



Statoil

Design-Build-Qualification and First Use of a New Remote Tie-in tool for Bolted Flanges in Six Months

- Norne ERB improvement*
- Norne Riser replacement II*

Kjell Edvard Apeland
R&T FT DPR
Statoil ASA

Background

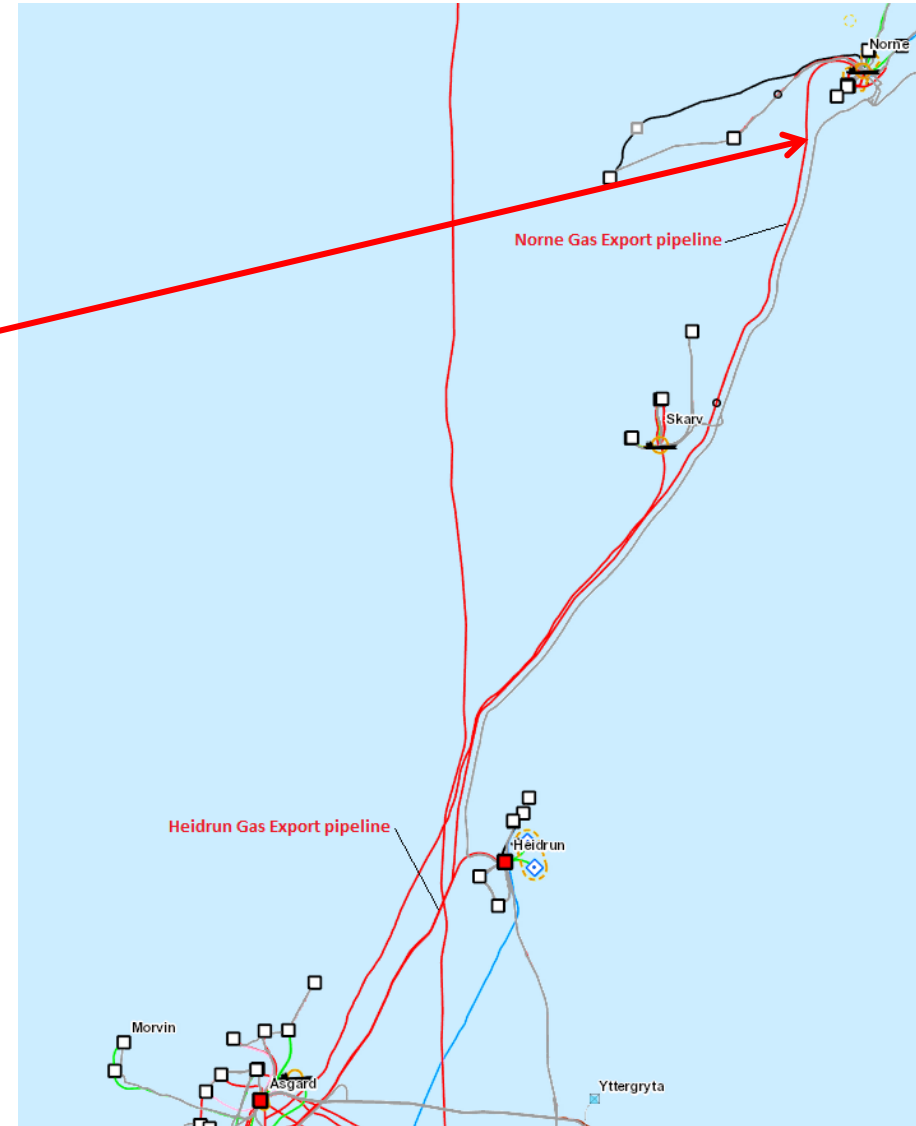
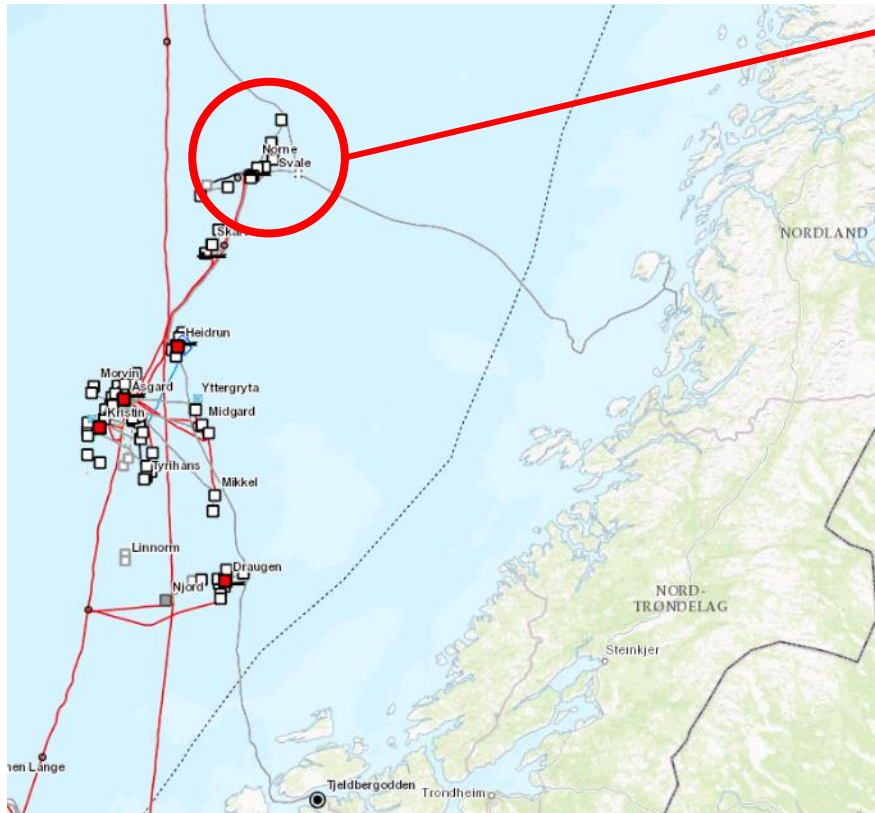


