

PLEASE CIRCULATE TO INTERESTED PEOPLE

NOTES ON IN-SEAM DRILLING OPERATORS AND SUPERVISORS MEETING WOLLONGONG 28TH FEBRUARY 1996

1. **Attendees:** Dam Truong, ACDRILL; Stephen Winter, Ray Lloyd, Ray Nolan, Metrop; Wayne Mulholland, Tahmoor; Malcolm Minnis, Boart Longyear; Scott Thomson, METS; Tony Knight, BHP Tech.Serv.; Richard Walsh, West Cliff; Wayne Murray, Chris Williams, CSIRO; Frank Hungerford, Shane Arnold, AMT; Ron Halsey, Oakdale; Richard Danell, BHPR; John Penrose, ACE Drilling; Bengt Stromquist, Asahi; Peter Hatherly, Matt Stockwell, CMTE; Peter Baker, Barry Jerome, Appin; Mark Finlay, CRAM; Alan Hargraves, Wollongong University.

2.2 Operators Reports

Appin - Currently reviewing drilling/drainage technology to determine best technology to implement. Preparing to trial CMTE water jet assisted drilling. Two holes will be drilled as normal rotary holes to test the CMTE high pressure rods, then water jet assisted drilling will be trialed. If successful, will trial water jet drilling. The water jet assisted drilling will be trialed in the same fan pattern as normal rotary gas drainage drilling for comparison. Matt Stockwell, CMTE reported that 65mm to 80mm bits will be trialed as well as some Longyear bits. The trial will be over 3 months with 3 holes planned per bit variety. Retrojets, reaming bits and pure water jet drilling will also be trialed. Water flow will be around 150 lpm (cf 120-250 for a small DHM and 200 lpm for a large motor). The high pressure pump is capable of 250lpm. Peter Baker is considering using an AW downhole motor from Asahi/ACE with a ProRam for better directional control of drainage holes, but will have to drill blind due to unavailability of a suitable survey tool. With rotary drilling, infill drilling is required to fill gaps, thus making the process inefficient. Appin is considering converting to guided drilling to increase efficiency.

Tahmoor - Experience with the ProPet is positive. RIM surveys are now conducted on all longwall blocks to assure lack of structures prior to mining. Some across panel holes collapse and rotary drilling has to be conducted to infill the drainage pattern. Tahmoor have developed a recoverable standpipe using copper standpipe and replacing the grout with rubber packers. Tahmoor are considering methods of plugging holes, eg when intersected by workings.

West Cliff - 2 DHM rigs are drilling across LW 23 and AMT are drilling 14x350m holes at 4m spacings to drain 350m of the next development panel. One DHM rig is drilling through an intrusion. During the last 3 months, 10 holes and up to 30 branches have been drilled through the dyke with no problems and now have drainage beyond the dyke.

Oakdale - The gas plant is due on stream at the end of the week. Previously discharging 14000 m³/day to atmosphere. Mining has improved with drainage. Will marry gas from drilling and from goaf capture. Some difficulties experienced sending data from gas plant back to mine. Gas drainage is being conducted by Wilsons and exploration drilling by ACDRILL.

ACDRILL - Comparing Surtron's Drill Scout and Champ survey tools. Over an 800m hole, there can be up to 5m difference between the location determined by a Champ and a single shot. Drilling is currently being conducted at South Bulli, and Oakdale.

AMT Drilling - At Appin, drilling two flank holes from Cataract panel to test for a fault and branching back towards the proposed panel line for drainage. Using a Fletcher rig with 25

tonnes thrust, had difficulty pulling the rods. At West Cliff, drilling is slowed to one 200m hole a week compared with 7 holes or 1500m a week at North Cliff. At West Cliff, in CO₂, there is more need for flushing of the holes due to instability of the ground. Drilling 1500m holes along the proposed longwall block with a +/- 1m window to maintain hole spacings at 5m. Contrary to previous experience, in this area of West Cliff the cleat does influence the trajectory of the down hole motor. Upgrading rods to CHD. In other sizes, can experience expansion of the female thread in copper beryllium rods. Also using a rock grade DDM with Mecca. Testing at Moura showed that longitudinal vibration was the main cause of tool failure. The new tool has both longitudinal and radial shock absorbers plus a flexible connection between the tool and the battery pack. The new system also uses disposable batteries to increase reliability. Mecca can be modified to handle a power input down the rods.

2. Research Reports

.1 CMTE - Peter Hatherly reported on the radiometric tool tests conducted at West Cliff in October 1995. The radiometric tool employs a natural gamma sensor to detect proximity to stone. Coal and clean sandstone contain very little mud and therefore produce little natural radioactivity. Shales and mudstones contain more radioactive minerals and give higher gamma counts. The trial at West Cliff showed the tool successfully detected changes in gamma counts as it approached roof and floor. As the tool approached a dull band in the seam the counts also rose indicating that the band could be used as a reference band for drill guidance. More work needs to be done and further trials will be conducted in holes to 90m length over the next few months. Comments were made that one of the early tools trialed at ? Tower had a natural gamma sensor which did not work. At Tower where early drilling was conducted, the roof was a clean sandstone which had a similar natural gamma count to the coal, perhaps this could explain the non-performance. Wayne Murray reported that the radar tool trialed at West Cliff is good at detecting mylonite which is parallel to the hole or at an angle up to 45° but at steeper angles, the radar cannot detect the structure. The next tool to be trialed soon will use a different antenna which should detect structures at high angles to the hole. Radar can detect structures which are near but not necessarily intersected by the hole. At this stage, it is envisaged that the radar will be developed as a post-drilling tool and the gamma will be incorporated with the survey tool and torque, thrust, rpm sensors being developed by Sibra as a measure while drill tool. The radar, which promises to be a more sensitive detector of structures than gamma, cannot be used as a MWD tool until an electromagnetically transparent rod housing is developed for it (researchers and suppliers note - this could be a project for ACARP funding for 1997).

The next stage of the project is to combine the gamma detector with Sibra/AGA's survey tool, torque, thrust and rpm sensors and suitable other geophysical logging equipment. This work will be covered by ACARP funding in 1996 and 1997.

