A
ter something of a barren period since
the 1980s, Caterpillar is finally making
inroads into the Chinese mining market
with its larger trucks, in a country that in recent
years has tended to see delivery of Komatsu and
the former Terex/Bucyrus Unit Rig line, which of
course is now part of Cat. Coal major, Shenhua
Group, set in motion plans recently to develop
the Xinjiang Zhundong coal field in Wucaiwan,
China into a modern, efficient, large-scale
mining base. Shenhua has opted to partner with
Caterpillar and China Gezhouba Group
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Corporation, a Chinese company known for
leading many large-scale projects, including the
Three Gorges Dam, to use Caterpillar 793D mining trucks as the coal mine’s
primary transportation equipment. The success
for the 793D follows the delivery of seven 789C
mining trucks to Benxi Steel’s Nanfen iron ore
mine in 2010.

Caterpillar states: “Long Xiaoming, Deputy
General Manager for project contractor
Gezhouba Xinjiang Engineering Co Ltd, was
excited about his company using Cat’s 793D
mining truck for the first time. He knows that
purchasing cheap equipment requires a smaller
upfront investment, but cheap equipment
cannot help reach high production capacity and
high efficiency. Conversely, Cat equipment is
perfect for big projects in harsh environments
because of its great performance, high efficiency
and low failure rate. A good example was the
positive results in using Cat equipment in the
construction of the Three Gorges Dam.” The
793D mining trucks are being used with other
Cat equipment such as wheel dozers, graders
and loaders.

Cat dealer, China Engineering Limited Xinjiang
(CEL), and Caterpillar Global Mining jointly
delivered the first four 793D large mining trucks
to Gezhouba Xinjiang in October 2011. CEL and
Gezhouba have signed a Maintenance and
Repair Contract (MARC), which was the first
MARC contract that Caterpillar has signed in
China. Attendees at the truck delivery ceremony
included Mining Sales & Support Vice President
Chris Cuffman, Asia Pacific Distribution Services
Division Vice President Rob Charter, Greater
China and Korea Mining Region Manager Kebao
Yang, and CEL Managing Director Jeffri
Davidson.

“We have co-operated with Caterpillar for
many years. We had visited Caterpillar factories
many times and we fully trust the products and
services of Caterpillar,” said Hu Kaijiang,
Chairman of Shenhua Xinjiang Energy.
Caterpillar believes that the introduction of the
793D large mining trucks, along with Cat track-
type tractors and Cat motor graders will
increase the customer’s overall
operation efficiency, “which will also set a
model for mining industry in Xinjiang.”

In smaller Chinese mines, Chalco Guangxi
mine is the first karst accumulation type
aluminium mine in the world. The orebody
consists of shallow and thin layers of ore that
are spread throughout the mine site. As a result,
mining operations must cover a large area. The
scattered mineral occurrence makes it difficult
to form major transportation routes, and the
rainy conditions keep roads wet and muddy
most of the time. The operation chose Cat
equipment including bulldozers, scrapers,
hydraulic excavators and articulated trucks, of
mainly used in mine development, stope preparation and reclamation operations. The site’s haulage fleet consists of 12 Cat 740 ADTs, purchased in 2010 due to their suitability for the difficult terrain.

As previously covered in IM, Chinese mining truck supplier XEMC has successfully shipped machines to Rio Tinto in Australia. On May 31, 2012, the company celebrated its first export to Australia of three SF33901 240 short ton electric dump trucks, with a delivery ceremony held at the factory in Xiangtan. The deal represents XEMC’s first export, with the rest of the fleet operating mainly in lignite mines in Inner Mongolia. XEMC owns full independent intellectual property rights of the truck, and sees the Australia move as a sign that China’s domestic mining equipment suppliers are achieving breakthroughs in the international market. In May 2011, the company had formally signed the agreement with Rio Tinto for the SF33901 order.

In addition to XEMC, it has been reported in the Chinese press that MCC (Xiangtan) Heavy Industrial Equipment, the Chinese manufacturing partner in the much talked about 400 short ton ELITE 6000 truck project, Detroit Heavy Truck Engineering (DHTE) joint venture, has signed an agreement to deliver the model, now being referred to as the HMTK 6000, to Fortescue Metals Group in Australia. No mention is made of DHTE in the report.

In May 2012, SANY signed a purchase agreement with T&C Heavy Equipment in Vietnam for delivery of seven 55-t SRT55C mining trucks. The vehicles will be used for coal-mining by COC SAU KTV, a subsidiary of Vietnam Coal Group, the largest open cast coal-mining company in Vietnam. On the first day at work, all the SANY trucks are reported as having operated efficiently, successfully moving 160
SURFACE MINING TRUCKS

The HMTK 6000 truck, which Fortescue has been reported as signing an order for, loads totalling 31.6 km, and transporting a total of 3,520 m³ of material. SANY also offers a 95t capacity model, the SRT195.

