

## Exploring New Developments in Loss Prevention and Asset Management of Trunk Mains

Jack Elliott  
President  
Pure Technologies Ltd. – Abu Dhabi

## Current Assessment & Asset Management Tools

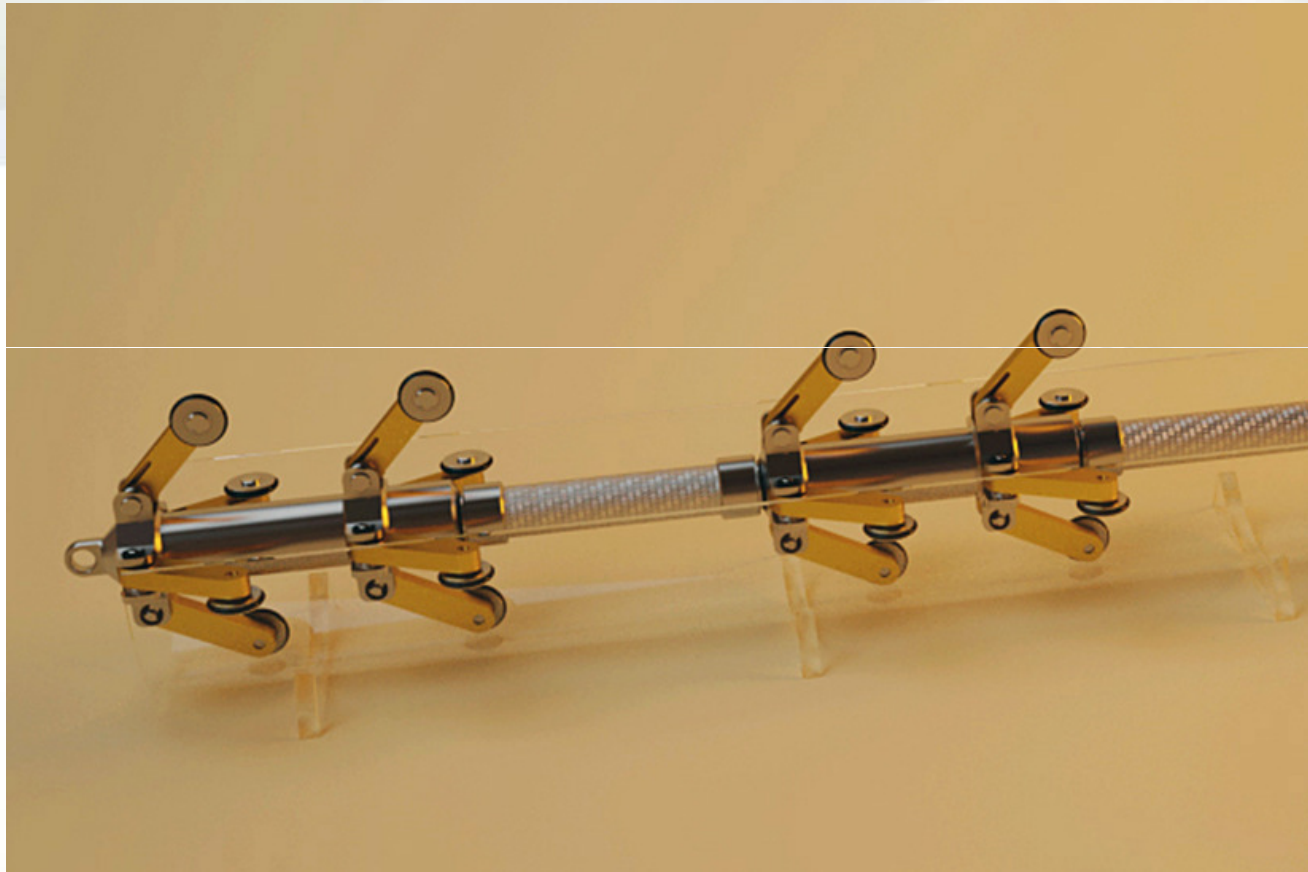
- Pipeline mapping.
- Long-range robotics.
- Leak detection.
- Monitoring.



