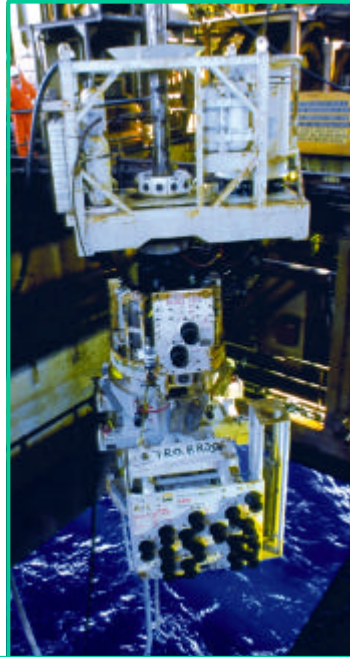


FREDRIK WITTING
Sales Manager
Subsea Production Systems
ABB Offshore Systems



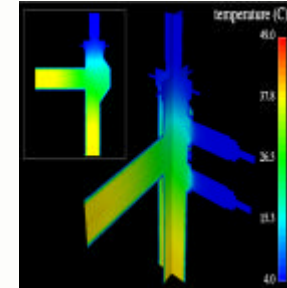
ROV intervensjon – Oppkopling av stålrørskontrollinjer



ABB Subsea Systems

ABB is a leading supplier of Subsea Project Management, Subsea EPC and Subsea Systems Engineering Services:

- Experience from delivery of more than 750 Subsea Trees, 300 Subsea Control Modules and 50 Subsea Manifolds
- More than 20 full scope Subsea EPC and EPCI Projects executed worldwide
- Four main FEED, Engineering and EPC(I) Project Execution locations:
 - Houston, Texas
 - Nailsea, Bristol, UK
 - Oslo, Norway
 - Sao Paulo, Brazil
- Subsea System Engineering competencies and capabilities ranging from Reservoir to Riser Hang-off



Connection of Control Lines

Traditional Methods:

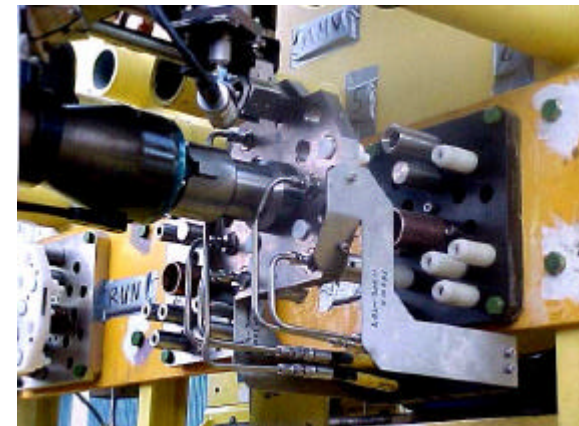
- Multibore Connectors
 - Clamp or Collet Connectors
 - Dedicated, proprietary ROT or ROV operated tooling package required for actuation
 - All metal sealing, hard piped system

Or

- ROV Jumpers
 - ROV Fly-To-Place Stab Plates
 - Thermoplastic Hoses
 - Jumpers deployed in separate basket
 - Manipulator held or TDU operated API/ISO ancillary tooling (e.g. Torque Tool) used for connection



Connection of Control Lines



Typical Pros and Cons

Pros

Multibore Connector

- Hard piped system
 - ✓ Collapse resistant
 - ✓ No permeation
- All metal connections
 - ✓ Long term integrity
 - ✓ Good thermal performance
- Subsea seal replacement
 - ✓ Good maintainability

ROV Stabplate

- Simple tooling
 - ✓ Low cost
 - ✓ Simple and robust
 - ✓ Suited for operation in remote locations
- Simple fabrication

Cons

- Expensive, proprietary tooling (ABB, KOP, FMC...)
- Tooling complexity
 - ✓ Not suited for operation in remote locations
- Complex fabrication
 - ✓ Jumpers and terminations

- Thermoplastic hoses
 - ✓ Collapse sensitive
 - ✓ Poor thermal performance
 - ✓ Permeation sensitive
- No subsea seal replacement capability
 - ✓ Jumper must be recovered to surface for repair

...The Optimum System?

Pros

- Hard piped system
 - ✓ Collapse resistant
 - ✓ No permeation
- All metal connections
 - ✓ Long term integrity
 - ✓ Good thermal performance
- Subsea seal replacement
 - ✓ Good maintainability
- Simple tooling
 - ✓ Low cost
 - ✓ Simple and robust
 - ✓ Suited for operation in remote locations
- Simple fabrication

■ ROV Jumper with steel tubes, i.e Steel Tube Flying Lead

+

■ All metal connections

+

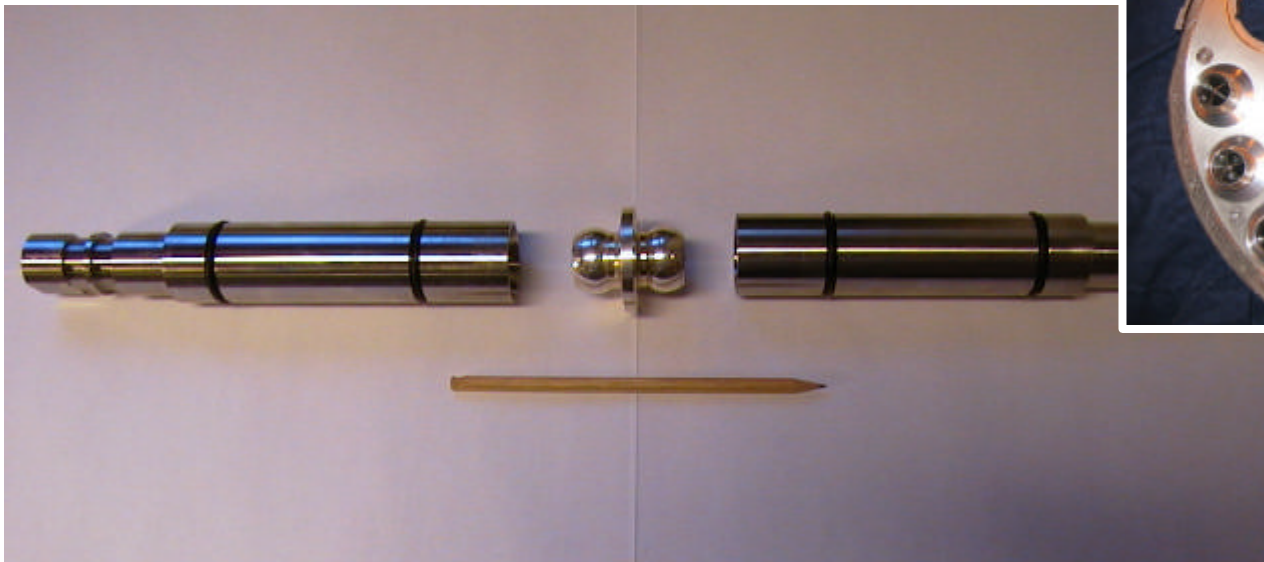
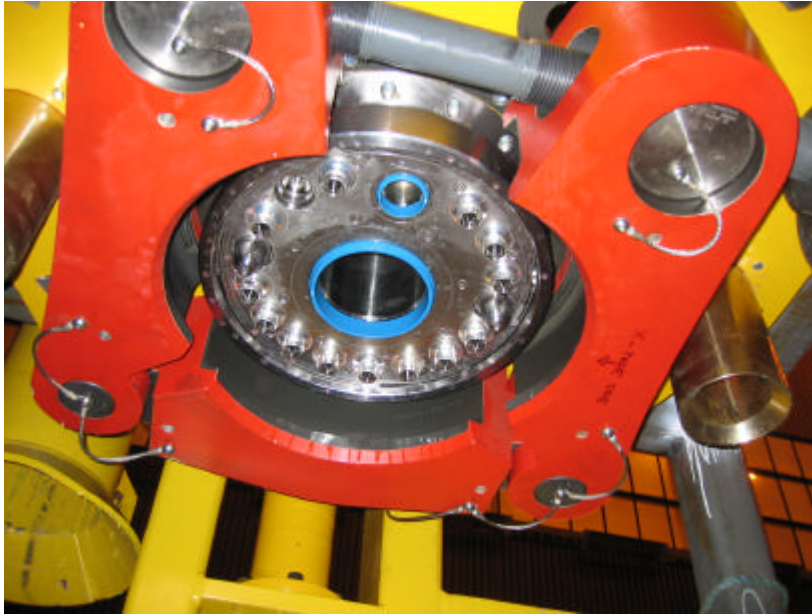
■ Subsea seal replacement

Steel Tube Flying Leads.....