- Norne FPSO in production 6 November 1997
- Field water depth: 380msw
- Gas Export in operation from 2001, owned by Gassled and operated by Gassco



Background

- Norne/Heidrun Gas Export pipeline («The Loop») in production February 2001
- Oil price down at 9.85 USD/barrel (1/12-1998) & break-even/profit requirement at 12 USD/barrel

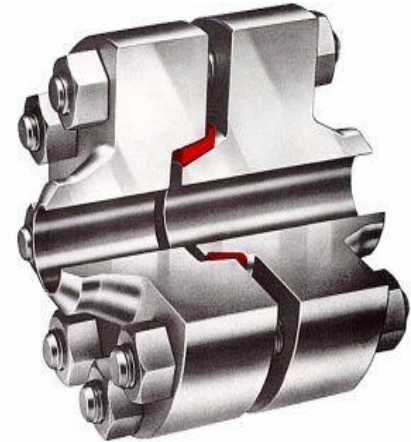


Background



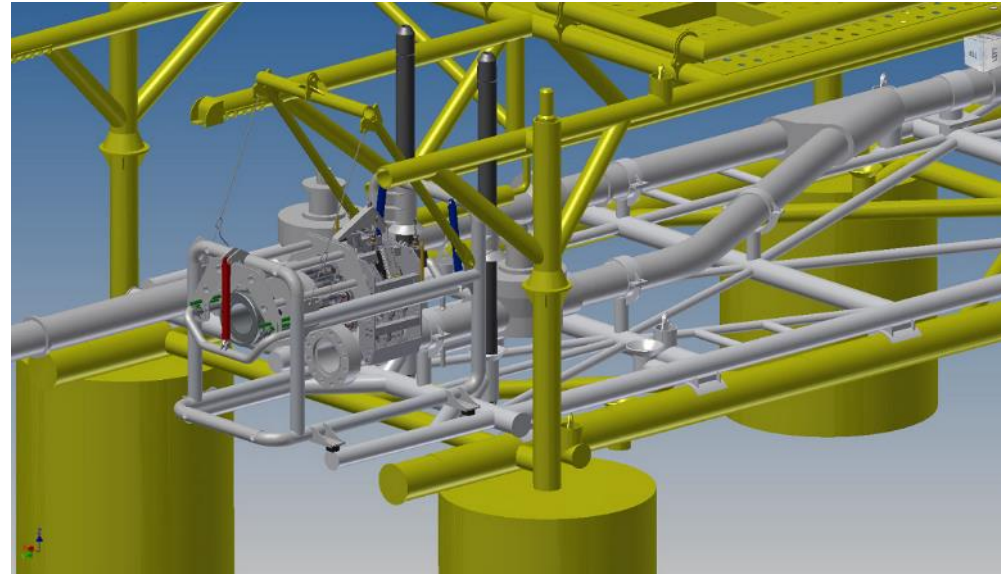
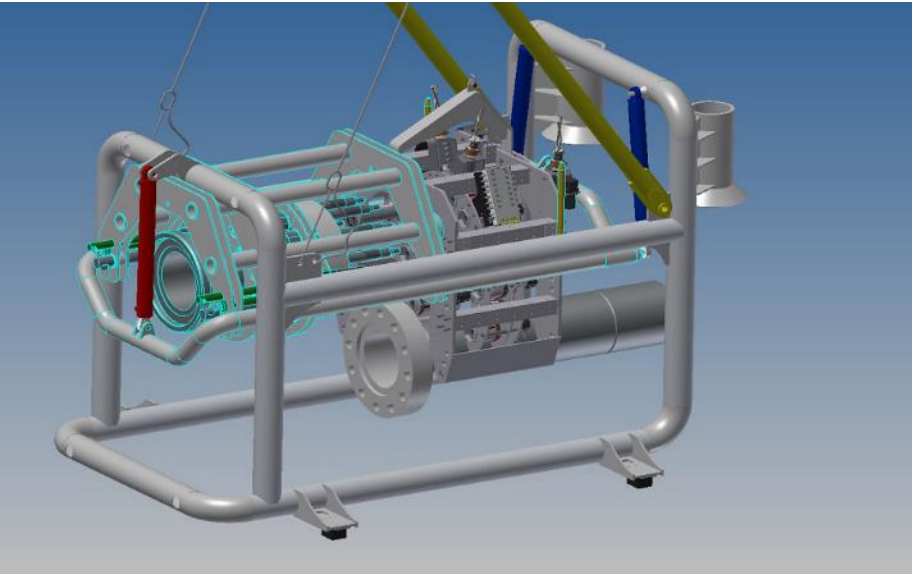
- Project chose bolted flanges due to low price (10-20% of traditional ROV connectors)
