BDUK Market Test Pilots

Exploring superfast coverage beyond 95%

Summary of initial findings from the feasibility phase

February 2015

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1 - Preface by the Secretary of State for the Department for Culture, Media and Sport

Through Broadband Delivery UK's (BDUK) programmes, the Government is investing in infrastructure that will deliver superfast broadband[1] to 95% of premises in the UK by 2017. Rollout of superfast broadband is accelerating: more than 2 million homes and businesses have now been reached, growing at a pace of 40,000 premises each week.

But our ambition is to go further; and in June last year we launched eight market test pilots to explore options for taking superfast broadband to some of the hardest to reach areas of the UK – from the heart of Exmoor to the highlands of Scotland. I am delighted to be able to share initial findings from the pilots in this summary and to signpost the detailed reports that the pilot suppliers have published today on their websites.

The final 5% of UK premises are challenging for a number of reasons: they are harder to reach because of demanding terrain and increased distances; and with lower density populations the cost per consumer can be prohibitively high. But the benefits of superfast broadband are clear – from increasing productivity and economic growth to transforming family entertainment at home - and through these pilots we hope to find ways in which those benefits can be brought to even more people.

The Rt Hon Sajid Javid MP
Secretary of State for the
Department for Culture, Media
and Sport

[1] DCMS defines superfast broadband infrastructure as enabling download speeds of at least 24 Mbps

2 - Introduction

Background to the Market Test Pilots

Public investment of £1.7billion will extend the reach of superfast broadband to 95%[2] of the UK by 2017, but the final 5% of the UK presents unique challenges. Following market engagement BDUK launched an open procurement in March 2014 to work with suppliers to learn about the technologies and commercial models that are best suited to delivering superfast broadband in the final 5%. We invited bids into a £10m competitive fund in three different categories:

- **Technology**: Testing a technology which is technically known to work, but where it is currently unknown or uncertain whether it can be used as a viable solution for deploying superfast broadband in the remaining unserved areas.
- **Operating models**: Testing novel operating models that increase investment levels through standardisation or aggregation and so reducing barriers to the market delivering superfast broadband solutions in the remaining unserved areas.
- **Financial:** Testing whether there are alternative public / private funding models which will be effective at leveraging new financing investment to allow superfast broadband solutions to be delivered in the remaining unserved areas.

The response from the market was positive with BDUK receiving 38 bids from 26 suppliers, covering a range of technologies, operating models and financial approaches. Bids were evaluated on criteria including the proposal's relevance to the final 5%; the potential for learning for the Government and industry; and the value for money offered.

Eight Market Test Pilot (MTP) projects totalling over £8million of public investment were selected in June 2014. These eight shortlisted pilots (see table overleaf) then undertook feasibility studies to demonstrate that the proposed projects were commercially and technically viable in locations which were chosen to be representative of the hardest to reach parts of the UK.

The eight Market Test Pilot projects selected in June 2014

[2] Commercial operators have currently declared plans to serve over 75% of UK premises with Superfast Broadband services.

Testing	Supplier	Proposed solution	Location	Total Funding
Wireless	AB Internet	A hybrid fixed line/fixed wireless superfast rural broadband network. All services on the proposed pilot network will be delivered via an end to end network and will deliver end user speeds of up to 50Mbps	Wales	£847,650
	Airwave	Demonstrating how four next-generation wireless systems will operate in the field. The four are: Wi-Fi at 2.4Ghz, point-to-multipoint broadband fixed wireless access at 2.4 Ghz or 5.8Ghz, LTE small cells and TV white space.	North Yorkshire	£1,562,933
	Quickline	Testing a range of line of sight, near line of sight and non-line of site technologies combined with reduced connection costs to maximise early uptake and avoid social exclusion.	North Lincolnshire	£2,054,000
Satellite	Avanti	Piloting a new superfast satellite broadband wholesale platform to deliver a 30Mbps service using its Ka-band satellites.	Northern Ireland and Scotland	£885,640
	Satellite Internet	Piloting superfast satellite broadband using Ka-band satellite for both uplink/downlink as backhaul for local wireless networks, and directly to customers' premises.	Devon and Somerset	£175,125
Mixed: Fibre, fixed wireless, sub-loop unbundling	Call Flow	Testing a range of innovative "hybrid" engineering techniques/solutions to achieve NGA delivery such as: sub loop unbundling of cabinets; building a significant fibre network that connects as many of the deployed 'SLU node areas' together as possible; NGA delivery using fixed wireless access; and fibre to the premise (FTTP).	Hampshire	£1,194,145

Financial model	Cybermoor	Financing through social investment Developing a financing solution to leverage social investment into fibre to the premise and wireless networks in the last 5%.	Northumberland	£449,997
Operating model	MLL	Aggregating small wireless networks Creating a common wholesale OSS/BSS platform for integrating/aggregating rural wireless networks. In addition integrate an existing rural network to allow it to be provided wholesale to other operators/ISPs and deploy a new Fixed Wireless Access network.	Kent	£957,900

3 - Feasibility reports and next steps

3.1 The feasibility and deployment stage

The Market Test Pilots have two stages:

The feasibility stage: This stage helped us better understand the factors likely to affect a full deployment. These include the size of the customer base, the costs of deployment, the services that might be offered, and how to meet the state aid requirements to qualify for public funding.

