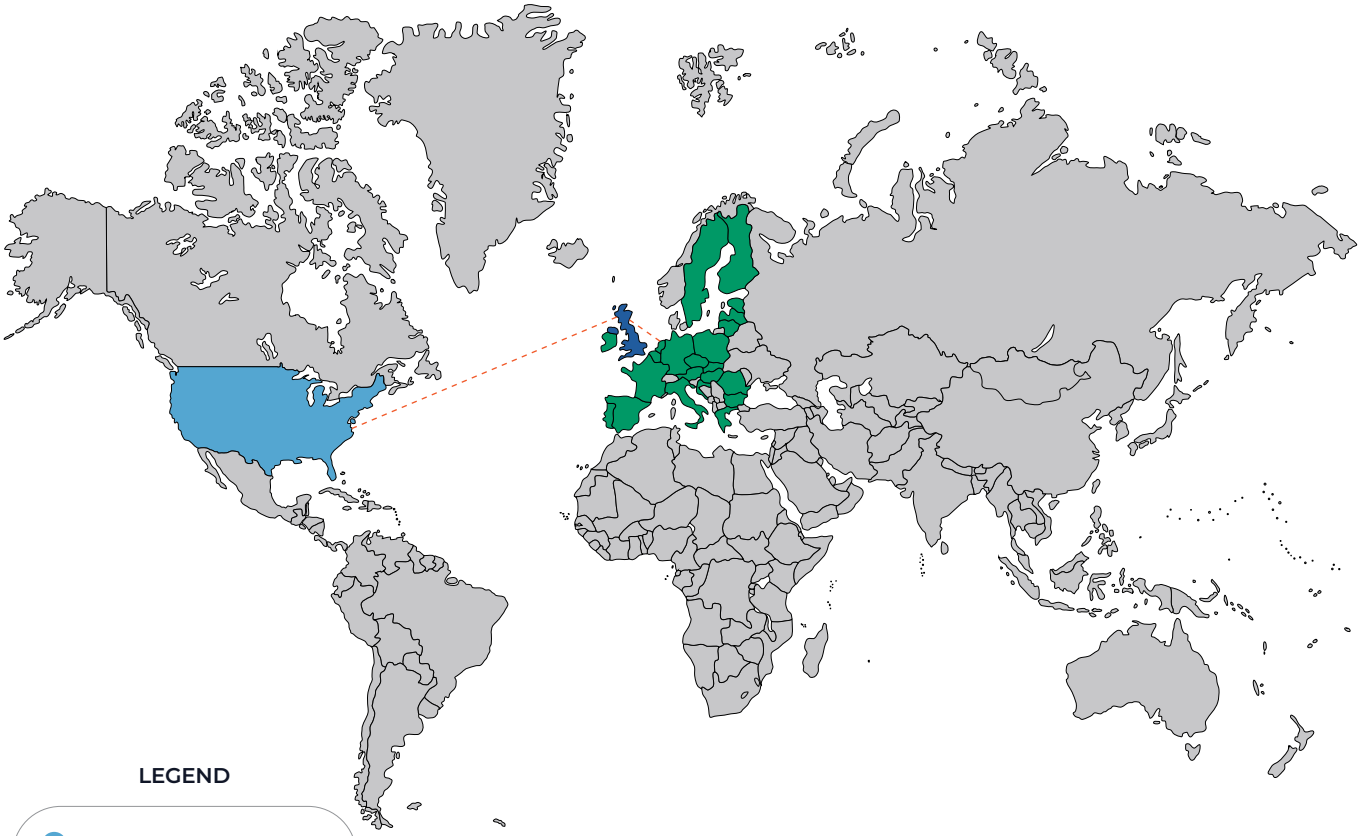
The North of England plays a vital role in the UK's national and international ambitions across all eight growth-driving sectors identified in the **Invest 2035: the UK's modern industrial strategy,** respectively advanced manufacturing, clean energy industries, creative industries, defence, digital and technologies, financial services, life sciences, professional and business services.

In particular, resilient communications developments in the region are closely tied in with critical sectors like cybersecurity and quantum technologies. The region aligns closely with the UK government's strategic goals, as outlined in the 2022 Cyber Security Strategy, and houses some of the country's most significant digital defence assets. These include **GCHQ Scarborough**, the world's longest continuously operating signals intelligence site, and the newly established **Dstl Newcastle** facility, which opened in 2023 to advance digital defence innovation. On the quantum front, universities such as Durham, Newcastle, Northumbria, and York are pivotal contributors to the National Quantum Strategy, reinforcing the UK's leadership in global quantum developments.

