Project Progress Report One

Key contributors / Co-authors:

Sam Wilson, SGN
Daniel Holland, SGN
Angus McIntosh, SGN
David Phelan, RPS
Mike Passeratti, ULC Robotics

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Document Control

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Reviewers

Name	Job Title
Sam Wilson	NIC Robotics Project Manager
Jenny Rogers	Networks Regulation
Angus McIntosh	NIC Robotics Project Director

Distribution List

Name	Contact Detail
Angus McIntosh	Angus.mcintosh@sgn.co.uk
Jenny Rogers	Jenny.1.rogers@sse.com
Keavy Larkin	Keavy.Larkin@ofgem.gov.uk
Networks Innovation	Networks.innovation@ofgem.gov.uk

Executive Summary

The purpose of this document is to report on the first six months progress of the NIC Robotics project and the key deliverables over the next six months. The report contains a summary of the progress made from SGN, with subsequent reports from ULC Robotics as the principle project partner, and RPS as the technical consultant.

The Robotics project is assessing the potential for a robotic system to be used in a live gas main to perform the following functions:

- Element 1 – Development of a robotic 'platform' and launch system to enable deployment of modular repair and inspection devices for tier 2 and tier 3 pipe
- Element 2 – Development of an internal mechanical joint installation module and Weco seal repair method for tier 2 and tier 3 pipe
- Element 3 – Robotic visual and non-visual inspection
- Element 4 – Automated live asset replacement for distribution services and mains for tier 1 mains

The project aims to realise the benefits of these methods on certain gas operations (tier 2-3 gas mains) in an attempt to reduce traffic congestion, overall excavation foot print, inspection time and general inconvenience to customers.

The key deliverable to date is the successful delivery of a detailed technical report highlighting the chosen conceptual designs for Elements 1 & 2 and the associated learning taken from exploring multiple design options. The content of this report and the identified project progress has been approved by SGN and RPS and satisfy the criteria set in the project direction for SDRC 9.1. SGN has confidence that the chosen designs can be developed through the design phase to deliver a potential step change in the maintenance and remediation of metallic gas distribution mains.

The risk register has been reviewed through meetings between SGN, RPS and ULC Robotics to review and finalise for the six monthly reporting periods. As a result of developments with the design we have added several new risks to the register as they better reflect the different elements associated with each type of technology, and de-escalate risks as a result of project progress to date.

Notable Achievements to date in the project are:

- Recruitment of Project Officer and Project Administrator to the project.
- Development of conceptual design of the robotics platform.
- Successful workshop meeting to define the requirements for the sensor technology on the robotics platform.
- Successful completion of the first SDRC9.1 report.
- Conducted first Stakeholder meeting with HSE.
- Conducted risk register reviews with ULC Robotics, RPS and SGN specialists.
- Interim report for sensor selection

This progress report has been written in accordance with the Network Innovation Competition (N.I.C) guidance document. Abbreviations will be listed at the back in the report to provide assistance if required by any party.

Risks to Project Delivery

A summary of the associated risks highlighted in the guidance document i.e. recruitment, procurement, and installation are listed below with a short paragraph of how they have been mitigated. All risks listed below are listed with the mitigation methods in detail in the project risk register in Appendix G of this document.

- Recruitment - this risk has been mitigated by the recruitment of a Project Officer and Project Administrator by SGN and a project team by ULC. Project team structure diagrams can be found in the appendices of this report
- Procurement - the main procurement event for the project to date has been the selection of the technical service provider for the project. Following a successful tender process RPS were selected as the technical consultant. ULC are currently selecting a vendor for the sensor technology. There is a risk that a suitable vendor who can provide the chosen technology on time and in line with the target price cannot be found.
- Installation - this risk does not affect the project at its current stage. Details of the field trial and the associated risk and mitigation methods are listed in the risk register.

Learning summary

The main outputs of this project are the technical and engineering knowledge gained from developing new methods to assess and remediate the existing large diameter metallic main gas networks; supporting future directive or ordinance in this field.

It is essential that learning opportunities generated by this project are successfully disseminated for GB GDN's, the wider gas community, national and international standard bodies, academia, local authorities and other key stakeholders such as the ENA, Department of Energy and Climate Change, IGEM and Ofgem. SGN adheres to the A1000SES standard for stakeholder engagement. The project will follow this standard to ensure learning is disseminated effectively and in a timely manner.

Project learning outcomes will be divided into two categories of dissemination: internal and external. The goal of this dissemination plan is to ensure accessibility to, and dissemination of the project results and methods. The knowledge dissemination plan details the format and timescales of the internal and external dissemination modes, ensuring transparency and effective communication with all stakeholders. A plan on how knowledge is disseminated between these 2 groups can be see on page 25.

Notable activities include the first draft of project website detail and creation of email address for contacting the Robotics team (robotics@sgn.co.uk). Internal sharing with key contacts including the stakeholder team and key department heads throughout the business. The submission of the SDRC 9.1 report detailing conceptual designs for Elements 1 & 2 to Ofgem and project progress update meeting with HSE.

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ROBOTICS
Reducing cost through innovation

Project Managers Report

Six months to date

The first six months of the project have been both exciting and productive, culminating in the project running in line with the project plan and on budget. Critical areas of the project including the appointment of key personnelfor both SGN and ULC Robotics, and the appointment of RPS as the technical consultant has ensured the project is well resourced allowing each milestone to be achieved to a high standard.

Figure 1 below shows the financial performance to date:

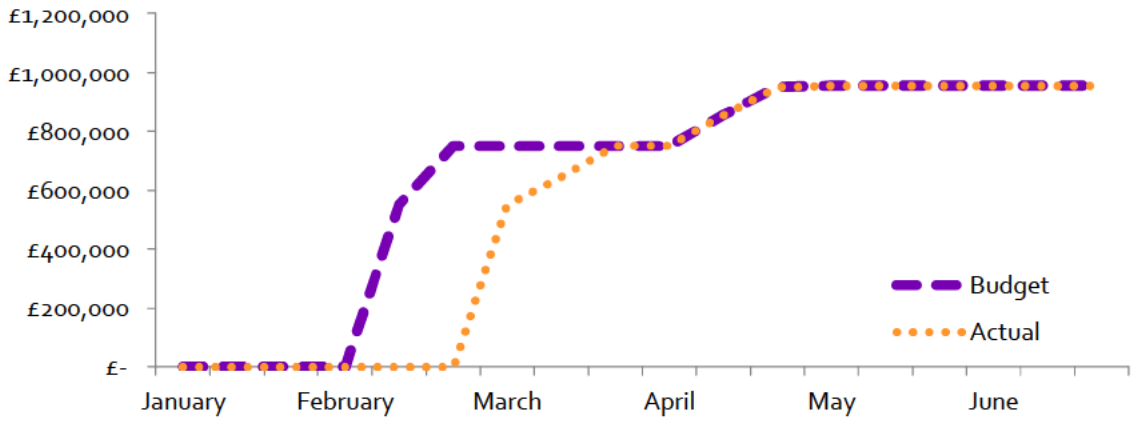


Figure 1 – Financial Performance

Key achievements to date include:

- Delivery of SDRC9.1 to Ofgem – development of conceptual designs (Elements 1 & 2).
- Element 3 Interim Report on the identification of suitable sensor technologies submitted by ULC.
- 3D Design, video simulation and sterolithography model produced of the conceptual design (Elements 1& 2).
- Project risk register revised and a management schedule in place to update the schedule as the project develops.
- SGN project steering group in place.
- Website development in its final stages.
- Stakeholder engagement plan currently being drafted for live trial for Element 1, 2 and Element 3.
- Initial knowledge dissemination meeting schedule held and set with Health & Safety Executive (HSE) representatives.

Delivery of SDRC9.1 to Ofgem - Development of Conceptual Designs (Elements 1 & 2)

The SDRC9.1 report submitted by ULC Robotics to SGN and the subsequent assessment and supporting documentation supplied by RPS provides an extremely positive update on the progress of the project to date. The content of the report is fully compliant with the winning NIC project proposal document. The chosen designs for both the robotic platform and the repair module meet all of the key criteria highlighted.

ULC have investigated in detail thirteen different designs for the robotic platform and assessed them against the key form factors identified in the proposal document. The key learning from the research and design of each concept has been recorded as part of the report; with consideration given to the use of the robot in practice, the ease of duplication and the target price set. The report clearly highlights the reasons behind the selection of the chosen conceptual design and the benefits it presents as well as the areas where there's an opportunity to stretch the goals set at the start of the project.

The SDRC summary section of this report provides further detail on the SDRC9.1 deliverable.

Element 3 Interim Report on the identification of suitable sensor technologies submitted by ULC.

ULC have performed research into a wide variety of sensing technologies for potential use on the NIC Robotics project, with each technology being vetted for its practical use in this unique robotics application. SGN and ULC are working to identify potential technologies and will be focusing efforts on sensors that are deemed capable of yielding risk reduction data and which are practical for implementation within the constraints of the current program.

ULC have hired two seasoned research professionals as consultants to investigate and to identify potential sensor technologies and assist in the down-selection process. In addition to background information on natural gas pipes and the NIC project, the researchers have been given a statement of work that outlines a set of tasks, the schedule and a deliverables list.

Although additional research is underway, the following sensor technologies have been identified as promising for potential use in our application: [redacted] Further evaluation is necessary to determine whether these technologies are applicable for use in a live gas scenario.

The interim report reaffirmed the sensor selection process is on schedule, and that the SDRC9.3 report detailing the selected sensor is on schedule for delivery by the 25th July 2014.

3D Design, video simulation and Sterolithography model produced of the Conceptual Design (Elements 1 & 2).

Following the submission of the conceptual design report by ULC to SGN; a meeting was held between all key project parties to review the design process and assess the selected concepts. To aid the discussion ULC created a scaled model of the chosen design with the repair module *in situ* and a video of the robot entering and operating inside the main. Both of these items are valuable tools at this critical stage of the design process, allowing for the design to be presented to key stakeholders and interrogated by the design team in more detail.

Figure 2 – Scaled Sterolithography model of chosen design

Figure 3 – Sample images from virtual simulation

Project Risk Register revised and a management schedule in place to update the document as the project develops

Once the necessary resources had been added to the project team and as the project develops through each key stage; the inherent and residual risks to the project have changed. In order to manage the risk and record it, risk register review meetings will be held at regular intervals throughout the project to ensure any risk can be identified, managed and eradicated as early as possible. Appendix G of this document covers the detail of the risk register and the mitigation methods in place.

SGN Project Steering Group

To support the NIC Robotics project SGN have created a steering group containingmembers who have been selected to provide appropriate levels of authority, influence and experience to support the project in delivering its objectives.

The key role of the Steering Group is:

- to champion the project
- to provide a point for escalation for key decisions and issues
- to provide strategic guidance
- to ensure required resources are available
- to provide a forum for senior stakeholders to review and approve reports.

The steering group meets bimonthly to ensure the project is on track andthat the outcomes are in line with the wider business requirements. The Terms of Reference document can be found in the appendices of this document, containing the members of the steering group and an outline of the meeting structure.

Website development in its final stages

The project website content has been drafted and key areas of dissemination highlighted for publication. Further detail about the website and its content can be found in the Learning Outcomes section of this report.

Stakeholder Engagement Plan currently being drafted for live trial for Elements 1, 2 & 3

Figure 4 shows the stakeholder planning tool. It has been broken down into each potential stakeholder. The team has used the planning tool to determine the type of interaction we might have with these stakeholders and the outcomes. The planning tool helps the Robotics team to plan ahead to record the best possible feedback we might achieve. Further use of the planning tool will enable not only feedback from the stakeholder but will also enable the team to disseminate the learning as the project progresses through each stage. The stakeholders have been categorised according to their priority and based on this – the methods or mediums of communications that will be used.

In this table, red is used to prioritize the key stakeholders; groups weneed to empower, amber is used for groups we should be involving and consulting with and the green group represent groups that need to be informed of our actions.