The deployment stage: This is when projects that have proved technically and financially viable in the feasibility stage will begin installing equipment and offering broadband services to consumers and SMEs in hard to reach areas.

A key output from the pilots is learning that can be shared across the industry and with other interested parties. The eight pilot suppliers have published their feasibility reports alongside this document. Links to the reports can be found at https://www.gov.uk/government/publications/superfast-broadband-programme-phase-3 and these will be updated as the pilots progress through deployment.

3.2 The initial findings

Seven of the eight projects shortlisted in June are now proceeding into deployment. Summaries of the initial learnings from each project are included in this document along with summary financial information. Please note that while BDUK endorses the publishing of the reports, the views contained within them solely reflect the findings and opinions of the supplier, and do not necessarily reflect the thoughts or opinions of BDUK.

The MLL project, which was testing deployment of a Fixed Wireless broadband Infrastructure combined with the creation of an open platform Wholesale Delivery Engine is not proceeding beyond the feasibility phase into deployment. Whilst the initial feasibility study was positive (refining the choice of software platform, securing statements of intent from partners, and completing rural network design), subsequent analysis by MLL has uncovered unforeseen implementation complexity and commercial risks which challenge the pilot's feasibility within its original cost estimates and budget. MLL has concluded that while the proposal's concept is good, the timing is not right for continuing and BDUK has accepted their proposal to halt the pilot before deployment. Findings from the feasibility phase and the rationale for not proceeding are available in the report published by MLL (https://mlltelecom.com/aggregating-small-wireless-networks-feasibility-study/).

3.3 What happens next?

We hope to share learning and to generate discussion within the superfast broadband industry through publication of this summary document and the more detailed findings the pilot suppliers have published today.

The seven remaining MTP projects are proceeding into deployment; feasibility reports will be updated during the deployment phase which runs until end March 2016, and we will provide periodic updates on progress. We expect the first customers to be connected by the end of February 2015 and we are looking forward to getting customer data from the projects as they go live. Please see Page 28 of this report for the scheduled deployment across the pilots.

Evidence from the projects and our broader engagement with industry are helping to inform decisions about future funding for superfast roll-out to go beyond the current 95% target.

4 - Market Test Pilot project summaries

This section provides a summary of the final 5% challenge that the pilot projects are addressing and provides a summary of lessons learned from the pilot feasibility stage.

4.1 Summary of the final 5% challenge

The remaining unserved premises (approx. 1.5 million) are geographically dispersed across the landmass of the UK and found in a mix of locations, with differing topographies, population densities and with different proximity to existing basic and superfast broadband networks. These different characteristics present distinct challenges to suppliers and reduce the likelihood that a 'one size fits all' approach can be used for roll-out

Unserved areas display varying characteristics:

- Individual sites, within the middle of a supplier's broadband footprint, that cannot obtain access to superfast speeds because of the particularities of the available network infrastructure;
- Island areas with multiple premises, surrounded by infrastructures that have been upgraded to support superfast broadband but which have not been upgraded due to economic factors applying to the specific areas (e.g. no intermediate access points, high power installation costs, low number of customers, wayleave issues); and
- Contiguous areas at the margin of existing broadband infrastructure(s), which are often not upgraded to support superfast services because of the relatively high cost of extending infrastructure capability to support these locations. These areas often have poor basic broadband availability as well.

The unserved areas vary significantly in terms of the density of premises:

- Approximately 20% of the unserved areas are likely to be in areas with greater than 2,000 premises per km2, however the majority of these are in cities where BDUK's current approach is to stimulate the market through demand-side measures.
- Approximately 20% of the unserved areas are likely to be in areas with population density between 500 and 2,000 premises per km2; and
- Approximately 60% of the unserved areas are likely to be in areas with population density below 500 premises per km2.

Other factors may affect how easy it is to deploy infrastructure in an unserved area. Considerations relevant to deployment typically include the cost of power provision, a roadworks moratorium, wayleaves negotiation issues, or planning issues within national parks. The impact of these and other factors will be a key learning from the deployment stage of the pilot projects.

4.2 AB Internet – link to report here

4.2.1 Project overview

Location	Monmouthshire, Wales
Ambition of the pilot	AB Internet's ambition is to educate the market about FWA networks and to establish their NGA credentials as well as their suitability to be deployed in the final 5%. To this, they will build a 'county-wide' network, with the advantage that long range links facilitate 'drop-off' connectivity in select areas.

