Coiled Tube In-Seam Drill Rig

Joe Cronin

CRC Mining

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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**

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What is CRC Mining?

Incorporated[1] 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

[1]Tax-Exempt, Not-for-Profit Company Limited by Guarantee

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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

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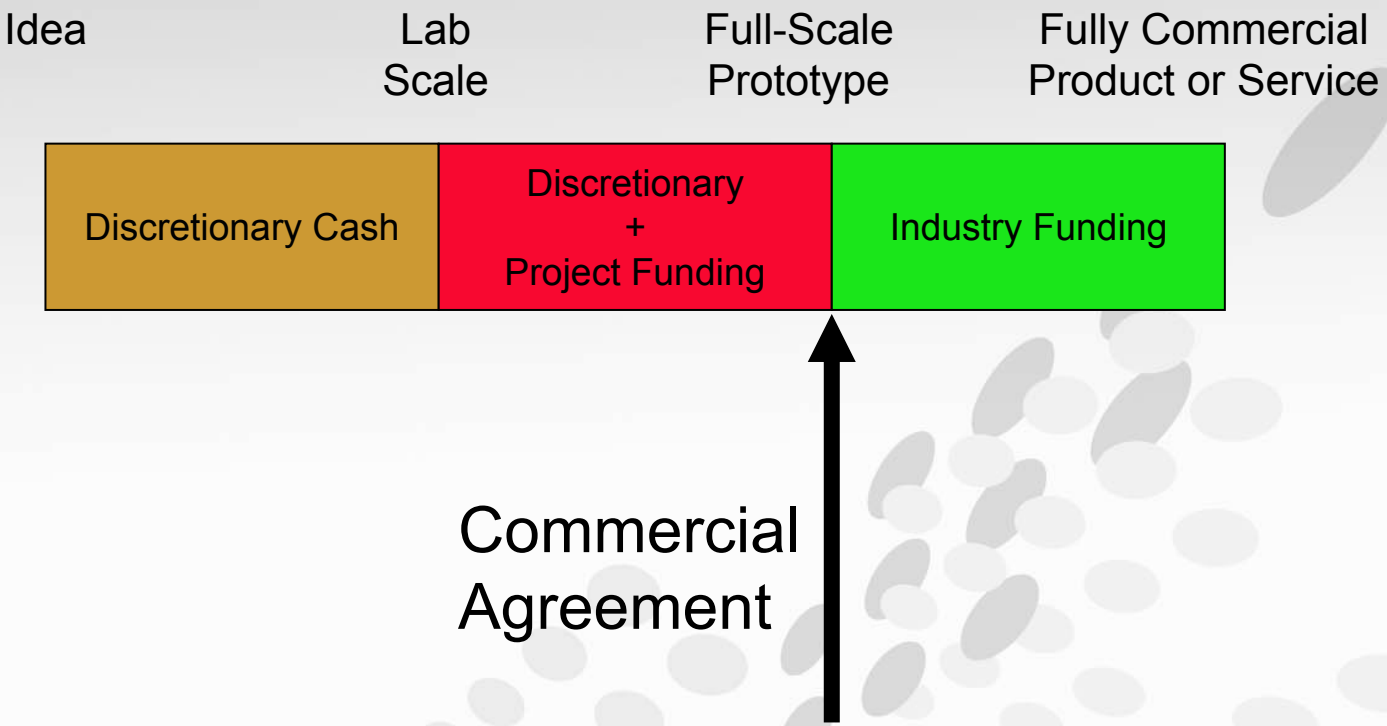
Project Commercialisation



