

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

Oct 2019

### Project Reference Number

NIA\_SGN0150

## Project Registration

### Project Title

Satellite Infrastructure Monitoring (SIM) – Stage 1

### Project Reference Number

NIA\_SGN0150

### Project Licensee(s)

SGN

### Project Start

October 2019

### Project Duration

0 years and 10 months

### Nominated Project Contact(s)

Oliver Machan

### Project Budget

£334,068.00

## Summary

The nature of LTS pipeline easements represents an asset management complexity. The monitoring methods used for transmission pipelines include aerial surveillance using helicopters and foot patrols along the pipeline route. These patrols prevent developments and events which could place the pipelines, the surroundings of pipelines or security of supplies at risk. Although these methods ensure a high level of safety in pipeline operation, the cost is also very high. Various agricultural practices remain permitted over the pipeline corridor, and recent changes in environmental policy allows natural processes such as lateral river movements across floodplains to go on unchecked by human intervention. It was once the case that artificial network defences were constructed, whereas now rivers migrate unimpeded. Where such river migrations place parts of the gas network at-risk, network licensees are responsible for redirecting their assets to accommodate these environmental changes.

Where allowable, visual inspections of around 2,400km of LTS network 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 by the use of satellites." As the existing policy contemplates multi-modal surveying techniques, the status quo of our current practices around LTS monitoring may be enhanced by using satellite imagery to reduce the overall risk to the high-pressure pipeline infrastructure and so deliver enhanced value to network customers.

### Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

## Problem Being Solved

The nature of LTS pipeline easements represents an asset management complexity. The monitoring methods used for transmission pipelines include aerial surveillance using helicopters and foot patrols along the pipeline route. These patrols prevent developments and events which could place the pipelines, the surroundings of pipelines or security of supplies at risk. Although these methods ensure a high level of safety in pipeline operation, the cost is also very high. Various agricultural practices remain permitted over the pipeline corridor, and recent changes in environmental policy allows natural processes such as lateral river movements across floodplains to go on unchecked by human intervention. It was once the case that artificial network defenses were constructed, whereas now rivers migrate unimpeded. Where such river migrations place parts of the gas network at-risk, network licensees are responsible for redirecting their assets to accommodate these environmental changes.

Normally, these aerial survey activities are completed by an observer from a helicopter but can also be achieved by fixed wing aircraft or by the use of satellites. As the existing policy contemplates multi-modal surveying techniques, the status quo of our current practices around LTS 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 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.

### **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.

## Method(s)

Phase 1 will determine the feasibility of satellite remote sensing and data analytics to support the identification of ground motion and encroachment activities along the high pressure gas pipelines.

By examining a number of test sites with a range of different types of encroachments; routine satellite, remote sensing and fully- or semi-automated data analytics will be used to provide:

1. a geo-tagged notification of ground motion hazards that are not presently able to be identified by helicopter survey; or
2. a rapid geo-tagged alert of hazards that cannot be identified with the frequency / cadence of helicopter surveys.

## Scope

This NIA feasibility project is the first Stage of a multi stage project and will inform the scope and direction of the next stage. The focus of this initial stage is to undertake a technical feasibility and business value study to determine the potential value in being able to use satellite sensor technology to monitor the transmission pipelines and to derive a basic technology specification requirement. The next stage will use this specification to look at testing the technologies and viability of capturing and creating a detection and reporting model.

## Objective(s)

The Stage 1 project represents a feasibility study to understand how satellite remote sensing (SARS), Visible Near Infrared (VNIR) and Short-Wave Infrared (SWIR) may best support the operational routine detection of such events to improve the expedition of intervention detection through a greater collection frequency, and over the longer term replace the traditional helicopter/walking surveys.

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

n/a

## Success Criteria

By the end of this Stage, SGN will be able to quantify the potential method and value in utilizing satellite sensor technology to accurately assess threats to our transmission network infrastructure.

Documented deliverables :

- D1 - User Requirements and Business Opportunities
- D2 - Technical Feasibility Assessment
- D3 - Plan for Service Development
- D4 - Network Customer Benefit Report

## Project Partners and External Funding

Telespazio Vega UK Ltd

## Potential for New Learning

Enhancements to data analytic algorithms to detect ground motion and various types of encroachment. At the completion of the project: we shall have identified the types of encroachment activities that that can be detected by remote monitoring and data analytics. With this new learning, the potnetial of Sateillite monitoring to improve our maintenance operation of the LTS will be determined.

## Scale of Project

The project is a feasibility study that will investigate the benefits of using satellite technology to maintain the local transmission system.

## Technology Readiness at Start

TRL2 Invention and Research

## Technology Readiness at End

TRL3 Proof of Concept

## Geographical Area

The feasibility study will be undertaken at SGNs and the Telespazio's office, however test sites across southern England and Scotland will be used to investigate the potential of satellite imagery.

## Revenue Allowed for the RIIO Settlement

As this is a feasibility project, there are no direct saving benefits anticipated.

## Indicative Total NIA Project Expenditure

The total expenditure for Stage 1 is £334,068, 90% of which (£300,662) will be recovered via the NIA funding mechanism in line with the funding conditions.

## 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)

As indicated by the low start TRL, the method is at an early stage of development and saving estimates will be refined as it is further developed.

#### Please provide a calculation of the expected benefits the Solution

N/A - feasibility study.

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

The potential outcome of this project is applicable across all GDNs who manage transmission pipeline.

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

There are no costs associated with sharing the outputs and recommendations of this study with the other Network Licensees, which will be the first step to roll out across GB.

### 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 learning from this project will benefit network licensees that manage and operate transmission pipeline. If the project leads to the successful development of a more cost-effective solution to the issues around monitoring our local transmission assets and decrease the overall risk to the pipeline, then this would deliver value to the network customers.

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

The project aligns to the target area of reliability and maintenance which aims to improve the efficiency of monitoring the LTS, as well as increasing the safety and security of our stakeholders and customers.

- 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.

A review has been made of all Network Licensees and no other similar projects 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

The project is innovative as it aims to develop a new method to monitor the transmission pipeline infrastructure. The technology has not yet been proven to identify the different types of encroachments that affect the LTS, therefore has not yet been tried.

### 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

This is a feasibility study to investigate the potential benefits of developing an industry usable system that has the potential to reduce maintenance costs and decrease our safety risk of encroachments that pose a risk to damaging our LTS. As the technology is not proven, the business case remains undefined which would not be funded under business as usual.

**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 NIA project has a low TRL and involves carrying out a proof of concept study to develop a novel approach to monitoring the LTS pipeline. This project is applicable to all the GDNs where the learning can be shared between the networks.

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

Yes