- Used extensively in Gulf of Mexico
 - ✓ Down to 2,200 m water depth
- System normally based on ROV stabplate with National type hydraulic couplers
 - ✓ No subsea seal replacement
- Same system used both for umbilical and STFL connections
- Caterpillar / tensioner and chute required on vessel

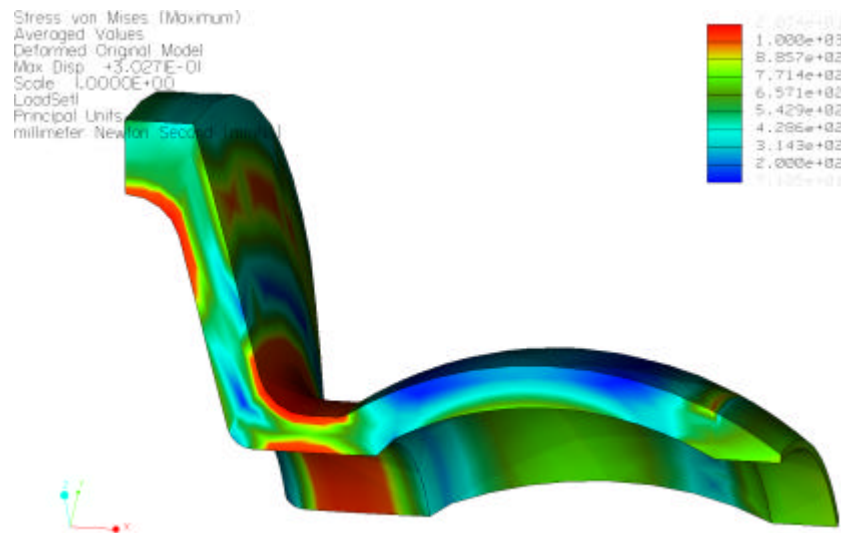
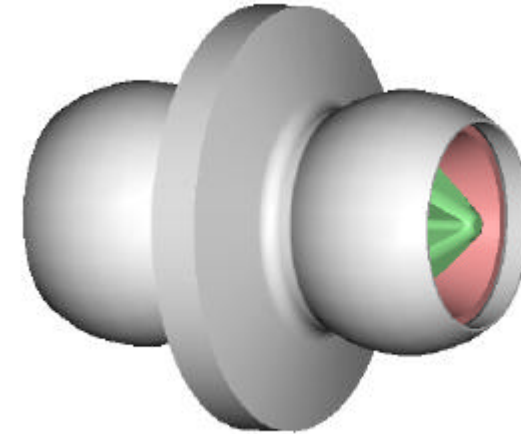


....combined with Seal Plate Technology

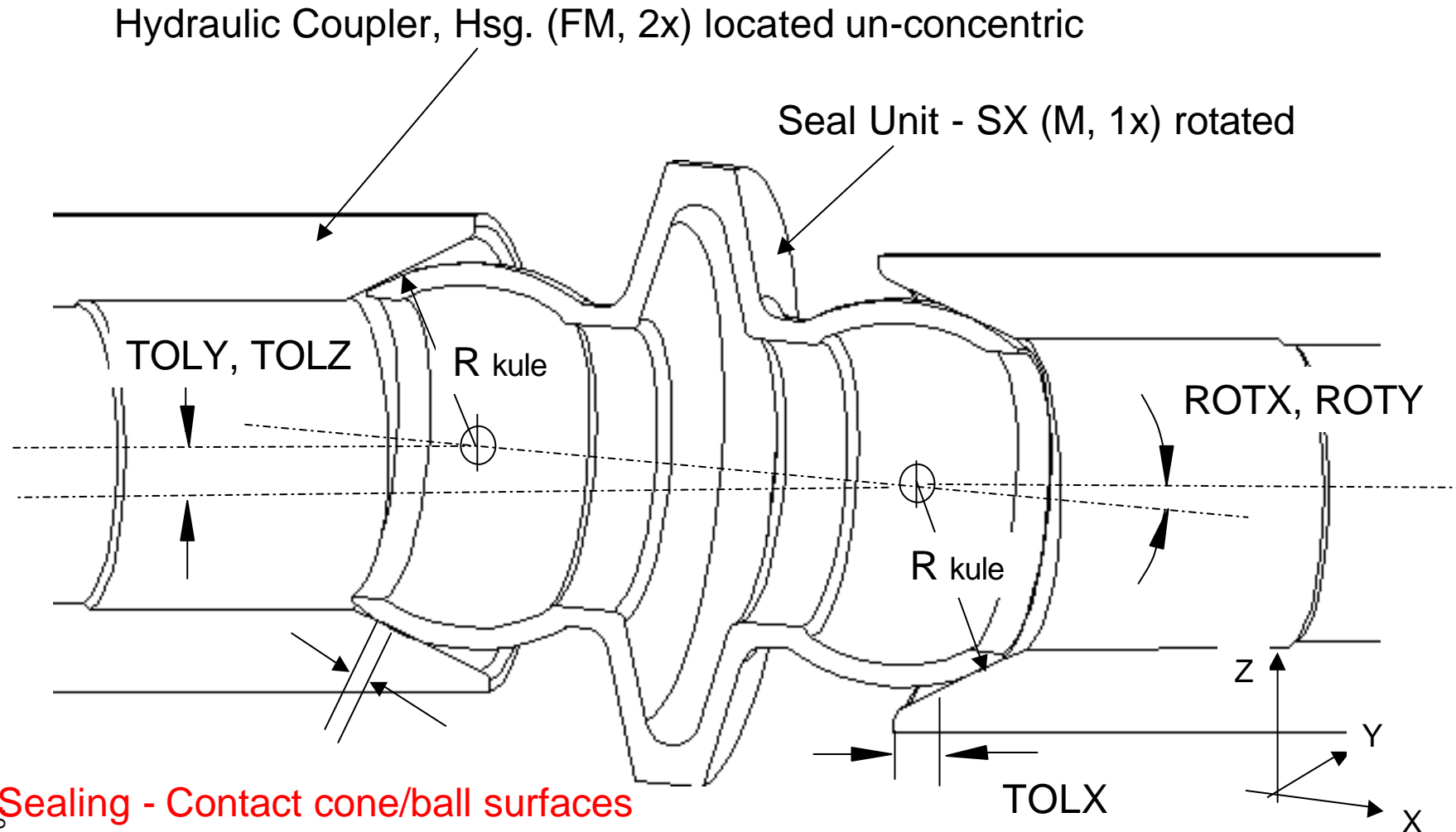


The SX Coupler

- Dual spherical sealing surfaces
 - ✓ Dual Ball / Cone sealing system - High angular and lateral misalignment capability
- Bellows style flexible mid-section
 - ✓ Accommodates large axial tolerances
- Used on the Snøhvit Project

