NIA Project Registration and PEA Document

Date of Submission

May 2016

Project Reference Number

NIA_NGGT0092

Project Registration

Project Title

Utilisation of 3D Laser Scanners for pipeline damage and coating assessments.

Project Reference Number

NIA_NGGT0092

Project Licensee(s)

National Gas Transmission PLC

Project Start

May 2016

Project Duration

0 years and 11 months

Nominated Project Contact(s)

James Gilliver, box.GT.innovation@nationalgrid.com

Project Budget

£113,000.00

Summary

Conventional measurement techniques to assess pipeline damage have largely been manual. Methods to improve accuracy and timeliness of these measurements have advanced and prompted National Grid to assess the capability of hand held 3D scanners under a former NIA (NGGT 0054) project. The findings of this laboratory based assessment concluded that:

3D laser scanners were more convenient to use.

The overall measurement process was easier and in the majority of cases more accurate than the comparable P11 techniques.

There was a potential 90% time saving in result collection.

The 3D laser scanner was compatible with the P11 procedure.

The original programme only provided the indicative 3D scanner performance envelope. To fully realise the potential of 3D laser scanners within the business, particularly for use assessing highly critical issues such as pipeline damage, it will be necessary to evaluate the representative equipment under field conditions.

This programme will incorporate the necessary protocols to provide a fully compatible set of 3D scanner trails covering the P11 procedure. This will enable a direct comparison with the traditional evaluation techniques. To fully evaluate the effectiveness and flexibility of the 3D laser scanner, these trials will be extended to incorporate the assessment of pipeline paint coating systems (as part of National Grid's CM/4 process) which is a departure from the original scanner evaluation programme. The implications of coating evaluation will have considerable potential benefits in time and consistency over the current visual survey methodologies.

The accuracy and the speed of data collection and retention capabilities of the 3D laser scanner offer considerable in field opportunities in terms of ease of use, data quality and repeatability. This programme will address the issues of technician familiarity, training and standard(s) alignment to ease the adoption of this equipment type within the business.

Preceding Projects

NIA_NGGT0054 - Pipeline damage measurement using handheld laser scanners

Third Party Collaborators

Creaform 3D

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Currently, National Grid Transmission (NGT) undertakes all its pipeline damage assessments, in accordance with the necessary standard, utilising manual measurement instruments by highly trained technicians. Depending on the location and type of the defect this is a time consuming activity. The NIA programme NGGT0054 conducted an assessment of the latest advances in 3D hand held laser scanners for assessment of pipeline damage assessments and concluded that there was considerable potential in this equipment.

The initial review provided indicative evidence as to the potential of 3D scanning techniques. However, to fully exploit these findings, a full set of comparative field trials will be conducted with the leading 3D scanning equipment. These field trails will be expanded to not only involve pipeline assessments (to National Grid's P11[1] procedure) as a result of inline inspection (ILI) findings but also incorporate the coating (paint) assessments (as part of National Grid's CM4 [2] assessments) of above ground installations (AGIs). It is considered that the P11 and CM4 assessments will be greatly enhanced in terms of data quality, consistency and timeliness by the adoption of 3D scanning technologies.

[1] /PM/P/11 Inspection, assessment and repair of damaged (non-leaking) steel pipelines above 150mm nominal diameter and designed to operate at pressures greater than 2 bar.

[2] T/PM/CM/4 Specification for the Assessment and Reporting of Plant Coatings, Painting and Cladding Inspections for National Transmission System Assets

Method(s)

The programme will provide the necessary field trial experience of 3D handheld scanners for the P11 assessment of pipeline defects and CM4 paint coating surveys. The programme will:-

- Provide the necessary 3D laser scanning hardware and trained technical support for the field teams to assess and use the equipment.
- Incorporate the necessary pipeline data consistent with National Grid's material and size diameter/wall thickness population in the scanner software database.
- Train specific users to act as subsequent trainers hence increasing the utilisation of the equipment across the network.
- Conduct comparison P11 in field trials against conventional measurement techniques.
- Incorporate a 3D scan survey in conjunction with a set of conventional CM4 paint surveys.
- To update the necessary National Grid standards to facilitate the use of 3D laser scanners across the business.
- To explore the potential of utilising the 3D scanning hardware and software for reverse engineering and Quality Assessment (QA) evaluations.