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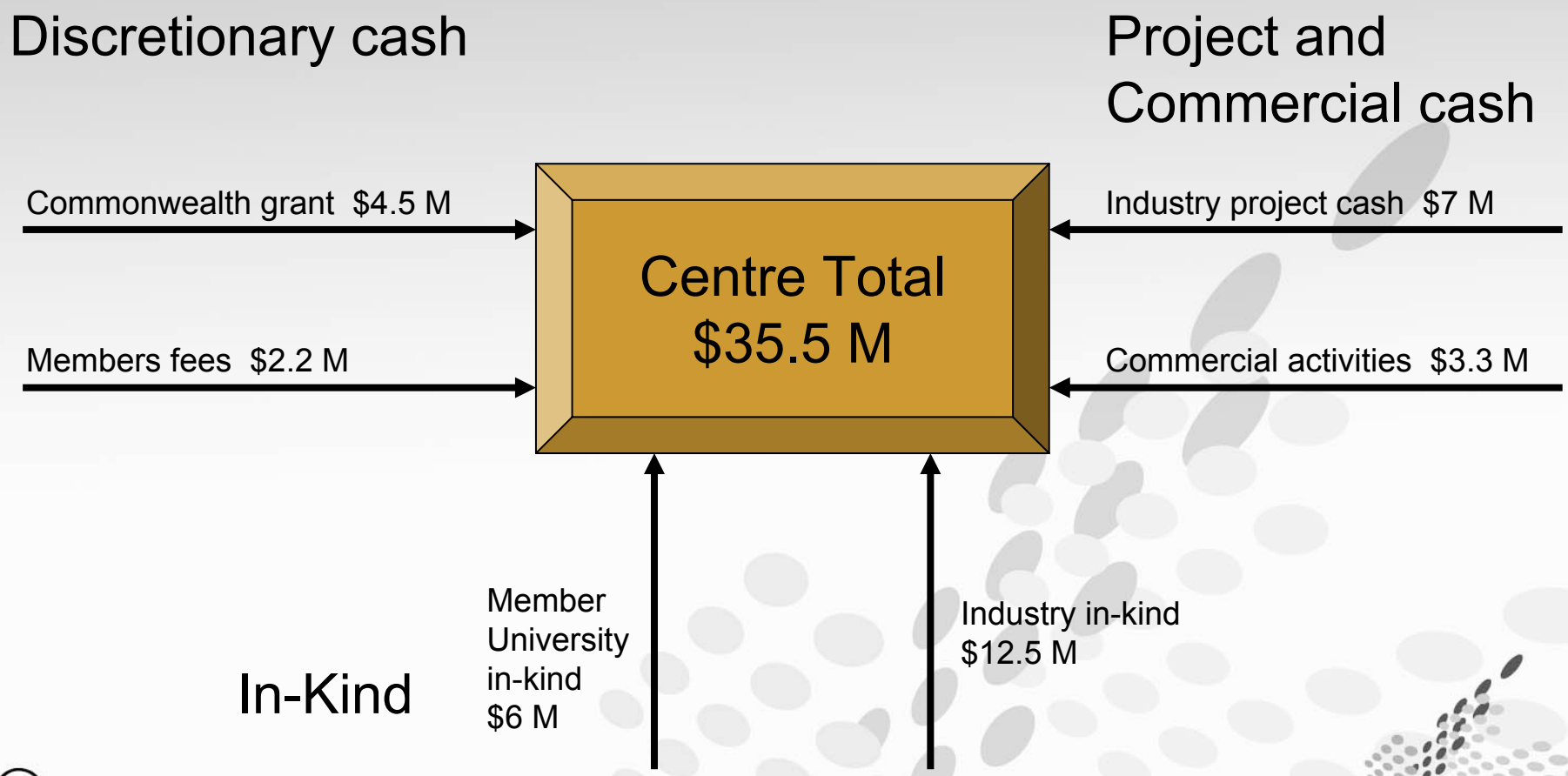
Centre Funding in 2005-06



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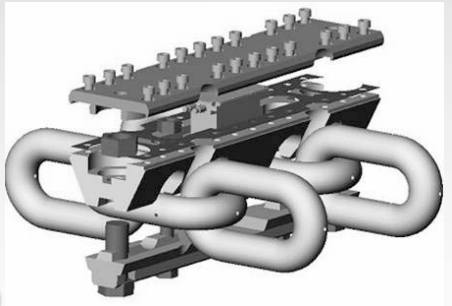
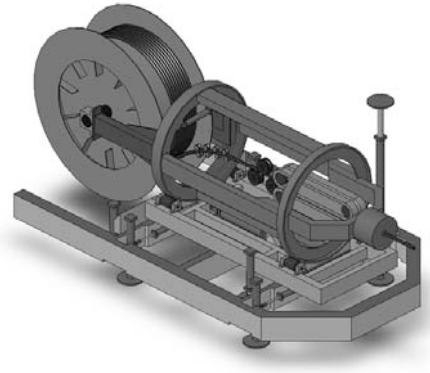
Coal Programme

