Leakvision - Sensor system for leakage det

ENIC - December 2020

# Introduction and Overview

Northern Gas Networks

> *NGN Innovation delivers improvements for our customers and networks, actively seeking ideas to help us modernise today and prepare for tomorrow. Through collaboration with colleagues and suppliers, we're developing new and novel solutions to deliver valuable benefits and make lives easier*

Reducing disruption:

- The current predominant methodology for leakage detection is through above ground bar holing.

- Gas readings are taken from these locations and used to triangulate the leakage location.

- The current method cannot determine how many leaks contribute to the above ground readings
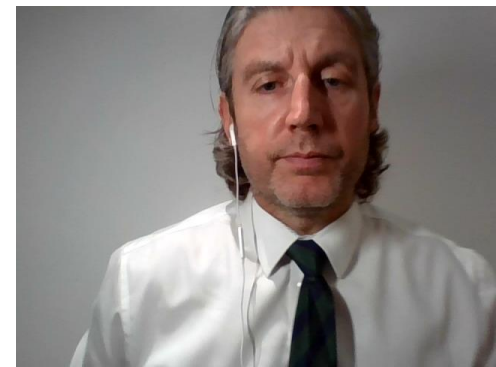
The challenge...and the opportunity

The current predominant methodology for leakage detection is through above ground bar holing. Gas readings are taken from these locations and used to triangulate the leakage location

LeakVision is an in-pipe leakage detection sensor, mounted to a robot base/push rod camera system
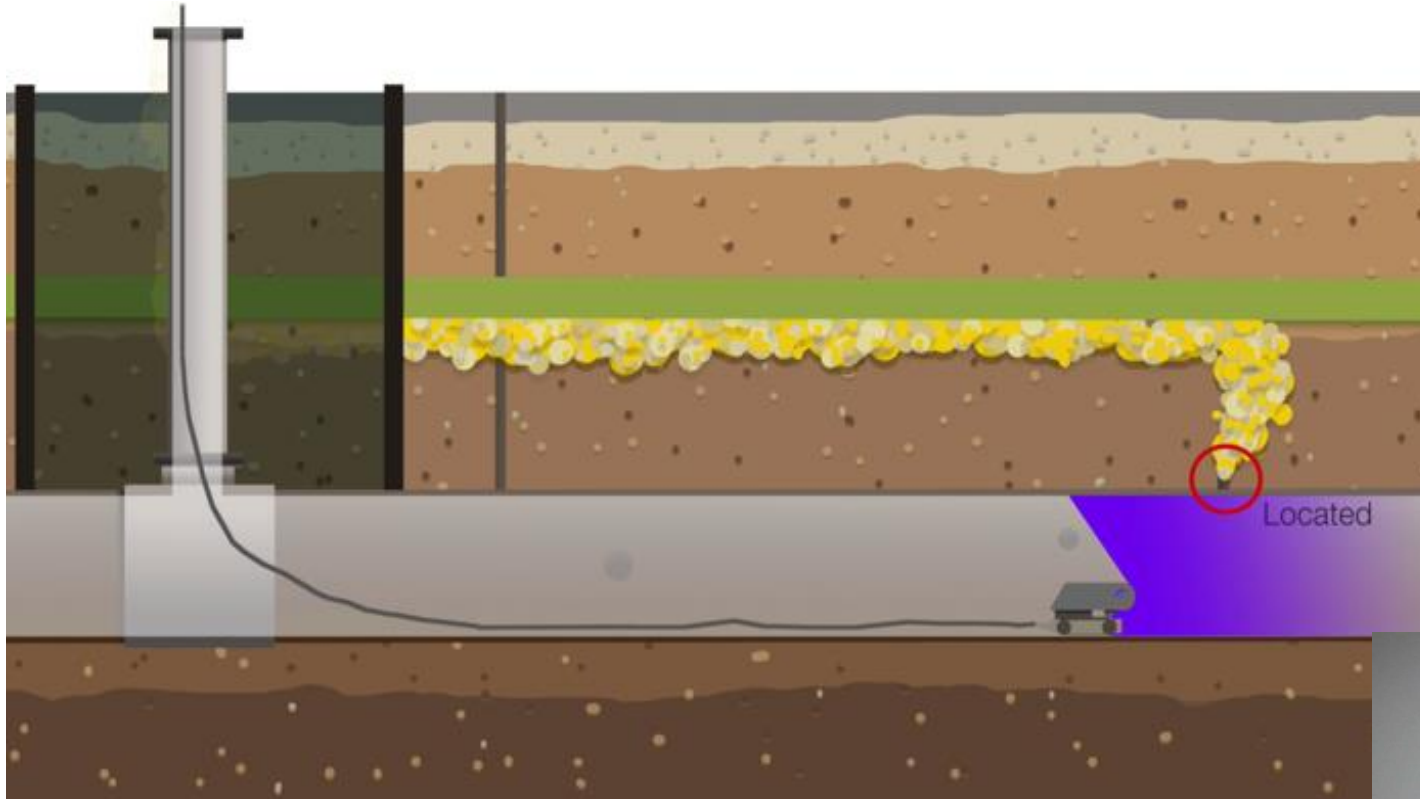
The scientific approach - Project drivers

This co-funded collaborative project will determine how the capturing of in-pipe data that can be used to support evidenced based investment decisions.

