



Department for
Digital, Culture,
Media & Sport

5G Testbeds and Trials Programme

Programme Update - July 2019

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Introduction

The 5G Testbeds & Trials (5GTT) Programme continues to work towards our ambitious targets and, through some excellent projects, is now demonstrating the value 5G will bring to the UK economy.

The 5GTT Programme remains a fundamental part of DCMS Digital strategy by supporting the Future Telecoms Infrastructure Review (FTIR) which was published last summer and, previous to that, the 5G Strategy, announced in the Government's Industrial Strategy in 2017.

The 5G TT programme will work to establish what policy interventions are needed to deliver on the Government future connectivity objectives, the FTIR sets out the framework and conditions necessary to underpin investment and innovation in 5G, and deliver the Government manifesto commitment to have 5G coverage for the majority of the UK by 2027.

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The purpose of this publication is to provide an update on the progress made by the 5GTT Programme in delivering projects that drive towards its targets and objectives.

The 5G Testbeds and Trials Programme

*The 5GTT Programme is here to **foster, build and lead.***

Foster - the development of the UK's 5G ecosystem

Build - the business case for 5G by stimulating new use cases and create the conditions needed to deploy 5G at scale and pace

Lead - the way in 5G R&D to drive UK 5G leadership

Through the 5GTT Programme, Government coordinates pilots and trial activities to identify potential deployment and technical challenges for 5G, seek to remove barriers to deployment, reduce commercial risks associated with investment in 5G by stimulating demand for new services, and help to inform future policy.

As part of a Government investment of over £1bn in digital infrastructure, £200m has been allocated to support 5G Testbeds and Trials.²

5G Development

In the previous update, we set out what the path to 5G might look like; namely that it is likely to integrate existing and new technologies and require wireless networks to align ever more closely with fixed networks.³ Moreover, we touched on some of the fantastic opportunities that 5G could enable for businesses and citizens across the UK. Since then, we have been

⁴<https://s3.eu-west-2.amazonaws.com/conservative-party-manifestos/Forward+Together+-+Our+Plan+for+a+Stronger+Britain+and+a+More+Prosperous....pdf>

²<https://www.gov.uk/guidance/broadband-delivery-uk#local-full-fibre-networks-programme>

³ <https://www.gov.uk/government/publications/5g-testbeds-trials-programme-update>

utilising the Programme’s testbeds and trials to demonstrate the applications and services 5G could offer. We are helping to define the business cases for 5G in enterprise markets and the ideal conditions needed to deploy it efficiently. In 2018/19, we have seen a number of big players in the UK service provider market announce their plans for 5G rollout and it is encouraging to see their ambitions. Commercial rollout of 5G has now started and DCMS will continue to undertake projects and introduce policy initiatives to help support efficient and timely deployment.

5GTT Programme funded projects



Figure 1 - 5GTT Programme Delivery Approach



5GUK Test Network

5GUK, the world’s first end-to-end 5G network, continues to support other projects in the 5G Programme and have demonstrated some innovative use cases during the last six months. The DCMS funded £16m network was created through a collaboration between the 5G Innovation Centre at the University of Surrey, the University of Bristol and King's College London.

- The University of Bristol deployed 5G capability in the Smart City and Smart Campus testbeds in the city, targeting 5G and fibre infrastructure convergence. Bristol also contributed to the key Software Defined Network technologies for end-to-end 5G service delivery. Public demonstrators were the focus of delivery, targeting media, gaming and transport applications.
- King’s College London delivered ultra-low latency 5G tactile internet developments with Internet of Skills applications. Through the King’s College London 5G Tactile Internet Lab, the university also pioneered several important 5G co-design approaches with various industries, including smart cities, smart transport, performing arts and health.

- The University of Surrey's 5G Innovation Centre (5GIC) led the project and developed 5G radio technologies and a fully virtualised mobile core network at 3.5GHz and 700 MHz frequency bands for enhanced Mobile Broadband (eMBB) and Ultra Reliable Low Latency Communications (URLLC).

