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

Feb 2018

Project Reference Number

NIA_CAD0019

Project Registration

Project Title

ThermalTrax Feasibility Study

Project Reference Number

NIA_CAD0019

Project Licensee(s)

Cadent

Project Start

February 2018

Project Duration

0 years and 8 months

Nominated Project Contact(s)

Cadent Innovation Team

Project Budget

£120,225.00

Summary

The scope of this project (Stage 1) is a feasibility study to determine if a prototype system to inspect pipelines using thermal imaging can be developed to pin point leakage
from within live gas pipelines and to determine the development work required to enhance and expand the capability of the Synthotrax system to include thermal leak detection.

- Evaluation of thermal technology in the stated operating environment
- Selection of the most suitable thermal imaging system(s)
- Demonstration of the selected camera element
- Space Model for ThermalTrax™ platform (Indicative design)
- Identifying and planning the future development work required

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

The HSE require that UK Gas Distribution Networks (GDNs) manage the risk from Tier 2 (above 8”, and below 18”) and Tier 3 (18” and above) iron mains. One of the most significant risks is that of leakage, predominately from joints and connections as well as potential defects.
It has been identified through the Health & Safety Executive (HSE) review that larger diameter metallic gas mains are less likely to fail through fracture and more prone to failure through leaks within the existing joints.
Predominantly leak detection within the gas industry is completed using bar-holing or acoustic methods. This project is aimed at realising a new methodology using thermal imaging to “see” leaks within pipelines.
Finding leaks through traditional methods of bar-holing and excavating can be costly and disruptive to the public, and therefore, a method of assessing the condition of the pipe and identifying leaks internally would be useful. This is particularly beneficial for built-up, congested areas where the cost of excavation and disruption to the public is significant. The ThermalTrax tool could be used to assess the whole pipeline to ensure that the most effective methodologies are applied for asset management.

The development is focused around the combining of technologies to allow Synthotrax to look for leaks thermally from within the pipe. The overall, long-term aim is to develop the Synthotrax system so it can travel up to 260m from point of entry (130m each direction) and internally identify leaks with a thermal imaging camera.

Method(s)

Overall Aim (dependent on result of this feasibility study):
The overall long-term aim is to extend the capability of the Synthotech SynthoTrax architecture to enable remote internal inspection of gas pipes that:
1. Are between 12" and 42" diameter metallic mains
2. Can operate at pressures that are ≤75 mBar
3. Have leakage that effects local pipe temperature
The will be done by bringing together three existing TRL 8/9 technologies:
1. ALH Bond and Bolt – TRL 9
2. Synthotrax – TRL 8
3. Thermal Leak Detection – TRL 4 in gas pipes (TRL 9 in other applications)
The plan is to build on the existing design knowledge gained through the development of the Synthotrax Profiler (NGGD IFI Funded) Synthotrax 1.1 (Synthotech Funded) and SynthoTrax STASS (NGN NIA Funded) Leak sealing Systems and to reconfigure the upper platform to allow the addition of thermal leak detection.

This phase of the project (Phase 1):
This project aims to investigate the thermal leak detection (lowest TRL of the three technologies) through desktop activities, research of available cameras, as well as laboratory testing of the thermal imaging camera. The plan is to select an effective thermal sensor and then test and review the thermal camera technology for detecting leaks. The three key challenges being tackled in this phase are:
• To review the operational environment and system variables
• To define the operating environment optical (current 8-14um range)
• To define the minimum pressure and flow rates detectable (detection envelope)
Phase one of the project will demonstrate thermal imaging technology embedded onto existing camera systems tested in a simulated environment. On completion of this project, the off line trials will be evaluated with a view of transitioning into a future development phase, should the opportunity remain viable.

