Programmes and Investment Committee

Date: 13 October 2017

Item: Emergency Services Network

This paper will be considered in public

1 Summary

1.1 The purpose of this paper is to request unbudgeted Financial Authority and Programme and Project Authority for the construction and operation of a neutral host 4G telecommunications infrastructure to support the extension of the new Emergency Services Network (ESN) within the below ground areas of London Underground (LU) and selected Docklands Light Railway (DLR) and London Overground (LO) locations, funded by the Home Office.

1.2 Under Standing Orders, the authority sought in this paper is reserved to the Board. On 19 September 2017 the Board delegated to the Programmes and Investment Committee authority to approve those matters reserved to the Board in relating to the ESN.

1.3 A paper is included in Part 2 of the agenda which contains exempt supplementary information. The information is exempt by virtue of paragraph 3 of Schedule 12A of the Local Government Act 1972 in that in contains information relating to the business affairs of TfL. Any discussion of that exempt information must take place after the press and public have been excluded from this meeting.

2 Recommendation

2.1 The Committee is requested to note the paper and the supplemental paper on part 2 of the agenda and in accordance with the delegation granted by the Board on 19 September 2017 to:

(a) grant unbudgeted Financial Authority and Programme and Project Authority of £267m, subject to TfL receiving matched grant funding from the Home Office, in relation to delivery and operation by TfL of neutral host 4G infrastructure to support the new Emergency Services Network service in the below ground sections of the London Underground and selected Docklands Light Railway and London Overground locations; and

(b) note that any contracts to be entered into in relation to the new Emergency Services Network service shall seek Procurement Authority in accordance with TfL's Standing Orders.

3 Background to ESN

3.1 UK Emergency Services (police, fire, ambulance services and other public safety users) currently rely on a dedicated voice-only communications service that is run

over a dedicated national terrestrial trunk radio (TETRA) radio based network provided by Airwave Solutions Limited (Airwave). The Airwave contracts are due to expire in December 2019.

3.2   On LU, Airwave is run over the Connect PFI TETRA radio system. The Connect PFI is due to expire in November 2019 at which point Emergency Services communications will cease, unless an alternative is found. Separate proposals on the future of the Connect PFI are due to be considered by the Finance Committee, recognising that the services provided by this contract are essential for the operation of London Underground.

3.3   In 2011, the Government set up the Emergency Services Mobile Communications Programme (ESMCP) to look at options to replace Airwave when the contracts expire. The programme is run by the Home Office, but co-funded by the Department for Health, Scottish Government and Welsh Government.

3.4   The ESMCP sets out to replace the Airwave service with one that matches it in terms of coverage and availability but in addition;

   (a)   makes high-speed data available to the emergency services to improve their performance;

   (b)   provides more flexibility to take advantage of new technologies as they emerge; and

   (c)   costs less than the current Airwave contracts.

3.5   In December 2013 the ESMCP decided to replace the radio-based infrastructure used under the Airwave service with a mobile-data (4G) based technology, which would be provided by existing commercial mobile networks rather than a dedicated national infrastructure. This new service has been termed the Emergency Services Network (ESN).

3.6   The ESMCP awarded three contracts for the provision of ESN: to Kellogg Brown and Root for programme implementation support; to Motorola to provide user services and devices; and to EE to provide mobile network coverage.

3.7   ESN is expected to cost £3,762m over the 17 years from April 2015 to March 2032, of which £1,182m will be spent on building and transitioning to ESN. Once transition is complete the programme expects ESN to cost significantly less than the current Airwave service and is targeting savings of around £3b over the lifetime of the ESN service compared to the cost of Airwave.

3.8   Each of the 9 UK regions in which ESN will operate will transition from Airwave to ESN separately. At present the ESMCP is targeting a transition from Airwave to ESN in London to start in January 2019. It is anticipated that ESN will be fully operational by December 2019.

