

Kanadevia
INOVA

PULSE PATROL

**Our autonomous robotic solution
for your daily inspections
of Waste-to-X plants**



Different players face the same 3 recurring issues

Pulse Patrol as innovative solution to address them



Safety Risk

Challenge: High-risk environments where human workers face potential hazards.

Solution: Pulse Patrol inspection reduces operator exposure time to hazardous zones. Pulse Patrol as first responder to critical alerts.

Impact: Enhanced safety for human workers, compliance with safety regulations .



Asset Integrity / Downtime Management

Challenge: Keeping availability at forecast while aiming at extending campaign time

Solution: Predictive maintenance through asset condition monitoring with .

Impact: Decrease unplanned downtime, increase in overall equipment effectiveness (OEE).



Workforce Shortage

Challenge: The workforce of skilled operators is aging rapidly, and recruiting new operators is becoming increasingly challenging on a global scale.

Solution: Pulse Patrol serves as a co-worker, capable of handling repetitive and monotonous inspection tasks with consistent reliability.

Impact: Ensures continuous operations with no downtime caused by personnel shortages.

Improved Traceability & Digitalization

Pulse Patrol – a solution developed externally

Two partners, two complementary areas of expertise in WtE and robotics



Technology Strategic Alliance

The partnership combines ANYbotics' expertise in autonomous robotics with Kanadevia Innova's historical expertise in energy recovery to achieve an integrated solution.

Integration and operational adaptation

The robots are developed for the needs of industrial plants, and their specific deployment to WtE plants by Kanadevia Innova ensures smooth integration into your operations.

Optimization and advanced services

The partnership includes data processing, analytics, maintenance optimization and the development of value-added services. Support from WtE experts can be added to this comprehensive offer.

