

# Ocean



## Balder Future Project: The Jotun FPSO tow and hook up *New life – same field*

Sondre Bryn Høgheim  
Senior Engineer  
Ocean Installer AS

# Installer

# Balder Future Project



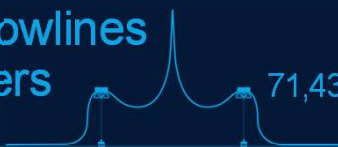
**2,816,557** Project total man hours per June 2025

0 Lost time injuries 0 Restricted work-day cases

**21** structures **2,596Te**



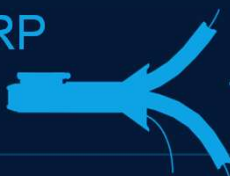
**26 flowlines & risers** **71,438m**



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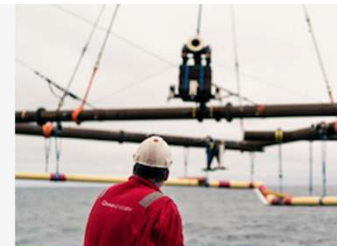


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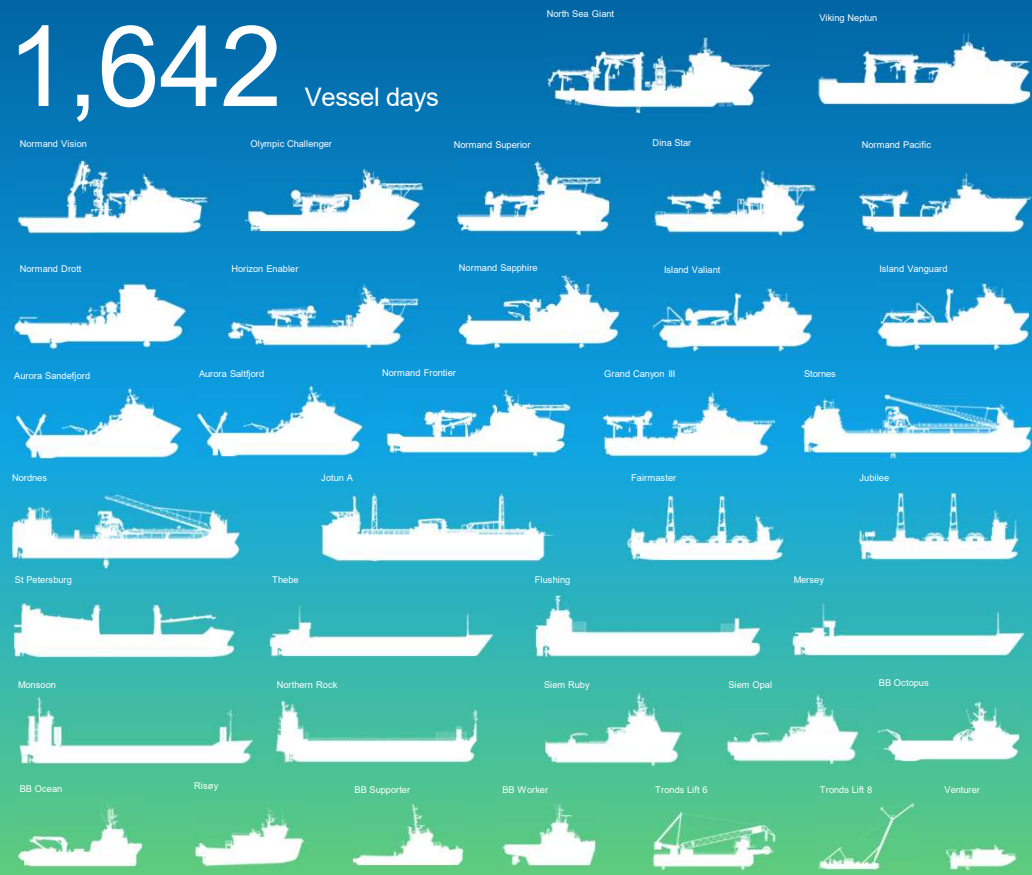


# Ocean Installer

2019 to 2025



**1,642** Vessel days



Client: vår energi

Consortium Partner: Baker Hughes

Flawless offshore project execution



# Ocean

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## Introduction and Project Overview

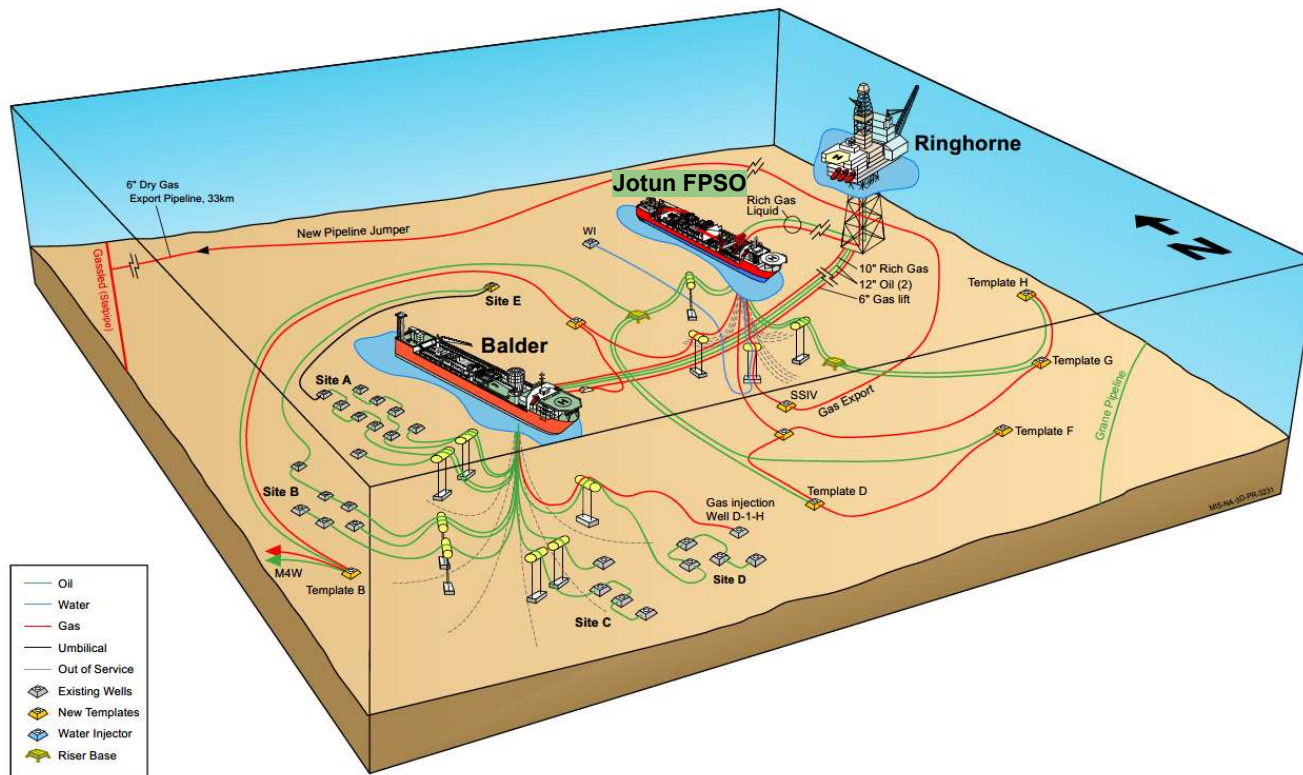
Balder Future Project – Jotun FPSO Hook Up & Tow 2025

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# Background and Project History

## Jotun FPSO – From Original Production to Redevelopment



New subsea infrastructure tied back to Jotun FPSO.

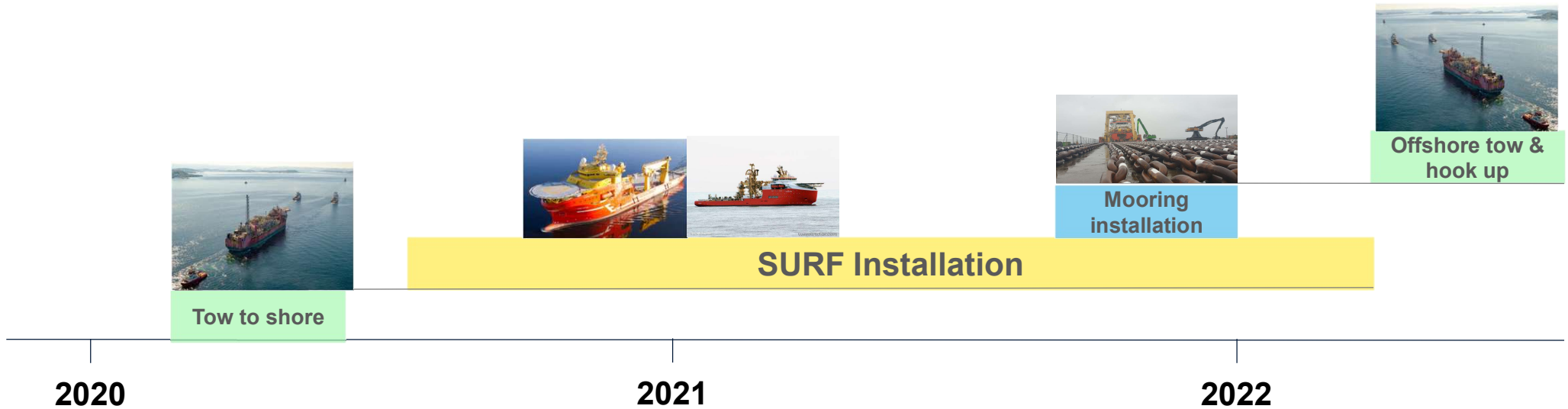
New wells, umbilicals, flowlines, structures, mooring system wet stored during yard stay  
Equipment wet stored during yard stay



# Background and Project History

Original schedule

*Repeat previous operations – don't change anything*



A photograph showing the installation of a mooring system for an FPSO vessel. In the foreground, a worker in a red jacket and white hard hat stands on a platform, looking out at the water. The water is filled with large yellow and red buoys connected by cables. In the background, a large dark structure, likely part of the FPSO, is being positioned or secured with ropes and pulleys. The sky is overcast.

# Ocean

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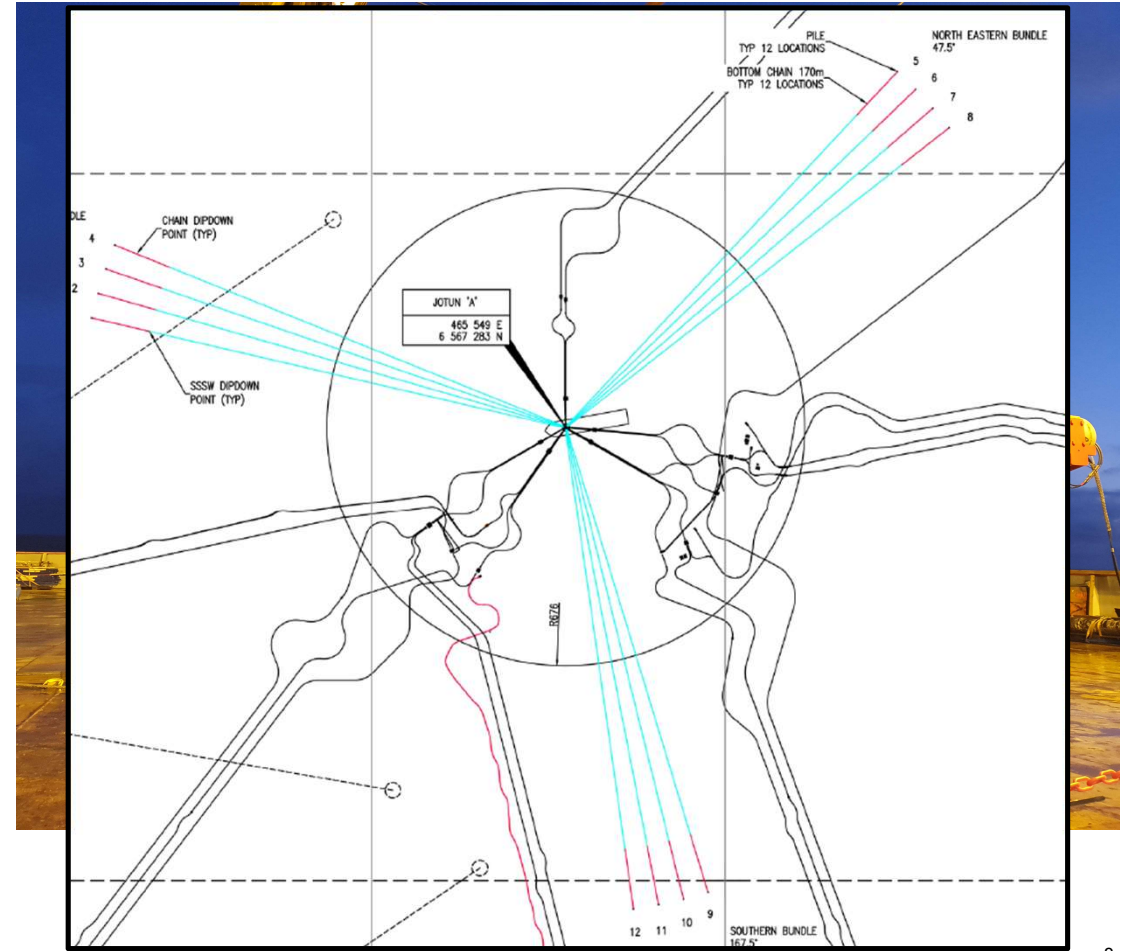
## Mooring System Installation (2021)