3.9   These dates remain subject to completion of multiple streams of activity, and are highly challenging. In order to mitigate the delay risk inherent in the programme, the ESMCP is considering an extension to Airwave; but this contingency option has a variety of challenges including issues with the availability of key pieces of infrastructure after 2019.

4 ESN Approach and Challenges

4.1 The National Audit Office (NAO) published a report on ESN in September 2016, highlighting several challenges the ESMCP faces.

4.2 ESN is technically cutting edge and the approach adopted has not previously been used nationwide anywhere in the world. The technical challenges to delivering ESN are;

(a) increasing the percentage of Great Britain's landmass covered by EE's 4G network from 70 per cent (July 2016) to 97 per cent (current Airwave coverage level);

(b) developing hand held devices that will work with ESN, as no suitable device currently exists;

(c) developing new push-to-talk software to enable 'radio-like' communications between emergency services personnel and control rooms over 4G; and

(d) implementing the software and protocols that are needed to give emergency services personnel priority over EE's commercial users.

4.3 The NAO classified the project as inherently risky due its ambitious approach. There were three main categories of risk associated to ESMCP highlighted by the NAO Report; technical; user take-up; and commercial arrangements, with an overarching risk due to the ambitious nature of the timeline adopted by ESMCP.

5 ESN in the London Underground

5.1 The current Home Office contract with EE for the provision of a 4G mobile network service and the extension of existing commercial coverage does not include several "not spots" in the U.K., where mobile coverage is currently unavailable. With the exception of a small number of locations, the contract excludes the below ground estate of London Underground (LU), Docklands Light Railway (DLR) and London Overground (LO).

5.2 The emergency services will not transition to the new ESN without coverage on the LU, DLR and LO estate. TfL has therefore been working with the ESMCP since 2015 to develop a technical solution for the provision of infrastructure to extend ESN into the below ground areas of TfL's network. This project has been termed 'the London Underground Services (LUS) Project' under ESMCP.

5.3 The LUS project is to be managed and delivered by TfL, with oversight and project funding provided by the ESMCP.

5.4 The LUS project covers 127 below ground stations (which include three DLR stations and three LO stations) and 197 tunnel sections. The LUS project does not include delivery of ESN on Elizabeth Line stations and tunnels, the infrastructure for which is being provided through the Crossrail Programme.

5.5 The primary project objectives of the LUS project are to:

(a) design, procure, install, commission and transition into service the infrastructure required to support the provision of a 4G service coverage below ground for ESN by the end of December 2018; and

(b) define, implement and operate a service model for the below ground ESN infrastructure. This will have to be aligned to the ESMCP's ESN service requirements and TfL operational requirements.

5.6 Separately, the Home Office will have to procure EE to provide ESN services below ground by connecting to the infrastructure TfL provides.

5.7 To date, the LUS Project has gone through various development, options analysis and feasibility stages. In July this year, an infrastructure design approach was agreed between the ESMCP and TfL. The project team has also delivered extensive survey and high level design work in preparation for the production of low level designs and construction delivery. The project has engaged with the ESMCP and EE to formalise a High Level Design.

5.8 Some physical infrastructure trials (such as the installation of cable in certain tunnel sections) have also taken place in order to assist with assurance related to the design, the delivery schedule, and cost estimates. This work has been fully funded by the ESMCP.

6 Infrastructure Options

6.1 The project's approach to infrastructure design has been heavily influenced by the need to ensure ESN services are available in below ground sections of LU, DLR and LO by 31 December 2018 to support the start of London transition in January 2019. This would help to alleviate the need to extend the Airwave contract. This is a challenging timescale given the scale of the deployment but it has been assumed that the alternative, having no underground capability for emergency services communications, is unacceptable from an operational and safety perspective.

6.2 In order to establish the 4G coverage required for ESN on TfL's below ground estate, it is necessary to ensure that sufficient propagating infrastructure, radio base stations and other pieces of active radio equipment are in place in both the station and tunnel environments, along with the necessary links back to EE's commercial network above ground.

