1013 iBus –
End of Project Report

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0. DOCUMENT CONTROL

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0.2 Document Summary

The purpose of this document is to provide the Project Board with a report on how well Project iBus has performed against its original criteria (as detailed in the Business Case and Project Initiation Document).

0.3 Document History

Version	Date	Changes since previous issue
00a	04.05.09	First draft
00b	26.05.09	Second draft following PMO review
00c	18.06.09	Third draft following Project Director & PMO review
00d	26.06.09	Fourth draft following TSG SMT review
1	06.07.09	Issued after final comments from Programme Manager
1.1	07.07.09	Minor changes to cost analysis table

0.4 Reference Documents

Future Business Solution Business Case

Future Business Solutions Project Initiation Document

Project Plan

078 – Lessons Learned Log

LBSL-RPT-033 Lessons Learned Report – Training

244 - Bus Stops Data Integrity - PMO Lessons Learned Register v00a

LBSL-SPC-RPT-201 Garage Installation Lessons Learned

227- iBus Change Control Forecast Summary

382 FS Quality Review

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959 Preparatory Final Acceptance Report

Draft iBus Final Acceptance Report

1005 – iBus Handover to Operations Report

0.5 Distribution

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0.6 Document Quality Assurance

Step	Step Description	Undertaken by	Date
01	Quality Review	Adrian Streeter	26.06.09
02	Project Director Review	Simon Reed	19.06.09
03	Senior Management Review	Chris Fowler	n/a
04	Senior Management Review	Silke Elvery	n/a
05	Senior Management Review	Anthony Gallagher	n/a
04	IPMO Review	David Hartley	03.07.09
05	Executive Review	Martin Davey	26.06.09

1. PROJECT OVERVIEW

The iBus project has been successfully delivered within cost budget with over 8000 vehicles installed with fully functioning Radio, Real Time Information and advanced Vehicle Location technology improving Service Control to London's Bus operators.

1.1 Background

The Business Case that gave rise to the iBus Project was set to procure a radio communication and AVL solution that would eliminate the obsolescence issues with the existing equipment and reduce the risk of a system failure. The legacy system was life expired and operating beyond its design criteria and capacity. It could not meet the (then) current or future business requirements of its users and the current performance levels were not meeting customer expectations.

The legacy Band III radio system operated by London Buses was over 19 years old and was designed to support voice and emergency communications only for a fleet of approximately 5000 buses. In 1990 LBSL began to investigate providing Automatic Vehicle Location (AVL) services using the existing voice radio network. This led to data transmission (to support AVL) being added to the radio network that was not part of the original radio design criteria. Following further area trials AVL was approved for fleet-wide rollout in 1996 and SLE was awarded the contract to develop and supply the AVL and MARQUIS system for a predicted fleet of 6500 buses. The development of AVL was pioneering at the time (no other large fleet wide system existed) and requirements were largely defined as the project developed. Changes to the requirements took place as the system rolled out (e.g. ticket machine linking) and requirements grew as further understanding of the requirements and in some cases, technology, developed (e.g. Bus Lane Enforcement Camera's, Signal Priority become part of the functional requirements). Rollout continued without a holistic assessment of the implications of the growing business requirements and limited understanding of the life-expectancy of the current system.

At the time of the Band III radio network's construction it was not envisaged that the bus fleet would grow to over 8,000 buses and data transmission (to support AVL) was never part of the original design criteria.

As a result, it was recognised by 2003 that the legacy radio /AVL system TSG operated was over loaded and life expired and was facing an increasing risk of failure on the network. These failures could have been safety critical, such as the loss of the code red emergency function or they could have resulted in the loss of AVL data, hence impacting significantly on the real time control of bus routes in London and the passenger information system, Countdown. The issues were summarized in the business case as follows:

- The legacy system was unsupportable

- The legacy system could not meet current or future requirements of the business

- The legacy system did not meet the requirements of its users

In early 2002 a project known as New Technology Development was created to research the available technology, refine and detail the requirements and, as one of it's deliverables in 2003, produce a business case under the Future Business Solutions project to address these issues with the procurement of a replacement system.

The requirements of the new system, later known as "iBus", were scoped to include the provision of a "Code Red" emergency service, service control facilities for bus operators, historical post trip journey information and system performance and diagnostic monitoring tools. Real time passenger information along with the provision of interfaces to support other TfL initiatives also formed part of the requirements.

1.2 Strategic Alignment

The iBus project was, and remains, closely aligned to the core TfL objectives.

Contribution to Surface Transport Goals

Managing travel demand: iBus has delivered comprehensive radio and AVL coverage and service control facilities to every Bus Operator. This will enable Bus Operators support improved service reliability and maintain driver and passenger safety. New real time information (RTI) sources have been enabled by iBus to ensure customers are informed of the availability of bus services and are informed of service affecting events. These services include on-bus next stop signs and direct information from LBSL's own control centre and, through the Countdown II project, the delivery of new on-street signs and SMS and web services for remote RTI access.

