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

Oct 2017

### Project Reference Number

NIA_NGGT0116

## Project Registration

### Project Title

LiDAR to support NTS pipeline management

### Project Reference Number

NIA_NGGT0116

### Project Licensee(s)

National Gas Transmission PLC

### Project Start

November 2017

### Project Duration

1 year and 0 months

### Nominated Project Contact(s)

Ian Crompton; box.GT.innovation@nationalgrid.com

### Project Budget

£279,500.00

### Summary

The management of pipeline infrastructures is a complex and costly activity. It requires high levels of technical expertise and the deployment of the latest inspection technology. Generally this inspection capability centres on the internal assessment (in-line) of the pipeline. External factors such as Cathodic Protection (CP) measurement, aerial surveys and physical line walking are also major contributors to the assess management processes.

The analysis of each pipeline related activity is normally treated separately, although where possible In Line Inspection (ILI) magnetic flux leakage data and CP information are usually aligned. However the advances in airborne laser scanning techniques offer high quality quantitative 3D digital representation of the topography of the ground. The alignment of laser derived data (LiDAR) of the pipeline corridor with exact pipe position, ILI and CP data could potentially enable a virtual map of the pipeline to be generated. This would then provide a clearer view of the pipeline condition and possible highlight any discontinuities which could be related to observed topographical features.

The programme will assess two LiDAR systems use their respective output to recent ILI data to inform the potential of this approach to future pipeline asset integrity management. The LiDAR data will be mapped to some of the latest Acoustic Resonance Transducer (ART) ILI results. The potential enhanced detection capability of ART ILI will provide further emphasis to the programme whereby high accuracy LiDAR data will be mapped to the ART ILI output.

### Third Party Collaborators

EnView

Network Mapping Ltd

### Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

## Problem Being Solved

There has been a tradition within gas transmission and distribution companies to regard their pipeline asset management activities as independent sets of information. Thus In line inspection (ILI) data will be treated independent of line walking for example. The recent advances in cost effective airborne laser scanning techniques (LiDAR) for generating high quality 3D presentations (digital elevation models) provide the potential to unify disparate data sets to a common topographical model. This will enable a more complete picture of the pipeline asset to be generated which will provide clearer metrics around future management and investment.

This programme will assess airborne LiDAR capabilities from two separate providers and align the respective data to a recent ILI analysis of the same gas pipeline section of the National Transmission System (NTS).

## Method(s)

This feasibility programme will perform a series of LiDAR assessments, inclusive of in-situ video records, along an NTS pipeline section which has already been subjected to the latest ILI run.

The goals of this programme would be:

**Combine LiDAR and ILI and other relevant data to provide:**

- Depth of Cover (DoC) assessment (x, y, z) incorporating DoC line walking data.
- Identification of interacting threats.
- Demonstrate methods of simultaneously visualising both data sets & GIS (Geographic Information System).

**Demonstrate LiDAR capability to support integrity/asset management activities:**

- Structure counting.
- Change Detection.
- Third party activities.

**Provision of second flight sequence over the same pipeline section to:**

- Demonstrate measurement of detailed topographical changes over time.
- Demonstrate measurement of third party activities over time.

Some of the data sets collected will be available to view via a web based portal. Inside the portal a 3D representation of the network is displayed, from terrain and base imagery through to high resolution LiDAR and asset images. These can all be layered up to provide a rich, detailed view of the terrain and its environment.

Update February 2018: Following the initial LiDAR survey there were data enhancements identified that can increase the effectiveness of the results in terms of:

- Adjacent pipeline marker post line of site determination which can improve the pipeline route assessment from the ground and assists in reducing potential third party interference risks.
- Superimposing a pipeline depth of cover RAG (Red/Amber/Green) status indicator on each pipeline section within the web-portal view.
- Adding a feature to enable marker post details to be logged and viewable from within the web portal views. This greatly improves the line walking monitoring process.

This change allows for the functionality to be a standard part of all future LiDAR studies.

## Scope

The management of pipeline infrastructures is a complex and costly activity. It requires high levels of technical expertise and the deployment of the latest inspection technology. Generally this inspection capability centres on the internal assessment (in-line) of the pipeline. External factors such as Cathodic Protection (CP) measurement, aerial surveys and physical line walking are also major contributors to the assess management processes.

