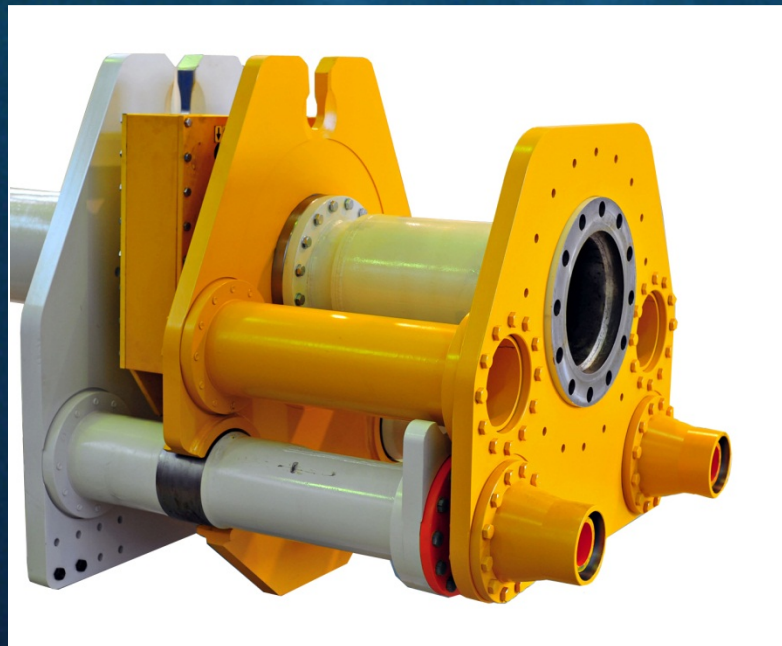


# Simplified Tie-in Systems; Challenges and Solutions

Ronny Haldorsen

Business Area Manager - Pipeline Products Stavanger



An underwater scene with a clear blue water surface. In the background, a range of mountains with snow-capped peaks is visible above the water line. Sunlight rays penetrate the water from the surface, creating a shimmering effect.

# Nemo

A Kongsberg Company



**KONGSBERG**

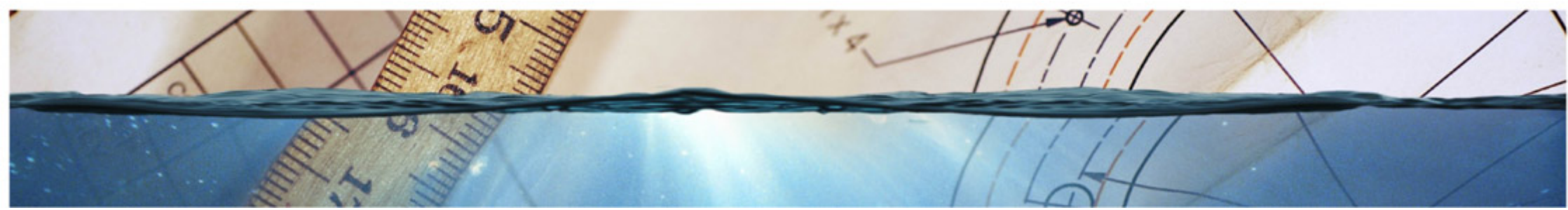
Nemo a part of Kongsberg Oil & Gas Technologies from 08.01.2013

**NEMO**



# Technology Status Tie-In Systems

- Demand for stronger tie-in's, limited by pull-in tooling and/or connectors
  - Spool/pipeline diameters are increasing
  - Spools consequently increases in size due to limitations in tie-in capacity
- Demand for simplified and more efficient Tie-in operations
- Demand for less tooling and specialised personnel
- Demand for less deck space, enabling a larger variety of Vessels to be utilised
- Demand for reduced lead time and costs



# Tie-In Environment

- Improved Systems for Dynamic Positioning
- Improved Crane Heave Compensation Systems
- Improved 3D Design, FEM Analysis and Installation Analysis
- Improved ROV Capabilities
- Oil and gas developments moving in to deeper waters and arctic regions



# Simplified Tie-in characteristics

- Direct landing
- Simple stroking and make up of connector
- Tools operated directly from a standard WROV
- High alignment capacity
- Connection strength matches pipe strength
- High load capacities for accidental loads
- Minimal additional deck space and functions required
- System should be capable of doing the full range of connections (rigid/flexible spools, direct pipeline tie-in, mono/dual/multibore, umbilical, pig launcher/receiver, pressure caps)



# Cost Efficiency

- Reduced tool spread (tool less)
- ROV operated tools
- Flexible tool packages, multi purpose tools
- Efficient operations
- Reduced hardware costs
- Reduced lead time on tooling
- Enhanced reliability for tooling
- Flexible tie-in systems with short lead time on structural components (connectors will still be longlead items)
- Simplified interfaces towards structures

