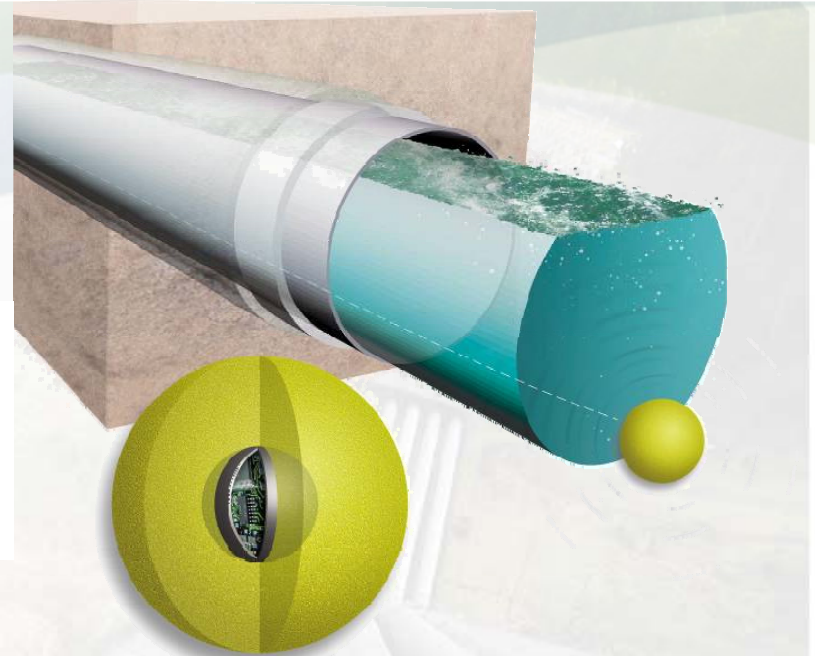




Free Swimming Leak Detection and Asset Management System for Large Diameter Pipelines

RAMUEL GARCIA
Branch Manager
Pure Technologies Ltd -Abu Dhabi

Pure Technologies Ltd.



- Incorporated in 1993
- Publicly traded on the Toronto Stock Exchange (TSX: PUR)
- Offices in Canada, USA, Libya, UK, Switzerland, UAE, and Hong Kong

Technologies & Services



- Monitoring of Bridges and Structures (SoundPrint AFO)
 - Monitor failures in high-tensile steel wire, strand or cable
 - reinforcement in post-tensioned structures
 - supporting elements in suspension bridges
 - monitoring of pre-stressed concrete cylindrical pipe (PCCP)

Technologies & Services



- Pipeline Condition Assessment
 - Leak Detection (SmartBall, SAHARA)
 - RFTC (PipeDiver, Pwave)
 - Long Range CCTV, Sonar (PureRobotics)_
 - Extra HR Magnetic Flux Leakage tools
- Engineering Consultancy Services
 - ✓ OPENAKA INC
 - ✓ PRICE BROTHERS UK LTD
 - ✓ JASON CONSULTANTS

Benefits of Leak Detection



- Knowledge about condition of pipeline
 - Minimize risk
 - Optimize repair & replacement programs
- Reduction of emergency response costs
- Water production cost savings – physical treatment and distribution
- Environmental sustainability – conservation of a natural resource

Water Authorities worldwide claim that their transmission mains are not leaking...

- They claim that if the main line are leaking then the leak will come out of the ground and easily located
- In the past there was no way of efficiently and accurately finding the leaks

Finding Leaks from the outside

"The Old Way"

External Methods

- Listening sticks
- Noise Logges/Correlators



State of the Art – Leak Detection (Internal Methods)



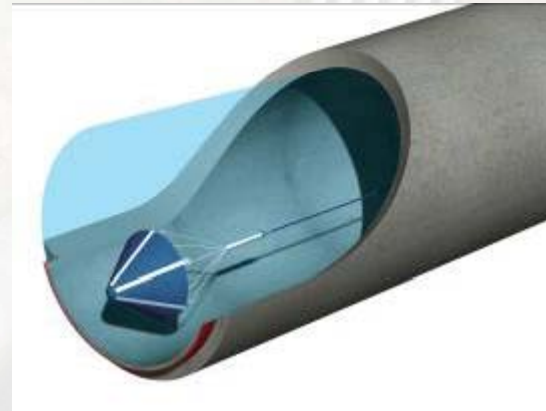
SmartBall®

- Long point-to-point transmission pipelines
- Minimal laterals



Sahara®

- Complex interconnecting networks
- Urban centers



“Solutions for Sustainable Infrastructure”

