

**NORTH STARS:** Syncrude uses Wenco's dispatching mostly in the North Mine running ore and has a full-time dispatcher on each 12 hour shifts, 365 days of the year



# Automatic haulage

**Bristol Voss** talked to users of Wenco software-based dispatching technology, across the globe

**H**ow fast can a mine management system make a difference at an open pit operation? Depending on the situation, almost immediately. "We didn't have any system - or (software-based) dispatching. We were manually capturing log sheets for production purposes," said Neil Ferreira, IT Analyst at De Beers' Venetia Mine in South Africa recalling the days before commissioning a Wenco fleet management and information control system in November 1997.

Mr Ferreira credits the system's implementation with a productivity increase of more than 20%, based on tonne/km/hr. "What this gave us immediately was the savings on the purchase of one truck (in 1999) and we delayed the purchase of another," he explained, describing how the diamond mine, despite its relatively small fleet, is now doing the same amount of work as before with essentially two fewer trucks.

Payback, he told his principals, was "instantaneous, there was a huge saving immediately."

Not all mines can so quickly quantify the system's potential savings, of course. And, there's another catch, said Mr Ferreira, echoing what other users told WME: Mine management systems are not

plug-and-play programs that run by themselves. They're only as good as the information put into them.

Wenco's president and chief executive, Paul Richard, couldn't agree more. "Some mines realise the potential and work towards maximising the use of the system and some mine cultures just don't get the same amount out of it as others. These systems do require care, feeding, and nurturing because you've got a dynamic situation."

Wenco got its start in the late 1980s as an engineering firm spun off from a now-defunct coal mining company. Today's Wenco system comprises the field hardware (the mobile data terminals - MDTs - installed on the equipment), the radio infrastructure, the base station, the host computer system, Wenco software, and turnkey commissioning with training and installation.

MDTs communicate in real time back to the host software through a dedicated radio link. Using GPS, Wenco can track the progress of a truck as it moves throughout the mine. In the dispatching mode, for example, the MDT reports at key road intersections or any other locations a user designates. The system recognises the truck is in the crusher area, for example, because the GPS system reports it's there. Second,



**MONITORING:** it's Syncrude's dispatcher who has responsibility over monitoring the shovels

when the box gets lifted, it triggers a dump switch and the MDT sends a message via radio to the computer system that this truck has dumped and is available for an assignment. The software calculates an assignment and sends it back to the truck operator's display.

The dispatching algorithm considers many factors, all of which are customisable based on a mine's plan and changing conditions but would generally consider travel times in relation to shovel options and any restraints, such as truck-loader matches. In addition it can keep trucks off certain routes. The goal is that the system's software calculates the best options more quickly and efficiently than a human counterpart. Further to dispatching, the system tracks production data in terms of cycle times and, when integrated with on-board diagnostics, it can produce reams of other data, including maintenance information from on-board condition monitoring systems.

Separate modules look more in-depth at specific concerns. Take ore grade, for example. The main system can be configured to control which trucks go with which grade ore to a crusher or stockpile, storing ore quality information by digging face and other parameters. It can also track ore quality and quantity on a load-by-load basis, calculating projected blends in real time, and dispatching trucks to certain shovels to keep the average grade within a specified range. For further refinement, Wenco's new Bench Master system uses high-precision GPS on shovels to improve bench elevation and ore quality control. At press time, this module was being commissioned as part of a complete mine management

system at Billiton's Maatschappij bauxite mine in Surinam.

Wenco's database is a key selling point for some purchasers. One of its distinguishing features (in its latest generation) is its full, open architecture, supporting Oracle and Microsoft SQL Server software.

The fact that it's not programmed in a proprietary format allows managers to use common front-end tools such as Crystal reports or Access to generate virtually any report and combine Wenco information with data from other databases.

Virtually any operations data can be tracked or queried. And, it can be fed to the database over the radio in real-time or at user-selected intervals. Or, as in the case of on-board diagnostics, a user can request that only certain levels of alarm codes be transmitted real-time with the maintenance department downloading the entire set of information later.