Moving from China to Canada, Detour Gold, the major first customer for the Caterpillar 795F AC truck first initiated construction activities for the Detour Lake open pit mine in November 2010 following receipt of approvals from the provincial government. Federal approval was obtained in December 2011. Construction is now 75% complete and remains on schedule for gold production to start in the first quarter of 2013. The 2012 pre-stripping operation is well underway and is supported by eight haul trucks, two hydraulic excavators and two additional rope shovels. The production rates are steadily increasing and have now reached a peak of nearly 120,000 t/d. The Company is still targeting to have up to 3 Mt of ore at an average grade of 0.8 g/t Au available for processing prior to the commencement of operations. In addition to the current pre-stripping fleet and in preparation for the 2013 production plan, the company will have by year-end 2012 a total mining fleet at site of 26 haulage trucks – 20 Cat 795F AC and six Cat 777F trucks – which will be joined by two 6060FS hydraulic excavators and two 7495 rope shovels and two smaller 385 hydraulic machines for ore loading.

Autonomous trucks

Rio Tinto has reported that its driverless trucks have achieved a new milestone at Yanacocha mine under its Mine of the Future programme. Rio Tinto and Komatsu Ltd celebrated a new milestone when the new 930E-AT driverless trucks recently commenced haulage of high grade ore at the Yanacocha mine in Western Australia. The Junction South East (JSE) pit now has a fleet of 10 Komatsu driverless haul trucks which will move high grade ore for the first time, marking a major step towards full operational deployment of the project. The trucks will be used for all haulage requirements in the pit, moving high grade, low grade and waste material from multiple loading units. Rio Tinto Iron Ore Chief Executive Sam Walsh and Komatsu President and CEO Kunio Noji, were at Yanacocha for the opening of the JSE autonomous pit.

Walsh said: “The deployment of these trucks at Yanacocha is the next step in our programme to introduce over 150 driverless trucks to our Pilbara operations, making us the world’s largest owner and operator of these vehicles. Autonomous haulage is an important component in our Mine of the Future programme. These new trucks will work with our pioneering Operations Centre that integrates and manages the logistics of 14 mines, three ports and two railways. They will be a critical part of our drive to outstanding safety and production efficiency as we grow our business towards 353 Mt/yr. Rio Tinto has been using Komatsu’s advanced truck technology at our mines, for almost 20 years.”

Noji said: “I am extremely pleased to witness this next stage in the expansion of our partnership with Rio Tinto. Komatsu and Rio Tinto are global partners and have developed a strong alliance throughout the years. We are confident that our leading-edge Autonomous Haulage System (AHS) technology will accelerate Rio Tinto’s Mine of the Future objectives through improving safety and mine operations.”

The deployment of the driverless truck fleet forms a key part of the Mine of the Future programme. Launched in 2008, Mine of the Future, “creates next generation technologies for mining operations resulting in greater efficiency, lower production costs, and improved health, safety and environmental performance” according to Rio Tinto. The mining group has been testing the Komatsu AHS, the world’s first commercial autonomous mining haulage system, in the Pilbara since December 2008 at West Angelas. During the trials the AHS technology demonstrated benefits in health, safety and productivity.

At MINEEXPO, Komatsu will be displaying a wide array of surface mining equipment. Richard Smith, Director Product Marketing and Planning for the Mining Division at Komatsu America told IM: “The range will include electric and mechanical drive haul trucks, wheel loaders, dozers and hydraulic shovels as well as specific information on recent innovations highly desired by the mining industry. There will be ample opportunity for customers to speak directly with our product experts on the benefits of Komatsu equipment from a quality, reliability and feature perspective. In addition, Komatsu will provide valuable information to help mining companies utilise their Komatsu equipment to full potential through information exchange opportunities on the MINEEXPO show floor. Mining companies will also be able to see the full Modular Mining suite of products and learn what those products can do for their operation.” In the wider market, the Sishen iron ore mine in South Africa is one of the most recent 960E customers, which are being used for waste haulage as part of the major expansion at the site. The trucks are performing well, with availabilities meeting expectations.

Fleet maintenance solutions

GE has reported on a successful deployment of its Proficy MaxxMine solution on haul trucks at an un-named mine in Australia. Because it saw quick results, the company decided, within six months, to expand the solution to the remaining mines in its Australian operations and thence to expand the solution to mines in Africa and South America. The company also is investigating addition of the solution to more assets, mobile and non-mobile, including dozers, excavators, longwall miners, draglines, pumps, crushers, and mills.

