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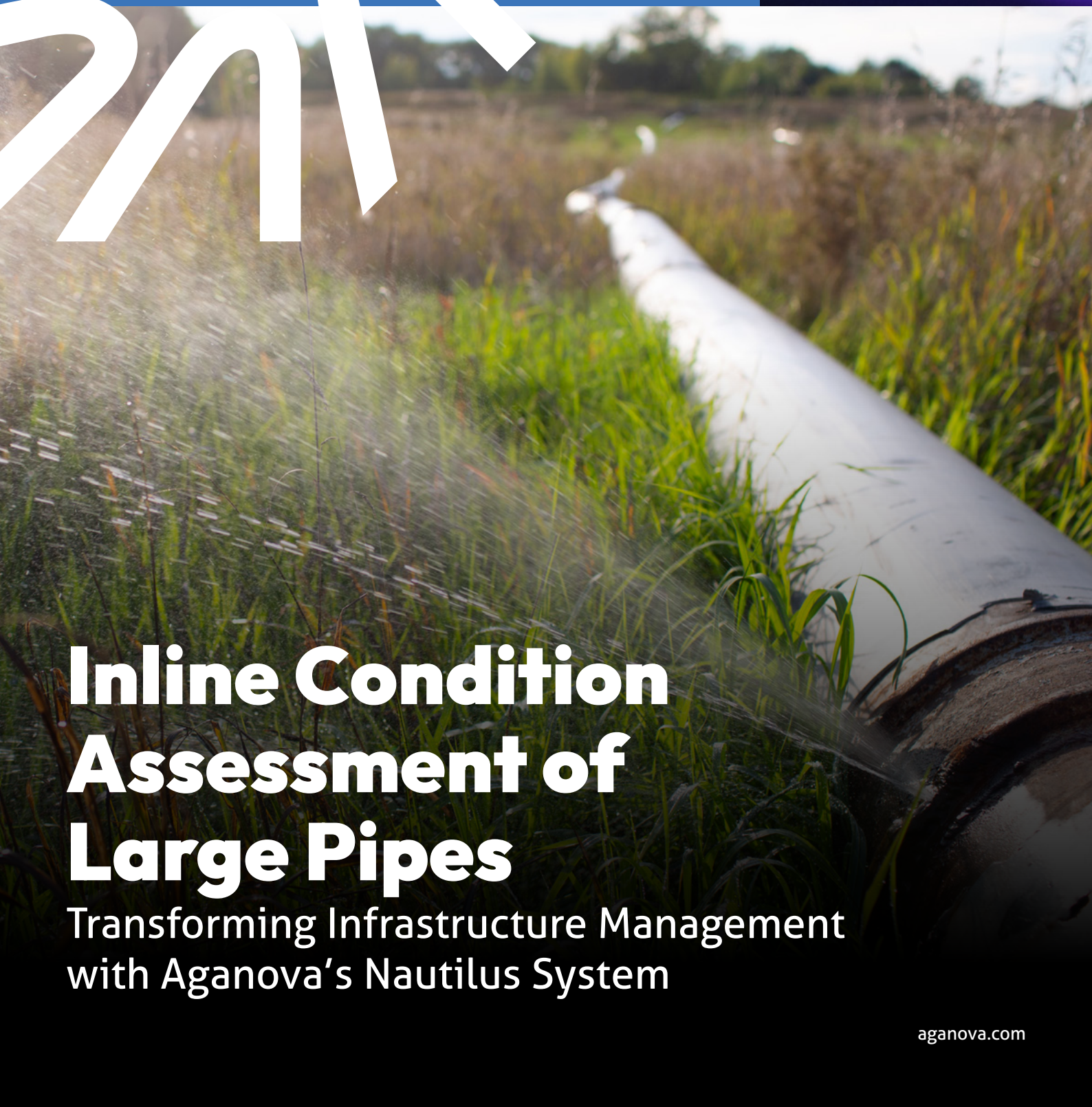

Inline Condition Assessment of Large Pipes

Transforming Infrastructure Management with Aganova's Nautilus System

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Rethinking Pipeline Integrity for “Forever Assets”

Large-diameter pipelines are not disposable assets, they are forever assets. Much like bridges or historical buildings, these pipelines are not meant to be replaced on a schedule, but preserved through intelligent, incremental investment and ongoing condition monitoring.