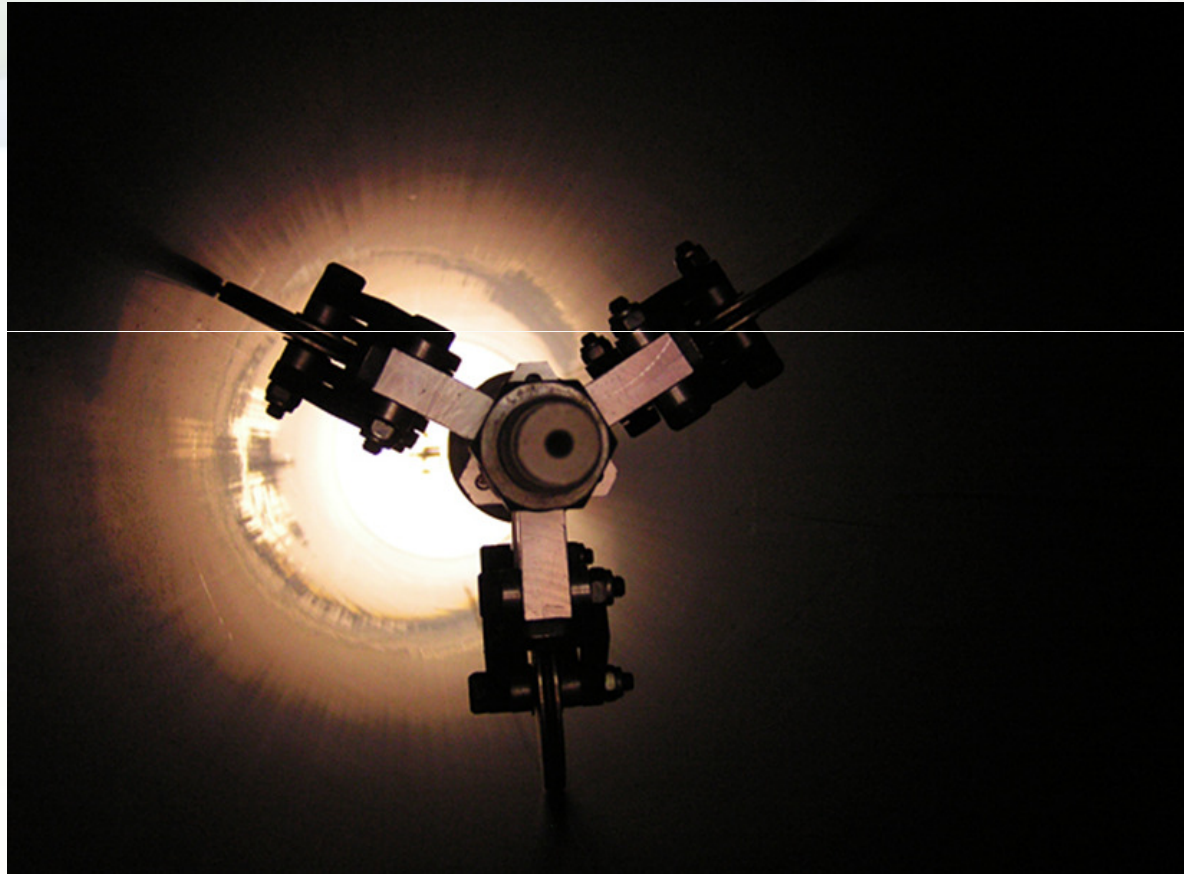
## Pipeline Mapping

- Laser gyroscope technology.
- Provides x-y-z coordinates of pipelines.
- Results integrated into web-based GIS portal.

# Pipeline Mapping



# Pipeline Mapping



# Pipeline Mapping





## Long-Range Robotics

- Up to 6 km from entry point.
- Up to 5-Bar operating pressure.
- Multiple sensing technologies available:
  - HD-CCTV
  - Sonar
  - Laser
  - Electromagnetic
  - Mapping

