Xstrata Technology notes the trend for mineral processing circuits “to get bigger and bigger to provide economic gains from the improved quantities of scale. However, just as important, is the need to become smarter, to exploit the orebody to the maximum of its potential. This does not always mean ‘big is best’, but often means that a blending of conventional and high performance technologies in the flowsheet will have a bigger impact on overall plant performance and the bottom line.

“Grinding circuits are a case in point, - larger and larger circuits doing a considerable amount of grinding to grind yet lower and lower grade material, but do they really need to grind the lot? Can the grind be coarsened up to enable only the gangue species to be liberated, separated and sent to tailings, while the wanted mineral, remaining as coarse composites, be recovered, ground to the size required for the valuable mineral to be liberated, and then separated to form the concentrate?

“Flotation is another area where bigger capacity equipment is the norm, with the application of ‘mega-cells’ to tackle the problem of increased tonnes at lower metal grades. However, is it possible to include smaller scale equipment to selectively treat some of the faster floating material and possibly reduce the amount of flotation equipment overall?

“At Xstrata Technology, we believe smart technology blended with smart design is the best way to tackle the challenges that are facing mineral processors today. Lindsay Clark, GM of Mineral Processing at Xstrata Technology, said the learnings of working with clients over the years, and trying to understand their processing needs, provides good insights as to what works and what doesn’t work. The success of the technologies developed at Xstrata Technology play an important role in working with conventional technologies, to provide superior results for the whole of the plant. Importantly, the ore characteristics play a key role in selecting the processing technology, and it is by exploiting the uniqueness and characteristics of the orebody, that smart circuit design can lead to improved metallurgical performance and economics.”

Floating off gangue can improve mineral metallurgy. Some orebodies are associated with readily floatable gangue, which is hard to depress with regular depressing agents in the flotation circuit. Sometimes it makes sense to float off a ‘gangue’ concentrate quickly to enable the valuable minerals to be floated off downstream, without being contaminated by the fast floating gangue. Xstrata Technology has installed Jameson Cells in a number of applications where this makes sense – quickly floating gangue particles, assisted by wash water, to limit the amount of valuables floating off with the gangue. Prefloat circuits at lead/zinc operations at Century mine in Australia (prefloat cleaner), and Red Dog in Alaska (prefloat rougher), use Jameson cells to produce a throw away carbonaceous gangue product, leaving lead/zinc tailings to report to.
The recently announced Increased Recovery Project at PanAust Phu Kham operation in Laos is an example of designing a circuit to recover more and coarser particles, which all need regrinding, increasing metal recovery, while using energy efficient grinding technology that eliminates iron contamination through the use of ceramic media.

Conventional flotation cells to produce lead and zinc concentrate.

Another tip from Xstrata Technology is to produce a concentrate as soon as possible. Conventional cleaners play an important role in producing final grade concentrate, usually using two or more stages of cleaning at low percent solids to minimise the entrainment of gangue to the final grade concentrate. At several sites however, the use of Jameson Cells at the head of a rougher, or at the start of the cleaning circuit, enables a final grade concentrate to be produced, reducing the load sent to the downstream cleaning circuits. Recent installations such as Newcrest’s Telfer mine produce final grade copper concentrate through the use of Jameson Cell technology at the start of the cleaning circuit, before conventional flotation cells, which treat the slower floating minerals.

Often the regrinding circuit is the most neglected part of the circuit; after all conventional circuits do all the necessary grinding on all valuable and gangue material at the head of the circuit, and the regrinding circuit only manages a small amount of tonnes in comparison. However, it often is the cause of high circulating loads, and the iron released through grinding media in ball or tower mills requires high amounts of flotation reagents to get some sort of metal recovery post regrinding. However, what if the circuit is designed to recover more and coarser particles, which all need regrinding, increasing metal recovery, while using energy efficient grinding technology that eliminates iron contamination through the use of ceramic media? The recently announced Increased Recovery Project at PanAust Phu Kham operation in Laos is an example of using this strategy, where better flowsheet design will enable big metallurgical gains.

The new project will involve less selective rougher flotation to produce more rougher concentrate, and incorporate another M10,000 IsaMill™ in addition to the existing mill for regrinding (both using inert ceramic media). Additional flotation capacity will be installed as well, resulting in improved gold and copper recoveries. Importantly, the project will result in lower production cost per pound of copper produced. (From a release to ASX on 18/5/2012).

