



World First Permanent Split Mooring System

Ocean Installer

Scope of Work

Project Overview

Client:

- ENI Congo

Scope:

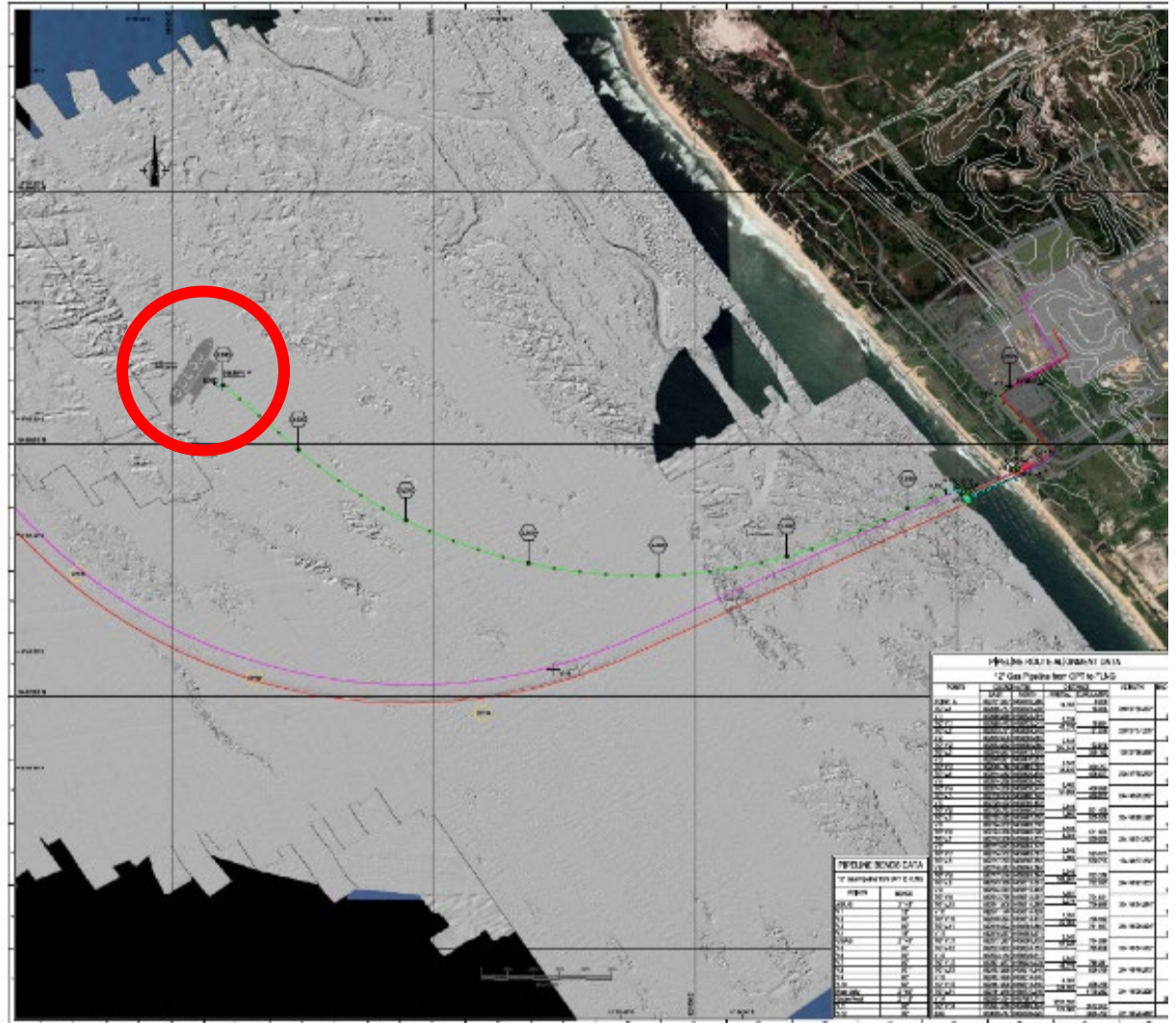
- Transport and Installation of Mooring System

What it involved (what we did):

- Detailed Engineering Design
- On-Shore Preparation of Mooring Chains
- Transport of 11-off Drag Anchors
- Installation of 7-off Drag Anchors
- Pre-Lay of 17-off top chains (incl. Stevadjusters)
- In-Shore FLNG TERMINAL Hook-Up
- Combined Tow and Station Keeping of FSU and FLNG
- In-Field Hook-up and Tensioning of FSU and FLNG
- Bonded Riser Installation

Location:

- Litchendjili Field, Congo
- Located approximately 2km from the shore
- Water depth: 17m – 20m



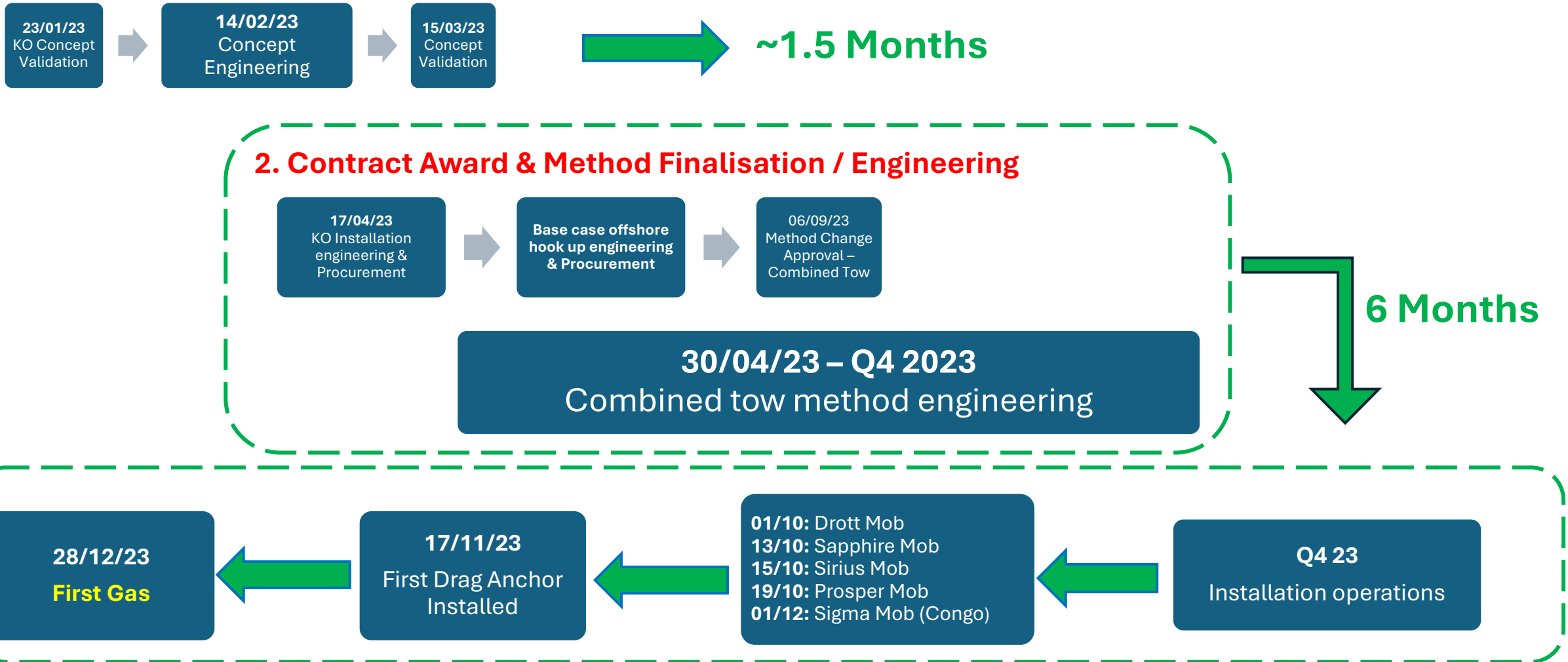
The Marine XII Design

The Split-Moor Design



Planning and Execution

Planning and Execution



Planning and Execution

FLNG Tow / Station Keeping

Towing Tug

General

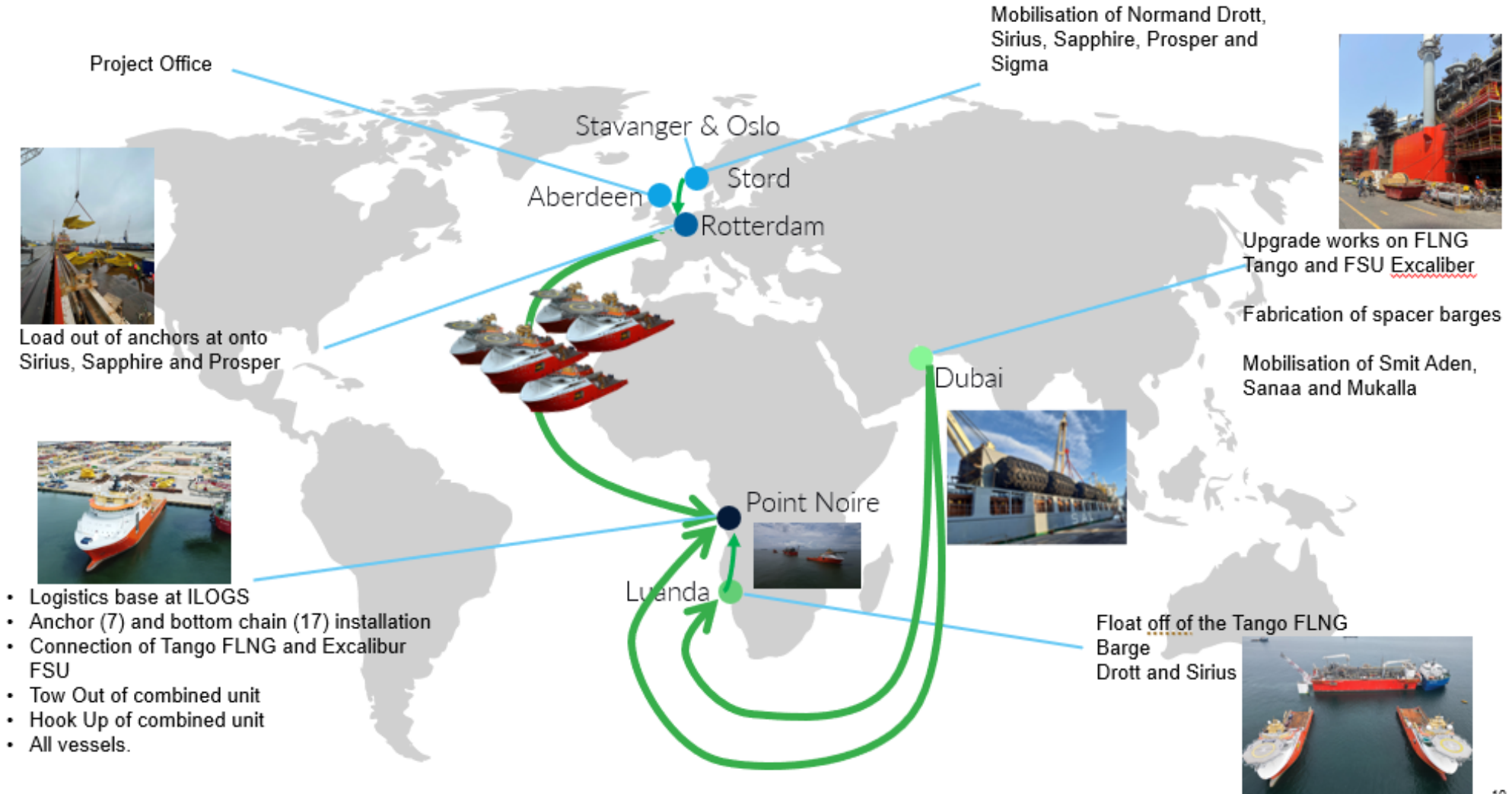



Vessel Name		SL Aden	SL Sana'a
Owner		SMIT	SMIT
Technical			
LOA		36.00	36.00
Beam		14.50	14.50
DP		-	-
Deck Crane		1t @ 13.2m	1t @ 13.2m
Deck Space		-	-
ROV		No	No
BP	95	90	90
Accommodation		10	10
Commercial			
Year of build		2009	2009

