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The application of Microsoft® Active Server Page technology in the mining environment as a management information tool

D.S. RICHARDS
Gemcom Africa (Pty) Ltd, SRK House, Illovo, Gauteng, South Africa

Computers have revolutionized the collection of data on modern mines. Never before has it been possible to collect data from all aspects of the mining value chain at rates now common. With this has come a new challenge. Deriving information from these copious amounts of data and disseminating it. This problem is being exacerbated by technical software systems, which use proprietary and binary data formats that severely inhibit the flow of data and information both across departments and the larger organization. Generally this had led to data duplication and data redundancy.

The Gemcom Enterprise Mining System (GEMS) makes use of industry standard, secure and open databases for all its data objects. It manages multiple users accessing the same bits and bytes in the database, preventing data duplication and redundancy. Developed in the Microsoft BackOffice® environment, GEMS is also able to leverage the enormous amount of tools available in this environment, whether it's for e-mail notification, reporting or data capture.

Microsoft's® Active Server Pages are one of these tools. These are standards used to create dynamic and interactive web pages with links into databases and many other objects. The real example outlined in the text, demonstrates how a user anywhere in the world is able to login to a web page and run a query that returns a report with vector plots of performance for the user-selected time frame.

As integration is tightened between the various components of the mining value chain, the importance and reliance on ASP pages will grow as the need for management information tools develops.

Keywords: mines, computers, ASP, GEMS, integration, Microsoft, Management Information.

Introduction

The use of personal computers in the modern mining environment has revolutionized the collection of data. Technical staff such as geologists, mining engineers, surveyors, metallurgists and others are able to gather and store data at rates and scales never matched previously. With this has come a new challenge. The analysis and processing of this data into information or knowledge within an organization is becoming more and more difficult. The situation is not being helped by technical systems currently being used by mining operations. It is fair to say that the modern global economy has been built around Microsoft's® technology. This has introduced not only many standards, but tools for other application developers that allow them to make use of this Microsoft BackOffice® backbone and leverage off applications developed by other vendors.

Apart from supporting the various computer operating systems, technical mining software has been slow to embrace this approach, continuing to use proprietary binary data formats that make the sharing and distribution of information difficult. These systems severely limit themselves in that, they are unable to leverage off third party applications and make use of all the tools already developed around the Microsoft® BackOffice environment.

The Gemcom Enterprise Mining System (GEMS) makes use of robust, industry standard databases for all its data objects built around the Microsoft BackOffice® environment. Not only is GEMS able to make use of the full suite of database management applications provided by these products, but it is able to leverage off this to other applications making use of the same standard, e.g. e-mail software to manage automatic e-mail notifications, and a veritable host of other applications for reporting. These reporting tools can be used to publish reports locally on a mine site through the use of an intranet, or publish nationally or internationally using the Internet.

Active Server Page (ASP) technology takes these reporting abilities to another level. By using ASP, these reports can be made interactive, with users anywhere in the world logging into a web page and running specified queries to generate user definable graphical and text reports. The movement of information via an ASP query can be bi-directional and in the same way they can be used to report information from a database, they can be used to capture data directly to a database.

Active Server Pages (ASP)

ASP is a technology developed by Microsoft®. Pages using ASP are primarily developed in JavaScript®, VBScript® , or PerlScript® and are integrated into the HTML (Hypertext Markup Language) of your Web pages[1]. The ASP code is compiled on-the-fly by the server and the resulting output is standard HTML. By using ASP, Web

pages can be dynamic, full of ever-changing content, and browser independent.

With the advent of the Internet during the 90s, businesses quickly realized the commercial potential of the Internet. However, at the same time competition was driving those businesses making use of the Internet to make their web sites as exciting as possible in order to attract visitors to these sites. It was quickly realized that popular web sites would be able to significantly add to their revenues by way of selling of space on these sites for the purposes of advertising. Not only was it clear that these web pages would have to be exciting and attractive to be successful, but there was also an enormous opportunity to gather information from potential clients and take orders from them over the Internet. As a result of these factors, software developers began to look at ways to make web pages more interactive.