GE states: “The company saw the need to move to condition-based maintenance. It wanted a simple and low-maintenance solution that would automatically identify problems, focus maintenance efforts, and work across the entire fleet. It started its project by focusing on the critical haul-truck fleet. Haul-truck maintenance costs were high, and replacement costs were staggering, at a cost of A$200,000 to replace an engine and A$5 million to replace a...
truck. An even larger expense was the potential lost production that occurred when a truck was unavailable."

Even though the equipment was supported by the OEMs, coverage did not include all the assets, particularly the older vehicles. In addition, each OEM has its own solution, which resulted in a fragmented approach to monitoring. Also, GE states that the OEM systems were not user-friendly: "With a large number of parameters to track for each truck, approximately 30 trucks per site, and readings coming in every hour, engineers had too much data and too little time, since they needed to manually analyse the data to dig for problems."

The company approached GE after hearing about the Proficy MaxxMine solution and a pilot project was set up to prove its potential value to the specific situation. GE comments: "Within two weeks, we were able to build a model for an engine that had failed. By blindly analysing the machine's historical data and comparing it to the model of expected behaviour, the Proficy MaxxMine solution automatically identified the deterioration early--five days before failure. The company was pleased with this test and proceeded with joint development of the first version of a solution for rollout."

The mining group rolled out the solution to all its haul trucks at a mine in Australia and monitored them from a central M&D centre. Within six months, GE states that the solution proved its value in conjunction with other interventions that were implemented on the site – increasing fleet availability from 70% to 85%.

As an example of problems that the Proficy MaxxMine solution identified early, the software indicated that a truck's exhaust temperature was out of normal operation. This pointed the engineers to a faulty fuel injector. The system also showed oil pressure problems. The mine detected fuel dilution in the oil of the engine, which resulted in a pressure drop. Fuel dilution is deadly for an engine because it degrades the oil's properties, causing insufficient lubrication. Fixing this problem prevented a possible engine replacement.

**Truck bodies**

Featuring safety, stability and increased productivity as hallmarks of its design, Philippi-Hagenbuch argues that its patented line of PHIL Rear Eject Bodies offer the "ideal solution" for challenging hauling applications such as mine reclamation and underground hauling situations where overhead barriers inhibit traditional dump bodies. The company states: "Easily adaptable to any make and model of articulated off-highway truck as well as a number of rigid frame trucks, PHIL Rear Eject Bodies curtail the challenges associated with traditional dump bodies. In eliminating the need to raise the body of the truck, the PHIL Rear Eject series allows for safely dumping materials while in motion and in the presence of overhead barriers. This versatility in operation increases efficiency without reducing stability by providing a lower centre of gravity and allowing dumping on downhill slopes and conditions with a soft footing." The group argues that enabling trucks to spread material while driving further enhances efficiency. In addition, the ability to effectively empty the truck without raising the body augments safety where overhead barriers such as power lines, roof lines or bridges may pose forgotten safety risks.

Without moving or raising the truck bed, the ejector blade pushes material toward the rear of the truck, while the tailgate lowers down and material is completely ejected. The sweeping action of the blade virtually eliminates all material – even material prone to sticking to the sides or floor of the truck bed. PHIL Rear Eject Bodies are also versatile enough to be used as auxiliary feeders within quarries and mines, providing an alternative tool for delivering material to a crusher if a primary feeder malfunctions or breaks down.

PHIL Rear Eject Bodies are constructed with a single hydraulic cylinder used to operate both the ejector blade and the rear tailgate mechanism. As
The PHIL Rear Eject series allows for safely dumping materials while in motion and in the presence of overhead barriers

the ejector blade moves to the rear of the body, the tailgate mechanism located in the sides of the body begins to move to the rear of the truck. This motion, naturally supplemented with gravitational forces, lowers the tailgate simply and mechanically without the need for additional hydraulic cylinders. To further simplify the design, PHIL ejector bodies employ exclusive ejector guides integrated into the inside of the body.

At the huge CITIC Pacific magnetite iron ore mine in Australia, General Manager Mining Scott de Kruijff states the current shovel bucket and truck body sizing on the MT6300 trucks supplied by Terex Mining prior to its acquisition by Bucyrus then Caterpillar, was suited to carrying ore but not to waste, which meant productivity suffered when digging waste. “For every tonne of ore we will mine in the future we also need to mine 0.8 tonne of waste. If we fill our current truck trays with ore they will carry a full 360 t payload, but when we fill them with waste they carry less than 300 t because of the lower density.” Scott said. Caterpillar has designed an extension to the existing truck trays to increase volume and tonnes. One tray has been modified and fitted and seven more will follow in March. In addition, a tray from another supplier is being trialled. Scott said that over the next few years, material mined would increase from the current 40 Mt/y to 140 Mt/y.