Standard sensor suites on Pulse Patrol

Standard Payload



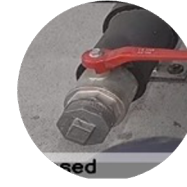
Identification of hot spots



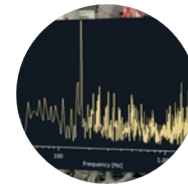
Digitization of pressure gauges



Digital gauge reading



Identification of the valve opening



Identification of acoustic dysfunctions

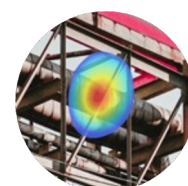
Acoustic Imager Payload



Detection of partial discharge



Abnormal vibration detection



Air/Gas Leak Detection

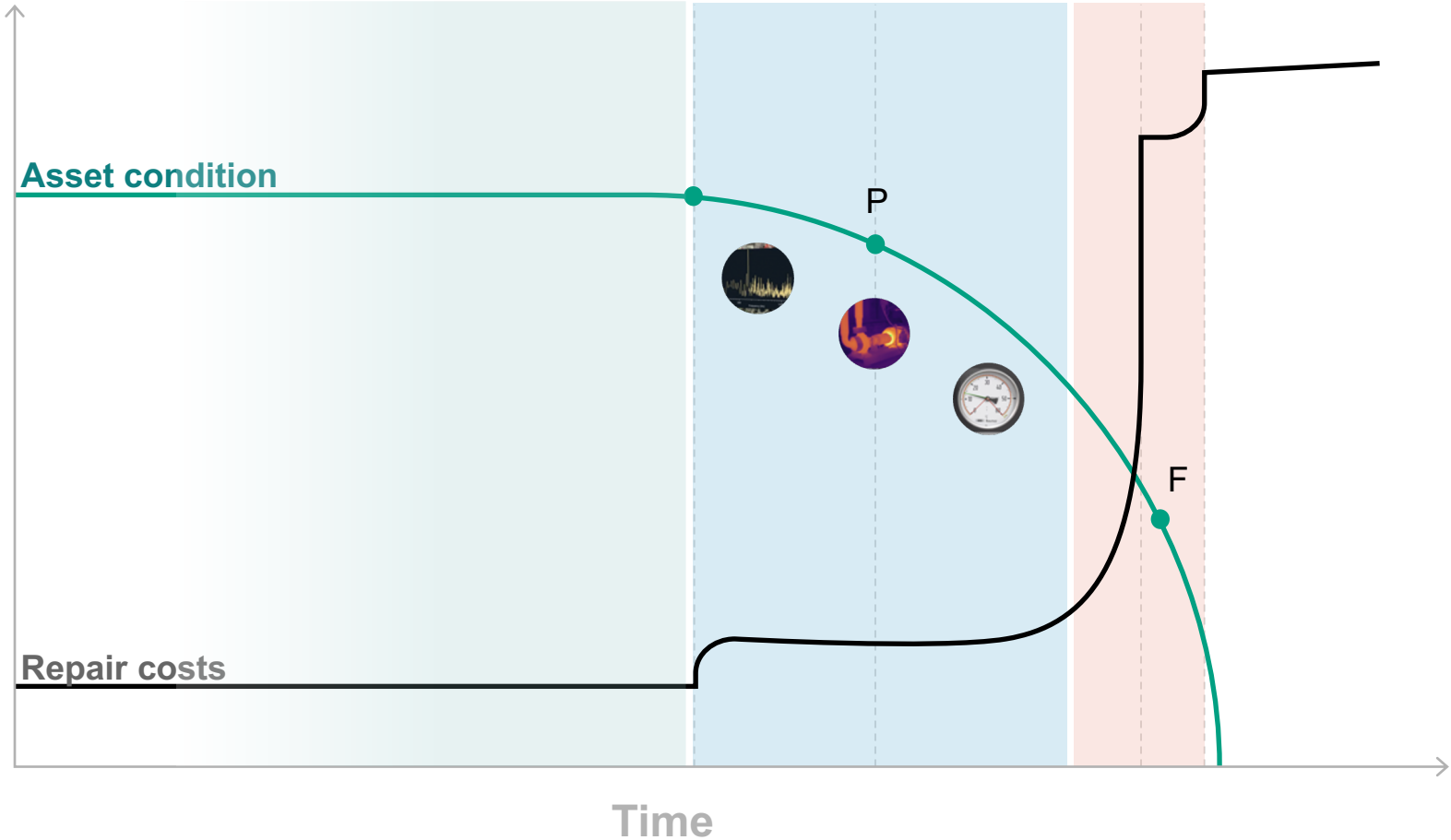
Gas Concentration Payload



Assessing the presence of gas

Benefits from our combined offer

Save maintenance time and costs by detecting early failures



Status Quo

Late DCS alarms or even machine trip. Long maintenance time and high repair costs

Timing: Reactive



Our offer

Regular inspections coupled to expert support based on robot and process data on Pulse 360. Low repair costs and scheduled maintenance.

Timing: Early failure detection



The future

AI algorithms applied to robot and process data. Unplanned downtime limited to minimum.

Timing: Predictive

Early Warning for Ash Build-Up in the Trouser Leg

Proactive Asset Health Monitoring for Reliable Operations

⚠ The Challenge

Blockages in trouser leg pipes cause ash buildup, leading to performance loss and potentially forcing a complete plant shutdown.



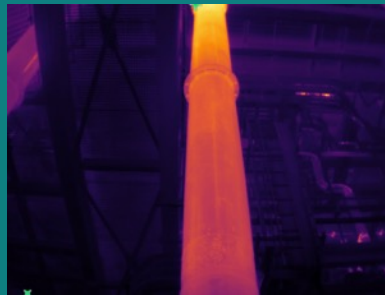
✂ Traditional Detection

Relies on switches or manual inspection with a heat gun.

Reactive, inconsistent, unsafe and often too late to prevent issues.

👤 Pulse Patrol Solution

A thermal camera detects early signs of blockage before they become critical—maximizing plant uptime and performance.



Impact on Operator work

Saves operator time (unblocking the trouser leg instead of the hopper) **- 6h**

Manual inspections in hazardous area **0**

Inspection Consistency,
in location without easy human access **100%**

Early detection means **proactive maintenance** instead of reactive, emergency repairs.

Detection of Cooling Water Pump Anomaly

Proactive Asset Health Monitoring for Reliable Operations

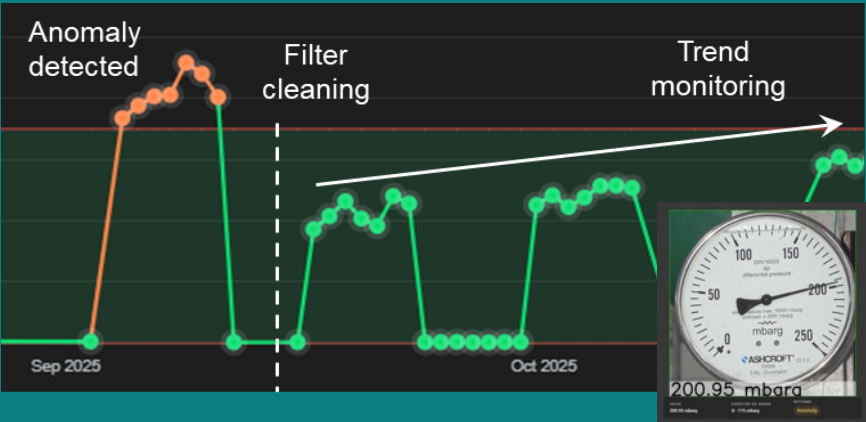
⚠ THE CHALLENGE

Mechanical faults drive unplanned downtime and costs.

✂ TRADITIONAL MONITORING

Relies on periodic manual checks or alarms triggered only after a fault has occurred, often too late for proactive intervention.

🤖 PULSE PATROL SOLUTION



Pulse Patrol continuously monitors equipment health and automatically detects anomalies early

With Pulse 360, go beyond reactive maintenance. Detect trends, predict time-to-failure, and plan maintenance proactively.

