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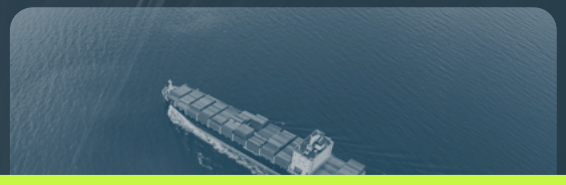
The COO's Guide to Industrial AI:

How to listen to your assets to optimize performance, cost and risk



Your assets are talking.

Your business produces massive amounts of data every day. Production and processing equipment, shipping and transportation vehicles, generators, pumps and IoT-enabled remote equipment are constantly generating valuable information. This data leads to healthier, more reliable machines. Healthier, more reliable machines reduce your operational risk while boosting performance and lowering costs. All you need to do is listen to your assets. AI can help you understand what they're saying. Welcome to your industrial translator.

Maybe you think this sounds like an unnecessary bit of technology. But ask yourself this: Are your assets operating at peak capacity? Do sourcing pains due to supply chain congestion limit your output? Are your employees missing work because of on-the-job accidents? Or maybe you're simply confronting an aging workforce and are looking for ways to increase institutional knowledge. These may seem like unrelated queries, but industrial AI can help solve all these issues, working alongside your employees to streamline operations. It's all part of using technology to:

- **Predict** and prevent costly disruptions and downtime
- **Diagnose** problems and detect untapped opportunities
- **Prescribe** and build optimal solutions
- **Automate** tasks for adaptable, self-correcting systems

The industrial sector is sometimes considered conservative and slow to adopt the latest technologies – and rightly so. Your assets, and therefore your decisions, need to last for decades. Your technology solution needs to address legacy and modern equipment you're using today, as well as assets that will be built in the future. The consequences of getting it wrong can be severe.

But as a company that has been building industrial AI solutions for the world's largest energy producers, the United States military, manufacturers, fleet operators and other essential industries for over a decade, we at Avathon have witnessed and accelerated the maturing of industrial AI. It is delivering critical advantages every day.

Industrial AI empowers you to extend the lifetime of existing assets, and much more. Instead of seeing AI as a single tool, integrate a holistic industrial AI platform into the root of your operations for success now – and in the autonomous future.

This guide will help you understand your opportunity to get faster answers and solutions to questions like:

- Which of this category of assets is most profitable and why?
- Is that recent drop in production related to a temporary condition, or are there more systemic factors at work?
- Where should I source my components or route my shipments given likely tariff conditions?
- Is there a faster way to analyze my seismic imaging results to optimize resource exploration?
- How can I reduce safety violations in real time?

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Your asset translator: Industrial AI

Globally, more than $100 trillion in industrial assets are under stress. That stat likely includes your assets: the equipment that powers your business, keeps you profitable and enables you to deliver your business goals year in and year out.

Maximizing these assets – making sure you take advantage of new revenue-generating opportunities while you extend the lifetime of your critical infrastructure – is crucial to success. And it's impossible to do without technology.

Industrial AI becomes a critical tool for reducing risk, cost and time-to-value. AI can listen to your assets, alerting to potential malfunctions or showing you how they might perform better. The right industrial AI platform then becomes more than a back-office technology tool. Integrating AI into your work alongside your employees enables you to detect risks and opportunities across assets, operations and supply chains — prescribing and automating solutions to drive safety, resilience and performance.

The International Energy Agency pegs the growth of global renewable electricity capacity at 2,400 GW between 2022 and 2027 — equal to the entire power capacity of China today. Yet many energy companies are struggling to meet this demand due to under-optimized assets, operational inefficiencies and safety constraints that limit throughput and scalability across wind, solar and storage operations. Recently, a large energy producer wanted to improve its asset productivity, optimizing its 5.5 GW renewables portfolio while reducing downtime. Fast.

By using industrial AI to listen to the information generated by its hundreds of wind turbines and inverters, the company was able to better understand and improve the performance of critical assets. Operational visibility grew by 90%, with the AI engine forecasting equipment failures before they occurred.