The Wenco system is not dependent on the on-board trucks systems to report production data and works on older fleets as well. If a truck did not have a payload monitoring system, for instance, the system would use two-zone GPS to differentiate how far the truck is from the shovel. If the truck is stopped in the inner zone (say within 20 m of the shovel), it will infer it's being loaded. The system detects when the truck moves out of the zone and will note it as at the end of the loading cycle using default numbers to calculate the load.

With all these variables, WME set out to look at how mine operators are really using Wenco, what their experiences are integrating it with other technology, what they gained by using the system, and how they continue to wring more value out of

it.

Mr Ferreira explained that Venetia uses the system primarily for dispatching and production monitoring - capturing all the production-related data that they had been gathering mostly manually. Not only does this speed up reporting, he said, but it gives more data to report on.

Venetia has integrated the system with the VIMS systems on its all-Caterpillar fleet so condition monitoring alarms ring in the control room as faults happen. "Within the system you can set which level of VIMS alarm we want reported and we've taken level 2 and 3 as what we want to be alerted on," he noted. There is always someone at dispatch monitoring the system during the mine's entire 24-hour-day, 7-day-a-week operation to handle exceptions and to act on them. On the software side, he said there have been no major problems and the support has been good, noting that there has been quite a lot of major customisation done for the site, integrating it into some of the group-developed systems.

Like Mr Ferreira, Peter Carter, manager of mining at Cameco's Kumtor mine in the Tien Shan region of Kyrgyzstan, said he saw a fast payback from the Wenco system which was commissioned a year ago and links the Kumtor fleet of 24 Cat 777B trucks, four O&K RH120C shovels, and four Cat 992C loaders. "We've been increasing our mining production about 15% per year since the gold mine started production in 1997," Mr Carter explained. "But what happened last year when we put in the dispatch system, we produced 17% over budget in terms of bank cubic meters (BCM) moved - but we did it at only 1.5% over our budgeted cost. As far as we're concerned, there's no other explanation than that we did it through increased efficiencies (from Wenco)."

Mr Carter has every intention of continuing to push the envelope, and Wenco is a part of that effort. "They guaranteed us 5% (production improvement) and said, 'You'll get 5-10% the first year'. But then, what most operations do is let the system idle. We've told Wenco we're going to get another 10% out of it this year. And that's not because we ran so badly before, but because we want to get the most out of the system. "The real savings for us is probably the cost of running the fleet. We have a fixed fleet, and mining faster to make more ore available at a better grade, saves us money by allowing us to use fewer trucks to move the same amount of material. The extra efficiency we get is the equivalent of having an extra haul truck, just by using the trucks we have better. The system saved us a truck last year and we weren't even dis-

patching in the best way. We had our dispatch office three km from the pit, down in the valley." Now that the dispatch office is next to the pit, the firm expects to get another 10% or the equivalent of another haul truck.

With loads generally within 2-3% each time, the firm can't justify the cost of load-weighing - not implementing the system, but keeping it running. "We have very harsh conditions, lots of dust, big temperature changes, sometimes on a daily basis, and it's just too hard on the electronics. Plus, our dispatch office is over 4,200 m in elevation and altitude is a big problem. We can burn out power supplies and computers without even thinking about it. When that happens, someone has to be around to fix it fast."

That said, he noted the Wenco hardware is pretty rugged. "Physical damage is not that big of a problem," said Mr Carter. "For us the biggest problem is when something goes wrong with the electronics that we can't repair ourselves." It also means people on site have to be trained to maintain the system. "We're in a remote location and there's only so much the vendor can do for us. We need computer expertise within our engineering group and MIS support for our engineering group from our MIS people. The engineers are learning and they know a lot because they've broken it every way that you can think of," he laughed. "That's the only way you learn - or miners learn, anyway."

Half a world away, Ian Brown, mine planning/truck shovel dispatch specialist, at Syncrude's oil sand mine in Alberta, Canada, agreed system maintenance is vital to maximising its benefit, especially in harsh environments. "In the winter it can be -50°C and in the summer +35°C," he said. "Oil sand is not nice stuff to be around at any time. And, if it's not dust, it's a 4-tonne rock that smashes the antenna, receiver, and operator."