6.3 There are a number of 'industry standard' infrastructure design approaches that are capable of achieving this and have been considered for their suitability to TfL's below ground environment. Other factors have also been considered when developing the infrastructure design approach, such as technical complexity, speed of delivery, future utility, ownership, safety, reliability and cost.

6.4 TfL has considered the following high level infrastructure options:

Stations

(a) Single Operator Solution: the creation of a dedicated infrastructure for use by EE only (effectively an extension of EE's commercial network below ground), owned and operated by EE. This would use "small cell" technology

to create coverage at station level linked directly to EE's core commercial network. This option has no future utility and raises several potential commercial and legal issues related to rights and powers EE would have over equipment they would own and operate in our environment.

(b)   Multiple Operator Solution: the creation of a "neutral host" independent infrastructure, owned and operated by TfL and initially sized solely for ESN use, but capable of being scaled for future utility, such as other operational uses or public cellular services. EE connects to the network at a "Base Station Hotel" located where access can be better managed, unlike the single operator solution where EE's equipment would be located throughout the operational station environment.

Tunnels

(a)   Existing Infrastructure: utilising existing infrastructure (i.e., passive "leaky feeder" and fibre optic transmission infrastructure provided by the Connect PFI) to connect to the EE network. Existing infrastructure is not suitable for use in its current state and provides no future utility due to its limited capacity, therefore any feasible use relies on agreeing a variation to the existing Connect PFI agreement to undertake the necessary upgrades required. This is a fall back option that may be needed in limited circumstances. As mentioned in paragraph 3.2, the Connect PFI is itself due to expire in November 2019. This would add significant complexity by adding on more work while managing exit from the Connect PFI.

(b)   New Infrastructure: install new independent leaky feeder and fibre optic transmission infrastructure within the tunnels. Provides future utility, such as public cellular services or operational use, although a second leaky feeder cable would be required to provide the capacity required for a full pubic cellular service by all mobile operators.

6.5   In July 2017, TfL and the Home Office agreed to progress the implementation of the neutral host option with new tunnel infrastructure as it offers:

(a)   the lowest infrastructure delivery risk in light of highly challenging delivery timescales;

(b)   ease of future transition and reduction of associated costs. Unlike an EE only network, a neutral host infrastructure offers the capability to more easily "switch" providers when EE's contract with the Home Office expires. This reduces the likelihood of gaps in service during future ESN provider transition phases and the risk of reliance on single source for ESN service provider if this cannot be managed;

(c)   minimal need for future infrastructure intervention (given any new provider of ESN in the future would be likely to require different equipment to EE, which would necessitate further infrastructure replacement works throughout TfL's underground environment); and

(d)   offers best value for money for the public sector as a whole, as it provides significant potential to incrementally add future capability (such as public cellular services).

6.6   There are two main technical options for the delivery of a neutral host infrastructure. The most common option is a Distributed Antenna System (DAS) that uses a combination of active (small cells) and passive (leaky feeder cable) infrastructure to distribute a mobile operator's signal from a base station hotel around the locations being served. This solution is commonly used on other metro railways such as New York. The newer alternative is a Multi-Operator Radio Access Network (MORAN) solution, which we have trialled on the Waterloo & City Line. The advantage of the MORAN solution is that it removes the need for mobile operators to install their own equipment in base station hotels, reducing the overall service cost. However, this solution is not yet widely used. EE has indicated it would not be possible to offer ESN services over this solution and our own independent analysis supports this view.

7   Delivery Approach, Project Sponsorship and Governance

7.1   The proposed delivery approach sees TfL, funded by ESMCP under terms of a Grant Agreement, delivering a solution design and procurement of equipment and certain infrastructure works to provide the necessary infrastructure to support ESN coverage and also securing its ongoing maintenance and operation.

