

Multipurpose mining

The range of mobile equipment used outside the main development and mining tasks underground are diverse and specialised, performing a range of tasks from roof access to explosives delivery and personnel transport, reports Paul Moore

Utility vehicles in underground mining perform a very wide range of tasks, from floor clean-up to general materials and personnel transport, service/maintenance, lifting and roof access. Often explosives charging, bolting, shotcreting, concrete mixing and scaling units will also be included in this category of equipment, which is sometimes considered to cover all mobile machines not directly involved in drilling, loading and hauling. However, these can also be considered as production or "in-cycle" equipment as opposed to units for lifting, installation and underground logistics. Maintaining high productivity in underground mines depends on the timely and reliable transport of a wide range of resources including men, explosives, fuel, oils, pipes, hoses, cables, rock bolts and other equipment.

As the major fleet item manufacturers such as Sandvik, Atlas Copco and Caterpillar tend to concentrate on the high cost, high unit production primary or "capital" equipment models in mining and development fleets, the utility vehicles market includes a number of smaller, specialised companies such as Getman, MacLean and GIA that in many cases have come to focus squarely on this quality not quantity product area, providing dedicated and often heavy duty, long working life ranges. Some are true mining specialists – in other cases, specific products from global players such as Genie (Terex), Kubota, Bobcat

(Doosan), Toyota, Manitou and others, have been modified to suit mining applications.

Given their size, many of these companies sell their products through dealers globally, and in some cases the larger OEMs will represent their products in a mutually beneficial arrangement, where the mine will negotiate the purchase of utility machines at the same time as sourcing the LHDs, trucks and drills. For example, the Nevada Caterpillar dealer, Cashman Equipment, represents Getman products in its territory, which complement the Caterpillar Underground range. At the minesites themselves, utility machines are often operated by contractors, especially in the case of explosives delivery units.

There are specialised products for coal and hard rock, but some model designs are common to both. Given their nature, attributes such as common carriers and common platforms are valued, allowing easier maintenance and inter-changeability, ie the use of different cassettes and/or attachments. As they have a relatively high initial cost and have to work around the main mining fleets, they are often very heavy duty machines, though this also relates to their roles which will often involve heavy haulage and a wide range of different tasks in the case of multi-purpose vehicles.

As with all vehicles used underground, emissions are also an issue with utility vehicles. Most vehicles used in the mining industry use

A Manitou MT 732 telescopic forklift with access platform at a South African hard rock mine, being used to set up mesh and install roof bolts prior to shotcreting

diesel engines because of the high relative power output and mobility, plus the avoidance of the maintenance and infrastructure issues that come with battery and cable reel attached electric models. However, as diesel emissions contain some unwanted gases, as well as diesel particulate matter (DPM), they are restricted by legislation, which in underground mining means MSHA (or equivalent outside the US), which is more stringent than the EPA Tier system of limits. As a result, many of the engines used in utility machines will not pass the required scrutiny without some aftermarket tweaking (such as retrofitting with purifiers) to get them underground rated – again another reason why this is a specialised market.

In the past, it is fair to say that much of the attention on increasing operator comfort, operator training and installing new technology such as on-board machine management systems on underground equipment was focussed on development and mining machines. Of course, part of the reason for this is that development and mining fleets in most cases are in use around the clock; whereas by their nature utility vehicles operate on an as needed basis, or as part of a staged process eg scaling/shotcreting post blasting.

However, as greater comfort and technology is applied to mining units, it does tend to filter through the other ancillary machines eventually and this is certainly happening.

Full range offerings

Getman is a US company focused exclusively on designing and manufacturing utility equipment for the underground mining industry. As such, it offers a range of utility and support equipment including explosives charging vehicles, mobile platform trucks, mechanical scalers, lubrication trucks, crane and maintenance trucks and multi-application cassette carriers.

The best seller units in Getman's product portfolio are its explosives charging vehicles (ECVs). Getman offers four coverage models of ECV (models 2-500, 2-500L, 2-500ER and 2-1300), which provide face coverage areas from 6 m x 9 m up to 9 m x 12 m with a single set-up. Derek Getman, Director of Sales at Getman told IM: "While typically referred to as utility equipment, we hold the position that our charging rigs are more accurately defined as production equipment. Our explosives charging vehicles are designed to improve mine productivity by offering equipment that can safely, quickly and efficiently load rounds in an underground environment, thus contributing to a shorter production cycle." Getman ECVs can be configured for the utilisation of ANFO or emulsion compounds depending on the needs of the mine.