Payload monitoring and collision avoidance

Italy-headquartered VEI manufactures and services worldwide on-board weighing solutions and payload management equipment for haul trucks and other mining equipment. A new generation of VEI devices features a bright colour display with “unparalleled comparison in the industry” according to VEI, including visibility in bright sunshine. The Dumper Load payload monitoring system for mining trucks was developed directly at open pit sites in order to perfect the instrument’s inherent operating and automation characteristics. Integration of the instrument into mine truck work cycles means that it is recommended by manufacturers as a guaranteed means of preventing overloading. The instrument is also capable of remote transmission of load status in order to optimise the distribution of the fleet within a mine.

Payload monitoring is delivered by easy-to-use software applications linked to the on-board device wirelessly or by connecting the VEI device with on-board fleet dispatching systems. VEI states that installations have been made in Russia, India, Colombia, South Africa and Brazil with average increases in production of 15% just through payload monitoring and therefore making it more easy for mines to efficiently plan equipment size, quantity and availability.

Another recent development is the helper21, which according to VEI is the first on-board weighing system to combine palmtop technology with the sophisticated VEI OS SmartCycle Operating System.

Brigade Electronics has developed a new wireless camera monitor system that can be applied on mine trucks. Wireless camera-monitor systems have been on the market for several years but have demonstrated poor picture quality caused by electrical interference from other vehicle systems. Historically, Brigade states that it has found that wireless systems only work in optimal conditions, not typical in mines and as safety experts, did not want to bring a product to market that was not safe.

New digital technology has vastly improved the stability of picture performance. The wireless system saves running cables along the vehicle reducing fitting time and preventing cables from becoming damaged, especially relevant for articulated machinery.

Brigade has also launched the Xtreme Backsense pulsed radar sensor system. The previously available Xtreme has been re-engineered with a new moulded cable connector increasing water resistance and making it even more robust and now with improved precision down to only 600 mm from the sensor. The heavy duty system is used for detecting moving and stationary objects around vehicles and mobile mining equipment. The system provides the driver/operator with graduated visual and audible warnings allowing the driver to judge speed and direction. Operators can choose 6, 8 or 10 m detection ranges ideal for larger machines. Sensors can be networked providing 360o protection of the vehicle. Operators can also configure the audio and visual warning boundary for the final detection zone.

One of the challenges seen in today’s haul truck cab involves the number of displays and alarm sources that require the attention of the operator. SAFEmine, based in Switzerland, provides traffic awareness and collision avoidance systems for surface mining equipment and at MINExpo, is launching what it believes to be a ground-breaking technology that integrates multiple safety technologies with a simplified operator interface. The goal is to reduce the number of displays, while increasing the effectiveness of the information provided. Their new product called SafetyCentre System (SCS) provides an “all-in-one” approach to situational awareness for heavy equipment operators.

Sophisticated algorithms generate intelligent, context sensitive alerts by fusing data from
multiple sensors, such as co-operative GPS-based traffic awareness and collision avoidance for tagged vehicles and objects, up to three radar units for close-in detection of all types of obstacles at lower speeds, and up to four video cameras monitoring the blind areas around the equipment. A single touch-screen colour monitor displays a top view of all surrounding equipment locations with respective identifiers. Multiple camera views are displayed and automatically selected based on direction of motion. The touch-screen interface allows the operator to quickly select a view of interest, switching to full-screen mode. Radar detection alarms are overlaid on the top view display and on the corresponding camera view and indicate the area where detection occurred.

This technology is well suited to haul trucks, shovels, and other heavy equipment. The system has been developed in cooperation with Kumba's Sishen iron ore mine in South Africa. The offering is 100% compatible with over 12,000 vehicles worldwide already protected by SAFEmine. It also enhances existing camera and/or radar installations with SAFEmine CAS, protecting investments. It can also integrate fatigue monitoring systems and can interface with mine management systems.

Capabilities include surrounding vehicles and equipment shown with identification numbers; graphical representations of speed limits, speeding and collision alerts; use of a graphical representation of the mine map with obstacles, overhead power lines, stop signs, geofences; an automatic video recording allowing analysis of incidents and near-misses for training purposes; and automatic movement and soiled lens detection, and cable/camera failure recognition. The system also shows, records, and reacts to driver ID, safety belt, door, and handbrake.

Terex retains value in smaller classes

With the acquisition of the larger Unit Rig truck line by Bucyrus then Caterpillar, it is often overlooked that Terex retained its Motherwell, Scotland manufacturing facility, which continues to be an important player in the 100 t class mining truck market. Recently, the final two trucks of a 20-unit machine order placed by Scottish Coal were shipped. The two TR100 rigid trucks are part of a large order placed at the end
of 2011 by Scottish Coal through TDL Equipment, the official UK distributor of Terex heavy line construction machines. They will join the remainder of the fleet across the company's open cast coal sites in Ayrshire, replacing some Caterpillar 777Fs.