Scope

The scope of this project (Stage 1) is a feasibility study to determine if a prototype system to inspect pipelines using thermal imaging can be developed to pin point leakage from within live gas pipelines and to determine the development work required to enhance and expand the capability of the Synthotrax system to include thermal leak detection.
• Evaluation of thermal technology in the stated operating environment
• Selection of the most suitable thermal imaging system(s)
• Demonstration of the selected camera element
• Space Model for ThermalTrax™ platform (Indicative design)
• Identifying and planning the future development work required

Objective(s)

This feasibility project will determine:
• Detection envelope (min pressure and flow)
• Review of thermal camera technology that is suitable for the use – space envelop and sensitivity (off the shelf technology)

- Camera(s) for integration
- Camera Pressure capability – up to 112mbar
- Camera comparison matrix
- Completed bench testing of cameras
- Camera capability demonstration

• Developments needed to the platform to incorporate a thermal inspection camera

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The main success criteria for the project are:
• Selection and demonstration of suitable thermal imaging camera which can detect gas leaks
• Understanding of further work required to incorporate thermal imaging into the SynthoTrax platform.
• Evidence that there is a high probability of successful development to justify progression of project into next stage.

Project Partners and External Funding

Cadent Gas Limited £120,250 via NIA Funding

The project will be wholly NIA funded

Potential for New Learning

This project will result in new learning that can be applied by all Network Licensees regarding the ability to thermally detect gas leaks and the operating parameters at which leaks can be detected. This knowledge gained will enable future projects to develop this technology which ultimately could be used by all GDNs.

Scale of Project

This project is a feasibility study which includes both desk activities and laboratory testing of thermal imaging cameras. The project plans to investigate the performance of a thermal imaging camera and identify further work required to integrate it with the SynthoTrax platform and therefore, this project itself will not result in a developed product which could be used on a live gas network.
This project is an enabler for future work to develop the entire SynthoTrax platform and it is essential to carry out this study first to determine the accuracy of thermal imaging technology and determine the value of adding this technology to the already existing Synthotrax platform. Conducting this feasibility study first limits the risk and determines the viability of using thermal imaging cameras to accurately pinpoint gas leaks.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

The research, evaluation and laboratory testing will be carried out by Synthotech at their site.

Revenue Allowed for the RIIO Settlement

No Revenue Allowed for in the RIIO Settlement

Indicative Total NIA Project Expenditure

£120,225 Total NIA Project Expenditure
External: £86,850
Internal: £24,690
Contingency: £8,685

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)

In addition to the operational, safety and customer benefits of this technology, the development of this equipment has the potential to deliver financial benefits once it has been deployed within the Network. Another financial benefit, which has not been quantified at this stage, is the ability to assess an entire pipeline internally using thermal imaging which would maximise operational effectiveness by ensuring the most effective methodologies are applied for asset management (repair vs replacement).
This project itself will not deliver net financial benefits to customers as it is a feasibility study and will not deploy the technology in the network, however, it is an enabler for further work which should deliver financial benefits to customers.
The initial estimated benefits, assuming successful further phases and deployment in the network, was calculated to be is approximately £500k per year

Please provide a calculation of the expected benefits the Solution

The saving calculated assumes successful future projects to develop and deploy the technology.
Today's cost – Future cost = Saving
£775k - £211k = £564k

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

This project will not deploy the technology in any of the networks as it is a feasibility study, however, in future this technology could be used by all networks.

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

Phase 1 is purely an offline trial to determine the viability of thermal imaging technology to detect leaks and therefore, during this phase we will not be looking to develop this technology and roll-out across the 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

All GDNs have issues relating to the detection of leaks and the number of excavations required in certain scenarios when the leak is difficult to pinpoint from traditional methods. This project will determine if thermal imaging can be used to pinpoint a leak and this learning can be shared with all Network Licensees.

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 reduction in the number of excavations leading to reduced operational expenditure and less customer disruption is a key objective for all GDNs.

☑ 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.

Using thermal imaging technology to detect leaks from within a gas pipe has not been tried or tested on the gas network in the UK.

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

To the best of our knowledge, the use of thermal imaging technology to detect gas leaks from inside a pipe has never been used on any gas network in the UK.

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

There are risks associated with developing a new technology which has never been used on a gas network in the UK. This risk and the unknown viability of the technology mean that Cadent would not fund this project as part of its business as usual activities.

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

There are technical challenges which need to be overcome which require specialist resources that Cadent does not have internally and therefore, requires the support of NIA to fund the development externally.

This project has been approved by a senior member of staff

☑ Yes