Also in the Getman range is the A64 scissor lift, a mobile elevated platform truck that assists in numerous support-related functions. Getman offers product enhancements designed to facilitate the installation of pipe, ventilation systems, screening and mesh. The A64 Scissor Lift is also commonly used for the installation of electrical systems and for geological surveying.

Getman's most diverse support vehicle is the A64 Pallet Handler – a single chassis, multi-cassette vehicle designed to transport gear, mine personnel, fuel, lubricants, explosives and more throughout the mine using a single carrier. Getman offers a wide range of application pallets, including customised pallets if required.

The S-Series line of Getman Scalers offers mechanical scalers capable of scaling from 3.5-10 m depending on the model. The company is currently expanding its scaling line, and will

A Getman ANFO charging unit



unveil its new Confined Space Scaler, capable of working in 3.5 m drifts, later this year. In addition, Getman also offers a range of knuckle boom crane trucks, personnel carriers, fuel and lubrication trucks and water spray trucks, all built on the basic A64 Carrier.

Going forward, the company will launch a new Shotcrete Sprayer in 2012, becoming a new market entrant in a niche area that is dominated by companies such as Normet and BASF Meyco. "For years we have felt that there is room for another global player in underground shotcrete equipment" said Getman. "With our understanding of underground mining and our global market presence, we feel we are the right company to fill that need."

Based in Ontario, Canada, **MacLean Engineering** specialises in the design and manufacture of mobile underground equipment for the global mining industry and counts mining companies and contractors such as Vale, Xstrata, Cementation and JS Redpath among its largest clients. Its product line includes bolting, shotcreters, secondary breakers and utility vehicles. The current range of utility vehicles is separated into two groups: Support Vehicles and Service Vehicles. The support group encompasses MacLean's line of utility vehicles which transport people, parts

and products, including a Personnel Carrier, Boom Truck, Fuel/Lube Truck, Water Truck, Deck Truck and Transmixer. The service group of utility vehicles includes a mechanic truck, scissor lift, ANFO charger and cassette system.

All MacLean utility vehicles feature ROPS/FOPS certified cabins and can be equipped with an open air canopy or a fully enclosed cab with air conditioning and heating for increased operator safety and comfort. All units are four-wheel drive and the 3-series of utility vehicles are available with optional Caterpillar drive train (engine, transmission, axles). This allows customers to use the Caterpillar network to enhance parts and service support. MacLean offers UTVs in the 3-series of 8 ft carriers and for small section applications, the 2-series of 6 ft carriers.

The PC3 personnel carrier features nitrogen gas-powered gas shocks and isolation mounts on the suspension system to provide a comfortable ride over harsh terrain. The SL3 scissor lift features forward and side-shift deck capabilities and a Remote Drive System (RDS); the latter allows the operator (while working from the elevated scissor platform) to reposition the vehicle. The CS3 cassette system is available with eight different cassette options, all married to one standard carrier. The BT3 boom truck is available with a Magnum® crane option; this crane is specially designed to fold up off the deck maximising deck space and minimising tramming height. The AC3 ANFO charger's compact multi-stage extension boom has a 2-person basket, with retractable canopy and basket swing feature to maximise face coverage. All MacLean UTVs are



MacLean AC3 ANFO charger with canopy



The new Minecat MC100E emulsion/ANFO carrier

built on the Mine-Mate™ carrier, offering common components to simplify and facilitate maintenance, parts stocking and training for customers.

In early 2009, MacLean launched a range of low profile, high speed vehicles specifically designed for work in potash, platinum and phosphate operations. The Profile Series UTVs are as small as 1.88 m wide by 2.08 m high and can reach speeds of 27 km/h in third gear when equipped with a Dana Clark 20,000 Series Powershift transmission. The Profile UTVs feature an automotive style front facing driver's seat for increased visibility and nitrogen charged cylinders with hydraulic dampening shock absorbers for increase ride comfort and control.

Northern Nevada Equipment is not a manufacturer but a family-run dealership, based in Nevada, which specialises in Kubota tractors and utility vehicles that are modified for the US underground mining industry. In addition to Kubota tractors, Northern Nevada Equipment also sells Bobcat equipment, Xtreme Telehandlers that can lift up to 30,000 lbs, and diesel purifiers that meet MSHA DPM limits. The purifiers are custom designed to directly replace the OEM muffler and are available for any vehicle or tractor.

