MICHELIN LAUNCHES THE MEMS EVOLUTION3

Michelin EarthMover Management System Evolution3

A new step towards the use of communicating tires in mining

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Une meilleure façon d'avancer

PRESS KIT - June 2015
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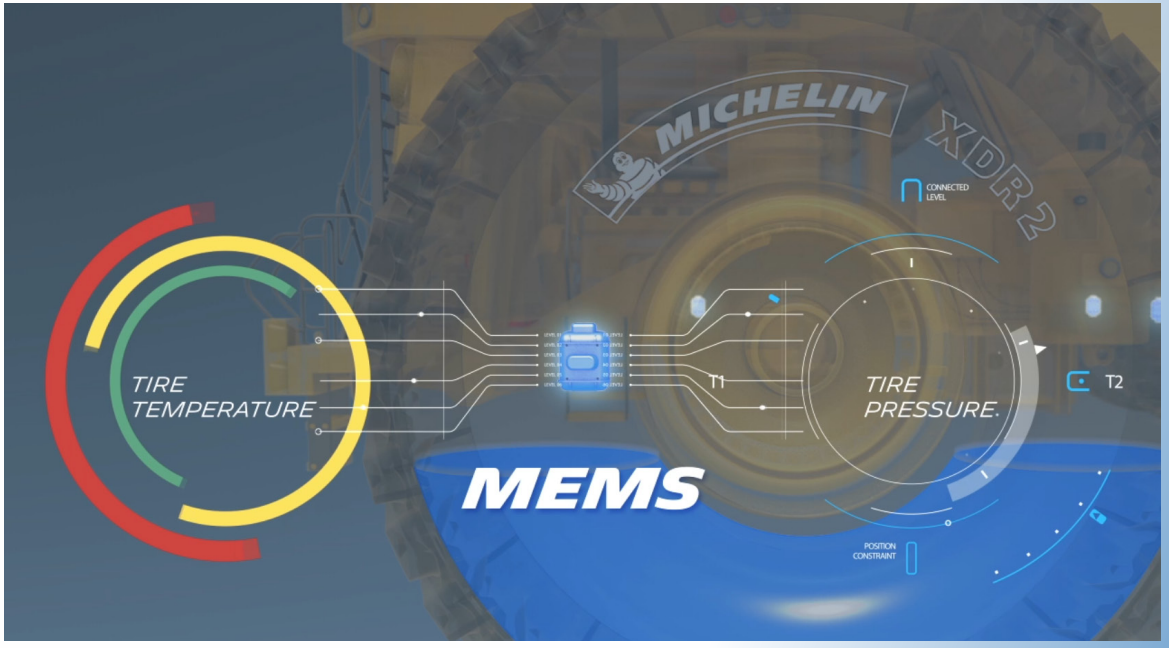
Pics and videos : http://mediaevent.michelin.com/PRESS/02_PNEUS-TYRES/GENIECIVIL-EARTHMOVERS/MEMS-3/



Welcome to the world of gigantism, 200 tonnes trucks worth $3.5 million dollars that carry loads as great as 400 tonnes up steep slopes.
The machines operating in surface mines work under the most difficult and demanding conditions. Here, the slightest problem takes on extreme technical and operational dimensions. For the operators in these mines, equipment downtime is the worst scenario. On these vehicles, changing a tire more than 4 meters tall and weighing 5 tonnes often requires more than 8 hours of work.

3G AND NEW SENSORS

A pioneer in mining tire monitoring technology with the introduction of the first **TPMS** (Tire Monitoring Management Systems), Michelin, with MEMS Evolution3, is fully introducing the communicating tire into the world of mining.
Given the extreme conditions of use, sensor reliability is paramount in the trust that mining operators place in the system.
Given that safety and reliability are core values for Michelin, the Clermont manufacturer followed an integrated approach, by designing the sensors and analytical software itself. There are two sensor models: conventional sensors and sensors for water-ballasted tires with additives, isolated in a capsule filled with an inert liquid.

THINGS TO REMEMBER

Michelin launched the MEMS (Michelin Earthmover Management System) Evolution3, an advanced tire-related data sensing and transmission system.

The MEMS Evolution3 not only gives tires the ability to communicate their temperature and pressure conditions in real-time, in addition it innovates by sending alerts to operators via various communication channels. Its features make it stand out from the strict context of TPMS (Tire Pressure Management Systems) to introduce it to the world of communicating tires. This is a major innovation in the world of mining tires.

The connectivity and integrated design of MEMS Evolution3 enables it to send real-time alerts to all mining actors through various means of communication: Internet, email, or SMS.

Michelin is increasing the operational efficiency of dumper trucks used in surface mines with this new generation MEMS. This is part of the Group's approach to offering, beyond a tire, increasing services that create added value for users.