Summary of Inspection Data



Diameter Of Pipeline	CI	Concrete	DI	GRP	PVC	Steel	Various	Unknown	Grand Total
10" (250mm)						1			1
12" (300mm)	11								11
14" (350mm)						1			1
16" (400mm)					1			1	2
18" (450mm)		1				15			16
20" (500mm)		1							1
24" (600mm)	19	5	65			9	1		99
30" (750mm)	76	1	2	2				2	83
36" (900mm)		57				9			66
42" (1050mm)	4	2	47					5	58
48" (1200mm)		4	3	2		4			13
54" (1350mm)		9	7					17	33
60" (1400mm)		6							6
66" (1650mm)		8				1			9
72" (1700mm)		6				6		3	15
Various	1	9				27	222	9	268
WRC/PPIC	1735	288					33	151	2207
Over 72" (1700mm)		16							16
Grand Total	1846	413	124	4	1	73	256	188	2905

Total Distance Inspected (km): 4008.7
 Total Distance Inspected (mile): 2490.9
 # Leaks Detected: 2905.0
 Average # Leaks per Km: 0.7
 Average # leaks per Mile: 0.5

Average of 0.7 leaks per KM

Large Diameter Mains Leak!

SmartBall Overview



Free swimming acoustic leak detection system for large diameter potable water, wastewater and hydrocarbon pipelines -DN300 / 12" or larger for water P/L -DN100 / 4" or larger for hydrocarbon P/L

- In-line inspection (travels with the flow in the pipeline)
- Suitable for all types of pipe material



SmartBall Overview



- Minimal disruption to Client operations
(Live insertion and retrieval of tool through existing valves)
- Efficient deployments covering up to 12 hours of inspection time each session
 - 35 km @ 1.0 m/sec
 - 18 km @ 0.5 m/sec



SmartBall Equipment

WRC UK approved for use in potable water



➤ SmartBall Core

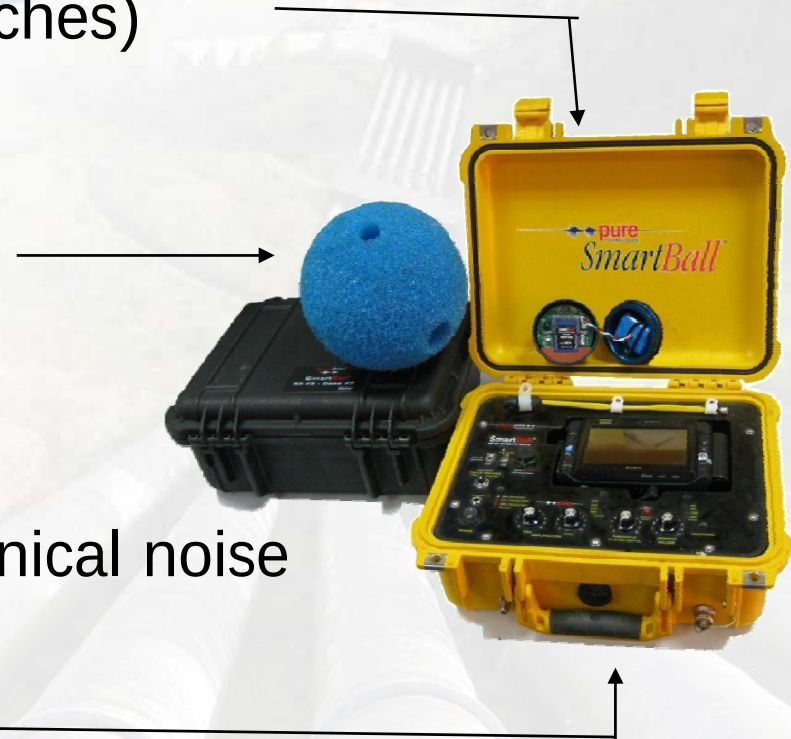
- Diameter of 66 mm (2.6 inches)