Kubota tractors can be adapted to personnel carriers with five to seven seats. Built from steel, the models are fitted with toolboxes, high quality seats, seat-belts and roll over protection to ensure the safety of the occupants. The tractor can also be fitted with a scissor lift deck which is installed with stabilisers and controls to prevent the vehicle from being moved while the equipment is in use. Special features have been designed and built for maintenance vehicles, ambulances, powder buggy cabinets for explosives and shotcrete sprayers. Another option for underground transportation is the Kubota RTV utility vehicle which according to NNE is now "bigger and better." The 1,123 cc, 24.8 bhp diesel engine provides more power and the

wet-type disc brakes make stopping effortless

while prolonging brake life. The RTV1140 comes standard with transformable seating from 2 to 4 and a hydraulic cargo bed. All NNE vehicles are driven by Tier 3 or interim Tier 4 diesel engines, fitted with purifiers to meet MSHA standards. The tractors are chosen for their small size, yet high power capabilities and reduced turning circles. All feature Kubota engines which range from 15-103bhp and have four-wheel drive options. Underground lighting packages and large, rear view mirrors are standard practice to improve visibility. Northern Nevada Equipment counts the Kubota 40-50bhp tractors as its most popular models, but also offers Kubota R520 forklifts, Bobcat skid steer loaders, Telehandlers and utility vehicles and Xtreme Manufacturing Telehandlers with attached forks, bucket or truss boom.

Industrial Fabrication Inc (IFI) now offers the Minecat Emulsion or ANFO loading carriers in both development and long hole applications. The Minecat 100 can cover up to 5.4 m x 5.4 m development face and with a lower capital cost than other traditional explosive loading carriers, according to the company. The Minecat 100 is a very compact machine and this latest model builds on already proven underground utility machines on the Minecat platform from 3 to 11 man personnel carriers, scissor lifts, lube vehicles, cable reelers, loader forklifts, and maintenance department service vehicles.

Normet's product range for underground mining covers vehicles for concrete spraying (Spraymec 1050 series and Spraymec 6050 series), concrete transport (Utimec MF and LF series), explosives charging (Charmecs), lifting and installation (Utilifts and Himecs), underground logistics (Utimecs, Variomec system and Multimec system).

For lifting and installation Normet have the Utilift scissor lifts (Utilift 6330 X and the new generation Utilift MF 540). Utilifts are designed for lifting and installation works in underground mines and low-profile tunnelling. They can be used for roof reinforcement work, installation of cables, pipes and ventilation equipment. They can also be used for explosives charging. Typical options and

accessories for them include a side shift platform, platform tilt, crane, pipe installation equipment, air compressors, electrically driven power packs for platform hydraulics, power take offs for electric or pneumatic tools and ANFO charging kits.

Utilift MF 540 scissor lifts have a lifting capacity of up to 4.5 t giving a safe working platform for all kinds of installation work in tunnels up to 6.5 m in height. They can be assembled with four different sizes of side shift platforms providing drift coverage from a single set-up for most types of mine headings. The Utilift 540 can be equipped with a remote drive system which is operated from the platform. The Utilift 6330 X has a lifting capacity of 3 t and its reach is up to 5.5 m. It is only 1.8 m wide and it can make a 90° turn into a 3.4 m wide passage.

For underground logistics needs Normet has three different system: the Multimec system (slide-on/slide-off cassette system), Variomec system with interchangeable work modules, and Utimec system (dedicated transporters for applications requiring full carrier utilisation). Multimec provides a multi-purpose solution for logistics at mines where a quick change of use of wide variety of transport requirements is needed. With one Multimec carrier and the right choice of cassettes most underground mine transport needs can be covered. Two different cassette carriers are available – the Multimec 6600 and the Multimec MF 100 (new generation). The Multimec 6600 has a maximum payload capacity up to 6 t and the Multimec MF 100, 10 t. A hydraulic cassette handling system slides the cassette on and off the carrier in less than one minute.

Standard cassettes available include a concrete remixer cassette with payload of 2.5 m³ for the Multimec 6600 and 4.2 m³ for the Multimec MF 100; as well as material and crane cassettes, personnel (capacity up to 16 persons), fuel and lube cassettes. Other custom cassettes can be provided for a variety of applications like concrete pumping, explosives transport, movable workshops and electric generators.

The Variomec system uses two different carriers: the Variomec MF with a maximum payload capacity of 10 t and the Variomec LF with a payload capacity of 16 t. Two dump kits are available for rock hauling, with a volume of 6 m³ for the Variomec MF and 9 m³ for the Variomec LF. Both the concrete remixer kit, with a 4.4 m³ payload and the lift kit can be used with either Variomec carrier. Featuring a basket boom with a 500 kg lifting capacity, the lift kit has a vertical reach up to 11 m and a horizontal reach of 10 m.