Syncrude, according to Mr Brown, tries to be as proactive as possible to maintain the Wenco hardware on the trucks and shovels. "We have a company that does all our maintenance for us and they spend time trying to identify potential problems before they happen," he said.

Mr Brown said aggressive maintenance is simply the price of doing business. "Would you drive your car all year without an oil change? It's part of operating a vehicle."

As a result of stringent maintenance, Mr Carter says that the hardware and software is extremely reliable at providing information. Since the Wenco system was commissioned so long ago - in July 1993 -

and since it along with Syncrude's fleet have been updated so many times, it's impossible to recall specific earlier gains the system may have made. However, Mr Brown noted, it is not used for 100% dispatching, but mostly data collection. "You name something and we're collecting data on it - performance, time, volumetric information."

Syncrude does not use it for all the dispatching, he said, because of the dynamics of the mine. "We have restrictions on where we can use the types of trucks we've got. Not having a homogeneous fleet - we've got 793s, 930Es, 797s - we've got areas of our roads that aren't wide enough for the 325 tonne trucks. We've also got underground pipelines originally designed for the 216 tonne trucks to drive over. We've got overpasses that are basically 216 tonne top level restrictions."

Enter Wenco. "The amount of information available to make decisions is, to put it bluntly, enormous. We have an opportunity to consistently collect our data and validate it. We start by analysing different areas of the operations, trying to minimise the amount of non-productive time on our trucks. We take a look at numbers to make sure they're consistent across all four teams."

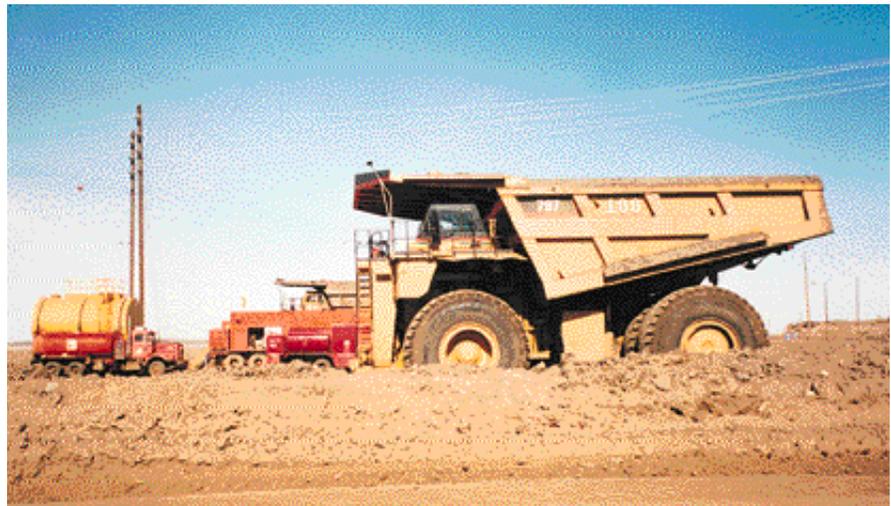
Another thing Syncrude does is pull the actual payloads off the trucks so they have a volumetric rather than a default load. "We can now tell exactly what's on a truck based on the payload the VIMS system is giving us, or the PLMII or the TPMS which the older Cat trucks have as well. Every two weeks we put reports out for shovel operators to let them know how they've done on their trucks."

Despite the limited bandwidth of a radio system and the volume of Syncrude's

information demands, Mr Brown said so far, there is no information bottleneck. "Basically, everything is real time, and we look at it at any given time. We also run all our system on GPS so we have a lot of data transfer that's going on. We have hits and glitches every once in a while, and we may be a little vulnerable as to how much information we can pull and transmit, I leave that to the radio people." Finning, the Cat dealer on site, downloads the VIMS information off the system as well.

