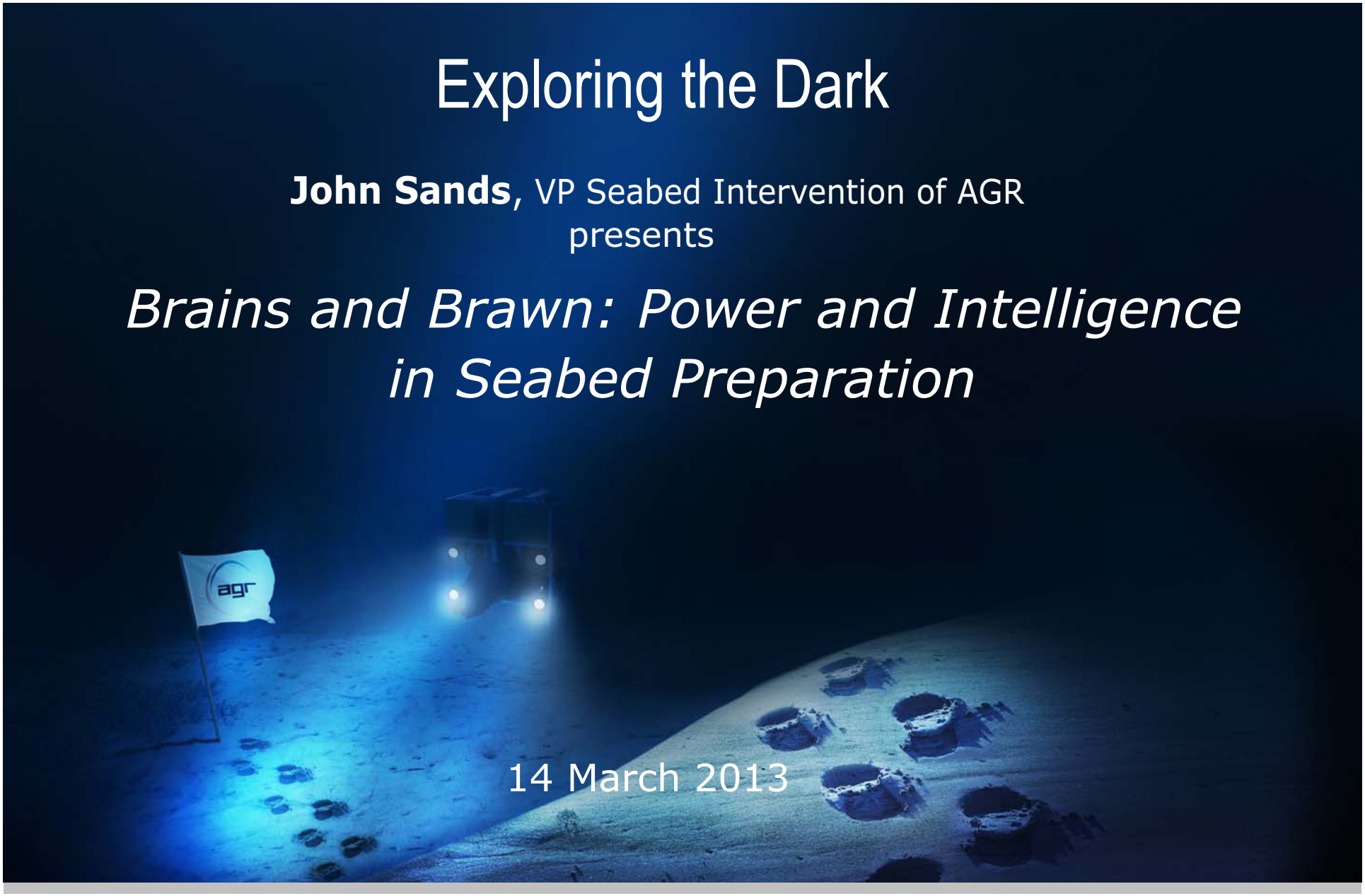
Exploring the Dark

John Sands, VP Seabed Intervention of AGR
presents

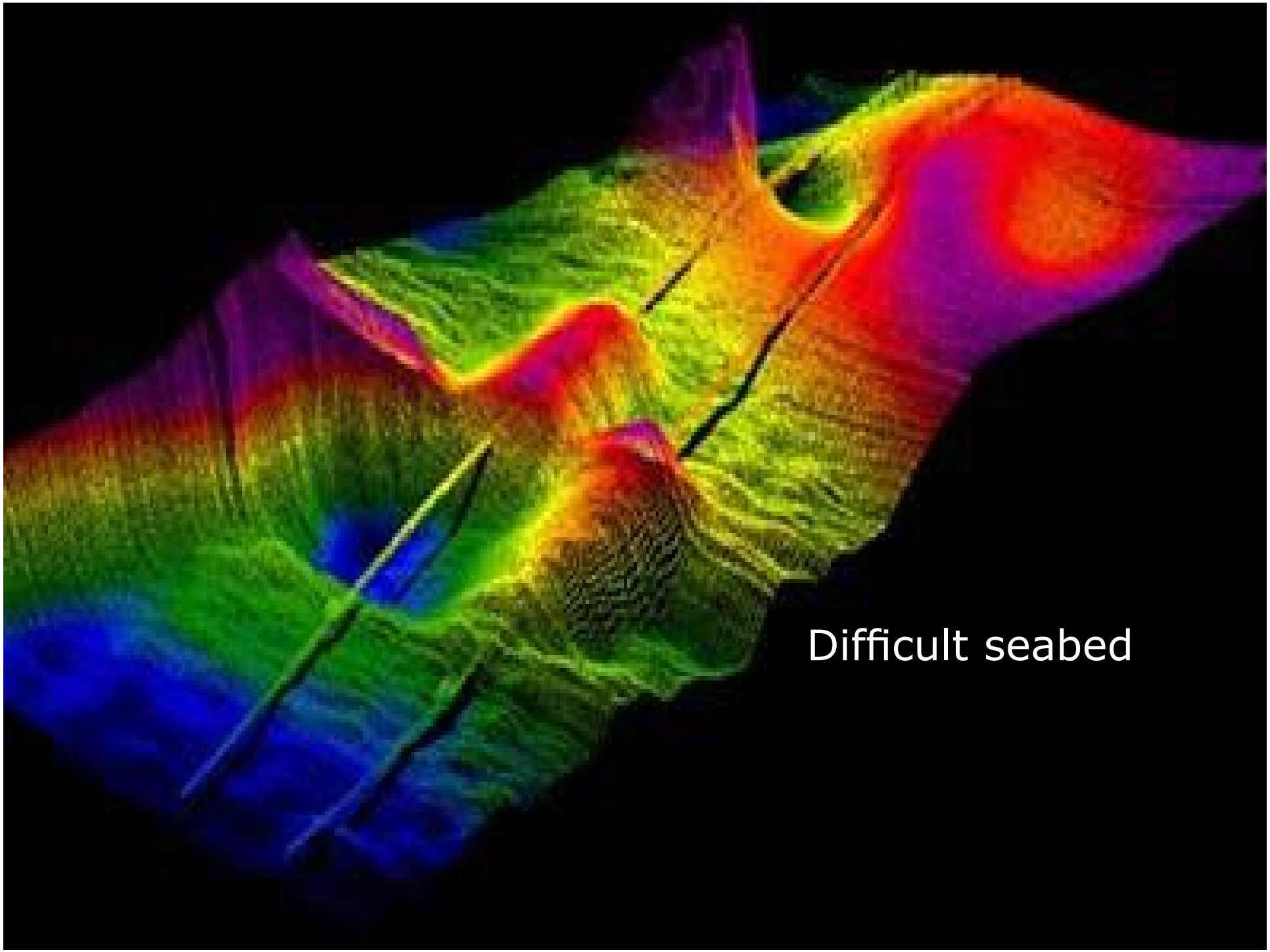
Brains and Brawn: Power and Intelligence in Seabed Preparation