+90%
Operational visibility

-10%
Unplanned downtime

+1.7%
Energy production

Unplanned downtime fell by nearly 10 percent. The company increased energy production by 1.7%, boosting revenues by $5 million.

In the quest to meet this renewables capacity demand, wind energy companies are building bigger rotors and towers to produce more energy. Compare a turbine installed 10 years ago with a new installation; on average, the new asset will be 60 percent larger than its older brother.

But larger turbines can make inspections and maintenance more dangerous, especially in strong wind conditions. Listening to these larger assets with industrial AI helps energy companies prevent asset breakdowns. When wind turbines do need repairs, industrial AI technology enables companies to improve safety for maintenance workers who are repairing turbines at extreme heights.

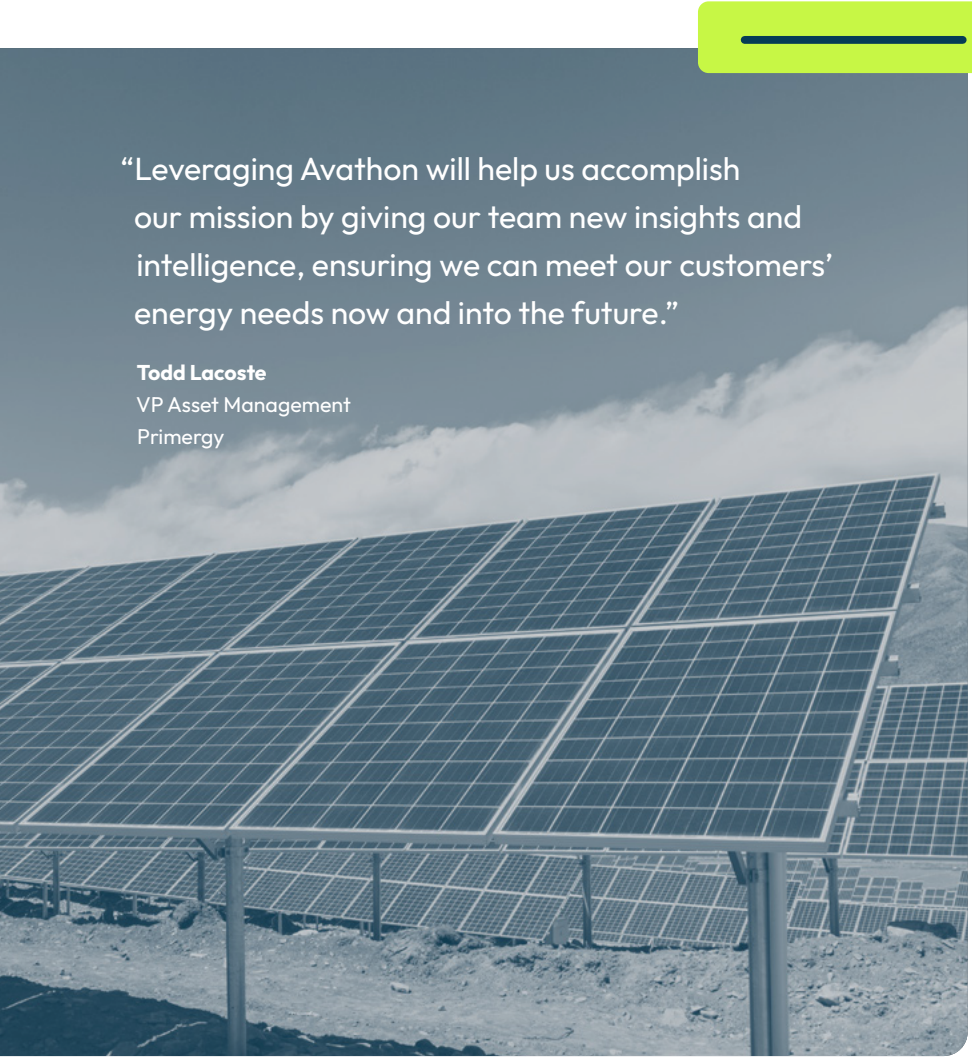
Agentic industrial AI platforms give you the power to listen to your assets, optimizing existing machines but also enabling you to build better assets now and in the future. Industrial AI goes beyond mere decision support. Suddenly data is turned into action, and you're using AI agents to diagnose, prescribe and autonomously act across assets, people and supply chains. The best part? You can tailor an industrial AI platform to the unique needs of your business. Increase first-time yield, maximize asset performance or prevent unexpected downtime all through the same system. You'll improve supplier collaboration, make sure workers are safe and secure, and stem the loss of institutional knowledge due to a retiring workforce.