Who are the stakeholders?	What are we engaging with them about?	Key contacts	Why are we engaging with them?	How will we engage with them?	When will we engage with them?	Key messages we want to get across	Invitation to annual conference?
Ofgem	To inform Ofgem of the project progression via six monthly reports. To present customer engagement plan and supporting documents. To liase with with Project officer if any problems arise.	Keavy Larkin	Ofgem's approval is required throughout the project. The regulator should pguide us through the project by providing comments on draft documents to endure the directive is being fulfilled.	Consultation meetings emails with the project officer presentations leaflets letters.	1. During planning process. 2.Throughout all stages of the process (where guidance required). 3. Six monthly project progress report (PPR). 4 Following project completion and submission of close down report.	Progress of project. Dissemination of learning to other networks.	yes
HSE	To inform HSE of the project plan including methods and detailed breakdown from ULC To provide particular attention to aspects of the plan requiring stringent H&S regulation.	Andrew Cooke	HSE will provide H&S advice and risk assessments throughout the project to ensure regulations are being followed.	Meetings emails presentations leaflets letters.	1. During planning progress. 2. Prior to field testing and actual trials for all emelents of the project. 3. Following completion of each element/trial.	To demonstrate that we are performing within expected health and safety standards.	yes
Local Council(s)	To obtain the necessary approvals and permits from the affected councils and inform them of possible disruptions. To advise them o the long term benefits to the customer and environment.	Dependant on field trial location identified March 2015	The project will require permits from local councils in order to conduct field trials in the area. It will also be beneficial to the project if the councils are aware and in support of the long term benefits we hope to achieve	Meetings emails presentations leaflets letters website invitation to LCNI	1. Prior to trial start date for each element. 2. Following element completion to report findings and collect feedback.	To demonstrate how beneficial the project will be if successful. To demonstrate how important the community's participation is.	no
TFL	To obtain the necessary approvals and permits from the affected councils and inform them of possible disruptions. To advise them o the long term benefits to the customer and environment.		The project will require permits from local councils in order to conduct field trials in the area. It will also be beneficial to the project if the councils are aware and in support of the long term benefits we hope to achieve The possibility to utilise TFL innovation funding	Meetings emails presentations leaflets letters website invitation to LCNI	1. Prior to trial start date for each element. 2. Following element completion to report findings and collect feedback. 3. Send invite to LCNI by August		yes
SGN specialists	To fully inform individuals of the work we are conducting to include overall objectives and a breakdown of the desired deliverables. To emphasise the deadlines and timescales	SGN steering group members. **see SGN stakeholders tab	Using the full range of skills available within the company will enable us to deliver the project to its fullest potential.	Team meetings/discussions email phone calls prject briefs.	1. During planning process. 2. Prior to the start of each element field testing. 3 Following completion of each element to report findings and collect feedback/suggestions.	Can they help with efficient communication/contacts?	yes
GDNs	To communicate openly with respect to IPR and make detailed information readily available. To encourage dialoge regarding higlights/low points. To abotain feedback at every stage on all levels.	David McLeod via GIGG	One of the objectives of the project is to minimise the amount of roadworks that are performed by GDNs. Communicating with other utility companies and sharing our knowledge will allow for robotics to be used across GB with the ultimate goal of reducing disruption and costs for customers.	Website emails phone calls meetings presentations/demonstratio ns feedback forms.	1. Prior to field testing - invite to demo's. 2. After field trials invitation to provide feedback/suggestions. 3. Upon completion of each element and overall project to provide access to IP.	To make IP as readily available as possible.	yes
RPS	To inform RPS of all activities that they will be involved in to achieve maximum output from the partnership.	David Phelan	To utilise as much knowledge and experience as possible to ensure all possible situations are experienced during trials rather than in the field.	Emails meetings phone calls.	Throughout the project and particularly when a deadline is approaching. Also as and when RPS asks for guidance. Make sure we can be made available to RPS.		yes
ULC	To be very clear with ULC at al stages of the project exactly what our expectations deadlines and specifications are.	Mike Passaretti	ULC will be providing their expertise in robotics knowledge and experience which currently doesn't exist within SGN.	Weekly meetings emails phone calls presentations face to face meetings.	Throughout the entire process. From start to completion.		yes
Environment Agency	To advise of our intentions and the possible disruptions caused during field trials. To inform EA of the long term benefits to the environment and the customer.	TBC	Could they boost our profile?	Do they have any events we could attend to boost our profile?			yes
Local press	To use local media to promote the work we are doing in the effected areas. To generate positive media with the aim of receiving positive feedback. Raise awareness of the benefits of the project.	Dependant on field trial location identified March 2015	Local press within the trial areas will not only inform stakeholders what we are doing but will also promote the project to further trials and provides a medium on which we can communicate our successes in reducing cos and disruption for customers	Website emails phone calls meetings letters.	Prior to the start of each element and field trials.		yes (any press)
Local residents/businesses	To inform the residents and businesses of the benefit of the project and of any possible disruptions to their service.	Dependant on field trial location identified March 2015	To keep them informed of the work we are doing in their area to improve the service we provide.	Leaflets website emails phone calls presentations demonstrations.	Well in advance to any work we conduct in their area or community. Also after we have conducted work to gain feeback/suggestions.		no
Emergency services	To inform local services of the project dates and our expectations with respect to disruptions.	Dependant on field trial location identified March 2015	So they are aware of our actions and can assist if their services are required.	Emails meetings phone calls.	Prior to field trials on public highways.		no
General community	Attempt to make our presence known throughout the community - enabling groups or individuals to communicate with us freely if they have the need to.	Dependant on field trial location identified March 2015	To alert people of our presence and to inform them of our project and its goals.	Leaflets website emails phone calls presentations demonstrations.	Prior to field trials on public highways.		no

Figure 4 - The live stakeholder engagement plan.

Knowledge dissemination meeting schedules set with Health & Safety Executive representatives

The Health and Safety Executive (HSE) is one of the key stakeholders for the project. The HSE has an invested interest in the impact robotic technologies could potentially have on the gas industry and the techniques used to manage the large diameter metallic main assets. To ensure the HSE are aware of the advances being made with the project, the types of technologies and resulting data being developed; bimonthly meetings have been scheduled to share information and receive feedback on the design process.

A communication log of all meetings and correspondence to date is available on request.

The next six months

July 2014 to December 2014

The main challenge for the project over the next six months will be the selection of the sensor technology for Element 3. There are a number of variables which could potentially have an impact on the project schedule and the target price for Element 3 of the project, centred on the availability of the chosen technology. If the chosen sensor technology is currently at a low technology readiness level (TRL), it will need to be developed so it can be used in the required environment. If a technology is selected which has a high TRL, there could potentially be availability and background intellectual property issues that could affect the cost of the product.

Key deliverables over the next six months:

- Delivery of SDRC9.3 to Ofgem – source vendor for sensor (Element 3)
- Development of conceptual designs for the sensor module (Element 3)
- Creation of detailed fabrication and manufacturing documentation (Elements 1 & 2)
- Development of conceptual designs for the launch system (Elements 1, 2 & 3)
- Design of innovative launch Tee and completion plug system (Elements 1, 2 & 3)
- Project presentation at the LCNI conference in October 2014

Delivery of SDRC9.3 to Ofgem - Source Vendor for Sensor (Element 3)

The next SDRC deliverable for SGN will be submitted by the 25th July 2014 detailing the sensor evaluation process, the type of sensors investigated and the learning gained. Once all of the requirements for the sensor have been satisfied, an order will be placed with the chosen vendor.

This milestone of the project is critical and has the greatest potential to affect the project schedule and target price. A number of challenges are present at this stage of the project, in an area where there has been limited development historically within the industry. Key aspects that need to be addressed include the sensor detection capabilities, data processing; and the form, fit and function of the sensor technology chosen. Depending on the type of sensor selected some or all of the hardware used may have to be developed specifically for the application, potentially having a negative impact on the project schedule. If an existing technology is used and adapted for use in a gaseous environment, potential

issues could arise with pre existing background intellectual property and its availability and cost of integration in to a system that meets the target price set.

Detail of the SDRC9.3 and the risk and associated mitigation methods are covered in more detailin the following sections of this report.

Development of Conceptual Designs for the Sensor Module (Element 3)

This stage of the project is dependent on the successful delivery of the SDRC9.3 report and the chosen technology and vendor. The conceptual design will need to considerthe physical size, deployment methodology, range of motion, position within the pipe, power consumption and data throughput. Figure 5 shows some initial conceptual designs developed to assist the design of the transportation module.

Figure 5 - Images from virtual simulation showing conceptual design ofsensor module.

Creation of detailed fabrication and manufacturing documentation (Elements 1 & 2)

For the robotic platform and repair module a detailed fabrication design will be presented to SGN and RPS by ULC Robotics. The design will include consideration of pipe loading, wall press verses free weight, size requirements for no-blow vertical launching, pneumatics, electronics, and manoeuvrability in the pipe. The design will be assessed against the relevant pipe standards such as BS78:1917 and BS1211 by RPS to approve its safe use against the project proposal document.

Any variance to the target price once the design has been finalised due to specific component purchase or development will be highlighted. If there is a variance to the target price the CostBenefit Analysis (CBA) will be recalculated by SGN.

Development of Conceptual Designs for the Launch System (Elements 1, 2 & 3)

Running concurrently with the detailed design of the transportation module forElements 1 &2, the design of the launch and retrieval system for the robot will be developed with a conceptual design presented to SGN and RPS for assessment.

The design of the launch tube will have been driven by the operational requirements of the robotic system and pipe fitting, considerations of the overall size of the robotic system with the aim of minimizing pit size to reduce the amount of excavation and disruption required to facilitate the launch of the robot.

ULC and SGN have experience of using a vertical launch system from the successful trial of the Large CISBOT™ system on UK gas infrastructure in 2013. The development of the launch tube isn't seen as a high risk area of the project. The development of the launch system and its practical implementation is listed in the risk register, reference number 15 and 16.

Design of innovative launch Tee and completion plug system (Elements 1, 2 & 3)

To facilitate the launch and retrieval of the robot using a cost effective method with minimal disruption tothe public and the environment; SGN are in the process of developing a new type of tapping tee and completion plug. Existing practice when tapping and flowstopping a large diameter metallic gas main is to 'tap' the main using a sacrificial valve which is left *in situ* once the operation is completed. As a result each valve can only be used once, adding considerable cost to a project where multiple entry points in to the main are required. A by-product of this is the potential for the valve to be damaged by third parties working in close proximity to the gas main in the future.

To allow for a higher specification valve to be used and to remove the cost of a new valve being purchased for each entry point in to the main, SGN and Flowstop Services are adapting a design commonly used in the water industry to 'plug' the main below the valve. As a result the valve can be recovered and reused with the launch tube at multiple sites. Figures 6 and 7 contain detail of the initial design of the new tee and completion plug.

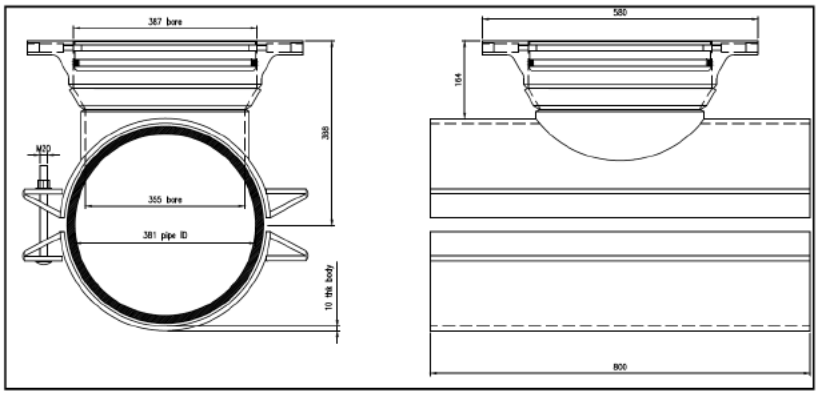


Figure 6 – Tapping Tee conceptual design

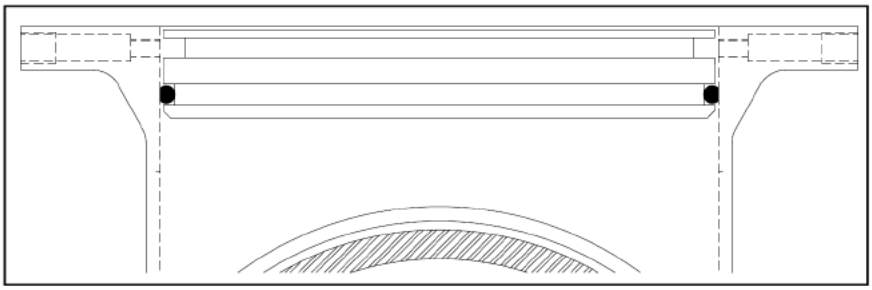


Figure 7 – Magnified view of the completion plug *in situ*

The new method will be trialled as part of the practical field trial of the project. If successful the method could potentially also be used on a number of large diameter flowstopping operations across the gas industry, presenting an opportunity for considerable efficiency savings. SGN will capture the trial findings and disseminate as part of the final project report.

Project presentation at the LCNI conference in October 2014

SGN is participating in the first LCNI conference, covering both the gas and electricity sectors, in October 2014. A key objective of our involvement is to disseminate learning from our innovation projects, including the Robotics project. We are participating in a breakout session entitled "How do the gas networks focus their innovation strategies to minimise customer impacts", hoping to attract up to 100 delegates. We will also showcase the progress we have made in the Robotics project at our exhibition stand, and we are actively participating in the ENA's film project, which will develop a series of short films demonstrating innovative gas projects across a number of themes, including replacement and repair, and asset management and integrity. Through this activity we hope to reach as many of the anticipated 900 delegates as possible. It is also an opportunity for our Robotics team and partners to engage with stakeholders to explain the learning from the project, and the value of Ofgem's innovation stimulus.

Business Case Update

At present there are no changes to the business case that was submitted in the full submission pro-forma report, or the target prices set. The Robotics team believes that over the next six month reporting period; no changes will be required.

Progress against Plan

At present the project is progressing in line with the project schedule agreed as part of the project direction. Reports from both RPS and ULC Robotics confirm the successful progression of the project to date.

The RPS report condenses and summarizes the PPR from their point of view as our technical consultants and highlights any concerns or areas of interest in the project they feel needs to be monitored closely. ULC Roboticshave also provided a condensed report from their perspective within the project.

Both of these reports can be found in Appendix D (RPS PPR Summary Report) and Appendix E (ULC Robotics PPR Summary Report).

