Cameco 'Pushes' New Borehole Survey Method

A mechanized, power-utility industry tool used for driving rods through crowded electrical conduit finds a cost-saving niche in underground exploration drilling

Uranium producer Cameco is on track to begin early-stage mining activity next year at its Cigar Lake project in Saskatchewan, Canada, with full production targeted for 2017. (Photos courtesy of Cameco and General Machine Products)

Cameco Corp.'s Cigar Lake uranium project located in northern Saskatchewan, Canada, is considered the world's largest undeveloped high-grade uranium deposit. Cigar Lake is currently in development with a target to begin commissioning the mining process in ore by mid-2013, with a ramp-up to full production by the end of 2017.

The Cigar Lake Technical Services Group—the company's on-site engineering team—along with the Geology department, has used geotechnical drilling rigs to deploy lightweight borehole survey tools for orientation mapping and geotechnical logging of underground boreholes. However, the geotechnical rigs—large, powerful tools meant for high-thrust applications—are labor intensive and expensive to operate, and that money is better spent on the drilling operations they were designed to do.

"The drills are in high demand for use in conventional applications," said Devon Loehr, Cameco mechanical engineer. "So, availability of the drills for survey tool deployment, and crews to run them, is limited."

The Technical Services Group (TSG), realizing that using geotechnical drills for survey probe deployment was inefficient, sought an alternative approach—one that was smaller, compact and mobile—that could accommodate their need for deployment of survey probes, weighing approximately 10 to 50 lb each, into overhead vertical 5-in.-diameter boreholes.

While searching the Internet, TSG discovered the Powered Duct Rod Pusher by General Machine Products Co. (GMP) of Trevose, Pennsylvania, USA. The device is designed for pushing continuous lengths of specialized fiberglass rod through utility conduits. Prior to the development of the Portable Powered Duct Rod Pusher, utility construction work crews usually had to manually push ⅜- or ½-in.-diameter fiberglass rods into conduits 1,000–1,200 ft long—a method that was difficult and time-consuming.

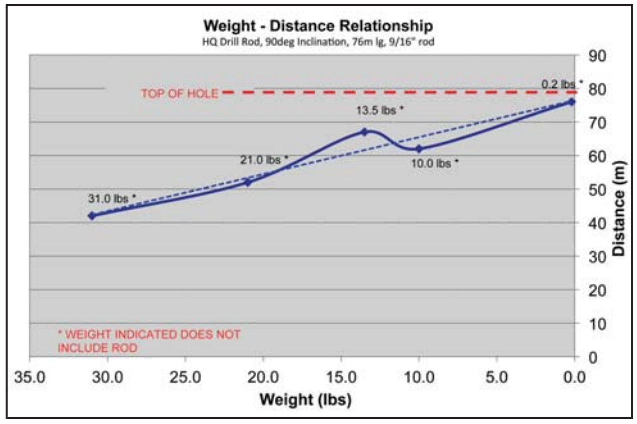
The introduction of GMP's Portable Powered Duct Rod Pusher changed all of that; the mechanized pusher was able to muscle rods through crowded or collapsed conduits without human effort. The machine features two opposing drive tracks that securely clamp down on a fiberglass rod. Its hydraulic drive motors then push the rod into the conduit with a force of about 300 lb at speeds up to 130 ft/minute (substantially more force than two men can generate on a continuous basis). Once the rod is pushed to the end of the conduit, a pulling line is attached to the end and pulled back by the machine. The conduit is now prepared for pulling a cable using the pulling line.

"The Portable Powered Duct Rod Pusher proves to be a very efficient way to rod and place pull lines in utility conduit systems," said Bob Young, sales and applications engineer for GMP. "It can be up to four to six times more productive than traditional hand work methods."

The original design enabled the device to push fiberglass rod along relatively horizontal planes, handling just the weight of the rod itself plus friction. But, was the pusher powerful enough to push rods 200 ft vertically, Loehr wondered. While it could generate 300 lb of force with its hydraulic motor system, the TSG team needed to push up to 50 lb of survey instruments plus the weight of the rod. They also wondered if the standard ½-in.-diameter fiberglass rod would be stiff enough to vertically deploy the load into a 5-in.-inside diameter, steel-cased borehole.

