CSIR’s Centre for Mining innovation (CMI) and the Simulated Test Stope

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IEEE AFRICON 2013
10 September 2013
The objects of the CSIR are, through directed and particularly multidisciplinary research and technological innovation, to foster, in the national interest and in the fields which in its opinion should receive preference, industrial and scientific development, either by itself or in co-operation with principals from private or public sectors, and thereby to contribute to the improvement of the quality of life of the people of the Republic…'

(Scientific Research Council Act 46 of 1988, amended by Act 71 of 1990)

Our line department is the Department of Science and Technology (DST)
CMI Mission

We support government to support the South African mining industry
We aim to generate new knowledge and technology that will enable us to double the South African mineral reserve by the year 2020 whilst extracting without harm to miners.
The realities: costs – safety – resource access
The risks

Causes of mining fatalities (05/05 - 03/10)
837 total

- Fall of ground / Rock burst: 35%
- Vehicle related: 22%
- Other: 10%
- Fall from a height: 8%
- Struck by machinery: 8%
- Caught in machinery: 6%
- Inundated by material: 5%
- Explosion: 4%
- Unspecified: 3%
- Gassing: 3%
- Struck by material: 3%
- Electrocuted: 2%
- Fall into machinery: 1%
FOG risk mitigation

Fall of ground (FOG) mitigating through making safe
Development roadmap for narrow reef mining system

2013

- Sensors (CMI)
- Platform (MSM)
- Navigation (MIAS)

Entry exam vehicle

- Rock breaking - CMI
- Ore tracking - NLC
- Materials handling
- Robot arm
- Power management
- Swarm robotics
- Mine design

2018

Robotic mining vehicle
The Mine safety platform (MSP)

- **The platform**
  - Enters the stope
  - Assess wall condition
  - Highlights unsafe areas

- **Sensors**
  - 3D thermal sensor (3DT)
  - Acoustic sensor (WSA)

WSA = wall stability assessor
Platform validation - challenges

- Conditions underground
- Accessibility
- Safety standards in mines

The need for a simulated environment
Simulated Test Stope - Specifications

• **Safe and controlled** testing environment
• To **verify and validate** the mine safety platform (MSP) and its sensors
• Extract the essential mine characteristics for testing
  – platform navigation
    • confined, cluttered space with obstacles
    • variable slope (min. 20° incline)
    • adjustable stope width
    • path following features
  – entry-inspection sensors
    • roof with different thermal and acoustic signatures
    • textured structures for mapping
Simulated Test Stope - Design

• Footwall
  – 6 m x 3 m
  – adjustable slope (0-28°) through Qty 2 x 200kPa hydraulic cylinders
  – 200 mm dia. mine poles
  – side walls
  – simulated wooden packs

• Safety features
  – Supports
    • Poles at 0°
    • locking system when tilted
Testing in the simulated environment

Foot wall
(MSP Navigation)

Hanging wall
(3DT Thermal delineation)

WSA
(Acoustic delineation)

WSA = wall stability assessor

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Test results

Foot wall
(MSP Navigation)

Hanging wall
(3DT Thermal delineation)

WSA = wall stability assessor

WSA
Acoustic delineation
Conclusion

• The simulated test stope (STS) offers a representative environment in which the mine safety platform (MSP) and its sensors can be tested
• It is designed to be reconfigurable such as to meet needs as they arise
Could this be the future of narrow reef tabular mining???
Questions