

NORCE

# Full-scale Infrastructure for well barrier integrity experiments and technology verification

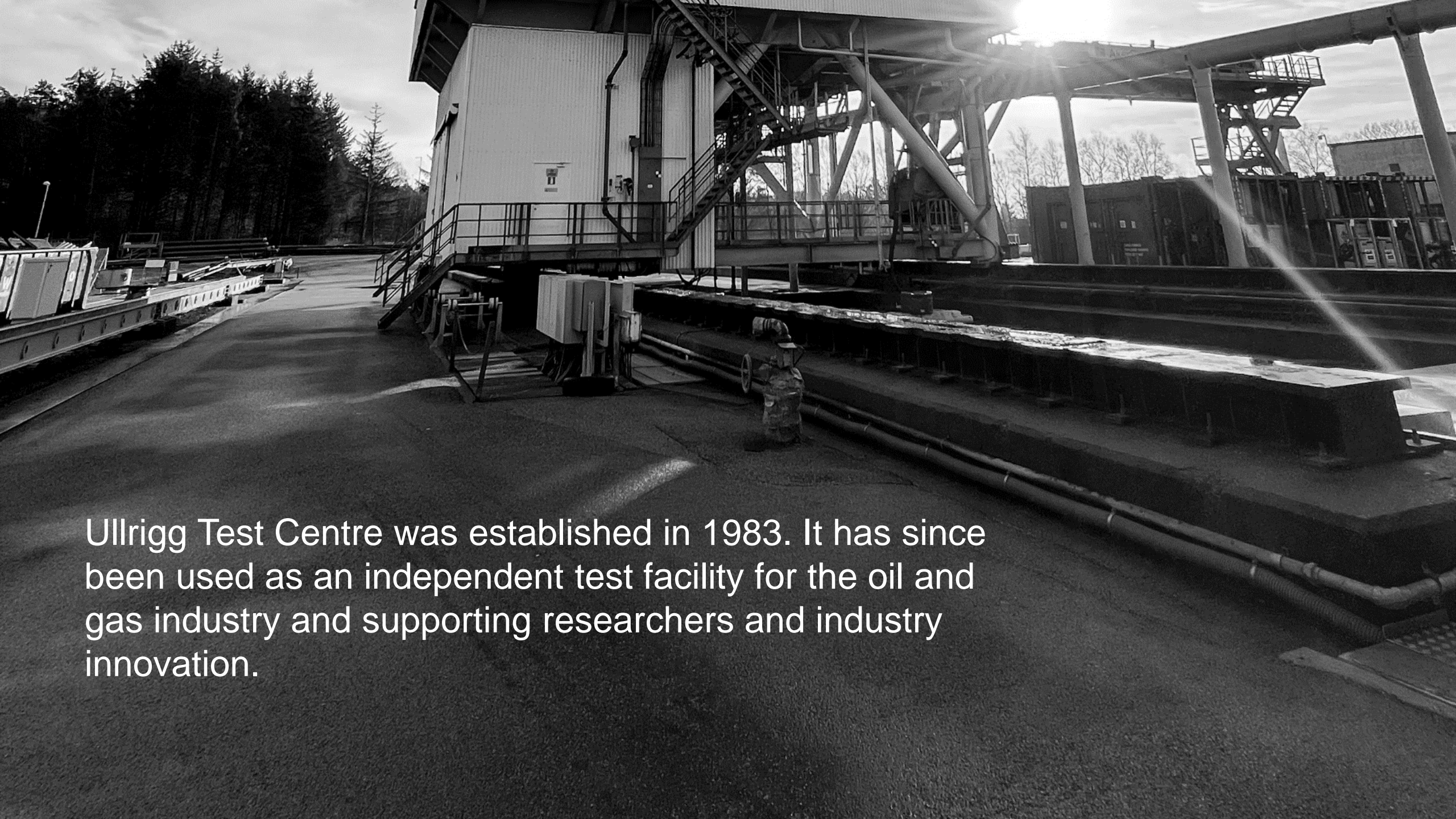
13th Plug and abandonment Seminar

Stavanger 2024

# Outline

1. Introducing Ullrigg
2. NORCE P&A initiative
3. Our Infrastructure
4. Possibilities





Ullrigg Test Centre was established in 1983. It has since been used as an independent test facility for the oil and gas industry and supporting researchers and industry innovation.