Circuit designers need to be aware the ‘adaptability’ of processing technology – if it works on one duty, can it be used for another? The IsaMill is a classic case, it delivered energy efficiency to ultrafine grinding, and over the years it has slowly been accepted into coarser applications. The recent installation of a M10,000 IsaMill at the Ernest Henry copper/iron operation in Australia was a standout on several accounts, Xstrata Technology says. “The first was that it efficiently ground feed ranging from 250 to 300 μm down to the required mid 40s μm product size, but it was also the first duty to treat magnetite. Sensible design and thorough test work ensured this application would work, and now offers an alternative route to other magnetite producers.

The introduction of Jameson Cells into oil sands is another example where work was conducted over many years to establish if this technology, used extensively in coal and base metals, could treat bitumen rich oil sands. Later, Jameson Cell downcomers were introduced to Syncrude’s Base Plant in Canada, and provided a simpler approach to bitumen recovery than the trains of conventional banks that has been the mainstay of the industry for years. Again it offers producers alternative flowsheet designs, and offers opportunities for improved metallurgy and project economics.

“By being smarter in our approach to flowsheet design, as well as reviewing the range of technologies on offer and their potential to add value to a project, mineral processors can meet the increasing metal demand from the challenging ore resources that are available.”

Striving for innovation

In June, CommodasUltrasort, the mining brand of TOMRA Sorting Solutions, became the latest member of the international AngloGold Ashanti Technology Innovation Consortium (www.angold.com). The consortium, based in South Africa, was established in 2011 by AngloGold Ashanti and, including CommodasUltrasort, comprises 46 industrial companies, eight universities and research institutions all of which regarded as innovators in their field.

The aim of the consortium is to create new ways of thinking and new opportunities for deep level mining. Mike MacFarlane, Senior Vice President Technical Development at AngloGold Ashanti says: “The consortium facilitates solutions by bringing the world’s leading innovators to solve mining’s toughest problems. Next generation mining requires collaborative breakthroughs.” CommodasUltrasort, has provided state-of-the-art sensor-based sorting technology for dry material separation in various minerals and ore applications since 1988. It was chosen as an expert partner for sensor-based solutions for gold ore sorting. Hartmut Harbeck, technical director at CommodasUltrasort comments: “This partnership will allow us to network with exclusive partners and share knowledge.”

CommodasUltrasort sorters are contributing to a more energy-efficient and cost effective pre-concentration as well as material recovery.

Rock fracturing and sorting is one of ten primary study areas, rock breaking being fundamental to current mining methodology. “Changing the way we mine therefore requires that we rethink how we break rock. The focus is on developing new methods and enabling a new mining paradigm.”

MMD is another consortium member involved in this research and development area. In particular, the company extended the technology of mineral reduction when
it patented the low-profile, high-capacity mineral sizer. The company says this is "the only breaking system designed for mobile installation and which the current range extends from the 500 series machine, through to the 1500 series, which is capable of handling lumps up to 5 m lumps at a capacity in excess of 12,000 t/h."

The Twin Shaft Mineral Sizer™, can process both wet, sticky material and hard rock, either separately or mixed - a combination of attributes making them ideal for even more unusual applications such as dredging. Sizers are currently used in a wide range of minerals and applications around the world. MMD designs and produces a range of heavy-duty feeders, primarily to convey unbroken material to the crushing plant. The combination of these units having allowed the design and supply of a series of successful innovative static, semi-mobile and mobile units to customers worldwide.

To complement the robust twin shaft sizer, MMD has designed and developed a range of heavy-duty apron plate feeders, which convey unbroken material to the crushing plant. MMD has also successfully designed and manufactured, mobile, semi-mobile, and static sizer stations for the complete mineral sizing solution.

Delivering end-to-end solutions for all mining, transportation, milling, processing and waste management activities, Weir Minerals is another consortium member. The company is of course a specialist in delivering and supporting a wide range of slurry equipment solutions, including pumps, valves, hydrocyclones, wear-resistant linings and de-watering products. Weir Minerals offers a comprehensive portfolio of high performance pumps and high-quality minerals processing equipment.