Primary lessons learnt from feasibility stage

- Commercial model: Confirmed that the commercial model is viable in the remaining 5% and especially in challenging geographies;
- Access to mast sites: Documented the approach to locating and acquiring suitable mast sites;
- Capacity planning: Documented capacity planning to meet NGA state aid requirements.

Primary lessons to be learnt from deployment stage

Technical

- Test speeds, latency and jitter of FWA networks in the field.
- Deploy and test a range of CPE[3] equipment and gather data on the cost and performance benefits of High, Medium and Low tier CPE.
- Identify if 'Next generation' 5.8GHz point-to-point wireless units have a role to play in middle-mile backhaul in Rural Areas.
- Establish if a mixed bearer network has any input on service level.
- Test the effectiveness of renewable power sources in deployment of FWA networks.

Commercial

- Gather data on the uptake ratio of different FWA retail offers.
- Gather data on the cost-per-premises in the pilot, which is typical of a final 5% area.

Other

- Gather data on delivery and installation timeframes
- Establish a failure metric of the percentage of customers that cannot economically access superfast FWA due to line of sight issues.
- Collect data on customer experience of FWA services for downloading, gaming and other online activities.
- Assess the impact of Local Planning Authority decisions on FWA networks, and how that risk can be mitigated.

Expected scalability

AB Internet's objective in this pilot is to establish the suitability of FWA for NGA networks in the final 5%. In their feasibility report, they draw attention to a number of potential limiting factors, including:

- Line-of-sight limitations: AB Internet identify this as the primary limitation of wireless networks. They plan to mitigate this via installing sustainably powered, remote-controlled masts on high, often remote hills, and by building a number of point-to-point masts in a village to provide multiple options for line of sight.
- Uplink capacity: The operator must ensure that they can purchase increased capacity backhaul if required, from BT Openreach to the demarcation point.
- Point-to-point capacity: The microwave backhaul capacity from the structure on the return path to the uplink needs to be carefully planned and the technology needs to be scalable, preferably through software.
- Sector capacity: The number of subscribers per sector needs to be considered carefully as the actual TCP[4]

[3] Customer Premise Equipment, located at subscriber's premises and connecting to the supplier's broadband network.

throughput on any given air interface is a finite resource.

- Structural loading: The load bearing capabilities of the mast or tower structure must be professionally assessed periodically to ensure that it is in good serviceable condition

However, AB Internet argue FWA nevertheless has some significant advantages over fibre for delivering NGA networks in the final 5%:

- Reach: Point-to-point can go 50km in a single hop, with a multiple chain of hops, and at each of these hops they can position a point-to-multipoint, which can reach 15km to premises in all directions.
- Rapid deployment: No wayleaves or complex trenching required, so can be deployed quicker than fibre.
- Resilient: FWA networks have been successfully deployed in remote areas such as Snowdonia.

4.2.2 Summary of commercial model – AB Internet

BDUK Market Test Pilots **Pilot location and funding summary**	
Company name	**AB Internet**
Project location	**Monmouthshire**: Abergavenny, Monmouth, Chepstow, Caldicot & Caerleon
Number of premises in intervention area	1,696
Target number of premises to be connected	1,000

Capital Expenditure (Capex)	
Public Capex contribution for feasibility study	£234,961
Public Capex contribution for deployment	£593,200
Total public funding	**£828,161**
Supplier Capex contribution for deployment	£86,520

[4] Transmission Control Protocol is one of the core protocols of the Internet protocol suite (IP). Web browsers use TCP when they connect to servers on the Internet.

4.3 Airwave – link to report here

4.3.1 Project overview

Location	North Yorkshire
Ambition of the pilot	The pilot aims to test the viability of four technologies for the last mile (to premises) of a broadband network. The four technologies are: 5GHz point to multipoint; TV White Space point to multipoint; Wi-Fi; and LTE (Long-term evolution). Airwave will test their viability by using each of them in the field when creating a wireless superfast broadband network in North Yorkshire.
Primary lessons learnt from feasibility stage	
• Both 5GHz point to multipoint and LTE appear to be viable solutions: Airwave conclude from their feasibility report that both 5GHz point-to-multipoint and LTE (Long Term Evolution) technology appear to be capable of meeting NGA requirements for the last mile to premises of a broadband network. • WiFi also appears viable for low numbers of users: Wi-Fi also appears in the feasibility studies to be NGA capable for the last mile with low numbers of users, i.e. less than 10 premises. • TV White Space does not appear to be viable at this stage: TV White Space point to multipoint technology does not meet the NGA requirement at this time; however, Airwave conclude that it could potentially offer an excellent method to provide capacity over difficult terrain or through foliage cover, and evidence suggests that future generations of this technology can be expected to be NGA compliant.	
Primary lessons to be learnt from deployment stage	
• How the four wireless technologies perform in the field: This pilot set out to investigate how these four wireless technologies performed in the final mile to premises; their deployment phase will now test the conclusions drawn in their feasibility report about the technologies' viability in the field. • Evidence of the commercial viability of a FWA network in the final 5%: In light of the perceived barriers to a FWA solution to the final 5% (set out in scalability below), this pilot will provide valuable evidence on take-up rates and opex costs.	
Expected scalability	
Airwave draw attention in their report to what they see as the barriers to entry for FWA operators providing superfast broadband for the final 5%, in particular: • The high cost of high-speed backhaul in rural areas. • The current lack of nationally available data about NGA white area locations. • The high cost of licensed spectrum. • The lack of the opportunity to cross-subsidise the opex costs for the final 5%, due to there being few remaining areas of significant population density. • For these reasons, they believe their FWA solution may not be viable to serve the last 0.5% of the population due to too high opex costs without cross-subsidisation. • Airwave identify a "sweet spot" for their FWA technology, in areas of moderate to low subscriber density, roughly in the range of 10 to 1000 per square kilometre.	

