

## Cutting edge information from deep underground

Daw Mill Colliery is the flag ship deep mine of UK Coal. Set against a background of the earlier wholesale closure of mines and privatisation, UK Coal found that they needed to take a complete review of their supervisory and control computing and find newer and more supportable technology. Wonderware products were selected and have been deployed to control and monitor all underground production and conveying at Daw Mill.

*John Ford, UK Coal Group SCADA Manager, "We could not achieve the budgeted planned output without the system."*

at the coal face

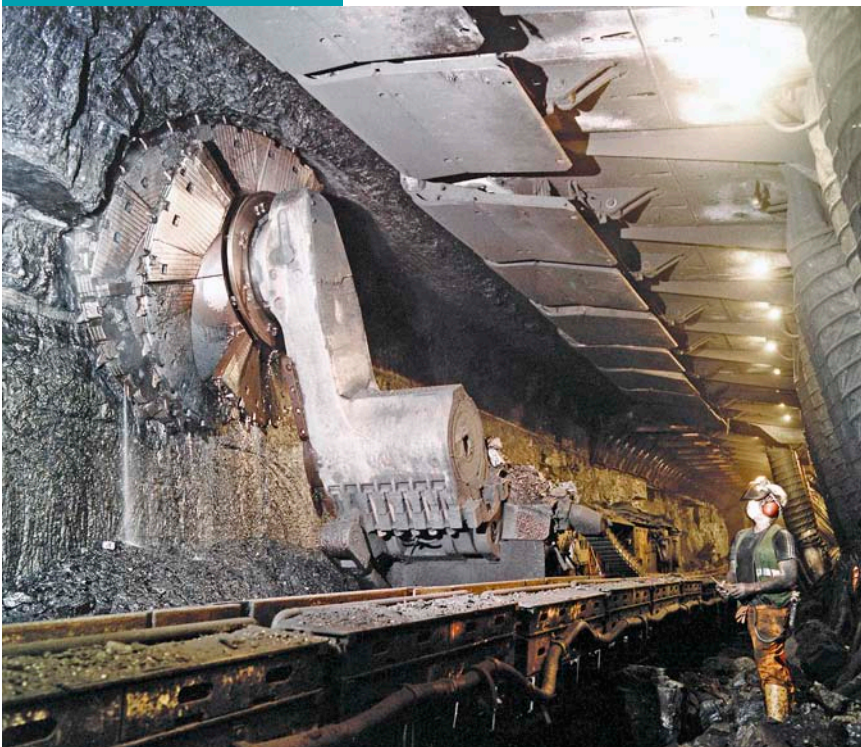
Daw Mill is situated above the Warwickshire coal field that is uniquely assisted by its favourable geology, by the width and depth of the seam, and by coal quality. The mine was opened in 1961, following the discovery of the rich seam during the sinking of a ventilation shaft for another nearby mine. Production is almost 3 million tonnes per annum and 96% of the extracted material is saleable. Almost all the coal is used for power generation at a rate of 1200 tonnes per hour. This business environment has to be carefully managed and full control made available to ensure that

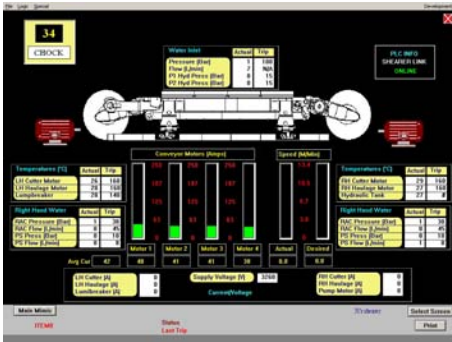
production is constantly economically viable in the face of imported coal.

Above all other considerations safety is paramount, in machine operation, transport, environment, ventilation and gas monitoring. Automation has been fully implemented at the mine with machinery being controlled by special intrinsically safe logic controllers. This underground intelligence allowed the use of commercially available real-time software to supervise, monitor and attend to alarms. In addition, data is extracted from the mine's equipment that is used to provide real time information for many management functions.

