

# MCEED

## DEEPWATER DEVELOPMENT

28 - 30 March 2023 | Millennium Gloucester Hotel | London, UK

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Quest Offshore

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## Advanced Subsea Robotics – Changing the Landscape of Subsea Fields with Innovative Resident Solutions

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MCEDD 2023, Millennium Gloucester Hotel, London, UK

Revision: A

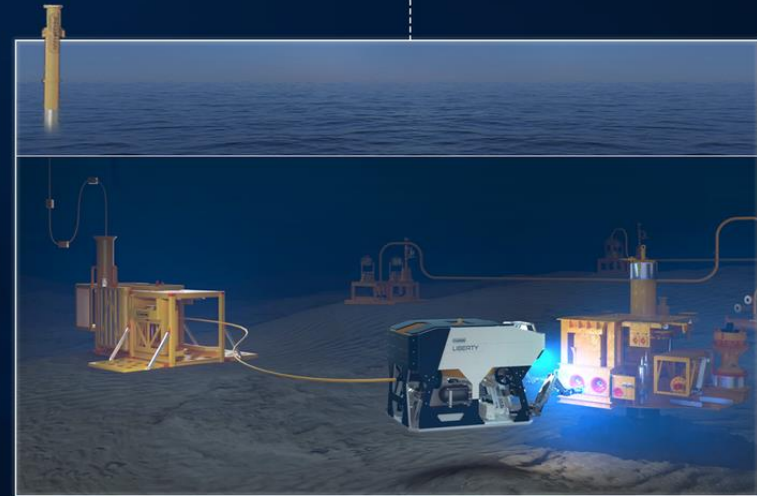
## 2 Main Categories of Residency

- Fixed Docking Station
- Mobile Docking Station

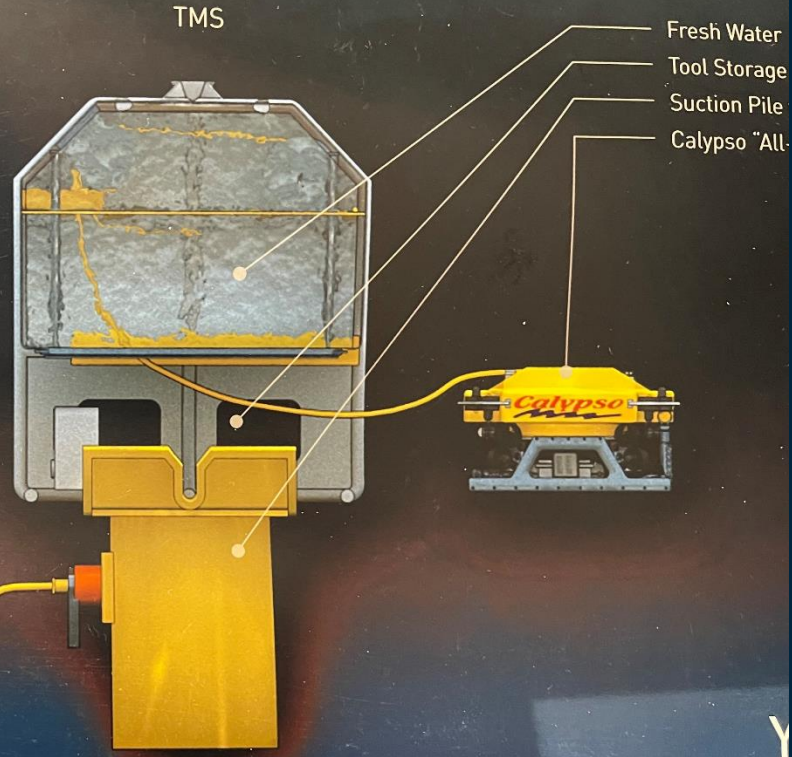


### This Presentation will focus on **Mobile Residency**, covering:

- The Opportunity Case
- Key Attributes
- Use Cases
- Its Benefits
- Oceaneering's Track Record Since 2019
- Enablers to Adapt for Deep Water



**Dive Duration:** >6 months  
**Depth Rating:** 3000 m  
**Reliability:** Proven electric propulsion  
**Excursion Dist.:** 1000 m  
**Redundancy:** 100 % of all systems  
**Manipulator System:** All electric  
**Tooling:** All electric  
**Video:** HDTV x 4  
**Sensors:** Temperature  
           Pressure  
           Oil  
           Glycol  
**Subsea Equipment:** RS-232/485  
**Interrogation:** TCP/IP  
                   CAN