FPSO mooring system – scope and configuration

# Installer

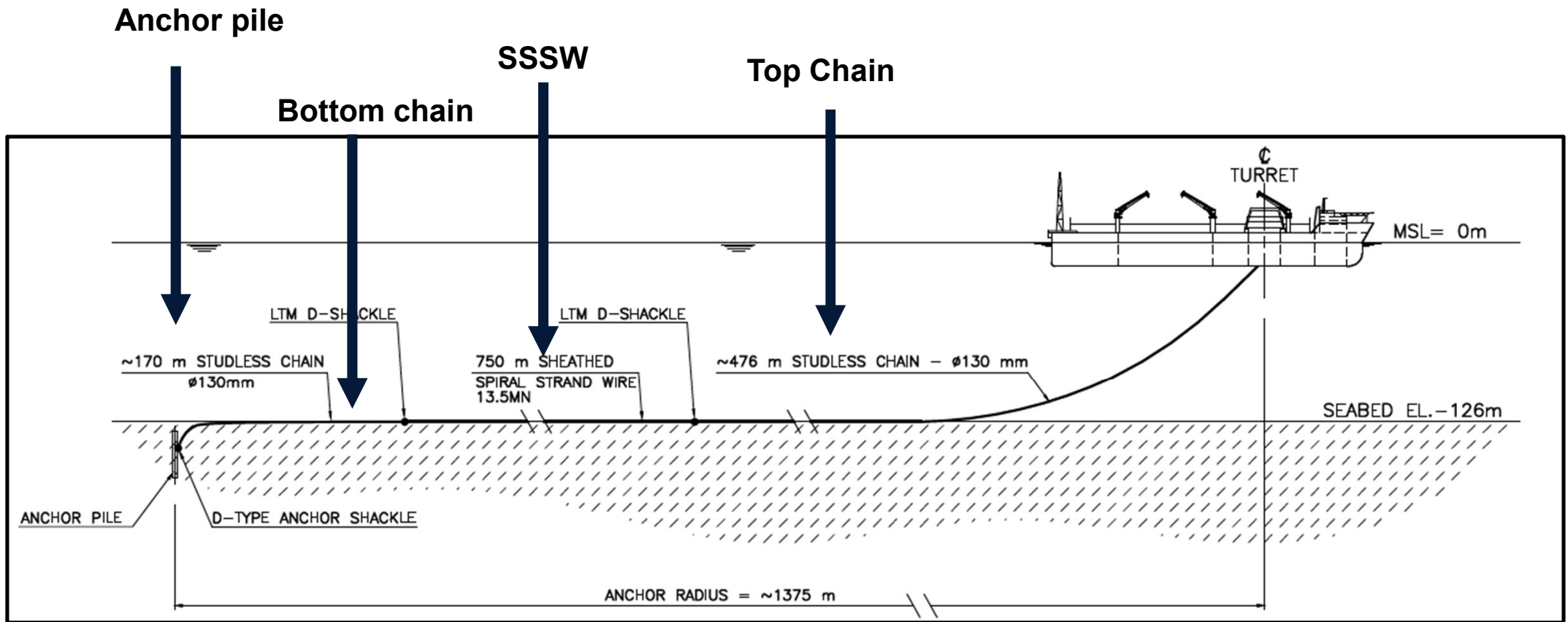
# FPSO Mooring System Installation

## Offshore photos



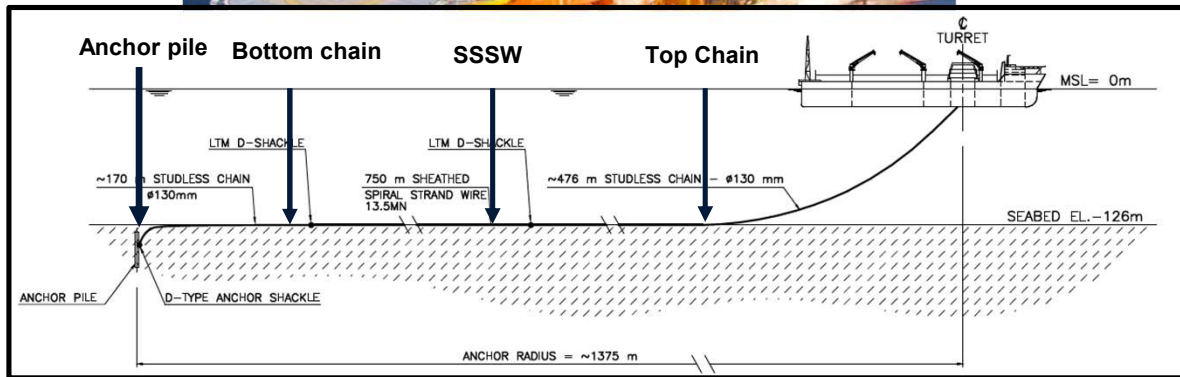
# FPSO Mooring System – Scope and Configuration

## Overview



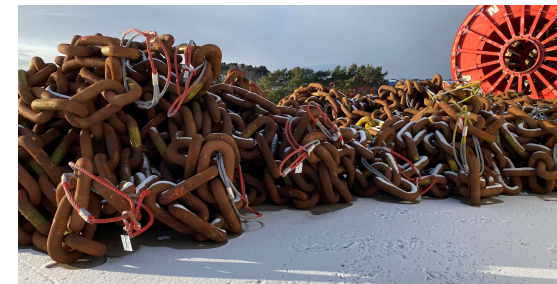
# FPSO Mooring System Installation

## Vessels



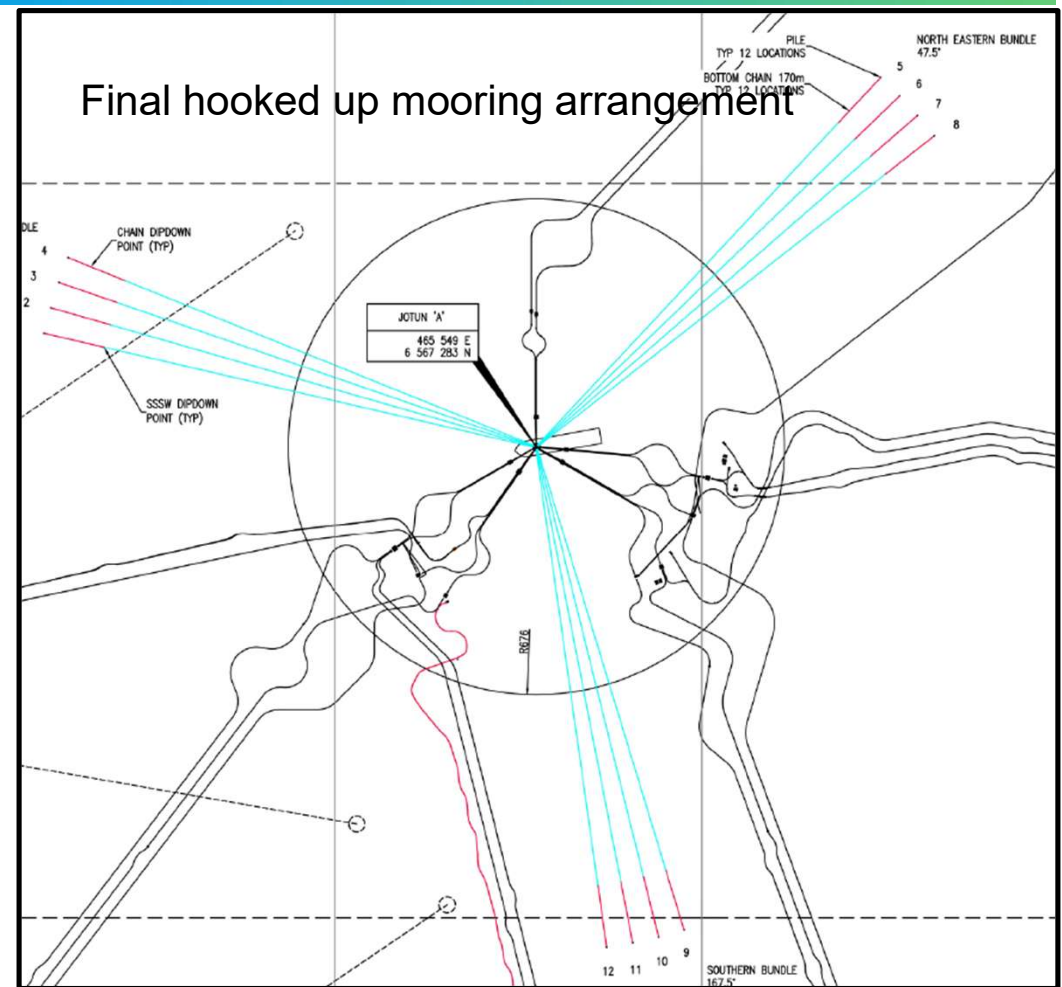
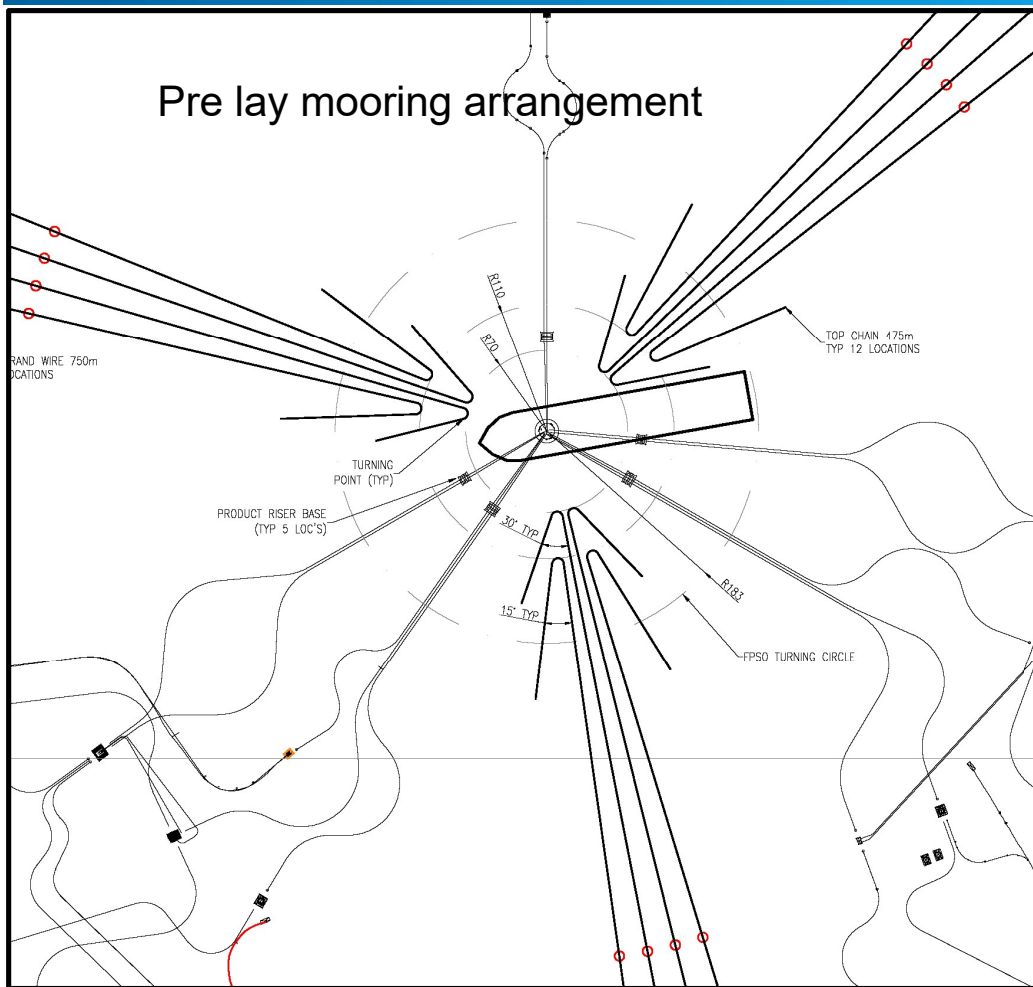
Normand Drott - 4x Trips

