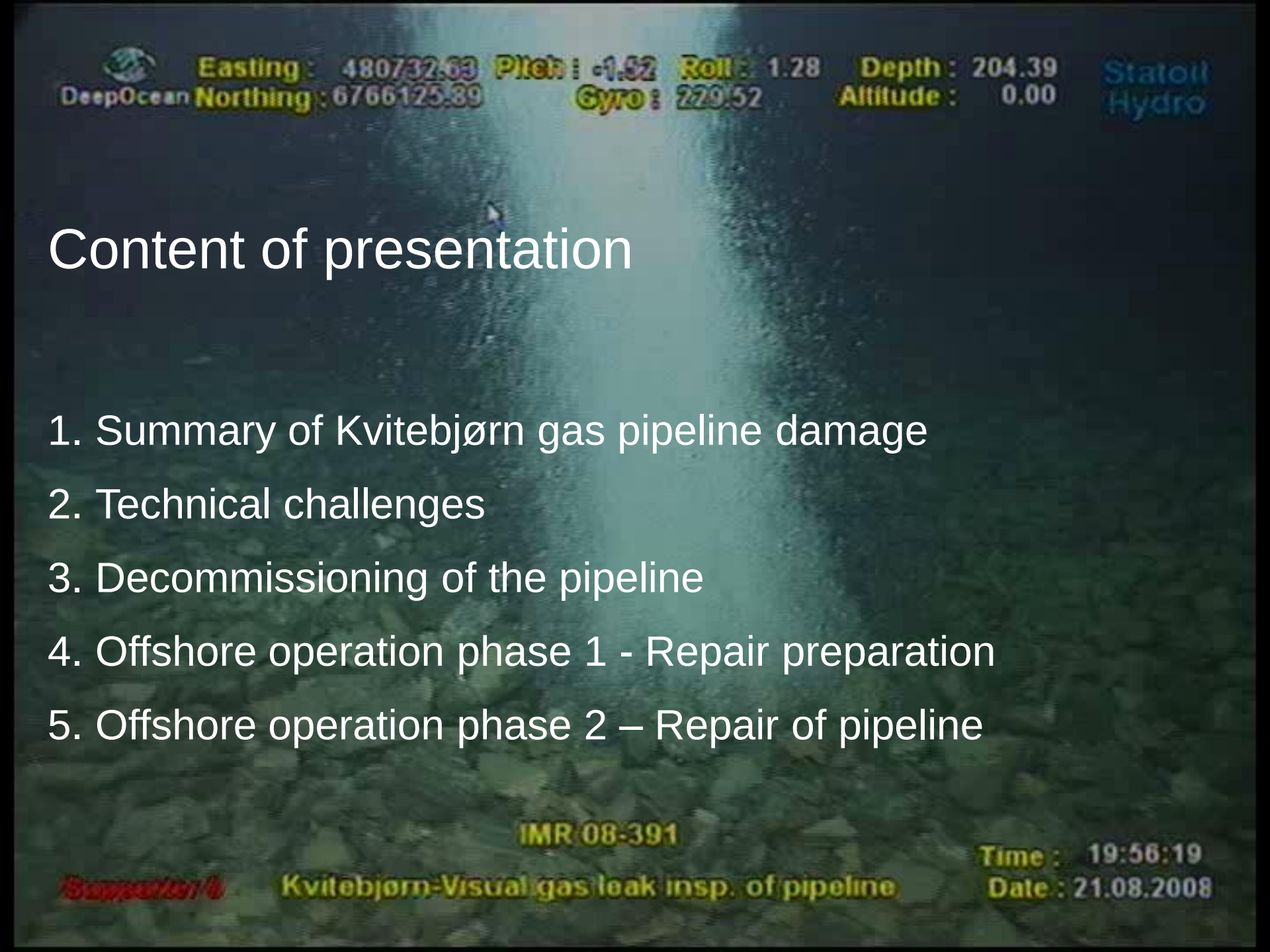
Kvitebjørn gas pipeline repair – UTC-Bergen 22-23 Sept 2010

