Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Jan 2017

Project Reference Number

NIA_NGGT0102

Project Registration

Project Title

Acoustic Resonance Technology (ART)

Project Reference Number

NIA_NGGT0102

Project Licensee(s)

National Gas Transmission PLC

Project Start

January 2017

Project Duration

1 year and 3 months

Nominated Project Contact(s)

Kirsty McDermott, box.GT.Innovation@nationalgrid.com

Project Budget

£361,474.00

Summary

In pipe inspection techniques are important in the ongoing maintenance of the gas transmission pipeline infrastructure. Acoustic Resonance Technology is a new type of in line inspection measurement which uses ultrasonic techniques.

The main advantage of the technique would be the ability to accurately locate features on the pipe circumferentially and accurately size any defects identified. This will be key information in understanding criticality of defects found when assessing the pipeline integrity and making effective, efficient decisions repairs and replacement.

The ultrasonic technique means there is no requirement for a liquid couplant between the measuring probe and the pipe wall. It can also cope with a large stand-off between the pipe wall and the sensor so multiple diameter pipelines can be inspected with the same sensor arrangement. This arrangement also offers advantages as it potentially requires less onerous network configurations for running inspections. In recent times changing flow patterns mean that the scheduling of ILI runs and the flow / speed control required can be problematic. A tool which can cope with higher gas flows would be advantageous.

Detection of coating disbondment is also seen as a key enhancement ART could bring. This is an area of risk particularly related to metal loss corrosion at AGI sites. Coating disbondment can lead to false cathodic protection readings and lead to rapid corrosion in localised areas. Current disbondment survey techniques are limited to EMAT. This technique remains expensive and has proven to be unreliable in evaluating disbondment. Evaluation of coating disbondment capability through ART, will, if successful provide additional information on an existing integrity risk which cannot currently be readily quantified or targeted.

Third Party Collaborators

Halfwave AS

Pipeline Integrity Engineers Ltd

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

The current industry in-line inspection (ILI) techniques are based on magnetic flux leakage (MFL) technology. The MFL technique is highly developed and as such the non-destructive evaluation for NTS is extremely comprehensive. However, acoustic resonance techniques (ART) offers potential advantages over the conventional MFL techniques in two key aspects:

> ART is a non-contact detection technique and thus ILI vehicles (PIGs) utilising this technique can operate over a wider range of network operating conditions.
>
> ART gives an absolute measurement of wall thickness and has been shown to be highly sensitive to coating disbondment or delamination and metal loss.

Changes to NTS flow patterns and operations as well as the increasing challenges associated with managing an aging asset base, mean that ART could offer a step change in improvement with regards to asset integrity assessment and maintenance.

Method(s)

The three key deliverables are associated with a demonstration run of the ART inspection tool on a NTS pipeline are as follows:

- Pre-inspection preparation
- Infield run: pipeline survey and pipeline inspection including operations procedures, lifting procedures, inspection tool preparations, and inspection run
- Data analysis and reporting: preliminary and final

The trial will be supported by a comparison of ART results with previous MFL results from the relevant pipeline section.

June 2017: Change Control

Following the initial run in April 2017, there were a number of operational issues that were experienced which reduced the total data set collected. Even accounting for these issues, the data collected and analysed offered considerable insight related to this technology and ILI technique and the benefits that it will bring to National Grid's ILI campaigns.

To ensure that the full potential of ART ILI has been examined, a further ILI operation on the well characterised feeder 10 will be performed. This run will enable a direct comparison with other ILI techniques and provide a comprehensive assessment of this technique and its viability for National Grid's ILI operation.

Scope

In pipe inspection techniques are important in the ongoing maintenance of the gas transmission pipeline infrastructure. Acoustic Resonance Technology is a new type of in line inspection measurement which uses ultrasonic techniques.

The main advantage of the technique would be the ability to accurately locate features on the pipe circumferentially and accurately size any defects identified. This will be key information in understanding criticality of defects found when assessing the pipeline integrity and making effective, efficient decisions repairs and replacement.

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Objective(s)

The objective is to deliver a full assessment of the ART inspection tool through an ILI demonstration of an agreed NTS pipeline section.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project is the completion of a trial and full evaluation of gas transmission pipe ART ILI capability.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project is a field trial demonstration on a NTS pipeline section.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will be a demonstration on a NTS pipeline section.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£361,473.66

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)

Total savings could be in excess of £5m.

Please provide a calculation of the expected benefits the Solution

The main financial benefit results from avoiding unnecessary excavations. Currently technology may indicate superficial defects but without relevant detail of sizing and criticality. Increased accuracy of wall thickness measurements will allow realistic corrosion growth assessment. A conventional ILI would provide a range of +/- 1.9mm for a wall thickness of 19.1mm as opposed to +/-0.2mm with the ART sensor. Policy assumes a rate of corrosion of 0.1-0.2mm/yr which means a potential misinterpretation of corrosion growth by up to +/-19 years or ART by +/- 2 years. Based on a conservative 10 year re-inspection interval this means that it should be possible to confirm with certainty whether a feature has grown using ART whilst it is not possible to do this with current MFL ILI technology.

Over the past three years, over 400 defects were identified through ILI on NTS pipelines that required further action i.e. excavation. A pipeline excavation can cost in the region of ~£70k, and of the 100 defects that have been assessed to date through excavation 25% have been assessed as "superficial" i.e. an unnecessary excavation. Assuming a similar rate for the remaining defects, savings of over £5m could be realized through improved ILI data leading to the improved elimination of any unnecessary pipeline digs.

From a network planning perspective, the possibility of being able to carry out internal inspection at up to 10m/s would provide significant benefits in being able to carry out inspections and could result in operations being able to be carried out through the year with minimal impact/restriction on network operation, this could have significant financial and operational benefits for NGGT and directly connected customers.

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

The ART inspection technique will have applicability across other gas networks operating pipelines within the required pressure constraints.

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

Estimated costs for ART inspection are in the region of £123,000 including preparation, inspection and data analysis.

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 could be applied to all gas network high pressure pipeline sections that operate within the working envelope of ART.

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

The project is aligned to NGGT's reliability theme.

☑ 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