Agenda

• Pipeline System
• Identification of Potential Problem
• Standard ILI Techniques
• Calipier Inspection
• PullTests
• Conclusion
Pipeline Details

• 14” Pipe, Wall Thickness 0.875”
• Installed 2003, Service 2003
• 30000 bbl per day of Oil, 58000 bbl per day Water, 40MMSCF of Gas
• Corrosion Inhibitor
• Regular MFL Inspection
Identification of Potential Problem

- Company Policy to use a Third Party Expert to Review MFL Data
  - At the Signal Level
- Identified Potential Slab Erosion
- Production Records High Flow Velocities
At the start and end of the inspection data the girth weld signals and also the signals associated with the seamless pipe type are clearly visible.

Weld signals at start and end of the pipeline

Seamless pipe signals clearly visible
Signal Visibility

• Seamless pattern is visible throughout the data; however the signals reduce in size from approximately 150m into the inspection

• Seamless pattern is always discernible at the “sides” of the pipeline – centred around the 3 o’clock and 9 o’clock orientations

• Towards the 6 o’clock and 12 o’clock orientations of the pipeline the signals within many pipe spools appear to be fairly flat, which would indicate that the pipe is much smoother as virtually nothing is being recorded by the sensors

• The extent of the “flatter” signals varies around the pipe circumference and throughout the inspection data
Signal Visibility

Seamless pattern visible

Flatter signals

Seamless pattern visible
Signal Visibility

Smaller signal recorded for many of the girth welds and on some welds the signals virtually disappear completely at various orientations.

- Weld signal between 5:15 and 6:45 barely visible
- Weld signal at 12:00 “normal” signal
- Seamless pattern clearly visible on the data
Standard ILI Techniques

- Magnetic Flux Leakage
  - Relies on Flux leakage
  - Indirect technique
  - Pull Tests
  - Unlikely to work on Slab Erosion
Standard ILI Techniques

• Ultrasonics
  – Direct Method
  – Would Work
  – Requires a Couplant
  – Expensive and Disruptive to Production
Potential Calipier Inspection

42 Caliper Arms

LN 200 Inertial Measurement Unit

Battery Can

Odometers
Calipier Measurements

- Tool measures Multiple Radius Measurements
- From that we determine Multiple Diameter Measurements
- From those Diameter Measurements
  - Minimum
  - Maximum
  - Average
PullTests

- First Series mimic Large Internal Defects
- Second Series mimic Slab Erosion
Large Internal Defects

3.8mm

2.8mm

1.9mm

1.9mm

0.9mm

7.6mm

4.7mm

Real world. World class. Worldwide.
Slab Erosion Pull Test

- Special Defect Spool Made
- ¼ Section cut from Pipe
- Welded Back in as Two Tapers
Diameter Measurement
Slab Erosion Spool

Diameter (mm)

Distance (m)

Geopig Internal Diameter Profile (Max)

△ Measured Internal Profile
Individual Diameter Measurements
Individual Radius Measurements

![Geopig Radius measurements chart](chart.png)
Conclusion

• Problem Identified through 3rd Party Expert Analysis of MFL Data
• Demonstrated Potential for High Resolution Geopig to detect Slab Erosion
• Run Planned for 2009. Pigging Gods willing
Questions