**HPGR**

Weir Minerals says KHD High Pressure Grinding Rolls (HPGRs) are successfully expanding to further fields of minerals processing. At El Brocal in Peru, KHD HPGRs are presently being installed for the treatment of both lead-zinc ores and copper ores. The RPS 13-170/140 HPGR (roll size 1.7 m diameter, 1.4 m width) is being applied to treat 1,250 t/h ore, for size reduction of secondary crushed feed to a product of 80 % < 5 mm. The well established KHD stud-lined rolls are projected to lead to long service life, and the easy access roll removal system is a standard feature.

KHD and Weir Minerals have established a pilot HPGR facility at the premises and in co-operation with the SGS-CIMM TyS Laboratory in Quilicura, Santiago, Chile quoted to provide availabilities of well over 95 %.

At CAP Chile, the presence of KHD HPGRs has been expanded to the new treatment facilities at Los Colorados expansion and Cerro Negro plants, with further RPS 16-170/180 (roll diameter 1.7 m, roll width 1.4 m) and RPS 13-170/140 units, following the successful operation of the existing equipment at the CAP Los Colorados and Romeral operations.

Further progress was made in Mauritania, where KHD RPS 16-170/180 units are being installed as part of SNIM's expansion program, treating a dry magnetite ore in conjunction with magnetic separation, for liberation from a secondary crushed feed to a fine pre-concentrate (-1.5 mm).

KHD has further put forth its RPS 20-220/200 size units (roll size 2.2 m diameter, 2.0 m width) as its new reference standard unit. While very flexible in application for a wide range of minerals operations, these units do fulfil present market expectations, Middleton explains, with rated capacities of up to about 3,000 t/h for copper ores, or up to 4,000 t/h for higher density iron ores.

KHD is proposing the use of HPGR processing and dry classification for selected projects, where there is a strong need to minimise water use, in arid areas with limited availability of water, or where dry processing ahead or after grinding is required. According to Frank van der Meer, HPGR development manager at KHD, dry processing HPGR circuits and equipment can be considered as proven and available technology, and are widely applied in other industries. HPGR and dry classification are be effectively integrated in the KHD Comflex® system, where a static cross-flow classifier is combined with dynamic (cage wheel) classifiers (SKS®-Classifier or Sepmaster®) to generate a fine product as desired for subsequent beneficiation or pelletisation. Grinding by HPGR and dry classification alone, without the requirement for a final ball mill grinding stage downstream, provides a means to reduce operating cost and energy consumption by 25-40%. In another field of operation, dry processing can also provide a process arrangement to dressing an HPGR product suitable for heap leaching, in cases where excessive fines may hinder the percolation process and heap stability.

The now well established co-operation with Weir Minerals provides for an intensive and globally well spread network of service and support staff and facilities, emphasising local presence and close client contact.

To facilitate HPGR testing at a pilot scale, primarily for the South-American region, but also for projects worldwide, KHD and Weir Minerals have established a pilot facility at the premises and in co-operation with the SGS-CIMM TyS Laboratory in Quilicura, Santiago, Chile. Running pilot-scale tests using small-scale industrial units (at the lower end of the industrial size range) provides results with a high relevance and applicability. Realistic feed sizes (40-50 mm) and capacities (50-70 t/h) can be used, at reduced wall effects (edge effect). Also, direct observations and measurements can be made of actual wear rate, flake formation, and moisture effects. Furthermore, discharge products or associated classification stage products can be collected for downstream testing, such as column or bottle roll leaching, flotation, magnetic separation or ball mill grinding, at a particle size condition that ensures a reliable and practical. This type of pilot testing presently provides for the most reliable approach to confirm initial expectations (either from smaller scale testing or ore characterisation), to establish criteria and parameters for equipment design and specification.

This KHD/Weir laboratory provides a full range of pilot scale testing facilities (including a full scale Weir minerals cyclone rig) and analytical services. The laboratory includes a KHD pilot HPGR with a roll diameter of 0.8 m and a roll width of 0.25 m. Depending on material and process conditions, the unit has a capacity up to 80 t/h, for feed particle sizes of...
up to 50 mm. Two motors of 125 kW each provide the grinding power to the rolls, via a variable speed drive. The hydraulic pressure system can provide a specific pressure up to 10 N/mm².

