



RWOCS: ROV Workover and Control System

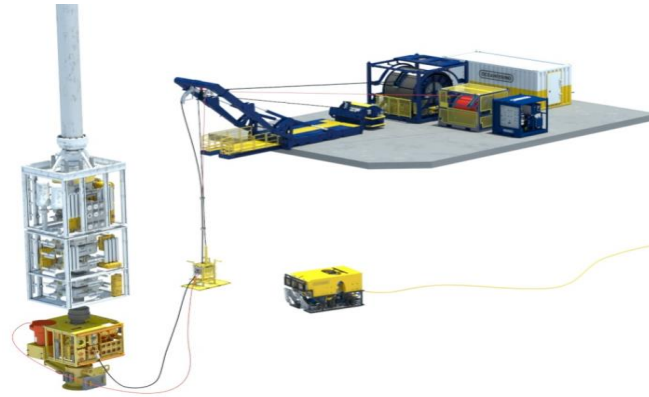
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Oceaneering



WOCS Options for Deployment

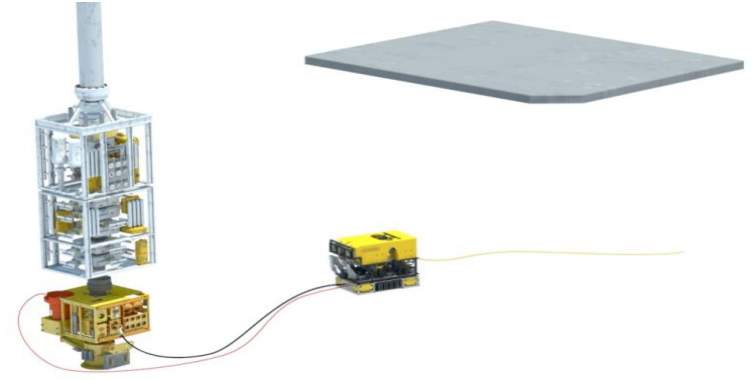
Traditional and High-Tech Solutions

- Six standard deployment options
- More flexibility in configuring your ideal WOCS solution than with any other service company.



Traditional LARS

1. Clamped to riser
2. Dual-guide wires
3. LARS (conventional umbilical)



High-Tech RWOCS

4. LARS (self-supporting umbilical)
5. RWOCS
6. Providing fluid subsea

What is RWOCS?

ROV Workover and Control System

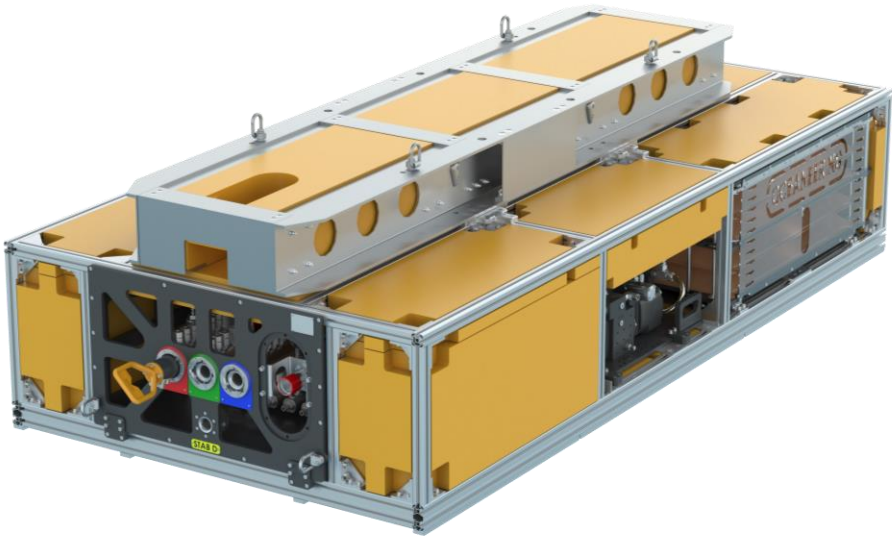
- RWOCS is a skid designed to install, test, commission, and intervene in a subsea X-mas tree, but can also be used as a chemical delivery system to a manifold or PLET.
- It can either be mounted to an ROV or deployed separately with a LARS.
- With this unit, all pumping and testing pressure is contained subsea during the operation. (no high-pressure exposure for technicians or others).
- The system will be operated through its own umbilical in the standalone mode (LARS) and through the ROV umbilical and tether in ROV mode.
- It is capable of pumping multiple fluids subsea at 15,000 psi.
- The modular design makes it flexible to customers needs.

RWOCS Evolution

- The evolution of skid-based systems for X-mas trees within Oceaneering began with our first-generation tree-on-wire skid.
- Later, we built the next-generation ROV power skid recently run for Statoil.
- Today, we combine what we have learned to introduce the RWOCS.



RWOCS System



Skid

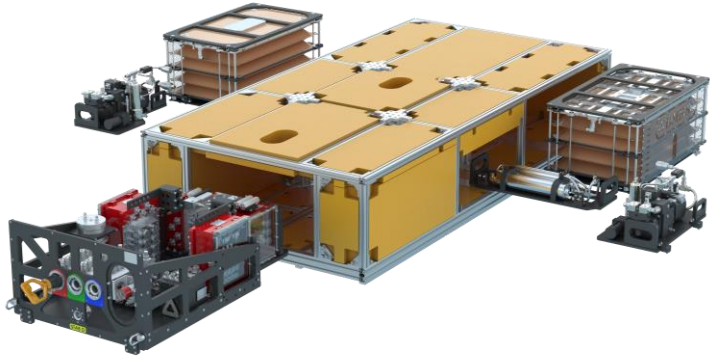


Test HPU



Test Unit

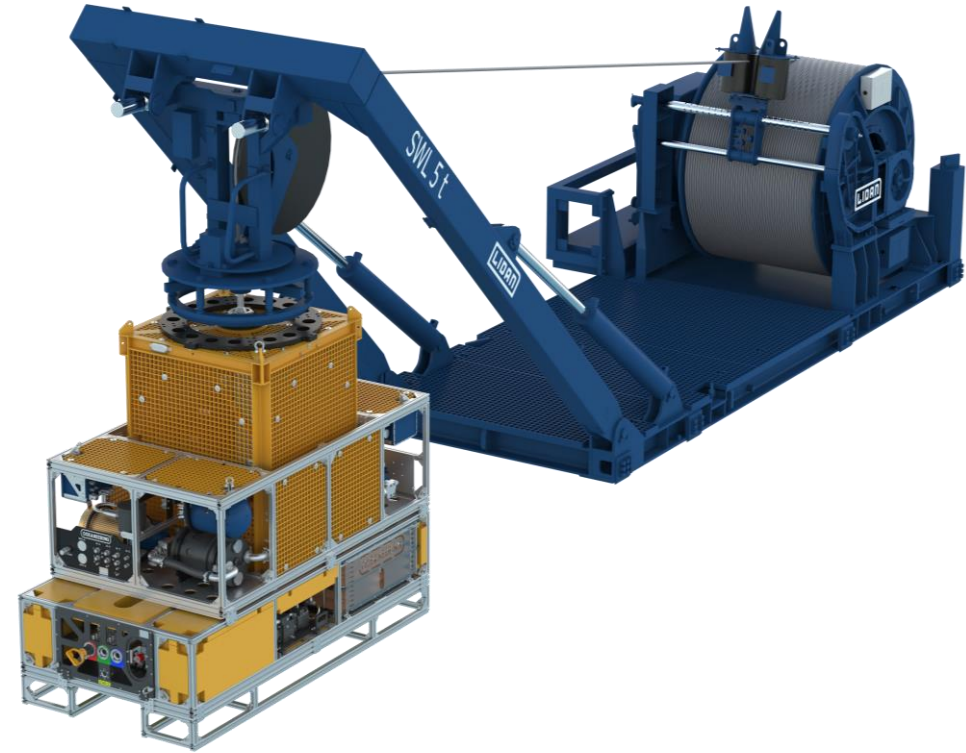
RWOCS Configurations



Skid



ROV Configured



Standalone Configured

RWOCS Highlights

Typical Operation Modes

- X-mas tree installation/recovery
- Completion operations (XT MQC)
- Auxiliary operations (tubing spool/flowline connector, chokes, etc.)