# Long-Range Robotics

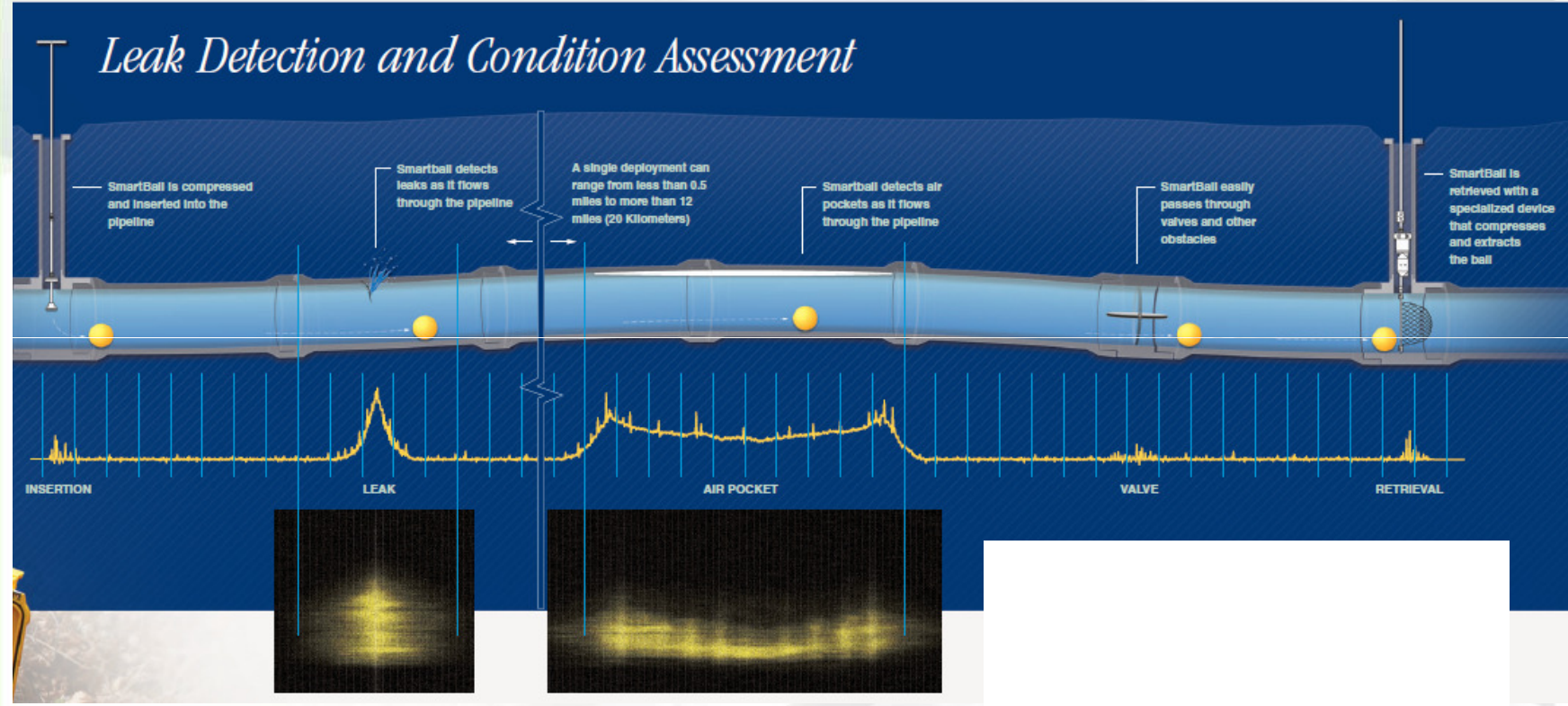




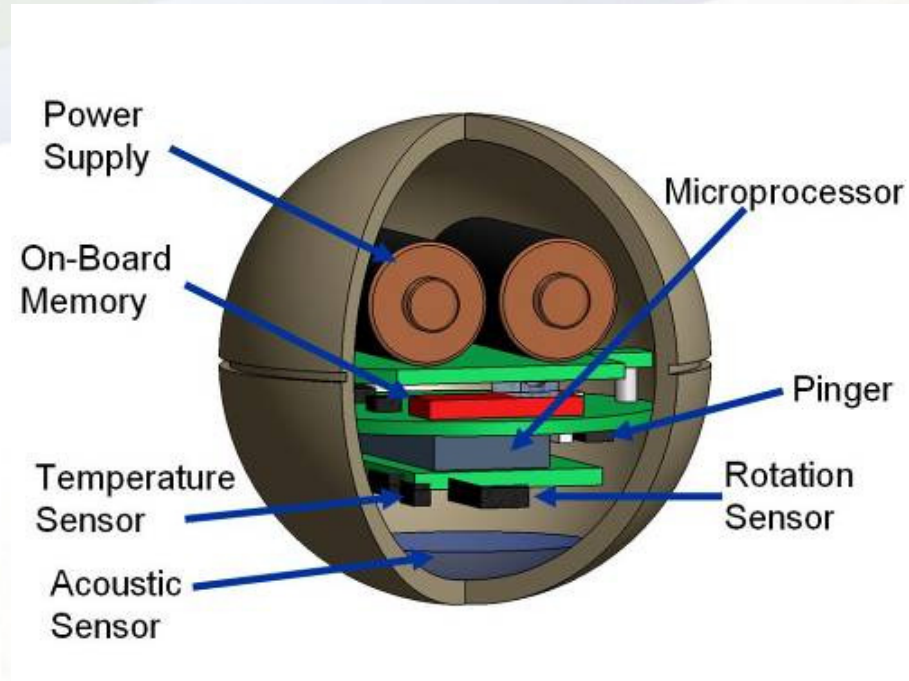
# Long-Range Robotics



## *Leak Detection and Condition Assessment*



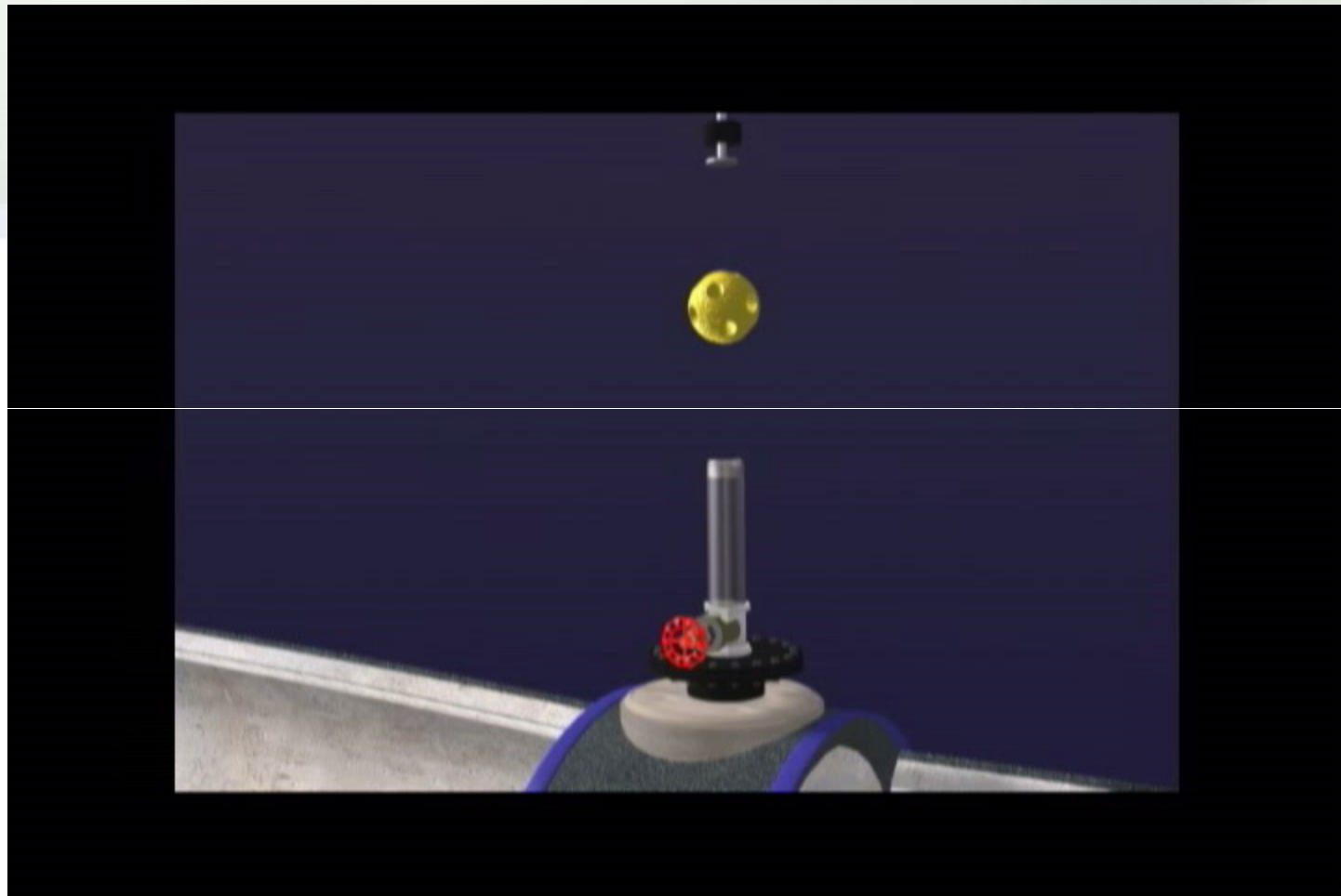
# SoundPrint® SmartBall



patents pending



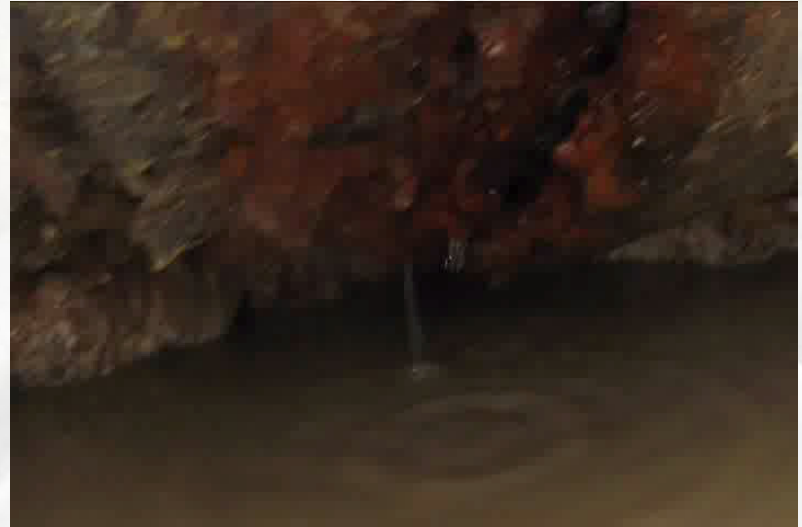
## SmartBall Acoustic Leak Detection



The rolling ball listens for leaks from *inside* the pipe...

patents pending





## Pipeline Monitoring

- Permanent acoustic fibre optic monitoring.
- Up to 40-km per system.
- Detects and locates structural events.
- Currently used primarily in prestressed concrete pipelines.