BHPR - Richard Danell reported on the progress of the monitored ProRam and IS 486 PC. Considerable extra data is being collated at Appin and the data are being processed to determine the best way to present the data and to interpret it. The IS computer is at Londonderry undergoing approval processes and should be ready for underground trials soon. Decisions have yet to be made on commercialisation of the entire monitoring system and also the PC. Richard showed results indicating that reasonably small structures can be detected in short rotary holes. A question was asked about how small of structures need to be detected, and was answered by Richard Walsh that at West Cliff, the outburst-prone strike slip faults generally have less than 10cm of gouge and often less than 5cm.

METS - Scott Thomson reported that RIM is now routinely applied at Metropolitan between boreholes to detect structures and to assess drainage efficiency, at Tahmoor between

across panel holes and at Appin where it is run between fraz cased holes at 110m spacings producing a higher frequency result for better resolution of smaller structures. Currently the limit for pushing the gear into holes is 250m. The indications are that drainage is generally good to about 200m, but not as effective at greater depths of hole. Tower is applying RIM to detection of target structures.

The AGA borehole pressurisation device with integrated cuttings sampler which should reduce the time needed for assessment of gas pressures ahead of the face has been completed and is ready for trial at Tahmoor in April. This tool will be required for use of integrated roof/floor/structure detection tools planned for behind the bit.

The Sigra drill rod testing rig has been constructed and calibrated ready for testing of drill rod joints. The rig will also be used for testing the AGA drill bit torque, load and RPM sensor which will have an integrated survey tool (not ACARP funded) to enable measurement and location of changes in drilling characteristics at the bit in both rotary and guided drilling. This tool should be available during 1996.

For 1996, the following projects have been approved for ACARP funding:

- J.Hanes, Coordination of Inseam Drilling Research (should be last year)
- Sigra, Trial of Borehole Pressurisation and Cuttings Sampling System for Outburst Assessment
- CMTE, Waterjet Assisted Rotary Drilling
- CMTE/AGA, Integration of Survey, Roof/Floor and Structure Sensing Tools
- Sigra, Gas Drainage Flow Meter`

3. Suppliers Reports

Cram - Mark Finlay reported a second Diamec 262 has been sold to Appin. It is the first in the world to have automated rod handling with 170 N rods per set. A second Diamec 262 goes to Metropolitan this week. Discussions will be held with Craelius in Mach on automation of drilling.

Boart-Longyear - Malcolm Minnis reported that a new LMC55/75 drill used by Strata Drilling at Dartbrook achieved 375m in an 8 hour shift with a down hole motor including survey.

4. GENERAL

.1 Broken Rods

Dr Ian Gray of Sigra has requested some broken drill rods for testing as part of his ACARP project with Uni Q on testing of Drill Rod Joints. He would like to have both sides of the break. Could you please send some broken rods to him. He will provide you with a copy of his test results on the rods. Without your help, good research cannot proceed.
send to:

Dr Ian Gray
Sigra Pty Ltd
32 Norman St
Coorparoo Qld

.2 Technology Transfer

The meeting was asked if there was interest in a workshop between coal drillers and metalliferous drillers with some keynote talks on oilfield horizontal drilling technology to be held probably in Brisbane at the CMTE in June. Response was positive. Appended to these notes is a paper by Prof. Cooper who will be asked to present the oilfield drilling topics. A program will be prepared and distributed soon. Costs should be around \$200 to

\$300 per person. Commitment will be required from all pits and suppliers to get this off the ground.

5. NEXT MEETINGS

Tentative dates for the next meetings are as follows. Please note them in your diaries and I will confirm a few weeks beforehand.

Newcastle/Hunter - Friday 12th or Wednesday 17th April, 9am Ellalong Colliery

QLD - Wednesday , 21st May, 10am Central Colliery.

John Hanes
Coordinator of ACARP Inseam Drilling Research
5/2/96

PLEASE CIRCULATE NEWSLETTER TO INTERESTED PEOPLE

QUEENSLAND AND HUNTER/NEWCASTLE INSEAM DRILLING MEETINGS - OCTOBER 1996

1. QUEENSLAND - CENTRAL COLLIERY - 1/10/96

1.1 **Attendees:** Derek Devey, Gordonstone; David Saunders, CRAM; Phil Draheim, BHPAC Moura; Gary Combe, Pontil; Norm Blanch, Gary Powell, Frank Blanch, Strata Drilling; Russ Dunmall, Ausmine; David Denman, Malcolm Minnis, Boart Longyear; Malcolm Waterfall, Capcoal; Grant Whitbourn, White Mining.

1.2 **Central Colliery:** Driven in from the highwall, the first longwall commenced in 1986. Currently working 200m (centres) by 2.5 km longwalls on either side of the main east-west development. The current workings have reached 280m depth of cover and the 7 m³/tonne gas content (prior to drainage) and content increases by 1 m³/tonne per longwall with depth. Mining conditions to date have generally been excellent, but some roof deterioration has been noted associated with a monoclinial roll. Inseam drilling is conducted for predrainage of gas. Strata Drilling's B15 drill with a 27/8" Drillex motor is used. Although Surtron's Drill Scout MWD survey tool is currently being used, much of the drilling has been conducted using an Eastman single shot camera. 650m across panel holes drilled with the Eastman are typically displaced 8 to 10m to the right of where they should have been intersected in the development roadways. Holes are drilled up to 1000m along the blocks from the main headings at 50m spacing and 250m holes are drilled across the blocks beyond the reach of the long holes. All drilling is conducted as guided drilling within an 800mm section between the roof and a horizontal shear zone in the central part of the seam. Drainage efficiency varies as permeability apparently varies, probably due to subtle geological changes. 305 panel on the southern side was drained from 7 m³/tonne to less than 2 m³/tonne over two years. The four 1000m holes drilled along 307 panel on the southern side produced at least one million m³/hole. In 205 and 206 panels on the northern side, drainage holes stood for two years and only reduced the gas content by 1 to 2 m³/tonne. The inseam drainage holes under unassisted flow produce an average total flow from the mine of 300 m³/hour, peak 600. The vertical goaf drainage holes under suction produce 2500 m³/hour.