40 years later, still assisting technology development through full-scale testing and piloting.

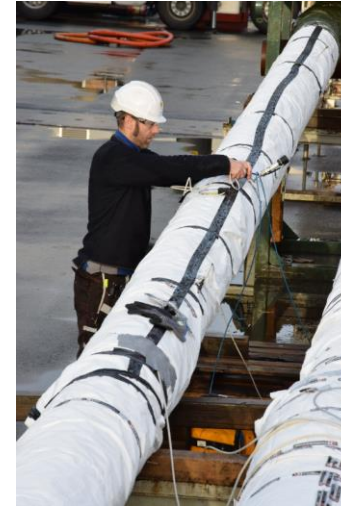




NORCE  
ULLRIGG

# P&A background

- Prioritized topic at IRIS / NORCE since 2012 through The DrillWell Centre for research-based innovation
- Full-scale experiments, testing & verification of well barriers and modelling
  1. *Tubing left in hole* (SPE 178840, 2016)
  2. *Leakage risk assessment for P&A wells* (SPE 185890, 2018)
  3. *Technologies for barrier evaluation and P&A* (SPE 194075, 2019)
  4. *Cementing irregular wellbore geometries* (SPE 194091, 2019)
  5. *Ultrasonic Log Response Evaluates Barrier Cells for Cementing Applications* (SPE-0520-0075-JPT, 2020)





# NORCE – Current P&A Activities



## P&A Innovation Program



- Joint Industry Project – 7 partners
- Applied Research
- Full-scale testing and verification
- Program manager; Erlend Randeberg
- Ph. I: 2018-2023, Ph. II: 2023-2026



## Norwegian P&A Laboratories



- P&A test well
- Full-scale lab for testing at downhole conditions
- NORCE Manager; Dave Gardner



## SWIPA



- Center for Research-Driven Innovation (SFI)
- Scientific understanding of permanent well barriers
- Improved well barrier design methodologies
- NORCE WP Manager; Erlend Randeberg

# P&A Lab

## *Pressure & leakage test facility*

- Measure the sealing capacity of barrier materials under realistic conditions:
- “Offshore” equivalent batch mixer, relevant instrumentation & field lab measurements
- Construction of test cells for experiments and technology verification
- Testing of leakage properties using high precision pumps / N2 pressure controller





