Coiled Tube In-Seam Drill Rig

Joe Cronin

CRC Mining
Who or what is a CRC?

Cooperative Research Centres (CRCs) are funded for a finite period (7 years) by the Commonwealth Govt to:

- Bridge the gap between research and industry
- Solve specific problems
What is CRC Mining?

**Incorporated Joint Venture between members:**

Anglo Coal
Anglo Ashanti Gold
BHP Billiton
Rio Tinto Technical Services
Hamersley Iron
BHP Billiton (WMC)
Phelps Dodge
Peabody Energy

P&H MinePro
Komatsu
Caterpillar
CSC

¹Tax-Exempt, Not-for-Profit Company Limited by Guarantee
And...

Research Partners

University of Queensland
    Mining and Minerals Processing Engineering Division
    Mechanical Engineering Division
University of Sydney
    Australian Centre for Field Robotics (ACFR)
    Geoscience
University of Newcastle
    Electrical Engineering – Power Electronics
University of Arizona
    Mining and Geological Engineering
Curtin University
    Western Australia School of Mines (WASM)
    Geomechanics – Underground Hard Rock
Centre Funding in 2005-06

Discretionary cash

- Commonwealth grant $4.5 M
- Members fees $2.2 M

Centre Total $35.5 M

In-Kind

- Member University in-kind $6 M

Project and Commercial cash

- Industry project cash $7 M
- Commercial activities $3.3 M

Industry in-kind $12.5 M
CRCMining

Coal Programme

Technology making a difference

The coal production programme is involved with a number of projects which are funded by:

- Industry – Members
- Industry – Non - Members
- ACARP
- Internal Funds
Technology making a difference

Universal Dragline System

25% + Productivity Improvement

For BMA equivalent to increasing production by 1 new mine (10 Mt/y) at 1/3rd capital cost of mine
AFC Chain Tension Measurement

Funded by ACARP, hardware is being developed to measure the tension in AFC chains in real time.
What is the Coil Tube Drill Rig??

ACARP project to investigate use of Coil Tube Technology for In-Seam Gas Drainage.

Research Partners;

CRC Mining
ACARP
Illawarra Coal
What is Coil Tube Technology??

First incarnation appears to be WWII;

Operation PLUTO (Pipe Laying Under The Ocean) rolled 100km of 75mm steel tube from England to France to support the D Day invasion.

1,000,000 gallons of fuel a day was delivered through 6 pipes.

Pumping stations disguised as Ice Cream Factory and Houses.

Concept, R&D, Prototyping, Full scale in 2 Years !!!!!
What is Coil Tube Technology??

First drilling application patent followed a few years later;

Major components already identified;

Arch Rollers

Injector

Reel & Drive
What is Coil Tube Technology??

Modern Rigs have not changed a great deal;

Major components still there;

- Arch Rollers
- Injector
- Reel & Drive
Why would it be better for In-Seam??

1) It’s a continuous process;
   • No stopping to add or remove rods
   • More drilling / hour
   • No manual handling of rods
   • Continuous water flow
   • Continuous pressurisation

2) It’s a continuous string;
   • Easy insertion of wire-line
   • Easy data acquisition and control

What does this mean??
CTD - Additional Likely Benefits

Boggy Ground Drilling
- Constant fluid circulation
- Drill cuttings do not settle during rod changes every three metres

Better suited to borehole pressurisation technique

Improved geological interpretation of drilled areas
- CTD Unit will have in-built drill parameter monitoring system

Smarter Drillers
- Less labour intensive, more technical equipment may improve appeal of drilling vocation
CTD – Potential Disadvantages

Inability to rotate
  We have got over this problem

Limited pump rates and hole sizes
  Probably not an issue for In-Seam

Limited Torque
  Not an issue for In-seam

Limited Weight on Bit
  Maybe an issue if we want to drill up or down to adjacent seams for pre-drainage
What’s an underground CT rig look like??

They come in all sizes;
What is Coil Tube Technology??

All use bent subs with orientors

Subs not available for purchase – can be rented for $60k per week.
What’s it going to look like?

- Real & Drive
- Arch Rollers
- Injector
Current project

4 Stages;

1. Research the technology - DONE
2. Identify challenges for taking it underground - DONE
3. Conduct theoretical and workshop studies – Sept 09
4. Update detail design of a rig based on above – Nov 09
What are the challenges??

<table>
<thead>
<tr>
<th>Risk Mitigation Issue</th>
<th>Likelihood of Success</th>
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<tbody>
<tr>
<td></td>
<td>Completed Paper Study</td>
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<tr>
<td><strong>1. Coil Tube</strong></td>
<td></td>
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<tr>
<td>a. Deployed tube meets straightness specification for use in-seam drilling to 700m.</td>
<td>50%</td>
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<tr>
<td>a. Ovality of the tube at the end of its fatigue life does not cause any issues with the functionality of the system.</td>
<td>50%</td>
</tr>
<tr>
<td>a. Actual fatigue life is not significantly less than predicted.</td>
<td>50%</td>
</tr>
<tr>
<td>a. Differences in tube handling characteristic when pressurised and depressurised not a problem</td>
<td>50%</td>
</tr>
<tr>
<td><strong>1. Coil Tube Reel Indexer</strong></td>
<td></td>
</tr>
<tr>
<td>a. Indexing system works as conceived</td>
<td>30%</td>
</tr>
<tr>
<td><strong>1. Tube Straightener</strong></td>
<td></td>
</tr>
<tr>
<td>a. Need for auto / manual straightener adjustment known</td>
<td>20%</td>
</tr>
<tr>
<td>a. Effect of varying coil tube storage radius on straightener performance known</td>
<td>40%</td>
</tr>
<tr>
<td>a. Three roll tube straightener is both necessary and sufficient to achieve tube straightness specs.</td>
<td>30%</td>
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</tbody>
</table>
Indexing
Current project
Current project

Workshop rig:

1. Test fatigue life
2. Determine Straightness- how many rollers
3. Test ability to reel
Next Steps

Workshop trials complete by September ‘09

1. Fatigue models verified
2. Indexing design verified
3. Updated detail design

ACARP Project 2010

1. Full scale prototype drill
2. Drilling ability tested in non-hazardous area
3. Final prototype design

CRC2 2011 - 2012

1. Production drill
2. 12 Month Trial
3. 3 more drills in 2012