The programme will summarise its findings in a full technical report and provide a widespread articulation of the equipment and its capabilities across the NGT network teams.

Scope

Conventional measurement techniques to assess pipeline damage have largely been manual. Methods to improve accuracy and timeliness of these measurements have advanced and prompted National Grid to assess the capability of hand held 3D scanners under a former NIA (NGGT 0054) project. The findings of this laboratory based assessment concluded that:

> 3D laser scanners were more convenient to use.

The overall measurement process was easier and in the majority of cases more accurate than the comparable P11 techniques.

There was a potential 90% time saving in result collection.

The 3D laser scanner was compatible with the P11 procedure.

The original programme only provided the indicative 3D scanner performance envelope. To fully realise the potential of 3D laser scanners within the business, particularly for use assessing highly critical issues such as pipeline damage, it will be necessary to evaluate the representative equipment under field conditions.

This programme will incorporate the necessary protocols to provide a fully compatible set of 3D scanner trails covering the P11 procedure. This will enable a direct comparison with the traditional evaluation techniques. To fully evaluate the effectiveness and flexibility of the 3D laser scanner, these trials will be extended to incorporate the assessment of pipeline paint coating systems (as part of National Grid's CM/4 process) which is a departure from the original scanner evaluation programme. The implications of coating evaluation will have considerable potential benefits in time and consistency over the current visual survey methodologies.

The accuracy and the speed of data collection and retention capabilities of the 3D laser scanner offer considerable in field opportunities in terms of ease of use, data quality and repeatability. This programme will address the issues of technician familiarity, training and standard(s) alignment to ease the adoption of this equipment type within the business.

Objective(s)

The programme will undertake a full field assessment of a 3D laser scanning system in terms of pipeline damage (P11) assessments and coating evaluations (CM4). The programme will provide the necessary training and standards alignment to facilitate the adoption of the equipment across the network if the trails crealise the potential benefits as indicated in the earlier review.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The programme will:

- Provide a full in service review of a 3D laser scanner for P11 (pipeline damage) and CM4 (coating) assessments.
- Provide the necessary trained technical resource to facilitate the adoption of this equipment type across the network.
- Align the necessary National Grid standards to allow the use of 3D scanners across the network for traditional NDT assessments.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The programme will utilise 3D laser scanners for representative number of P11 assessments and CM4 coating surveys across the NTS

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

All assessments will be conducted on NTS assets only.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£113,000

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)

Estimated savings are in the region of ~£300k and £500k per year.

Please provide a calculation of the expected benefits the Solution

National Grid Transmission plans to conduct 70 P11 (ILI) digs in 2016/17. The utilisation of the 3D laser scanner will form part of 70% of those digs as the equipment becomes accepted and embedded across the network regions.

The expected time saving in data capture and subsequent data analysis (which will now be performed in real time by the 3D scanner software) is estimated at between £5,500 and £9,500/dig. (due to reductions in labour, result quality, savings due unnecessary remedial action, and excavation time).

Estimated total saving due to 3D scanner adoption of 2016/17 P11 digs is between £269,000 and £465,500

The use of the 3D laser scanner for CM4 surveys is expected to considerably improve the data capture and reduce interpretation anomalies reducing unnecessary remedial work.

The proposed CM4 assessment savings (2 sites in 2016/17 using 3D scanning data capture techniques) are evaluated as between £3,000 to £4,000/survey day saved (due to the considerably (65%) reduced survey time, improved data collection and savings due to unnecessary remedial actions).

Expected CM4 survey savings are estimated at between 3 to 6 survey days for a typical Above Ground Installation (AGI).

Estimated savings will be between £18,000 and £48,000.

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

The 3D scanners being evaluated are conventional units, albeit with slightly defined material and pipeline size database. This database will be available to all units as a standard offering.

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

The unit cost is approximately £60,000. National Grid will have the necessary trained technical support to facilitate the

widespread roll out of this technology. The savings per unit will be realised as the business adopts and embed the technology.

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 equipment used for this programme will be a standard 3D laser scanner equipment. National Grid will also have resolved a method to incorporate a standard set of typical materials and UK pipeline sizes into the software database which will greatly ease any subsequent adoption by other operators.

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 proposed programme forms a component of National Grid's Reliability & Availability and Safety innovation strategy objectives

☑ 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