

The optimum 3D modelling choice for

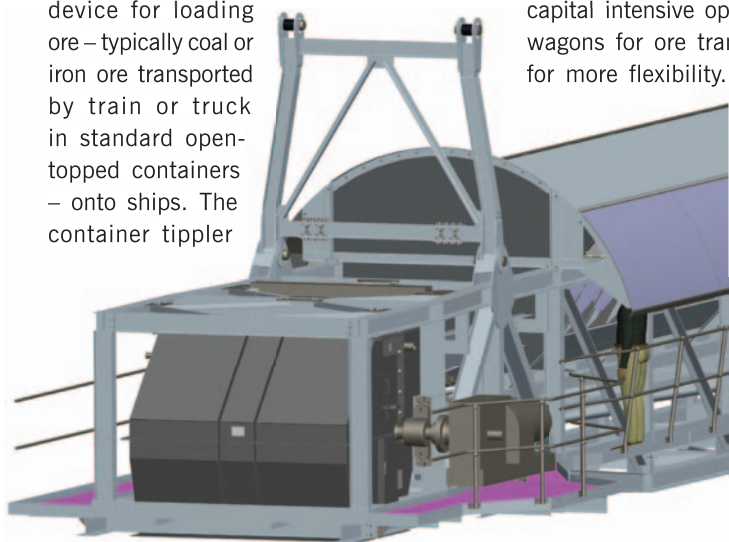
ThyssenKrupp Materials Handling (TKMH), a division of ThyssenKrupp PDNA Engineering – the design, engineering and construction specialist of turnkey bulk materials handling equipment across southern Africa – is in the process of adopting Pro/ENGINEER as its CAD program of choice. *MechTech* talks to Carel van der Merwe, engineering manager and Matthias Göing, knowledge manager at the company's Sunninghill offices.



The TKMH product development team with the productOne support team. From left: Matthias Göing, Damie Galleymore, Jason Fagan (productOne), Johan Botha, Nick Howe, Keith Caverhill, Leon Botha, Claudia Alexander (productOne), Carel van der Merwe, Paul Berry, Pierre Vosloo.

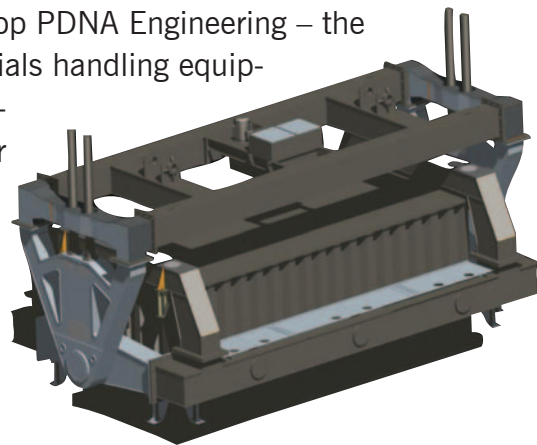
“We began to test Pro/ENGINEER on a mini-project in October last year to see if it would work for us,” says van der Merwe. “We used it to produce a 3D model of our container tippler, a fairly small machine ideal for trial modelling of the type of work we do.”

ThyssenKrupp's container tippler is a device for loading ore – typically coal or iron ore transported by train or truck in standard open-topped containers – onto ships. The container tippler



The head-end of a cross conveyor model. TKMH has a contract for two stackers, two reclaimers and nine conveyors for the coal handling system between the Goedgevonden coal mine and the Medupi power station.

is attached to the head block of a container crane, and is then lowered over the container. The device clamps onto the container, the crane lifts it and transports it over to the ship's storage hold, where the container tippler tips the contents and replaces the empty container back onto the train for recirculation. The use of standard containers and container handling equipment is a far less capital intensive option than using tipping wagons for ore transportation and allows for more flexibility. “By using containers, relatively small volumes of many different products can be handled and, for environmental cleanliness, you can cover containers with tarpaulins and stockpile the product in the containers, where they are not exposed to wind and rain and the elements,” explains van der Merwe. “Container tipplers have a purpose designed structure



A Pro/Engineer model of a container tippler developed by ThyssenKrupp to evaluate the suitability of the software for its development work.

combined with lots of mechanicals, which makes the engineering requirements typical of many of our products,” he adds. “We used Pro/ENGINEER to update and build a 3D model of an existing machine, check clearances with the rotation/kinematics features and then we used the visualisation features to produce marketing presentations. Based on this trial, we decided that Pro/ENGINEER was the ideal software for us to use for our engineering development. We initially bought five seats and trained five designers, but we have since bought a further two seats,” he adds.

