Leading our nation's digital future

Paul Coffey, Chief Executive

Share your feedback via Twitter #5GConnect
5G will be transformative for Scotland

Job growth
Economic gains
Rural and urban development
Safer, more connected, more productive
5G will be transformative for Scotland

- £17bn by 2035
- 3,000 new businesses
- 160,000 jobs
Introducing
The Scotland 5G Centre
Our mission:
To accelerate the deployment & adoption of 5G in Scotland
Our mission:

To help businesses all over Scotland recover and rebuild following COVID-19
Our mission:

Raise awareness of 5G and the benefits to businesses, people and communities

And be their catalyst for collaboration
Building the 5G eco-system
Success is:

A thriving 5G eco-system
S5GConnect Programme

Objectives

Objective 1: Transforming 5G demand
Objective 2: Accelerating regional networks
Objective 3: Shaping a technological eco-system
Objective 4: Generating awareness and engagement
Transforming connectivity
Transforming regions
Satellite Comms, Transforming the Sector - Scotland

Strength of the Sector

1. Employees 26,000 with a current GVA of £2.5 billion
2. Projected as £4 billion (2030)
3. Nearly a fifth of all UK space jobs are based in Scotland
4. More than 130 space organisations in Scotland – including the headquarters of 83 UK space industry firms – combined income of £140 million
5. Glasgow manufactures more satellites than any other city in Europe
Flagship Projects & Key Players

Strong industry cluster

Supported by a strong supply chain with extensive experience
Strong R&D and Skills Base

Graduate and Postgraduate - Engineering and Technology, Physical Sciences and Mathematical Sciences
To Summarise

- Strong industry sector
- Mature ecosystem and supply chain
- Developing interdependence of technologies - 5G and satellites
- Natural collaborative opportunities
- Supportive policy environment - e.g. S5GC and Scottish Space Leadership Council
- Integrated economic development and research networks
The Scotland 5G Centre

Share your feedback via Twitter #5GConnect
Space and 5G Event – Opportunity in Scotland

09:30 – 09:40 WELCOME
Paul Coffey, CEO Scotland 5G Centre

09:40 – 10:10 THE PROJECT OPPORTUNITY - INTRODUCTION AND INFORMATION SESSION
• Emily Gravestock – UK Space Agency
• Mohammad Lari - DCMS
• Rita Rinaldo - ESA

10:10 – 10:40 WORKED EXAMPLES OF ADVANCED 5G LOGISTICS
• 5G Transport and Logistics: Robert Gardner, Senior Innovation Engineer, Network Rail
• Introduction to Smart Ports: Elaine Scott, North East Satellite Applications CoE
• 5G and Urban Mobility: Adrian Talbot, Head of CoE for Mobility - Ferrovial

10:40 – 11:00 OPEN DISCUSSION
Moderator: Paul Coffey
• Kenneth Gordon - Scotland Ambassador ESA Business Applications
• Open Discussion on potential projects in Scotland
• Agreement on formative consortia and collaborative actions
Build
Business cases

Foster
5G Ecosystem

Lead
Research & Development
UK5G is a ‘network of networks’ to facilitate, encourage and coordinate 5G activities across the UK.

(Electronic copies available [UK5G.org](http://UK5G.org))
Thank you

Mohammad Lari
Head of Cross-Government & International Coordination

mohammad.lari@dcms.gov.uk

https://uk5g.org/
Call for Proposals “Space and 5G convergence: Transport and Logistics”

• **What:** Demonstration projects focusing on the development and pilot of sustainable downstream services addressing UK Government’s priorities in the Logistics sector.

• **How:** The services shall rely on converged 5G terrestrial and satellite communication networks and shall demonstrate innovation and sustainable business models.