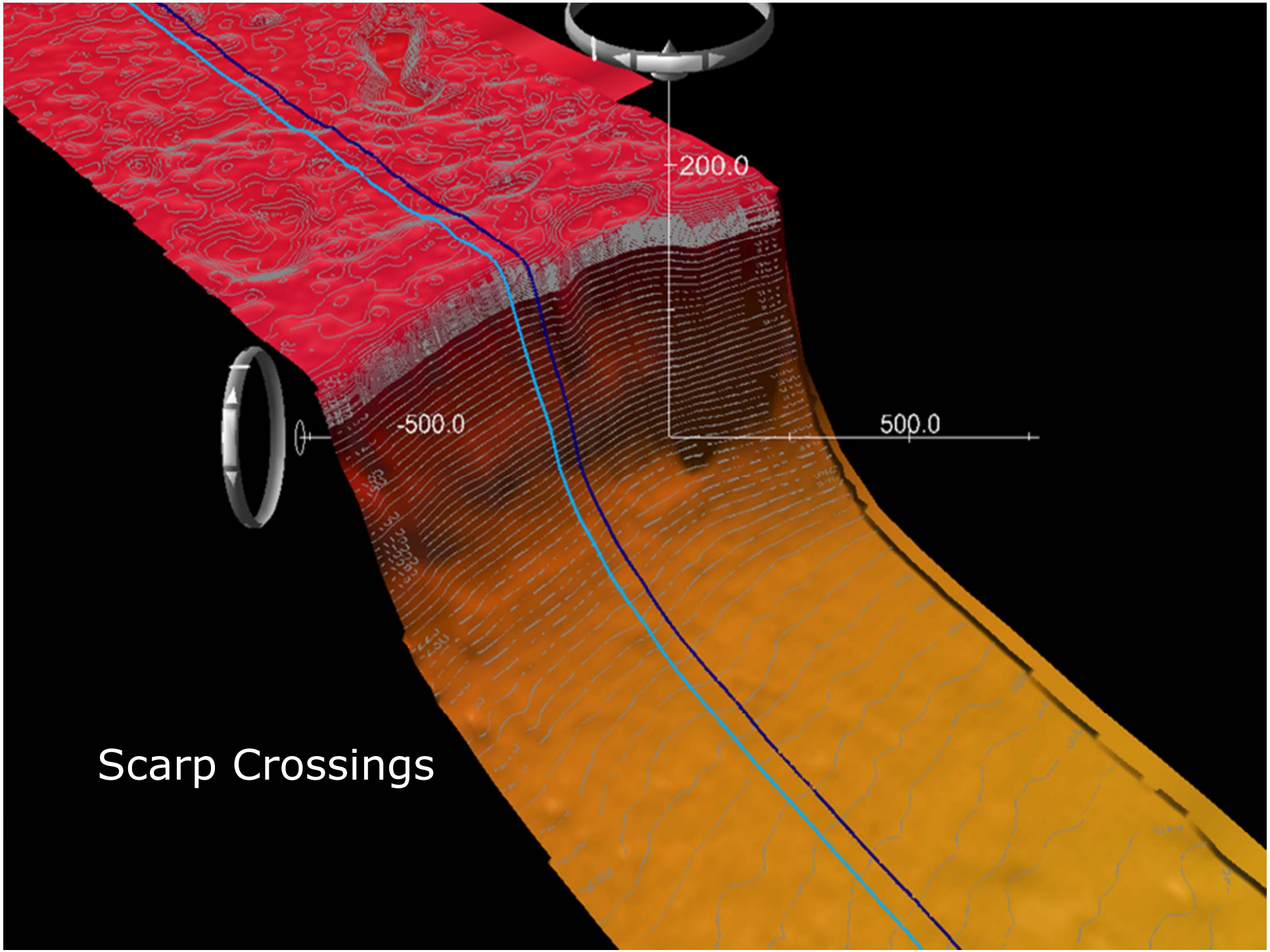


14 March 2013

400 WELLS IN 10 YEARS
1000 RESERVOIR STUDIES IN 5 YEARS
500 WELLS WITH RMR™ CTS™

agr


Difficult seabed

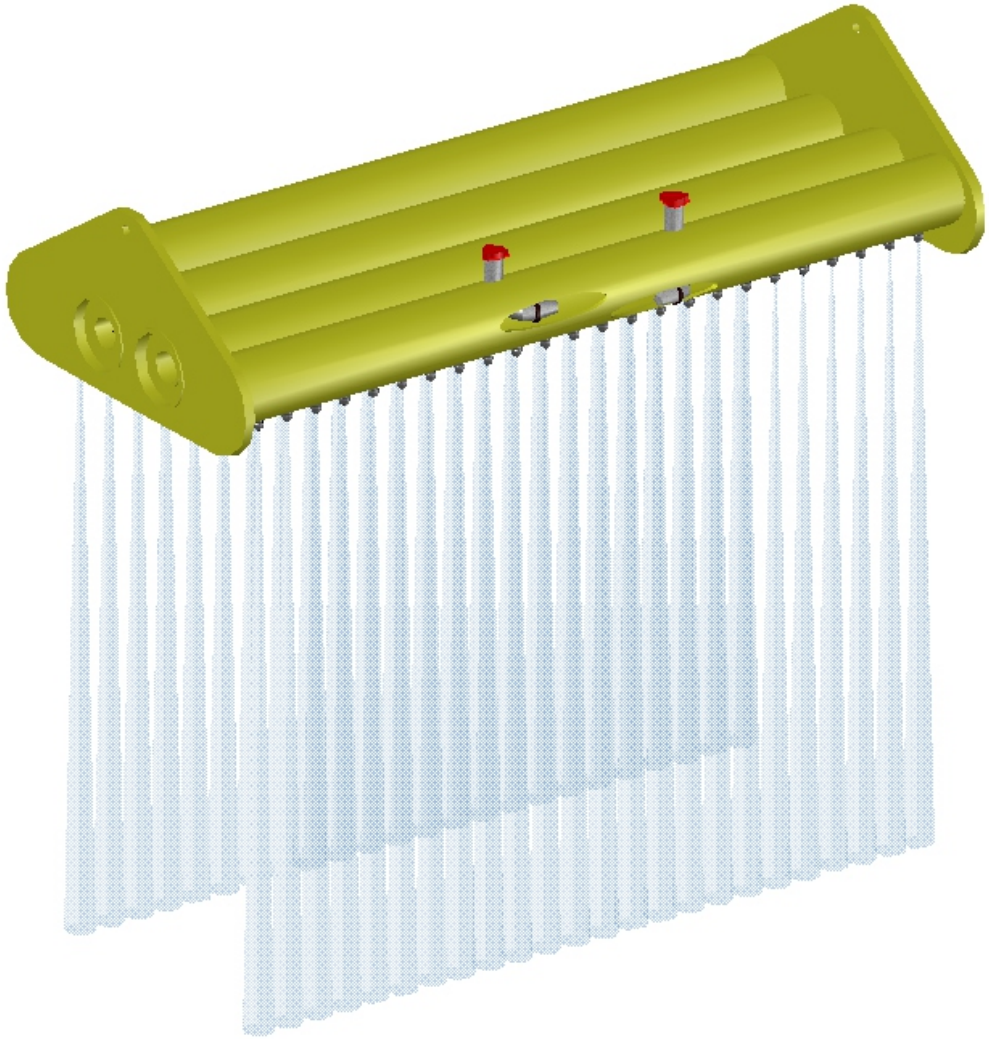

200.0
-500.0
500.0
Scarp Crossings

ClayCutter X
Route Preparation System