Nor

and Sirius

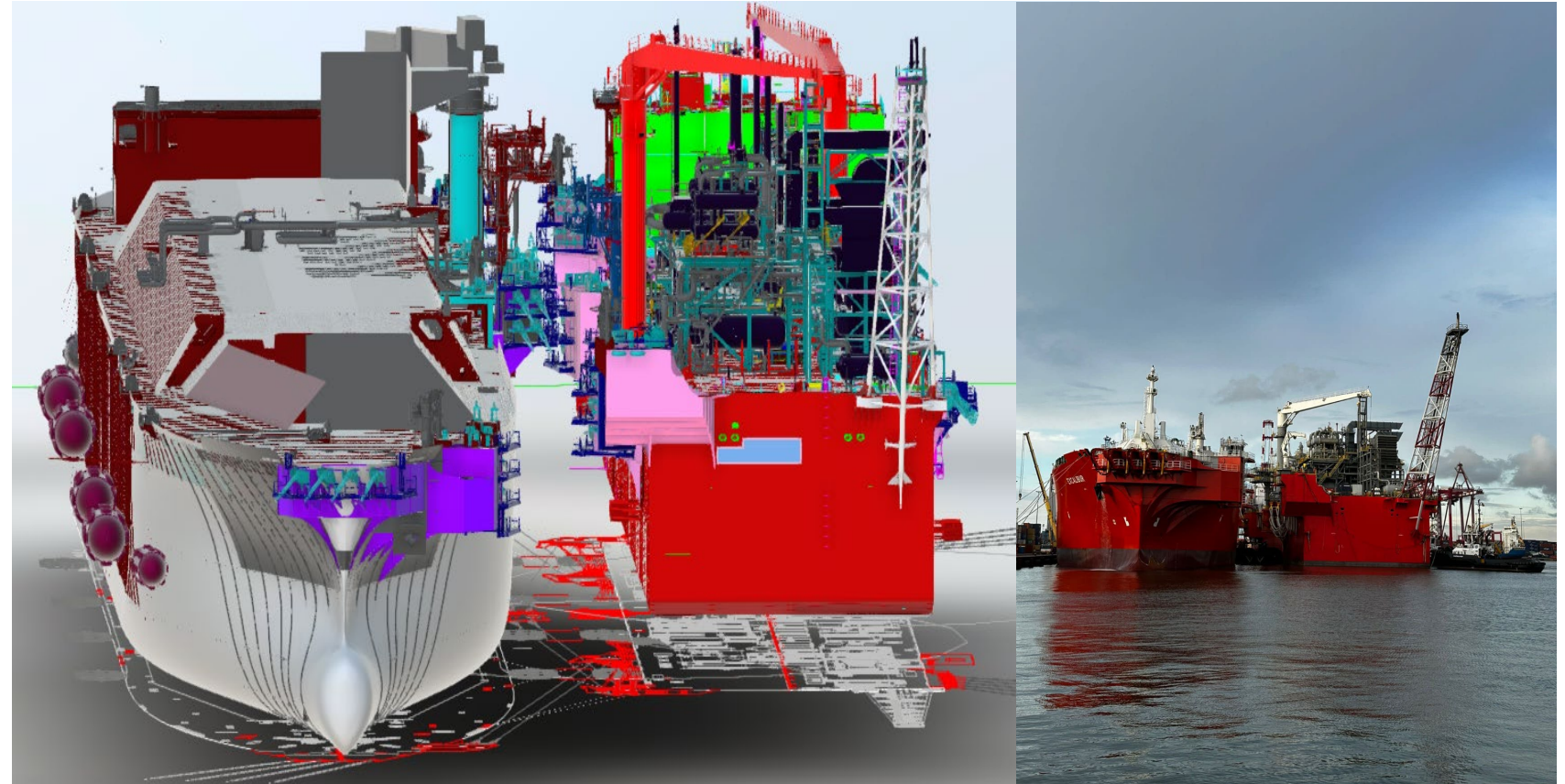
Planning and Execution



Basecase Solution

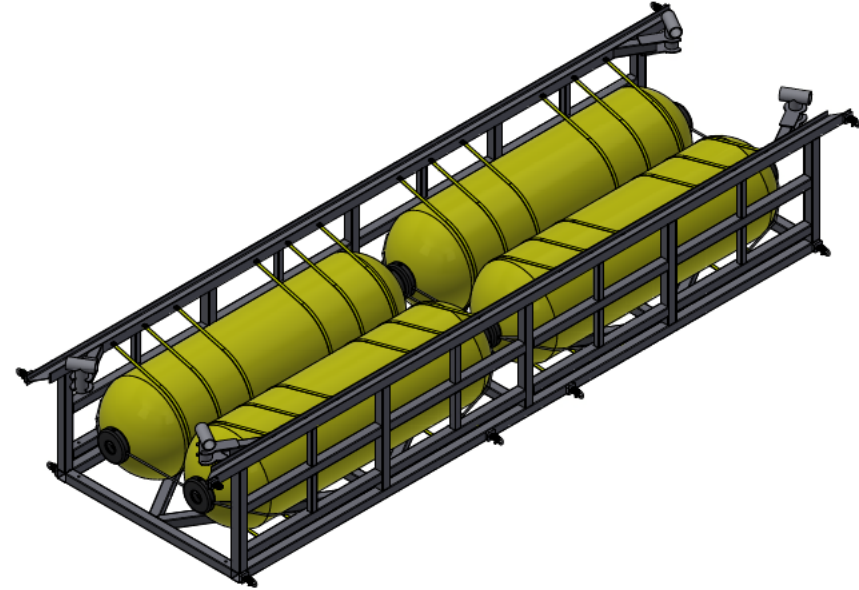
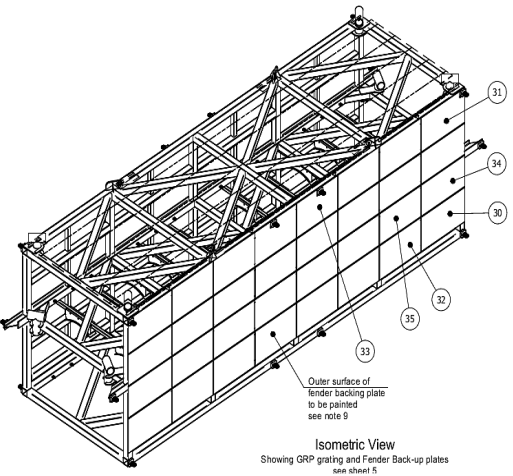
Basecase Solution

- Normal operating separation is 25m
- Installation separation needed to be 15m (hull-to-hull)
- Protruding structures made steel-to-steel separation ~4m



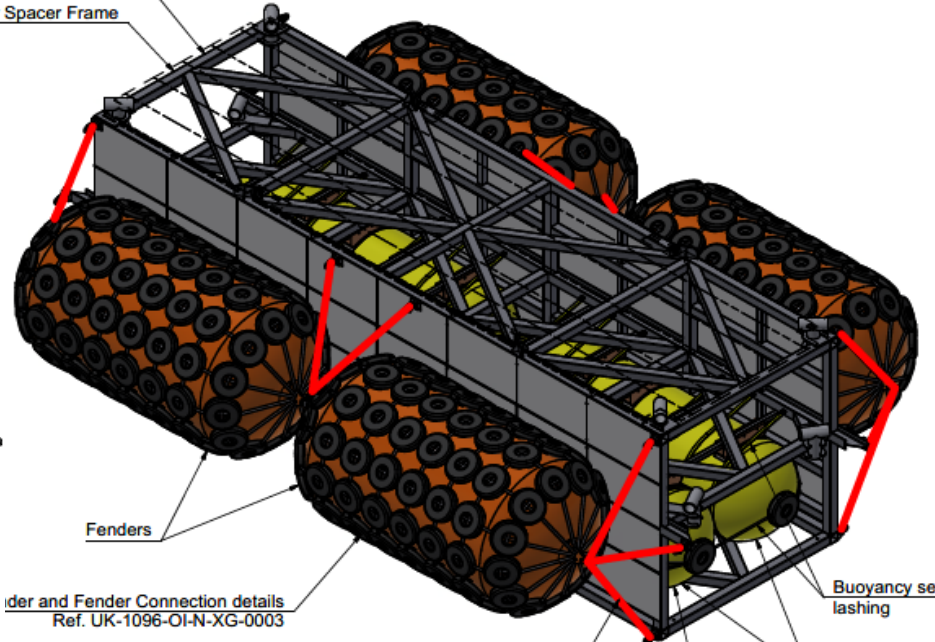
Basecase Solution

- Max. dimensions [LxWxH]: 24m x 16.7m x 7.5m
 - Frame: 24m x 6.8 x 7.5m
 - Average two storey house in UK: 12-14m x 7-8m x 6-7.5m
- 4x Marine salvage bags used to provide buoyancy to the frames
- Each fender rated for 770Te (7551kN)