TANGIBLE RESULTS

Reliability	Costs	Maintenance	Schedule
Ensures redundancy and operational continuity, minimizing risk of simultaneous failures	Prevents catastrophic failures, reduces repair lead time, and avoids costly outages	Proactive repair is scheduled, often without interrupting plant operations. Trending values allows for proactive planning.	Early warning allows for spare parts ordering and resource planning, reducing lead times and emergency costs.



Kanadevia Inova Pulse Patrol

Additional support services enables you to extract 100% of the value from the robot

ANYbotics

Robot-as-a-Service

- Provides robot hardware and software
- Provides sensor data via API to 3rd parties
- Webapp to monitor robot data only
- Signal processing with threshold-based alerts
- No data contextualization

Kanadevia Inova

Product Support Services

- Experienced execution lead helps you set up missions and POIs
- They provide support and system maintenance, all along the operational lifetime of the solution

Remote Technical Expertise

- Go beyond the basic detection of anomalies
- Get WtE process and plant experts to provide recommendation based on combined robot and DCS data

Data integration

- Cross-correlate information across systems to detect issues earlier and more accurately
- Generate automatic work orders
- All available in Pulse 360

WtE Robot Operational Expertise

- Benefit from the lessons learned from our 2 first deployments in WtE plants
- Tap into our case studies dedicated to WtE to get fast ROI

Autonomous plant inspections

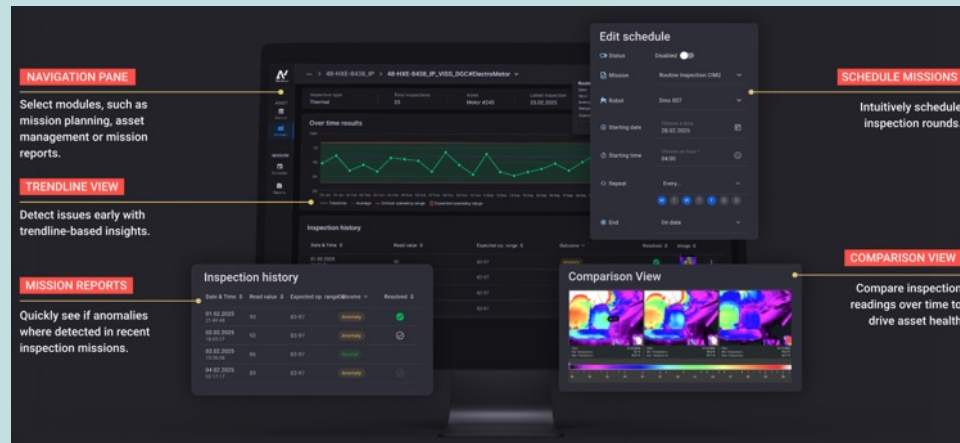
Next step towards standardized and digitized inspection reports to enable predictive maintenance

⚠ THE CHALLENGES

1. Manual inspections generate written reports without long term value.
2. Resulting data not standardized and of uncertain quality, too dependent on the operator performing the inspection.
3. Due to ageing workforce, plants bear the risk of losing expertise and experience, while not being attractive enough for new generations.



PULSE PATROL SOLUTION



Data Navigator is the centralized platform that transforms Pulse Patrol's inspection data into actionable insights.

Transferred to our cloud via a secure API, Pulse Patrol data are contextualized in Pulse 360, enabling