opening up new possibilities in
pipeline installation

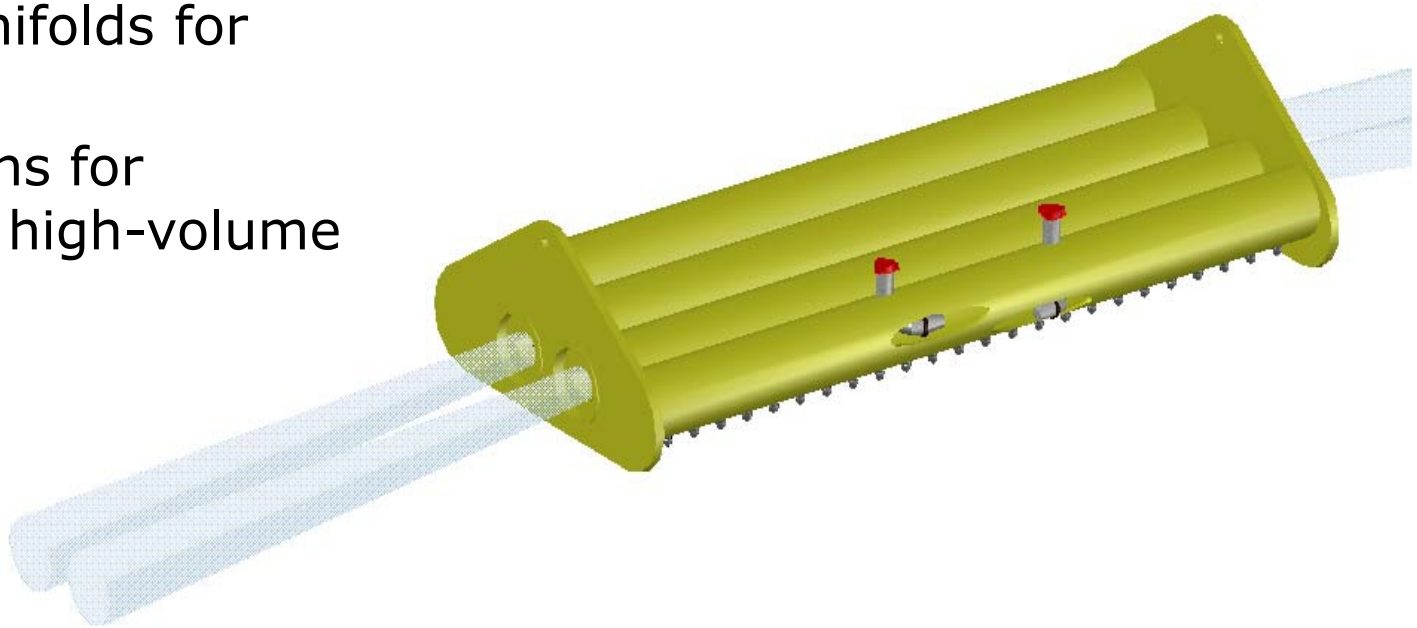
Operating Modes

- 2 jetting manifolds for stiff soils



Operating Modes

- 2 jetting manifolds for stiff soils
- 4 side cannons for levelling and high-volume excavation