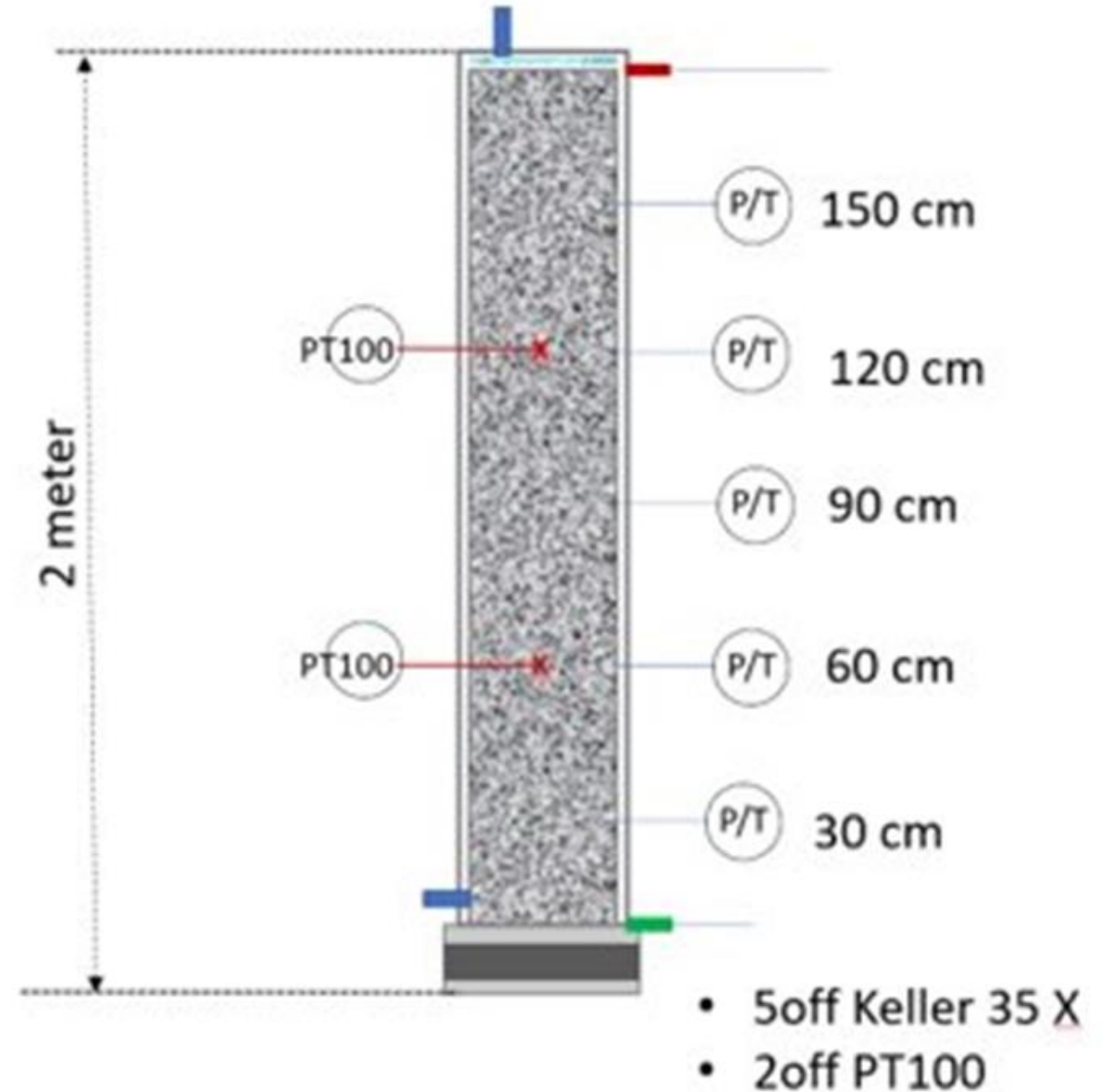
# P&A Lab

- Established standard for test cells
- Procedures for creating micro-annulus
- Recipe for recreating “bad” cement jobs



# P&A Lab

- Expanding cement
- Cement alternatives
- Mechanical treatment
- Chemical treatment



# P&A Lab

- Expanding cement
- Cement alternatives
- Mechanical treatment
- Chemical treatment



# P&A Lab

- Expanding cement
- Cement alternatives
- **Mechanical treatment**
- Chemical treatment



# P&A Lab

- Expanding cement
- Cement alternatives
- Mechanical treatment
- Chemical treatment



# P&A Lab

- Expanding cement
- Cement alternatives
- Mechanical treatment
- Chemical treatment