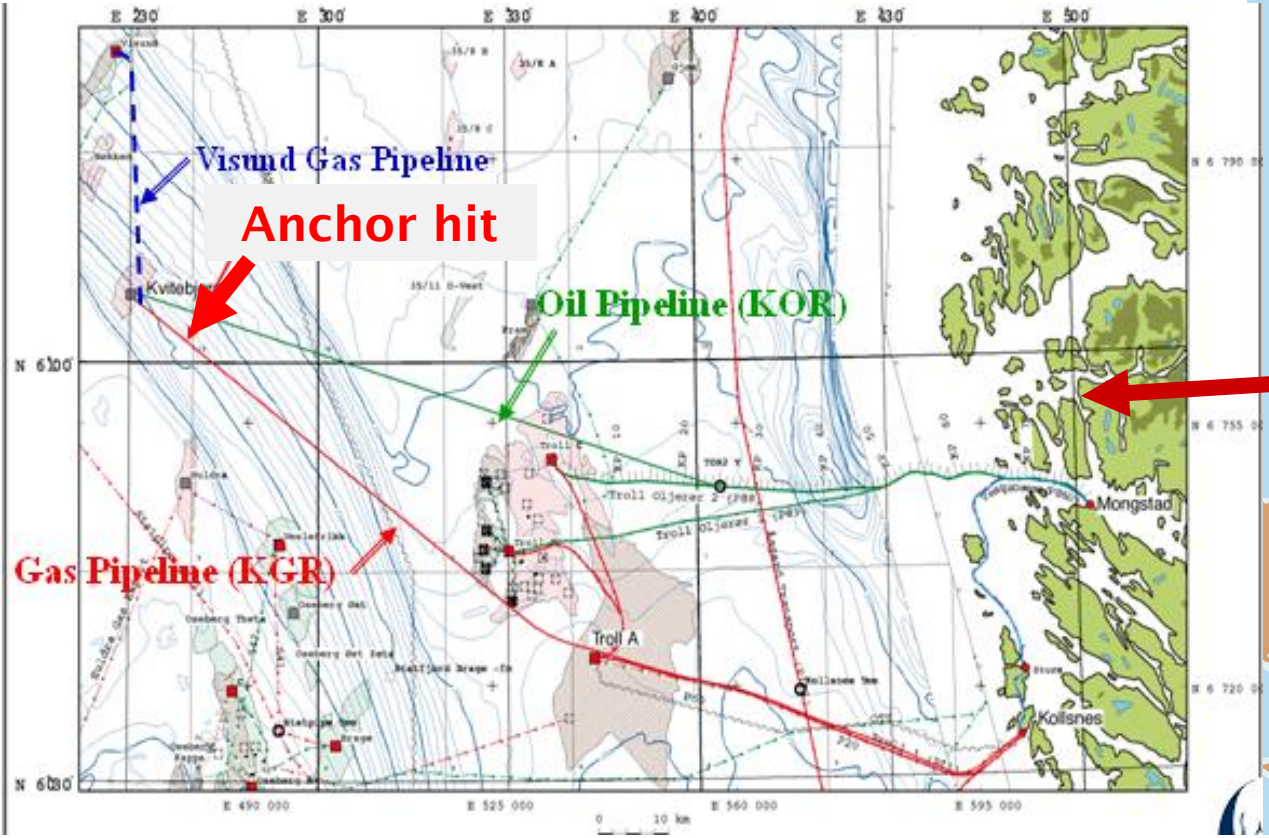
Erling Gjertveit,
Senior Advisor Pipeline technology
Statoil ASA



Content of presentation

1. Summary of Kvitebjørn gas pipeline damage
2. Technical challenges
3. Decommissioning of the pipeline
4. Offshore operation phase 1 - Repair preparation
5. Offshore operation phase 2 – Repair of pipeline