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



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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

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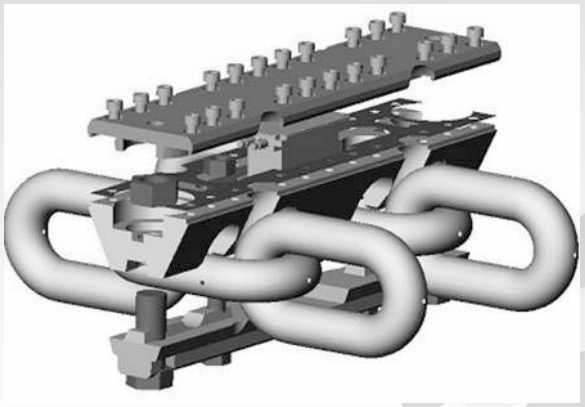
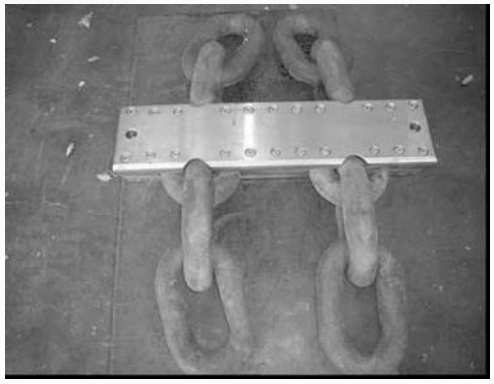
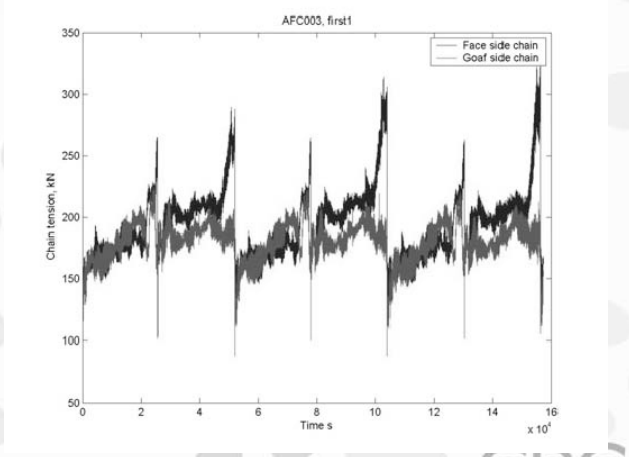
AFC Chain Tension Measurement

Funded by ACARP, hardware is being developed to measure the tension in AFC chains in real time.







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What is the Coil Tube Drill Rig ??

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

Research Partners;

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ACARP

Illawarra Coal

What is Coil Tube Technology??

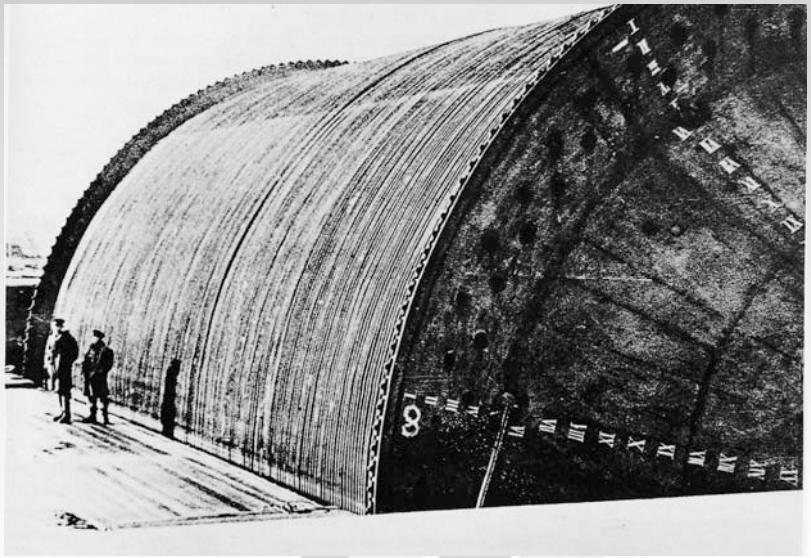
First incarnation appears to be WWII;