The data generated is expected to be able to support a CBA to enable data driven decision making with increased ability to act on factual information

Do we repair or replace a pipe that has been identified as for condition replacement?

Proceed with replacement or undertake repair activity with the confidence, and knowledge that the repair can be targeted and once complete that the asset is in a good state of health

The scientific approach - Project drivers
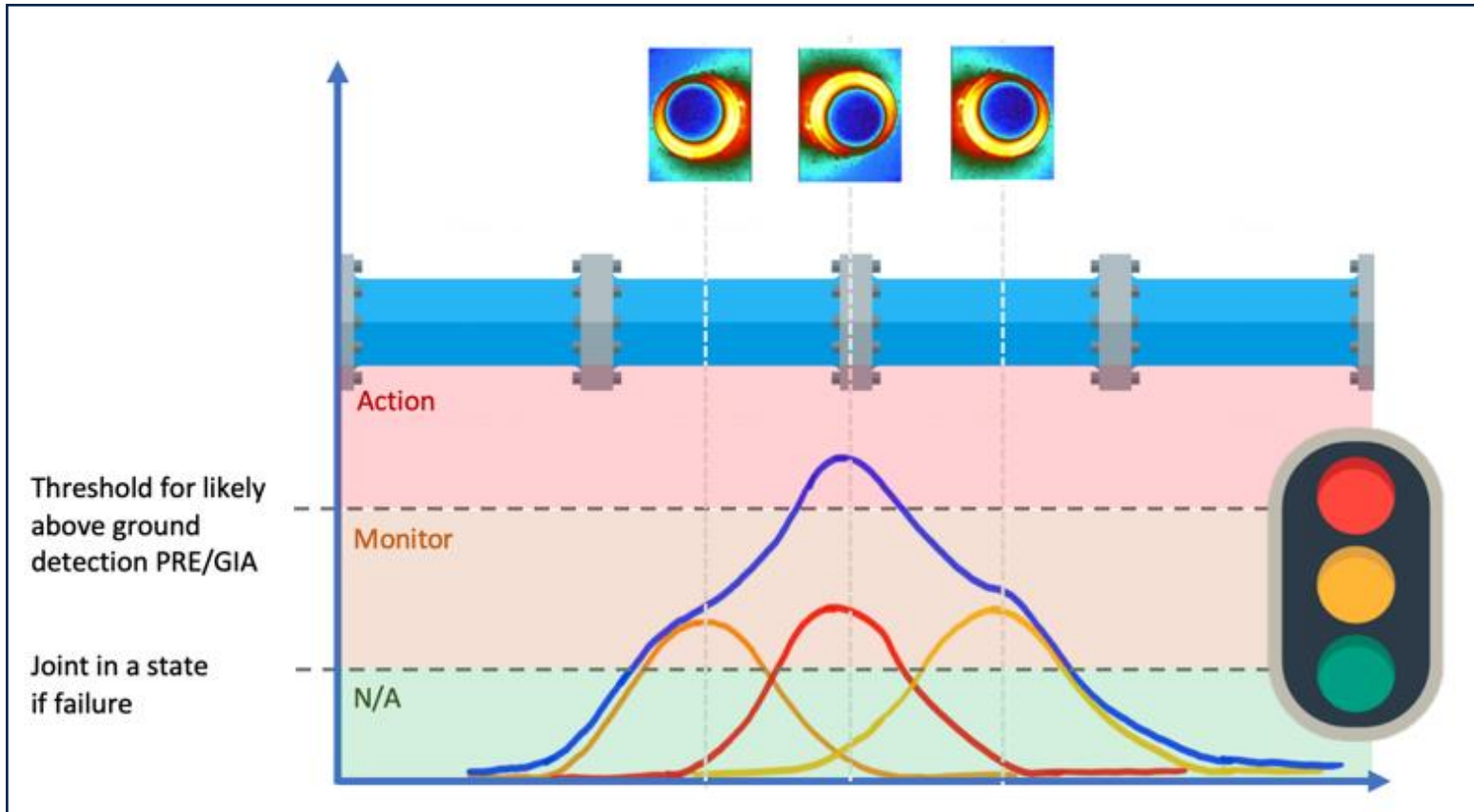
This new technology will capture data that can be used to support evidenced based investment decisions

The scientific approach

The ability to use thermal imaging technology for asset deterioration and leakage detection present NGN with an opportunity for transformational change in the way that these tasks are managed

- The sensor detects pipeline leakage using a combination of **thermal imaging and machine vision** to look for pipeline wall temperature changes at a leakage location

- Where leakage is present the system detects a **temperature variation** in the pipe-wall due to the leak

- A **combination of thermal imaging, CCTV and gas sensors** to consider local environmental conditions to estimate the relative scale of any leakage