- 12x Bottom Chains
- 12x Top Chains
- 12x SSSW



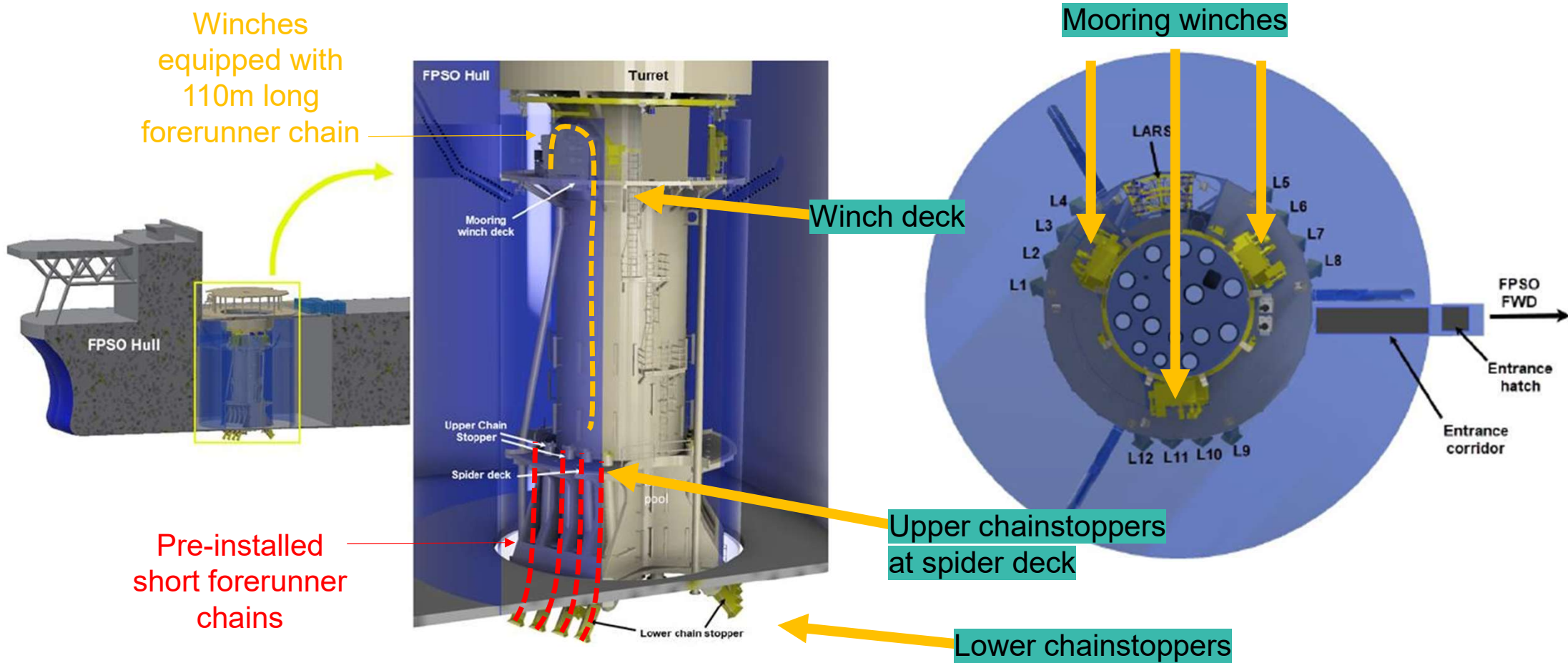
# FPSO Mooring System Installation

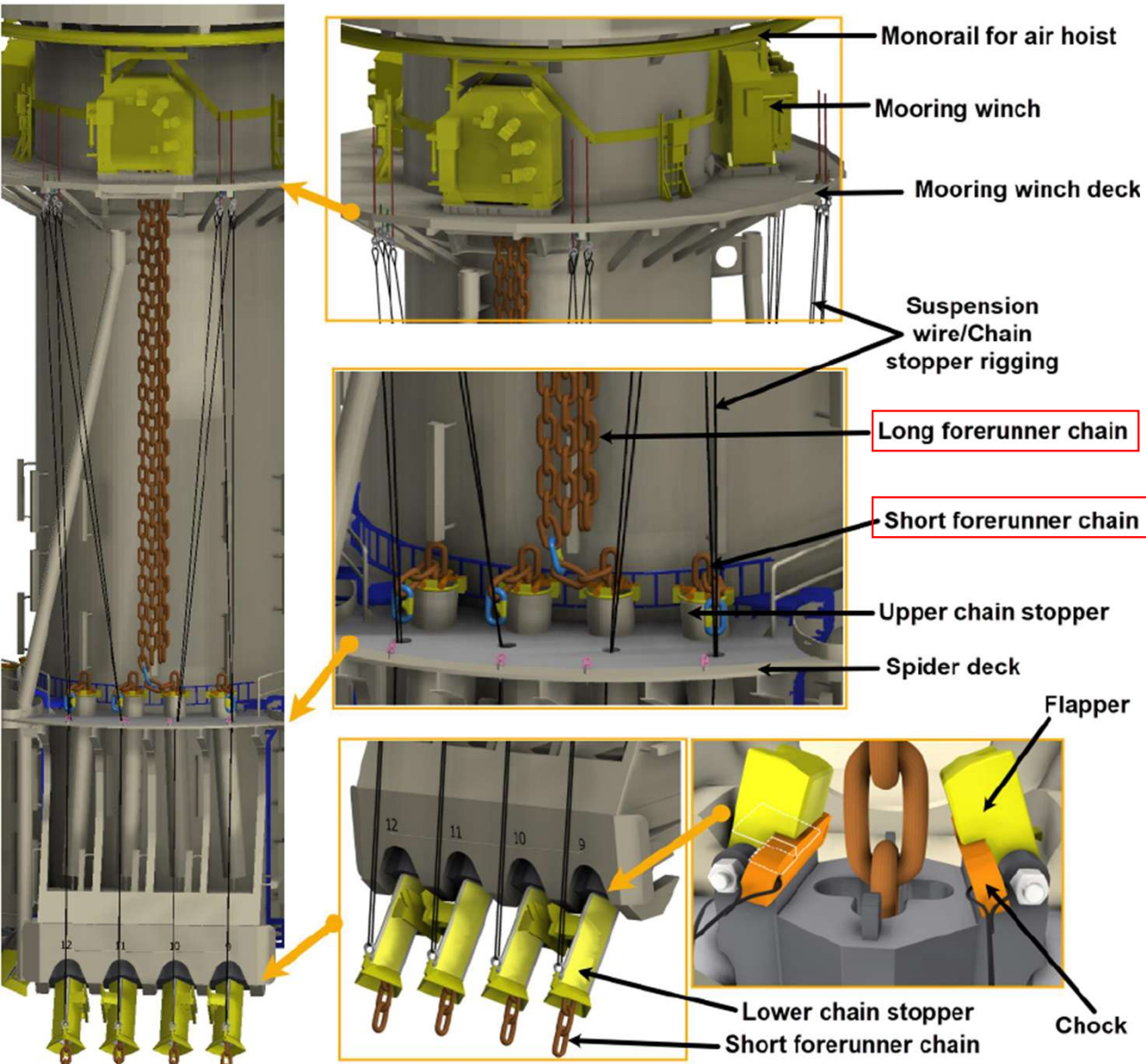
## Mooring system configuration



# FPSO Mooring System

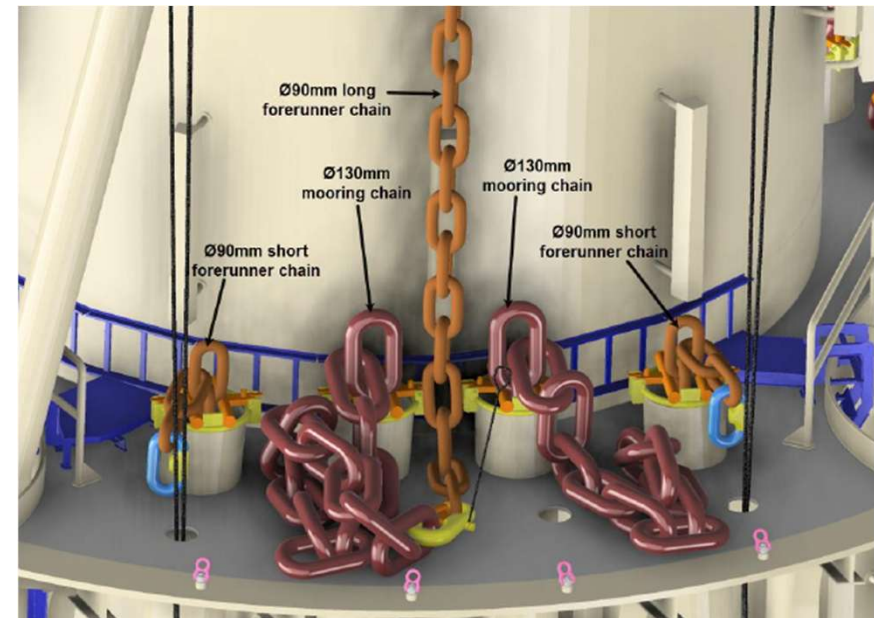
## Turret-moored FPSO

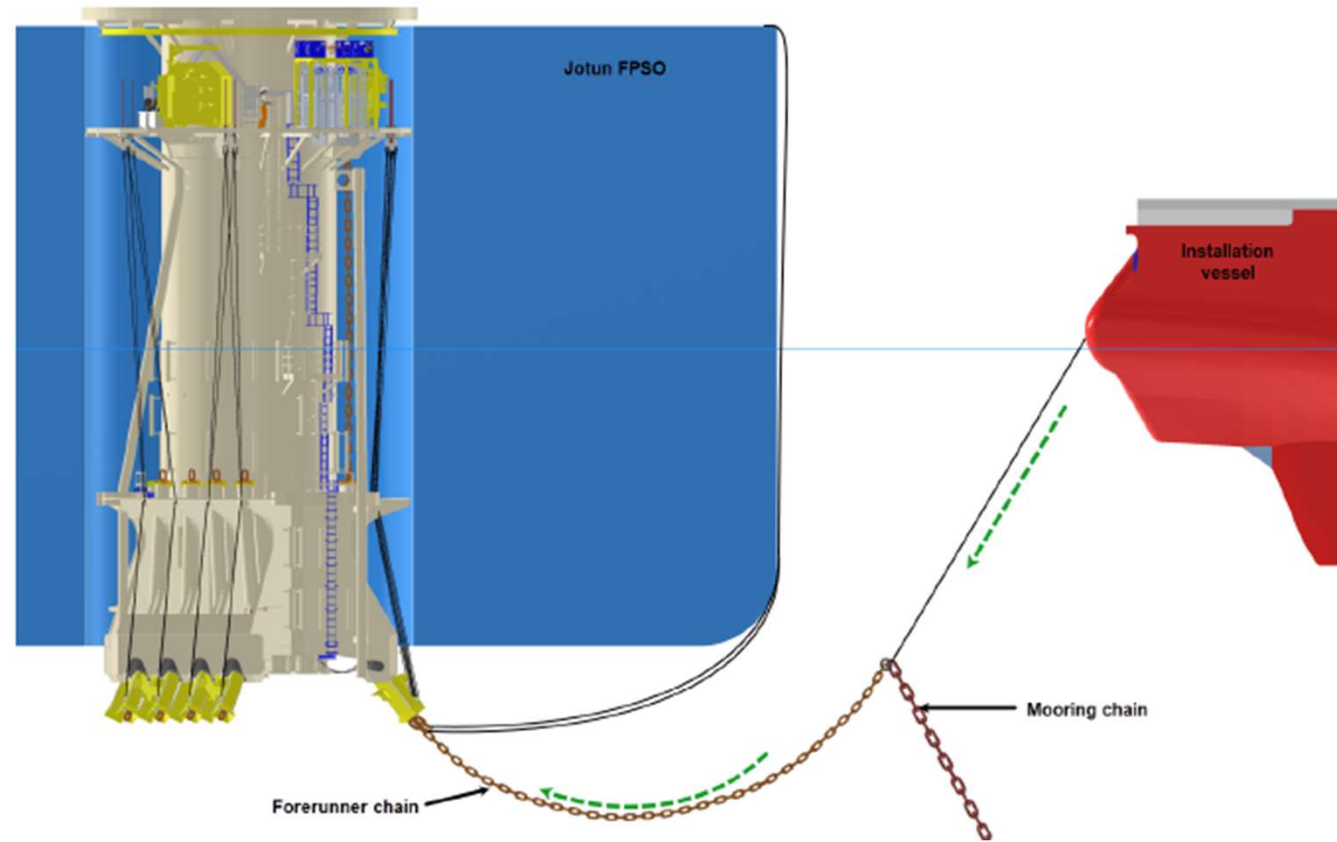




Turret-moored FPSO

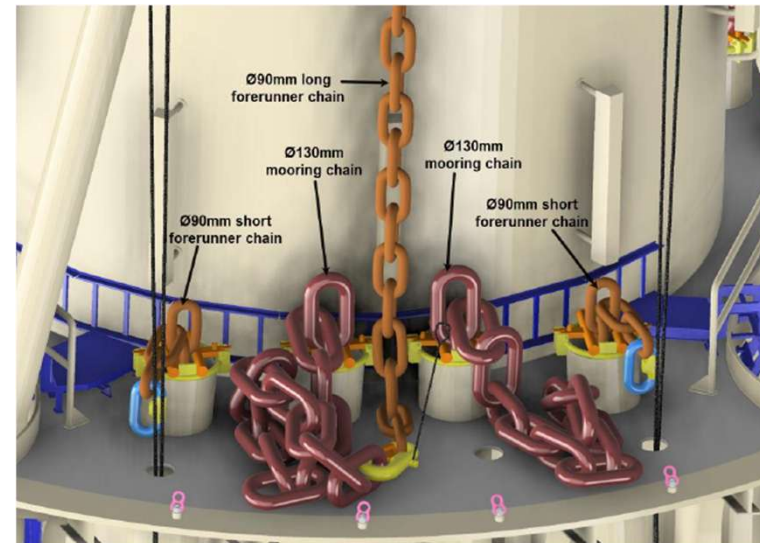
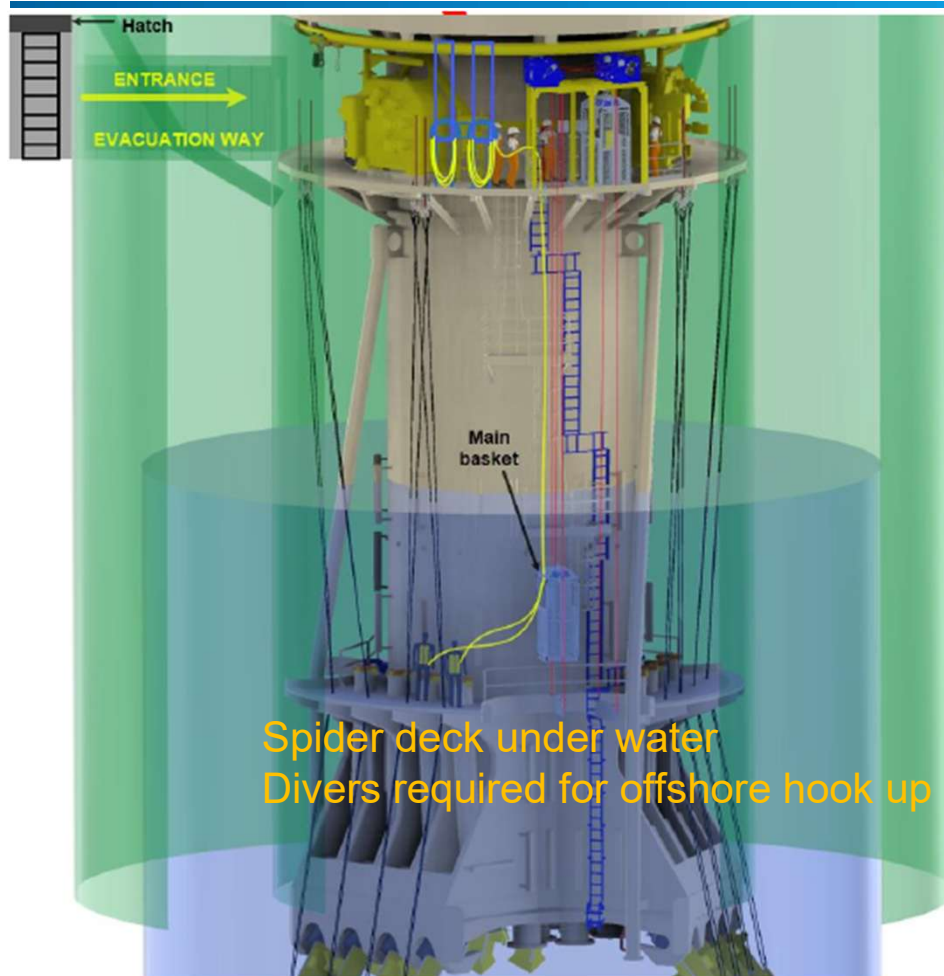
Personnel required at spider deck for connecting forerunner chain





# FPSO Mooring System

## Diving work – original plan



Original plan is as per old hook up system – you need human hands to reconnect forerunner chain after each pull in

Full dive spread planned on board Jotun FPSO – Requires FPSO to follow rules and regulations as a dive vessel.

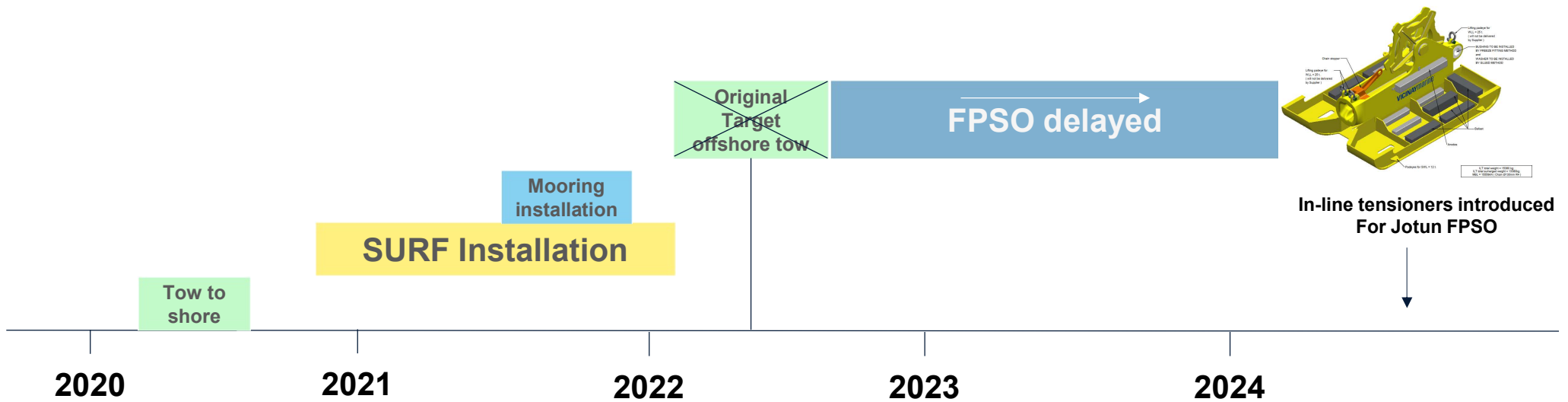
High risk operation – low operational limit (below 2m Hs) – confined space for divers – like diving inside washing machine

LARS installed at spider deck

# Timeline

## FPSO delays

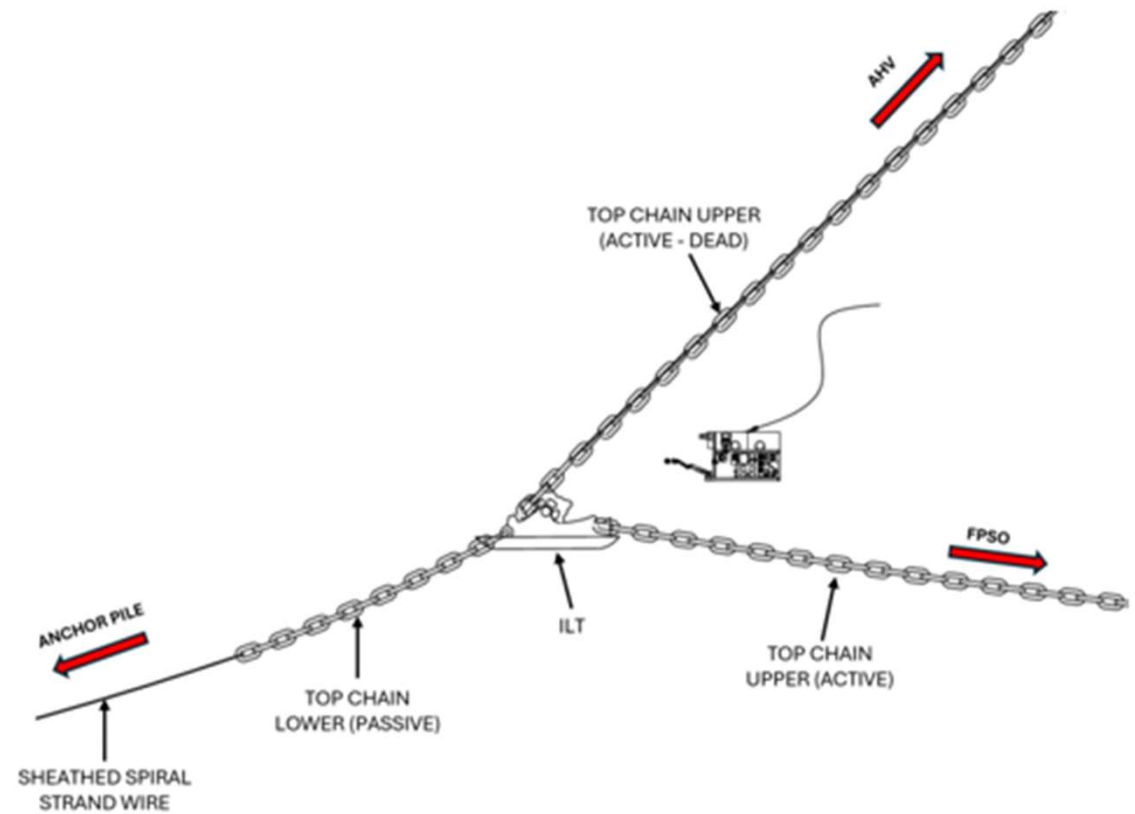
- Original FPSO mooring hook-up philosophy relied on diver-assisted operations