Across panel drilling from 305 panel overshot proposed development roadways by 15m to provide gas drainage for the development. Drilling in places from 306 panel has been plagued by "weak" and highly permeable ribs. It is difficult to set standpipes. Several 2.5mX47mm have to be drilled and grouted to allow the standpipes to be set. 8m standpipes have achieved marginal success. Malcolm Waterfall believes that the drainage of gas and water from the ribs has weakened the coal. When the predrained longwall was cut, the coal peeled from the face without having to be cut. Collapse of the standpipes was also experienced as a flattening due to apparently increased vertical load. This deformation of standpipes might have been associated with geological structures.

The longest hole drilled by Strata Drilling at Central was 1020m when they ran out of rods. Using the Drill Scout, surveys are taken each 3m rod length. A survey takes 3 seconds and shows the bit face orientation and inclination. A hole drilled with the Drill Scout has not yet been overmined. Flip flops are made about each 2 rod lengths as indicated for hole straightness. Strata, Moura and Pontil all said that the straighter holes make it more difficult to branch as they have to pull back further to find a suitable lip. They are tending to deliberately leave upward lips each 50m or so. The bore holes are cased with black

polypipe to keep the holes open, using special anchors and a non return valve designed by Norm Blanch.

The mining crews have expressed concern over mining into gas filled boreholes. Capcoal leave holes to vent into the returns via a flexible hose to prevent pressure build up.

Gary Powell told of the brittle fracture of a CuBe rod which was near new. He heard a ping from the rod string and on retrieving the rods, found that the CuBe rod and motor were left in the hole. He fished them out and found that a 75mm wide by 250mm long section had fractured out of the end of the rod. It was quite brittle. Is this related to the spiral fracturing of CuBe experienced by Bruce Ross of Oceanic? Norm Blanch also experienced the spiral fracture.

1.3 Gordonstone: Mining is being conducted to the north and south of the main east-west development at a depth of cover of 220 to 290m. Two longwalls are operated consecutively as the washplant cannot handle the output of two longwalls operating together. Designed mine output is 4.2M tonnes per year. Seam gas is mainly CO₂ at 1 to 2 m³/tonne. There were remnant pockets around pit bottom at 4 to 6 m³/tonne. At depths around 350 to 400m, CO₂ appears to increase up to 7 m³/tonne. Inseam drilling is conducted for water drainage. Surface drilling indicated that the coal contained 1 to 3 m³ water per tonne of coal, but underground practice has experienced higher levels. Auger holes 1.5m deep are regularly drilled into the floor to act as sumps. Long holes have been used in an attempt to drain areas and this has been partly successful. Drainage appears to be directionally controlled. The seam is essential flat which leads to many pools of water in the workings. The water is acidic and corrosive. A major problem at Gordonstone is roof control. The roof sandstone has around 50% of quartz grains held in a soft clay matrix. Although the clay breaks down easily in water making the rock weak, the quartz grains are very abrasive on the mining equipment. Cable bolting is used throughout the mine. The longwall roof caves plastically.

1.4 Moura: Moura's surface gas drainage project is aiming at a production of 6 petajoules per year (1 PJ approximately equals 26.7 million cubic metres). Seams A to E which are in a 180m sequence are sourced. They dip at 4 to 20 degrees and have many rolls. The roof and floor are of similar material. Vertical hole hydrofracture was attempted for long term drainage but was not economic. Multiple branches from vertical holes have been tried to increase the number of seam intersections by 6 times from one vertical hole. Tests are continuing, but the drainage time is longer than expected. Inseam drilling is conducted from highwall exposures and from cross measure holes from the same highwall. To assess gas reserves, 35 HQ vertical holes and 22 open holes were drilled totalling 16,600m. 456 cores from 203 seam intersections were desorbed for Q1+Q2 (Q3, residual gas was not of interest). Inseam drilling is conducted within the top third of the seams to avoid soft floor. Seam gas is 99+% CH₄ and 95% of the gas in a core is desorbed in 5 days. A compressor station has been set up which compresses the gas to 10MPa pressure before pumping it into a (now) privately owned pipeline to Gladstone. Currently selling 5 terrajoules per day (roughly equivalent to 2.25 PJ or 65 million cubic metres per year) at 98.9% CH₄. Flow tests on the holes indicate that after dewatering for 60 days at a constant water flow of 4 lpm, gas flow was 300 m³/hour. If any back pressure builds in the hole, gas flow drops dramatically.

Moura operates two inseam drilling rigs. One is their own B20 rig with an AMT Mecca system and the second is Pontil's top drive surface rig laid on its side and using a Wellnav survey system. The deepest hole with the Moura rig is 1351m and with the Pontil rig, 1674m. In the last 6 months there have been some drilling /survey problems experienced.

The initial spiders (anchors supporting the communication rod) in the Mecca system were

The initial spiders (spacers supporting the communication rod) in the Mecca system were brittle and tended to break and the communication rod joints experienced leakage. The 2nd model Mecca experienced some spider failures and the connectors to the battery pack failed under the considerable vibration caused by drilling through stone. (At the South Bulga meeting, Frank Hungerford thought the extra vibration experienced at Moura compared with at NSW mines could be a function of the use at Moura of the larger Drillex motor. Ian Baillie experienced considerable vibration with a small Drillex motor. Frank bench tested a Drillex motor with considerable vibration experienced and then benchtested a Slimdrill motor with no vibration. Both AMT and ACIRL now use Loctite back to the first steel to prevent the motor vibrating off the string). AMT addressed the problems and the model 3 Mecca has been in use for 3 weeks. Back pressure is being experienced and in a 800m hole, 1300 psi has been experienced down the hole causing the relief valve to release thus reducing the pressure reaching the motor. Phil Draheim feels the high back pressure could be caused by the increased number of spiders in the rods and he will monitor pressure versus depth in the next hole. The Pontil drilling with the Wellnav system is producing better results lately. Vibrations when drilling through the interburden caused survey tool problems, but these were overcome by building up the nonmagnetic rods to 73mm to 75mm OD. 13mm PCD cutters are OK at Moura in coal (Gary Powell of Strata Drilling feels they are too aggressive at Central), but they caused excessive vibration in stone. The 8mm cutters in a bit built by Longyear dramatically reduced the vibrations without loss of production. Pontil use heavy wall Monel nonmagnetic rods for survey to reduce the vibration. The heavy walls allow a stronger thread. To help remove cuttings from the hole, Moura have adopted a mud flush system using PHPA mud which is supposed to be biodegradable and have the least affect on seam permeability. In one hole, the mud was still intact 3 months after use. Now they use slugs of mud to clear cuttings and clean the hole out on completion. Then a heavy chlorine slug is used to break down residual mud in the hole.