Syncrude is in the process of ramping up increased maintenance tracking. One of the key areas for attention is overspeeding. "It's a major killer of engines," said Mr Brown. Another goal will be to try to run equipment longer before doing maintenance. "It's a major saving to us. The engine you're going to change out anyway, so it's not necessarily the cost savings, but if you can get another 1000 hours out of an engine, that's a 1000 hours of truck time available. We don't supercede our warranties, but it allows us to push the limits. If we've got information to say 'I think we can run it longer,' we've been fortunate that our suppliers and managers have taken that to heart and recognise our maintenance program."

As far as other upgrades, it's hard to say what's next. Mr Brown said, "We continually ask Wenco to improve their products and they've been extremely responsive to that. Condition-based monitoring is probably the next big step that I can see. We just finished an event tracking project and that's being upgraded as well. Just with the event tracking information last year, we saved three rear ends. At \$250,000 a rear end, that's a major saving. The idea is to try to identify potential problems before they actually happen. We'll be taking more



Pic: Bristol Voss

**ASSIGN:** the system can assign trucks and identify when they are supposed to be fuelled

information off the truck diagnostic systems and doing real-time analysis of the information. We're heavily involved with Wenco and we're lucky to be a participant in these activities."

Another long time user is US Steel's Minntac Mine in Mt Iron, Minnesota. Jim Tieberg, Senior Shift Manager said the system covers a fleet of 28 Cat 793s, 17 shovels and six loaders all of various sizes, as well as six Euclid R-170s used on the tailings basin. A crucial concern at iron mines, especially those in North America, is the dramatic range of ore grade from face to face - sometimes from 15-50% iron content. With plants set up to operate efficiently in certain bands it's important to deliver a correct blend. It's equally important that the blending be done real time not in batches, since as soon as you go into a stockpile and rehandle material it's introducing inefficiency.

Minntac uses Wenco for ore grade control as well as dispatching and reporting. "We also use Wenco to blend in the silica (content of the eventual taconite pellets), to keep that where we want it to be," explained Mr Tieberg. "Over the last year or so, we've made a switch so it would blend on quality, not so much on quantity. We have to change our blend every day, based on updated information from the engineers."

The system's savings was measured when it was first commissioned in 1992, when Minntac was a train operation. "One of the big ways that my predecessors saw that it paid for itself, was when they found they were sending a lot of cars not loaded to capacity. With the feedback that that the shovel runners got through the Wenco system, they were able to properly fill the cars. Trains coming up to the crusher properly loaded more than made up for paying for the system. We saw the same increases when we converted to trucks." The rest of the system, he said, "keeps good track of the trucks and is a good statistician. It keeps track of all our production numbers."

Frank Blanchfield, Senior Mining Engineer at PacMin's Tarmoola gold mine in Western Australia uses the Wenco system strictly for its reporting capabilities on production from the fleet of nine 789-C trucks and two 120-E O&K excavators for both ore and overburden removal. It was a little early for Mr Blanchfield to quantify how much Wenco was helping, with the system coming on line as he was speaking to WME. Still, Mr Blanchfield described what he considered the system would help him gain. "We want to use the Wenco system to optimise the owner mining fleet and

demonstrate that we've got cost efficiencies over contract mining. We know exactly what costs that contract mining incurred and now we'll use the Wenco system to compare the costs of owner mining."

Wenco will be the data collection tool feeding the mine's customised accounting system, Tarmoola Pit Reporting System (TPRS). "We think we can get 10% cost benefit from implementing ownership mining and Wenco's got a key role to play to actually report the key performance indicators (KPIs) used in that cost analysis. There's potential for that kind of increase and this is our target."

Mr Blanchfield explained that when Tarmoola made the decision last summer to use Wenco, the firm started manually collecting and reporting data. This was not a simple proposition since the firm had neither GPS nor radio signals from shovels or trucks feeding into the Wenco system. "We manually entered equipment movements by using pit technicians (sitting) in an office perched on the edge of the pit, watching all the trucks' exit points and destinations and keying the salient movements into the Wenco system."

