

USA MINING & CONSTRUCTION



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A DISTANCE**

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MECHANIZED ROCK
EXCAVATION WITH
ATLAS COPCO

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Atlas Copco

Proof of concept

Minntac takes Pit Viper Teleremote for a test drive

United States Steel Corporation has been undergoing a transformation of its core business processes amid challenging markets since 2013 with a series of program strategies they are calling “The Carnegie Way.”

Located on the Iron Range, a formation of taconite in northern Minnesota, U. S. Steel’s Minntac Mine is looking to technology. Teleremote-drilling operations touch upon many of the company’s values, supporting continued sustainability through increased efficiency for generations to come.

The teleremote capability of the Atlas Copco Pit Viper 351 rotary blasthole drill rig was introduced to the Minntac operation so the company could see how it integrated into its existing operation. Remote operation of a drill rig generally gives mines safe access to areas that are otherwise difficult to drill or muck. It can also give a single driller the ability to operate multiple rigs simultaneously from one operating platform. This improved

performance, greater productivity and enhanced safety are key principles of The Carnegie Way initiative.

Matt Luoma, Area Manager of Mine Engineering and Development at Minntac, said: “We just don’t have the safety issues some other mines are faced with. We have competent rock and good drilling conditions throughout our mine. So we wanted to look at the teleremote Pit Viper as proof of concept regarding increased efficiency: Will it increase productivity?”

Teleremote operation eliminates some of the crew’s non-drilling duties, such as inspecting the area around the rig prior to tramping, raking the cutting pile, plugging the hole, etc. Patterns can be completed faster since drilling is controlled from a distance. Tasks are reduced that allow the driller to operate multiple rigs at one time, whether the rigs are on the same pattern or in separate pits.

This is already being done in a Canadian operation, where drillers are oper-

ating two rigs from the same teleremote control station. And in one Australian mine, a driller operated an Atlas Copco Pit Viper drill rig from his remote operating station 1,347 kilometers (837 miles) away from the rig. In theory, a rig could be teleremotely operated from a control station anywhere in the world.

Minntac first wanted to see how well their experienced drillers would adjust to operating a rig without physically being in it. “We expected some pushback,” Luoma said. “But actually, our drillers are all for it.”

Minntac driller Casey Sundahl had no problem making the adjustment, though he admitted he was at first apprehensive. “Drillers get used to drilling ‘by the seat of their pants,’ ” he said. “Eventually they begin to rely on feelings and sound, so they are unsure what will happen without those sensations. I was worried about it, too, at first. When the bit starts to bind, the string wants to bounce around. You can feel that in the rig. But I learned right away the cameras



and gauges more than make up for those sensations."

The mine committed two weeks for the demonstration period, allowing each driller three days to operate their diesel-powered Pit Viper 351 drill rig from the remote station. Although the teleremote unit was on loan from another mine and had been customized to its specifications, the system is compatible with other rig models and was adapted for use with Minntac's PV-351 without any problem.

Sunsdahl said teleremote drilling might have even refreshed his drilling skills. "In teleremote operation, you really have to rely on your gauges more. But that's not new. You were always supposed to be watching your gauges. When I try to compare it, I think the difference is, before I would watch my gauges to get a second opinion about what I believed was happening. In teleremote, gauges are primary, not backup."

"Just look at the views you get from these cameras." Sunsdahl zoomed in on the drill string until the revolving pipe nearly filled his screen. "You can't see it this well from the rig's cabin."

Then he panned up the drill string to the rotary head. "And you can't see up the tower from your cab seat, either." He panned around the rig, then out to survey the entire bench. "I can see in all directions, so I know for sure no one is on the bench. I can see any possible obstacles before propelling the rig."

As for drilling operations, "It's basi-



cally the same," Sunsdahl said. "The only thing I had to learn was synchronizing the rig."

Sunsdahl said it's simple to synchronize the remote platform with the drill. First he boots up the remote station, and then goes to the rig to boot up. By the time he's done with his pre-shift inspection and back to the teleremote cab, the drill is ready to go. He said, "If someone else was there to do the pre-shift inspection and boot up the computer, I wouldn't have to go to the rig at all."