➤ Foam Outer Shell

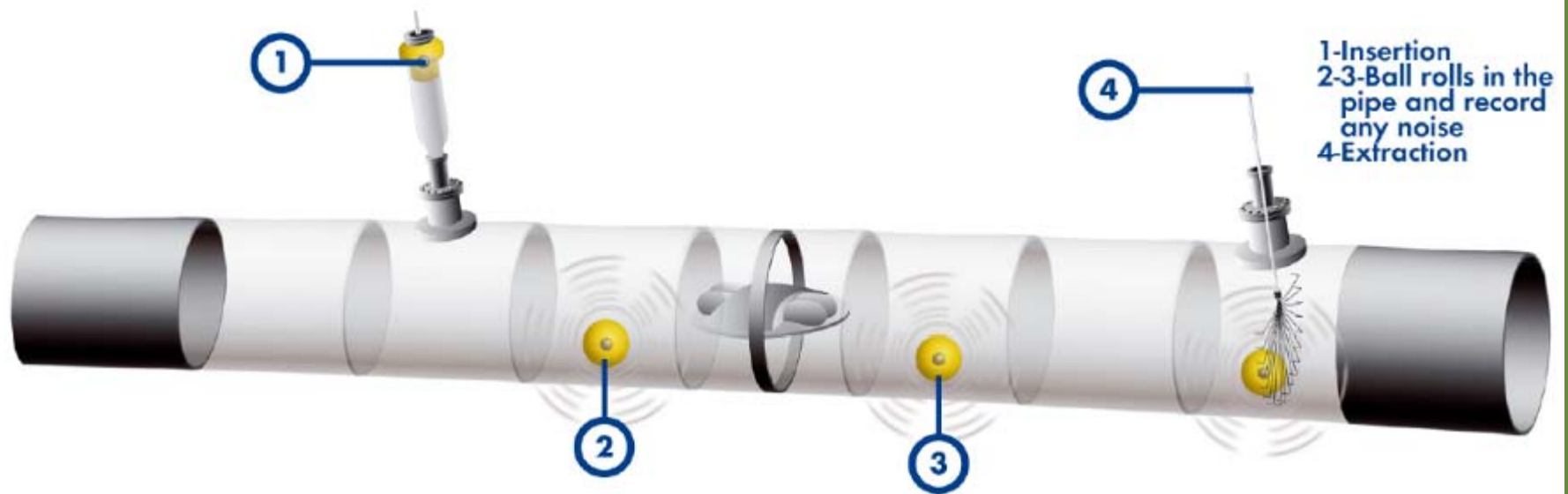
- Provides extra surface area and buoyancy to core
- 175 mm (7 inch) diameter
- Minimize frictional / mechanical noise

➤ SmartBall Receiver (SBR)

- Real time tracking of SmartBall



SmartBall Inspection Process

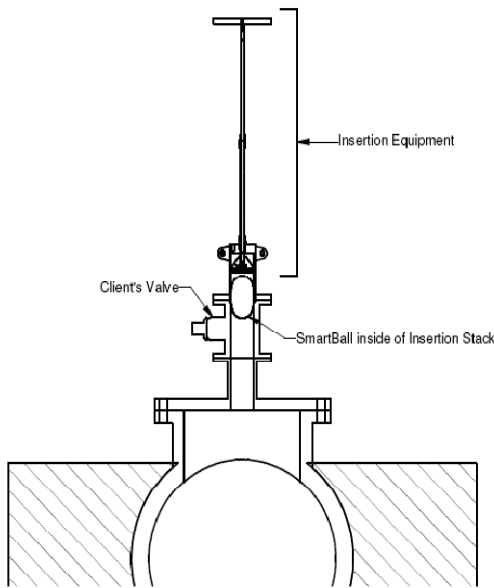


[Animation Link](#)