Traditional approaches based on age or isolated failures are no longer sustainable. Inline condition assessment is now the key to maximizing public investment by identifying degradation where it actually exists and preserving what remains in serviceable condition. This avoids unnecessary bulk replacement, which is rarely feasible and often unnecessary.

Understanding the Real Nature of Pipeline Degradation

Pipes, particularly metallic transmission mains, degrade stochastically due to localized conditions (e.g., corrosive soils, poor installation, external environmental factors). They rarely fail catastrophically and do not degrade uniformly over time. Therefore, the optimal strategy is not to replace entire systems, but to identify and address small areas of concern, targeting repairs and life-extension programs where they are needed most.

Why Utilities Need a Smarter Alternative

Today's market offers a range of pipeline inspection tools and predictive models. However, most fall into one of two categories:

- **Invasive and costly:** requiring shutdowns, excavations, or specialized access
- **Purely theoretical:** relying on historical data or predictive algorithms without physical validation

For utilities managing vast, aging networks, these tools present a dilemma: they either cause disruption, lack accuracy, or demand resources that are simply not available.

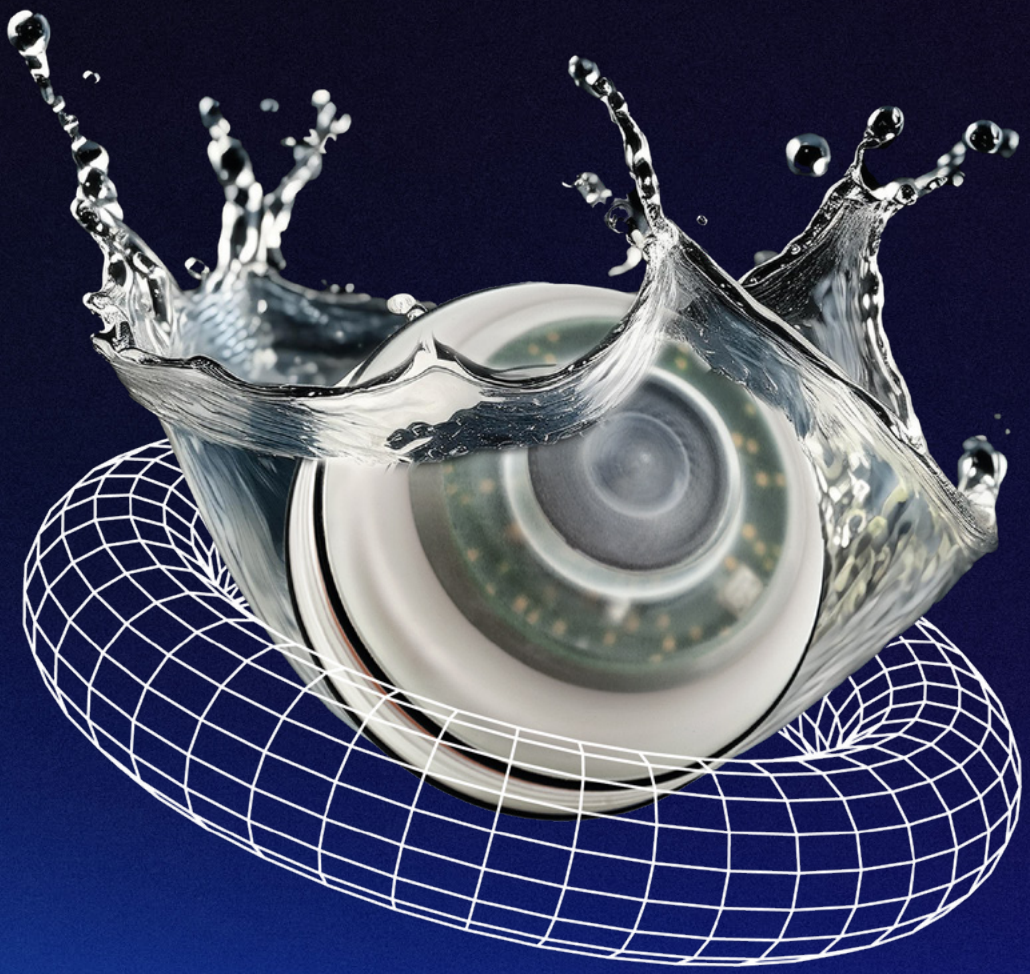
Key limitations include:

