Horizon GmbH

DeepSea OFFSHORE International

Preparatory Activities/ Enginnering for Recovery of offshore Wind Park Submarine Cable

February 2021

Company Introduction

Horizon GmbH

CEO: Capt. M.R. ILIATI

Operating in Europe

Essen, Germany

www.horizongmbh.net

Deep Sea Offshore Int.

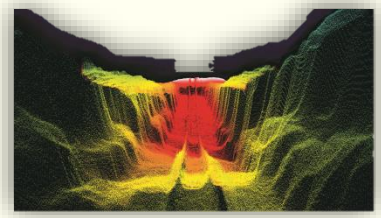
CEO: Capt. M.R. ILIATI

Operating in Middle East

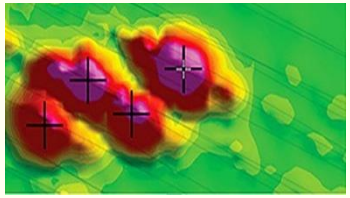
Dubai, UAE

www.deepseaoffshore.net

Service Capabilities



Geophysical Seabed Services



UXO Survey Services

orcina

Engineering Services

ROV Services

Horizon GmbH

DeepSea
OFFSHORE
International

PHOTOGRAMMETRY & REMOTE SENSING

Diving Services

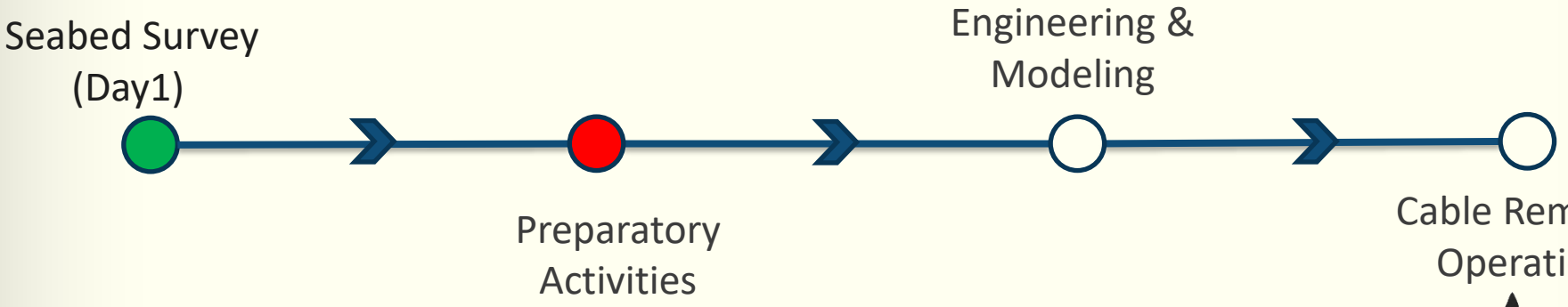
Geotechnical Services

Positioning Services

Track Records
(2011-2020)

Categories	No. of Jobs
Geophysical Site Survey	58
Geophysical Route Survey	24
Geotechnical Investigation	9
ROV Services	53
Positioning Services	22
Diving Services	23
Engineering	14
Cable Activities	3
Construction Jobs	11
Rig Movement	3
Ship Management and Logistics	10

Overview of Cable Removal



Preparatory Activities for Removal of Cable

- Removing Protection of Cable in Crossing Area
- Cutting Cables in Crossing Area
- Cutting Cables near J/I Tubes
- Connect the Buoy to Loose Heads of Cable
- Securing the Loose Heads of Cable for Avoid Further Moving
- Removal of Marine Growth