- Brutus tie-in part of large Lump Sum EPCI contract
- Brutus had poor performance, production startup delayed by 4 months

- Flow induced vibrations were discovered in the Gas Export Riser in 2013
- Brutus mobilized again for tie-in of a new «smooth bore» riser
- Once again, the Brutus had poor performance, Tie-in campaign alone took 3 weeks
- Flange in the end tightened by ROV operated torque wrench (backup tools)



Concept Study for pigging of Norne GE

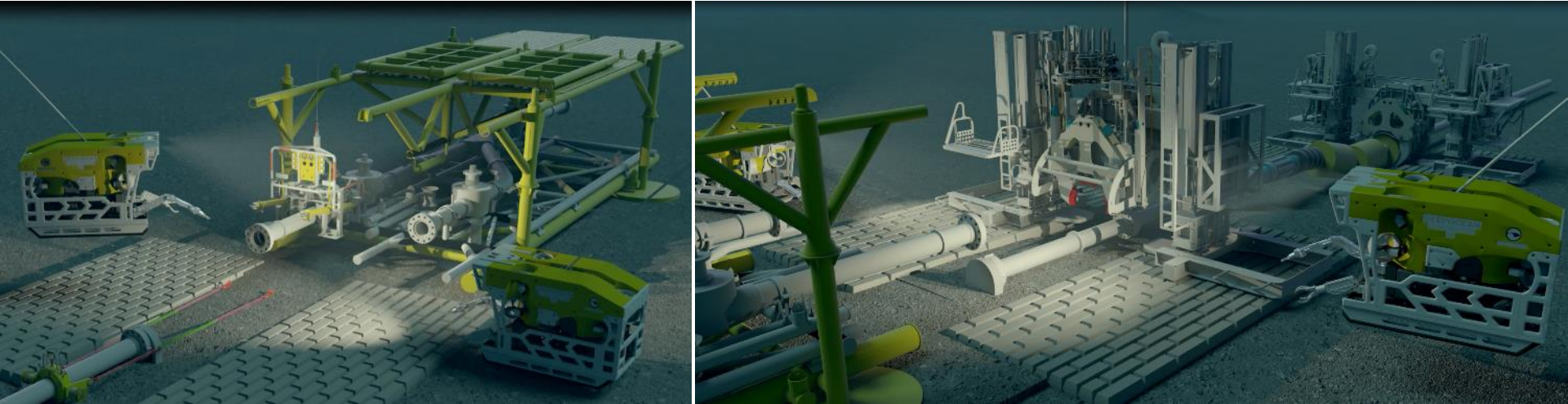
– ERB Improvement – ROV friendly adaptor for pig launcher