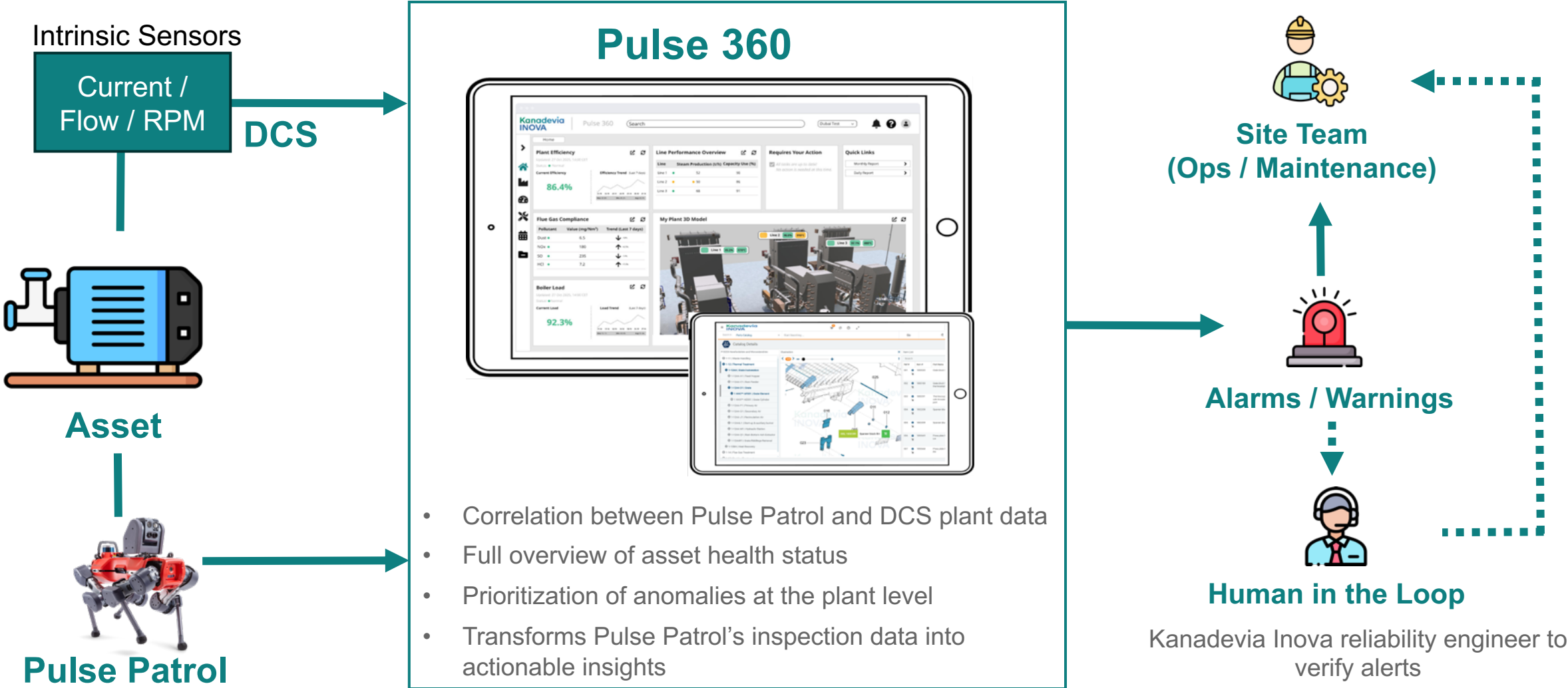
- Correlation with DCS plant data
- Prioritization of anomalies at plant level

The screenshot shows the Pulse 360 software interface with a table of findings and alerts. The table includes columns for Finding ID, Line, Asset, Criticality, Date, Metric, Value, Trend, Source System, and Status.

Finding ID	Line	Asset	Criticality	Date	Metric	Value	Trend	Source System	Status
123.345	Line 2	Induced Draught Fan	High	17.10.2025	Asset Health	58%	↑	Anomaly Detection Equ.	New
346.987	Line 1	Feedwater System	High	17.10.2025	Sound Intensity	199.27 dB	↑	Pulse Patrol	New
678.913	Line 1	Condensate System	High	15.10.2025	Sound Intensity	118.88 dB	↓	Pulse Patrol	In Prog
678.910	Line 1	Secondary Air System	High	13.10.2025	Asset Health	49%	↓	Anomaly Detection Equ.	Resolved
245.678	Line 2	Induced Draught Fan	High	05.10.2025	Asset Health	31%	↓	Anomaly Detection Equ.	Resolved
347.987	Line 2	Boiler	High	09.10.2025	Steam Stability	48%	↓	-	Resolved
456.987	Line 1	Feedwater System	High	08.10.2025	Temperature	79.29 °C	↓	Pulse Patrol	Resolved

Autonomous plant inspections

Next step towards standardized and digitized inspection reports to enable predictive maintenance



Meet our users

Experienced operators driving innovation in WtE plants



Alexander Weston

Maintenance Supervisor
WtE Earls Gate Plant, UK

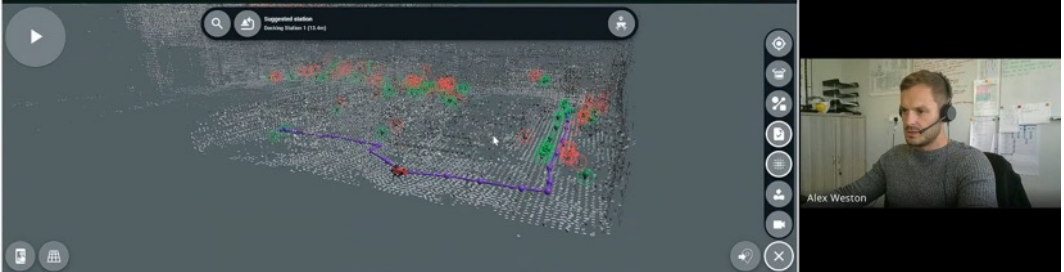
«The Robot gives us data in a completely different format than before»

«We are able to visually collect and trace component history to observe process or equipment changes and trend data that were previously not possible. »

«The robot also allows diagnostic support and the ability to check the plant remotely, allowing us to assist operators and maintenance personnel from the outside. »