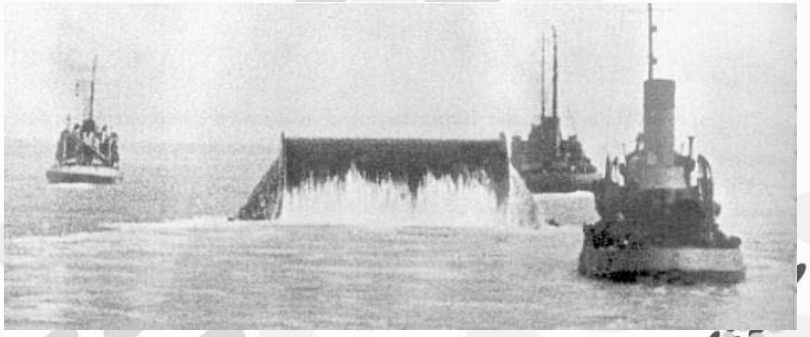
Operation PLUTO (Pipe Laying Under The Ocean) rolled 100km of 75mm steel tube from England to France to support the D Day invasion.

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 !!!!!





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What is Coil Tube Technology??

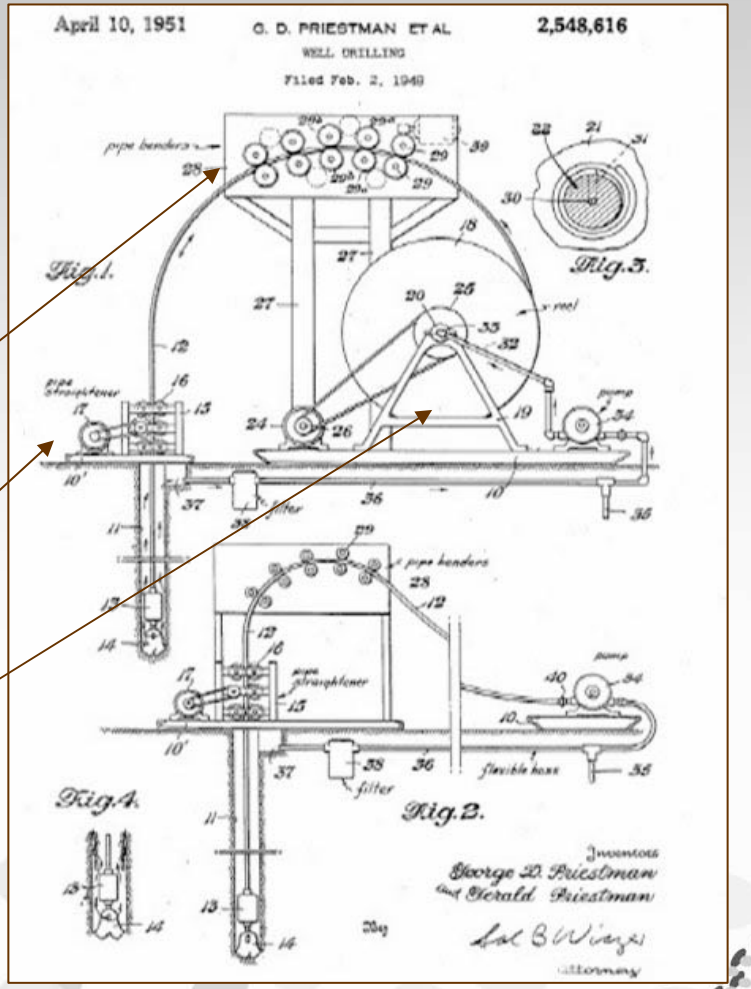
First drilling application patent followed a few years later;

Major components already identified;

Arch Rollers

Injector

Reel & Drive



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What is Coil Tube Technology??