## Innovation: 2005

### The Calypso Resident Subsea Robotics Concept

- Pile Foundation
- Retrievable TMS Cage
- Water / Glycol Mixture for Corrosion Protection

Today's Technology exist thanks to Yesterday's Innovation



## The Opportunity Case

**Rethink** the way ROV Services are provided end-to-end

**Resident Subsea Robotics**  
A cost efficient and environmentally friendly alternative to vessel-supported ROVs

**OCEANEERING**<sup>®</sup>

# The Liberty™ Resident System

All-in-one deployable mobile docking station for ROV's & AUV's

4G LTE Connection



Onshore Remote Operations Center (OROC)



11/06/2019  
10:26:47

## LIBERTY CAGE



## FREEDOM AUV



## LIBERTY CONFIGURATIONS



## WORK ROV



## LIGHT INTERVENTION ROV



## Vehicle Agnostic

The Liberty Cage can accommodate any form factor, size and type of ROV or AUV to suit operational needs



# Liberty Key Benefits

Every day at work is a day saved in vessel cost and CO<sub>2</sub> emissions



Eliminated 550 vessel days since service entry in 2019



Eliminated 18500 MT of CO<sub>2</sub> emissions since service entry in 2019



Reduces total cost of ROV operations



Reduces POB and HSE risk by purely use of remote operations



At work 24/7, not affected by vessel crew change



Access to ROV without any permanent installations



Flexibility for ROV availability anywhere you want

Do you know the daily cost of an IMR vessel and 1 ton CO<sub>2</sub> allowance?



Service Entry in 2019



Field Proven (TRL 7 API 17N)

## Liberty™ Operations Track Record February 2023

### Operational Statistics (since service entry June 2019)

Missions	→	152 dives
Operational Time	→	13 411 hrs
Longest Dive	→	1 445 hrs (60 days)

### CO2 Emission Savings (comparison to Vessel Supported ROV)

Daily	→	33 MT
14 Day IMR Campaign	→	466 MT
Since Service entry 2019	→	18 440 MT

### Operational Tasks

**Inspection**  
**Commissioning**  
**Valve Operation**  
**Pipeline Isolation & Pigging**  
**Leak Testing**  
**Conductor Guiding**  
**Decommissioning**  
**UXO**