Insertion Equipment



Foam covered SmartBall pushed through existing 100mm valve



SmartBall Retrieval

Collapsible Net Inserted through 100mm Tubing



SmartBall Retrieval



Real time video of the SmartBall entering the extraction net



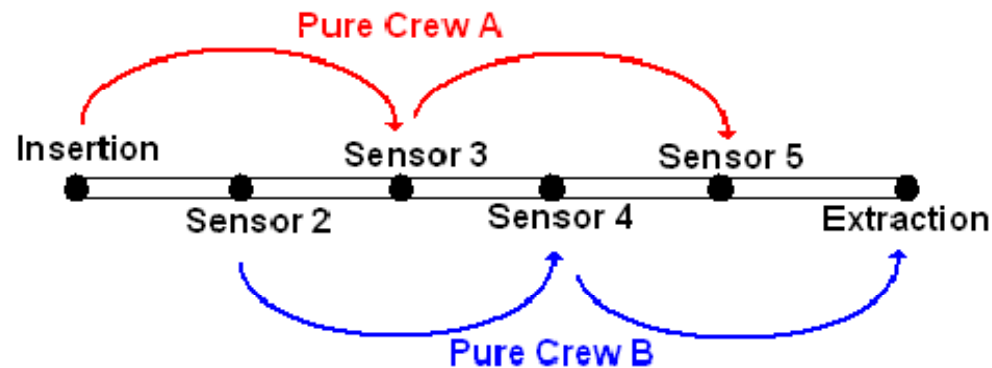
Video Camera
Cable

Leak Calibration Port

SmartBall Tracking



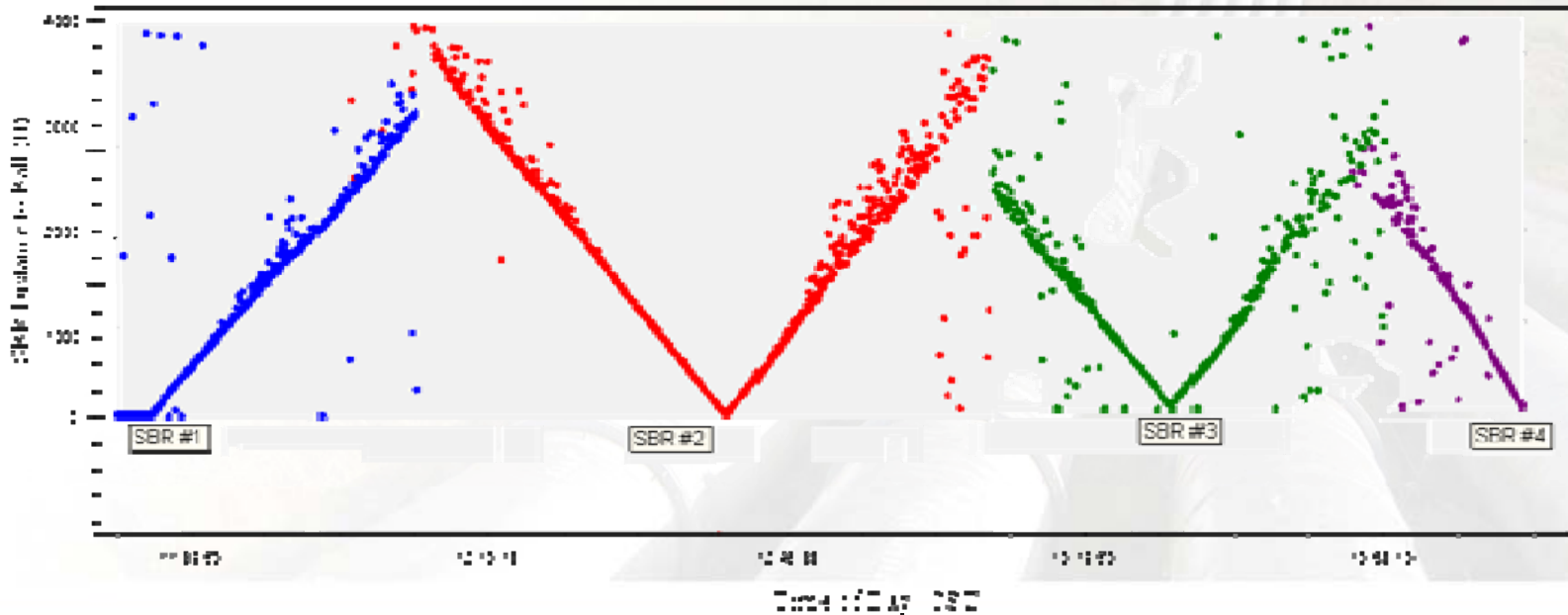
- Sensor is glued to flange or appurtenance of pipeline
- Crew leapfrogs as they track the SmartBall



SmartBall Tracking

Real time tracking of SmartBall's position in pipe up to 4000 feet (1200 meters) away