Making travel more accessible, safe and secure: iBus has facilitated the delivery of on-bus signs which have been proven through research and customer feedback to give strong benefits, particularly to visually impaired passengers and customers unfamiliar with the bus network. The project has expanded the availability of bus arrival time predictions to the existing Countdown network and enables future projects (Countdown II) to deliver revised sign, SMS and web services. These sources will provide easy to understand information with audio facilities, accessible to a range of disability groups. Comprehensive radio coverage is essential for driver and passenger safety. iBus has also expanded the radio service providing coverage of over >95% of the network and is handling three times as many calls as the Band III service it replaced with less queuing time. The comprehensive AVL system supports improved service reliability and improved accuracy of RTI, providing reassurance of wait times.

Improve our understanding of user needs: Extensive passenger research was carried out during the on-bus sign pilot to ensure that the proposed sign information and format met passenger needs. This research included a range of disability groups. Several research phases are also being undertaken to understand passenger requirements for on-street signs, SMS and web services.

1.3 Objectives and Planned Benefits

Prior to the procurement of iBus, the following objectives were stated within the business case:

- Simplify and reduce multiple points of failure to enable more robust service delivery to customers
- Add wireless data and voice capacity to improve Grade of Service
- Develop an 'open' platform of technology that can be evolved to meet the growing needs of the business both now and in the future
- Provide increased flexibility, innovation and scalability
- Use industry standard protocols to enable data transfer to support wider dissemination of information, e.g. web enabled browsers
- Reduce technical risk as far as possible by transferring network design and integration to the supplier
- Simplify on-bus architecture and provide improved integration of associated initiatives such as Bus Lane Enforcement Cameras, Ticket machines, CCTV etc Removal of 5000 roadside beacons. (This objective was then removed from the project scope.)

Each of these objectives was expanded through the procurement process to a formal statement of system requirements. In summary this consisted of

- The Central System Infrastructure including all AVL, radio and performance reporting components
- Voice Communications (Individual, Group and Broadcast)
- Data Communications (GPRS)
- Code Red Communications (Emergency calls)
- Bus Location Technology (Enhanced GPS)
- Passenger Information Systems (on-bus and interface for dissemination of information)
- Historic Data; including automatic statistical analysis of service delivery
- Radio/AVL System Monitoring and Diagnostic Tools
- On Bus Equipment for over 8,000 buses
- Garage Based Equipment, over 150 networked AVL workstations and over 100 networked radio dispatchers and lines.
- AVL workstations and radio dispatchers at various TfL locations
- Flexible to provide the ability to have enhanced functionality
- Services
    - Support – Incident and Problem Management
    - Operations – Service control and monitoring

- Maintenance – Break-fix and scheduled
- Installations, De-installations and commissioning
- Hosting – Data Centre and Radio Infrastructure
- Training – For All Drivers, Service Controllers and key TfL Staff

The business benefits of iBus are addressed in section in 3.1.

1.4 Baseline Estimates and Assumptions

The business case was based on the quantifiable performance benefits (EWT savings) and on bus sign benefits (Willingness to Pay).

- Performance benefits were based on at EWT savings of 0.075 minutes/boarder
- The WTP benefits were £0.026 per passenger journey

It was also assumed that entire fleet of buses was fitted over a period of 3 years, such that 4% of benefits are realised in the first year, 68% in the second, and 100% in the third.

These assumptions gave rise to the following business case summary

Benefit/Cost Ratio Analysis:

	NPV 10 Years	
Total Benefits	£	472.5
Total Revenue	£	132.6
Total Cost of System	£	104.6
Net Financial Effect	£	28.0
Benefit Cost Ratio	**Revenue Positive**	

NB: All figure in £ Millions

The benefit/cost analysis above showed that the total revenue generated from this project is greater than the cost of procuring and maintaining the system. It was therefore 'Revenue Positive'.

Following final scope agreement and BAFO the sums payable to the contractor were contractually agreed and summarised in the table below.

Category of Charges	**Total price (in £ sterling)**
System Price	£65,802,112
Refresh Price	£1,333,524
Service Charges	£39,130,171
Network Charges	£9,929,435

Grand Total	**£116,195,242**

2. END OF PROJECT REPORT

The iBus Project was the implementation phase of a ten year contract to provide an advanced radio and Automatic Vehicle Location platform across London Buses Garage and Bus fleet. The project itself can be measured in terms of the deliverables and the delivery of the primary project objectives. These are summarised below. The full Business Benefits of the project will need to be assessed at points along the contract length and it is expected that this will be performed at the half and full-term of the contract.

2.1 Achievement of the Projects Objectives

2.1.1 Deliverables

The project successfully delivered all of the technology components to the agreed functional specification. This was measured by the successful completion of the System Acceptance Test milestone. The technology deliverables were double-checked against the original requirements as part of that stage closure (see document 682 – FS Quality Review).

Central Systems Infrastructure: Following a successful SAT (systems acceptance test) the components required to support the first bus running on the system were installed and fully operational.

Voice Communications (Individual, Group and Broadcast), Data Communications (GPRS) and Code Red Communications (Emergency calls): The design and build of a ten base station Mid-Band Analogue voice radio network with GPRS data traffic was successfully in place in time for the installation of the first buses in March 2007 and was completed in June 2007, providing coverage for the entire TfL bus network to the expected coverage level (95%).

