

ORIGIN

INTEGRITY  
MANAGEMENT

# Pipeline Surveillance And MOP Affirmation Using High-resolution Satellite Imagery

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# TD/1 MOP Affirmation Audits

- Pipeline Operators are required to audit their networks on a regular basis to:
  - Demonstrate that the pipeline has been designed, constructed, operated and inspected in-line with the requirements of IGEM/TD/1 standard.
  - Risk management, for example, of third party damage due to:
    - Increased population density beyond the area types allowable limit
    - Increased traffic
    - Other encroachments within the minimum building proximity distance (BPD) of the pipeline.
  - Manage the risks posed by these assets to the surrounding environment and population



**IGEM/TD/1 Edition 6  
Communication 1848**

***Steel pipelines for high pressure gas  
transmission***

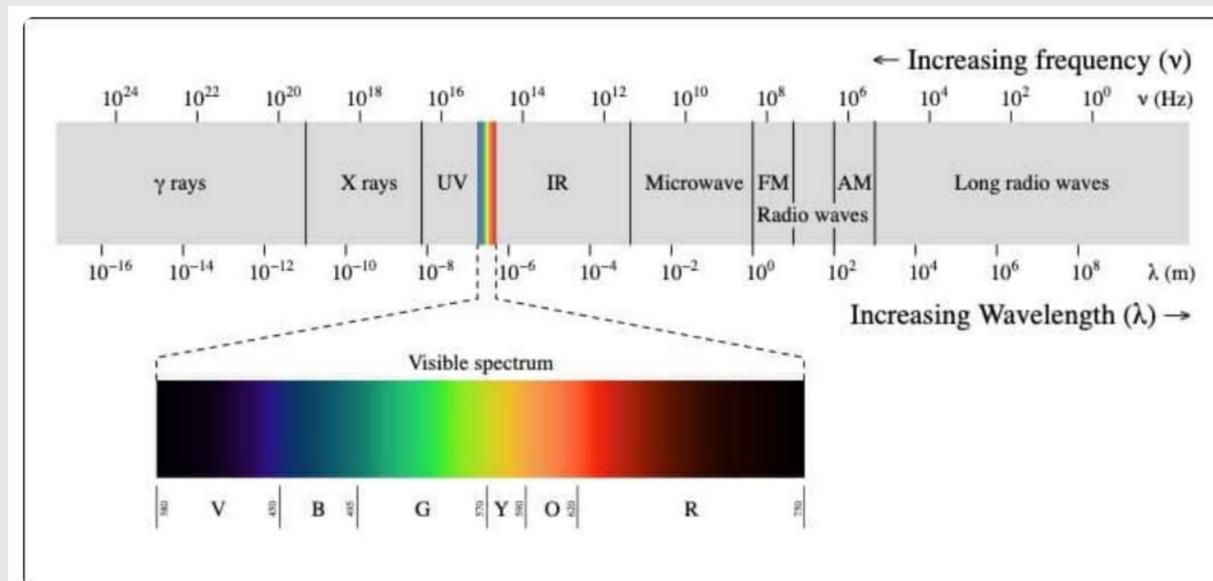


Founded 1863  
Royal Charter 1929  
Patron: Her Majesty the Queen



# Earth Observation

- When light shines on an object, some wavelengths are absorbed and others are reflected.
- Satellites are equipped with a wide range of sensors that can detect these wavelengths.
- These bands can then be assigned to colours we're able to see, allowing us to interpret the information.



## True Colour Image

- A true colour image is the combination of the red, green, and blue bands.



- The result is an image that looks like how our eyes perceive the world and its colours. For that reason, true colour is the preferred image output for visual inspections.

# Pipeline Inspection Survey

Audits have been traditionally performed using aerial photography.

In 2022 following a project with Innovate UK and the Satellite Applications Catapult Origin IM successfully performed the first ever affirmation audit of NGN's pipeline network using high-resolution satellite imagery.

Aerial Imagery Example



Satellite Imagery Example



## Benefits of Satellite Imagery:

- Health & Safety: lower risk by eliminating the need for aircraft flying close to pipelines.
- Environmental: reduction of harmful CO<sub>2</sub> emissions by aircraft.
- Time saving: High cadence of EO satellites allows for faster imagery procurement and processing.
- Cost saving: Satellite imagery costs are becoming cheaper due to technology development and increased availability.
- Reliability:
  - Not reliant on 3rd party flying schedule e.g. other clients
  - Unaffected by Force Majeure e.g. pandemic
- Potential for Automated Change Detection in pipeline encroachment zone.

# 2022 Pipeline Inspection Survey

- 2022 Total network inspection length: ~ 420 km
- 2022 Total area surveyed: ~ 179 km<sup>2</sup>
- All high-res satellite imagery was procured within two weeks of project kick-off
- Satellite imagery acquired had great spatial resolution that allowed for detailed inspection and identification of features within the pipeline corridor.
- Technical support provided by Catapult - Satellite Applications

Imagery Example 1 with pipeline overlay



Imagery Example 2 with pipeline overlay



# 2022 Pipeline Inspection Survey

Using High-Res Satellite imagery and GIS software:

- Rolling Circles of 8 x BPD to identify R and S areas
- Buffer Areas for:
  - Rural BPD Infringement
  - Suburban BPD Infringement
- Other features identified along the pipeline:
  - Depth of Cover
  - Road and Rail Crossings
  - Pipeline Crossings
- Detection of encroachments within BPDs
  - With potential for automated change detection using algorithms and engineering judgement

**Example of BPDs and Rolling Circles**



**Example of Depth of Cover Tags**



**Example of detection of encroachments**



# Going Forward

- Use of Satellite based Earth Observation Imagery:
  - To perform On-going (fortnightly) monitoring of pipelines:
    - Revisit times for satellites are higher (often daily), allowing for increased surveillance frequency of pipelines
    - Option to include inspection of non-high pressure pipelines considered critical but located in remote areas with difficult inspection access.
    - Feasibility study performed in collaboration with Catapult Satellite Applications & ESA
      - Including a cloud cover assessment to determine optimal timing for frequent image acquisition
- Use of other satellite products to support pipeline management and integrity scopes.

# Thank you

## Contact Details

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