- In 2024, client elected to implement an In-Line Tensioner solution
- ILT allows subsea tensioning of mooring lines, eliminating the need for divers inside turret offshore



# FPSO Mooring System

## In-Line Tensioner (ILT)

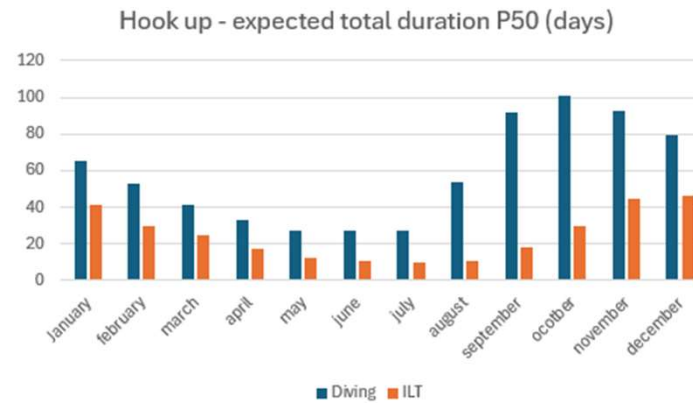
ILT – operational limit 2.5m – 3.0m (Hs)



# Comparison

## Offshore Hook Up Diving vs. ILT

Aspect	Diving Hook-Up	In-Line Tensioner
Execution	Divers inside turret	Subsea Tensioning
HSE Risk	High – confined space and diving risks	Low (diverless)
Hs Limit Weather sensitivity	< 2.0m Highly weather dependent	~2.5 – 3.0 m Reduced
Schedule Robustness	Weather-critical	More reliable Prep work performed outside critical path
Complexity	Lower (tensioning)	Higher (equipment and controls)
Overall cost impact	High offshore costs, delay-driven	Higher upfront cost, engineering, fabrication, additional campaign required



# Ocean

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## ILT Installation 2024



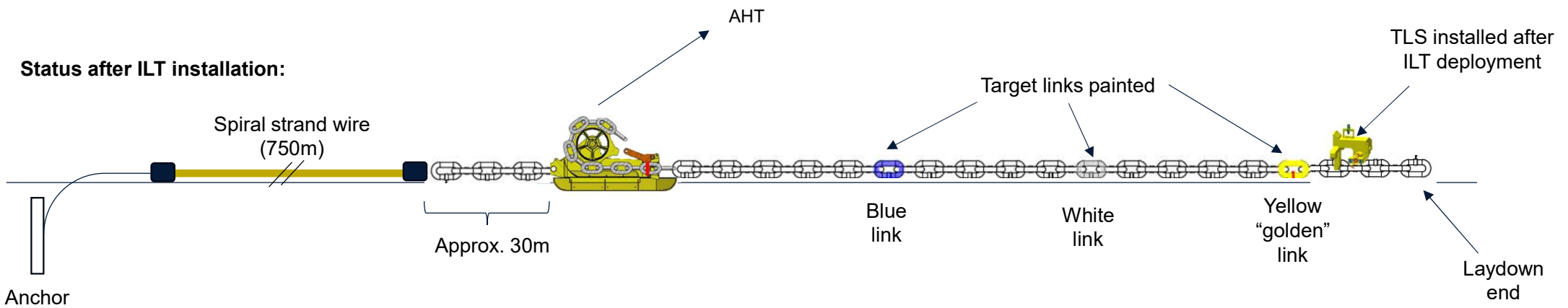
Evolution of mooring installation approach

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# New Installation Philosophy