1

Define the mission and path of your robot



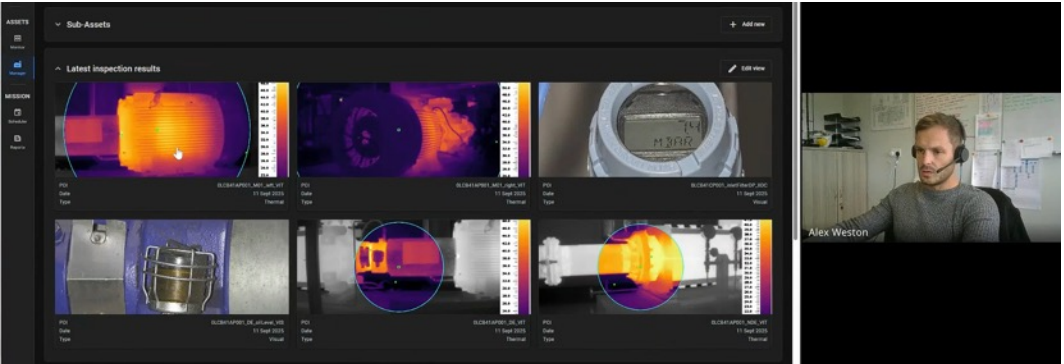
2

Trigger and follow the robot mission



3

Visualize inspection data and take decisions



Kanadevia
INOVA

Thank you for your
attention

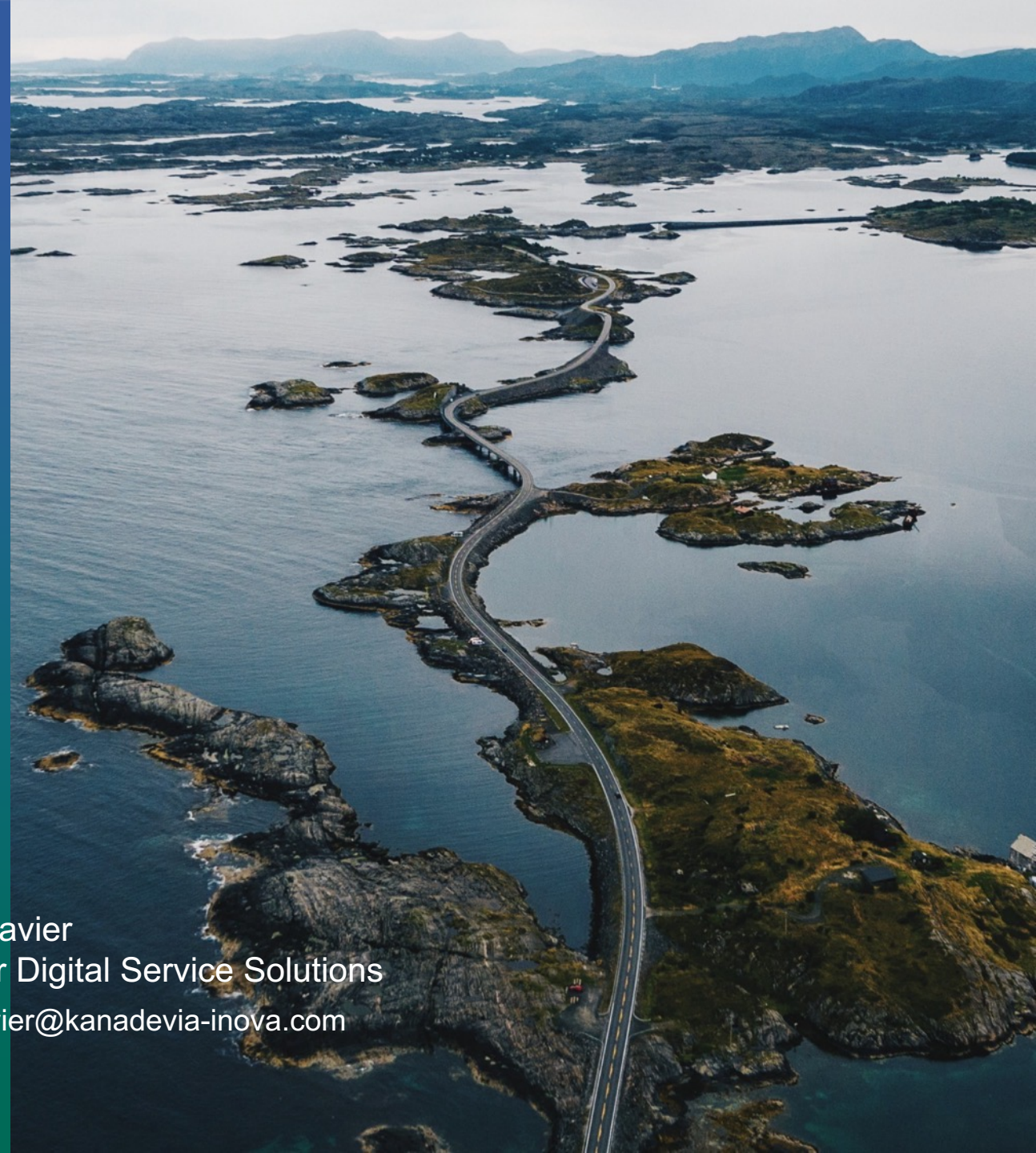
Reach out to continue the
conversation



Malte Nørgaard
Business Expansion Lead
malte.norgaard@
kanadevia-inova.com



Julie Clavier
Director Digital Service Solutions
julie.clavier@kanadevia-inova.com