For Fender Spacer Frame Fabrication detail
Ref. UK-1096-OI-N-XG-0002

Fender Spacer Frame

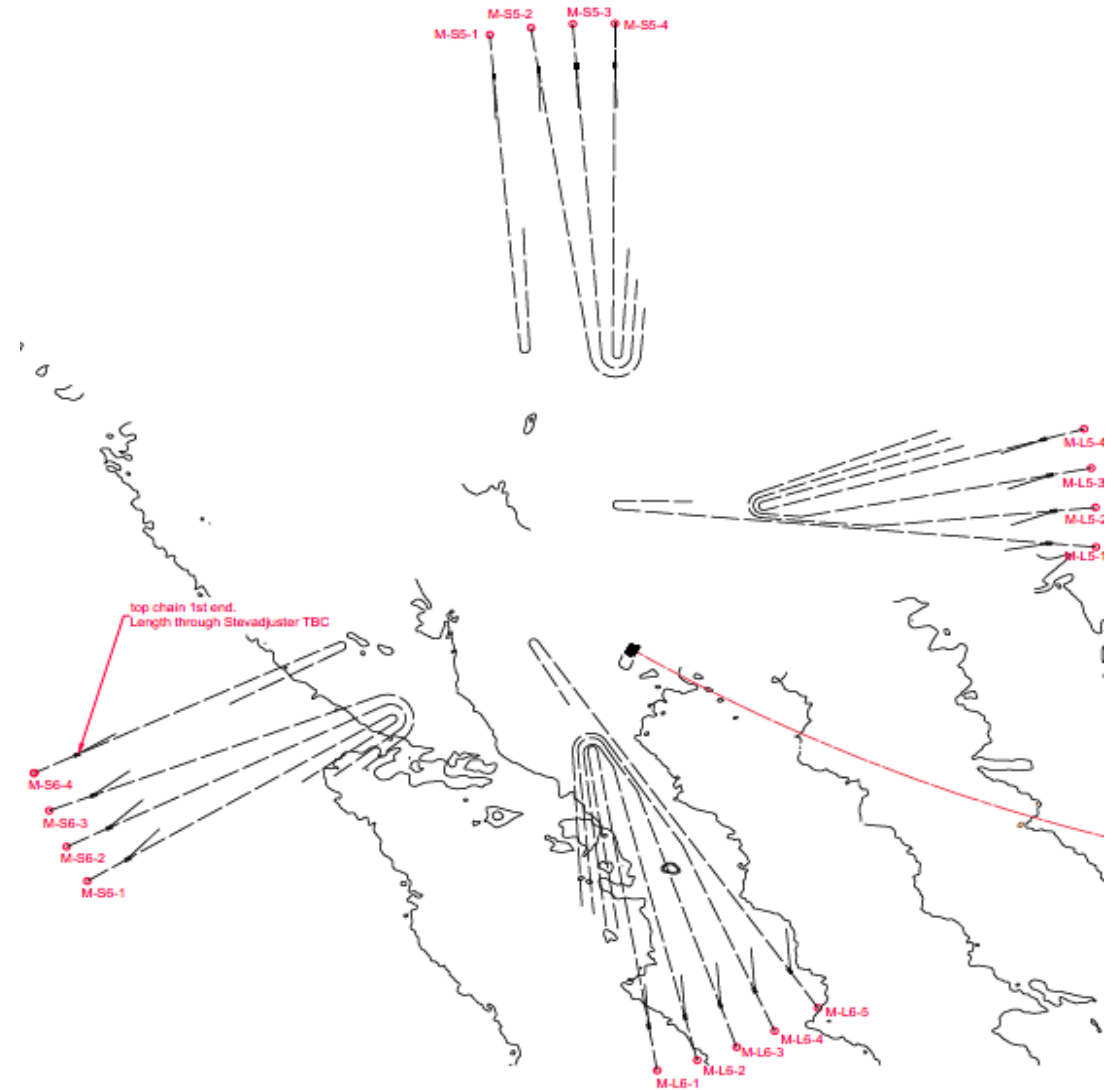


For Buoyancy and Buoyancy connection details
Ref. UK-1096-OI-N-XG-0003

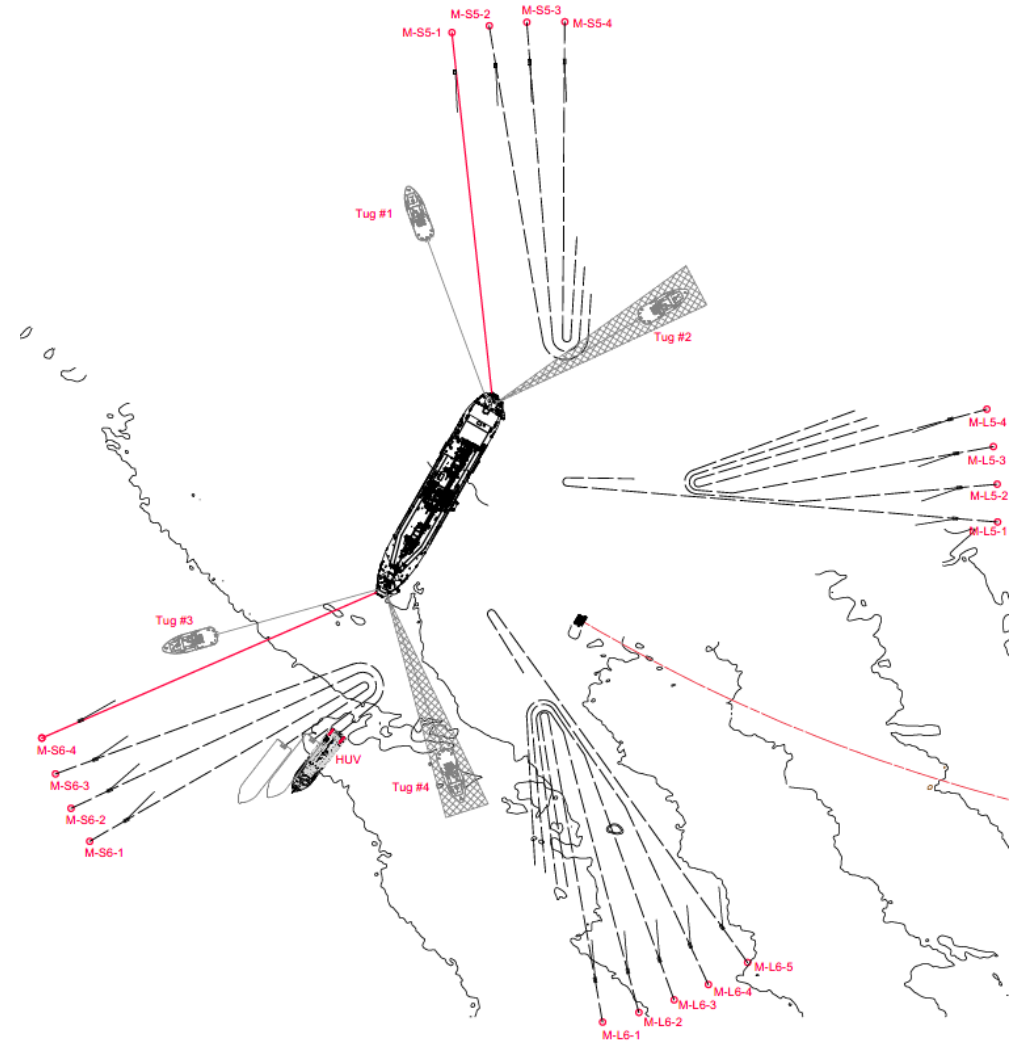
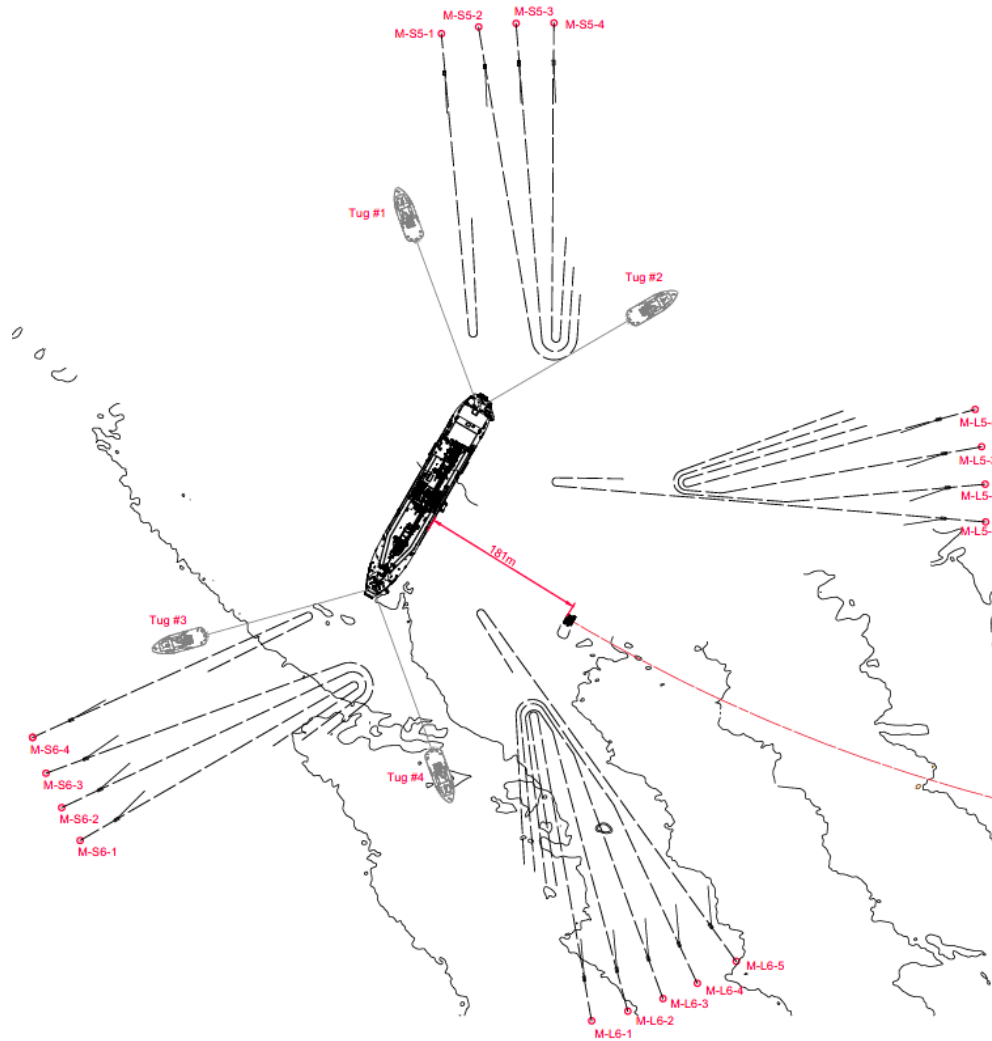
Isometric View
Scale: NTS

Basecase Solution

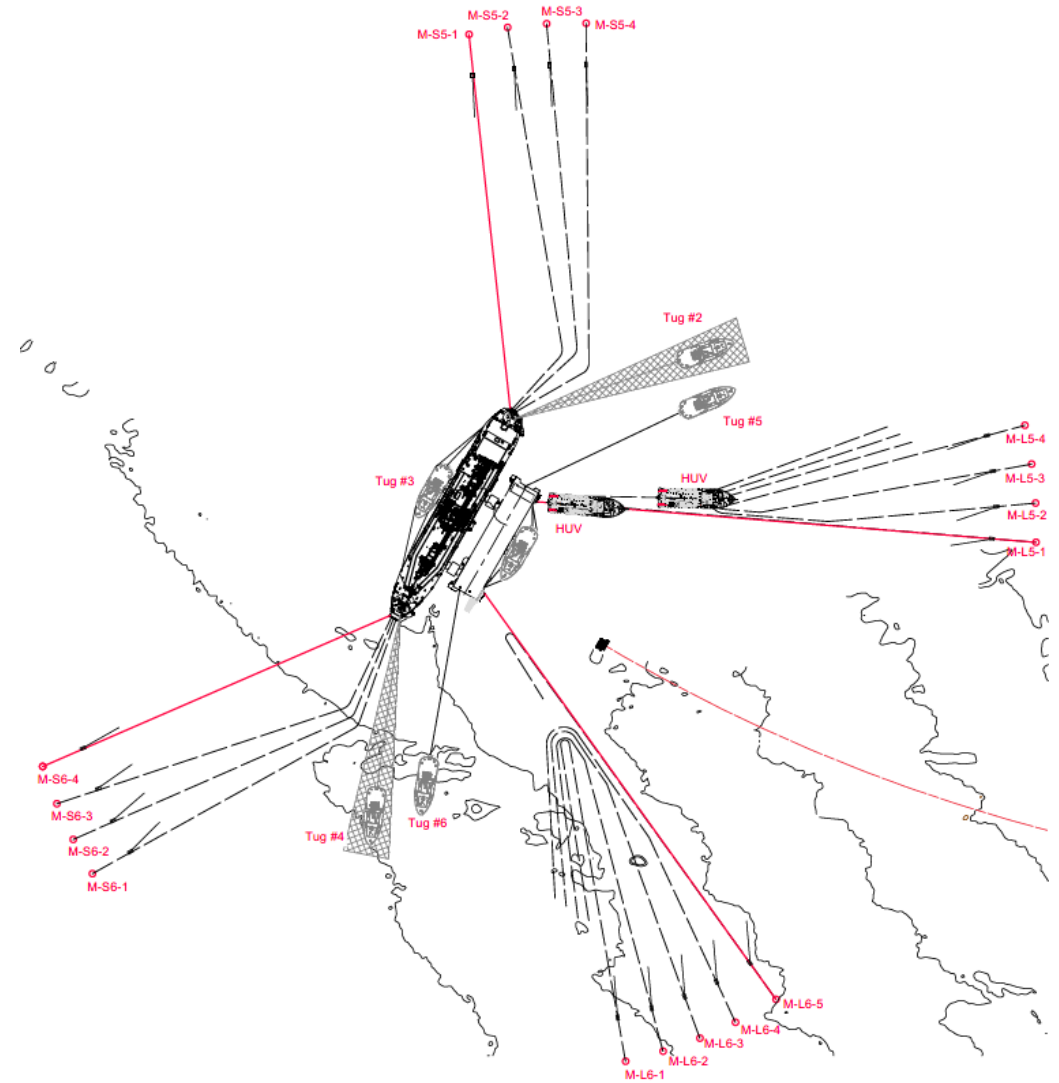
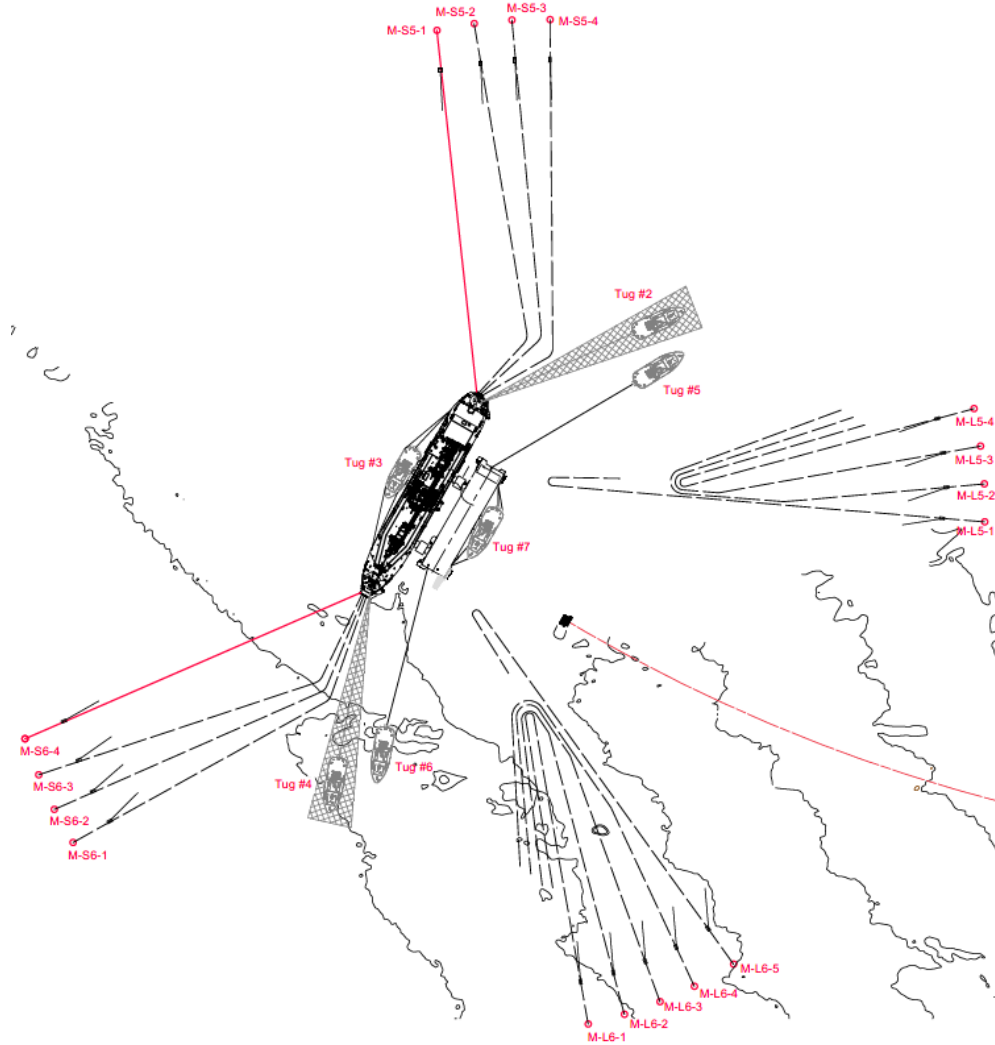
- Installation Vessel arrival at ILOGS Base and mobilisation of Project Personnel, Equipment / Material
- Load-out Chains by pulling pre-flaked chains into chain lockers, load-out and sea-fasten Stevadjusters, joining shackles, H-links etc
- Transit to Site, complete DP Trials and preform As-Found Survey
- Pre-Lay Mooring Chains
- Repeat process for remaining chains