From “break and fix” to agentic AI:
The three waves of industrial asset management

In the early days of industrial asset management, forward-thinking operators realized that waiting for things to break was creating costly and disruptive unplanned downtime, so they introduced **scheduled maintenance**. This calendar-based approach was more proactive, but without alignment to actual asset conditions, could result in expensive over- maintenance and component consumption. Assets still failed unexpectedly.

The first **modern enterprise asset management** systems emerged in the early 2000s, integrating basic **condition monitoring** and **preventive maintenance** planning features. In the 2010s, the rise of the Industrial Internet of Things (IIoT) and machine learning led to new **asset performance management** (APM) platforms capable of **preventive and predictive** analytics using real-time sensory data, historical trends and anomaly detection.

From “break and fix” to agentic AI:
The three waves of industrial asset management



Technology has advanced in the last decade and so have expectations. The age of **agentic industrial AI** builds on earlier generations of APM to take advantage of cloud-native computing and AI-powered smart agents to deliver autonomous and holistic asset optimization at scale.

In addition to traditional inputs such as visual AI and time-series data, these next-generation platforms analyze information such as sound and smell. They also process unstructured and semi structured data – everything from weather and supply chain fluctuations to operating manuals, inspection reports, asset blueprints, and even email and chat transcripts.

Advanced AI technologies then allow the platforms to use these inputs to not only predict risks and opportunities in your business, but to **diagnose and prescribe** a solution, and even **build and automate** that solution.

What might that look like? To go back to the example of the wind energy company, the platform could detect that one turbine is outperforming the others and analyze why. It might then prescribe that you adjust the yaw of another turbine to increase its energy production or automatically order a part and dispatch a technician to replace that component on another. It might also observe that the technician isn’t wearing required safety gear and prevent him from accessing the nacelle (the housing that contains key turbine components) until properly equipped.

Perhaps the original equipment manufacturer no longer produces that component and after-market suppliers are still six months from ramping up their production. The platform could even help you 3-D print that component on demand. Industrial AI allows you to operate across three time horizons, focusing on existing assets as well as those being built while optimizing how assets operate in the future.

What to know:
A broad range of technologies power the best industrial AI platforms

Industrial AI is still a emerging field, but there are providers with ten or more years in applied AI science for complex and critical assets. This experience leads to domain knowledge toward a singular focus: training a model library purpose-built for industrial assets and workflows.

These are some of the key AI and machine learning technologies that enable AI-powered "listening."

Agentic AI – Processes data, makes decisions and acts autonomously, finishing tasks and improving systems without human oversight. In an industrial AI platform, agents enable autonomous interventions, protecting people, optimizing performance, and preventing disruptions in real time.

Generative AI – Creates new content based on what it has learned from existing content. Generative AI models learn the patterns and structure of input training data, generating new data that has similar characteristics. This empowers users to engage in a conversation with their industrial AI platform. For example, you could ask the platform to summarize asset performance, how to fix a certain machine or even what to do to improve and optimize a current process.

Knowledge graphs – Organizes and connects information from a wide range of sources to provide insights about working relationships and performance results. On the supply chain side, these graphs can model logistics uncertainty and manage risk, ensuring resilience amid shifting supply chain disruption.

Natural Language Processing (NLP) – Improves operational and maintenance performance by automatically ingesting enormous quantities of written records and insights from unstructured data such as operating manuals, event logs, fault reports, emails and text messages.

What to know:
A broad range of technologies power the best industrial AI platforms

Normal Behavior Modeling (NBM) – Analyzes vast quantities of real-time performance data so companies can detect asset anomalies that might suggest impending failure or opportunity.