7.2   The project has already developed a high level design for the neutral host infrastructure in tunnels and for four primary stations types. This is in final review stage with the ESMCP and EE. In addition to normal TfL Engineering assurance and approvals, ESMCP will approve the high level design following an assessment against their requirements. The network provided by TfL will work in a more restricted environment in London Underground stations and tunnels and is unlikely to be capable of delivering exactly the same service as that delivered by EE above ground.
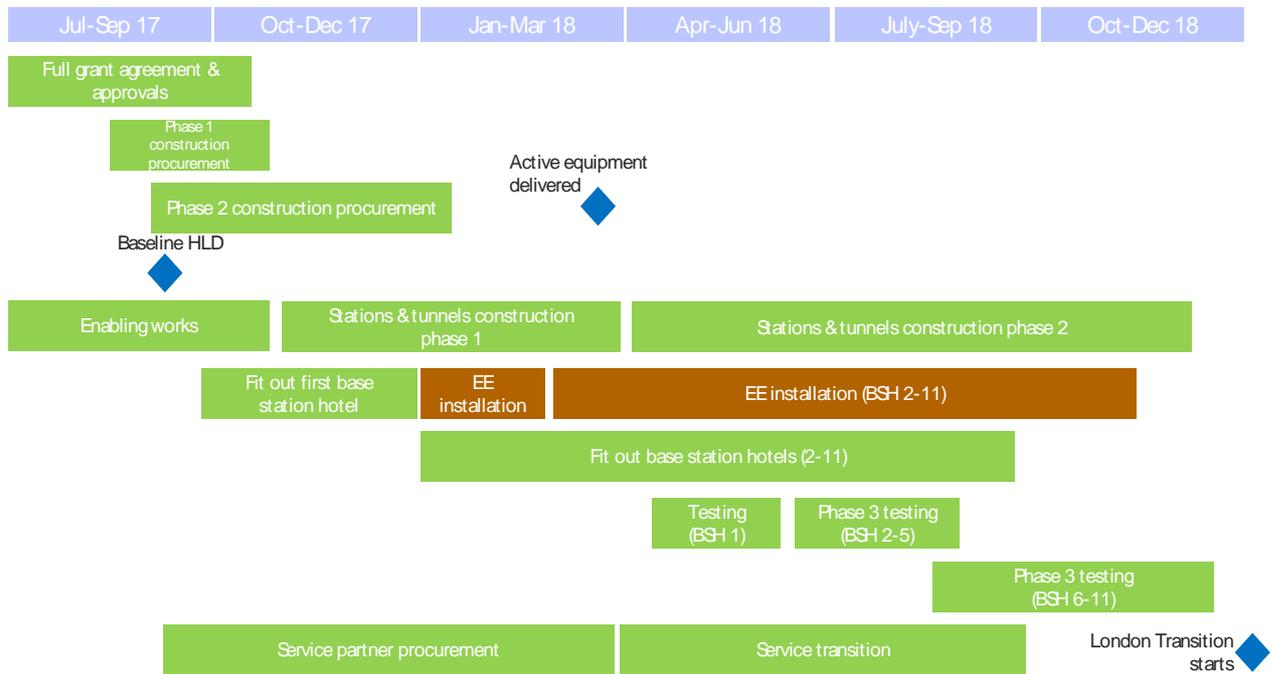
7.3   The project is now procuring the development of the next layer of site-specific low-level designs using information from surveys that have been undertaken. The current phase of design and enabling works will complete at the end of October, after which, the main construction phase is planned to begin, subject to funding.

7.4   The overall construction plan has been developed based on both the previous related experience of deploying Wi-Fi services across all LU stations and cable deployment in tunnels for other major LU projects. The installation schedule and cost metrics have been benchmarked against previous projects to ensure they are realistic from a cost and schedule perspective, recognising that the ESMCP timeframes do not allow for the levels of schedule contingency that would normally be expected. The deployment approach of using multiple teams capable of working across different sites on any given shift will minimise the impact of any frustrated access that may occur on the night for unforeseen reasons. This sort of parallel working is, in any case, needed to meet the demanding timescales over which this project needs to be delivered.