- PRSI Pool has been responsible for storage of Norne subsea pig launcher since 2001 on behalf of Gassco (operator) and TN (TransportNet) Kårstø (TSP)
- Pig stopper installed in riser as part of replacement in 2013
- Poor tie-in system performance discussed with TN (subsea pigging needed)
- August 2015: TN Kårstø asks DPR to perform a tie-in study for pigging of Norne GE
- GOAL: Develop a simplified, cheaper, more efficient and more reliable tie-in system for bolted flanges and enable efficient future subsea pigging operations

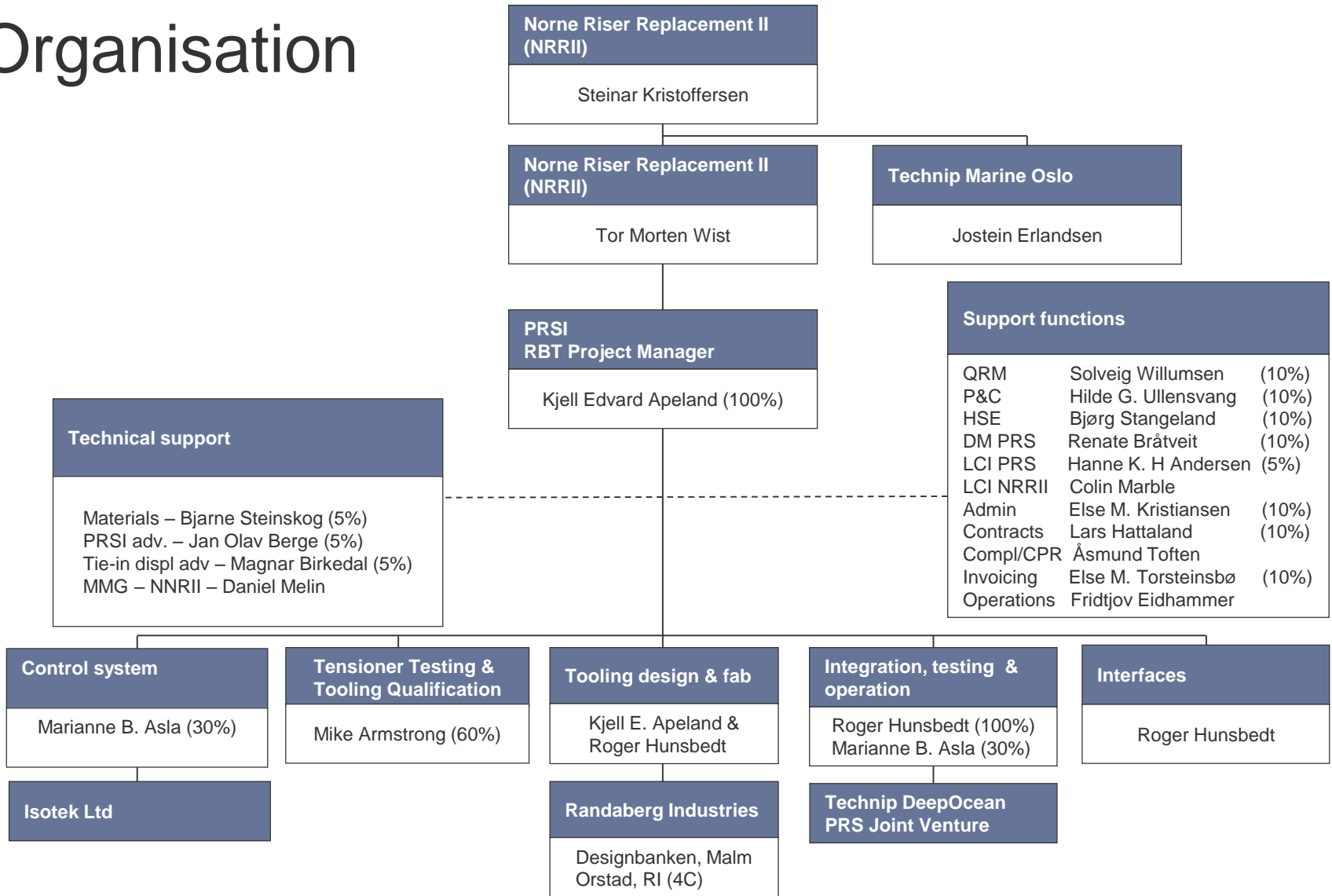
Concept study expanded

– Tie-in of new riser for Replacement project



- October 2015 PRSI approached by project in Oslo
- Ongoing study with 4C Solutions expanded to include riser replacement