For example, in pharmaceutical manufacturing, a golden batch is an ideal production run where quality, yield and efficiency are all optimal. By training an NBM system on historical sensor data, process parameters and outcomes from known golden batches, the system can learn a "normal" profile for ideal operation — effectively modeling:

- Temperature, pressure and pH curves
- Reaction times and sequencing
- Equipment behavior (e.g., vibration, flow rates)
- Material inputs and timing
- Cleanroom and environmental conditions

Manufacturers can then automatically compare future batches in real time against this golden standard to drive peak performance.

These technologies can continuously analyze wind turbine output versus normal operation and identify when blade planes are out of alignment with the wind direction. AI-enabled analysis can identify yaw misalignment of five degrees or more with 96% accuracy.

Visual AI – Visual AI is one of the most common tools in industrial asset management, particularly to visually detect safety and security risks such as intruders, unacceptable proximity to dangerous equipment or failure to wear appropriate safety gear. Such systems are often compatible with existing CCTV infrastructure, so they are relatively easy and inexpensive to deploy.

Broader applications include co-pilot tools that guide operators in step-by-step maintenance or installation procedures by "seeing" the right angle to place a component.

For example, pipeline welds are critical to maintaining safety and quality in oil and gas infrastructure projects. Weld defects like cracks, porosity or incomplete fusion can lead to leaks, environmental damage or safety hazards. Visual AI can flag welds that fail quality thresholds. Agentic technology can then trigger automatic rejection or rework workflows, update quality logs and audit trails for compliance and send insights to human inspectors for edge cases. The advantages include improved throughput, accuracy, traceability, and cost savings by avoiding downstream failure and rework.

Multimodal sensors – Manufacturers can dramatically enhance asset performance monitoring and extend equipment longevity by integrating sensory AI systems using acoustic, olfactory (smell/particle) and tactile data.

Early signs of bearing wear, misalignment or cavitation in rotating equipment generate subtle acoustic anomalies detectable by high-frequency microphones. Particle sensors can "smell" volatile organic compounds (VOCs), gas leaks or burnt insulation particles. Embedded sensors can track real-time heat, pressure, torque or friction on equipment surfaces or in process flows, with tactile AI identifying any abnormal thermal patterns or force signatures that precede stress fractures, warping or tool wear.

Sensory AI is ideal for early detection of invisible hazards in enclosed or hard-to-inspect environments and can be particularly effective in multimodal combinations (for example, sound plus smell or vision plus sound).

How do digital twins work?

Digital twins are yet another technology tool in your industrial AI toolbox. The digital twin uses real-time data inputs from sensors on the actual system or device rather than predicted or OEM-provided values for important performance parameters. Companies use digital twins to both improve performance, by simulating new opportunities, or to identify operational degradations before they happen in the real system.

You can input alternative performance data into the model to conduct scenario analyses in support of proposed maintenance actions. The digital twin model can also make real-time recommendations about proactive actions intended to avoid failures or performance compromises.

Digital twins have several important uses:

- Monitor real-world conditions and operating performance of a physical system.
- Model system performance prior to actual production or modification of a physical asset.
- Improve operation of physical systems in the field.
- Predict maintenance needs and prevent failures.
- Identify potential operating hazards.

Digital twins are two-way streets: sensor performance data flows from the physical system into the model, and performance improvement recommendations flow from the model back into the physical system. This bidirectional flow allows the physical system to operate better over time. The cyclical nature of the data flow also allows the digital twin model to constantly improve its own analytical abilities. The digital twin is an ever-improving source of value going forward.

Exploring digital twins

A digital twin is a digital model of an intended or actual real-world physical product, system or process.

$110B

Global digital twin market to rise by 2028

60%

Increase from 2023 levels

Can you hear them? An asset listening roadmap

Implementing an industrial AI platform to improve asset performance and longevity requires a strategic, phased approach. By selecting the right platform, you can also break out of the lifecycle of OEM services. You'll have more agency to control profitability and maximize costs.