The current renewal and update programme can be traced back to 1998 when the industry had shrunk and questions were being raised about the ongoing viability of the legacy highly bespoke data gathering solution. In addition to this the existing system's architecture was inherently slow and prohibited effective supervisory control from the surface. Deciding upon a solution for the programme involved visits to heavy industry sites and discussions with several suppliers. The decision was made to use Wonderware from SolutionsPT owing to its world-leading InTouch SCADA (Supervisory Control and Data Acquisition) with particular emphasis upon its ease of use.

The initial deployment was to add InTouch at the surface control room and use this to manage the underground logic controllers. High value coal cutting machines and conveying as well as the underground environment were thus brought under proper control. Safety, as already stated, is the primary concern and particular emphasis was made upon monitoring airflow, methane and carbon monoxide. Alarms





**Shearer Mimic**

are set that shut equipment down at pre-determined levels and also initiate evacuation.

Machinery control includes the coal-face coal shearing machines, ventilation, conveyors and tripper positioning. The coal face at Daw Mill is currently 10Km from the control room, therefore communication has to be fast and effective, fibre optic Ethernet being used extensively throughout the mine.

One of the unique differences found in mining as opposed to manufacturing is that the plant is under continuous movement and redeployment. When a coal seam arrives at a boundary the whole of the equipment may be moved to a position several kilometres away and have totally different operating conditions. It was therefore important to the UK Coal engineers that the SCADA solution was capable of easy re-configuration and ongoing development. The roll-out programme included

**Daw Mill**



specialist consultancy from SolutionsPT and UK Coal put several key engineers from local and group staff through the SolutionsPT training school.

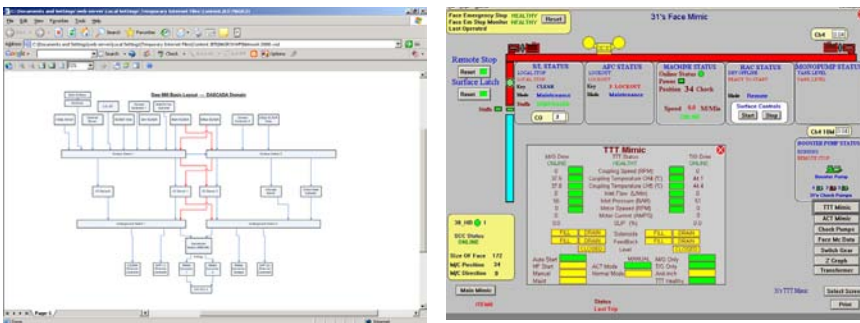
The large distances involved also caused InTouch Terminal Services to be utilised, in addition to solving the topographical problem this has also brought MTTR (Mean Time To Repair) to a minimum. A faulty workstation can now be swapped out in minutes without any subsequent software loading and configuration.

Once that the supervisory control had been established it was clear that the system contained a great deal of useful data that would provide information for the better running of the mine. Wonderware's Historian database historian and the Active Factory reporting tool were deployed to fully take advantage of data availability. The high compression available in Historian allowed UK Coal's engineers to acquire and store fine resolution data, in real time; this being particularly useful when looking for anomalies in operation and also in providing realistic and meaningful trends.

The characteristics of the Wonderware Historian database product solved UK Coal requirement to have detailed insight by offering fast and frequent data for information reporting, without filling up PC hard drives on a weekly basis. The system is currently set to a one minute frequency – this being the general resolution of data acquisition which can be accelerated if certain preset thresholds are exceeded. The inherent continuous compression of data in Historian means that hard-disk storage is no longer a real limiting factor to operational performance; combined with Historian's capability to reliably absorb masses of data in real-time, with data & time stamping, means that the product was an ideal choice for the application. Date Time stamping means that each piece of data can be viewed in chronological order when investigating occurrences. Built-in administration facilities automatically ensure that the Historian database is optimised and is running at peak performance.

Having the good and detailed data is one thing, turning this into useful information is done by the Active Factory software reporting tool that interrogates Historian on the fly to produce the very latest information for many and varied uses.

The availability of data has been exploited in an innovative way in monitoring the performance of the motors on the coal shearing machines. Approximately 50 data tags are continuously monitored and stored; in turn this is made available by SSL transfer through a web portal to the OEM supplier of the motors – their



## Overview and Face Mimics

expertise can then be accessed to determine likely failure through remote condition monitoring, as well as allowing application-specific MTBF to be calculated.

