national gas transmission

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

Dec 2020

Project Reference Number

NIA_NGGT0169

Project Registration

Project Title

Analytical Approach for Vegetation Management

Project Reference Number

NIA_NGGT0169

Project Licensee(s)

National Gas Transmission PLC

Project Start

December 2020

Project Duration

0 years and 4 months

Nominated Project Contact(s)

Graham Harvey

Project Budget

£49,500.00

Summary

RSK Orbital currently conduct detailed aerial photography of the NTS network over a four year rolling programme for the purposes of TD1 population density and Building Proximity Analysis.

The survey output is a digital report identifying building and population change since the last survey (four years previously), categorized into severity. The photography captured for this purpose is delivered via the RSK Orbital Visivi tool. Consecutive photographs have been captured with considerable overlap, with an effective orientation to identify usage, type and condition of the buildings in the corridor. This potentially also lends itself to creating 3D models of the pipeline route from the same data.

Generating 3D models we propose to then analyse a central corridor spanning three metres either side of the pipeline centreline to create a Digital Surface Model (DSM). Using the DSM, We propose to identify the precise mapped whereabouts of vegetation ingress. The results can be reported against the Network length, Pipeline or sub sections thereof.

In addition to providing the visual evidence which will clearly show the colour and shape of the vegetation, we also propose to report on the following:

1. Self-seeded vegetation locations, Using DSM against a wider area Digital Terrain Model (DTM)
2. Sub-Metre Vegetation (not on a hedge row), using GIS analysis
3. Sub-Metre Vegetation (on a hedge row), using GIS analysis
4. Height of vegetation, using the DSM
5. Volume of vegetation, using our software tools
6. Vegetation Species - For this trial using our in-house arboriculturalists
7. Criticality of vegetation ingress delivered via a thematic map
8. Comparison analysis for year-on-year showing differences in vegetation volume and location

All applicable outputs will be ESRI Shape file Map layers for use with your corporate GIS systems. Otherwise the data will also be displayed and be accessible via the Visivi tool.

We propose to utilise data from a pipeline flown during the 2020 survey runs for the purpose of the trials, but also propose to refly the same line with the new camera and camera rigs which we will be using for the 2021 surveys. This will give an interesting idea of how the technology is developing and can be honed to provide the best possible data for the purposes at hand.

Third Party Collaborators

RSK

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

The National Transmission System (NTS) comprises approximately 7650km of buried high pressure steel pipelines, installed between the late 1960's and today. The majority of the pipelines were laid in the countryside, predominantly in farm land and away from population. There are strict controls on what activities can take place in the land immediately above and adjacent to each pipeline. These controls extend to include the species of shrubs and trees which can be planted.

Whilst the planting activities are controlled, there are occurrences where trees and shrubs can "self seed" or encroach from the surrounding area.

This project looks to identify the possibility of utilising the existing aerial footage in a manner that would allow an accurate determination of the vegetation along the route.

Method(s)

The existing survey outputs largely focus on the production of a digital report identifying building and population change since the previous survey along any given pipeline, categorized into the severity of any potential threat to the pipelines integrity.

The input data for the survey is currently captured utilising high-resolution digital full-frame still image sensors, high-end military grade INU's and Differential GPS. Consecutive photographs are captured with considerable (87%) overlap, and an effective orientation to enable usage, type and condition of the buildings in the corridor to be identified. These already captured images, potentially lend themselves to creating basic 3D models of the pipeline route.

To create a single fly-through model of each pipeline existing photography and combined imagery will be used. The process will inevitably create a Digital Surface Model (DSM). It is by having so much overlap in the oblique imagery that a 3D representation of whatever lies above the pipeline route can be created.

The inspection of the central corridor spanning three metres either side of the pipeline centreline to create a Digital Surface Model (DSM). Using the DSM to identify the precise mapped whereabouts and amount of vegetation ingress. The results can be reported against the Network length, Pipeline or sub sections thereof.