Progress against Budget

The first mobilisation payments for the project were made three weeks behind schedule due to some required alterations to the partnership agreement between SGN and ULC. The delay had no impact on project performance against the project schedule, resulting in the successful selection of the conceptual design for Elements 1 & 2, and the interim report on sensor selection for Element 3. No variance to the budget or payment schedule are expected between now and the next Project Progress Report as demonstrated in Figure 8.

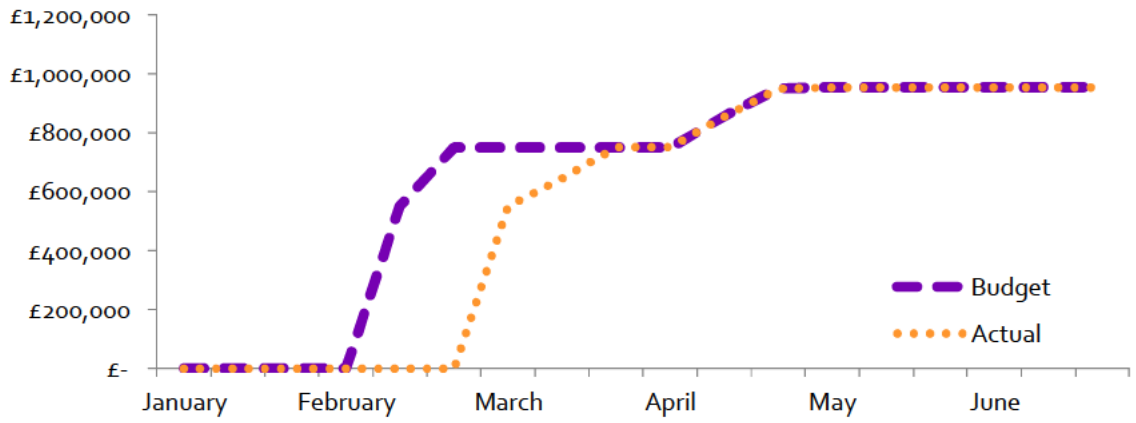


Figure 8 - Financial Expenditure against Budget

				Projected variance (at project conclusion)	
	Budget (£000s)	Expenditure ITD (£000s)	Comparison with expected expenditure (%)	(£000s)	%
See note			1		
LABOUR	**5566.9**	**840.6**	**1.5%**	**0**	**0.0%**
EQUIPMENT	**716.3**	**126.9**	**0.0%**	**0**	**0.0%**
CONTRACTORS	**163.9**	**9.7**	**0.0%**	**0**	**0.0%**
IT	**59.2**	**3.3**	**0.0%**	**0**	**0.0%**
IPR	**39.6**	**1.5**	**0.0%**	**0**	**0.0%**
TRAVEL AND EXPENSES	**583.9**	**2.7**	**0.0%**	**0**	**0.0%**
CONTINGENCY	**276.9**	**0**	**0.0%**	**0**	**0.0%**
TOTAL	**7406.8**	**984.7**	**-0.3%**	**0**	**0.0%**

1 - Actual expenditure to date is compared with phased projected spend over the same period.

Figure 9 - Financial expenditure breakdown

Bank Account

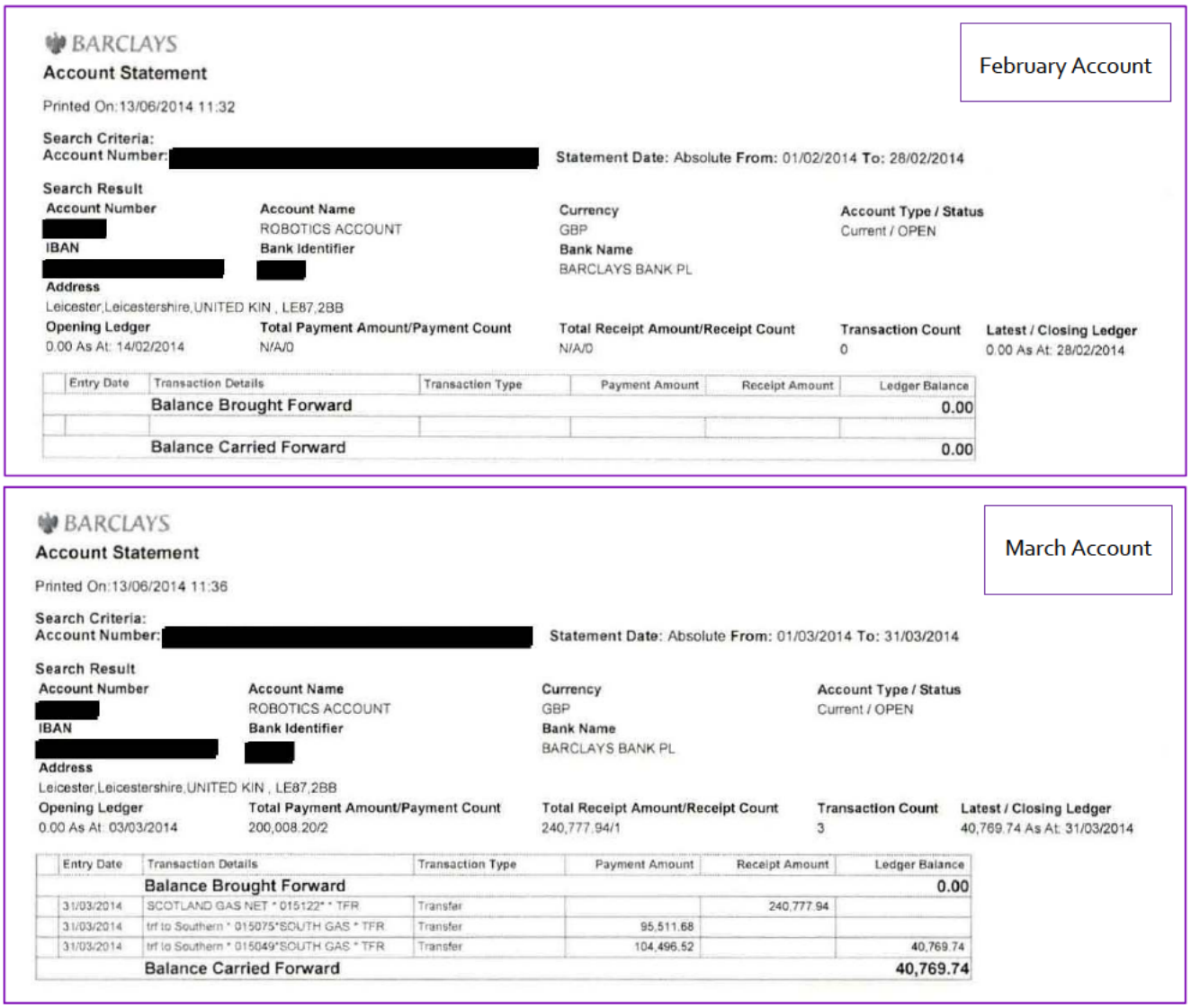
Figure 10 is an image showing the project bank account

Mobilisation payments of £550,192.87 were due to be paid to the project partner, ULC Robotics LLP, before the project bank accounts were fully operational. As a result, the mobilisation payments were made from the Southern Gas Networks plc main account.

This has been deducted from the SGN compulsory contribution to the project of £739,431.33, leaving a net transfer to the project bank account of £189,238.46.

To facilitate cash flow, a payment of £240,777.94 was made to the bank account in March 2014, the surplus being refunded to the SGN main account in June 2014 after the Ofgem directed funding was received.

Figure 10 – Project bank account.



BARCLAYS

Account Statement

February Account

Printed On:13/06/2014 11:32

Search Criteria:
Account Number: [redacted] **Statement Date:** Absolute **From:** 01/02/2014 **To:** 28/02/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
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IBAN	**Bank Identifier**	**Bank Name**	
[redacted]	[redacted]	BARCLAYS BANK PL	

Address
Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
0.00 As At: 14/02/2014	N/A/0	N/A/0	0	0.00 As At: 28/02/2014

Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
	Balance Brought Forward				0.00
	Balance Carried Forward				0.00

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Account Statement

March Account

Printed On:13/06/2014 11:36

Search Criteria:
Account Number: [redacted] **Statement Date:** Absolute **From:** 01/03/2014 **To:** 31/03/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
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IBAN	**Bank Identifier**	**Bank Name**	
[redacted]	[redacted]	BARCLAYS BANK PL	

Address
Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
0.00 As At: 03/03/2014	200,008.20/2	240,777.94/1	3	40,769.74 As At: 31/03/2014

Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
	Balance Brought Forward				0.00
31/03/2014	SCOTLAND GAS NET * 015122* * TFR	Transfer		240,777.94	
31/03/2014	trf to Southern * 015075*SOUTH GAS * TFR	Transfer	95,511.68		
31/03/2014	trf to Southern * 015049*SOUTH GAS * TFR	Transfer	104,496.52		40,769.74
	Balance Carried Forward				40,769.74

April Account

BARCLAYS

Account Statement

Printed On:13/06/2014 11:38

Search Criteria:
Account Number: [redacted] Statement Date: Absolute From: 01/04/2014 To: 30/04/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
[redacted]	ROBOTICS ACCOUNT	GBP	Current / OPEN

IBAN: [redacted]4 Bank Identifier: [redacted]
Bank Name: BARCLAYS BANK PL

Address: Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
40,769.74 As At: 01/04/2014	N/A/0	544,311.54/1	1	585,081.28 As At: 30/04/2014

Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
	Balance Brought Forward				**40,769.74**
15/04/2014	TRANSCO PLC * 015054*NIC FUNDIN* TFR	Transfer		544,311.54	585,081.28
	Balance Carried Forward				**585,081.28**

May Account

BARCLAYS

Account Statement

Printed On:13/06/2014 11:40

Search Criteria:
Account Number: [redacted] Statement Date: Absolute From: 01/05/2014 To: 31/05/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
[redacted]	ROBOTICS ACCOUNT	GBP	Current / OPEN

IBAN: [redacted] Bank Identifier: [redacted]
Bank Name: BARCLAYS BANK PL

Address: Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
585,081.28 As At: 01/05/2014	1,224,908.46/6	639,827.18/2	8	0.00 As At: 30/05/2014

Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
	Balance Brought Forward				**585,081.28**
13/05/2014	BX14051311306906 * 007469*ROBOTICS I* TFR	Transfer	585,081.28		0.00
15/05/2014	NGRID GAS MAIN CHARITY-LICENCES BGC	Bank Giro Credit		544,308.00	
15/05/2014	CHARGES*012258* ULC Pipeline Rob * TFR	Transfer	7.50		
15/05/2014	ULC Pipeline Rob * 012258*ULC PIPELI* TFR	Transfer	104,496.52		
15/05/2014	BX14051511387358 * 014637*ROBOTICS I* TFR	Transfer	439,803.98		0.00
23/05/2014	CHARGES*005083* ULC Pipeline Rob * TFR	Transfer	7.50		
23/05/2014	ULC Pipeline Rob * 005083*ULC PIPELI* TFR	Transfer	95,511.68		-95,519.18
27/05/2014	S G N PLC - ROBO * 011916* * TFR	Transfer		95,519.18	0.00
	Balance Carried Forward				**0.00**

June Account

BARCLAYS

Account Statement

Printed On:13/06/2014 11:43

Search Criteria:
Account Number: [redacted] **Statement Date:** Absolute **From:** 01/06/2014 **To:** 13/06/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
[redacted]	ROBOTICS ACCOUNT	GBP	Current / OPEN
IBAN	**Bank Identifier**	**Bank Name**	
[redacted]	[redacted]	BARCLAYS BANK PL	

Address
Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
0.00 As At: 02/06/2014	86,045.85/2	86,045.85/1	3	0.00 As At: 13/06/2014

	Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
		Balance Brought Forward				0.00
	13/06/2014	S G N PLC - ROBO * 004590* * TFR	Transfer		86,045.85	
	13/06/2014	BX14061312080667 * 004650*SOUTH GAS * TFR	Transfer	34,506.37		
	13/06/2014	BX14061312081560 * 004629*SOUTH GAS * TFR	Transfer	51,539.48		0.00
		Balance Carried Forward				0.00

February Interest

BARCLAYS

Account Statement

Printed On:13/06/2014 11:31

Search Criteria:
Account Number: [redacted] **Statement Date:** Absolute **From:** 01/02/2014 **To:** 28/02/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
[redacted]	ROBOTICS INTERES	GBP	Deposit / OPEN
IBAN	**Bank Identifier**	**Bank Name**	
[redacted]	[redacted]	BARCLAYS BANK PL	

Address
Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
0.00 As At: 14/02/2014	N/A/0	N/A/0	0	0.00 As At: 28/02/2014

	Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
		Balance Brought Forward				0.00
		Balance Carried Forward				0.00

March Interest

BARCLAYS

Account Statement

Printed On:13/06/2014 11:34

Search Criteria:
Account Number: [redacted] Statement Date: Absolute From: 01/03/2014 To: 31/03/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
[redacted]	ROBOTICS INTERES	GBP	Deposit / OPEN

IBAN	Bank Identifier	Bank Name
[redacted]	[redacted]	BARCLAYS BANK PL

Address
Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
0.00 As At: 03/03/2014	N/A/0	N/A/0	0	0.00 As At: 31/03/2014

Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
	Balance Brought Forward				0.00
	Balance Carried Forward				0.00

April Interest

BARCLAYS

Account Statement

Printed On:13/06/2014 11:37

Search Criteria:
Account Number: [redacted] Statement Date: Absolute From: 01/04/2014 To: 30/04/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
[redacted]7	ROBOTICS INTERES	GBP	Deposit / OPEN

IBAN	Bank Identifier	Bank Name
[redacted]	[redacted]	BARCLAYS BANK PL

Address
Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
0.00 As At: 01/04/2014	N/A/0	N/A/0	0	0.00 As At: 30/04/2014

Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
	Balance Brought Forward				0.00
	Balance Carried Forward				0.00

May Interest

BARCLAYS

Account Statement

Printed On:13/06/2014 11:39

Search Criteria:
Account Number: [redacted] **Statement Date:** Absolute **From:** 01/05/2014 **To:** 31/05/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
[redacted]	ROBOTICS INTERES	GBP	Deposit / OPEN
IBAN	**Bank Identifier**	**Bank Name**	
[redacted]	[redacted]	BARCLAYS BANK PL	

Address
Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
0.00 As At: 01/05/2014	95,519.18/1	1,024,885.26/2	3	929,366.08 As At: 30/05/2014

	Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
		Balance Brought Forward				**0.00**
	13/05/2014	S G N PLC - ROBO * 007469* * TFR	Transfer		585,081.28	585,081.28
	15/05/2014	S G N PLC - ROBO * 014637* * TFR	Transfer		439,803.98	1,024,885.26
	27/05/2014	BX14052711640666 * 011916*ROBOTICS A* TFR	Transfer	95,519.18		929,366.08
		Balance Carried Forward				**929,366.08**

June Interest

BARCLAYS

Account Statement

Printed On:13/06/2014 11:41

Search Criteria:
Account Number: [redacted] **Statement Date:** Absolute **From:** 01/06/2014 **To:** 13/06/2014

Search Result

Account Number	Account Name	Currency	Account Type / Status
[redacted]	ROBOTICS INTERES	GBP	Deposit / OPEN
IBAN	**Bank Identifier**	**Bank Name**	
[redacted]	[redacted]	BARCLAYS BANK PL	

Address
Leicester,Leicestershire,UNITED KIN , LE87,2BB

Opening Ledger	Total Payment Amount/Payment Count	Total Receipt Amount/Receipt Count	Transaction Count	Latest / Closing Ledger
929,366.08 As At: 02/06/2014	86,045.85/1	59.78/1	2	843,380.01 As At: 13/06/2014

	Entry Date	Transaction Details	Transaction Type	Payment Amount	Receipt Amount	Ledger Balance
		Balance Brought Forward				**929,366.08**
	02/06/2014	INTEREST PAID GROSS FOR PERIOD TO 1JUN	Credit		59.78	929,425.86
	13/06/2014	BX14061312081589 * 004690*ROBOTICS A* TFR	Transfer	86,045.85		843,380.01
		Balance Carried Forward				**843,380.01**

ROBOTICS
Reducing cost through innovation

Successful Delivery Reward Criteria

The SDRC 9.1 report was submitted to Ofgem on 25th April 2014. The following extract is taken from the 'Project Managers Report' summarising the successful selection of the conceptual designs for Elements 1 & 2.

"The SDRC9.1 report submitted by ULC Robotics to SGN and the subsequent assessment andsupporting documentation supplied by RPS provides an extremely positive update on the progress of the project to date. The content of the report is fully compliant with the winning NIC project proposal document. The chosen designs for both the robotic platform and the repair module meet all of the key criteria highlighted. Coupled with the interim report for the selection of sensor technology for element three of the project, it provides confidence that ULC Robotics have a strong team working on the designof the robotic solutions and this challenging project is on schedule to deliver its full potential."

"The selection of the repair technique to be progressed highlights the importance of ULC's experience in the research and development of robotic solutions for the utility industry. The use of the Large CISBOTTM robot to demonstrate the effects of a robotic tool on existing Weco seals in situ within a gas main allows ULC to assess the theory behind the design principles accurately. Previous experience also held in the joint gap 'filling and bridging' approach to sealing joints has also been invaluable in accurately assessing the technique."

The Robotics team is currently working towards the next deliverable (SDRC 9.3). An interim report has been received from ULC outlining interim research contributing to Element 3 of the project.

"The sensor technologies that we have investigated thus far show promising results with respect to the form, fit and function desired for the NIC project."

"The end goal is to provide meaningful and usable data, in a format that can be used to objectively and reliably by gas utility companies to assess pipe integrity"

"Sensor technologies exist that, in their current form, can reliably detect all of the properties mentioned above (wall thickness, corrosion, etc.). No single technology has been identified thus far that can detect all of these properties."

Below is a tabular form of the SDRC reporting structure showing the report names, date required and the current status at the time of writing this report. Also listed below is a breakdown of the SDRC's and the evidence that needs to be provided in the reports.

Completed (SDRC met)	Emerging Issue, remains on Target	SDRC Completed Late
On Target	Unresolved Target	Not Completed and Late

Below is a breakdown of the immediate SDRC's deliverables over the next twelve month period of this report.

SDRC	Due	Description	Status
9.1	28/03/2014	Development of Conceptual Designs (Element 1 & 2)	Completed
9.2	14/12/2015	Development of Conceptual design (Element 4)	On Target
9.3	27/07/2014	Source vendor for Sensor (Element 3)	On Target
9.4	03/08/2015	Configuration of testing with Robotic Platform (Element 3)	On Target
9.5	17/04/2017	Tapping and Fitting Tool Validation (Element 4)	On Target
9.6	04/12/2015	Launch Robot (Element 1 & 2)	On Target
9.7	04/12/2015	Launch Robot (Element 3)	On Target
9.8	13/10/2017	Launch Robot (Element 4)	On Target

SDRC 9.1 Development of Conceptual Designs (Element 1 & 2)

- Research and conceptual design will have been performed into methods of repairing Weco seals and mechanical joints with a robotics system
- Various tools and methods for repair will be considered and judgement criteria will be based on effectiveness, ease of deployment, technical feasibility and cost in line with the target price.
- A detailed technical report outlining these findings and suggestions will be delivered by ULC Robotics to SGN
- SGN will have reviewed the proposed repair method and carried out a risk assessment and gap analysis against the identified performance specifications in order to determine what the off-site and on site testing success criteria will be.
- For the robotics platform, the design will have included consideration of pipe loading, wall press vs. free weight, size requirements for no-blow vertical launching, wheel torque, traction, power transmission, pneumatics, electronics, form factor, manoeuvrability in the pipe, travel distance, and the ability to negotiate bends as desired. An estimation of a variance against the target price will have been carried out.
- Provided the method identified has the potential to be deemed an "interim" repair as defined within SGN/PR/EM/74 part B, and the high level performance specifications are feasible, the project will progress.

Evidence

- Delivery of technical report
- Approval and sign off by project director that the report defines the outputs required in Elements 1 & 2.
- All specifications, designs, risk assessments and supporting documentation to be documented in project file.

SDRC 9.3 Source Vendor for Sensor (Element 3)

- ULC Robotics will have drawn on previous experience with researching and deploying sensors for pipe wall analysis for this task, and used the outline performance requirements provided by SGN for guidance. After identifying an appropriate sensor technology, or combination of sensors for evaluating pipeline structural integrity, SGN will have confirmed the suitability of the sensor technology outputs as an indicator of pipe condition that can inform pipe risk.
- Following a suitability assessment an appropriate vendor will be identified to provide the sensor at best price and within budget. ULC Robotics will have discussed lead times and manufacturing capabilities with the vendor related to specific components that may pose a concern. Once all the requirements are satisfied, ULC Robotics will place a purchase order with the sensor manufacturer.
- If no suitable sensor technology is identified that can inform pipe risk following the SGN and independent assessment; element 3 of the project will be terminated.
- SGN will engage with HSE and other stakeholders to keep them informed as to the identified method and its potential to inform pipe risk.
- If successful, SGN will progress this project forward.

Evidence

- Sensor Technology evaluation accepted by project director.
- Project plan will be revised to incorporate lead times and manufacturing capabilities.
- All purchase orders will be documented in project file and controlled by ULC Robotics.
- All invoices and transactions documented in project file and controlled by Finance Manager.
- All discussions with HSE will be documented in project file i.e. minutes of meetings or email correspondence.

The full SDRC breakdown can be viewed using this link below:

https://www.ofgem.gov.uk/ofgem-publications/84774/gasnicsubmissionfromscotiagasnetworks-robotics.pdf

Learning Outcomes

The main outputs of this project are the technical and engineering knowledgegained whilst researching new methods to assess and remediate the existing natural gas network. Therefore it is essential that learning opportunities generated by this project are successfully disseminated for GB GDN's, the wider gas community, national and international standard bodies, academia, local authorities and other key stakeholders. Learning will be disseminated so that the technology can be incorporated by all GB GDNs upon successful completion of the project. In support of learning dissemination, the Robotics team will be incorporating stakeholder engagement planning, steering group review meetings and will be attending the Low Carbon Network Fund (LCNI) Conference.

The project has gained positive interest from the other gas distribution owners during the regular Gas Innovation Governance Group (GIGG) meetings. We have highlighted how we disseminate information to the project stakeholders and what importance and influence they have on the project. This can be seen in the section entitled 'Learning Outcomes– Dissemination' which is on page 30.

The table below highlights the key outcomes to date, which have been broken down into the followingsections; technology, safety and dissemination.

Technology

- SDRC 9.1 was submitted to Ofgem on 25.04.2014 containing the conceptual design and learning taken from the selection of the chosen design.
- The Robotics team is developing and defining the sensor technology that is required for Element 3. The criteria for the sensor technology has been defined with our key project partners. This has led to a potential sensor being investigated to determine if this viable for the working environment and whether is can be installed on the robotics platform. The results will be published in SDRC 9.3 which is due for submission on 25.07.2014.
- RPS are conducting the load and weight calculations to determine the maximum safe working load (SWL) of the launch tube and the pipe. These calculations should be reported by the 24.11.2014

Safety

- The Robotics team held the first meeting with the HSE on the 06.04.2014. The purpose of this meeting was to fully brief HSE on the project, its aims and outcomes.
- The project risk register has been updated to allow a more accurate representation of the risks involved as the project learning developes. This will allow the team to mitigate problems and reduce the liklihood of time and/or financial drift from initial projections.
- It was important for the Robotics team to involve SGN's 'Head of Assets' and for the incumbent to join the Robotics steering group.
- The first steering group meeting will be held on 22nd July 2014. This will provide an opportunity to demonstrate the progress to key members of SGN but also to discuss any safety concerns that may be raised by the groups members.

Dissemination

- A key learning outcome for this project reporting period has been the developmentof the Project Progress Report (PPR) and ways in which to present the report so that it reflects the guidlines described in the guidance document.
- The Robotics team has developed a number of presentations to describe the new technology to different target audiences. For example, a powerpoint presentation has been drafted to detail the technology and the concepts it uses. This will allow the team to effectively communicate with different stakeholders with differing levels of knowledge. This will allow SGN to fulfil the dissemination criteria set out in the NIC governance document.
- The Robotics team has begun working towards the LCNI Conference which is being held in Aberdeen from 20th-22nd October 2014. This event will showcase the NIC Robotics project progress and will provide a platform for the dissemination of knowledge to stakeholders and interested parties. The full outcomes of the event will be evaluated in the next PPR in December 2014.
- Throughout the duration of the project, the Robotics team will adhere to the Stakeholder Engagement Standard (AA1000SES). This will ensure that the correct information is disseminated to all stakeholders in an effective manner.
- Development of the stakeholder engagement plan.
- Development of the Robotics website for both internal and external dissemination.