Operating Modes

- 2 jetting manifolds for stiff soils
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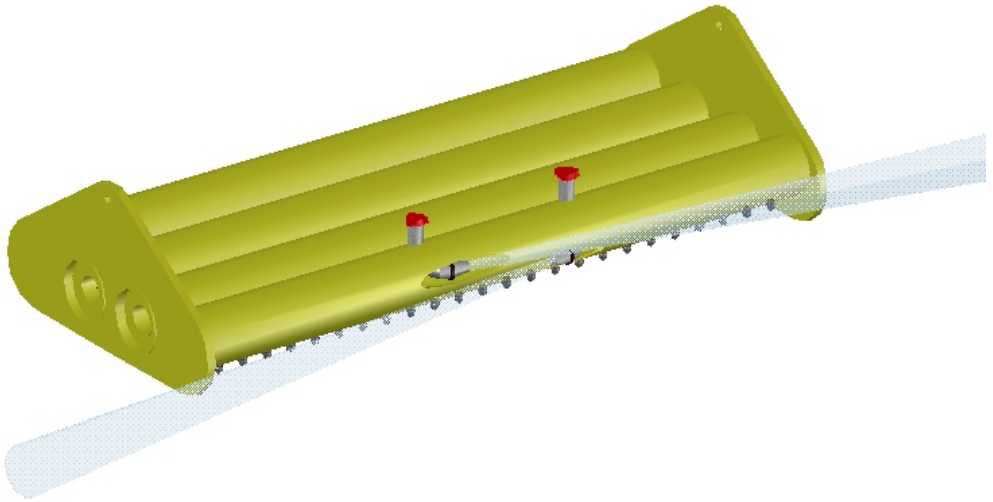
- Leading edge cannons can be fitted for boulder clearance



