Technology Knowledge Base for Coal Mining: Websites at the University of Wollongong

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AN INFORMATION TECHNOLOGY KNOWLEDGE BASE FOR COAL MINING: WEBSITES AT THE UNIVERSITY OF WOLLONGONG

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ABSTRACT: A new web portal “Coal Mine Science and Technology” has been established at the University of Wollongong to provide common access to a series of websites operating from its Information Technology servers. The portal links to three active websites and one that is in the process of development. The currently active websites are: Longwall Mining, Coal Mine Outbursts, and Bord and Pillar Mining websites. The fourth website on Heading Development is currently being prepared. All the active websites are designed with a common format and layout but differ in colour scheme. ACARP has funded the Coal Mine outbursts, and Heading Development websites while the other websites are partly funded by the University of Wollongong (UOW) and partly by the industry. The focus of the websites content has a technical orientation and provides the latest information and technology transfer aimed at the mining industry specifically for Australia and generally world wide. The content of all the websites has a predominantly Australian focus.

INTRODUCTION

The initial creation/establishment and subsequent success of the Longwall Mining website, has demonstrated that the UOW is the leading provider of an information technology knowledge base in coal mining. The second in the series of websites to follow was the ACARP sponsored website on Coal Mine Outbursts. This is now followed by the launching of a third website on Bord and Pillar Mining. All these three websites are currently functioning and have attracted significant attention from both the industry and education institutions world wide, both in mining and related disciplines.

A common web portal has been established to act as an umbrella of single access, or gateway to all UOW coal mining related websites. Known as Coal Mining Science and Technology Website (CMST), this common portal enables better organisation of the current (UOW) mining websites and provides unification of different information knowledge features as shown in Figure 1. Recently a new space has been created to accommodate the currently under construction and yet to be launched website on Heading Development. The website is aimed at a variety of issues related to improvements in the speedy development of headings to serve high production longwall faces.

At present the content of all three functioning websites is focused on the Australian coal mining operations. However, plans are underway to include information on mining from overseas operations and related research that will benefit the Australian coal industry. Already the Coal Mine Outbursts website contains reports from overseas practices and research, notably from Poland and links are already in place with NIOSH of the United States of America.

Presently the Coal Mining Science and Technology Web Portal has three functioning websites. The Heading Development website is yet to be realized as the project is in the infancy stage. The current strategy is that all the websites will be uniform in layout and structure, but differ in colour. The common look to the websites is intended to:

- remind the user (browser can be confused with a web browser) of the location and source of the websites, in this case the University of Wollongong,
- facilitate the easy navigation of each website, through familiarisation and consistency, and
- make available common menu items for all three websites such as glossary, the links menu (to a certain extent) and the contact details of the development team.

The web address or Uniform Resource Locator (URL) of the Coal Mining Science and Technology portal is: http://research.uow.edu.au/coal

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WEBSITE CONSTRUCTION METHODS

All three functioning websites, namely: Longwall Mining, Coal Mine Outbursts, and Bord and Pillar Mining websites were constructed with several tools. In the first instance the sites were constructed using a text-based HTML (Hyper Text Mark-up Language) editor. Graphics and photographs for all sites were created in Photoshop and loaded to the site in the JPEG format. Adobe Dreamweaver and a small amount of JavaScript were incorporated to each site. Dreamweaver, while more expensive than text-based HTML editors, has the advantage of providing two windows: one in which the developing site is visible and another for the code. The JavaScript has been incorporated to assist in navigation of the site as it provides the interactive menus.

All three mining websites has a similar look, with lateral navigation menu bars beneath the website banner. The menu bar contains a range of menus with drop down lists of links to different topics. Sub-menus are incorporated in some menus which also link to the core content of the website.

CONTENTS OF THE WEBSITES

The three functioning websites linked from the Coal Mining Science and Technology portal are similar in design but differ in page colour and content.