Initially there were problems with some of the early developments such as JavaScript® and VBScript®[2]. Then and even now, a lot of Internet users were making use of computers with low operating speeds and lacking sufficient memory. These scripting languages run applications on the web site visitor's computer, and therefore these languages are severely limited by the computing capacity of the visitor's machine. Active Server Pages were then developed as an alternative. These are different in that they run in a server-side scripting environment. What this means is that these scripts run on the web sites' computer and not on the visitor's computer. Another big advantage is that no special software is needed, as ASP pages integrate their special coding with normal HTML codes and therefore any web-authoring tool that allows editing of HTML can be used[3]. In their on-line help, Microsoft® defines HTML as '*a simple markup language used to create hypertext documents that are portable from one platform to another. HTML files are simple ASCII text files with codes embedded to denote formatting and hypertext links. Hypertext Markup Language is also called HTML*'[4].

ASP supports and works with many other Web technologies such as Microsoft® ActiveX, Javascript, VBScript, DHTML and Java and is basically an HTML page containing ASP statements. These statements are used to modify the HTML in some way on user requests[2]. For example, if you've ever shopped on-line over the Internet and bought something, the chances are extremely good that ASP read over the information you submitted on the order form, evaluated whether it was valid and then returned some sort of thank you or order confirmation with your name printed there on the page. Years ago this was impossible, but is so commonplace nowadays that we take it for granted.

Technical mining systems and integration

Figure 1 shows a typical implementation of technical software on an average operating mine. Every functional area is being serviced by its own suite of software (some general mine planning packages can cover more than one functional area). As a rule, each of these functional areas are still serviced quite well by the software they are using. The big issue begins when it becomes necessary for data to move from one functional area to the other. To do this it becomes necessary for users to export data, reformat it and then import it into the systems of the next functional group. Apart from the time being wasted doing this, this approach then raises the spectre of data duplication and redundancy. The same dataset can exist in multiple systems. In each system data is being added to and removed from the original dataset in isolation of the other functional areas. When the question 'What is the correct version of the truth?' is raised, it becomes difficult to answer as it could be the version held by one department or a combination of three.

In the tough and competitive world of modern mining, it has never been as important to be able to answer this question. In order to stay competitive, mining companies need to be continually measuring and assessing their performance (actual versus planned). Furthermore, they need to be able to respond quickly to any deviations or to market conditions. Gone are the days when it was acceptable to take weeks to update your resource or reconcile monthly. In modern mines, this is sometimes done a couple of times a week. Unfortunately this is extremely difficult and expensive to achieve with technical systems implemented as shown in Figure 1.

The Gemcom Enterprise Mining System (GEMS) uses a very different model (see Figure 2). Here all data is stored in a secure, centralized, industry standard data repository (Microsoft SQL Server 2000®) over a standard network. Systems used by the functional areas read and write the exact same bits and bytes in the database. Therefore, any changes made by one functional department are

