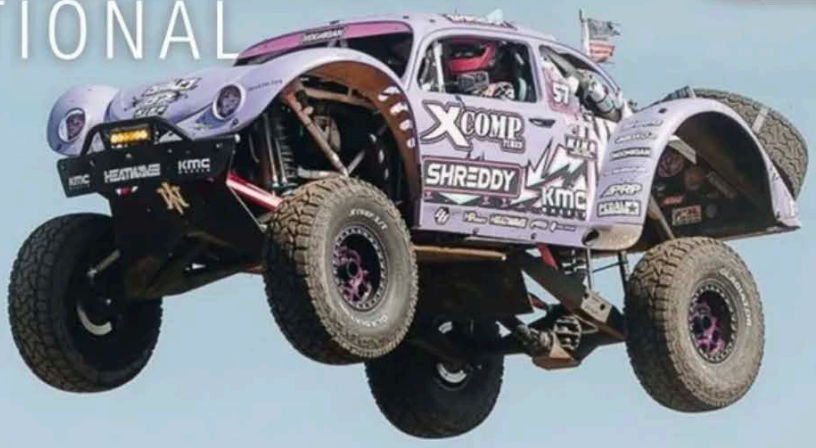
MARCH 2026

tire TECHNOLOGY INTERNATIONAL

TTI AWARDS 2026
Meet the winners of this year's Tire Technology International Awards for Innovation and Excellence
p52

INSIDE



Jeff Kreitzman, chairman and founder of American Pacific Industries, talks exclusively to *TTI* about design, quality and testing – and taking care of customers

LOFTY AMBITIONS

www.tiretechnologyinternational.com

Smart thinking

Mithun Nagabhairava, principal director for data science and AI at Rockwell Automation, explains why a structured approach – Automation Intelligence – is vital to enable reliable AI in tire manufacturing

Why do you think the tire industry is approaching AI with more caution than other sectors?

Tire manufacturing – and virtually all businesses that manufacture – operate under fundamentally different constraints from those in the tech or consumer sectors. Unlike software environments, a tire plant cannot tolerate hallucinations, instability or unverified recommendations as these can introduce unacceptable risks to scrap rates, product quality or equipment. Mixing, component preparation, tire building, vulcanization and quality inspection processes are all tightly coupled physical systems that require stability, repeatability and safety. Furthermore, good decisions in the industrial space must be based on evidence, with traceable and repeatable results.

Modern AI systems are inherently probabilistic. They generate outputs based on statistical likelihood rather than deterministic guarantees. In a tire plant, you cannot accept recommendations that 'sound reasonable' – they must be bounded by equipment limits, compound specifications, process stability rules and analysis of sensor inputs.

So, the industry's cautious approach is not resistance to innovation. AI offers enormous promise, but only if adapted to the deterministic requirements of industrial control and optimization. Bridging this gap requires a new methodology that combines contemporary AI capabilities with the foundational principles of control engineering. This approach can be described as Automation Intelligence.

What is Automation Intelligence and what does that mean in practice?

Automation Intelligence is a structured methodology for the application of AI constrained by process physics, control rules, safety requirements and governance so outputs are safe, traceable and deployable in production.

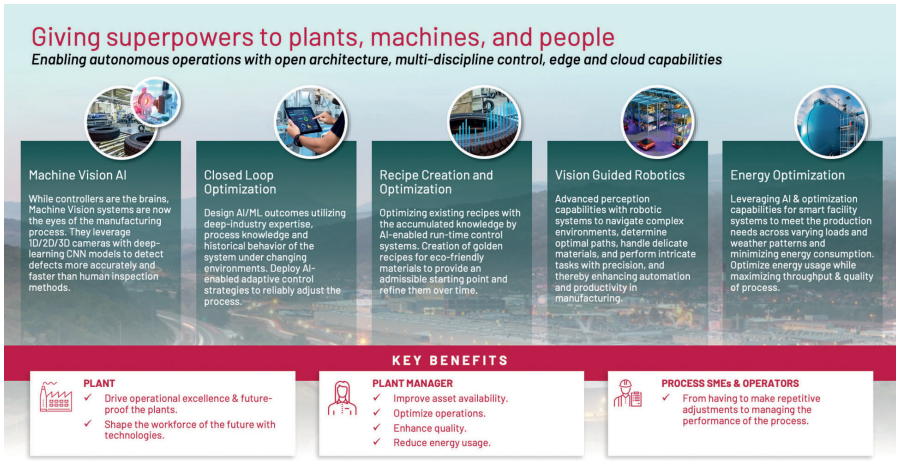
Rather than allowing AI models to generate unconstrained recommendations, their outputs are evaluated and shaped through defined process boundaries. These constraints may include physical equipment limits (such as torque, temperature, pressure and speed); quality tolerances and specification windows; process stability requirements; safety interlocks; sensing constraints and control system rules; and regulatory compliance.