The 5GUK test network is being used to trial further 5G applications and technologies with over 25 further projects using it beyond the 5G Programme. It's currently providing core network services and research and development expertise to three of the initial portfolio of projects from the Programme, Worcestershire, Smart Tourism and 5G RuralFirst. The Digital Catapult have also connected to the network, which enabled a world first at the Smart Tourism March showcase event, where two violinists, a pianist and a singer performed a piece of music together, live from 3 different locations over the 5G network.⁴



UK5G Innovation Network (www.uk5g.org)

The UK5G Innovation Network has entered its second year and continues to grow in membership, capability and influence. DCMS funded, but independent and impartial, UK5G is the national innovation network dedicated to the promotion of research, collaboration and the commercial application of 5G in the UK. It acts to enhance links between ongoing research and development and other activities being undertaken by organisations across telecoms and other sectors.

A senior national advisory board steers the activities of UK5G, and advises the 5GTT Programme, providing expert feedback from industry, identifying priorities and advising on potential future areas of focus.

UK5G has now built up a membership base of around **1,750 individuals from more than 850 organisations** and have had a presence at over 50 industry events in 2018.



Use Case Trials

Initial Portfolio of Projects

In March 2018, the Government selected six proposals from across the UK as the winners of the first Phase of funding from the 5G Testbeds and Trials Programme. This involved developing consortias of over 70 organisations including over 40 SMEs. Since then the projects have all successfully completed their initial year of funding and delivered some exciting and innovative applications, including in agritech, delivering low-cost health and social care solutions into homes and enhancing productivity in manufacturing. Investing around £40m of funding from Government, and public sector and commercial partners. Following this first successful year of funding all the projects have been extended. Some of the projects will be further developing the use cases created in the first year whereas others will be developing new applications. On 10th/11th April, all six projects demonstrated their fantastic work at 5G Realised in London.⁵

AutoAir

Since March 2018 the AutoAir project has worked with a host of organisations to help the development of Connected and Autonomous Vehicles (CAVs). Using the testing ground at

⁴ <https://uk5g.org/discover/read-articles/uks-leading-tech-pioneers-give-glimpse-future-5g-s/>

⁵ <https://5grealised.com/>

Millbrook in Bedfordshire, they have successfully demonstrated how 5G connectivity solutions could be used in the high speed transportation industry. Providing Gbit/s to moving vehicles and simulating a 5G connected highway. The project has been granted an extension of six months, bringing in new partners O2.⁶



Live demonstrations at Millbrook showed transmission of data to fast-moving vehicles at speeds of 1Gbps and a 70GHz data link in the event building

The project demonstrated its capabilities in a showcase at the Millbrook Proving Ground in February 2019⁷. They demonstrated the transmission of live 4K video at 1Gbps from fast-moving vehicles, to a screen on a bus - this was powered by 23 small cells that were installed on the site. The ability to rapidly transmit large amounts of data could improve safety, and help accelerate the development of the generation of connected and autonomous vehicles. The site also hosts the UK's only independent 5G-enabled infrastructure for CAVs.

5G Rural First (5GRF)

5GRF has created rural testbeds and trials for 5G wireless and mobile connectivity across three main sites in the Orkney Islands, Shropshire, and Somerset. They have delivered 5G benefits for rural communities and industries like agriculture, broadcasting, and utilities. They are using cow collars to monitor the wellbeing of livestock in real time, autonomous tractors and drones to monitor and cultivate crops, and sensors in salmon enclosures to ensure the wellbeing of a hugely important export for the local economy. The project has been granted an extension of funding for six months⁸. This will enable them to extend and develop some of the existing trials, launch new ones and to continue to test and showcase the benefits 5G can provide to rural communities.



Connected Cows at the Agri-EPI Centre's South West Dairy Development Centre.

In February 2019 5GRF launched their Me+Moo app.⁹ The app supports the overall 5G RuralFirst communications activity by showcasing one of their agritech use cases - remote monitoring of cows using Afimilk's connected collars. The app provides an opportunity for the general public to engage with a real-life cow to understand how 5G connectivity and Internet of Things applications could help the agricultural industry. To date, they have had over 11,000 downloads on the app store.

⁶ <https://news.o2.co.uk/press-release/o2s-5g-network-to-power-autonomous-vehicle-testing/>

⁷ <https://uk5g.org/discover/read-articles/autoair-5g-test-bed-launched-millbrook/>

⁸ <https://www.5gruralfirst.org/the-journey-continues-beyond-the-city/>

⁹ <https://uk5g.org/discover/read-articles/introducing-memoo-app-puts-cow-your-pocket/>

Worcestershire

The Worcestershire 5G Consortium focuses on live trials in the Worcester Bosch and Yamazaki Mazak factories investigating: increased productivity in manufacturing; detection and prevention; remote maintenance; new models for manufacturing as a service; security by design, and training the next generation 5G engineers.

