

SEEDA Connected City Project – Extract from Final Report.

Please note that the following is an extract from a 17mb document reporting on aspects of the SEEDA project. I have extracted the project summary for your perusal but am happy to send you the whole document if required.

In summary, the Connexionz element was an unqualified success with the mobile nodes working very well and reliably, with various data formats and volumes. This project was cutting edge in a number of ways and the product that came from it has proven to be robust and efficient.

Evaluation Report

Deliverable no.	
Dissemination level	
Author(s)	
Co-author(s)	
Status (F: final, D: draft)	D1
File Name	rpt-Seeda-v7.doc
Project Start Date and Duration	01 April 2007 - 30 July 2008

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Executive summary

The “Reading Area Transport Information Network” project has been focused on the delivery of an enhanced unified communications network for Reading Borough Council using WiMax/Wi-Fi and on the use of the latest 3G communication capability to better deliver existing transport services and to provide a platform for the delivery of enhanced services in the future.

The capability and the potential of this communications network to deliver enhanced data collection, network management, traveller information and payment services was tested through a series of sub projects, namely:

- UTMC Communications Trial
- On –Bus Communications Trial
- UTMC Information Dissemination Sub Project
- Secure Payment Sub Project.

This report presents the findings of the evaluation study for the delivery of the Reading Area Transport Information Network project.

The first chapter sets out background of the project and reviews the objectives of each sub-project. A brief introduction to partners is also provided together with the programme and project management structure.

The WiMax/Wi-Fi network which was delivered by Metranet and referred to as the Reading Metranet is described in Chapter 2. The network is a Point to Multi Point system (PtMP) where one WiMax Base Station site communicates with a number of Subscriber Units (SUs) which provide the communications link to the on street UTMC equipment. These SUs are then Wi-Fi enabled providing Wi-Fi clouds around each SU. These provided a unified communications platform for connecting RBC’s Urban Traffic Management and Control system to on-street equipment, and also deliver Wi-Fi clouds to provide blanket Wi-Fi coverage. Detailed descriptions of the geographical layout of the wireless network, together with operational performance are provided. Three applications utilising the WiMax/Wi-Fi communication platform are outlined.

Chapter 3 describes in detail the UTMC communications trial and the evaluation. The trial demonstrated the capability of WiMax to provide a secure, reliable and efficient communications network for local authority transport management in the urban area, including communications with Traffic Signal Controllers and with CCTV cameras. Traffic signals require a high level of reliability to maintain second by second 2-way communication between the control room and the signal controllers. CCTV requires high levels of data transfer to match the existing analogue signal which is connected via Fibre Optic cable. The performance of UTMC data communication was evaluated based on a prolonged observation. Evaluation results suggest that the quality of communication via the wireless network is superior to the wired network

The application of the wireless system for communication with moving buses is described in Chapter 4. A multicarrier interface for the in-bus on board unit was developed which enabled seamless connection via GPRS, 3G and the wireless network. The capability of the interface

to provide connectivity with the buses using the wireless network was demonstrated and evaluated. A large quantity of communication data was collected and analysed. The results confirmed that the multicarrier interface was able to effectively transfer data from moving buses using the project WiMax/Wi-Fi network. It was found that the wireless connectivity provided much higher data rates and lower latencies than those provided by the GPRS/3G network.

Chapters 5 and 6 introduce two UTMC information dissemination trials, the on-foot navigation and in-vehicle navigation applications. The on-foot navigation sub-project involved the development of a Pedestrian Navigation system for a trial in Reading which had links to live public transport information for selected key destinations such as the Hospital and GreenPark. Detailed pedestrian mapping was developed together with enhanced navigation software to reflect pedestrian navigation requirements and the integration of UTMC real time public transport information. Using SmartPhones provided by Orange as a platform, handheld on-foot navigation devices were trialled in Reading by both familiar and unfamiliar users. Evaluation was carried out using both questionnaire surveys and focus group. The findings revealed that test subjects could envisage great potential of on-foot navigation device which offers on-foot navigation in combination with real time public transport information. Potential improvements to achieve a better on-foot navigation service were also summarised.