Bus Location Technology (GPS): Following combined efforts from TfL and Siemens, a location algorithm and design technology was developed which, when tested proved that we had a 95% confidence of location accuracy $\pm$ 12m with a mean of approximately 3m 24/7/365 across London.

Passenger Information Systems (on-bus and interface for dissemination of information): On bus information was trialed in the Pilot phase of the project in January 2006 and was initiated in all vehicles in July 2007. Since that date all buses have been fitted with active on bus information services. Since MR1 (Maintenance Release 1 in January-March 2008) all iBus fitted vehicles have been providing iBus data for prediction on Countdown signs.

Historic Data: Accurate recording of bus information for analysis has been an issue with the necessary infrastructure and data becoming available in late Spring 2008. Since then we have been monitoring the availability of data and note that data is still not available for all trips run.

Radio/AVL System Monitoring and Diagnostic Tools: The design and build phase of the project produced a set of business and system "dashboards" providing real-time and historic analysis tools that illustrate the performance of the system. These were trialed through the project phase known as POFT Pre Operational Functional Testing, and have been available and used for system monitoring since that project milestone.

On Bus, Garage Based Equipment, AVL workstations and radio dispatchers: Equipment at various TfL locations has been incrementally delivered in line with the rollout schedule completing in March 2009.

Item	Contract	Final number	Comment
Workstations	135	175	Agreed changes and expansion since contract signature
Garages	90	88	Garage closures since contract signature
Buses	8206	8260	Fleet expansion since contract signature
Drivers Trained	n/a	22992	Numbers clarified post contract signature. documented in CCN51
Service Controllers trained	n/a	1213	Numbers clarified post contract signature. documented in CCN51

Figure 1 Key Project Deliverables

The bus rollout commenced on the 11th March 2007 and was completed on the 21st April 2009. During that time 8260 vehicles were fitted.

Type	FGA	First Fit (Clapton)	First Fit (Norwood)	Clapton	Norwood	Roving Team	Grand Total
Artic	76			6		317	399
DD	118	12	4	2665	2189	192	5180
RM		1		17			18
SD	19	22		1040	1316	266	2663
Grand Total	**213**	**35**	**4**	**3728**	**3505**	**775**	**8260**

Figure 2 Analysis of Bus Fitment

2.1.2 Performance against Project's Planned Time/Cost Targets

The project achieved all the main objectives by the 21st April 2009 when the last vehicle was fitted.

The original project plan envisaged the installation of 8208 vehicles and a bus installation programme commencing in autumn 2006. Following a series of change requests the scope was intentionally altered to cope with the (expanding) London fleet and to rebase-line the plan and milestones to cope with difficulties experienced during the trials and development of the technology. As a result the definition of the original project "Final Acceptance" milestone was altered and was reset to the 6th July 2009.

The re-phasing of milestones was to ensure that LBSL separated the deliverables and project objectives from the need to ensure that the service level was achieved. For example, The Final Acceptance milestone has, through change control, been altered to a separate Preparatory Final Acceptance covering the deliverables, followed by a further proving of the system performance which.

	Planned	**Actual**	**Difference**
Project End Date	21/01/2009	06/07/2009	5 months
Capital Contract Cost (£)	£65m	£65m	£0
Project Cost	£84m	£81.7	£-2.3

The above costs are further described in section 4.

2.1.3 Scope History and Impacts of Approved Changes

The iBus project had a contractual change request process and change request register that defined all changes to the scope and deliverables to the project. The changes break down into three key groups:

1. Changes to enable other parts of LBSL to order enabling equipment through the iBus contract; Bus Priority (SVD) and Centrecomm

2. General changes resulting from design/project reviews

3. Key changes that changed the scope of the project in terms of key milestones and milestone dates:

    a. CCN026 – Change to use Installation Centres to complete rollout

    b. CCN088 – Change to milestone dates; Planned Final Acceptance moved to 28th February 2009

    c. CCN133 – Change to milestone dates; Planned Final Acceptance moved to 6th July 2009

The changes to the scope detailed above do not adversely affect the business case. The delays in the original bus fitting programme (acknowledged in CCN088) were mitigated by an increase in vehicle fitting rates as a result of CCN026. The table

below shows all additional expenditure on the project through changes to the contract.

	Financial Yr 05-06	Financial Yr 06-07	Financial Yr 07-08	Financial Yr 08-09	Financial Yr 09-10	Total
TSG	**£1,590,084**	**£559,903**	**£1,880,861**	**£489,561**	**£0.00**	**£4,529,411**
SMS (Remedy)**	**£0.00**	**£1,669,166**	**£63,559**	**£0.00**	**£0.00**	**£1,732,725**
SVD **	**£127,200**	**£10,510,909**	**£184,650**	**£126,765**	**£0.00**	**£10,949,524**
TPED	**£324,664**	**£0.00**	**£0.00**	**£0.00**	**£0.00**	**£324,664**
CentreComm	**£0.00**	**£0.00**	**£82,015**	**£0.00**	**£127,600**	**£209,615**
Total	**£2,041,948**	**£12,739,978**	**£2,211,086**	**£625,326**	**£127,600**	**£17,745,940**
	*** Costs for SMS and SVD include the base contract price, as well as any contract changes, as delivered through the iBus contract.*					

This table shows all expenditure relating to Contract Changes, by financial year and cost incurred by department, as at period 2 09/10.