Preparatory Activities for Removal of Cable

ROV Assets

Swift XL09

- 125 HP Work Class ROV
- 2000 m Rated

Explorer3

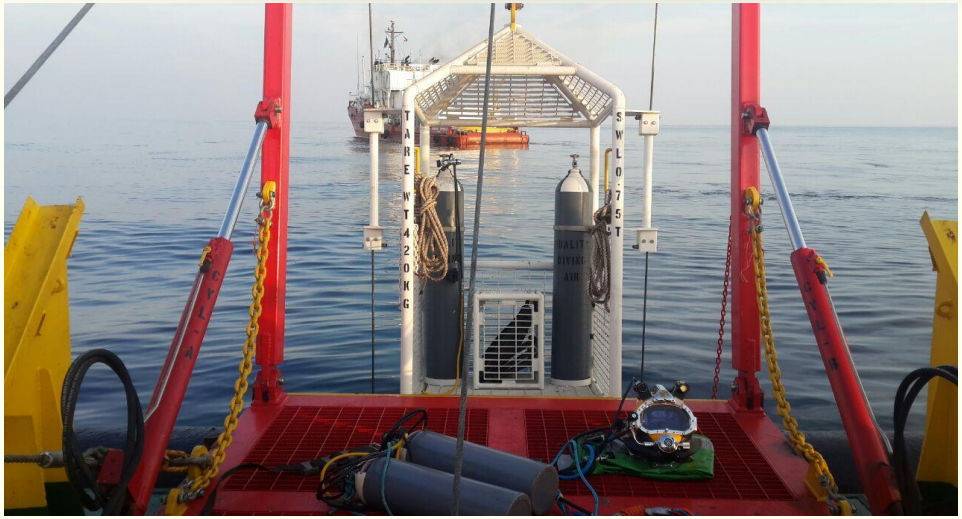
- 100 HP Work Class ROV
- 1000 m Rated

ROV Benefits Vs. Diver:

- Quick Deployment
- Extended Dive Times
- Video Recording Capabilities
- Fit into Confined Areas
- Safety Improvement
- Cost-Effective
- Minimal Maintenance

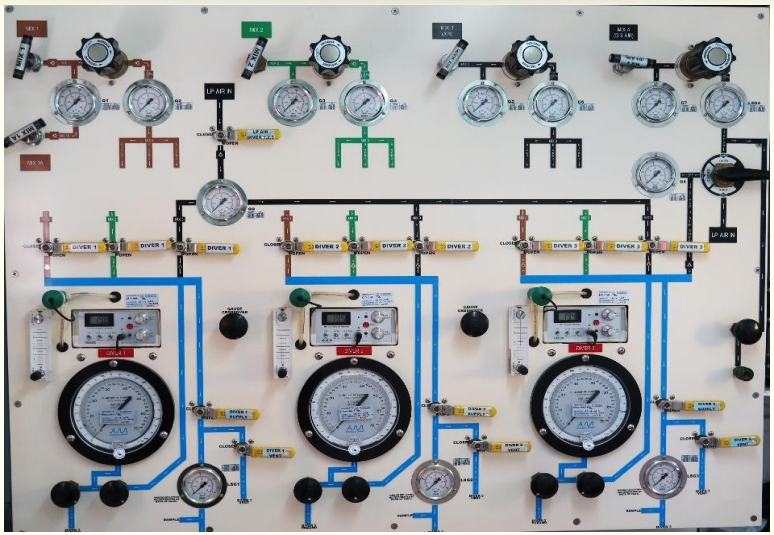
Preparatory Activities for Removal of Cable