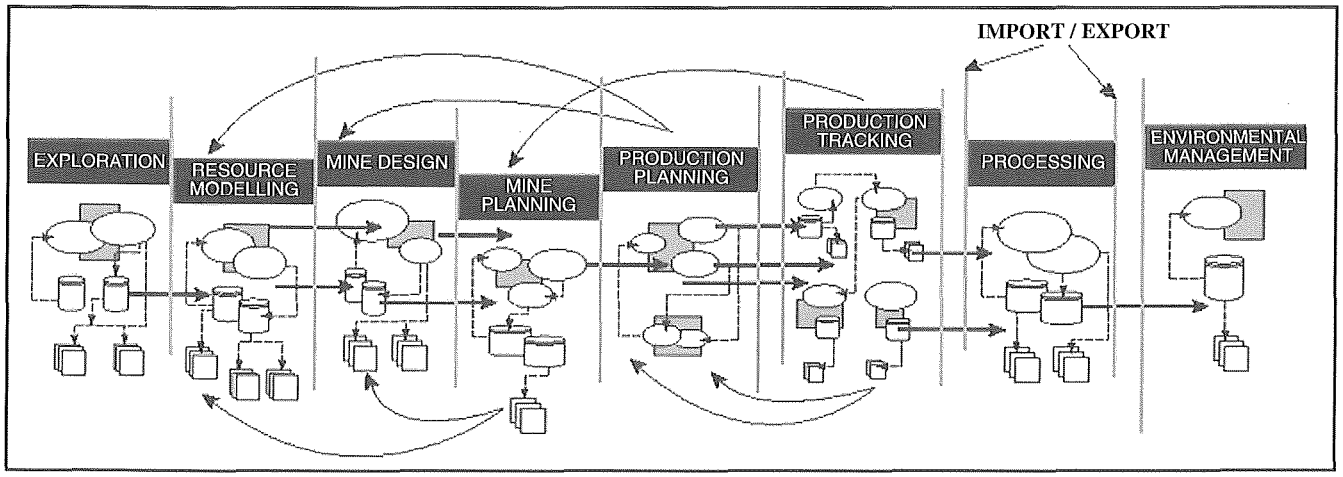

Figure 1. Typical implementation model of technical systems on a mine

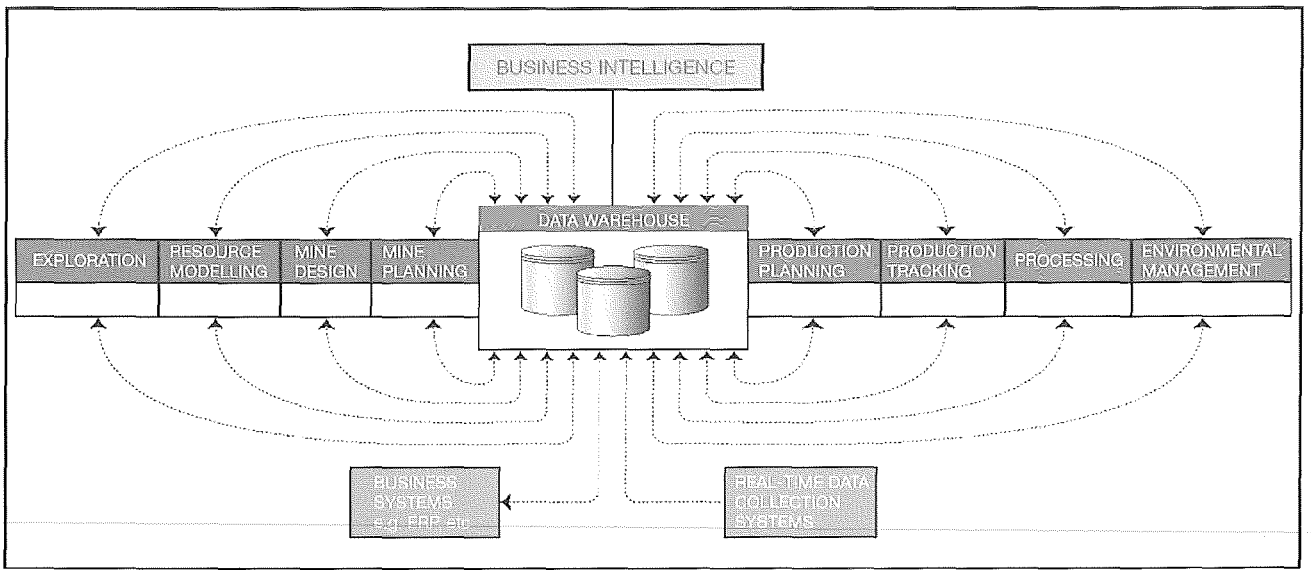

Figure 2. The GEMS implementation model

automatically carried through to the other departments by default without the use of any import/export routines. At the same time the system is able to address issues such as simultaneous access of the same data by multiple users and security. It also removes all issues related to data duplication and redundancy. Because it is built in the Microsoft BackOffice® environment, GEMS is able to leverage off the vast array of tools available here. Apart from the auditing functions available in SQL, the system is able to automatically generate e-mail notifications based on predefined triggers to all parties or individuals affected by certain changes to the database.

As an example, consider the following: a geologist maps a new contact in the pit. The survey department surveys this contact and downloads it into GEMS. Visual checks are made, and when the surveyor is satisfied he '*publishes*' this contact to the database. By publishing, automatic e-mail notifications are sent to the geologist and the mine planners telling them the contact has moved. The geologist loads that contact, updates his model and '*publishes*' this revised model. Again survey and mine planning are notified automatically. The GEMS system tracks and records all these notifications for auditing purposes, and it becomes possible to derive an accurate history for the geological model. The system also encourages technical staff to take ownership of their work like never before. By linking this integrated system into business and plant processing systems, business intelligence also now becomes possible.