“We mostly get involved with purpose-designed structures which make extensive use of plate and hot rolled section, combined with mechanicals,” says Göing. “So we also bought Pro/ENGINEER EFX, the structural steel extension module and AAX, the advanced assembly module. EFX is ideal for modelling connection detail, welded or bolted connections common on our products, and the advanced assembly module allows for a top down development approach for a machine. We needed that in order to get maximum reuse out of our design components.”

Van der Merwe explains: “If we were to design a stacker from small parts up, then, later, if you wanted a version with a boom 10 m longer, you would have to go down to component level details to make the change. By designing from the top down, ie, defining an overall parametric skeleton first, you can later go back and for the same type of stacker, for example, you could move the pivot point of the boom, or make it wider and longer. Top down design helps to minimise the amount

heavy engineering

of redesign work you need when changes are necessary."

TKMH was awarded the coal stockyard equipment for Medupi Power Station and is currently using Pro/ENGINEER software for the drum reclaimer design for the coal handling system. "We have also added the finite element analysis (FEA) tool, Pro/ENGINEER Mechanical, for the stress analysis of this project," says Göing.

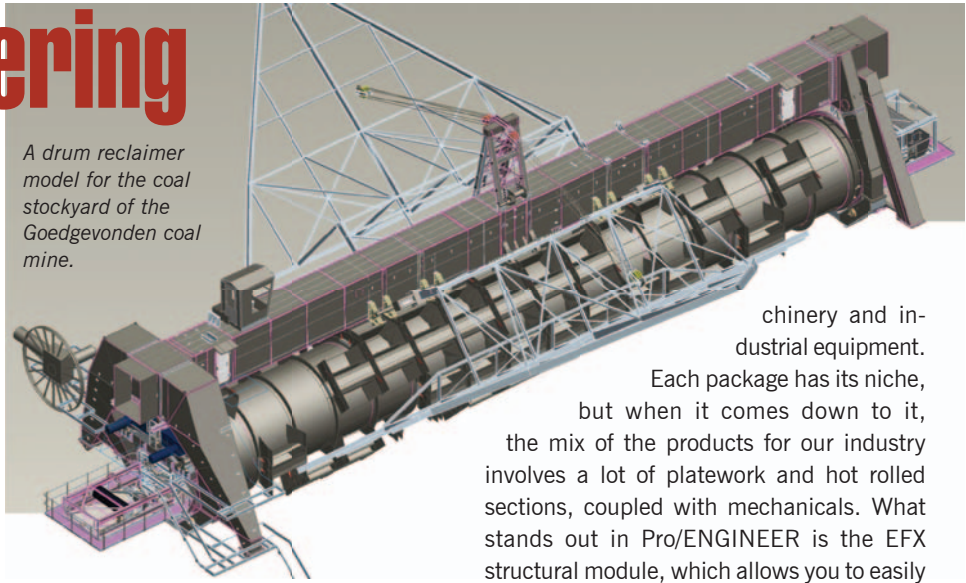
The stockpile system between the mine and the coal bunkers of the power station receives coal from an overland conveyor from the mine and stores it in four lines of stockpiles. "Our scope of work includes two stackers, two reclaimers and nine conveyors, along with all the civils from the foundations upwards," says van der Merwe.

Van der Merwe explains the advantages of the Pro/ENGINEER Mechanical FEA tool. "Previously if we had a 2D layout of a bogie for example, and wanted to analyse that, we had to rebuild that geometry in the FEA package. Once you had rebuilt and meshed the new geometry, if you then wanted to change the size of anything on that mesh, you basically had to redo it, erase a whole area, move everything and fill in all the missing bits. It was a massive exercise to update any component.