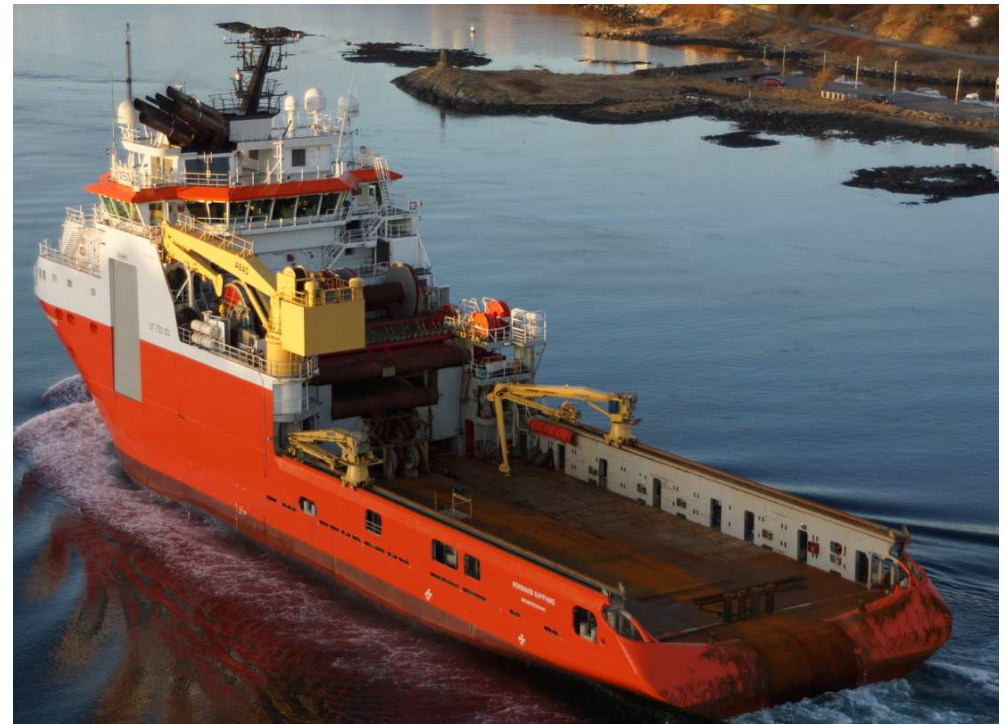
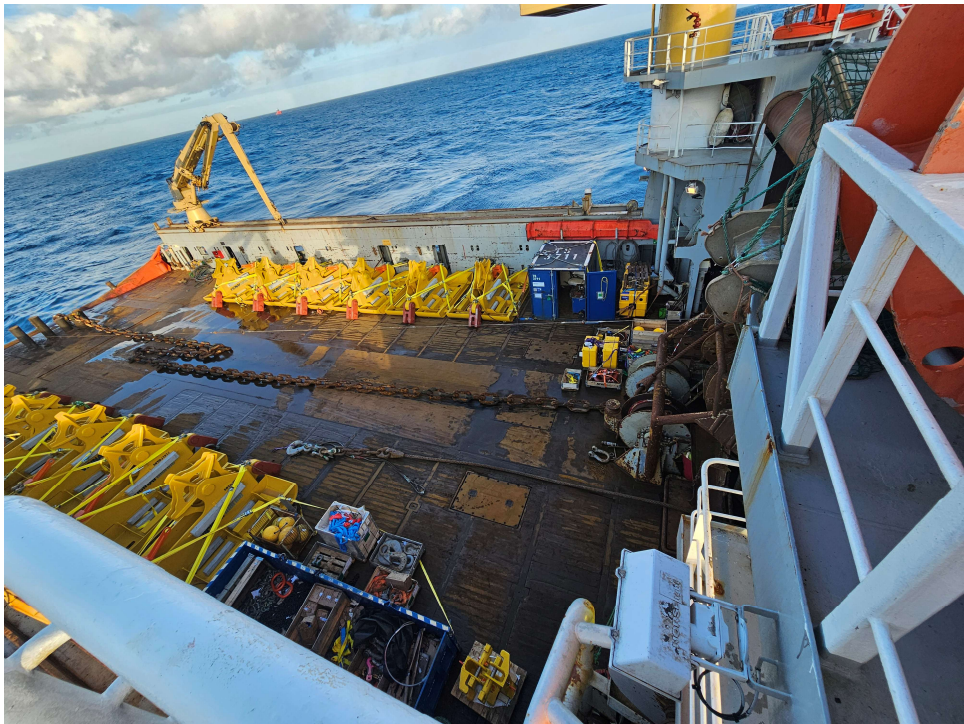
## In Line Tensioners



# Offshore ILT Installation

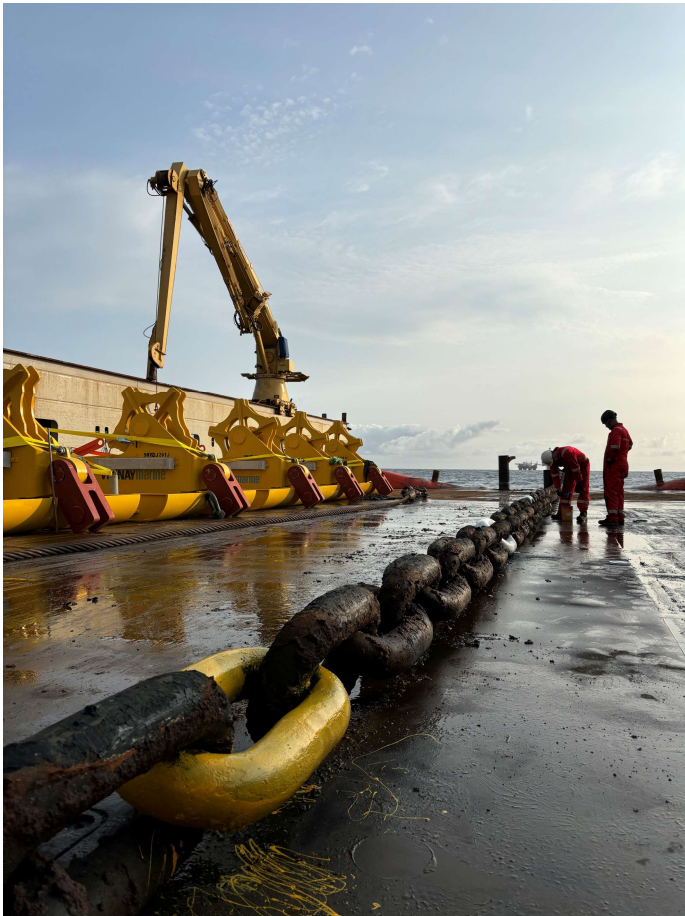
Normand Sapphire

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# Offshore ILT Installation

Normand Sapphire



# Offshore ILT Installation

## Normand Sapphire

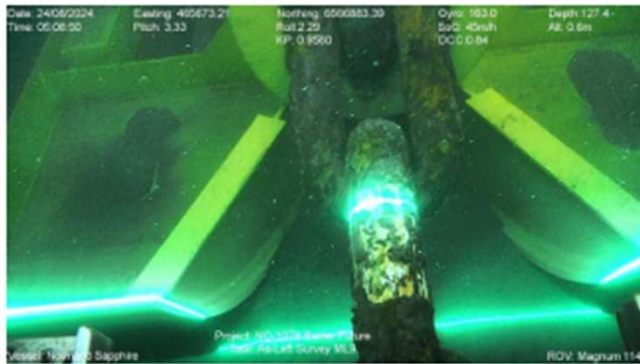


Figure 13: As left North structure heading – KP 0.956

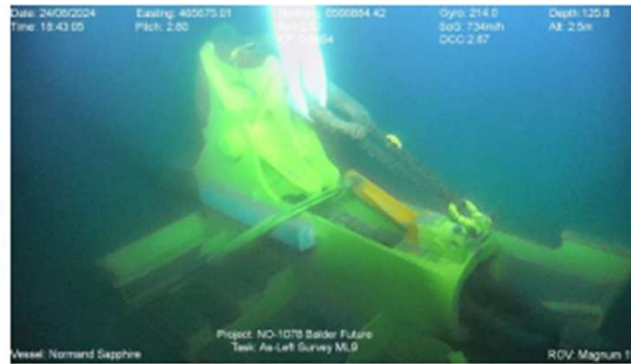


Figure 14: As left ILT overview

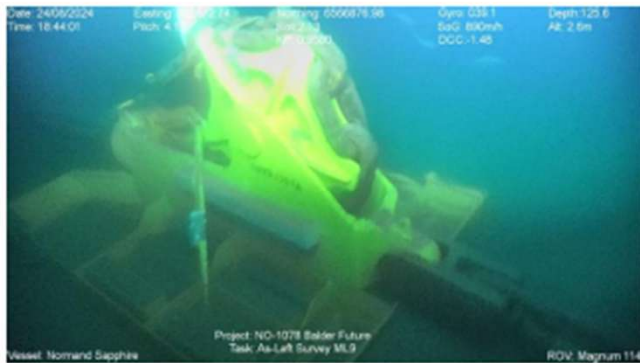
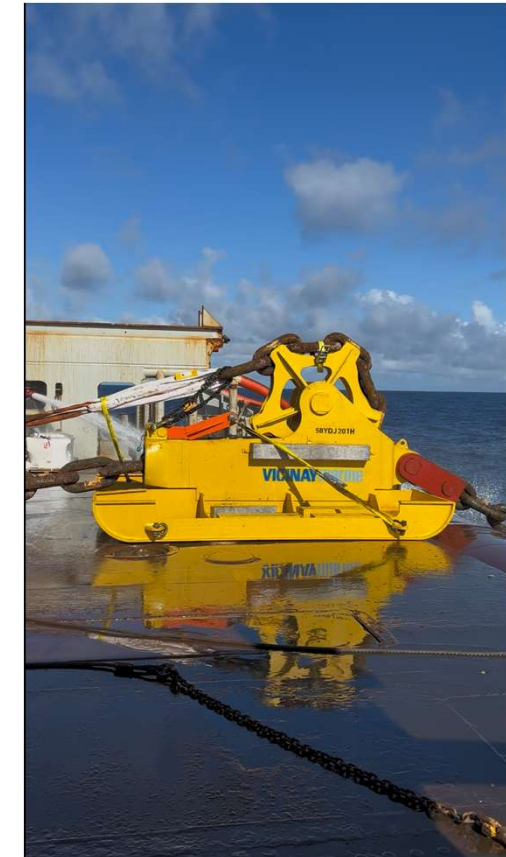