### Operational Areas (NCS)

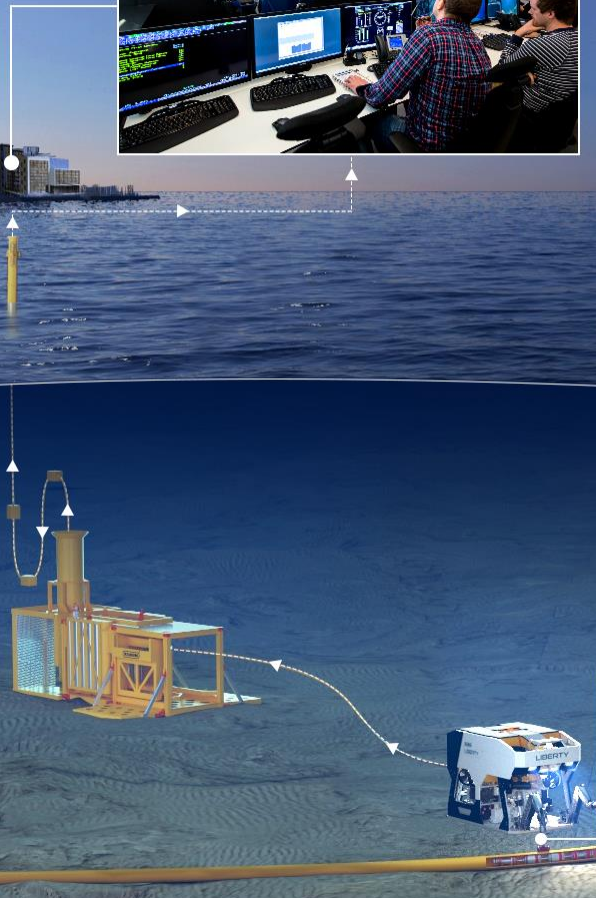
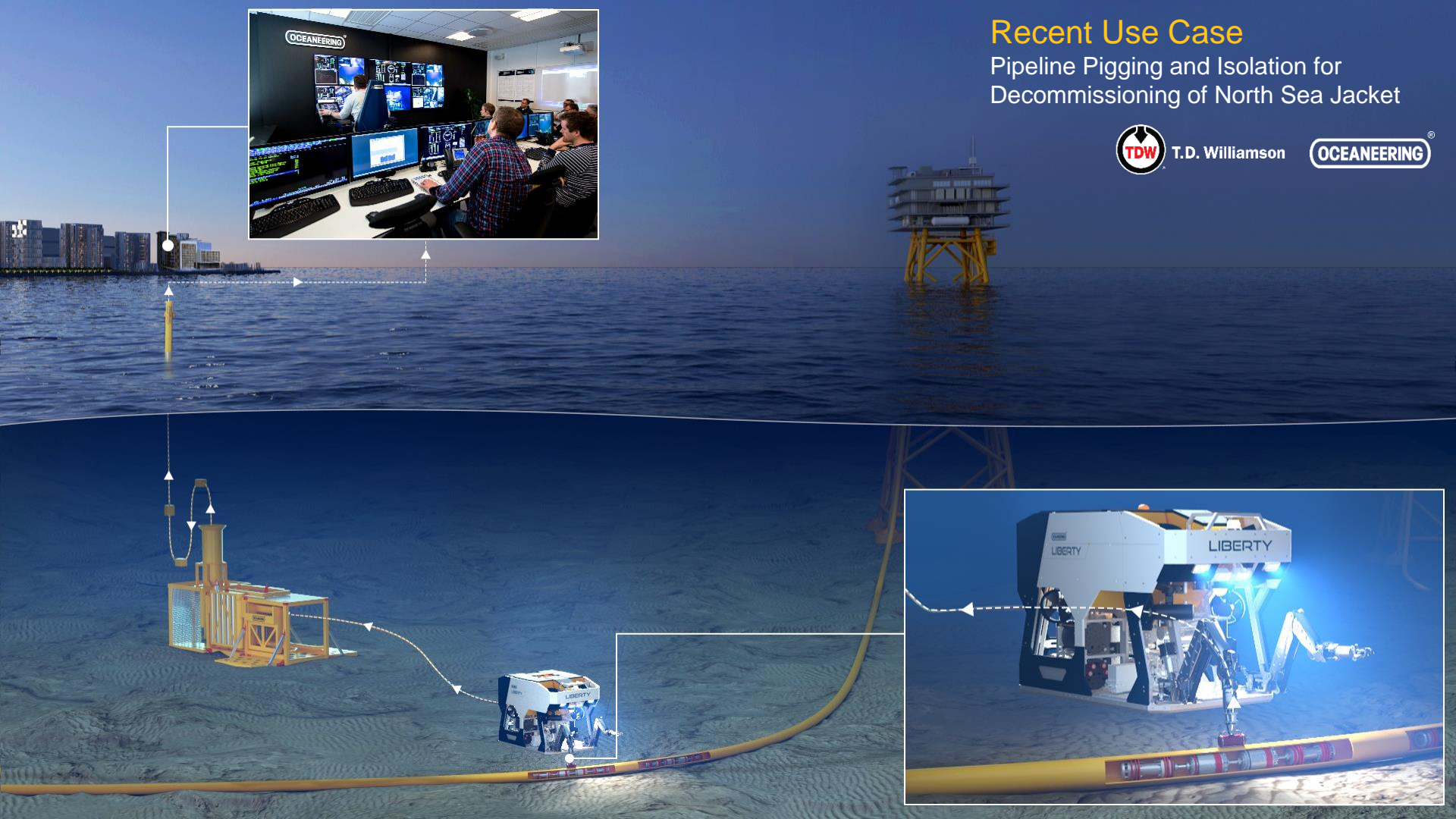
Gullfaks	Troll
Heimdal	Valemon
Johan Sverdrup	Veslefrikk
Oseberg	Vigdis
Sleipner	Åsgard
Snorre	
Statfjord	