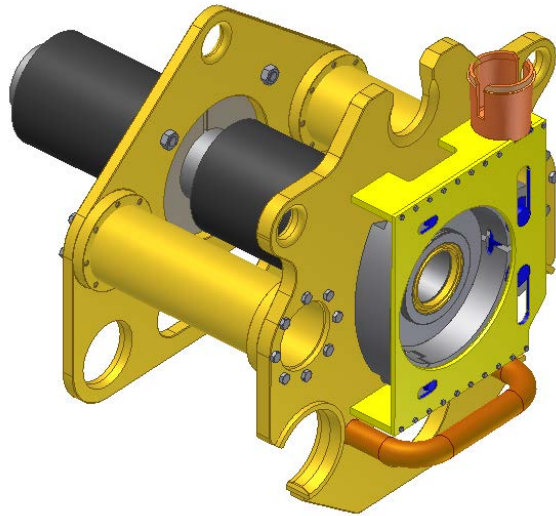
## Nemo Solution: Thor Tie-In



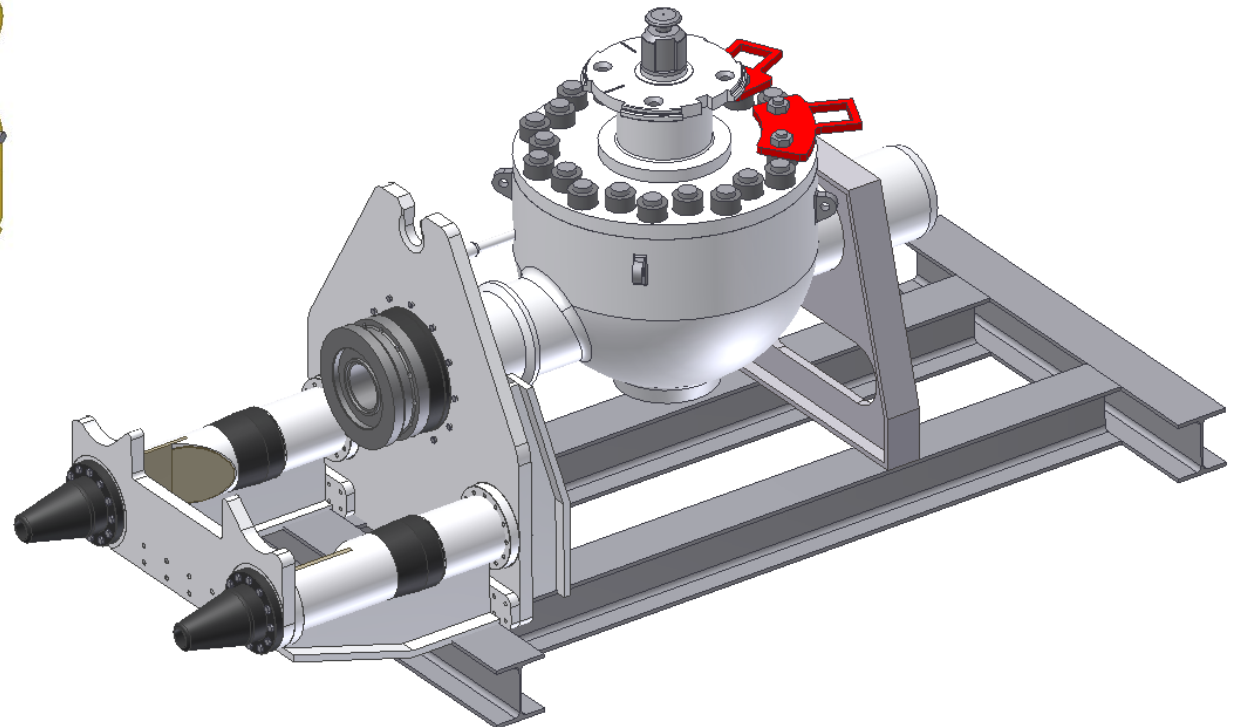


# Thor Tie-In – Main Components

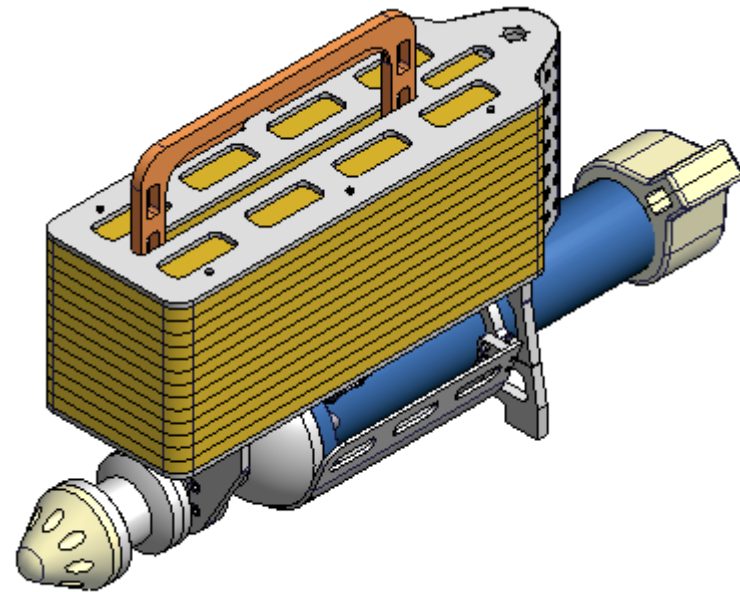
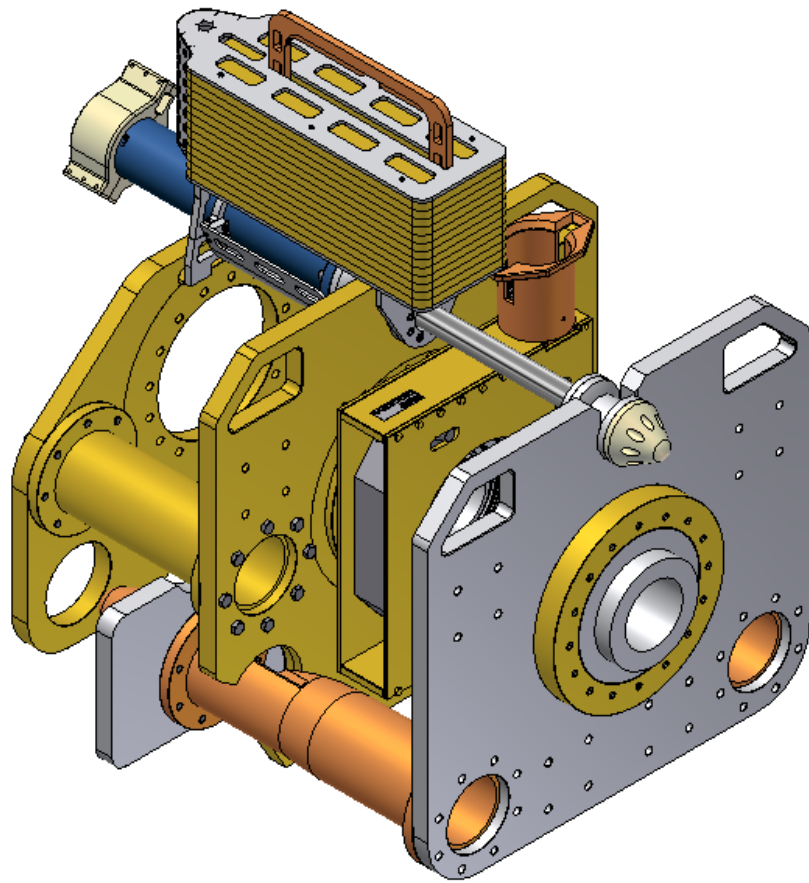
Termination Structure