Specifications

System

- Redundant 5,000-psi HPU
- Redundant 15,000-psi boosters
- Fully redundant subsea control system
- Fully redundant sensors (PTs/FMs)

Fluids

- Control Fluid
 - 11 × 15,000 psi functions
 - 4 × 5,000 psi functions

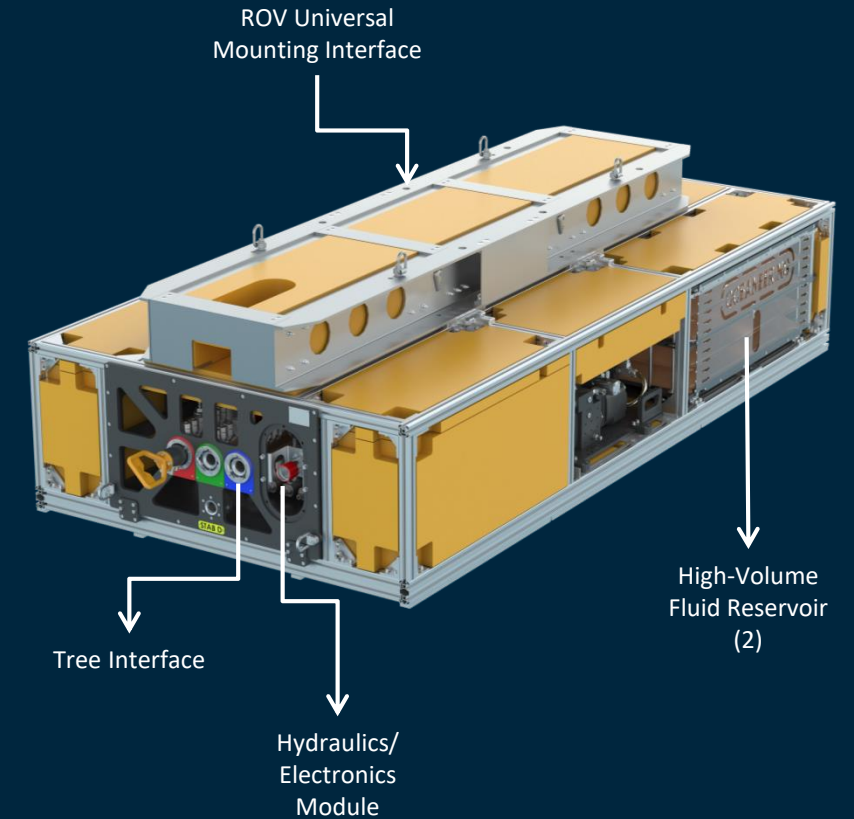
- Volume: 300 L (80 gal)
- Option for collecting and separating dirty fluid
- Chemicals
 - 1 × 15,000 psi HP chemical test Circuit
 - Volume: 300 L (80 gal)

Sensors

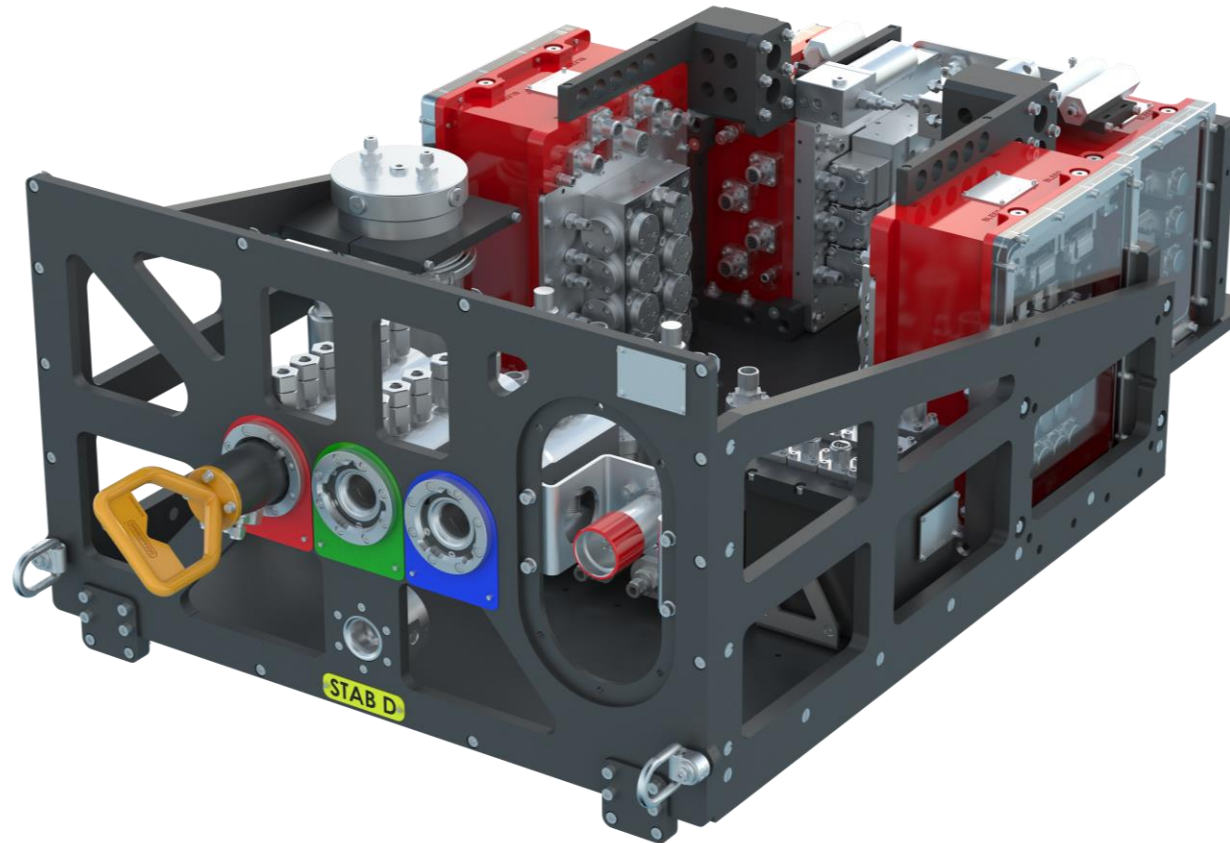
- Pressure reading on all functions
- Reservoir accumulated flow
- High-accuracy flow reading of special functions

Logging

- Pressure logging of functions
- Flow and pressure graphs (signatures of functions)



