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

Jul 2023

Project Reference Number

NIA2_NGET0043

Project Registration

Project Title

Aerial inspections of OHLs from Beyond Visual Line of Sight (BVLOS)

Project Reference Number

NIA2_NGET0043

Project Licensee(s)

National Grid Electricity Transmission

Project Start

March 2024

Project Duration

0 years and 10 months

Nominated Project Contact(s)

Amrit Sehmbi

Project Budget

£596,000.00

Summary

It's important we have a good understanding of the condition of our assets to ensure we maintain reliability of the network. This project will focus on the automation of data collection for OHL fittings and broaden its application on the network using drones from Beyond Visual Line of Sight (BVLoS) building on work done during VICAP (NIA2_NGET0009).
If successful there will be a reduction in the amount of flying required by helicopters, a reduction in the number of assets that are missed on primary inspections and a reduction in the number of climbing inspections.

Preceding Projects

NIA2_NGET0009 - Visual Inspection and Condition Assessment Platform for OHL Steelwork (VICAP)

Third Party Collaborators

Sees.ai

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

It's important we have a good understanding of the condition of our assets to ensure we maintain reliability of the network.
For OHL fitting inspections the primary inspection tool is a helicopter. Whilst they allow us to survey the volume of assets we require, they are expensive to run, noisy and emit high levels of CO2 emissions. Due to the noise they produce and the downwash from the rotors, the helicopters are only able to achieve about 85% of the targeted assets in any one year. The missed assets subsequently require either a manually flown drone inspection, or a climbing inspection. The coverage of inspections needs to be increased whilst reducing costs, environmental impact, and resource requirements.

Method(s)

This project will carry out a number of trials using drones from BVLoS to assess the condition of OHL fittings. This will allow the technologies current performance to be measured and to enable its future performance to be extrapolated with a high degree of confidence. Flight plans with be developed and tested to allow for longer flights. The Civil Aviation Authority (CAA) will evaluate the technology and approach to determine system safety.

Scope

The project will be delivered in seven work packages:

- Design, Planning, Reporting and dissemination
- Core technology development (incorporating trials feedback)
- Integration in to NGETs workflows and tools
- Testing and Evaluation
- Advance aviation permissions
- Extension to long linear flight
- Demonstrate data transfer to third party data platforms

Objective(s)

The main objectives of the project are to:

- Generate automated flight plans that cover OHL fitting inspections for the various configurations on the network.
- Combined these with the steel work flight plans to create an all-encompassing inspection regime.
- NGET to secure extended BVLOS permission that covers a larger part of the transmission network.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having either a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register.

This project has been assessed as having a neutral impact on customers in vulnerable situations. This is because it is a transmission project.

Success Criteria

The project will be considered successful if the following are achieved:

- Automated flight plans for configurations on the network produced
- These flight plans are combined with steelwork flight plans to create all-encompassing inspection regime.
- NGET to secure extended BVLOS permission that covers a larger part of the transmission network.

Project Partners and External Funding

N/A

Potential for New Learning

New learnings are expected to include an optimised OHL fittings assessment regime for BVLoS drones, an understanding of the economic comparisons between drone use and helicopter use, learning around the CAA's acceptance of the proposed solution and what constitutes an acceptable safety case. Finally, it is expected that we will learn how to develop a training package that allows National Grid to train its own pilots to operate the drones used in this project.
Learnings shall be disseminated via reports and presentations.

Scale of Project

The aim of the project is to develop and demonstrate automated OHL fittings inspections at scale on the network. Doing so will build a body of evidence to present to the CAA to support a safety case for applying the BVLoS permissions across a larger percentage of the network. If we were to reduce the scope of the project, it's unlikely we'd be able to collect sufficient evidence to support the

Operational Safety Case document that would be submitted to the CAA.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

The project will carry out drone flight trials on selected OHL tower locations within England and Wales.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

NIA funding of £536.4k

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:

The energy system transition requires networks to move to a more proactive condition-based asset management process. This project will improve the efficiency and effectiveness of managing health of OHL fittings by digitising and automating condition assessment practices which will in turn see a reduction in our carbon footprint.
The project has potential to reduce network outages and allow better system access ensuring the network remains reliable and resilient.