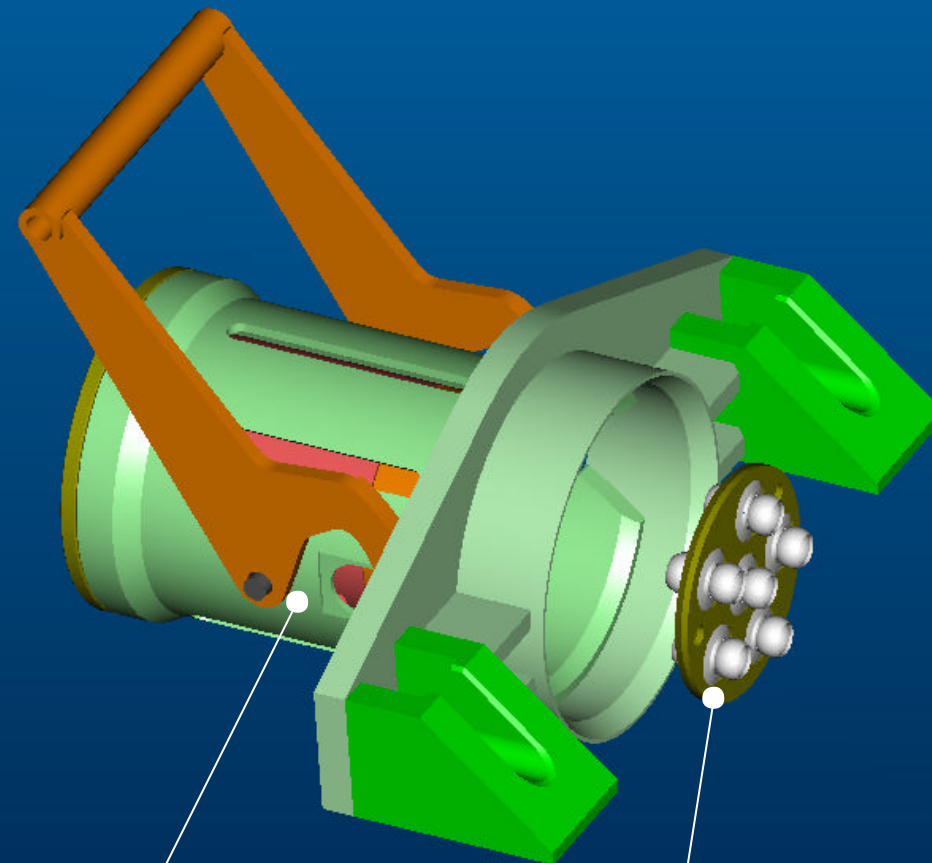


The SX Coupler



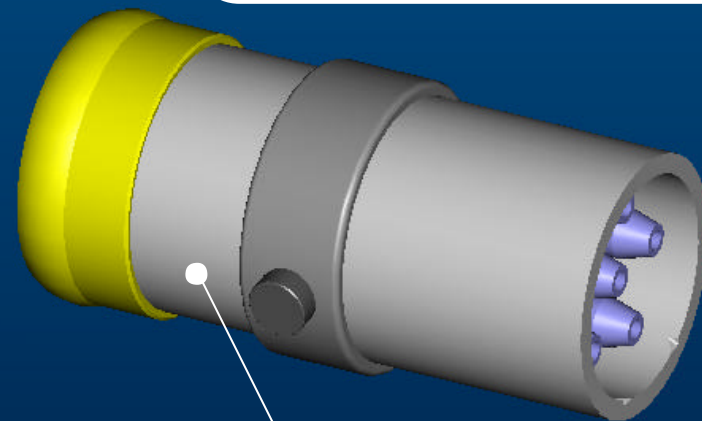
The RACE System

- ROV Advanced Connection Evolution
- ROV jumper / Steel Tube Flying Lead connection system, based on SX coupler and seal plate
 - ✓ All metal sealing
 - ✓ Facilitates subsea seal replacement