Kvitebjørn pipelines



Kvitebjørn gas pipeline damage

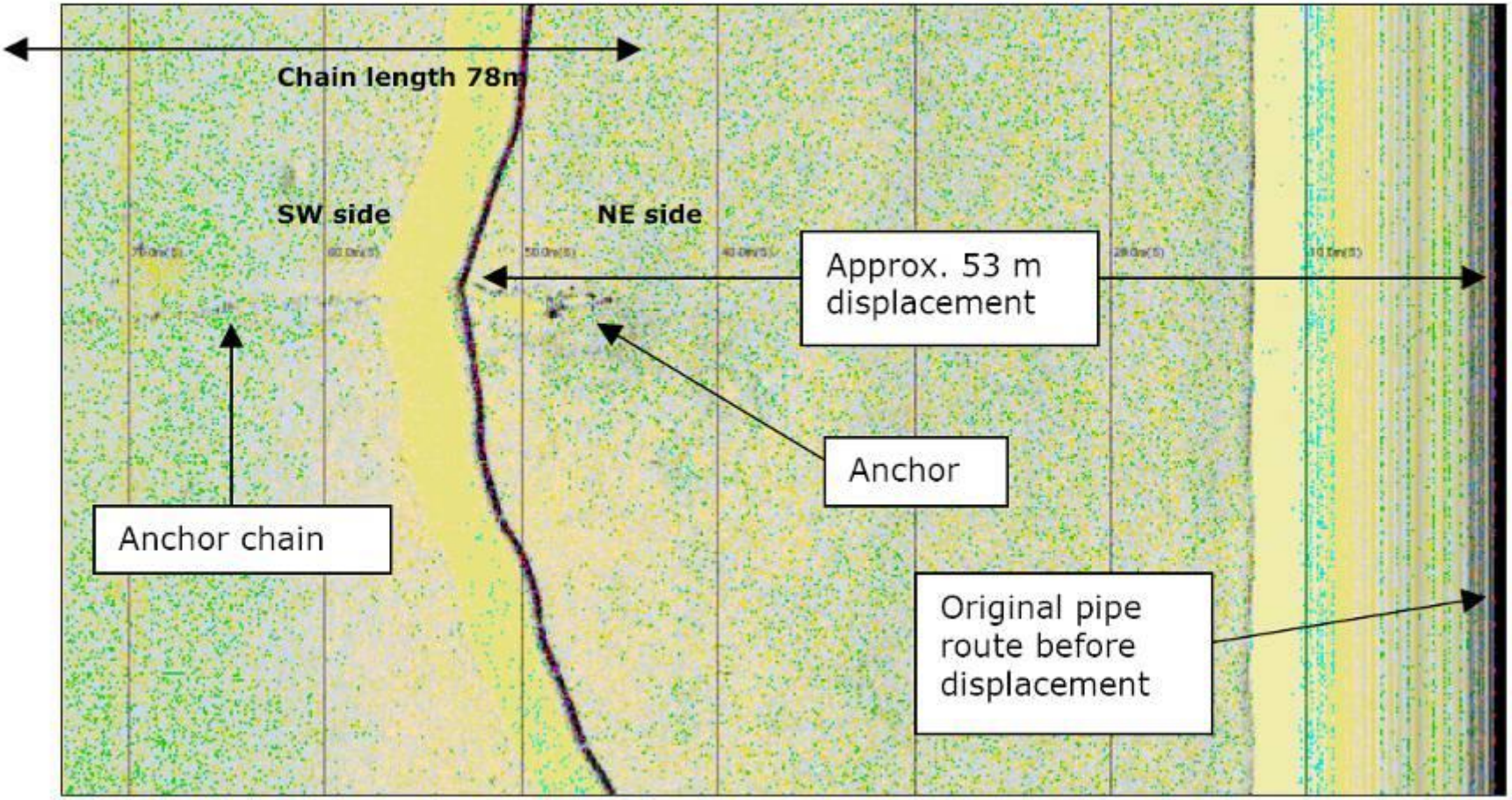


Figure 1. SSS Image at damage location, KP 9.697

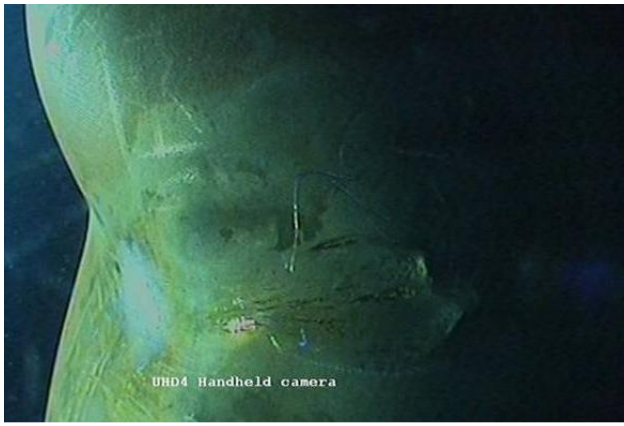
Kvitebjørn gas pipeline

Damage survey 1. November 2007

Kvitebjørn pipeline damage

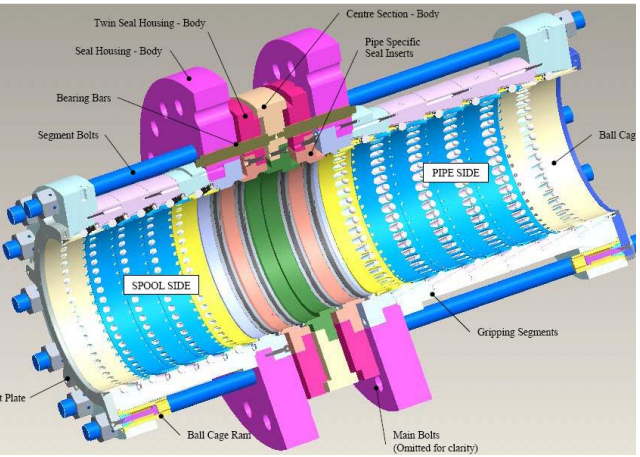
Purpose of the damage survey:

- exact measurements of the external geometry (ovality and deformations)
- detect and measure possible cracks



Morgrip coupling challenges

1. Seals leaking on spool side during testing
2. Balls failing to indent the pipe wall and thereby not providing the required structural capacity




DeepOcean
Easting : 480732.63
Northing : 6766125.89
Pitch : -1.52
Gyro : 229.52
Roll : 1.28
Depth : 204.39
Altitude : 0.00
Statoil Hydro
IMR 08-391
Time : 19:56:19
Date : 21.08.2008
Kvitebjørn-Visual gas leak insp. of pipeline

Alternative repair concepts

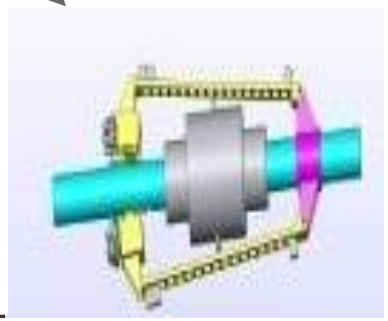
Modify existing Morgrip couplings

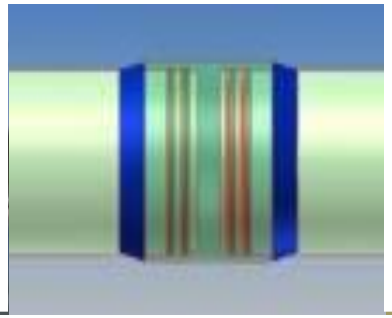
Modify existing Morgrip couplings with additional external anchoring force

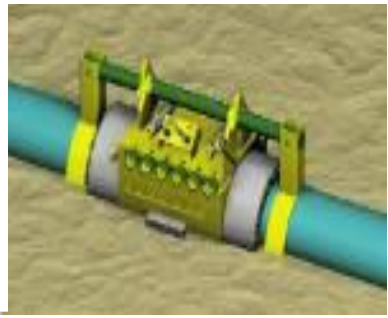
- Fabricate new Morgrip couplings
- Diver assisted hyperbaric welding

Remote PRS, welded sleeve

- Dry welding of hubs by lifting pipe ends to surface. Tie-in by clamp connector.
- Purpose built repair clamp





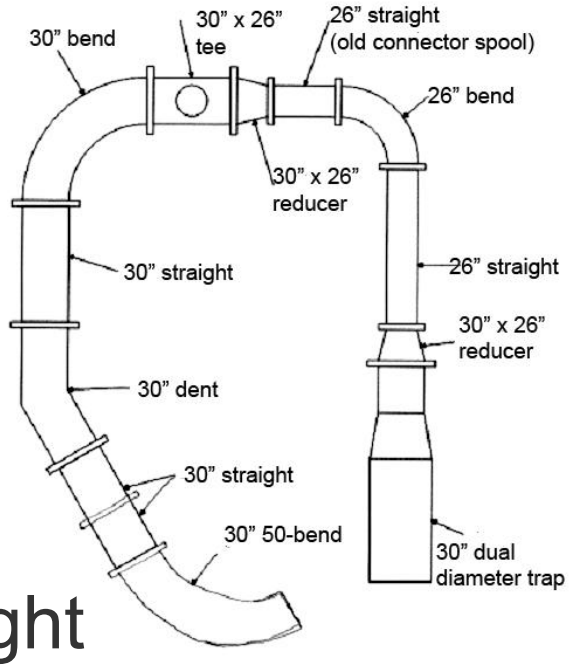


Pipeline contingency repair method

for the Kvitebjørn pipeline

- Cut out a pipeline section, about 25 m long
- Produce and install new spool
- Tie-in using two remote operated sleeve couplings (Morgrip)

Test loop for pig testing



- Verification of pig ability through damage and pipeline components
- Screening of leakage rate in 30” straight