The HPGR is generally operated batch-wise. Depending on the envisaged application, series of single pass tests are carried out to assess parameters for a full-scale open circuit operation. Closed circuit tests are run to investigate effects of recycling coarse fraction from classification of the HPGR product, or of recycling a proportion of the HPGR discharge, or of recycling a (middlings) product from downstream beneficiation (such as in iron ore magnetic separation).

The materials handling properties of HPGR products are a growing subject of attention and investigation. The HPGR discharge generally contains a proportion of compacted material. These agglomerates may sometimes be very competent, and would require desagglomeration to provide a proper feed to subsequent classification or beneficiation. Testing for flake strength and desagglomeration therefore are an integral part of the HPGR test programs. Closed circuit tests also incorporate observations of material handling and material condition aspects, such as classification efficiency, eventual extrusion and material slippage between the rolls. Especially for wet classification, an assessment on build-up and material slippage between the rolls. Tests results from the KHD/Weir Minerals facility at the CIMM laboratories have proven to be reliable and are successfully used as basis for scale-up, design, and specification of HPGR equipment and auxiliary equipment.

One of the innovations at Antamina was a new pebble crusher plant. The pebbles are the result of milling the M4/M4A ores, which contains copper, zinc and bismuth. This is a hard material and size reduction is difficult in the SAG mill. Pebbles are considered surplus material, so it is necessary for the crusher to reduce the pebble size sufficiently so that it can be fed into the grinding circuit and be processed again. This was a high impact project for the company. With the substantial improvement of the grinding process, the operation now recovers part of the material that was previously discarded, obtaining an increase of 12% in actual production from this grinding circuit. Antamina became the first Peruvian mining company to implement this type of plant, it allows the processing of 316 t/h of pebbles from line one of the existing SAG mill and left enough capacity to process the pebbles from a future line 2.

The novel design improvements for HPGR rolls with forged steel tyres and a unique patented tungsten carbide geometry insert is designed to improve wear life, enhance autogenous layer build-up, and to reduce breakage and chipping under load. The challenges presented that Hofmann is overcoming in this manner are:

- Premature wear on rolls
- Studs suffering breakage
- Short life of tyres/rolls
- Customers looking at reducing costs
- Increasing throughput requirements
- To achieve consistent product size P80.

Positive results have been achieved in abrasive quartz/gold applications in terms of regular wear and an “excellent autogenous layer.”

Also, Hofmann has developed forged fabricated mill heads using rolled and welded high-tensile steel plate as alternatives to cast conical mill heads.

The Coalition for Eco-Efficient Comminution (CEEC) presents that annual CEEC Medal – a global award intended to recognise and celebrate the contribution of outstanding published papers, articles or case studies profiling beneficial strategies for eco-efficient comminution.

“The standard of the papers nominated for the 2012 CEEC Medal was outstanding. Our review focused on aspects including the energy savings described in each paper, the ability to integrate the proposed solution into existing comminution circuits and the breadth of the evidence supporting the proposed strategy. We also sought papers which communicated ideas clearly and effectively” said Dr Zeljka Pokrajcic, CEEC Director, Principal Process Engineer at WorleyParsons, and Chair of the CEEC Medal Evaluation Committee.

“The CEEC Medal is intended to bring attention to ‘best-in-class’ research or documentation in the field of eco-efficient comminution. This area of mineral processing provides significant opportunities for improved profit and energy savings in the mining industry” noted CEEC Chairman Elizabeth Lewis-Gray.

The CEEC Medal Evaluation Committee thoroughly reviewed the nominated papers
assessing aspects including originality, applicability, supporting research and documentation, prospective impact, potential energy savings, and presentation style. The results of this assessment process were presented to the CEEC Board for its final approval.

Of the many papers nominated for the 2012 CEEC medal, the three papers shortlisted were:


It was the Antamina paper that won and the award was collected by Metso’s Walter Valery. The judges complimented the paper saying that the study was thorough and achieved significant operational improvement. “The paper illustrates a strong partnership between a mining company and a supplier working together to achieve a superior outcome. The paper is seen as a classical study, well supported by evidence using a clear and implementable methodology. The data is clearly presented, easily understood and involves some important innovation.”