1.5 North Goonyella: Resumed longwall mining at 80,000 to 90,000 tonnes per week last month after 8 months production loss following a tailgate crush. Two limited in-seam drilling trials have been conducted. Two 250m across panel holes were drilled by Strata Drilling for gas contents then were reamed to 150mm for water drainage. Gas contents were less than 2 m³/tonne. Following a perceived increase in gas content in the main development headings, further drilling was conducted for a comprehensive gas survey by Geogas. Gas contents were shown to be higher than contents indicated from surface drilling by around 2 m³/tonne. (Phil Draheim reported that at Moura, vertical cores drilled with tungsten bits yielded around 2 m³/tonne lower gas content than diamond cores). The gas composition is 80% CH₄ and 20% N₂. Current depth is 200m and higher gas contents are anticipated as the workings get deeper.

1.6 Supplier News

Norm Blanch advised that due to his poor health, Strata Drilling and AMT Drilling will be amalgamating and Norm will run the Queensland operations from Mackay.

David Denman announced that Boart Longyear now has a branch in Mackay where they can do PCD refurbishments. Malcolm Minnis reported that smaller PCD elements were tried in a NSW colliery for drilling hard strata and a better penetration rate was experienced.

Russ Dunmall of Ausmine advised he is now based in Brisbane for supply and service of single shot cameras.

David Saunders advised he is based at the new Mackay branch of Cram.

2. HUNTER/NEWCASTLE - SOUTH BULGA COLLIERY 16/10/96

2.1 Attendees: Simon Barnett, South Bulga; Ian Baillie, ACDRILL; Les Lunarzewski, Lunagas; Alan Hargraves, Uni Wollongong; Bruce Ross, Oceanic; Frank Hungerford, Shane Arnold, Tony Bate, AMT; John Weissman, Geogas; Roundy von Stanke, Chris Hagar Freer, Valley Longwall Drilling; Derek Fitton, Asahi; Grant Mitchell, CRAM; Malcolm Minnis, Boart Longyear; Tim Britten, Russell Rigby, Ellalong; Roy Moreby; Dartbrook.

2.2 South Bulga - Simon Barnett, Development Superintendent

The mine was sunk at the northern end of the old BHP Saxonvale open cut mine. Bulga Coal is part of the Oakbridge Group which produces 10 MTPA. The underground has a manning of 166 plus 6 contract drilling crew (AMT). There is no gas drainage engineer or anybody devoted to gas. The gas problem is adopted by all. The mine started as a trial development off the highwall. The first longwall started production in October 1994, and finished October 1995. It was 200m wide by 3.5km long. The third longwall is now being extracted. The LW is supported by one continuous miner on development and one on main roads. Productivity this year to date is 24,000 tpm. LTR frequency last year was 9 and this year 11. The coal is hard and mining conditions very good. Panel development averages 20m per unit shift with good shifts producing up to 35m. Four 6' roof bolts are installed each 2m. No rib bolts are needed. The seam is generally 2.7m thick with local scouring to 1.9m. The depth of cover is from 50m to 170m. A 15cm clay band occurs 1m off the floor. Although the clay band is impermeable, the floor coal doesn't have to be drilled, so all drilling is above the clay band. The coal seam is very permeable. The gas content is less than 6 m³/tonne and 96% CH₄, 4% CO₂. Gas has completely drained from the longwall blocks before longwall mining starts. There have been 8 frictional ignitions to date. Gas emits as blowers from some open cleats. The seam contains siliceous nodules. When the picks strike the nodules, high temperature sparks are produced. The last ignition occurred at roof level and it was interpreted that the gas was coming from the seam above (8 to 38m separation). A threshold gas content to reduce the risk of ignitions has been self imposed at 4 m³/tonne. On development, there is little gas until the depth of cover exceeds 90m and the gas make increases rapidly over a pillar length. Although the gas content at this depth is around 4 m³/tonne, the rib gas emission is high and it is difficult to maintain intake CH₄ at less than 0.25%; hence the need for drilling. The coal is very permeable and drains easily. Virgin gas content of longwall 2 was measured from a surface borehole as 5.7 m³/tonne. Underground coring during development could only record 50% of virgin content.

Ventilation is 29 m³/sec at 0.2% CH₄. Mining stops when CH₄ in intake exceeds 0.25%. The last line of cutthroughs must have less than 0.25% CH₄. It was decided to use gas drainage to reduce rib emissions and to reduce the need for high ventilation. Across panel guided holes were drilled from 3 panel to 4 panel, 100m spacing, 300m long, ending 50m beyond the 4 panel development. These holes produced 70 lps with peak flows reached quickly. A dry hole is fully drained of gas in 4 weeks. Flanking holes are now drilled ahead of developments. At the current face where the roof ignition occurred, a hole was drilled out to 120m ahead of the face when excess water make (+7 lps) occurred from the hole. The mine pump was swamped. The hole was turned off and the rib burst out and collapsed. The rib had to be injected with silicon resin to stabilise it. The resin appeared on the rib 30m away from the injection site. At 170m depth, the insitu pressure is 1.2 Mpa, gas 5 m³/tonne. A geological structure is expected ahead. The seals on the goafs are monitored each night.

A two stage stuffing box is required to help reduce the danger of ejecting the motor from the hole when it is withdrawn as the gas blows with such volume. From 90m depth "zebra" stripes appear on the ribs where water is emitted. A gel forms on the ribs around the cleats.

The gel is formed of soil bacteria (bleached algae - no chlorophyll) sourced at the surface. Air leaks into the mine from the surface, especially in the shallow cover areas.

An on site gas chromatograph is used to analyse 20 bag samples per week. There is a tendency to spontaneous combustion.

The roof is sandstone 8 to 30m thick up to the overlying Upper Whybrow seam. The pit experiences cyclic loading on the longwall. Longwall advance starts with no gas production, but cyclic loading occurs with support yield a roof break occurs at 160m with gas emitted from the Upper Whybrow seam. After this, cyclic loading occurs starting midface and curving back towards each side, each 20m or 2 shifts. Every leg of the longwall supports is continuously monitored by the Scitec system. This allows the whole history of support behaviour to be reviewed.

