Presentation Outline

- Introduction to CSG Drilling
- Introduction to Dymaxion Drilling
- Slimhole Surface to Inseam
  - The Drilling Process
  - New Innovations
  - Previous Experience
- Directional Production Drilling
  - The Drilling Process
  - Previous Experience
- Rig Advancements
  - Top Drive
  - Iron Roughneck
About MITCHELL DRILLING

- Began Operations in 1969
- Currently operates 25 rigs throughout Australia and India
- Can offer all facets of CSG drilling including
  - Conventional Vertical drilling
  - Surface to Inseam (Dymaxion)
  - Cavity Completion
- Can offer a complete Integrated Service
  - Planning & Procurement
  - Drilling & Completions
  - Engineering & Ongoing Remedial Works
Mitchell Vision Statement
To be a world leader in CBM drilling technology, offering a complete integrated service able to supply the entire project from conception to completion.

Fundamental values include:
• Continuing a tradition of excellence
• Increasing client’s asset value
• Pioneering technology
• Optimising drilling efficiencies
• Raising the industry bar
• Tenacious pursuit of excellence
Introduction to CSG Drilling

Three Main drilling types for CSG

- Low Pressure
  - Lower Flows
  - Reduced Costs
- Low Pressure
  - Medium to High Flows
  - Medium Costs
- High Pressure
  - High Flows
  - Higher Costs

Shallow Wells
Surface to Inseam
Gas Capped Wells
Traditional Oil & Gas
Introduction to CSG Drilling

- Shallow CSG Vertical wells
  - Low pressure water saturated coal seams
    » Moura, Sydney Basin, Walloon Coals
  » Modified Deep Mineral Rigs
Introduction to CSG Drilling

- Surface to Inseam
  - Shallow Low pressure alternative to cavitation and frac
    » Moranbah, German Creek, Bowen Basin coal mines
Introduction to CSG Drilling

- Traditional Oil & Gas Technology
  - High Pressures e.g. Gas Capped Areas
    » Fairview, Durham, Scotia
  
    » Soilmec G-102
The use of modified exploration rigs for shallow inseam wells.
What is a Surface to Inseam well

- Surface to Inseam drilling or Dymaxion drilling allows the extraction of Coal Seam Gas (CSG) from the coal seam.
- The hole is started from the vertical, steered through a medium radius bend to enter the coal seam horizontally. The horizontal section is directionally drilled up to 1200m through the coal seam. This safe and cost effective method substantially increases the area degassed compared to a conventional vertical well.
Dymaxion Drilling Advantages

- Viable production from marginal fields
- Use of mineral drilling equipment and highly trained personnel
- Does not hinder mining operations
- Less holes required than U/G drilling – cost reduction
- Not tied to mining schedules – longer lead time
- Borehole trajectory can be controlled to take advantage of coal seam directional permeability
- Multiple horizontal holes can intersect single vertical production well – infrastructure cost savings
Possible Uses For Surface to Inseam Wells

- Methane gas production for sale
- Methane Gas extraction ahead of mining
- Water removal ahead of mining
- As an exploration tool ahead of mining. Gives real information such as the position of rolls, folds, faults, etc, in the targeted coal
Dymaxion – A proven technique

1,000,000 feet

By the end of 2005

Total Number Directional Metres Drilled

- 2001: 14288
- 2002: 35840
- 2003: 67148
- 2004: 109801
- 2005: 56108
CONVERTED MINERAL RIG WITH MAST SET AT 61°.

(A) 5 3/4” HOLE DRILLED TO 610m AND CASED WITH 4” I.D. STEEL CASING.

(B) $\phi 96$mm HOLE DRILLED STRAIGHT TO WITHIN 125m OF THE TARGET COAL SEAM.

(C) $\phi 96$mm RADIUS BEND DRILLED TO LAND HORIZONTAL AND INTO THE COAL SEAM.
   BEND RATIO IS 7” PER 30m.

(D) $\phi 96$mm HOLE STEERED TO STAY WITHIN THE TARGET SEAM AND TO INTERSECT THE VERTICAL PRODUCTION WELL - DRILLED DOWN DIP.

(E) LIMITED “ROOF TOUCH” BRANCHES TO ACCURATELY POSITION THE INSEAM HOLE IN THE SEAM AND TO CONFIRM SEAM DIP ANGLES.
New Innovations

- Coil Tubing Drilling
- Electromagnetic MWD
- DAWD, Data Acquisition While Drilling
- Solids Control – Mud System
- UDR 1200 Drilling Rigs
Electromagnetic MWD

**OIL & GAS APPLICATION**

Applications:
- Underbalanced drilling
- Under pressured formations
- Vertical control drilling
- Directional drilling
- Horizontal drilling
- Air drilling
- Re-entry wells
- Relief wells
Mud System

- Trailerised complete mud treatment unit for precise drilling fluid and environmental control
The Drilling Process & Equipment used to date

- Conventional mineral exploration rigs and equipment have been modified and utilized to keep costs to a minimum.

- Proven steering equipment and methods from the civil engineering have been adapted.

- Focused Gamma ray equipment helps us know where we are inseam in relation to the roof and floor.

- Conventional medium low RPM - high torque mud motors are used.

- P.D.C. bits are used for increased ROP.
The Drilling Process & Equipment used to date

- Threaded seamless linepipe is used as casing where possible to reduce costs.