## SoundPrint® AFO Pipeline Monitoring

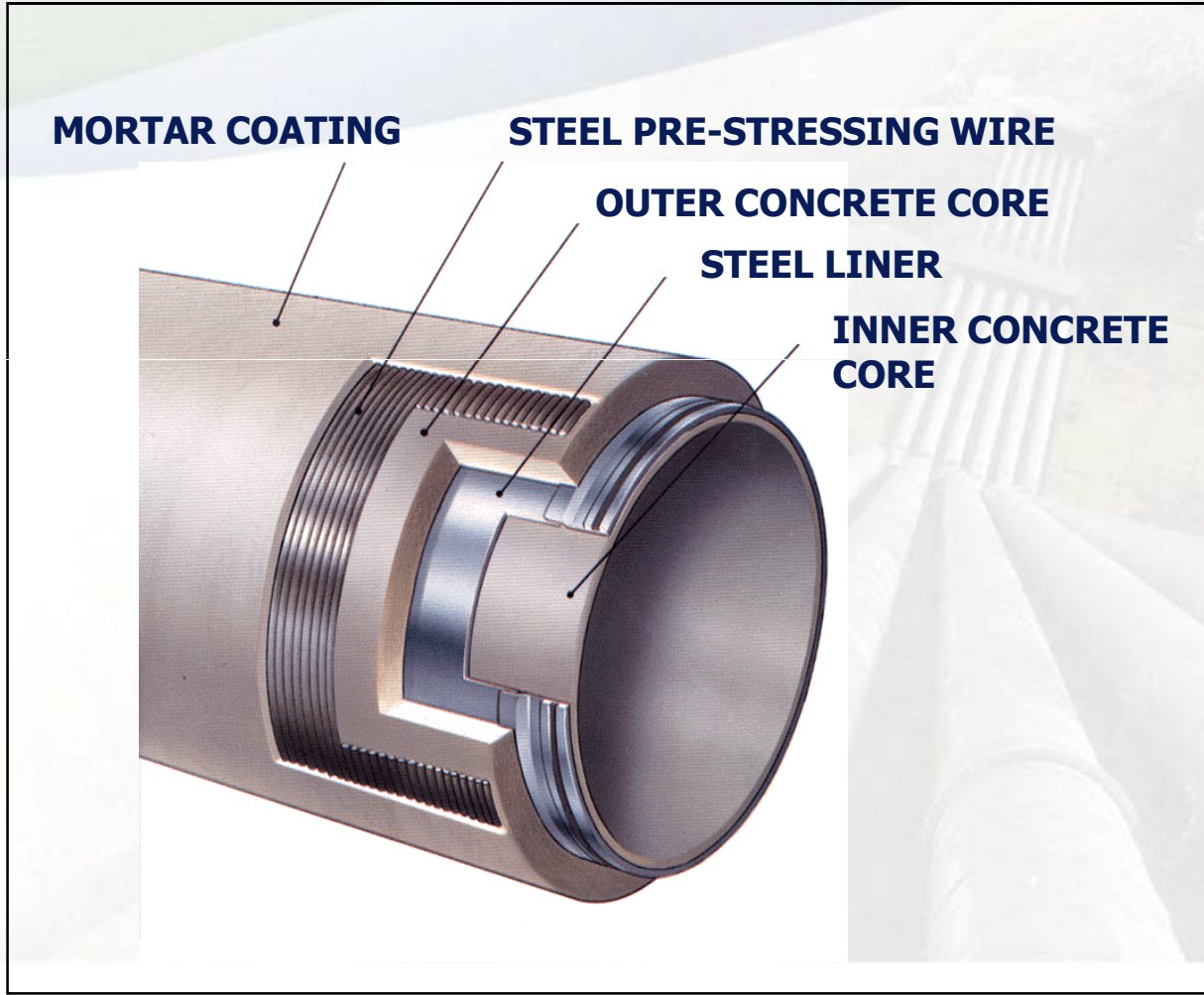


- Electronically monitors acoustic activity in a pipeline
- “Hears” the sound of a prestressing wire failure as it occurs, and accurately locates source
- Performed successfully since mid 1990s, and used by GMRA since 2000