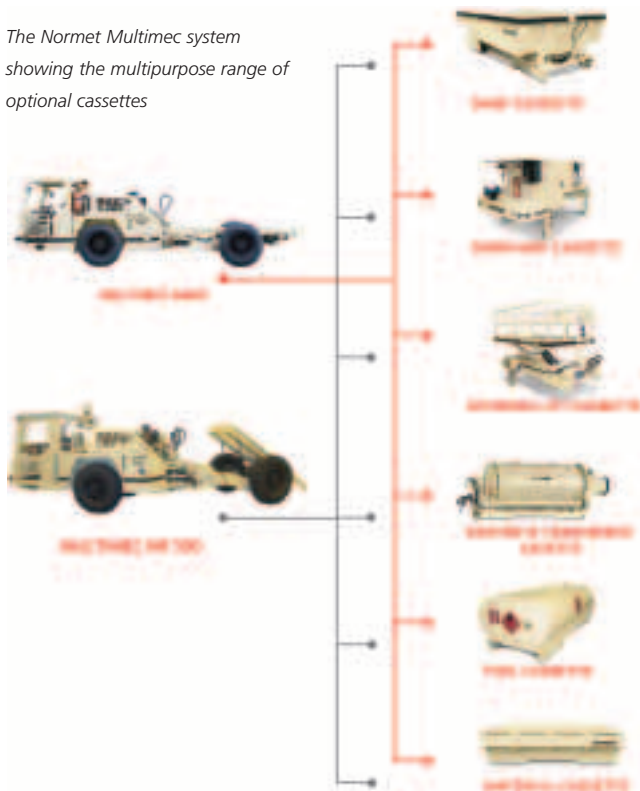
Utimec systems dedicated transporters can be custom-built for any purposes, such as fuel transport, lubrication, a mobile workshop, personnel or material transport and also for concrete transport.

The standard personnel transporter has a passenger compartment for 14 or 16 people on a carrier with a load capacity of 6 t or 10 t respectively. The standard Utimec material transporters have a 2 m by 3.4 m platform and a payload of 4.5 t on the smaller carrier and 10 t on the larger carrier. Both versions are equipped with a hydraulic crane to facilitate loading and unloading of material on and off the platform.

For oil changes and refuelling machinery at the work site, two standard Utimec fuel and lube transporters with total tank capacities of either 2,000 l or 4,200 l are offered. Both Utimec Lubes are equipped with fuel and lube pumps with hose reels and filling nozzles and can also be fitted with a greasing and tyre inflation system. The Utimec system also includes concrete transmitters and agitators.

Normally in smaller mines the Multimec system is preferred because of its versatility, according to Normet. In some mines, the transport needs call for dedicated Utimecs to be used. The Variomec system is mainly used in underground construction sites and in mines only one of two modules are used (typically a dump kit for rock hauling and/or mixer kit for concrete transport). In all mines the lifting and installation needs are similar so company

The Normet Multimec system showing the multipurpose range of optional cassettes



Case study – Oyu Tolgoi

Different types of mines make use of this type of equipment in different ways. Oyu Tolgoi in Mongolia is a large block cave, and has a growing fleet of Normet machines. When IM visited the mine at the end of November 2010, there were two Normet Spraymec 1050 WPC concrete sprayers equipped with a hydraulic scaling system. The mine also has one Normet Utimec 1600 Transmixer and two Normet LF 600 Transmixers. The Utimec 1600 is an older model. All have the same concrete transport capacity of 5.6 m³. These units are designed for heavy concrete transportation in underground mines where drift heights are 2.6 m or more. The powerful liquid cooled turbo charged 170 kW Tier 3 approved engine provides clean and efficient operation and gives a maximum speed of 8 km/h fully loaded in an upward inclined drift at 1:7. On the horizontal the maximum speed is 18 km/h. The standard drum lifter feature allows flexible adjustment of the concrete discharge height up to 2 m making it possible to discharge the load even in circumstances where the receptive unit is not on the same angle or same level as the concrete transporter. The FOPS and ROPS approved safety cabin provides superior visibility and comfortable compartment for the driver and his assistant. The enclosed cabin provides noise level <75 dB. All daily checks can be done from the ground level. Normet has also delivered a Utilift 1430 X scissor lift for different assembly works in the mine. The lifting capacity of the platform is 3.5 t (platform floor) and lifting height up to 4 m. The platform also has a hydraulic extension capability of 0.7 m on both sides.

supplies similar models of scissors lift across the board.