Figure 15: As left ILT overview

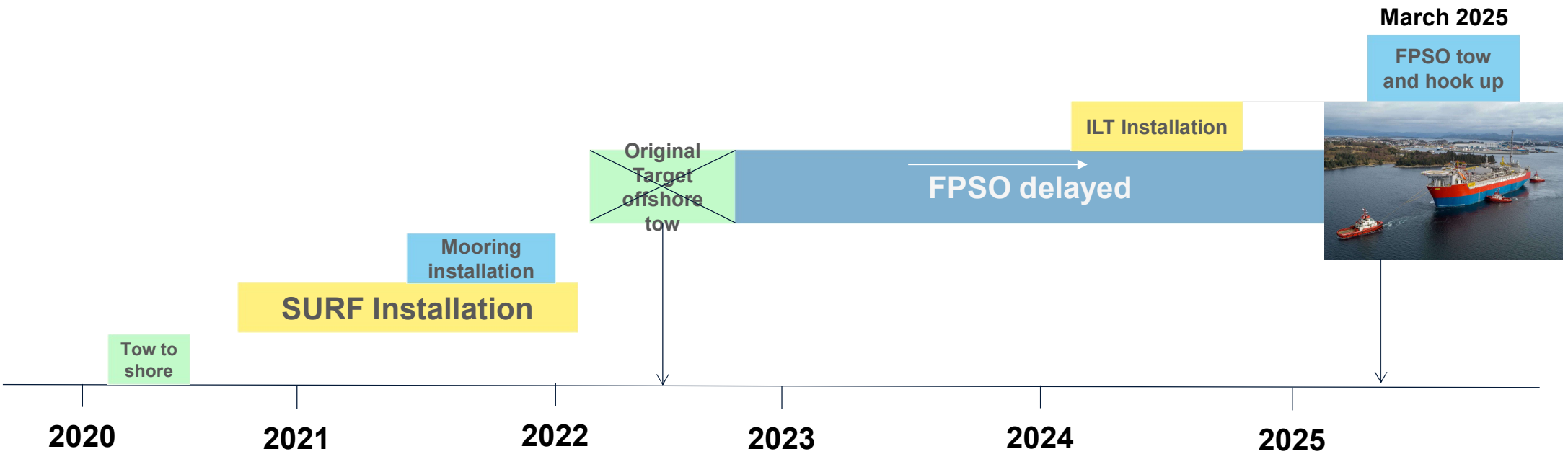


Figure 16: As left Blue link – KP 1.027



# Timeline

FPSO complete



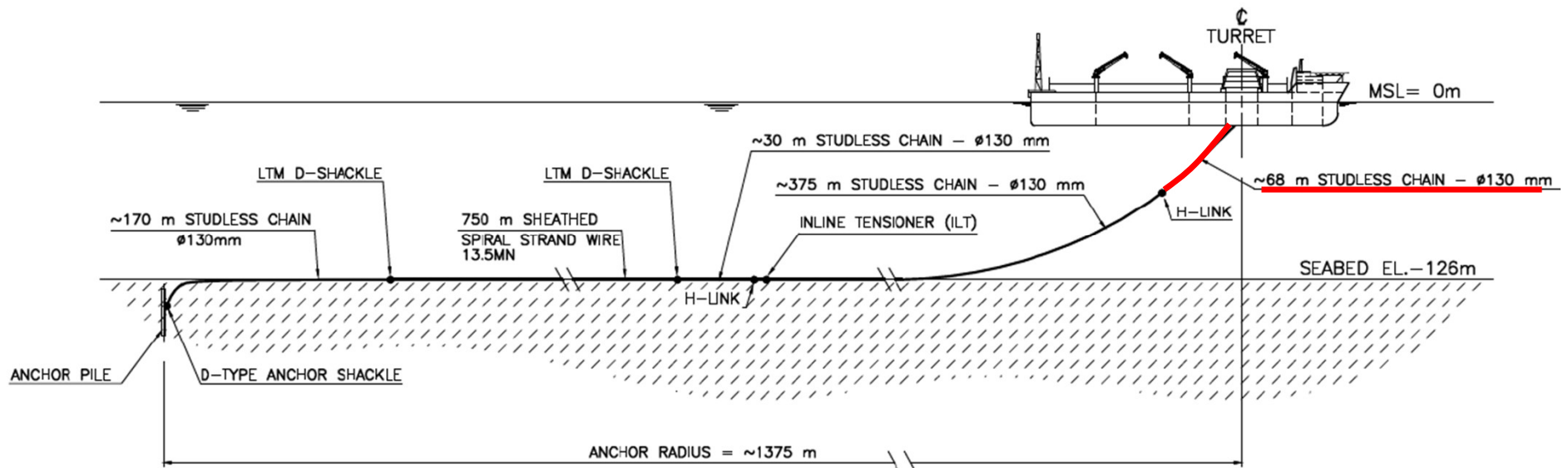
# Inshore Operations

Jotun FPSO completed March 2025



- Five years at Rosenberg yard

**NEW:**



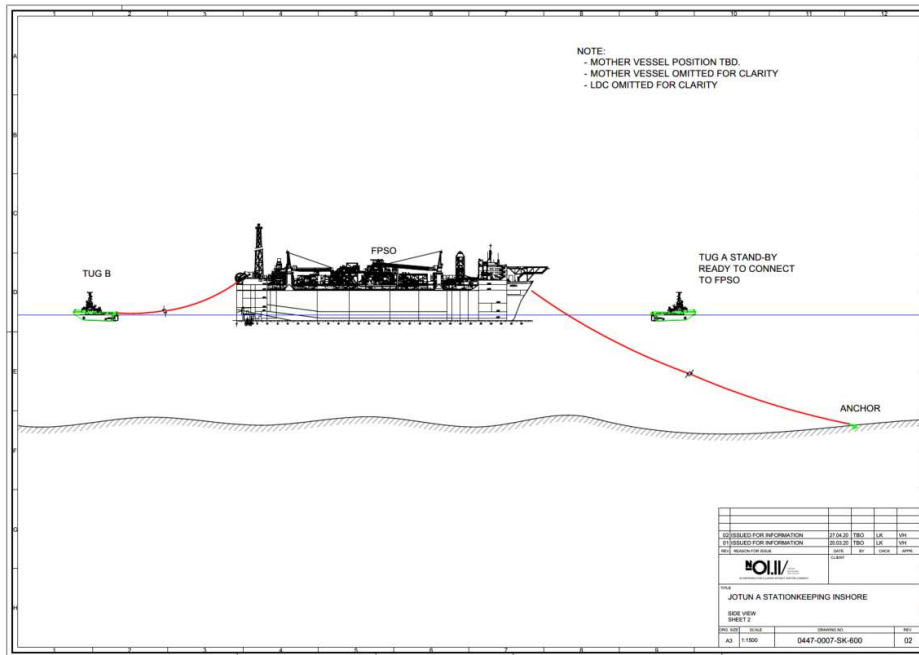
12-off 80m chains ( $\phi 130\text{mm}$ ) installed to FPSO before tow out

# Inshore Operations

## Chainstopper chain installation

- Drag anchor installation & station keeping thereafter
- FPSO at "Lightship" Draft ~5.0m
- Riggers working at Spider Deck ~0.5m above waterline
- Normand Sapphire loaded with 12 x 80m chainstopper chains

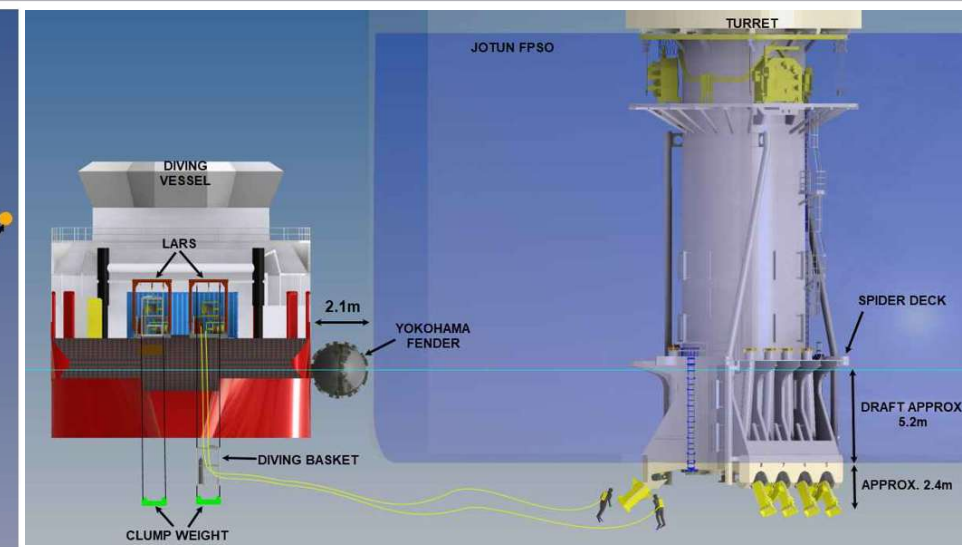
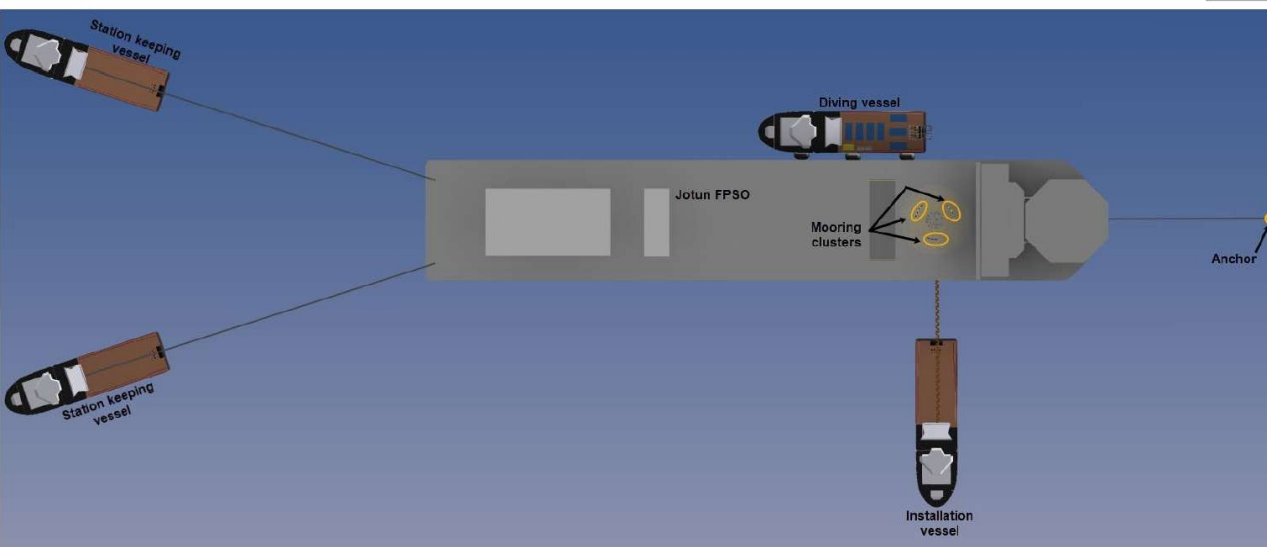
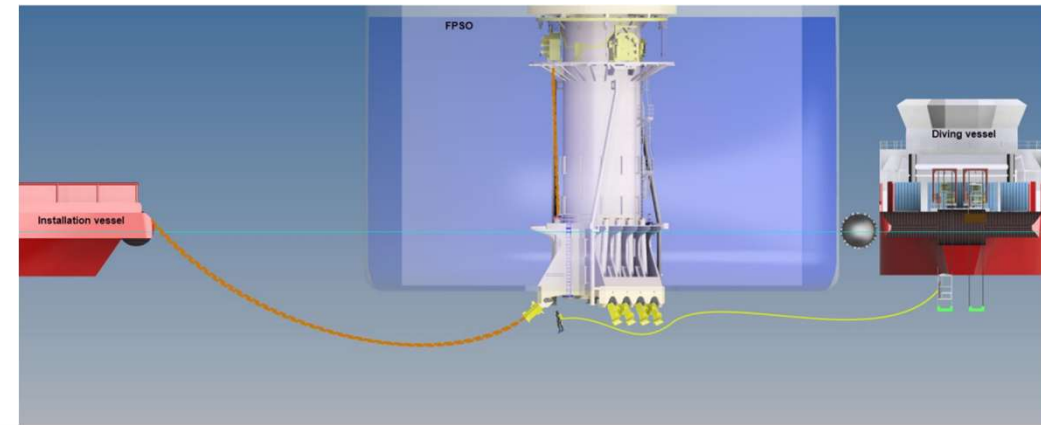
- Diving vessel BB Ocean mobilised with dive spread and moored at FPSO port side



# Inshore Operations

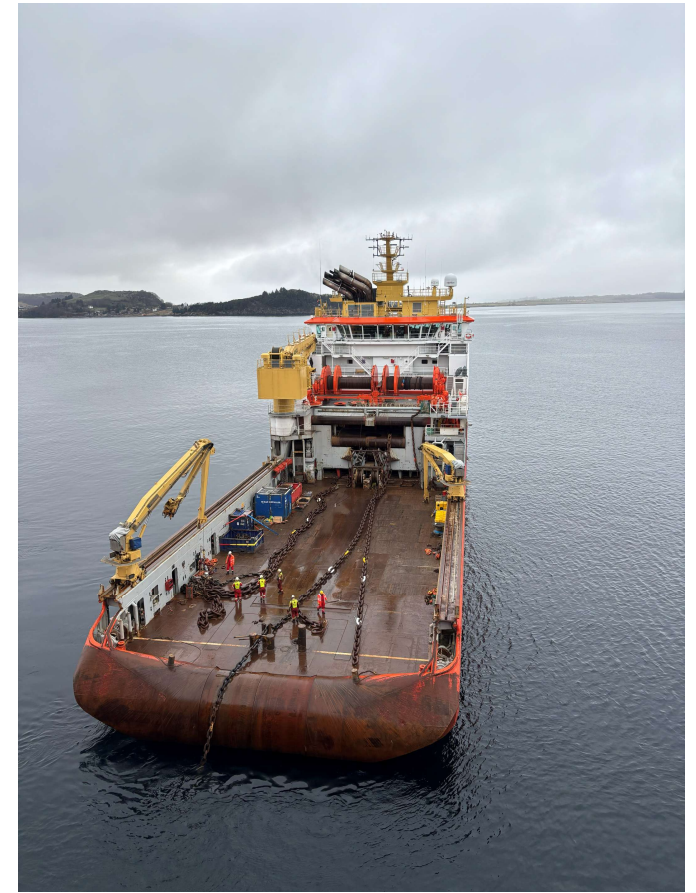
## Chainstopper chain installation

- Diver operations completed:
  - Cleaning lower chainstoppers
  - Connect rigging at lower chainstoppers
  - Remove suspension wires
  - Survey



# Inshore Operations

## Chainstopper chain installation



# Inshore Operations

## Chainstopper chain installation

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A photograph of an offshore oil rig installation. In the foreground, a worker in a red jacket and white hard hat stands on a platform, looking out over the sea. The jacket has "OceanInstaller" written on the back. In the background, large dark pipes are being lowered into the water by a crane. The sky is overcast.

# Ocean

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## Offshore Tow-out to Field

- Fjord to Balder Field

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# Offshore Tow to field

## Vessels

### Tow & Station Keeping

- TV1 – Aurora Sandefjord (390Te BP)
- TV2 – BB Octopus (201Te BP)
- TV3 – Siem Opal (297Te BP)



### Hook-Up

- AHT1 – Normand Sapphire (282Te BP, 25Te AHC Crane, AHC work winch)
- AHT2 – Saltfjord (397Te BP)

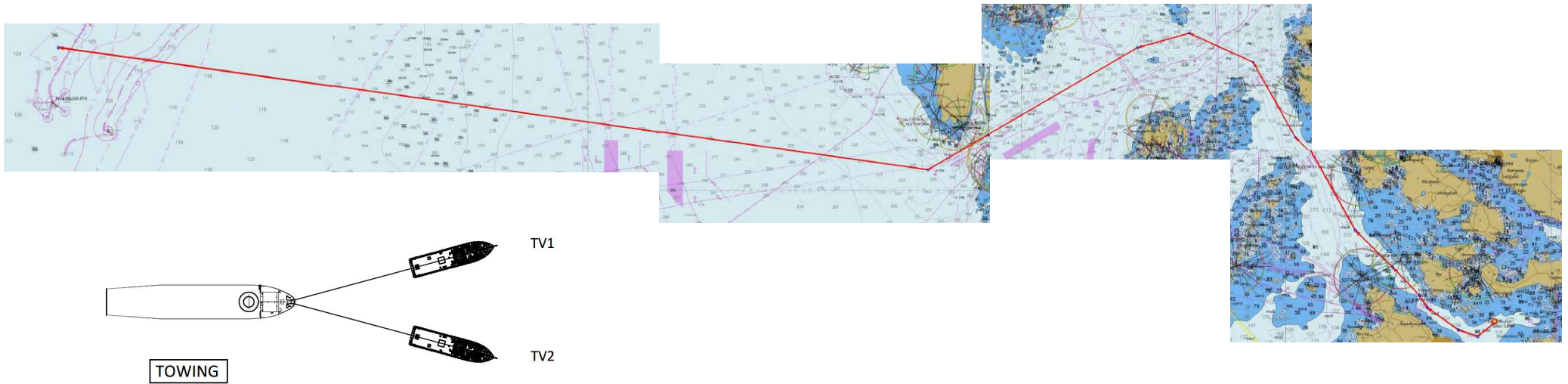


# Offshore Tow to field

## Tow route

- 68m chain lengths hanging below turret for tow out.
- Extreme tow draught of ~79m – some extra drag forces induced
- Tow route planning to ensure sufficient water depth during tow
- Offshore Tow ~106Nm