# P&A Lab

*-What's next?*

- Casing/Tubing with gauge cable
- Bismuth – full-scale, lab tests



# Ullrigg U7 - CBL reference well

## Evaluate cement logging tools - through tubing

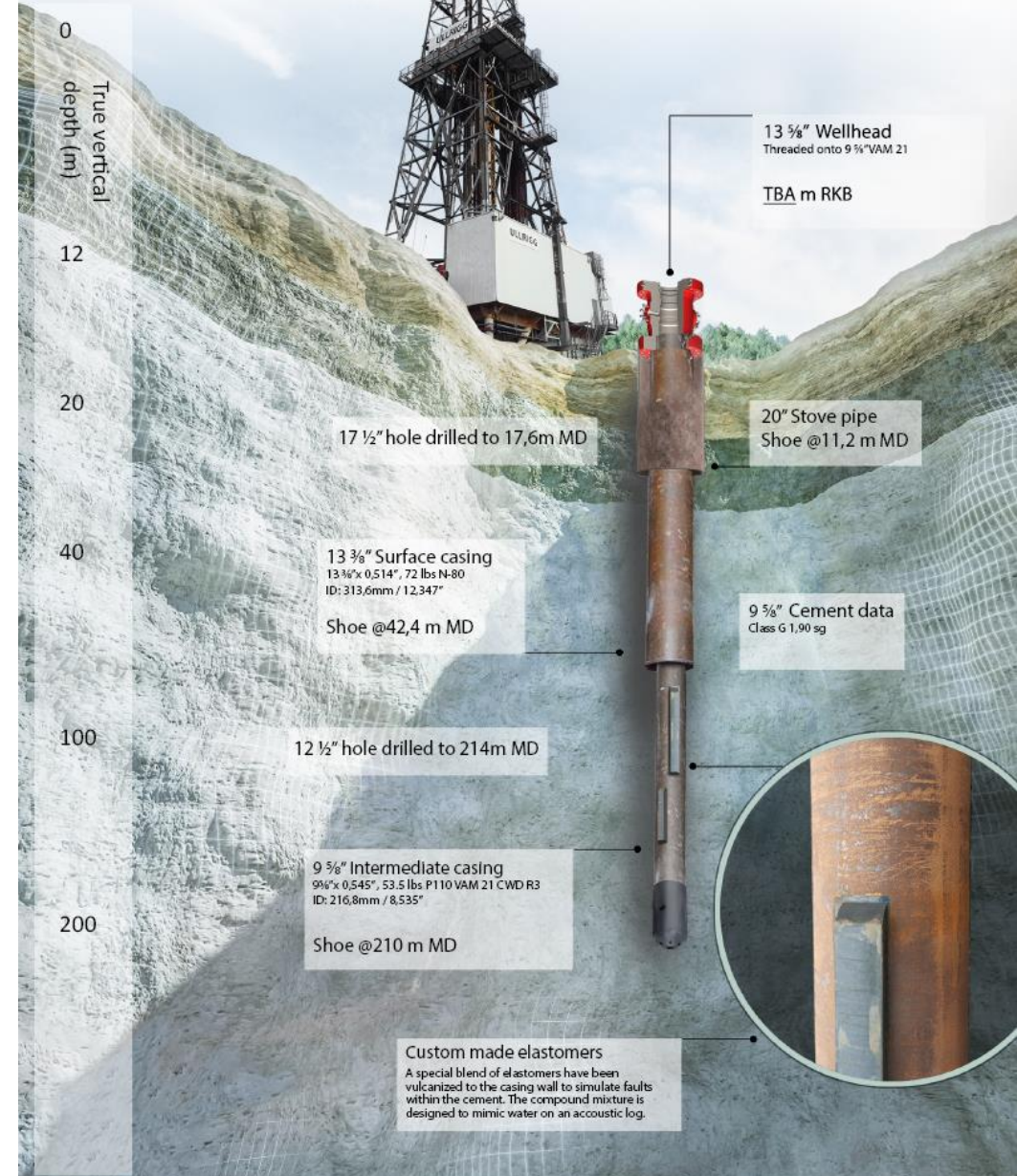
- 210m of 9 5/8" casing with 1,92 sg Class G cement
- Cemented "channels" of varying length & azimuthal coverage
- Allows a range of tubing sizes and fluids