To test the operation of the teleremote unit at Minntac, line-of-sight radio signals were used for simplicity. Atlas ▶

Driller Casey Sunsdahl says operation of the Atlas Copco PV-351 is no different from 100 feet above and 1,000 feet away from the rig than if he were in it. At first he worried about not feeling the vibrations and hearing the sound from the rig cabin. "I learned right away the cameras and gauges more than make up for it."



Minntac cordons off the drill site during the demo. The sign reads, "Remotely operated equipment—Authorized personnel only," followed by the radio channel to contact the operator.

Copco drill trainer Bryan Scoggin, who was on site throughout the two week test period, said mining operations would typically run teleremote over their own wireless network, bandwidth permitting. Alternatively, mines can set up a separate wireless network dedicated to teleremote operations.

The teleremote control cabin set up for the test was the newest style of Pit Viper cabin mounted on a trailer. “The only thing it doesn’t have that would make it totally self-contained is a bathroom,” said Luoma. The cabin offers a larger, roomier interior with plenty of storage space, audio, power and climate controls. The remote operating station can be made to order.

Scoggin said, “One mine wanted its station set up in a pickup truck. So we removed the passenger side seat for the displays and control and put a little generator in the bed. That operator can drive down, do the rig inspection, boot up its computer, then drive back up to his remote location far from the drill.”

PEACEFUL DRILLING

Sunsdahl rated drilling conditions for the ore body at this location as “medium hard for this mine,” with a drilling rate averaging about one minute per foot. Total depths specified for this pattern’s 150, 16-inch-diameter blastholes ranged from 35 to 50 feet.

Sunsdahl watched the rig control system monitor as his rig lined up over the hole, a green circle on the white display. He leveled up, checked air and water, and started the drill. Except for radio communications, there was no other sound in the rig and no vibrations—an extreme contrast when compared to the typical environment a driller experiences as 100,000 pounds of downpressure is applied to a tricone bit on taconite and his 400,000-pound Pit Viper shakes on its tracks. The bit generally makes a screaming noise like steel on steel until it settles deeper into the bore hole.

Real-time images on the drill platform’s camera monitor showed the drill string slightly binding soon after the bit entered the ground. “The computer sorts this out. We’re drilling in competent rock, except for the surface. It’s a little bit fractured. That’s normal. But some



Atlas Copco drilling trainer Bryan Scoggin.

of that rock breaks free in big enough chunks to bind up the tricone. It could get stuck, but the rig has such great software that won’t happen,” Sunsdahl said.

“Normally I’d feel the string thrash or want to bounce around on the rig. I thought I needed to feel that so I could correct the bit’s down-pressure. But I see it just fine on my monitor and by watching gauge pressures. Did you see how the computer immediately backed off weight on bit to get rotation back? That’s exactly what I’d do, but I didn’t need to touch it.”

SAVING TIME BY ELIMINATING UNNECESSARY PROCEDURES

Because of rigorous safety standards to protect anyone who may be on the ground around the drill rig, standard drilling procedures at many iron mines in this region require drillers to exit the rig after each hole to reposition using a remote control.

The process is time consuming. Drillers must inspect the immediate environment for tramping obstacles, de-level the rig, propel away from the hole, exit the rig to rake down the cuttings pile, plug the hole, move the rig to the next hole 30 or 40 feet away, center over the next survey stake, then climb back in to level the rig before drilling can continue.

Teleremote operation renders most of this protocol unnecessary, as drillers



Only the roof of the teleremote operating station can be seen atop the bench in the distance. The operator is 100 feet above and 1,000 feet away from the Atlas Copco PV-351. Line-of-sight is not required, however. The system has been demonstrated from distances as great as 837 miles. Theoretically, a rig can be operated from any location in the world.

don’t need to leave their control station. De-leveling, tramping, centering and leveling up take as little as two minutes for the same pattern spacing. Raking and plugging are still required but can be done all at once upon pattern completion or at shift’s end. And in Northern Minnesota, where winter temperatures are extremely cold and can be icy on the stairs and bench, the operator is safe and warm in the teleremote cab.

Luoma said, “Just how much time is saved waiting to rake and plug the holes all at once rather than one at a time? We’re studying that.”

Should Minntac opt for the teleremote control station, Luoma said the ultimate goal will be to cross-train all drillers on it. ■