DYNAMIC NATIONAL AND INTERNATIONAL PARTNERSHIPS

Internationally, the North's space and resilient communications sectors have cultivated strong global connections. The region's outward-looking ethos is firstly highlighted by the presence of major international businesses, with 60% of the local companies being part of global organisations. Industry giants such as **BAE Systems**, **Honeywell**, **Jacobs**, **Lockheed Martin**, **Northrop Grumman**, **Raytheon UK**, and **Teledyne** operate in the North, contributing to its global connectivity and reputation as a hub of innovation.

The region has led several trade missions with countries such as Canada, the Netherlands, Australia, and South Korea, as well as fostered regional partnerships with regions like Queensland and Flanders. This has led to a major drive in export opportunities, inward investment, and collaborations between universities and international space organisations, including via projects with **NASA**, **ESA**, **UNESCO**, **Intel**, **IBM**, **TSMC**, among others.



LEGEND

- UNITED STATES OF AMERICA
- UNITED KINGDOM
- EUROPEAN UNION

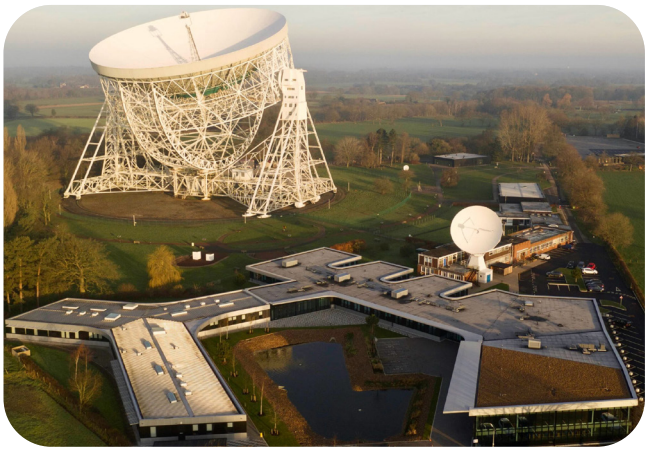
TOTAL EXPORTS TO THE EU:
£356 BILLION (42% OF GLOBAL TOTAL)

TOTAL EXPORTS TO THE US:
£186.7 BILLION (22% OF GLOBAL TOTAL)

UK INTERNATIONAL EXPORT DATA OF GOODS AND SERVICES WITH MAJOR TRADE PARTNERS EU AND USA, ACCOUNTING FOR ALMOST 65% OF TOTAL EXPORTS AND DEMONSTRATING EXTENT OF INTERNATIONAL PARTNERSHIPS.

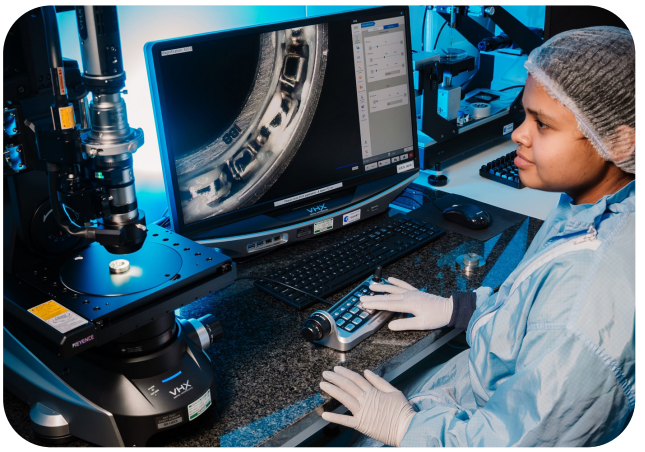
CASE STUDIES

The SKAO (Square Kilometre Array Observatory), headquartered in the North West of England, oversees the world's largest radio telescope project, exemplifying the region's global leadership in cutting-edge science and technology. This ambitious project brings together expertise from more than 16 countries to build and operate two telescopes located in radio-quiet zones in South Africa and Australia. The telescopes will enable unprecedented insights into the cosmos, from mapping dark energy to investigating the origins of life.