Daw Mill has two shafts, one for the miners, one for equipment, but in fact is a drift mine in that the coal is transferred to the surface by inclined conveyors. The conveyors have powerful motors to cope with the weight and loading changes in operation.

These conveyor system motors are also monitored. Within the project period it was noticed that a motor was drawing higher than normal current, but examination of the fine resolution data showed that this was caused by external effects rather than imminent motor failure. The fault proved to be a belt scraper that was pressing on the belt and causing slipping – thereby explaining the high current. The benefit to UK Coal of accurate diagnosis was the best part of £500K (calculated from parts and lost production), whereas the cure was a 5 minute job to clear a blocked air pipe. This was correctly analysed from the availability of fine resolution archive data.

These examples show immediate cost savings that were made possible by the system. The benefits of real-time computing applied at the colliery are felt in day to day running by improved insight to events and ease of access to meaningful and useful information. The system is currently running side by side with the existing system and functional beneficiaries are being transferred to the new and richer

data source.

A key feature of the project was to make this data available to remotely situated suppliers. In this way “first hand” data is accessible to machinery suppliers allowing them access to core operational characteristics of their products in day to day application. The reliability of data was a key concern of the suppliers, and they have been uncompaining about what the new system offers them.

This is a considerable improvement from previous procedures of providing verbal fault descriptions and non real-time process values. Suppliers of coal cutting, conveyors, motors, controllers, roof supports and switchgear are each provided with full real-time data access through UK Coal’s system Portal using web technology. This allows such suppliers to have a rich data source to provide preventative maintenance advice (and alarms), condition monitoring and performance monitoring. This in turn is useful to further requirements that UK Coal may have from them in future procurements. The system is also subject to SolutionsPT’s SPlan support and remote on-line access will also be provided for this purpose.

Dual data access, by UK Coal and by its suppliers, has allowed an environment of shared responsibility to be developed. Working from reliable and shared data has built up mutual trust and confidence and provides a method of “working the problem” rather than spending time addressing peripheral issues.

The system itself has over 30 users on site and 15 external concurrent users. Controllers, operators, managers and suppliers can access the information that they require from the system. Over 4000 data “tags” are historised at a one-minute frequency, providing a rich source of information for many differing requirements. The ease of use of the Active Factory reporting tool allows UK Coal engineers to show users how to get their own information, rather than having to request a special report. Self-empowerment is at the heart of concept of



Active Factory and the effect upon businesses is that users can investigate independently of IT department support or User Requirements Specifications, UK Coal has fully adopted this method of working.

Self-empowerment has also been adopted by UK Coal's engineers themselves. New screen designs and operating procedures can be prepared on the engineering system and placed before operations staff to gain their feedback and further requirements. Although initially the system was designed to reflect the "look and feel" of the legacy MINOS system, the easier-to-assimilate features of new screen displays have been readily accepted by control room staff.

John Ford, UK Coal Group SCADA Manager, says, "We could not achieve the budgeted planned output without the system."

The system has become the backbone of the way that the colliery operations communicate; information that is required underground is readily available where and when it is required. This allows manpower to be allocated in the most optimum way – with added certainty

that the right team is being deployed for the right reasons. With distances being measured underground in kilometres it is clearly very time consuming to be "on the wrong mission".

Currently, the system is being engineered to provide further information to suppliers, which will be in real-time and have a controlled degree of closed loop feedback. The entire mine electrical schematic will also be visualised on the system, allowing faster maintenance access and fault diagnosis. Further plans exist for underground SCADA (possibly on wireless tablet PCs), Video over IP, Voice over IP, and tracking people and trains underground with RFID.

The use of readily available and standardised software products from Wonderware has benefited UK Coal by providing advanced features that are easy to assimilate and take advantage of. The real-time system is subject to constant change and development according to changing operating conditions and the realisation of solutions that will directly affect productivity and cost, cutting edge technology delivering benefits in depth!

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*Wonderware UK wishes to thank the following company for its valued contribution to this success story...*

UKCoal plc

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