1

Define business goals and ROI targets

- ✓ Identify key pain points (e.g. unplanned downtime, low OEE, maintenance overruns)
- ✓ Set measurable objectives: improve uptime by X%, extend asset life by Y years, reduce maintenance cost by Z%
- ✓ Prioritize use cases with high ROI and low barriers to implementation

2

Assess asset readiness and data landscape

- ✓ Audit the critical assets and their current sensor instrumentation
- ✓ Evaluate available data sources: SCADA, historians, CMMS, manuals, inspection logs, etc.
- ✓ Identify gaps in structured and unstructured data (e.g. missing sensors, tribal knowledge)

Can you hear them? An asset listening roadmap

3

Choose the right industrial AI platform

- ✓ Look for capabilities like:
  - Asset modeling and digital twins
  - Time-series analytics and anomaly detection
  - Multimodal data ingestion (visual, acoustic, vibration, etc.)
  - No-code/low-code customization and natural language interfaces
  - Edge computing compatibility for low-latency environments
- ✓ Ensure the platform supports hybrid deployment (cloud, edge, on-prem)
- ✓ Ask about implementation and integration time. Some providers require months or even years of costly services before your system starts to deliver value.
- ✓ Consider selecting a vendor-agnostic platform that doesn't tie your activities to an OEM.

4

Integrate data across sources

- ✓ Build a unified data layer with contextualization (tag normalization, equipment hierarchies)
- ✓ Connect siloed systems (maintenance logs, DCS/SCADA, ERP, sensor networks)
- ✓ Use AI to clean, align and structure messy or legacy datasets

5

Develop asset models and use-case pipelines

- ✓ Create or import digital twins of key equipment
- ✓ Train AI models on historical data for predictive maintenance, anomaly detection, or yield optimization
- ✓ Incorporate subject matter expert feedback to improve model relevance

Can you hear them? An asset listening roadmap

6

Deploy AI in operational workflows

- ✓ Integrate AI-driven alerts and recommendations into existing operator dashboards or mobile apps
- ✓ Use AI copilots to guide troubleshooting, root cause analysis and maintenance decisions
- ✓ Enable closed-loop feedback where AI models adapt based on outcomes and user input

7

Monitor, iterate, scale

- ✓ Continuously evaluate model performance and retrain with new data
- ✓ Quantify gains in uptime, cost savings, safety improvements
- ✓ Gradually expand to additional assets, sites and use cases

8

Upskill teams and foster adoption

- ✓ Train operators and engineers on AI tools, dashboards, and decision support systems
- ✓ Establish cross-functional teams to champion adoption (IT, operations, reliability, data science)
- ✓ Emphasize AI as an accelerator—not a replacement—for human judgment

Real-world applications of industrial AI

"Using Avathon's Industrial AI Platform, we can detect and address equipment problems early, avoid unplanned downtime, minimize customer interruption and costs, and potentially extend the operating life of our LNG Terminal assets."

Simon Culkin
Managing Director
National Grid Grain LNG

You now have the industrial AI roadmap. You've learned about the AI solutions that enable you to predict, diagnose, prescribe, build and automate your way to optimized business operations.

With AI listening, you can now take advantage of new opportunities, protect your people assets and extend the lifetime of critical infrastructure.

Here are just a few of the real-world applications of industrial AI:

Optimize resource exploration

In oil and gas exploration the traditional approach to subsurface imaging and data analysis is time-intensive and costly. You need to process terabytes of data, high-performance computing and complex physics-based algorithms to analyze and identify exploration opportunities. Using industrial AI to listen to the ocean floor and see what's hidden, companies can accelerate the pace of imaging and exploration of subsurface structures. It starts with deep learning, which generates reliable subsurface images using far fewer seismic shots—as little as 1% in completed field trials—than traditional methods. AI algorithms process large amounts of data and automate the analysis. It all adds up to a vastly compressed exploration timeline: one company saw the time drop from an average of 12 months to just 12 days.

Real-world applications of industrial AI

Logistics routing and planning during supply chain uncertainty

AI can help not only identify how one part of the supply chain affects the other but also automate decisions when disruptions occur, weighing when when the product is needed against cost constraints to ultimately improve revenue. Imagine you suddenly need to source product from a supplier in a more tariff-friendly location. How do you make sure your value chain stays intact? AI delivers that agility, reducing duty and tax processing costs while ensuring companies stay ahead of new tariffs.