Established in 1972 and based in Warrington, the **European Space Tribology Laboratory (ESTL)** specialises in tribology - the study of friction, wear, and lubrication - under the extreme conditions of space. ESTL has directly contributed towards several high-profile missions across various domains, including the Ariane 5 and Vega launch vehicles; the Beagle II, Rosetta, and BepiColombo missions; and the Hubble and James Webb Space Telescopes.

Whilst also directly supporting EO and telecom satellite R&D, ESTL has successfully applied its expertise to terrestrial industries such as automotive engineering, renewable energy, and advanced manufacturing.



Europe is a critical export market for the UK space sector, accounting for *42% of total exports and 13% of total income*.

Furthermore, the UK is a founding member of ESA and continues to play a leading role in its programmes, investing in several initiatives that enhance communications, navigation, and space safety. For instance, The UK has committed £206 million to telecommunications programmes under ESA, focusing on enabling faster 5G and developing 6G networks, advancing optical and quantum communication systems, and supporting LEO satellite constellations. Additionally, £111 million from the UK has been allocated to improve space safety and security, addressing challenges like space weather and debris management while catalysing growth in innovative areas such as in-orbit servicing and satellite manufacturing.

The UK is also a prominent participant in the ARTES programme, committing £206 million to strengthen satellite communications research and innovation. As part of this, Harwell's European Centre for Space Applications and Telecommunications (ECSAT) drives opportunities in integrating satellite and terrestrial networks with its dedicated 5G/6G Hub.

The UK's continued involvement in Copernicus and related European meteorological organisations like the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), and Mercator Ocean additionally ensures access to critical satellite data for monitoring land, marine, atmospheric, and climate change services.

05

ROBUST SUPPLY CHAIN SYNERGIES

> *"The Northern RF cluster is on a rising tide of growth, enabled by the exchange of knowledge, collaborative projects and a strong, agile supply chain of resources. This all attracts bright, innovative talent to regional universities and businesses, establishing a pool of problem solvers ready to evolve resilient communication systems."*
>
> **Sarah Gregory**
> Commercial Director, Slipstream Engineering Design

The North of England has established itself as a powerhouse for resilient communications, hosting nearly **160 companies** spanning the entire end-to-end supply chain spectrum, from raw material production to systems integration, testing, and deployment of complete communication solutions, as well as extensive digital capabilities and supporting services.

Manufacturing lies at the heart of the North's resilient communications supply chain, accounting for over **30% of the local sector**. This includes extensive expertise in producing high-performance materials and structural components, ceramics for optical applications, semiconductors, and antenna systems.[7]

In addition, the North is home to critical ground telecommunications infrastructure that supports both regional and national connectivity. This includes extensive fibre-optic networks, data centres, and wireless communication hubs that enable secure, high-speed data transfer and form the backbone of modern communication systems. In particular, key facilities such as the **Smart City Innovation Testbed** in Leeds, and advanced 5G testbeds across Manchester and Liverpool underscore the region's position as a hub for telecom innovation. Similarly, the **Maritime 2050 Innovation Hub** at the Port of Tyne also offers a 5G testbed for cleantech and port efficiency solutions.

The region also boasts specialised hubs like the **AMRC North West** in Preston, which is developing 5G-enabled manufacturing solutions, and **York's National Railway Museum**, which houses the UK's only dedicated railway communications testing facility. These assets support the research, development, and application of cutting-edge telecom technologies for use across industries and public sectors.

Beyond resilient communications, the North excels in a range of complementary sectors, including advanced manufacturing, digital technologies, renewables, nuclear, life sciences and health, and logistics and distribution.

[7] *PLEASE REFER TO VOL 2 OF THIS SERIES FOR MORE INFO, PG. 28-36*

AEROSPACE & DEFENCE

The North West is home to one of the largest aerospace clusters in Europe, hosting companies like BAE Systems, Rolls-Royce, and Safran Aircelle, which are driving advancements across lightweight materials, green aviation fuels, next-generation fighter jets, drones, and innovative production methods.

In particular, Rolls Royce and BAE Systems have been in close cooperation with Japan's Mitsubishi Heavy Industries and Italy's Leonardo S.p.A. to produce the first prototype of the BAE Tempest, with its first prototype currently being assembled at BAE Systems' site in Warton, Lancashire, where the European Eurofighter Typhoon is also manufactured.