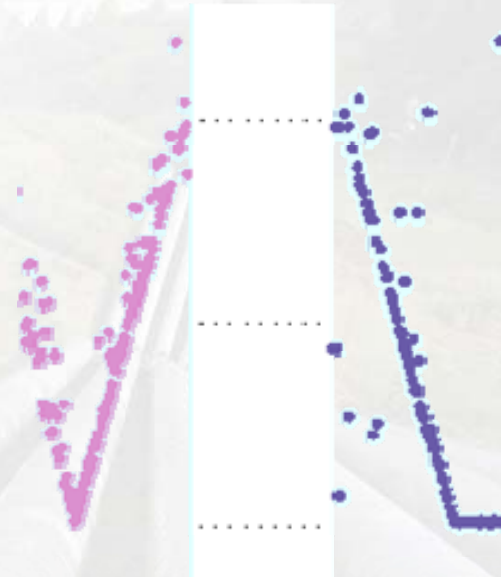
- SmartBall Pulse Audio



SmartBall Data Analysis



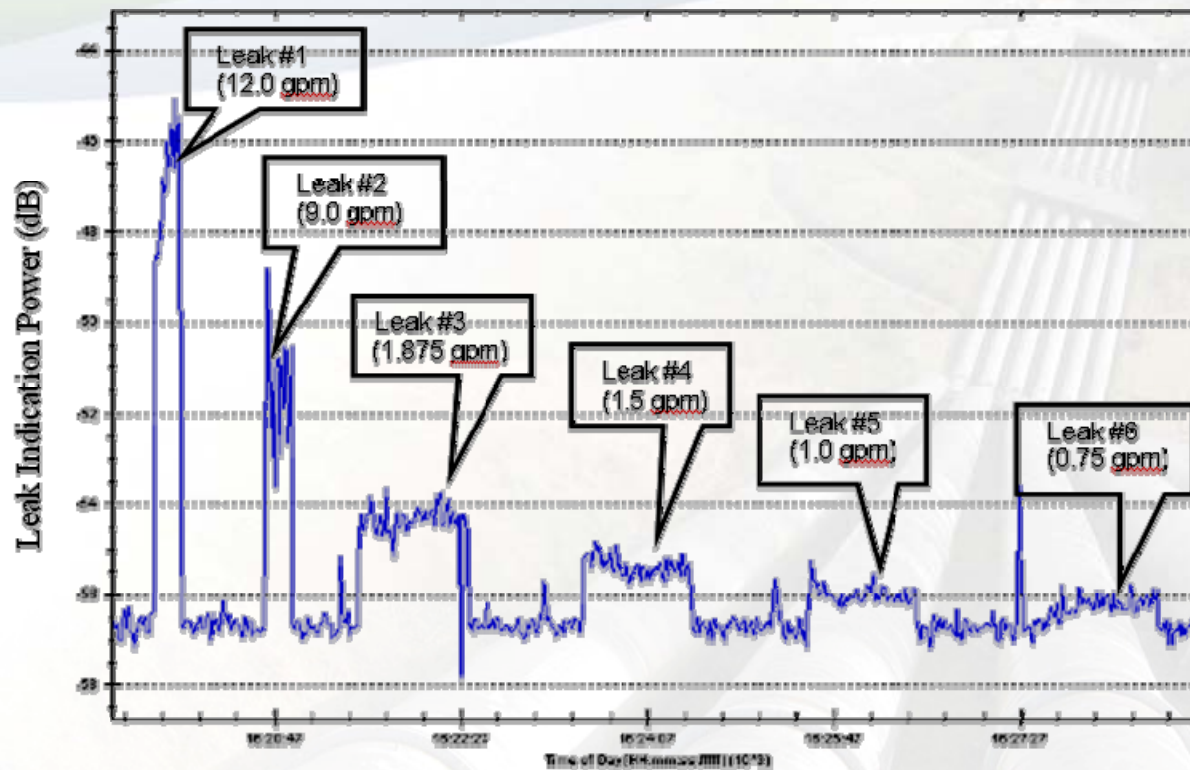
- SBR data and accelerometer data is used to create position profile
- Tracking of the ball as it approaches and leaves sensor locations
- Fixed points in time as the ball passes a sensor location
- Accelerometer data fills in gaps beyond sensor range
- Magnetometer to detect metallic features along the line



SmartBall Data Analysis



-Quantify size of leaks using calibration leaks created on site

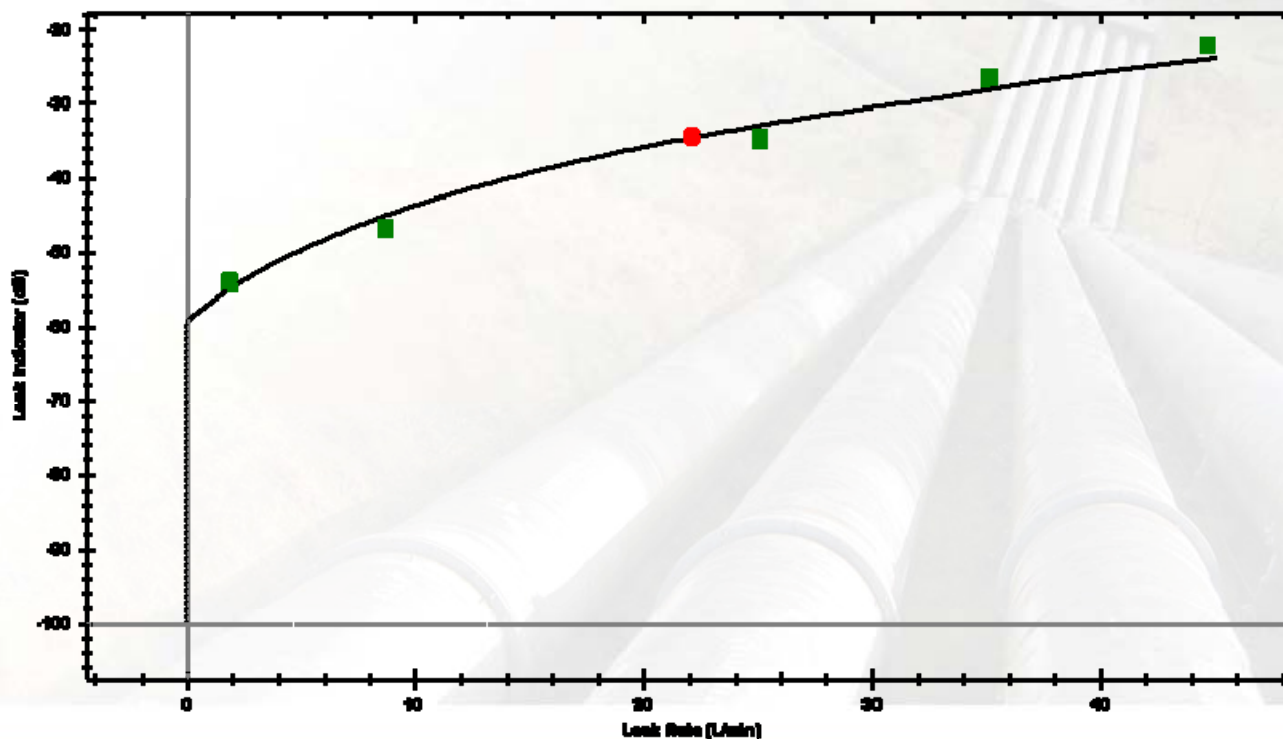


Leak Indication Graph of Simulated Leaks
(The Larger the Leak Indication Power the Larger the Leak)