• **Why:** to deliver innovative and sustainable services for a longer term efficient, competitive and low carbon logistics sector.
Project Proposal Requirements

- Implement as a minimum one pilot within the UK territory addressing UK users
- Obtain the commitment of relevant representatives of UK-based user communities in the Logistics sector (including land, air and maritime) to participate in the project
- Include the service provider with a leading role
- Establish agreements with 5G infrastructure providers (satellite and terrestrial)
- Include all technology and product ground developments as required for the delivery of the proposed service
How to apply

- The call is part of the 5GSPLOf ARTES 4.0 Programme
- Companies registered in the following Member States will be eligible to apply: Austria, Czech Republic, Denmark, Finland, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Norway, Portugal, Romania, Spain, Sweden, Switzerland, the United Kingdom and Canada.
- Companies are requested to obtain a Letter of Authorisation from all the respective national delegations
- ESA will fund up to 50% of the total project cost
- SMEs activities can be funded up to 80%, depending on the funding level authorised by the related National Delegation(s)
- Opening date: July 09th
- Closing date: December 15th
- The UK Delegation has allocated 5.0 MEUR funding to this call

https://business.esa.int/funding/intended-tender/space-and-5g-convergence-transport-logistics
Satellite & 5G Communications in Rail

Space and 5G: Transport & Logistics (ESA/DCMS)

Webinar hosted by the Scotland 5G Centre

28th September 2020

✉️ robert.gardner2@networkrail.co.uk

Network Rail Telecom

Picture credit: AAC Clyde Space Epic 6u Cubesat
Satellite & 5G Communications in Rail

Satellite communications within an integrated and converged 5G networking ecosystem are potentially capable of transforming data communications connectivity that supports transport logistics (especially, perhaps, in rural and remote areas) owing to:

- Global coverage
- 5G integration and interoperability
- Diverse data service capabilities
- High reliability
- Lowering costs for initial entry and data
- Competitive service-provider market

Developing the 5G-enabled Digital Logistics Ecosystem

The “Physical Network” of passengers & freight transport, enabled by 5G “Internet of Things” & Automation:

How to facilitate the efficient transportation of passengers and freight, system-wide, origin to destination, similar to datagrams in the Internet, according to constraints (e.g. link cost, time, etc.)?

How to enable monitoring and tracking of passengers and freight, end-to-end, and ethically so?

How to provide relevant information for passengers & freight handling systems (human or automated)?

How can transport logistics systems be connected reliably and efficiently to enable greater automation?

Some railway telecoms use cases include:

• Rail Vehicle:
  - Passenger Broadband Connectivity
  - **Customer Information, Communications and Surveillance Systems**
  - **Retail Point of Sales Systems**
  - **Rolling Stock Condition Monitoring and Diagnostics**
  - **Location Services and Tracking (for safety and logistics)**
  - Operational Voice Communications Systems (e.g. GSM-R successor)
  - Operational Train Control Systems.

• Trackside:
  - Level Crossing Safety
  - **Remote Condition Monitoring of Assets (Intelligent Infrastructure)**
  - **Workforce Communications and Safety**
  - Emergency and Secure Telecommunications Services
  - Operational Telecoms Connectivity
  - **Station, Depot and other Facilities Connectivity.**
Satellite Connectivity Application Domains

Broadband Communications
- Characterized by:
  - High throughput
  - Multi-bearer integration or interoperability (satcom & terr)
  - Modest system reliability
  - Good mobility coverage [satellite union. terrestrial]

Narrowband Communications
- Characterized by:
  - Modest throughput ~1Mbps
  - Multi-bearer integration or interoperability (satcom & terr)
  - Ultra system reliability ~100%
  - Ultra-high mobility coverage [satellite union. Terrestrial]

IoT, GNSS & Sensor Communications
- Characterized by:
  - Low rate, bursty or intermittent
  - Optionally interoperable and/or integrated with terrestrial wireless
  - Good reliability
  - Mobility coverage n/a
  - Low power / ultra-long field life
Converging Networks in the Space-Terrestrial 5G ‘ecosystem’

Space and High Altitude
- IoT LEO (e.g. Orbcomm.)
- Future? 5G/4G/3G 3GPP HAPS or LEO
- Narrowband LEO (e.g. Iridium.)
- Broadband LEO (e.g. OneWeb II, Starlink, Telesat.)
- Broadband GEO (e.g. Inmarsat, Hispasat, Eutelsat etc.)