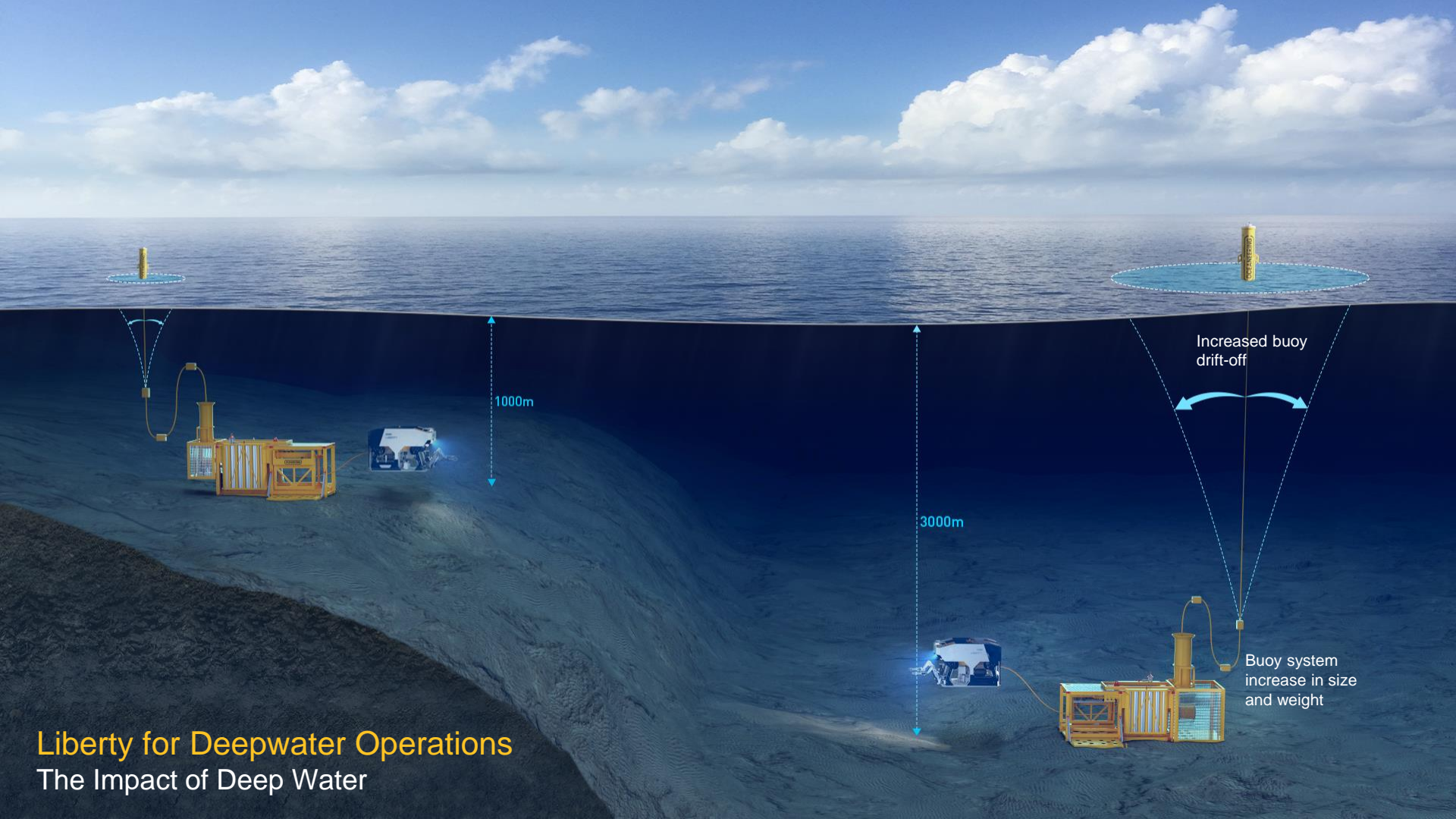
## Recent Use Case

Pipeline Pigging and Isolation for  
Decommissioning of North Sea Jacket



T.D. Williamson





# Liberty for Deepwater Operations

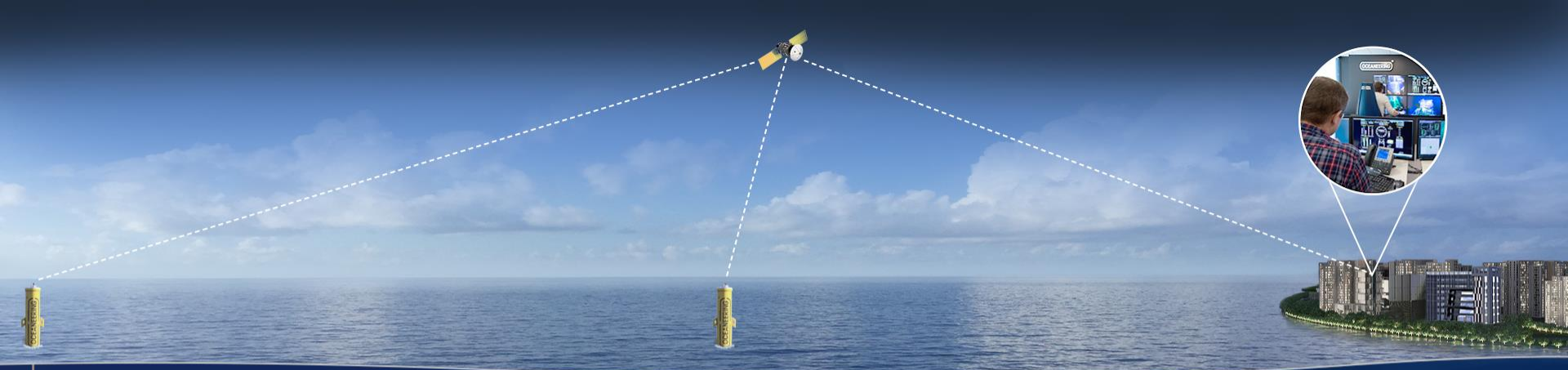
## The Impact of Deep Water

1000m

3000m

Increased buoy drift-off

Buoy system increase in size and weight



### Integrated Buoy System (current solution)

- Increase size and weight
- The most favorable solution



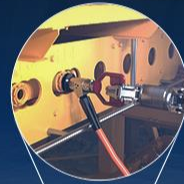
Liberty for Deepwater Operations  
Deepwater Buoy for Brownfields

### Standalone Buoy Solution

- Sizing of the resident system can be kept to a minimum