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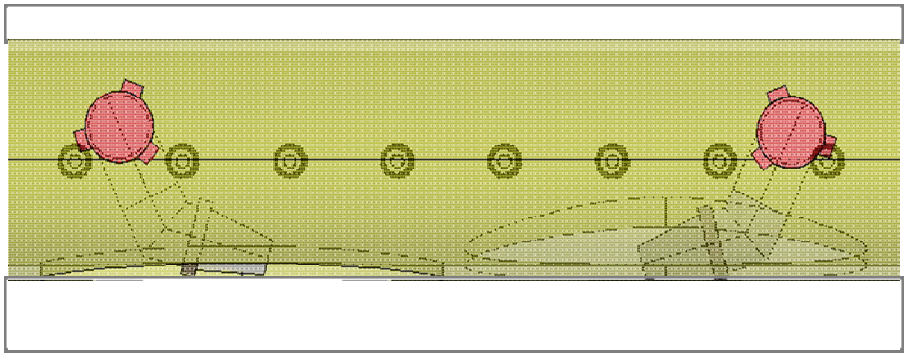
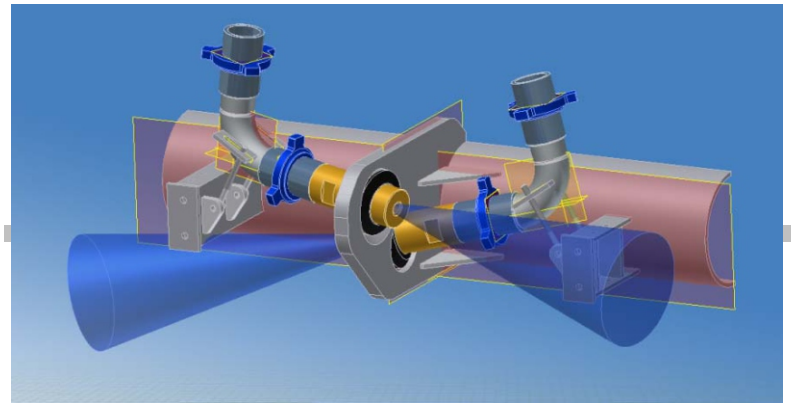
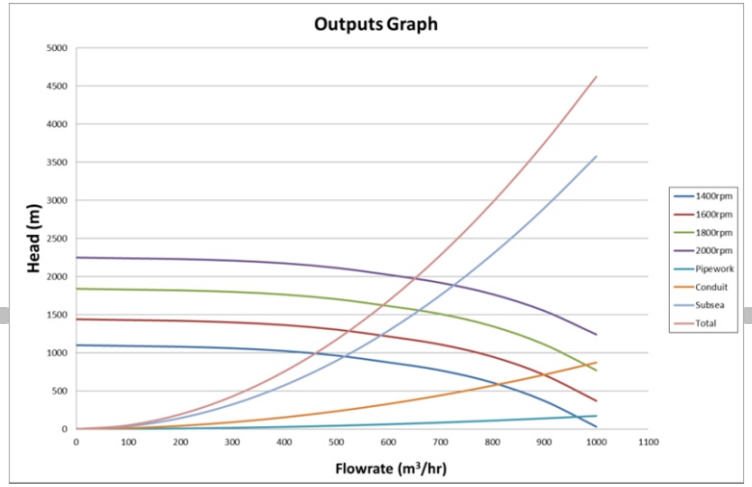
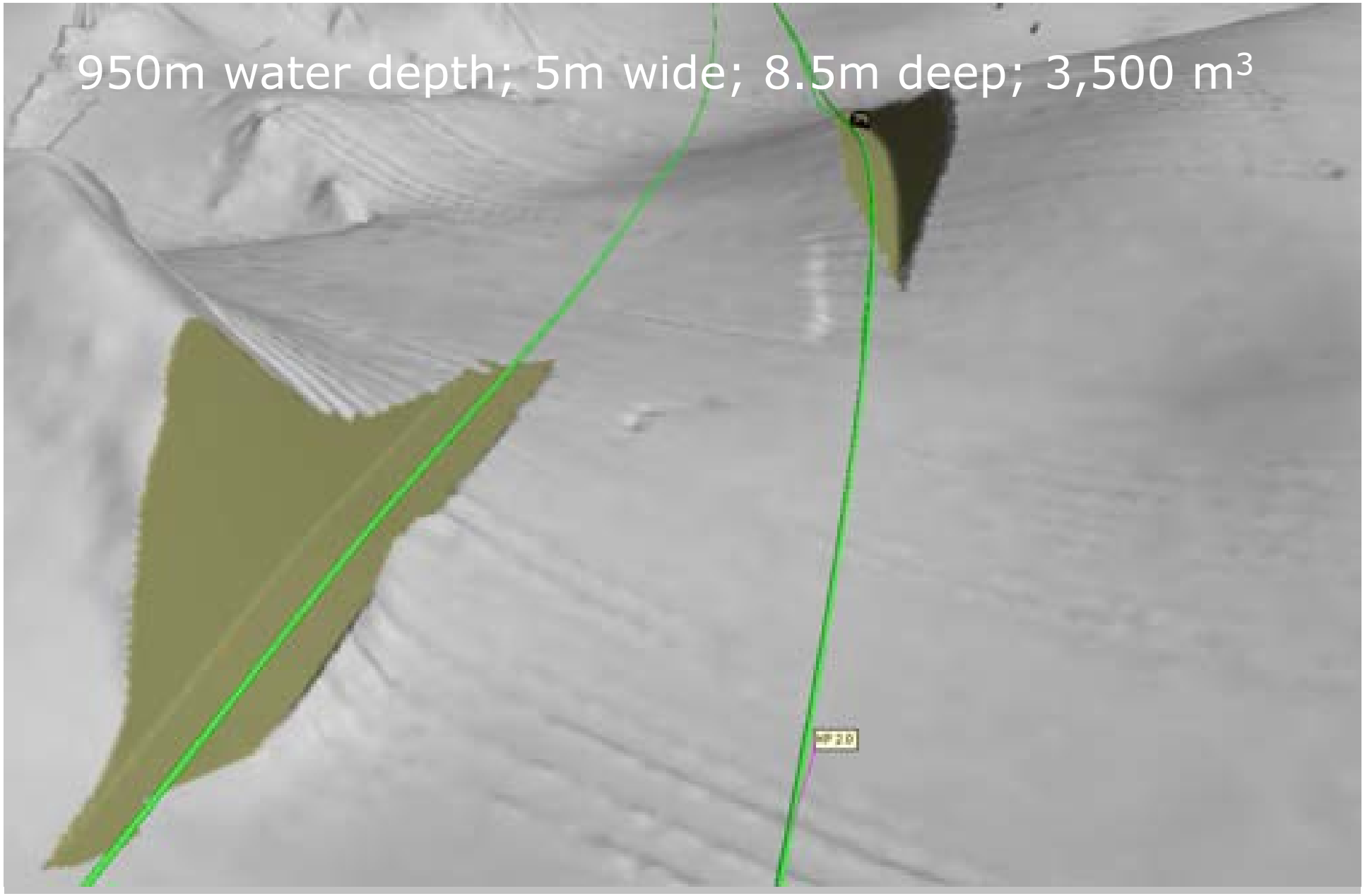