ASP as a Management Information Tool

As mentioned already ASP is coded into the HTML of the web pages of an Internet web site and is used to make the page dynamic and interactive[3]. ASP supports interaction between page user and the server, it allows web page access to databases and directory services and is also able to incorporate and make use of high-powered COM (Component Object Model) objects[5]. In order to demonstrate this, let us consider the following real example. Figure 3 shows a web page on a mine intranet. Anyone with the necessary permissions can access this page. The user has a choice of three reports he can produce. In this example the user clicks on 'Long Term Planning vs. Actual Tonnage Report'. The web page shown in Figure 4 then appears. The user can select a period over which they want a report and have the option to produce this report bench by bench. In this example, the period selected is the first quarter of 2001, and bench 50 is chosen. The user then selects the option to produce a report.

The moment the user selects 'Get Report', the following occurs. The query defined by the user i.e. Bench 50 data for the first quarter of the year 2001, is taken to the GEMS SQL database, and the data matching the query is returned. What this report does is compare the face positions of bench 50 as they were planned to the actual positions as they were mined. This returns three parameters: over-mined where the actual face has advanced beyond the planned position; under-mined where the actual face position hasn't reached the planned face and on-planned mined where the actual position matches the planned.

This is used to compile the bar graphs shown and the text report shown in Figure 5. From this we now know that during quarter 1 of 2001, only 33,312 tons were mined to plan, 99,917 tons was over-mined and 77,332 tons were under-mined. Thus this simple little report gives an excellent snapshot of production performance during this period. Note also that the page has its own toolbar, which allows the user to print the report, browse through multiple pages and also run searches.

The parameters being reported though, have a significant spatial component so in order for the numbers to be really understood a plot of the face positions is required. The user returns to the page shown in Figure 4 and selects 'Get Visual Report'. The query goes to the GEMS database and returns the spatial data for the planned and actual face positions for bench 50 during quarter one of 2001. This is used to automatically generate a vector plot of these face positions with over-mined and under-mined areas highlighted as shown in Figure 6. The resultant report is a vector plot that is to scale. By using the navigation buttons below the plot the user can zoom in, zoom out and pan. This report therefore shows another powerful feature of ASP pages. Gemcom Software International have developed their own ActiveX control which allows plot files that are generated by GEMS to be published via an ASP query on a web page.