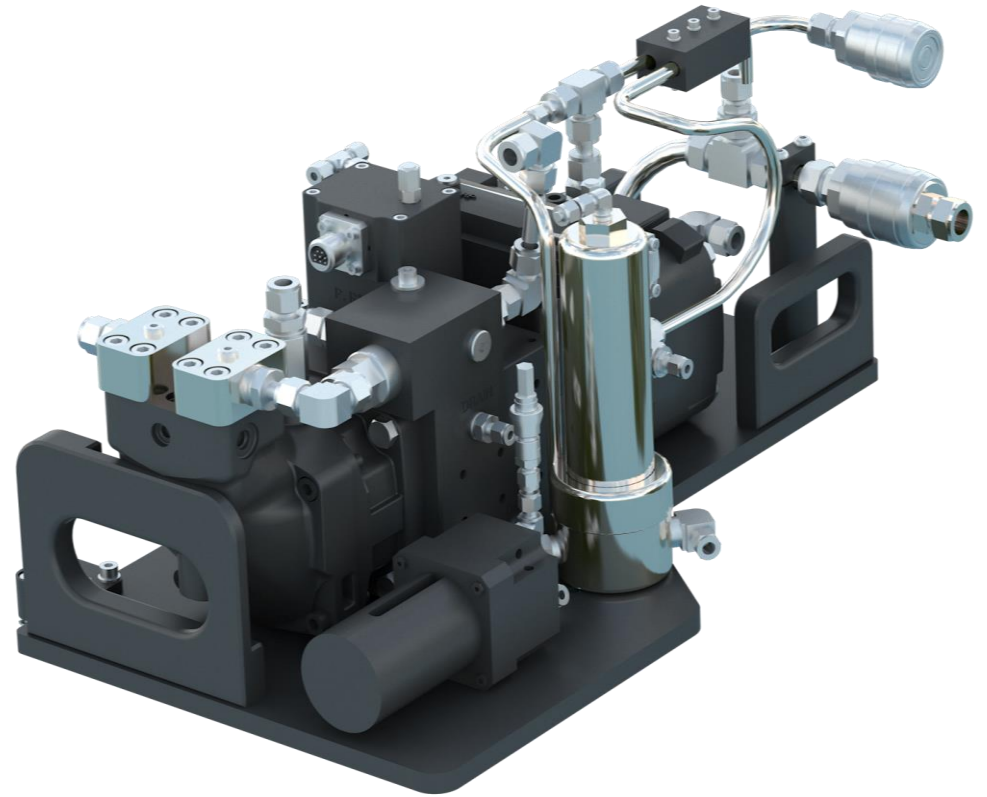
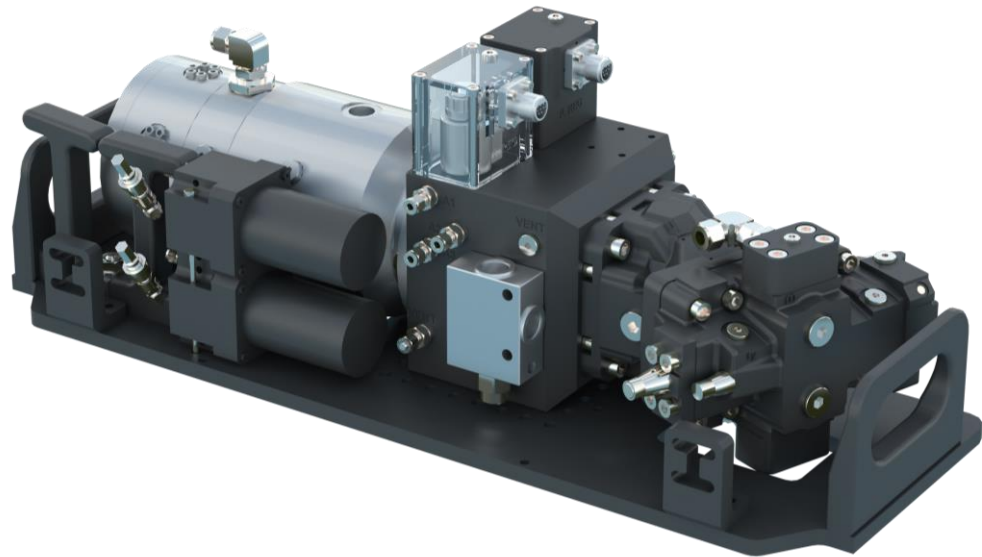
RWOCS Tray



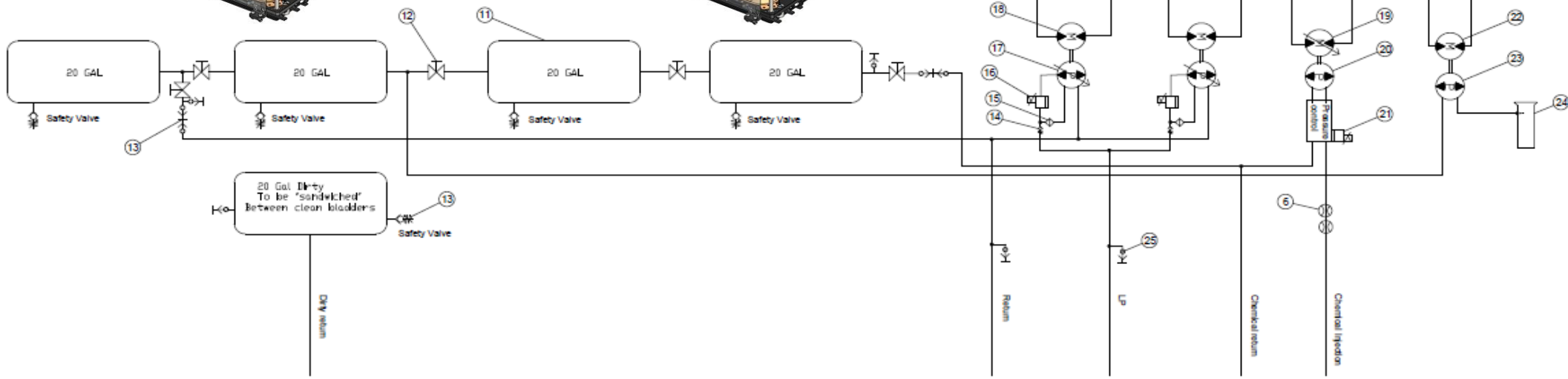
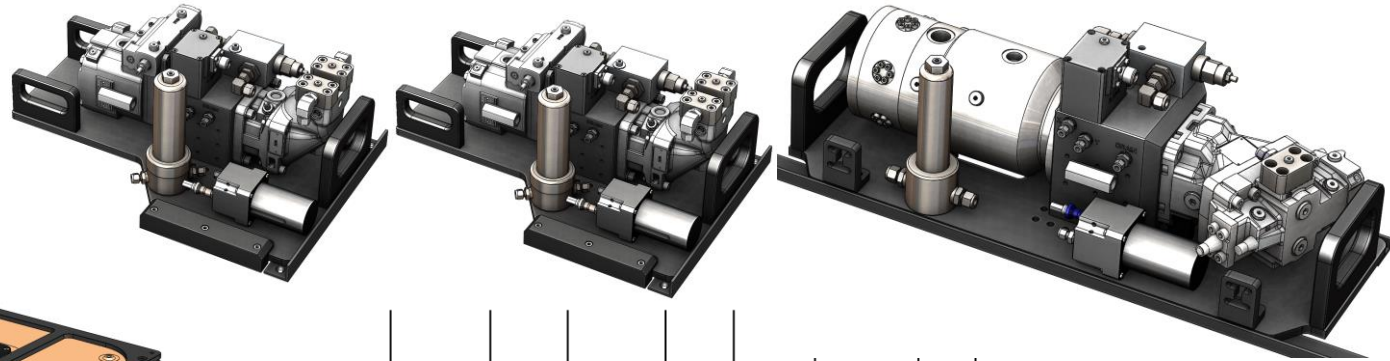
RWOCS Fluid Reservoirs