This table is updated and published in the Surface Strategy Board every period.

3. BENEFITS DELIVERY

3.1 Strategic contribution

The project's objectives were originally scoped within the business case to deliver improvements under the twin TfL operational strategies: 'Improve system safety and customer security' and 'Improve network reliability and service delivery quality'.

Specifically these goals were to be achieved by providing a Code Red emergency response service for the safety of passengers and staff and by providing the automatic vehicle location service which enables bus operators to operate a more efficient and reliable service to passengers.

Since contract signature, the original strategic goals have changed and iBus addresses the Mayoral Priorities as shown below

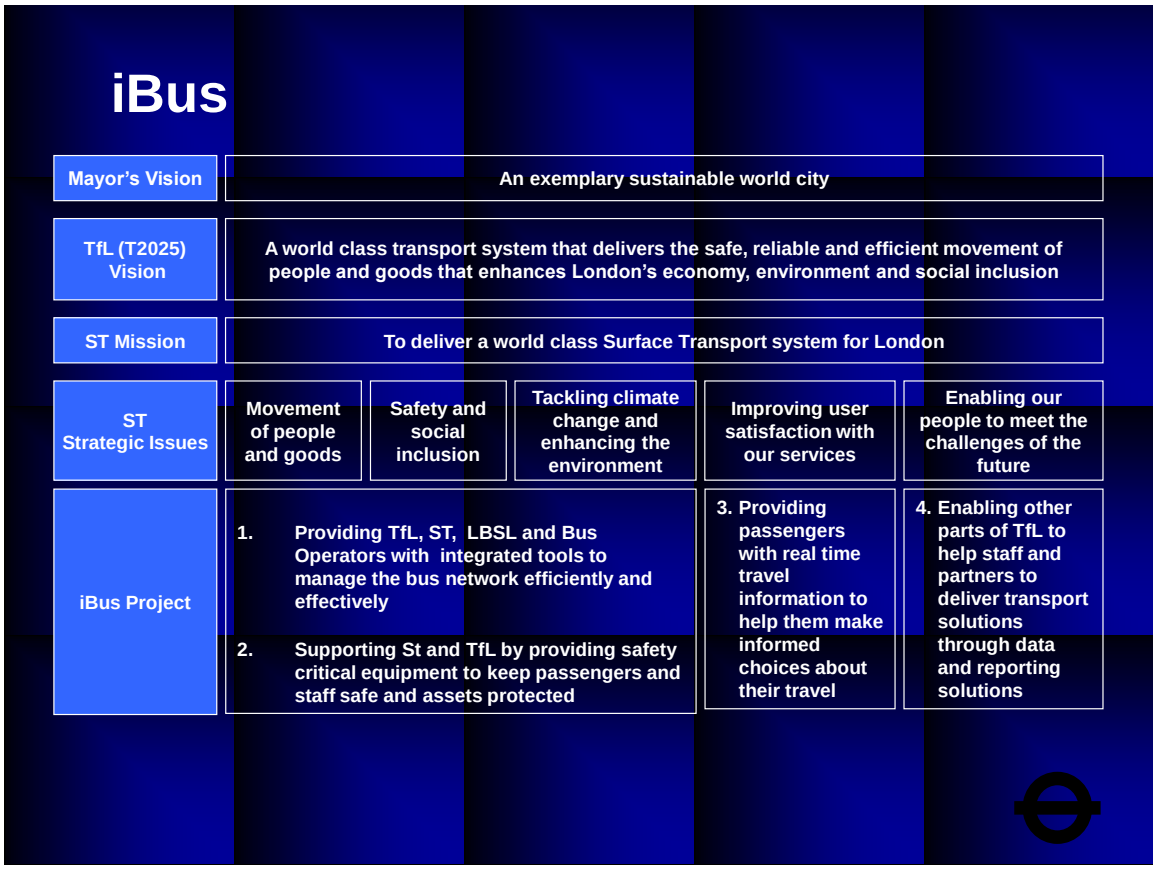


Figure 4 iBus Benefits mapped to Strategic Aims

3.2 Project Benefits – Proposed v Actual (including unexpected results)

The business case for the project that became iBus was split into a number of areas each of which was monitored pre-iBus, during the project and will continue to be reviewed for the foreseeable future (see Benefits Realisation below).

To the extent that it can be assessed at “project close”, all of the key business benefits are being delivered:

Performance benefits were based on EWT savings of 0.075 minutes per boarder. Improved service reliability is expected as a result of improved service control functionality at bus garages and more powerful analysis of historical journey time information which will enable more effective route scheduling.