Moving forward, the firm will use Wenco as an analysis tool. "What we're collecting are the production statistics and reporting the KPIs," he explained. "We record machine locations, cycle delays, swing times for excavators, and fleet cycle times to report productivities and KPIs and efficiently manage our mine." The 'dispatch tool' for the mine's two shovels and nine trucks will be the mine shift supervisor. "He's the person who will change the truck from one route to another. He'll make his decision assisted by what he sees on the Wenco screen using the Mine Vision aspect of Wenco."

The firm will be interfacing Wenco with the TPRS reporting system which is Access-customisable and which will report material movements, KPIs and grade information. It will have a direct interface with Wenco and will also input information about the ancillary fleet including the graders and loaders. That information, said Mr Blanchfield, will be keyed in manually. All information regarding material movement will be picked up from Wenco and reported through TPRS. "We've had a look at the Wenco reports and while the information in them is accurate, we wish to represent it in a way that we see as being customised to our needs at Tarmoola," he explained.

Like Syncrude, Tarmoola has a contract with a Cat maintenance provider (in their case Westrac) and their technicians will be pulling the VIMS information off the trucks too. At the time of the interview,

Tarmoola was still reconciling Wenco data against manually collected truck data until the crews had a chance to get comfortable with the system. Mr Blanchfield can see they'll probably need someone overseeing the Wenco system all the time, even though they won't be using the dispatch mode. "Someone to address problems as they occur, somebody in the chair acting as the Wenco administrator," he said. "It makes more sense correcting data problems as they occur rather than at the end of the month. With GPS data collection you've actually got to be there and solve the problem at and manually override the system. It might only be a few GPS clashes, or a receiver has a problem, but if you don't pick that problem up at the time and fix it, then for the period you've got that problem, the data integrity is an issue." Even without glitches, he said, the firm would need someone to update information in terms of digging locations, virtual beacons on waste dumps, route changes and maintenance codes.

Another new user wrestling with start up questions is John Capehart, Mining Engineer and Wenco Systems Administrator, Kalgoorlie Consolidated Gold Mines, in Western Australia. Kalgoorlie has been using the Wenco system since October 1999 covering a fleet of 18 Cat 793s, three Komatsu PC8000s hydraulic shovels, and two 793s due for delivery in April. Also on the system is the re-handling fleet of 10 777s, three 992s, and other auxiliary machines for a total of about 45 pieces of equipment. Like Tarmoola, Kalgoorlie has switched to owner mining, although the contractor had been using Wenco for around five years. The Wenco information is fed into their own KCGM-developed in-house Oracle database, Open Pits Reporting System (OPRS). "We essentially copy the tables from Wenco's MIS database to our OPRS site-wide database." The OPRS is a three tiered system. On the first level, a series of customised reports are available on the company Intranet. The second tier is more of a users section with commonly used queries and forms to input data. The third tier is access to the raw tables where Mr Capehart can write his own queries, look at trends and production data.

Wenco users can get similar information from the Wenco OIS database, and it has a wide variety of reporting features including summary and production data. Mr Capehart, like some other users, prefers to have Wenco generate the data and then manipulate it on his own system. He did note that KCGM is considering purchasing Wenco's Oracle database. Obviously,

Kalgoorlie has a strong grip on the reporting side of things, the issue is getting the best efficiencies out of the trucks and shovels. And Mr Capehart was frank, "I think we're still learning in what conditions dispatching can help us. Every mine has certain constraints it operates under. In the case our Super Pit, we're mining through an old underground district with very large stopes," he said, naming just one of the concerns he has. "We have a stringent procedure in place to make sure that equipment doesn't operate in certain areas because we're afraid it might go through the stopes. That affects the way we can dig the rock as well as our blasting. At times we can have very irregular dig rates, obviously some blasted areas don't get fractured as well as others because of these voids." With one truck getting loaded in two minutes and the next in five minutes, Mr Capehart wondered about the efficiency of automated dispatching in these conditions.