Longwall Mining website: http://www.uow.edu.au/eng/longwall

The Longwall Mining website was the first website to be constructed and is also the most frequently visited within the portal.. The technical contents of the Longwall website are contained in seven menus and sub-menus with drop-down lists. These menus and their details are summarised as follows:

- **Overview**: About the site, history and methods, glossary, Australian longwalls.
- **Equipment**: shearer, plough, powered supports, AFC, pantechnicon, beam stage loader, communications and environmental controls.
- **Ground Control**: Abutment pressures, support capacity, gate road support, chain pillar design, ground subsidence, instrumentation, difficult conditions.
- **Ventilation**: Ventilation systems, dust control, auxiliary ventilation, gas drainage, spontaneous combustion.
- **Face Transfer**: Bolt up cycle, equipment recovery, Heusker system (DVD).
- **Heading development**.
• **Punch Longwall.**
• **Links:** International longwall news, NIOSH, Department of Mineral Resources, and Coal services NSW, Joy Mining Machinery, and DBT Mining.

Generally the Longwall Mining website has maintained its progressive edge on different aspects of longwall mining. The contents are regularly updated to maintain currency of technical information and of the technologies used. Issues that require future attention include increasing the numbers of references and publications as well as the inclusion of some key papers or articles which have had significant impact to the development of longwall mining technology.


The technical content of the Coal Mine Outbursts website is specifically related to mine gas and outburst control. Topics contained in the six menus of the navigation bar and sub-menus are as follows:

• **Overview:** Site map, definitions, aims and objectives of the website, contacts, glossary, and picture gallery.

• **Factors:** Including geological conditions, and coal properties.
  o Geological conditions including: Depth of mining, faults and folds, seam thickness, gas environment, gas content and mining induced stresses.
  o Coal properties including: coal seam strength, coal rank, coal permeability, volumetric change and cleat and joints.

• **Management,** including:
  o Prediction: Geology, prediction indices, monitoring, geophysical, gas environment, and gas content.
  o Prevention: Ventilation, gas threshold value, gas drainage, and borehole survey techniques.
  o Control: Ground de-stressing, gas drainage, borehole survey technique, hydro-Facing, pulse infusion shotfiring, outburst hazard control, and outburst management plan.

• **Research and Development,** including:
  o ACARP and NERDDP reports.
  o Seminar presentations, in power point slides, held in both Mackay and Wollongong.
  o Publications, both from Australia and international.
  o Reference list of past publications, totalling more than 300, and
  o John Hanes’ library of quality photographs and drawings from several Australian outburst sites spanning up to 30 years.

ACARP reports are “End of Project” reports. A number of relevant and important reports are currently available on the outburst website. They include:

• Coal Mine Outburst Mechanism, Thresholds and Prediction Techniques, by Ian Gray.
• ACARP Project C14032.
• Gas and Outburst Workshop - 22nd November 2003.
• Outburst Scoping Study - John Hanes.
• ACARP project C 3076, Real Time Return Gas Monitoring for Outburst and Gas Drainage Assessment - July 1997.
• ACARP project C 4034, Outbursting Scoping Study - March 1996 (Lama & Bodziony).
• ACARP project C 3079, Outburst Symposium - March 1995.

The website includes seminar presentations from both Wollongong and MacKay outburst seminars, held twice a year in each location. The PowerPoint presentation list starts from 2002 with a single paper being identified and uploaded, and in 2007 there were eight presentations in each of MacKay and Wollongong seminars.

Publications include full text papers, both Australian and international papers published since 1980. The Australian papers include presentations mostly held in various Aus IMM Conferences and seminars including (Aziz et al, 2007):


ii) 1981 *Ignitions fires and explosions.*
iii) 1982, Seam gas drainage with particular reference to the working seam, Wollongong.


vi) 1991 - 11th International Conference on Ground control in mining, University of Wollongong/ Illawarra Branch, Wollongong.

vii) 1992 Symposium on Coalbed Methane - Research and Development in Australia, November, Townsville, Australia.


ix) COAL2002- 3rd Coal Operators Conference, Coal 2002, Wollongong


xii) COAL - 2005, 6th Underground Coal Operators’ Conference, 26 – 28 April, Brisbane.