Transport for London
London Buses

AVERAGE EXCESS WAITING TIME (Minutes) **HIGH FREQUENCY**

All Information Is Based On Financial Quarter Data
Please note 16 weeks worth of data for this Financial Quarter

LARGER OPERATORS

OPERATOR	MINIMUM PERFORMANCE STANDARD	15th Sept 2007 to 4th January 2008	13th Sept 2008 to 2nd January 2009	CURRENT / [PREVIOUS] POSITION	VARIANCE FROM STANDARD
London General	1.43	1.21	1.05	1 [1]	0.38
Arriva London North	1.47	1.28	1.18	JOINT 2 [3]	0.29
London United	1.41	1.31	1.12	JOINT 2 [JOINT 4]	0.29
Metroline	1.41	1.25	1.16	4 [JOINT 4]	0.25
London Central	1.35	1.35	1.18	5 [JOINT 8]	0.17
London Bus Services Average*	**1.38**	**1.31**	**1.26**	**N/A**	**0.12**
Metrobus	1.16	1.05	1.06	6 [7]	0.10
First London West	1.49	1.52	1.42	7 [10]	0.07
Arriva London South	1.40	1.19	1.34	8 [2]	0.06
Selkent	1.33	1.41	1.30	9 [11]	0.03
First London East	1.32	1.21	1.38	10 [JOINT 4]	-0.06
East London	1.38	1.33	1.48	11 [JOINT 8]	-0.10
Travel London	1.25	1.52	1.51	12 [12]	-0.26

The table above shows the Q1 2009 figure with a London Buses average improvement of 5 seconds. This is an early snapshot and is not claimed as the full benefit of the project as other factors may have applied during this period. However, EWT benefits are likely to accrue once iBus is established at garages and iBus historical reports are in operation (June 2009) with a time lag of several months to allow for new working practices to be embedded. Therefore, although initial results are encouraging, full benefits are not expected to be available for sometime.

It is hoped that EWT savings that result through the implementation of iBus can be derived by the following techniques using QSI data that is collected each 4-week period; 1) monitoring network EWT over time 2) comparing EWT for routes with iBus against those without iBus, 3) comparing network EWT against traffic congestion data (which is considered the most important influence on EWT). Initial results are due in August 2009.

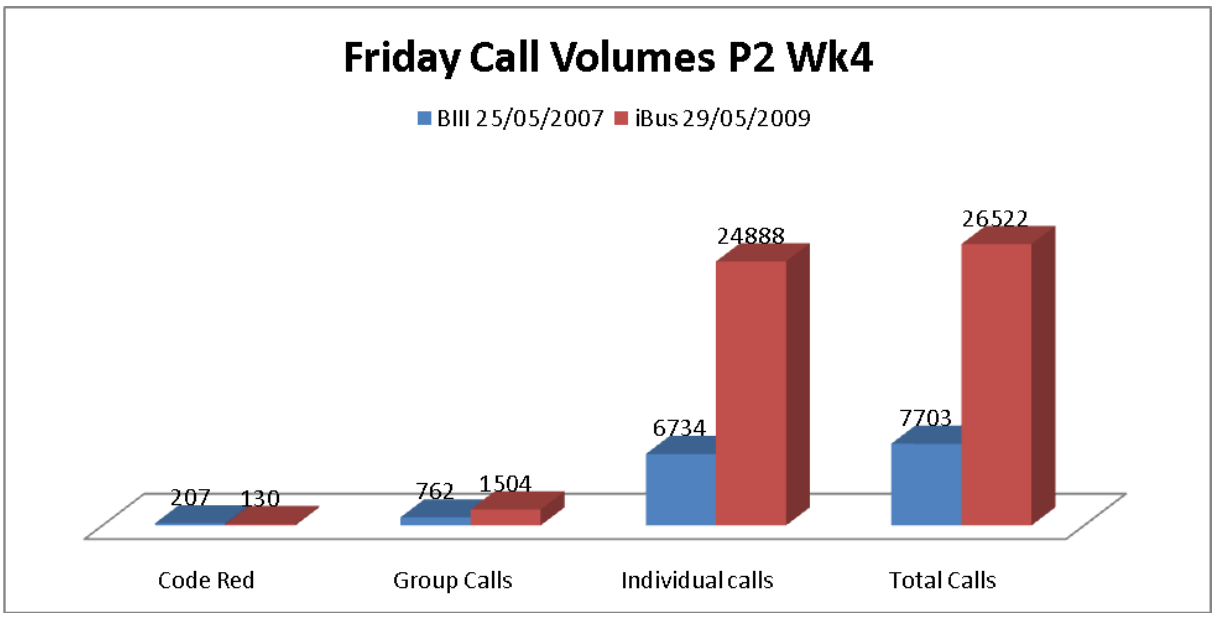
On Bus Next Stop benefits are derived from TfL research which derived a ‘Willingness to Pay’ value for OBNSS per passenger journey. ‘Willingness to Pay’ for On Bus Next Stop is a standard TfL measure and was calculated at 2.3p in 2001 (and cited within the 2005 Business Case at 2.6p) and 4p in 2008. The next surveys that will take place post-iBus rollout are due in 2013 when a revised value will be available. Until then, the availability of on-bus information is monitored by Mystery Traveller Survey where since December 2008 continuous auditing of system KPI’s such as OBNSS accuracy and audio quality has taken place using data from the TfL Mystery Traveler Surveys. Over 2000 vehicles are checked every period and the audits have shown a low level of equipment faults (~2%), a low level of inaccurate

next stop displays/announcements (<0.1%) and a high level of satisfaction with the audio announcement quality (only 1% of announcements were considered too loud or too quiet).