- Christmas 2015: Study concluded including cost estimates
- Mid January 2016: Oslo project presented new concept for partners - instructed to go-ahead
- Main milestone: SIT/qualification completed and system ready for shipment 28.07.2016
- At Kick-off: 6 months available for design, fabrication and testing/qualification
- Two months summer holiday season...

Organisation



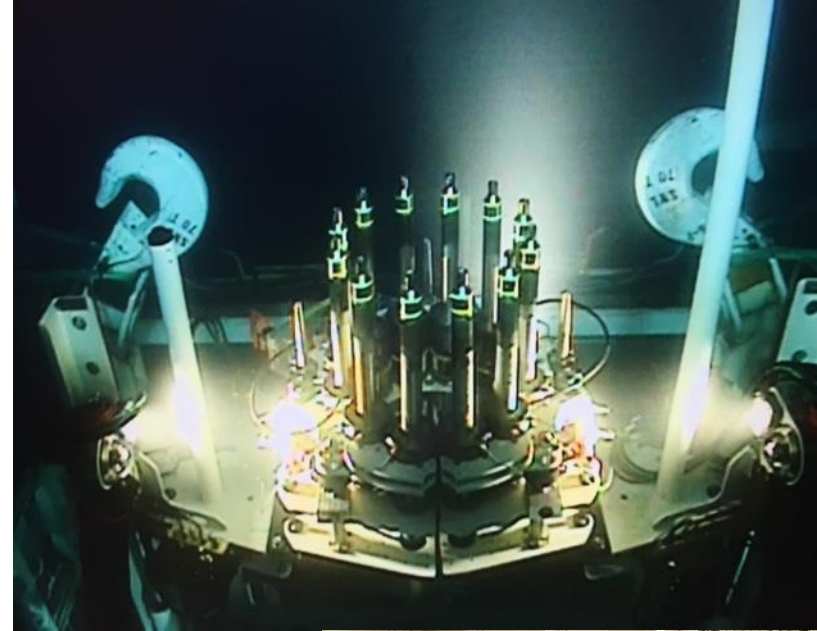
Solution

- Use of existing Pipe Handling frame (H-5) from the PRSI pool
 - Carrier of the new bolt tensioning tool
 - Termination lifting and alignment by H-5
 - H-5 control system platform
 - Use of solutions & experience from Hot-tap Tee installation
- Alignment assisted by H-6 further back