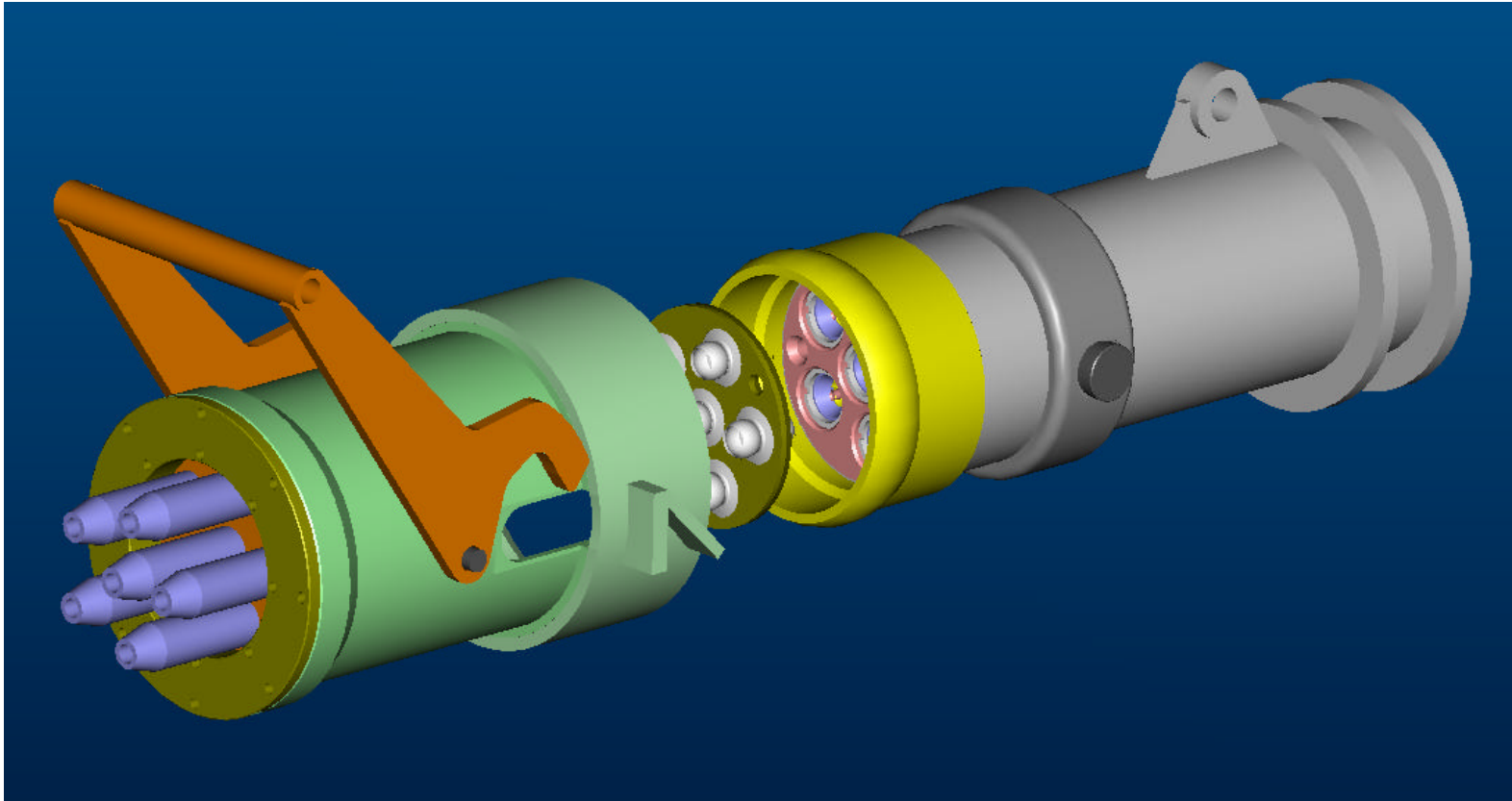
Inboard Receptacle

Seal Plate with SX seals

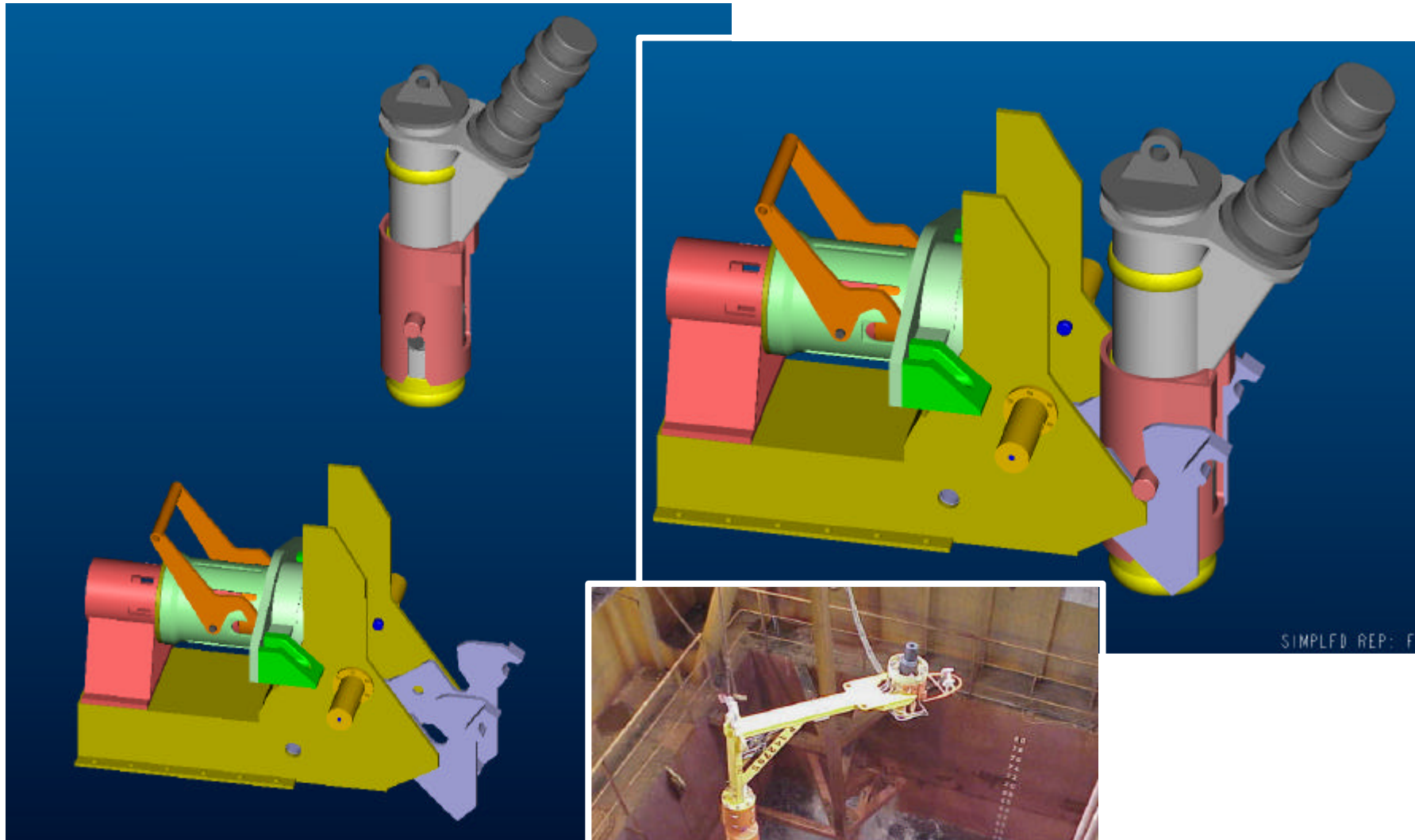


Jumper Termination

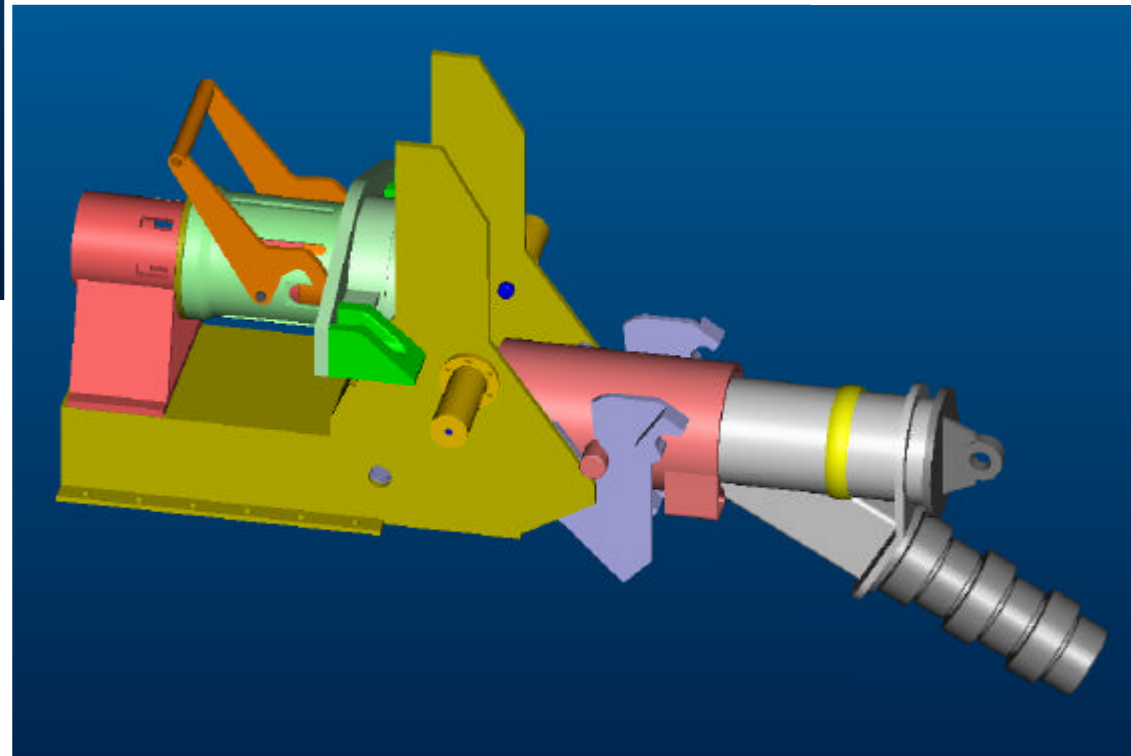
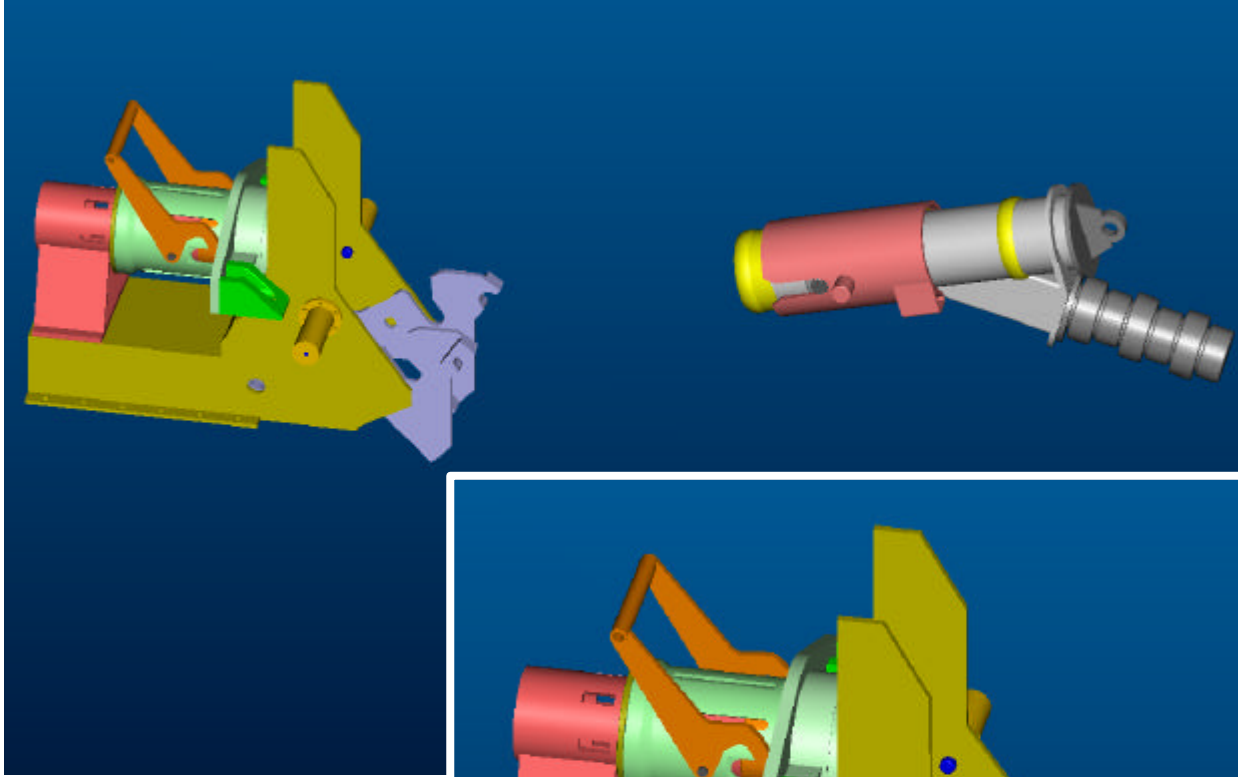
The RACE System