Non-financial (Business Case) benefits include the following;

Radio Coverage

The iBus system allows for scalability to meet the current expansion of the bus network (i.e. more garages, vehicles and routes). The legacy radio and AVL systems had been operating with a limited number of radio channels, radios and base stations, hard wired telephones, AVL workstations, and on-bus radios. The additional capacity and coverage is providing improved communications and therefore should enable improved service control. The iBus radio system has now been shown to be carrying three times as many radio calls with 50% of the queuing time compared with the Band III system.



The rollout of iBus has enabled an expansion of the radio and AVL networks. 88 garages, 705 routes and 8260 vehicles have been installed compared to 67 garages with radio and 63 with AVL covering 592 routes on the legacy system. Radio system improvements such as better radio coverage and user Grade of Service, reduced code red failures, and longer voice calls will benefit Bus Operators. iBus Radio coverage has been measured to 97% of the LBSL network, compared to <93% for the legacy system. Voice calls are now on air for 2 minutes rather than 1 minute under the legacy system. Grade of Service statistics will be measured later in 2009.

Driver Logon

Availability of buses on AVL Service Control screens has improved, with 95% on average, compared to 90% for the legacy system.

Countdown

Countdown performance is being continuously measured through 4-weekly audits of 240 signs and approximately 3000 observations per period. The accuracy of prediction 'cleardowns' has improved by ~15% on average since the introduction of iBus. Surprisingly, the availability of prediction cleardowns remained at the level prior to iBus rollout for some time but recent software changes have raised availability by ~10% and closer to the target level of 95%. A review or the accuracy of bus arrival time predictions is currently being undertaken, with a view to further optimisation of the prediction algorithm.

Additional functionality means that longer predictions (buses further away) are available to passengers, with a higher probability of predictions being displayed, particularly at signs near the start of routes. Customer satisfaction with Countdown performance is monitored through quarterly surveys (one question incorporated into the TfL Surface Transport CSS). The satisfaction 'score' rose from 76% in 2006-07 to 79% in 2008-09.

Real Time Information

Real Time information benefits certain groups such as visual and hearing impaired passengers. Benefits will be far stronger than suggested in the Willingness To Pay value. New or irregular bus users will also be expected to benefit more from OBNSS. Passenger research is being undertaken during Spring/Summer 2009 to gauge levels of awareness, 'usage' and satisfaction of On Bus Next Stop signs and announcements. These will be compared with the results that were obtained during the 2005 pilot study and the 2007 study.

The number of customer complaints regarding on board information is being collected and reported once every 4 weeks, with a breakdown of complaint type provided (i.e. availability, accuracy, volume, repetition). The level of complaints is currently low with ~30 in total per 4-week period.

Historic Journey Information

Improved historical data availability will allow a more detailed knowledge of bus operations and improved scheduling through journey time reports and automated QSI and mileage reporting, and will benefit Bus Operators, LBSL Performance and other report Users across TfL. The QSI and mileage reports are to go live in March 2010.

Automated QSI reporting will result in a higher coverage of data, and slightly different methodology which in turn will impact on QSI results. These changes will need to be monitored closely in order to ensure TfL and Operator buy-in or determine any bias with the legacy performance monitoring regime.

A more comprehensive set of QSI reports should result in more effective analysis and decision-making leading to better scheduling, understanding of route issues or service control management. These will be difficult to quantify, other than through changes to EWT or Schedule Adherence (or User satisfaction with the reports).

Automation of reports may lead to wider use across TfL and will result in cost savings which can be measured.

Automated mileage claiming should lead to a number of benefits;

- Reduced workload for Operators and TfL staff
- More accurate claims and the ability to audit claims at TfL. Changes to lost mileage results (including categories of lost mileage) should be monitored before and after implementation

Bus Priority

Bus priority at traffic signals can benefit passengers through time savings at junctions. A study to be implemented in the latter half of 2009 is being set up to test this hypothesis

Low "Bridge" Alarms

It was always expected that the iBus "Low bridge warning" functionality would lead to a reduced numbers of vehicle collisions with bridges.

Incident Event	06/07	07/08	08/09
Collision with Bridge	8	9	3

4. COST ANALYSIS

The overall costs of the system are outlined in section 2.2 and the capital, project, costs are expanded in the table below.

	Total Actuals + Plan	IP One Pager totals	Project Authority
FBS Contract Deliver	37,569,973		
iBus Contract Garage rollout	27,612,000		65,181,973
iBus Communications Management and Change Management	27,402		
iBus Labour	3,113,506		
iBus Travel	80,512		
iBus Radio Research	12,577		
Risk & Change Management	602,280		
iBus Voice & Studio	87,202		
iBus Installation Sites	845,571		
iBus CCN Refunds	(659,311)		
iBus Contract Change	5,391,379		
ETB Bus Drivers	1,060,174		
iBus Re Engineering	966,446		
Fleet Additions	1,639,591		
FBS Pre - Contract Award Cost	433,200		
FBS Pre - Contract Award Cost	532,394		
	79,314,897	**79,314,897**	
iBus - Training	681,014		
iBus - Spare buses	1,700,485		
	2,381,499	**2,381,499**	
	81,696,396	**81,696,396**	**84,000,000**

The table shows (from left to right) the total capital spend as allocated to individual headings and reported via SAP. The next column shows how the individual accounts have been summed and reported via IP Reports. The third column shows the authorised Project Authority amounts, with the original contract approval of £65m and the overall Project Authority approval of £84m

The figures are grouped with the payments to the contractor as predefined and milestone related totalling £65m.