De-commissioning

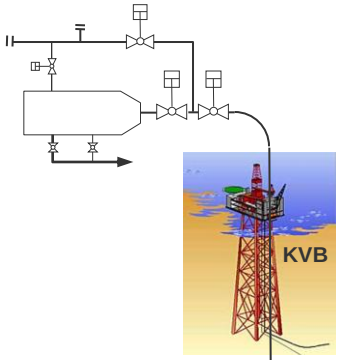
Two–phase gas condensate pipeline

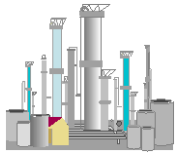
a) Uncover Visund template

b) Close valves and isolate KVB pipeline

c) Depressurise the pipeline

d) Flood the pipeline





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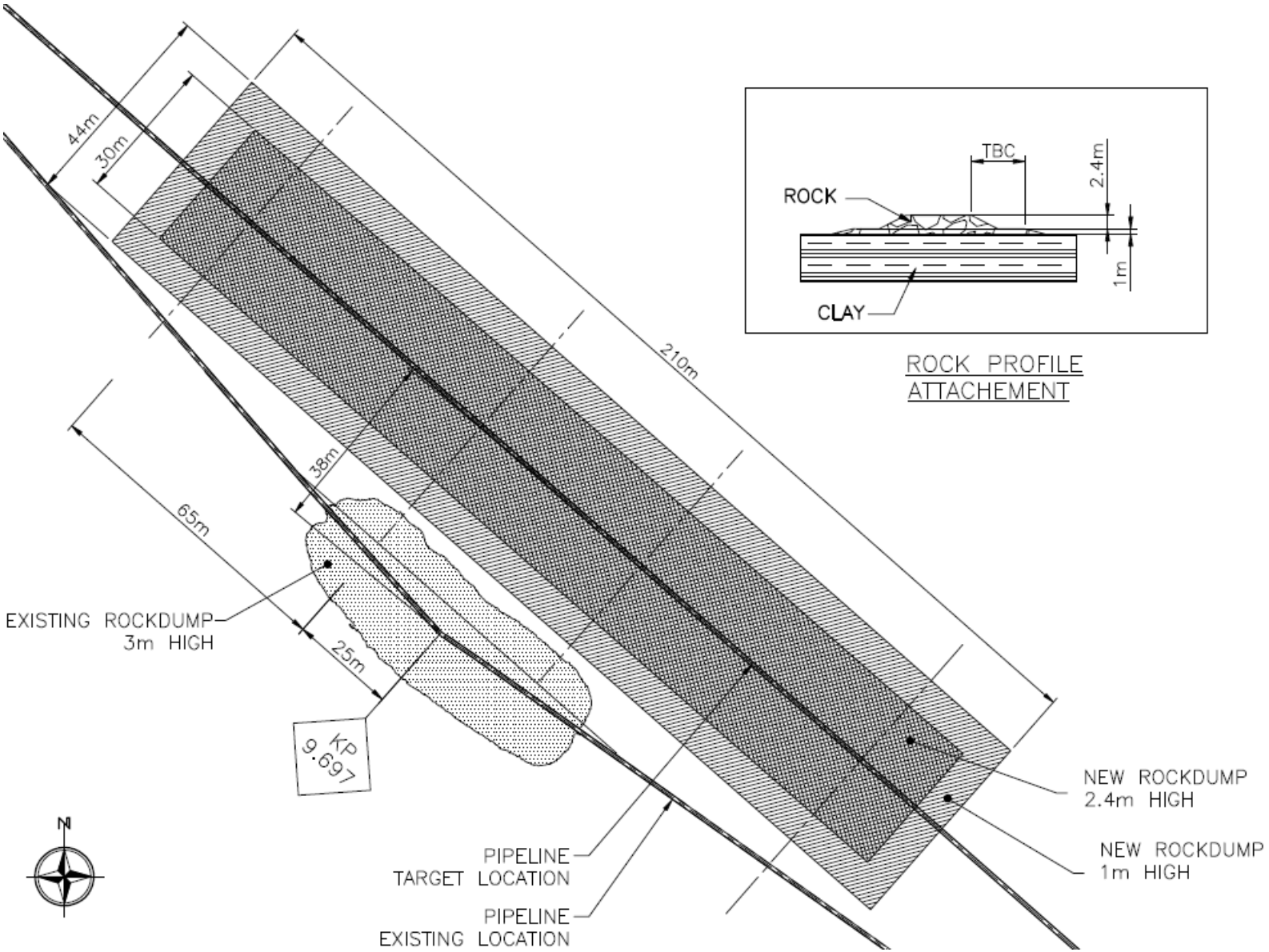
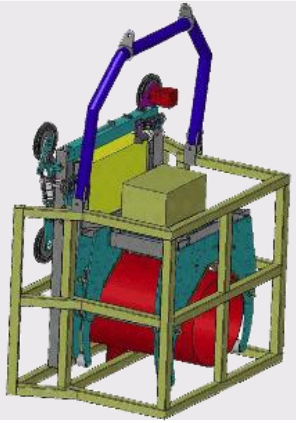
Offshore operation Phase 1 – Repair preparation