Diving Assets



Preparatory Activities for Removal of Cable

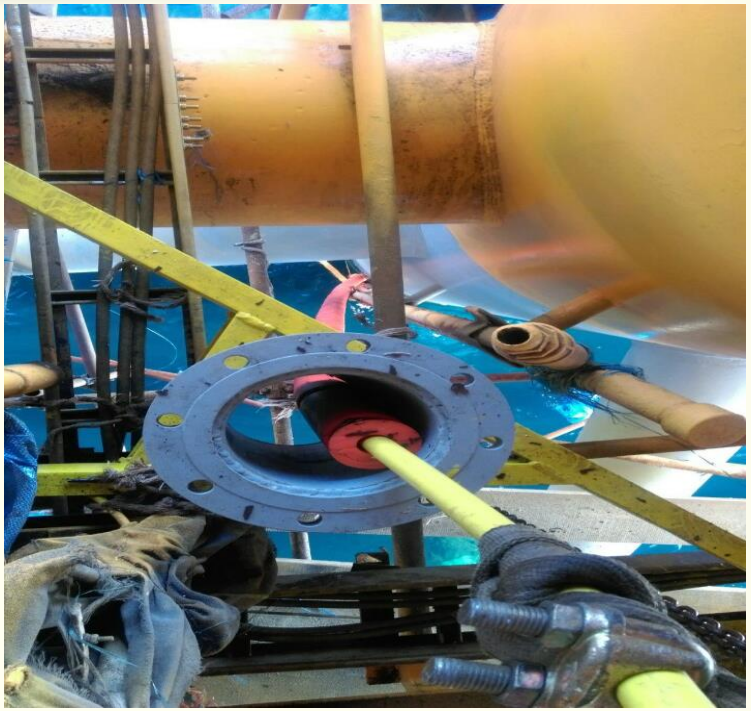
Diving Assets



Preparatory Activities for removal of cable

Visual Inspection of Cable Status Before Cutting

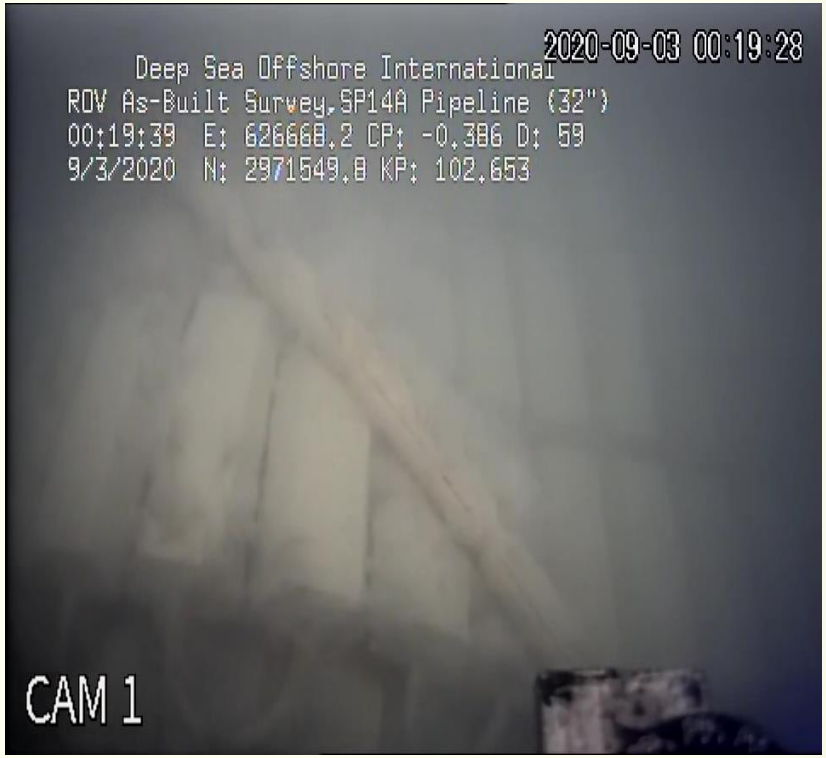
Cable Status in J-Tube



Cable Status in I-Tube

Preparatory Activities for Removal of Cable

Visual Inspection of Cable Status Before Cutting



Cable Status in Crossing Area

Preparatory Activities for removal of cable

Removing Protection of Cable in Crossing Area

Remove mattress from crossing of cable

Existing mattress protection should be removed

Remove sandbag protection from cable

Preparatory Activities for Removal of Cable

ROV/Diver Tools for Cable Cutting and Remove Marine Growth

- The Stanley GR29 is a portable tool, designed for use by a diver or ROV.