In addition to the core contract payments, TfL had a number of other costs that are detailed above. Project staff ensured that the management of these payments remained within the authorised £84m of the Project Authority.

The variable elements of the contract going forward (i.e. following the completion of the project) are those items linked to the expansion/contraction of the bus network. Each new Garage or vehicle will need to be fitted with iBus equipment and the costs of these items are pre-agreed in the published Contractual Price book. Therefore on-going costs can be forecast and provided as an input to any decision regarding expansion of the fleet.

4.1 Value for money

The assets represent good value for money in terms of the widespread benefits delivered including a critical safety benefit and the ability to support fleet growth and changing business needs. Further details of these benefits are given in section 4.2 below.

4.2 Return on investment

- The project has delivered the full set of deliverables and achieved the stated objectives.
- The business case outcome for this project was financially positive based on the benefits of the on-bus signs and service performance.
- The final benefit can only be measured retrospectively and it is recommended that a Post Project Review is completed in 2010 to recheck the benefits against the costs to confirm that the project continues to return on its investment.

It is forecast that at that review the business case will reaffirm the benefits of the project as

- Critical safety benefits through the 'Code Red' emergency service and the near elimination of the risk of system failure have been achieved
- The recent growth in the Willingness to Pay value for on-bus signs (from 2.9 pence per passenger journey when the business case was produced to 4.0 pence) has further strengthened the business case and passenger research has confirmed that the signs have been well received

While the service performance benefits will require longer term assessment (see benefits section). The system is able to support future expansions to the fleet and additional and enhanced interfaces, such as GIS mapping for 'Code Red' calls, low-bridge alarms, digitisation of bus lane enforcement cameras and availability of on-bus CCTV in real time. It also provides new telematics options, such as a mobile and web real time services.

The project was therefore essential for safety reasons but has also provided widespread benefits to support a variety of business functions and services moving forward.

Section 2.2 shows that the project with a large high-risk delivery phase slipped one quarter over a duration of four years. This in itself is a statement on the methodology and resources used by all parties to achieve the outcome.

5. PROJECT MANAGEMENT EVALUATION

The Project was structured, in terms of contract and control, so that it would be a success with both parties having clear roles and responsibilities with clear work stream owners, decision makers and review channels. Some of the key parts of this approach to management are detailed below:

People: In general the core TfL iBus team consisted of dedicated staff (while engaged on the project) to ensure that there was no clash of priorities during the project. The majority of staff were also taken from the existing teams and were therefore already knowledgeable about the business before addressing the new technology.

Managing Change: Both parties adhered to the contractual Change Management process which formalised the management of Clarifications, Proposed Changes and the issue of Change Control Notes. Scope change was managed efficiently through these mechanisms and, although there was some £4.5m of change (see section 2.3), the changes themselves did not result in major slippage.

PPM Process / Controls: Compliance to SPEARMINT methodology – although both TfL and contractor recognised that planning (Gantts/reports etc) could have been improved. A joint risks/issues list was held between the LBSL and Contract project teams which was used to ensure joint management of major issues. For example, at an early stage this identified the key risk of vehicle installation and resulted in a change of approach, detailed under CCN026, where the majority of bus installation was completed in one of two LBSL provided installation centres in exchange for a reduction in the system price.

The project was broken down to a series of work streams with an individual LBSL owner and one or more supplier teams from within the contractor's resource pool. Each work stream was separately accountable and included its own risks and issues register and process.

Systems & Management: TfL's intention with the contract was to ensure that TfL remained the "informed customer" with controlling input to the design phase and responsibilities for the sign-off of the technology solution. The contract was also designed to ensure that the outsourced arrangement de-risked the overall solution.

Quality/Output: Through the testing regimes and the close working between the two parties, the solution is of high quality. This has been achieved by both parties working together in the design phase and at the testing phase to ensure that full agreement on the requirements, deliverables and test regime was achieved.

The Contract also helps to ensure that the delivered product "works." The Contract contains a service "performance" regime where the delivered system has to perform to pre-agreed performance criteria for system and service availability and performance. As a result, the contractor would have incurred high costs as a result of low quality deliverables when the performance was measured. Governance: The

project governance strategy was defined and managed according to 326 – iBus Org Structure and Scope, and during the project it was subject to:

- Internal Audit (February 2006)
- Independent Engineer Review (April 2007)
- Internal IM Audit (March 2009

In all cases, only minor observations were recorded.

6. LESSONS LEARNED

6.1 Summary

The entire project was run as a series of individual work streams where each work stream was managed as an individual sub-project.

As a result, each work stream had its own objectives, management overview and monitoring and ultimately a closure report that included a lessons learned section appropriate to that work stream. This included logs for training, garage infrastructure, data preparation etc.

These reports can be found in the project library under “Siemens Documents” as a stage report within each folder, or included in the Lessons Learned Log (078).

