DAP Symposium 2015

Rob Selles, CEO

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Introduction

- **Akiet BV was formed after completion of a private equity funding round of Acquit Business Development BV (ABD)**
- **Founders of ABD were Tom Bakker, Dick Swart and Willem de Jong who are also founding fathers of DAP (WEP & IDN Concepts)**
- **ABD exists to pursue the vision of:**

Drilling to 3000m+ from a parking lot

to significantly reduce the surface impact and capital expenditure of geothermal doublets

- **ABD started developing High Strength Composite Casing in 2006 and Akiet now is ready to supply!**

Enhanced Composite Casing Installation (ECCI)

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Maximum load for 1000m well with 9-5/8” casing:

Material	Specific Weight	Buoyancy in mud	Hook load (tons)
Steel casing	70 kg/m	0,85	60
5” drill pipe	29 kg/m	0,85	25
HSCC / ECCI	20 kg/m	0,45	9

Conventional rig

Super single rig

Super HSCC/ECCI rig

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Composite Technology

- **GRE composite consists of glass fibers in an epoxy matrix**
- **With traditional GRE pipes, fibers, drenched in epoxy, are wound around a mandrel. Disadvantages include:**
  - **Fibers under an angle with main forces => requires thicker walls**
  - **Air inclusions giving weak spots under high pressures**
  - **Uneven surfaces => vulnerable to handling damage and weak spots**
- **Traditional GRE threaded couplings are thick and relatively weak**

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Rotary Casting Technology

- Fabrics are wound around a mandrel
- The mandrel is placed inside a rotary mould
- The mould is spun at high rpm
- Centrifugal forces position the fabrics tightly against inside of mould
- Resin is injected and driven into the fiber structure pushing out all voids
- After curing the pipe is removed from the mould

- Glued couplings are slender and strong

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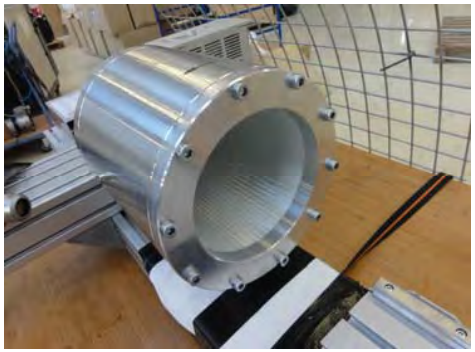
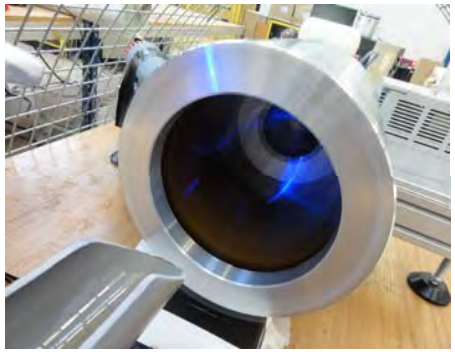
The long road to success

- **Rotational casting pipes with glued composite couplings**
  - **Fibers run in direction of largest forces**
  - **Thin walls**
  - **Small off-set on couplings**
  - **Smooth surfaces**
- **Tested on 20cm machine proving concept**
- **Production tested on 2 meter machine trying different materials and epoxy**
- **Production proven on 4 meter 7” machine**
- **First orders expedited and successfully installed**





World record @5000 meters vertical depth

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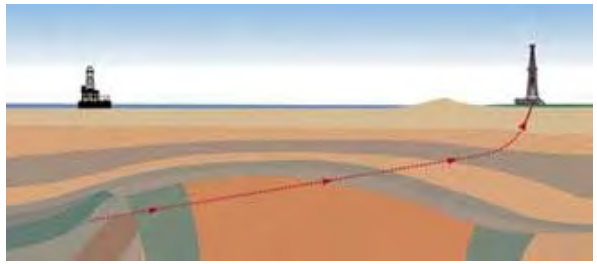
In search of larger markets