Antamina is a polymetallic mining complex that produces copper and zinc concentrates as primary products and molybdenum and lead/bismuth/silver concentrates as byproducts. In 2007, Metso Process Technology and Innovation (PTI) was contracted to increase SAG mill throughput by integrating and optimising blast fragmentation, crushing and grinding for the harder M4/M4A (CuZn) ores.

Following the implementation of recommendations provided by Metso PTI, the SAG mill throughput increased from 2,750 t/h to reach an average of 3,600 t/h for the remainder of 2007. Due to continued application of mine to mill integration and optimisation philosophy, by 2010, the concentrator consistently exceeded the target of 4,400 t/h while processing harder copper-zinc ores.

Fine grinding and more
Established in 1992 RSG celebrated its 20th anniversary in August. This equipment manufacturer specialises in fine dry milling and air classification systems. Its systems are in operation on all five continents, processing industrial minerals, cement, lime, fly ash, clays and numerous other fine and ultrafine dry products. RSG maintains a state of the art pilot plant for air classification, dry ball milling, crushing and ultrafine grinding.

As part of a program of continuous product improvement, International Innovative Technologies (IIT) has further developed its patented m series of high efficiency vertical milling equipment with the introduction of a new second generation system for high yield minerals and powder milling applications. This technology is suitable for the milling of a wide range of natural raw materials and industrial products, such as aluminium oxide, silicon carbide, zirconia, calcium carbonate and limestone products, coal, fly ash and different types of slag.

With over 200 successful plants in operation throughout the world some notable RSG installations are an ACS-300TD - high efficiency classifier for 50 t/h ultrafine hydrated lime (shown here), MCS-600 classifier - world’s largest fly ash beneficiation plant in South Africa; 4,500 kW mill - ball mill and classification system for calcined alumina and Ufg-200 - ultrafine grinding mill system for calcium carbonate.

Jeffrey Rader Corporation is a leading manufacturer of Vibratory Feeders and Conveyors for the coal aggregate and mining industries. With their unique low-maintenance design and positive drive components, Jeffrey Rader vibrating feeders provide reliable, quiet operation while reducing energy cost.

Jeffrey Rader Mini Mill incorporates hinged swinging doors allowing optimum access while maintaining durability. These units are ideal in moderate volume applications where changing material specifications is required.

The module body of IIT’s m series fine grinding mills is manufactured from heavy duty austempered ductile cast iron and internal wear resistant polyurethane coatings can be incorporated in the inlet and outlet feeds, and a ceramic tile lining used in the grinding module itself.
The upgraded system uses heavy duty castings in a range of modular grinding options to meet the needs of different materials, particle size requirements and throughput volumes. These include a special twin mill system configuration, using two grinding modules operating in parallel from a common feed, for complete flexibility of material throughput and increased production outputs.

Grinding modules can also be arranged vertically in series for multi-stage milling required for the production of certain grades of material.

The second generation m series mills also incorporate pressurised oil cooling and lubrication for extended bearing life, enhanced sealing integrity and the cooling of critical equipment assemblies. In addition, systems can also be provided with forced air circulation through the mill for product cooling and moisture removal where necessary.

In addition a number of special features have been introduced to both reduce wear in the mill caused by hard materials and eliminate the danger of contamination of product.

Compact and powerful, the centrifugal grinding mechanism of the m-series is extremely efficient with the vertical material flow path and special roller assembly ensuring that the force produced is translated into maximum particle grinding power. To meet the specific requirements of particularly demanding applications and hard minerals, this feature has been further enhanced in the upgraded system with a range of material options for the grinding rollers and rings, including abrasion resistant tool steels, high chrome iron and ceramic tooling.

Across the full range of m series mills, new engineering design has enhanced the original modular concept of the technology, with simple access, break down and reassembly features enabling fast in-line maintenance and replacement of the grinding modules when necessary.

IIT mills and classifiers incorporate electronic control and process monitoring systems developed in collaboration with Siemens Industry Sector and Siemens motors, drives and instrumentation systems form an integral part of the milling and materials processing systems.