- System optimised for each job






950m water depth; 5m wide; 8.5m deep; 3,500 m3

High Pressure Pumps – 3,100 hp each

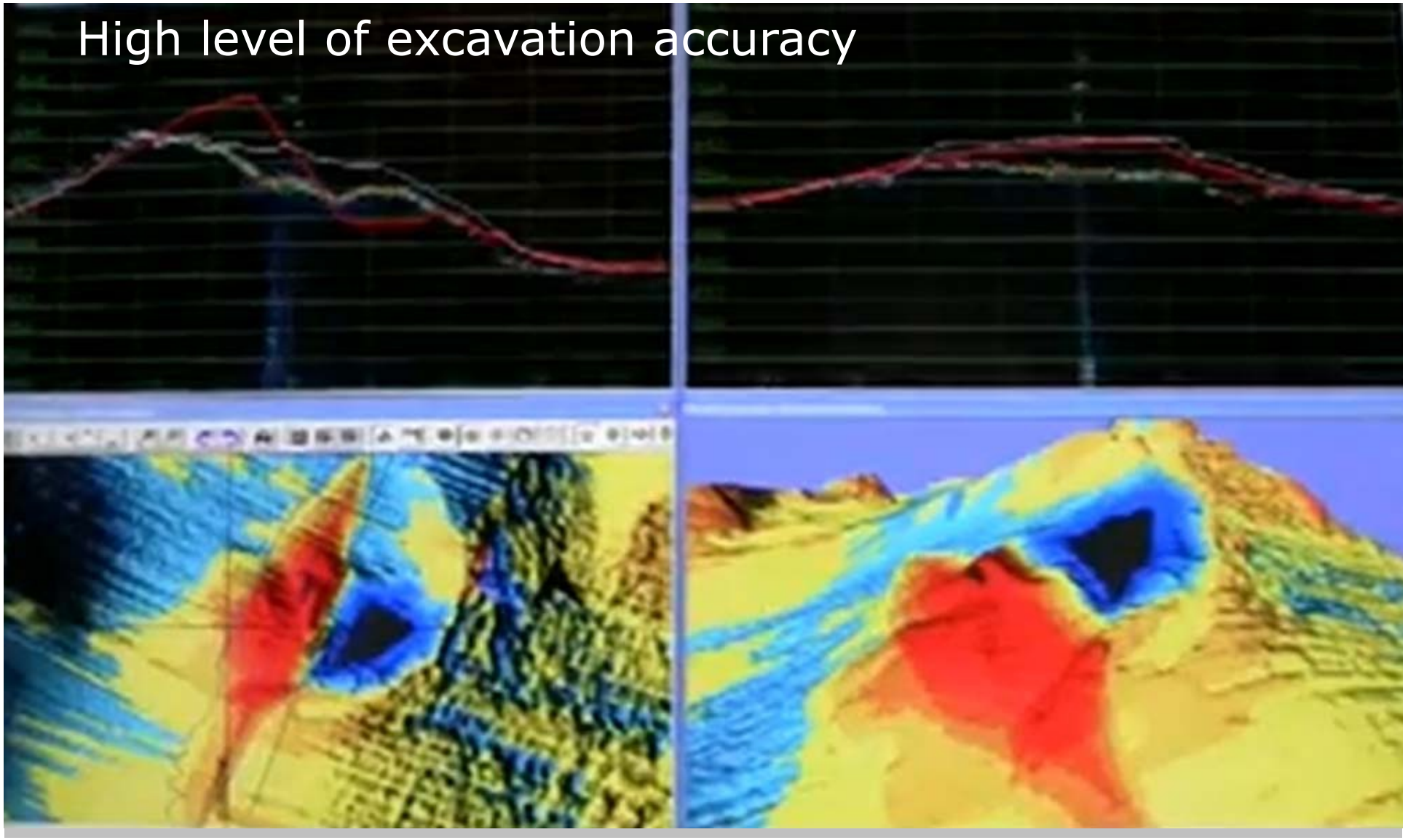
Pumps on Deck

High Pressure Pumps

The pumps are key to the success of ClayCutter X

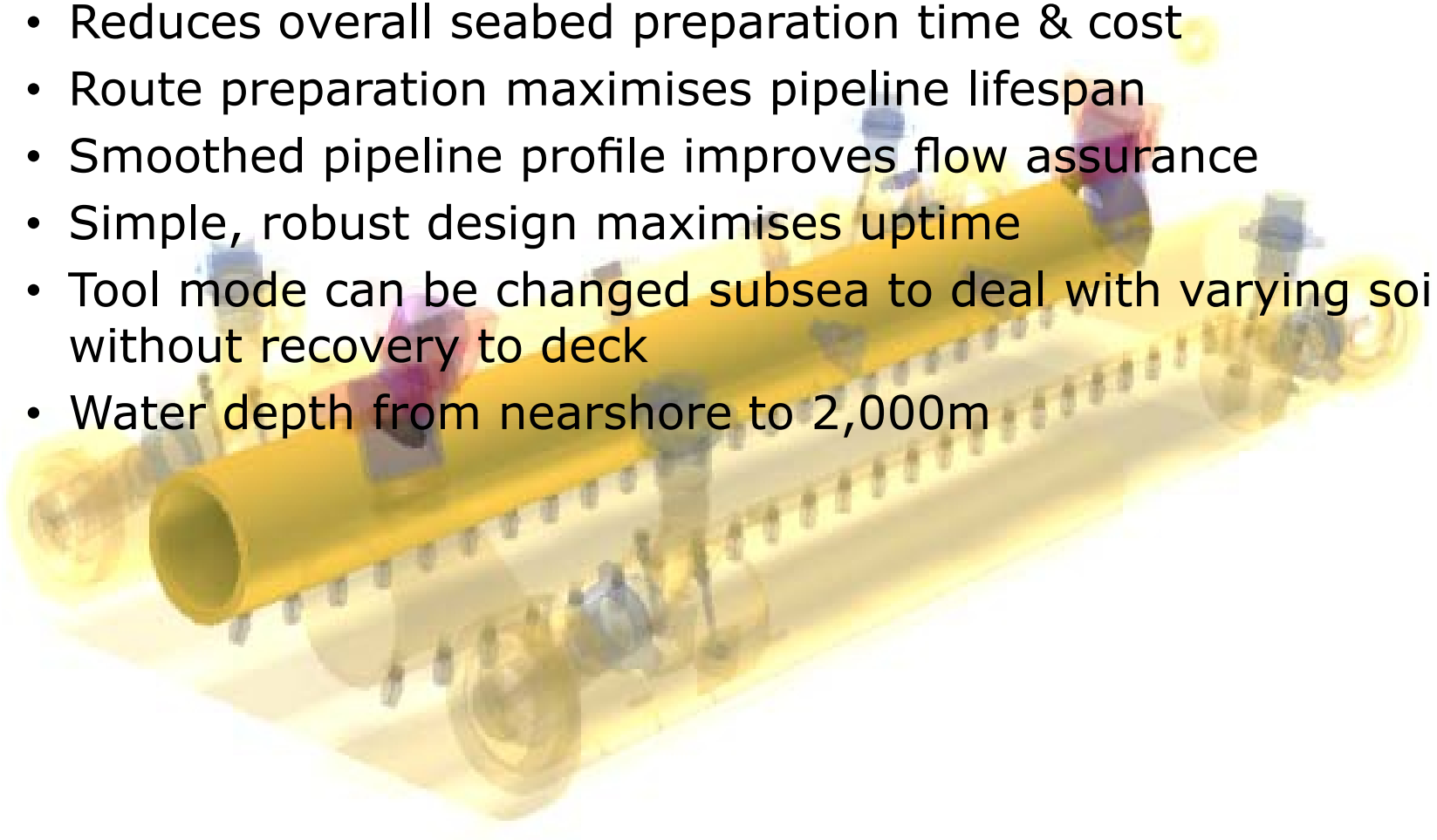
- Each pump delivers from 180m^3/hr at 190 bar differential pressure to 450m^3/hr at 135 bar
- Pump ends designed for continuous service
- MTU 65 litre V16 marine diesels – tight control over emissions
- Fuel consumption at maximum power 500 litre/hour per pump

High level of excavation accuracy



ClayCutter X Benefits

- Opens up previously impossible routes for pipe-lay
- Reduces overall seabed preparation time & cost
- Route preparation maximises pipeline lifespan
- Smoothed pipeline profile improves flow assurance
- Simple, robust design maximises uptime
- Tool mode can be changed subsea to deal with varying soils without recovery to deck
- Water depth from nearshore to 2,000m