- Well Control to date has been achieved by ensuring the well is full at all times and non-rotating diverter is used to control gas flows away from the rig, however B.O.P.s are available.

- Equipment and methods used are tried and proven. Very careful selection of “Fit for Purpose” equipment is the key to the success of this drilling method.

- Where possible oilfield equipment and services are avoided to keep costs to a minimum.
CONVENTIONAL WELLS

Traditional Oil & Gas specifications for deep inseam wells > 6” dia.
Success in the 99mm holes has given MDC the experience and confidence to now offer Dymaxion Drilling technology to client’s who have deeper seams and want larger diameter wells drilled.

Mitchell have completed 3 deep CBM wells in collaboration with Weatherford and Tipperary Oil & Gas.
Surface to Inseam Example

- 7” Cased Main Wellbore
- 6’ & 5-7/8” Open Hole, Short Radius Curve
- Drilled Underbalance to Minimize Formation Damage

Whipstock with Quick-cut Window System

Lateral Angle: +/- 91.5 deg.

Coal Seam

73 degree hole angle

7” Casing Shoe @ 1003m.

Sump for Production Equipment

TD @ 1722m. MD
Vertical CSG Production Drilling

Two types of CSG well designs used in Australia

1. Conventional Oil & Gas – 7” production casing
2. Shallow Mineral adaptation – 5 1/2” production casing
Well Design Vs Rig Design

**HH-55 – 5 ½” Csg**

- Designed for water saturated CBM reservoirs:
- Used in inexpensive CBM wells with low risk of blow out
- Unable to run 7” casing to 1200m
- Less personnel
- Faster rig up & shift site
- Reduction in location size
- Single annular BOP only
- Angle Mast

**HH-102 – 7” Csg**

- Traditional Oil & Gas specifications and must be used for 7” casing design wells:
- Used with UBD techniques where high possibilities for blow out occur
- Capable of larger well designs
- Increased depth capacity
- Triple stack BOP, annular & double ram
Safety and Low Environmental Impact

The new technology has been shown that the increased control of all the drilling operations and the increasing of the safety parameters have reduced the risk of accidents.

- Less people involved in tubular handling
- Reduction in noise levels with silenced engines
- Best visibility of the operations
- More compact equipment and less components to facilitate assembly/disassembly of the rig and reducing of the risk of accidents
- Reduction of the environmental impact due to the reduction of the dimensions of the location
Drillmec G-55

Soilmec G-55 Rated at 55 ton pullback
HH-55 Technical Specifications

- Max. weight on moving: 38 tons
- Self-erecting substructure: 1.0 m
- Independent “jib” crane max. capacity: 2 tons
- Hydraulic power pack (No. 1 diesel engine): 450 HP
- Max. static hook capacity: 55 tons (110,000 lbs)
- Max. pull down: 7 tons
- Max. operating tripping velocity: 1 m/s
- Power swivel speed ranging from: 0 - 200 rpm
- Max. torque: 3.600 Kgm (at 60 rpm)
- Max. drilling capacity: 1200 m (3,900 ft) with 3 1/2” DP
- BOP Stack: 9” x 3000 psi
- No. 1 Taurus Reagan annular
Hydraulic Hoist Basic concept
Technology & Safety

Hydraulic hoisting equipment

Top drive with torque wrench
G-102
G-102 Technical Specifications

- Max. weight on moving: 42 tons
- Self-erecting substructure: 4.3 m
- Independent “jib” crane max. capacity: 6 tons
- Hydraulic power pack (No. 1 diesel engine) 660 HP
- Max. static hook capacity: 100 tons
- Max. pull down: 14 tons
- Max. operating tripping velocity: 1 m/s
- Power swivel speed ranging from: 0 - 200 rpm
- Max. torque: 3,600 Kgm (at 60 rpm)
- Max. drilling capacity: 2,000 m (6,500 ft) with 3 1/2” DP
- BOP Stack 11” x 3000 psi
  - No. 1 Hydrill “GK”
  - No. 1 Shaffer “LWS” (3”1/2, 5”, 7” pipe, blind rams)
New Technology

- Integrated Drilling System based on the followings:
  - High Automation with minimizing the risk of accidents and the environmental impact.
  - Reduction of the location requirements
  - Easy and fast tripping
  - Reduction of cost of operation and increasing of quality and efficiency of the work.

Advantages:
- Reduced Height
- Telescopic mast
- Integrated Top drive
- Integrated Power Tong
- Automatic Power slips
- Automatic handling system
- Integrated automatic jib crane
- Hydraulic device for casing screwing
- Cementation System
- Integrated system for drilling parameter continuous monitoring

Conventional

Hydraulic

165 ft

65 ft
Equipment Advantages

- Small rig footprint and minimal lease preparation requirements
- High mobility and able to move all rig equipment
- Lower cost operation
  - Personnel, camp, crew rotation, fuel, rig maintenance costs
- Major HSE risks reduced
- Equipment specifically designed for this type of operation
Under Balanced Drilling Equipment

- **Air Compressor**
  - 3 x Atlas Copco XRVS455, rated at 365 psi / 950 cfm

- **Booster**
  - 1 x Ariel J GP-2, Rated at 1450 psi / 2700 cfm
  - 1800 psi injection pump, hammer oiler, and walkways

- **Trailer mounted for fast rig up & down**

- **Silenced engines for residential operations**
Who to Contact for Further Information

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