Learning Outcomes: Dissemination

Stakeholder Dissemination Table

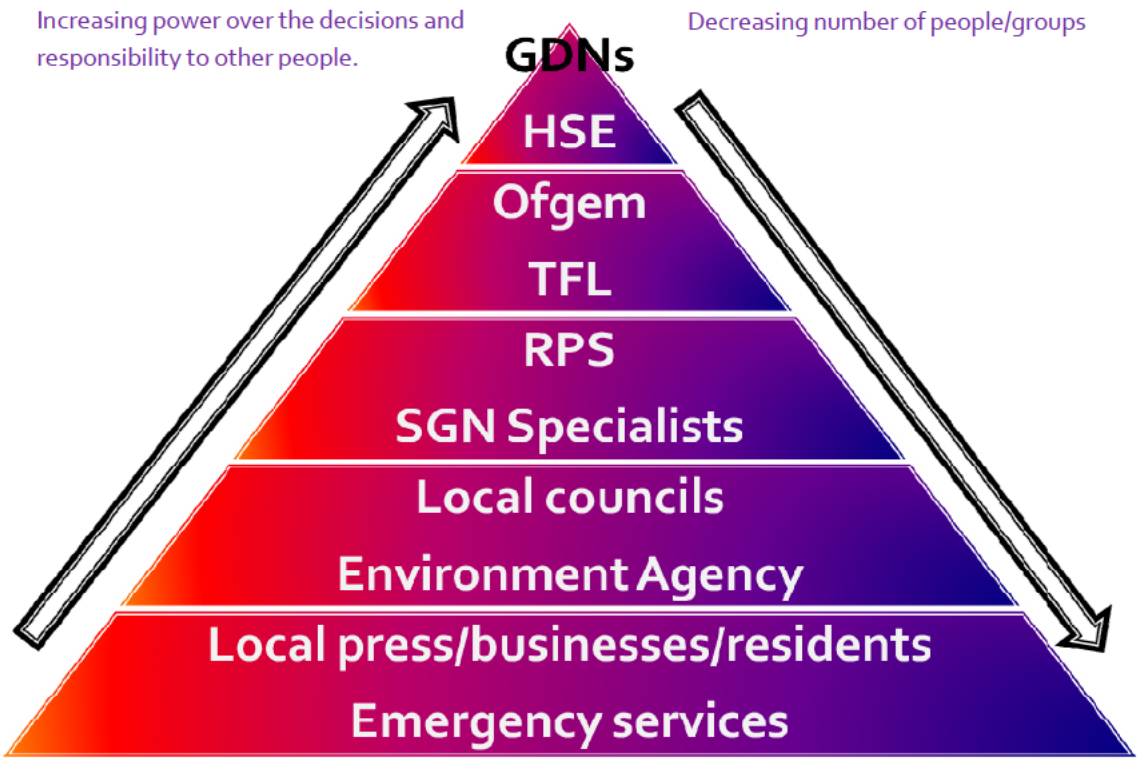


Figure 11 – Image showing stakeholder dissemination

Figure 11 shows the influence that differing stakeholders can have on the project. For example Ofgem and HSE have a high interest and high influence over the project and its execution. These groups contain a small number of individuals who have significant influence over the decisions that are made, with a direct impact on the project path. This demonstrates the importance of disseminating the learning so that it is available to all parties, in a variety of mediums so that the learning outcomes are widely accessible.

Learning Outcomes-NIC Robotics Website

The Robotics team is currently finalising the design and structure of the NIC robotics website, so the site can go "live" in the next 6 month period. The website will potentially include the following information for all stakeholders to view:

- An overview of the Robotics Project.
- Structure of the project team.
- Project news/events.
- Project library for documents.
- Plans for practical trials and demonstrations.
- The website will also provide an opportunity for stakeholders to provide feedback and ask questions.

Figure 12 shows a mock up of the website home page and overall design of the site, the site will go live when the company launches the new brand in September 2014, this rebranding is outlined more clearly under the section of the report called "other" which is on page 34.

Figure 12 - Mock up of the NIC Robotics Project website

Intellectual Property Rights (IPR)

In accordance with the Gas Networks Innovation Competition Governance Document, ULC Robotics have confirmed to SGN that a provisional patent application for the selected concept of the transport platform (Element 1), repair module (Element 2) and sensor module (Element 3) has been filed with United States Patent and Trademark Office (USPTO) on the30th April 2014. In accordance with the NIC Project Agreement, the non-provisional patent will be assigned to SGN once granted in May 2015.

Risk Management

This section has an update on the live risk register at the time this document was produced. The purpose of this section is to show risks that have the potential to affect the following areas of the project:

- Financial
- Project Schedule
- Delivery
- Reputation

The Robotics team and our partners have identified a number of risks that have been down-graded as they have been managed in a way that reduces their effect on the project. Overall there are no high category risks on the register. The most recent risk register review meeting was held on 03.06.2014, between SGN, ULC and RPS. The group re-evaluated all of the risk scores on the project to more accurately calculate the residual risk following the progress of the project to date.

One area that is important in this PPR and the next PPR is the selection of a vendor for the sensor payload of the robotics platform. The type of sensor selected is critical to the effectiveness of the system being developed, the type of data gathered and the cost benefit of the operating system. The risk is being mitigated by the appointment of several experts on sensor technology by ULC Robotics to help with the selection process of the technology and the vendor. Biographies of the consultants working on the project can be found in the appendices. With this project there is no effect or risk on "customers" as the project is being developed in an environment that is controlled by SGN and should have no noticeable effect on residential or commercial customers or gas suppliers.

A full copy of the risk register can be found in the appendices in Appendix G on page 53.

Other

Company Rebranding

SGN is rebranding on 1 September 2014. The new brand has been developed following feedback from internal and other stakeholders. The section below discusses some of the justifications for the updated brand:

- We want to help people to better understand who we are and what we do and to clear up any customer confusion e.g. with Scottish Gas, and this needs to be reflected in the re-brand.
- We've listened to internal feedback from the past two years and want to bring members from all aspects of our business together under one unified flag that everyone can support.
- We want to increase our efficiency as a business. This means looking at how we can reduce our expenditure on communications whilst strengthening our impact.
- Our old look and feel doesn't always reflect us as a business. It can look old fashioned and unprofessional and doesn't show us as the bright, forward thinking experts that we are.

The new branding will support the robotics project by providing a stronger, more modern look and feel to the business, which is more in-keeping with the progressive, confident nature of the project. All communications materials for the Robotics project will be developed in the new brand, which will provide a clear, consistent message to all our stakeholders.

Accuracy Assurance Statement

To provide the upmost accuracy to this report and any other future reports the Robotics team produces, several steps have been incorporated to gauge authenticity and accuracy; and to comply with the governance document issued.

Figure 14 outlines how accuracy is managed with project documentation. All reports are reviewed in weekly telephone conferences and in monthly executive reports to senior management.

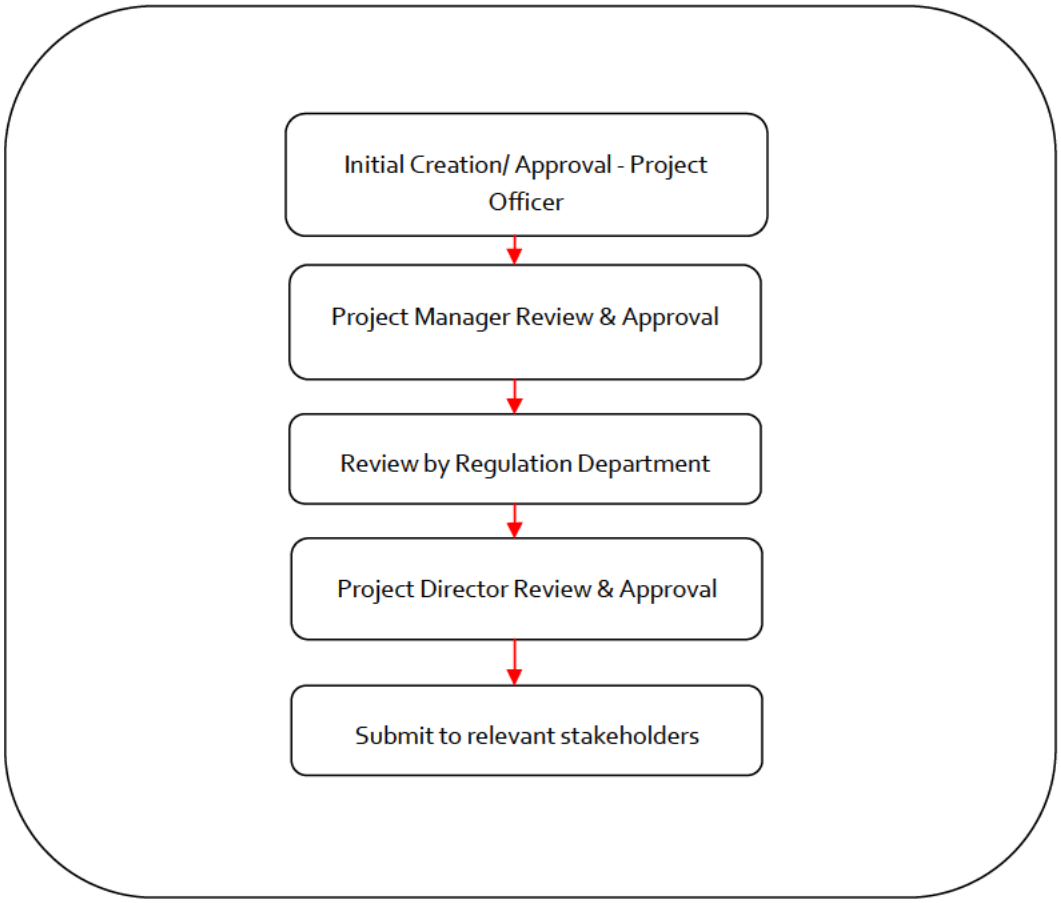


Figure 13 - Accuracy Assurance Flow Diagram

Project Progress Report Appendices

Appendix A

Project Report Appendix

A

- ATEX - Atex Directive (Explosive Atmosphere regulations)

B

- BS - British Standards- BS

C

- CISBOT - Cast Iron Robotics System
- CI - Cast Iron

D

- DECC - Department for Energy and Climate Change
- DNO - Distribution Network Owner
- DI - Ductile Iron

E

- ENA - Energy Networks Association
- EMAT - Electromagnetic Acoustic Transducer

G

- GDN - Gas Distribution Network

H

- HSE - Health and Safety Executive

I

- IPR - Intellectual Property Rights
- IFI - Innovation Funding Incentive

K

- KPI - Key Performance Indicator

N

- NRO - Non Routine Operations
- NIC - Network Innovation Competition
- NIA - Network Innovation Allowance

O

- Ofgem- Non-Ministerial Energy Regulators in the U.K

P

- PPR - Project Progress Report

Q

- RO - Routine Operation

S

- SDRC - Successful Delivery Review Criteria
- SGN - Scotia Gas Networks (Southern Gas Networks/Scotland Gas Networks)

T

- TRL - Technology Readiness Level
- Tier 2 main – 9-17 inch diameter metallic main
- Tier 3 main – 18 – 48 inch metallic main