**Flotation progress**

Designed and engineered at FLSmidth’s technology centre in Salt Lake City, Utah, the 600 Series SuperCell offers active cell volumes in the range of 600-660 m³ accompanied by a multitude of mechanism offerings. “With the increasing demand for larger flotation cells, FLSmidth has invested in research and development to create these large SuperCells,” said Peter J. Flanagan, Non-Ferrous Division Executive Vice President. “The SuperCells will help increase efficiencies while reducing capital expenditures. This places FLSmidth and our products in a prime position in the field of flotation.”

The company says it “remains the only equipment supplier capable of offering both naturally aspirated and forced air mechanisms.”

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**sensor-based are sorting**
interchangeability for added customisation and performance capability,” said Frank P. Traczyk, Director of Flotation Products. “Single flotation cell volume has more than doubled over the past decade. Economies of scale, declining ore grades and near-term commodity pricing stability bode well for the integration of the 600 Series into large concentrators.”

Innovative cell characterisation tools and novel simulation techniques contributed to technical improvements over existing rotor-stator technologies. “Mineralogical diversity, its interaction with fine and coarse particle recovery and lowering energy and operating costs are just some of the challenges faced by mineral processing operations around the world. The Flotation group at FLSmidth is committed to solving these types of problems with revolutionary rotor-stator designs that were created and tested aggressively in our research facility,” said Traczyk. “Maximising valuable mineral production requires a mind-shift away from historical norms, and the SuperCell 600 Series is another step in this evolutionary process.”

Following the approval by Ludowici’s shareholders on May 31 and the necessary regulatory and court approvals, FLSmidth’s acquisition of the Australian engineering and equipment supply company Ludowici was completed on July 3.

FLSmidth says “Ludowici is the world’s leading provider of coal centrifuges, vibrating screens and complementary wear resistant products and services for the minerals industries. Headquartered in Brisbane, Australia, and with approximately 65% of its revenue being generated in Australia, the acquisition of Ludowici will significantly expand FLSmidth’s presence in this important mining region. Furthermore, the acquisition will support FLSmidth’s aspiration to expand its Customer Services offering as approximately 60% of Ludowici’s revenue is related to services activities, spare parts and consumables.”

FLSmidth’s strategy to become a market leader in six focus industries; coal, iron ore, fertilizer minerals, copper, gold and cement. The acquisition of Ludowici will allow FLSmidth to substantially complete its coal processing flowsheet and complement its copper and iron ore processing offerings with leading technologies and brands.

Innovative plants
Weir Minerals Africa has received a substantial order for the supply of its cyclones to Base Resources’ flagship Kwale mineral sands project in Kenya. Not only is this one of the company’s biggest orders to date in Africa for the supply of Cavex® cyclones, but it is also the first time that it will supply Linatex® rubber liners in the Cavex technology. Both Cavex clusters include the supply of Isogate® valves with Linatex rubber linings.

This order was swiftly followed by a second from the project calling for the supply of 55 pumps including tailings pumps, cyclone feed pumps, plant and sump pumps — one of the largest orders across the product range that Weir Minerals Africa has received out of East Africa.

Kwale is located 10 km inland from the Kenyan coast and 50 km south of Mombasa. Production is scheduled to commence in August 2013 with a 13 year mine life that will produce ilmenite, rutile and zircon.

“We believe this substantial order for cyclones was received as a result of Cavex’s reputation as a premium brand for classification efficiency, coupled with our ability to offer Linatex’s proven wear resistant lining. Both products are field proven in the harsh mineral sands arena throughout the world and this gave our customer added confidence in the combination,” Weir Minerals Africa’s Cyclones and Engineered Systems Product Manager, JD Singleton, says.

“This is a global first for us, offering the customer the best of both worlds — the superior metallurgical efficiency that Cavex cyclones can deliver, combined with the formidable performance of Linatex liners. This order is a great example of our ability to adapt our offering to support specific customer needs.”

The order will be delivered in October this year and Weir Minerals Africa’s branch in East Africa will provide product support and commission the equipment alongside the Kwale team. The order comprises one cluster of 12 500CVX cyclones and a second cluster of eight 650CVX cyclones, as well as a variety of 24 additional cyclones and stackers ranging in size from 100CVX to 650CVX.