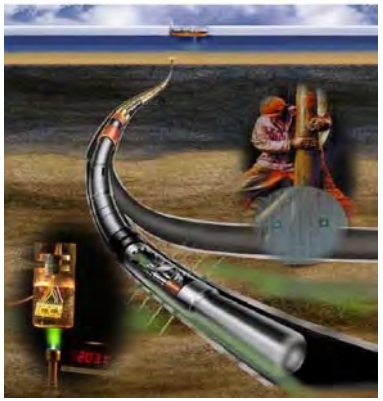


Light weight:

- **Extended Reach Drilling**
- **Small hook load**
- **Helicopter supplied sites**

Eliminate corrosion problems

- **Corrossive formations**
- **Water injection wells**
- **Disposal wells**



Enable "See-through-logging" (STL™)

Extensive testing showed reliability and consistency

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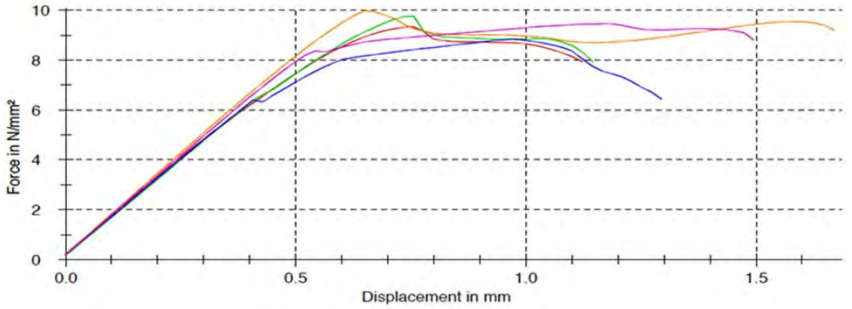
Tests performed to demonstrate:

- **Capability to handle required loads**
- **Reliability / durability**
- **Handling / robustness**
- **Logging responses**



Test results

- **Pipe system can handle loads with sufficient safety margin**
- **Cement bonding can be logged**
- **Pipe is transparent for the requested measurements i.e. magnetic and acoustic logging**
- **Current temperatures up to 105'C. Route to higher temperatures identified**
- **Sufficient data collected to prepare detailed casing installation program**

7" HSCC system (pipe & connection)	**test result**	**unit**
Burst	275	bar
Collapse	207	bar
Tension	1250	kN
Compression	588	kN
Torsion (limited by test set-up)	16.3	kNm

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Geothermal Doublet Research Program (Research, Development & Education , “3 O”)

- **Enhanced Composite Casing Installation (ECCI) technology (casing while drilling)**
- **Fundamental understanding of the loading conditions, the material properties, and the dynamic behaviour of the equipment involved.**
- **Cooperation with the faculties**
  - **Aerospace Engineering (composite materials, non destructive testing),**
  - **3me (engineering mechanics, robotics, systems and control, materials)**
  - **Civil Engineering and Geosciences (geoscience aspects)**
- **BSc and MSc internship and graduation opportunities:**

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Further research subjects

- **Improved heat resistance of composites**
- **Improved wear, impact and creep-resistance of composites**
- **Dynamic characterization of composite materials in drilling operations**
- **Innovative full composite connection technology**
- **New metal-composite-integration technology**
- **Composite cased well abandonment**
- **Non-Destructive Testing**

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Phasing to full roll-out

- **1000 meter HSCC geothermal system. Traditional equipment**
- **2600-3000 meter geothermal system. Light weight drill rig. DAP Objectives**
- **1000 meter geothermal system. Crane based**
- **3000meter crane based geothermal system.**
- **All technology proven and applied**

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Close to commercialisation

Within the next 12 months Akiet will have:

- **proven technology**
- **tested systems**
- **manufacturing capability**

Achieved by working with strategic partners,

…..to enable geothermal system operators to reduce the total cost of drilling by 20%, with less operational cost than a traditional system

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With thanks to:

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