

IRON FIST

FMG conveyor spans BHP Billiton's rail line in Port Hedland



Perhaps the ultimate 'company making' project, **John Chadwick** examines the technology behind "The New Force in Iron Ore"

A number of conventions have been broken by Fortescue's Pilbara project, as well as it bringing technical innovations to the iron ore industry. Most obviously, the conventional wisdom that only large companies can handle the huge infrastructure required for a major iron ore operation has been smashed by Fortescue Metals Group Ltd (FMG). It is big now but it started small, only five years ago. It also made its CEO one of the wealthiest men in Australia.

Perhaps its most important technical innovation has been its pioneering use of

surface miners in iron ore, and widespread conveyor use that is saving a considerable number of trucks. In other words FMG is pioneering continuous mining techniques in hard rock mining. It certainly made Rio Tinto sit up and take notice, and examine surface miners for itself (see *IM* March 2008).

Today FMG holds a larger land position in Western Australia's Pilbara than its 'big brothers' – well certainly 'older brothers'. FMG has 40,000 km², Rio 11,000 km² and BHP Billiton 7,000 km². Fortescue has over 2,400 Mt of resource (including 1,050 Mt of reserves)

and a further 2,600 Mt of resource expected. Ore production is forecast at 55 Mt/y with a planned market driven expansion to 200 Mt/y in the foreseeable future.

It all started in 2003 when The Metal Group, the company's majority shareholder, acquired Allied Mining & Processing. Soon after, the shareholders, with Andrew Forrest as CEO, voted to change Allied Mining and Processing's name to FMG and enter into the iron ore industry. At the time, Allied Mining & Processing held substantial tenements at Mt Nicholas and promptly acquired Iron Ore Australia – along with its Mt Lewin tenements – under the FMG banner. The scene was set for the planning of both open-access port and rail infrastructure and a mine site to begin.

At the time, when many were predicting a rise in iron ore prices of up to 40%, with long-term demand expected to remain strong on the back of Asian growth, the Pilbara's infrastructure was insufficient to cope with such increases in tonnage. Nevertheless, FMG set out to become the first major iron ore entrant in 40 years.

The completion of construction is drawing near and the company is confident that its first shipment of iron ore will leave its port facility at Anderson Point on schedule in May of 2008.

Project construction commenced at the port in February 2006. Since then the site's transformation has preceded with great speed: dredging was completed, which was followed by driving of the wharf piling and recently the placement of the wharf modules. The train dumper cells were also recently installed, marking a significant accomplishment in the final stages of port completion.

In January, the Happy Buccaneer heavy lift ship raised FMG's Thyssen Krupp shiploader, weighing 800 t, onto the deck at the Anderson Point port facility in Port Hedland. Constructed in Xiamen in China, it has a rated capacity of 12,500 t/h and is the last major product handling item to be delivered to site.

Work continues on project optimisation, reviewing the scope change to the original project. Optimisation plans include bringing forward the construction of the lump circuit at the mine, the construction of a third de-sand plant and the commissioning of the second ship berth to a loading berth.

A concerted effort has been mounted to ensure that completion of the rail occurs on schedule. During November and part of December last year some of the mining team assisted the program by undertaking

earthworks along the rail line. This involved some 40 people and 18 pieces of equipment ranging from a CAT D11 down to haul trucks and light vehicles. This assisted in finishing a critical section of the rail line between chainage 120 through to 150.

In late February, FMG announced:

- The mine site was 80% complete as at end January with continuing progress on the crushing and screening plants and the product load out vaults
- Rail works were 85% complete at end January with the automated track laying complete to chainage 110 and a total of four manual track laying teams deployed along the rail line
- Project final forecast cost is A\$2.765 billion which is an increase of A\$66 million from last period. The adjustment was primarily due to an increase in the estimated EPCM costs to WorleyParsons of A\$61.6 million.

The company reported that "in a strategy to bring forward the commissioning date for the key port assets of the train unloader, the stacker and the reclaimer, plans have been developed to load ore onto trains at the 185 km-mark. Under the current schedule the track



Stacker mounted on ring-beam at Cloud Break

rationale is to expedite the delivery of loaded wagons to the port to create a saving of some four weeks on the wet commissioning program. It is anticipated that wet commissioning at the port will be near complete by end April which is sufficiently in advance of the First Ore On Ship (FOOS) date of mid May."

The dry commissioning process was expected to be completed by end March and wet commissioning to commence immediately thereafter. "The date for the first delivery of ore onto train is now early-/mid-April which provides a month for the building of stockpiles at the port in readiness for FOOS." For the plan to process some ore and truck it from the mine site to a loading point part way along the rail line at the 185 km-mark, there is already a stockpile of mined ore on the ROM pad at Cloudbreak. The portable crushing and screening plant used during the trial mining program in 2005 was being recommissioned to provide for a target of 150,000 t of product. The ore is being trucked along the access road to the 185 km mark by

is expected to be complete to this point by mid-March which is about a month earlier than the full connection to Cloudbreak. The ore to be loaded is to be trucked from Cloudbreak over the next few weeks via the access road that runs the entire length of the rail line. The



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The Thyssen Krupp shiploader on the Anderson Point wharf

power train trucks of 200 t capacity. The ore is placed into the rail wagons by wheel loaders and railed to the port to enable wet commissioning of the port equipment.