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)

N/A

Please provide a calculation of the expected benefits the Solution

Project business case is built based on volumes and cost details from the current practice in OHL fitting condition monitoring at NGET.

The baseline method considers the costs related to inspection target of 2500 fittings on towers per annum which includes costs for helicopter usage for image capture, drone usage where towers are not accessible by a helicopter, manual assessment of captured imagery by a pool of inspectors and climbing inspections for those towers that cannot be flown by either a helicopter or a drone.

If the innovation option is proven successful by year 2024/25, it is anticipated that helicopter usage for image capture will reduce by 10% in 2025/26 and further incremental decreases per annum until 2030/31, with similar increase in drone usage.

Considering the above, the innovation method has a NPV benefit of approx. £3,970,000 for UK consumers over the next 8 years. This number also includes benefits from avoided use of helicopter fuel due to reduction in helicopter usage for image capture.

This system has the potential to be employed by other network licensees with similar asset types.

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

It is estimated that if the innovation project is successful, the new condition assessment process could be employed on 75-80% of the NGET network of around 22,000 towers. The findings have the potential to benefit all GB network licensees (at both Transmission and Distribution level) that own and operate similar asset types.

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

Costs of rolling out this method will be evaluated as part of the techno-economic assessment to be undertaken in 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

The project will seek to produce optimised inspection flight paths that facilitate automated OHL Fittings inspections at scale on the network. The project will also seek to establish a CAA approved Operational Safety Case permission which allows National Grid to operate Beyond Visual Line of Site at any location on the network which meets certain criteria. Learnings shall be disseminated via reports and presentations, including the Operational Safety Case document. The system learning will be relevant to other network licensees with similar asset types.

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

N/A

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 have been few projects (completed: NIA_SPEN_0063 and NIA_WWU_037) in the UK that explore the use of drone flights for visual inspection of electricity assets. They, however, have focussed on detection of common defects in OHL assets such as broken/contaminated/flashed insulator, cracked pole, conductor damage, missing danger plates etc.

The scope element of trialling BVLOS flights for visual inspection is relevant to the one in NIA_WWU_045. The difference between the

two is that NIA_WWU_045 involves a more extensive work to enable BVLOS operations in the UK while it is an optional element within the proposed project.

The precursors to this project are:
NIA_NGET0215, provided the feasibility outcome for automating the corrosion grading of OHL tower steelwork based on physical samples and trials at pre-decided tower locations.
NIA2_NGET0009 – Project focussed on automating the end-to-end process of detecting, quantifying and reporting on the corrosion element of OHL tower steelwork condition.

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 set to revolutionise inspection of transmission network OHLs to enable connected & autonomous aerial inspection of OHL from Beyond Visual Line of Sight (BVLOS) using innovative technology. There is currently no one carrying out automated assessments of OHL fittings.

Relevant Foreground IPR

The default IPR arrangements will apply.
The foreground IPR will relate to the automation patterns designed for the various configurations of OHL fittings we have on the network and the Operational Safety Case document that supports BVLoS application of the technology.
Suppliers will contribute background IP in the form of autonomous drone flight technology which will remain their property.
NGET will contribute background IP in the form of expertise in OHL condition monitoring, and fitting assessment methodology.
Foreground IPR developed in this project will include reports detailing requirements, use cases, imagery collected during drone flights, detailed steps involved in the automated condition assessment process, implementation plan, process documentation and the Operational Safety Case.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

- A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click 'Contact Lead Network'. National Grid already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
- Via our Innovation website at https://www.nationalgrid.com/uk/electricity-transmission/innovation
- Via our managed mailbox box.NG.ETInnovation@nationalgrid.com

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

This project involves being able to develop several complex automated flight paths to achieve the desired outcome and then being able to demonstrate to the CAA that those flight paths can be safely replicated across the network. The CAA have never granted an operating permission as advanced as the one we are seeking through this project. As such, there is an inherent level of risk not suitable for business-as-usual operations.

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

NGET could not achieve the project outcomes on their own. All parties involved in the project will bring critical assets, knowledge and resources to the project. This is not a small project as it involves a significant amount of testing - testing that is essential, as without it the CAA would be unable to determine system safety; and NGET would be unable to appraise performance / efficiency and hence value.

This project has been approved by a senior member of staff

☑ Yes