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Description	Recommendation
Governance	
TfL’s Governance processes changed through the duration of the project and either a) required existing approvals and reporting to be rewritten to new standards and b) new governing bodies with no knowledge of the projects objectives were unable to report performance correctly.	*All projects of this value should have the reporting method and governance levels agreed at the outset and these should not be changed until completion.*
Management	
Bus Stop Audit – Difficulties in obtaining uniform approach by the individual network controllers	*The staff training programme should have included three monthly refresher classes to feed back “latest problems”*
Bus Stop and Feature Recording – High risk approach dependency on one audio voice	*Plan to use two near-identical voices or exploit latest text-to-speech technology.*
Supplier Management	
Training – Difficulties with overseas supplier with full visibility of LBSL the primary training materials were developed by Siemens (later Continental) and A2B; a Swiss company. As a result all training material had been translated. This resulted in perceived poor quality and a clear delay in accepting the	*Contractual guarantees on either a) country of origin or b) allow more time for supplier validation of material. The developed technology solution was however very reliable and vindicated the use of the solution.* *See document : LBSL-RPT-033 Lessons Learned Report – Training*

training material.	
Bus Stop Data Integrity (Bus stop audit) – Difficulties with development using TfL IM. TfL IM (Logica CMG) delivered the equipment and software for the Bus Stop Audits (WP3) for this project. The project was mismanaged and delayed more than 2 months.	*If TfL IM is subcontracting, ensure "contract" has delivery data and appropriate penalties. Ensure IM have engaged Account Manager.* *See Doc. 244 - Bus Stops Data Integrity - PMO Lessons Learned Register v00a*
Installation (garage) – A number of issues arose here concerning the planning and organisation of the installation when more than one contractor was involved. The contract was signed with only one sub-contractor. By conclusion in 2009 some work streams had three sub-sub-contractors.	*Difficult to contractually control this fragmentation, but closer scrutiny of sub-contracting should have helped. see doc: LBSL-SPC-RPT-201 Garage Installation Lessons Learned*
Documentation	
Installation (bus) – Very complicated process – difficult to manage, cost to TfL and Continental to complete obligations	*Document every vehicle movement and installation process and review all installations with operators weekly. Failure to do so resulted in lengthy, time consuming and costly delays. See Doc: 078 – Lessons Learned Log*
Scale and makeup of the bus fleet	*TfL has a number of different sources of fleet data, but none of the data was sufficiently accurate to detail actual vehicle types in each garage to sufficient detail to enable installation to commence. See Doc: 078 – Lessons Learned Log*
Quality	
Configuration Management	*Testing of the iBus (or any) system is paramount and it became apparent the Contractors test platforms were (often) not configured to the same specification as the live system resulting in inaccurate test results. See Document 078 – Lessons Learned Log*

Please also note the following documents where further "Lessons Learned" information is provided:

LBSL-RPT-006 – Lessons Learnt Analysis – iBus Pilot

LBSL-RPT-033 – Lessons Learnt Analysis – Training Project

LBSL-SPC-RPT-201 Garage Installation Lessons Learnt

078 - Lessons Learned Log

6.2 Follow on Action Recommendations

All business affecting actions resulting from the above have been taken forward to and are monitored by the Service Level Meeting, run by the TSG Operations function.

The entire ‘lessons learned’ results were also taken forward and used as an input to the contracting of Countdown II, specifically around the areas of Contract Monitoring, Services and Performance.

7. HANDOVER TO OPERATIONS

This project had a named "customer" from the outset; the TSG Operations team responsible for providing the AVL and Radio service to London Buses. One of the work streams of the project, "Services", was tasked to a) design, b) test and c) through a series of Pre Operational Functional Tests – prove the procedures between LBSL and the Contractor (Continental) and the capacity and ability of the contractor to perform to the contract.

According to the initial project plan, all operations testing would be completed prior to the first bus installation. This was not possible in practice owing to the failure of the contractor to deliver the supporting Remedy (call management) and CMDB (asset management) systems (a separate project).

However this was fully noted during the completion of the initial testing project phase and did not delay the first bus entering service in March 2007. FGA (First Garage Acceptance) was completed in September 2007 with observations on the services delivered to Operations, but these were agreed and rollout across the fleet commenced.

Since that point (closure of FGA), services have been monitored by the operations team using the contracted Key Performance Indicators which is a formal review process; The SLM Meeting and service credits have applied where service levels have dipped below accepted standards as appropriate and in-line with the contract.

It should be noted that the Final Acceptance report will continue to observe known KPI deficiencies. LBSL continues to work with Continental to propose new measures to address and remedy any shortfall.

7.1 Items Outstanding at project close

Outstanding project deliverables from Continental have been included in the Preparatory Final Acceptance document and Final Acceptance document. The "Handover to Operations" document, written by iBus internal project staff covers the project work streams and their hand over to a responsible function with the Operations Team.

BUSINESS FUNCTION	**RESPONSIBLE TEAM**
Proposed Change Requests & Contract Change Notes	Surface Transport Procurement and TSG Planning Cell
Clarifications	TSG PMO
Garage Moves/Changes	Moves and Changes Team
System Performance and Availability	TSG Network Operations Centre
Fault Reporting & Management	Tech Services Helpdesk

Bus Installation/De-installation	Moves and Changes Team