The company also reported that “the ore preparation facility does not need to be 100% completed until well into the ramp up program. The reason is that the three desand modules – which collectively represent [about] 10% of the construction value – are not required under the first stage of the mine plan. The type of ore extracted initially is of low clay content and not requiring the washing process to reduce alumina levels. Accordingly completion of the three de-sand modules can be delayed beyond the FOOS date without any impact on operations.”

The majority of FMG’s product is direct ship ore that meets the high purity requirement without any processing. However there is also an amount of approximately 25% of the run-of-mine fines that has a contaminant level of ~ 8.3% in ground. This ore does benefit from minor processing to enhance its functionality to the steel mills to get the contaminant level down to ~ 6.3% of final product.

Innovative mining

Construction at the mine site is on schedule and the ramp-up to major mining operations has begun. Terex is supplying 20 MT3700AC haul trucks (190 t payload electric drive units) and four O&K RH340 (550 t) and three RH170 (370 t) shovels for the excavation of the overburden material above the orebody. Caterpillar is supplying 24 777s (95 t payload mechanical drive haul trucks) to haul to the ore handling conveyors and the major ancillary equipment such as D10 and D11 dozers and 16H graders.

The ramp-up to major mining at Cloud Break has begun with ore already stockpiled at site in preparation for full-scale production. Plans are advanced to ensure that the mine team will deliver the initial production target of up to 55 Mt/y of iron ore as soon as possible. Furthermore, the initial plans have been optimised to ensure that any future expansion can occur without impediment.

The Cloud Break ore is covered by overburden with an average thickness of around 20 m (starting at surface and reaching more that 60 m in depth). The overburden is free digging offering low cost removal. The mineralisation is gently undulating, with a typical dip of 2° to 5°.

The Terex fleet removes overburden conventionally and exposes the iron ore as a reasonably flat tabular body, allowing extraction by surface miners. At FMG’s Cloud Break the flat lying nature of the deposit lends itself to layouts similar to those used in the strip coal mines in the Powder River Basin (USA) and in Queensland (Australia). Although initially overburden stripping is a truck and shovel operation, as the mine grows, the overburden will be loaded into a hopper then onto a conveying system that will deposit it in the mined out strip. The conveying system is mobile and is programmed to enable the deposited material to take up a similar land form to that which

existed before the overburden and ore was removed.

From the end of 2008 a substantial reduction in the use of conventional methods will occur when the overburden removal system is introduced; however, conventional methods will always form part of the process.

FMG teamed with FLSmidth Rahco to design, engineer and fabricate an overburden removal system that takes existing technology to another level. The revolutionary system, capable of removing 25 Mt/y of overburden, should deliver true uninterrupted removal of overburden with costs below other less-efficient methods.

The system’s design affords the mine team exceptional control over the repositioning of overburden, allowing them to mimic the natural form of the landscape and begin the work of environmental restoration almost immediately. Being able to create an extremely flat bench of stripped overburden means that the top soil is far less likely to wash away, making revegetation more successful and allowing cattle to eventually return to the area.

FLSmidth RAHCO is currently working on the contract to develop and supply two mobile overburden handling systems, including innovative size reduction equipment. These systems are a collaborative effort among several FLSmidth Minerals companies: FLSmidth RAHCO from the US, FLSmidth Minerals Pty. and FLSmidth ABON in Australia, and FLSmidth MVT GmbH in Germany.

The first group of what will be a full fleet of 14 Wirtgen surface miners has been mobilised to site. FMG reports that “results using this innovative technique have been very encouraging and the benefits of using surface



Artists impression of the overburden conveyor removal system

miners on this particular deposit are numerous. [They] include:

- Elevated grade control
- Removes need for primary drilling, blasting and crushing
- Reduced downtime as post-blast remobilisation becomes unnecessary
- Cleaner pit floors, which leads to reduced damage to vehicles and tyres
- Multiple pit faces across the flat deposit can be mined simultaneously
- Increased safety as a by-product of higher predictability
- Ability to begin environmental rehabilitation work promptly.

“These benefits will directly translate into better, more cost efficient product.” Furthermore, Wirtgen says that Surface Miners

in iron ore offer selective mining, enabling areas of different ore grades to be mined in separate operations. “The production of small-sized material considerably facilitates processing, while cutting costs at the same time.”

The Wirtgen 2500 SMs weigh over 100 t and deliver over 750 kW in power. That power is delivered to four crawler track systems through an all-track hydraulic travel drive. The milling drum drive is mechanical and the drum offers a cutting width of 2,500 mm to a cutting depth from 0 to 600 mm.