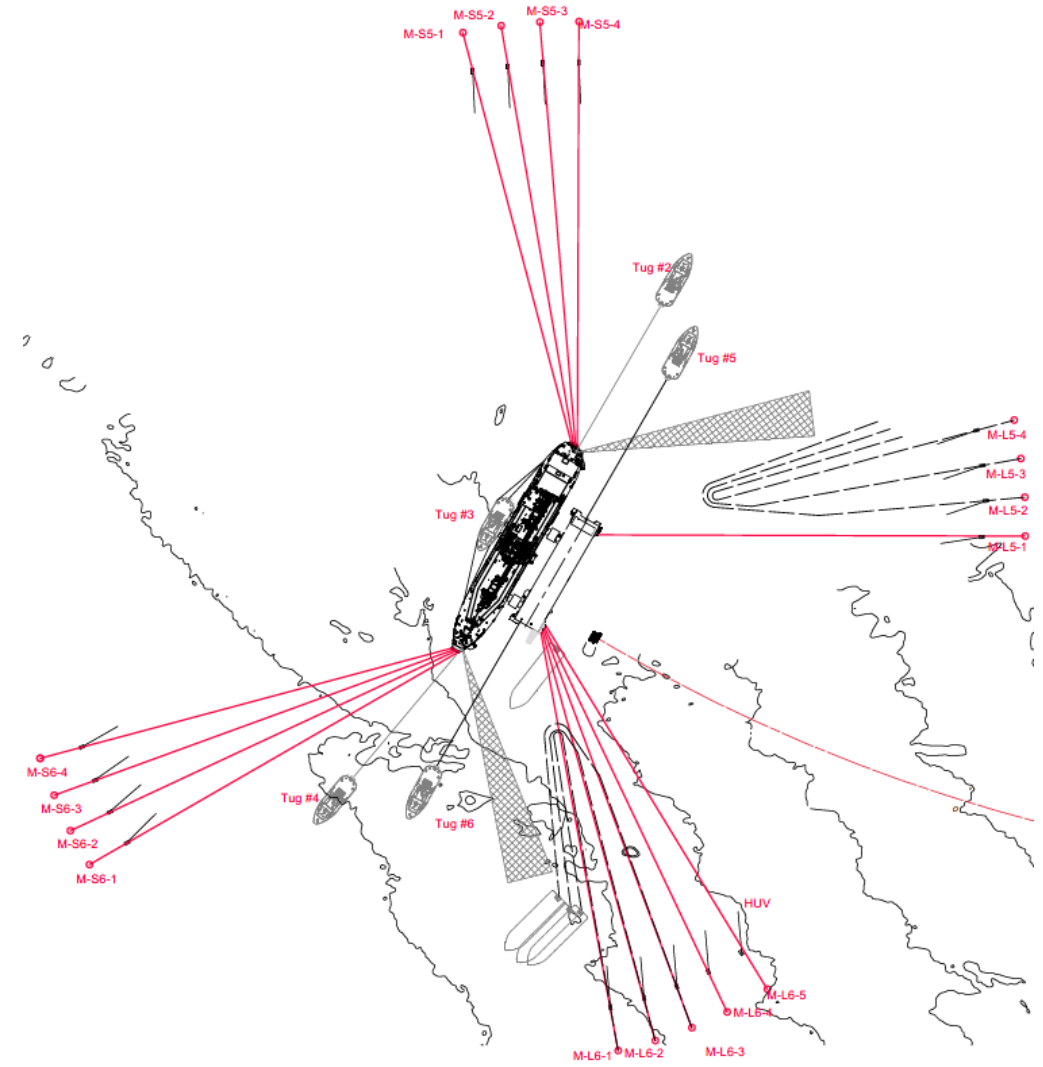
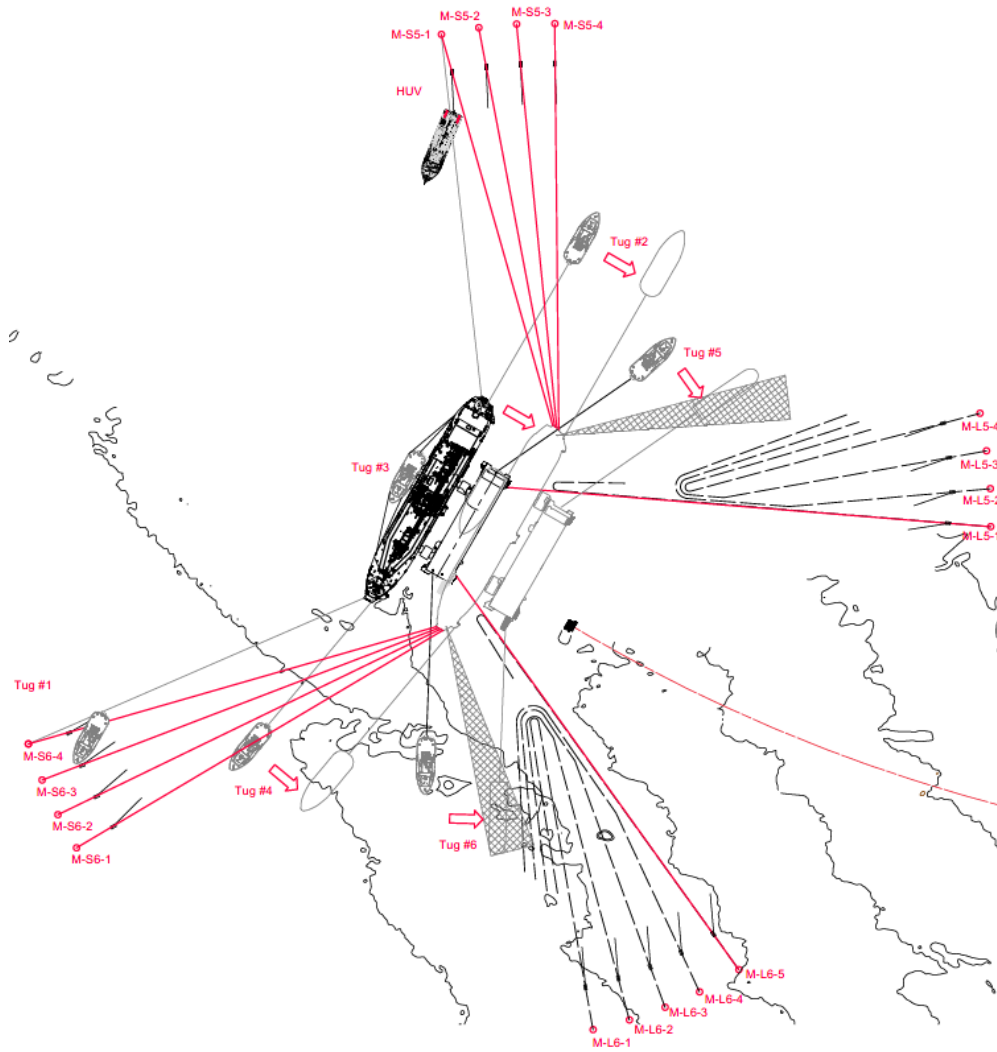
Basecase Solution



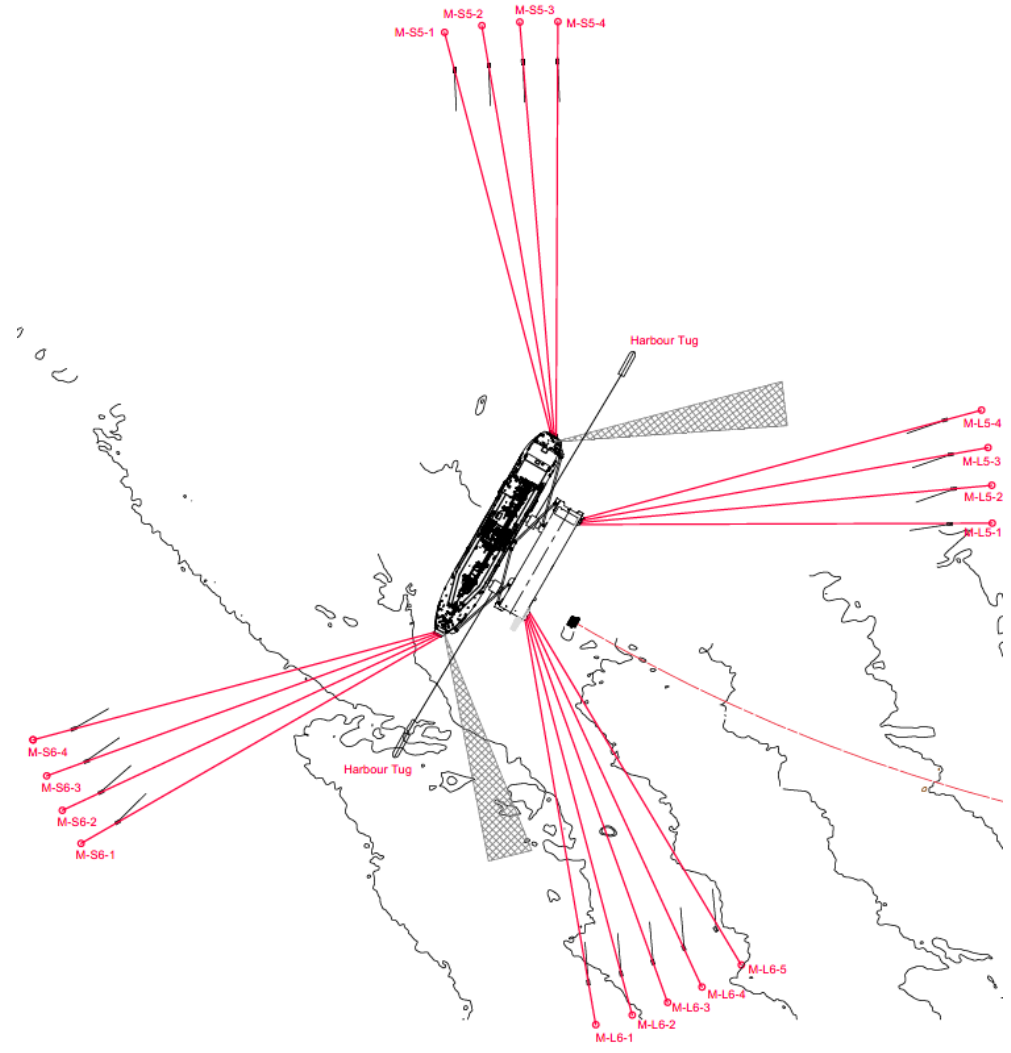
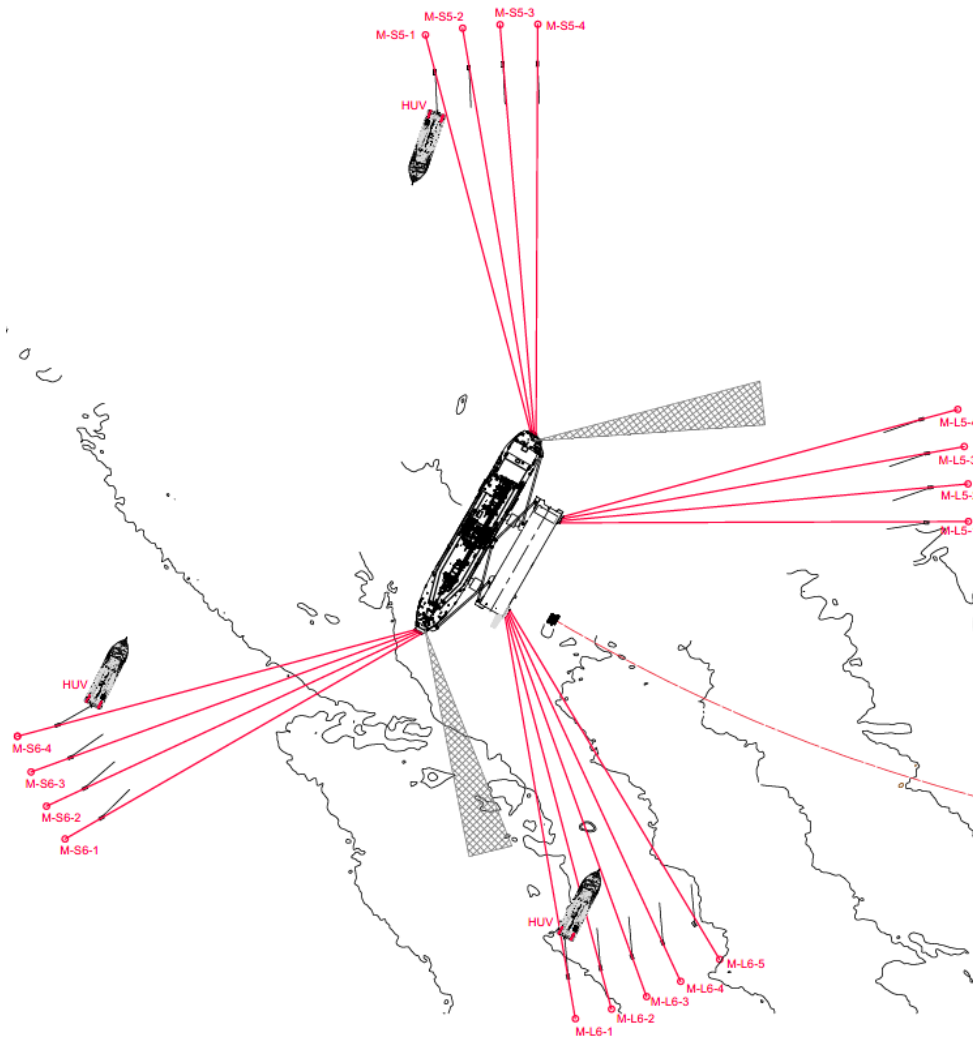
Basecase Solution



