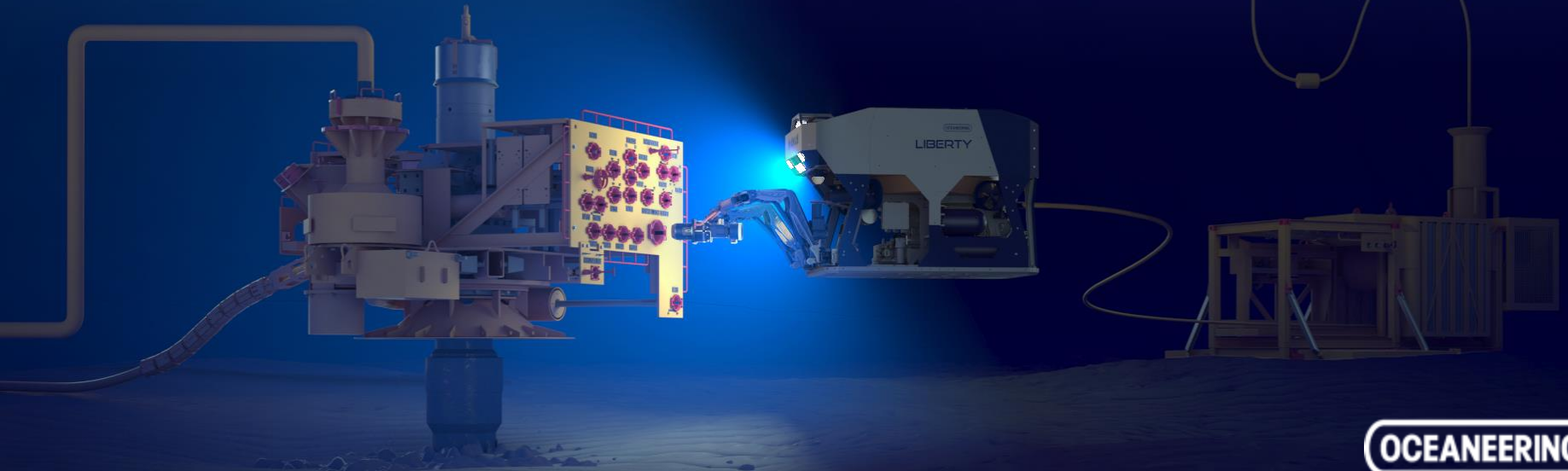


Reducing Emission, HSE Exposure, and Cost: The Liberty™ E-ROV System

Christopher Lyon
Onshore Remote Operations Center Supervisor



Liberty™ E-ROV

- The Benefits
- Remote Piloting
- System Development
- Operational Experience
- What's Next?