4.3.2 Summary of commercial model – Airwave

BDUK Market Test Pilots **Pilot location and funding summary**	
Company name	**Airwave**
Project location	**North Yorkshire**: Esk Valley area and Upper Dales
Number of eligible premises in State aid area	374
Expected number of premises passed	300

Capital Expenditure (Capex)	
Public Capex contribution for feasibility study	£276,800
Public Capex contribution for deployment	£1,286,133
Total public funding	**£1,562,933**
Supplier Capex contribution for deployment	£328,071

4.4 Quickline – link to report here

4.4.1 Project overview

Location	
Ambition of the pilot	Working with Hull University, Quickline aim to demonstrate that a wireless solution to Superfast Broadband delivery to the currently unserved last 5% of UK premises is possible, and with the right funding models can be made available at appropriate cost.
Primary lessons learnt from feasibility stage	
• The effectiveness of desk top planning exercises: Good wireless propagation models exist which, when linked to terrain databases such as Ordinance Survey maps and maps such as Google Earth, provide excellent link planning tools, enabling a significant proportion of wireless planning to be undertaken in the office. However, Quickline caution that the output is only as good as the data used, and on-the-ground checks are still needed – e.g. some obstacles can be used as reflectors – and it's not always clear from maps if tree foliage will block a radio path. • The need for three main propagation scenarios (Line of Sight, Near Line of Sight and Non-Line of Sight technologies): Quickline conclude from their feasibility study that it is clear that these technologies will be needed in many cases to reach the final 5% of premises. One of the expected learnings from deployment will be to gain operational experience and measure the real-world performance of technologies for the three scenarios.	
Primary lessons to be learnt from deployment stage	
• Testing the performance of three main propagation scenarios (Line of Sight, Near Line of Sight and Non-Line of Sight technologies): Quickline will gain operational experience and measure the real-world performance of three scenarios, and benchmark these against the performance of fibre to the cabinet. As deployment progresses, any technology which shows a clear disadvantage in performance will be dropped from the study, so that the financial resources can then be directed towards more promising technologies. • Creating a scalable, generic blueprint for commercial loans for Local Authorities: Quickline propose to create a scalable, generic blueprint for commercial loans from Local Authorities, including the indicative costs, the method to be employed in defining need, and the procurement approach to be taken in addressing the final 5%. It is envisioned this would involve a commercial loan from Local Authorites with an interest-only period upfront, followed by a capital repayment. Quickline pioneered this approach in West Lindsey district in Lincolnshire, and will incorporate lessons learnt from this project in the final blueprint they produce. • The impact of demand stimulation on take-up: Quickline have proposed to send installation discounts that would cover 50% of the cost of customer installation to households in the target area. These discounts will be redeemable with all wholesale partners or white-label retailers operating in the pilot area. The purpose is to produce rapid customer uptake in the target area, which is needed to make the commercial network sustainable. This can then be compared to take-up for wireless pilot schemes that are not subsidising installation costs.	
Expected scalability	
The deployment phase will test the viability of the Non-Line of Sight technologies, as well as the commercial loan and the impact of discounted connection fees.	

4.4.2 Summary of commercial model –

BDUK Market Test Pilots **Pilot location and funding summary**	
Company name	**Quickline Communications**
Project location	**Northern Lincolnshire**: North Lincolnshire and North East Lincolnshire
Number of eligible premises in State aid area	4,211
Expected number of premises passed	4,211

Capital Expenditure (Capex)	
Public Capex contribution for feasibility study	£54,000
Public Capex contribution for deployment	£2,000,000
Total public funding	**£2,054,000**
Supplier Capex contribution for deployment	£573,505 After March 2016, additional £18,823

4.5 Avanti – link to report here

4.5.1 Project overview

Location	Scotland and Northern Ireland
Ambition of the pilot	Avanti are piloting a new superfast broadband wholesale platform across the UK to deliver 30Mbps services to customers in the pilot areas of Northern Ireland and Scotland.