SmartBall Data Acquisition Analysis of the Data



- Plot calibration leaks on a curve and determine a trend for the pipeline
- Plot real leaks on the trend line to determine their estimated size



What the SmartBall is capable of:



**Pass through
butterfly valves**



What the SmartBall is capable of:



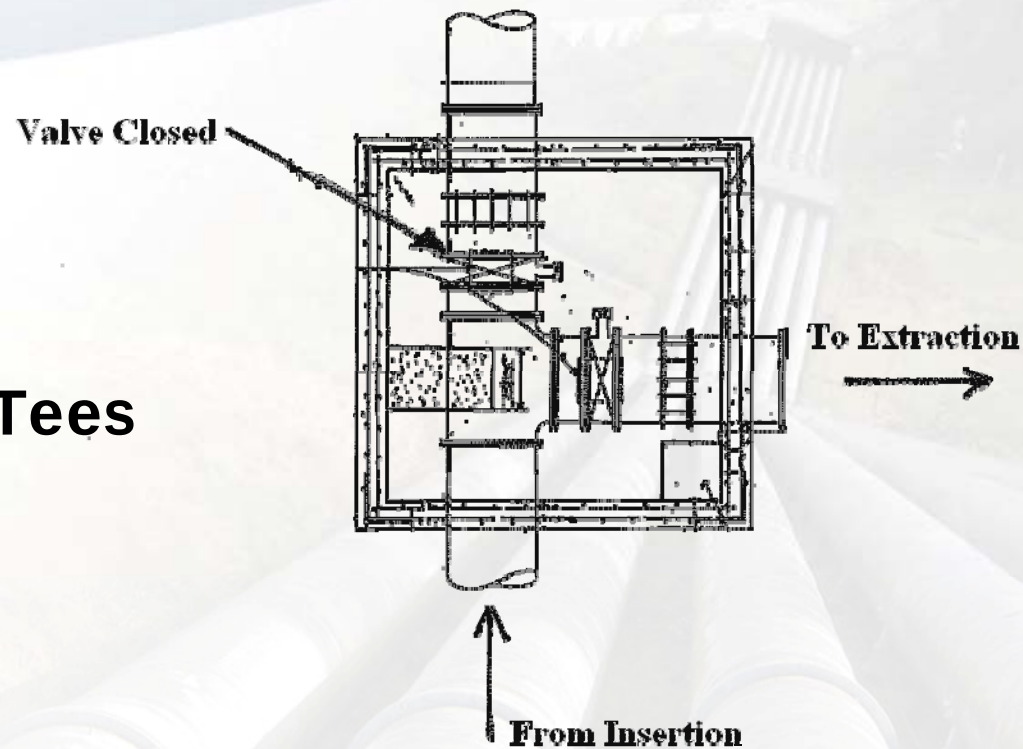
**Pass by washouts or
bottom off takes**



What the SmartBall is capable of:



Going Into Tees



What the SmartBall is capable of:



Going Into Wyes



What the SmartBall is capable of:



Going Into Vertical Sections



Location: Bay County, Florida

SmartBall System Performance



- Sensitivity to 0.5 L/Min
- Location accuracy of +/- 1 meter
- Discriminates between multiple leaks in a run
- Estimation of leak size using calibration
- Identifies air pockets in line