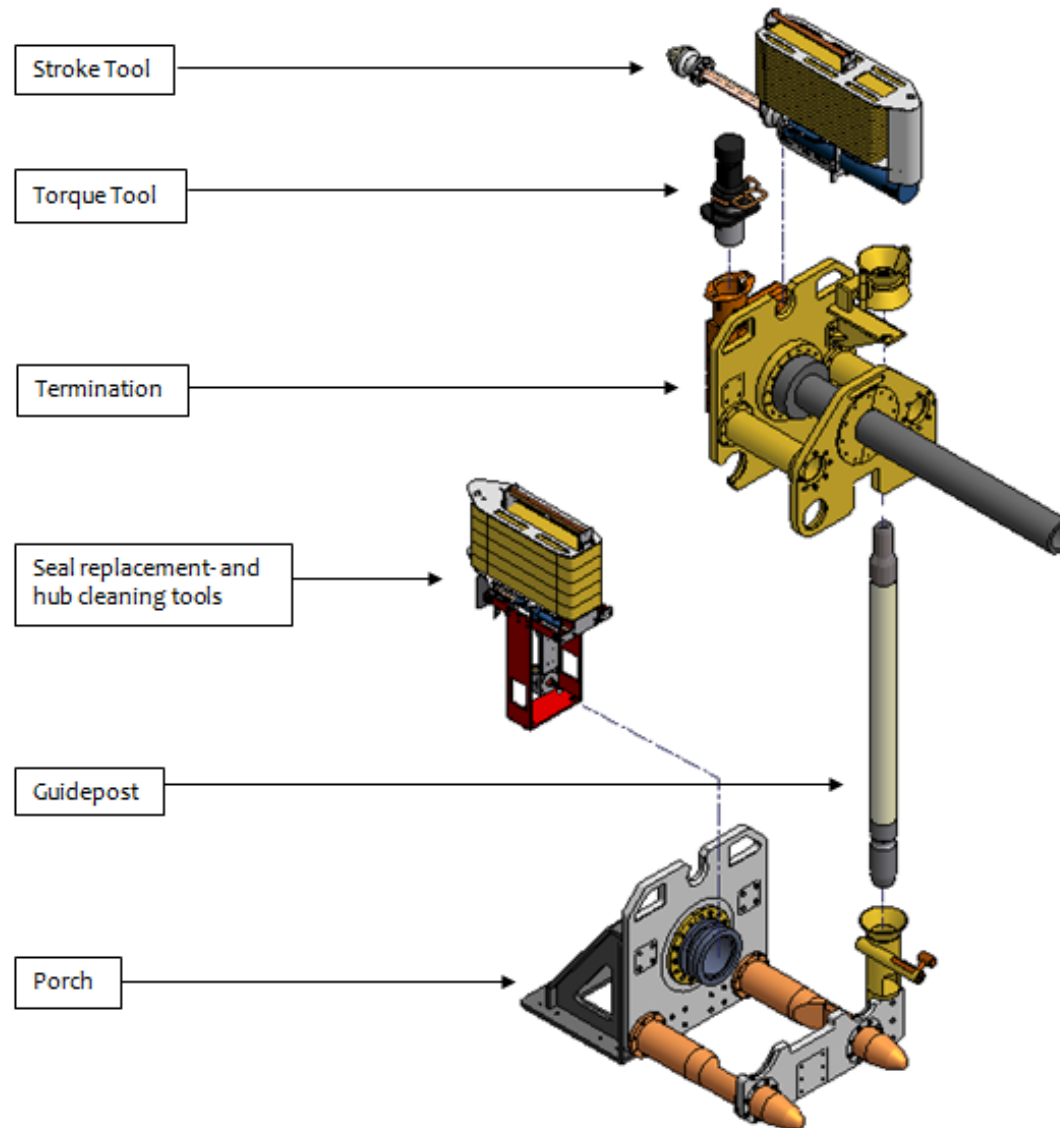
Porch Structure






# Thor Tie-In System - Stroke Tool

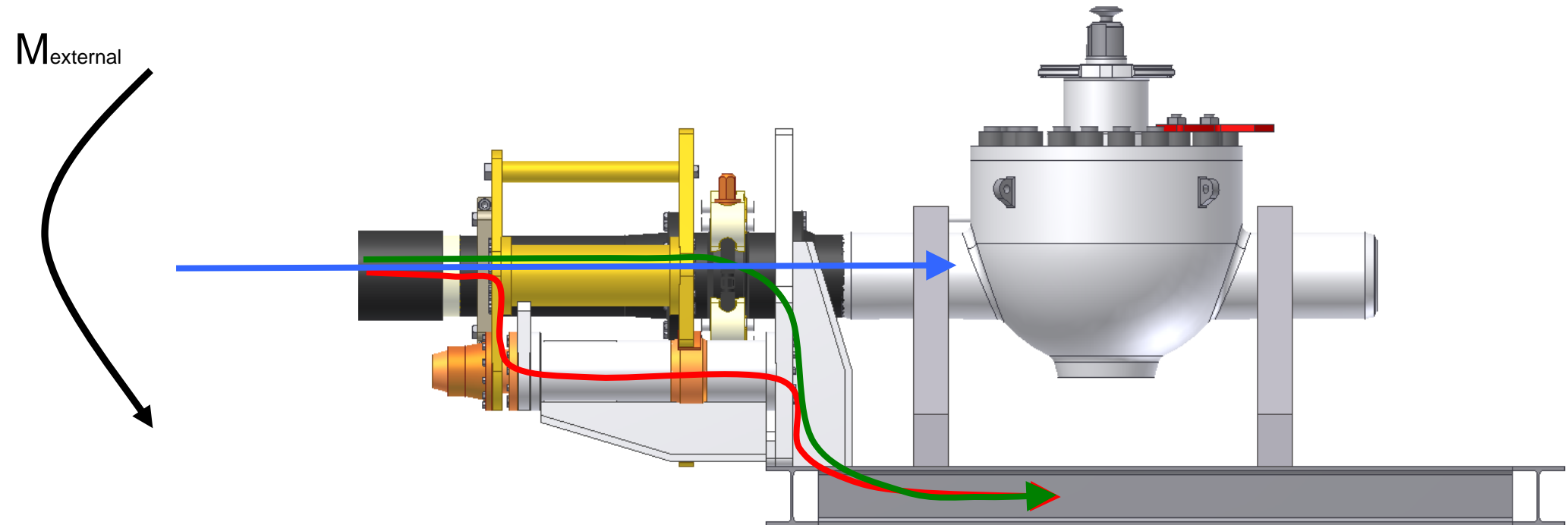


# Thor Tie-In System



# Thor Tie-In System – Distribution of external moments

-  Moments absorbed via termination, guiding tubulars into support structure
-  Moments absorbed via termination, connector into support structure
-  Moments absorbed via termination, connector into piping



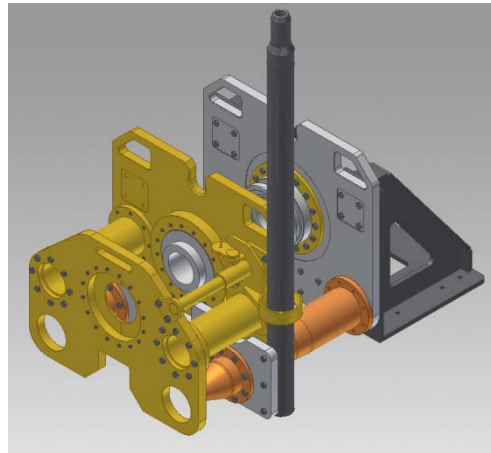
# Thor Tie-In System – Key Design Features

## Independent of connector manufacturer

- Simple customization
- All field proven clamp manufacturers can be utilised
- Various capacities

## Reduced manufacturing cost

- Easy to machine
- Easy to assemble
- No advanced materials
- No sensors



## Reduced operation cost

- Simple interfaces
- Easy handling on deck
- Only one supervisor required
- Utility tools available for rent