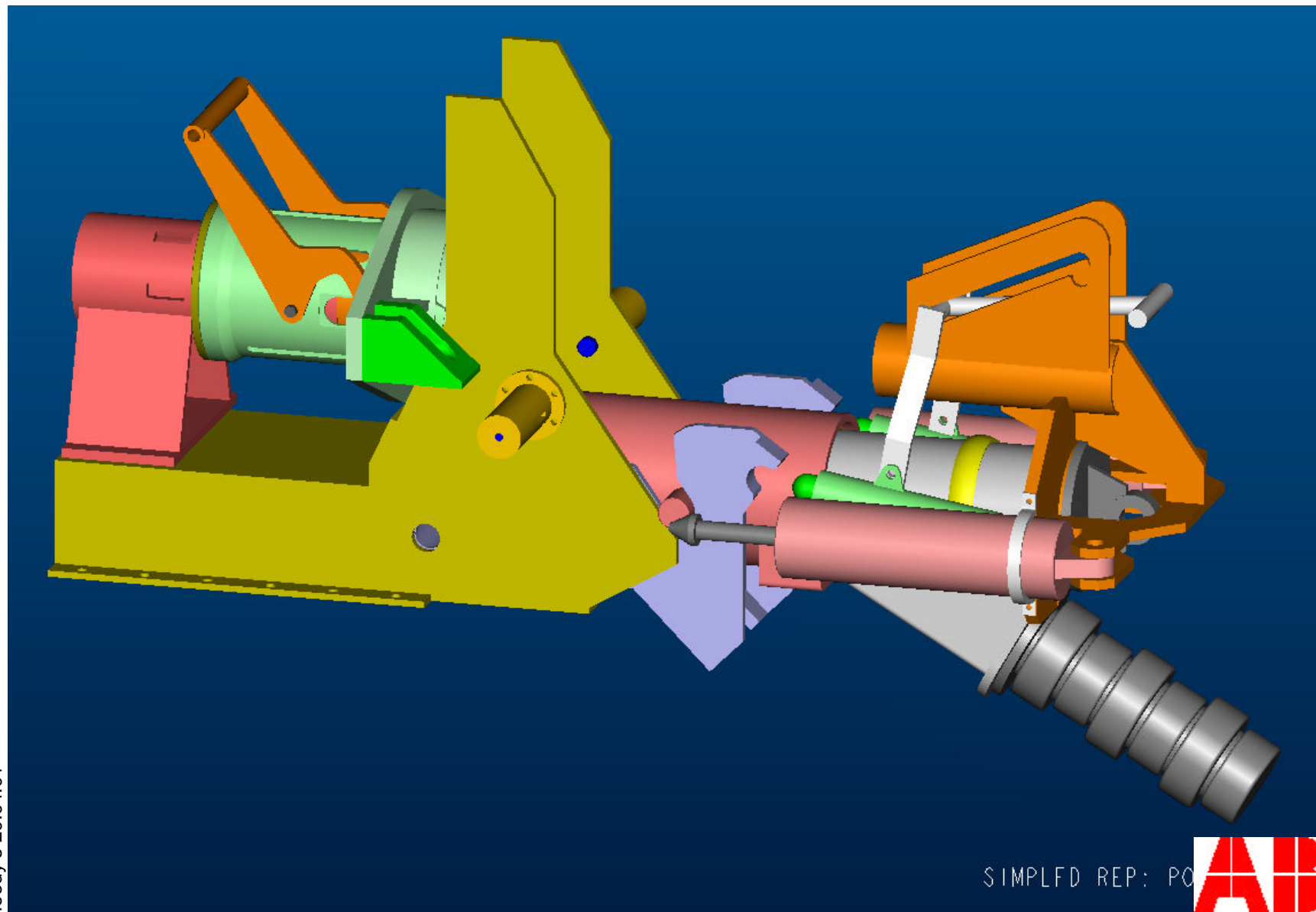
1st End S&HO Installation



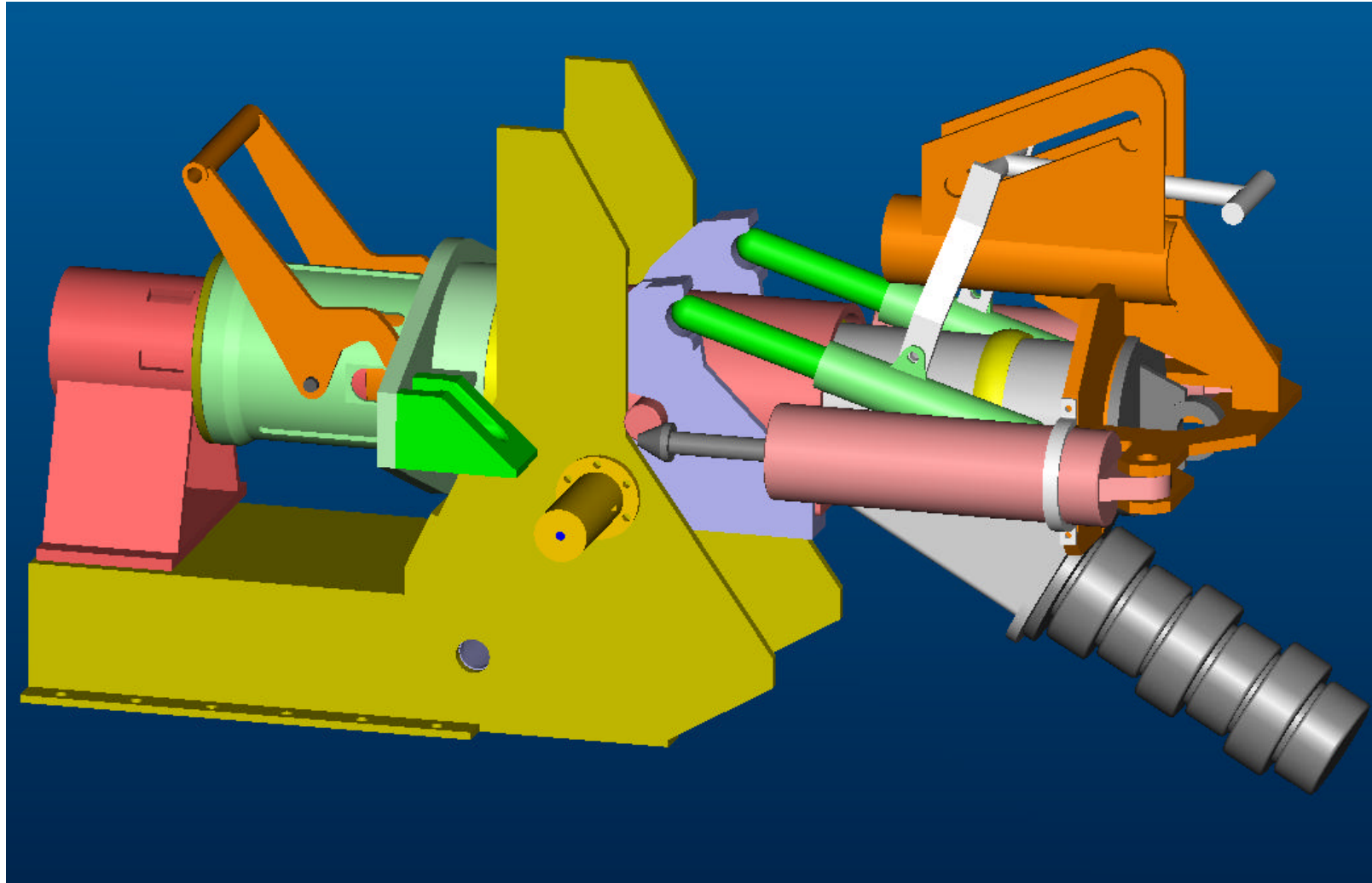
2nd End Laydown



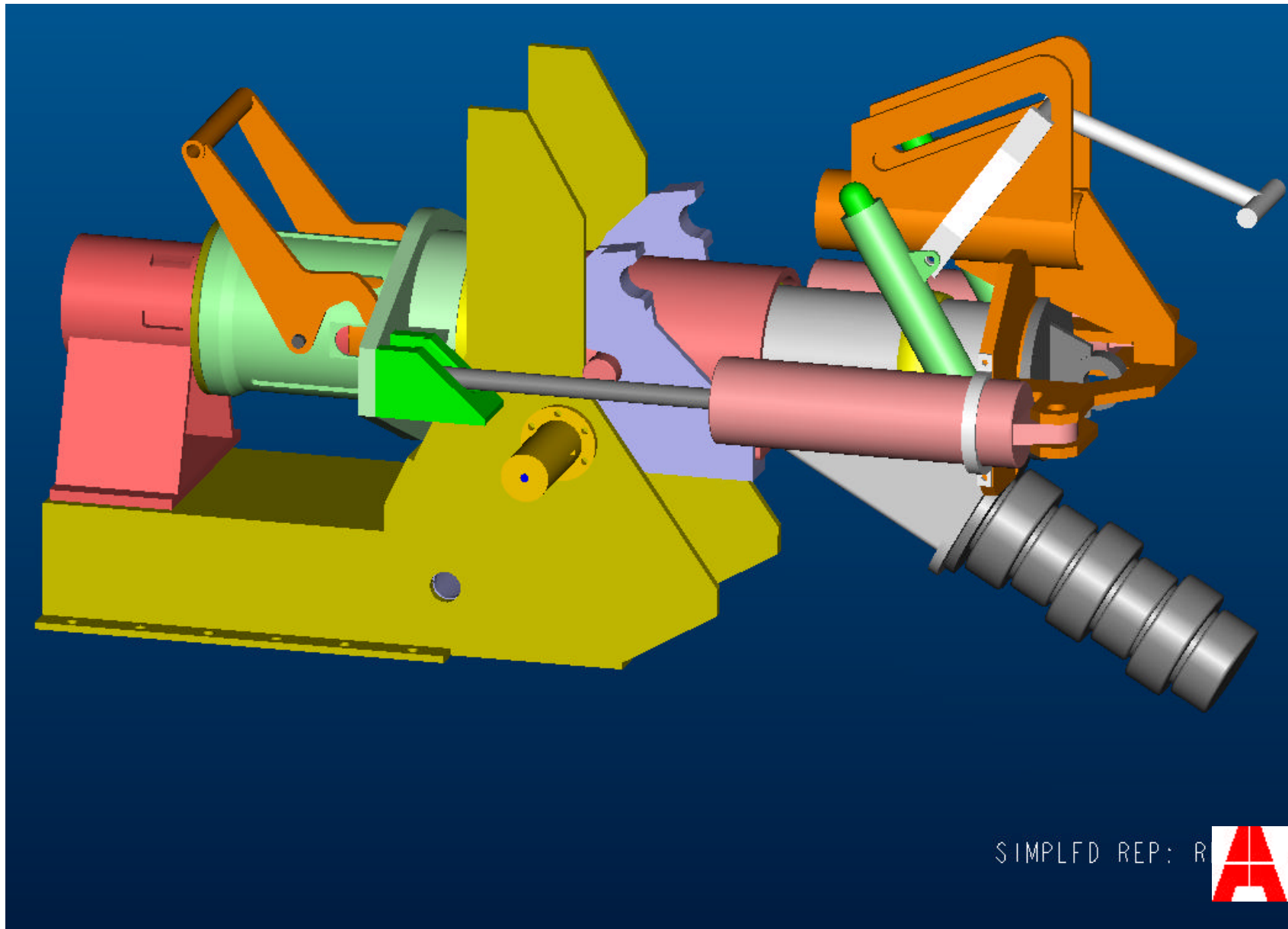
Connection Tool in place



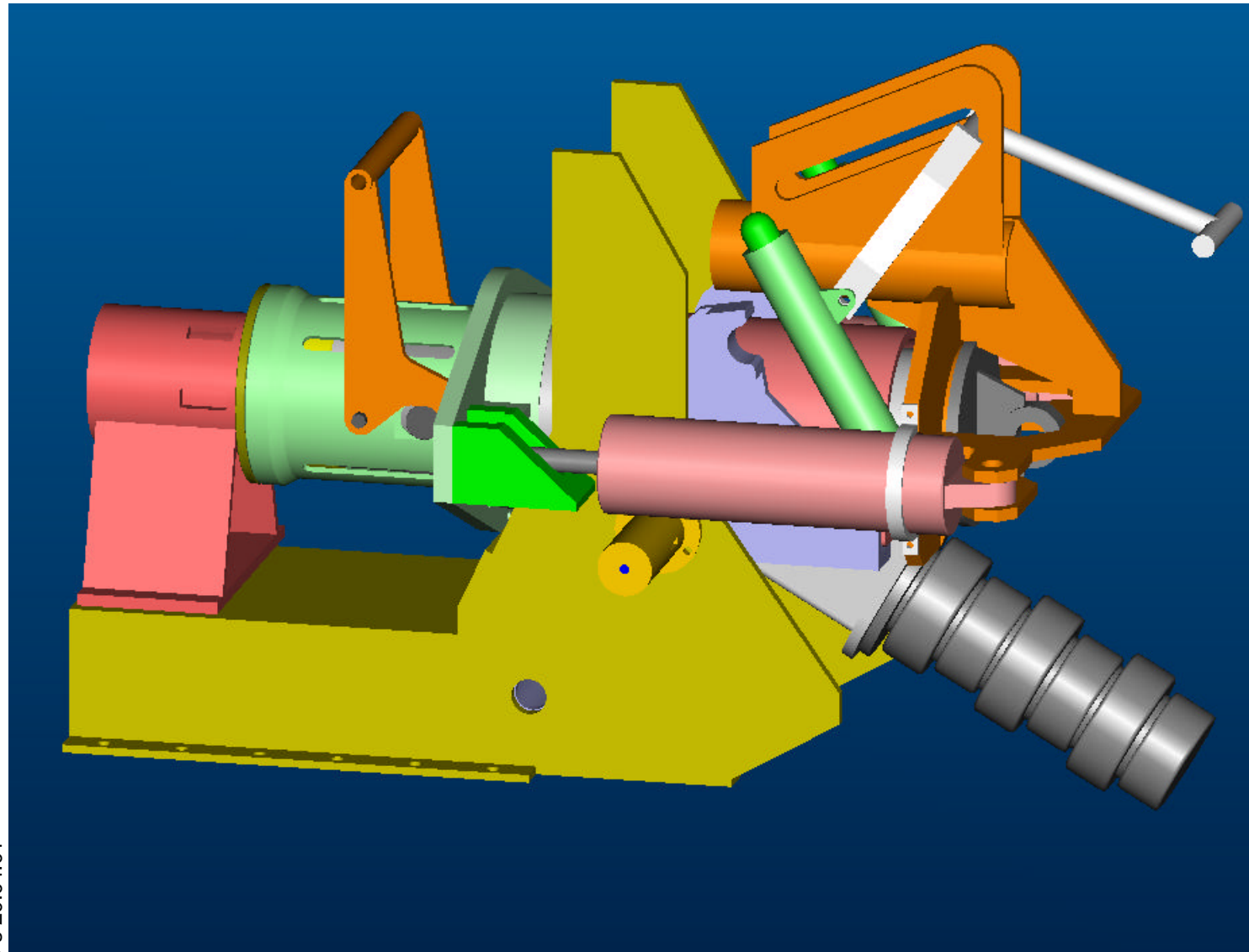
Hinge-up



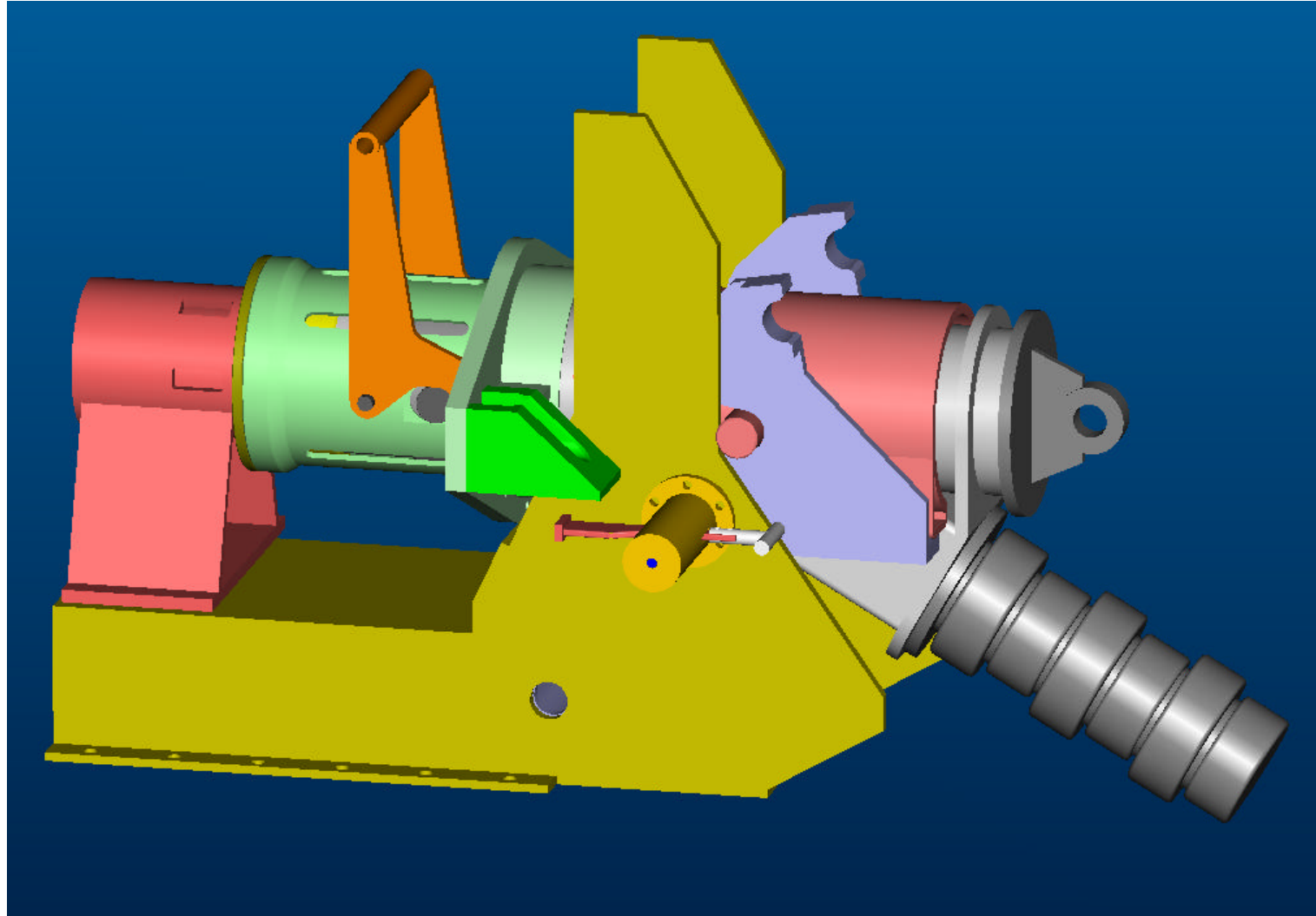
Engage Stroke-in



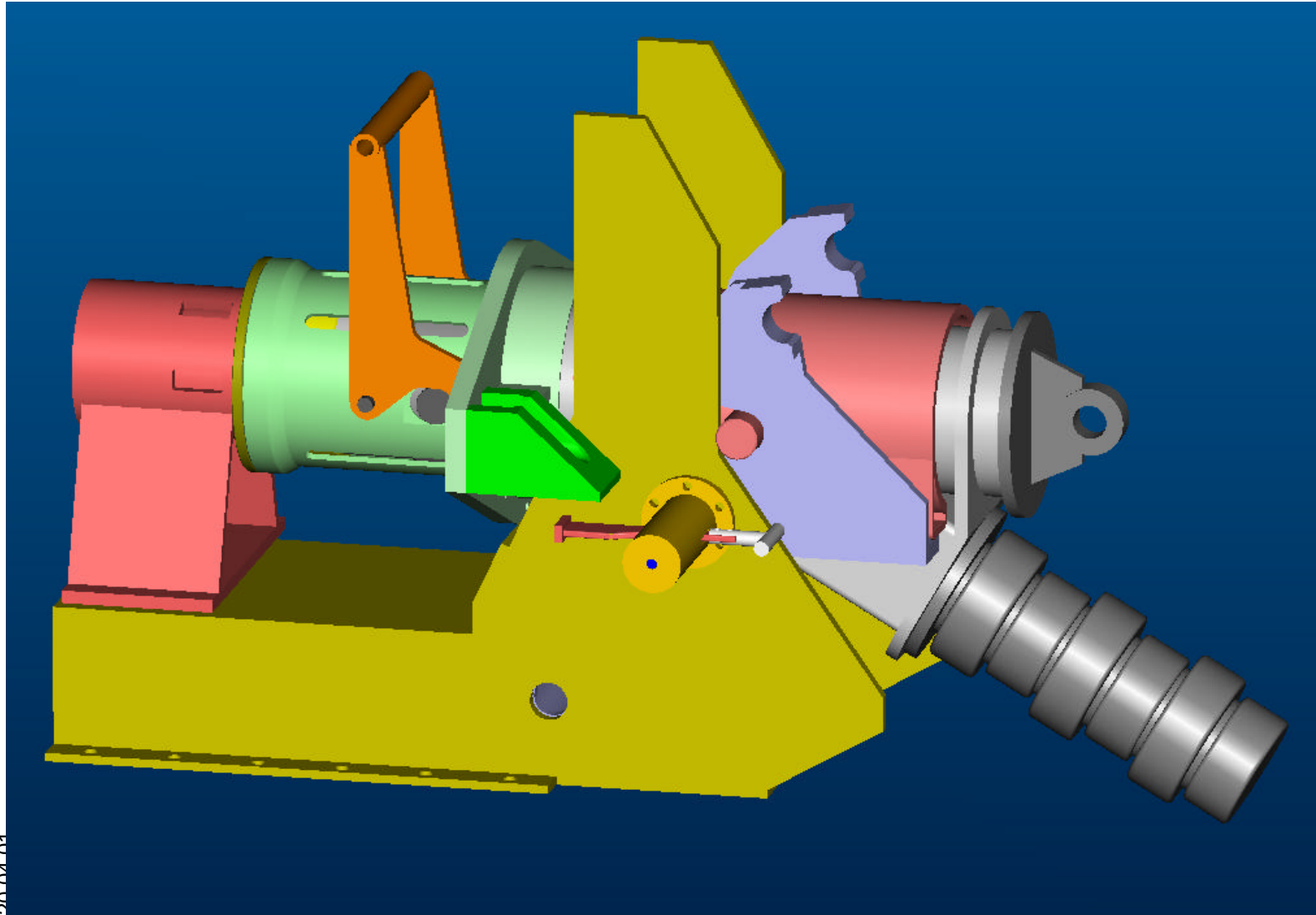
Stroke-in completed



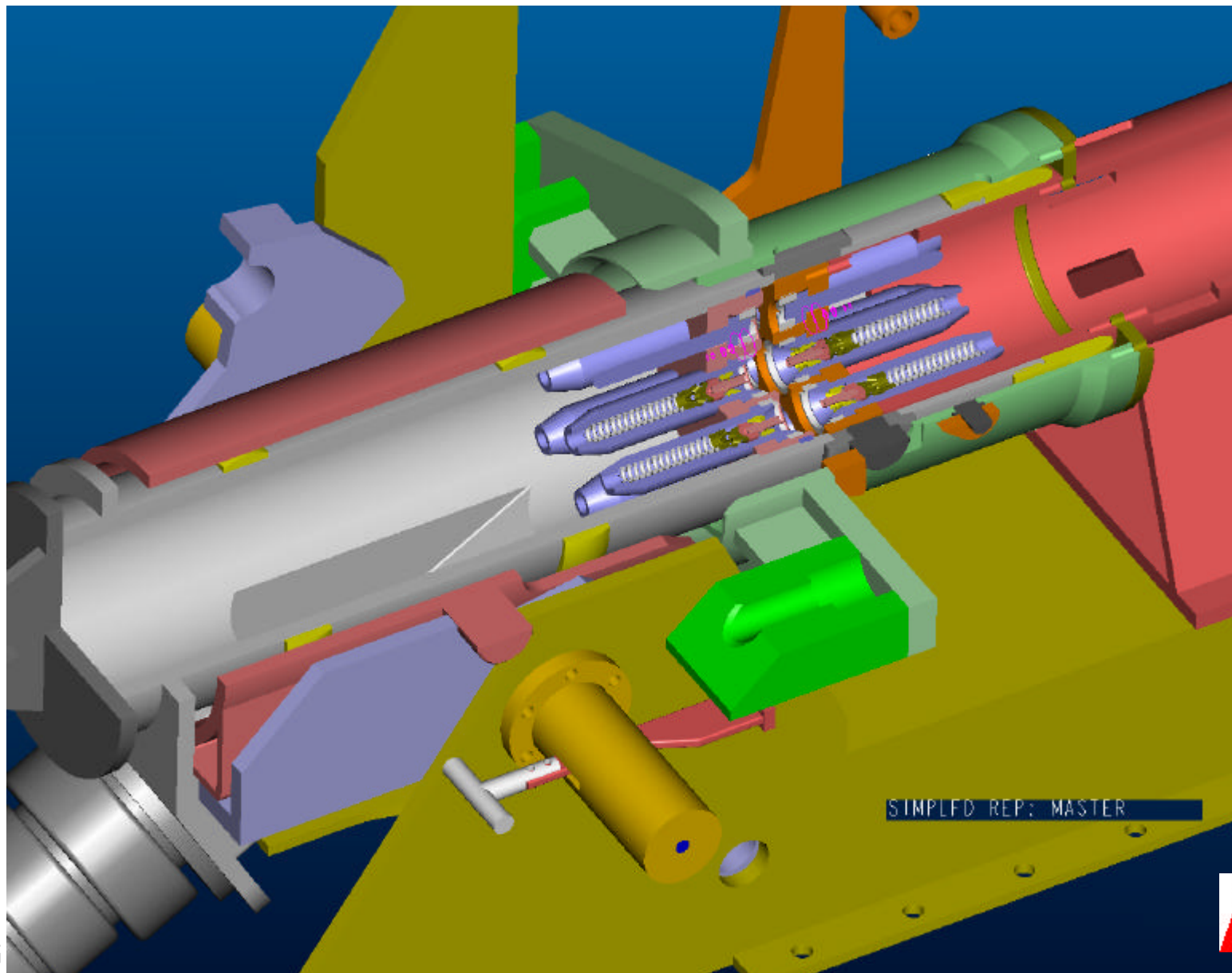