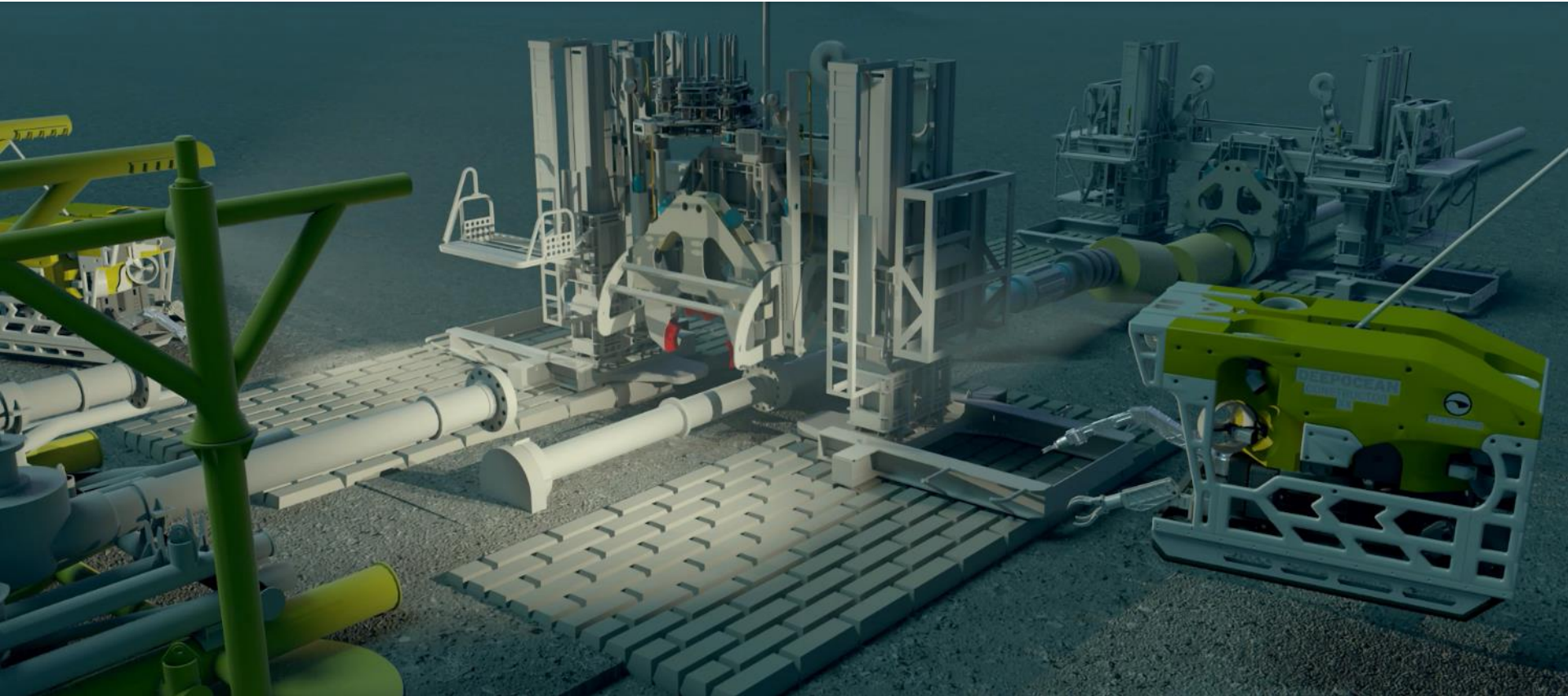


Solution

- Bolt tensioning tool included functions for rotation of swivel flange, threading of bolts, bolt tensioning and lock-down at full pressure
- Several ROV operated tools developed for measurements, alignment verification and backup operations
- Separate «Remote Nut Running Tool», installed by crane/ROV and powered from H-5
- ROV operated «Remote Pull-in Tool» (lay-down about 5 meters from ERB flange)



Animation



Results

- Riser replacement project



- 100% flawless offshore delivery from PRSI Pool
- Time consumption on critical path offshore reduced from 3 weeks to 30 hrs (comparison 2013 with 2016 riser replacements)
- Cost for design, fabrication and qualification about 50% lower than cost to only mobilize the existing Brutus tool
- Brutus system no longer in a monopoly situation

Results

- Long term



- TN will in future avoid to have a costly separate preparedness contract to ensure availability of the Brutus tool
- TN will avoid costly mobilization of Brutus and the old & obsolete subsea pig launcher for their planned inspection pigging
- Large synergies between riser replacement project and TN inspection pigging 2018
- Phase 2 of project kicked-off and ongoing to adapt the developed tools to the ERBs pigging point and building of a new subsea pig launcher for TN
- Professional PRS JV technicians available from the Pool to support at all times
- Brutus system no longer in a monopoly situation