IADC/SPE-208699-MS

### Construction of a Reference Well to Support the Qualification of Cement Evaluation Logging Tools and Data Processing

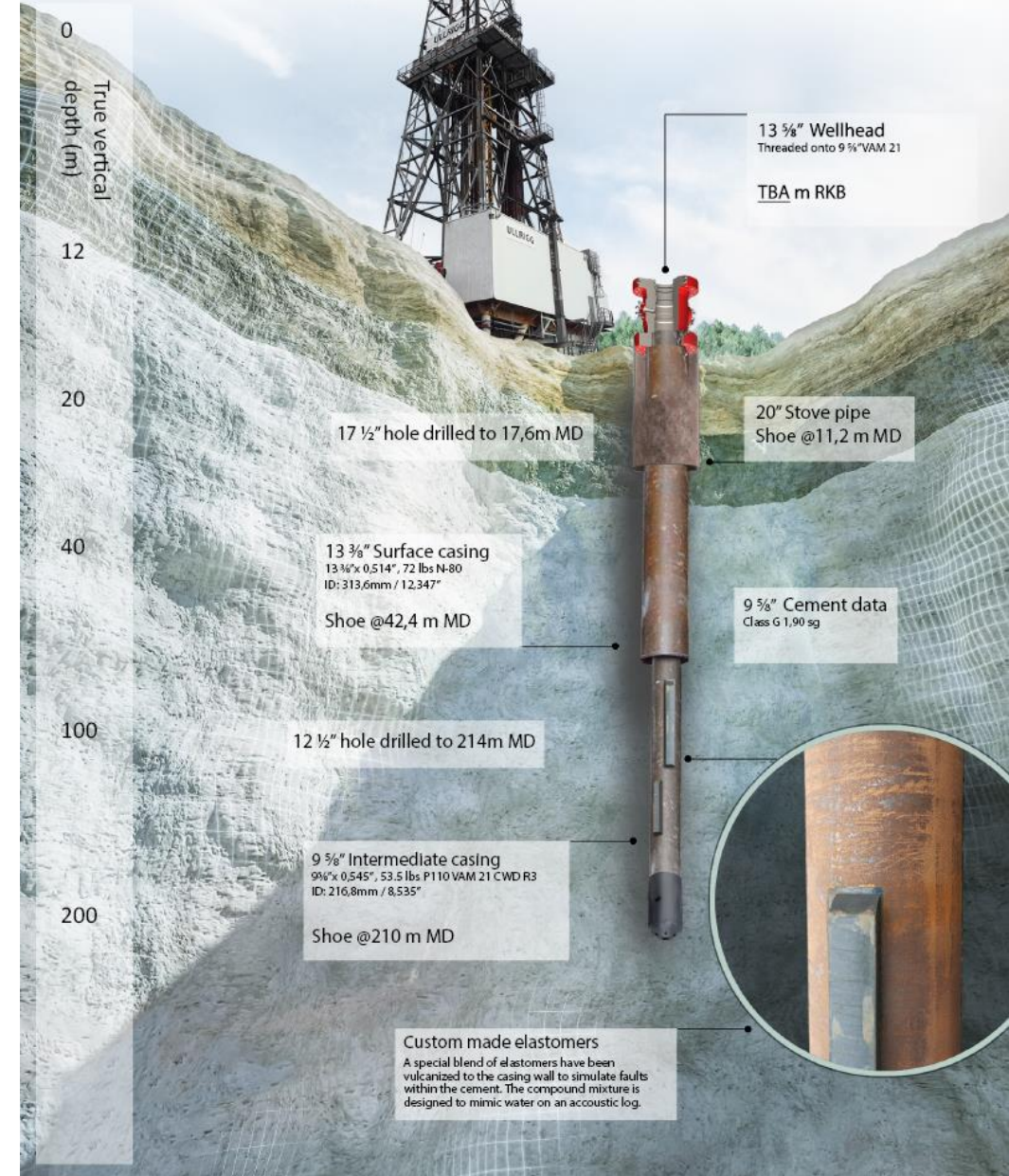
Katherine Beltrán-Jiménez, Norwegian Research Centre NORCE; Ioan Alexandru Merciu, Equinor ASA; Dave Gardner, Norwegian Research Centre NORCE; Amit Govil and Sandip Bose, Schlumberger; Stig Lomeland, Norwegian Research Centre NORCE; Pål Viggo Hemmingsen, Olga Kuragina, Rune Godøy, Konstantin Mitelshtet, and Eirik Berg, Equinor ASA