Terrestrial Wireless
- 5G/4G/3G 3GPP
- Non-3GPP

Possible aggregation of multiple bearers to provide suitable services to applications
Aggregation of multiple bearers to provide suitable services to applications (see FRMCS)
If you have a proposition that you think would be of interest on the railways, please get in touch: robert.gardner2@networkrail.co.uk
North East SMART Ports
Elaine.scott@durham.gov.uk

Space and 5G Convergence: Transport and logistics webinar
28 September 2020
Why SMART Ports?

Primary reasons and drivers:

- Various satellite applications across multiple value chains – a great demonstrator platform!

- Changing role of ports, partly driven by environmental and political factors

...and then, Maritime 2050 : Navigating the Future strategy
SMART Ports

Shifting focus from administration, infrastructure and capacity to... improving connectivity between the port and the hinterland through various means of intermodal transport.

In other words, port authorities today are no longer concerned only by moving goods from sea to land, but they all act as facilitators in international logistic chains.

This is the essence of a ‘Smart Port’ through optimising port processes and infrastructure, creating platforms to integrate more closely with stakeholders in the supply chain, and develop strategic relationships with businesses and citizens in their hinterland.
North East ports

Berwick
Blyth
Tyne
Sunderland
Tees
Uses of 5G in ports:

• Video surveillance including AI recognition
• Remote control of equipment
• Remote connection
• Remote monitoring
• Providing a cheaper network compared to ducting/fibre
• Environmental monitoring within the port and external to the port
Key considerations:

• Lack of fibre infrastructure
• Private vs public networks
• Legacy systems and compatibility
• Culture and engagement including data sharing agreements
• Be clear about the goals – danger of too much data
• Digitisation of vessels
• Common industry standards – shipping is fragmented
Thank you for listening.

Contact: Elaine.scott@durham.gov.uk
07786 026916
We are on LinkedIn and Twitter (@satelliteapps)
Digital Infra & 5G/SatComms Opportunities

Adrian Talbot | Head of Centre of Excellence for Mobility | ferrovial

September 2020
Ferrovial improves the future through the development and operation of sustainable infrastructure and mobility solutions. We are committed to the highest level of operating excellence and innovation and we create value for society and our stakeholders and employees.

E6.1 Bn revenues (2019)

- Mobility
- Power Infrastructure
- Water
- [Services]
• Leader in Dynamic Pricing & Managed Lanes
• Multiple concessions: LBJ | NTE | i66 | i77 & 407ETR
• 18 toll-road concessions (barriers & free flow)
• Spain | Portugal | Ireland | UK | Slovakia | Colombia
• 1474 km of highway under management
• Complex transport & mobility infrastructure
• Specialist tunneling, bridges, embankments
• Airports (runways) & rail (including tracks)
• Past: LHR T2 & T5, Madrid Barajas T4, HSR Espana
• Current: i66, HS2, NLE, Crossrail, Silvertown
Largest shareholder in LHR (25%)
HAL is owner/operator of Heathrow Express
75% owner of ULTRA GLOBAL (AV PODs)
10 yrs fully commercial AV POD service at T5
50% owner of ABZ, GLA & SOU airports
ABZ world’s busiest helicopter operation
MOBILITY: ZITY

- ZITY Madrid – Free Floating Car Sharing
- Joint-Venture Ferrovial+Renault (since 2017)
- Fleet of 750 fully electric Zoes
- City+metro area thanks to 400km range
- 300k+ registered users
- ZITY Paris launching in 2020 (650 vehicles)
• First Mobility-as-a-Service Platform in Madrid
• Launched in 2018; Partnership with Moovit
• Focused on B2B2C ride-sharing & DRT services
• Integrated payments
• Wider expansion within Spain & Portugal in 2020
# The Mobility Landscape & Transversality