Fast track project

- Succes factors



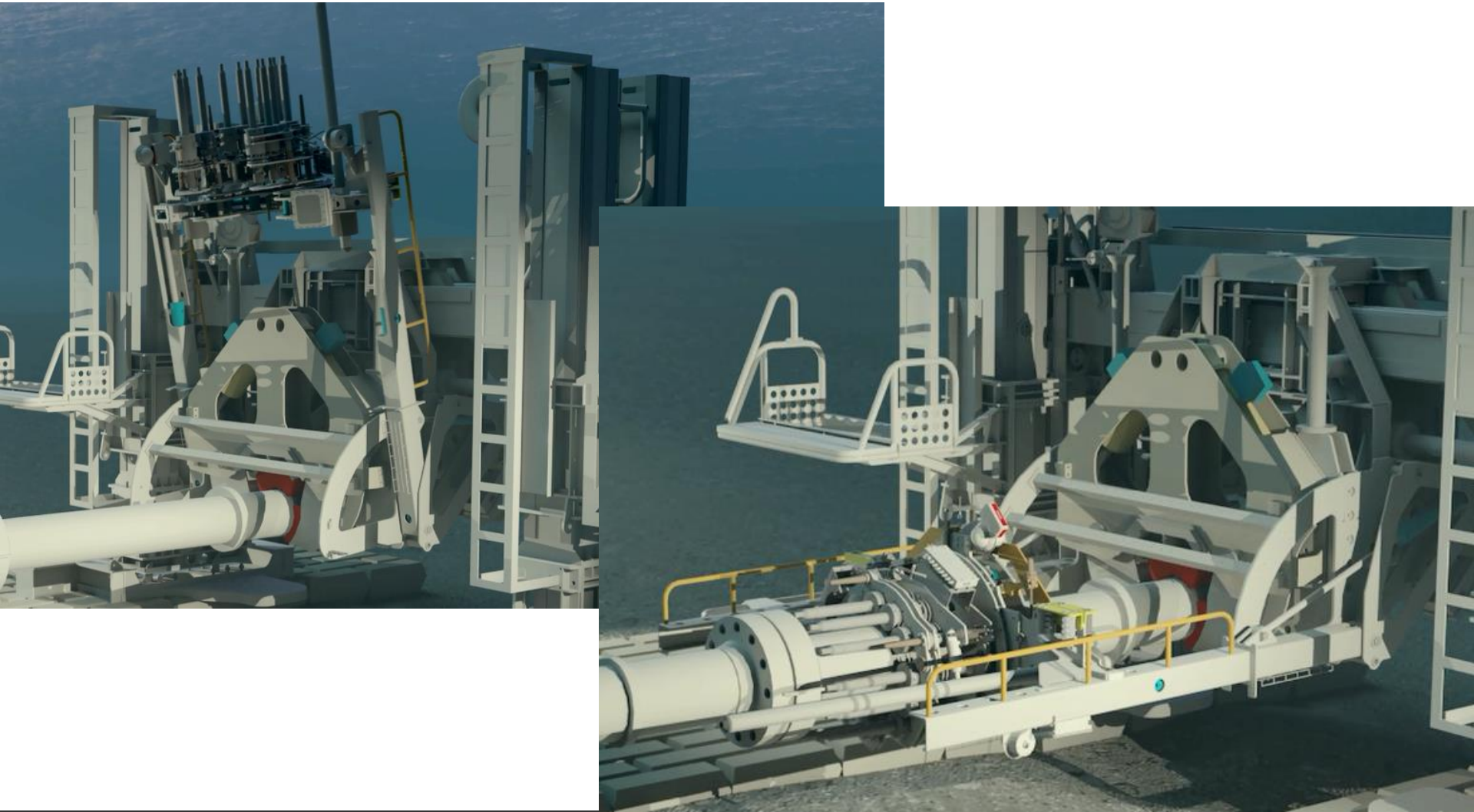
- Large degree of re-use for qualified technology elements from the PRSI Pool
 - Pipe handling frames & control system
 - Remote Hot-tap system concepts
 - Proven solutions in a «new wrapping»
- Project organized as an integrated team consisting of personnel from:
 - Pools key suppliers
 - The larger main contractors for PRSI Pool
 - Statoil personnel experienced with technology qualification
- Quality first time by hands on follow up and several detailed design reviews every week (minimum re-work)