Developed as part of the GCAP (Global Combat Air Program), the aircraft is expected to make its first flight in 2027 and eventually replace Typhoon fighters in the Royal Air Force and Italy, as well as F-2 fighters in the Japanese Air Self-Defense Forces.

RENDERING OF A 6TH-GENERATION FIGHTER JET, THE BAE TEMPEST. PHOTO BY BAE SYSTEMS

ENERGY & FUELS

The North of England stands as a powerhouse of energy innovation, boasting a rich legacy and cutting-edge expertise across renewable, nuclear, and low-carbon technologies.

Its infrastructure not only underpins the UK's transition to cleaner energy but also creates opportunities for synergy with the space sector, particularly in renewable energy advancements.

In particular, the **Renewable Energy Northeast Universities (ReNU) formed in 2019** and the **Renewable Energy Northeast Universities Plus (ReNU+)** - due to open in 2025 - are providing doctoral training in energy systems and materials that can provide an equitable energy transition towards Net Zero.

The **Offshore Renewable Energy Catapult** based in Blyth, Northumberland, is serving as a world-leading R&D centre for offshore wind, tidal, and wave energy. The region is also home to the world's first commercial nuclear power station, as well as both the UK's first and largest offshore wind farms, with investors like **Siemens** currently developing new advancements for this sector, as well as for the hydrogen economy. Similarly, **Northumbria University** has been working with **Lockheed Martin** on **'Project Silverlight'** to explore the delivery of space-based solar power by developing specialised photovoltaic cells.

The UK's first sustainable aviation fuel (SAF) handling terminal, the **Lighthouse Green Fuels (LGF) project**, has also been recently announced to be constructed on North Tees and is expected to convert approximately 1 million tonnes of non-recyclable waste into SAF. Similarly, the **Fulcrum NorthPoint** facility is expected to be soon located at the Essar Stanlow Manufacturing Complex in Ellesmere Port, Cheshire, and convert around 600,000 tonnes of non-recyclable household waste into 100 million litres of SAF annually for **Jet2** aircraft usage.

The North is also working to contribute to the UK's target of delivering 10GW of low-carbon hydrogen by 2030 with several sites including **HyNet North West**, **Life Wallsend**, **Gowy Green Hydrogen, Tees Green Hydrogen**, and **H2H Saltend**.

TRANSPORTATION

Since opening its first manufacturing plant in Sunderland in 1986, **Nissan** has also been a major investor in the North, currently constructing two new battery gigafactories within the region's International Advanced Manufacturing Strategic Site (IAMSS) to support its vehicle electrification journey. Similarly, **Hitachi Rail** in County Durham has recently secured a £2 billion contract to manufacture electric trains for High Speed 2 (HS2), further contributing towards the region and the UK's greener transportation and logistics goals.

DIGITAL TECHNOLOGIES

The North is also a hub for the digital economy, with thriving sectors in fintech, gaming, and immersive technologies, represented by companies like **Atom Bank**, **Nivo**, **Rockstar Leeds**, **Sage**, **Sumo Digital**, **Team 17**, **Tombola**, **Virti**, and **ZeroLight**. These are well supported by initiatives like the **Digital Catapult North East Tees Valley**, which is working to empower the ethical adoption of advanced digital technologies across the region, offering technological matchmaking, research consultancy, and horizon scanning, as well as facilities including 5G testbeds and immersive labs.

SUPPORTING INDUSTRIES

The **Liverpool City Region (LCR)** - recognised as a "Rising Star" by Financial Times' fDi Intelligence in its Global Free Zones of the Year awards - has established itself as a hub of excellence in advanced manufacturing, health and life sciences, biomanufacturing, and digital and creative sectors, whilst **Teeside Freeport** and **Humber Freeport** are focusing on offshore projects, renewable energy, and hydrogen production.

The North of England is also uniquely positioned to offer ample downstream opportunities for companies seeking to leverage space data and technologies for practical applications across other industries as well. For example, Space Hub Yorkshire has recently partnered with Satellite Applications Catapult to pilot **UK Earth Observation Network for Sustainability (UK-EONS)**, a programme focusing on advancing the use of EO data to address sustainability challenges across the UK.