Basecase Solution

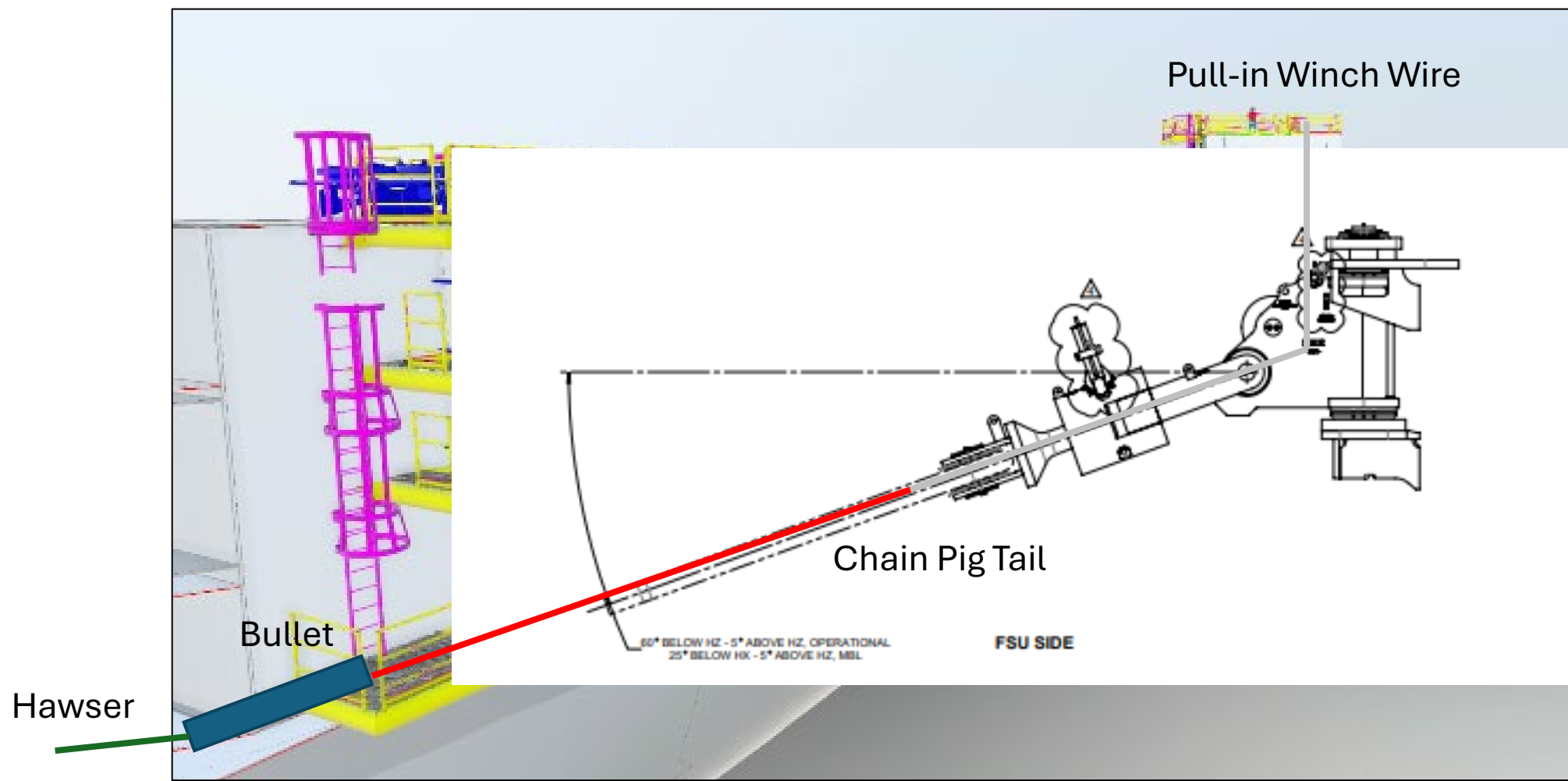


Basecase Solution



Challenges with the Basecase

Challenges with Basecase



Challenges with Basecase



Combined Tow Solution

Combined Tow Solution

[IIMS News](#) / Poor risk assessment contributed to the sinking of two Maersk supply ships says newly published DMAIB report

Poor risk assessment contributed to the sinking of two Maersk supply ships says newly published DMAIB report

Posted on September 4, 2017 by News Hound

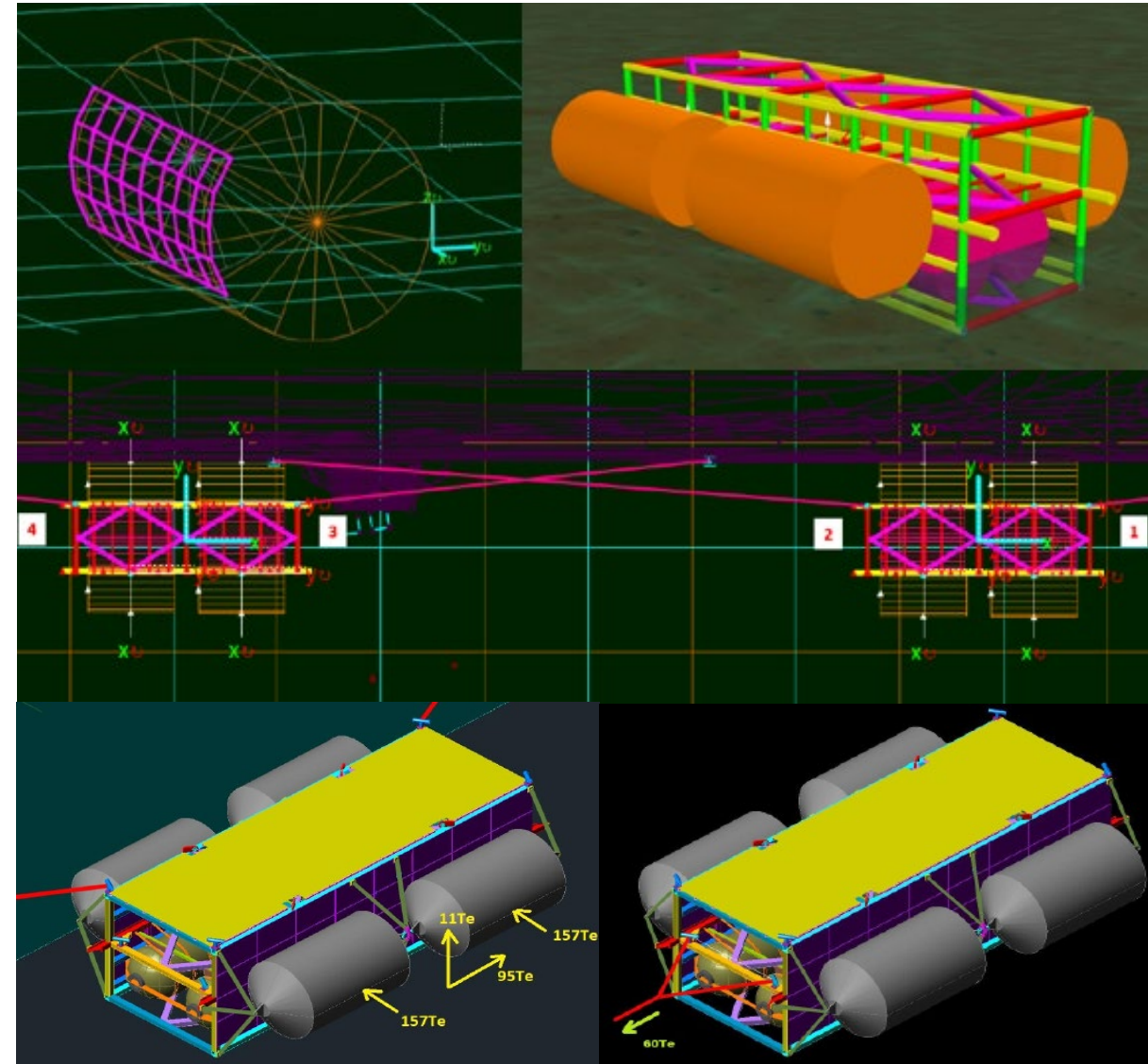


On the night of 21 December 2016, the Danish offshore supply ships MÆRSK SEARCHER and MÆRSK SHIPPER capsized and sank in the Bay of Biscay, off the French coast, while being towed by another offshore supply ship, MÆRSK BATTLE, en route to Turkey. The Danish Maritime Accident Investigation Board has now published a report on the accident.



Combined Tow Solution

- A lot of analysis! Every and all eventualities assessed
 - Analysed loads on fenders (and as a result, frames), connection points, mooring ropes
 - Analysed tow of frames to ensure they would not “dive” into water under tow
- Houlder (specialists in ship design) perform motion & stability analysis combined unit providing results for:
 - FSF Motion
 - Fender loads
 - Lashing loads
 - Hawser loads
- Global Maritime performed analysis of the combined tow
- Sealand Projects performed analysis of station keeping (and offshore hook-up for basecase solution)



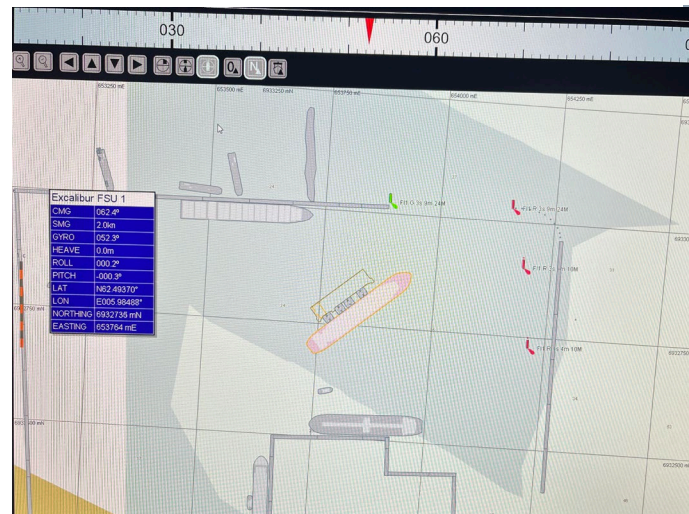
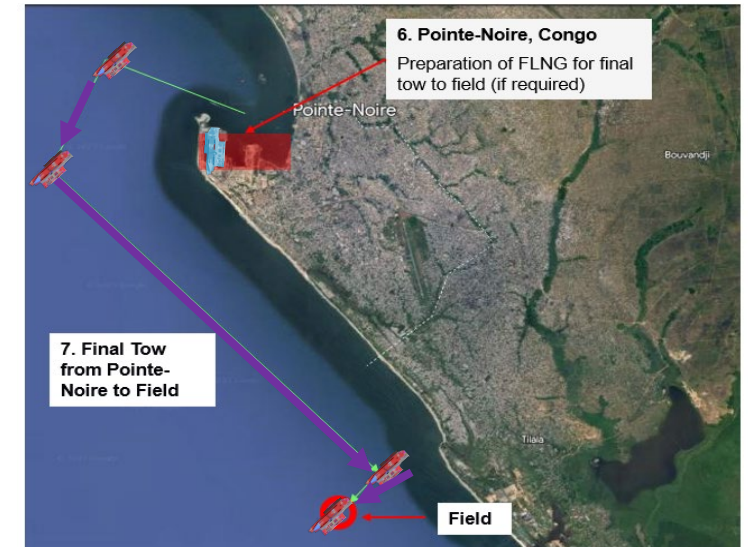
Combined Tow Solution

- Simulation set up to model real operations in a noncritical set up to enable actual execution team to execute the offshore operations.
- This allows
 - collaboration for improvement,
 - error without consequence and
 - optimisation of all parts of the operations
 - Discovery of potential failures ahead of operations allowing them to be engineered out
- The simulations are set up to capture
 1. Connection of Hawsers
 2. Tow of FLNG into PN and alongside FSU
 3. Combined tow of FSU & FLNG out of PN to location for change over to AHT tow
 4. Combined tow of FSU & FLNG from handover outside PN to site
 5. Station keeping FSU & FLNG at site for mooring hook up



Combined Tow Solution

1. Inshore hook-up
2. Combined tow to installation site
 1. Tow of FLNG into PN and alongside FSU
 2. Combined tow of FSU & FLNG out of PN to location for change over to AHT tow
 3. Combined tow of FSU & FLNG from handover outside PN to site
 4. Station keeping FSU & FLNG at site for mooring hook up



Combined Tow Solution

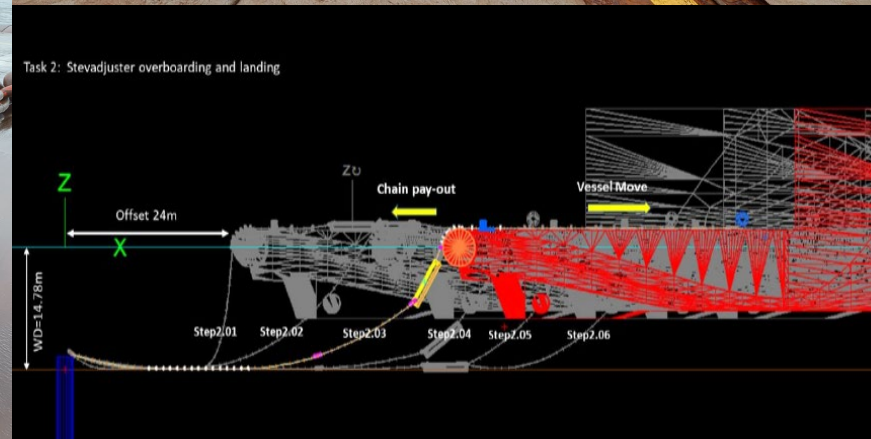
- Bridge simulator of FSU
- Bridge simulator of harbor tug
- Bridge simulator of AHT



Operations

Operations

- Recover Anchor chain to deck
- Manoeuvre SA to firing line and connect anchor chain to Passive end
- Bring out top chain from lockers and feed through SA active end
- Deploy over stern roller
- Pre-lay of mooring chains, by Drott
 - Sapphire and Prosper also performed some
- At the pre-defined link, Golden Link marked and, Chain Stopper was installed
- In a controlled manner, wet-stored top chain

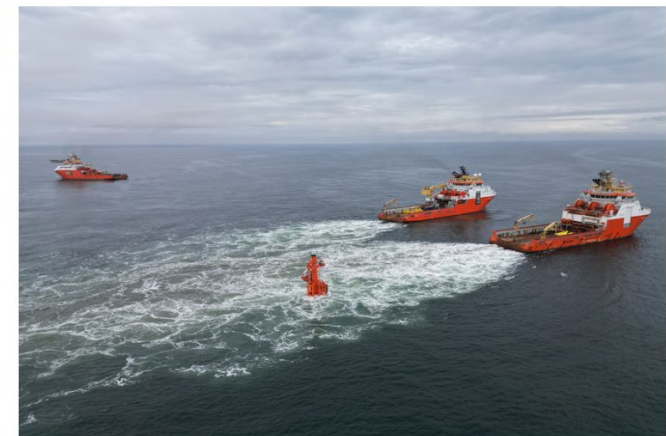
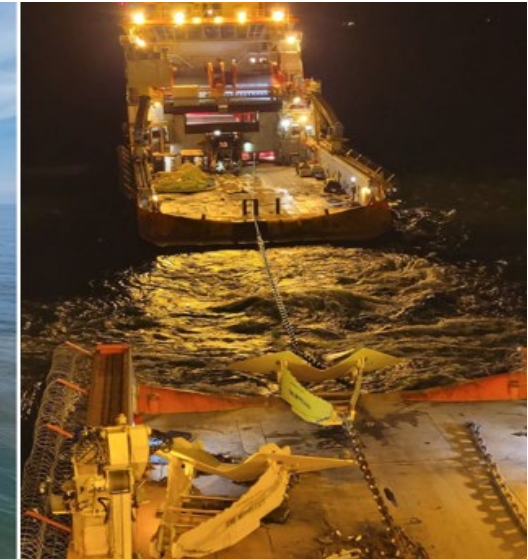