# Ullrigg U7 - CBL reference well

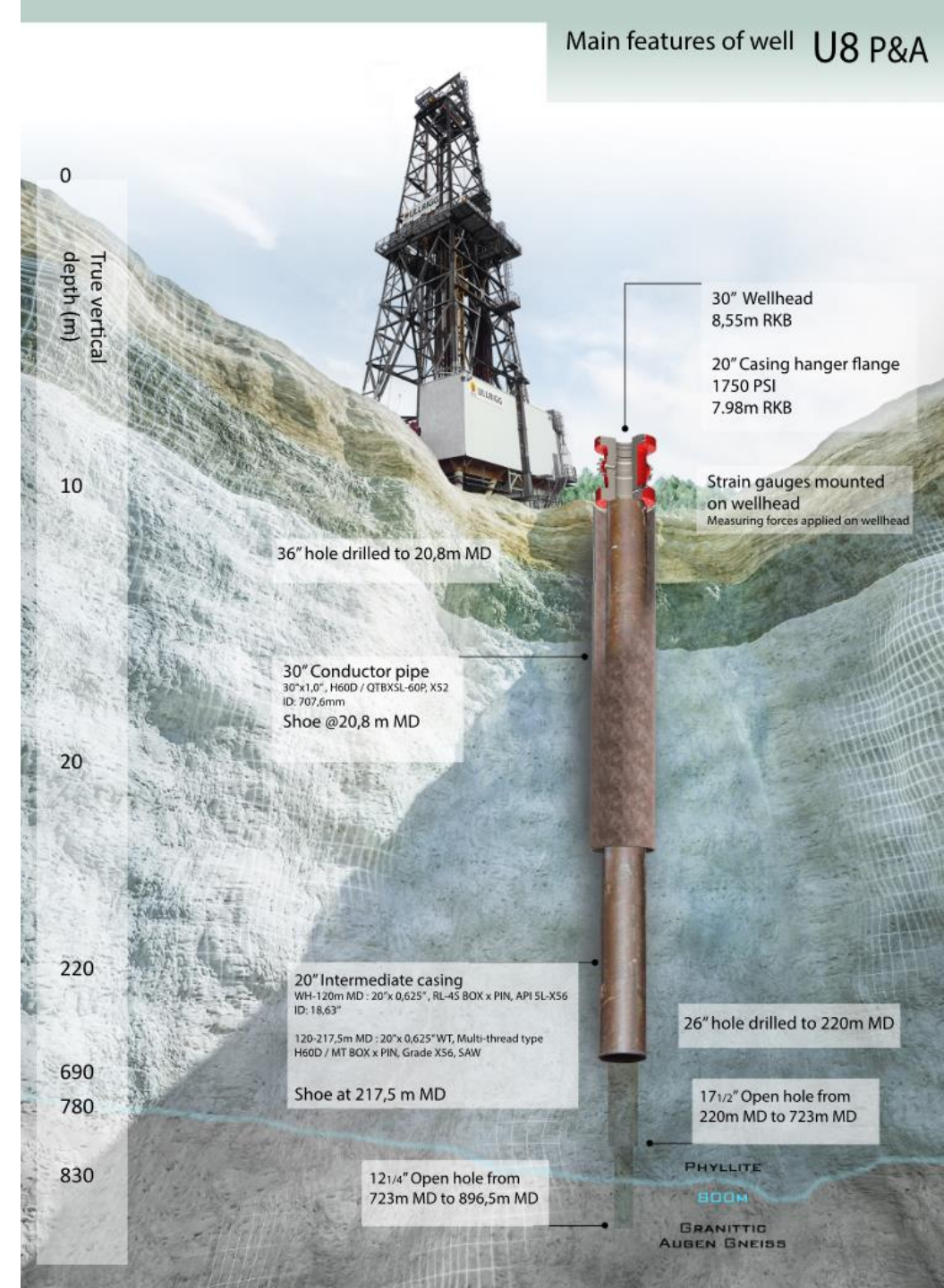
- Used by SLB for testing through tubing cement evaluation technology