Fast track project

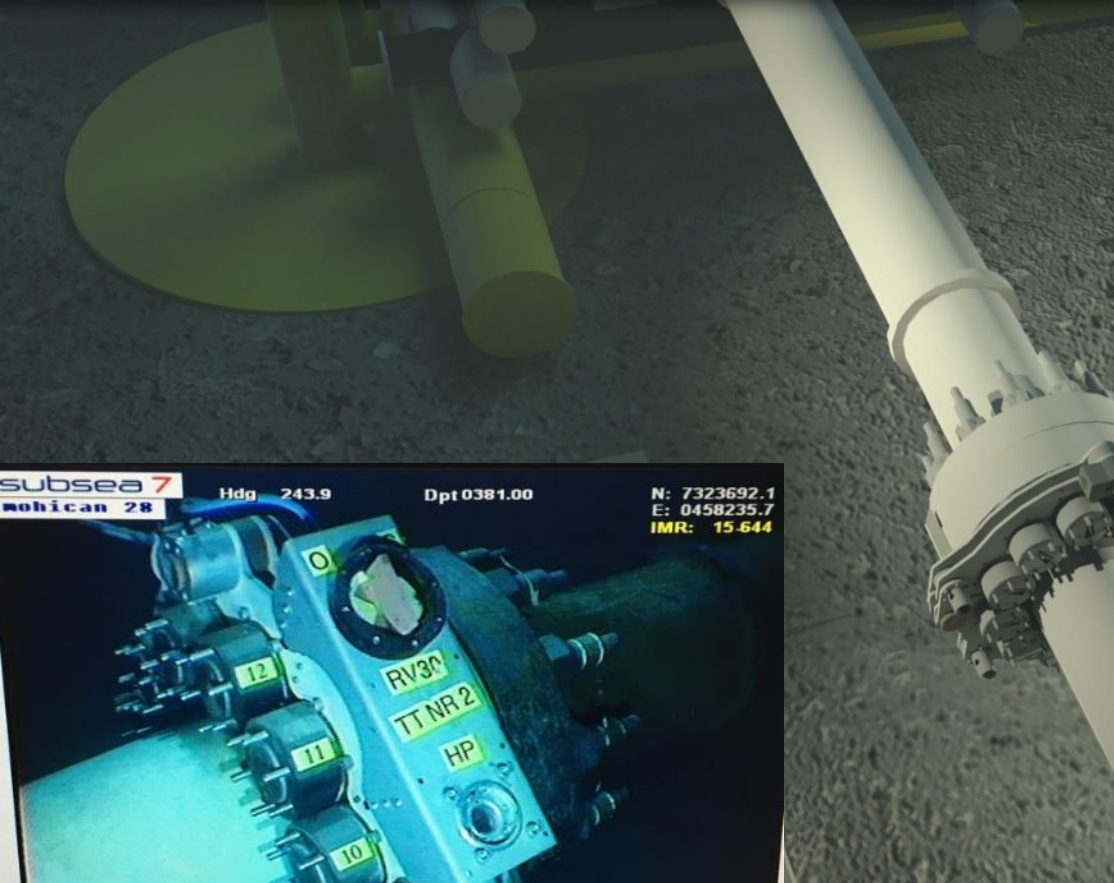
- Success factors

- Relevant stake holders present at all technical meetings – fast buy-in to solutions
- Offshore operators = PRS JV technicians
 - Present in design reviews and FMECA sessions, this provides better technical solutions
- Lean and responsive Statoil follow up
- Priority to first user, riser replacement
- Very able and responsive supplier on design and fabrication (4C Solutions)
- Dynamic approach to scope and responsibility, agreed transfer of scope from 4C to PRS JV when needed to maintain delivery date
- PRS JV an experienced and professional contractor – efficient delivery at high quality
- PRS JV delivered high quality interface engineering towards Marine Contractor

H5 with “front loader” and bolts



As left



Questions?