Primary lessons learnt from feasibility stage

- Previous consumer experience of Satellite Broadband services can create a barrier to entry for updated satellite services.
- Basic white areas are very distributed and sparse.
- Lead time for state of the art satellite equipment (CPE and ground station equipment) needs to be factored into deployment plans.
- State aid approval, even for intervention on Basic white areas needs careful consideration and appropriate service design.
- Working through local bodies to facilitate delivery on the ground is essential.

Primary lessons to be learnt from deployment stage

- Whether the project is able to successfully deliver speeds of 30Mbps for all customers: This service will be deployed in basic broadband areas (i.e. less than 2Mbps) and deliver up to 30Mbps; this will represent the first time speeds of this level have been offered to domestic customers over satellite in the UK.
- What the customer experience of superfast satellite is compared to other delivery technologies: This is the first time domestic superfast satellite services are being made available in the UK on a large scale; the project will deliver valuable learning in terms of customer experience in light of the latency factor inherent with satellites.
- Local planning restrictions: Can local planning restrictions on dishes be addressed via the use of dual-feed using TV antennas?
- Technical challenges for ISPs: This project will help demonstrate what the technical challenges are of satellite broadband for ISPs to potentially enable service operators to create hybrid networks involving other technologies such as fibre.
- Demand stimulation: Monitor and assess the impact and effectiveness of a targeted marketing campaign, including the use of onward referrals from existing customers.

Potential advantages of using superfast satellite

- Ubiquity: Avanti make the point that satellite broadband is accessible for any customer with a line of sight to the satellite. To this end they include the evidence that during the Scottish Government's Reach project, only nine customers from a base of over 2400 could not achieve line-of sight to a satellite (0.375%).
- Outside-in: This ability to reach all areas allows satellite to potentially form part of an 'outside-in' approach to rolling out broadband, starting with outlying areas and then moving into more densely populated areas.
- Spectrum availability: This is a fundamental constraint for any wireless technology, including satellite; however, Avanti's satellite, HYLAS 2, operates in Ka-band, a relatively unexploited frequency, which reduces this constraint.

Expected scalability

If successful, this solution could be deployed to almost any part of the UK (subject to satellite line of sight). However, it is currently constrained to Basic white areas if State aid subsidy is required under the current BDUK State aid approvals.

Current constraints on using superfast satellite

Avanti believe that despite this, there are currently constraints on satellite's ability to fill in the final 5%

because of the overall capacity in the current UK satellite provision. They believe that the number of customers served by superfast satellite could be increased, however, by:

- Contention: This pilot will help Avanti refine how they manage contention on their network, with the aim being to free up more capacity for users.
- Advanced data compression techniques: Avanti report that improved data compression techniques have, in vendor testing, resulted in a 35% saving in bandwidth use; again the pilot will give Avanti an opportunity to test these improved techniques.
- Satellite capacity: The largest constraint on satellite's ability to deliver services on a mass scale is the current capacity of satellites over the UK.

4.5.2 Summary of commercial model – Avanti

BDUK Market Test Pilots **Pilot location and funding summary**	
Company name	**Avanti Limited**
Project location	**Scotland and Northern Ireland**: Antrim, Fermanagh, Aberdeenshire, Dumfries and Galloway, and The Borders
Number of premises in intervention area	13,000 premises in Scotland and 2,388 postcode areas in Northern Ireland
Expected number of premises to be connected	1,000

Capital Expenditure (Capex)	
Public Capex contribution for feasibility study	£35,640
Public Capex contribution for deployment	£850,000
Total public funding	**£885,640**
Supplier Capex contribution for deployment	(Commercially sensitive)

4.6 Satellite Internet (BeyonDSL) – link to report here

4.6.1 Project overview

Location	Devon and Somerset: Luxborough, Simonsbath and Priddy
Ambition of the pilot	Demonstrate two satellite-based technologies: 1 – Satellite as a backhaul providing a Superfast broadband downlink into a central point to be distributed over a fixed wireless access network (3 x 50 premises) 2 – Superfast satellite direct to home on the same service levels as the wireless offering. (50 premises)
Primary lessons learnt from feasibility stage	
• There are high management overheads for small scale projects (Supplier, BDUK and local body.) • The commercial model for a backhaul hub requires circa 20 premises to be connected to offer commercial advantage over direct to home service. • Negative perceptions exist from previous satellite deployments	
Primary lessons to be learnt from deployment stage	
• User experience • Actual deployment costs • Performance trials • Take up levels	
Expected scalability	
Once installed, the service is expected to be commercially sustainable for the next 5 years. Growth is possible but two issues likely to impact: 1 – Overall UK satellite capacity; 2 – Local satellite and wireless installers are required to design and deliver bespoke services to communities. At present, there is considerable resource committed to satellite dish installation and this may need to be re-trained and deployed if a large scale mobilisation is required.	