Terex stated: “This order reflects Scottish Coal’s continuous investment strategy in its fleet and demonstrates the strong improvement partnership built up between TDL and Scottish Coal. These recent additions bring Scottish Coal’s fleet of TR100s up to a total of 44 units operating in their Ayrshire sites.”

All 20 trucks will be covered by a TDL full repair and maintenance contract and will include a range of reliability, performance and safety improvements that have been jointly developed by Scottish Coal, TDL and the Terex manufacturing plant. Scottish Coal Managing Director Andrew Foster commented: “We have been particularly pleased not only with the performance of the Terex TR100 truck and the uptime it offers, but also with the high standard of product support that we consistently receive from TDL. TDL and Terex have demonstrated a willingness to work closely with us on health and safety initiatives and truck design. This is imperative to a company such as ours that places the highest priority on safety.”

Cameron Watson Managing Director for TDL added: “Over the last three years we have been delighted to work in partnership with a company like Scottish Coal which is prepared to invest heavily in their capital equipment. With this commitment in capital, our view has always been that we need to reward their faith in us by designing aftermarket support packages that provide maximum availability of the equipment and value for their investment. Working jointly with Scottish Coal and liaising with the manufacturing facility to meet individual customer requirements has provided us with a very strong value package which we believe surpasses our competition commercially, productively and in terms of the support packages we offer.”

An example of this partnership is an all-round vision system which will be fitted to the new trucks. The new safety camera system which affords the operator a 360° bird’s eye view of potential obstructions around the truck was established based on the customer’s increased safety requirements for better visibility. This system has been jointly developed and trialled by TDL in conjunction with Scottish Coal.

Modelling refuelling time
VBKom Projects is a South African consulting company specialising in project management, risk management and simulation within the mining industry. The group was recently approached by a client to simulate movements of heavy mining equipment in an open pit mine in South Africa. This project was taken on with ongoing support from Simio software resellers, such as Analista Modelling Systems (AMS) as well as Simio itself. Simio LLC is a private company headquartered in Pittsburgh that is “dedicated to delivering leading edge solutions for the design, emulation, and scheduling of complex systems.”

The project’s aim was to determine the optimal placement of new diesel storage tanks and an accompanied diesel refuelling station for the primary haul trucks on the mine. The mine is expanding further away from existing infrastructure. This requires the haul trucks to spend more time on travelling and refuelling than haulage. The business case for this project was therefore to reduce the refuelling travel and standing time that can be better utilised to move waste and ore. This equates to a significant saving due to the high capital and operating cost of the heavy mining trucks and is of high importance.

The model addressed the following aspects with the capabilities provided by Simio: The possible placement/positions for the new refuelling station; the planned movement of heavy mining vehicle over the life of mine; varying fleet sizes as trucks are decommissioned and brought into service; refuelling station processing of vehicles; vehicle

Gridcom Enterprises Ltd. concentrates on building the most complete range of braking resistors for off-road diesel electric mining trucks and LeTourneau electric loaders. Completed braking resistors are always in stock: D model, B model (Poly-ZI), H model and the newest 33D-K model. Besides manufacturing new units we can also repair most of failed resistors.

Gridcom also provides individual after-market parts (e.g. plates, barriers, hardware) for all makes of off-road diesel electric mining trucks, including Euclid, Komatsu (Wabco, Dresser), Unit Rig and others. We will always provide effective solutions fitting your specific needs.
task allocation prioritisation process logic; varying distances and speeds between areas as the ore body is mined, such as between refuelling stations, mining areas, waste dumps and ore crushers; refuel process logic was built in line with the mine operated dispatch system which monitors each truck and fuelling station to continually optimise the movement of the trucks; and daily work schedule and crew change over.

The ability to make use of standard objects as well as defining specific process logic assisted the team to provide a realistic model that could be verified and validated with operational personnel. Simio’s experiment capability allowed multiple scenarios to be evaluated for each year and simulated for the total life of mine study period. The results indicated that a certain scenario were preferred above the rest due to a lower overall refuel cycle time and distance travelled as well as shorter queue lengths and durations. Further metrics evaluated different fuel station configurations, fuelling station utilisation and vehicle fleet sizes. The team believes that the time saved if the chosen scenario is implemented will justify the cost of building and operating the new fuelling station.

**Looking to larger trucks**

Mining haul truck major BELAZ hosted a delegation from the Kemerovo region on April 10, 2012 at its factory in Zhodino. It included representatives of the Kemerovo Region government, managers of CJSC Siberian Business Alliance and BELAZ service centre, KuzbassBelAuto. During the visit, General Director Petr Parkhomchik revealed that the company is well along the road of completing a mining haul truck with a 450 t payload capacity, which would dwarf the current largest trucks on the market such as BELAZ’s own 360 t 75600, plus the Liebherr T282C and Caterpillar 797F, both at 363 t. The company plans to assemble the first 450 t model in 2013.

