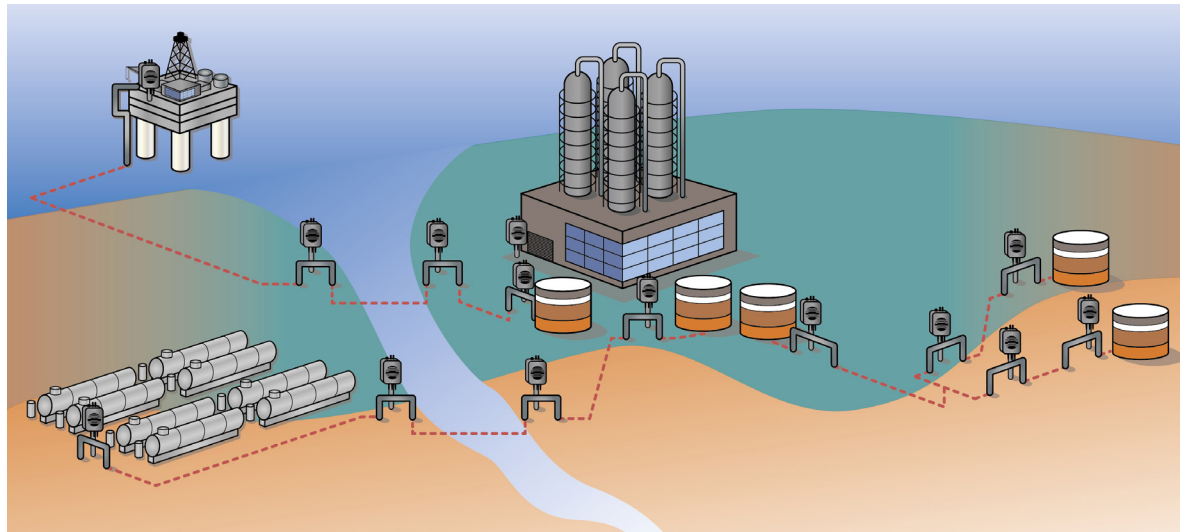


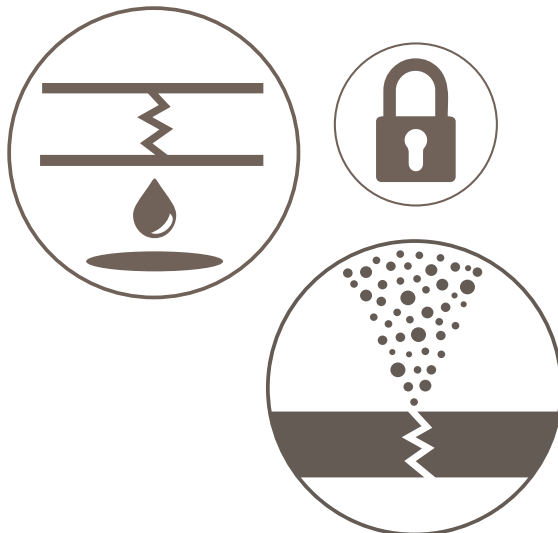
## Pipeline Guardian

### Pipeline leak detection hardware and software for turnkey LDS anywhere



- Complete range of advanced LDS hardware and software to fill any gap in your leak detection program (API 1175)
- Designed to overcome traditional LDS limitations - measurement uncertainties of conventional pipeline instrumentation,
- lack of instrumentation in the right locations and lack of infrastructure at those locations
- Can detect leaks that are a fraction of a percent in minutes with accurate leak location

### LDS for pipelines with insufficient instrumentation, power & communications



Components designed for easy installation wherever sensitive leak detection is needed:

- Stub pipelines
- Inter-refinery and terminal pipelines
- River crossings
- HCAs
- Any location, no matter how remote
- Fast detection time
- High sensitivity
- Accurate leak location
- Fits easily to any pipeline