# Prestressed Concrete Cylinder Pipe (PCCP)



# SoundPrint® AFO Pipeline Monitoring



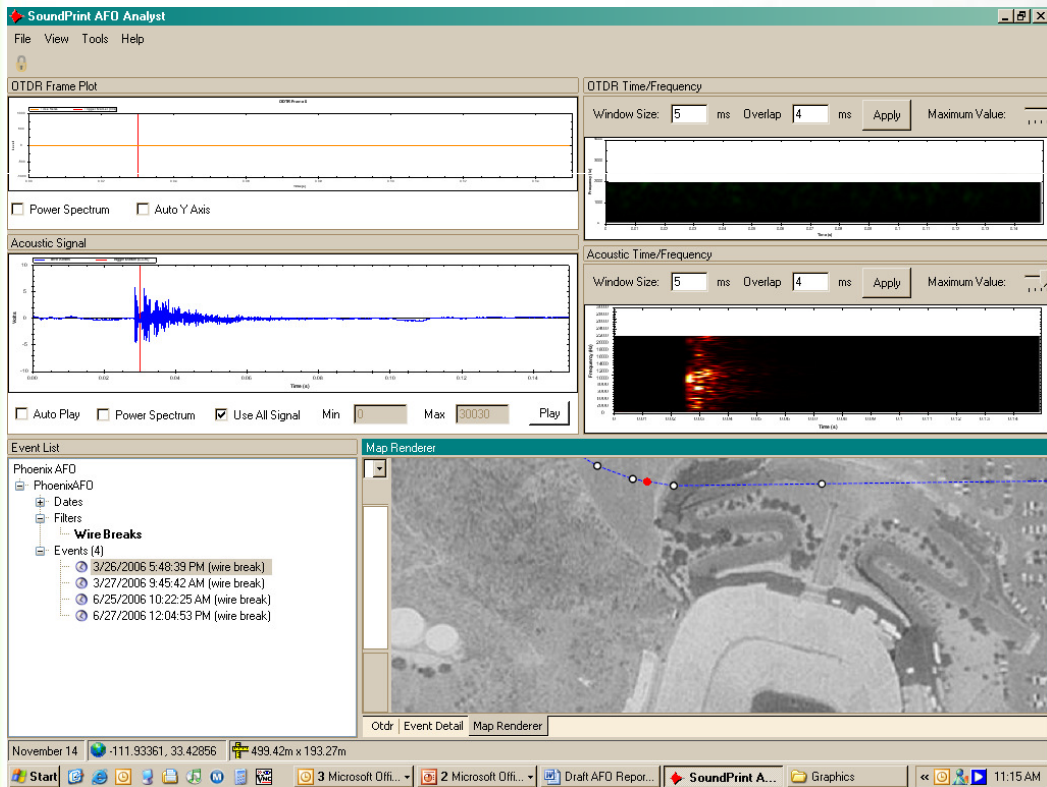
Optical-fibre cable installation



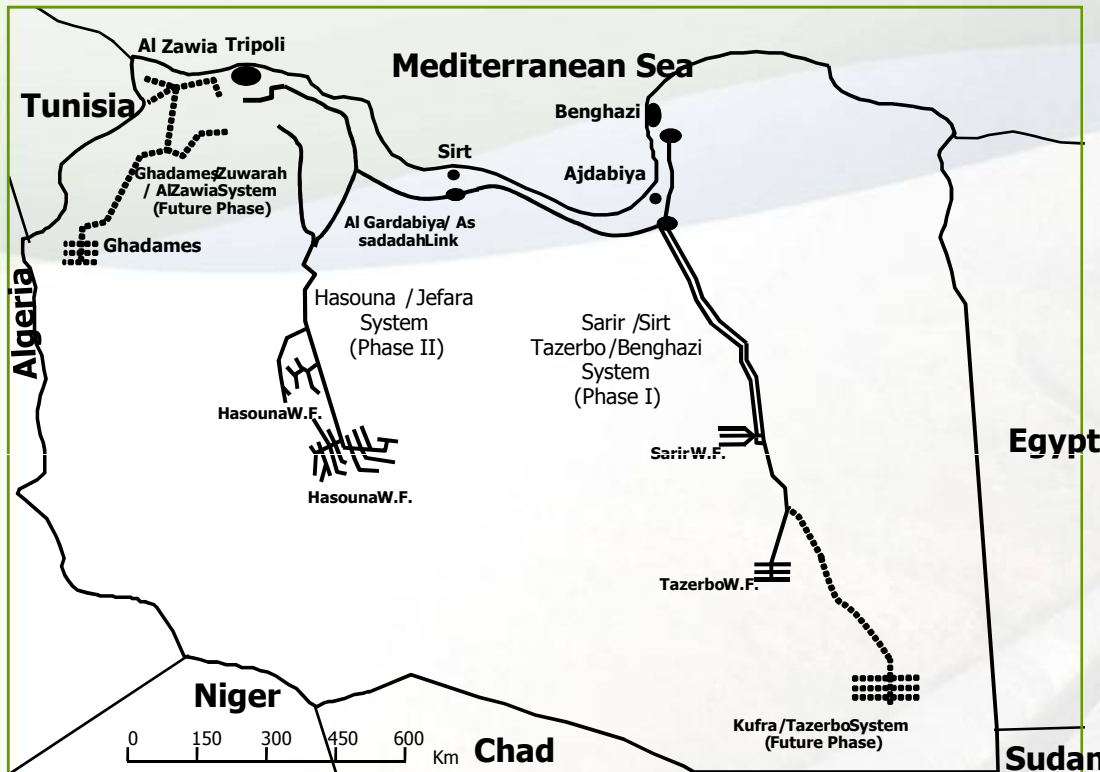
# SoundPrint® AFO Pipeline Monitoring



AFO system and user interface



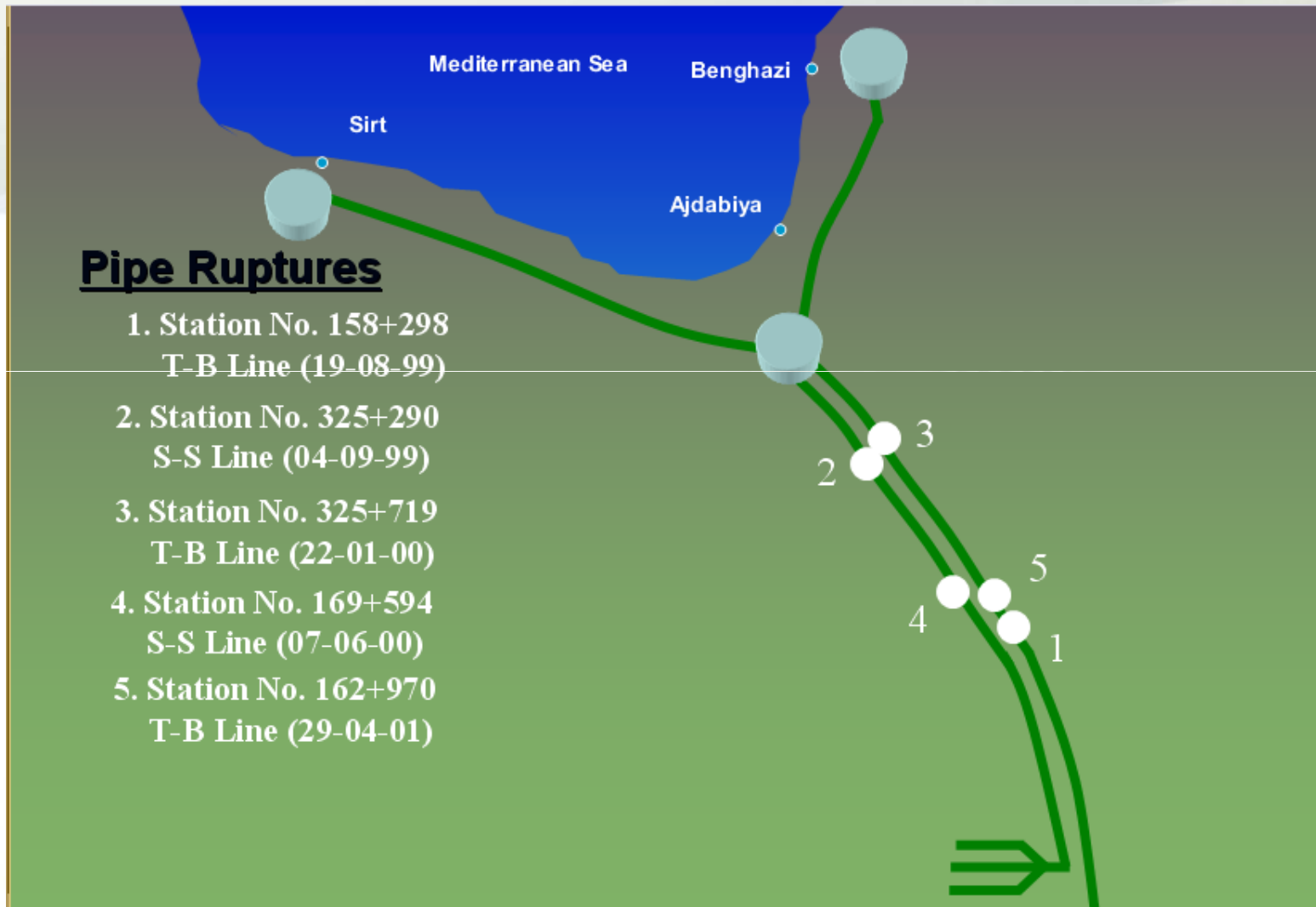