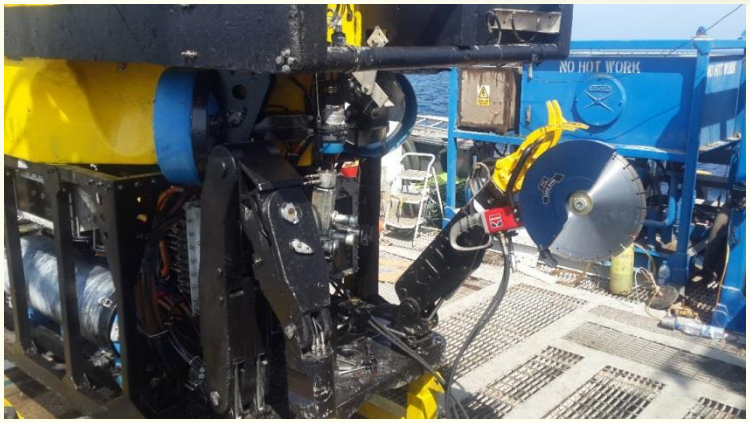
Hydraulic Grinder

- Sample of compatible tools of ROV And divers for removing marine growth

Multipurpose Cleaning Tool

Preparatory Activities for Removal of Cable

ROV Mobilization for Cutting of Pipeline/Cable



Mobilized ROV for cutting pipeline

Start cutting pipe using hydraulic cutter

Using underwater positioning to fix the cutting point

Pipe has been cut by ROV

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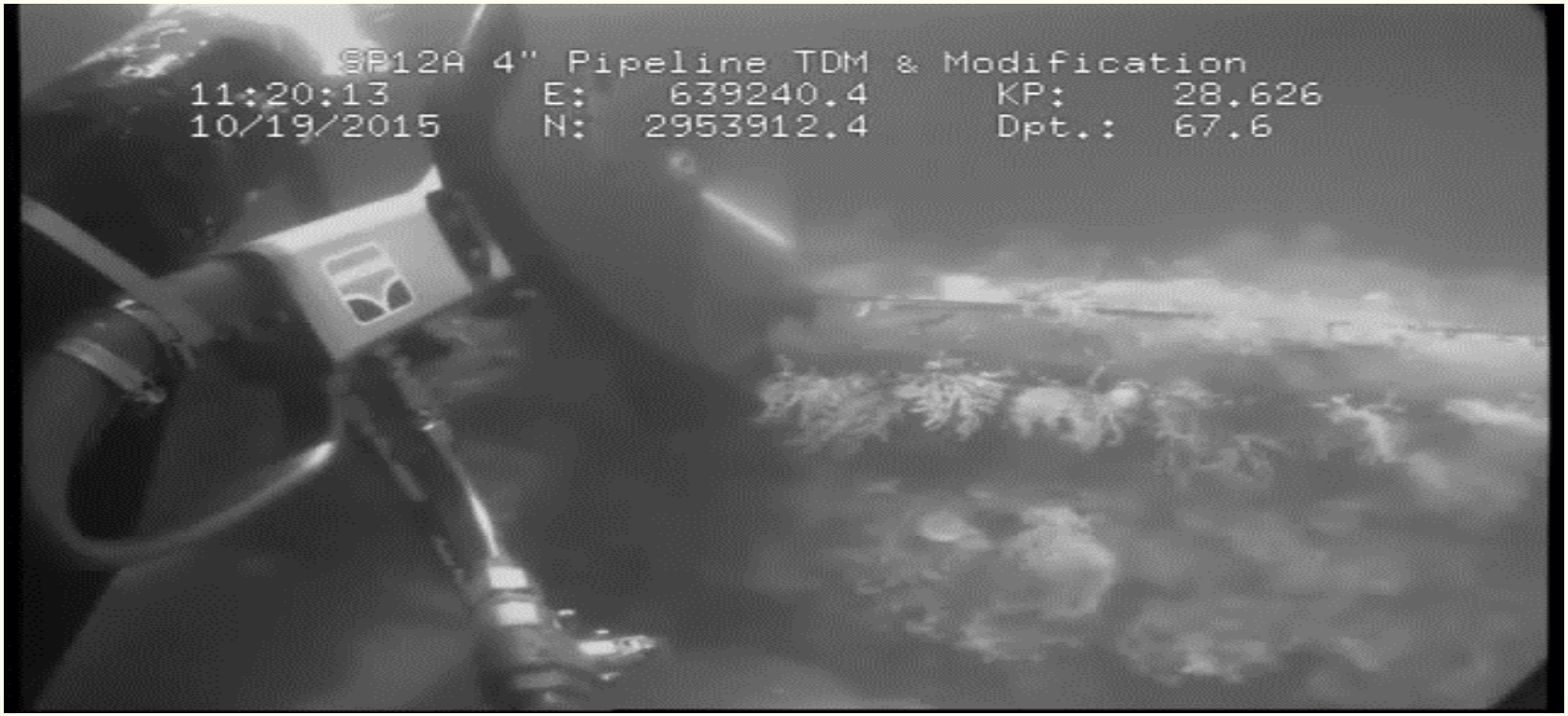
Preparatory Activities for Removal of Cable

