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NIA Project Registration and PEA Document

Date of Submission

Aug 2018

Project Reference Number

NIA_CAD0024

Project Registration

Project Title

In Pipe Drone Feasibility

Project Reference Number

NIA_CAD0024

Project Licensee(s)

Cadent

Project Start

July 2018

Project Duration

0 years and 10 months

Nominated Project Contact(s)

Vishal Dhanji - Cadent Project Manager

Project Budget

£73,333.00

Summary

Cadent are seeking to undertake a programme of work to identify solutions or technologies that can be used to map the network or pipes without the need for significant operator intervention, and act as a technology platform to enable rapid inspection internally in future operations.

The focus of the work will be untethered devices such as, but not limited to, drones and will evaluate all appropriate existing and available technologies, and identify any possible solutions to take forward for future development.

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

Cadent's network of over 130,000km of pipe requires regular maintenance through inspection and pipe renewal to proactively prevent leaks and service disruption from failure. Inspections require access to the pipework, this can entail large (or several) excavations which are both disruptive and expensive. Once the pipe is located a service port needs to be fitted using a saddle drill on the live pipe. Inspection can then be performed with a tethered camera or robot, typically only giving engineers a range of up to 50-100m respectively.

The current methods are complex, disruptive and costly to locate and inspect the gas network which limits Cadent's ability to inspect large sections of the network cheaply and without the need for significant operator intervention.

Method(s)

Cadent are seeking to undertake a programme of work to identify solutions or technologies that can be used to map the network or pipes without the need for significant operator intervention, and act as a technology platform to enable rapid inspection internally in future operations.

The focus of the work will be untethered devices such as, but not limited to, drones and will evaluate all appropriate existing and available technologies, and identify any possible solutions to take forward for future development.

Scope

This project will be split into the following 4 phases of work:

Phase 1 (3 weeks):

- Problem statement to outline understand of the problem from Cadent's perspective and establish detailed requirements and factors affecting solutions
- Outline full scope of challenge, identifying limits of the problem space, factors affecting solution and key requirements
- MTC to use discovery process tools such as VOTC, QFD and Function analysis to explore and fully define problem space and understand critical success factors from customers perspective
- Deliverable: PowerPoint presentation with supporting technical appendices

Phase 2 (4 weeks):

- Market review and technology survey
- State of the art review of current solutions, including established and emerging technologies and any background IP, to ensure Cadent is aware of currently available capabilities and if an appropriate solution exists it can be pursued. All solutions to be scored against performance requirements identified in Phase 1
- Functional analysis from Phase 1 used to identify appropriate technologies across a wide range of engineering and scientific sectors, using horizontal innovation to obtain a high degree of innovation in the solution space
- If no existing solution can be identified a concept must be generated and tested to fill the space, scored against performance requirements identified in Phase 1
- Deliverable: PowerPoint presentation with supporting technical appendices

Phase 3 (12 weeks):

- Concept generation, simulation, prototyping and selection
- Generate numerous solutions for each area of the problem, creating selection criteria in conjunction with requirements identified in Phase 1 and 2
- Each proposed solution is explored for feasibility, trials or prototypes may be explored if deemed appropriate
- Test ideas using rapid development techniques and down select the most suitable concepts based on agreed criteria and performance.
- Deliverable: CAD models, subscale prototypes, PowerPoint presentations with supporting concept sketches, morphological charts, trials videos, performance data

Phase 4 (7 weeks):

- Concept refinement and system visualisation
 - The most successful concepts/output(s) from Phase 3 will be further refined into high level CAD models for packaging and spatial analysis
 - Various deployment scenarios and operational modes to be explored in a virtual pipe network, including insertion, removal, recover, simple pipe transit, complex pipe transit, junction transit and power generation
- Deliverable: High level CAD model and simulation video of the virtual mapping system

Objective(s)

This project aims to identify solutions for further development to inspect and map Cadent's gas network without the need for significant operator intervention or the addition of frequent service ports on the network. The identified solution will focus on untethered devices which will include, but not be limited to, drones. If a solution can be identified, and further developed, Cadent will be able to realise significant improvements in time, efficiency and cost for inspection activities as well as improvement in future asset management models.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Successful identification of possible solutions with high level CAD models and simulation videos of the virtual mapping system to allow for further development of the solution in the future.

Project Partners and External Funding

The project will be wholly funded by the NIA

- Manufacturing Technology Centre - £50,000
- Internal Costs - £18,333
- Project Contingency - £5,000

Total: £73,333

Potential for New Learning

This project will identify solutions for future development which can significantly enhance current inspection activities, providing a

method for inspection which could lead to significant improvements in time, efficiency and cost as well as reduced disruption for customers as well as a future improvement in Cadent's Asset Management methodologies.

Scale of Project

The scale of this project will be across all Cadent networks however learning will inform all Gas Distribution Networks which have similar issues with inspection of their networks. The scale of investment in this project is necessary as feasible solutions have not yet been identified which can improve upon current inspection methodologies.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL2 Invention and Research

Geographical Area

This project will be delivered from the Manufacturing Technology Centre facilities and the Cadent network.

Revenue Allowed for the RIIO Settlement

No revenue allowed for in the RIIO settlement.

Indicative Total NIA Project Expenditure

£73,333

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)

This project can provide future savings if the proposed solution is further developed through significant enhancement of current inspection activities, providing a method for inspection which could lead to improvements in time, efficiency and cost as well as reduced disruption for customers. The platform will also provide a future improvement in Cadent's Asset Management methodologies through the ability to easily and quickly map assets on the network

Please provide a calculation of the expected benefits the Solution

N/A

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

The proposed solutions for pipeline inspection can be rolled out across all gas network licensees.

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

Roll out costs will be dependent upon the further development of any identified solutions

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 proposed solutions can be adopted by other GDN's which face similar problems related to the inspection of their network

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

This project supports Cadent Gas' drive to serve our customers efficiently and effectively and maintain a safe and reliable network

- 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.

This project looks at new technology to carry out in-pipe inspection. No other similar project has been identified on the ENA portal.

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

This project is innovative as it involves the use of untethered robots or drones which can be inserted into pipes to perform inspection activities with minimal operator intervention. The technology has not yet been proven within the gas industry and hence has not been utilised before in the inspection of the gas network.

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

The Network Licensee will not fund this project as business as usual due to its innovative nature of work, and the high level of risk associated with the possibility that solutions will prove to be unsuitable for in-pipe inspection of the gas network.

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

This project can only be undertaken with the support of the NIA as it looks to innovatively explore possible solutions that include previously unused tools and technologies.

This project has been approved by a senior member of staff

Yes