Normet states that it is currently working on new concrete spraying technology. Its first example is the Spraymec 8100 VC for concrete spraying in tunnel construction. It has a new control system – Norsmart – which enables low pulsation concrete spraying, accurate and reliable accelerator dosing, accurate and fast boom movements and positioning and spraying process diagnostics with accelerator, concrete and ambient temperature control.

For explosives charging, Normet has launched its new Charmec MC and LC series which also have electronic control systems. With the new Tier 4 emission regulations resulting to new generation diesel engines, electronic control systems are coming also to basic lifting and transportation vehicles as stated in the introduction. Normet told *IM*: "The new engine generation affects not only the equipment and vehicle suppliers but also the maintenance and use of the vehicles. These new engines require more maintenance and higher quality fuels which are not available

in all parts of the world. That also means differentiation of equipment offering. High end equipment will be needed in areas where the emission regulations are tightest and lower specification equipment in other areas of the world."

In addition to the new emissions regulations, Normet states that it is focussing on operator comfort and serviceability improvements across its ranges. All the current products have a FOPS/ROPS approved canopy and an optional FOPS/ROPS approved enclosed cabin.

Ground support and clean-up

Putzmeister's mobile shotcrete equipment is used in mines and tunnels globally, offering concrete output rates of up to 30 m³/h and spraying reaches of up to 17 m. The common denominator of all Putzmeister machinery says the group, is its "high performance and reliability in rough working conditions above and underground." Putzmeister's most advanced model for concrete spraying in mining is the Sika-PM 4210, a further development of the well-known Sika-PM 4207. The first machine of this new series is to be used by Sachtleben Bergbau, which operates the Clara fluorspar/barytes mine in Oberwolfach, Germany.

The Sika-PM 4210 concrete spraying equipment will be used in all of the three main fissures of the mine for structural support in roadway heading as well as special operations in critical situations. According to Sachtleben, the greatest challenges which the machine will be facing are the frequently changing geological conditions of the rock, varying significantly in composition, strength and stability. Therefore, the machine operator



needs to be flexible during the shotcreting process as far as concrete output and additive dosage are concerned, depending on the early-strength and drying times requirements of each specific situation.

The new proportional remote-control of the Sika-PM 4210 responds to this need, according to Putzmeister, as it allows the complete regulation of the concrete output as well as fine adjustments of the preset additive dosage. All other functions of the machine are also available via remote-control, including the automatic start of the spraying sequence (air, concrete and additive).

In addition to this, the reach of the spraying arm has been increased by 1.4 m in comparison with the standard model, achieving a maximum vertical spraying reach of 10.5 m. Besides, the spraying arm is more agile, with an increase of 25% in the spraying speed at the tip of the arm. The cylinders of all arm extensions are covered for protection, but nevertheless easily accessible for maintenance. Furthermore, new high intensity xenon working lights have been incorporated into the spraying arm.

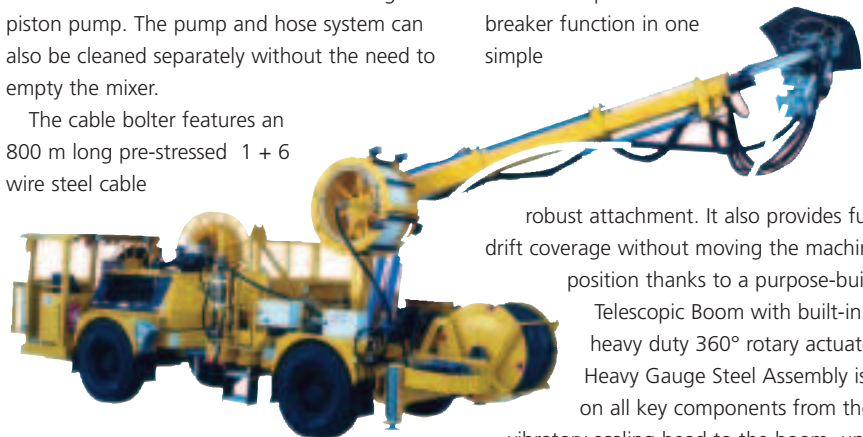
Other improvements include the incorporation of state of the art heavy duty axles with mining tyres; a manually released automatic fire extinguishing system which comes into action at six critical spots of the machine at once; a heavy duty switchboard made of stainless steel; a special low profile concrete hopper with a discharging height of only 1,150 mm; and a strong stainless steel additive tank with a capacity of 450 l.