- Opportunity for connection of other subsea assets, as needed



Onshore Remote  
Operations Center  
(OROC)



Field Node for Power and  
Communications Interface

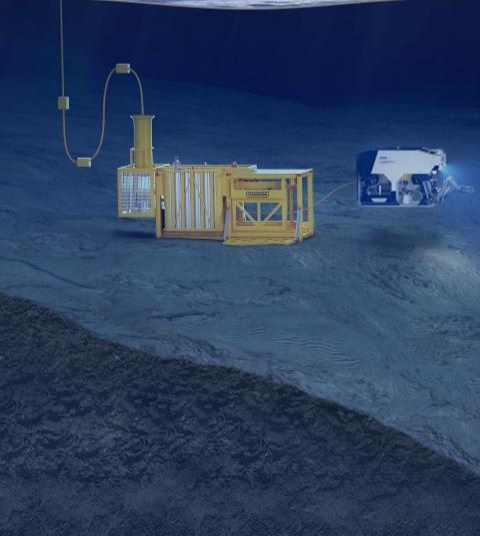


## Liberty for Deepwater Operations

Subsea connection for greenfields enable resident subsea robotics to be planned as an integral part of the IMR philosophy

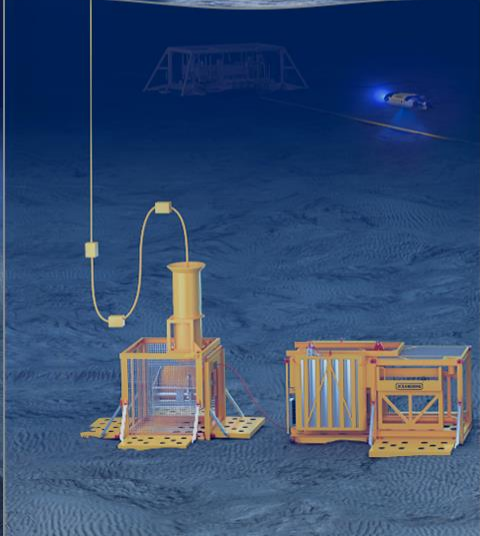
### Integrated Buoy Solution

Favored for both shallow and deep water



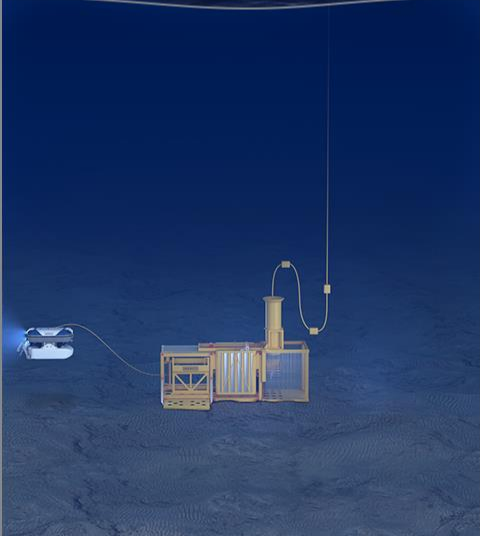
### Standalone Buoy Solution

Option for deep water



### Rig Downline Solution

Opportunity for both shallow and deep water (used at the NCS)