Operations

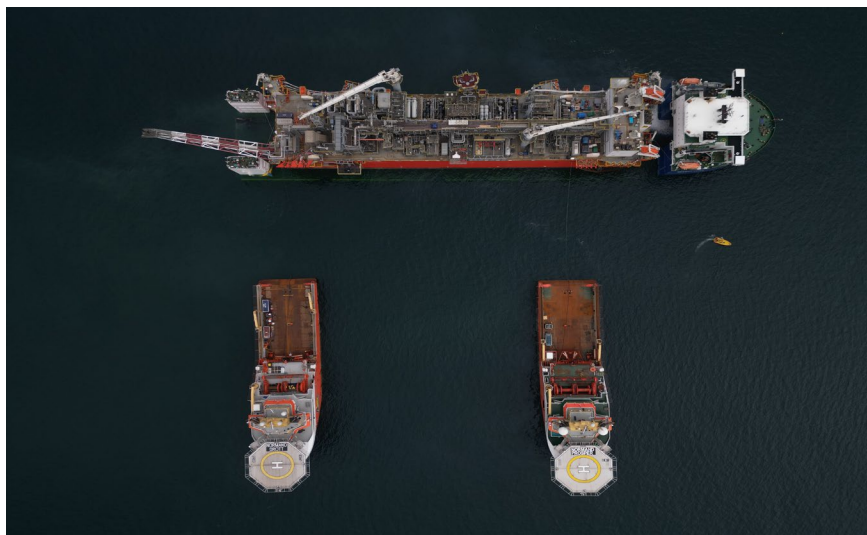
1. Anchor contains 200m x 120mm R4S work chain on FWD end and chain bridle on Aft end
 1. Chain bridle had dual purpose.
 - 1) For piggyback and 2) Recovery of anchor
 2. Sirius carrying anchors and work chain (200m x 120mm R4S)
 3. Sapphire carrying top chain and Stevadjusters
2. Work wire transferred from Sapphire to Sirius and connected to Bridle
3. Sapphire “pulls” anchor off deck whilst Sirius controls with hold back with Work chain
 1. Deployed up-side down to prevent damage to vessel deck and
 2. “up-ended” once anchor in water column
4. Lowered and landed on seabed
5. Sapphire disconnects and Sirius performs initial pull to get initial embedment (using combination of work chain and work wire)
 1. Once confirmed successful, final tensioning/embedment can be done
6. Recover back Sirius work wire (disconnect at work chain)
7. Sapphire comes alongside and both vessels connect to anchor chain via tri-plate and work wires (Y arrangement)
8. Perform tandem pull up to 390Te.



- 7-off drag anchors
- Installed by Normand Sapphire and Sirius
- 66Te per StevShark anchor (by Vryhof)
- Dual tensioning to 390Te
- Connected to top chain via Stevadjusters



Operations



Operations

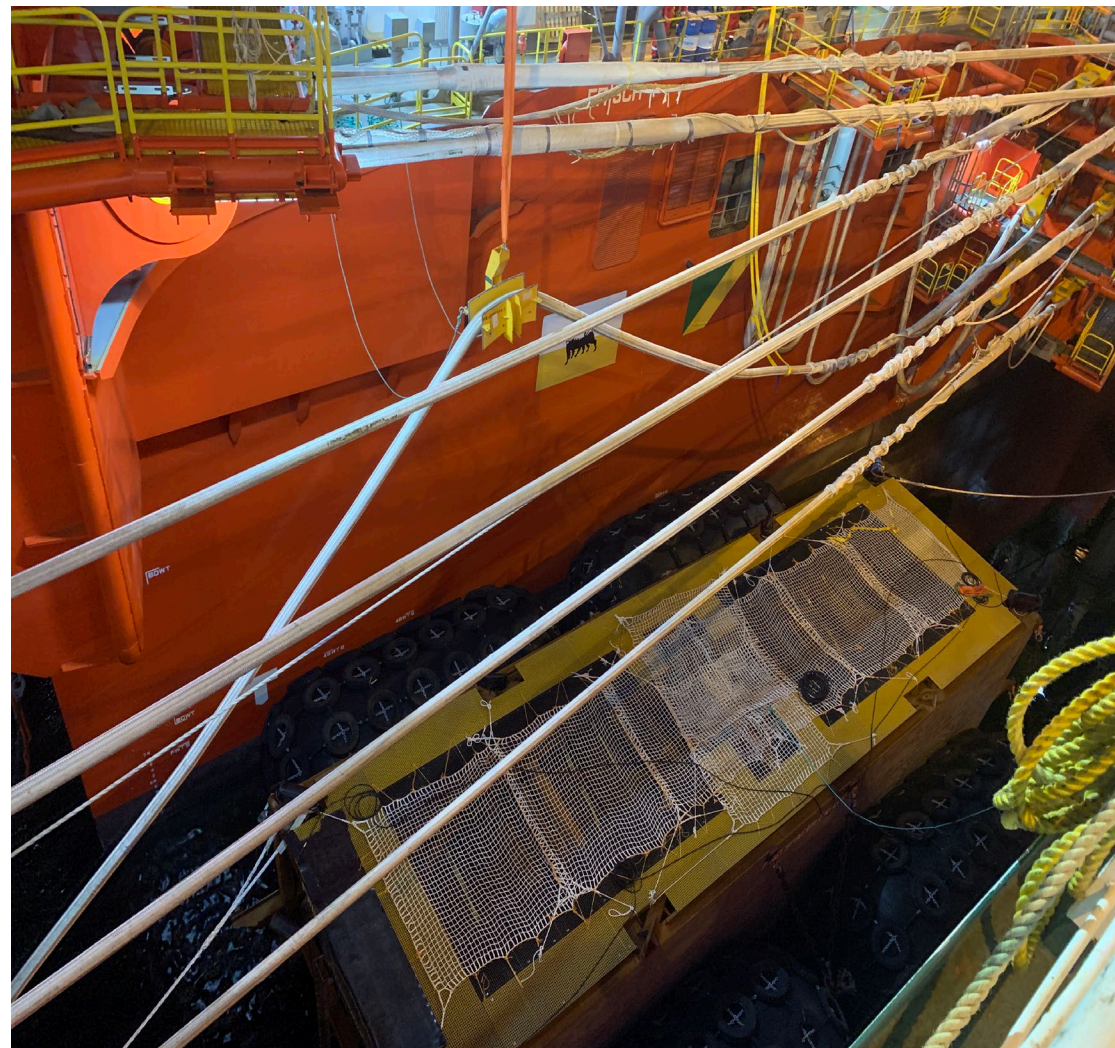
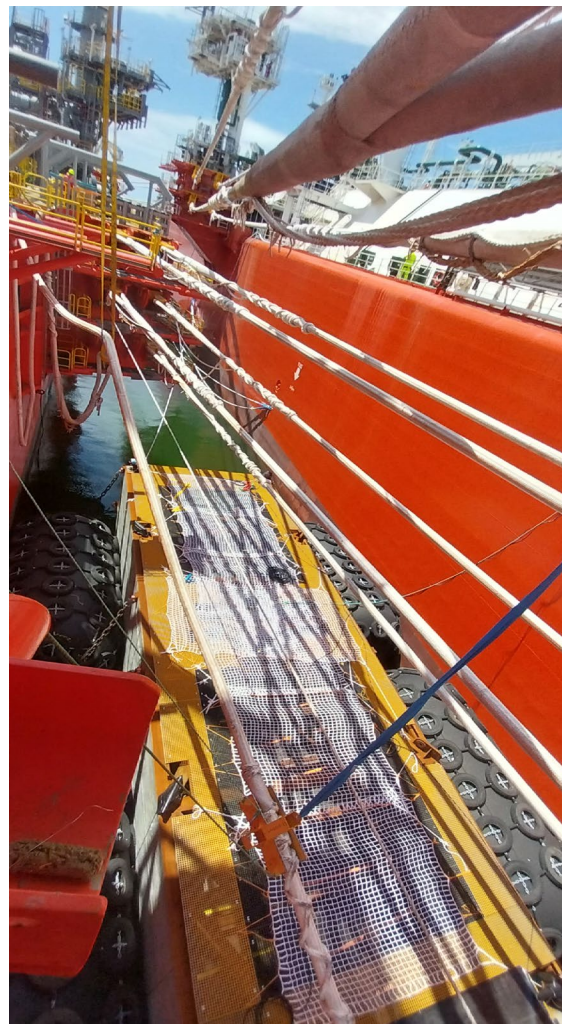
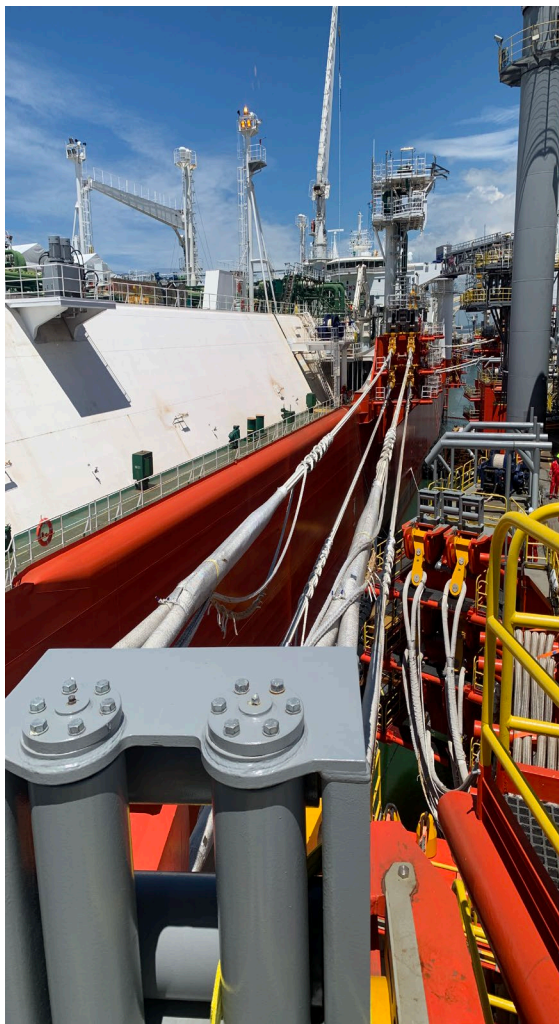
- Best laid plan don't always work though