Reduce Emissions



Less HSE
Exposure

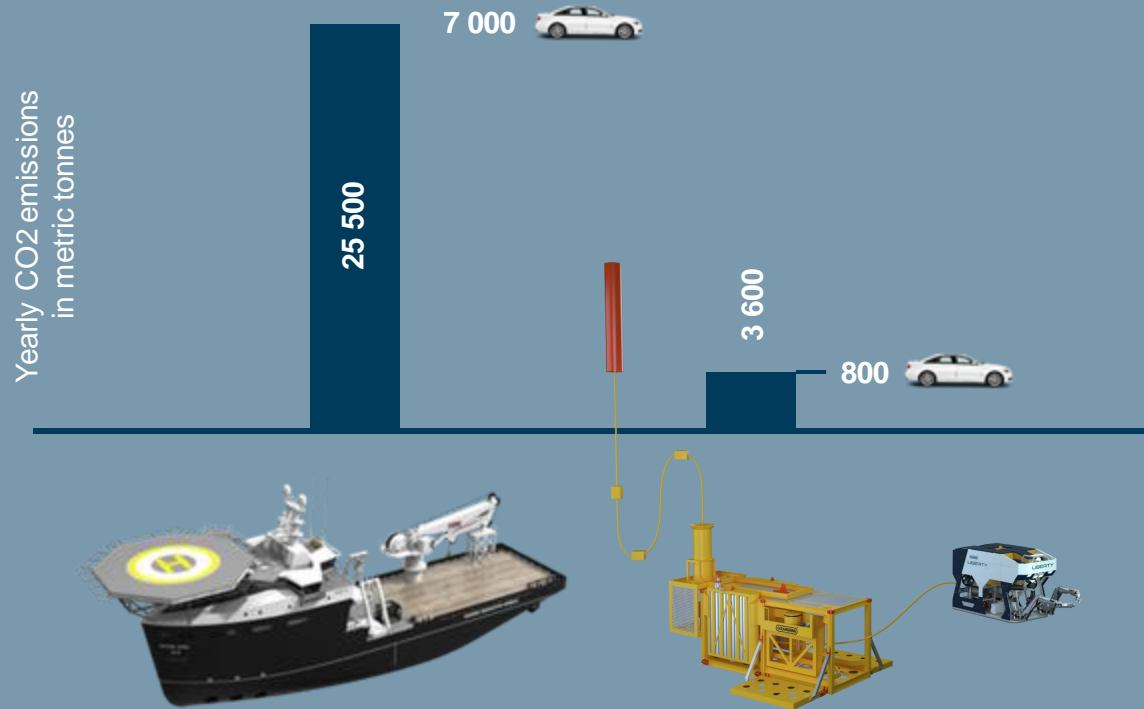


Reduce Cost

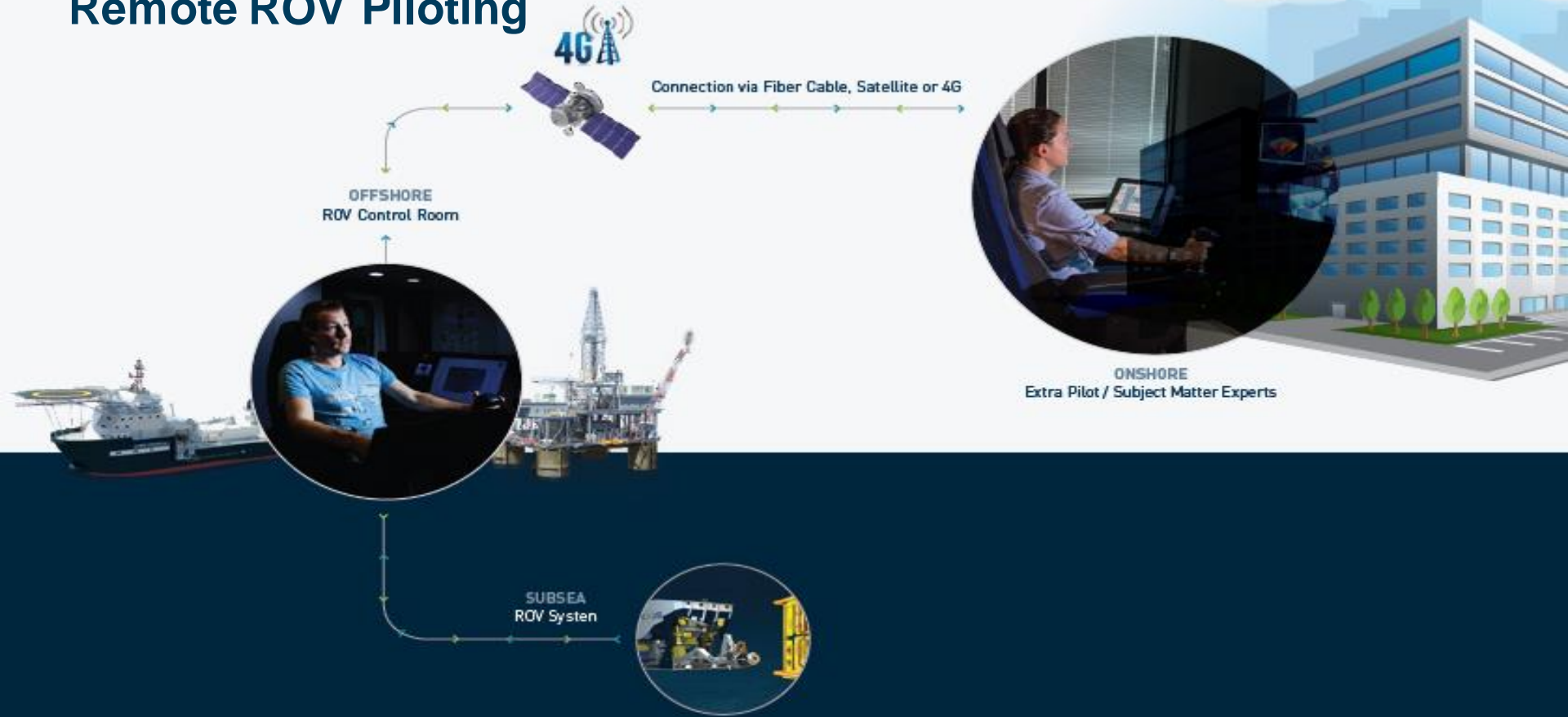


Improve Service Quality
and Flexibility

Environmental Footprint



Remote ROV Piloting



Task specialist

ROV pilot

Tooling specialist

ROV co-pilot

Client representative

Onshore Remote Operations Center

- 4 Pilot Stations, Morgan City, LA - USA
- 5 Pilot Stations, Stavanger - Norway
- 24/7 staffed onshore remote operations center