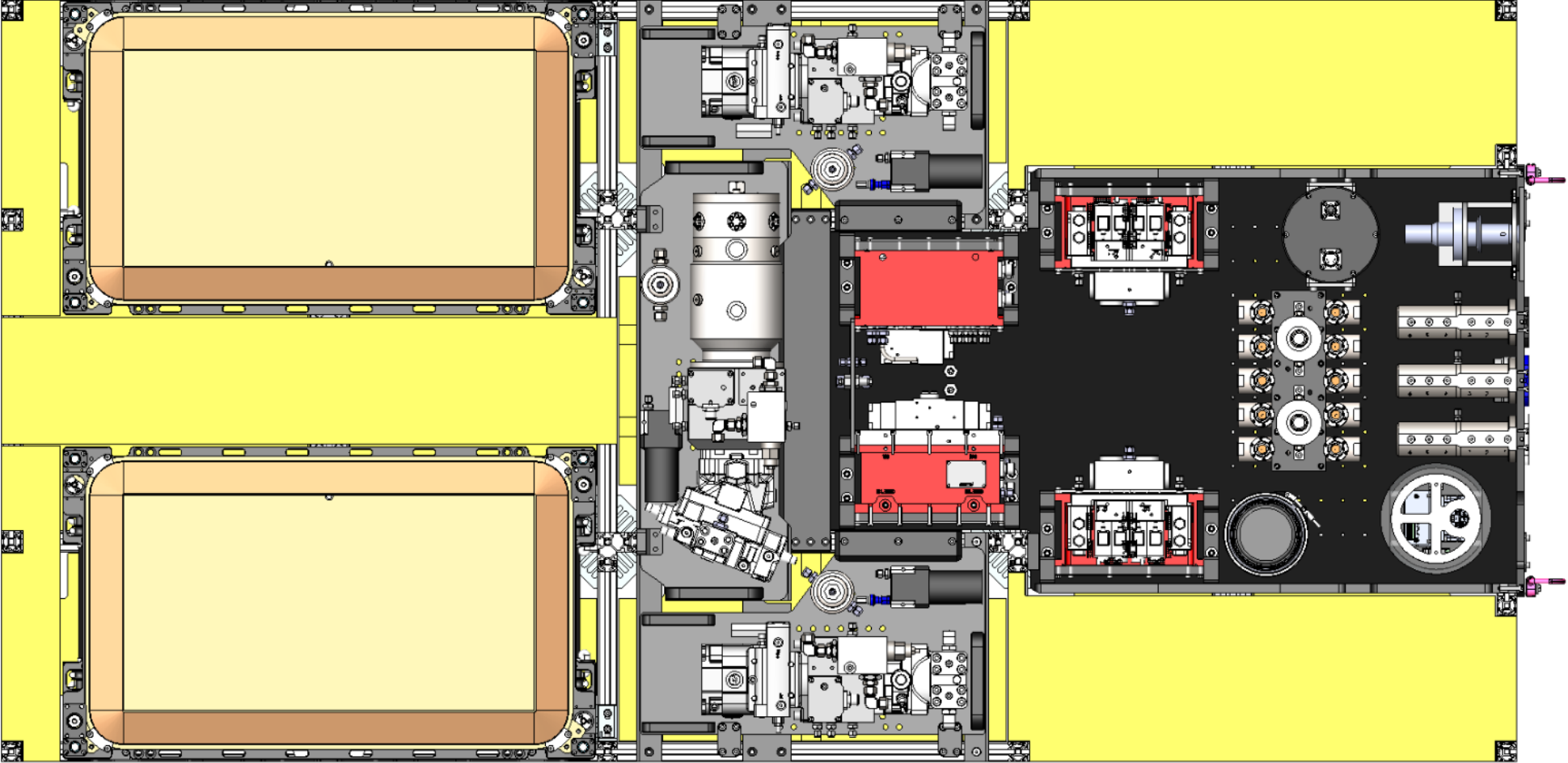
RWOCS Chemical Pump and Glycol Pump



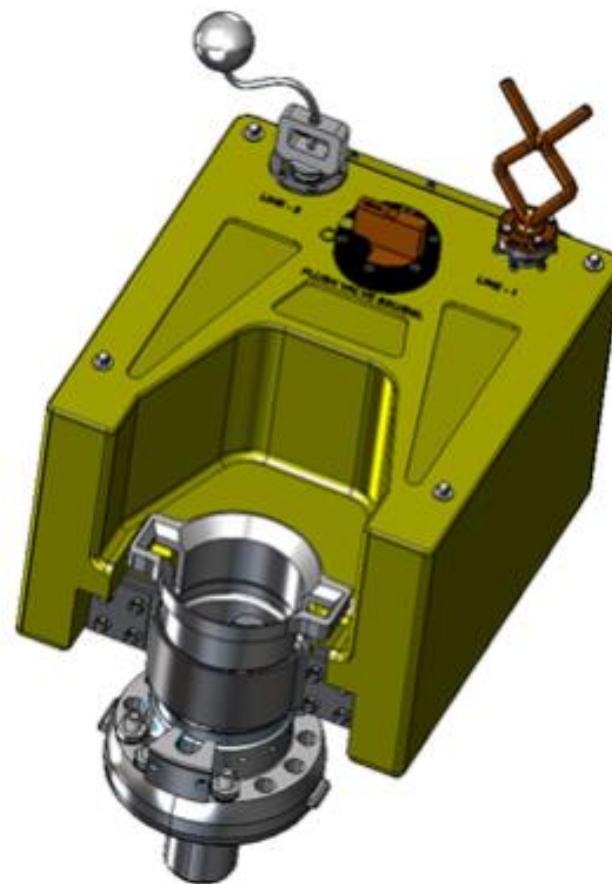
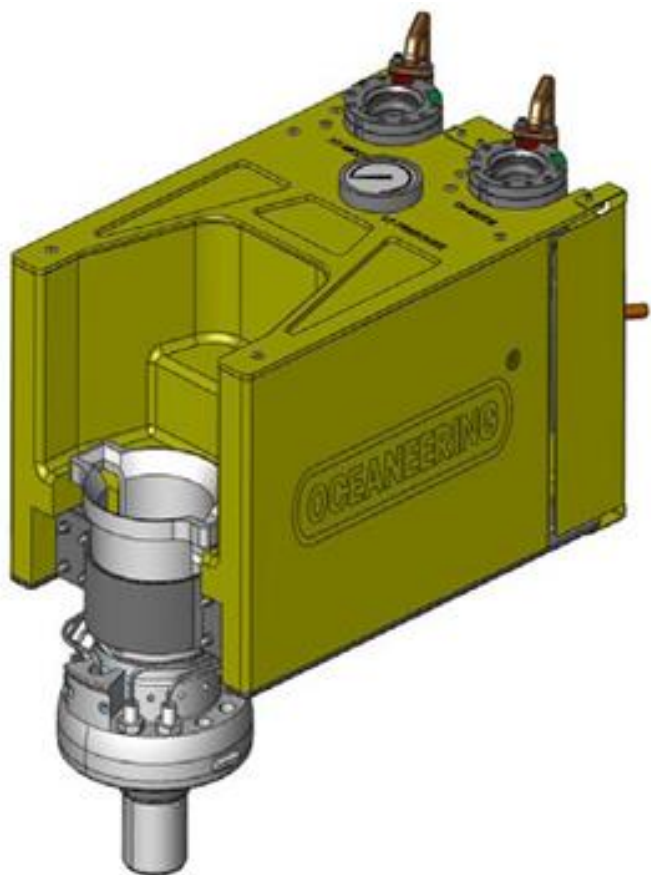
RWOCS HPU & Reservoir Hydraulics



