

# Atmos SIM, Real-Time Transient Model leak detection



## Today's leak detection challenges demand the most modern solution

### An accurate model to assure the highest sensitivity **More robust**

Fast, sensitive and reliable leak detection requires a real-time transient model that remains accurate as operating conditions change in a pipeline. The unique Maximum Likelihood State Estimator in Atmos SIM uses available flow and pressure data to provide a highly-accurate calculation of the hydraulic and compositional properties of the product in a pipeline network in real-time. The Tuning Assistant helps keep the model as close to reality as possible at all times.

### Proven statistical module for maximum reliability especially during transient conditions

Atmos SIM has overcome the limitations of other RTTMs in maintaining maximum sensitivity and shortest detection time in transient conditions. Atmos SIM incorporates the proven statistical algorithms from the most deployed leak detection system in the world, Atmos Pipe, to minimize false alarms.

### Accurate measurements anywhere on the pipeline

Atmos SIM is especially suitable for pipelines where it is not feasible to install intermediate flow meters and pressure sensors, such as sub-sea. Atmos SIM accurately models pipelines with minimum instrumentation, e.g., flow and pressure meters at the pipeline inlets and outlets only. Also, it requires pressure sensors upstream and downstream of intermediate pump or compressor stations.

The Maximum Likelihood State Estimator, advanced data validation, and advanced filtering techniques reduce the effect of poor data significantly.

### Outstanding performance

- Robust and reliable leak detection during steady-state, transient running, and shut-in conditions
- State estimation, advanced validation, and filtering techniques reduce the effects of poor data so the system seldom issues a false leak alarm
- The statistical element optimizes leak detection time for all leak sizes from very small to a rupture
- Detects onset and existing leaks
- Uses data from existing SCADA or DCS, no additional hardware or infrastructure required
- Common technology - suitable for both gas and liquid pipelines and networks
- Additional business benefits - a complete decision support tool to optimize your operations with optional modules such as batch, composition and pig tracking
- Supports compliance to: API 1130, API 1175, API 1155, API 1149, CSA Z662, German Regulations for Pipeline Leak Detection (TRFL)



## Why Atmos SIM is better than other RTTMs

Atmos SIM Leak Detection is a module within Atmos SIM Real-Time Transient Model (RTTM). It continuously calculates the volume balance on a pipeline network based on the total flow into and out of the pipeline and the model calculated inventory change.

Atmos SIM guarantees fewer false alarms than other RTTMs because the Sequential Probability Ratio Test (SPRT) calculates the ratio of leak probability over no-leak probability.

SPRT is the powerful statistical tool from Atmos Pipe, the most successful leak detection system in the world, proven over 22 years on hundreds of pipelines all around the world.

This ratio is applied to the volume balance calculated by Atmos SIM and tested against a configurable threshold value to provide leak alarms. The combination of RTTM with the statistical analysis is also referred to as E-RTTM (Extended Real-Time Transient Model).

The Real-Time Transient Model always assumes that the pipeline is leak free for hydraulic simulation. The pressure at the leak location decreases when a leak occurs. This pressure drop causes deviations between the measured and calculated pressure values along the pipeline. The SPRT is also applied to the pressure deviations to optimize the leak detection performance. Atmos SIM generates a leak alarm if the probability of a leak reaches a pre-configured threshold, e.g., 99% by either the volume balance or pressure deviations; only if operational variations or data faults did not cause the change.

Feature	SIM	Other	Benefit
Maximum Likelihood State Estimation (MLSE)	✓	✗	Removes the effects of instrument errors, increasing the stability of the leak detection system.
State Estimation Based Data Validation	✓	✗	Reduced instrument errors enables leak detection sensitivity better than instrumentation accuracy.
SPRT Leak Detection	✓	✗	The SPRT algorithm reduces false alarms. Tried and tested on over 800 pipelines.
Intelligent Instrumentation Learning	✓	✗	Learns long term instrumentation offsets for increased leak detection sensitivity.
Large Complex Networks	✓	✗	Reliably operates on pipelines of all sizes. One application for all pipelines.
Detection Technology	✓	✗	The leak size threshold need not be increased during transient operations.
Transient Leak Detection Technology	✓	✗	Reduced errors, time saving.

## System outputs

- Leak alarm
- Leak location
- Leak time
- Leak rate
- Total volume lost
- Watchdogs via OPC

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.

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