## Pipeline Guardian hardware

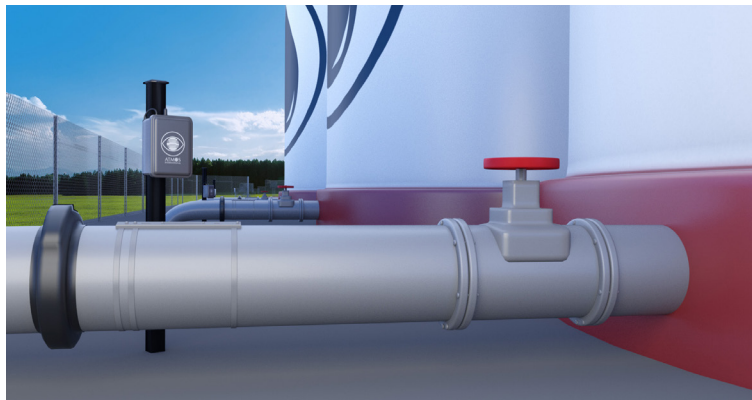
### Guardian master control panel

- **Intelligent panel houses the components to collect, analyze and transmit LDS data**
- **On-board data storage, saves data during long communication outages**
- **Communications options, TCP/IP, line of sight radio, GSM, satellite uplink**
- **EXd packing option**
- **Local processor options for locations with limited comms. The data is processed locally and leak detection results are passed back to the pipeline control center**
- **All power options – 110-220v line, solar power, or 24v DC**



### Clamp-on flow meters

Clamp-on flow meters are less than one tenth of the cost of conventional flow meters, and are much easier and cheaper to install (especially for a retrofit). The limited accuracy of clamp-on flow meters makes them unsuitable for use with traditional leak detection systems. Atmos's revolutionary software is designed to achieve high sensitivity with inexpensive clamp-on flow meters, customized to the Atmos leak detection solution. This lowers equipment costs, installation costs, and maintenance costs while still providing best in class leak detection.



*No flow conditioning of clamp-on flow meter. Install in tight pipeline configurations. Designed to work specifically with the Atmos LDS software packages.*

### Pressure sensors

Inexpensive, high resolution sensors, specially selected for leak detection, to capture even the smallest pressure changes.

### Acoustic sensors

Allows acoustic noise correlation to detect a leak by correlating the noise the fluid is making as it escapes the pipeline.

### Solar Panels

Absence of electric power at remote sites frequently hinders pipeline leak detection. Solar panels specifically designed to power any, or all, of the Pipeline Guardian components in the field. The compact rugged design makes them easy to install anywhere along a pipeline,



*Pipeline Guardian solar panels (also available with security cage)*

opening a whole new dimension of hardware based improvements to pipeline leak detection.



## Pipeline Guardian software

### Intelligent flow balance (Wave Flow)

The mass, volume or flow balance element of Atmos Wave Flow corrects both measurement errors and inventory.

### Negative pressure wave

Uses comprehensive algorithms to filter process noise and interference from pressure data associated with the rarefaction wave, caused by the onset of a leak, into a detailed 3-dimensional map. This map allows the system to clearly differentiate true leak/theft events from the pressure changes caused by transient operation. The result is a more responsive system with reduced uncertainty.

### Dynamic model analysis (pressure/flow rate modeling)

A leak changes the pipeline flow and pressures in a distinctive pattern. The dynamic model analysis module analyses the pressure and flow behaviors, and can achieve a leak sensitivity better than the accuracy of the flow meters.