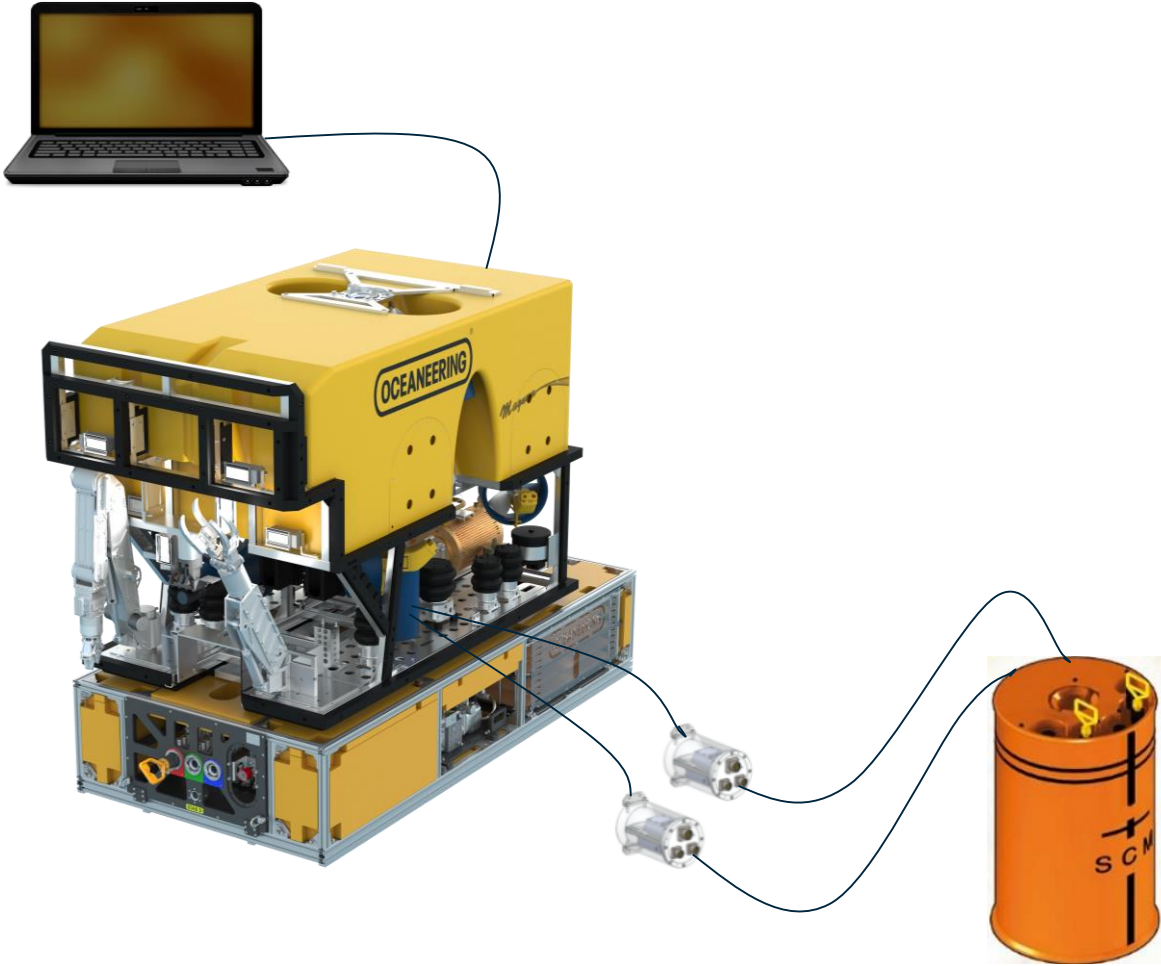
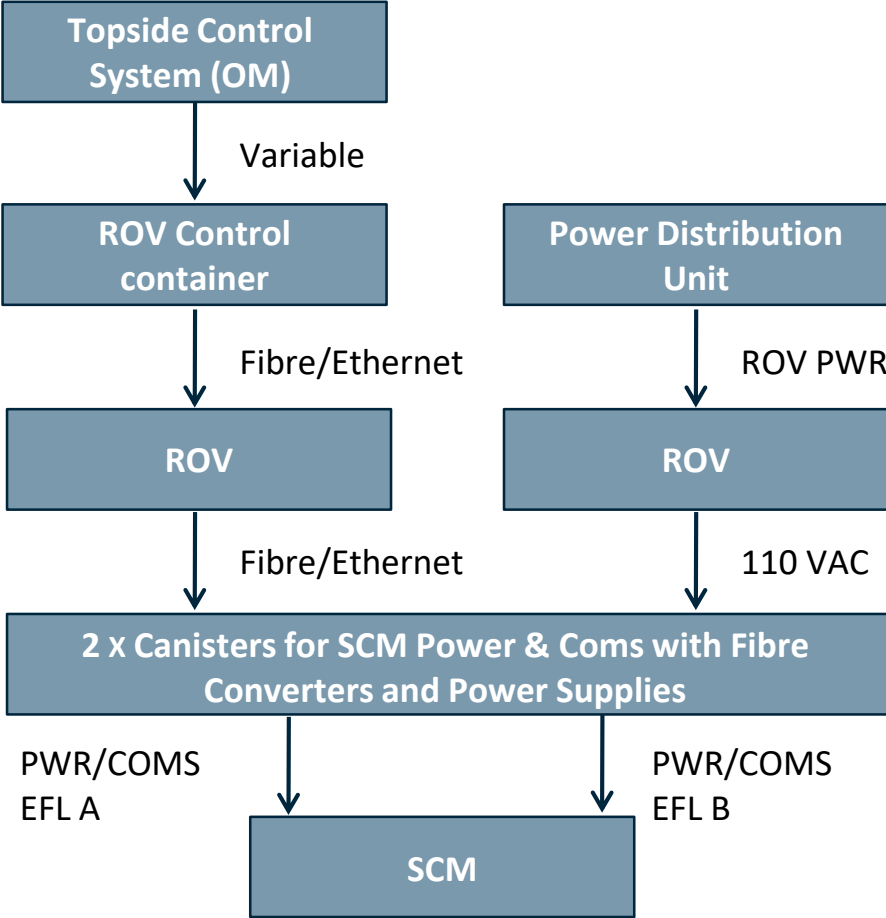
RWOCS Component Overview