- External tools that can't "see" inside the pipe
- AI models that depend on incomplete or outdated datasets
- Technologies that only work on specific pipe materials or configurations
- Lack of visual outputs that support clear decision-making

What's missing is a solution that is non-intrusive, adaptable, data-rich, and easy to interpret, a tool that integrates seamlessly into existing workflows and helps utilities prioritize action based on real conditions, not assumptions.

Aganova's Nautilus System makes this possible through advanced inline inspection combined with intelligent data analytics, enabling smarter, more defensible decisions about infrastructure management.

What Is the Nautilus System and How Does It Enable Condition Assessment?



Nautilus is Aganova's cutting-edge inline inspection device designed specifically for large-diameter water pipelines. Traveling passively with the flow of water, it collects high-resolution, real-time data from within the pipe, offering a level of internal visibility that external or surface-based technologies simply cannot reach.

This non-intrusive method allows utilities to assess integrity, detect leaks or anomalies, and identify early signs of degradation without interrupting service or requiring excavations. By preserving operational continuity, Nautilus makes proactive infrastructure management both feasible and cost-effective.

What sets Aganova apart is not just the inspection itself, but what comes after. The collected data is analyzed through **Nemo**, our proprietary platform, using machine learning to deliver first-level condition assessments. The results are visualized through an intuitive **heatmap (Red-Amber-Green)** that pinpoints areas of high, medium, and low risk, helping operators immediately understand which segments require intervention and which are in good health.

Together, Nautilus and Nemo provide a powerful, AI-enhanced pipeline management solution that transforms inspection data into clear, actionable insights.

Key Capabilities and Advantages

Multi-Layered Detection:

- **Leaks:** Detects even minor leaks with high accuracy.
- **Gas Pockets:** Identifies trapped air or gas reducing hydraulic efficiency.
- **Structural Anomalies:** Pinpoints obstructions, working pressure too close to limits, or other integrity issues.

AI-Driven Condition Assessment with Heatmap Output

- Risk levels are represented on a Red-Amber-Green heatmap, making insights easy to interpret and act upon
- In addition to color codes, the system indicates the type of anomaly (e.g., corrosion, sediment) and its estimated probability

Real-Time Data & Analytics:
High-resolution, inline data is integrated with existing datasets—soil surveys, hydraulic models, failure history, and more—for a comprehensive view of asset health.

Minimal Operational Disruption:
No excavation or shutdown required. Inspections are completed with pipelines in service.

Cross-Material Compatibility:
Works across pipe materials, metallic, concrete, plastic and composites, making it adaptable across networks.

Actionable Outputs:
Condition data is delivered through GIS formats, detailed reports, and our intuitive Nemo web platform—providing users with clear, actionable asset management plans.

Sustainable and Cost-Effective:
Supports long-term asset preservation strategies like cathodic protection, soil remediation, and coatings, avoiding unnecessary replacements and reducing environmental impact.