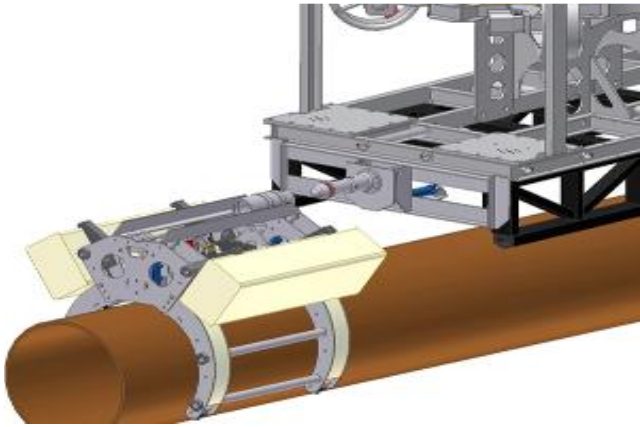

44m
30m
210m
38m
65m
25m
EXISTING ROCKDUMP
3m HIGH
KP
9.697
N
PIPELINE
TARGET LOCATION
PIPELINE
EXISTING LOCATION
NEW ROCKDUMP
2.4m HIGH
NEW ROCKDUMP
1m HIGH
TBC
2.4m
ROCK
1m
CLAY
ROCK PROFILE
ATTACHEMENT

Offshore operation phase 1 –

repair preparation

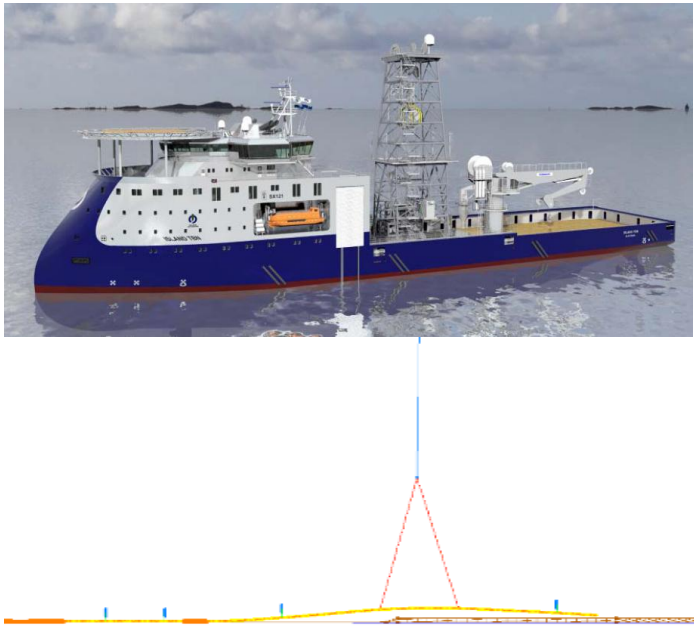
- Dredging to top of pipe for the entire length currently covered by gravel
- Pipeline cutting and relocation
- Coating removal
- Longitudinal seam weld cap removal