### Subsea Connection

Greenfield opportunity for both shallow and deep water, plan for the future





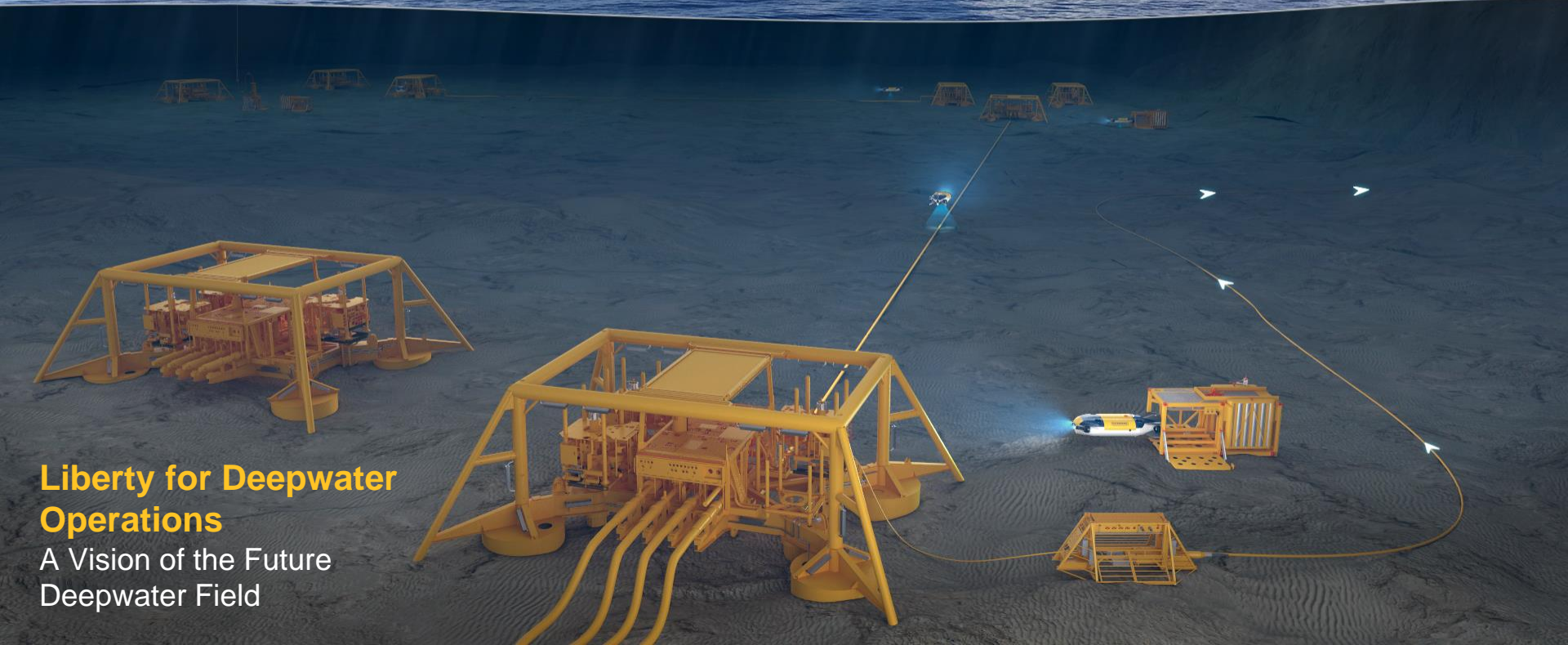
Connecting What's Needed  
with What's Next™

Thank you for listening!







