Enhancing safety training by incorporating virtual reality: Module 7 – Outburst management

Presenting today: James O'Rourke, Chris Fowler, John McKendry

- The University of New South Wales School of Mining Engineering is developing virtual reality training material for use by Mines Rescue Pty Ltd.
- There are five modules in the second tranche which is currently under development.
  - Hazard Awareness
  - Isolation Procedures
  - Spontaneous Combustion
  - Outburst Management
  - Deputies Inspection
- The Outburst Management module will include training in outburst indicators.

Module 7
Outburst management

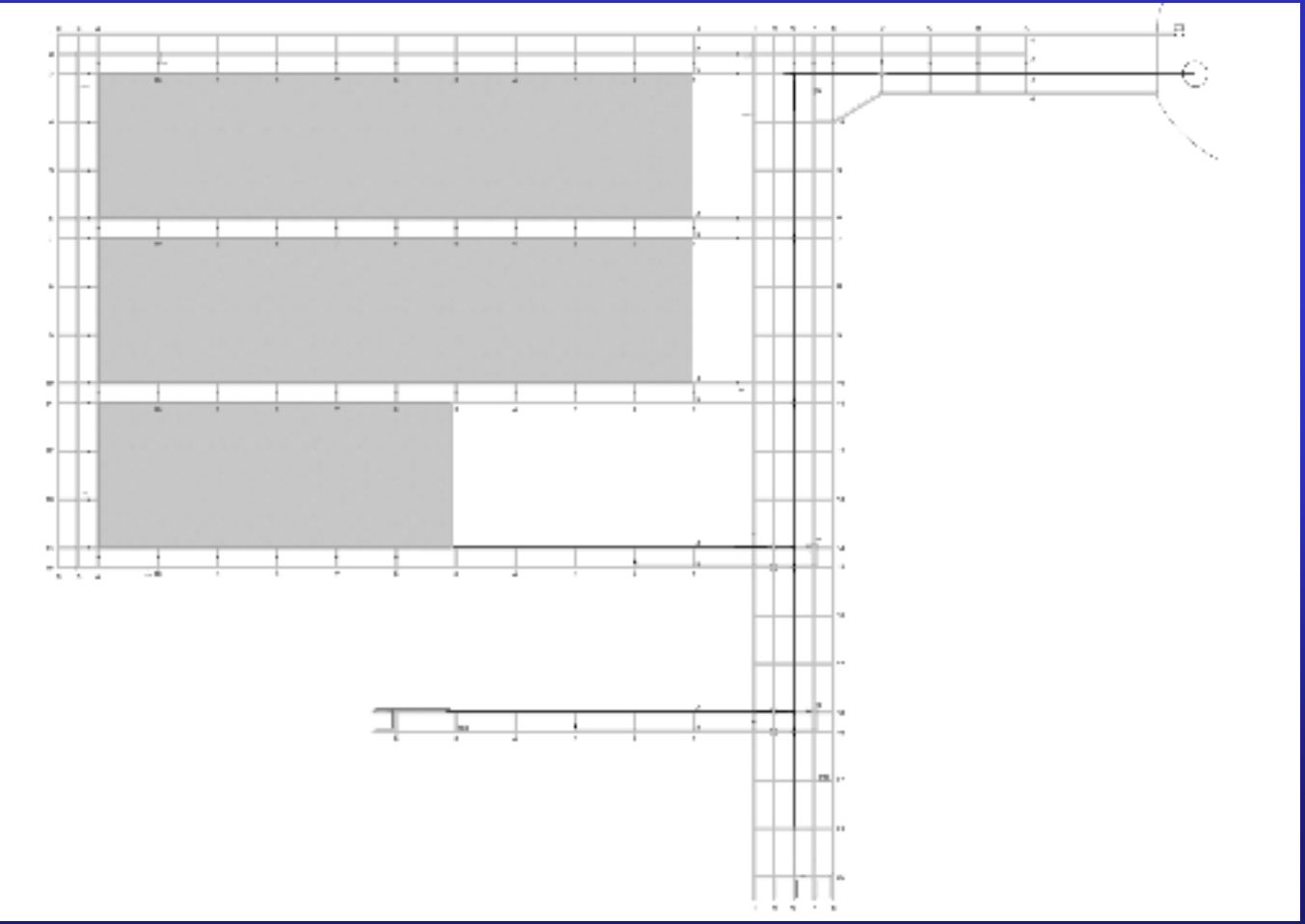
- The outburst module is located in a virtual longwall coal mine that is being developed to house this and other modules.
- The action will take place in the longwall development panel.
- The module will include ten outburst indicators.
- It is designed to run on Virtual Reality (VR) systems which range from a flat screen with single projector to a fully-immersive, twelve projector 360 degree 3-D environment.
- A new Southern Mines Rescue Station is currently under construction at Woonona. It will include

  A 360 degree AVIE (Advanced Visualisation and Interaction Environment)