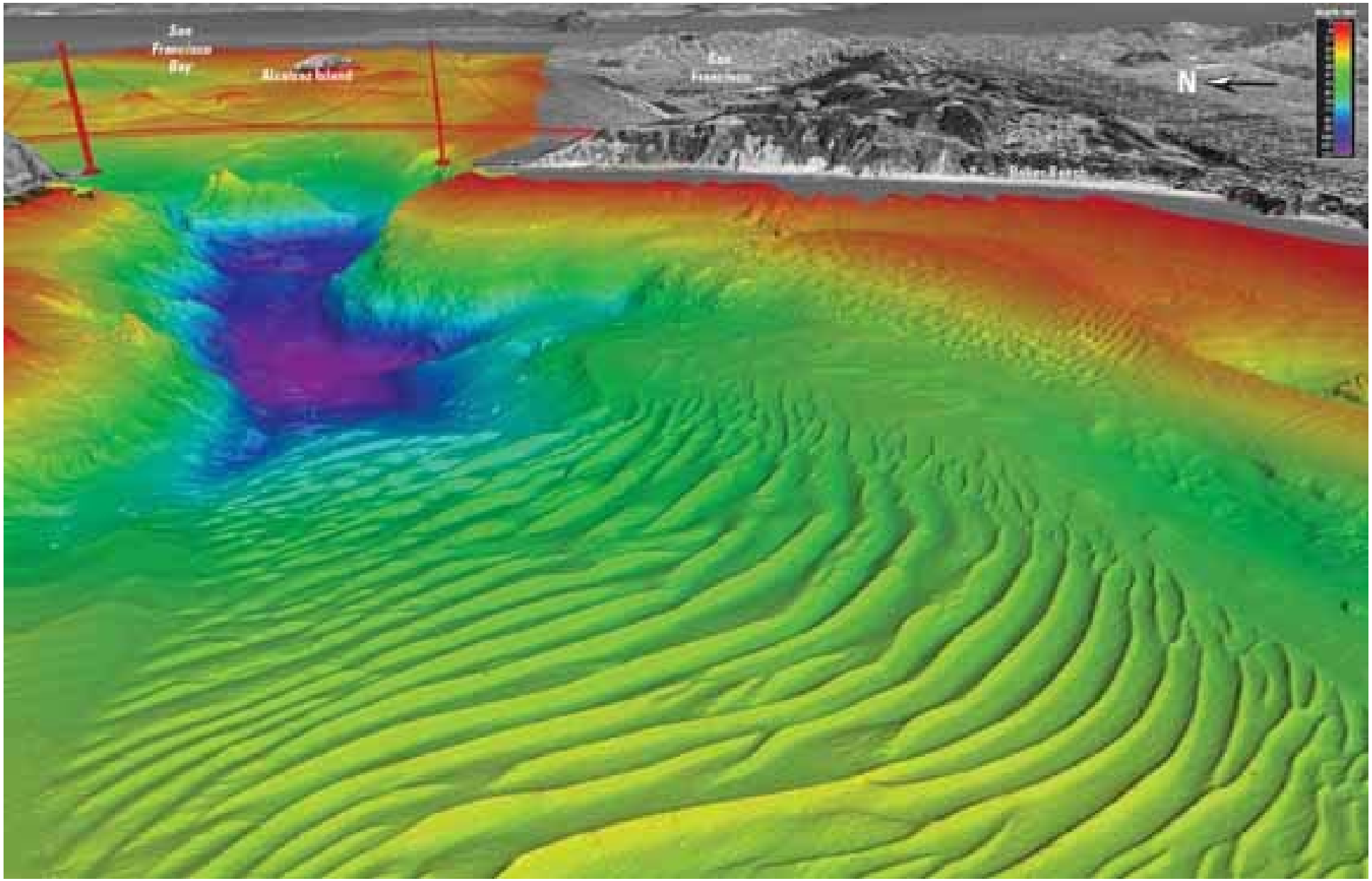


Deepwater Seabed Issues…

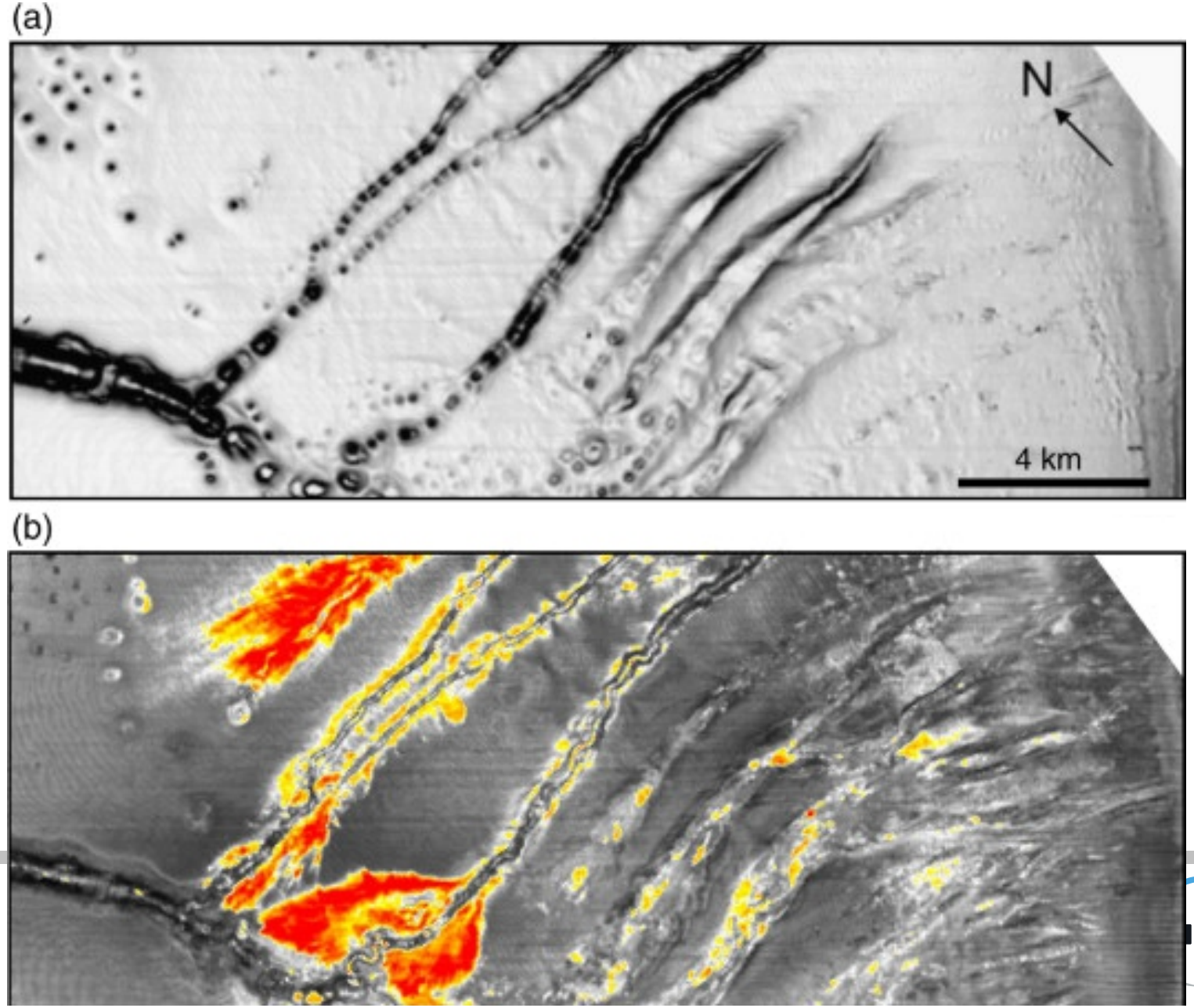
- Sand waves and mega ripples
- Slumps
- Thermal insulation
- Lateral and upheaval buckling