The delegation also saw in the factory a BELAZ 75600 320 t truck that is to be exhibited in Las Vegas at MINEEXPO, after which it will be shipped to a coal operation in Colombia. BELAZ also states that it continues to work on product promotion for new markets and is scheduled to supply equipment to both Peru and Brazil in 2012 in addition to continuing exports of BELAZ trucks to Chile.

Finally, the president of Russian holding company Siberian Business Alliance, Mikhail Fedjaev, stated that a production line of BELAZ dump trucks with a payload capacity of 90 t in the Kuzbass is under consideration. The reason for the move would be to allow the large demand for smaller capacity trucks for coal mining in the Kemerovo Region to be met by the new capacity, thereby freeing up more production capacity at Zhodino for larger dump trucks of 130 t and above. At present the Russian market demand in this class amounts to some 150-200 units per year.

In other BELAZ developments, mining group Mechel OAO has acquired 15 BELAZ mining dump trucks as part of a long-term partnership agreement signed by Mechel and BELAZ in November 2011. The mining trucks are being acquired on behalf of Yakutugol Holding Company and Korshunov Mining Plant on lease contracts. The trucks were delivered to the mines by June 2012. Yakutugol Holding received eleven trucks of 220 t, 130 t and 55 t capacity for hauling overburden and coal, which will be used at Nerunginsk open pit and Elga Coal Complex. Korshunov Mining Plant OAO will operate four 150 t trucks, which will be used to transport soil and iron ore at the Korshunovsk mine.

Due to structural improvements, the new trucks have higher capacity and efficiency than their predecessors, Mechel reports. “BELAZ trucks are widely used at our mining plants and have proven themselves well. As such, the 10-year agreement with Belarus Autoworks (BELAZ), which guarantees us supplies of these trucks in the amount we need, is highly important for us, especially considering the growing production volumes at the Elga deposit. Systematic efforts for technical re-equipment enable the company to increase production, cut
Hitachi and AC drive technology

Hitachi’s new electric-drive EH4000ACII combines Hitachi’s front trailing arm and NEOCON-E suspension system with the vertical integration of Hitachi’s own IGBT AC-drive technology. Hitachi is the only mine truck manufacturer in the world that provides its own IGBT control, alternator, and AC-drive wheel motors. Competitive models all depend on outside suppliers such as Siemens and GE for this technology. Hitachi comments: “The result is a smooth-steering, smooth-riding, highly dependable, and long-lasting haul truck that mining operations will appreciate. Because it utilises AC-drive technology, the EH4000ACII delivers lower life-cycle costs and better performance on uphill or downhill grades with superior rimpull and retarding capabilities. The brushless motors of the AC-drive system provide lower maintenance costs with increased uptime.”

Trolley-assist options are available to improve performance on grade by increasing productivity while reducing fuel consumption during the haul cycle.

The company adds: “The EH4000ACII manoeuvres easily in tight spaces and comfortably handles the haul road with steady speed on grade. The turning diameter is 30.2 m.”

The air-ride seat and optional semi-active seat, combined with a three-point rubber iso-mount on the cab, deliver a comfortable operator ride, while a Hitachi-made controller monitors truck systems and replaces multiple outsourced controllers. A simple flat-panel dashboard consists of a 26.4 cm LCD monitor that eliminates all independently placed gauges and lights. The philosophy behind the monitor in the trucks is the same as the Hitachi EX-6 series mining excavators; it allows for quick machine troubleshooting to reduce costs and downtime.

Auto Cruise Control keeps vehicle speed constant within the set range by limited minimum vehicle speed. Auto Retarding Control keeps vehicle downhill speed constant within the set range by limiting maximum vehicle speed. Hitachi states: “AC-retarding slows the truck to near-zero ground speed, greatly reducing brake wear. To come to a complete stop, the service-brake blending feature automatically kicks in to combine the braking action of the service brakes with the dynamic retardation of the IGBT AC-drive system. This means just one pedal is needed to achieve smooth braking all the way to zero. A hill-hold brake feature is also included as part of service-brake blending.” Other features include planetary design with two fixed planetary gears; final drive with gear-oil circulation and cooling system; rugged frame with bolt-on high-arch member of a new design; new body design with sloped floor and tail chute for less spillage and smoother shedding of materials; and a Hitachi load-weighing system with correction by axle/weight ratio and slope angle for greater accuracy. External display is optional. The truck has easy-access front stairs as standard and a fast-filling system that is ground-level accessible for coolant, grease, hydraulic oil, and engine oil; couplers are optional. The company concludes: The EH4000ACII is well-matched to Hitachi excavators. It enables six passes from an EX1300-6, fouro five passes from an EX5000-6, and three passes from an EX8000-6.” Hitachi’s two other electric-drive trucks which incorporate many of the same features are the EH3500ACII and the EH5000ACII.