The in-vehicle navigation sub-project involved the development of a navigation system which integrated real time traffic information on delays and incidents from RBC's UTMC system with a satellite navigation system. Using portable computer as a platform, the in-vehicle navigation service was trialled by John Lewis professional drivers on their delivery journeys between their out of town depot and town centre store in Reading. The technical reliability and user acceptance of diversion routes provided by the navigation system to avoid congestion were evaluated. The results clearly demonstrated the feasibility of integrating UTMC traffic information into in-vehicle navigation systems. It was shown that acceptance level for route guidance advice was high (in excess of 80%) by professional drivers who had very good local knowledge of traffic conditions. It was also shown that the overall quality of journey time information from the UTMC system was satisfactory.

Chapter 7 presents the results of a test of Voice over Internet Protocol (VoIP) application using the wireless communications network. The test was carried out at a WiMax/Wi-Fi site using Skype as soft phone to deliver the telephone service. The test results showed that the network has the capacity to support VoIP communication although some inconsistency was experience in a limited test as a result of the temporary installation.

Chapters 8 and 9 introduce the two secure payment trials, the use of advanced mobile devices to pay for car parking and off-bus ticketing to Near Field Communication (NFC) mobile phones using smartcard emulation, to demonstrate technical feasibility of secure payment systems.

In the secure car park payment trial, a closed purse back office was developed by Euro Baltic Software Alliance Ltd. and their partners to process payments for parking. Car park payment using mobile phones based on three interfaces, the SMS, WAP and Web, was tested. The trial evaluated the functionalities and performance of the secure car park payment system based on user experience and technical data analysis. The evaluation results provide clear evidences that the system is a viable car park payment method which is convenient and easy to use.

The NFC bus payment sub project involved the development of prototype mobile-based payment systems for transport facilities to assess off-bus ticketing on mobile phones using smartcard emulation to integrate with the current ticketing systems. The use of NFC enabled mobile phones for bus fare payment was trialled in Reading and supplementary tests were also conducted. Technical feasibility of the NFC bus payment system was examined based on user experience and technical data analysis. The evaluation results provided clear evidences that the NFC bus payment system is a viable payment method which is convenient, easy to use and fast in transaction.

Chapter 10 discusses commercial opportunities and further development in the four sub-project areas. It sets out the next steps and future directions following the project's substantial success on the technical performance and on the user acceptance.

1 Introduction

1.1 Background

The project was a response to a competitive call by the South East Economic Development Agency (SEEDA) for an Intelligent Transport Systems (ITS) based project that aligned with national transport policy.

The call was the first of its type from the Government's new Innovations Platforms and is the first example where an RDA has closely aligned its work with the Technology Strategy Board.

The overall project value was £1.8m with half coming from SEEDA and half coming from the private sector partners in the bid. The project was led by Peter Brett Associates LLP (PBA) with six other main private sector partners. The project was hosted by Reading Borough Council (RBC) and has been evaluated by the University of Southampton's Transport Research Group (TRG).

The first stage call for projects went out in late 2006 and the consortium were advised that their bid had been successful in December 2006 and the project started in January 2007. Originally due to complete on the 31st March 2008, a four month extension was granted by SEEDA to allow for delays and to ensure that TRG were able to properly evaluate the project.

The project is focused around the opportunities generated for a local authority through the application of the latest wireless communications technology both to improve the efficiency of their existing transport services and to enable the provision of enhanced traveller information services now and in the future.

Local authorities require communications to collect data from the roadside, control road side equipment and to disseminate multimodal travel information to the travelling public. This project encompasses all aspects of this requirement as well as also demonstrating mobile

payment systems for travel services. These are demonstrated through a series of sub projects.

The project builds on RBC's Urban Traffic Management and Control (UTMC) system. Reading was one of the DfT's UTMC demonstrator sites (UTMC 29b) and UTMC enables the different transport systems to communicate through a common database. Through UTMC RBC have a large data set and RBC is already disseminating a large amount of information to the travelling public over voice, through mobile phone WAP services, over the internet and via on-street equipment. Enhanced communications have the potential to significantly enhance the provision of traveller information services.

The first stage of the project was to undertake the feasibility study and this was completed in March 2007. The project has delivered on all aspects of this feasibility study although with some minor variations as is expected with a R&D project. The exception to the is the Near Field Communications Trials which will be following in September and will be reporting separately.