Modern Rigs have not changed a great deal;

Major components still there;

Arch Rollers

Injector

Reel & Drive

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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??

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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

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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

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What's an underground CT rig look like??

They come in all sizes;

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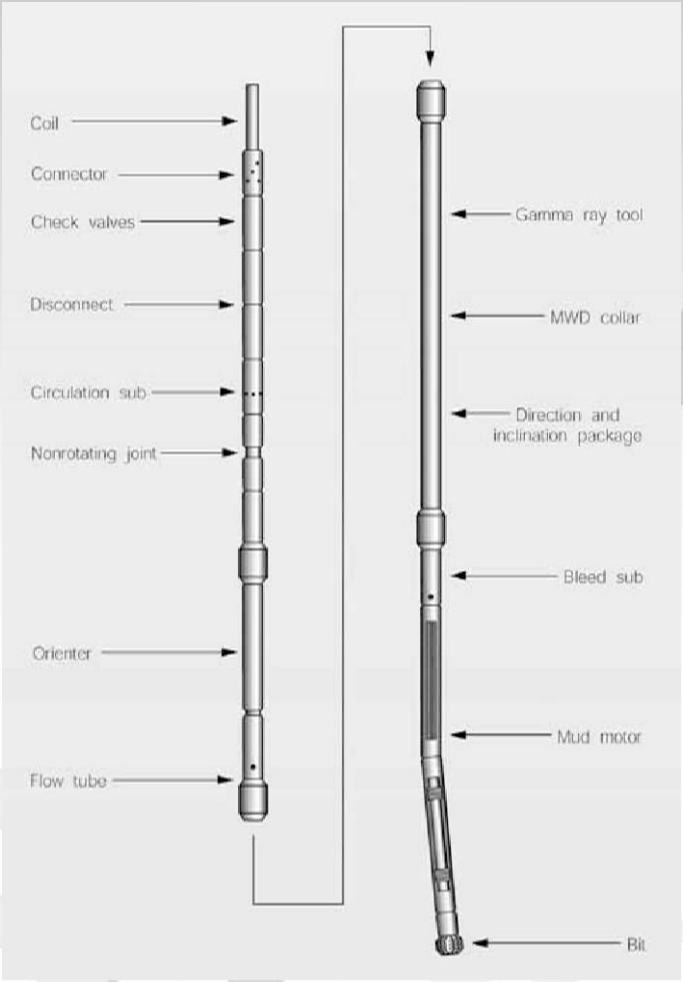
What is Coil Tube Technology??

All use bent subs with orientors

Subs not available for purchase – can be rented for $60k per week.