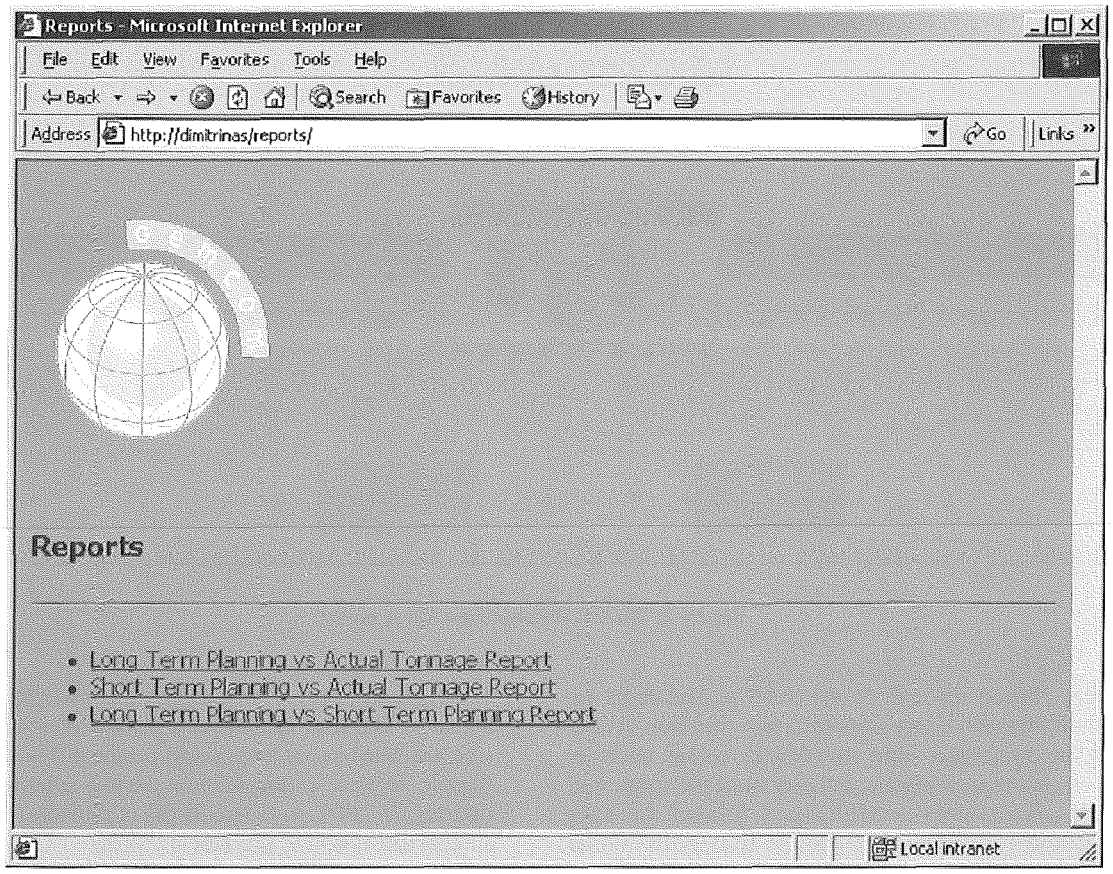

Figure 3. ASP web page in internet Explorer® with three reporting options

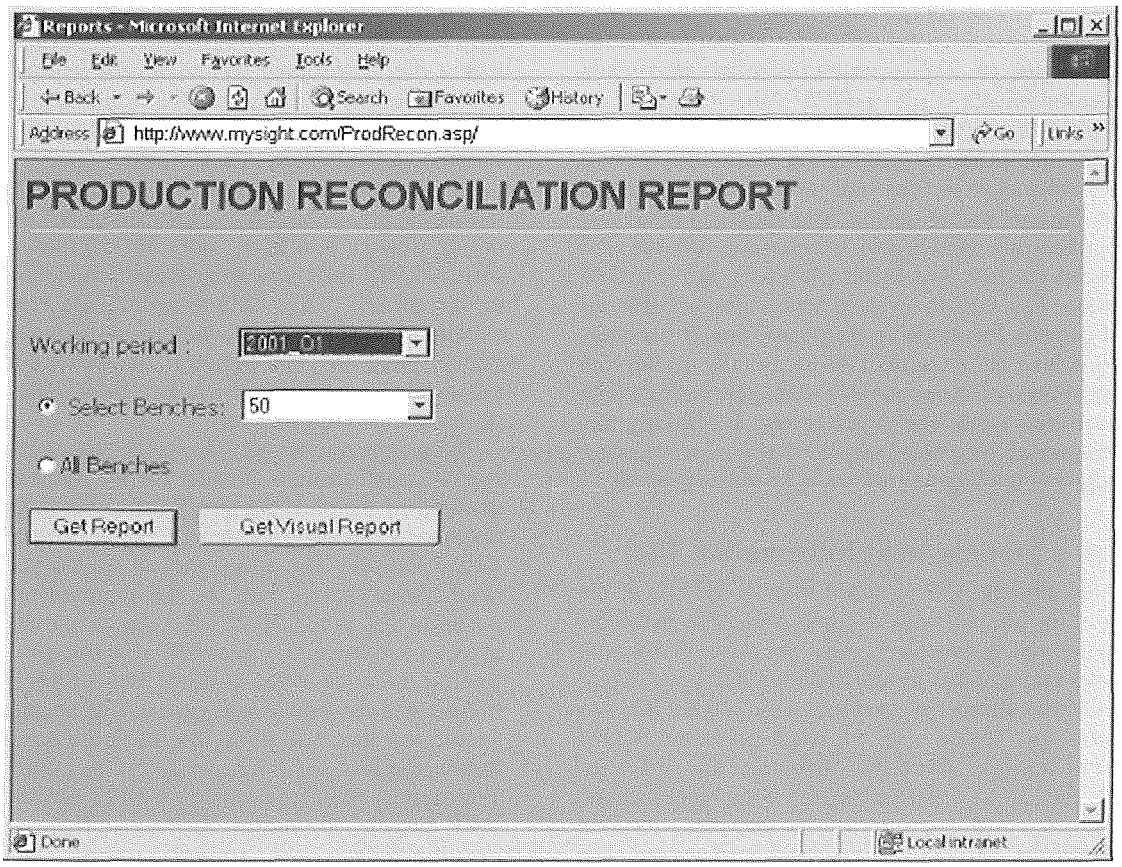

Figure 4. ASP web page dialogue for the generation of long-term planning vs. actual tonnage report