How It Works

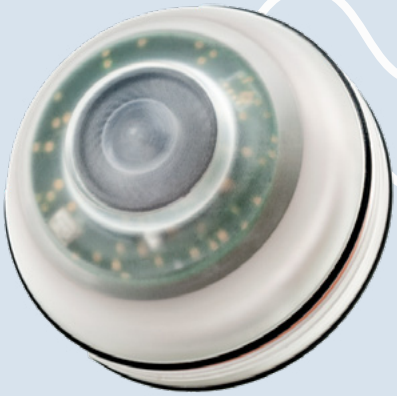
1. Model Creation
A digital model of the pipeline is created using data on pipe materials, diameters, historical repairs, and maps.

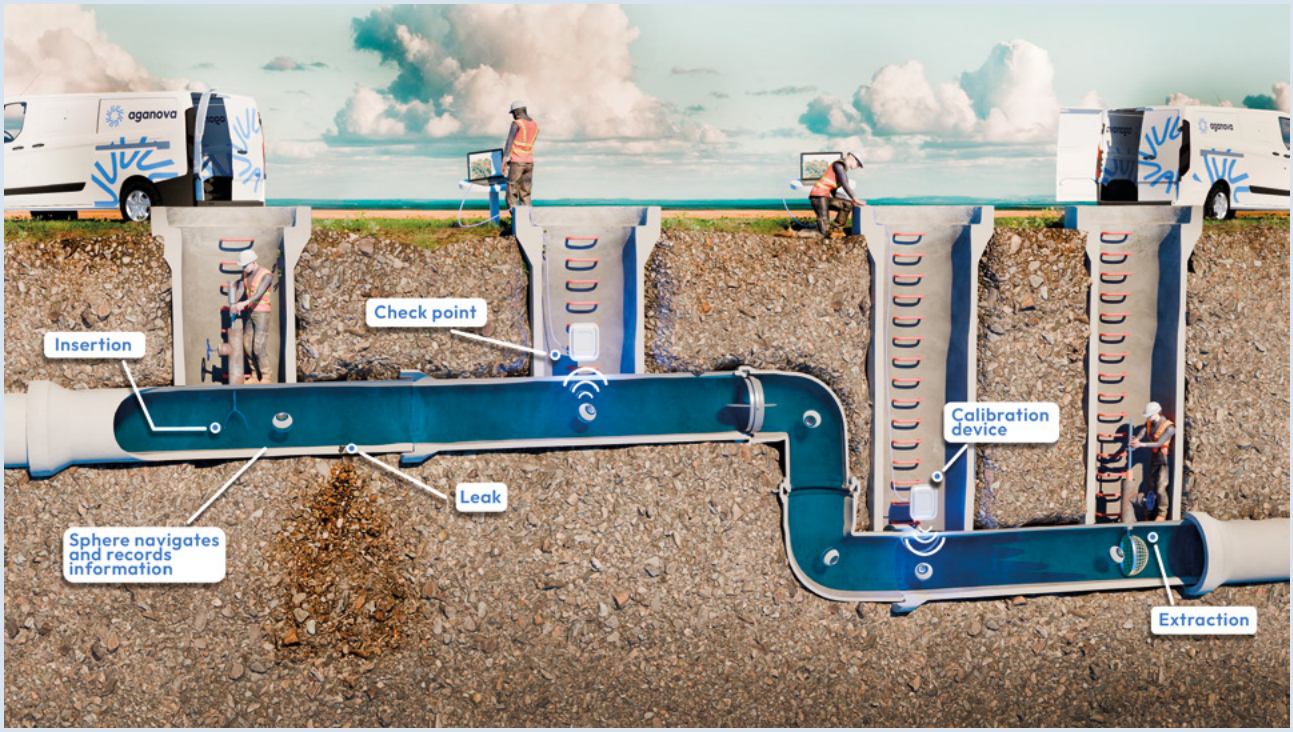
2. Inline Inspection
The Nautilus device is deployed into the water main and collects real-time data as it flows through the pipeline.

3. Data Processing with Nemo
The collected data is analyzed using Aganova's proprietary software (Nemo), which compares it to the original model and identifies discrepancies.

4. Heatmap Output
A Red-Amber-Green heatmap is generated, clearly showing areas of concern. Each anomaly is classified by type (e.g., leak, corrosion) and probability.