Similarly, the North is home to 25% of England's agricultural labour force, providing an immense opportunity for space-driven solutions like precision farming, crop monitoring, and resource optimisation. In late 2022, the University of Leeds and its partners received funding from the UKSA for its GreenSpace Research, Development, and Innovation (RD&I) activity, aiming to establish new networks at the intersection of space, agriculture, and financial technology.

CASE STUDIES

The North has become a sought-after destination for international companies seeking to capitalise on its thriving industrial ecosystem, with global giants such as Leonardo, Lockheed Martin, CGI, McLaren, Boeing, Nissan, GSK, and Hitachi having chosen the region for their operations.

The area also nurtures numerous homegrown success stories, with several examples outlined below across the space-based resilient communications supply chain.

Precision engineering specialist **Agemaspark** has been at the forefront of innovation for over 20 years, supporting industries such as aerospace, medical, food processing, and oil & gas. The company's expertise was highlighted through a recent collaboration with NASA, Boeing, and Radstone Technology to produce components for the International Space Station (ISS). In 2019, Agemaspark further demonstrated its precision engineering capabilities when commissioned by Rolls-Royce to support their manufacturing processes for a mission to Mars.

Today, Agemaspark continues to produce high-performance components for microwave satellite communications while also charting a new course into the nuclear industry, actively refining its operations to meet the sector's stringent standards.

Founded in 1999, **e2E** has been providing systems engineering support for customers seeking to define, develop, or operate space-based communications networks, as well as offering services for integrating and testing new satellite systems.

The company, acquired by **Telespazio UK**, has previously provided verification and testing for Inmarsat, operations engineering support for OneWeb, and is part of a consortium developing the UK's multi-billion-dollar Skynet 6 Military SATCOMs program. In 2019, e2E also validated its NEATaccess (a credit-card-sized radio communications module for space applications) and Uam (a managed communication service providing more affordable data in under-served regions) offerings in-orbit in partnership with Open Cosmos.

CASE STUDIES

35-year-old **BSC Filters** focuses on RF and Microwave filters, subsystems, and modules, currently supporting the development of direct-to-device satellite connectivity, with all SATCOM capabilities recently announced by Apple set to pass through BSC Filters products. Similarly, the Rosalind Franklin Rover's communications to Earth also relied on components from the York-based company.

As part of the Microwave Products Group (MPG) - a parent organisation with over 75 years of space heritage - BSC Filters benefits from a legacy that includes over 200 NASA and ESA approved designs. MPG's contributions span historic programs such as the Apollo 17 Lunar Sounder Experiment and the Delta Launch, to contemporary projects like the Webb Telescope and Telesat and Amazon's LEO constellations.

The Group unifies seven brands producing spectral purification, interference mitigation, and spectrum monitoring solutions used in RF & microwave applications, Connecting & Protecting People® across space, aerospace, and defence.

"The region stands as a global powerhouse for RF microwave and resilient communications, offering exceptional collaboration opportunities and robust support from the local public sector. It's the perfect environment for businesses to establish themselves and thrive within a rapidly growing and dynamic ecosystem."

Andrew Stringer
Senior Director, BSC Filters

Founded at Leeds University and currently based in NETPark, **Filtronic** has over four decades of providing solutions for telecoms, aerospace and defence, quantum computing, and much more.

A specialist in award-winning advanced RF, microwave, and mmWave components and subsystems, the local champion is also one of the largest companies to spin out of a UK university and continues to grow from strength to strength.

Recently, the company announced a key partnership with SpaceX, which was marked by an initial ***$20 million order for E-band Solid State Power Amplifiers (SSPAs)***. Critical for enabling high-speed, low-latency internet connectivity, these components will be integrated into SpaceX's Starlink satellite constellation beyond 2025. Furthermore, Filtronic has already received a follow-on order of around ***$8.5 million from the US giant*** and a commitment for ongoing orders for the next 5 years.

"Our growth and success have been assisted by the quality and strength of the local space ecosystem, especially in the RF domain, and the support of the world class science parks where we operate. The North's uniquely decentralised geography provides unparalleled opportunities for innovation and collaboration. Combined with the region's high quality of life, it's an exceptional place to live and grow as a business."

