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 2016

Project Reference Number

NIA_NGGT0085

Project Registration

Project Title

New techniques for the measurement of pipeline depth of cover

Project Reference Number

NIA_NGGT0085

Project Licensee(s)

National Gas Transmission PLC

Project Start

January 2016

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Paul Ogden

Project Budget

£196,000.00

Summary

The following project scope is to be undertaken:

1. Develop a methodology to identify areas of reduced pipeline depth of cover using inertial measurement data, ground elevation data and additional geographic data.

2. Perform an assessment of depth of cover using the developed methodology for 1 pipeline. This pipeline will be internally inspected using an intelligent pig which will include an inertial measurement unit, once inspected this data will be processed to provide an accurate route showing the position and elevation of the pipeline. The accurate route of the pipeline will then be processed with ground elevation data and additional geographic data sources to identify the depth of cover along the pipeline.

3. Evaluate the accuracy of the developed methodology by performing in-field measurements of depth of cover using pipe locating and survey equipment

Third Party Collaborators

ROSEN

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Third party interference is widely documented as being primary source of damage to buried pipelines within the UK. In addition to routine surveillance, depth of cover is recognised as a primary method of mitigation against third party interference, therefore ensuring that the depth of cover is adequate is important to reduce the likelihood of third party interference occurring.

Current depth of cover measurement techniques are deployed in the field and only provide spot measurements, therefore any close interval depth of cover surveys for an entire pipeline require a considerable amount of effort.

Develop a methodology to effectively identify areas of reduced depth of cover over an entire pipeline. This would support National Grid in reducing the likelihood of third party interference events occurring.

Method(s)

As part of the trial, it is proposed to utilise pipe location data obtained from internal pipeline inspection to provide an accurate position and elevation profile for the entire pipeline. The trial will combine pipe location data from in-pipe inspection with ground elevation data and other applicable data sources, to identify areas of reduced pipeline depth of cover.

The following discrete tasks are proposed. It should be noted that all tasks are required to complete the trial.

Task 1 – Technology Survey

The project will undertake a survey of available literature related to technologies that can be used to locate reduced depth of cover on buried pipelines. Information will be obtained from published studies, manufacturer's literature, internet search and personal correspondence. The technology survey will consider technologies for: 1) direct measurement of depth of cover, 2) mapping of buried pipelines, and 3) acquisition and derivation of digital elevation models. The output from this task will be a short technical report which will discuss and document technologies and, where appropriate, offer guidance to the remainder of the tasks to be completed in this proposal.

Task 2 – Inspection Preparation

To ensure that an accurate position and elevation profile of the pipeline is obtained from the internal inspection, thorough preparation is required. NGG currently use ROSEN to undertake internal inspections of the buried pipeline, specifically with the remit to identify corrosion or damage to the pipeline which may impact pipeline integrity. As part of the inspection an inertial measurement unit is included with the inspection tool (often referred to as a pig), the inertial measurement unit provides data to identify changes of direction along the pipeline i.e. bends. This data can be processed following the inspection, to provide an accurate map of the pipeline for use in a geographic information system (GIS). To complete this inspection ROSEN will provide an optimised inertial measurement unit to ensure that accurate pipeline position information is collected during the inspection. In addition to the optimised inertial measurement unit, accurate tracking of the inspection tool is required. This is achieved by deploying above ground markers, prior to the inspection tool being launched, which are detected by the inspection tool. Accurate position data (differential GPS coordinates of the marker and depth of cover on the pipeline) at each above ground marker is used to correct for drift in the IMU, thus improving the accuracy of the pipeline coordinate data used for input to GIS. To complete this study it is proposed to deploy above ground markers at 0.5 km intervals along the pipeline. It is recognised that this may be time consuming to complete and therefore this study will also evaluate the impact on accuracy of the results for a range of marker intervals.

Task 3 – Internal Inspection

It is proposed to trial this methodology on a pipeline that is currently scheduled for an internal

inspection1. The optimised inertial measurement device will be included within the inspection tool for this inspection. The costs to complete this inspection are not included within this scope of work. The internal inspection will be completed in accordance with NGG policies and procedures and undertaking this trial will not comprise the quality of the data retrieved for the purposes of evaluating the pipeline integrity.

