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## NIA Project Registration and PEA Document

### Date of Submission

Mar 2023

### Project Reference Number

NIA2\_SGN0035

## Project Registration

### Project Title

Orbital Eye

### Project Reference Number

NIA2\_SGN0035

### Project Licensee(s)

SGN

### Project Start

April 2023

### Project Duration

0 years and 7 months

### Nominated Project Contact(s)

Thomas Jackson

### Project Budget

£197,645.00

## Summary

Orbital Eye technology has the potential to produce a cleaner, more effective, and reliable monitoring package with the use of satellite imagery. This system compared to the conventional process which uses a helicopter to fly the line as well as foot patrols, would offer SGN and National Grid a higher frequency of monitoring (weekly) and have a less environmental impact where the helicopter releases approx. 173 tonnes per CO2 a year. Unlike our helicopter process, Orbital Eye is not subject to weather and would be able to analyse gradual encroachments like ground movement using artificial intelligence. This offers new opportunities for earlier indication of potential landslides permitting SGN and National Grid to proactively divert high risk pipeline protecting our assets and our customer's supply.

### Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

## Problem Being Solved

With the aging UK energy industry there is a requirement to modernise these systems to improve efficiency and longevity of our infrastructure, which is critical in meeting our net-zero targets.

Where allowable, visual inspections of around 2,400km of LTS SGN network alongside National Grid Gas Transmissions of 7500km are conducted by helicopter surveys on a fortnightly basis. Helicopter surveys include a Raptor system of GPS-tagged full motion video, and the ability to annotate threat observations by on-board surveyors in real-time. In a small number of cases, immediate threats require the safe landing of the survey helicopter and direct intervention. Most threat observations however undergo secondary assessment through a systematic post-flight log review by asset managers. Subject to the nature and severity of the threat observed, asset managers will initiate any number of response mechanisms as defined by policy. Whether the threat is deemed an immediate threat or a normal threat observation, we face difficulty with the speed in which it may respond to a threat at all. For immediate threats,

activities could conceivably have been occurring for up to 13 days prior to the survey acquisition, or it may be unsafe to land adjacent to an immediate threat, further delaying intervention. Policy guidelines of fortnightly surveying is the result of risk/affordability assessment at the time of policy drafting, rather than a decision around the safety margin criticality for detecting and responding to threats in a timely manner. The policy goes further to state, "An aerial survey of all pipelines should be undertaken every two weeks. Normally, this activity is completed by an observer from a helicopter but can also be achieved by fixed wing aircraft or using satellites."

With the adoption of Satellite Infrastructure Monitoring (SIM) system has the potential to produce a cleaner, more effective, and reliable monitoring package with the use of satellite imagery. This system compared to the conventional process which uses a helicopter to fly the line as well as foot patrols, would offer SGN and NGGT a higher frequency of monitoring and have a less environmental impact where the helicopter releases approx. 173 tonnes per CO2 a year.

## Method(s)

Unlike our current helicopter process, SIMs is not subject to weather and would be able to analyse gradual encroachments like ground movement using artificial intelligence. This offers new opportunities for earlier indication of potential landslides permitting SGN and NGGT to proactively divert high risk pipeline protecting our assets and our customer's supply.

CoSMiC-EYE technology is a modified SAR Coherent Change Detection algorithm that compares a stack of co-registered radar images at different capture times. Overview of the three main steps that define the change detection algorithm: stack of SAR images, the detected changes and the filtered change maps eliminating all non-threatening events. The system acquires radar satellite images along the pipeline routes, and automatically processes and analyses these images to detect anomalies and filter irrelevant changes. For this, both classical image processing and filtering techniques are used, as well as Artificial Intelligence (AI) based filtering and classification techniques.

Orbital Eye will provide the CoSMiC-EYE platform, available for both desktop and mobile devices, on which the detected activities can be analysed and classified, and on which additional information such as pictures and documents can be added. Besides, Customer can manually create events and points of interest on the platform.

If the concept above is proved successful, other commercial opportunities exist where SIMs could monitor other assets or even another pipeline owned by a different utility companies.