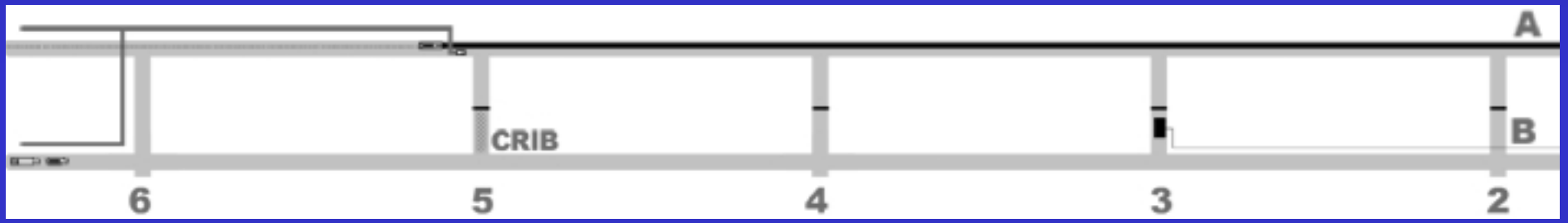
  A VR theatre with large curved screen

  Three iDomes (single user immersive environments)

Outburst management module
Virtual longwall coal mine



Outburst management module
Development headings



Outburst management module Scenario

- You are a member of a longwall development panel crew. The crew enters the panel and ‘does the wrong thing’, proceeding directly to the face without confirming gas has been properly drained and there is a Permit to Mine.
- You are in the vicinity of the face when you witness an outburst.
- You are advised that the incident was not inevitable and could have been avoided by proper adherence to procedures.
- You inspect the aftermath of the outburst.
- History is rewritten! This time the crew ‘does the right thing’. After entering the panel they pause at the crib room for a briefing etc. You read the permit to mine, structures mapped and refresh your knowledge of outburst indicators.
- You then commence mining, ‘spotting’ each outburst indicator.
- You will given a score as to indicators observed. You may review any indicators that have been missed.

Scene One
Outburst witnessed

- Mining is taking place when a deterioration in face conditions is observed.
- Coal is under stress and observed to be spitting (visual/sound) and a bulge is evident. Bumping takes place.
- Suddenly a ‘gas trip’ occurs.
- Believing an outburst be imminent, both the miner driver and the shuttle car driver leap from their seats and run outbye.
- You follow (not altogether surprisingly!).
- Before you get very far, you are all caught up in an outburst.
- What has happened is explained.
- It is emphasised that the incident could have been avoided by proper adherence to procedures.

Scene Two
Inspection of the aftermath

- You inspect the aftermath of the outburst.
  - Partially buried continuous miner
  - Partially buried shuttle car
  - Damage to ventilation system
  - Outburst cone at face

Scene Three
History is rewritten!

- This time the crew ‘does the right thing’. After entering the panel they pause at the crib room for a briefing.
- You peruse relevant documentation which includes
  - Permit to Mine and conditions
  - Outburst Hazard Plan (map)
  - Deputies’ Reports
- In particular, you refresh your knowledge of outburst indicators.
- A Summary of Outburst Indicators (ten items) is displayed in the crib room.
- Clicking on each item opens a dialog box with text and graphics explaining the indicator. Optionally, you may ‘drill down’ for more detail of outburst mechanisms, etc.
- The program will not permit you to proceed further until all ten outburst indicators have been covered.

Scene Four
'Spotting' outburst indicators

- You leave the crib room and commence mining.
- For the first 10 metres advanced, conditions are 'normal'.
- In the zone comprising the next 15 metres of roadway, ten outburst indicators are present (see following slide).
- You are allocated a score at the beginning of this zone.
- Your score is displayed and is decremented as time elapses.
- You are required to 'spot' each outburst indicator by clicking on it.
- For a 'real hit', a dialog box will open explaining the nature of the indicator.
- If an area is clicked where there is no indicator, you will be informed and your score will be decremented.
- You score will also be decremented if you pass an indicator without selecting it.

Visual outburst indicators

Observing change is emphasised

- Increase in CH_4/ CO_2 concentration .
- Sudden deterioration of roof conditions (stretch marks? guttering?).
- Sudden deterioration of face/rib conditions (coal splitting/bulging).
- Significant change in direction/intensity of cleat/jointing.
- ‘Bumping’
- Mini outburst cones.
- Changes in water make.
- Slickensides in the roof or coal.
- Mylonite zone.
- Intersection of a structure (strike-slip fault or dyke).

Scene Five
Scoring and review

- Your score will be visible.
- You may review any indicators that you have missed.
- If you choose to do this, a dialog box will open listing all ‘missed’ indicators.
- Clicking on any item in the list will take you back to a location near to the ‘missed’ outburst indicator.
- The indictor will be highlighted.
- A dialog box that describes the indicator in detail will also be displayed.
- As in Scene 3, you may ‘drill down’ for more information.

Outburst management module
Today's presentation

- The module is the last of the current tranche to be developed.
- What you are going to see today is an early 'work in progress'.
- James is now going to show you the framework of scenes one, two and three.
- Further information is required by the development team.
- If you can contribute relevant material, please contact Chris Fowler (c.fowler@unsw.edu.au).