Hitachi has also been working on an even more advanced drive system, to be called HDCS, which stands for New ACII Hitachi Drive Control System, which will form the basis of the its next generation of electric drive products for the mining industry.

New Brazil-Italy co-operation

Brazil’s Randon Veículos has delivered the first RDP 470 mining trucks for the Brazilian market. Cia Riograndense de Mineração (CRM) purchased two trucks equipped with automatic transmissions for hauling coal at the state’s Candiotá mine. The RDP 470 is the result of a joint-venture between Perlini Equipment of Italy and Randon Veículos. The mining truck can handle a 65 t payload and has demonstrated “excellent suitability to meet the demands of the Rio Grande do Sul energy sector”, especially at coal sites, say the two companies.

Randon had provided RDP 470 vehicles for evaluation by potential Brazilian clients, including CRM, who tested the demonstration vehicle prior to acquiring the first two units for their operation. The truck underwent feasibility studies that confirmed previously released data about productivity and operational cost gains in mining and construction companies.

Part of its strong performance, durability and driveability is related to its automatic transmission – an Allison 6000 Series. According to Clovis Kitahara, Marketing Manager for Allison in South America, “We have a long-standing partnership with Perlini in Italy and Randon in Brazil. This experience allowed our companies to work together to supply a vehicle especially designed for the rigors of South American mining sites.”

The model belongs to a wide range of off-road trucks that can haul from 30 to 100 t payloads. Randon and Perlini have developed this project together, securing an option for organisations in South America. The Perlini RDP 470 will be manufactured in Brazil and have compatible local content to be eligible for FINAME financing. “We intend to produce them as components are gradually nationalised. The basic structure will be manufactured at the Randon plant, always respecting the product’s original characteristics,” said Norberto Fabris, Managing Director of Randon Veículos.

Some RDP 470 specifications include an ABS brake system; 760 hp, electronically managed engine; Allison fully automatic transmission; independent hydraulic steering system, with pump and two double-acting cylinders; single-wheel front and dual-wheel rear tyres with interchangeable rims (24.00 R35); and MTU Detroit Diesel 12V-2000 engine.

New horizons

It is well known in the industry that trolley-assist trucking works in the right situation but that the number of installed systems remains few and far between, with Lumwana still the only one put in recently. But now one of the major groups progressing trolley-assist installation is First Quantum. The company said in its April 2012 Greenhouse Gas Report that it
At the First Quantum Kansanshi mine, shown here using a conventional set-up, a trolley assist program has commenced and trials with the initial purpose-built trolley assist trucks have started in the main pit continues “to seek practicable and economically viable ways to reduce its carbon footprint.” In 2011, First Quantum began construction of a trolley assist system at the Kansanshi copper mine in Zambia. Phase 1 was commissioned in the second quarter of 2012. A fleet of 16 Hitachi EH3500 ACII trucks fitted with pantographs are being introduced this year, followed by a further 19 trucks in 2013. The trucks will use trolley to haul both copper ore and waste. Four Liebherr ER9350 electric excavators were introduced in 2011 replacing some of the diesel loading machines in the mine. At the Sentinel operation in Zambia, due to be commissioned in 2014, three Caterpillar 7495 rope shovels will be used along with two Komatsu PC5500 excavators, and a fleet of 21 960E-iKT and 15 Komatsu 860E-iKT trolley assist trucks along with electric blasthole rigs. Komatsu may choose to display its new 960E trolley variant at MINExpo 2012, following on from the launch of the 860E trolley truck at MINExpo 2008.

As stated before in IM, European Truck Factory (ETF) has developed what it describes as “a new and innovative mining truck range which combines the features of large haul trucks and articulated dump trucks.” Because of the all-wheel-drive/all-wheel-steering capability, ETF trucks can operate in both off-highway and off-road conditions. Production delays due to slippery roads during heavy rain or snow are avoided. The company has also developed two new truck types – 320 and 400 short ton dual fuel versions. ETF is understood to have its first major customer, a mining group in South America, for which the first truck of a new fleet was due to be shipped by end-August 2012; with two more in September. Mining companies in North America have also shown interest in the concept. Major performance related features versus conventional trucks claimed by ETF are shown in the attached table.