# The Great Man-Made River Project



- More than 4000km of pipeline.
- Mainly 4m dia. PCCP (approx. 575,000 pipes).
- Water is extracted from underground aquifers
- Once complete, system will be capable of producing over six million m<sup>3</sup>/day



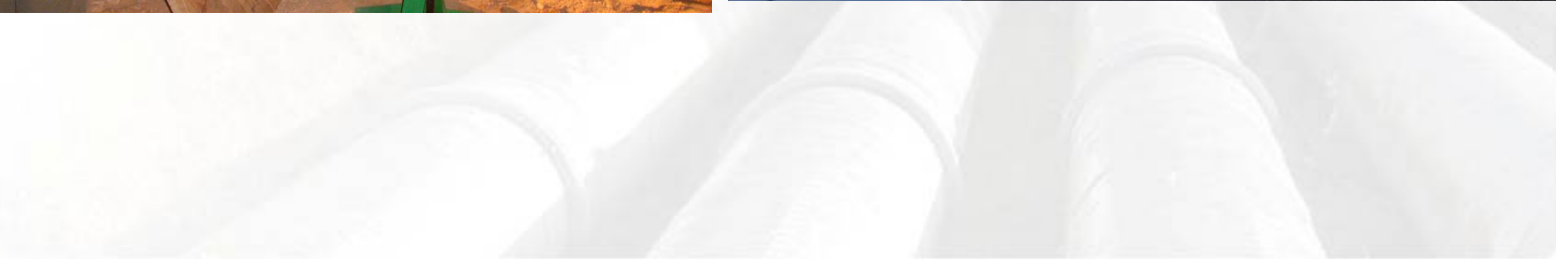
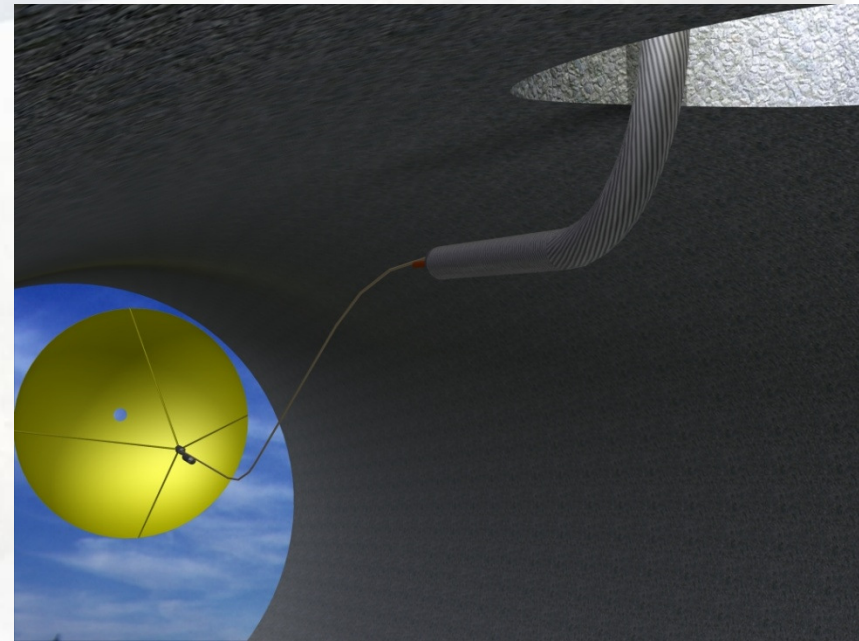
# Pipe Failure History