The latest MEGCIS (mechanised grouting and cable insertion system) cable bolter from

GIA Industri features the latest technology with a guillotine effect cutter to ensure a cleaner and more smooth finish; an upgraded piston pump for a continuous concrete flow and reduced pulsation; and remote control operation. MEGCIS provides a fast and efficient system for the reinforcement and stabilisation of roofs and hanging walls in mines and underground installations. It has been designed to insert grout and a steel cable into a predrilled hole in variable lengths up to a borehole depth of 40 m; compared with traditional rock bolts of 4-5 m. The units' cement grouting system features a cement mixer/agitator for an optimal working cycle of 80 l volume. An upgraded double acting piston pump with a flow of 15-30 l/min at a maximum pressure of 70 bar provides a continuous concrete flow and reduced pulsation.

The water/cement ratio is mixed in a mixer system where the grout is pumped in to the borehole with the aid of the double acting piston pump. The pump and hose system can also be cleaned separately without the need to empty the mixer.

The cable bolter features an 800 m long pre-stressed 1 + 6 wire steel cable



The latest MEGCIS cable bolter from GIA

Sika-PM 4207 working at the San Cristobal Mine, Peru

offering a low relaxation grade of 270 kN and a dimension roller diameter of 800 mm. Additional features also includes cable feeding and cement hose feeding depth measurement.

The bolting system has a maximum boom height of just over 9 m and a horizontal reach of 7.26 m to cover a boom hit area of 84 m² (12 m x 7 m).

Remote control operation is available for improved operator visibility and safety. The driver is also well protected by a FOPS 11 approved canopy and has a comfortable seat with armrests. An extra seat is also provided for an additional passenger. Both seats are equipped with two point safety belts. An electro-hydraulic drive system provides low energy consumption and zero air pollution.

The truck also has articulated frame steering by two hydraulic cylinders and a safety locking device for easy maintenance.

The model is available with the option of two engines – a Deutz TCD 2013 turbo charged diesel engine rated at 113 kW or a Perkins 1104D – E44TA rated at 106 kW. Optional extras include an automatic fire extinguisher, emergency steering, a xenon light on the roof (front or rear), and low smoke emission electrical and halogen free electrical cables.

With the growing focus on safety in mining following the recent rescue of trapped miners in Chile and the growing concerns about injuries due to loose rock falls, mechanical specialised scaling machines are becoming popular additions to the utility truck market space. **Breaker Technology International's** (BTI) VPS16 and VPS 25 series mobile scalars are two models in its versatile range of underground scalars both equipped with a patent pending revolutionary Vibratory Pick Scaling Head that combines a pry-bar like action with pick and breaker function in one simple

robust attachment. It also provides full drift coverage without moving the machine position thanks to a purpose-built

Telescopic Boom with built-in heavy duty 360° rotary actuator. A Heavy Gauge Steel Assembly is used on all key components from the vibratory scaling head to the boom, upper frame and undercarriage, enabling the units to

work in very harsh mining conditions.

Veekmas in Finland is the Nordic countries' only motor grader manufacturer. Having been manufacturing motor graders since 1980s, the company now offers a new motor grader model FG 7 C for underground hard rock mines. The FG 7 C is a somewhat more capable, higher and wider than its sister model FG 5 C. Its driving capacity is exceptional for such a small motor grader according to the company, due to its all-wheel drive system. The frame articulating joint is situated under the front of the canopy, which eases turning and reduces outer turning radius. A highly strengthened main frame and chassis together with wear-resistant components make 9 ton FG 7 C ideal for operating in hard rock mining conditions. The technical solutions make it easier to operate effectively in small dimensional and sharply curved mine galleries.

A large ROPS/FOPS canopy offers safety and increased operating comfort. The instrumentation and controls are conveniently located and readily visible for ease of operation. Coupled with "exceptional maneuverability" the motor grader is productive but still maintaining excellent operator visibility.

An advanced hydraulic system with low oil pressure and an automatic hydraulically operated blade shock suspension installation makes FG 7 C better equipped than other models to absorb impact damage. The installation gives the unit increased ability to absorb impact damage normally associated with hard mining conditions. The system means that the middle blade can be moved up to 10 cm upwards without affecting the motor grader itself when the machine encounters material that is too hard to grade down at the required level.

Veekmas now produces three motor grader models for underground mines. The FG 5 C weighs 8.1 t and is 1.99 m high while the FG 7 C weighs 9.1 t and is 2.45 m high. The biggest model is the FG 15 C at 16.4 t and 2.65 m high.