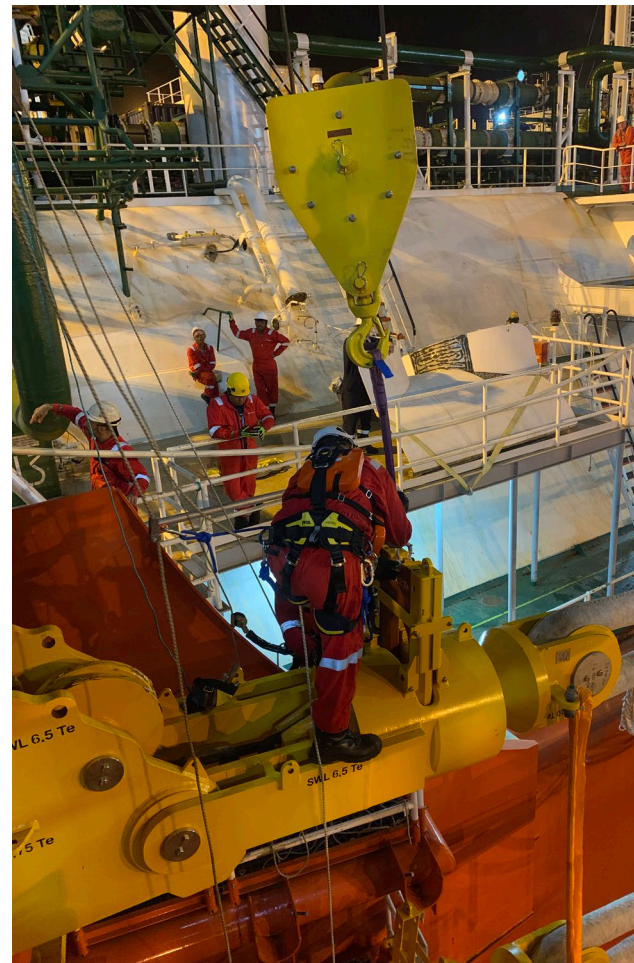
Operations



Operations



Operations

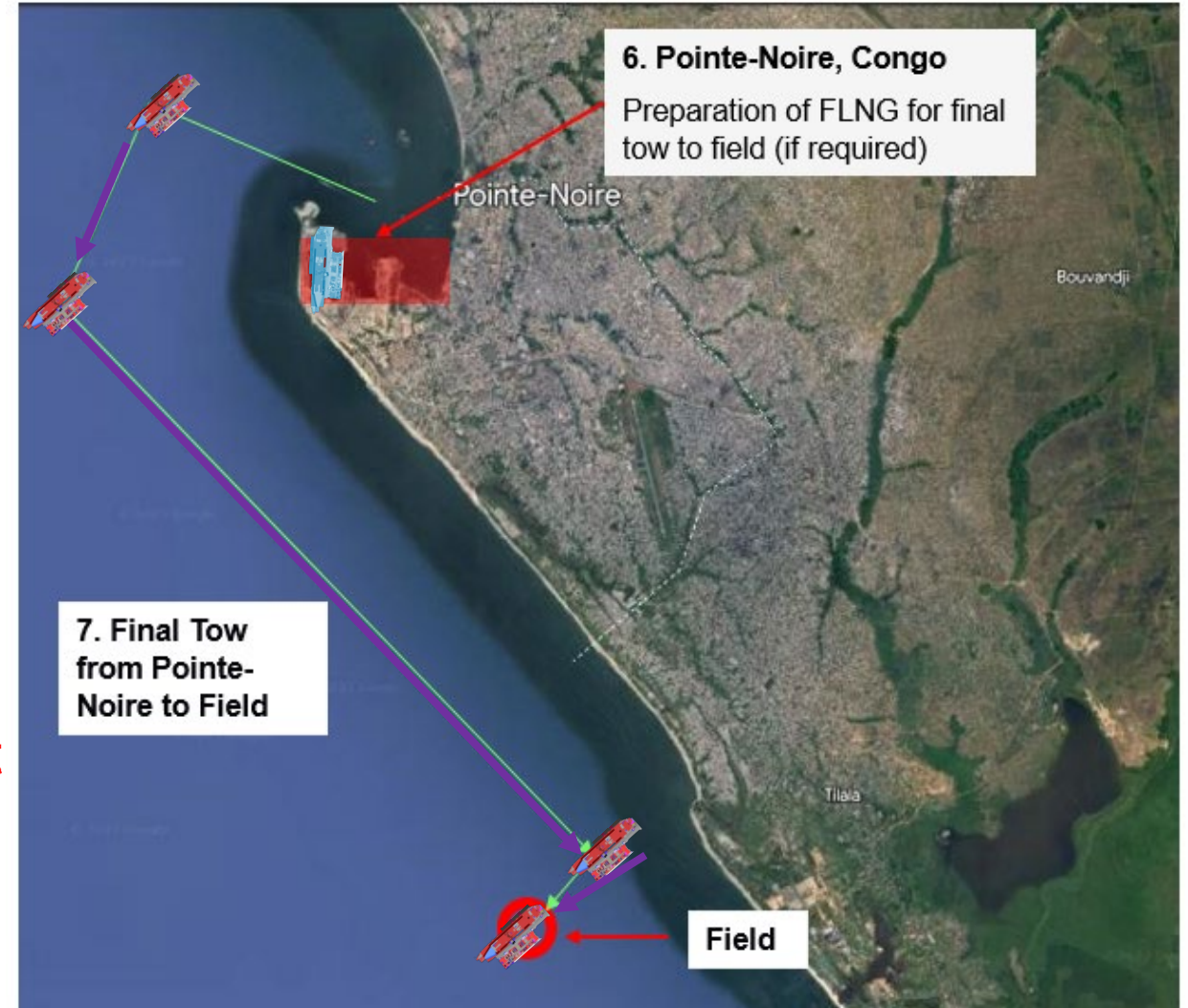


Operations

- The tow to field will commence from the handover location and progress along the following waypoints:

WP	From (Lat/Long)	Water Depth (m)	Distance (nm)
1	Pointe Noire Pilots	17	-
2	Old Wharf	33	4.22'
3	Pointe M'Vassa	32	4.60'
4	Marine XII Location	19	2.10'
Total Distance			10.92'

- The tow will head into the prevailing environment (wave/swell), and maintain ± 15 deg relative heading to incoming waves/swell**
- Expected tow duration is 12 hours, based on tow speed of 1knot
- 48hr Weather Window required for tow



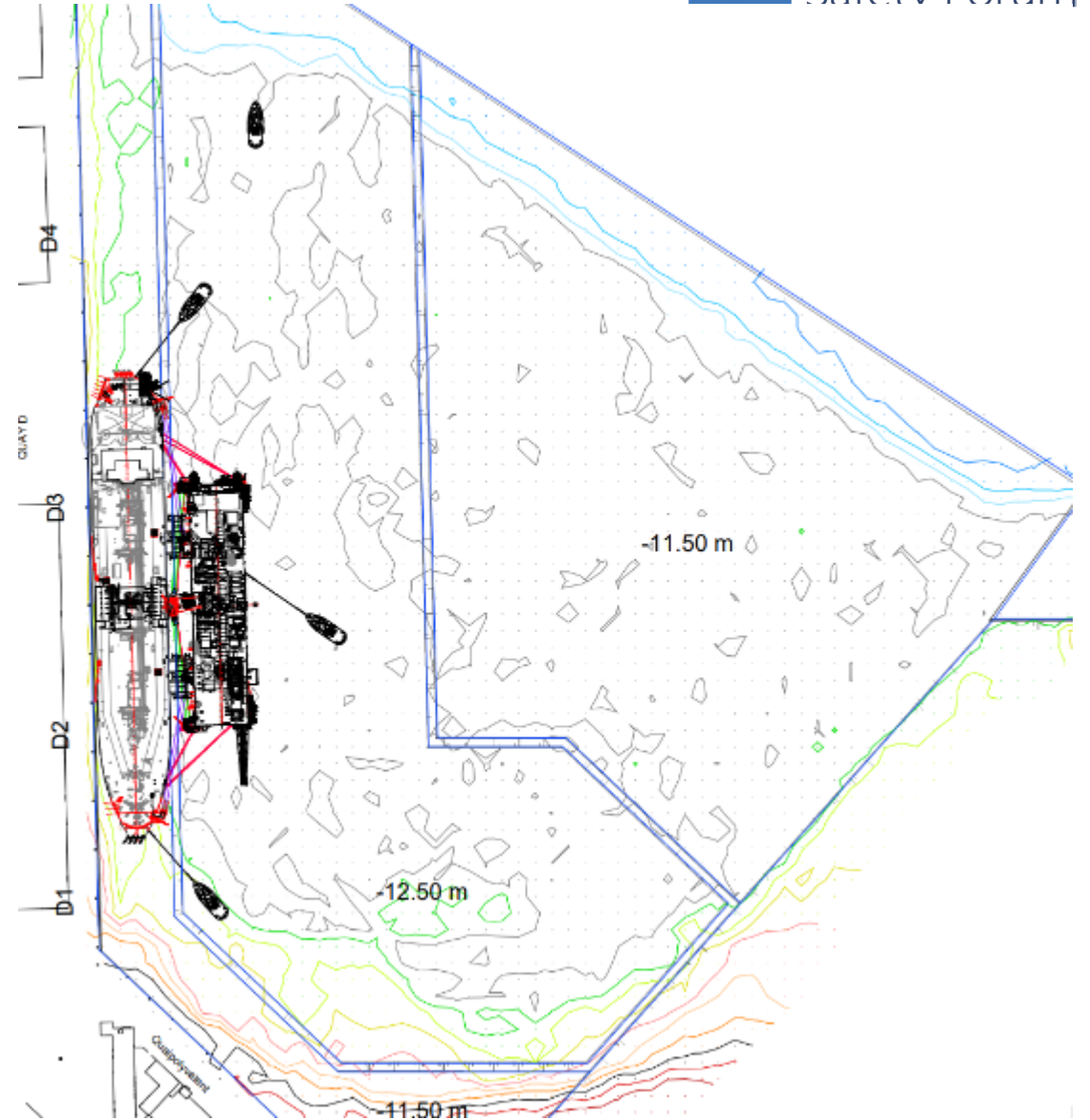
Operations

- 2-off fender spacer frames between vessels
- 3-off harbour tugs for port exit
- 4-off AHT's (Sigma/Sapphire/Prosper/Sirius)
- Station-keeping while Drott connected mooring lines



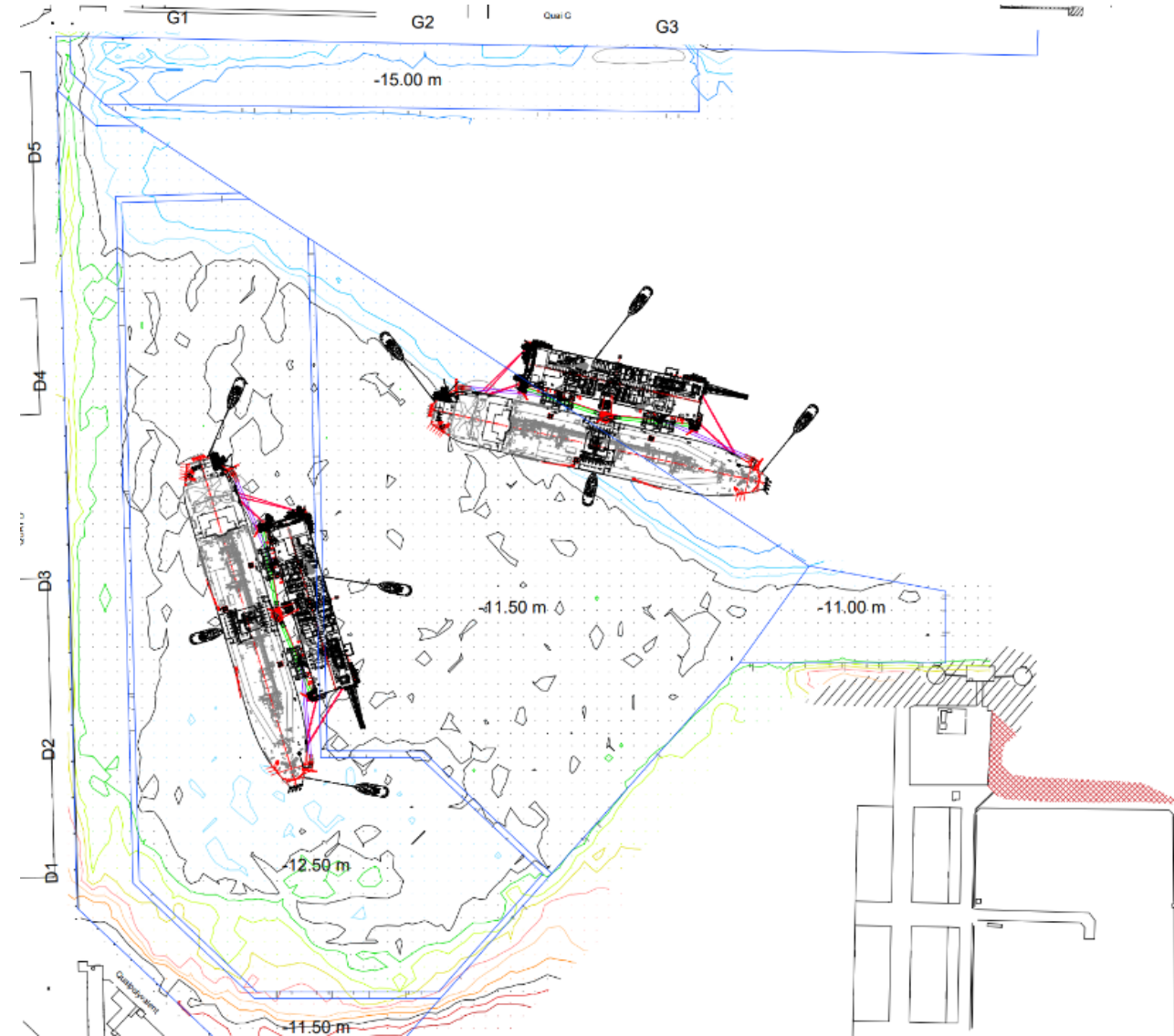
Operations

- Combined arrangement will be maneuvered from quayside to handover location under control of Pointe Noire pilots, assisted by OI Tow Master
- 4 off harbour tugs to be utilized for the operation – this has been discussed with Pointe Noire pilots
 - NOTE: Simulation highlighted that no harbour tugs should connect to FLNG for port exit operation
- It is expected that there will be a minimum of 2 pilots on board FSU for the move from quayside to handover location
- Quayside moorings to be released and harbour tugs to maneuver combined unit to port and aft (north)



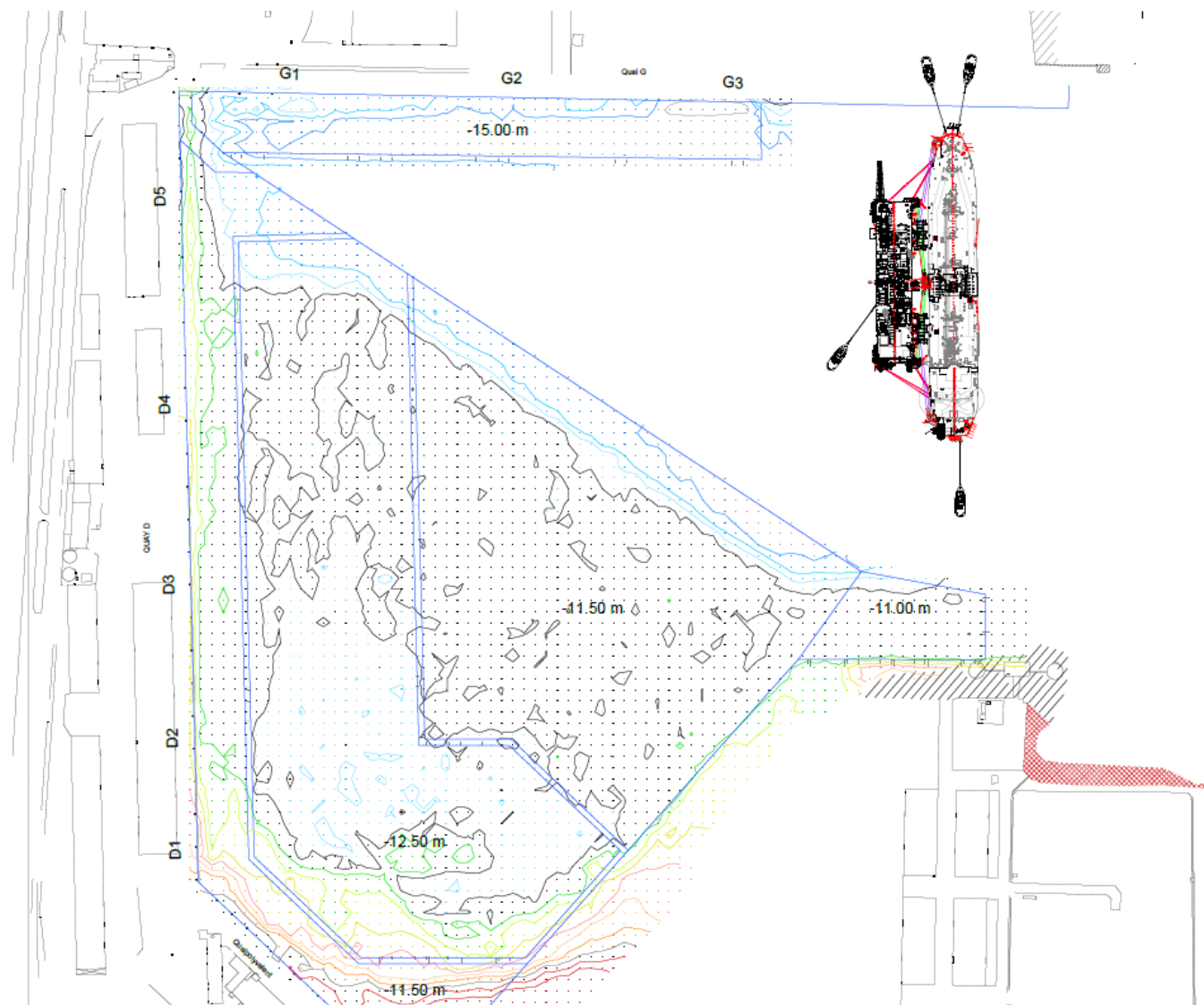
Operations

- Harbour tugs to maneuver combined arrangement off of berth and move towards port exit
 - Tow master and Pilots to be aware of water depth restrictions
- Harbour tugs to rotate arrangement through 180deg so tow is heading forward
- Harbour tugs to be reconfigured as required by pilots