Longitudinal Crack

The scientific approach

To develop a framework for the thermal detection of leakage, the approach was to develop **3D Computational Fluid Dynamic (CFD) models** to understand the heat transfer between a leaking gas and the pipeline wall. These **models are calibrated on laboratory rigs to simulate real world conditions** and isolate key relationships between leakage rate and temperature change under precise conditions.
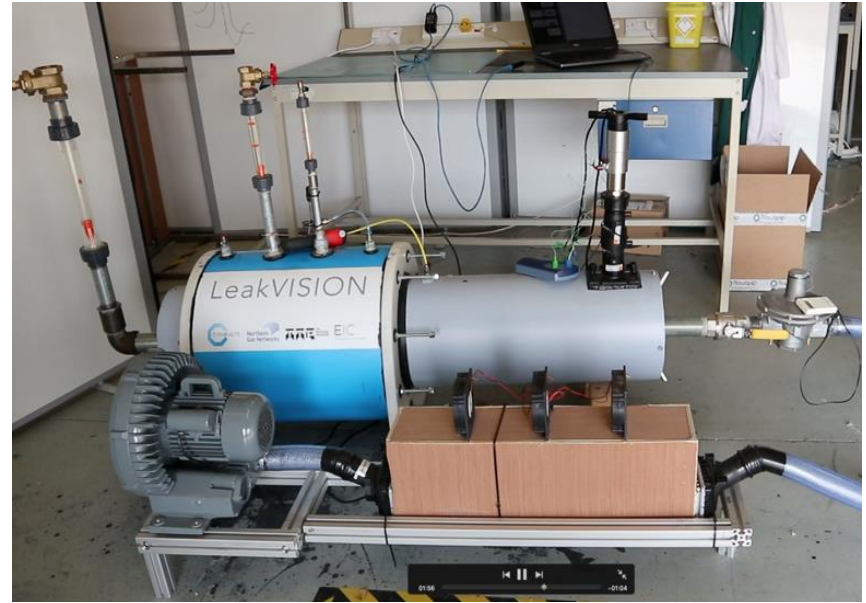
The **thermal signature of a leak** is captured and can be compared to the other areas of the pipelines to provide a **quick comparison** which highlights areas of interest for further investigation.

At these areas a detailed scan can be completed to **infer the scale** of the leakage. The quick and detailed approach was developed to enable large distances to be covered efficiently.

Project benefits

| Benefit Type (Cost Saving, CO Reduction, Customer Satisfaction)	Benefit Description
Cost saving	• Cost savings through reduction in excavation • Cost saving through deferred / avoided replacement • Asset management and monitoring of leakage in areas of engineering difficulty
Increased ability to monitor more asset and varied asset types.	• Ability to directly inspect asset for leakage/deterioration • Asset management of non-mandated mains • Leak location capability in areas of engineering difficulty (i.e. cross roads, train crossings, commercially sensitive locations)
Societal benefits	• Reduced excavation minimises impact on stakeholders and transient customers • Minimisation of return call outs (profile main leakage locations in single operation) • Management of leakage
Safety benefits	• Asset management method for non-mandated mains providing evidence to support repair versus replace decision. • Reduction on digging down on unknown quantities during leakage investigation
Environmental benefits	• Reduced excavation and reinstatement • Assessment of pipeline leakage and shrinkage
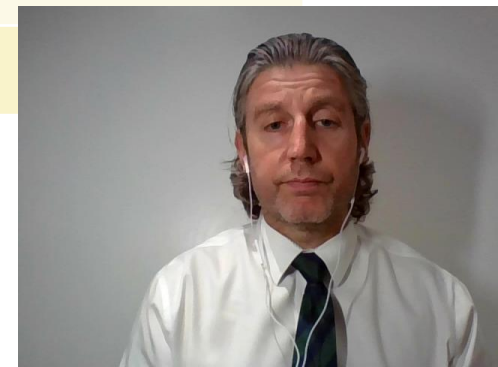
Progress to date

The project has progressed to the completion of stage 1 where we have completed the first round of CFD modelling and test rig analysis on PE pipelines and leakage

The **analytical frameworks for leakage** and a **proof of concept sensor package** have been developed and verified in the PE scale test rig

Based on the testing to date the sensor has been shown to detect and respond to scaled leakage **and shows strong correlation to the simulations and expected results**

The machine vision system has been developed and is able to **detect and store the data across a number of inspections**. This can be used to create a picture of the change of leakage of a timeframe or a change in conditions between inspections
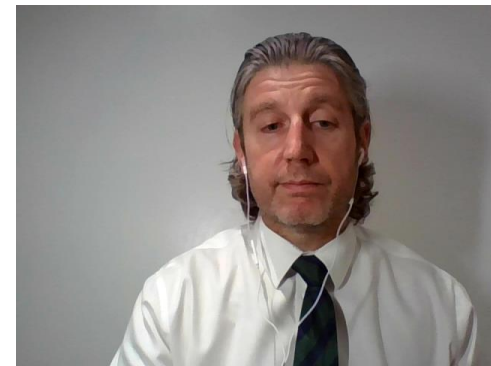
Thank you

Any questions?

Contact rhynes-cooper@northerngas.co.uk for more information