The project launched the UK's first 5G Industrial trial in the Worcester Bosch factory in February 2019.¹⁰ They have demonstrated how they have been working with local businesses to focus on ways to increase industrial productivity through preventative and assisted maintenance using robotics, big data analytics and augmented reality over 5G. Using this technology the project has shown how this could help factories make significant efficiency gains.



First-ever British 5G factory trials at the Worcester Bosch factory.

5G Smart Tourism

Smart Tourism have successfully delivered enhanced visual experiences for tourists using Augmented Reality (AR) and Virtual Reality (VR) technology in major attractions in Bath and Bristol, including the Roman Baths and Millennium Square. One of the use cases involved simultaneous streaming of interactive VR content filmed at major Bristol tourist events (Bristol Pride, Harbour Festival) to multiple users wearing VR headgear. They have also developed an augmented reality app that allows visitors to see additional information about exhibits in a museum and AR tech to see the Roman Baths through history along with other tourism based use cases. The project's funding has been extended for a further six months.¹¹



AR Tourism Trial at the Roman Baths. Allowing visitors to experience reconstructions of the Baths at key moments in history, on a mobile AR app.

The project showcased its capabilities at their Connected Futures event in Bristol in March 2019.¹² The showcase brought together some of the UK's leading 5G tech pioneers for a day of innovative demonstrations, playable experiences, talks and workshops at the M Shed, Millennium Square and We The Curious.

5GRIT

5GRIT demonstrated innovative use of 5G technology across a range of rural applications, such as smart agriculture, tourism and providing internet services to poorly-connected communities.

¹⁰<http://www.worcestershire.gov.uk/news/article/1727/worcestershire-county-council-welcomes-5g-progression-as-factory-trials-commence-in-the-county>

¹¹ <https://www.westofengland-ca.gov.uk/west-england-5g-smart-tourism-trial-extended/>

¹² <https://uk5g.org/discover/read-articles/uks-leading-tech-pioneers-give-glimpse-future-5g-s/>

In the case of tourism, the project has developed 5G Augmented Reality and Virtual Reality tourism applications with locations around the North Pennines including: Nenthead Mines; the South Tynedale Railway, and Alston High Mill. Within the field of precision farming, the agricultural use cases employ drones and machine learning to provide farmers with timely insights on the state of their livestock and crops. Blue Bear Systems Research have used a drone control system which used the 5G network to demonstrate the feasibility of flying beyond the visual line of sight. Within the rural broadband space, their service has shown that 5G can deliver 30Mbps broadband to remote rural areas. The project's funding has been extended for a further six months.¹³ This will allow the project to expand the trials and show the benefits of 5G to rural areas.



Blue Bear Systems Research drone control system used the 5G network to demonstrate flying beyond the visual line of sight

Liverpool 5G Testbed

The 11 trials were focused around parts of Liverpool where communities have limited access to reliable broadband. They have connected The Royal Liverpool and Broadgreen Hospital and Sensor City with the new accelerator, which is in the Knowledge Quarter. Their work has also extended into parts of the Kensington area. Some of the use cases they have developed include: Safehouse Sensors, which are installed in homes to detect falls, changes in temperature and unusual behaviour patterns and PAMAN, which provides a video link to a local pharmacy, helping people to take medicines at home safely to both improve health outcomes and reduce costs.



Minister for Digital and Culture, Margot James, visit to some of the trialists taking part in the Liverpool Testbed

The project's showcase in March included demonstrations from the partners involved in the project, with participants from the trials also in attendance. They showed how the applications had made a significant difference to the quality of life for those in the community, for example the Push to talk technology and other applications have reduced loneliness in unpaid carers and people facing social isolation. The new technology has also improved the quality of life for people managing long term health conditions from the comfort of their own homes. DCMS has extended the project's funding for a further six months which will allow the project to further explore the benefits of providing affordable 5G technology to people living in digitally deprived communities, with long-term health conditions.