## User Behavior
Driver/Pilot Dynamics, Rider Dynamics, Citizen Dynamics

<table>
<thead>
<tr>
<th>User Behavior</th>
<th>Goods Logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility as a Service</td>
<td>Mobility</td>
</tr>
<tr>
<td>Ride Sharing/Hailing</td>
<td>Airports</td>
</tr>
<tr>
<td>P2P/Fleet Vehicle Sharing</td>
<td>&amp; Power Infra</td>
</tr>
<tr>
<td>Demand Responsive Transit</td>
<td>Highways</td>
</tr>
<tr>
<td>Micro-Mobility Provision</td>
<td>Construction</td>
</tr>
<tr>
<td>Smart Parking</td>
<td>Mobility Infrastructure</td>
</tr>
<tr>
<td>Data Services</td>
<td>Technologies</td>
</tr>
<tr>
<td>In-transit services</td>
<td>Role</td>
</tr>
<tr>
<td>Pre/Post Journey Services</td>
<td>Owner</td>
</tr>
<tr>
<td>First/Last Mile</td>
<td>Enabler</td>
</tr>
</tbody>
</table>

## Network Management
- **Single-Mode Network Management**
  - Managed Lanes, Light Rail, Air Traffic Control
- **Multi-Modal Network Management**
  - Transport inter-connect, Resilience, Hubs
- **“Smart City” / Geo-fenced Operator**
  - Airports, Campuses, LLZ & C2

## Fleet Management
- Procurement, Finance & Insurance, Maintenance, Disposal/Repurpose

## Fleet Operations
- Real-time logistics, Vehicle Tracking & Allocation, Dynamic routing/pricing, mixed fleet

## Vehicles
- **Type**
  - Ground, Air, Sea, Space, Sub-surface
- **Control**
  - Autonomous, Assisted, Manual
- **Power**
- **Connection**
  - Connected, proprietary/interoperable
- **Capacity/Use**
  - Single/multi personal/shared
- **Ownership**
  - Private, Leased, Subscription
- **Cargo**
  - People, Goods, Mixed

## Technologies

## Infrastructure
- Highways, Streets, Parking, Rail, Airports, Vertports, Spaceports, Transfer hubs, Power Infrastructure, Safety & Security

## Role
- Owner, Enabler, Advisor, Design, Build/Develop, Operate, Maintain

## Context/Scope
- Urban, Inter-urban, Rural, Regional, National, International, Inter-planetary
Enhances capacity & value of existing assets
Insulates against “value chain squeeze”
Unlocks new customer segments and social value
Extends reach beyond existing assets
Enables exponential growth (NFX)
sustainability (+20%), energy & operational efficiency (+30%)

Increase capacity (x4), oversight & resilience of existing infrastructures

<table>
<thead>
<tr>
<th>Highways</th>
<th>Construction</th>
<th>Airports</th>
<th>Power Infra</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolling &amp; Dynamic Pricing</td>
<td>AR/VR for iterative design</td>
<td>Vehicle Telemetry</td>
<td>Automated inspections</td>
<td>User modal choice data</td>
</tr>
<tr>
<td>Stopped-vehicle detection &amp; HOV</td>
<td>Temp. private networks</td>
<td>Stand Automation</td>
<td>Drone platform</td>
<td>W O N D O MaaS platform</td>
</tr>
<tr>
<td>V2X for safety &amp; payments</td>
<td>Simulation</td>
<td>ARTele maintenance</td>
<td>Microgrids</td>
<td>Teleoperated</td>
</tr>
</tbody>
</table>

- Tolling & Dynamic Pricing
- Stopped-vehicle detection & HOV
- V2X for safety & payments
- AR/VR for iterative design
- Temp. private networks
- Simulation
- Vehicle Telemetry
- Stand Automation
- ARTele maintenance
- Automated inspections
- Drone platform
- Microgrids
- User modal choice data
- W O N D O MaaS platform
- Teleoperated

