Putting Tires to Work: How the development of Smart Tires will change fleet economics

Author: David Shaw

Since the inventions of the first TPMS in the 1980s, the technology has advanced dramatically. In particular the development of smart phones and other portable communications technology has accelerated the development of micro sensors such as accelerometers and GPS locators. As a result intelligent tire technology is now approaching commercial reality. The first fully integrated solutions have been seen in high-value vehicles such as earthmover trucks in mines and autosport.

Tire-based electronic systems can broadly be divided into three categories. At the most basic level a sensor can be used to measure temperature and pressure. Such systems are often abbreviated to TPMS (Tire pressure monitoring systems).

The next broad category is Radio-frequency identification (RFID)-tagging. The RFID tag contains static information such as tire size, model and date of manufacture. It can be read using a reader which might be either hand-held or fixed to the gateway to a service depot, for example.

The most sophisticated devices are the intelligent tires, which carry accelerometers in addition to temperature and pressure sensors. Intelligent tires can update their information many times each second and transmit that data to a central processing unit.

TPMS are now commonplace with legislation in place in the US since 2008 and Europe since November 2014. RFID tags are routinely used during manufacture to keep track of components and also in truck tires to allow fleet managers to keep track of each individual tire. Intelligent tires, however, are only now starting to see commercial implementations in truck and bus applications. But it is not customers who are driving the development. Truck tire makers are changing their economic model. Instead of selling tires to the fleets, tire makers are selling mobility. Fleets pay according to the total distance travelled, while the tire makers provide tires and tire servicing. Under this business model, it makes sense for the tire maker to install all kinds of technology into the tire to track it and to preserve its value over an extended period. While any fleet manager could take advantage of these same technological tools, few are prepared to invest the time into understanding their tires.

Pirelli has been most vocal with its Cyber Tire system. This was initially fitted to buses and coaches in Brazil, where Pirelli carried out an extensive trial involving hundreds of vehicles. This showed tire makers that they needed to work with Telematics providers to make best use of the data and integrate with existing telematics technologies.
Following integration as a tire module within a pre-existing telematics system, Cyber Tire has evolved into a Cyber Fleet system. This can monitor pressure and alert both driver and fleet manager to issues. It also tracks total mileage of the tire by counting the number of revolutions, and it provides location data. This can be used in case of theft, and also to locate a trailer fitted with the smart tires. Truck fleets own drive units and trailer units. Often there are twice as many trailers as drive units. If those trailers lie idle, then money is wasted. Managing the trailers, locating them and minimizing idle time is one way to improve operational efficiency.

Image: Sensors in the Pirelli Cyber Tire will convey information about the tire’s grip

Michelin has also developed a passive RFID system for trucks and buses which it first tested in 2003. The system was rolled out again for the 2012 London Olympics, and has since been quietly introduced into many of Michelin’s truck tires. The company has a well-developed intelligence system for use with large-diameter mining tires, but surprisingly for a company so advanced in truck fleet operations, it has not been aggressive with electronic systems.

In June 2014, Michelin announced its acquisition of Sascar, a Brazilian company which provides telematics services. The deal was supervised by Michelin CTO, Vic Koelsch, but Koelsch left Michelin a few weeks after the deal completed, for a more attractive role with Exide batteries.
Continental, as part of an automotive electronics group, has been pushing this development hard. Most recently – in August 2015 – the company installed its ContiPressureCheck system on an electric-powered 40-tonne truck developed by BMW.

The power train in electric vehicles places a higher requirement on energy efficiency than in vehicles based on internal combustion engines. As a result, an electric vehicle requires greater monitoring of tire pressures in order to get the absolute maximum efficiency from the system.

Like Pirelli, Conti is rolling out the full telematics system in its managed fleets and to enlightened fleet operators. In passenger car, the arguments are less obvious. While engineers can promise measurements such as grip, treadwear and vertical load, these are not top of the consumer priority list. Multiple projects in the tire and car industry seek to exploit these technologies, but the commercial argument remains far from clear. If the Internet of things (IoT) is applied to tires, then the benefits in terms of ‘big data’ may help the business case.

A system mounted on vehicles and linked to GPS locations, which measures instantaneous grip as well as lateral and in-line slip could be used to alert drivers – and vehicle management systems – to specific patches of ice or low grip. Current route guidance systems can use reported average speeds to alert other drivers to traffic congestion, and re-route accordingly. If the local grip data were available, then the system could adopt similar re-routing policies to help drivers avoid danger spots. Furthermore, if a location is frequently identified as a danger spot, then local authorities can change the surface, or implement specific measures to slow drivers down.

Moving another step into the future, autonomous vehicles are expected to maximize the use of sensors. Maximum available grip defines the maximum cornering speeds and minimum braking distances. A sensor which measures the instantaneous available grip is therefore likely to be crucial to in-vehicle safety management systems, especially where there is any possibility of extreme weather or road conditions. Development of ‘smart’ tires has therefore something of an indicator of how tire makers view the future. Companies who are committed to the concept and have invested research time and cash tend to be those who also see the Internet of Things as being a part of the future. They will be the leaders as tires become more fully integrated with vehicle electronics.

**About the Author**

David Shaw runs a small consultancy called Tire Industry Research based in the UK. He has spent over 25 years as a commentator and analyst in the global tire and rubber industry and was the editor of European Rubber Journal. David takes a long-term view of the industry. Most importantly, he is independent of external influences and can offer real insights into the global rubber industry based on extensive conversations with industry leaders around the world.
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If you have any questions, get in touch via Carrie.Simon@qpc.com