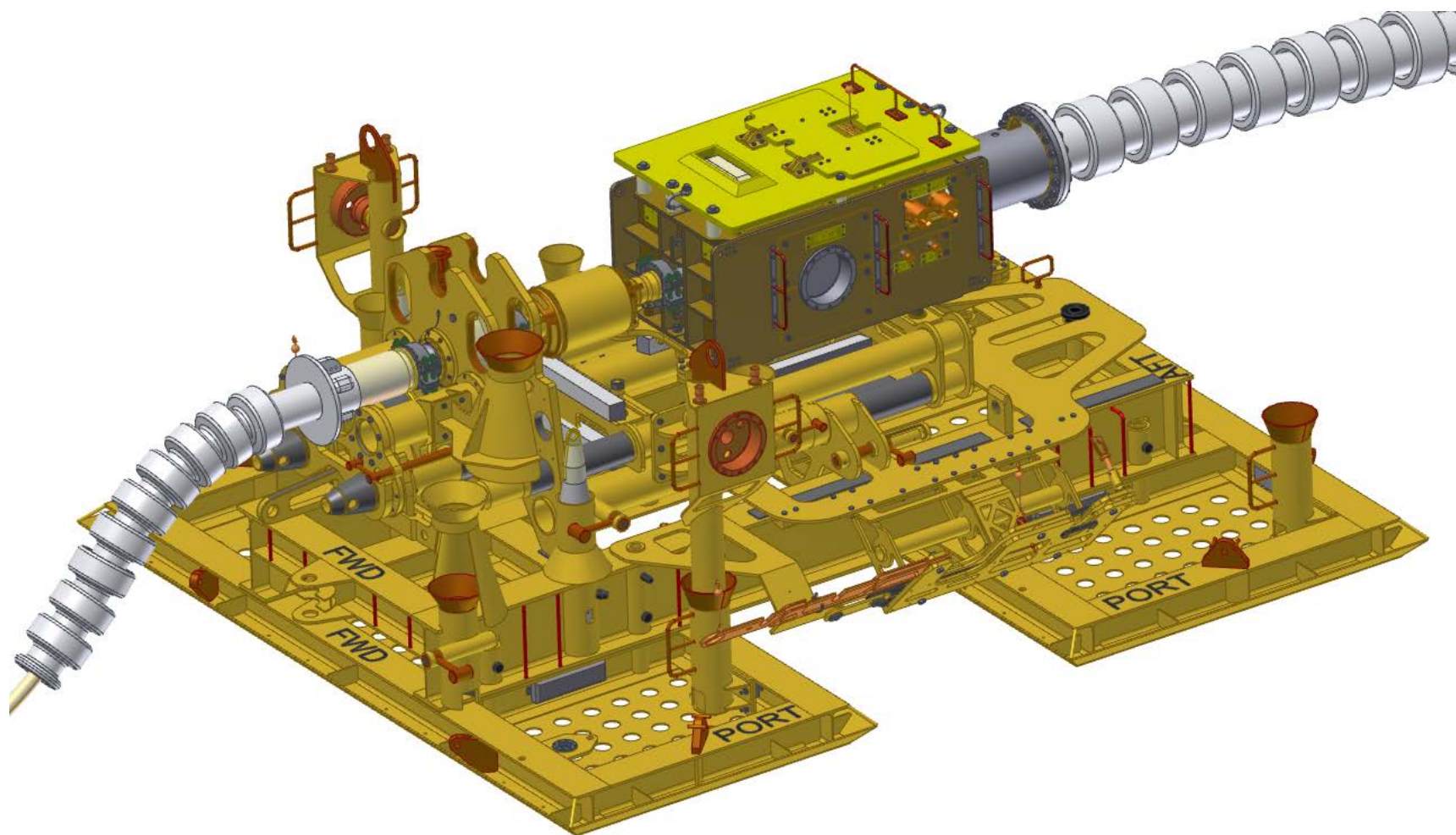
## Part transfer of moment to foundation structure

- Reduced size of valves
- Reduced size of piping
- Reduced size of connector
- Significantly increased capacity for accidental loads