4.6.2 Summary of commercial model – Satellite Internet

BDUK Market Test Pilots **Pilot location and funding summary**	
Company name	**Satellite Internet**
Project location	**Devon and Somerset**: Luxborough, Simonsbath and Priddy
Number of premises in intervention area	300
Expected number of premises to be connected	200

Capital Expenditure (Capex)	
Public Capex contribution for feasibility study	£97,875
Public Capex contribution for deployment	£77,250
Total public funding	**£175,125**
Supplier Capex contribution for deployment	£17,000

4.7 Call Flow – link to report here

4.7.1 Project overview

Location	Hampshire
Ambition of the pilot	To achieve maximum superfast broadband within a rural area with a combination of technologies that are determined by the local topography: FTTC/SLU (61% of the premises), FTTP (28%), and FWA (12%). The aim is to establish whether this hybrid approach can be applied successfully in whole rural exchange areas and tests various methods to reduce the cost of deploying fibre and wireless superfast networks such as the use of Physical Infrastructure Access (PIA – access to BT's poles and ducts), installing new poles, innovative installation techniques such as the use of a vibratory plough for trenching, high capacity wireless links, and bonding copper pairs at the cabinet.

Primary lessons learnt from feasibility stage

- Innovative hybrid delivery method to maximise coverage: Call Flow believes that the chosen area is typical of the final 5% in that a single delivery method will not be cost-effective for all premises. The feasibility study demonstrates its hybrid delivery method is suitable for entire rural exchange areas, and offers the potential for these areas to achieve close to 100% superfast coverage with a commercially viable model.
- Utility and scalability of desktop exercises: Much of the network design in the final 5% can be carried out accurately using desktop tools such as radio planning tools, Google Earth and Google Street View, and can reduce the overall cost of the on-site scoping stage. The tools make it possible to investigate and iterate multiple route options efficiently to find a viable option. In this project the tools have also been used to identify opportunities to leverage the initial stages of the network design, in which the FTTC and FTTP solutions are configured, to reach more of the premises that are currently too far from existing cabinets to get superfast via FTTC.
- Local liaison: for rural projects, targeted local liaison can be extremely useful, particularly at the network design stages.
- Use of Physical Infrastructure Access (PIA): Call Flow will deploy approximately 70% of its core routes between cabinets using BT's duct and pole infrastructure where viable. Although PIA has been in place since 2010, Call Flow believes it is the only active operator taking advantage of this regulatory remedy, and it also believes that PIA is an important enabler to achieving fibre connectivity in rural areas to minimise costly and contentious new network build.
- Taking advantage of the relaxed planning rules: There is a window of opportunity currently available for 5 years to take advantage of the revised planning regulations. Call Flow has benefited from working closely with the County Councils and the National Park on local planning, and see this as a useful fall-back should the other better/cheaper deployment methods fail.
- Working with land-owners: Previous commercial models often do not apply to the type of deployment required in the final 5%. Call Flow has demonstrated successful collaboration with landowners that allows significant leverage on the mutual benefit of bringing the network to the landowners' farm and other premises, and usually other buildings they own/lease. The landowner will receive a peppercorn rent (typically £1 p.a.) for cable installed on their land in return for superfast connectivity.
- Impact of incremental fixed operational costs on a small scale deployment: Call Flow will be charging customers in this pilot 30% more than a standard broadband package to reflect the additional costs it incurs by deploying a stand-alone rural network that is unable to substantially leverage existing backhaul infrastructure in the area. Call Flow believes that an area of approximately 3,000 premises would provide the necessary scale to bring the retail cost back to the current market levels.
- The Valuation Office Agency (VOA) approach to business rates: The VOA approach for new fibre NGA networks is not specifically harmful to the commercial viability of these networks. Call Flow believes that the uncertainty of the implications for FWA networks are mitigated by their hybrid deployment model.
- Gigabit radio links in the uncoordinated 'light licenced' spectrum can be a cost effective means to deliver high capacity bandwidth over relatively short distances for deploying the core network in rural areas, and

assists in achieving the required economies of scale in the final 5%, where premises are highly dispersed.

Primary lessons to be learnt from deployment stage

- Bonding of copper lines: Call Flow plans to explore two different techniques for bonding copper pairs, which extends the reach of FTTC/SLU from 1km 'straight line' distance to 1.85km.
- Trialling the vibratory plough technique: Call Flow plans to use a vibratory plough for trenching where viable as an alternative to deploying new poles. The benefit is twofold: firstly, to avoid local objections to planning proposals; and secondly it can be beneficial from a long-term operational expenditure perspective.
- The variation in take up rate in relation to the current broadband service: Call Flow has observed that take up rates are currently low where existing download speeds are in excess of 4 Mbit/s. Typically the more rural the exchange, the higher the level of Exchange Only (EO) lines, where there is no cabinet between the exchange and the customer, and therefore no option to deploy FTTC/SLU. These lines are more likely to have a 'good' existing ADSL broadband service because they are often close to the exchange. Nearly 100% of the EO lines in this project will have a FTTP solution; this pilot hopes to provide evidence on the relationship between take up and current speed.

