

## NIA Project Registration and PEA Document

### Date of Submission

Feb 2014

### Project Reference Number

NIA\_SGN0005

## Project Registration

### Project Title

Corrosion Mapping System for Buried "Orpheus" Regulator Modules

### Project Reference Number

NIA\_SGN0005

### Project Licensee(s)

SGN

### Project Start

January 2013

### Project Duration

0 years and 11 months

### Nominated Project Contact(s)

Ryan Smith, Innovation Delivery Manager

### Project Budget

£209,602.00

## Summary

This project will aim to support the technical development of the buried Orpheus module corrosion mapping system, which will enable Network Licensees to carry out internal long range NDT inspection of Orpheus 10 governor installations without having to excavate or grit blast the pipework.

The scope of works will provide a fundamental basis to work from when progressing through the key stages of this project, comprising of:

- Design
- Procurement and Assembly
- Testing and Commissioning
- Reporting and Delivery.

This project is innovative as it has the potential to provide 95% corrosion mapping through the utilization of the newly designed ultrasonic probe.

### Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

## Problem Being Solved

All pressure systems operating above 0.5barg are included within the scope of the Pressure Systems Safety Regulations (PSSR) 2000. In order to maintain the integrity of buried regulator modules that fall within the scope of the regulations it is essential that the have cathodic protection (CP) with monitoring being undertaken. Where CP has not been applied or has failed, a detailed ultrasonic inspection should be carried out at a frequency not exceeding 6 years. Buried Orpheus regulator modules have a history of failed CP

and where appropriate, must therefore be subjected to conventional Non Destructive Testing (NDT). The installation must be carefully excavated, the vessel and associated pipework will then be grit blasted and inspected and assessed for corrosion prior to being repaired (if necessary) and re-painted with the excavation being reinstated at a later date. In specific circumstances this maintenance operation may require road closure notices and lane rental payments to be agreed with the local road authorities. The time associated with carrying out this particular maintenance inspection on the buried Orpheus module is approximately 3 weeks.

In order to minimise the completion time and the operational activities associated with this process, the development of a technique that requires no excavations or grit blasting and can carry out internal long range NDT inspection of affected Orpheus modules would be advantageous to all Network Licensees in Great Britain (GB)

## Method(s)

This project aims to design, build and manually deploy a suitable mechanism for carrying out corrosion mapping on Orpheus 10 governor module installations. In order to achieve the anticipated expectations of this project SGN have delivered a standard Orpheus 10 governor installation to the project supplier's research facilities, located at Egremont, Cumbria.

This has provided them with a fundamental basis to work from when exploring the methodology of solving the problem as described:

1. The deployment system sits flush on the Orpheus 10 flange and locates on the protruding pins. The deployment system comprises a turntable ring and a frame to deploy an ultrasound probe vertically into the valve. The poles are initially fed through the deployment wheels.
2. The ultrasound head and camera is then attached to the end of the deployment pole. A cover plate can be used to allow the operator to attach the camera and ultrasound head to the deployment poles safely after it is clear from the deployment wheels. Afterwards the ultrasound head would be lowered to the top of the vessel and zeroed for scan.
3. The operator deploys the ultrasound head mounted to the deployment poles into the Orpheus vessel at the desired speed.
4. The ultrasound head is deployed to the base of the Orpheus vessel, the poles will be designed to ensure the vertical line is retained when the ultrasound head passes over the 14" opening from the pipe inlet.
5. The ultrasound head is attached to the deployment pole by a hinge, as it reaches the curved base it pivots to ensure the probe keeps contact to the base.
6. The ultrasound head traverses to / past the mid point of the base.
7. The ultrasound head reaches the opposite wall to ensure complete coverage on the base of the valve.
8. The ultrasound head is retrieved then the top assembly is rotated by one increment and the process repeated.
9. Once 80-90% of scanning has been completed the lower pole section is reconfigured to be 90° to vertical and offset to allow the ultrasound head to reach around and under the 3" and 14" pipe profiles
10. To allow the ultrasound head & probe to reach around the pipes, the turntable at operator level is rotated whilst the ultrasound head is lowered under the desired pipe. This would allow the ultrasound head to reach past the centre line of 14" pipe and ensure complete coverage.

Following completion of the project, which includes a rig trial that will be carried out in Egremont, SGN will be provided with a final report that presents the findings, conclusions and any further recommendations of the project.

## Scope

This project will aim to support the technical development of the buried Orpheus module corrosion mapping system, which will enable Network Licensees to carry out internal long range NDT inspection of Orpheus 10 governor installations without having to excavate or grit blast the pipework. The scope of works will provide a fundamental basis to work from when progressing through the key stages of this project, comprising of:

- Design
- Procurement and Assembly
- Testing and Commissioning
- Reporting and Delivery

This project is innovative as it has the potential to provide 95% corrosion mapping through the utilization of the newly designed ultrasonic probe.

## Objective(s)

The objectives of this project are to:

- Design and build a mechanism that can be manually deployed, whilst being attached to the internal cover surface of the installation and provide 95% corrosion mapping of Orpheus 10 governor.
- Eliminate the need to excavate for maintenance inspection of Orpheus modules and as a result eliminate excavated material sent to landfill.

- Eliminate the hazardous operation of grit blasting, along with the safety and environmental impacts associated with painting the pipework.
- Reduce the time taken to carry out the maintenance inspection operation for Orpheus modules.
- Reduce the amount of excavation work required, which in turn will reduce the amount of disruption to customers.
- Reduce the amount excavated material sent to landfill.

**Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)**

n/a

**Success Criteria**

In order to determine whether this project has been successful or not the project must progress through a number of stage gate milestones. SGN's project manager will evaluate the design and the mechanism's performance against the requirements before approving progress to the next stage. Some of the key expected outcomes, representing successful delivery of the project, will be to assess:

- The potential to develop a unit that will carry out 95% mapping of the Orpheus 10 governor
- Whether the need to excavate for maintenance inspection of Orpheus modules can be eliminated
- The reduction in the amount of excavation required and the amount of material sent to landfill
- Whether the use of grit blasting for inspection purposes can be eliminated

**Project Partners and External Funding**

n/a

**Potential for New Learning**

n/a

**Scale of Project**

This project has been developed to initially undertake research testing off site, this scale is deemed appropriate to establish technical feasibility and therefore whether further investigation would be beneficial.

**Technology Readiness at Start**

TRL2 Invention and Research

**Technology Readiness at End**

TRL4 Bench Scale Research

**Geographical Area**

This project will take place at James Fisher Nuclear research facilities in Egremont, Cumbria.

**Revenue Allowed for the RIIO Settlement**

During GD1 it is estimated that SGN will spend approximately £53.1m on regulator modules, which will largely cover replacement, maintenances and inspection. While no direct saving on this is expected during the project, it is anticipated that successful completion of this project could in future potentially provide Network Licensees with a valuable tool with regards to maintenance and inspection of buried regulator modules.

**Indicative Total NIA Project Expenditure**

The Initial cost of this project was funded from SGN's Innovation Funding Incentive (IFI) in 2012/13. The outstanding expenditure is expected to be £181,847, 90% of which is allowable NIA expenditure.

## Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

### Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

#### How the Project has the potential to facilitate the energy system transition:

n/a

#### How the Project has potential to benefit consumer in vulnerable situations:

n/a

### Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

#### Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

The introduction of this newly developed NDT corrosion mapping system project has the potential to deliver large financial savings against the original method if successful outputs are achieved. At present, it costs each Network Licensee on average £40,000 to comply with industry requirements and manage the maintenance inspection of each one of their Orpheus modules every 6 years. It is anticipated that the majority of these operational costs that make up the maintenance inspection can be eliminated if this project solves the problem the industry currently faces.

#### Please provide a calculation of the expected benefits the Solution

At present SGN currently spends an estimated £1,400,000 every 6 years to ensure compliance is met with their below ground Orpheus installations.

The introduction of this new project technique, if implemented successfully has the potential to provide financial benefits. However, at present this is a research project and it is not possible to determine the cost of undertaking a live site inspection using this newly developed NDT corrosion mapping system.

#### Please provide an estimate of how replicable the Method is across GB

SGN asset records show we have approximately 35 Orpheus 10 governor installations across our networks where the techniques from this project could be applied.

Based on a 4:2:1:1 split with reference to the size of the networks, it could be assumed National Grid have approximately 70 governors installations and Wales & West Utilities and Northern Gas Networks have around 17 each, giving an estimated total of around 139 Orpheus 10 governor installations to be inspected every 6 years in GB.

While this estimate provides an indication of potential applicability, it is important to note it is necessarily based on a number of unqualified assumptions and therefore subject to a large sensitivity margin. It must be noted that these figures are based on averages and estimates rather than real network data and the complexity of Orpheus 10 governors will vary from site to site as each one is unique. The main focus of this project is to test the technique. It is fully understood that not all Orpheus 10 governors will be the same dimensions as the one that this project is being tested against i.e. not all installations will have a 14" opening from the pipe inlet.

## Please provide an outline of the costs of rolling out the Method across GB.

If it is estimated that there are 139 Orpheus 10 governor installations GB-wide and the cost of carrying out a site inspection using this newly developed NDT corrosion mapping system is estimated to cost £10,000 per governor (assuming an average of 2 streams per governor), it can be estimated that it would cost around £1,390,000 every 6 years to inspect all relevant governor installations. This compares with a current estimated total expenditure for GB of around £5,560,000 every six years.

## Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

- ☒ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).
- ☐ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)
- ☐ A specific novel operational practice directly related to the operation of the Network Licensees system
- ☐ A specific novel commercial arrangement

RIIO-2 Projects

- ☐ A specific piece of new equipment (including monitoring, control and communications systems and software)
- ☐ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven
- ☐ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)
- ☐ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology
- ☐ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution
- ☐ A specific novel commercial arrangement

## Specific Requirements 4 / 2a

### Please explain how the learning that will be generated could be used by the relevant Network Licensees

The learning from this project will benefit Network Licensees as it will provide them with a clear evaluation of the current techniques against the potential benefits of the new Orpheus valve corrosion mapping system. If successful the learning from the project (new design and prototype testing of ultrasonic probe) will allow network licensees to make an informed decision on whether they would like to acquire this specialist technology and implement on the Orpheus 10 governors on their networks.

### Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

n/a

- ☒ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

### Is the default IPR position being applied?

- ☒ Yes

## Project Eligibility Assessment Part 2

### Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

### Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

n/a

**If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.**

n/a

## **Additional Governance And Document Upload**

**Please identify why the project is innovative and has not been tried before**

n/a

### **Relevant Foreground IPR**

n/a

### **Data Access Details**

n/a

**Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities**

n/a

**Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project**

n/a

**This project has been approved by a senior member of staff**

☒ Yes