## Very high alignment capacity

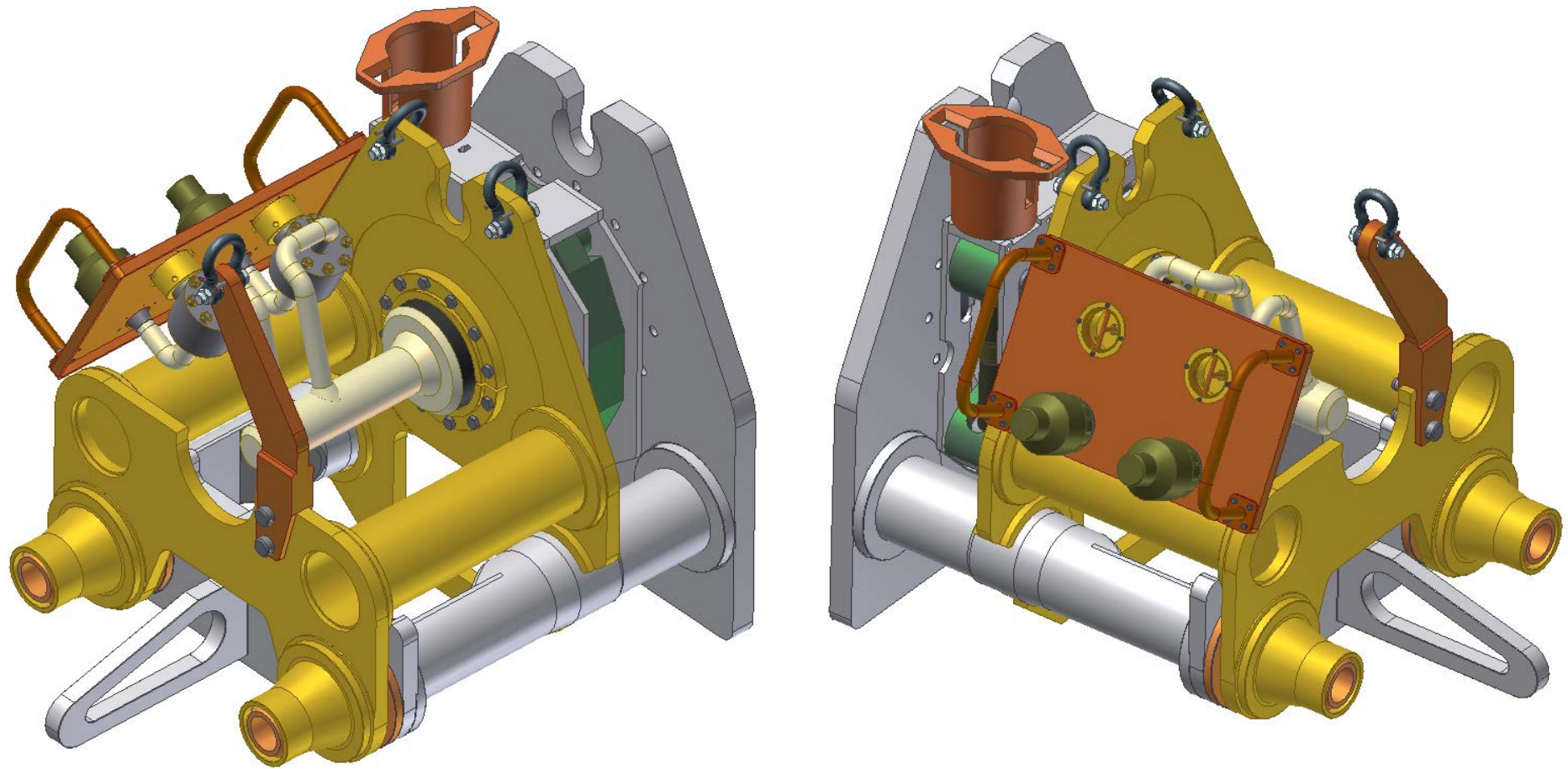
- Reduced size of spools
- Direct pipeline tie-in
- Robust connections