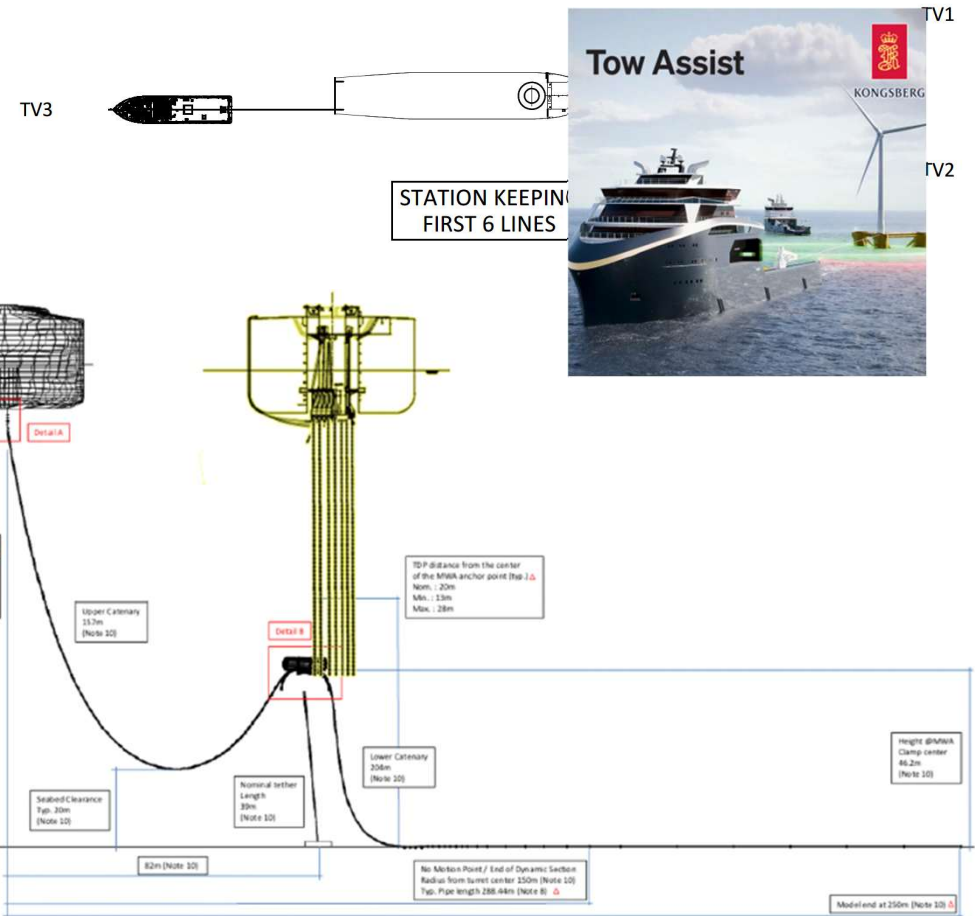
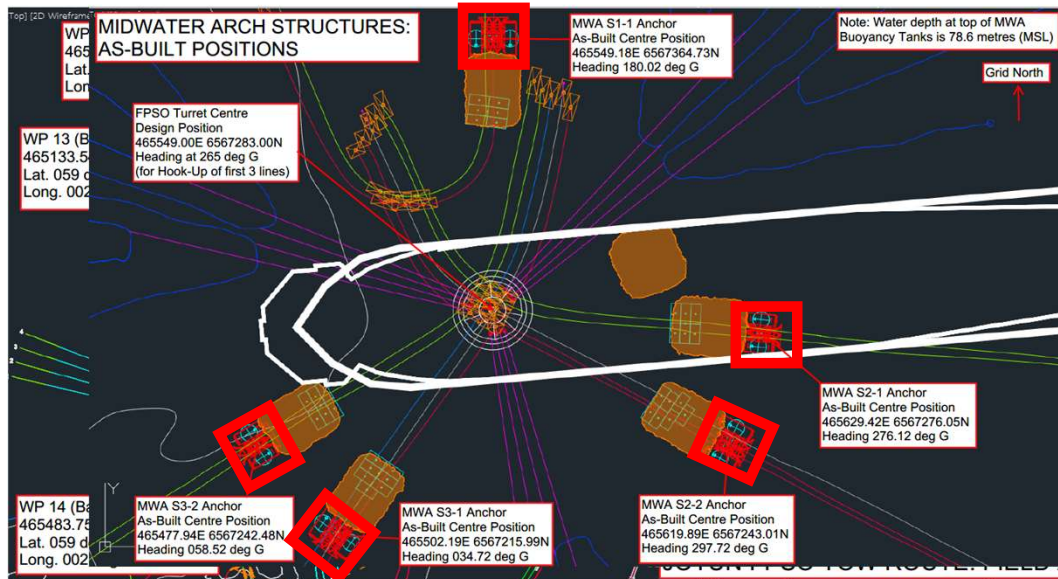
Leg	Dist (Nm)	TPOP (hr)	TC (hr)	TR (hr)	Weather criteria OPLim
Offshore Tow	106	24	12	36	BF 5 (2m Hs and 20 knots wind) for commencement  Restricted thereafter: 3.6m Hs 30 knots wind



# Offshore Tow to field

## Station Keeping

- On arrival at the field outside the 500m zone the 3<sup>rd</sup> tow vessel connected
- Station keeping trial performed with 3 off TVs
- Relocate FPSO to turret centre position
  - Moving in from north west
  - Tight corridor between MWA's
  - Strict weather limitations
  - Simulator training conducted with captains and tow masters beforehand



# Ocean

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## Offshore Hook-Up Operations



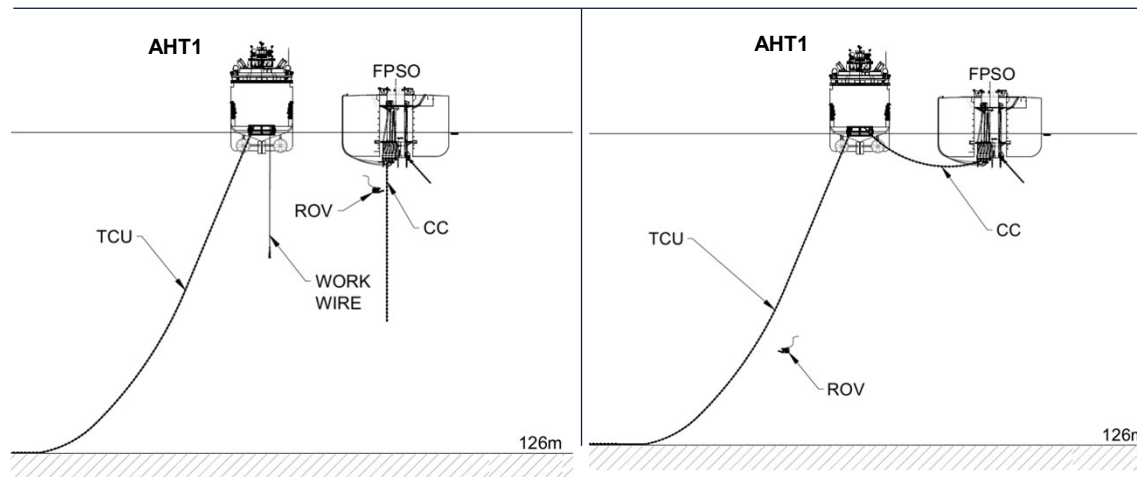
ILT subsea tensioning

# Installer

# Offshore hook up

## Connect mooring line to FPSO

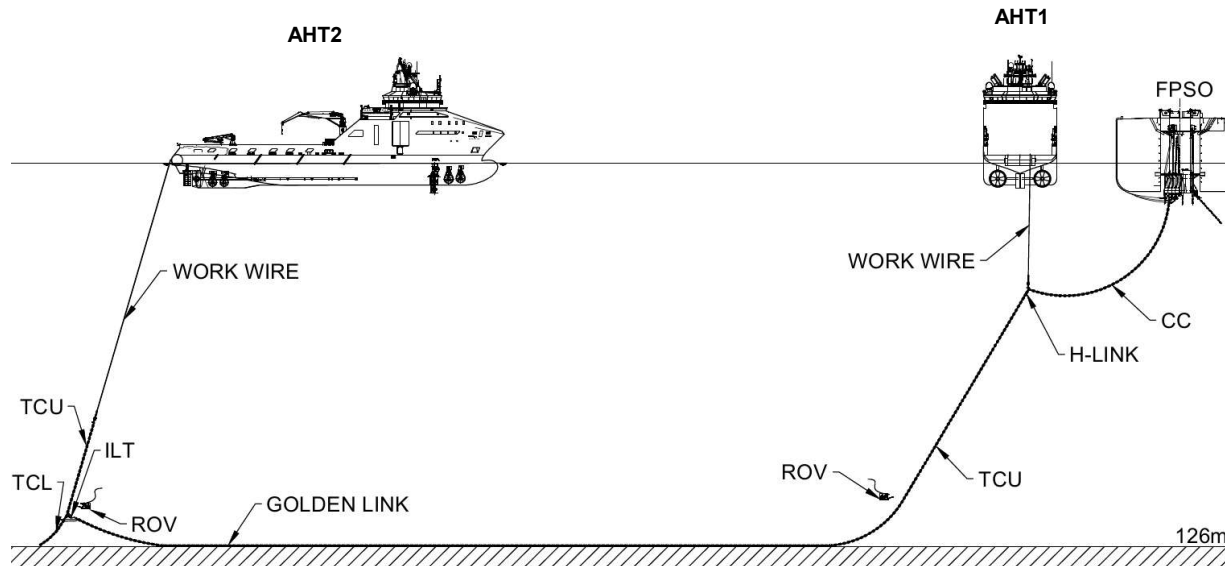
- AHT 1 (Aurora Saltfjord) recovered wet stored mooring line from dog leg position
- AHT 1 recovered chainstopper chain from FPSO
- Connected mooring line to chainstopper chain via H-link



# Offshore hook up and tensioning

## Subsea tensioning

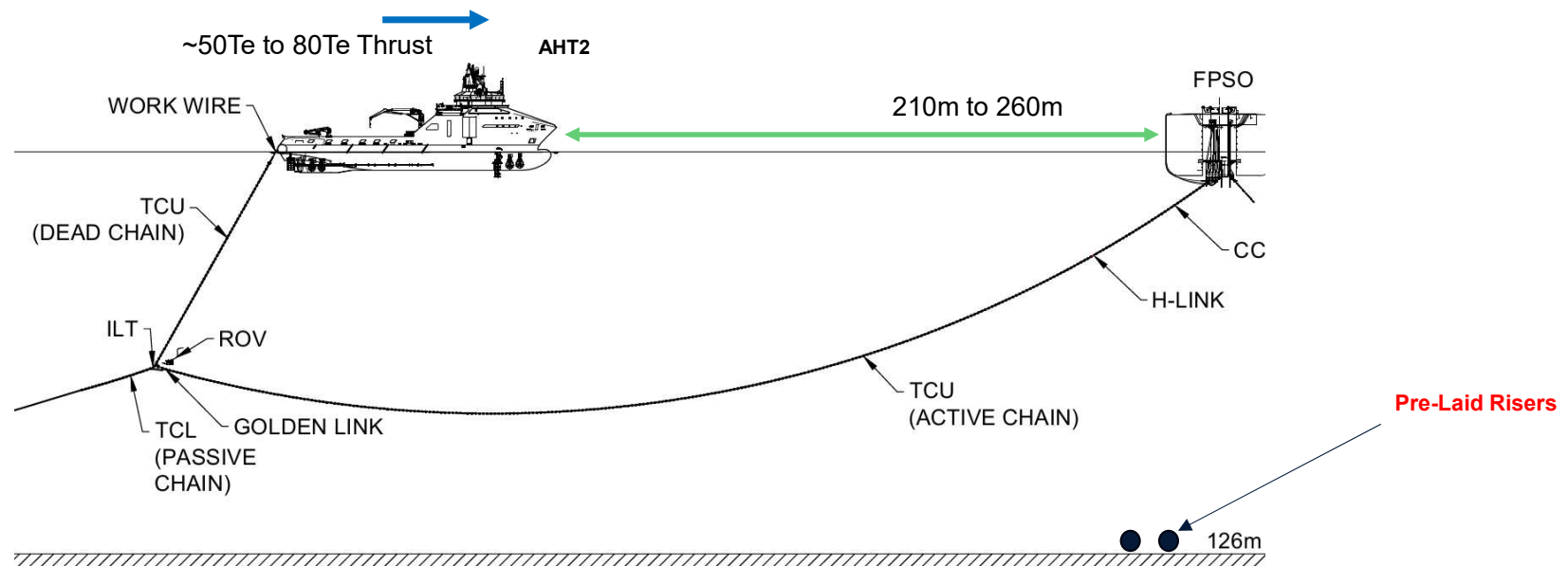
- AHT 2 connect to active chain on ILT resting on the seabed – Sapphire with AHC winch
- AHT 1 deploy chain connection whilst AHT 2 tension the mooring line
- AHT 1 disconnects from the chain connection (and moves clear)



