



SmartBall®

SmartBall®, a revolutionary patent-pending technology for leak detection in large diameter pipelines.

Introduction

SmartBall was invented by Pure Technologies Ltd, a world leader in the development of infrastructure management technologies, with particular emphasis on loss prevention in the water and wastewater sector.

Along with our license agreement for the UK and Ireland, Mouchel also have a strategic alliance with Pure Technologies on the international market and have recently completed a number of large projects in Australia and the Middle East.

Pure Technologies Background

Pure Technologies Ltd. (Pure) is a Canadian listed company specializing in the development and application of technologies for inspection and monitoring of physical infrastructure including bridges, pipelines and other structures. The company has been in business since 1994 and has offices in Canada, USA, UK and Libya.

Pure have particular expertise in inspection, assessment and monitoring of pre-stressed concrete pipelines. Through their subsidiaries, Openaka Inc. and Price Brothers (UK) Ltd, they can provide a full range of services including condition assessment, structural analysis and repair recommendations.

Their P-WAVE® electromagnetic

system can provide a "snapshot" of the condition of each pipe and their SoundPrint® AFO (Acoustic Fibre-Optic) monitoring systems can provide continuous structural health monitoring of pre-stressed pipelines.

Leveraging its expertise in acoustics, Pure introduced SmartBall in 2005 and following two years of development and filed trials, the system was commercialised in June 2007. Since then, SmartBall has been used to survey over 600km of pipelines for a number of different agencies world wide and identified many leaks which have been verified through the repair process.

The Technology

SmartBall® is an internal free-swimming acoustic leak detection tool ideally suited to large diameter transmission pipelines.

The device consists of a water tight aluminium core that contains the power source, electronic components and instrumentation (including acoustic sensor, accelerometer, magnetometer and GPS synchronized ultrasonic transmitter).

The core is encapsulated inside a protective outer foam shell which provides additional surface area to reduce the effective density of the ball and allow it to be propelled by the water flow. It also eliminates any noise the device might make whilst traversing the pipe.

Benefits

The SmartBall system does not require the pipeline to be decommissioned and it can survey long pipelines efficiently, accurately and cost effectively.

The diameter of the outer sphere will vary dependant on the pipeline diameter and flow conditions. The SmartBall is deployed into the water flow of a pipeline and it simply rolls along the base of the pipe propelled by the hydraulic flow, until it is captured at the retrieval point downstream.

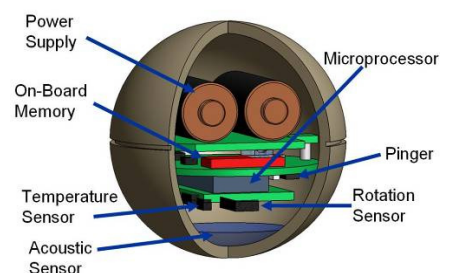


Fig 1 – SmartBall Instrumentation

Since the SmartBall acoustic sensor passes no further than a pipe diameter from a leak, three significant advantages can be seen relative to conventional correlator technology:

1. Large Diameter Pipe: Unlike conventional correlation methods, SmartBall can be used to detect leakage on large diameter pipe (>18" in diameter).
2. Pipe Material: SmartBall is not sensitive to pipeline material, as it is not dependant on the pipeline to transmit the acoustic energy to surface mounted sensors.
3. Leak Sensitivity: Due to SmartBall rolling past the leak, it has optimum acoustic sensitivity and can detect leaks smaller than two liters per minute (dependant of line pressure and ambient noise floor).

The device is introduced into the pipeline through an available 90mm (min) open port valve (Fig3) and retrieved through an extraction point with the same parameter. The length of pipeline that can be surveyed is dependant on the battery life of the device and the flow rate in the pipeline.



Fig 2 – SmartBall, SBR, GPS and Foam

Dependant on water temperature, battery life is anticipated to be in the region of between 12 and 15 hours. Based on a flow rate of 0.5m/s, this equates to a survey range of between 20 and 30km. As the device travels along the pipeline, it records the acoustic environment and all data is stored on board the device.

The system utilizes proprietary SmartBall™ Acoustic Receivers (SBR) attached to the surface mounted sensors to track the location of the device as it travels through the pipeline.

Once the SmartBall™ is retrieved from the pipeline, the acoustic data is analyzed to identify the location and approximate size of any leakage. The leak locations can be presented in GPS coordinates if the alignment of the pipe is known.

A schematic representation of SmartBall is shown in figure 1 and an actual device with foam cover and SBR is shown in figure 2.

The SmartBall is extracted by deploying a net assembly into the pipeline at the extraction point (Figure 4). A camera is used to ensure that the net is properly deployed and to confirm when the ball has been captured.

Prior to extracting the ball, a calibration process is performed to permit an estimation of leak size. The data collected from the device is uploaded to a laptop computer and is analyzed using the SmartBall Analyst software. A typical calibration graph is shown in figure 5.

Data Analysis

Once the ball is retrieved, the data from the entire run can be analyzed and figure 6 shows the signal analysis from a single leak trace. The estimated size of this leak falls within the 'Medium' category and thus between 7.5 and 30 litres/minute. Once all the leaks have been identified, the information is tabulated and included in the report. If the alignment of the pipeline is known, the leak locations can be shown in GPS coordinates and overlaid on to a Google Earth image.

The information provided by SmartBall permits the pipeline owner to easily and quickly estimate the total loss from the line and to make informed decisions about repair or replacement. For example, it might not be cost effective to repair a line with many leaks and a replacement or relining program may be warranted. This quality of information is an important component of a comprehensive asset management program.

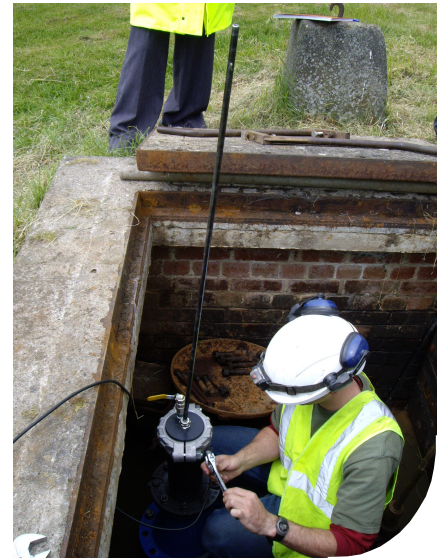


Fig 3 – Insertion Location



Fig 4 – Extraction Location

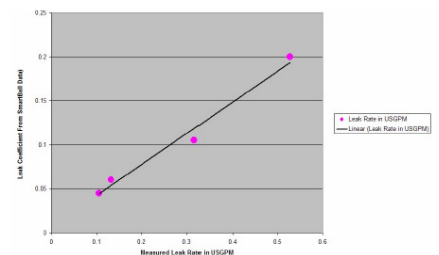


Fig 5 – Calibration Graph

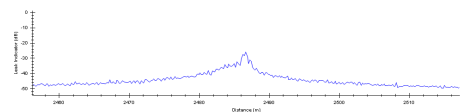


Fig 6 Leak Indication Power