# Thor Tie-In Of Umbilical with integrated WeakLink



Completed Flexible Tie-In: Hibernia Project

# Thor Tie-In System – Longterm Pressure Cap with stab access

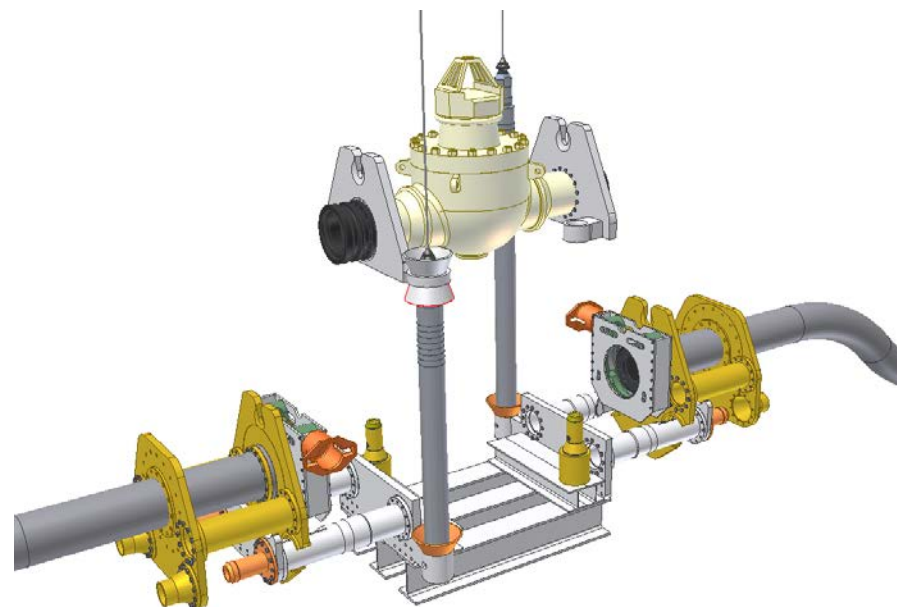
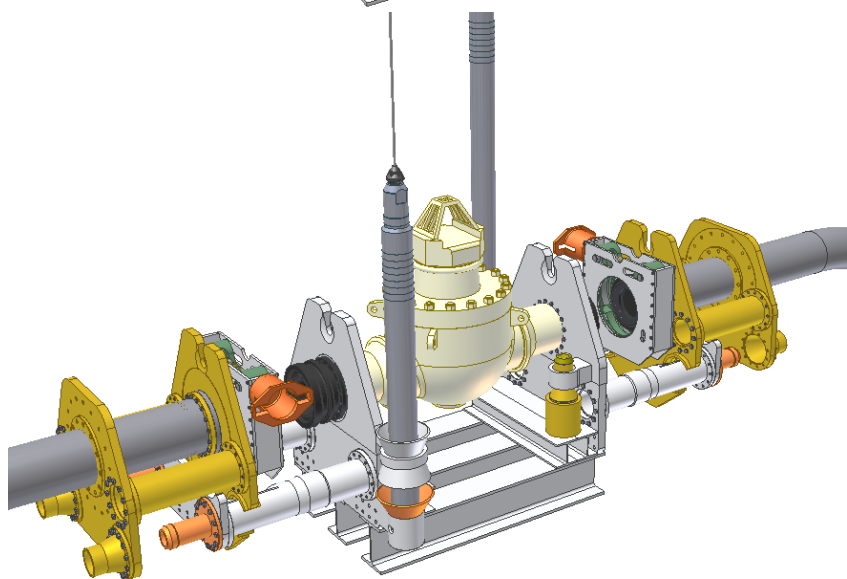
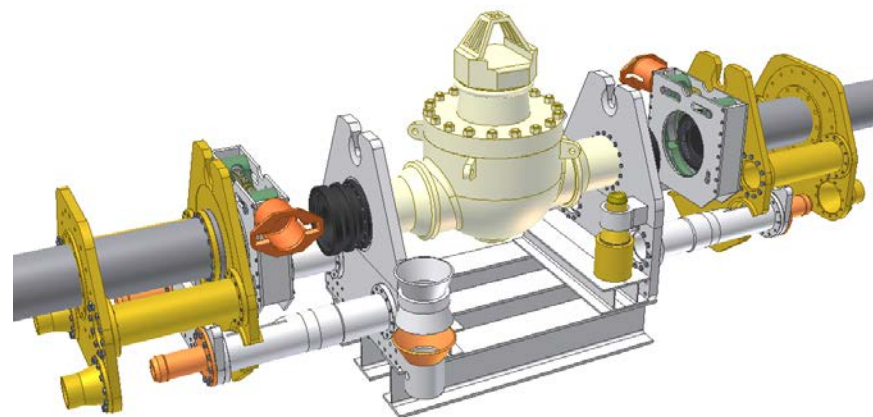
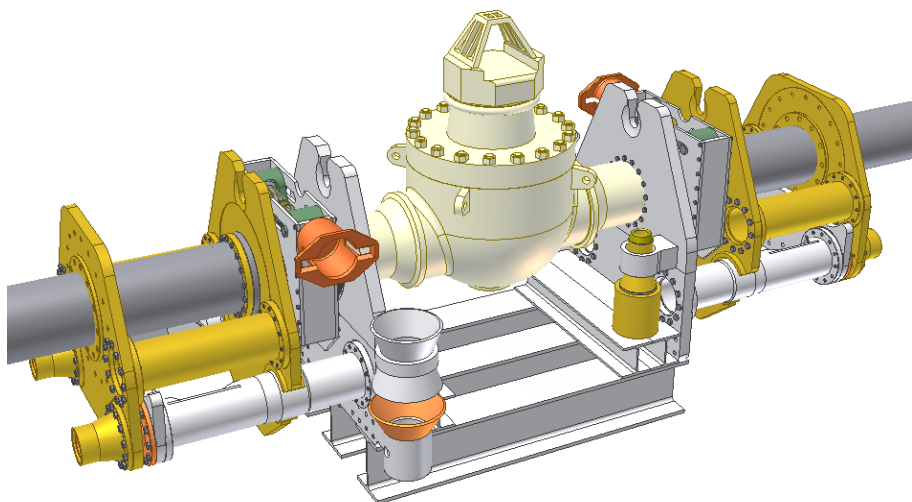