"Now we use the assembly capability of Pro/ENGINEER to define the key parameters of the assembly, make a 3D model of it and the FEA mesh is automatically created on the same 3D model. If you want to change something, move wheels closer together, for example, as soon as you change the 3D model, the mesh will automatically be updated. This makes it very easy to look at different scenarios. We are finding it very easy to build in 3D with Pro/ENGINEER and then analyse and change the dimensions or even the complete geometry of a model. Optimisation that used to take several weeks can now be completed in less than a week," he adds.

"What we also now do is discrete element analysis for optimising bulk material flow," continues Göing. "Translating this back into designs was also a problem, but with Pro/ENGINEER, this can all be done in an integrated way. It's easier to see it with a 3D model and easier to use the results," he explains. He shows us his vision for integrating all of ThyssenKrupp's engineering software tools: "Integration is essential. We

A drum reclaimer model for the coal stockyard of the Goedgevonden coal mine.



do the conceptual design in Pro/ENGINEER and take it right through engineering, into detailed design, which can be re-evaluated and optimised using Pro/ENGINEER Mechanical, the FEA module, and you can then go back into engineering and capture the lessons learned for the future.

"The visualisation is also excellent, which significantly simplifies the checking process. This is especially useful for complicated structures, which are difficult to visualise in 2D. Instead of 2-3 engineers all looking at 2D drawings of an arrangement and trying to determine whether there are any interferences, the clash detection feature of Pro/ENGINEER automatically red-flags any problems and these are easily rectified on the 3D model," Göing adds.

"Internally, the visualisation features help project managers to more quickly convey information to fabricators and erectors and convey what needs to be fabricated or constructed," says van der Merwe. "QC personnel also see a benefit. Workshops still use 2D drawings but we can put different isometric views on any 2D drawings, which makes the assemblies a lot easier to understand. Our QC people spend less time explaining the drawing and much more doing actual QC. It is also very nice for producing our marketing material and maintenance manuals."

We ask why Pro/ENGINEER was chosen above other CAD packages. "The biggest driving factor in pursuing 3D design is that it supports the reuse of designs," responds van der Merwe. "After pre-selection across the whole range, we did in-depth evaluations of three high-end packages, using a team of three senior designers. Our conclusions showed what the market reflects, that Pro/ENGINEER is widely preferred for heavy ma-

chinery and industrial equipment.

Each package has its niche, but when it comes down to it, the mix of the products for our industry involves a lot of platework and hot rolled sections, coupled with mechanicals. What stands out in Pro/ENGINEER is the EFX structural module, which allows you to easily detail connections and structural assemblies within a mechanically orientated overall model. Pro/ENGINEER also proved to be able to produce high quality 2D assembly and fabrication drawings, which are essential for the type of fabrication we do locally."

"Pro/ENGINEER integrates whatever it has learned from their customers into its libraries, so much less set-up was required from us. It is very suitable for the machine building heavy engineering industry," adds Göing. "Some people go into software selection with bias, but we investigated each of the packages thoroughly to find out which would be the best engineering solution for our needs. The decision was therefore based on the fit of the software and its local support structure."

The successful transition to 3D design is, however, not ensured simply by the choice of a suitable software package. A structured implementation approach, incorporating: a defined configuration; naming and model structure conventions; work rules; and suitable templates, is required. Once the decision was made to go with Pro/ENGINEER, TKMH formed a project team for the implementation, headed by Mr Johan Botha, who interfaced directly with specialist implementation consultants from Pro/ENGINEER, lead by Jason Fagan.

"A big factor in the successful implementation was the support productONE personnel (the suppliers of Pro/ENGINEER software) provide our designers to get them up and running and productive quickly. ProductONE is experienced in implementing 3D software and its staff have proved themselves to be willing and able to help us to get the best out of the Pro/ENGINEER software," van der Merwe concludes. □