The project centres on an experimental concept and uses trusted technologies.

This demonstrator project will help to ensure the future safety and resilience of our network as it is today, by investing in our infrastructure to keep our assets safe, whilst maintaining supply of gas and reducing consumer vulnerability across the network.

For the data that we aim to use (SAR/Multispectral/Optical), we will have automated mechanisms in place to acquire and process this data. As soon this data is not delivered to us in the way expected, or steps in the processing are deviating from standard procedures, our system sends alerts to data analysts who then verify why the data is deviating from its normal quality/availability/processing. For Optical data, Orbital Eye will only provide optical data of 50cm resolution to SGN. Data of lower quality will simply not be acquired in this project and therefore the quality of this data is ensured. Data delivered to SGN and NGGT (activities that can pose a threat to the pipeline + optical data for the locations of these activities) is always checked by one of Orbital Eye's data analysts as part of our Quality Control processes.

## Scope

As the existing policy contemplates multi-modal surveying techniques, the status quo of our current practices around LTS and NTS monitoring may be enhanced in two ways, both of which would reduce the overall risk to the high-pressure pipeline infrastructure and so deliver enhanced value to network customers:

The project will look to carry out extensive testing on the effectiveness on the following.

The nature of threat detections.

It may be possible using Synthetic Aperture Radar (SAR) and/or Visible Near Infrared (VNIR) and/or Short-Wave Infrared (SWIR) satellites for remote monitoring to improve the overall detection process across the complex asset network. Orbital Eye will monitor several segments of the pipeline network of Customer, to detect activities that could potentially be a threat to the pipeline. Activities that take place within a corridor width of 30 meter (15 meter either side of the pipeline centre-line), will be reported to Customer. For

locations where an activity has been detected, Orbital Eye will provide a high-resolution optical image (if available) of before and after the event was detected, to enable Customer to assess activities from the office and decide whether on-site follow-up is required.

The timeliness of threat detections.

The satellite sensors have improved revisit rates over what was achievable just a few years ago. This coupled with; wide-area acquisition in a single overpass; cloud penetrating properties of SAR imaging; and sophisticated change detection algorithms and high-performance automated processing environments translates to an improved temporal window between threat initiation and threat detection. The reporting interval of the CoSMiC-EYE service during the demonstration can be weekly or biweekly. This means that all collected satellite data covering the monitoring area during the chosen interval is used to detect activities, and that Customer will receive an overview of all detected activities once per chosen reporting interval.

## Objective(s)

### 3.1 CoSMiC-EYE monitoring service

Orbital Eye will monitor several segments of the pipeline network of Customer, to detect activities that could potentially be a threat to the pipeline. Activities that take place within a corridor width of 30 meter (15 meter either side of the pipeline centre-line), will be reported to Customer. For locations where an activity has been detected, Orbital Eye will provide a high-resolution optical image (if available) of before and after the event was detected, to enable Customer to assess activities from the office and decide whether on-site follow-up is required.

### 3.2 Pipeline network to be monitored

Within the scope of this demonstration, 150km of SGN LTS and 150km of NTS network has been selected for monitoring

### 3.3 CoSMiC-EYE platform

Orbital Eye will provide the CoSMiC-EYE platform, available for both desktop and mobile devices, on which the detected activities can be analysed and classified, and on which additional information such as pictures and documents can be added.

### 3.4 Reporting Interval

The reporting interval of the CoSMiC-EYE service during the demonstration will be weekly, an improvement on existing biweekly reports. This means that all collected satellite data covering the monitoring area during the chosen interval is used to detect activities, and that SGN will receive an overview of all detected activities once per chosen reporting interval.

### 3.5 Reporting format

Orbital Eye will provide an overview of detected activities in the CoSMiC-EYE application. Besides, all detected activities will be reported by email to Customer. Attached to this email, an overview of all detected activities is also provided in a PDF and CSV format.

Under this task, Optical Eye will analyse the acquired data and evaluate their characteristics such as resolution, data collection frequency, and pricing. The software team at Optical Eye will also analyse the possibility to identify SGN's SRP requirements in data sets procured from different vendors. At the end of this task, a comprehensive report will be generated to guide all the future development in this project.