The Portable Powered Duct Rod Pusher by General Machine Products Co.

The GMP Vertical Rod Pusher frees up geotechnical drills, such as the one shown here, from survey tool deployment assignments.



Results of original, simulated tool-weight test results for the rod pusher in a mine environment.

GMP built a prototype specifically to meet the needs of Cigar Lake's unique application. This first prototype needed only one modification: For use in the mine, GMP replaced the gasoline engine driving the hydraulic power pack with a 600-volt electric motor. Loehr also had GMP supply a ½-in. Duct Rodder (in its normal cassette) and the Portable Powered Duct Rod Pusher without its carriage. Cameco would fabricate a frame for mounting the power pack and pusher (also referred to as the drive head).

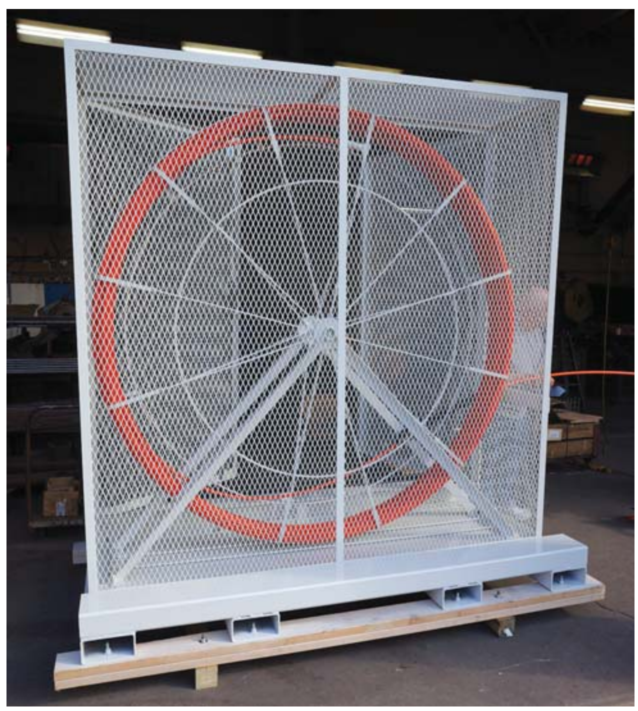
Once the GMP equipment arrived at the mine, additional modifications were made in preparation for underground vertical borehole testing, including a skid to which the power pack and drive head were attached, and a cage that contained the Rodder and cassette.

After the preliminary work was completed, the Portable Powered Duct Rod Pusher was put to the test. The first trial sent a bare rod (without tool weight) up a 258-ft-long, 3-in.-diameter, near-vertical borehole. The machine easily pushed a distance of 252 ft under those conditions. After that, different simulated tool weights were added and the results were measured for each test. Testing conducted with standard ½-in. rod proved sufficient to deploy simulated tools of various weights to distances of 137 to 252 ft. This satisfied the deployment requirements of several existing survey instruments.

But the tests also exposed issues concerning the stiffness of the fiberglass rods; they were bending, snake-like, from tool weight and self-weight, thus creating friction against the inner wall of the borehole. Because long-term applications would require deployments into even larger (up to 5-in.) boreholes, "we needed to solve the serpentine problem," Young said.

To achieve the desired distances and borehole diameters without rod deflection, GMP provided a thicker, stiffer 5/8-in.-diameter fiberglass rod. However, the thicker rod required a much larger storage cassette. GMP fabricated this to accom-

Vertical Rod Pusher and electric hydraulic power pack mounted on Cameco-fabricated deployment frame.



New ⅝-in.-diameter rod cassette and cage. The cage is 8 ft square x 53 in. wide.