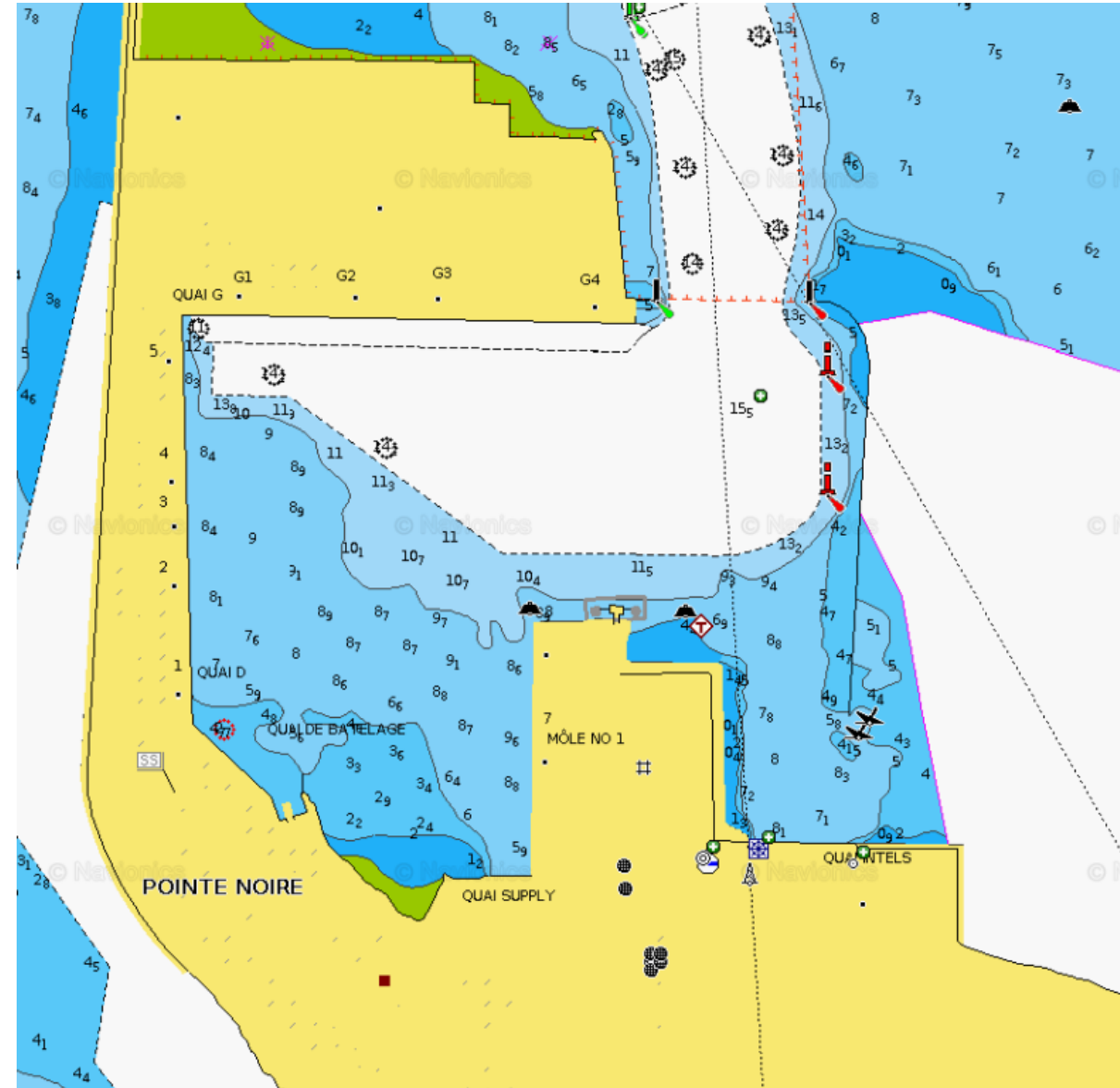
Operations

- Units moved to centre of basin with exit channel straight ahead
- Units are stabilized in the basin using harbour tugs



Operations

- When clear to do so, the units can be manoeuvred out between the breakwaters/inner mole and into the channel
- Once clear of the breakwater/inner mole, the harbour tugs will continue with manoeuvring the combined arrangement toward the handover/connection location

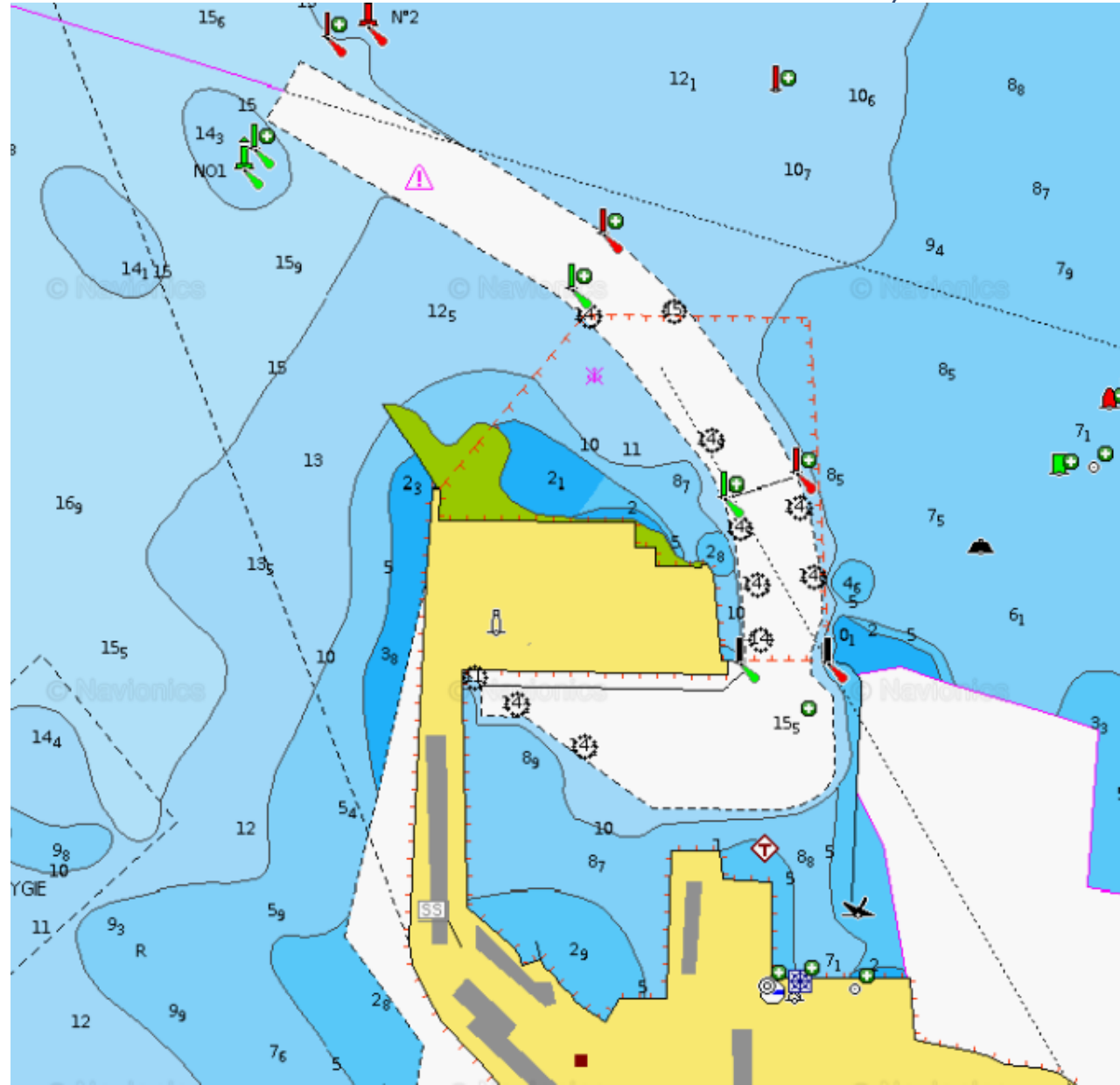


Operations

- As the tow clears the breakwater/inner mole, the heading of the combined units will be gradually adjusted
- This operation will be performed by the harbour tugs

Heading Adjustment

- The tow heading is adjusted such that the FSU/FLNG are heading into the prevailing wave/swell conditions
- Heading to be maintained ± 15 degrees from head seas at all times
- Majority of wave/swell expected to be from SW/SSW



Operations

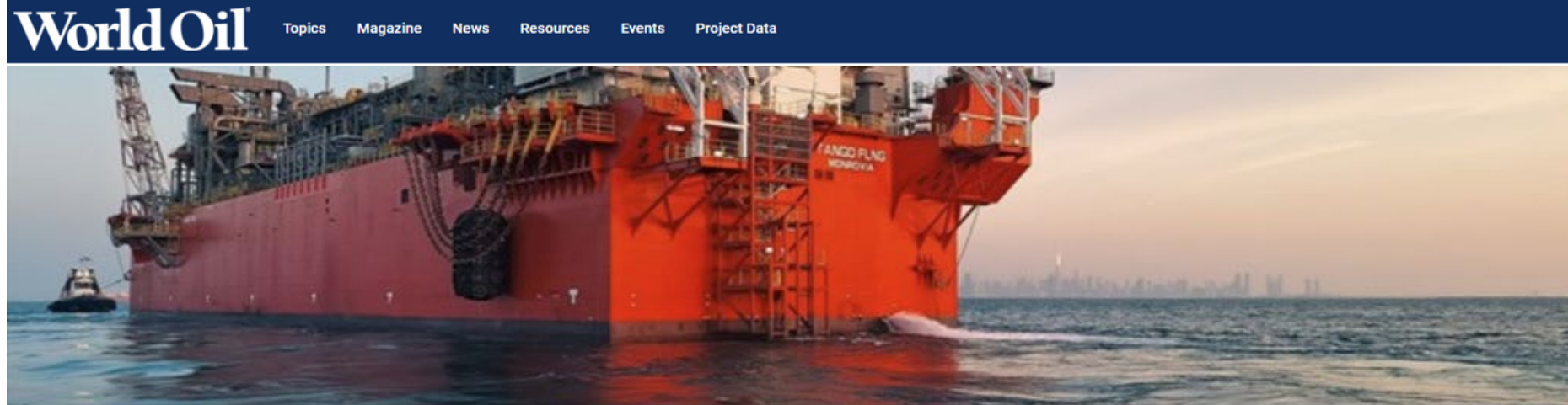


Operations



Operations





AFRICA ENERGY TRANSITION LNG

Eni introduces gas into Congolese LNG project in “record time”

January 02, 2024

(WO) - Eni announced the introduction of gas into the *Tango Floating Liquefied Natural Gas* (FLNG) facility moored in Congolese waters.

Gas introduction has been achieved in record time— **only twelve months after the final investment decision**. This is a key milestone for the Congo LNG project, which encompasses the adoption of new technologies and a strong synergy with existing producing assets. Following completion of the commissioning phase, *Tango FLNG* will produce its first LNG cargo by the first quarter of 2024, placing the Republic of Congo on the list of LNG-producing countries.

The *Tango FLNG* facility has a liquefaction capacity of about 1 Bcm per year and is moored alongside the *Excalibur* Floating Storage Unit (FSU), using an innovative configuration called “split mooring,” implemented here for the first time in a floating LNG terminal.

Congo LNG will enhance the gas resources of the Marine XII permit and achieve approximately 4.5 Bcm per year of plateau gas liquefaction capacity through phased development and with a target of zero routine gas flaring. A second FLNG facility with a capacity of about 3.5 Bcm per year is currently under construction and will begin production in 2025. The entire volume of LNG produced will be marketed by Eni.

Eni has been operating in Congo for 55 years and is the only company active in the development of the country's gas resources. Eni currently supplies gas to the Centrale Électrique du Congo (CEC).



Source: Eni