ETF argues that one major issue with conventional large haul trucks is a lack of stability, such as body swaying and frame cracking, which it states are avoided with its machines. Haul road maintenance is also not as critical as it is with operating conventional truck fleets. Undulation on haul roads and loading impacts are absorbed by the advanced hydro-pneumatic suspension / oscillating axle combination engineered into ETF mining trucks and haul trains. Haul trains can be configured of two, three and four trucks depending on...
ETF hopes to confirm its first major orders for its mine trucks by year end. One advantage cited by the company is their ability to operate in all weathers.

Application with payloads of up to 1,370 t possible. ETF trucks also only use 24.00 R35 tyres which are cheap with no supply issues and are transported in ISO containers.

Maintenance and repair is conducted in the workshop without the truck, as only the major components are exchanged and the truck returning to production within 15 minutes for wheels, power-modules and cabins; and 45 minutes for axle groups. This is one aspect that competitors are very sceptical of, so all eyes will be on the first fleet later this year.

Unique to ETF, each haul train truck irrespective of capacity can operate together with others of the same capacity – the individual trucks can easily be linked together using a steel arm carrying an enclosed armoured data cable within its structure. Information data from

<table>
<thead>
<tr>
<th>Performance features</th>
<th>ETF mining trucks and haul trains</th>
<th>Conventional large mining trucks</th>
</tr>
</thead>
<tbody>
<tr>
<td>All wheel drive</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>All wheel steering</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Automatic axle lifting on empty return</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Automatic wheel lifting in case of flat tyre</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Multiple engines, power on demand</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Larger engine power</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Variable-speed fans on all coolers</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>100% usable rimpull</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>950 mm wheel travel</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Oscillating axes 10° left and right</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Unlimited laden driving distance</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Integrated braking control (including retarder control)</td>
<td>Yes</td>
<td>Optional</td>
</tr>
<tr>
<td>95% technical availability during full life cycle</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Increased utilisation during bad weather (rain, snow and fog)</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Source: ETF

ETF-claimed performance features versus standard mining trucks

Grintec is engaged in designing and producing different ceramic grinding media for mining industry. Considering different solid content and material hardness, Grintec is providing different ceramic for different use conditions. We are open to give our customers any technical suggestion to improve the grinding efficiency and save energy cost.

Welcome to visit our booth No. 5927 for MINEXPO INTERNATIONAL HELD IN SEPT. 24–26, 2012 at LAS VEGAS CONVENTION CENTER

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www.grintec.net
the first operator controlled truck is transmitted
via the link arm to the following trucks guiding
and controlling all important operating functions
like engine power, steering direction and brakes,
just as if each unit had separate operators
following each other.

ETF states: “The real operational advantage
soon becomes very obvious, as for every train
there is just one operator, so as unit numbers
increase payload capacity go up while operator
costs come down. Each haul train features “three
way dumping” capability, each truck can dump
individually left or right or together at the same
time at the dump area and crusher. If for any
reason the mine plan should change requiring
fewer units in the train each truck unit can be
de-coupled, allowing each truck to operate
independently. This unique configuration
provides a mine wishing to increase operating
capacity simply by increasing the number of
trucks in the train.”

**New trucks from Liebherr**

At MINExpo 2012, Liebherr will introduce two
diesel-electric haul trucks: the new T284 as the
follow-up to the successful T282C in the 400
short ton class, and the newly-designed T264
which brings Liebherr into the 240 short ton
payload class. Liebherr will also introduce two
new large hydraulic excavators: a face shovel
version of the 386 t R9400 as well as the brand
new 140 t R9150 (see Surface Loading article).

The T284 offers the
equal highest payload in
the industry and features
the latest generation of
Liebherr’s own Litronic
Plus AC drive system.

Developed and built by Liebherr, the
Litronic Plus drive system determines the
optimal way to extract power from the diesel
engine. With this system more power is
available to accelerate the truck and climb
grades. This system also conserves fuel when
the engine is idling. The aim is to minimise fuel
consumption and maximises performance and
load-carrying capacity.

The T264 fuel-efficient mining truck is sized
to match the Liebherr R996B and R9800
hydraulic excavators, as well as electric shovels
and wheel loaders for optimal performance. In
order to maintain a safe working environment,
the T264 features payload and overload
warnings. An anti-rollback feature keeps the
truck stationary when stopped on grades in
either forward or reverse. The advanced Traction
Control System with four-wheel speed sensing
capability automatically adjusts torque to the
rear wheels in order to maximize traction when
cornering, accelerating from a standstill, or
travelling down wet or icy roads. Developed by
Liebherr exclusively for mining trucks, this
system enables operators to consistently
maintain steering control and truck stability. The
integrated electronic system monitors, records,
and outputs vital truck health and performance
data. Data is stored and available for download
to perform detailed analysis. This system
supports predictive maintenance strategies to
minimise unscheduled downtime. **IM**