7.5   As part of the planned installation approach, the project will be looking to reuse existing fibre optic cabling and related infrastructure on the estate, where that infrastructure is of an appropriate specification, is readily available within the timescales required by the programme, and it is cost effective to do so. Where

new fibre optic cabling is required, it will be deployed so that it is capable of reuse by future projects.

7.6   The delivery schedule and main activity phases are summarised below:

Jul-Sep 17	Oct-Dec 17	Jan-Mar 18	Apr-Jun 18	July-Sep 18	Oct-Dec 18

Full grant agreement & approvals

Phase 1 construction procurement

Phase 2 construction procurement

Active equipment delivered

Baseline HLD

Enabling works

Stations & tunnels construction phase 1

Stations & tunnels construction phase 2

Fit out first base station hotel

EE installation

EE installation (BSH 2-11)

Fit out base station hotels (2-11)

Testing (BSH 1)

Phase 3 testing (BSH 2-5)

Phase 3 testing (BSH 6-11)

Service partner procurement

Service transition

London Transition starts

7.7   Given the highly challenging timescales within the programme, it should be noted that ESN infrastructure works may require access priority over other planned TfL projects. The project is actively engaging with access management teams to ensure that access planning is proactively managed to mitigate delay.

7.8   The project is sponsored by the Home Office (via the ESMCP) with internal teams acting as sponsor's agents. In addition to the normal TfL governance structure, the project also reports into a TfL-Home Office Joint Steering Group (JSG) chaired by the ESMCP programme manager. As the project moves into the construction phase, TfL and the Home Office are establishing a Joint Delivery Board below the JSG, chaired by the Home Office. This Board will meet on a fortnightly basis and act as the primary vehicle for programme monitoring and control. A sub-set of this Board will also act as the change control board for the project in accordance with the agreed change control process. This structure is set out in the following diagram.
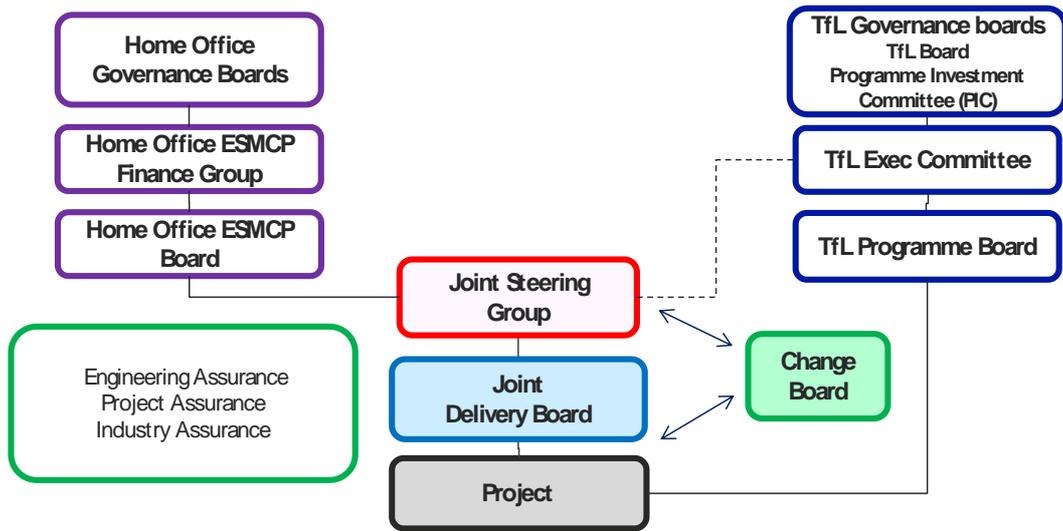
List of Appendices:

A paper on Part 2 of the agenda contains exempt supplementary information.

List of Background Papers:

None.

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