Carriers, attachments and platforms

Since 1979, **Marcotte Mining Machinery Services** has had a long and productive relationship with operators throughout the mining industry and specialising in underground utility vehicles. Marcotte's core offering is the Minejack® carrier which is the



The VPS16 and VPS 25 series mobile scalers from BTI

base on which many of today's rugged mining utility vehicles are built. All of Marcotte's mobile equipment is available in the M30 and M35 models for narrow vein applications as well as in the M40, M50, and M60 models for large drifts.

Marcotte scissor lifts are still being used primarily for the installation of ground support and service activities such as the installation of water and air piping. For the logistics of moving materials such as pipes, rock bolts and shotcrete bags, Marcotte offers a range of flatbed and crane trucks capable of handling the extreme weights of materials. Personnel carriers of various sizes move manpower underground and our fuel trucks transport and supply fuel and lubricants to all underground mobile units.

The range also includes wet and dry shotcrete haulers, sprayers and self-contained combination units ready to meet specific mine requirements. The dry shotcrete truck is a fully self-contained carrier requiring a single operator and is capable of applying the 9 t/h of dry mix shotcrete in under an hour. A recent development was the design of a new innovative spray arm for wet shotcrete application. Traditional boom-style sprayers have always been prone to damage from rebounding rock or operator generated accidents. The new arm solves this by being highly maneuverable and having fewer vulnerable external parts. Encrustation with cement during operation was also a significant problem as it made it very difficult to grease the old style boom. The hydraulic design of the new arm means it doesn't require greasing, leading to downtime and maintenance savings. The development stage of the project is now complete, with the next step to fit the build of the

first unit into the company's current production schedule.

The French company **Manitou**, well known as a worldwide leader in the supply of rough terrain lifting equipment, also has a strong mining pedigree going back more than 25 years. The essence of the name Manitou which means "handles everything" in French, makes a lot of sense in a utility mining application. Current solutions for underground applications include material distribution, maintenance support, personnel lifting and production tasks, always with a focus on safety and productivity.

The three main families of Manitou Group products used in mining are the skid steers, rough terrain forklifts and telehandlers – all

FG 7 C is a low-profile motor grader specially designed for continued use in underground conditions.





The EMU-LR from Pillar Innovations seats two miners in full gear

available with dedicated specifications matching international standards for use in hard and soft rock mining, in either controlled or explosive conditions. The range includes standard and flameproof models with a large range of options to match the specific needs of every single mine. Cabin protection and reinforcement, specific light ramps, engine protection, fire suppression systems are examples of the options offered. Flameproof telehandlers and skid steers are available and a new generation of models is in the final phase of development to keep ahead of safety requirements.

Dedicated attachments are available from regular handling on forks to compact tyre clamp for low profile vehicles, work platforms up to 1,000 kg, hooks, jibs, buckets, jack hammers and others, all able to be used on Manitou's Quick Hitch carriage. With a rated capacity of the machines starting at 3 t, the attachments can manage most required duties in the mine working area for maintenance, material distribution, production and construction applications, according to Manitou.

The EMU, or electric mine utility vehicle from US-based **Pillar Innovations** is a side-by-side, battery powered utility vehicle designed specifically for mining. From moving material, to aiding in the transport of injured miners, the EMU can be configured to handle a multitude of tasks. One special feature is an independent suspension that is designed to easily traverse rough mine terrain while providing a stable ride for heavy payloads. Rear suspension is self-levelling to eliminate rear end squat and maintain ground clearance even when heavily loaded. The vehicle can be used simply for transport, or it can be configured with

additional enhancements. Many of the configurations utilise the front mounted hydraulic lift system that is capable of moving 500 lb loads. Adam Brenneman, Director of Sales and Marketing commented: "The biggest needs were independent suspension and a wide enough seat for two miners comfortably with all their gear. With the EMU, we are able to deliver that, plus a lot more with the addition of the hydraulic lift." Pillar offers a full line of EMU vehicles to service a variety of needs. The EMU LT, EMU SD and EMU HD all seat two miners, but are designed for varying levels of duty ranging from light to standard to heavy. The EMU 6 x 6 seats two miners and utilises an extra set of wheels for increased traction. The EMU CRU provides additional seating to transport four miners. In June, Pillar is launching its newest EMU model, the EMU LR (Low Rider), which was developed after the company saw a need for a vehicle that could navigate lower seam heights. Brenneman commented: "We wanted to develop something that would be comfortable for the

miners riding the vehicle and maintain the EMU standard of holding up to the rigors of everyday mine duty." The vehicle is 129 in long, 60 in wide and 44 in high while still maintaining a 10 in ground clearance. Modified bucket seats allow for two miners to ride with their gear. Like the other EMU models, the LR is completely electric and has a full size EMU bed with a payload capacity of up to 1,000 lbs. The EMU LR is currently undergoing the process for approval by the Pennsylvania Bureau of Mine Safety.