Expected scalability

Call Flow believe their hybrid deployment model could be geographically applicable to between 50% and 70% of the final 5%, and is scalable to large portions of the UK, to provide a commercially viable approach to achieving near 100% superfast broadband coverage in some areas. Economies of scale are essential in the final 5% to achieve financially viable networks in the short term.

4.7.2 Summary of commercial model – Call Flow

BDUK Market Test Pilots **Pilot location and funding summary**	
Company name	**Call Flow Solutions (CFS)**
Project location	**Hampshire**: Bramdean and Ropley exchange areas, plus the villages of Gundleton and Bighton
Number of eligible premises in State aid area	1,478
Expected number of premises passed	1,419

Capital Expenditure (Capex)	
Public Capex contribution for feasibility study	£50,000
Public Capex contribution for deployment	£1,144,145
Total public funding	**£1,194,145**
Supplier Capex contribution for deployment	£25,000 p.a. from March 2016

4.8 Cybermoor – link to report here

4.8.1 Project overview

Location	Northumberland
Ambition of the pilot	The Cybermoor project will deliver an alternative financing solution using grant funding to leverage social investment into fibre to the premise (FTTP) and wireless networks in rural communities. It will also build a fully funded community FTTP network in Northumberland. The aim of the project is to open up new forms of finance to support other similar communities to develop their own NGA projects.

Primary lessons learnt from feasibility stage

- The social investment market is becoming more established and several brokerage organisations are operating in the market; however, their fees add at least 5% to the cost of the funding.
- The EIS / SITR tax allowances are raising the attractiveness of social investment in rural broadband projects – both to philanthropic major investors and local investors in individual communities.
- Cash flow challenges: As well as investment in projects, the issue of cash flow can present an even greater challenge for these projects. Typically the community has no access to the level of project funding available from commercial banks. In addition, social investors do not provide sufficient – or sufficiently timely – investment to allow the project to process, due to their unwillingness to commit until the risks and returns have been firmed up. Future reports will identify possible ways to overcome this issue.
- Logistical lessons from working with communities: It is important the communities understand the legal guidance and the grant application guidance from the beginning. It also preferable that community representatives are provided with rigorous templates and clear timeframes for the start-up phase so that they don't become disillusioned by slow progress.
- Managing community expectations: Enthusiasm is high at the start, but maintaining support in community projects can be a challenge over time. Local communities tend to under-estimate what it takes to make projects happen, so their expectations need to be managed from the beginning.
- Project management needs to be well structured to ensure delivery on time and budget; but at the same time sensitively managed when local resources are a key element of the low-cost delivery mechanism.
- Start planning wayleaves and easements as soon as possible: Although most are already in place and others are in progress for this project, Cybermoor has found that the process can be delayed by issues such as finding the correct landowner, and crossing farming land which might be receiving EU subsidies. Farmers can be concerned that installing cable will impact the ability to receive these EU payments – this is not true, but necessary documentation can be made available from English Nature, and should ideally be dealt with at a national level, as local level agreements can take months to arrange.
- Ensuring communities understand the options available: Cybermoor also emphasises the need to ensure communities properly understand the full range of technical options and relative costs and benefits of a future-proof service.

Primary lessons to be learnt from deployment stage

- The extent of reduction of labour costs that can be achieved by using local contractors and engaging the local community to assist where possible. It is anticipated that engaging with residents – the so-called – 'dig-where-you-live' concept, can reduce costs further.
- Take-up patterns: Cybermoor has a concern that customers may initially opt for cheaper, non-superfast services, which would reduce the viability of this project due to the impact on revenue. However, they think the demand pattern will change towards superfast speeds in the longer term.
- Whether community-funded models represent a successful model to scale up. In light of the concerns regarding cashflow and community engagement, the deployment of this project will help demonstrate whether community-funded delivery models represent a lasting model to scale up for delivery of superfast broadband to the final 5%.

Expected scalability

One key purpose of this project is to determine whether and how the concepts developed during the project can be formed into a template(s) which can be applied to other rural communities.

Cybermoor has been in operation for more than 12 years and has consolidated its learning into a product badged as “Broadband-in-a-Box” (BBiaB). The concept works on the basis that the product includes everything needed for a rural broadband project and users could take as much or as little from the box as they needed for their individual project. Cybermoor believes that this pilot project can develop the product set further and improve the opportunity to provide scalability for the final 5% by adding new elements such as social investment funding to the items already covered, which includes volunteer policies, wayleave contracts, and tenancy agreements.