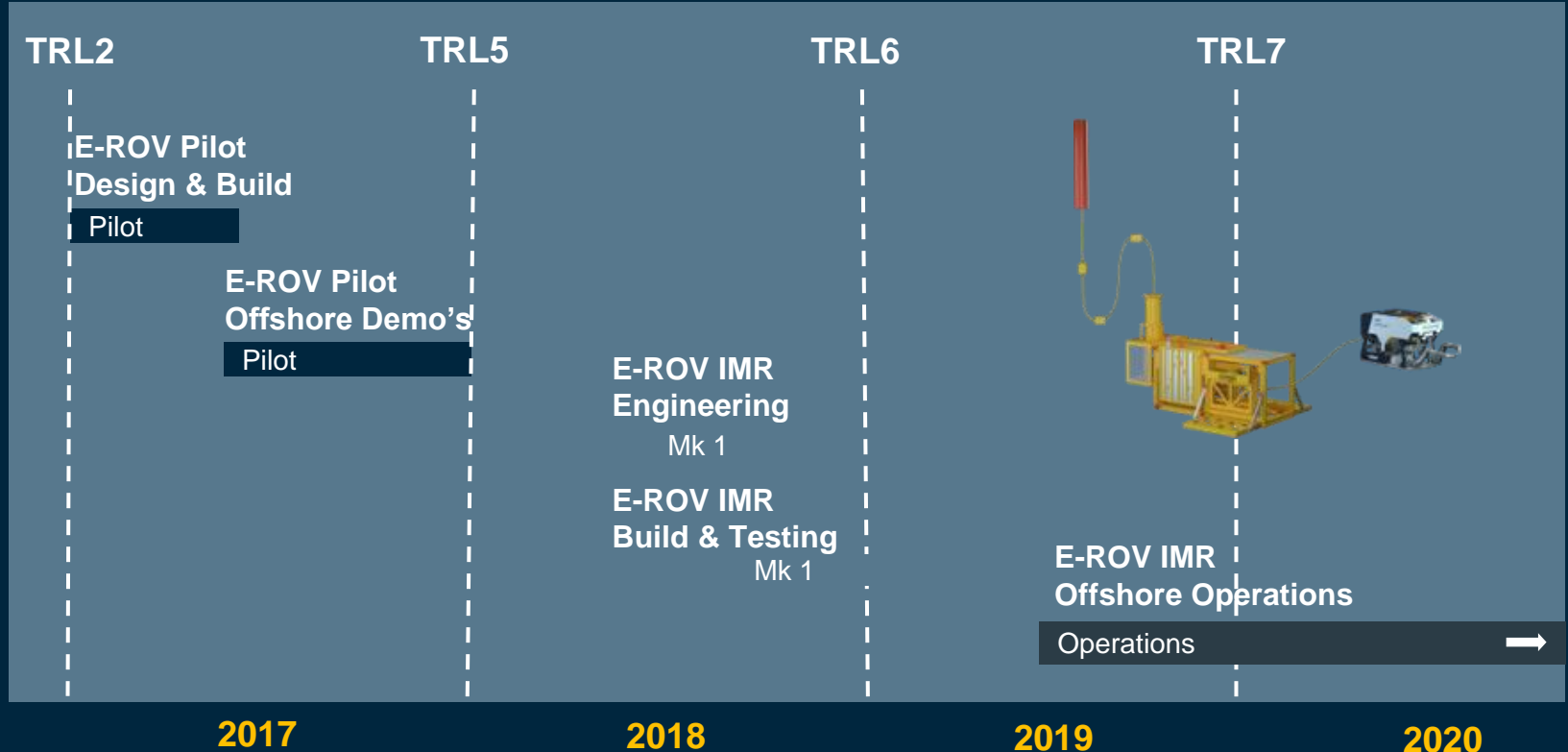


## Liberty for Deepwater Operations

A Vision of the Future Deepwater Field

# Liberty E-ROV – Development Cycle

Battery-powered ROV System



# Liberty™ E-ROV

Battery-powered ROV System

## Endurance Timings

### Liberty Endurance Data

Task	Power Consumption	Endurance (550 kWh Lithium-Ion )
<b>Standby</b> (In Liberty cage)	0,15 kW	153 days
<b>Observation</b> (ROV grabbed onto structure and used only for observation)	1 kW	22.9 days
<b>Valve Manipulation</b> (ROV locked to structure and only using manipulator and/or torque tool to complete ops)	7 kW	3,3 days
<b>Free Flying</b> (Hover)	3 kW	7,6 days
<b>Free Flying</b> (Transit between targets)	5 kW	4,6 days