# Ullrigg U8 - P&A test well

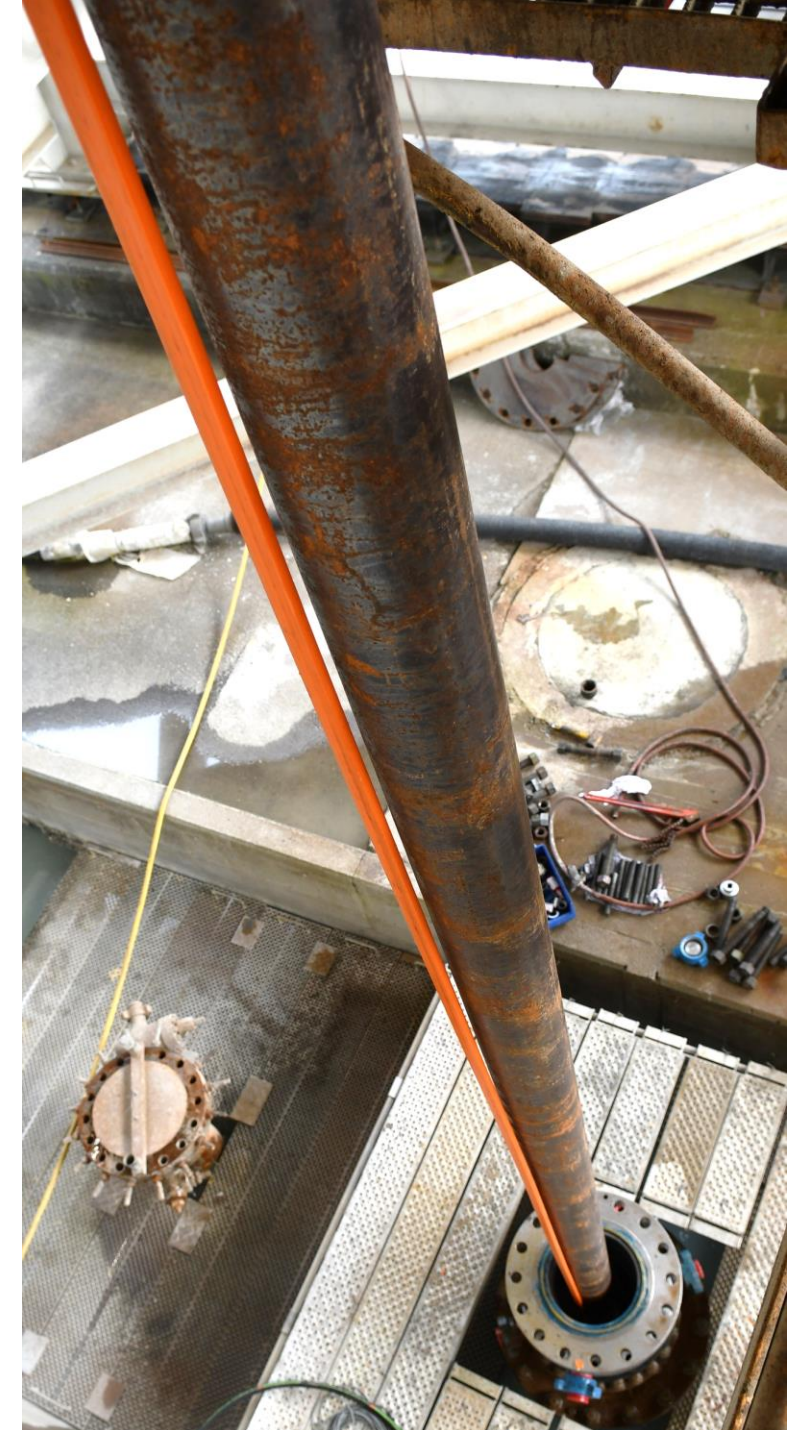
*Large-diameter well for testing P&A tools & methods*

- Repeatable “permanent” well abandonment, completion recovery & analysis
- Focus on rigless applications using Wireline and Coiled Tubing



# Ullrigg U8 - P&A test well

- Mimic the main features of well in Brazil
- Through Tubing detection of control line flatpack (4 x tool types)
- Flatpack ablation using perforating charges (2 x gun configurations)
- PWC on coiled tubing, drill out and log cement with Isolation Scanner
- Retrieve well completion and cut into sections for inspection



# Ullrigg U8 - P&A test well

- Workover unit demonstration
- Scheduled at Ullrigg



**TER BRON**

**Mantis**  
compact remote HWU

# Ullrigg U8 - P&A test well

- Coil tubing – Perf Wash Cement



# P&A Research - Possibilities

- Challenges

- Where do we go?
- How to move faster?
- Safe and durable solutions?

- What is needed?

- Industry connection
- Relevant infrastructure
- Authority involvement

Thank you. Takk.  
Merci. Gracias. Obrigado.

Steinar Lomeland

[stlo@norceresearch.no](mailto:stlo@norceresearch.no)

[norceresearch.no](http://norceresearch.no)

NORCE