All the Cavex stackers will be fitted with Linatex discharge regulating valves, with Linatex separator technology incorporated. All clusters will be lined with Linatex rubber and the cluster distributor is top fed as per the customer's specific requirements. The Cavex cyclone was originally developed in response to industry concerns relating to cyclone wear and reduced efficiencies in grinding circuits. Typical feed designs are 75° and 180° involutes. Existing designs were prone to wear near the inlet as a
result of turbulence and coarse particle scouring.

"Cavex cyclones offer a unique solution for slurry applications in mining and mineral processing and have been designed to deliver maximum efficiency and capacity, while providing longer wear life than conventional designs," Singleton says. "These cyclones provide enhanced dewatering and desliming efficiency, reduced product loss, improved product recovery and increased circuit capacity by minimising the quantity of material escaping to the underflow or overflow streams.

"Their distinctive design provides a natural flow path for slurry material. The unique shape has no sharp edges, no square corners and allows the feed stream to blend smoothly with the rotating slurry inside the unit, minimising localised wear on the feed chamber and vortex finder. These design improvements result in lower operating costs and fewer cyclones required for a given duty. The end result is greatly reduced turbulence creating more even wear, longer life and more efficient classification."

The order for 55 pumps for Kwale will be delivered between December 2012 and February 2013. "This extensive range of cyclone and pump products includes most of our leading brands," Rui Gomes, Slurry Pumps Product Manager explains. "We've been able to supply all the customer's needs from our existing product portfolio, with a particular focus on increased wear life to decrease the total cost of ownership. Specifying Linatex is pivotal to this. "This significant pump order is being supplied from our complete range of Warman AH pumps, the world standard for the most difficult slurry applications. The order includes a 450MCR and 550MCR units — two of the biggest sizes in this range."

One of the strategies employed by Weir Minerals Africa to gain market acceptance is to offer customers equipment on trial with an option to the technology once proven. "Every one of the trials we ran in Africa was successful," says Gomes. "The pumps remained in operation after the trial period expired, resulting in the purchase of the equipment. "For this particular project we were able to offer the customer a variety of pump construction materials to suit the different applications including R55 rubber and polyurethane liners, which deliver excellent performance in the mineral sands sector. This has been a focus of our R&D efforts for several years, gearing our products for longevity, longer wear life and improved efficiencies in harsh applications."

In July, Randy Agius and Sandy Gray signed an agreement to establish the Gekko Cyanide Detox group. Agius is a global authority in this field and approached Gekko earlier this year to establish a dedicated cyanide detox group within the Gekko organisation. The group will use his knowledge of cyanide detox chemistry and industry relationships to create a total solutions Gekko CN Detox Group.

Agius commented, "Gekko's chemical engineering skills from its intensive leach division provides an excellent platform for this alliance and will ensure that my knowledge and skills in this specialist area are retained within industry for the long term. This is a classic 'one plus one equals four' scenario."

The combined group that will be able to offer customers a specialised package for greenfield projects from test work through to installation and ongoing service of a fully engineered modular system. The brownfield projects will be more focused on the ongoing audit and optimisation of current cyanide detox systems, operating under Gekko's Advantage Plus Service Support agreements.

Gray, Gekko's Technical Director, commented on the importance of a correctly functioning cyanide detox system. "Requirements for the discharge levels are becoming more stringent and the complexity of the cyanide detox systems will become more intense as government insists on lower discharge levels."

Agius has successfully managed the design and/or operation of over 120 cyanide detoxification installations worldwide and he will now work closely with Gekko as Vice
President, Global Detox Group to ensure the gold industry can gain access to an experienced detox support network.

**Plant asset management**

The compelling case that Plant Asset Management (PAM) Systems provides for reducing operational costs while simultaneously improving performance is the primary factor driving growth of PAM. The worldwide market for Plant Asset Management Systems will experience growth this year and throughout the forecast period according to a new ARC Advisory Group study.

PAM growth is being fuelled in part by the increased amount and complexity of automation equipment. “As aging workers leave the workforce, maintenance specialists are vanishing and are being replaced with generalists. These generalists will need user-friendly tools and more simplified work procedures to maintain plant equipment,” according to Sr. Analyst Paula Hollywood, the principal author of ARC’s *Plant Asset Management Systems Worldwide Outlook* (www.arcweb.com/market-studies/pages/plant-asset-management-systems.aspx).