# Offshore hook up and tensioning

## Subsea tensioning

- AHT 2 tensions the mooring line until target/golden link achieved at ILT
- AHT 2 reduces tension and lowers ILT to seabed
- AHT 1 measures and records mooring line angle with ROV

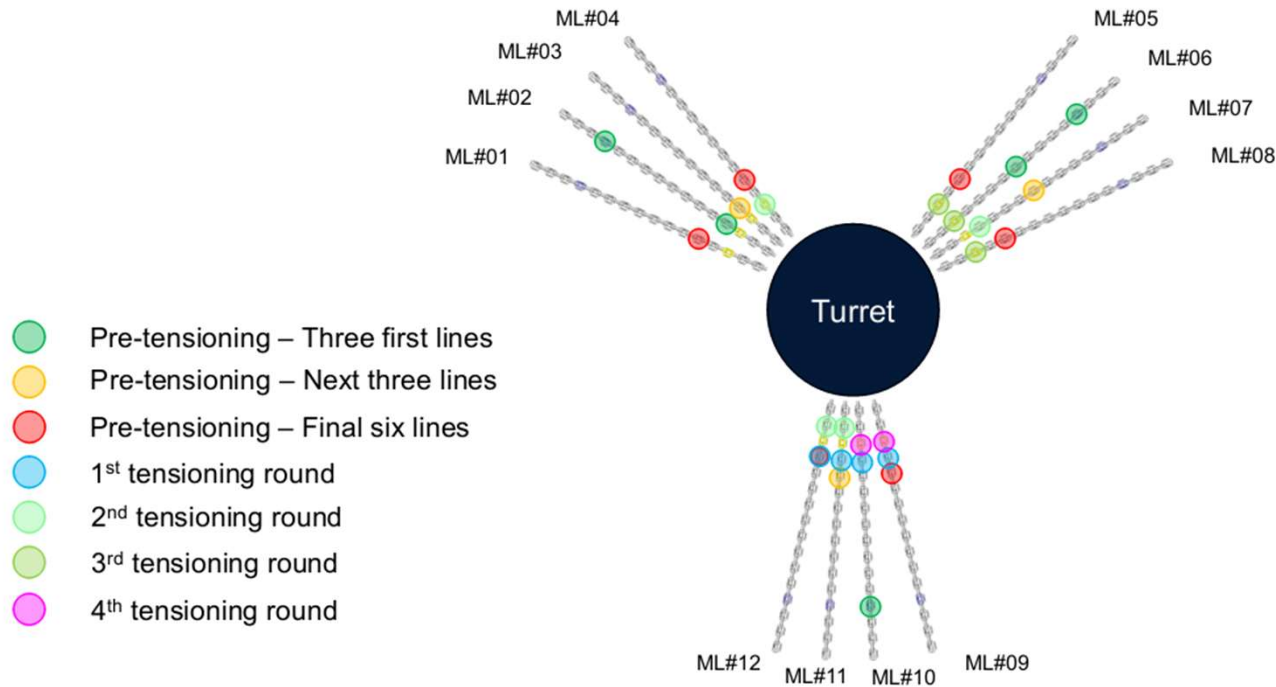




# Tensioning operations

## Tensioning sequence

- Loads during final tensioning stages were higher than predicted – keeping bow station keeping tug and using its bollard pull to offset Jotun towards the line being tensioned allowed to reduce the Sapphire winch and bollard pull loads



# Tensioning Operations

## Tensioning sequence

### bluewater

**Project Data**

Project number: 0-2211-M  
 Installation code: JBX  
 Reference: ~

**General**

Date of measurements: 16/04/2025  
 Local time: 10:59

**Water depth and vessel draft**

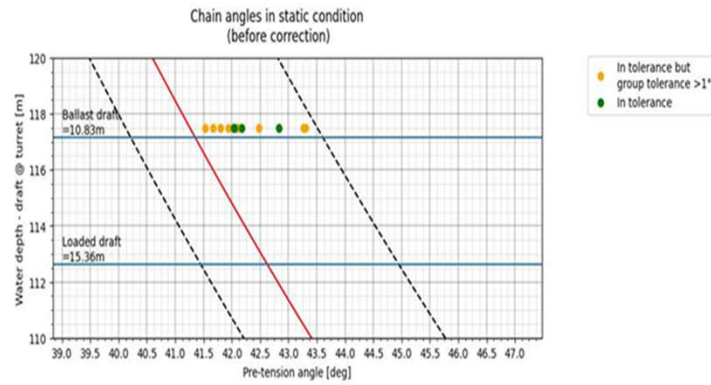
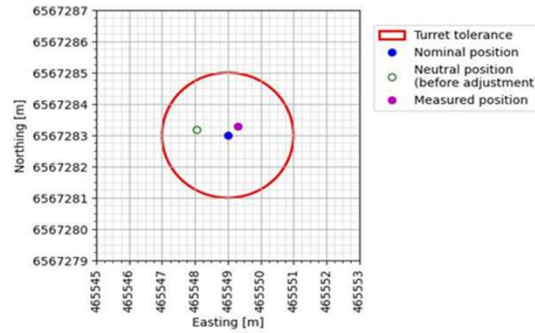
Actual water depth: 128.0 [m]  
 Vessel draft: 10.5 [m]  
 10.5 [m]

**Vessel position**

Measured position: Easting [m] 465549.31, Northing [m] 6567283.29

**Measured chain angles**

Line	Chain angle [°]
Line1	43.3
Line2	41.9
Line3	42.1
Line4	41.7
Line5	42.8
Line6	42.2
Line7	42.0
Line8	42.0
Line9	42.5
Line10	43.3
Line11	41.5
Line12	41.8

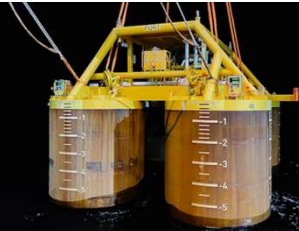


# Complete

FPSO Ready for Production – first oil late June 2025



# Balder Future Project



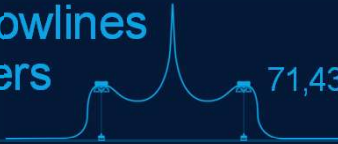
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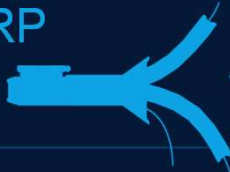
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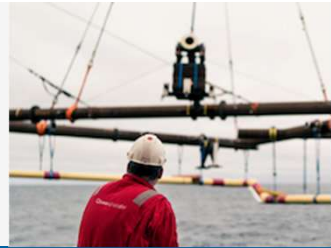


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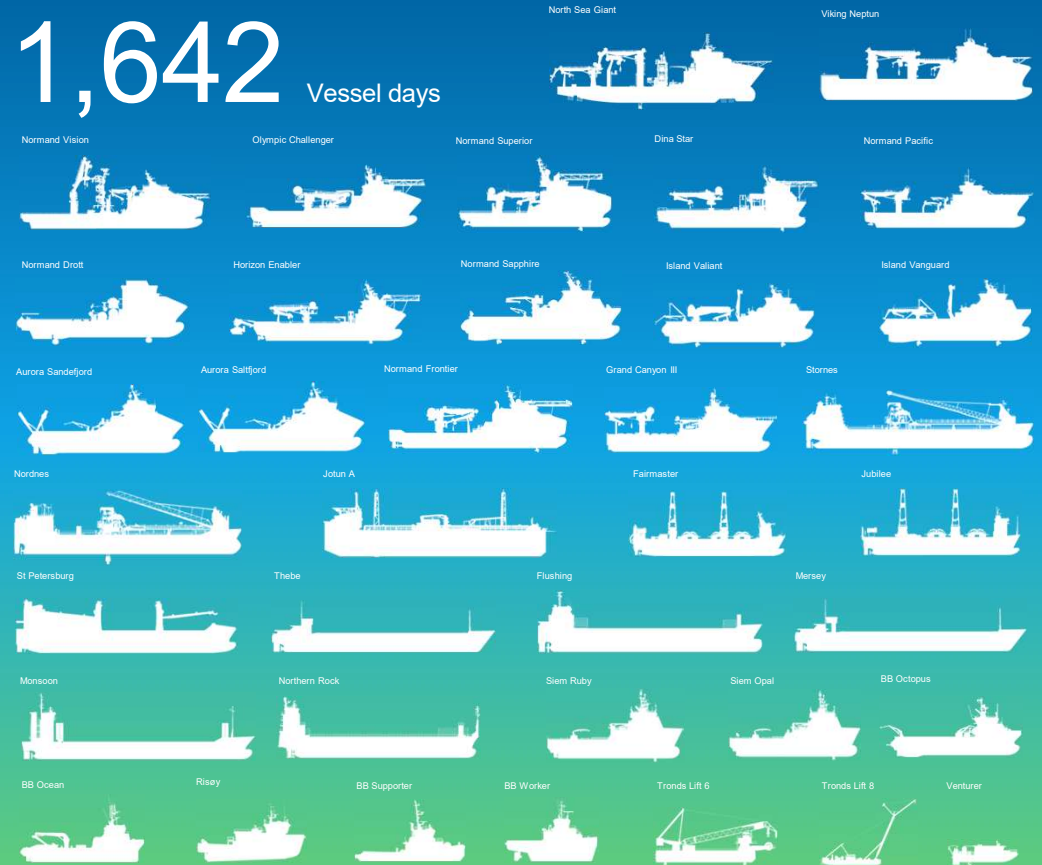


# Ocean Installer

2019 to 2025



**1,642** Vessel days



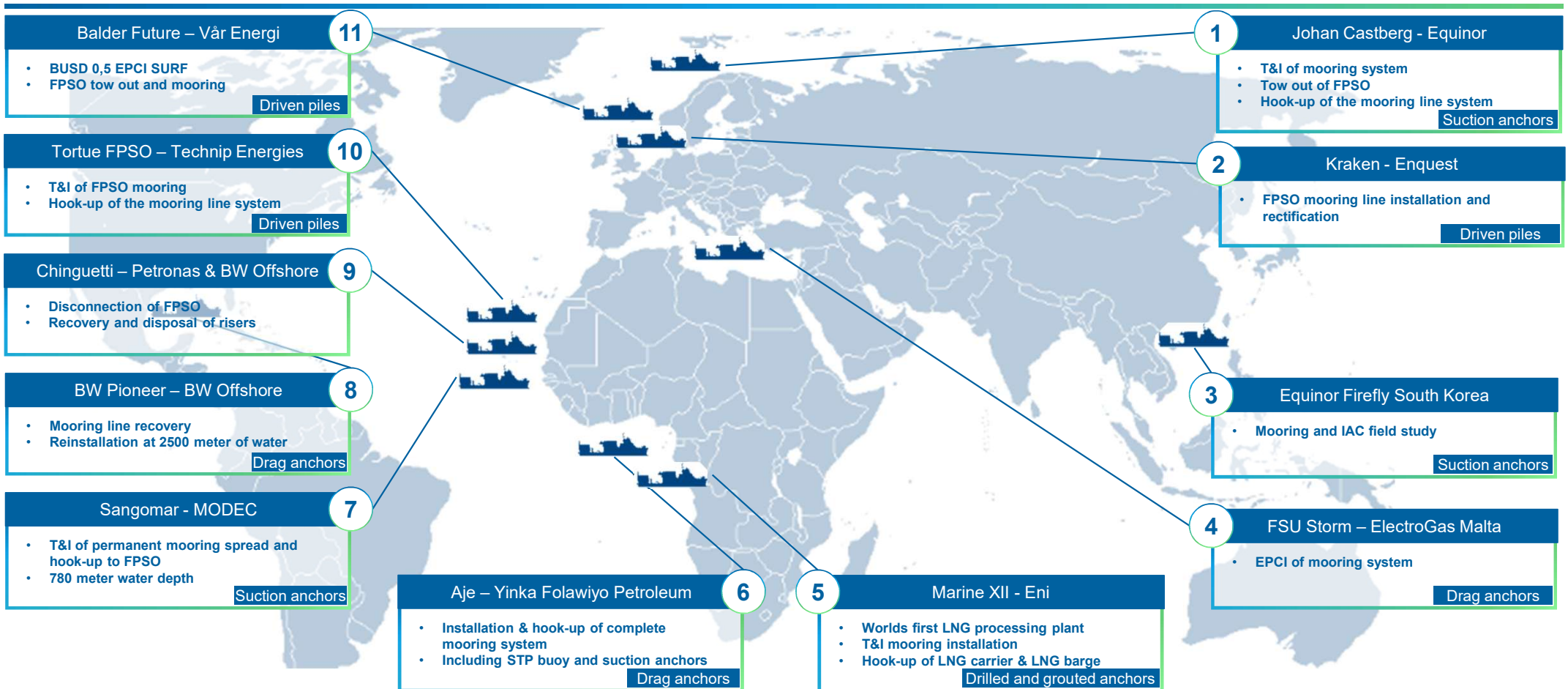
Client: vår energi

Consortium Partner: Baker Hughes

Flawless offshore project execution

# Global provider of mooring related services

Track-record in both remote and harsh environment



Sondre Bryn Høgheim

Sondre.hogheim@oceaninstaller.com

**Thank You**

**Ocean**Installer