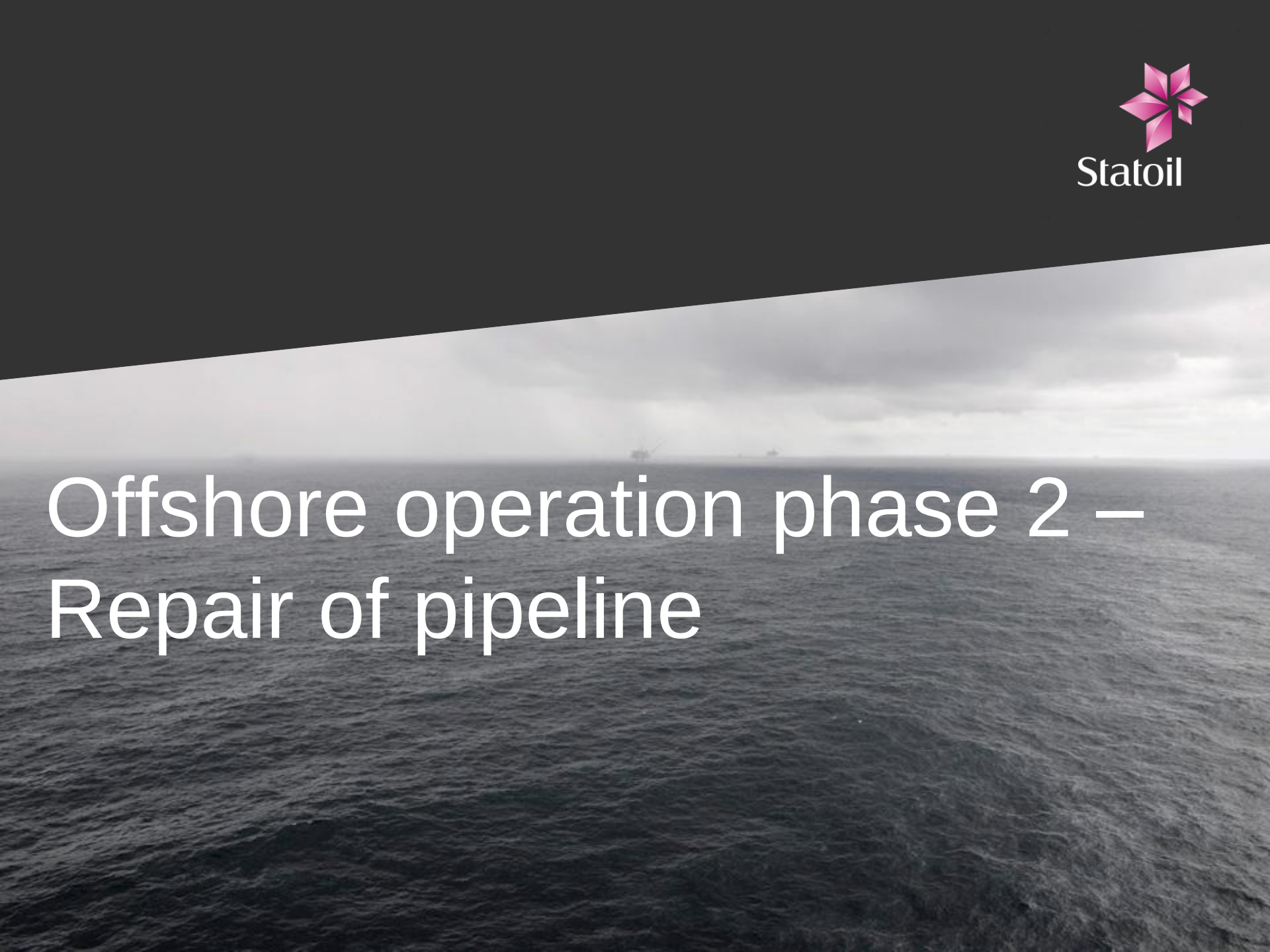
Offshore operation phase 1 –

repair preparation



Relocation of pipe ends:

- Winch wire brings in 7.5 m of wire
- Pipeline end lift approximately 5 m from seabed
- Touch down approximately 200 m from pipeline end
- Winch wire through moon pool will allow the vessel to have free heading during relocation operation
- Vessel translates until pipeline is relocated to desired alignment and location, then lowered to seabed