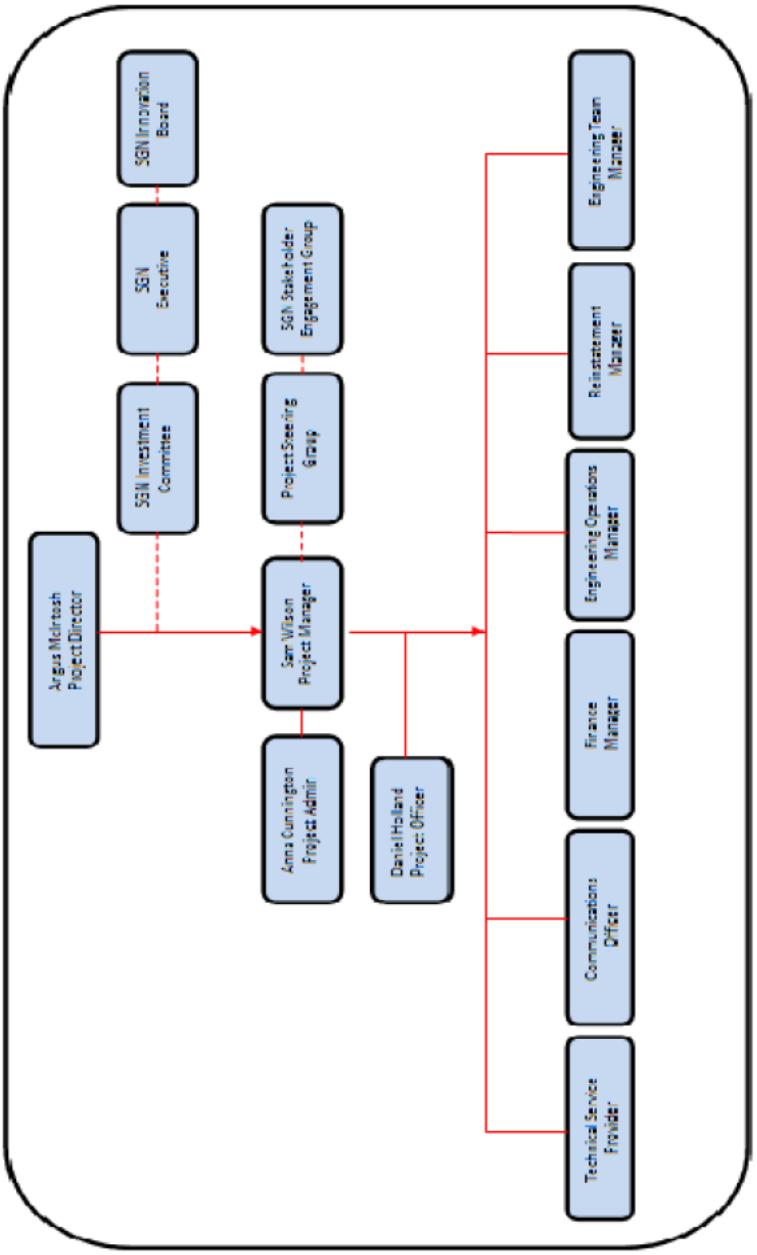
U

- United States Patent and Trademark Office- USPTO

Appendix B

Project team Organograms

SGN Project team



ULC Robotics Organogram

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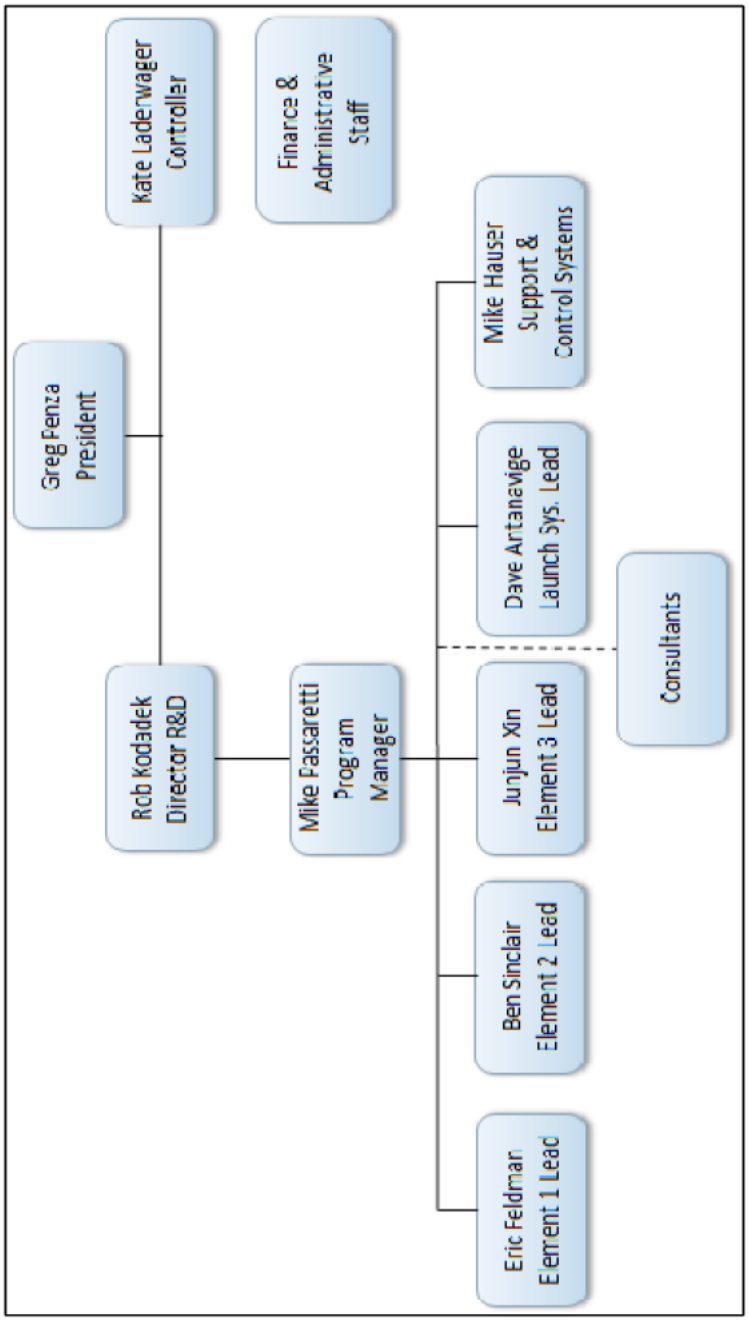

Kate Laderwager
Controller
Finance &
Administrative
Staff
Greg Fenza
President
Mike Hauser
Support &
Control Systems
Dave Artanewige
Launch Sys. Lead
Rob Kodadek
Director R&D
Mike Passaretti
Program
Manager
Junjun Xin
Element 3 Lead
Consultants
Ben Sinclair
Element 2 Lead
Eric Feldman
Element 1 Lead

Appendix C

Project Steering Group terms of Reference

NIC ROBOTICS

PROJECT STEERING GROUP

TERMS OF REFERENCE

Reference to the "Group" shall mean Scotia Gas Networks' Robotics Project Steering Group.

Reference to the "Company" shall mean Scotia Gas Networks.

Reference to 'NIC Project Director' and 'NIC Project Manager' shall mean as defined in winning 'Robotics' NIC bid and associated Ofgem direction.

1 Membership

1.1 The Members of the Group shall be appointed by the NIC Project Director and shall comprise:

- NIC Project Director / Chairman - Angus McIntosh
- NIC Project Manager - Sam Wilson
- Meeting Secretary - Anna Cunnington
- MD Scotland - John Lobban
- Corporate Comms - Chloe Boyce
- Operations - Ray Gould/Ged Paver
- Stakeholder Engagement - Susan Grey
- Safety - Mark Elliot / Malcolm Smith
- Legal - Alastair Scragg
- Engineering Policy - Paul Weller / Malcolm Green
- Asset Management - Steve Catling
- Regulation - Jenny Rogers

1.2 The Chairman of the Group shall be the Innovation and New Technology Manager or in his absence a deputy may be appointed by agreement with the Chairman.

1.3 The Group shall be attended by others (as non-members) as deemed necessary by the Group.

1.4 If a regular member is unable to attend he/she may, with the agreement of the Chairman, appoint another person to deputise.

2 Secretary

The secretary shall be nominated by the Chairman of the Committee.

3 Frequency of Meetings

3.1 The Group will meet every two months, and at such other times as necessary, as the Secretary of the Committee shall invite.

4 Notice of Meetings

4.1 The date, time and location of the next meeting will be agreed by the members at the close of each meeting, otherwise meetings shall be convened by the Secretary at the request of the Chairman Committee.

4.2 A summary of the Project Progress report shall be forwarded by the NIC Project Manager to the Secretary for circulation to each member of the Group, and any other person attending, not less than 3 working days prior to the meeting.

5 Minutes of Meetings

5.1 The Secretary shall minute the attendance, proceedings and resolutions of the Group. Minutes of meetings shall be circulated promptly to all members of the Group.

5.2 Purpose and role of steering group

5.3 To champion the project
5.4 To provide a point of escalation for key decisions and issues;
5.5 To provide strategic guidance;
5.6 To ensure required resources are available; and
5.7 To provide a forum for senior stakeholders to review and approve progress reports.

6 Agenda Items (typical, but not limited to)

- Attendance
- Review of previous actions
- Summary of project progress
- Financial summary
- Project status (RAG assessment)
- Successful Delivery Reward Criteria
- Any other business
- Date and location of next meeting

Appendix D

RPS Summary on Project Progress Report

Executive Summary

This unique project was approved by Ofgem on 19th December, 2013 as part of the Network Innovation Competition (NIC). RPS was appointed by Scotia Gas Networks (SGN) to provide technical services and commenced work on the project on 24th February 2014.

The objective of the project is to support the development of robotic solutions for the GB Gas Distribution Network capable of internally sealing mechanical joints and Weco seals. The robot will also have the ability to collect data using sensor technologies for pipe risk analysis. The project is divided into four key elements:

- Element 1 – Development of a robotic 'platform' and launch system to allow the robot to carry out repair and inspection of large distribution pipes,
- Element 2 – Development of a repair module for repairing mechanical and rubber seals of large distribution pipes,
- Element 3 – Robotic visual and non-visual inspection,
- Element 4 – Automated live asset replacement for smaller distribution pipes.

This industry leading project will see RPS partner with SGN and ULC Pipeline Robotics, a US firm that provides Research & Development on robotic solutions in addition to pipeline maintenance services. RPS will provide technical assessments at key milestones in the development of robotic solutions such as:

- Assessing and carrying out technical reports,
- Supporting the development of operational procedures & deployment,
- Provide analysis of field trial data throughout deployment.

This short project progress report update provides a concise summary of the following areas:

- Progress and achievements for the first six months of the project,
- An overview of the risk management strategy,
- Key objectives for the next six months,
- Description of areas that may have potential to delay the project.

In summary, the project programme is currently progressing well. There is a competent project team in place from all three companies. A risk register has been discussed with all members of the project team with all key project risks identified. Appropriate controls and mitigation measures have been put in place. One key SDRC (Service Delivery Reward Criteria) report on the Conceptual Design has been submitted to Ofgem by SGN. A second SDRC report is due to be submitted by SGN to Ofgem on 25th July 2014 on sourcing a vendor for the sensor technologies.

Progress against Plan and achievements for the first six months

There have been three successful face to face meetings held in London. They have facilitated very useful discussions, clarifications, provided direction and brainstorming sessions as follows:

Date	Meeting Purpose	Attendee's	Comments / Key Outcomes
Friday 21st March, 2014	Project Kick-Off	SGN & RPS	Initial Face to Face Meeting between SGN & RPS. Presentation on RPS experience and project team.
Tuesday 22nd April, 2014	Conceptual Design Overview	SGN, ULC & RPS	Introduction to ULC and presentation on Conceptual Design
Tuesday 13th May, 2014	Sensor Technology Overview	SGN, ULC & RPS	Identification of potential sensors and key pipe defects (graphitic corrosion, stress & strain and wall thickness) to be considered.

In terms of Technology Readiness Level (TRL), this robotics solutions project currently has a rating of 2-3 as it has applied research driven by a desire to broaden scientific and technical knowledge for application on the gas network and is related to an identified problem (i.e. leaking of gas via mechanical & Weco seals).

Risk Management

Risk Management has and will become a fundamental tool in the efficient delivery of this project. A specific Risk Register has been developed in collaboration with Scotia Gas Networks and ULC. The risk management system has been tailored specifically to the requirements of this project but will broadly follow the risk management process as follows:

- Provision of an inherent risk score. This is a product of the likelihood and impact of the risk before any risk management has been put in place.
- Control and mitigation measures will be described to counteract the risk.
- A residual risk score. This is a product of the likelihood and impact of the risk once control and mitigation measures have been implemented.
- Each risk will be given an owner, and
- Provision of an estimated date by when each risk can be eliminated or made redundant.

To date, there have been inputs to the risk register from all parties. An online WebEx Risk Workshop took place on 3rd June 2014 between SGN, ULC and RPS to discuss all relevant risks associated with this robotics project. All potential risks identified were provided with a risk score accordingly by the project team.

The risk management system will be a time-efficient, concise and well-managed process that will maximise value for money for Scotia Gas Networks in the delivery of this project. The project risk register will be dynamic and regularly updated with a structured approach to identify and manage the risks that may impact on the projects aims and objectives. It will serve as a very important tool to ensure the project runs accordingly to the project programme.

Key targets and objectives for the next six months

The key targets for the next six months involve:

1. The provision of SDRC 9.3 – Source Vender for Sensor Technology. Submission for this is due on 25th July 2014.
2. RPS will carry out structural assessments for the maximum allowable forces to which Cast Iron, Ductile Iron and Steel pipes can take. These assessments will provide useful analysis and insight into possible scenarios when determining the suitable condition of pipe to take certain loads when installing the robotic launch tube and also the forces exerted from the robotic wheels.
3. Develop a means/methodology to maximise the value of data gathered by robotic sensors to use in SGN's maintenance regime including integration with the Mains Risk Prioritisation System.
4. Preparation will begin on procurement and testing of the sensor package along with integration and testing the tether with sensor / data acquisition. ULC will continue the development of the robotic platform & joint repair module and prepare for the preliminary functional tests.
5. Preparing testing procedures of the launch system, robotic platform launch including retrieval & travel testing and seal repair tool testing. These tests are scheduled to take place in the 1st six months of 2015.

Any potential areas of concern

The project programme is currently on schedule. The main potential area of concern at the moment revolves around the sensor module and sourcing a suitable vendor given the associated constraints with pipe size and fitting it onto the robotic platform. Selection of the optimum sensor for the project is of paramount importance. If this is not done, it has the potential to delay the project. The sensor must have a high 'Technology Readiness Level' equivalent with the capability of accurate data acquisition, excellent processing time and useful interface for the project. Above all, the selected sensor technology must not put pipe safety at risk.

In addition to this, the robotic platform and repair module is also a potential area for concern if not developed accordingly to specification and also has the potential to delay the project. The above items have been detailed in the project risk register and have gained the highest inherent risk score. ULC are well aware of these risks to the project and have put in place control measures to mitigate these potential areasof concern.

Appendix E

ULC Robotics Summary on Project Progress Report

Executive Summary

The objective of the NIC Robotics project is to develop new, cutting edge robotic repair and inspection technologies which can operate inside live gas distribution mains. This new technology will not only remotely repair leaking mechanical joints and failed Weco seals, but will also support the pipe fracture risk management processes by providing enhanced inspection capabilities.

ULC Robotics has been under contract since February 2014. In that time all of the contractual milestones and their associated deliverables have been submitted on time or ahead of schedule. The detailed design of the transport platform (Element 1) and repair module (Element 2) are in-progress. The research for the sensor module (Element 3) is in-progress and will conclude shortly. The project is fully staffed with dedicated engineering personnel. A total of five engineers and one manager are assigned, full-time to the NIC Robotics project. Additional resources such as sensor consultants have been hired as well. A summary of the project's progress and upcoming objectives are given in this report.

Progress against Plan and Achievements for the First Six Months

Element 1&2

The development of the transport platform and repair module is currently on schedule with no major problems or areas of concern. The specification for the transport platform (Element 1) and repair module (Element 2) was submitted ahead of schedule in February. Immediately following acceptance of the specification, brainstorming and conceptual design work began. Numerous concepts were generated and discussed by the ULC Robotics engineering team. After severalweeks of concept generation, research and analysis, a down-selection process was conducted that yielded a single conceptual design. The conceptual design for the transport platform and repair module was been completed in accordance with the requirements set forth in our agreement. A detailed report (SDRC 9.1) was submitted on time. In addition to submitting the report, ULC Robotics built a plastic stereo-lithography (SLA) model, generated a three-dimensional animation and prepared a presentation of the concept. These were presented to SGN and RPS in London on the 22nd of April 2014.