For example, consider tire mixing. An AI model analyzing historical batch data may identify correlations suggesting extended mixing time and resting time sequences to improve dispersion consistency. While it may be statistically valid, it must be validated against maximum allowable mixer torque, temperature rise limits to prevent premature curing, compound degradation thresholds and impact on downstream extrusion and tire building stability. Only if the recommendation satisfies deterministic process rules would it advance to plant deployment, often first validated in simulation. This transforms AI from an advisory experiment into a disciplined augmentation layer integrated with traditional control systems for process optimization.

Many manufacturers have piloted AI projects that did not scale. Why does this happen?

Industrial organizations have now discovered, largely through unsuccessful pilots, that the path to success with AI must first resolve major obstacles to adoption: lack of determinism, insufficient traceability, difficulty integrating with MES, historian and control systems, and limited mechanisms for scaling improvements. Often, AI pilots demonstrate analytical capability but fail to integrate into execution layers safely.

Tire makers face these challenges acutely. They have globally distributed plants and long-established production architectures. Despite many tools and technologies deployed, improvements made in one location do not automatically propagate to others. The incentive to resolve



these challenges for AI adoption is huge for the tire sector – given the wealth of innovation, know-how and design embedded on the factory floor. Therefore, implementing methodologies today to resolve the challenges of AI adoption in tire manufacturing represents a major value proposition and competitive advantage.

How are autonomous operations and software-defined automation reshaping tire production?

Historically, automation logic in tire manufacturing has been tightly coupled to specific hardware and site-level implementations. Improvements to mixing control, extrusion profiles, building sequences or curing recipes were often engineered locally and remained difficult to replicate across plants. Even small refinements required manual revalidation and site-specific adjustments. Software-defined automation decouples application control logic from physical hardware. With this, control strategies can be treated as governed software assets rather than fixed configurations embedded within individual machines.

This shift is foundational for autonomous operations. A critical enabler here is deterministic simulation. Before introducing updated logic into live production, changes can be validated in a virtualized environment that models process dynamics and control behavior continuously, synchronized and augmented with running plant sensors. This ensures that modifications maintain stability under expected real-world variability and prevents unintended consequences in tightly coupled downstream processes.

Once validated, structured CI/CD pipelines tailored for industrial environments allow streamlined rollout across plants. Versioning, traceability and governance ensure that updates are repeatable and auditable.

In practical terms, software-defined automation enables faster compound profile updates when new materials are introduced, reducing commissioning time for new SKUs and enabling safer and more structured parameter updates, and greater consistency across global manufacturing sites. This agility is particularly vital today, with challenges such as electrification and sustainability calling for expanded product portfolios – without sacrificing the stability that tire production depends on.

Industrial chat agents are gaining a lot of attention. How must they differ from consumer AI assistants?

Consumer chat systems are optimized for conversational fluency, and they often respond with high confidence even when uncertain. This approach is incompatible with the rigors of tire manufacturing. For industrial applications, prioritizing operational grounding with reliability, transparency and determinism are more important than linguistic confidence.

Industrial chat agents must clearly distinguish factual data from probabilistic interpretation; cite the underlying data source; indicate confidence levels or uncertainty, and limits of system's knowledge; respect role-based access and governance policies; and escalate when beyond validated knowledge boundaries.

Based on our experience, intelligent chat agents are preserving knowledge continuity and serving as a conduit for transferring best practices from experienced operators to newer personnel, while grounding recommendations in validated data. Edge-based deployment with local storage of chat history and historical run data enables cross-shift and cross-user knowledge sharing and continuity. Any response can be deterministically traced back to the data from which it was derived. This allows operators and plant personnel to quickly diagnose root causes and arrive at better actionable information, thereby building trust in AI adoption on the plant floor.

What do you think is the future for AI in tire manufacturing?

The tire industry has accumulated decades of process sophistication. Automation Intelligence provides a methodology for applying AI in a way that incorporates that sophistication, without reinventing the wheel – it accelerates adoption of AI, yielding enhanced stability, consistency and innovation rather than disrupting them.

Through Automation Intelligence, machine vision transitions from anomaly detection to process-aware intervention, enabling true closed-loop optimization by feeding constrained, validated recommendations into deterministic control systems. Integration with MES/MOM platforms enables codification and replication of golden batch parameters across sites, while advanced optimization coordinates AGV/AMR fleets and robotic systems to improve material flow, throughput and overall efficiency.

When implemented with discipline, AI becomes not an experimental overlay but a reliable extension of the control ecosystem that tire manufacturing depends on. The result is an operational framework where systems continuously adapt, but always within defined process boundaries.