Recently Completed SmartBall Projects

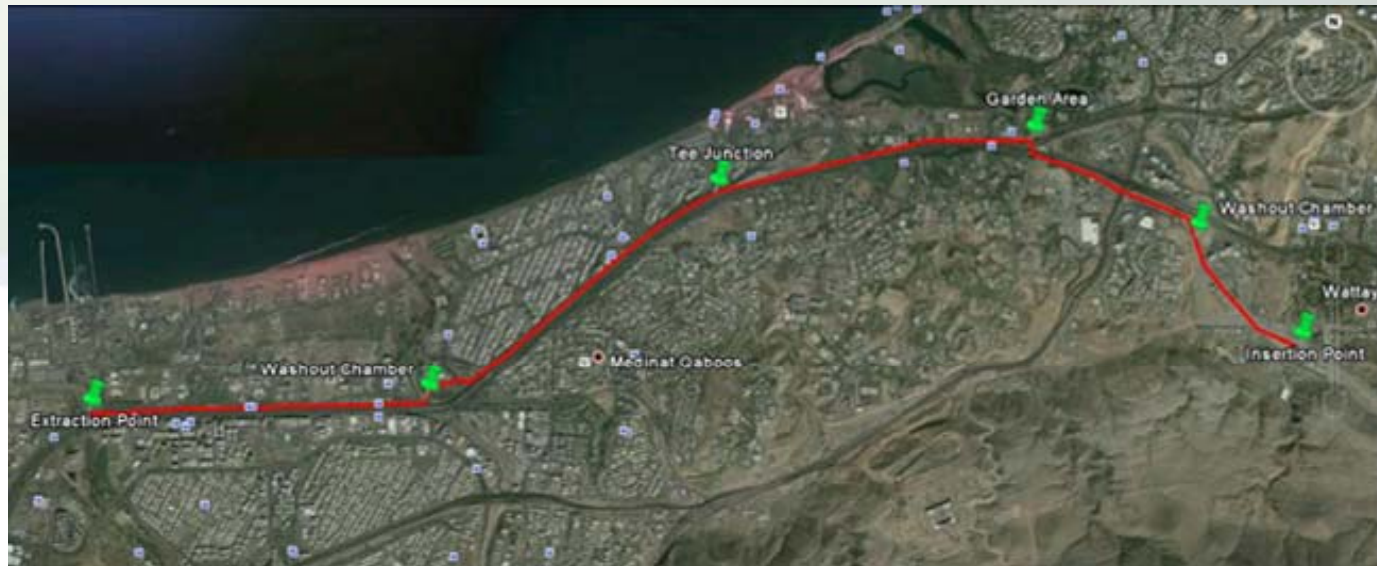
KAHRAMAA (Qatar Water & Electricity Authority) SmartBall Project

DN1200 / DN 1600 x 53 kms



25 leaks found, 1 simulated leak, 1 blind leak

Public Authority for Electricity and Water Sultanate of Oman



DN600 x 10.5 kms
6 leaks
6 air pockets



NWC – Jeddah Business Unit



DN800 / DN600 x 32 kms

11 leaks

14 air pockets



MOALAJAH (Veolia Ajman)

15 km DN 600 / DN 800
Force Mains Inspection
2 Simulated Leaks



TRANSCO (UAE)

DN1200 x 5.5 kms
1 simulated leak



Extraction Site



Extraction Site

Other Projects



New Orleans, LA

- 5 miles of 46 inch & 35 inch water pipelines surveyed
- 26 leaks found – none visible above ground
- Total loss estimated at 33,000 gal/day with revenue loss of \$350,000/year



Allen Town, PA

- Single 2.8 mile feeder main with no redundancy
- Metering suggested presence of at least one leak
- Inspection program revealed 10 leaks with water loss of 0.5 MGD
- Replacement of the entire line was deferred

Other Projects



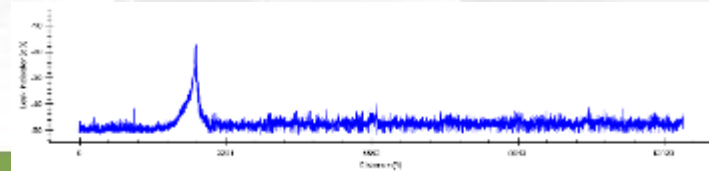
Calgary, AB

- SmartBall inspection of a 36 PCCP feeder main
- A leak was suspected in the 10,000 ft section of pipe since its construction
- No signs of a leak from above ground
- A single leak was discovered, allowing for a strategic repair
- Leak was 12 gal/min



Washington DC

- SmartBall inspection identified significant leak in 54 inch line
- Above ground signs of sinkhole beginning near a major downtown roadway
- Utility was able to repair line prior to failure



Advantages:



- Free swimming - distance covered each deployment not limited by cable length
- Live insertion and retrieval
- Easily negotiate bends, valves, other pipeline features.
- Use existing valves, no need to hot tap access points

Advantages:



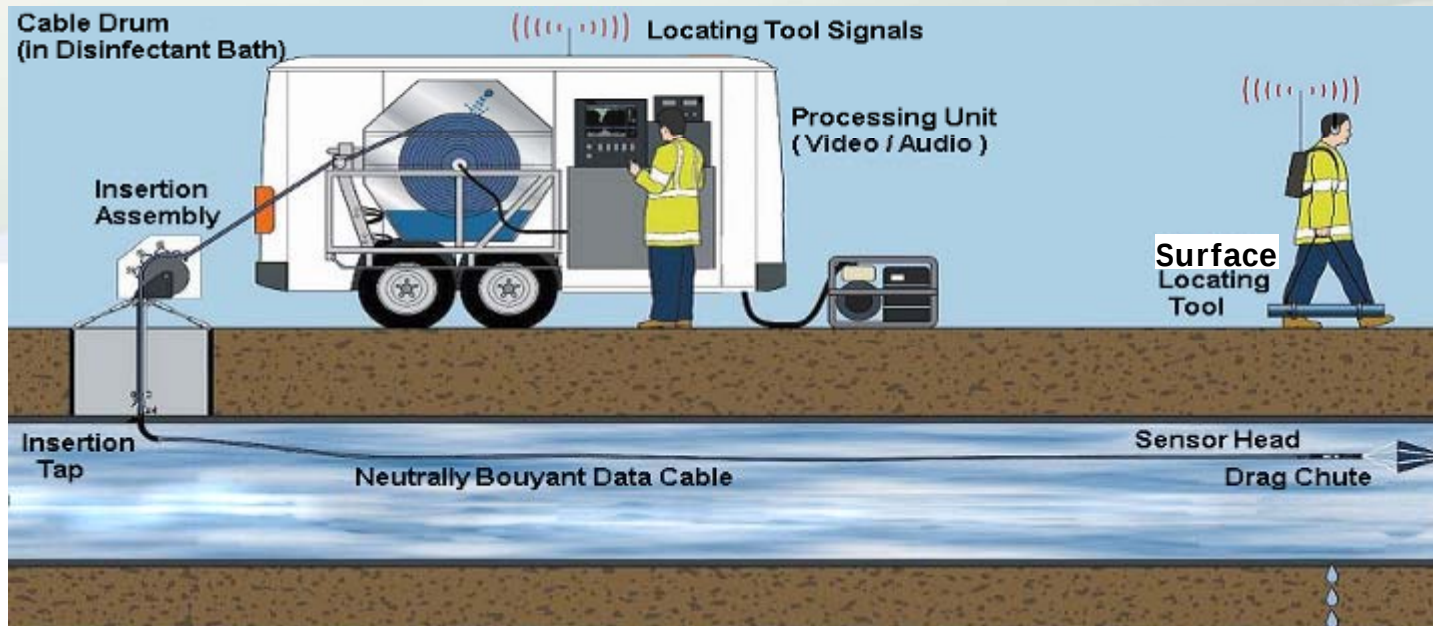
- Tool sensitivity independent of pipeline material and diameter
- Cost effective due to:
 - Higher output per day, faster completion
 - Minimal cost to deploy

SmartBall offers to Clients:



- Powerful tool in providing leakage data (baseline) for asset management strategies and planning.
- Accurately locate leaks and quantify scale for individual leaks .
- Useful tool for new pipeline commissioning and handing over
- Take the lead in best practice and state of the art technologies.

Sahara Description



- Technology first introduced in 1995 by WRC in London. Significant experience gained in urban environments
- Tethered cable provides high degree of operator control
- Inspection results are provided in real time
- Platform technology offers leak & gas pocket detection, video inspection, wall thickness

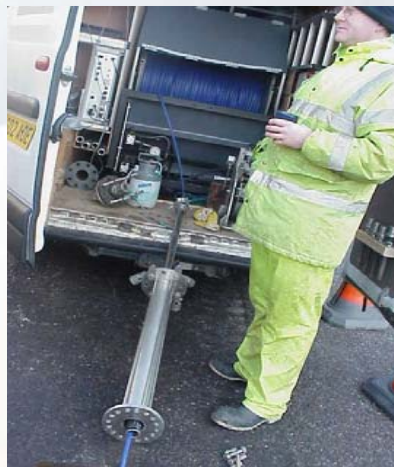
Sahara Equipment Overview



Electronics Stack



Neutrally Bouyant Cable



Insertion Tube



Cable Winch



Sensor and Parachute



Tracking Device

Sahara Parameters



Pipeline Materials	All Types
Pipeline Diameter	12" (DN300) and above
Pipeline Pressure	3 psi and above
Flow Velocity	0.3 m/sec (1 ft/sec) and above
Insertion Point Bore	Any tap point 50 mm (2") or greater
Cable Length	Up to 2 kms
Survey Distance per Insertion	300 ft @ 4"/s flow (100 m @0.1 m/sec flow) Up to 6,000 ft at > 2.5 ft/s (2 kms @ 0.7 m/sec)
Survey Distance / Day	Typically 1 to 2 miles / day
Directional Change Accomodation	135 degrees of bends
Except in PCCP*	Interior sharp edges may damage cable
Sensitivity	Detects leaks as small as 1 liter / hr
Vault Configuration	Must accommodate insertion tube (72")

Long-Term SAHARA Programs



Thames Water, UK

- Program started in 1998
- 652 miles surveyed
- Over 1,700 leaks found
- Mostly ductile iron
- Water loss reduction ~ 69 MGD
- First Sahara technology client



Manila, Philippines

- Program started in 2009
- Multi-year program includes leak detection and video inspection
- 50 miles inspected with over 157 leaks located
- Visual confirmation of 79 illegal connections or unknown laterals