The strong private sector consortium includes Peter Brett Associates, a leading international consultancy (lead partner), wireless system integrators Metranet, Connexionz on bus equipment suppliers, Telematix providing on-foot and in-vehicle navigation software, EBSA providing secure payment systems, Transept public transport consultants and Orange, who have supplied smartphones and supporting services for the trial. The University of Southampton's Transport Research Group will be undertaking an evaluation of the project. The project aligns with the wider Government agenda on transport and shows clearly both the value of collaboration with key partners and how to successfully exploit the knowledge base of the private and public sectors to drive imaginative transport solutions.

1.2 Objectives

The main objective of the project was to demonstrate how the latest communications technology, WiMAX / WiFi and the latest 3G mobile 'broadband' services can be used to enhance the quality and efficiency of the transport and travel services provided by a local authority. It also looks to understand how developments in traveller information will affect how people travel and the role of the local authority as information provider in the future.

The overall project is summarised in Figure 1.1 and consists of the following elements:

- **Communications Network** – Implementation and trial of WiMAX / WiFi radio communications technology as a communications platform for municipal authority UTMC systems. The key objectives were to:
 - Demonstrate the suitability of WiMAX as a communications platform for a municipal authority for data collection, communication with on street equipment and for dissemination of traveller information.
 - Demonstrate the potential of a municipal radio frequency standard as a communications platform for Local Authorities.
 - Demonstrate communication with moving vehicles such as buses.

During the project the final objective was modified for all communication to be via Wifi connected to the WiMAX network as the necessary WiMAX equipment for

direct WiMAX to moving vehicle communication was not available.

- **UTMC Communication Trial** – Trialling of connecting on street equipment (Traffic signal controllers and CCTV) via WiMAX with the objective of evaluating quality and reliability of service and hence its suitability as a replacement for traditional wired networks. The key objectives are to:
 - Demonstrate the reliability of communications through the control of traffic signal junctions under SCOOT control which require very reliable two way second by second data transfer.
 - Demonstrate the capability of WiMAX to handle large amounts of data through using it for CCTV traffic management cameras.

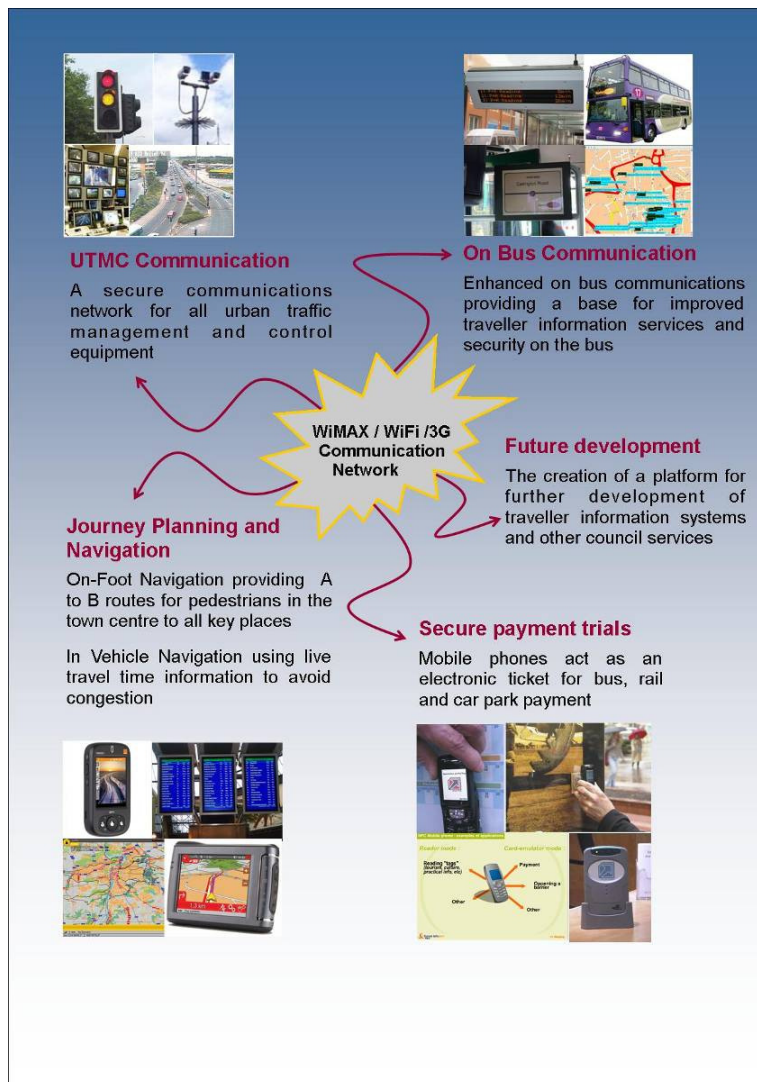


Figure 1-1: Project overview

- **On Bus Communication Trial** – Developing and demonstrating a reliable on bus

communications unit that can continue to transfer live data to / from the bus whilst switching seamlessly between 2G, 3G and WiFi communications. The trials aimed to demonstrate connectivity to the WiMAX network through the WiFi end user interfaces. The main objectives are to:

- Demonstrate the technical feasibility and deliver working on bus units that can seamlessly switch between different communications for the communication of GPS positioning data for Reading's Real Time Passenger Information System.
- Test the potential to transmit higher levels of data transfer between the UTMC system and the bus that could in the future be used for enhanced on bus systems such as real time CCTV and travel information services to on-bus screens.

On-Foot Navigation Trial - Development of a satellite navigation device for travellers using public transport and walking. Small scale trial to:

To technically demonstrate the feasibility of an On-Foot Navigation system and the integration of this with real time public transport data to demonstrate it as part of a future vision for a seamless navigation device for all modes of transport.

To evaluate the user acceptance and user benefits of the system through trialling with various members of the public and evaluate its potential role in encouraging more sustainable transport patterns.

- **Vehicle Navigation Trial** – Development of a Satellite Navigation device that can utilise Real Time Journey time information from UTMC to avoid congestion. Trial is focused around providing real time information from UTMC to John Lewis delivery vehicles to improve the reliability of journey times, and hence reduced environmental impact, of their deliveries between the out of town depot and town centre store and customer collection point. The main objectives are to:
 - To technically demonstrate the feasibility of integrating UTMC data on the state of the network information into an In-Vehicle Navigation System.
 - To evaluate the user acceptance and user benefits of the system through trialling with John Lewis delivery vehicles.
- **Voice over IP Trial** – A small scale trial with the objective of demonstrating the potential of the municipal wireless network to support Voice over Internet calls enabling local authority employees to make free internal calls between council employees whether they are in the building or out on street. The main objectives are to:
 - Evaluate the quality of service using VoIP over the WiMAX / WiFi network communications network.
 - Identify the potential for this to benefit a local authority.
- **Car Park Secure Payment Trials** – Development of a mobile phone web (WAP) based parking payment system for payment for local authority car parks with enhanced user interface compared to current SMS systems and development of new back office management software for use by a local authority. Key objectives are:

- To technically demonstrate the system through a simulation exercise using a car park in Reading.
 - To evaluate the usability and reliability of the service and evaluate WAP based service against SMS service and internet based parking payment.
- **NFC Secure Payment Trials** – Link to Orange funded NFC payment trials for payment of bus journeys using smart card emulation within the mobile phone. The main objectives of the trial are:
 - To demonstrate the technical feasibility of payment by mobile phone through emulating the smart cards used for Reading Buses.
 - To evaluate user acceptability of NFC and to understand how this may influence patterns of travel.

1.3 Partners

Peter Brett Associates, PBA (Reading)

PBA was established as a private partnership in Reading in 1965 and over the last 40 years has grown organically to more than 500 staff. PBA is an integrated, multi-specialist consultancy, which offers a broad range of engineering, transport, land development and environmental services to market-leading organizations worldwide which have an interest in the implementation and management of sustainable development, regeneration and infrastructure projects. PBA is currently working closely in partnership with RBC, supporting them in the development and delivery of their local transport plan strategies.

Specific link into project: Project lead, Programme Management and consultancy support for on-foot navigation and in- vehicle trials.

Reading Borough Council

Reading Borough Council has an excellent record in both partnership working and delivering change, and is one of the leading local authorities in the UK in delivering Local Transport Plan commitments. RBC has gained considerable experience through participating in the DfT's Urban Traffic Management & Control programme as one of four demonstrator sites. In recognition of our record in local transport delivery, Reading has been awarded Centre of Excellence Status for Improved Transport Choices.

Specific link into project: Project demonstrator and technical services for the integration of UTMC.

Metranet Communications Ltd (Brighton)

Metranet is an experienced systems integrator and network operator, the “Brighton Metranet”, a metropolitan intranet being Europe's first fully-integrated pre-WiMAX network, constructed in association with Brighton & Hove City Council and The University of Sussex. This achievement, which feeds the internet to thousands of students and many businesses in Brighton, was recognized in SEEDA's eCommerce Awards 2005. The build of the Reading Metranet presents for the first time how local authorities can take control of their network infrastructure through investigating the feasibility of a licensed municipal wireless network.