# Thor Tie-In System - Pig Launcher / Pig Receiver

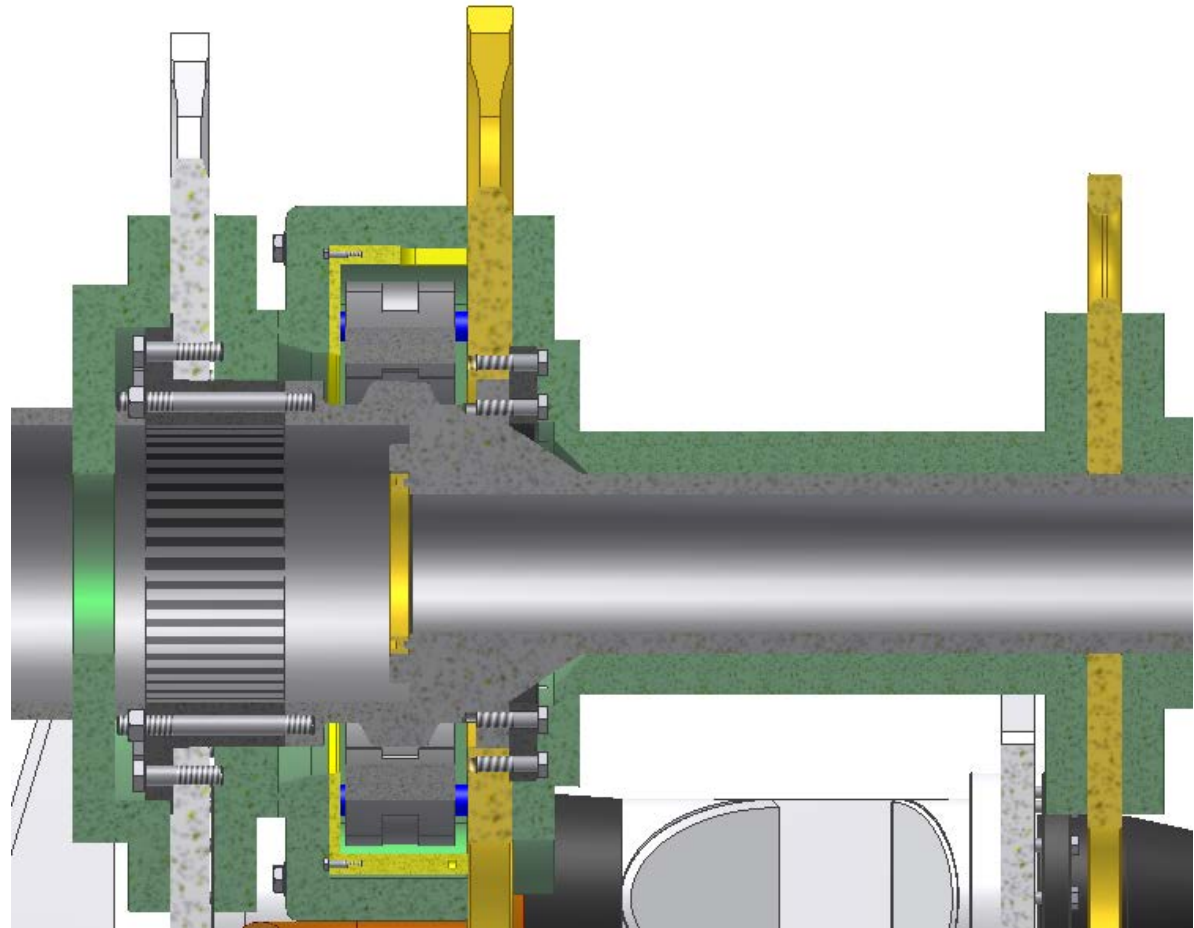
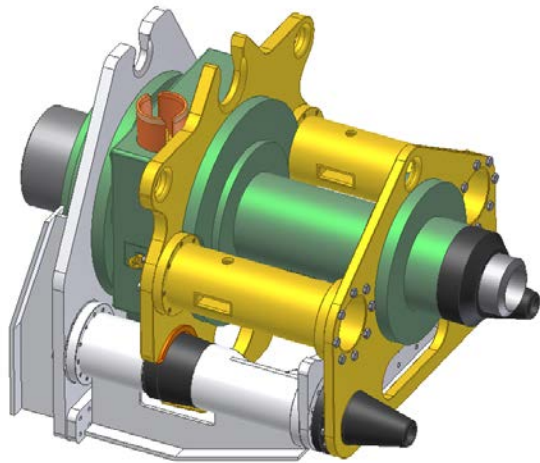
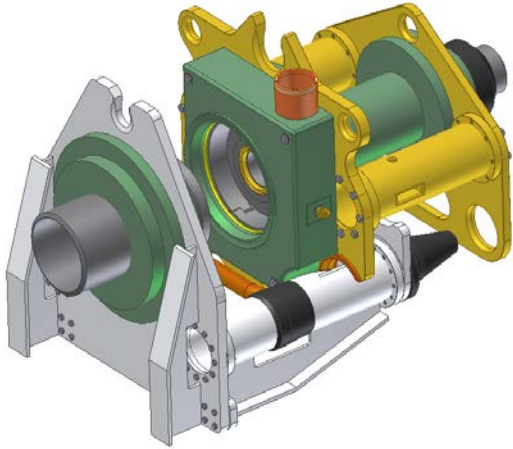


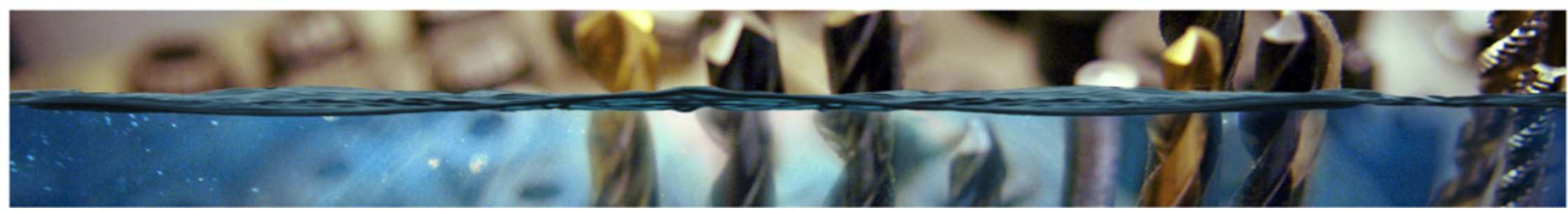


# Thor Tie-In System – Valve Recovery



# Thor Tie-In System - Thermal Insulation System





- Ongoing Tie-In Projects

- Hibernia Project, Technip/ExxonMobil, Delivery 2013
- Ivar Aasen Field Development, Det Norske, Delivery 2013-2014
- Fram H Pig-Launcher, Statoil, Delivery 2014