- Leak onset detection
- Fast leak detection
- Improved sensitivity

### Acoustic noise correlation

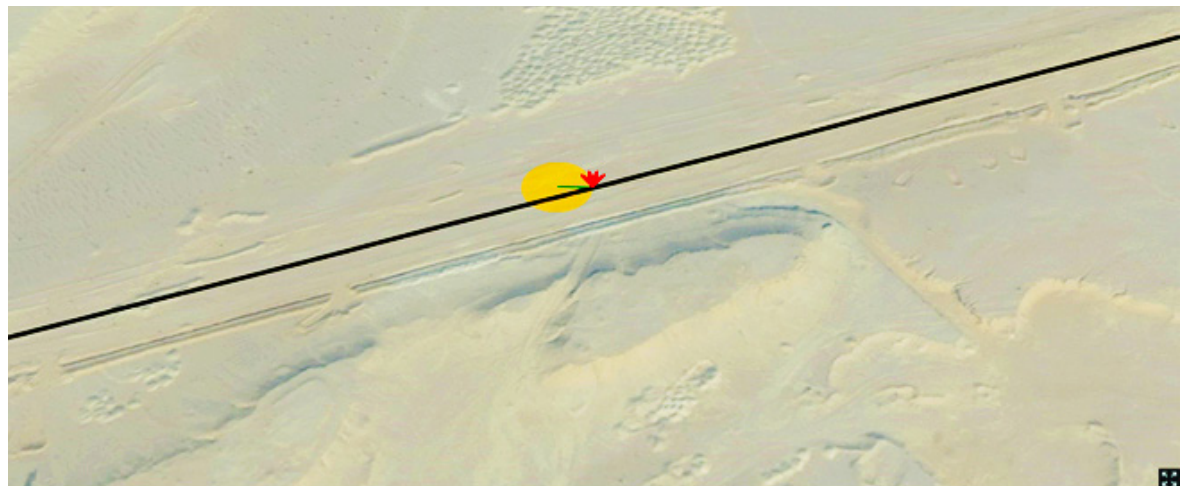
A small pipeline leak creates a white noise sound that travels through the fluid to the high performance Atmos acoustic sensors, placed upstream and

downstream of the monitored section.

- Detects existing leaks
- Detects corrosion leaks as they open
- Provides accurate leak location

### Main features

- Response time in minutes for shut in, transient, and steady state conditions
- Sensitivity <1% of flow rate
- Minimal product release before a confirmed alarm
- High leak location accuracy
- Detects slowly developing leaks (corrosion leak detection)
- Leak detection and location
- High performance, proven pressure sensors and flow meters
- Non-intrusive sensor options available
- On-board data storage to mitigate the effects of communication failures
- Not reliant on flow meter's performance or calibrations
- RTTM for inventory (line pack) and integrated hydraulic profile
- Turnkey packaging and sensor options
- Complies with API 1130 (R 2012) and API 1175

