COAL TERMINAL
WHEN YOU CAN'T SEE THE PORT FOR THE STOCKPILES

This illustrates how a Knowledge Base can be used. The material is drawn from a number of sources.

BACKGROUND

A bulk commodities terminal, one of the world's largest, has a capacity of over 65 million tons a year.

The terminal is owned by a number of major mining companies.

Storage space and throughput is allocated to each shareholder in proportion to their shareholding.

OBJECTIVES

To find the most effective and efficient way to layout the stockpiles in order to maximise the capacity of the terminal.

This task was beyond the capabilities of the modelling techniques used by the terminal's management.

KEY RESULTS

A working replica of the terminal was built to explore a variety of stockpile layouts, operational methods and equipment permutations.

The model was used to design a more efficient stockpile layout. Over 2,000 simulation runs were conducted.

The potential to handle an increase of more than 12% throughput was identified. It was demonstrated that this could be achieved without any major capital expenditure.

The model is currently in use for two key functions:

-- To design long term stockpile layouts.

-- For the day to day management of the coal handling operations, including re-planning and modifying stockpile layouts as required.

The terminal had always relied on simulation models to justify and motivate all major expansions of the terminal's coal handling capacity. Typically they would look at the effects of purchasing new equipment and utilising more land to handle expected increases in throughput.

Management were aware that efficiencies could also be gained by smarter layout of the terminal's stockpiles. However they were unable to determine the extent of the potential improvement this would bring in throughput and performance. Due to the limitations of traditional computer modelling techniques, management were unable to simulate the detailed equipment and operational complexities of the terminal.

The company decided to upgrade their modelling capabilities, replacing their existing modelling systems with knowledge based systems. The primary purpose was to conduct feasibility studies into continued terminal expansions.

During one such study it was discovered that the terminal capacity was highly sensitive to stockpile layouts - changes to the stockpile design had the potential to achieve a significant impact on the terminal's overall performance.

Management commissioned the development of a system that could design a new stockyard layout - one that could provide optimal stockpile layouts now, be flexible enough to manage the day to day vagaries, and be able to cater for any future expansion plans.

TAKE ALL THIS INTO ACCOUNT

Not much about the terminal is simple. Sixty five million tons each year is delivered to the facility, originating from a host of different sources with different procedures and requirements.

The terminal is serviced by approximately 750 ships and 7,000 trains each year. At any one time there can be 100 stockpiles on the ground, varying from 30,000 to 140,000 tons.

There are about 40 grades and qualities of material, divided into numerous sizes depending on where and how they are to be shipped.

There are restrictions on where stockpiles can be placed due to a complicated set of shareholder rules. The space allocated for stockpiling coal from each mine is determined according to the mining company's shareholding in the terminal facility.

Additionally there are a plethora of other operational and hardware considerations - such as the need to take stacker and reclaimer utilisation and maintenance cycles into account in order to prolong the life of equipment.

REPLICATING REALITY

A fully operational replica of the terminal was built. This replica was true to life - taking into account theoretical processes and empirical knowledge.

After spending time on site with operators information was included on how they worked and the rules of thumb they used in making decisions. For example, it was generally accepted that 10 per cent of a grade's annual throughput would be required in stockyard space. Operators would make adjustments from that base.

Once the replica was developed 2,000 simulations were run to assess the most effective placement of stockpiles from each of the 50 sources. This took into account grades, product characteristics, shareholder rules, storage constraints, shipping schedules, and equipment utilisation.

Fluctuations in material supply and

demand were tested. And a host of hard reality complications were thrown in - for example the impact of the wrong shipment arriving from a mine, breakdowns in equipment, and ships failing to reach port at the allotted time.

SHORT TERM, LONG TERM

The new system was developed to design a new layout from scratch. A task required every three to four years. However, it became apparent that the same system would be the most effective way to determine and manage the minor layout changes required in the terminal's daily operations. It provides operators with a faster and more accurate method of determining the least amount of moves in order to achieve the optimum stockpile layout.

HELP THEM GROW

The terminal is continually required to expand its product handling capabilities to cater for ever increasing shipments. The new knowledge based system for stockpile planning is a crucial part of this. It is used to identify the optimum configuration of the terminal, including best utilisation of existing land and equipment, and the impact of capital expenditure on further acquisitions.

KNOWLEDGE BASED SYSTEMS (KBS)

KBS is a major leap forward from traditional business modelling systems.

Traditionally mathematical formulae are used to describe the components of a business - with limited scope. Change the business scenario and the formulae may no longer be valid.

KBS learns and understands the business in much the same way that people do. It can replicate the entire business, including human and operational subtleties within that business. It preserves the knowledge within the business's own computer systems, providing a maturing knowledge base on which to continually build.

That knowledge can be used to simulate any imagined business scenario, and to improve the planning and control of business processes.

Within a few weeks KBS can begin to provide management with previously unheard of decision making power. It can deliver immediate answers that may otherwise take a team of engineers many years to obtain.