Urban Connected Communities Project (West Midlands)

The Urban Connected Communities Project is a large 5G pilot across the West Midlands region.

¹³ <https://uk5g.org/discover/read-articles/government-extends-revolutionary-5g-project/>

It will demonstrate how 5G will support economic growth and benefit citizens, using 5G connectivity in public and commercial services. This will include working with network operators in designing wireless infrastructure to deliver high-quality connectivity and allow new 5G applications to be trialled in a number of sectors. The project will allow industry to test different deployment models for 5G infrastructure; and help inform the development of policy and regulation to support efficient 5G deployment.

At least £25 million DCMS funding is available for the project, from 2018 to March 2022. (Subject to project approvals, delivery and investment from the local public sector and the private sector).-West Midlands 5G Ltd (WM5G), a new organisation set up by West Midlands Combined Authority (WMCA), is leading delivery, working with industry and the public sector.

Planning was completed earlier this year, and early feasibility studies and in-depth market engagement have begun. The first projects include: action by the seven WM local authorities to support infrastructure deployment ('barrier busting'); and a demonstration of a connected ambulance, with mobile, remote ultrasound scans by paramedics supported by doctors in nearby hospitals.

Upcoming projects include: testbeds in several public and commercial sectors in the region; and a project to provide facilities and help for small businesses and other organisations developing and testing new applications and services using 5G.

Alongside this West Midlands project, UK5G will be engaging with local authorities all over the UK to help continue to develop their digital strategies, including preparing to take full advantage of 5G and its benefits.



5G Transport

The previously mentioned, 5G Strategy takes on board recommendations from the National Infrastructure Commission 5G report including exploring commercial options to improve mobile coverage on roads and rail.

The Government is committed to improving mobile and wi-fi for passengers on mainline rail routes. As part of that commitment, DCMS has recently funded a 5G test bed at the Rail Innovations and Development Centre (RIDC) in Melton Mowbray.

The Government has two, interlinked, commitments for roads connectivity: full and uninterrupted mobile phone signal on all major roads (led by DCMS); and promote the development and adoption of Connected and Autonomous Vehicles (led by DfT). We will continue to work with Ofcom, mobile network operators (MNOs), industry and other key stakeholders, to address mobile connectivity challenges where people live, work and travel, and this includes the road network.

The Government has allocated funding to review future requirements and to consider business models for 5G connectivity on the UK's roads. A feasibility study has been completed to identify demand for applications of 5G technologies on roads. This included exploring potential new commercial opportunities with road authorities and mobile network operators to work together and share infrastructure. This reviews how new technology and business models can support future demand and ensure we have connectivity on the roads that is fit for the future. Following completion of the study next steps are being reviewed in collaboration with other ongoing projects and departments, e.g. UCC, UK CITE, West Midlands CAV testbed, Transport for West Midlands and the Centre for Connected and Autonomous Vehicle (CCAV) to ensure benefits and findings of these programmes are

incorporated into any further projects and investment. We expect to announce further details shortly.

We have upgraded Network Rail's test track facility, the Rail Innovation and Development Centre (RIDC) at Melton Mowbray to enable future rail connectivity trials. RIDC will be an asset for future 5G technology testing providing a location to test without the complexities of dealing with a live railway and providing opportunities for equipment to receive approvals prior to deployment on the live rail. An industry day at RIDC Melton Mowbray took place on the 8th May with approximately 30 companies in attendance.¹⁴

Security

The security and resilience of the UK's telecoms networks is of paramount importance. The 5GTT Programme allocated up to £10 million to create capabilities where the security of 5G networks can be tested and proven. Working with the National Cyber Security Centre and industry, we plan to launch a number of security projects later this year. With initial work in this area already complete, we continue to ensure our testbeds and trials follow and incorporate security best practices and inform the development of government policy.¹⁵

International Collaborations - UK Korea: 5G Infotainment Services for Transport

The project will test the live deployment of infotainment mobile services in a subway environment, initially across the Seoul subway system, but also extendable to other forms of transport. The aim of this collaborative project is to develop new and novel applications and services ready for 5G, in collaboration with South Korean partners, who will provide the test environment.