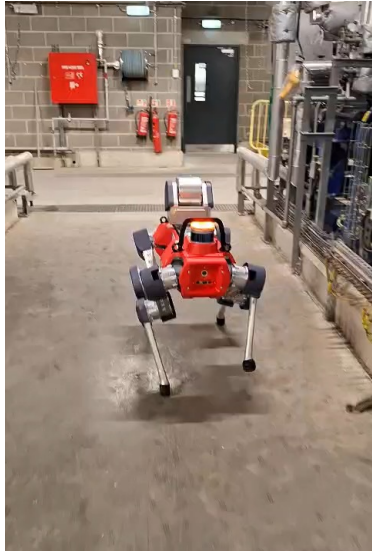


Kanadevia INOVA

info@kanadevia-inova.com | www.kanadevia-inova.com

First Pulse Patrol deployment to Earls Gate

A pilot plant to prove its value and adapt its operation to WtE plants



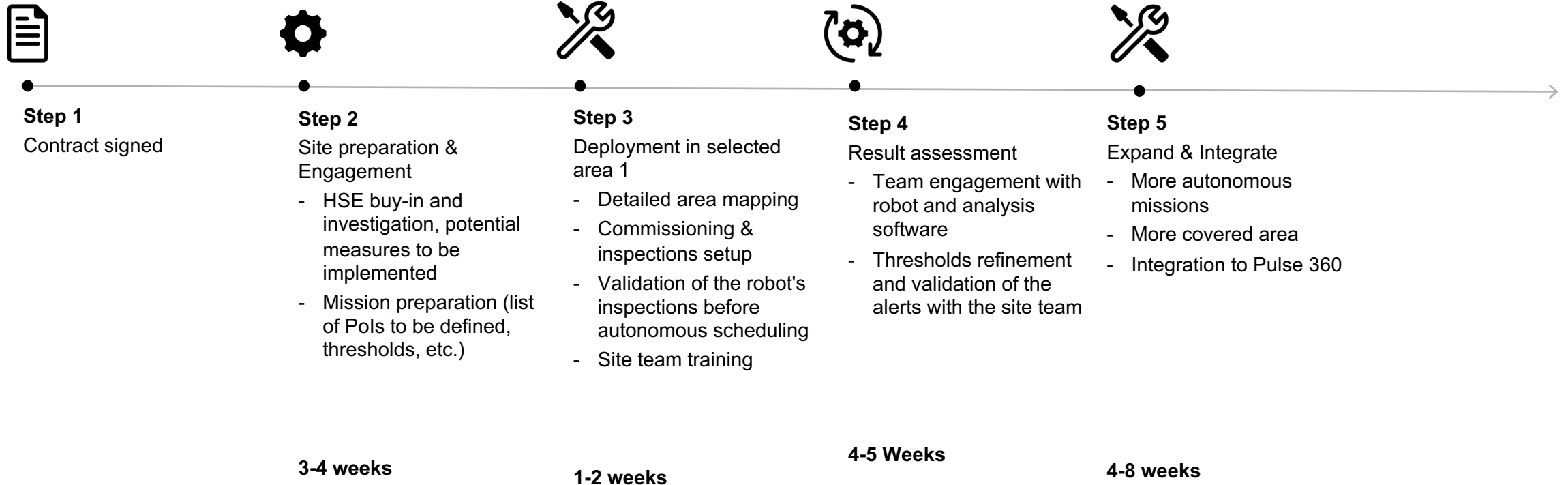
- ▶ **2026**
Extension to other sites (Slough in progress)
- ✓ **July 2025**
First automated mission
- ✓ **May 2025**
First deployment at Earls Gate
- ✓ **January 2025**
Partnership signed

A FEW STATISTICS

- ✓ 10 months of autonomous operation
- ✓ 3 Inspected Factory Areas
 - Boiler Hall – Ground Floor
 - Boiler Hall – Middle Floor
 - Turbine Hall – Ground Floor
- ✓ Up to 8 missions per day
- ✓ Over 350 missions completed
- ✓ More than 13,000 measurements (>99% success)
- ✓ 46 anomalies detected in the last month, 16 under evaluation, 2 having led to actual maintenance action
- ✓ Extensive Learnings and KVI Expertise needed to increase deployment speed

