Digital Pipeline Integrity Management

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PIGGING CHALLENGES

- **INTELLIGENT PIGGING**
  - Managing schedules and risks
  - Larger footprint
  - Data processing time

- **PROGRESSIVE CLEANING**
  - Decisions based on lack of data

- **PIG TRACKING**
  - Technology limitations

- **STUCK PIG CONTINGENCY**
  - Limited provision to test contingency plans
High cost, high impact; reliance on skilled manual processes and transporting short pipe sections

IS CURRENT PIPELINE CONSTRUCTION TECHNOLOGY SUSTAINABLE?

A typical 40km cross country gas transmission pipeline needs...

1000+ truck movements & 48,000m² pipe dumps

Long sequence of heavy manual processes unchanged for 75 years

- Iron ore
- Plate mill
- Pipe mill
- Coating
- Stringing
- Welding
- Jointing
- Burial
A mobile factory moves across the terrain laying pipe

- **Automated Construction**
  - Manufactured by mobile factory
  - Digital Quality Control
  - Directly laid in trench
  - Hydrotested

- **Digital Operation**
  - Real time data
  - All along pipeline
MASIP—Flexible Pipe Structure

PIPE STRUCTURE:
- HDPE liner
- High strength steel reinforcement
- Optical fibre cable
- 2 layers of environmental coating

ENGINEERING ANALYSIS:
- Full 3D local analysis - to 1mm elements
- Global 2D analysis – 1m elements
Technology Qualified by DNVGL

Pipe burst tests to 1700psi

Bend tests

Excellent correlation between FEA and pipe tests

Pressure cycling – simulating 50 years life with hydrogen rich gas

ENDORSEMENT OF QUALIFICATION PLAN

This is to endorse in accordance with the provisions of DNVGL-SE-0160/1 that the qualification plan/2/ for Mobile Automated Spiral Interlocking Pipe (MASIP)
Factory modules are shipped to site in containers, assembled in a tent and pipe made in the field
Spirally wound optical fibre enables sensitive real time integrity monitoring- leak detection, 3rd party interference, pipe displacement.
Pipe trials included different types of pipe section and a range of pressure cycles with hydrogen rich gas.
The pipeline is divided into channels of information with spatial resolution of 0.1m.
MASiP – Pipe sensitivity trials

Sandbags applied to pipe under gas pressure to test optical fibre sensitivity to local change in pipe wall strain
An alerting system will ‘red flag’ threats in real time linked into GIS system
Finite Element Analysis and Physical tests lead to a simplified design chart to determine Maximum Allowable Working Pressure (MAWP)
Full scale trials are planned for 2021 with Pipeline Operator participation – contact us for details
CONCLUSIONS

- **SPIRAL OPTICAL FIBRE – NEW APPROACH**
  - 1000x More sensitivity
  - Real time data
  - Good spatial resolution

- **PIGGING AS REQUIRED**
  - Decisions based on clear and detailed data

- **PIG TRACKING**
  - Accurate digital tracking with optical fibre

- **FIELD TRIALS OPEN TO PARTICIPATION IN 2021**
  - Opportunity to try specific solutions
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Thank you and Questions

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