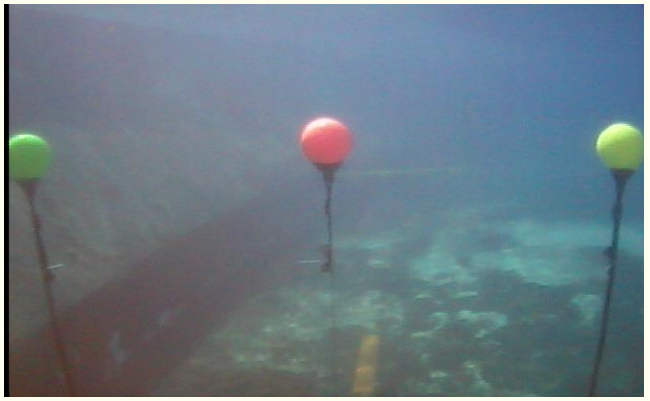
Sample Video of Cutting 4inch Pipeline by ROV



Preparatory Activities for Removal of Cable

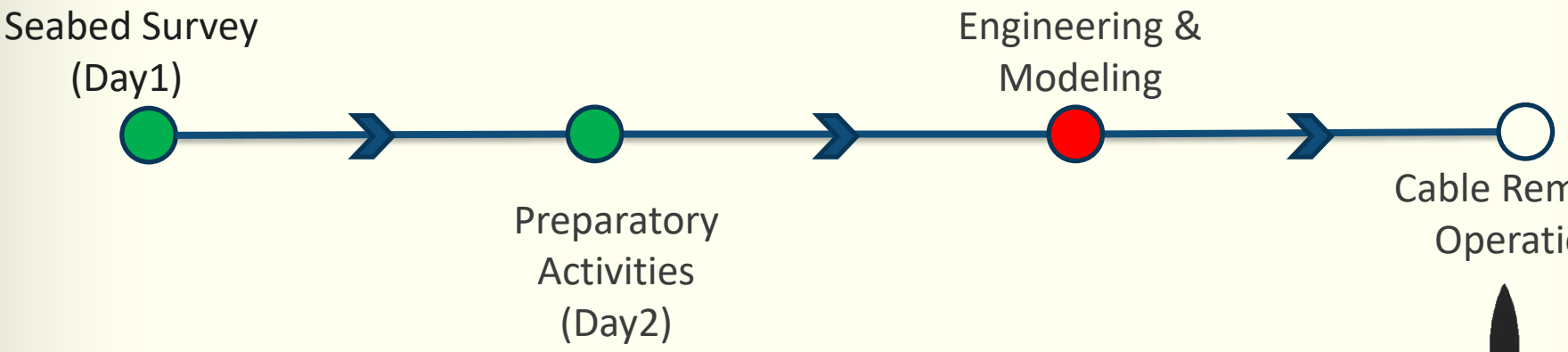
Connect Buoy to the Loose Heads of Cable and Securing