The testing of content and services will enable businesses and researchers to innovate and address technical and user challenges that are crucial to market adoption. These are likely to include: providing services while travelling across multiple stations and which match commuter timescales; provision of immersive experiences in busy public spaces; achieving lower latency services in environments where the radio channel is rapidly changing. This project will help, through new industry partnerships between UK and Korean institutions, to further trade opportunities for UK companies as well as building on UK strengths in new use cases enabled by 5G.

The UK and Korean Governments are offering £1.2m grant funding each (total project funding of £2.4m) to support organisations in their respective countries to participate in the collaboration.

Industrial 5G Testbeds and Trials

We are soon to launch a competition for projects that will have a primary focus on industrial and enterprise applications. With these projects we aim to develop and demonstrate digitalisation solutions using 5G in UK vertical industry sectors, starting with manufacturing

¹⁴<https://www.networkrail.co.uk/industry-commercial-partners/research-development-technology/ridc/ri-dc-melton/>

¹⁵ <https://uk5g.org/discover/research/technical-report-5g-network-architecture-and-secu/>

and logistics. We have partnered with the Digital Catapult to explore the opportunities for activity and to help coordinate this programme of use case focussed testbeds and trials. In time, we hope to open for consideration of other industry or enterprise sector projects.

The Industrial 5G Testbeds and Trials competition is making available UK Government investment to trial new industrial 5G services and applications in the manufacturing and logistics industry sectors. The aim of these projects is to demonstrate the value of 5G beyond enhanced mobile broadband by targeting industrial users that can help improve efficiency and productivity in the UK economy, and helping the UK lead the development of enterprise use cases of 5G.

The Secretary of State for Digital, Culture, Media and Sport announced the allocation of around £40m to support a number of industry sector testbeds at London Tech Week in June 2019. Working with the Digital Catapult we have analysed the opportunity for interventions and are developing a programmatic approach to investing in sectors testbeds and trials in order to ensure businesses of all types and sizes benefit from the development of the ecosystem. Projects will receive funding from the 5GTT, which will need to be matched alongside commercial funding, and will be supported by Digital Catapult as a collaboration and coordination partner. Projects in the manufacturing and logistics sectors are expected to commence later in 2019.



Rural Connected Communities Project

There are challenging economics to the deployment of telecoms infrastructure in rural areas. However, as more and more social and economic activity - from education and healthcare to retail and business - takes place online, patchy and poor connectivity is an impediment to economic growth and social mobility in some rural areas.

DCMS aims to use the Rural Connected Communities (RCC) project to build the business case for rural mobile connectivity by testing a range of innovative 5G-enabled technical solutions and commercial models, and stimulating demand by developing use cases. RCC will also allow the development and testing of new delivery solutions that could help address coverage challenges in rural areas.

In order to help define how RCC can most effectively do this, DCMS ran UK-wide workshops during Summer 2019. The workshops helped test planning assumptions for the project, including the barriers to rural connectivity; possible innovative solutions (both technological and commercial); appropriate use cases to demonstrate demand; and inform future competition design for public funding.

The workshops were open to those interested in taking part in delivering RCC projects, including local authorities and other public service delivery bodies; network providers; technology vendors; and other organisations involved in the development, trialling and usage of applications and services.

DCMS will use the workshops to gauge the appetite, possibilities and opportunities within the market. These findings will then be used to inform a competition for RCC which will launch in Summer 2019.



Additional Future Projects

The 5GTT Programme continues to consider options for additional future interventions. These may include a series of smaller scale funding opportunities to cover a broader range of activities. As with the UK-Korea collaboration described above, these will help build and sustain the development of the 5G ecosystem. Further details will continue to be shared throughout the year.

Alongside the projects and funds listed in this publication, DCMS is keen to promote other funding streams for potential 5G related projects beyond the 5GTT Programme, namely initiatives like:

- The next wave of Local Full Fibre Networks Programme funding (<https://www.gov.uk/guidance/broadband-delivery-uk#local-full-fibre-networks-programme>)
- Other competitions for funding from the Industrial Strategy Challenge Fund (<https://www.gov.uk/government/collections/industrial-strategy-challenge-fund-joint-research-and-innovation>)
- Innovate UK competitions (<https://apply-for-innovation-funding.service.gov.uk/competition/search>)

DCMS recommends joining the UK5G Innovation Network (www.uk5g.org) to link into the activities of the growing 5G community in the UK, and to stay up to date with further funding opportunities.