4.8.2 Summary of commercial model – Cybermoor

BDUK Market Test Pilots **Pilot location and funding summary**	
Company name	**Cybermoor Services Ltd**
Project location	**Northumberland**: Three shortlisted communities; one community – South Tyne Valley – progressing to deployment.
Number of eligible premises in State aid area	300+
Expected number of premises passed	300

Capital Expenditure (Capex)	
Public Capex contribution for feasibility study	£100,909
Public Capex contribution for deployment	£349,088
Total public funding	**£449,997**
Supplier Capex contribution for deployment	£374,562

4.9 MLL - Project overview: link to report here

Location	Kent
Ambition of the pilot	MLL identified four challenges facing small Wireless Internet Service Providers (WISPs) who seek to scale-up in size to address the final 5% of premises: Barrier to expansion presented by the required investment in operational and business support systems (OSS/BSS); minimum viable project size; access to fibre backhaul; and enabling open access. The pilot undertook to reduce these barriers via three innovations: 1. A business support system specifically for the Wireless Broadband Access (WBA) marketplace, 'WBA Marketplace', with defined technical and business interfaces for both network providers and ISPs. 2. A Software as a Service Solution (Saas) for the Operational Support Systems (OSS), compatible with the WBA marketplace interfaces. 3. Providing affordable backhaul extension by wireless radio. To prove the concept, MLL proposed that the pilot would: • Create the WBA Marketplace, Software as a Service (SaaS) OSS Solution, and the supporting infrastructure. • Demonstrate the approach to overcome the barrier to expansion by integrating existing WISPs as WLA and/or ISP market participants. • Demonstrate the approach to overcome the minimum viable project size by operating a new small FWA network as a WLA participant in the WBA Marketplace. • Including a demonstration of Backhaul Extension by Radio (BEBR) in the new FWA network. • Demonstrate an Open Access solution through operation of the WBA Marketplace.

Decision not to proceed into deployment

BDUK considers a 'not now' finding is a valid outcome for the pilot. Whilst the initial feasibility study was positive—refining the choice of software platform, securing statements of intent from partners, and completing rural network design— subsequent analysis by MLL uncovered unforeseen implementation complexity and commercial risks which challenge pilot feasibility within its original cost estimates and budget, and MLL raised these immediately with BDUK. MLL has concluded that the proposal concept is good, but the timing is wrong and has agreed with BDUK to halt the pilot before deployment.

Implementation complexity: MLL's detailed project planning uncovered process engineering complexity around WBA Marketplace and the SaaS OSS. It has found that the costs to implement these elements are considerably in excess of MLL's initial estimate and that whilst full project costing was not completed, every option examined showed required capital investment significantly in excess of the capital grant and forecast revenues, with a further complication of uncertainty of timing. Further, there had been no adjustment for optimism bias in sizing the software development, integration, and configuration works required for the implementation of the selected software products.

Commercial risks: Forecast revenues in the pilot period were to be contingent on smooth technical and commercial operation. MLL identified three main risks to this:

1. As an initiative involving substantial software and process change, project planning revealed an expectation of an iterative approach, suggesting technical risk to net revenues.
2. Updated commercial modelling demonstrated revenues were dependent on retail of broadband connectivity outside MLL's direct control.
3. Successful revenue generation depended on commitment to 2 years of operation (for example, to support the minimum contract term an ISP would engage a retail customer), even in the event that there was a decision to sunset the service on production of the final pilot report after 6 months.

Primary lessons learnt and conclusions from feasibility stage

The barriers to small wireless networks: MLL concludes that the four challenges facing small Wireless Internet Service Providers (WISPs) who seek to scale-up in size that MLL sought to address may be overcome in time by bringing together parties via an open wholesale marketplace.

Cost estimates for projects with a significant software component: Complete detailed costing must include people and process as well as technology costs, and must allow for iteration and discovery typical of programmes with a significant software component.

Commercial risks and certainty around future state subsidy: The commercial attractiveness of operating in such a marketplace is critically dependent on a thriving wireless broadband market, in turn dependent on level and timing of state intervention. The supplier's supporting revenue model must allow for big-picture risks, such as political and regulatory risks.

Expected scalability

While the project did not prove viable for MLL under the BDUK Market Test Pilots Programme, MLL believes its proposition remains valid. Market research MLL conducted as part of their feasibility stage suggested a keen interest in the potential solutions from both retailers and wholesalers of broadband.

MTP Supplier	2014/15 Jan	Feb	Mar	2015/16 April	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Satellite Internet Satellite Devon & Somerset	Network Deployment						Customer Connections and Service Delivery								
Call Flow Fibre, Fixed wireless, sub loop unbundling Hampshire	Network Deployment				Customer Connections and Service Delivery										
Airwave Fixed Wireless Access North Yorkshire	Network Deployment				Customer Connections and Service Delivery										
Avanti Satellite NI & Scotland	Network Deployment			OSS/BSS systems and processes		Customer Connections and Network Roll-out							Service Delivery		
AB Internet Fixed Wireless Access Monmouthshire	State Aid	Network Deployment									Customer Connections and Service Delivery				
Cybermoor Social Investment, FTTP and Wireless Northumberland	State Aid	Network Development							Customer Connections and Service Delivery						
Quickline Fixed Wireless Access, alternative financial model	State Aid Consultation and Clearance			Network Development					Customer Connections and Service Delivery						

Concurrent Customer connections and network build

5 - Scheduled deployment of the Market Test Pilots