Fin Farrely
Marketing Manager, Filtronic

CASE STUDIES

SatixFy, now part of **MDA Digital Communications**, is a leader in next-generation satellite communications, providing end-to-end solutions for both space and ground systems. The company recently announced its collaboration with Telesat to develop and supply Landing Station Baseband systems for their highly anticipated Lightspeed Network, advancing global connectivity.

SatixFy has also played a pivotal role in OneWeb's technological advancements in 2023, contributing to the development of the JoeySat satellite. This innovative satellite featured a digital, electronically steered multi-beam array (ESMA) payload capable of beam-hopping and beam-steering, with the ability to switch between multiple locations on Earth up to 1,000 times per second and adjust signal strength dynamically. This breakthrough was supported by a ***£32 million UK Space Agency grant*** through the Sunrise Partnership, a collaboration between the European Space Agency and OneWeb.

"Since establishing ourselves in the North of England, we've witnessed ever-expanding opportunities to leverage our digital communication products across a variety of industries. Moreover, the region's dynamic industry growth, vibrant cities, and exceptional quality of life make it the perfect location for our continued expansion and an attractive destination for our growing workforce."

Christian Facchin
Site Lead (Manchester), MDA Space

ROKE

Established in 1956, **Roke Manor Research** is a British centre of excellence renowned for cutting-edge innovation and engineering in data, telecommunications, and digital intelligence. Over the decades, Roke has earned its reputation as a leader in resilient navigation and SATCOM protection technologies, as well as an influence over Roke's work directly influences national investment in critical areas such as law enforcement and intelligence, ensuring the country stays ahead of emerging threats.

The company made history in 1984 by developing the world's first Anti-Jam GPS receiver, a groundbreaking achievement that set the stage for decades of advancements in secure navigation. Today, Roke continues to innovate at the forefront of SATCOM protection, notably creating advanced strategies to counter SATCOM spoofing. Similarly, the company also designed a matchbox-sized unit for alternative navigation independent of GPS, called RENS. This device integrates inertial navigation and video analytics to track movement and orientation without relying on external systems, making it ideal for applications where GPS signals are compromised.

In addition to its technical innovations, Roke has been instrumental in national security. The company was recently tasked with developing and operating the UK's National Threat and Opportunity Hub, which is now fully operational. This hub delivers cutting-edge horizon scanning, research tools, and impact assessments, playing a pivotal role in shaping the UK's strategic priorities.

06

DIVERSE ACCESS TO CAPITAL

> *"The North offers unparalleled opportunities for investors, driven by the exceptional talent and innovation emerging from its world-class universities and thriving businesses. It's a region where investments deliver not only outstanding value for money but also create meaningful local impact"*
>
> **Jason Hobbs**
> CEO, North East Fund

The North of England offers a comprehensive and robust ecosystem for accessing capital, designed to support businesses at every stage of their journey. Whether you're a start-up, scaling business, or established company, the region is home to entities equipped with the expertise to provide tailored support, funding opportunities, and practical resources to help your enterprise thrive.

Local enactors, such as **Business Durham**, and region-wide supporters like the **North East Fund**, the **North West Fund**, and **Finance Yorkshire** bring a wealth of knowledge and experience, whilst also providing access to a wide network of partners that enhance their offering and deliver strategic guidance. Together, they provide a comprehensive range of services, from helping businesses secure premises - be it incubator space, state-of-the-art labs, manufacturing facilities, or Grade A offices - to offering bespoke research, local intelligence, and expert knowledge that highlights why the North is an ideal location for business success. Their backing also extends to recruitment support, organising site visits, facilitating introductions to local networks, and identifying grants and funding opportunities.

Additionally, Freeports in Northern England, including the **LCR Freeport**, **Humber Freeport**, and **Teesside Freeport**, are driving significant economic transformation through their ability to attract global investment across key sectors such as green energy, chemicals, logistics, advanced manufacturing, and technology. These zones offer a range of tax reliefs, including relief from stamp duty, business rates, and national insurance contributions, and represent a powerful collaboration between public and private sectors, designed to foster innovation, economic growth, and sustainability.

Space North has also leveraged strategic partnerships to drive growth in advanced manufacturing and renewable energy. A prime example is the **South Yorkshire Investment Zone**, the UK's first investment zone, which collaborates with local authorities and universities to attract private funding and stimulate job creation. This initiative is expected to generate 8,000 new jobs and £1.2 billion in investment by 2030, significantly benefiting communities and industries across the region. The Investment Zone has already garnered support from global players like Boeing, who recently announced an £80 million commitment to a portfolio of cutting-edge aerospace R&D projects within the area.