…same as in shallower water

Sand Waves



Slumps



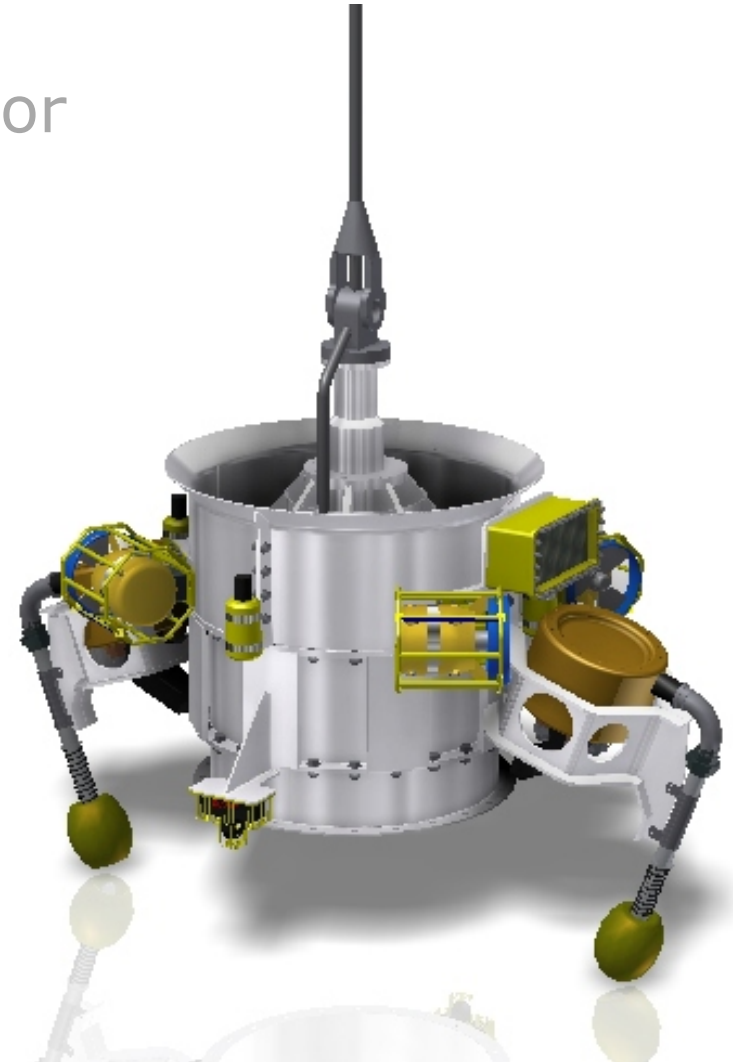
Shallow Water Solution

- In water depths up to ≈150m we would use a Mass Flow Excavator to resolve these issues
- Ship’s propeller mounted in housing
- Driven by hydraulic motor
- Downwards water flow from tool moves soft or uncosolidated soils at very high rates
- Guide wires and clump weights to maintain heading of tool
- Tool position entirely reliant on vessel positioning

Typical Mass Flow Excavator

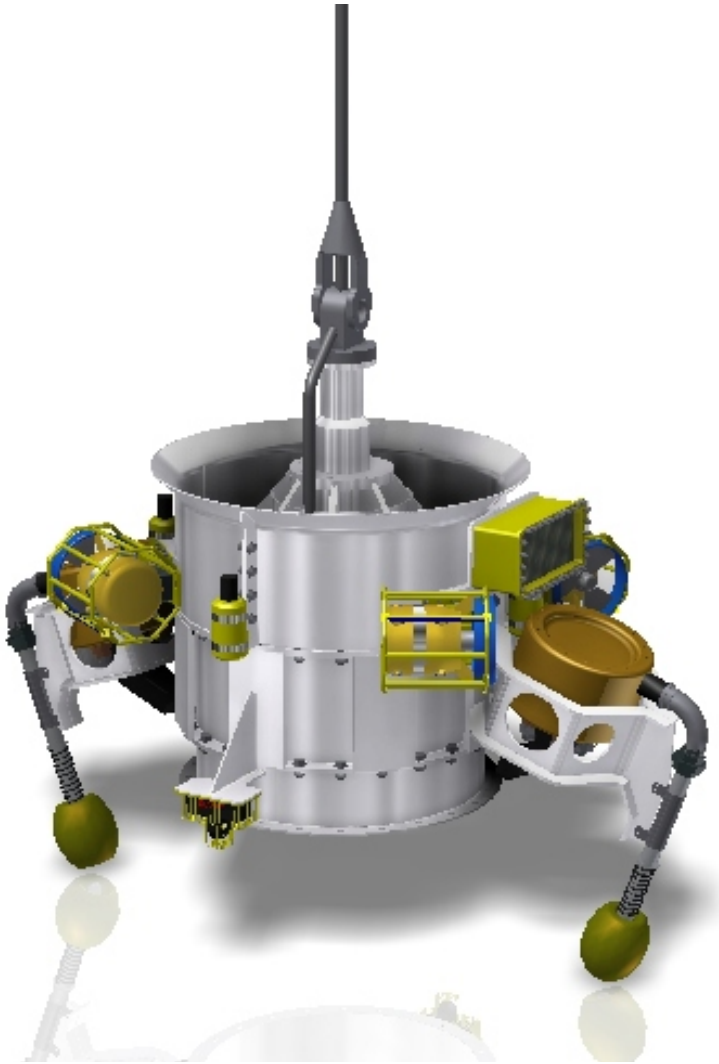
Deep Water Solution: E-Vator

- New ultra deepwater excavator
- Design depth 3,000m
- Auto heading
  - Improved station keeping
  - Semi-autonomous tracking
- Electric drive propeller and thrusters
- ROV umbilical provides support, power conductors and fibre-optic data transfer



E-Vator controls

- Incorporate data from:
  - Multi-beam echo sounders
  - Pipe trackers
  - Seabed beacons
  - Inertial Navigation System
  - Doppler Velocity Log
  - Ring laser gyro
  - Digiquartz pressure sensor
- AUV-based software gives:
  - Intelligent positioning
  - Track seabed features
  - Track based on relative or absolute coordinates



Contact us...

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Image credits

With thanks to:

- Norsk Hydro
- Chevron
- Norske Shell
- USGS