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**Drilling a milestone**

*Caterpillar, Thiess and WesTrac collaboration surpasses 1M meters autonomously drilled milestone using three Cat® drills*

In April, Caterpillar, Thiess and WesTrac officials gathered at the Mt. Arthur South coal mine in New South Wales, Australia, to celebrate a major autonomous milestone three years in the making. Leading global mining services provider, Thiess surpassed 1 million meters autonomously drilled using Cat® MineStar™ technologies installed on a Cat MD6250 and two Cat MD6310 drills.

Currently with Thiess at its mining operations at Mt. Arthur South mine in NSW, the three fully autonomous drills are managed by a single operator sitting in a remote operating station (ROS) using Cat MineStar Command for drilling. However, the journey toward autonomous drilling at the mine didn’t happen overnight.

A multistep evolution toward automation saw the three companies implementing a building block approach beginning with the MD6250 drill. This required close collaboration between Thiess, WesTrac and Caterpillar, not only to implement technology but also to develop processes specific to autonomous operations, work through change management and develop new training programs for site personnel. These processes helped Thiess move from staffed to autonomous owning and operating procedures for the drills, including safe work procedures.

“Thiess’s commitment to this project and openness for deep collaboration has been a driving force behind its success,” commented Sean McGinnis, vice president and general manager of technology and global sales support for Cat MineStar Solutions. “We worked closely with Thiess and WesTrac to ensure our autonomous solution would meet their key performance indicator goals along the way.”

Thiess’s Head of Autonomy and Operations Technology, Trent Smith, added: “At Thiess, we are proud to be a leader in automation and autonomy for mining services. WesTrac did an outstanding job managing the project and providing onsite support to assist us with technology implementation, training and navigating the hurdles – including those posed by the global pandemic – encountered along the way.”

As the three companies worked together to evolve operations toward autonomous drilling, the results reported by Thiess were amazing.

* + 20% improvement in drilling performance.
  + More than 23 hours per day drill utilization.
  + Zero redrilled holes using autonomous operation.
  + Improvement in safety and reduction in fatigue by removing the operator away from the drill, noise, vibration and dust.

**Building block approach**Thiess’s path toward this major drilling milestone at Mt. Arthur South began in the fall of 2021 with the MD6250, a vision, and entry level assist technology. “The phased approach progressed through three stages of drill automation,” explained Nakia Brewer, technology and solutions manager for WesTrac, “operator machine assist (OMA), semi-autonomous drilling, and full autonomous drilling with collision avoidance.

Caterpillar offers diverse levels of autonomy as a building block approach to autonomous drilling. Catdrills, with on-board and expanded Cat MineStar technologies, provide a range of capabilities that enable drilling systems to be configured to meet budgetary and site needs.

The journey into autonomous drilling begins with onboard Drill Assist automated functionality, which is broken into three major machine functions:

* Auto Level – provides machine leveling and monitors conditions to ensure it can adjust or lock out if there is an issue.
* Auto Mast – the drill independently raises the mast to the ideal angle for the drill pattern.
* Auto Drill – eliminates over- or under-drilling by enabling configurations for site- and ground-specific parameters like hole diameter, depth and drilling method.

McGinnis explains Auto Drill assumes a greater level of complexity and is available for both rotary and down-the-hole (DTH) drilling modes, and in single- or multi-pass applications. “Under most geological conditions, Auto Drill technology enables drilling without operator intervention and monitors and reacts to complications like clearing a hole that has elevated fall back,” he said. “Due to variations in cutting tools used and ground conditions, our drills use onboard drilling algorithms to adapt to and work through complicated ground conditions without operator input.”

**Further automation with Cat MineStar**

Cat MineStar Solutions continues the journey to autonomy. MineStar Terrain for drilling provides precision guidance to help complete patterns accurately and productively. “The state-of-the-art guidance technologies with Terrain help ensure holes are correctly located and drilled to the correct elevation,” commented Brewer.

Cat MineStar Command for drilling is the final autonomy building block. Early in the program, Thiess equipped the Cat MD6250 with OMA technology, which leverages Terrain for drilling and its existing network backbone to gain operator buy-in and start seeing the benefits of autonomous drilling, while keeping their operators on board the drill.

OMA allows the operator to select a row, and the machine automatically navigates from hole to hole and drills each one in that selected row. It leverages Drill Assist auto functionality, the GPS and navigation package of Terrain for drilling. “OMA increases productivity and positional accuracy of the tramming, ensuring the drills consistently match design, which goes a long way in instilling confidence in the system,” said McGinnis.

Smith added, “After installing OMA on the MD6250, we immediately saw the value of the technology and how it could enable better drilling performance for our operations.”

The next step for Thiess was to remove the operator from the cab. Command for drilling offers two levels of autonomous drilling for multiple drills – line-of-sight (LOS) and non-line-of-sight (NLOS). Thiess opted for the NLOS autonomous drilling system using the ROS to position the operator away from the drilling site.

It is from the ROS that the company operates three fully autonomous Cat drills and achieved a first of simultaneously operating the three Cat autonomous drills – a multi-pass MD6250 and two MD6310s equipped with Auto Multi Pass – with one operator.

The close teamwork between Caterpillar, WesTrac and Thiess is driving the success of the full autonomous system at Thiess’s operation. And it is through this collaborative effort that Thiess was able to successfully drill 1 million meters with Command for drilling.

Beyond the operational benefits of improved and consistent drilling performance, increased utilization, and lower rework costs, Trent Smith cites the significant people benefits gained with the autonomous drill program. “It improves safety for our operators, helps to reduce fatigue by allowing them to take short breaks without interrupting drilling operations, and presents more attractive opportunities for upskilling to work with the latest technologies,” Smith said.

To date, Thiess has upskilled more than 30 of its people at Mt. Arthur South from traditional drill controllers to autonomous operators, and a range of other support functions during the million-meter journey. And more broadly, it has invested in autonomous mining systems training for more than 500 employees.

**Full family integration**

Both the Cat MD6250 and MD6310 drills share common platforms, parts, components and technologies to help Thiess maximize lifecycle value, streamline operator training and lower operating costs. Every drill component and subsystem are matched to work together as a system for increased uptime, greater efficiency and low cost-per-meter drilling.

The MD6310 drills hole diameters from 203 to 311 mm (8 to 12.25 in) with single-pass bit loads reaching 42 149 kg (92,922 lb). Single-pass hole depths reaching 13.7 m (44.9 ft) and 17.5 m (57.4 ft) are achieved when equipped with the 13.7 and 17.5 m mast, respectively. Multi-pass hole depths with the 13.7 m mast reach 74.6 m (244.9 ft), while the 17.5 m mast drills down to 48.0 m (157.4 ft).

Reaching bit loads of 32 655 kg (71,993 lb), the MD6250 drills hole diameters from 165 to 200 mm (6.5 to 9.88 in). It can be equipped with either an 11.2 m (36.7 ft) or 13.6 m (44.5 ft) mast. Multi-pass drilling depths reach 53.9 m (176.7 ft) with the 11.2 m mast, while the 13.6 m mast offers up to 37.9 m (124.6 ft) multi-pass depths.

To improve safety and prevent potential failures or misuse, both models are built with proven Cat electronics and interlocks. Electronic compressor regulation boosts productivity while reducing fuel burn. The Cat Electronic Technician provides onboard health monitoring for Thiess for fast troubleshooting to increase drill uptime availability.

“The impressive results achieved with Thiess can be replicated with other miners to improve their operations with drilling autonomy,” concluded McGinnis. “We look to continue collaborating with Thiess and WesTrac and look forward to the millions of meters to come.”

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