- Connecting Buoy to Loose Heads of Cables



- Securing of Loose Heads of Cables

Overview of Cable Removal



Engineering

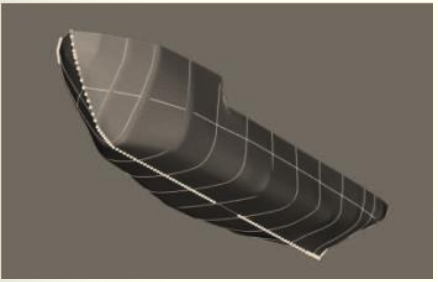
Digital Assets

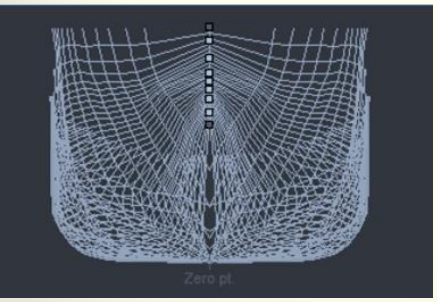
BENTLEY

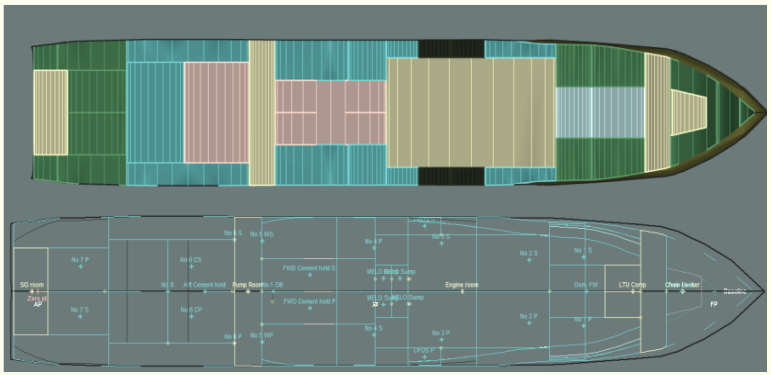
(MAXSURF)

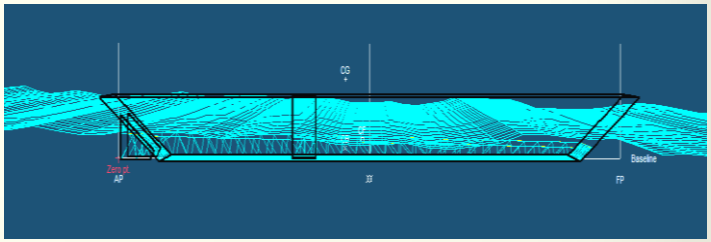
Potentials

- Hydrostatic Analysis
- Tank Arrangement
- Tank Calibration
- Load Arrangement
- Stability Analysis (Intact – damaged)
- Structural Strength Analysis
- RAO Calculation
- Motion Sickness Indication (MSI)
- Resistance Calculation
- Minimum Required Power Estimation





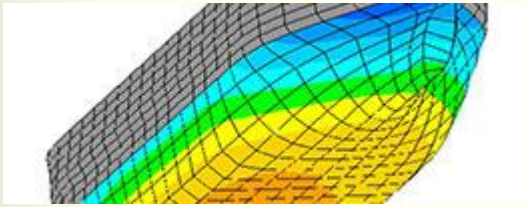




Engineering

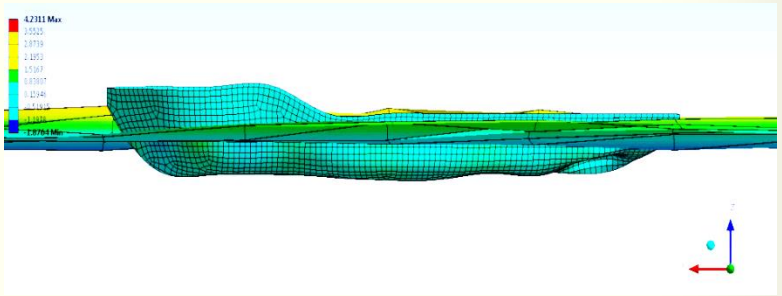
Digital Assets

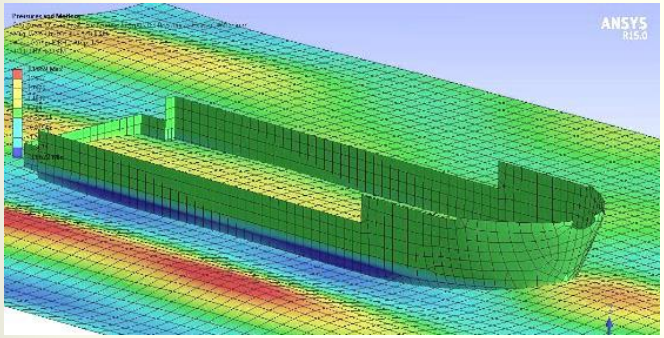
AQWA



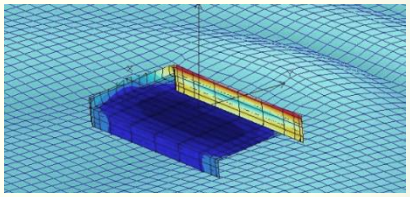
Potentials

- Stability analysis
- Hydrodynamic analysis
- Time response analysis
- Rao calculation