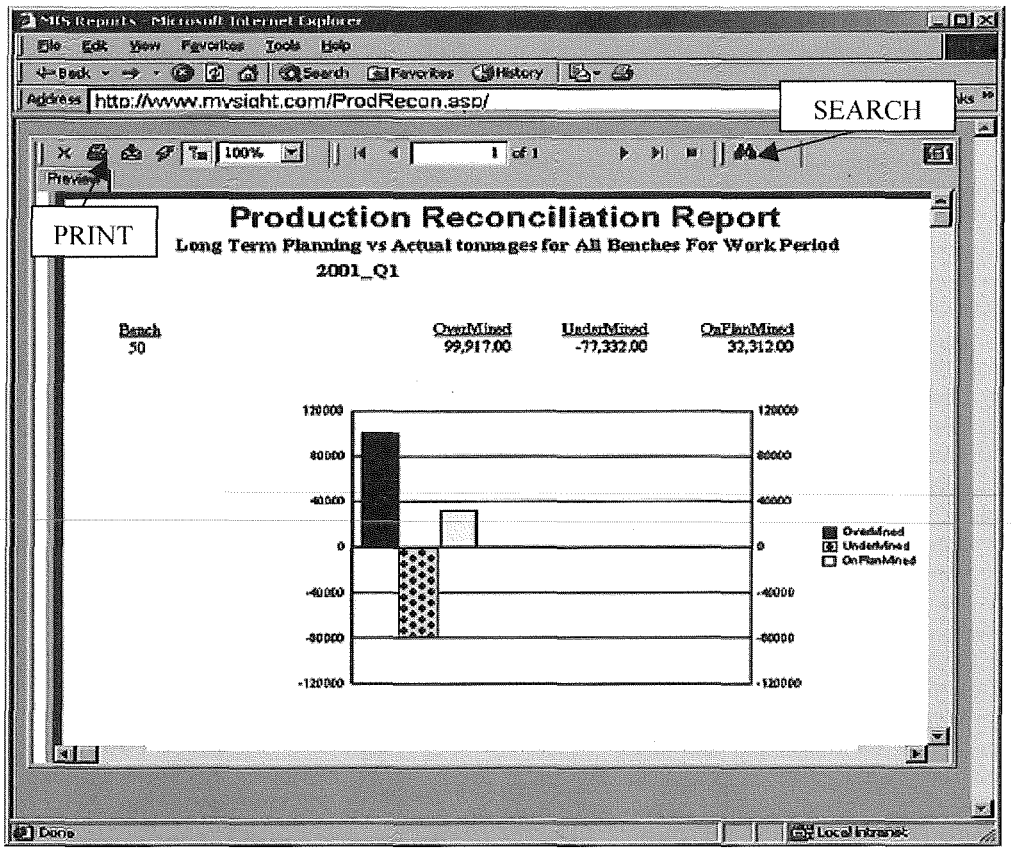

Figure 5. ASP generated web report showing statistics for user defined period

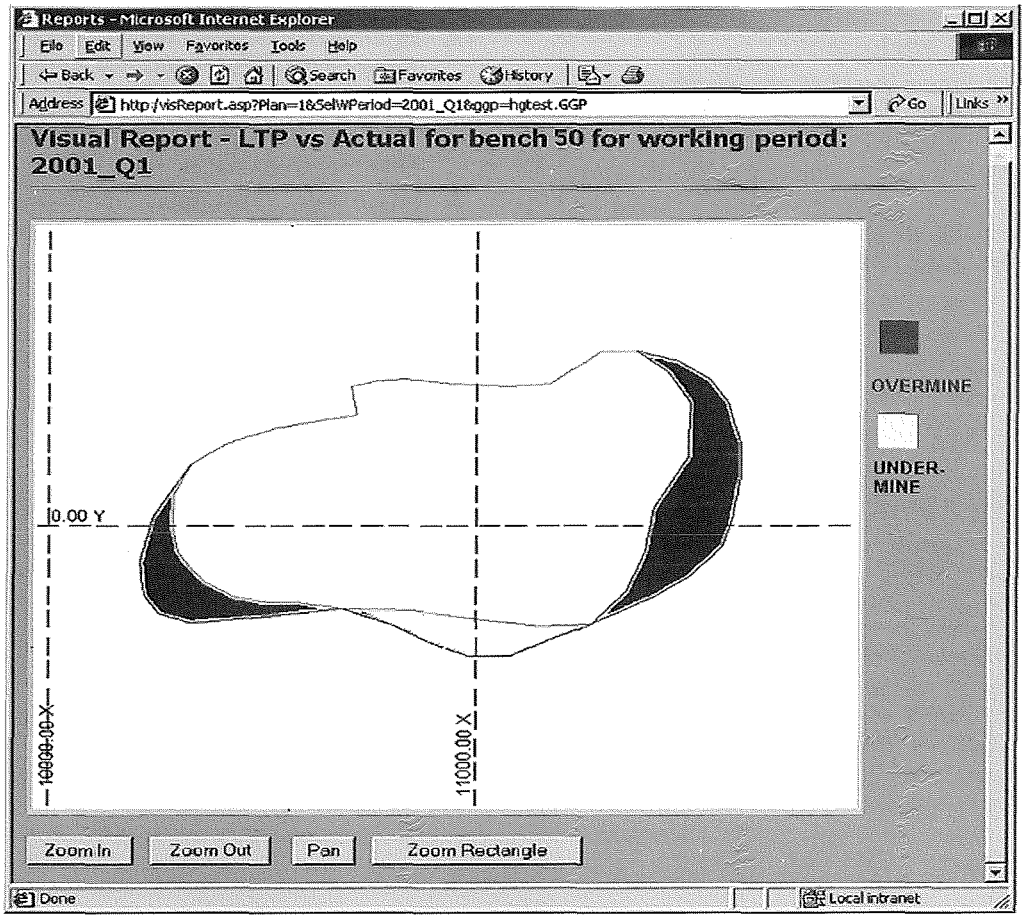

Figure 6. ASP generated vector plot showing planned and actual face positions

This example demonstrates a real world example of how ASP pages can be used as a management tool. People who use this web page require no knowledge of the GEMS system and are able to quickly report what they need from the system. This example was also cost effective to produce as it utilizes (with the exception of the Gemcom Viewport ActiveX control) objects and tools already available in the Microsoft BackOffice® environment. Systems not developed in this environment would require extensive (and expensive) ActiveX control development in order to do something similar. Also, because all GEMS objects (drillholes, block models, geological models etc.) are stored in the SQL database, the amount of variations on this report are enormous e.g. instead of using polygons representing the face positions, this could use wireframe models of the pit surfaces for planned and actual face positions, and incorporate grade information from the block model.

In an environment where business systems, technical systems and plant systems are linked, these queries can be made extremely complex. Consider an analyst for a coal company who gets the inside scoop on a enormous demand for a particular type of coal. Without leaving his desk, through the use of ASP pages, he should be able to determine how many mines within his organization produce that type of coal product, whether they are ahead or behind plan, what production capacities exist and how much of that product is available in stockpiles. He will also be able to look forward and see what the production plans for that mine are over the next few months. All of this would allow him to analyse his options and decide on an appropriate strategy in a few hours, with the confidence that his decision is based on the latest information available from that mine.

Conclusions

In the modern competitive world of globalization, mining companies and mining operations are looking for an edge to make them more competitive. More and more they are looking to technology to give them that edge. However, most software systems, while good at collecting and producing data, prohibit the effective flow of information. This is the edge that many forward-thinking companies are aiming for. By utilizing secure, open database technology and leveraging off the Microsoft BackOffice® environment, these companies are able to deploy powerful methods for the generation and dissemination of information.

Active Server Pages are a standard for the creation of powerful, dynamic and interactive web pages that can either be used to report information on request or capture it, or both simultaneously. This technology has been used extensively by businesses around the world but in mining, only as a Human Resources tool. However, it is becoming very obvious that the potential exists for these to revolutionize the way information is captured and reported within mines and mining companies around the world. Because ASP is a standard, the necessary skills are fairly easy to come by, and more importantly as a development platform, it is cheap by comparison to others. Since ASP also runs server-side, it only needs to be deployed once (on that server) following which it can be accessed from anywhere in the world. As integration improves on mines, the use of ASP will increase incorporating more and more levels of complexity as this happens.

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