"Right now, we're trying to get more aggressive and use dispatching more because I think there are some gains to be made. Still, 18 trucks is still small enough to manage with good foremen and good superintendents," said Mr Capehart of his own situation. "They can be fairly close to the mark. What we're hoping to gain from dispatch is that couple of extra percents those guys are missing. Our goal is to optimise the truck to shovel ratio and make that fraction of an improvement in production."

At the time of his interview, Mr Capehart had just completed his own, unofficial study of mine management systems, having just returned from a two-week long tour of various sites across North America using various systems. So far, he like many WME talked to, doesn't have an exact answer on the question of performance measurement - determining exactly how much a system like Wenco contributes to production increases compared to other factors. Those who did have some solid measurements, didn't always have an answer on how to get more out of the system. Baseline studies, noted one, can be problematic because mines are so dynamic: "In two month's your mine has changed, gotten deeper. You may be further from dump sites, your operators are more skilled," he said.

Mr Capehart gave another example. "Wenco has a payload monitoring system that ties into VIMS that records the payload weight on each truck. We monitor that on a regular basis by operator, by shovel, and by truck. When I was gone over the holidays, the amount the trucks carried fell. When I got back and printed up the graphs and gave them to the superintendent, he



Pic: Bristol Voss

**WIDE RANGING:** today Syncrude's system covers a fleet of 40 trucks (with payloads ranging from 216-325 tonnes), three hydraulic shovels and six electric shovels

went out and talked to the shovel operators. Next day, problem gone. That feedback is very important. To say the system gave you a performance improvement, however, is arguable. What it did do is give you a tool to analyse that data and give the operators feedback. The real system improvements come from the actions you take, which are based on conclusions reached through data analysis."

Ian Brown of Syncrude shares the concern. "How to measure savings is the toughest question to answer. We recognise there's an improvement in our performance and in production. Still, the fleet keeps changing and sometimes you don't know if your performance improvement is due to the truck technology, the system, or the people and just the experience of the people operating. There's an improvement, but to quantify it is difficult."

Still, Mr Brown said it's worthwhile noting even vague savings because they're important. "We've been able to save, just by being able to monitor things like payloads," he explained. "We can see that we're putting the proper payload on our truck and more importantly we're not overloading it which becomes a maintenance problem. And when you're dealing with equipment worth \$3 to \$5.5 million dollars, the last thing you want is to have it in the shop."

Peter Carter of Kumtor said the firm also struggles to quantify savings. "One of the hardest things to do is to nail down what the system saves you because there are so many factors involved. That's one of the things we're looking at seriously this year. When the dispatcher can see the operator running his machine, he can help him be more efficient. The bottom line is, if you buy the system and plug it in, you'll get something out of it, say 5 or 10%, depending on what your operation's like. But like any tool, if you install it, use it, and try to figure out

what it's doing and why, it will deliver way more than what the vendor will tell you."

Wenco's Mr Richard hears the measurement question a lot. "Some can argue, 'Why would Wenco take credit for truck-shovel optimisation, or things like that?' We get the information off the equipment and allow people to use it more effectively, even though it's the truck manufacturer that has the payload system. We provide the reporting off the system and through charts or histograms can show consistent underloading of trucks. At one mine they realised they were underloading by about 5% and when we put all this through, they started doing that much more effectively. For that mine, 5% underloading meant 1 in 20 trucks is hauling air all day."

One mine manager summed the whole issue up this way, "A lot of times the problems with justification is that it brings up things you don't want to tell your boss. For instance, there's no mine that doesn't ship ore to the dump by mistake. And there's no question the system has paid for itself making sure we haven't done that. And nobody can say, and probably nobody would want to say how much ore they've pitched over the dump, because if they knew, someone would turn around and say 'Stop doing that.' That's a good example of why sometimes it's hard to justify a system like this. It will prevent you from making those mistakes, but if you use it for justification, your boss will invariably turn around and tell you 'Stop wasting the ore over the dump and you won't have to spend the money on the dispatch system.' That's why you have to be your own boss." And have a good system.

*Note: This article only considers the Wenco system, parts of which are being used or under consideration for purchase by those interviewed here. Modular Mining, another major player in the industry, will be the subject of a future article.*