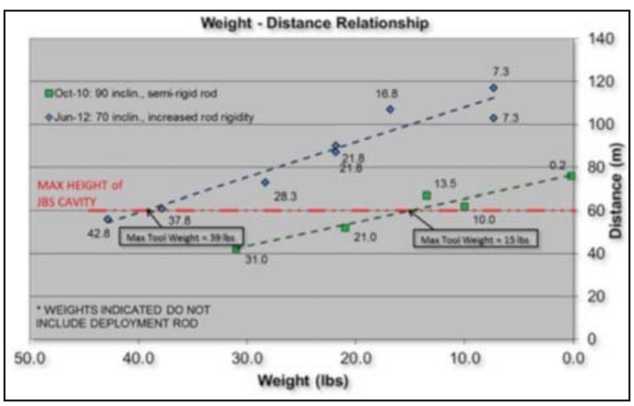
Retesting at McArthur River mine.

modate a larger minimum radius for curvature. Although the storage cassette was relatively large and cumbersome, its primary purpose was containment of the rod during transport from surface to underground. Once the storage cassette and rod were underground, the required rod length would be cut from the reel and stored on pipe racks on the tunnel walls.

With the final modifications complete, the new rod type was tested. In order to better simulate the actual conditions of the long-term application, the retesting was carried out in a longer and larger borehole (the largest diameter available at the time of testing) at Cameco's nearby McArthur River operation.

The results from retesting significantly longer deployments, within larger diameter boreholes, and with greater tool weight loads, were positive. The new, stiffer rod provided deployment of vertical distances of 180 to 377 ft, with simulated tool weight loads of 42.8 to 7.3 lb respectively. Results from testing with the original diameter rod are also shown in the figure below for comparison.

The capacities and distances achieved with the customized 'Vertical Rod Pusher' are expected to easily satisfy primary long-term application requirements involving a 200-ft deployment of approximately 25 lb within a 5-in. borehole diameter. The new, stiffer rod allows deployment weights of up to 39 lb, within a 4-in. borehole diameter, at a distance of approximately 200 ft.



Data from retesting at McArthur River.

Test probe, McArthur River mine.

The success of GMP's new Vertical Rod Pusher eliminated the need for very expensive geotechnical drilling operations for deploying survey instruments at Cigar Lake, where it will contribute to savings by reducing labor and equipment inefficiencies. Time will be the ultimate judge, but for now, the new Vertical Rod Pusher offers a potential solution for other mining companies that have similar application requirements.

"GMP came through for us," said Loehr. "They were responsive to every suggestion and engineering request. Together, we have developed a cost-effective solution for a troubling and expensive mining application. I'm glad we partnered with GMP."

Information for this article was provided by Cameco and General Machine Products Co. Devon Loehr is a mechanical engineer with the Technical Services Group of Cameco's Cigar Lake project. Bob Young is a sales and applications engineer for General Machine Products Co. He can be reached at (215) 630-6264 or ryoung@gmptools.com.

Serving the Power Industry—from Opposite Ends of the Spectrum

Cameco is one of the world's largest uranium producers, accounting for about 16% of the world's production from its mines in Canada and the US. Its leading position is backed by about 435 million lb of proven and probable reserves and extensive resources. Cameco holds land positions in the world's most promising areas for new uranium discoveries in Canada and Australia as part of an intensive global exploration program. Cameco is also a provider of processing services required to produce fuel for nuclear power plants, and generates 1,000 MW of clean electricity through a partnership in North America's largest nuclear generating station located in Ontario, Canada.

General Machine Products Company, Inc., is a global supplier of a wide range of products for the telecommunications, power utility and cable television industries, and the contractors who serve them. Product applications include the placement of fiber optic, copper conductor, and coaxial cable both aerially and underground. GMP's aerial cable lashing machines, Adams® continuous duty winches and fiber optic cable pullers are accepted as the industry standard. The complete line of GMP's 1,100+ products also includes cable reels and aerial blocks, cable cutters, unique RJ plug pressing tools, fiber optic cable blowing equipment, and other specially-designed tools for the data, telecommunications, and power utility markets.