Industrial AI can also optimize the entire shipping value chain from terminal and bunkering locations, costs and qualities to weather and piracy risk mitigation to rapid product classification to streamline customs processing. AI helps companies nimbly adapt manufacturing schedules, shipments, orders and other functions across their supply chains.

Spare parts supply planning

Seconds count when you need to avert a disaster, repair a machine or navigate hazardous conditions on a remote platform. Optimizing your supply chain so that you have the right part at the right time in the hands of the right technician is a vital ingredient of that readiness.

With industrial AI, you can:

- Source key components before they cause delays
- Combine asset-listening data to improve the accuracy of spare parts planning
- Plan based on science models that run IoT and time series data, as well as knowledge-based Gen AI agents tuned for domain and equipment
- Integrate with 3D printing systems for custom/hard-to-source

Real-world applications of industrial AI

Reduce unnecessary consumption with vendor-agnostic solutions

When industrial operators rely on asset performance management solutions provided by OEM equipment vendors, they may unknowingly lock themselves into that vendor's service and parts ecosystem. These OEM platforms are often designed to favor their own components, diagnostics and recommended maintenance schedules—regardless of whether they're optimal for total cost of ownership or operational performance. In environments with mixed fleets or where uptime is critical, this bias can drive unnecessary costs and reduce asset management flexibility.

Vendor-agnostic asset management solutions offer a more balanced and strategic view. By decoupling asset performance insights from OEM sales incentives, these platforms can help operators make data-driven decisions based on actual equipment behavior, failure patterns and economic tradeoffs. For example, a global mining operator using only the OEM's platform for its haul trucks found itself replacing hydraulic components on a fixed schedule that was overly conservative. After switching to a vendor-agnostic system that monitored actual conditions, the company was able to extend service intervals by 20% without compromising safety.

Eliminating asset downtime with prescriptive maintenance

Given the steep cost of equipment downtime, powered prescriptive maintenance solutions are essential tools for extracting peak performance from industrial assets. As maintainers reach retirement age, you also need a solution that supports the next generation of workers.

Prescriptive maintenance enables maintainers, both veterans and new hires, to improve asset performance and reliability by automatically:

- Tracking asset health continuously and automatically
- Identifying pending failures days/weeks in advance
- Recommending best actions to remedy emerging issues
- Using system feedback to continuously improve asset performance

Real-world applications of industrial AI

You'll need a maintenance program that unites two approaches. Predictive AI identifies patterns in data and uses them to alert operators and managers when there are subtle anomalies or deviations in the patterns. With those predictive alerts, you can fix issues before they become more significant problems—long before the expectations of performance degradation. The true power of industrial AI comes in the form of prescriptive maintenance, which identifies the root cause of any issues and the remediating actiony that will solve the problem. Think of prescriptive AI as that one technician who always has the answer for any maintenance issue; he or she is always around to teach new workers how to complete critical repairs.

Maintenance alerts, delivered well in advance of equipment failures, derive from predictive maintenance models built on input from subject matter experts. These models identify and alert on known, and previously unknown, harmful events by exploiting threshold-based deviations that can lead to equipment failure. Such disruptions can knock production offline for hours or days without advance warning.

AI models also mitigate noisy alerting processes that can create alert fatigue. That's a problem operators at National Grid's UK liquefied natural gas terminals used industrial AI to address. They were listening to everything, and it was getting overwhelming. As the distributor of 25 percent of the UK's natural gas, constant alarms from its compressor assets led to constant headaches.

Analyzing the status of assets as they evolve is as crucial as understanding how they've performed in the past. Driven by user knowledge and effective alert management, prescriptive maintenance makes it easier to adapt to "new normal" operating states as assets age and maintenance practices and operating environments change. You can now fully meet the challenge of maintaining technical expertise as the workforce ages, making knowledge readily available to a new generation of workers.