With the conceptual designs complete, the initial designs for the transport platform and repair module are currently underway. Additionally, the launch system and supporting control systems are also in progress.

Element 3

The development of the sensor module is currently on schedule with no major problems or areas of concern. ULC Robotics is currently researching visual and non-visual inspection technologies in support of the NIC Robotics project objectives. A wide range of technologies are being investigated, evaluated and compared for integration into the NIC Robotics project sensing module (Element 3). Element 3 is being developed in parallel with the repair module as well as the transport platform. These development efforts are tightly integrated within the program and are being continuously informed by one another to minimize risk and maximize project efficiency. Research into sensor technology areas for Element 3 is being conducted by the ULC engineering team with the guidance and support of consultant research specialists and a dedicated sensor engineer. In addition to the areas of sensor technologies which were identified in the proposal, we are

investigating many others. Alternative areas included variants of the originally proposed technologies but also completely new areas that were not previously considered. A number of technologies have been identified that could be applied to this project.

An interim report on the research conducted was submitted on the 11th of April 2014. A meeting to discuss sensor requirements was held in London on the 13th of May. The purpose of the meeting was to decide on requirements for the sensor module (Element 3). The meeting was successful in achieving its goals. The goals for the sensor module requirements meeting were defined as follows:

1. Gain clear understanding of pipe risk model.
2. Discuss specific pipe properties which contribute to pipe risk.
3. Determine what specific pipe properties are the target(s) for the element 3 robotic sensor module.
4. Determine an action plan to add specified target pipe properties to risk model.

In reference to the goals mentioned above, pipe property targets for sensing were determined for the Element 3 robotic sensor module. The pipe property targets were discussed by their importance at the meeting so that they could be listed in order of priority for practical development. ULC will pursue sensing the following pipe property targets:

1. Graphitic Corrosion
2. Stress and/or Strain
3. Pipe Wall Thickness

ULC is working with RPS and SGN to update the current pipe risk model to incorporate data obtained from sensors. RPS will review the pipe risk model to determine how well it fits the pipe diameters inquestion for the NIC robotics project.

ULC Robotics is on schedule to complete the sensor research and deliver the final report to SGN on 20th June 2014. The report will include a recommendation for sensor technology along with methods of use for application on the NIC Robotics project. Sources for the vendors of the technology, along with necessary development services will be preliminarily identified in preparation for the SDRC 9.3 "Source Vendor for Sensor" milestone due 25th July 2014.

Submitted Deliverables Summary

- Element 1&2 Preliminary Specification, due 21 February, submitted 20 February 2014
- Element 3 Preliminary Specification, due 28 February, submitted 27 February 2014
- Element 3 Interim Report on Sensor Research, due 11 April, submitted 11 April 2014
- SDRC 9.1 Element 1&2 Development of Conceptual Designs, due 16 April, submitted 16 April 2014

A summary of the successful delivery reward criteria milestones are shown in Table 1.

SDRC No.	SDRC Description	Status	Due Date

9.1	Element 1&2:	Development of Conceptual Designs	Completed	25 APR 2014
9.2	Element 4:	Development of Conceptual Designs	On-schedule	6 NOV 2015
9.3	Element 3:	Source Vendor for Sensor	On-schedule	25 JUL 2014
9.4	Element 3:	Configuration Testing with Robotic Platform	On-schedule	28 AUG 2015
9.5	Element 4:	Tapping & Fitting Tool Validation	On-schedule	12 MAY 2017
9.6	Element 1&2:	Launch Robot	On-schedule	7 DEC 2015
9.7	Element 3:	Launch Robot	On-schedule	6 NOV 2015
9.8	Element 4:	Launch Robot	On-schedule	15 SEP 2017

Table 1- Overall Project SDRC Schedule

Risk Management

In accordance with the Gas Network Innovation Competition document risks are being tracked and monitored throughout the duration of the NIC Robotics project. ULC Robotics, along with RPS and SGN have recently reviewed the project risk register and collaboratively made updates to it. At the time of this report, the recent changes have not been finalized but are expected to be by the time of the submission of this project progress report.

Key Targets & Objectives for the Next Six Months

The following key targets & objectives are taken from the project schedule.

Element 1&2

The key targets & objectives for the next six months are as follows:

- Initial Design of the Transport Platform, due 18th of July 2014
- Initial Design of the Repair Module, due 18th of July 2014
- Launch System Electrical Schematic Design & Parts Selection, due 27th of June 2014
- Launch System Mechanical Specification Document, due 1st of August 2014
- Development of Launch System Conceptual Designs, due 29th of August 2014
- Creation of Detailed Fabrication & Manufacturing Documentation, due 10th of October 2014

Element 3

The key targets & objectives for the next six months are as follows:

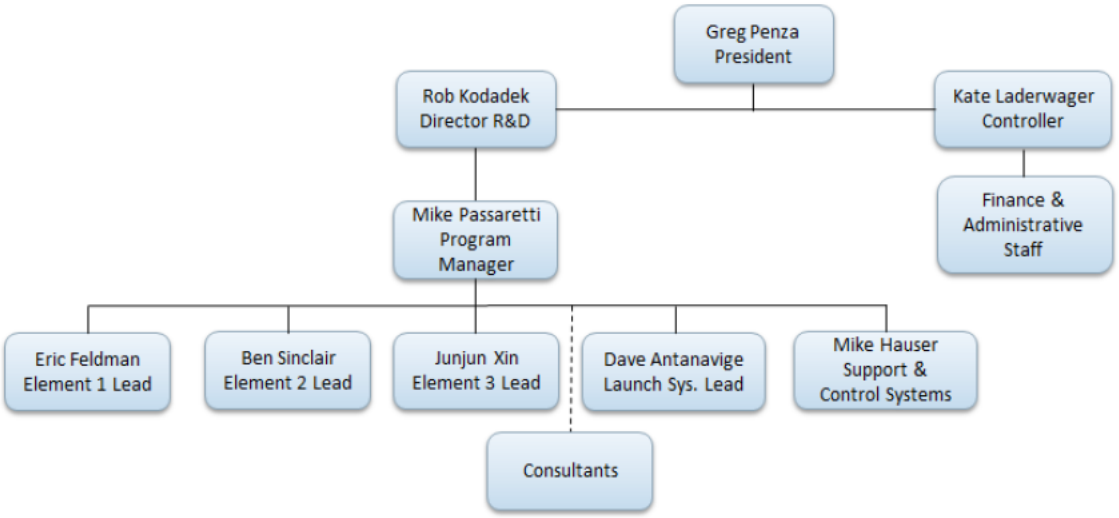
- Final Report on Sensor Research w/ Sensor Recommendations, due 20th of June 2014
- Source Vendor for Sensor, due 18th July 2014 (**SDRC 9.3)
- Procurement & Testing of Sensor Package, due 6th of March 2015
- Electrical & Software System Block Diagram, due 22nd of August 2014
- Initial Electrical Schematic & Parts Selection, due 9th of January 2015
- Sensor Module Specification, due 5th of September 2014

Note: Part of the acceptance criteria for the SDRC 9.3 deliverable is to evaluate the development schedule and make changes where it is appropriate. Therefore some of Element 3 key targets & objective dates listed here could change following the SDRC 9.3 submission.

Intellectual Property Rights

In accordance with the Gas Network Innovation Competition Governance Document, ULC Robotics can report that a provisional patent application for the selected concept of the transport platform (Element 1), repair module (Element 2) and sensor module (Element 3) has been filed with the USPTO on the 30th of April 2014. In accordance with the NIC Project Agreement, the non-provisional patent will be assigned to SGN.

Organization Chart



Expected Variance to Target Price

None

Areas of Concem

None

Appendix F

ULC Robotics Biographies on Sensor Engineering Team

Biography for Joseph Siewick, Sensor Research Consultant,
Joseph Siewick has over 25 years of experience developing sensors and associated technology for commercial and government applications. He earned his doctorate in Chemical Physics (Physics Department) while running a Laser Laboratory and managing the efforts of numerous undergraduate students working as interns in the Electrical Engineering Department of the University of Maryland over a six year period. The diverse sensing technology he has devised and developed include many novel devices and systems, including: various types of secure communications; numerous radars; trace chemical sensing; multi-frame image processing for tracking moving, unresolvable objects in highly-cluttered terrain; IED and landmine sensing and exploiting botanical effects of indigenous plants exposed to explosive and chemical warfare chemicals for military sensing application. One of his fascinations is spoofing sensors to cause them to produce bogus data by exploiting inherent weaknesses of susceptible sensors.

Dr. Siewick is the author of numerous sections of a winning proposal for $4Billion contract for the United States Government focused on Countering Weapons of Mass Destruction that was recently won by Alion Science and Technology where he is currently part-time as the Chief Scientist of Alion's largest business sector. Alion has designated Dr. Siewick as its Key Person for WMD Standoff Sensing under its new C-WMD contract. He was the recipient of the Alion CEO Award for Technical or Scientific Innovation in 2009 that recognized his development of a new type of IED sensor (the Magnetic Effects Sensor) that operates on a distinctly different principle from other such sensors.

Biography for Martin Sala, Sensor Research Consultant,
Martin Sala is a native of Buffalo New York, growing up on the lower East side and receiving a Renaissance education at the State University College of New York at Buffalo with a major in biophysics, a minor and electrical engineering and graduate studies in both biophysics and pathophysiology. He is also a graduate of the US Navy Advanced Electronics Training Command, graduating first in his class, and saw six years of duty.

His career has been spent providing biomedical services to hospitals, clinics and physicians; including designing new medical equipment, experimental devices and techniques. Martin was the first to utilize a CO2 laser and Nd:YAG LASER for surgical procedures at Roswell Park Cancer Institute and has a vast career in inventing and designing measurement instruments for medicine, industry and science. In 1990 he was awarded a research grant from the National Institutes of Health to develop an endoscopic measuring device. Shortly after he invented and patented the first rear-vision system for large vehicles called RetroSpex, being manufactured in Mount Morris New York.

In 1997, Martin was invited to join the research team at Corning Inc.'s Sullivan Park facility, in Corning, New York. At Corning, he established the company's first nondestructive evaluation department, was member of an elite team to solve impossible tasks at any of Corning's production facilities globally; has nine US patents awarded, with 23 applications including work for inventing a means to fabricate nano particulate semiconductor materials in an atmosphere.

Appendix G

Full Project Risk Register

Please find Risk Register on the next pages.

ROBOTICS

Reducing cost through innovation

Definition	Explanation	Probability	Score
Almost certain	event is expected to occur in most circumstances	>90%	5
Likely	event will probably occur in most circumstances	50-90%	4
Possible	event should occur at some time	30-50%	3
Unlikely	event could occur at some time	10-30%	2
Rare	event may occur only in exceptional circumstances	<10%	1

AM - Angus McIntosh
SW - Sam Wilson
SG - Susan Gray
DP - Dave Phelan

Scoring Key

16-25	10-15	1-9

Ref No	Risk	Business Risk	Inherent Risk			Controls & Mitigation	Owner	By When	Project Plan Ref	Residual Risk			Status
			Likelihood	Impact	Score					Likelihood	Impact	Score	
1	**Insufficient Resources** Insufficient resources assigned to the NIC Project Manager and/or ULC's Director of Research and Development. SGN unable to resource personnel for on-site management and management of SCO procedures.	Time / Financial	3	3	9	A - Regular resource review at monthly innovation group meeting. B - Implement and maintain a project programme to monitor deliverables against the timescales and ensure that any shortage of resources impacting delivery of the overall project are clearly identified. Review programme at monthly progress meetings. C - ULC Robotics to contract additional staff to the project. D - SGN to identify dedicated resources to undertake site management and management of SCO procedures. E - RPS has assigned committed resources to carry out technical advisory of the NIC Robotics Project.	A- SW B - SW C - AM D - AM E - DP	Ongoing	N/A	1	3	3	
2	**Local Authorities Communication for E1,2&3** SGN unable to obtain notices from Local Authorities to allow work on the highway.	Time / Financial	2	4	8	A - SGN to liase with Local Authorities as early as possible to expedite the process. B - Input from the SGN Regulation and Corporate Communications Officer where necessary to support engagement with customers.	A - SW B - SW & SG	10/04/2015	54	1	4	4	
3	**Local Authorities Communication for E4** SGN unable to obtain notices from Local Authorities to allow work on the highway	Time / Financial	2	4	8	A - SGN to liase with Local Authorities as early as possible to expedite the process. B - Input from the SGN Regulation and Corporate Communications Officer where necessary to support engagement with customers.	A - SW B - SW & SG	17/02/2017	228	1	4	4	
4	**Stakeholder Opposition for Elements 1,2&3** Has the potential to influence the public's perception of the project. This could lead to a negative response if not handled appropriately; conversely can result in a very positive response.	Reputation	1	4	4	A - Implement and maintain a stakeholder management plan. B - Input from the SGN Regulation and Corporate Communications Officer to ensure high level engagement with customers as early as possible. This will allow our stakeholdeis to understand exactly what we are aiming to achieve and what the benefits are.	A - SW & SG B - SW & AM & SG	Ongoing	N/A	1	4	4	
5	**Stakeholder Opposition for Element 4** Has the potential to influence the public's perception of the project. This could lead to a negative response if not handled appropriately; conversely can result in a very positive response.	Reputation	1	4	4	A - Implement and maintain a stakeholder management plan. B - Input from the SGN Regulation and Corporate Communications Officer to ensure high level engagement with customers as early as possible. This will allow our stakeholdeis to understand exactly what we are aiming to achieve and what the benefits are.	A - SW & SG B - SW & AM & SG	Ongoing	N/A	1	4	4	
6	**Technical Issues with Robotic Platform for Elements 1,2&3** Any technical issues when developing the robotic platform could delay the Project and lead to increased costs. Further issues may arise if the project timeline begins to slip.	Time / Financial	4	4	16	A - ULC Robotics to divert staff from other aspects of the business to support the project. B - Go / No Go Stage Gate at early stages of the project.	A - ULC B - SW & RPS	10/04/2014	54	1	4	4	