The longwall works 13 shifts per week producing 95,000 + tonnes per week. Development of 100mX30m pillars produces one pillar per week on 15 shifts. It is anticipated that future longwalls will be 250m wide by 7km long. Consideration is being given to drilling in seam from surface using coiled tubing.

AMT Drilling at South Bulga allow 38% extra drilling over charged metres for branches each 80m for horizon control. As drilling is conducted above the claystone band, the drilling target is 1.5m. The hard coal produces a constant penetration rate of 2m/minute flat out. The cuttings are fine. A hard flinty band of around 90 MPa occurs just above the clayband is hard on bits as are the siliceous nodules and bands. Cores are taken at the end of each hole. One hole ended in a siliceous nodule; when the driller tried to break off and pull the barrel, the siliceous core would not break and the barrel was damaged and 90m of rods were left down hole. 6m CHD rods are used with an NMLC barrel and Mecca system. 5m copper standpipes have replaced earlier fibreglass. A special system was developed to allow safe insertion and removal of the downhole motor from holes which are producing high gas or water flows.

2.3 Dartbrook, Roy Moreby

Now driving the third set of gateroads with gasouts (+1.25%). Flank holes were drilled along A heading. Across block holes have just been started. As B heading was exposed to the block, a program of rib holes was put in with 4 drill rigs to get the CO₂ emissions to an acceptable level. The longwall has been installed but has not yet commenced production. 30% of the gas has been drained at the start of the panel. The target is 50% predrainage which appears to have been achieved for the rest of the block. The focus is on making rib capture successful. The aim is to drive to the mine boundary at 3.5 km. This will require successful drainage. The mine development is, for its first time, far enough ahead to be able to drill across in front of gateroads before mining. Niches are driven in the block to allow drilling with the Diamec and Longyear rigs for 14 fan holes from each location. The first holes are drilled as flank holes for structure detection then across panel holes are drilled. The aim of across panel holes is to intersect future gateroads in the working section, but as the seam is thick, it is difficult knowing where the holes are in the section. Surface holes are on a 250m grid. As there is a tuff band with a strong natural gamma output at the floor, AMT have been asked to incorporate a gamma tool in their DDM Upgrade. An average of 6 to 8 km of holes are drilled each 2 weeks or 15000m per month. The drilling contractor is Valley Longwall Drilling, now owned and operated by the old Strata Drilling crew.

2.4 Ellalong Colliery, Russell Rigby

A structure hole with a 200m target length is currently being drilled for LW13 by ACDRILL. Surface holes were planned on a 25m spacing at 400m depth to clarify the 80m fault, but rain and surface water prevented this. The in-seam hole will have several detailed branches to test the fault. Some drilling has been conducted with small rotary rigs at Gretley to test a dyke which is parallel to the gateroad. The dyke is hard and has to be shot-fired. The dyke cannot be penetrated by a Proram rig at 100m depth. Different types of bits have been tested on the dyke with rotary drilling, but all grind away.

2.5 Oceanic, Bruce Ross

Development is heading towards a dyke and cinder zone 40m thick. Holes are required on each side and one in the centre of the zone to assess the best method for penetration of the dyke. As there is a roll before the dyke, downhole motor drilling will be used and the dyke will be cored as rotary drilling drops in the soft material around the dyke. The dyke can swell rapidly and expands on removal from the barrel. A 700m hole has been drilled and the 2nd hole is current.

2.6 ACDRILL, Ian Baillie

At South Bulli, the workings are approaching a thick dyke and cinder zone. It is near impossible to drill through the soft cinder which is up to 100m wide on either side of the dyke. As drilling through this zone is difficult, drilling past the zone was conducted through the floor. Dyke/plug strength is up to 350 MPa. The Surtron Drill Scout has been used and although it provides good drilling accuracy with MWD tool face angles, it is not user friendly. Whenever the cable has to be cut or joined in an upsloping hole, the water runs out of the rods. A non return valve cannot be used because of the wire. In practice, the driller has to wait for the water to stop running out of the rods, connect the wire then refill the rods. The practice currently adopted at South Bulli is to drill out to the full length of hole required with the Drill Scout then pull back and branch as required with the single shot to core. Malcolm Minnis advised that diamond bits are available for DHM drilling.

2.7 AMT Drilling, Frank Hungerford.

A Fletcher longhole rig is being used at Appin with one Appin trainee and one AMT driller in the new LW development area. AMT also supplied labour for United Mining's rig at Appin which was drilling a hole into the Wongawilli seam with plans to conduct in-seam drilling once the seam was intersected. A thick swelling clayband at the top of the seam stalled the motor. Rotary drilling was tried to penetrate the clayband, but unsuccessfully.

The B15 rig is at West Cliff where five 700m holes are being drilled as LW exploration holes. Branches off the main expected structure were intersected earlier than expected. On 1/11/96, Strata Drilling, owned by Norm Blanch will merge with AMT. Norm will manage the Queensland operations from Mackay.

Scott Thompson has had Chinese and Japanese visitors. The Japanese want to drill gas drainage and protection holes above the working seam. AMT International in USA is drilling LW block holes in W. Virginia. The holes are 1500m in a 1.3m seam. In another mine, an environmental protection hole is being drilled down dip from an open cut mine to entrap and check CH₄ emission from the coal. This hole is 1350m.

2.8 Suppliers News

Grant Mitchell of CRAM reported the semiautomatic rod handling stem is being used at Appin Colliery. A new system is being developed with greater rod handling capacity.

Derek Fitton of Asahi advised users of downhole motors to conduct routine preventative maintenance of DHMs each 3 months rather than wait for them to break down. Using them until they stop can cause considerable expensive damage. Service includes stripping, checking, and reassembly. A bit for reverse circulation coring was designed for continuous coring of coal seams but to date nobody has tried it. Bruce Ross reported he tried reverse circulation coring using a PCD core bit. The holes tended to cave and the bit slowly dropped. Malcolm Minnis reported that at Cleaveland Potash in Britain, very long reverse circulation core holes are drilled (1305m in a week) using NQ rods.