At the time of writing more than 250 references are listed in this section, mainly dealing with journal, conference, and other publications spanning more than 60 years. This website is constantly revised and updated. Figure 2 shows a web page typical of the outburst reference section.

Figure 2 - Typical reference list page of the Coal Mine Outbursts website

Links: links are provided to selected websites that provide specific additional information. The selected websites are various recognised entities, technical websites, such as, ACARP, CSIRO, NIOSH (USA), Lunagas, and specialist companies such as, Sigra Pty Ltd, Luna gas, and Valley Longwall, Joy Mining.

Discussion: this section is aimed to establish chat room for direct dialogue, but is not yet fully operational.


The technical content of the website is specifically focused on Australian methods of Bord (room) and Pillar mining. Topics contained in the six menus in the navigation bar and sub-menus are as follows:

- Overview: Includes information about the website, coal deposits and types, history of coal mining in Australia and glossary of technical terms.
- **Methods**: Methods of bord and pillar mining including the first working in a tabular deposit, traditional methods of pillar extraction, panel and pillar extraction, and modern pillar extraction methods.
- **Equipment**: An overview of the equipment used including continuous miners, shuttle cars and continuous haulage systems, mobile breaker line support systems, belt conveyors, and ancillary equipment.
- **Ground Control**: Contains pillar design and principles of ground support.
- **Ventilation**: General introduction to bord and pillar ventilation systems. Other topics include dust control, auxiliary ventilation, and soon to be added spontaneous combustion.
- **Links**: International longwall news, NIOSH, Department of Mineral Resources, and Coal services NSW, Joy Mining Machinery, and DBT Mining and others.

Figure 3 shows a typical page from the Bord and Pillar Mining website.

### BORD AND PILLAR Mining

- **EXTENDIBLE CONVEYOR**
  
  It is obvious that shuttle car conveyance is a batch, discontinuous process which reduces the overall production rates achievable from a continuous miner as a result of the inter car wheeling delays.

  Extendible or flexible conveyor systems reaching from the tail end of the panel conveyor to the continuous miner enable continuous conveying to take place thereby eliminating the shuttle car delays from the production cycle.

  While the production advantages of such systems are self evident, the systems also suffer several defects;

  1. They may have difficulty in readily negotiating 90° turns at intersections.

  2. They have been designed largely for solid development work rather than pillar extraction work and thus if they are not speedily retractable they could cause an associated continuous miner to be caught and buried at the face.

**Figure 3 - Bord and pillar mining website**

### WEBSITE SURVEY AND STATISTICS

Recently a new statistical counter was introduced on each of the three websites. There have been 32,139 hits on the Longwall website, while the Outburst website received 4,900 hits and the Border and Pillar Mining website, launched in October 2007, has had approximately 2500 hits. The higher number of visitors to the Longwall website is expected due to its long-term establishment (launched 1999) as well as being the most widely publicised website.

Figures 4 to 6 show the statistics on the number of visits since August 2007. As can be seen the websites have both national and international appeal. The trend of the access varies for different periods of the year and from one country to another. Clearly, visitors from Australia and North America are the two most regular users. It is envisaged that the interest from Australia will grow even further once the website is formally launched with wider publicity and presentations in conferences and seminar.
Figure 4 – Longwall Mining Website monthly visits statistics (August - December 2007)

Table 2 - Countries that visited the Longwall Mining Website (August - December 2007)

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<tr>
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Figure 5 - Coal Mine Outbursts Website monthly visits statistics (the next page) (August – December 2007)
Table 4 – Countries visiting Coal Mine Outbursts Website (August - December 2007)

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<td>Japan</td>
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</table>

Figure 6 - Bord and Pillar Website monthly visits statistics(August - December 2007)