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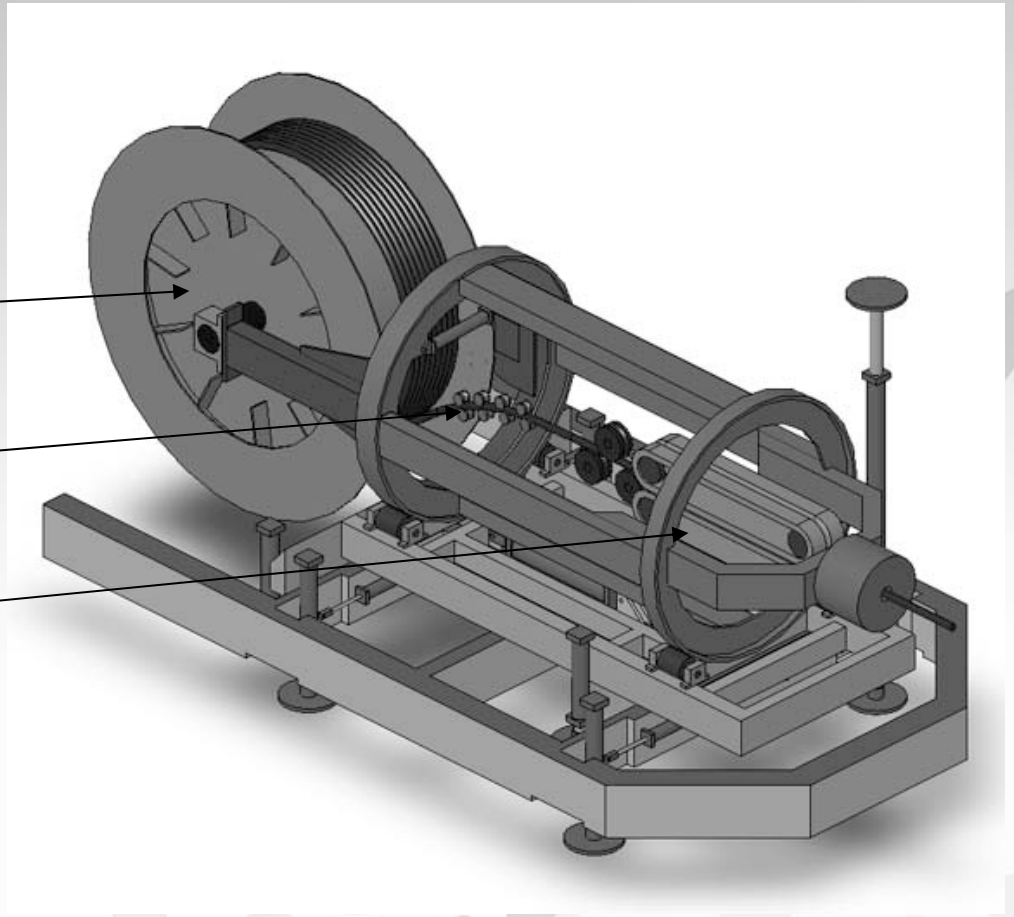
What's it going to look like?



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

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What are the challenges??

Risk Mitigation Issue (Success means prototype will not require field modification for this issue)	Likelihood of Success		
	Completed Paper Study	Inspection of CTD	Workshop Trials
1.Coil Tube			
a.Deployed tube meets straightness specification for use in-seam drilling to 700m.	50%	65%	95%
a.Ovality of the tube at the end of its fatigue life does not cause any issues with the functionality of the system.	50%	75%	95%
a.Actual fatigue life is not significantly less than predicted.	50%	85%	90%
a.Differences in tube handling characteristic when pressurised and depressurised not a problem	50%	50%	95%
1.Coil Tube Reel Indexer			
a.Indexing system works as conceived	30%	40%	90%
1.Tube Straightener			
a.Need for auto / manual straightener adjustment known	20%	50%	95%
a.Effect of varying coil tube storage radius on straightener performance known	40%	50%	95%
a.Three roll tube straightener is both necessary and sufficient to achieve tube straightness specs.	30%	50%	95%

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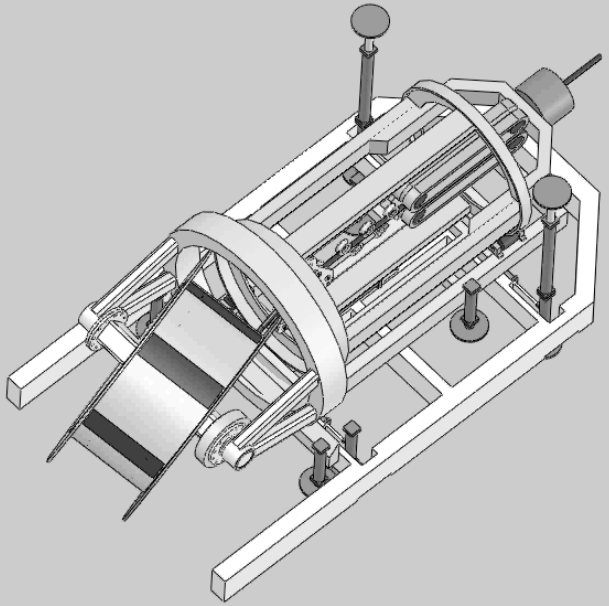
Indexing