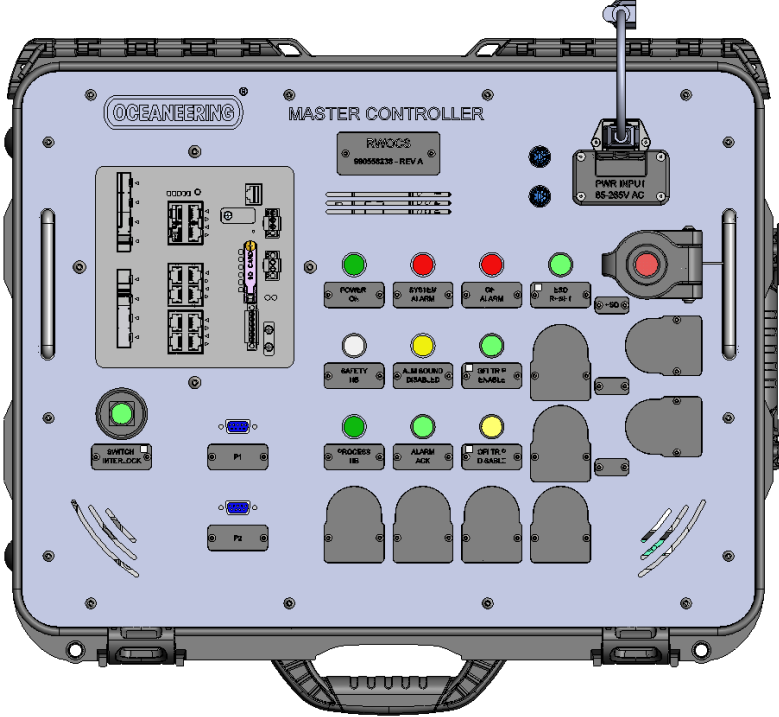
RWOCS Hydraulic Interface to XT/SCM



RWOCS Power/Communication Diagram: Interfacing to SCM



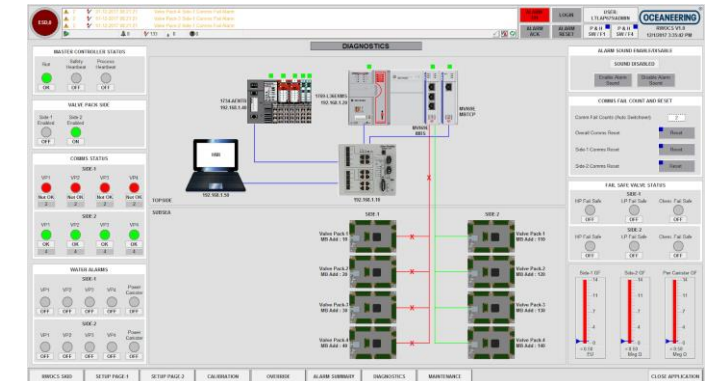
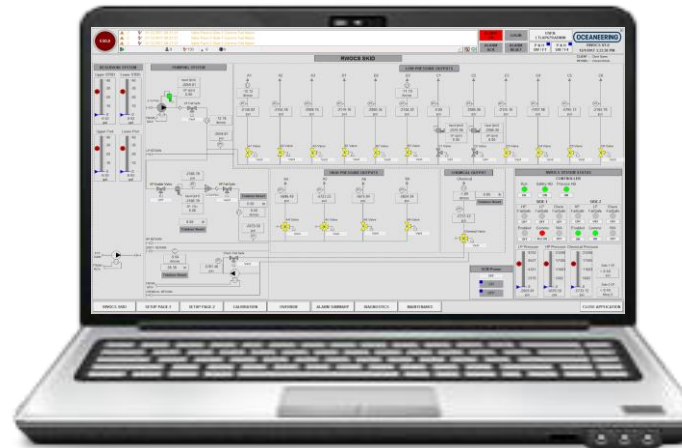
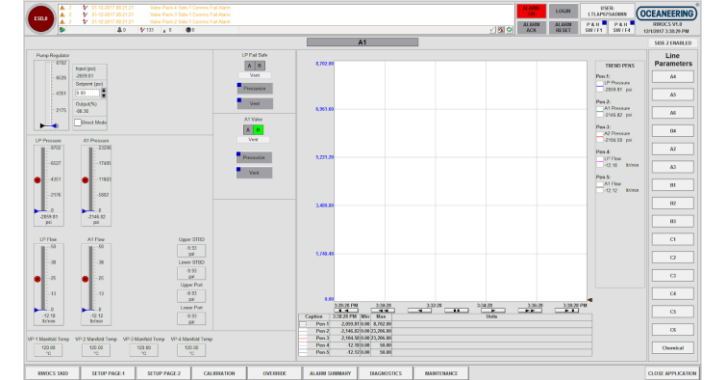
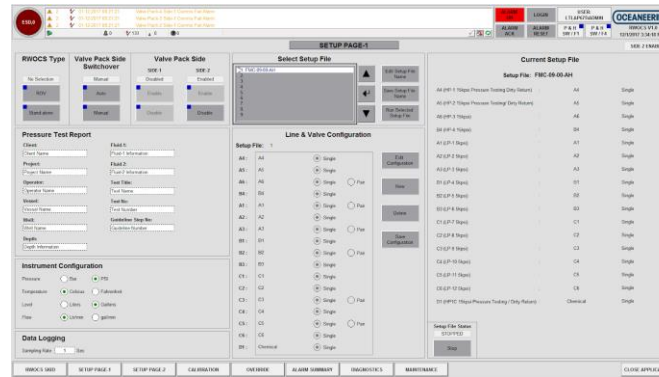
RWOCS Master Controller



RWOCS Controls and Condition Monitoring

Features

- Pre-set of test parameters
- Automatic notification when test parameters have been met
- Manual override possible on all automated functions
- Full pressure test report automatically compiled after completion
- Fully automated valve cycling available



RWOCS Technology Enables Cost Savings

What sets this solution apart?

With our IWOCS and ROV domain knowledge, Oceaneering is best prepared in the industry to leverage this opportunity.

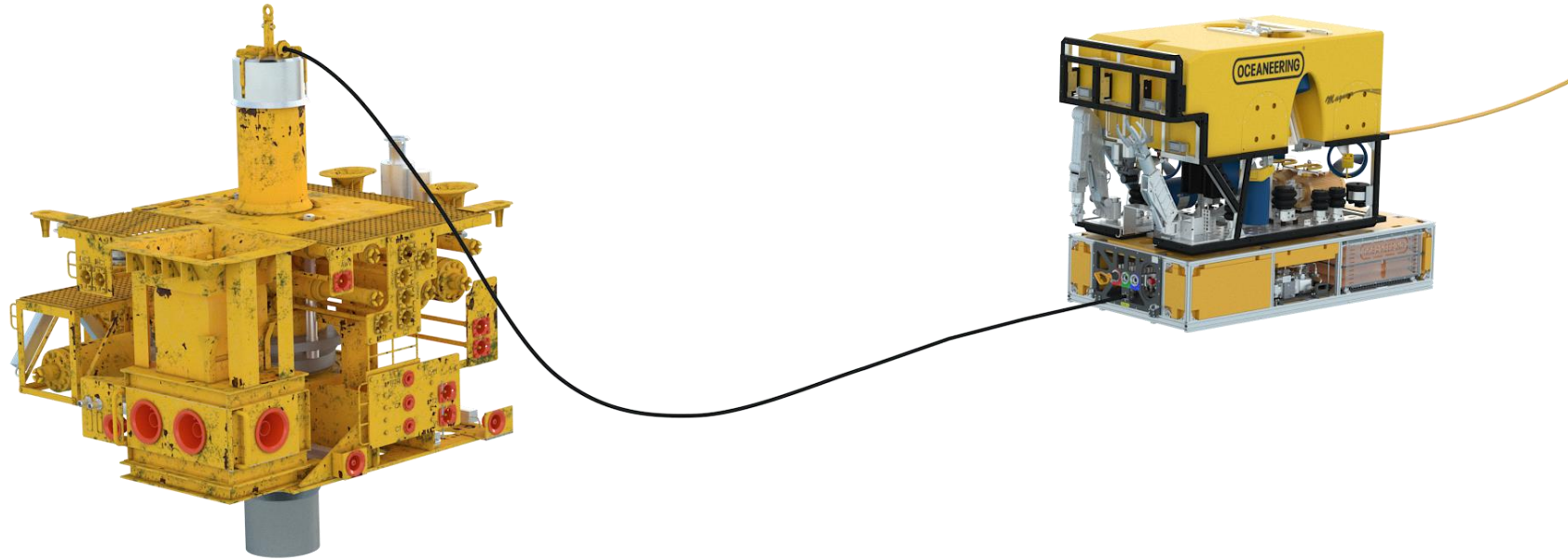
- Configured to meet your specific needs.
- Built in redundancy using field-proven technology.
- Accommodates multiple operational situations.
- Works with multiple ROVS.
- ROV crew can be trained over time to operate system, reducing POB.
- Reduces footprint on rig.
- Transportation cost reduced with size of equipment and amount of auxiliary equipment.
- Decreased HSE risk and exposure.