Real-world applications of industrial AI

"By deploying Avathon's cutting-edge renewable solution, we can improve the effectiveness and lifespan of our land-based assets and maximize energy output, propelling us toward a more sustainable future. "

Rob Keiser
VP, Asset Management
Orsted

Reduce safety violations in real time

Your most important assets are your people. A huge part of asset listening involves keeping those workers safe. But if you find yourself reacting to health and safety incidents instead of preventing them, you need visual AI.

Visual AI analyzes images and videos from existing CCTV cameras, automatically identifying and alerting health and safety incidents while letting you keep an eye on the productivity of both human and machine assets. This infrastructure enables HSE managers to prevent accidents, detect security breaches and streamline day-to-day operations. Unlike traditional camera monitoring tools that are primarily valuable for retrospective investigations, industrial AI platforms offer real-time alerts that can warn workers, notify managers, trigger door locks and machine shutdowns, and even summon emergency responders before hazards multiply.

Real-world applications of industrial AI

Here are three common health and safety use cases for visual AI:

PPE compliance

Maintaining personal protective equipment (PPE) compliance is one of the most common reasons companies adopt visual AI. Failure to wear appropriate PPE is often a direct contributor to accidents and resulting injuries. This could be as simple as hard hats, reflective vests, safety shoes and gloves up to items like a photo-ID badge to ensure that only authorized workers enter certain areas. Perhaps it's the use of an inappropriate tool for a specific job type. Outcomes from this 24/7 surveillance can include regular reporting on compliance instances (ranked by severity, location, recurring offenders, etc.), proactive alerts to affected people and their managers, or even shutting down equipment to reduce risk.

Working at height

Few operating environments are riskier than working at height, whether at the top of a wind turbine, an oil rig or a manufacturing facility. These environments often feature tight workspaces, narrow walkways and people working alone. In addition to PPE compliance, you need to ensure adherence to safety harnesses, secure tools and other height-related protocols. After all, a dropped tool is just as dangerous to the worker below as a slip for the person working at height. Visual AI watches continuously for all of these risk factors, alerting workers and managers whenever a risky situation develops and sending alerts to affected workers in real time.

Hazardous interactions

One of the most common unreported incidents? Near misses – when a vehicle comes too close to a worker, even if for only a moment. This could be a car in a parking lot, a forklift in a warehouse or even a flight line worker near a running jet engine. In many of these cases, neither the worker nor the vehicle operator is even aware that they've experienced a hazardous situation. Visual AI technology can spot these interactions in real time, alert the affected individuals or even shut off the vehicle.

Why Avathon?

Deep science

Backed by 186 patents (granted and pending), built on 12 years IP developing AI solutions for Global 500 industrial companies

Knowledge platform reasons with structured and unstructured OT, multimodal sensor and Bill of Material data

Agentic technology

Go beyond predictions to diagnose, prescribe and autonomously act across assets, people and supply chains

Vendor-agnostic, maximizing performance of diverse assets, not OEM service and component revenue

Purpose-built

Proven in the most demanding environments, from U.S. military to world's largest energy producers

Cloud-agnostic and edge-optimized, with full support for hybrid and air-gapped environments

Speed-to-value

Quick deployment, with out-of-the-box support for 40 industrial asset classes across OEMs

Easily accessible from executives to engineers and data scientists, with intuitive natural language interface

Avathon extends the lifetime of critical assets through a holistic approach to industrial AI

As an industrial AI pioneer, Avathon has spent more than a decade extending the life of critical infrastructure while advancing the journey toward full autonomy through its Industrial AI Platform, a unique approach to asset optimization. That means whether you want to maximize asset life, improve safety or streamline your operations, Avathon's scalable technology will support you through decades of technological advancement.

Deployed in over 17 countries, the Avathon Industrial AI Platform takes risks and opportunities from detection to action--proactively driving asset, supply chain and worker performance at scale and speed.

The first generation of AI tools, which enabled powerful analysis. Avathon's AI agents move beyond insights and static AI analysis, not only diagnosing potential challenges and opportunities, but prescribing best-fit solutions and automating tasks to reduce cost, complexity and time-to-market.

avathon.

Learn how Avathon's industrial AI platform can optimize your operations, create new business opportunities, and extend the lifetime of your assets.

Speak to an expert