Task 4 – Post Inspection Data Processing

Following successful completion of the internal inspection (Task 2) post processing of the data obtained from the IMU will be completed by ROSEN. The output from this will be an accurate centreline profile for the pipeline, provided in a GIS compatible data format. Completing the post processing of the IMU data will not impact the delivery of the standard inspection data required by NGG policies and procedures.

Task 5 – Depth of Cover Assessment

To identify areas of reduced depth of cover, accurate ground elevation data above the pipeline is required. It is proposed to utilise a national database of Light and Detection Ranging (LiDAR) data available from the Environment Agency. This database has a vertical accuracy of between 5 and

15 cm, at a horizontal resolution of between 25 cm and 2 m. MACAW will integrate the ground elevation data with the position and

elevation data for the pipeline in a geographic information system (GIS), to identify areas of reduced depth of cover.

MACAW will use additional data sources such as geology, flooding data and the position of other features such as watercourses and traffic routes within this assessment to diagnose possible causes for the reduced depth of cover. The output from this task will provide up to 10 locations of suspect reduced depth of cover for infield verification within Task 5.

Task 6 - In-Field Verification

In order to verify the results from the depth of cover assessment, it is proposed to undertake in-field verification at up to 10 locations along the pipeline.

This will be completed using a pipe and cable locator which has the capability to measure the depth of cover above the pipeline. Depth measurements will be taken at the locations of suspect reduced depth of cover identified in Task 4 and these will be compared with results obtained from the depth of cover assessment.

Successful completion of the in-field verification will provide important information regarding the absolute accuracy of the depth of cover assessment.

2.7 Task 7 – Report and Presentation of Findings

A technical report summarising the tasks undertaken within the study and documenting a methodology to identify areas of reduced depth of cover on a buried pipeline will be delivered. The report will include the assessment of one pipeline.

The delivery of the technical report will be supported with a GIS compatible database containing the accurate pipe position, ground elevation and estimated depth of cover along the pipeline. This data can be utilised by NGG to determine if remedial measures are required at any locations along the pipeline.

A summary presentation of the key findings and conclusions from the project will be delivered to key Stakeholders within NGG.

Scope

The following project scope is to be undertaken:

1. Develop a methodology to identify areas of reduced pipeline depth of cover using inertial measurement data, ground elevation data and additional geographic data.
2. Perform an assessment of depth of cover using the developed methodology for 1 pipeline. This pipeline will be internally inspected using an intelligent pig which will include an inertial measurement unit, once inspected this data will be processed to provide an accurate route showing the position and elevation of the pipeline. The accurate route of the pipeline will then be processed with ground elevation data and additional geographic data sources to identify the depth of cover along the pipeline.
3. Evaluate the accuracy of the developed methodology by performing in-field measurements of depth of cover using pipe locating and survey equipment

Objective(s)

Investigate the feasibility of using a new methodology to identify areas of reduced depth of cover on a buried pipeline.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Deliver of a technical report documenting a methodology and the results from a trial on 1 pipeline including in-field validation.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project is to develop a desk based methodology utilising in pipe inspection and available ground elevation data, the project will involve in-field verification of the results.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

This is a project to develop a desk based methodology which can be applied to all pipelines within the National Transmission which are internally inspected with an intelligent pig.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£196,000

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 technique would be complementary to exisitng practices and if the technique avoids a single pipe damage incident, that would potentially save a cost that could be up to £10m.

Please provide a calculation of the expected benefits the Solution

Not completed due to low TRL.

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

Potentially replicable across all of National Grid's pipelines that are able to have in-line inspections, (currently 99.6% for the NTS) and similarly for all Licensees.

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

This will be determined as part of the project development.

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

If the technique proves successful it would be useable by all relevant licenses who have concerns over depth of cover.

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

Achieving reliable depth of cover information in a systematic way, so that specific areas of concern can be identified and mitigation works arranged.

☑ 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