Stop-vehicle detection, HOV & vehicle supervision
Airport stand automation & quick turnaround
Digital construction & simulation
Linear asset management inspection using drones
Mobility-as-a-Service Platforms
5G Opportunities

**Network Infrastructure**
- Involvement in the provision of network infrastructure; either alone or in partnership

**Use Cases**
- Network owner & operator (Private) with sub-let opportunities (for TR/Airports)
- Mast (co)-ownership (sub-let to MNO) - within infrastructure asset or over wider area (e.g. with local administration)
- Mast/fibre install & maintenance

**Impact**
- New strategic infrastructure revenue source
- Leverages existing capabilities
- Ability to accelerate coverage to strategic locations (for Ferrovial and clients)
- Access to data
- Risk mitigation/leverage with MNOs

**5G Exploitation**
- 15 high-level use case themes (100s specific use cases) identified from the perspective of a network user

- Real-time asset monitoring & management
- Infrastructure development for AV/CAV
- Improved usability of digital services
- Improved User/Passenger/Citizen Services
- Real time visualization/collaboration

- Service enabler & enhancer
- Revenue enhancing
- Operational efficiency
- Improve safety & security
- Improved customer experience
- Increased productivity/remote presence
5G/SatComms Use-Case

- Funded project kicking-off in Q4 2020
- Drone logistics network for Scotland (& UK)
- Focused on medical supplies (drugs & “wets” invc. Test)
- Leveraging existing hubs (eg. AGS, Inverness etc) but also identifying locations for new fixed infra
- Currently no specific COMMS focus

Opportunity for complementary project targeting:
- 5G (private networks at hubs + public where exists)
- SatComms everywhere else (big oppportunity for Scotland – drones will use direct fligh-paths where possible which means MANY blackspots)
**Challenge:** use 5G to provide all site connectivity and remote site inter-connectivity

**Reality:** 5G and private licensing not yet ready to deliver site interconnectivity solutions

**Reality:** For Full Private Cellular, 4G LTE+ 5G NSA is the most comprehensive solution today

**Reality:** MNOs 5G capabilities target consumers, “telco-grade” and network consistency

---

**Use Case Themes**

**Construction:**
- Connectivity
- Health & Safety
- Security
- Site Comms (PTT, PTV)
- Operations

**Concession:**
- Connectivity (ITS + public)
- Situational Awareness
- Operations

**Innovation Opportunities**
- AR/VR – Remote Worker
- Site Automation
- Mission Critical Ops (TBM)
- Hybrid networks
- Neutral host
Future Private Network Options at Silvertown

HYBRID Public/Private

North Site

South Site

South Satellite

5G private (R17)

North Site

South Site

South Satellite
THANK YOU!
YOUR BUSINESS
POWERED BY SPACE

28TH SEPTEMBER 2020
**Name:** Ken Gordon  
**Role:** Regional Ambassador Platform (RAP) Midlands & North East England  
**Background:** >12 years experience as an innovation funding specialist helping Scottish businesses understand and apply for funding including trade visits overseas promoting the Scottish Aerospace industry. Significant business support skills in proposal preparation, finding collaborative partners and proposal review to assist the space and non-space sectors. RAP-SNI will have good collaborative links to business support organisations including Scottish Enterprise (SE), Highlands and Islands Enterprise (HIE), and Northern Ireland’s economic development agency, Invest NI.  
**Location:** University of Strathclyde  
**Contact:** kenneth.Gordon@strathclyde.ac.uk
ESA Business Applications Ambassadors – Service Offer

**Access to ESA Near Me Network and Partners**

**Hands-on customised assistance**

**Door opener to industry, research institutes and Universities**

**News and Success stories**

**Proposal support & advice**

**BENEFITS offered by ESA Business Applications Ambassadors**

**Access to ESA Business Applications Funding (€25k-€2M+)**
NEXT STEPS

Ask Questions
Get in Touch
Discuss and Develop Your Idea

CONTACTS:
kenneth.gordon@strath.ac.uk
07970 981050
linkedin.com/in/kennethgordon/
Twitter @ESABA_ScotNI