

RoGeo PD – A new platform for pipeline movement screening

Throughout Australia and Oceania, recent climate change has intensified rainfall and raised the mean temperature, causing hydrological hazards such as shifting debris, landslides, erosion and flooding. Pipelines are particularly vulnerable to those geohazards, which can result in pipeline movement and bending strain. Remaining undetected, those stresses will cause these lines to fail.

More and more operators with pipelines located in areas susceptible to geohazards utilise inertial measurement units (IMUs) as indispensable components of pipeline integrity. IMUs are typically integrated into combined technology platforms, including corrosion or crack detection systems and geometric calipers. While these technologies can provide additional relevant information on the threat situation, more complex in-line inspection technologies require more resources than a simple IMU unit. Moreover, they have longer lead times and are often significantly more expensive.



With this in mind, ROSEN has developed the RoGeo PD (PipeDrift) technology platform to provide pipeline operators with the option of running a simplified and more efficient inertial inspection tool to assess pipeline integrity. The RoGeo PD platform combines an IMU with a standard cleaning tool, which allows an operator to successfully mobilise and deploy the IMU with significantly less effort than an intelligent inspection tool, thus reducing costs and the resources required to complete the assessment. The solution has been successfully deployed multiple times in the last few years on a pipeline system with known movement areas and with historical ILI data from more conventional combined ILI and IMU technology platforms. Tool velocities of 6.9 m/s have been achieved.

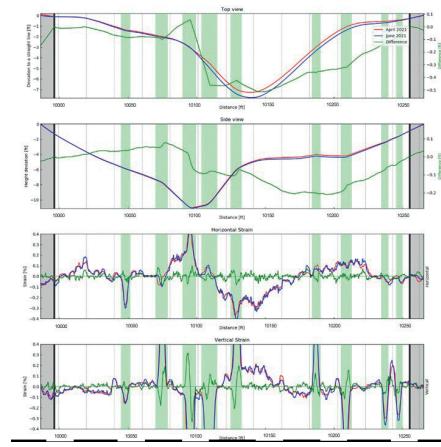
The first RoGeo PD inspection in 2021 was

performed within 24 hours of a standard inspection using IMU combined with a caliper technology. The target inspection velocity was 3 m/s. The top illustration in Figure 1 shows excellent agreement in the trajectory of ≤ 0.046 m, and the third illustration shows excellent agreement in strains ≤ 0.05 per cent. The results indicate that the PipeDrift platform did detect and size the pipeline movement features on the pipeline segment with equivalent accuracy to the data captured by the IMU tool.

The second PipeDrift inspection in 2021 was performed several months later as a standalone inspection on the same system.

All values and differences are within the accuracy quoted for IMU inspections at 80 per cent certainty and show excellent agreement between the two methods.

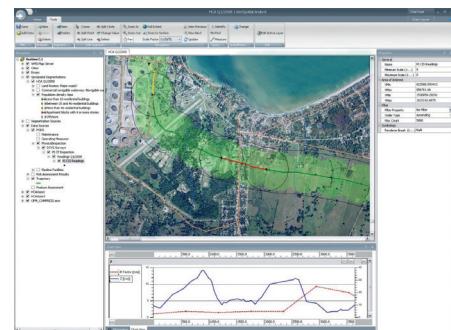
The new RoGeo PD platform is based on existing XYZ mapping inspection systems, but ROSEN has developed new hardware and software components to assess pipelines of 200 mm (8 in) in diameter and larger. Data on inclination and rotational motion is collected using battery-operated MEMS (microelectromechanical systems) and stored in internal memory. Bespoke algorithms have been implemented in a new dedicated software solution for rapid and reliable evaluation. The RoGeo PD probe can be installed on most



ROSEN cleaning pigs.

In contrast to the combination of an IMU unit with classical geometry inspection platforms, neither is an odometer mounted nor are above-ground markers (AGMs) distributed on the surface above the pipeline.

Reporting thresholds are defined based on the service specifications and tailored to the pipeline operator's requirements. The accuracy of the results for pipeline movement is related to the length of the recorded movement because the assessment is based on the difference in position rather than an absolute position measurement. Therefore, a longer section length will increase the measurement tolerance.



Comparisons between ROSEN's RoGeo PD and third-party IMU datasets as the baseline are possible if reliable, and high-resolution, log-distance-based pitch/azimuth values are available. Pipeline movement reports contain a detailed description of each movement area. These include graphs showing the vertical and horizontal pipeline trajectories and strain profiles and a joint number representation.

The premise of the technology has been demonstrated successfully in liquid and gas lines. **P**

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