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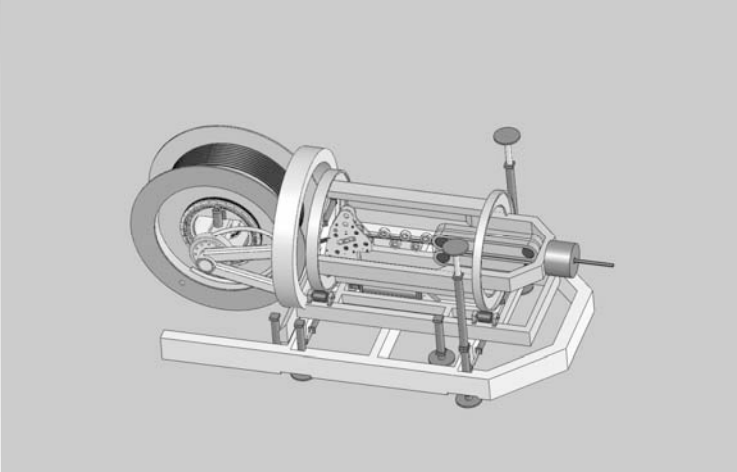
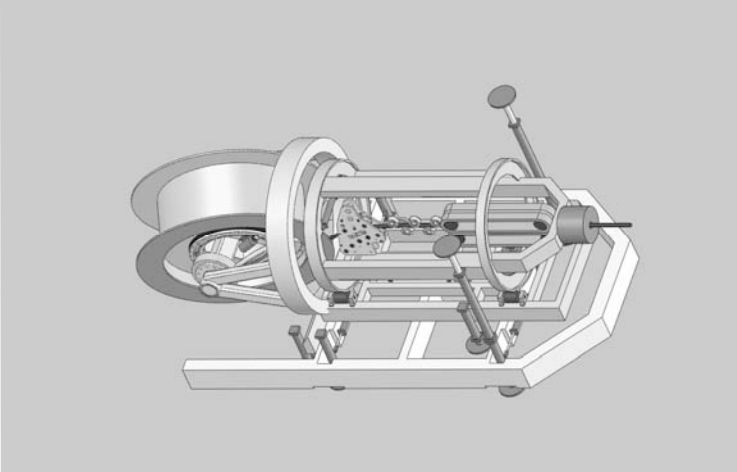
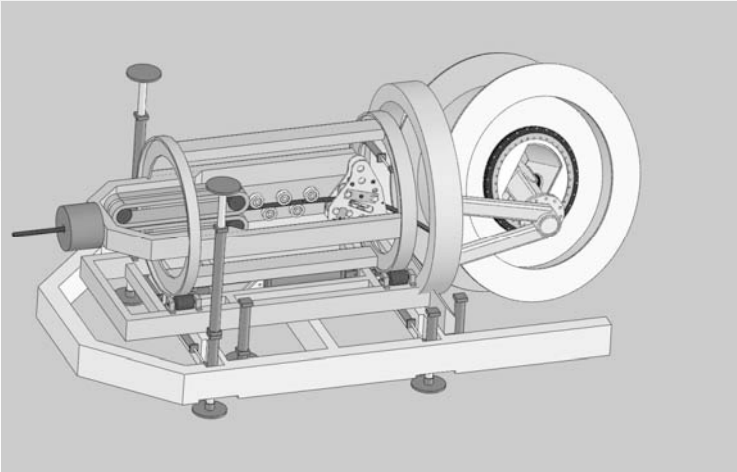
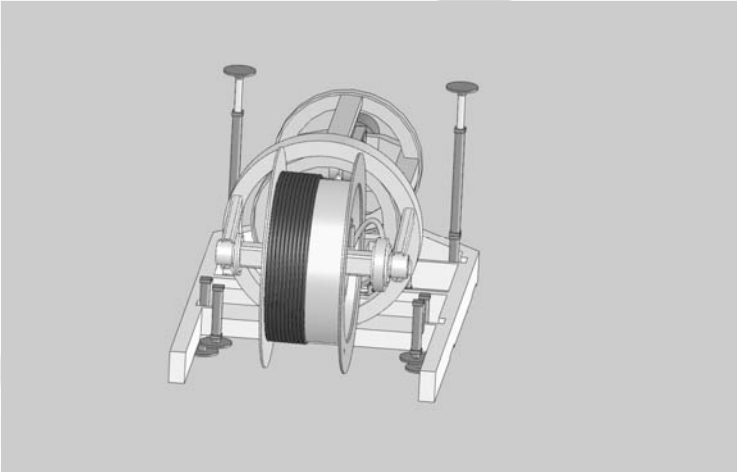
Current project