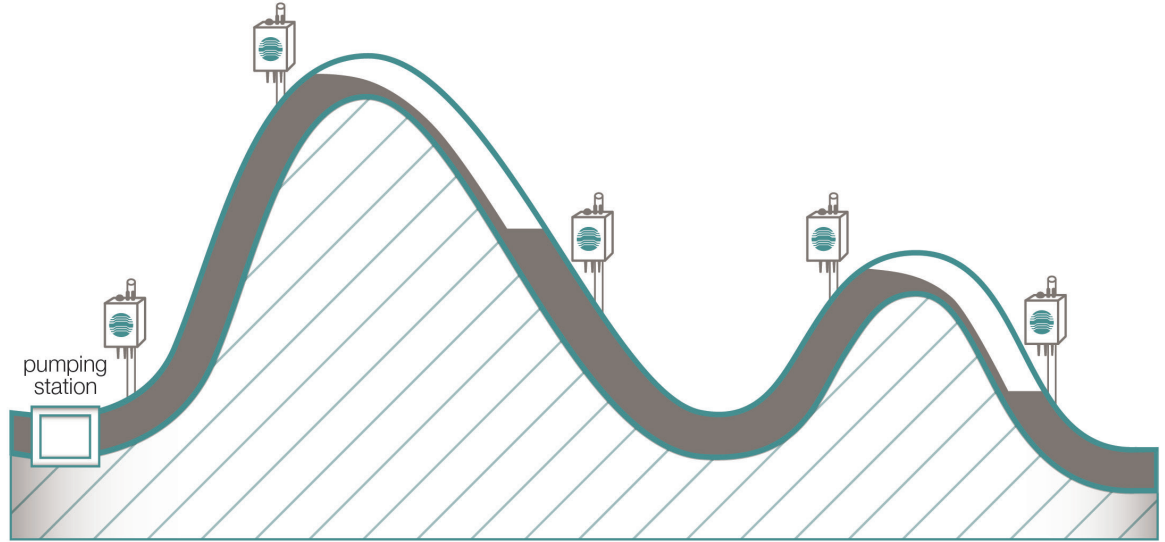


Pipeline Name	Time of Event	Index	Alarm	Leak Size (cuM/hr)	Leak Location (km)	Line ID	LDU	Span Name	Latitude	Longitude
Suned_1	11:52:28 06/05	14183864	wave leak	1037.28	-0.01	1202	Wf	Ain_Sukhna-East Nile	29.604873	32.32267
Suned_1	11:03:46 06/05	14183779	wave leak	123.3	89.97	1202	Wf	Ain_Sukhna-East Nile	29.768951	31.396484
Suned_1	10:46:36 06/05	14183748	wave leak	985.2	30.02	1202	Wf	Ain_Sukhna-East Nile	29.656788	32.014348

Guardian in a web browser with terrain map and run off direction

## Pipelines with column separation

Guardian hardware can be placed to optimize leak detection in slack pipeline sections as well as filled pipeline sections.



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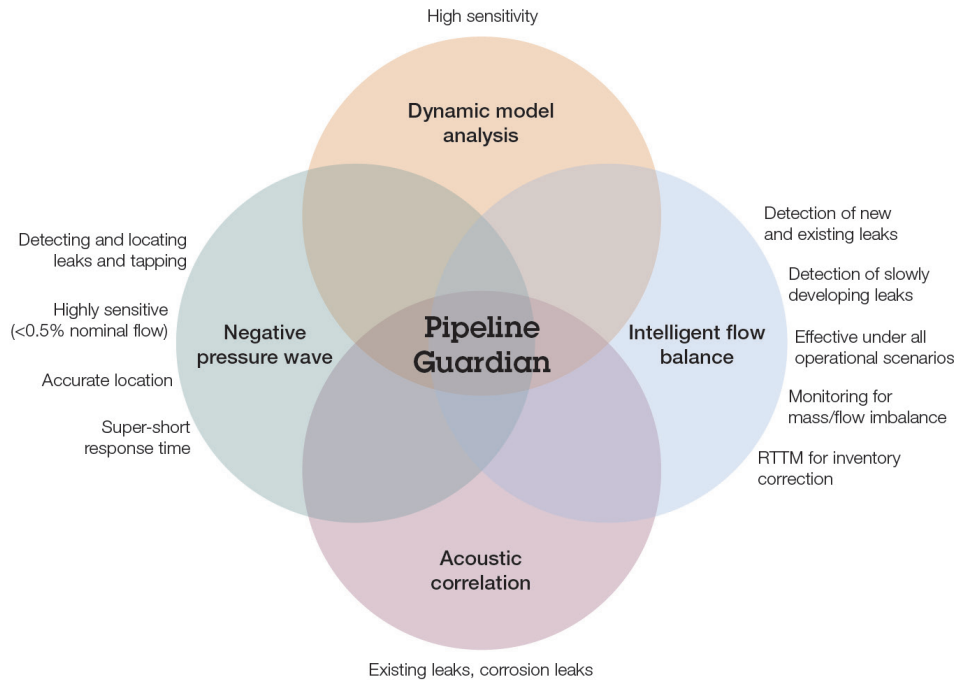
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### About Atmos International

Atmos International (Atmos) provides pipeline leak detection and simulation technology to the oil, gas, water, and associated industries. The company was founded in 1995 in the UK by the inventor of the statistical pipeline leak detection system – Atmos Pipe, now one of a suite of leak and theft detection solutions from Atmos. These technologies are implemented on hundreds of pipelines in over 50 countries, including major oil and gas companies such as Shell, BP, ExxonMobil, and Total. With associated offices in the USA, China, Russia, Singapore and Costa Rica, and local agents in 28 countries, the multi-cultural and multilingual team can provide effective support all over the world.

[www.atmosi.com](http://www.atmosi.com)