# Liberty™ E-ROV Enables CO<sub>2</sub> Emission Savings



Vessel Supported ROV

**644**

MT of CO<sub>2</sub> emitted



Emission Savings

**466**

MT CO<sub>2</sub>



Liberty™ E-ROV

**178**

MT of CO<sub>2</sub> emitted

CO<sub>2</sub> emissions by vehicle over a 14-day IMR campaign

# Daily Liberty™ E-ROV CO<sub>2</sub> Emission Savings



Daily Emission Savings

**33**

MT CO<sub>2</sub>



# Liberty™ E-ROV CO<sub>2</sub> Emission Saving

**Vessel type:** IMR

**Transit:** 200 km

**Campaign length:** 14 days

**Liberty launch and recovery:** 6 hrs

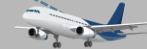
Vessel will work on other jobs in between launch and recovery of Liberty™ E-ROV

Vessel will return to base after end campaign

Only vessel emissions used in calculation, not any other logistics



200km



# Operational Challenges

Liberty E-ROV

## CHALLENGE

- Limited IMR Support Vessel availability
- IMR Vessel scheduling

## SOLUTION

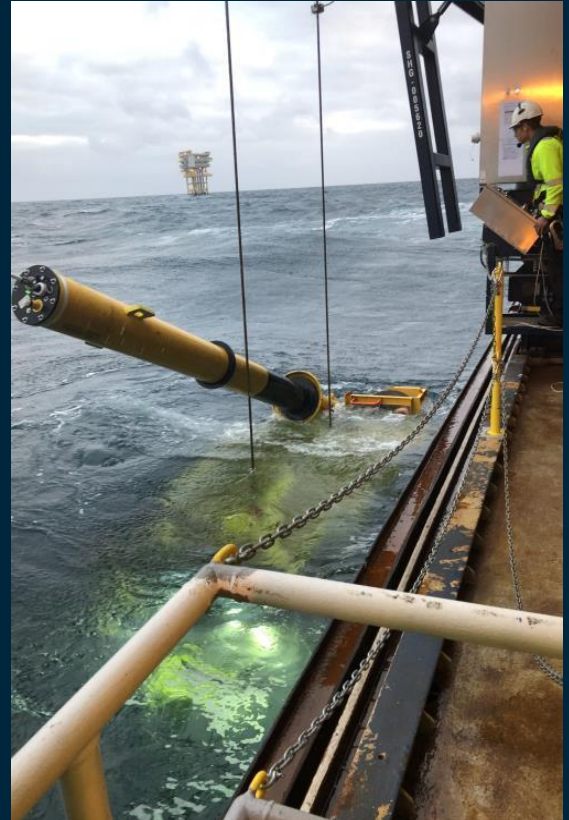
- Area Support, Rescue Vessel or PSV
- Custom Dual Wire LARS System
- Weather Criteria for L&R Hs=3m











# What's Next

Features on the roadmap:

Eyeball Integration (daughter ROV, successful pilot test performed)

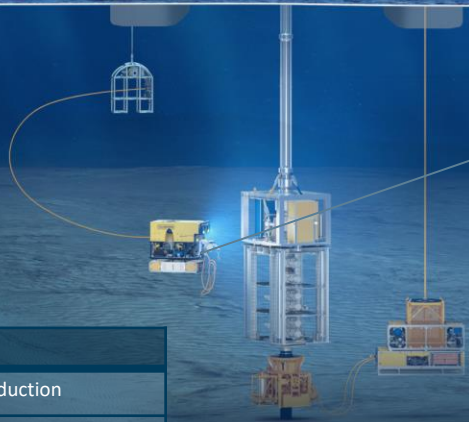
Deepwater Liberty ( > 1000 m)

Freedom AUV/Drone integration (AUV Deployable Docking Station)





	Good	Better	Best
Bandwidth (Up/Down)	3/1 Mbps	6/2 Mbps	>10 Mbps
Video Streams	1	1-2	multiple
Data Transfer Method	VSAT	LTE (cellular)	Optical Fibre
Latency	800 – 1,500 ms	250 ms	<100 ms
Availability	Wide coverage offshore	Limited coverage offshore	Limited availability offshore



Rig	System	Methodology	Comments
A	WROV x 1	4 Offshore x 2 Onshore	33% POB Reduction
B	Spectrum x 1	2 Offshore x 2 Onshore	50% POB Reduction



# MICEDD

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