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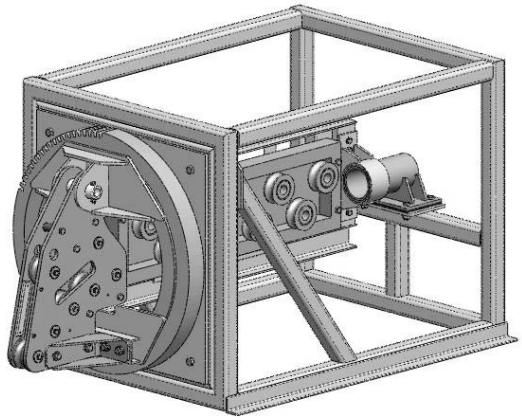
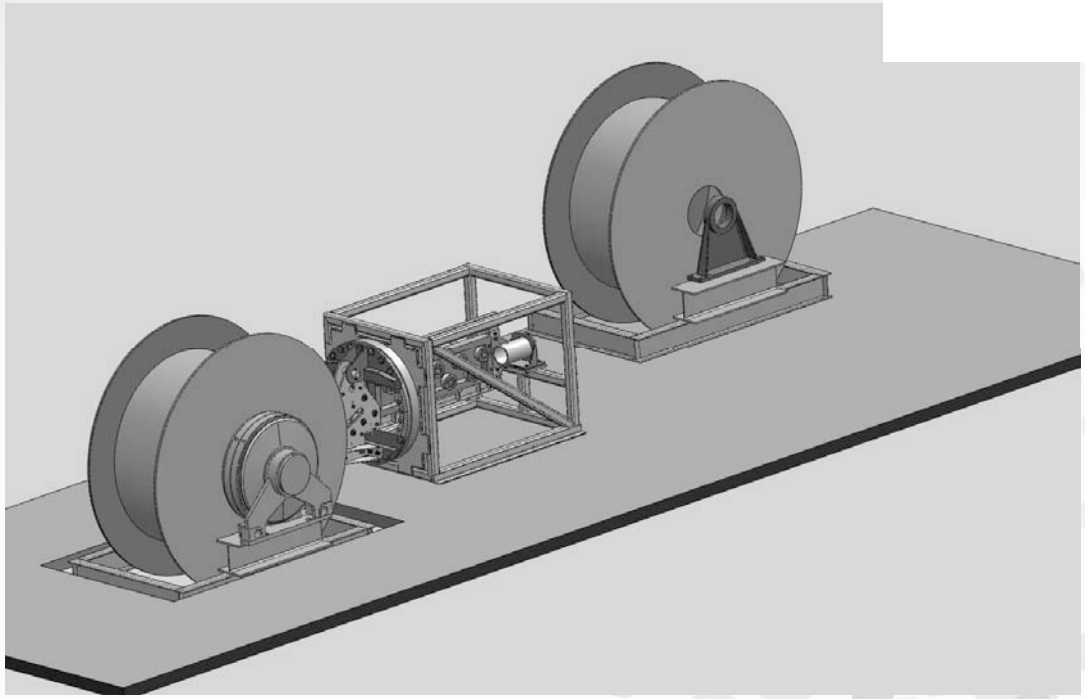
Current project

Workshop rig;

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





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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

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