Surface miner trials last year provided for significantly improved “pick” life during production. A range of cutting picks were trialled with varying tungsten coatings and designs to determine the style best suited to the ore mined at Cloud Break. Wear rates from second and third generation pick designs significantly outlasted the original picks used in the trial mining exercise in 2006. It was “confidently envisaged that pick life can be extended from 70 t per pick to in excess of 250 t per pick.

Mining removed some 809,237 m³ (bank) of overburden during January. Total ore mined

Terex is supplying 20 MT3700AC haul trucks (190 t payload electric drive units) and four O&K RH340 (550 t) and three RH170 (370 t) shovels to excavate overburden



out the ROM pads and some is being used for the trucking of 150,000 t to be loaded onto the train at the 185 km mark.

The inventory schedule for mobile mining equipment continues to grow at Cloudbreak with the site in January home to 15 Terex 190 t overburden haul trucks; 6 O&K shovels and backhoes; 24 CAT 100 t trucks, four D11 CAT dozers, four D10 CAT dozers, three water trucks, two graders, five service trucks and five Wirtgen SM2500s.

Other suppliers include:

- Mine variable speed drives – ABB
- Port and mine conveyor drives and belting – David Brown Gear Industries
- Conveyor idlers – Continental Conveyor & Equipment (Joy Mining)
- Mine crushing plant – FFE Minerals (Australia)

during the month was 249,310 t which came from the Hayman pit and was extracted by the Wirtgen Surface Miners. The total amount of iron ore mined as of the end of January was 914,310 t. Some of this was used for sheeting

(FLSmidth)

- Mine screen and feeders – Ludowici Mineral Processing and JEOST Australia
- Mine control systems – Motherwell Automation

Surface miners offer selective mining, enabling areas of different iron ore grades to be mined in separate operations





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OPERATION FOCUS

- Mine belt feeders – RCR Engineering
- Mine train loader – Schenck Process Australia
- Construction and commissioning of ore stackers and reclaimers – Thyssen Krupp

As already noted, the Wirtgen Surface Miners take care of primary crushing of the ore. The main crushing facility comprises eight FLSmidth-Excel Raptor 1100 cone crushers. Two are performing a secondary crushing at 4,000 t/h, the other six are in the tertiary role.

Mastering the flexibility

FMG will use a suite of best of breed mining software packages as part of its overall IT/IS and mine operations strategy. Among the various technologies chosen were QMASTOR's specialist management information systems: Pit to Port.net, SMS3D.net and iFuse that will form the essential backbone to manage the outbound ore supply chain to ensure the right ore is available at the right place at the right time.

Pit to Port.net is being deployed as the product supply chain management application for operations at Cloud Break and Anderson Point. The system will provide users with a vast array of functionality including: pit mapping with resource definition; mine planning and scheduling; stockpile management; stockpile modelling; process plant management; rail management; end to end ore tracking; grade control and blending; port stockpile management; ship loading; vessel scheduling; despatch/demurrage management; contract management; invoicing and web based reporting.

SMS3D.net will be implemented to provide advanced 3D modelling of port stockpiles at Anderson Point. The system integrates to stacker/reclaimer yard equipment to build a transaction repository and using complex algorithms develops a real time 3D model. The system will primarily be used as a planning tool to assist with precise blend management and reclamation/load planning.

QMASTOR's iFuse application provides the necessary framework for Pit to Port.net and SMS3D.net to interface to correlated systems in the mining chain. At FMG, this includes integration to and from: Babelfish (data visualisation tool); Primavera (mine modelling/scheduling tool); Dome (reporting tool); laboratories, port and rail systems.

Fortescue has an obligation to its customers to deliver continuing shipments of ore of a consistent quality that meet contract specifications. QMASTOR systems assist with the management of this process by providing a holistic view of the supply chain combined with the ability to drill down and manage each task as a process on an individual level. The QMASTOR solution will be integral to FMG's daily operations and is expected to be used by personnel in functional areas including geology; mining; engineering; planning/scheduling; plant; rail; port; marketing and finance/accounting.

Multiple pits with independent faces will create production flexibility and blending options. FMG ore will be conveyed to crushers and screened into lump and fines products and then railed 260 km to Port Hedland to FMG's port facilities for stockpiling, awaiting vessel loading for delivery to the customer.

Construction of the project commenced in February 2006 with the turning of the first sod at Fortescue's site at Anderson Point in Port Hedland. First ore is scheduled to be shipped in the second quarter of 2008. Facilities at the port include two loading berths, one ship loader, a single loop 1 x 2 car train unloader and a lump circuit. There is a 3.2 Mt stockpile.

Possible future development plans are to expand from 55 to 100 Mt/y (target 2009/2010) and to expand from 100 to 200 Mt/y (target 2010). **IM**