This multifaceted approach ensures that businesses in the region have access to the resources and connections necessary to attract capital, drive inward investment, and flourish within an innovative economy. By aligning these efforts with the region's strengths in advanced manufacturing, digital technologies, and resilient communications, the North continues to improve its position as a prime destination for business growth and investment.

In addition to these resources, universities across the region play a pivotal role in supporting business growth through dedicated accelerators and incubators. For instance, the **University of Manchester's Innovation Factory** fosters spin-outs and start-ups by connecting them with industry experts and investors, while **Durham City Incubator** provides mentorship and tailored support to budding entrepreneurs. Similarly, Northumbria University's Incubator and the **University of Sheffield's Innovation District** offer businesses access to state-of-the-art research facilities, expert guidance, and networking opportunities, ensuring they have the tools needed to scale and succeed in competitive markets.

CASE STUDY

Northern Accelerator

The **Northern Accelerator** is a transformative partnership between Durham, Newcastle, Northumbria, Teesside, Sunderland, and York Universities. Launched in 2016, the initiative aims to enhance the ability of North East universities to translate their research findings into commercially viable products and services, fostering social and economic impact across the region.

These efforts have reshaped the region's university innovation ecosystem, resulting in the creation of ***47 spinout companies and projected to contribute over £123 million in additional GVA to the local economy within a decade***. The program's success has drawn national recognition, with **Research England** awarding an additional £1.5 million in Connecting Capability Funding to expand its scope.

Building on the region's diverse capital ecosystem, the North of England offers a wealth of investment opportunities that extend from local to national levels, empowering businesses to innovate, grow, and thrive. Regional venture capital firms such as **Northstar Ventures** and **Northern Gritstone** play a pivotal role in providing early-stage funding to high-growth companies like Phlux, Pragmatic Semiconductors, and Optalysys, while national players like **Seraphim Space**, the world's first VC fund dedicated exclusively to space-related companies, demonstrate the increasing alignment of the UK's investment landscape with cutting-edge industries like space and resilient communications.

The UK space industry secured more than £1.3bn secured in primary equity between 2018-2023 alone[8] , with a landscape of over 300 investors in the sector.

[8] SOURCE: SPACE INSIDER

At the national level, the **Northern Powerhouse Investment Fund II**, managed by the **British Business Bank**, brings a £660 million commitment to smaller businesses in the North, whilst the **Defence and Security Accelerator (DASA)** specifically aims to bolster resilient communications and defence technologies through its Open Call for Innovation. Local champion Filtronic have directly benefited from this initiative, for example securing a £335,000 grant in 2023 to develop advanced communications solutions tailored to meet national defence challenges.

The UK government is also significantly investing in satellite communications technology through the **Connectivity in Low Earth Orbit (C-LEO) programme**, committing up to £160m between 2024-2028. In March 2024, the first funding call under C-LEO allocated up to £60m for innovative satellite constellation technologies, aiming to accelerate the commercialisation of key technologies, secure high-value global contracts, and boost UK industrial capabilities in R&D. Focus areas include on-board processing, active antennas, optical inter-satellite links, networking and routing, and user terminals - ultimately supporting national security, military operations, and disaster response.

Additionally, the government offers several grants and funding schemes, such as Innovate UK's Smart Grants and R&D tax credits, with eligibility typically based on criteria like the business's location, size, and innovation potential, as well as the alignment of projects with national priority sectors.

Similarly, **ESA Business Incubation Centre (ESA BIC)** - the world's largest space business incubation network - offers startups technical expertise, funding, and commercial support to develop groundbreaking products that utilise space technologies for terrestrial and extraterrestrial applications. With a regional site located at Sci-Tech Daresbury as part of a growing list of 30 locations, the network has been assisting more than 1,450 companies since 2004.

NOTES

SPACE NORTH™

For more information about Space North and the opportunities within our resilient communications industry to invest, innovate or collaborate, reach out below:

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Innovation Clusters | North West Space

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Follow this QR code to learn more about the Resilient Communications ecosystem in Space North.

WILL YOU BECOME PART OF THIS THRIVING ECOSYSTEM?