5. Actionable Reporting
Results are shared via detailed reports and GIS-integrated dashboards, helping asset managers prioritize maintenance and investments.





Why Choose Nautilus?

Proactive Risk Management: Spot potential failures before they happen, reducing emergencies and water loss.

Smarter Use of Resources: Focus your maintenance and investments on high-risk areas instead of blanket replacements.

Fast, Cost-Effective Insights: No need for disruptive, expensive physical inspections—our method builds on existing leak detection data.

Easy to Scale: From one pipeline segment to entire city networks, our approach scales to fit your infrastructure strategy.

Benchmarking Against Alternatives

As utilities refine their asset management strategies, one reality stands out: not all pipelines are the same—and neither are the technologies designed to manage them. Yet, many industry benchmarks still treat predictive analytics, inspection tools, and monitoring systems as interchangeable, applying them uniformly across all asset types.

In practice, **distribution and transmission mains require fundamentally different approaches.**

- **Distribution networks—**typically shallow, redundant, and lower in criticality—are well suited for predictive models that leverage historical failure data to guide proactive replacement programs.

- **Transmission mains,** by contrast, are high-consequence, large-diameter assets that fail rarely—but often without warning. Their stochastic nature makes them poor candidates for AI-only predictions, which tend to underestimate risk.

This is why leading utilities increasingly rely on **non-invasive, targeted inspection technologies** to assess the condition of these critical pipelines and prevent catastrophic failures.

This benchmark section evaluates the current technology landscape. While some solutions are heavily data-driven or invasive, others strike a more practical balance—delivering actionable insights with minimal operational disruption.

Across the board, the most versatile technologies share three traits:

- **Accurate, field-validated data**
- **Non-intrusive operation without service interruption**
- **Adaptability to varied materials and configurations**

These characteristics are especially valuable in complex or aging networks where operational risk and infrastructure diversity are high.

Technology Comparison: Choosing the Right Tool for the Right Pipe

As utilities strive to stretch capital budgets and manage risk, **technology selection becomes not just important—but strategic.** The most valuable tools deliver **reliable insights, minimal disruption, and broad applicability.**

• **In-line acoustic inspection tools:** Operate within the water flow, combining non-invasive access, real-data precision, and cross-material adaptability. Data is processed using advanced AI engines to generate actionable insights. Ideal for utilities seeking scalable coverage without shutdowns or extensive prep work.

• **External acoustic correlation tools:** Non-invasive and cost-effective for metallic pipes. However, accuracy declines significantly in plastic or mixed-material systems, limiting their usefulness in diverse networks.

• **Free-swimming electromagnetic tools:** Provide detailed data for large, high-priority mains. However, high cost and operational complexity make them impractical for system-wide deployment.

• **Acoustic transient technologies:** Deliver precise diagnostics but struggle with material transitions and often require shutdowns to collect usable data—reducing ROI for large-scale assessments.

• **AI-based predictive platforms:** Useful for distribution planning but rely entirely on historical data, offering no direct insight into actual pipe condition. Their value diminishes as pipeline length and material diversity increase—especially in transmission networks.

The Future of Pipeline Management is Inline

Choosing the right technology means aligning **capabilities with pipe type, risk level, and deployment scale.** While many solutions excel in narrow applications, only a few address the broader challenges of modern water networks.

Technologies like **Nautilus**—which combine non-invasive access, flow compatibility, and actionable insights across materials—are setting a new standard for condition assessment. They offer utilities a powerful blend of **cost-efficiency, scalability, and reliability** for both distribution and transmission environments.

As infrastructure ages and budgets tighten, **investing wisely—using the right tool for the right pipe—will define the next generation of utility performance.**

The Nautilus System redefines how large pipelines are managed: through precision, data, and long-term thinking. By moving away from reactive replacements and toward predictive, preventative action, utilities can unlock the true value of their infrastructure—ensuring continuous service, financial sustainability, and environmental stewardship.

Let’s preserve what works.
Let’s build smarter infrastructure.

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