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MICHELIN MEMS EVOLUTION3 OFFERS THE FOLLOWING BENEFITS:

- Monitoring of each tire through a unique identifier, which allows analysis throughout its entire life to improve performance in the mine.
- Real time data recording, allowing reactive monitoring of alarms.
- Connection and data transfer via 3G or Ethernet
- Sending of multichannel real-time alerts

IMMEDIATE OPERATIONAL BENEFITS

MICHELIN MEMS Evolution3 provides immediate operational gains for surface mine operators. Thanks to their on-going connectivity to the system, tires equipped with MEMS Evolution3 are able to continuously inform operators about their temperature and pressure conditions.

Thus, slow pressure losses are detected and downtime can be anticipated and avoided. Temperature increases are reported, which allows operators to change itineraries in real time. If needed, maintenance operations are also more easily foreseen. The effective running time of the trucks is thus increased.

Michelin has provided MEMS Evolution3 with a complete range of services: **MEMS engineers are present in geographical areas where equipped machinery operates.**

MEMS Evolution3 enables mine operators to enter a virtuous circle: increase safety, increase the life of the tires, reduce costs and increase mine productivity.

Sensors and data reliability are MEMS key factors.

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MICHELIN MEMS AT A GLANCE

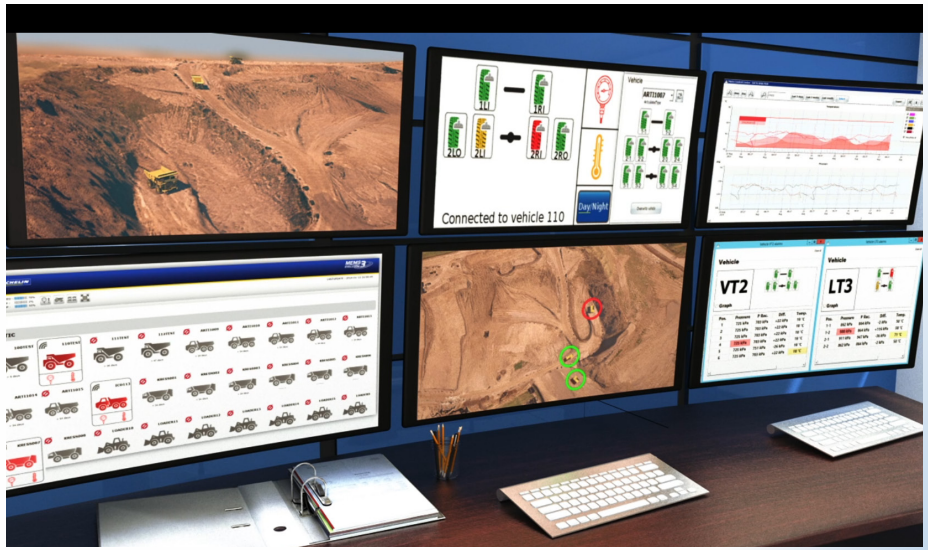
Michelin was the first manufacturer to offer an integrated tire monitoring system (TPMS), relieving operators from having to perform manual tire pressure monitoring, or having to resort to deals offered as accessories.

Since its launch in 2006 in the mines of South America, **MEMS is the most common tire monitoring system, with over 1400 rigid dump trucks equipped around the world, in 35 mines in 9 countries and on 4 continents.**

In 2006, MEMS enabled temperature and pressure data to be collected for each tire via a unique identifier and to be transmitted in real time to the control room and to a PDA device. First marketed in South American mines, it was offered on the North American, Australian and African markets the following year.

In 2012, MEMS Evolution2 became a system connected to the mine Wi-Fi network with a server allowing access to the data from any place covered by Wi-Fi. Integrated software and an industrial and ergonomic PDA terminal provide overall reliability.

In 2015, MEMS Evolution3 fully introduced the MICHELIN Civil Engineering tire into the world of communicating tires: real-time alerts can be sent throughout the life of the tire, via the Internet, email or SMS to all mine actors, wherever they may be. Multiple analysis reports with statistical indicators are also offered to mine operators.



MICHELIN MEMS is available for rigid dump trucks using tires with a diameter from 49 inches and up to 12 tires per vehicle. MICHELIN XDR2 and MICHELIN XDR250 tires are pre-equipped for MEMS Evolution3: a factory integrated patch allows the rapid installation of MEMS sensors.

Michelin, the leading tire company, is dedicated to sustainably improving the mobility of goods and people by manufacturing, distributing and marketing tires for every type of vehicle. It also offers innovative business support services, digital mobility services and publishes travel guides, hotel and restaurant guides, maps and road atlases. Headquartered in Clermont-Ferrand, France, Michelin is present in **170 countries**, has **112,300 employees** and operates **68 production plants** in **17 countries**. The Group also has a Technology Center, responsible for research and development, with operations in Europe, North America and Asia. **(www.michelin.com)**

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