Typical Deployment Strategy

Based on deployment experience



ANYbotics

Improved uptime, efficiency and productivity of WtE plants

Operating benefit

Associated measurement points

Availability

- Thermal inspection: surface monitoring for abnormal temperatures
- Video inspection: misalignment detection to prevent belt breakage

Quality

- Thermal inspection: avoid unplanned shutdowns and damage
- Analog gauge reading: pressure/temperature/level check

Lifetime Extension

- Thermal inspection: planning of bearing/motor replacements
- Video inspection: tension/clearance adjustment to extend component life

Security

- Thermal inspection: reduced risk of fire on conveyors
- Video inspection: reduced risk of catastrophic failure

Planning & Safety Assurance

- Gas concentration measurement: O2 detection to plan repairs

Health & Compliance

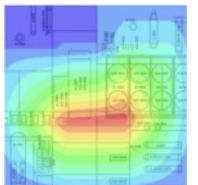
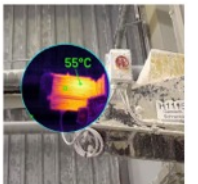
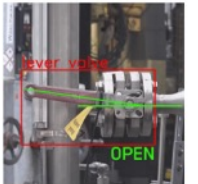
- Gas concentration measurement: documentation of TLV exceedances

Overall Equipment Performance

- Gas/steam leak inspection: location of leaks for rapid intervention

Cost & Planning

- Leak inspection: prioritization of high-flow leaks to reduce expenses
- Analog gauge playback: round reduction and automatic recording



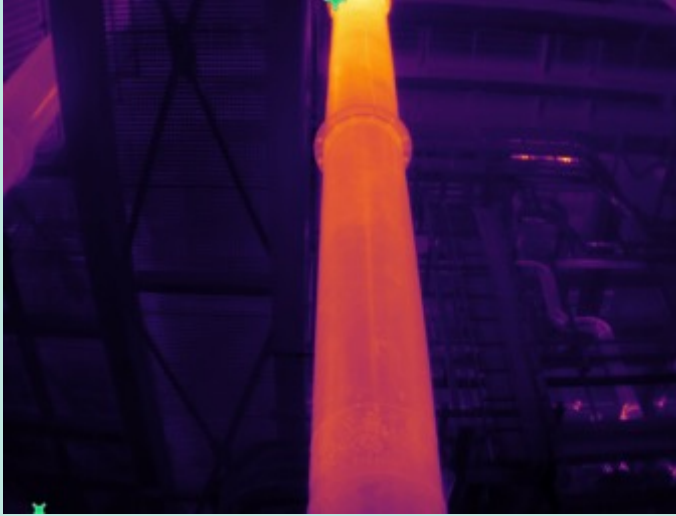
Detection of Trouser Leg Blockage

Early Warning for Ash Build-Up, Maximizing Plant Uptime and Performance

THE CHALLENGE

Blockages in the trouser leg pipes can cause ash buildup, leading to performance loss and potentially forcing a plant shutdown.

Traditionally, detection relies on switches or manual inspection with a heat gun.



PULSE PATROL SOLUTION

Pulse Patrol uses thermal imaging to continuously monitor the temperature across the trouser legs and yield early detection of blockages.

It allows operator to intervene before the ash builds up in the hopper

TANGIBLE RESULTS

<i>Time saved</i>	<i>Safety</i>	<i>Costs</i>	<i>Maintenance</i>	<i>Schedule</i>
Daily inspection time Unblocking trouser leg: up to 2 hours; hopper: up to 8 hours	Fewer hazardous manual interventions Decrease in recorded injuries.	Avoids unplanned downtime and catastrophic failures	If a blockage is confirmed, targeted cleaning is scheduled—often without stopping the plant	If escalation is needed, intervention is planned proactively, minimizing risk and downtime.

Early Warning for Ash Build-Up in the Trouser Leg

Proven Use Case with ROI

⚠️ The Problem

Blockages in trouser leg pipes cause ash buildup, leading to performance loss and potentially forcing a complete plant shutdown.

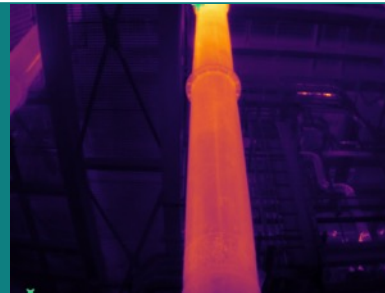


✂️ Traditional Detection

Relies on switches or manual inspection with a heat gun.
Reactive, inconsistent, unsafe and often too late to prevent issues.

🤖 Pulse Patrol Solution

Continuous monitoring detects early signs of blockage before they become critical—maximizing plant uptime and performance.



Impact on Operator work

Saves operator time (unblocking the trouser leg instead of the hopper) **- 6h**

Manual inspections in hazardous area **0**

Inspection Consistency, in location without easy human access **100%**

Early detection means **proactive maintenance** instead of reactive, emergency repairs.

Anomaly detection

A digital service using Artificial Intelligence and IoT technologies to detect equipment failures.