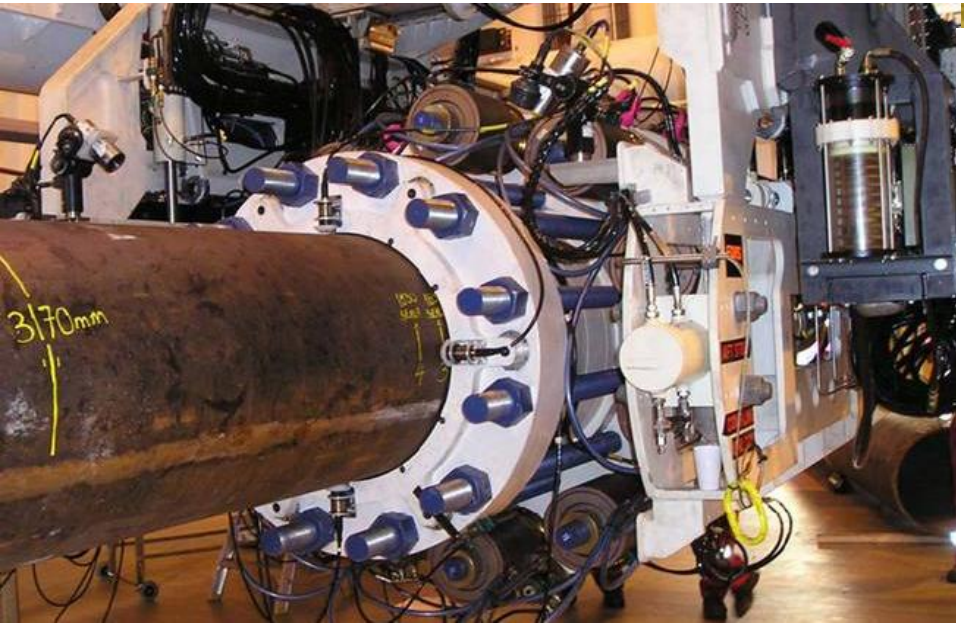


Offshore operation phase 2 – Repair of pipeline

Offshore operation phase 2 –

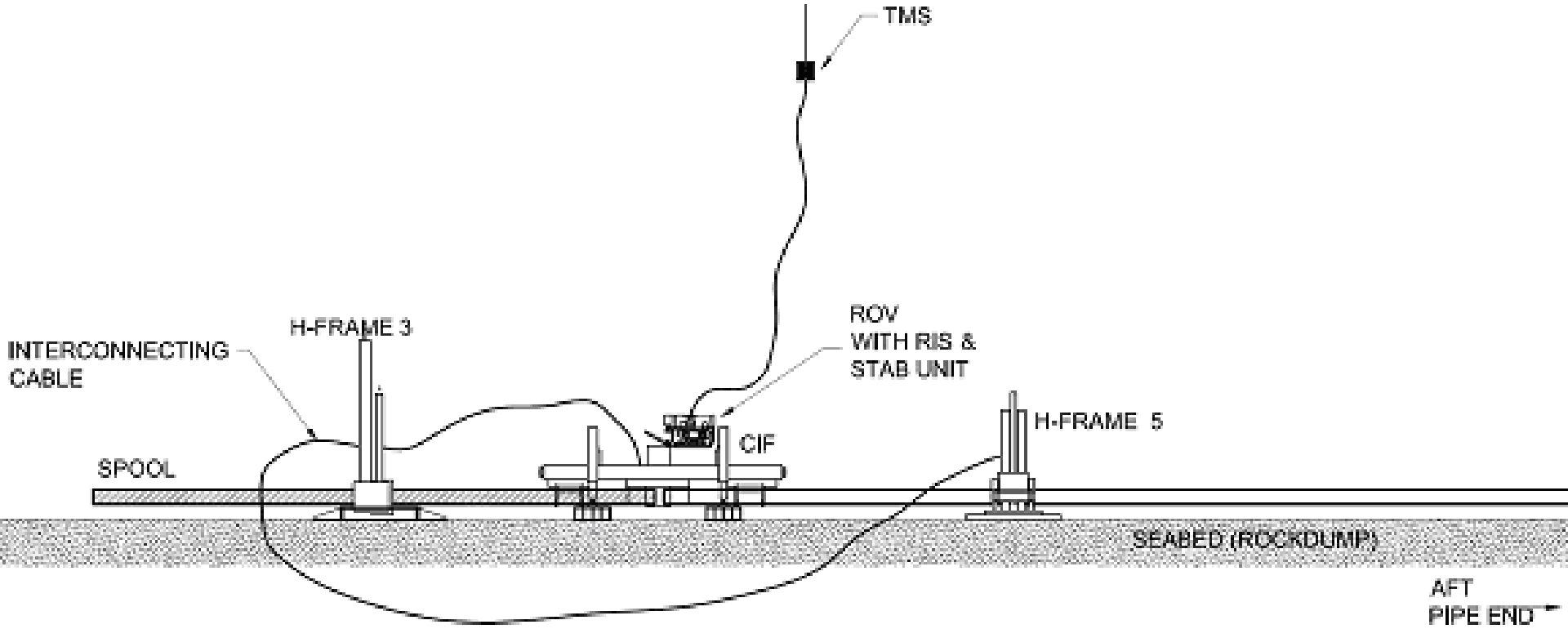
repair of pipeline

Mobilisation of Coupling Installation Frame at PRS Pool base in Norway



Offshore operation phase 2 –

repair of pipeline



Offshore operation phase 2 –

repair of pipeline

- Adjust pipeline and perform final cut
- Install the Morgrip coupling, first on one end then back over the other end
- Activate the coupling and perform inter seal leak test
- Cut all hydraulic connections and release coupling from installation frame
- Lower pipeline and coupling to seabed, repair completed
- System pressure test and re-commissioning, and start up!!

Kvitebjørn

Phase 1

Kvitebjørn
Phase 2

Conclusions

- Repair of a damaged pipeline at 210m water depth is a large project
- It would not be possible without pre-investment made in equipment, procedures and trained operators in place
- One year and three month after the damage discovery the pipeline was back in operation
- Due to a period of temporary operation, the real repair time was 5 months
- The Kvitebjørn incident has shown how important it is to be prepared for the unexpected
- Improvements are possible and will be made
- The Kvitebjørn damage and repair was a real baptism of Statoil's repair contingency

Acknowledgements

Statoil wish to acknowledge the other owners and operator of the Kvitebjørn pipeline

GASSCO petoro Enterprise Oil TOTAL

(Operator since 1st March 2009)

Statoil also want to acknowledge the main contractors participating in the repair project

- Technip Offshore Norge (marine contractor and PRS operator)
- Isotek Electronics (supplier of PRS control system)
- Hydratight (supplier of Morgrip couplings)
- Halliburton (contractor for de-and re-commissioning of pipeline)

Who we are

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- The second largest **exporter of gas** to Europe


PRS Pool Base at Killingøy
Thank you!