Specific link into project: WiMAX systems development, integration, deployment and operation.

University of Southampton (UK), Transportation Research Group (TRG)

The Transportation Research Group (TRG) at the University of Southampton is a multi-disciplinary group. Major activities relate to all aspects of the development, application and understanding of the impacts of a wide range of Intelligent Transport Systems (ITS), for which TRG has an international reputation. These include areas such as motorway traffic operations, congestion and incident prediction and management, access control, real time traveller information and GPS applications for highway safety and traffic management. In addition there is fundamental research in the areas of Traffic Management, Safety, the Environment/Sustainability, Public Transport Operations and Freight and Goods movement. Results from many of the studies have been incorporated into Government Advice Notes and Technical Memoranda as well as into computer programs.

Specific link into project: Evaluation of the benefits of applications and services.

Telematix (Czech Republic)

Telematix has extensive experience of working closely in cooperation with public and private sectors. The company is split into two divisions, Telematix Services and Telematix Software. Telematix Services is focused on the development and implementation of ITS applications and their experience has included creating national and regional ITS architectures and advising on road user charging schemes. Telematix Software is focused on the development of personal navigation software and they have developed Dynavix, an in-vehicle navigation package. A recent development of this has been tracking moving objects on the runway of Prague Airport, which has included the use of GPS and WiMAX technologies.

Specific link into project: Development of their existing vehicle navigation package, Dynavix, to integrate with RBC's UTMC system for real time data and to develop their software for in-vehicle navigation and pedestrian navigation trials.

Transept Consulting (Theale, West Berkshire)

Transept Consulting is an independent specialist public transport and transportation-planning consultancy advising local authorities, major employers and transport providers. Transept has particular expertise in the specification and introduction of leading edge information and ticketing systems in the context of promoting the use of public transport.

Specific link into project: Consultancy advice on the secure payment and on bus communications trials.

Connexionz

Connexionz provided the Centurion automatic vehicle location and passenger information system that is currently operational in Reading. They have developed software and hardware solutions for the delivery of bus network performance information to passengers and operators.

Specific link into project: Development and supply of onboard Bus Communication Units

Orange

Orange has been a supplier to businesses since 1994 and has a strong foothold in the UK and international business markets. We aspire to be a market leader by marrying innovation, reactivity and dynamism with an absolute commitment to delivering against the needs of our business customers. With our wirefree heritage and the broad spread of assets of our parent, France Telecom, we have a unique opportunity to work with our partners to deliver converged communication services that add value for businesses of all sizes.

Specific link into project: Supplier of 3G and enhanced 3G mobile phone equipment including datacards and GPS modules, support and airtime. Integration of NFC trials.

Euro-Baltic Software Alliance (UK & Estonia)

EBSA develops application software, mainly solutions for B2B and B2M data transfer. These solutions include both server-side systems as well as embedded applications in mobile devices. The company has recently developed financial systems for the Estonian Ministry of Finance which demonstrated a cost-effective and low-risk process for testing, extending and upgrading complex software systems whilst maintaining existing live data flows.

Specific link into project: To provide technical consultancy expertise for mobile phone based payment services and applications and to support the integration of other applications in the UTMC environment.

1.4 Programme

The overall programme was set by SEEDA within the bidding process and the programme reflected SEEDA's 3 year funding cycle which ended in March 2008. The project was bid in two stages towards the end of 2006 and the project started on the 1st January 2007. The first 3 months focused on undertaking the feasibility study with the project starting properly in April 2007. Overall the project timescale was tight.

The challenges associated with the R&D project resulted in a number of delays which had a knock on effect of achieving substantial completion of the project at the end of July 2008. As set discussed further in the project management section below, the project was set up such that there was a minimal interaction between project partners. The exception was that all parties were required to work with RBC as the demonstrator and also with TRG for the evaluation.

The key challenges that had implications on the programme were:

Planning process – The WiMAX base stations for the wireless network were the first of their kind in Europe and therefore did not have the necessary CE compliance. Extensive negotiation and independent surveys resulted in delays in obtaining planning which delayed the ordering of the full WiMAX equipment.