Malcolm Minnis of Boart Longyear advised that a 65mm PCD bit with 8mm cutters has been successfully used for drilling hard dyke where larger buttons could not penetrate. CHD76 rods are becoming more popular for DHM drilling. At Moura, 8mm PCD buttons were used for drilling hard sandstones to reduce the vibration affect on the survey equipment. There was no significant change to penetration rate.

Les Lunarzewsky of Lunagas reported that the laboratory model of the gas/water separator was built and connected to a BHPR IS data logger. Slurry has been pumped through the system to test it. The underground prototype will require some minor modifications. Results to date are promising. To assess the drainability of coal, Lunagas are testing macroporosity of coal. The test is simple and allows comparisons of coals. Les has related macroporosity to the flow obtainable from drainage holes. Computer modelling at Lunagas allows determination of best target zones for gas production in the roof and floor of the coal around a longwall. The software has been considerably enhanced over the last year. Can now design the optimum orientation and number of holes for drainage and gas capture. The software calculates the gas resource and the location of the shear zones. Input is a sonic or geotechnical log of roof and floor.

John Weissman reported that Geogas has recently set up a Hunter Valley lab (mainly for Dartbrook analyses at present) and a Central Queensland lab. Geogas are conducting a simulation of the South Bulga reservoir parameters.

3. Research News

3.1 CMTE - Paul Dunn, Uni of Q - waterjet assisted drilling trials. A day's lost production can cost \$50,000 of lost profit. The aim of the project is for waterjet assisted drilling to make rotary drilling more efficient in target accuracy and speed of drilling. The project used custom built 3 blade bits and some Longyear bits. The amount of water used varies with jet size. Feed pressure drops to around a quarter with waterjet and there is a slight reduction of torque (but still rotating 3 tonnes of rods). The trial used an older diamac drill drilling at the rigs limits. Five bench mark holes were drilled using high pressure BQ rods. The holes diverged towards the cleat. With high pressure water jet drilling, the holes were straight, but they hit the floor due to erosion of a larger diameter hole than the bit. The jets were changed to cut a smaller diameter hole and the next holes stayed in seam. The waterjet drilling to date has produced straight holes which stay in seam. Waterjet drilling will only need an electric motor about 1/5 the size of the current motor. A submission has been made for ACARP funding to further test waterjet assisted drilling in 1997. It appears that waterjet assisted drilling will enable rotary holes to be drilled to target along a straight trajectory at a greater production rate than DHM drilling and with far less capital cost in the hole. The next phase of the project is due to start at Appin soon with pump down single shot surveying to total length.

Peter Hatherly, Roof Floor Proximity - This project is essentially completed and the final report is due soon. The follow up project with AGA to produce a drill guidance system has not yet commenced.

3.2 BHPR - Richard Danell reports the IS 486 computer is approved and three companies have expressed interest in commercialising it. It is hoped an agreement to commercialise will be reached before the end of the year.

3.3 AGA - Ian Gray reports that the survey part of the torque, thrust and RPM tool is complete, the RPM sensor is complete and the torque and thrust sensors are to be calibrated by drilling coal set in concrete to assess the sensors for identifying rock type being drilled during October. Drill rod testing is substantially completed. Important findings to date include:

1. The importance of tolerance control in the manufacture of the tool joint,
2. The need for careful initial makeup procedure,
3. The desirability of always running the same mating threads together,
4. That clever design is only a partial substitute for metal in a tooljoint.

The borehole pressurisation tool is to be tested on the surface during November before being taken underground at Tahmoor to avoid underground complications. A prototype borehole flowmeter has been developed based on a vain type arrangement. Results from a survey of mines indicated that most hole flows are significantly lower than the high figures that operators initially indicated. The initial flowmeter will be for a 2" pipe.

4. Next Meetings

Tentative meeting arrangements are as follows. More details will be faxed out about two weeks prior to the dates stated.;

Wollongong Operators	Master Builders Club	Wednesday 27/11/96
Researchers	CMTE Brisbane	Tuesday 10/12/96
Queensland Operators	Emerald?	Tuesday 15/04/97
Hunter/Newcastle	?	Wednesday 02/04/97

I hope I have not misrepresented any of my colleagues in the above notes. Please advise if there are any blunders or clashes for the meeting dates suggested.

John Hanes
21/10/96

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**NOTES ON IN-SEAM DRILLING OPERATORS AND SUPERVISORS
MEETING WOLLONGONG 27TH NOVEMBER, 1996**

1. **Attendees:** Ron Cassidy, Richard Bell, Tahmoor; Frank Hungerford, Shane Arnold, AMT; Derek Fitton, Asahi; Grant Mitchell, CRAM; Mark Menegazzo, MMI; Kevin Meaney, Geogas; Wayne Murray, Chris Williams, CSIRO; Paul Thompson, Appin and Down Under Eng.; Philip Robertson, Alminco; John Penrose, ACE Drilling; Peter Roberts, Neville McAlary, United Australia Mining; Peter Baker, Appin; Steve Finch, Valley Longwall Drilling; Stephen Loneragan, Surtron; Phillip Hardcastle, .

2 Research Update

2.1 **CMTE** - Paul Dunn, Uni of Q - waterjet assisted drilling trials. A day's lost production can cost \$50,000 of lost profit. The aim of the project is for waterjet assisted drilling to make rotary drilling more efficient in target accuracy and speed of drilling. The next phase of the project is due to start at Dartbrook in December with pump down single shot surveying to total lengths of holes.

Peter Hatherly, Roof Floor Proximity - This project is essentially completed and the final report is due soon. The follow up project with AGA to produce a drill guidance system has not yet commenced.

Wayne Murray addressed the meeting on progress with the radar and dielectric tools. The radar tool clearly detected roof and shale bands in the trials, but it requires an electromagnetically transparent rod and will not be useful for MWD. The dielectric tool will be OK for use MWD and shows much promise for detecting mylonite. ACARP funding has been approved to further develop the dielectric tool.

2.2 **BHPR** - Richard Danell reports the IS 486 computer is approved and three companies have expressed interest in commercialising it. It is hoped an agreement to commercialise will be reached before the end of the year.

