

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 2019

Project Reference Number

NIA_CAD0034

Project Registration

Project Title

Phased Array Phase 3

Project Reference Number

NIA_CAD0034

Project Licensee(s)

Cadent

Project Start

February 2019

Project Duration

0 years and 9 months

Nominated Project Contact(s)

Rebecca Payne - Cadent Project Manager
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Project Budget

£535,750.00

Summary

All street excavations carry a potentially serious risk of hitting a live electrical cable. These cable strikes are a continual safety concern for network operations. The risk of significant injury to operatives is currently mitigated using tools and procedures, however there are many situations where this risk is not at zero.

Current cable locating technology requires the cable to be either radiating a magnetic field due to carrying power or remotely energised in a way that creates a signal that a detector can then pick up. There are occasions on the electricity distribution network where cables have been terminated (not feeding a demand) leaving a live cable in the ground that is not creating a magnetic field, these are known across the industry as "Pot End Cables". In addition, cables carrying balanced loads may also not create a magnetic field that can be detected.

At present, the EIC has found that there is no commercial device that can detect Pot End or balanced cables or locate these services with any great accuracy. Cadent have also collected data on cable strikes and have observed that 25% are due to pot-ends which still leaves a significant amount of strikes on cables that current equipment and procedures should find.

It has become clear that the work in this project will enable a specific product that will find both pot-end cables and ones that are in normal service along with metal pipes and armoured network cables.

Cadent also spend significant effort and cost on training staff on the current products. This project may create a specific product that in addition to the above reduces training and on-site effort thus creating significant business benefits beyond the original aim of detecting pot end cables.

Previous phases cost: I-0050 £87,000 & I-0123 £369,000 these phases looked at feasibility, understanding the coils and proving the depth and identification of cables was possible. Using the learnings from these previous phases has supported the scope of this third phase

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

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Method(s)

To complete Phase 3 research and development of phased array and continues the research and development work by building two prototype systems containing an array with representative custom electronics and software, with the objective of enabling Cadent to collect data and feedback from real work sites.

Scope

This development is a staged approach with the aim of managing risk and taking the project to Technology Readiness Level five. The sanction value is to cover further development of the core elements of the array system, testing difficult ground types and tolerance of depth. One of the two testing units will also be taken to site and tested against existing “Pot End Cable” locations from Cadent incidents. The second will remain at TTP for testing and support

Objective(s)

Stage 3a Objectives – Research and Design

The design tasks will create an architecture for the electronics and embedded software design activities to work against. Schematic diagrams will be created as an input to PCB layout. This will also incorporate prototype design.

Stage 3b Objectives – Stage Sample Build, Testing, Laboratory Demonstration and training

Stage 3b work will be concentrated on building, testing and refining two prototypes, one for delivery to the EIC/Cadent teams on site and the other for back-up at TTP. The tasks outlined below are a significant part of the programme as the engineering is still at an experimental stage and is now required to be used outside of TTP by non-engineers.

A local to TTP supplier will be used to manufacture and assemble the circuit boards, packaging and arrays from the design output.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

project has been a success, and whether the performance of the innovation is as desired.

The outputs of this development stage will be:

- Research on cable and pipe effects and cable depth estimation accuracy. Confirm that real world array elements operate in line with the stage 1 and 2 predictions.
- Confirm that low cost electronics can be developed with sufficient performance to meet the measurement parameters for stub cable detection.
- Confirm that in the laboratory that the system can detect cables and pot ends up 0.5m below the surface.
- Delivery of one system consisting of an array and processing package.

Project Partners and External Funding

Energy Innovation Centre & The Technology Partnership

The project will be wholly funded by the NIA, total: £535,750

Energy Innovation Centre & The Technology Partnership

Potential for New Learning

This Stage of the project will build on all the lessons and deep learning of the last two stages to enable the development of the two prototype systems consisting of an array and the associated signal processing hardware and software that will allow basic testing and data collection in a real-world on-site environment.

The techniques proposed draws heavily on TTP expertise in wireless communication technologies to allow for more predictable performance in a highly variable environment using digital processing and other more specialist signal processing algorithms.

This stage may also create new learning from how these technologies from adjacent markets can be applied to the detection of buried services.

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 cable avoidance across their networks. The scale of investment in this project is necessary as feasible solutions have not yet been identified which can locate pot-ended cables.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

This project will be delivered from TTP facilities and the Cadent network mainly in the West Midlands.

Revenue Allowed for the RIIO Settlement

No revenue allowed for in the RIIO settlement.

Indicative Total NIA Project Expenditure

Total: £535,750

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 method cost is still too early to articulate however the savings will be associated with the savings against utility damages. Savings will be achieved through reduction in injury rates, and reduced volume of excavation if more accurate location of services is possible. Reduction of utility damages by 25% could bring a saving around £173K

Please provide a calculation of the expected benefits the Solution

Cost of Equipment (Per Unit) £1000 - £500 (estimated cost)

Cost of Damages to utilities reduced £694K - £520K (25% reduction)

Likelihood of injury & cost associated (4% pot-ended cable strikes) 8 – 6 / £143,200 – £107,400 (25% reduction in danger of injury)

Likelihood of death & cost associated (4% pot-ended cable strikes) 8 – 6 / £12M – £9M (25% reduction in danger of death)

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

Solution would be used prior to excavating and could be used by all utilities & construction to avoid damages to utilities when excavating.

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

No current costs for the potential solution as at prototype stage at the end of this project.

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

This technology has the potential to reduce cable strikes across all GDNs. In doing so, this new learning will be shared in order to make sure GDN's are safeguarding their employees against the risk of cable strikes

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 directly addresses a major issue in operational safety i.e. its purpose is to identify hazardous cables and prevent operatives striking them (and potentially creating the conditions for electrocution) during digging operations

- 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.

The Project could be considered a duplication of Projects NIA_NGG0091 & NIA_CAD0010. However, the reason this project is not a duplication is this project will build on the learnings from the first two phases to develop prototypes and test against different ground conditions which has not previously been done.

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 is the 3rd Phase of the project to develop a tool to locate pot-ended cables, all current technology doesn't identify these and only works on locating live cables.

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 it's the innovative nature of work, and the high level of risk associated with the possibility that the new tool may not be effective at locating pot-ended cables

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

Due to the technical nature of the project and the risks associated with trialling such un-proven technology.

This project has been approved by a senior member of staff

Yes