# GMRP Acoustic Monitoring



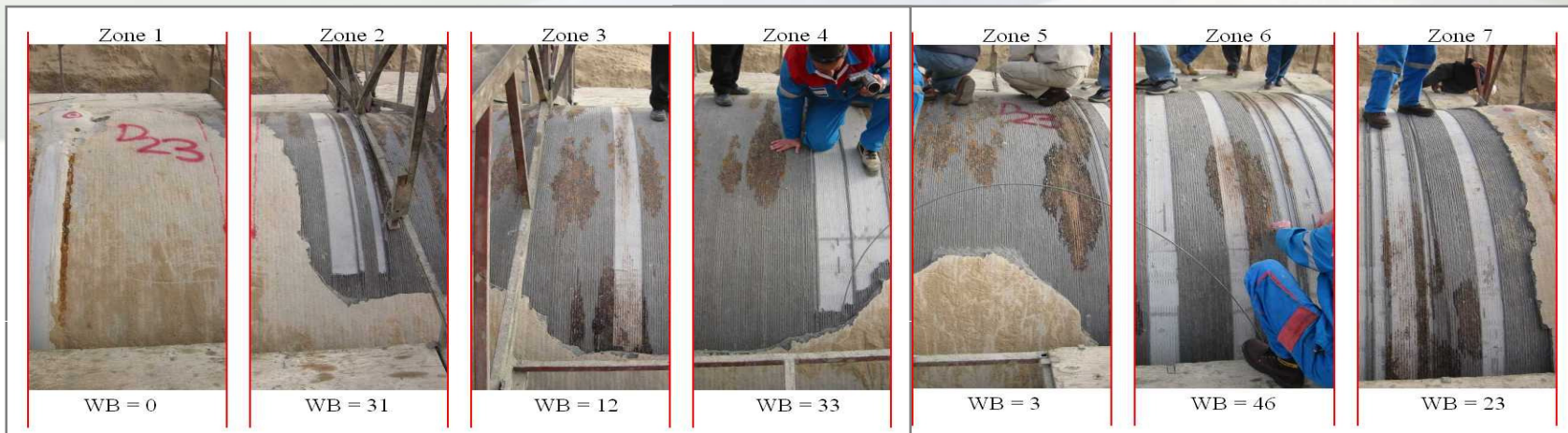
## Fibre Cable Deployment



# GMRP Acoustic Monitoring



## Case Study – Forensics



Visual inspections done during repair confirmed:

- Accuracy of Acoustic Monitoring:
  - No. of wire breaks were as expected (104 recorded v. 148 observed)
- Validity of the model:
  - Cracks of outer core where expected.



# GMRP Acoustic Monitoring



## Case Study – Repair



# GMRP Acoustic Monitoring



## Great Man-Made River Project



# GIS Interface



Pure Technologies - Pipe Charts - Windows Internet Explorer

http://secure.soundprint.com/PureGIS/Default.html

File Edit View Favorites Tools Help

Pure Technologies - Pipe Charts

Criticality Impact Consequence Risk Assessment View 1 View 2 View 3 View 4

**Available Layers**

- 2D Pipe Chart
- 3D Pipe Chart
- Impact
- Consequence
- Risk Assessment
- Roads
- Borders
- Terrain

1319 ft

Image U.S. Geological Survey

Imagery Date: Aug 2006 39°02'31.20" N 77°10'41.52" W elev. 339 ft Eye alt 4932 ft

**Potomac Contract C - Pipe Chart Generated 7/30/2009**  
 Displaying all recorded acoustic wire breaks in the monitoring period from the beginning of Wednesday, January 09, 2008 to the end of Thursday, July 30, 2009

Upstream Events: 0

|                                      |                                       |                                      |                                      |                                       |                                      |                                       |                                      |                                       |
|--------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|---------------------------------------|
| C-41<br>B<br>0+0=0<br>0<br>168+05.67 | C-42<br>D<br>0+0=0<br>0<br>168+21.7   | C-43<br>B<br>0+0=0<br>0<br>168+37.73 | C-44<br>B<br>0+0=0<br>0<br>168+53.23 | C-44A<br>B<br>0+0=0<br>0<br>168+54.23 | C-45<br>B<br>0+0=0<br>0<br>168+69.73 | C-46<br>B<br>0+0=0<br>0<br>168+85.65  | C-47<br>B<br>0+0=0<br>0<br>169+01.68 | C-48<br>B<br>0+0=0<br>0<br>169+17.71  |
| C-49<br>B<br>0+0=0<br>0<br>169+33.57 | C-50<br>B<br>0+0=0<br>0<br>169+41.72  | C-51<br>B<br>0+0=0<br>0<br>169+57.72 | C-52<br>B<br>0+0=0<br>0<br>169+73.72 | C-53<br>B<br>0+0=0<br>0<br>169+89.58  | C-54<br>B<br>0+0=0<br>0<br>170+05.61 | C-55<br>B<br>0+0=0<br>0<br>170+21.64  | C-56<br>B<br>0+0=0<br>0<br>170+37.67 | C-56A<br>B<br>0+0=0<br>0<br>170+39.67 |
| C-57<br>D<br>0+0=0<br>0<br>170+52.17 | C-57A<br>D<br>0+0=0<br>0<br>170+54.53 | C-58<br>D<br>0+0=0<br>0<br>170+70.56 | C-59<br>D<br>0+0=0<br>0<br>170+86.51 | C-60<br>D<br>0+0=0<br>0<br>171+02.54  | C-61<br>D<br>0+0=0<br>0<br>171+18.57 | C-61A<br>D<br>0+0=0<br>0<br>171+20.07 | C-62<br>D<br>0+0=0<br>0<br>171+29    | C-63<br>D<br>0+0=0<br>0<br>171+34     |
| C-64                                 | C-65                                  | C-66                                 | C-67                                 | C-68                                  | C-69                                 | C-70                                  | C-71                                 | C-72                                  |

Done Internet 100%

# GIS Interface



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Pure Technologies - Pipe Charts

Criticality Impact Consequence Risk Assessment View 1 View 2 View 3 View 4

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399 ft  
Image U.S. Geological Survey  
39°02'17.24" N 77°10'46.38" W elev 336 ft  
Google  
Eye alt 1439 ft

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| C-64                                 | C-65                                  | C-66                                 | C-67                                 | C-68                                  | C-69                                 | C-70                                  | C-71                                 | C-72                                  |

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## Future Developments

- Long-range fibre-optic camera for pressure pipe applications incorporating leak detection, pipeline mapping and pipe wall condition assessment capabilities.



# Questions