RWOCS Typical OEM Items

Items typically provided by the OEM:

- Installation philosophy
- OEM personnel
- X-mas tree installation procedure
- Smart tool for SCM communication
- MQC/XT interface adaptor
- EFL pig tail

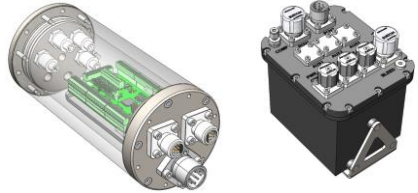


RWOCS Scope of Supply

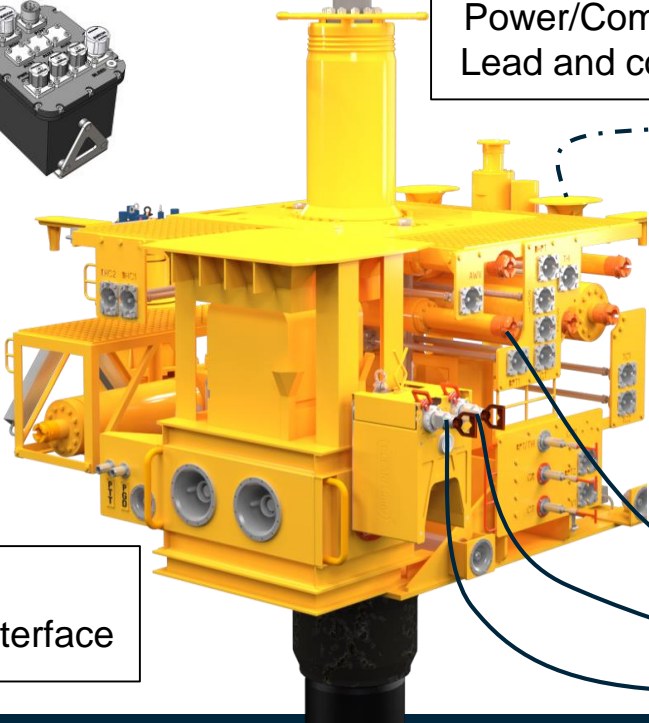
CPI
Topside SCM Coms
Module – User Interface