In addition to providing the visual evidence which will clearly show the colour and shape of the vegetation, RSK will report on the following:

1. Self-seeded vegetation locations, Using DSM against a wider area Digital Terrain Model (DTM)
2. Sub-Metre Vegetation not on a hedge row, using GIS analysis
3. Sub-Metre Vegetation on a hedge row, using GIS analysis
4. Height of vegetation, using the DSM
5. Volume of vegetation, using our Visivi software tools
6. Vegetation Species - For this trial using our in-house Arbor culturalists
7. Criticality of vegetation ingress delivered via a thematic map
8. Comparison analysis for year-on-year showing differences in vegetation volume and location
9. Alert the user of maintenance schedules before growth becomes critical to the assets
10. Provide the coordinates of the extents of the vegetation growth

By undertaking the second survey along the same route, RSK aim to compare the two 3D models in order to identify the change in vegetation. This is only applicable if a survey is carried out at the same time each year in order to give a like for like comparison.

In any event, if the vegetation species can be determined from the model and the imagery then it may also be able to predict the likely changes in growth over the coming four years, based on specific vegetation characteristics. This would feed directly into a

maintenance schedule for vegetation management before growth becomes critical to the assets.

Scope

National Grid performs a series of inspections of the pipeline route which include both fortnightly aerial surveillance and annual walking patrols to capture a range of information, predominantly to detect immediate threats to the pipelines, however the capture of the volume and nature of plant growth has been problematic.

National Grid has access to high resolution oblique aerial photography and video footage but does not currently have a method to determine the volume of shrub and tree growth over the pipelines. This presents problems in the management of vegetation in proximity to the pipeline.

Objective(s)

Determine whether historic oblique aerial photography, captured for one specific application (population density), can be appropriately adapted to fulfil an alternative application (vegetation survey).

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

- The survey methodology improves both new and existing aerial survey applications
- Can 3D models derived from the existing imagery be used to automatically show vegetation changes.
- The generation of 3D models, creating a Digital Surface Model (DSM) and using the DSM to identify the precise mapped whereabouts of vegetation ingress.

Project Partners and External Funding

Project Partner – RSK Orbital
External Funding – (nil)

Potential for New Learning

There would be greater clarity of the volume of shrubs and tree growth over the pipelines, this would help to determine what maintenance would be required to eliminate the vegetation.

Scale of Project

A trial in a working environment.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

UK

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£49,500.00

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 proposal is not driven by a financial saving. The benefit is an enabler for compliance with the industry standard IGEM/TD/1 and therefore legislation (the Pipeline Safety Regulation 1996). At present, National Grid does not have a robust mechanism to understand the volume of tree or scrub growth within the pipeline easement. Consequently, National Grid has historically responded reactively to instances of tree growth or vegetation clearance, rather than prioritising and managing vegetation proactively.

National Grid has not historically had a budget for vegetation management. This has been recognised as an issue and therefore, an allowance has been built in to the RIIO 2 plan. The project is key to enabling that funding to be used sparingly and wisely to achieve compliance.

Please provide a calculation of the expected benefits the Solution

RSK Orbital currently conducts detailed aerial photography of the NTS network. Therefore, no additional cost for current aerial photograph is required.

The benefit of the proposal is not financial. It will enable a future allowance to be used appropriately to achieve compliance with the industry standard and legislation.

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

The use of DSM to identify the precise mapped whereabouts of vegetation ingress can be replicated across the NTS.

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

The project is to establish whether or not historic oblique aerial photography, captured for one specific application (population density), can be appropriately adapted to fulfil an alternative application (vegetation Survey). Therefore, it is not possible to provide an outline of the costs at this time, however the process may provide indication as to how to capture TD/1 data differently in the future to enable TD/1 and vegetation survey to be optimised in a single flight.

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

n/a

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 addresses reliability and maintenance as it will seek to improve asset knowledge of pipelines by capturing the volume and nature of plant growth that occurs from self-seed/encroaching vegetation, as a result mitigate damage to the pipeline.

☑ 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 are no known projects carrying aerial photography to capture vegetation on pipelines.

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

One of the techniques used to survey and inspect the pipeline is aerial surveillance, high resolution oblique aerial photography is used

to seek population density and building proximity analysis. High resolution oblique aerial photography has not been used to determine the volume of shrub and tree growth over the pipelines.

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 project will not be funded as part as business as usual as the quality of the 3D modelling is yet to be known. National Grid must be informed whether the data will provide sufficient information for accurate analysis of the vegetation.

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

The existing aerial photography of the NTS network largely focuses on identifying building and population change, it is no known whether it can determine volume, scale, species and severity of vegetation along the pipeline, hence the need to examine how the existing data can be utilised.

This project has been approved by a senior member of staff

☑ Yes