7	**Technical Issues with Robotic Platform for Element 4** Any technical issues when developing the robotic platform could delay the Project and lead to increased costs. Further issues may arise if the project timeline begins to slip	Time / Financial	4	4	16	A - ULC Robotics to divert staff from other aspects of the business to support the project. B - Go / No Go Stage Gate at early stages of the project.	A - ULC B - SW & RPS	09/01/2017	253	1	4	4	
8	**Repair Module (Element 2)** Issues that may occur when developing the Repair Module has the potential to delay the project.	Time / Financial	4	4	16	A - ULC Robotics to divert staff from other aspects of the business to support the project. B - Go / No Go Stage Gate at early stages of the project.	A- ULC B - SW & RPS	18/07/2014	48	1	4	4	
9	**Sensor Module (Element 3)** Issues that may occur when developing the Sensor Module has the potential to delay the project. Selection of optimum Sensor. Sensor Accuracy, Processing Time, Interface & Usefulness. Sensor Module proposed puts pipe safety at risk.	Time / Financial	4	4	16	A - ULC Robotics to investigate optimum solution to satisfy the needs of the project. B - Go / No Go Stage Gate at early stages of the project.	A- ULC B - SW & RPS	23/10/2015	160	2	4	8	
10	**Repairing Leaking Joints** There is a risk that a solution for remotely repairing leaking Weco seals and mechanical joints will not be determined.	Financial	1	5	5	A - Develop sealing methods and conceptual designs early in the project schedule to ensure that a method is determined. B - Shop testing will be performed to ensure that the methodology provides an adequate seal. C - Go / No Go Stage Gates added into the project plan in case a solution has not been determined.	A - ULC B - ULC C - SW & RPS	03/07/2015	79	1	5	5	
11	**Sensor Manufacturer Not Found** There is a risk that a sensor manufacturer will not be found which meets the requirements i.e. functioning and transmitting data accurately over a long distance, providing accurate measurement of pipe wall loss, measurements in varying pipe diameters etc.	Time / Financial	2	5	10	A - Generate a report outlining options for sensors and the pros/cons of each will be performed early in the project. B - A collaborative decision relative to the sensor selected for the project will be performed. C - Go / No Go Stage Gates added into the project plan in case a manufacturer is not found.	A - SW B - SW & ULC C - SW & RPS	25/07/2014	129	2	5	10	
12	**Sensor Manufacturer** Delays from the sensor manufacturer could affect the overall schedule.	Time / Financial	3	4	12	A - ULC Robotics to divert staff from other aspects of the business to support the project. B - Review project plan if required for sourcing sensor vendor	A - SW B - SW	25/07/2014	129	2	4	8	
13	**Technical Issues with Service Replacement** Any unforeseen technical issues with service replacement could hamper the effectiveness of the robotic system and delay the Project. For example; identifying custom flexible PE tubing to insert in the service line, identifying custom fittings for service replacement and ensuring a reliable and gas tight seal on the newly connected service.	Time / Financial	4	4	16	A - ULC Robotics to divert staff from other aspects of the business to support the project. B - Test robot in mock up main. C - Go / No Go Stage Gates at early stages of the project.	A - SW B - SW C - SW & RPS	14/04/2017	247	1	4	4	
14	**Field Trial Challenges** The mains selected for the field trial are not suitable for the robotic operation.	Time / Financial	3	3	9	A - Network Analysis undertaken. B - Familiarity with site location and mains. C - Pre inspection of main using camera.	A - SGN B - SGN & ULC C - SW & RPS	23/06/2017	267	1	3	3	
15	**Launch Robot for Elements 1,2&3** SGN / ULC Robotics are unable to launch the robot into the main.	Time / Financial	1	5	5	A - Ensure entry tee compatible with launch tube and manufacturer requirements. B - Design parameters well defined. C - Go / No Go Stage Gate at early stages of the project.	A- ULC B - ULC C - SW & RPS	18/01/2016	80	1	2	2	
16	**Launch Robot for Element 4** SGN / ULC Robotics are unable to launch the robot into the main.	Time / Financial	1	5	5	A - Ensure entry tee compatible with launch tube and manufacturer requirements. B - Design parameters well defined. C - Go / No Go Stage Gate at early stages of the project.	A- ULC B - ULC C - SW & RPS	27/11/2017	253	1	5	5	

17	**Robot Manoeuvrability E1,2&3** There is a risk that a motor drive system capable of transporting the robotic system for each element cannot be developed.	Financial	2	4	8	A - ULC have significant experience developing and deploying complex electromechanical systems in live natural gas mains and other inaccessible locations. B - Ability to apply past engineering knowledge along with computer modelling and simulation to guide the conceptual design of the robotic platform drive system. C - Go / No Go Stage Gates added into the project plan in case a solution has not been determined.	A- ULC B - ULC C - SW & RPS	06/02/2015	74	1	4	4	
18	**Robot Manoeuvrability E4** There is a risk that a motor drive system capable of transporting the robotic system for each element cannot be developed.	Financial	2	4	8	A - ULC have significant experience developing and deploying complex electromechanical systems in live natural gas mains and other inaccessible locations. B - Ability to apply past engineering knowledge along with computer modelling and simulation to guide the conceptual design of the robotic platform drive system. C - Go / No Go Stage Gates added into the project plan in case a solution has not been determined.	A- ULC B - ULC C - SW & RPS	09/09/2016	241	1	4	4	
19	**Structural Assessment** Risk associated with the Launch Tube and the structural integrity of the pipe condition to take loads.	Time / Financial	1	4	4	A - RPS to carry out assessment with review from Structural Engineers. Structural Assessment takes into account maximum loads in ideal scenarios and then provides assumptions that affect maximum loads (for example wall thickness & unsupported pipe lengths). B - ULC to agree and be satisfied with assumptions.	A- RPS B - ULC	12/05/2017	N/A	1	4	4	
20	**Robotic Functionality For E1,2&3** There is a risk that the technology developed cannot be operated at the target length of 150 meters or manoeuvre around debris, obstacle and bends.	Financial	2	4	8	A - Utilise 3D modelling and simulation techniques throughout the design to determine the estimated travel distance and ability to manoeuvre within the pipe (launch, retrieve, avoid or travel over/through debris and obstacles, etc.). B - Once the manoeuvrability and the overall travel distance for each pipe size has been determined a decision can be made to pursue one concept, modify the design to meet the specifications of the project or modify the project criteria to meet the design limitations. C - Go / No Go Stage Gates added into the project plan in case a solution has not been determined.	A- SW / ULC B - SW & ULC C - SW & RPS	25/09/2015	74	1	4	4	
21	**Robotic Functionality for E4** There is a risk that the technology developed cannot be operated at the target length of 150 meters or manoeuvre around debris, obstacle and bends.	Financial	2	4	8	A - Utilise 3D modelling and simulation techniques throughout the design to determine the estimated travel distance and ability to manoeuvre within the pipe (launch, retrieve, avoid or travel over/through debris and obstacles, etc.). B - Once the manoeuvrability and the overall travel distance for each pipe size has been determined a decision can be made to pursue one concept, modify the design to meet the specifications of the project or modify the project criteria to meet the design limitations. C - Go / No Go Stage Gates added into the project plan in case a solution has not been determined.	A- SW / ULC B - SW & ULC C - SW & RPS	16/08/2014	245	1	4	4	
22	**Capabilities of the Tether for Elements 1,2&3** There is a risk that a tether capable of carrying power and data connections meeting the distance and bend radius requirements cannot be developed. For example; transmitting data over a long distance, providing sufficient bend radius, manufacture lightweight and robust tether to the desired length.	Financial	2	5	10	A - Deliver a list of conceptual design requirements to cable manufacturers for quotations early in the project to mitigate against technical and schedule risk. B - Experience working with several industrial cable manufacturers to develop custom, highly specialised tethers for powering and controlling robotic systems. C - Conceptual Design Go / No Go Stage Gate added into the project plan at an early stage in case a solution cannot be determined. D - ULC are aware of the issue of gas leakage at the gland arrangement of the large CISBOT launch tube.. This will be factored into conceptual design	A - SW B - SW C - SW & RPS D - ULC	06/02/2015	73	1	5	5	

23	**Capabilities of the Tether for Element 4** There is a risk that a tether capable of carrying power and data connections meeting the distance and bend radius requirements cannot be developed. For example; transmitting data over a long distance, providing sufficient bend radius, manufacture lightweight and robust tether to the desired length.	Financial	2	5	10	A - Deliver a list of conceptual design requirements to cable manufacturers for quotations early in the project to mitigate against technical and schedule risk. B - Experience working with several industrial cable manufacturers to develop custom, highly specialised tethers for powering and controlling robotic systems. C - Conceptual Design Go / No Go Stage Gate added into the project plan at an early stage in case a solution cannot be determined. D - ULC are aware of the issue of gas leakage at the gland. This will be factored into conceptual design	A - SW B - SW C - SW & RPS D - ULC	09/09/2014	243	1	5	5	
24	**Tapping and Fitting Tools** There is a risk that a tapping and fitting tools capable of being carried and operated by the service replacement robot cannot be developed.	Financial	2	5	10	A - Tools for service replacement will be identified early in the development stage of the robotic system. B - Experience developing a prototype service replacement robot which performed tapping and fitting of a new service connection on inserted PE pipe. C - The entire system will be shop tested at ULC to ensure it performs prior to being deployed in the field. D - Tapping and Fitting Tool Validation Go / No Go Stage Gate added into the project plan in case a solution cannot be determined.	A- ULC B - ULC C - SW & ULC D - SW & RPS	12/05/2017	250	1	5	5	
25	**Cost Escalation** Costs may escalate due to unforeseen circumstances and / or unknown delays in Programme, procurement, shipping, field trials etc.	Financial	2	5	10	A - Build sufficient float into Project plan B - Project has built in Go/No Go Stage Gates to ensure an opportunity to halt Project at anytime.	A- SW / ULC B - SW & RPS	Ongoing	N/A	1	5	5	
26	**SME Cashflow** There is a risk that ULC may not have the required cash flow to complete each task defined on the project plan.	Financial	2	5	10	A - Up front mobilisation payment. B - Project has built in payment milestones to ensure steady cash flow. C - Go/No Go Stage Gates added into the project plan at critical points.	A - SW B - SW & ULC C - SW	Ongoing	N/A	1	5	5	
27	**Timetable Slippage** Timetable may slip due to unforeseen circumst ances and / or unknown delays in procurement, custom and shipping to the UK.	Time	2	4	8	A - Build sufficient float into Project plan B - Regular steering group reviews to monitor progress against the programme C - If required there is an opportunity to halt programme at Go/No Go Stage Gates	A - SW & AM B - SW & AM C - AM	Ongoing	N/A	2	4	8	
28	**Operational of Robot in Live Main For Elements 1,2&3** Safety risk - pollution risk from gas leakage and potential for debris from inside the main to be spread when removing the robot	Time / Financial	2	4	8	A - Spillage kits available at trial sites B - Monitor level of debris being removed from main visually using robot camera	A - SW & RPS B - ULC	02/03/2015	168	2	4	8	
29	**Operational of Robot in Live Main For Element 4** Safety risk - pollution risk from gas leakage and potential for debris from inside the main to be spread when removing the robot	Time / Financial	2	4	8	A - Spillage kits available at trial sites B - Monitor level of debris being removed from main visually using robot camera	A - SW & RPS B - ULC	09/01/2017	253	1	4	4	
30	**Structural Integrity of Pipe Wall** The structural integrity of the pipe wall should be accounted for when the robot is traversing past it.	Reputation / Time / Financial	1	4	4	A - A Structural Assessment will be carried out to mitigate this risk B - Launch tube oper ational weight design parameters set for ULC C - Coupon sample t aken from main at initial survey to confirm main material prior to the launch tube being fitted	A - RPS B - SW & RPS C - SW & ULC	24/11/2014	61	1	4	4	
31	**Communication of Project Team** Due to geographical split of team across UK, Ireland and the USA, there is a risk that effective communication channels may not be maintained efficiently.	Time / Financial	1	4	4	A - Face-to-face meetings for key stage gate deliverables B - Use of virtual meeting centre and secure file share	A - SW B - SW	Ongoing	N/A	1	4	4	
32	**Impact of UK legislation/HSE acknowledgement of remediation technique.**	Time / Financial	3	4	12	A - SGN to set up regular progress meetings with HSE B - RPS and SGN to check legislative requirements for system operation and outputs	A - SW & AM B - RPS	Ongoing	N/A	2	4	8	