- Remote piloting of conventional ROVs as well as our new resident vehicles
- Communications via fiber, 4G, and satellite

Liberty™ E-ROV

Battery Powered ROV System

Wireless
4G / Internet

4G Coms
Buoy



Onshore Remote
Operations
Center (OROC)

Buoy mooring with
video & data
communication

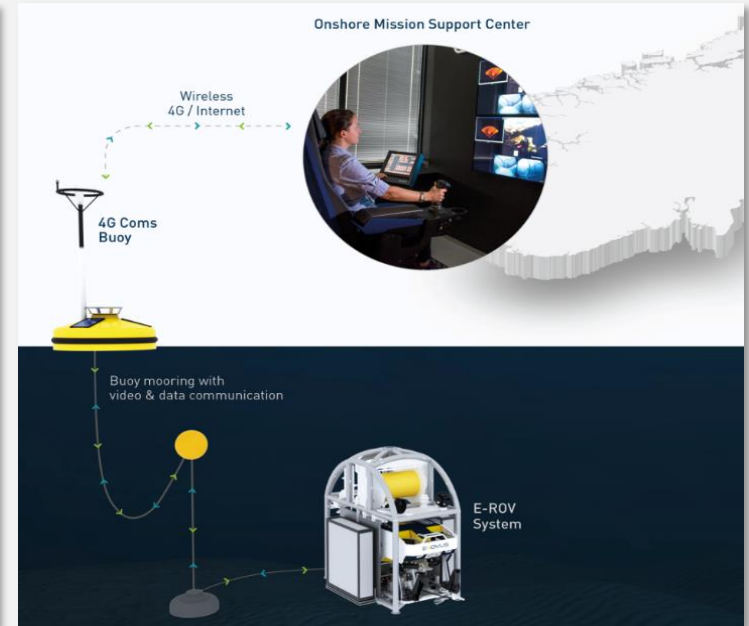


Resident Vehicle

E-ROV Pilot Project 2017

Proof of Concept for Equinor

Fully stand-alone and battery powered Work class ROV system remotely piloted from onshore via surface 4G LTE data communication buoy