Technical challenges – Innovation across all elements of the project resulted in technical challenges to make equipment and software operational and to meet the requirements of the feasibility study.

Integration with UTMC – A number of the projects, including the on-foot; in-vehicle and the UTMC Communication Trial included integration with the UTMC system. Integration of systems created a number of challenges to provide reliable communication between UTMC and project servers.

3rd Parties – there were a number of 3rd party suppliers providing small scale input to the project, but not part of the R&D project. Whilst the input was small scale, often it was on the critical path, and their timescales delayed the project.

As the project had been set up to make it simple, with the exception of RBC and TRG, the timescale of delivery of one party had little impact on delivery of other parts of the project. The key overlap between commercial parties was Metranet with delivery of the Communications Network and the live trialling of the on bus units with Connexionz.

A key departure from the programme was the delivery of the NFC part of the trial. This element of the project tied in with Orange NFC trials and was therefore subject to their

internal programme. In addition, a negotiation with a 3rd party, Wayfarer, was required to provide the ticket machines for the trial and this took some negotiation. At the time of writing it is anticipated that the NFC trials will go ahead in September.

Whilst there have been overruns, this in part reflects the ambitious targets with a tight timescale. Ideally the same project and deliverables would have had a timescale of around 2 - 3 years more in line with European funded (FP7) projects.

1.5 Project Management

PBA undertook the project lead and undertook a programme management role. As with the other elements of the project, the project management was only 50% match funded and the input from PBA to the project was only able to invest half the amount of input that would be considered usual for a project of this size.

To mitigate the impact of a lower level of project management input, the project was set up to minimise the amount of management required. The key aspects of this were:

- 1) Each private sector party was largely delivering their own product with limited interaction between the parties required. This also enabled the Intellectual Property Rights (IPR) to be simply contracted.
- 2) The sub projects were grouped with split responsibility for managing the input. Metranet was responsible for the Communications Network, PBA was responsible for the UTMC communication trials and the In-Vehicle and On-Foot Navigation trials; and Transept was responsible for the secure payment trials and the NFC trials (see Table 1 below).
- 3) A steering group was set up with monthly meetings to manage the project delivery. Steering Group members were PBA, TRANSEPT and Metranet, leading the sub-projects and RBC and TRG.
- 4) All party meetings were kept to a minimum with 3 during the project.
- 5) Telephone conferencing was used throughout the project to reduce meeting costs.

Table 1-1: Summary of management structure and relationship between parties

Trial	Sub Project Manager	Sub Trial	Main Parties
Communications Network	Metranet		Metranet / RBC / TRG
UTMC Communication Trial	PBA		Metranet / RBC / TRG
UTMC Dissemination Trials	PBA	On –Foot Navigation	Telematix / PBA / RBC / TRG
		Vehicle Navigation Trial	Telematix / PBA / RBC / TRG
		Voice Over IP	Metranet / RBC / TRG
On Bus Communication Trial	Transept		Connexionz / RBC / TRG
Secure Payment Trials	Transept	Car Park Secure Payment Trials	EBSA / RBC / TRG
		NFC Secure Payment Trials	Orange / RBC / TRG

The limitation of the project management budget meant that it was not feasible to actively manage the project to an ideal level and more active management may have reduced some of the delays that occurred during the project.

One of the main challenges of the project management was agreeing the contracts. PBA were contracted by SEEDA based on the SEEDA standard form of contract and then PBA subcontracted the main parties with back to back contracts.

The challenge with the contract was that the general SEEDA contract had not been written with this type of collaborative innovation project in mind. Significant negotiation was required with the parties to agree the wording of the back to back contracts to fully cover PBA against the terms and conditions of the SEEDA contract. Ultimately, Orange were unable to sign up to this contract within the timescales and therefore a work around was required. Orange subcontracted under RBC against an existing contract but still adhering to the match funding requirements.

The time taken to negotiate the contracts resulted in a two stage contract process with an initial contract signed just for the three month feasibility study and then a final contract for the rest of the project period.

Intellectual Property Rights (IPR) were a potential issue with a collaborative R&D project as there was some overlap between companies in the services that they provide. Consideration was given in the development of the back to back contracts to specifically list the likely outcomes from the project and who held the IPR. Ultimately it was decided that IPR should be dealt with very simply by stating that it stayed with the company that had provided that input to the project and this was accepted by all parties.

Overall, the parties worked in the spirit of the Research and Development project and have worked together with no significant problems.