Germany's **GTA Maschinensysteme** is a well-known supplier of specialised machines for roadway drifting, both in mining and tunnelling. The basic idea of GTA suspended platforms is the performance of simultaneous operation of different works at the face by creating a second working level, what the company calls the "upper level." A technology for performing all required work during the duty cycle at the face has been developed and improved by GTA. Today, what were simple platforms suspended on monorails have changed into complex multipurpose machines which are used for up to eight working steps, including drilling, bolting, shotcreting, charging and scaling, leaving the "lower level" free for trackless or track-bound equipment for loading and transporting. Some of the multipurpose machines weigh nearly 100 t and are equipped with an automatic push-pull device for fast advance.

Based on their experience with platform-mounted booms, GTA together with NormRent have developed vehicle mounted working platforms for heavy loads and for extreme long reach, complying with the needs of large



The double boom NormLifter from GTA in action in a tunnelling project



The Sandvik Quick-Detachable-System (QDS) on an LS191 coal loader

tunnel cross sections. The overall product line is called NormLifter.

The NormTruck, manufactured by GTA is the basic vehicle and may be also equipped with double lifting platforms carrying 750 kg each at maximum reach, with a single lifting platform carrying up to 2,500 kg at maximum reach or with extensible platforms with manipulators for installation of steel arches. When equipped with remote controlled shotcreting nozzles, the unit is named NormSpray.

All NormUnits fulfil the latest requirements of European legislation. Cabins are equipped with ROPS canopies and the engines are in accordance with Tier 3 standards.

The single boom NormLifter 2500A is particularly designed for the installation of heavy steel arches. Even connected segments can be installed in a one pass operation at 12 m in height. The articulated telescopic boom, together with a turnable and inclinable platform and arch handling unit provide fast and safe operation.

The double boom NormLifter is mainly used for installation of steel grid arches and steel mesh. Individual movement of the platforms and the extreme reach of 12 m height and 16 m width make the double boom NormLifter the ideal tool for large tunnels and underground caverns.

NormSpray is designed for the same tunnel

dimensions and has been proven successfully in both tunnelling and mining.

In the coal industry, utility vehicles are widespread, used in both longwall and room & pillar mining. Multi-purpose options include **Sandvik's** Quick-Detachable-System (QDS) utility modules which can be connected quickly, safely and easily to any compatible vehicle, and quickly exchanged with each other. The QDS modules are intended for use with underground coal vehicles such as utility scoops and shield haulers fitted with QDS front-end connections, as they make each vehicle considerably more versatile and facilitate much greater vehicle utilisation. Bucyrus offers its Rapid Attachment System (RAS), which is designed to provide the strength required for multifunctional usage of coal tractors, utility vehicles and LHDs. This allows operators to change everything from a bucket to a fork to a jib crane or CHT 50 trailer without removing the backing plate. One machine can take on many roles and one man can change the attachments. Options include an ejector plate bucket, side shift forks, belt reeler, cable reeler, jib crane (static and slewing), work baskets, fuel and lubrication modules, materials pod system and concrete hopper.

Low-profile dozers, while mainly designed for mining reef type deposits of platinum and gold ore, also have application in cleaning up

underneath and around underground conveyors. DOK-ING is a market leader in XLP dozers, with the most units working globally, mainly in South Africa. It has two dozer models available currently – the XLP diesel engine dozer (83 cm high), but also now an ultra low profile (ULP) battery powered dozer (only 58 cm high). DOK-ING finished the trial for this model in South Africa in 2010. A new redesigned prototype is working in a South Africa mine and several more are now being delivered. The group is also working towards developing its complete XLP mining suite, including the addition of a ULP drill rig prototype (65 cm high) and bolter. The first ULP drill rig will be delivered in August/September 2011 and the bolter after that. The drill rig will be equipped with brand new drifter developed by DOK-ING' own R&D department. The final XLP/ULP mining suite will include five machines – an announcement and associated article in **IM** will appear in the first half of 2012.

Also in the dozer market, the **Dugless** Conveyor Spillage Cleaning Units (900 and 1200) products from Australia's **Minprovis** are soon to be available for utility use underground. The process to have the Dugless 1200 model certified for underground use (both ERZ and NERZ use) is underway, and the group states it is in discussions with interested parties in Australia and overseas about underground applications. **IM**