The analysis of each pipeline related activity is normally treated separately, although where possible In Line Inspection (ILI) magnetic flux leakage data and CP information are usually aligned. However the advances in airborne laser scanning techniques offer high quality quantitative 3D digital representation of the topography of the ground. The alignment of laser derived data (LiDAR) of the

pipeline corridor with exact pipe position, ILI and CP data could potentially enable a virtual map of the pipeline to be generated. This would then provide a clearer view of the pipeline condition and possible highlight any discontinuities which could be related to observed topographical features.

The programme will assess two LiDAR systems use their respective output to recent ILI data to inform the potential of this approach to future pipeline asset integrity management. The LiDAR data will be mapped to some of the latest Acoustic Resonance Transducer (ART) ILI results. The potential enhanced detection capability of ART ILI will provide further emphasis to the programme whereby high accuracy LiDAR data will be mapped to the ART ILI output.

## Objective(s)

The programme will assess two providers of LiDAR services to evaluate the capability of the techniques to support the on-going management of Gas Transmission networks, particularly in relation to line walking and ILI results. The two providers will enable a broad assessment of LiDAR and the secondary processing of the results to provide analysis on:

- Depth of Cover.
- Pipeline Threats (inclusive of third party interference).
- Change Detection.

The analysis will be conducted along a gas transmission pipeline from which recent ILI results will be available.

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

n/a

## Success Criteria

The programme will provide a detailed assessment of 3D laser mapping techniques (LiDAR) and how these can be aligned to other pipeline assess integrity data such as ILI, CP or the results of line walking. The harmonisation of these data sets to a common topographical map will provide considerable consistency to the on-going pipeline management activities as data sets become uniquely referenced to the respective pipeline section.

The results will be available on a web portal which presents the data to a wider engineering base. The initial LiDAR programme is intended to concentrate on areas of the NTS of particular interest in terms of terrain, depth of cover and location (ease of access).

## Project Partners and External Funding

Project Partner – NM Group, EnView

External Funding – (nil)

## Potential for New Learning

The provision of LiDAR based surveys will be universally applicable across the gas transmission and distribution businesses. The results from this study will inform all potential users as to the suitability of LiDAR surveys for monitoring network topography.

## Scale of Project

The programme will present the results from dedicated aerial surveys and align this data with the recent ILI results of the same Gas Transmission pipeline section. The LiDAR data will be presented in standard formats with some of the data being made available via an online interactive 3D geospatial portal.

## Technology Readiness at Start

TRL7 Inactive Commissioning

## Technology Readiness at End

TRL9 Operations

## Geographical Area

The LiDAR survey will be conducted on a defined NTS Gas Transmission feeder (pipe section).

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

£237,000

# 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 provision of LiDAR surveys is projected to offer potential savings of **£140,000/annum** across the RIIO T1 and T2 periods. This is based purely on the improved efficiencies in the line walking surveys currently undertaken. Other risk mitigation benefits are expected but it is deemed inappropriate to quantify these prior to this demonstration programme.

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

The fixed wing LiDAR survey enable National Grid to gain a holistic view of the surface topography of the transmission pipeline corridor in terms of depth of cover (in conjunction with In-Line Inspection data) and risk mitigation in relation to third party encroachment or interference. LiDAR surveys are comparable in cost on a flight basis to National Grid's existing aerial survey provision but offer considerable advantages in the quantity and speed of data capture.

The provision of LiDAR data will greatly assist and improve the effectiveness of the current line walking surveys by providing clear information on location of any necessary remedial action. This is estimated to have potential saving of £140,000/year on the line walking costs.

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

The proposed LiDAR analysis and data capture will be performed using appropriate fixed wing aircraft with the LiDAR functionality and proprietary analysis software provided by the respective vendors. The provision of LiDAR services is already well established within other utilities and this learning will be employed across the Gas Transmission network. Developing a LiDAR analysis routine and survey frequency will be established for GT but similar surveys could be easily transferred to gas distribution operators.

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

The cost per kilometer of a LiDAR survey will depend on various factors (length of flight/survey, post analysis requirements for example) but it is expected that LiDAR surveying will be available across all networks.

## 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 provision of LiDAR based surveys will be universally applicable across the gas transmission and distribution businesses. The results from this study will inform all potential users as to the suitability of LiDAR surveys for monitoring network topography.

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

Safety

☑ 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.

There is no NIA reported work (ENA portal) on aerial LiDAR surveys in relation to gas networks.

### 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