2.3 **AGA** - Ian Gray reports that the survey part of the torque, thrust and RPM tool is complete, the RPM sensor is complete and the torque and thrust sensors were calibrated by drilling coal set in concrete to assess the sensors for identifying rock type. The final report is due. Drill rod testing is completed and the final report will be produced in early 1997. The borehole pressurisation tool is to be tested on the surface soon before being taken underground, hopefully at Dartbrook, to avoid underground complications. A prototype borehole flowmeter has been developed based on a vain type arrangement and is nearly ready for production. It will have a hydrocyclone cleaning device built in. The initial flowmeter will be for a 2" pipe.

2.4 **ACIRL** - The borehole caliper project which ground to a halt when ACIRL went through its restructure has been revived and will be completed over the next few months with a second version of the tool being built and trialed.

2.5 ACARP Projects for 1997 - The following projects have been approved for funding in 1997 and are to be coordinated by J. Hanes as industry monitor.

- a) Thanks to your support, John Hanes has received approval to continue his role as Inseam Drilling Research Coordinator for another year.
- b) C6021 Automatic Valve for Immediate Shutdown of Gas Capture - Lunagas. A device to automatically shut down suction/pressure supplies to or from gas drainage operations in the case of an accident or pipe breakage. This device will use a membrane and push spring assembly joined to the main drainage line through an internal by-pass connection.
- c) C6022 Gas Drainage Shut-off Valve - Sigra. Similar objective to project C6021. Apparently the selection committees saw sufficient merit and dissimilarities in both projects to support them both.
- d) C6026 Borehole Dielectric probe - CSIRO. Develop and trial a non-contact NQ diameter dielectric probe capable of detecting mylonite zones without additional data processing.
- e) C6028 Longhole Waterjet Assisted Drilling - CMTE. Produce a long hole drilling system which has the accuracy of DHM drilling and the productivity at least equal to rotary drilling while minimising the loss of expensive equipment down hole. The ultimate aim is to drill holes up to and beyond 1000m.
- f) C6029 Inseam Drill Monitoring Stage 3 - BHPR. Develop and implement real time interpretation software for the integrated drill monitoring system (based on ProRam plus IS computer).

3 Operators Reports

Tahmoor - Following commissioning of the Mecca system, drilling per shift over the last 3 weeks averaged 90m and peaked at 120m. Tahmoor are planning to try water infusion into multiply branched holes for dust suppression. Will also conduct some experiments on cross measure holes. Will turn off or drill and not commission to test if they are worthwhile. 95% of drilling is currently with downhole motor and 5% rotary. Ron is experimenting with Mintec inflatable bags using polyurethane which expands and fills 3m of the hole, as an alternative to CO2 bags. Polyurethane will withstand 30 psi, but can develop a channel through it. Mintec will increase the density, but will have to convince the inspectorate that it can be used safely. Ron conducted a risk analysis which found that nobody was concerned about the chemicals, but there was concern over transport of the polyurethane. He raised the question "Did anyone do a risk analysis of the use of chemical anchors for roof bolts?".

Appin - Appin is in the process of changing from rotary to DHM drilling. Currently, 75% of inseam drilling is DHM and 25% rotary. All cross measure drilling is rotary. Mecca was commissioned 9 months ago and is working very well. It will be incorporated onto the Cram automatic rod handling drill rig in early 1997. Appin will not be shutting off cross measure drainage holes. Total production from the Wongawilli seam is 2000 to 3000 lps. A peak flow of 1000 lps has been recorded in one hole. Gas emission from the Wongawilli seam migrates from the tail gate to the main gate. Normally, a fan pattern of holes is drilled. If a structure crosses the face, a larger flow of gas occurs to the face than to the drill holes. The trial hole to be drilled from the Bulli seam into and along the Wongawilli seam has been abandoned. It was planned to be drilled 500m in the Wongawilli seam with a Diamec 262. However, when the soft clay bands above the Wongawilli were intersected, they could not be successfully penetrated and kept open. The hole was started at -20° and the first 70m was drilled rotary. The inclination was then changed to -17°. It was planned to intersect the coal at -7° (actually -10°). Because of the shallow angle, the intersection of the last 1.5m clayband was around 6m long. This caused the motor to stall. Detergent was used in the

hole and although it did not help drilling, it did assist recovery. Casing while drilling plus a 20 tonne push/pull rig are required.

Peter feels that water infusion from branched holes is successful at Appin, but Paul Thompson was concerned about the triangle of coal left between holes at their outby end. Appin are considering infusion from the maingate end of holes. Ideally the mining crews should pack off the holes in the ribs when they see the holes on mining. Peter Roberts stated the self inflating Mintec bags work well for packing off holes. Ron Cassidy reported that when testing them in pipes, the packers are ejected at 40 psi pressure. Paul Thompson said his packers made of a PVC bag on a conduit string work well when inflated by pit water pressure, but they must be inflated before the water is infused into the hole. Reports from USA indicate that the best water infusion of the coal occurs around blockages in the hole. Therefore, at Appin, packers are installed at various locations in the hole to get a wider infusion pattern. This has been the practice for around 8 years. Have only had one failed dust count which occurred when cutting a dyke. Prior to this practice Appin had a 70% dust failure rate.

Peter advised suppliers that Appin needs to be able to survey rotary holes drilled with AW rod, hole diameter 80mm while drilling. He wants to be able to drill the hole, take a core and have the survey results available on completion of the hole. Appin has recently produced a Gas Drainage Operators Handbook which incorporates standards, safe drilling practices etc. It is well illustrated and easy to read and understand. He offered it as being available for the industry as a whole.

AMT Drilling - At Appin, drilled flank drainage holes with the Fletcher rig. Drilled through 2 clay dykes by branching into roof but has troubles with shales braking up. Two holes are to be drilled from the one location to cover two roadways. One hole has been drilled up over the proposed roadway 2.7m into the roof and down into the seam (as the hole will be on suction, it is assumed that the roof integrity will be good - JH). At West Cliff, 5 holes each 750m long are being drilled to check for structures which could bound the next longwalls. At Springvale, two 200m holes were drilled in 3 days for a RIM survey. The coal has strike slip fault zones which can collapse on mining and cause large longwall face roof falls. At the adjacent Angus Place mine, the zones could not be drilled. The drilling at Springvale found that although the faults were closely spaced, the coal between them was relatively intact. At Elouera Colliery where mining of two roads is advancing in the American Creek seam to replace the Wongawilli seam track and belt roadways which are breaking up, two holes will be drilled to target the Wongawilli seam workings 10m above the American Creek seam to test for water in the workings. The holes will be mainly drilled DHM, changing to rotary for the breakthrough. At South Bulga, flanking holes are being drilled to reduce rib emissions to below 0.25% CH₄. The seam is very permeable and because of a flinty band, the pit has had 9 ignitions. In one hole a large water inflow occurred. Within 3/4 hour, the water on the floor had built up to 2' deep and by the end of the shift the heading was filled. AMT has now bought into Strata Drilling which is still managed by Norm Blanch. At Central Colliery, a standpipe of 2mm copper was installed and by the time drilling proceeded 100m, the standpipe was crushed by vertical stress load.