OCEANEERING®

Liberty™ E-ROV

System Overview

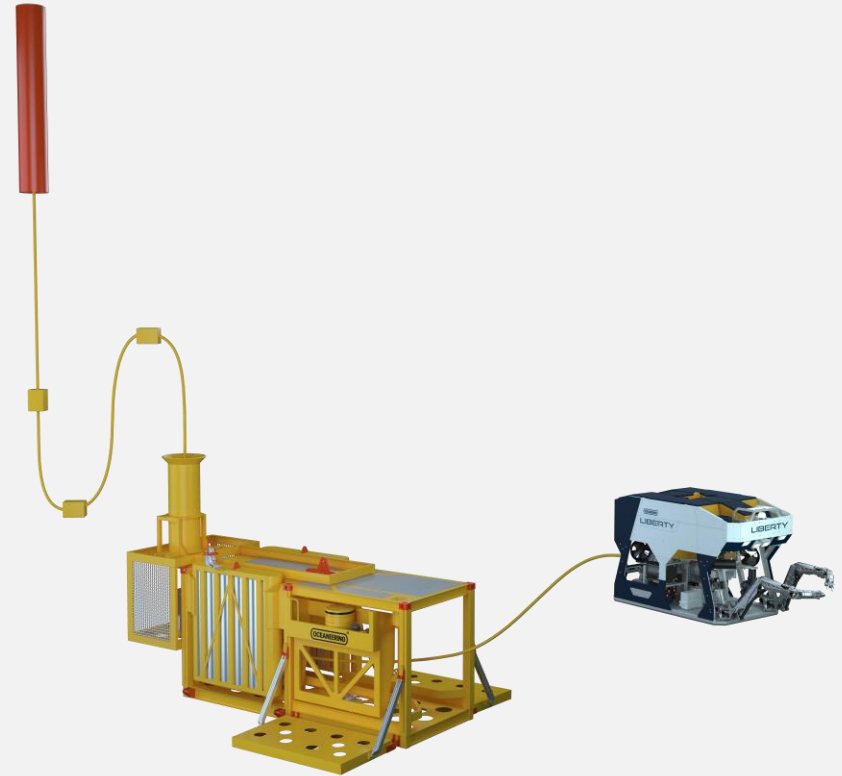
eNovus Electric Work Class ROV

Weight in air: 28 Ton

Depth rating: 1000 m

Tether length: 1000 m

Battery capacity: 500 kWh



Liberty™ E-ROV Quay Testing May 2019



Liberty™ E-ROV Operations June 2019 - May 2020

Operational Stats

- Number of dives 24 (deployments)
- Dive time 3790 hours (158 days)
- Longest dive 1445 Hours (60 days)

Missions:

FIELD	TASK
• Statfjord B&C	Periodic ROV Inspection
• Oseberg A	Periodic ROV Inspection
• Johan Sverdrup	Commissioning
• Johan Sverdrup	Periodic ROV Inspection
• Gullfaks A&C	Periodic ROV Inspection
• Fram East Valve	Operation of Gas Line Flapper Valve
• Troll A&B	Periodic ROV Inspection
• Valemond	Riser Inspection
• Åsgard B	Leak Detection
• Snorre A	Riser Monitoring (x 110)
• Troll B&C	Well Commissioning



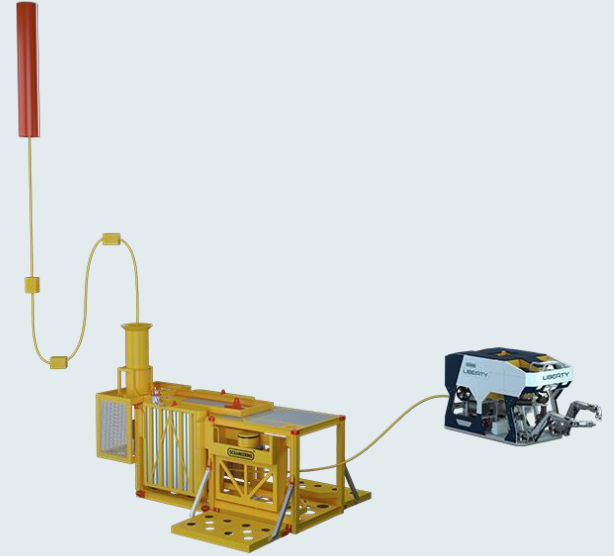
Liberty™ E-ROV Applications

Subsea Field Inspection, Maintenance and Repair Work

WROV Support for Jack-up Rigs

Second WROV for Rigs Set Up with Only One ROV System

Temporarily Resident ROV



What's Next?

Features on the drawing board

Observation / Light Work Class System

Deepwater system (> 1000 m)

Freedom Drone Technology Integration

Marine Broadband Radio Communication

Satellite Communication Buoy





Connecting What's Needed with What's Next™