The process industries as a whole recognise the need to minimise downtime and maximise asset availability. Certainly, asset intensive industries provide the greatest opportunities for PAM suppliers. Here responsibility for asset availability is no longer the domain of maintenance alone as operators take a more active role in data collection and machine inspection.

**Design solutions**

As minerals extraction and processing projects have progressively increased in scale and complexity, so too has the need for more powerful engineering and design software. AVEVA’s 3D design solutions are used to create the most advanced minerals processing facilities.

It is AVEVA’s opinion that “apart from scale and mechanisation, the processes of minerals extraction have remained largely unchanged throughout history. However, unprecedented changes are now taking place in the sophistication of the processes themselves and in the engineering of them. These changes have been brought about by a number of factors.

“Perhaps most important of these is the dramatic increase in scale to meet the demands around the world. At the same time, pressure to minimise costs and the environmental impacts of extraction, concentration and waste disposal have led to new processes and a need for more sophisticated engineering. Reconciling these conflicting pressures has inspired leading contractors to make imaginative use of engineering and design technology which was originally developed to serve the process plant industries. They realised that 3D plant design software not only provides all the necessary capabilities, it could easily be applied to the unusual needs of the minerals industry. As a result, recent years have seen the growing adoption of advanced, object-centric 3D design systems in an industry for which the drawing board had long been the standard design tool.

“One way of achieving quicker and more efficient projects is, for example, the reuse of previous design work, something which was difficult in the world of paper drawings, but very easy with an object-centric plant design system. Similarly, large scale and technical sophistication quickly hit a ‘complexity barrier’ in 2D design which such 3D systems have long overcome, enabling right first time design of massively complex engineering projects. 3D visualisation can also greatly improve project planning and design communication, which can be vital to achieving approval for minerals projects, which are subject to much closer scrutiny than before by investors, governments and regulatory authorities.

“Another good example of how the latest design technology can speed up projects is in modularisation. Once one has created a design for, say, a separation unit of a certain capacity, it is easy to replicate it across a site – or even across multiple projects – even if each module requires some adaptation to suit its particular
location. Contractors can build up libraries of proven design modules, capturing their specialist expertise in a form which is readily applied to future projects.”

AVEVA has seen some impressive applications of its PDMS software in the minerals industry, most notably in Latin America. At a recent industry conference, one PDMS user described how they had first converted global co-ordinate data from an aerial survey into a 3D rectangular grid model of the mountainous region concerned and then used this to design and plan a concentration and conveying system to deliver product direct to bulk cargo vessels 250 km away. Needless to say, this made an impressive 3D model!

With increasing scale and complexity, it becomes more important to be able to thoroughly review a proposed design as early as possible and regularly as it is developed. Object-centric modelling tools provide powerful means for doing this, such as interactive walk-through or fly-through review, the ability to check object information and take measurements in 3D, and the ability to animate movement. These functions also enable operations planning, safety assessment and staff training, well before the plant is even constructed.

AVEVA also believes “minerals projects are also becoming increasingly collaborative activities, either because a contractor has offices in several locations, or because a project may involve a number of design partners. Leading design solutions support this with a number of information exchange functions. Multi-site collaboration on a single project model is now robust and efficient, thanks to technology which synchronises work by transmitting and managing changes, rather than trying to duplicate the entire database to every site. In addition, open, standards-compliant interfaces exist to enable design work in different systems to be combined in a single project.

“Pioneering contractors who have already taken the plunge into an advanced 3D solution have no doubts about the boost it has given their businesses. The inherently higher productivity achievable, together with the ability to integrate engineering and design data in a single project model, not only makes them more efficient in project execution, it enables them to tender confidently for larger projects, either alone or in partnership with others. More accurate and detailed materials requirements add direct cost savings to those achieved through greater automation in the design office and fewer construction problems.

“There are often unexpected benefits as well. Being able to work concurrently on a design can foster a strong team spirit, as designers can see each other’s work as it develops and contribute ideas or help solve problems in real time. Clients appreciate the way in which high design quality minimises project delivery time, but mostly they value the way in which integrated, object-centric design technology is removing barriers to their own business growth.”

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