Driving innovation in the off-highway industry: Trelleborg Tires' smart solutions

Tires are connecting. As the world is moving into the era of innovation and digital transformation, the tire industry is also implementing new connected technologies under the umbrella of Artificial Intelligence of Things (AIoT), a combination of artificial intelligence (AI) technologies and the internet of things (IoT) infrastructure that is paving the way for the transformation of vehicle maintenance and performance.

In fact, real-time data processing of the actual tire usage helps not only the OEMs to examine and improve existing specifications, allowing them to adjust existing and new products to specific customer circumstances, but it is also and foremost a powerful ally in the end-users' operations.

It is not by chance that, according to the latest industry research, the global Smart Tire Market is expected to reach a value of US$ 200 billion by 2033, expanding at a CAGR of 7.8% over the next ten years, with the off-highway sector playing a consistent part in the growth.

More precisely, the benefits connected tires offer in terms of predictive maintenance, operational efficiency, and long-term cost savings are driving their adoption in various demanding applications. At the same time, as technology advances, the capabilities and reliability of smart tires are expected to improve, further solidifying their role in the future of off-highway operations.

In this complex scenario, Andrea Evangelisti, Digital Innovation & Solutions Director at Yokohama

TWS explores the evolution of Trelleborg Tires digital solutions in the tire market. *“So far, the scenario has mainly revolved around Tire Pressure Monitoring Systems (TPMS), electronic systems designed to monitor the air pressure inside the pneumatic tires of various types of vehicles, providing real-time tire-pressure information to the driver, or remotely, to the fleet manager”*, he comments.

In fact, these kinds of solutions rely on sensors placed inside the tire collecting data about internal pressure and temperature, then transmitting the information directly to a video terminal placed on vehicle or rather to the cloud and returning it back to be displayed on the chosen device. “Usually, such solutions allow for the creation of reports and the recording of statistics and analytics history”, says Evangelisti.

For example, the Trelleborg Tires’ TPMS system allows operators to measure pressure and temperature every five seconds, providing instant access to vehicle status and monitoring data through a computer or mobile devices. Furthermore, thanks to the full connectivity and cloud data transmission, the operator or the fleet manager can benefit from automated email notifications in emergency situations and personalized vehicle warnings.

Evangelisti continues “So far, these kinds of solutions have especially thrived for construction applications, integrating tire sensors with a central gateway on the machine and an online platform, offering predictive maintenance capabilities, reducing vehicle downtime, and preventing accidents”.

But what if the gathered data could also show a way to deploy adaptive solutions at full vehicle scale; for example, capable of adjusting tire pressure dynamically, based on real load sustained by tire and terrain characteristics? What if vehicles could adapt other controls linked to operations’ parameters?

“In the case of farming equipment”, Evangelisti points out “the tire sensing with the soil can also be a reliable source for information gathering and automated equipment decision making”.

As the addition of smart technologies has become part of the evolution of agricultural tires, more and more attention is being paid by producers everywhere to the effects of tire pressure on tractor performance and soil issues like compaction, since optimal tire pressure can lead productivity increase while reducing fuel consumption, improving crop yields and preventing damage of soil.

For this very reason, Trelleborg Tires has developed an Adaptive Tire Management System (ATMS), allowing tractors to always work effectively according to the application, but not only. According to Evangelisti, “The great advantages of the ATMS, when compared to a TPMS, are its new functionalities, such as the tire dynamic load, the tractor load distribution and the recommended tire pressure”. During work and depending on the type of activity, the farmer is then constantly informed on how to optimize the tractor set-up with regard to the most appropriate tire

inflation pressure and ballasting for optimized traction and floatation on soil and better set-up for road handling at lower rolling resistance.

“Consequently, while Tire Pressure Monitoring Systems (TPMS) have significantly enhanced vehicle safety and reliability by ensuring proper tire pressure, Adaptive Tire Management Systems (ATMS) represent a further evolution in the smart tire field, with a comprehensive approach that provides real-time optimization and predictive maintenance, ultimately offering superior safety, improved fuel efficiency, and extended tire lifespan”, sums up Evangelisti. As technology advances, ATMS showcases the future of intelligent tire management, setting a new standard for vehicle performance, soil performance and safety.