A comprehensive report after evaluation of the purchased data will cover the strength and weaknesses of the data provided by different vendors, the possibilities to identify different objects in the SAR data and the potential to identify changes in the environment.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Risk To supply of gas - SIMS has the potential to improve the current 2-week monitoring schedule to a weekly service which has the potential to decrease the risk of damage on our LTS and NTS. With a higher frequency of monitoring, If the project is successful, the developed solution has the potential to minimise the risk of third-party damage to our LTS network, preventing showdowns and loss of supply to all customers.

## Success Criteria

The following success criteria for the project include the completion of:

- Prove cheaper than the current process of the helicopter runs.

- Negate the current helicopter process which relies on carbon-based fuel leading to a cleaner more sustainable system.
- SIMS has the potential to improve the current 2-week monitoring schedule to a weekly service which has the potential to decrease the risk of damage on our LTS and NTS with a higher frequency of monitoring.
- Accuracy of AI filtrations of encroachments to prevent false alarms
- Operational excellence of integrated software
- Image quality and effectiveness of analysis
- Data acquisition is safe and sustainable

## Project Partners and External Funding

Orbital Eye and National Grid Gas Transmission

## Potential for New Learning

The project aims to further enhance remote monitoring within the utility sector and to improve efficiency and longevity of our infrastructure

The project is expected to deliver the demonstration and validation of the combined software solution in a test environment.

## Scale of Project

The project involves carrying out inhouse testing to prove the physical and software concepts. This will be followed by live trials to demonstrate the technique and gain feedback during the trial.

We will be running the trail on 2 GDN networks –

- 150km of National Grid Transmission NTS
- 150km of SGNs LTS

This will give the project a wider scope of learning and stress testing the technology that is now available to us from Orbital eye.

## Technology Readiness at Start

TRL4 Bench Scale Research

## Technology Readiness at End

TRL8 Active Commissioning

## Geographical Area

Trials to be carried out for 150km in Scotland SGN LTS Network, alongside, 150km of National Grids Transmission

## Revenue Allowed for the RIIO Settlement

If the project is successful the developed solution has the potential to minimise the risk of third-party damage to our LTS network, preventing showdowns, improve carbon footprint, increase frequency security of our LTS network and loss of supply to all customers including multiple vulnerable.

## Indicative Total NIA Project Expenditure

The total project expenditure is approximately £148,238 90% (£197,645) of which will be recovered via the NIA funding mechanism in line with the funding conditions. Total project value is £177,880.

## 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 risk profile of pipelines changes when transporting hydrogen (i.e. the risk increases). This could lead to an increased need for monitoring – which can be perfectly addressed by CoSMiC-EYE. The transition to hydrogen pipelines therefore can be a stimuli for companies to adopt CoSMiC-EYE.

#### How the Project has potential to benefit consumer in vulnerable situations:

This demonstrator project will help to ensure the future safety and resilience of our network as it is today, by investing in our infrastructure to keep our assets safe from third party damages to both networks LTS/NTS network, whilst maintaining supply of gas and reducing consumer vulnerability across the network.

### 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

From a biweekly standpoint, the technology would outperform current methods of working financially and environmentally. With this trail we are looking to increase our security by monitoring weekly with the estimated cost of this coming close to under what we are currently performing.

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

SGN Network and asserts are similar across the UK, therefore this project is applicable to all Gas Networks.

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

Cost for full testing and demonstration would be determined upon completion of the 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 NIA framework offers a robust, open framework to support this work and ensures the results are disseminated to all licenses.

#### 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.

The project scope has been reviewed against all existing projects and no areas of duplication have been identified

#### 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

N/A

#### Relevant Foreground IPR

Findings generated from the project will be available on the smarter networks portal and available upon request from the project partners

#### Data Access Details

Data and project information can be obtained by contacting the project managers

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

## activities

This project involves developing a new satellite monitoring solution which requires development and field trials

**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 NIA framework offers a robust, open framework to support this work and ensures the results are disseminated to all licenses.

**This project has been approved by a senior member of staff**

Yes