A customer-oriented service

Value Proposition

- ✓ **Early detection** of equipment failures
- ✓ This **proactive approach** turns unplanned maintenance into planned maintenance, **reducing downtime and costs.**
- ✓ A **fully automatized solution** providing the operators with a **standardized and continuous** plant monitoring system.

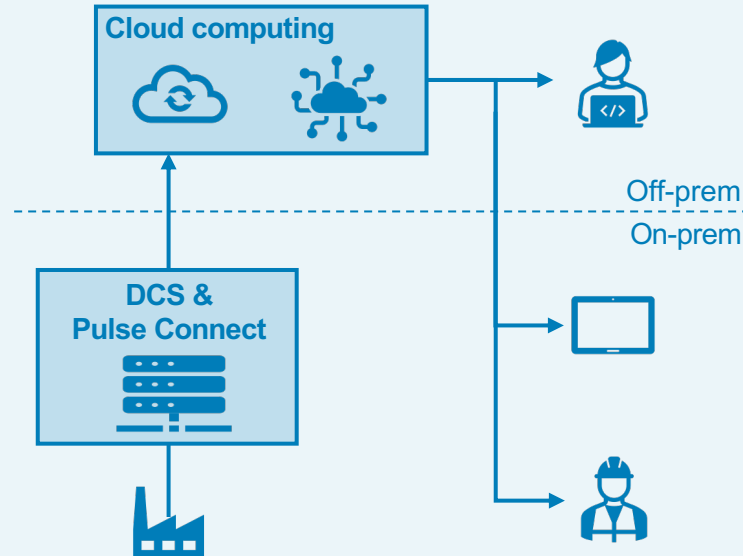
Scope

Based on operator feedback:

- Primary air fans, Secondary air fans, ID fans
- Recirculation fans, water feed pumps

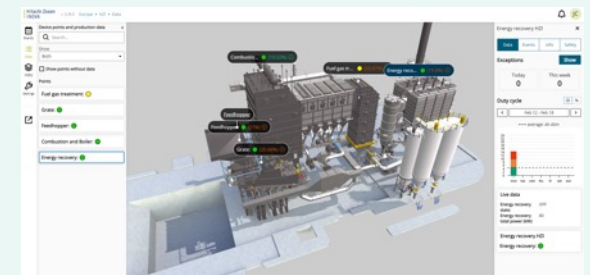
A scalable technology

An end-to-end digital solution to detect contextual anomalies by using a **scalable cloud technology.**



An integrated solution

Displayed on Pulse 360



Link to CMMS and data exploration tool

The screenshot shows a data exploration tool interface with a detailed table of equipment data. The table has multiple columns, including equipment ID, name, location, and status. The data is organized into rows, with some rows highlighted in red and yellow to indicate specific conditions or alerts. The interface includes search and filter options at the top.

ROI: What Drives the Business Case

Value Creating Areas

• A. Routine Inspection Efficiency

- Reduced manual inspection hours
- Inspections during operation
- Reallocation of skilled workforce

• B. Asset Condition Monitoring

- Early detection of mechanical / thermal / electrical issues
- Reduced unplanned downtime
- Shift from reactive to planned maintenance

• C. HSE Risk Reduction

- Less exposure to hazardous areas
- Fewer manual rounds in hot / confined zones
- Reduced incident and near-miss risk

Use Case #1		Routine Operator Inspection Round	
Item	Value	Status quo	With Pulse Patrol
Number of inspection man hours per day		3,5	0,97
% of inspection tasks covered by Pulse Patrol instrumentation (visual, thermal, acoustic)			85%
% of these inspection tasks ANYmal can actually take over			85%
Production days per year with inspection		339,5	339,5
Annual inspection man hours		1188	330
Average hourly cost per worker (EUR) (fully loaded FTE cost, hiring, equipment, training, certificates)		50	50
Annual plant unavailability related costs in EUR		59.404	16.485
Total yearly cost savings			EUR 42.919,21

Use Case #2		Asset Condition Monitoring: Prevent Unplanned Downtime	
Item	Value	Status quo	With Pulse Patrol
Avg. unplanned downtime hours per year if cause not detected		262,8	262,8
Share of downtime attributed to mechanical, electrical, thermal incidents. (excl. stops due to operations, holidays, shift changes, other factors)		30%	30%
Percent of incidents ANYmal can detect early		0%	10%
Downtime hours per year asset condition related		79	71
Capacity in kilo tons /year		778	778
Avg. price per accepted ton, EUR/ton		100	100
Avg. lost revenue per accepted ton per hour		9549,76	9549,76
Avg lost revenue of unsold energy per ton hour			
Multiple of lost revenues for ad-hoc repair (external contractors, fines from not delivering energy, cool down /heat up phase)		500%	500%
Downtime Cost per hour at full capacity production		47748,81	47748,81
Annual maintenance related costs		3764516,13	3388064,52