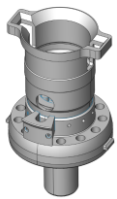
CPI
SCM Subsea Coms/Power
Canister



CPI
Power/Coms Flying
Lead and connector



CPI
Hydraulic tree interface



RWOCS
Master Controller PLC



RWOCS
Laptop - User Interface



RWOCS
Topside Test HPU



RWOCS
Topside Test Unit Assy



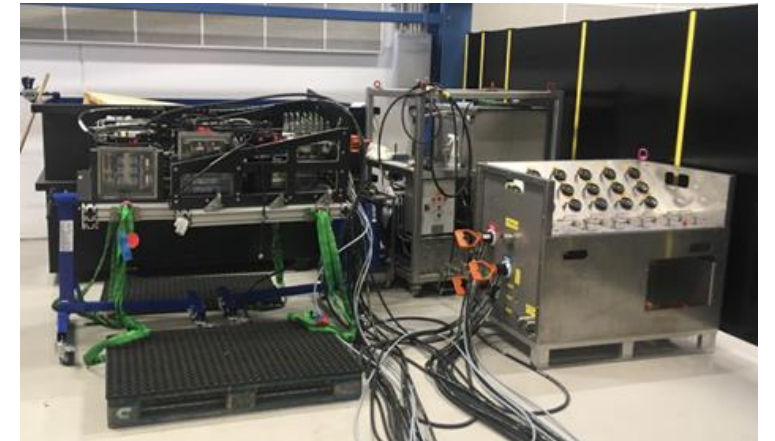
RWOCS Skid and
interface adapter to ROV



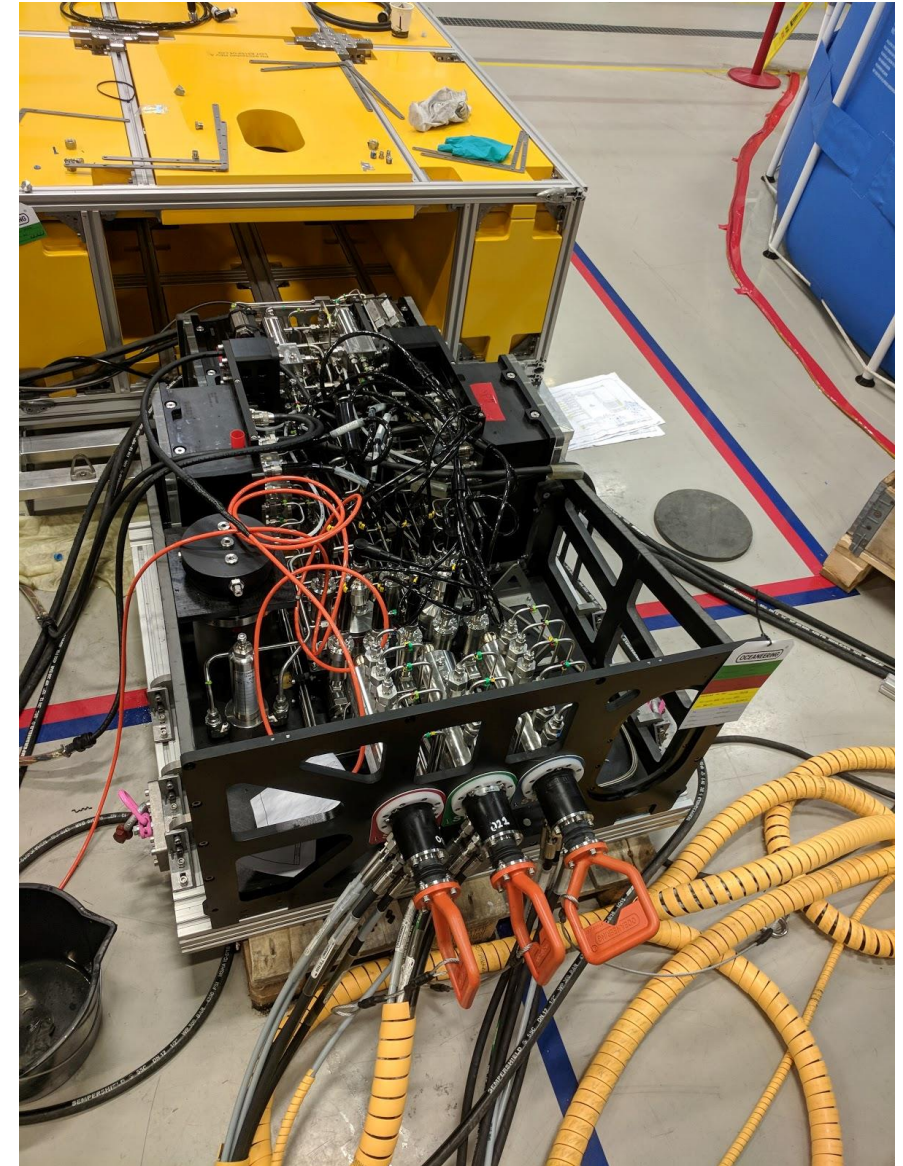
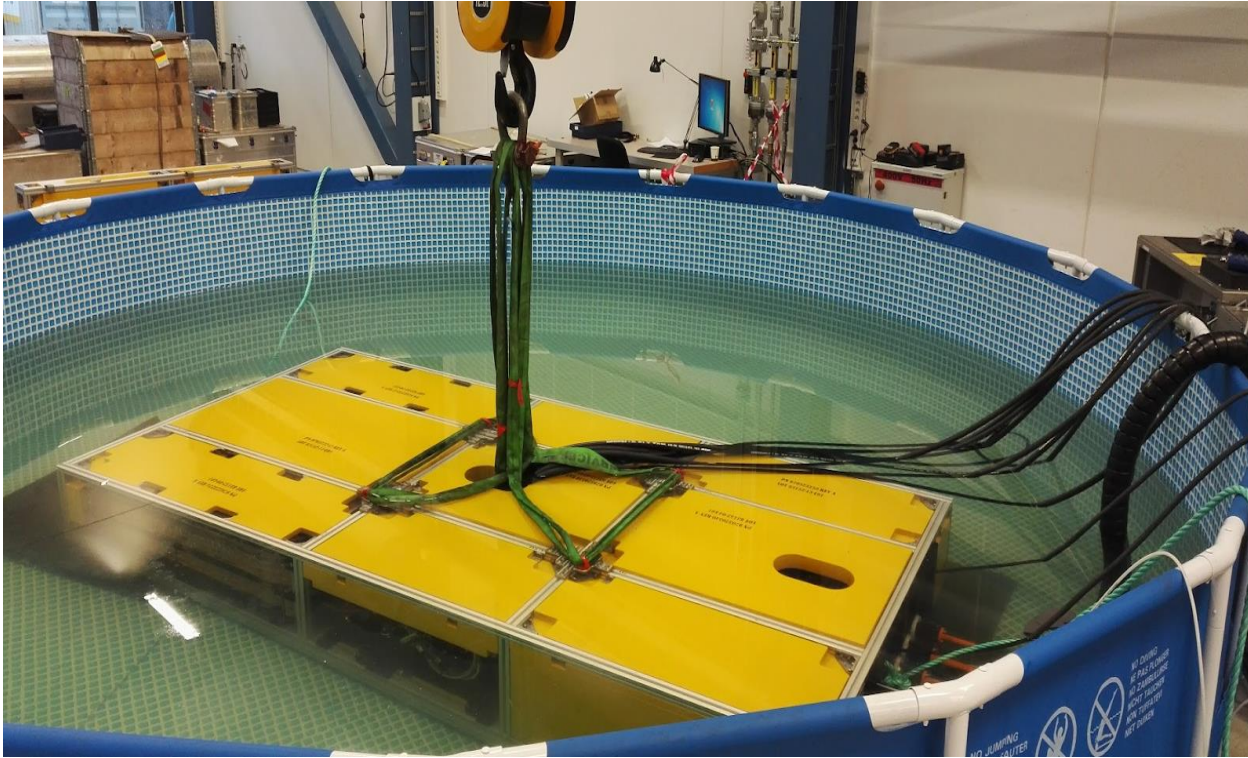
RWOCS
HFL's

RWOCS Testing

- December 2017: FAT completed
- Q1 2018: Three skids manufacture, two functionally complete
- Q2 2018: Two LARS systems in manufacture
- Engineering ongoing for Compact Systems



RWOCS Extended FAT



ROV WOCS PROS/CONS

• Interfaces (Rig, ROV Company, SPS Company)

- Rig- Less foot print, quicker installation, less POB can be operated from shore.
- ROV Company - Interfaces to all ROV companies W-Class ROV
- SPS- EFL and HFL need the MQC and SCM connector provided by SPS as well as the controls for SCM

• System Deployment & Recovery

- Less deployment time as this is integrated to the ROV and will allow for the same operational window as the ROV.
- Could restrict the ROV access subsea, depends on tasks.
Rig Specific, 3rd Party or Company Provided Specific Equipment/Services
- SPS- EFL and HFL need the MQC and SCM connector provided by SPS as well as the controls for SCM

• Performing SIMOPS

- The Work Class ROV will be tied to the XT envelope during commissioning, depending on tasks to be perform maybe two Work Class ROV would be beneficial.
- Operational Limitations (Weather, ROV capability, functionality, water depth etc.)
- According to the Work Class ROV capabilities and specifications

• Operational Uptime / Operational Downtime

- Our experience by utilizing this technology is in general positive. A few problems has occurred related to the quality of fluid received back from the XT that has clogged up valves and filters. For new XT installations we will recommend to dump the XT return to sea.

• HSE Benefits

- Elimination of heavy lifting and a reduction in rigging requirements,
- No exposure to high pressure on surface except during testing
- Less CO2 footprint due to shorter operations and less crew

• Redundancy / Reliability

- Reliability factored in via components TRL & built in redundancy / back up system
- Technical Safety
- The system fail-safe is designed to bleed of all valves in a event of loss of communication or system pressure, this will allow the SCM functions to fail to safe. In the event of drift offs situations the HFL,EFL stabs will be pulled out its receptacles by the safety wire.

RWOCS: Do More with an ROV

Intervention functions move from topside to subsea, simplifying tool spread and reducing POB.

- Configurable to meet specific application
- Reliability factored in via high end components and redundancy
- Works with multiple ROVs
- ROV crew can operate system



Reduces costs by 50%



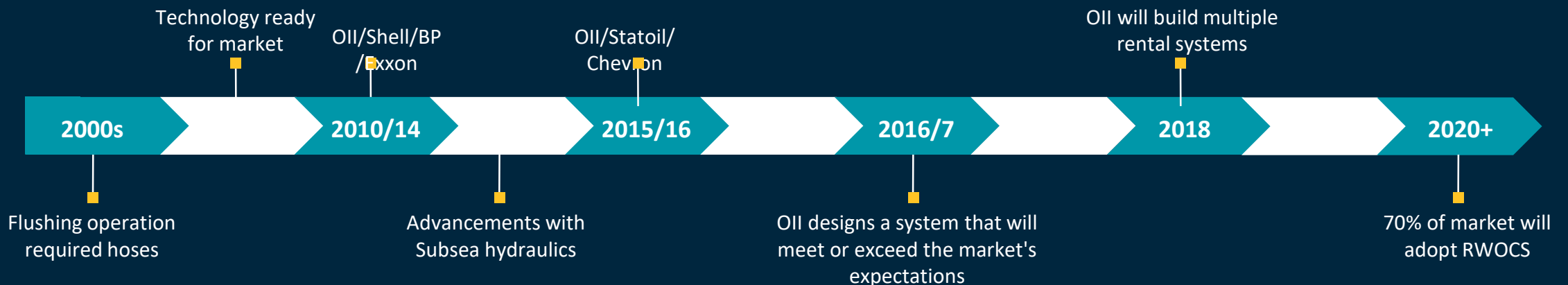
Reduces topside space by 70%



Customer installs tree in record time



Two crews is now one, with fewer people



An offshore oil rig is shown at night, illuminated by its own lights against a dark blue sky. The rig's complex structure of steel beams and platforms is visible. Two large yellow L-shaped graphic elements are positioned on the left and right sides of the text.

**CONNECTING
WHAT'S NEEDED
— WITH —
WHAT'S NEXT™**