Frank has found some problems with Acudrills imported directly from USA. AMT are now sending these motors to Asahi before use to have them properly set up.

Valley Longwall Drilling - This drilling contract company was previously Strata Drilling's NSW operation and is now owned by Roundy von Stanke. Drilling is conducted at Dartbrook (see Dartbrook meeting notes for full description of the operations) in a 25m

seam which contains mainly CO₂ at 6 m³/tonne. The holes are mainly 300m to 400m long with 3 holes drilled per site (one horizontally, one in floor coal and one in roof coal). Dewatering is a big problem. Most holes get 2 to 3 months drainage time. In 6 months the gas content can be reduced to 40%. Currently surveying with a DDM in BQ rods. This is OK to 400m. The coal is very strong producing fast drilling. Have currently drilled 200 km. Drilling averages 7000m per 2 weeks or 50 shifts with 3 rigs.

United Mining Australia - Drilling is being conducted at South Bulga where rotary drilling is used towards old workings and at Chain Valley to test for old workings. At Chain Valley where the roof is conglomerate, holes were required parallel, but close to old workings. The seam to be drilled passed down through a monocline which dipped at -6° then flattened to -2°. The hole was successfully drilled with a ProRam with appropriate surveying and stabiliser etc changes to control the inclination. Peter feels there will always be applications for rotary drilling. At Clarence Colliery, a hole was required through a 50m barrier into old workings which had been used as a sump. A Diamec drill was used. A pilot hole was drilled to just short of full distance and then opened out to 12" diameter. It was cased with PVC and then grouted under pressure to infuse the last 0.5m which remained to be drilled. At Invincible Colliery, a ProRam hole was drilled with surveying into old flooded workings. At Chain Valley, a 30m vertical hole is to be drilled into flooded old workings. The strata are 27m of massive conglomerate overlain by 3m of bad clay. A ProRam will be used to drill a +4" diameter hole using a thin walled core bit for the conglomerate. The hole will be cased.

4 Suppliers Reports

Checked-Out - Phil Hardcastle addressed the meeting on his proposals to produce a lower cost survey tool in response to industry's requirements. The tool which will have either twin inertial spheres or a single inertial sphere with a magnetic bias element as options will be cableless and use electrical transmission. It will have a range to 5000m and will use one 3.65V battery which will last 3 years before having to be replaced. The replacement cost of the downhole section will be \$30,000 for the inertial spheres option or \$35,000 for the magnetic. The total cost for the two options will be \$100,000 and \$105,000. The inertial option will be 300mm long by 25mm diameter and the magnetic option, 500mm long. The uphole section will be a laptop computer in an explosion proof case. Delivery should be late January, 1997 and Phil is seeking a long hole to trial and prove the tool. He feels the tools should be useable in both rotary and DHM drilling. Phone Phil for an information booklet on 047 223968.

Asahi - Asahi have a DHM service facility and recommend regular preventative maintenance servicing. They also have a DHM recover tool which can recover the rotor of a DHM if the stator is pulled back. Asahi also have a sieve sub which fits behind the motor. A service on a DHM recently revealed a 55mm piece of rubber from a survey tool stuck in the universal of the motor. It went through the stator and ended up in the bearing assembly.

Mark M Industrial - Efforts are currently being concentrated at Tahmoor producing a simple method to shut off all drainage holes to drain the water tank.

Surtron - Steve Loneragan (background in oilfield directional drilling) announced that Surtron has established an office in Sydney to provide a service to guided drilling on the east coast. The wireline unit of the Drill Scout has been improved to reduce its problems. They have developed a Miniature Multishot Tool (MMT). It is 1.5m long with a programmable memory chip. It is programmed for shot frequency using a laptop computer. Five units are operating 24 hours per day in gold mines in WA. The tool is programmed on the surface and placed into its explosion proof case. It records magnetic parameters

according to the operator defined timing requirements using an oil damped triaxial accelerometer combined with three orthogonal sets of fluxgate magnetometers. It can be pumped into a hole or pushed up on conduit and should be OK in a rotary drilling operation as a MWD in-rod tool. The diameter is $1\frac{3}{8}$ ". Battery life depends on recording frequency, but is around one week. Approvals are under way and expected soon. The cost is around \$52,000. Phone Steve for a fact sheet on 02 9808 5341.

Much interest was expressed and a desire was expressed to be able to access the data underground. Wayne Murray suggested it would not be difficult to design a magnetic interface for interrogation and Phil Hardcastle suggested fibre optics should provide a simple solution.

Cram - The Diamec 262 at Appin with automated rod handling initially with 170 N rods per set, now has 340m capacity. The new rig for Appin is based on a Kempe feed which is OK for a 1200m hole plus a NW magazine with 250 3m rods set on a Ramtrack. It will be joystick controlled and IS. It will have onboard diagnostics and monitoring potential. The operator will be seated on the 75 kW power pack.

5 GENERAL

At the Guided Drilling Seminar in Brisbane, many of the drilling supervisors expressed interest in a survey to summarise drilling methodologies and equipment used.

Consequently I intend visiting drilling supervisors from the mines and contractors in early 1997 to collect information. I would like to take this opportunity to thank you for your support and to wish you and you family a happy Christmas and a healthy 1997.

6 NEXT MEETINGS

Dates for the next meetings are tentatively as follows. Please note them in your diaries and I will confirm a few weeks beforehand.

Newcastle/Hunter - Tuesday, 8th April, 10am, location to be advised,

QLD - Tuesday, 29th April, 10am, Crinum or Gordonstone,

Wollongong - Wednesday 5th March, 9am, Master Builders Club

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John Hanes
Coordinator of ACARP Inseam Drilling Research
10/12/96

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