Engage Latch



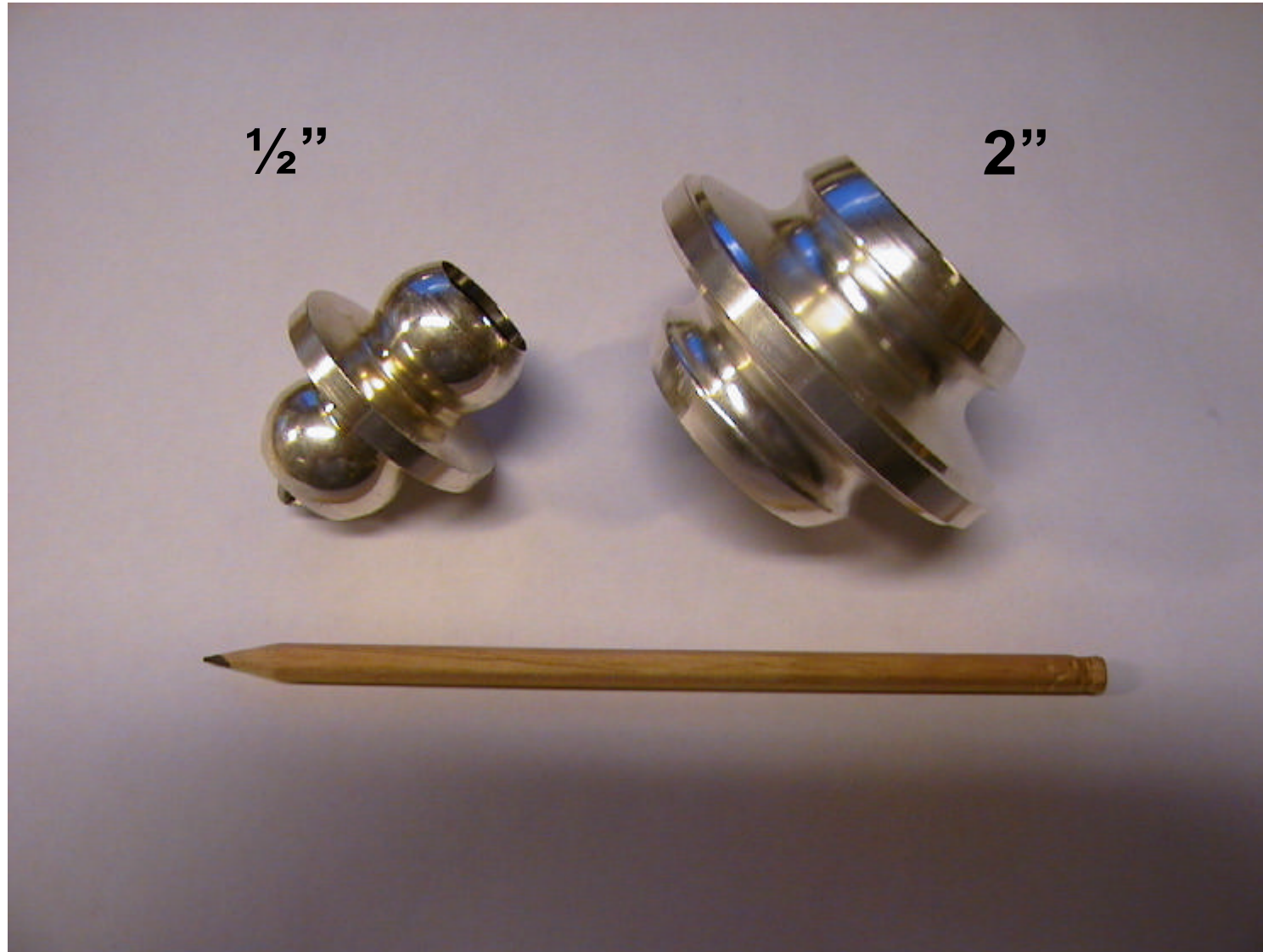
Connection completed



Connection cross-section



2" Monostab (MeOH / Gas Lift Service)



Testing and Verification

- Performance verification testing of ½" SX coupler performed at DnV
- ½" SX coupler used in umbilical and choke bridge connections on Snøhvit
- Performance verification testing of 2" monostab coupler planned for spring 2004
- Full scale prototype test of RACE planned for spring 2004
 - ✓ Dry test, simulating handling of Steel Tube Flying Leads
 - ✓ Shallow water test, verifying ROV operations
- SX couplers and RACE planned for use in deepwater subsea projects during 2004



The image shows two large, flatfish-like fish, possibly turbot or flounder, resting on a dark, textured surface. They are positioned horizontally, with their heads facing left. The fish have a mottled, greyish-blue pattern on their skin. Above them is a curved, rusty metal edge, likely part of a ship's hull or a large container. The text "THANK YOU FOR YOUR ATTENTION" is overlaid in white, bold, sans-serif capital letters across the middle of the image.

THANK YOU FOR YOUR ATTENTION



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e-mail: subsea@no.abb.com