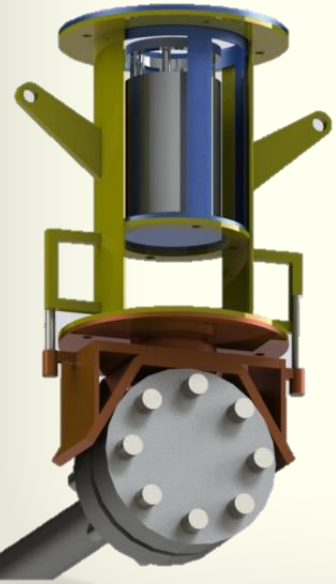
- Mooring analysis
- Drift Analysis
- Winch-fender-Joint-mooring failure
- Hydrodynamic interaction analysis
- Scenario Based Analysis



Engineering

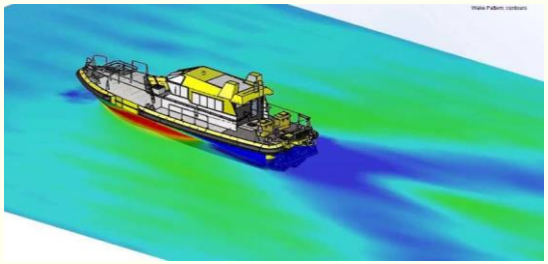
Digital Assets

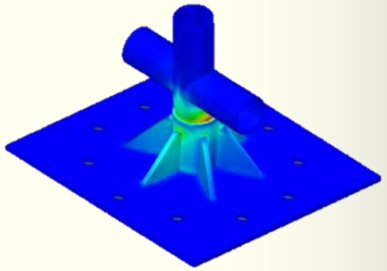
SOLID WORKS

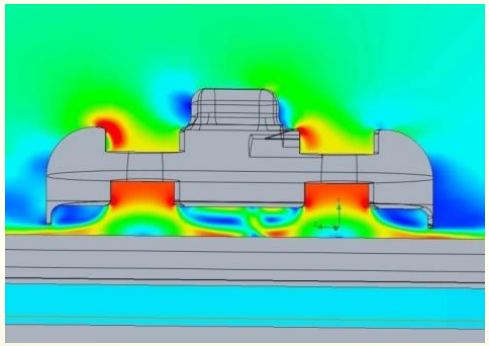


Potentials

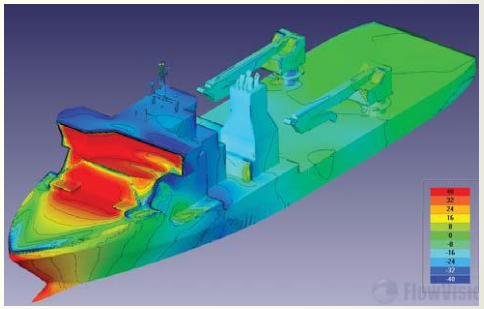
- Structural modeling
- Structural analysis
- Structural cost study analysis

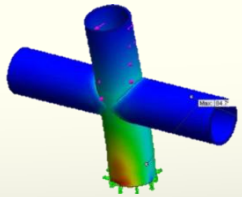






- Flow simulation analysis
- Aerodynamic Analysis
- Drag coefficient Calculation





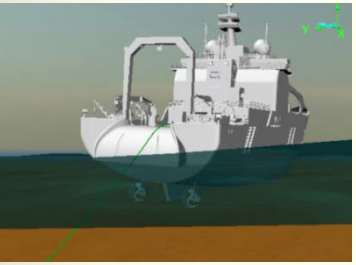
Engineering

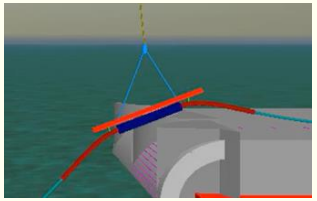
Digital Assets

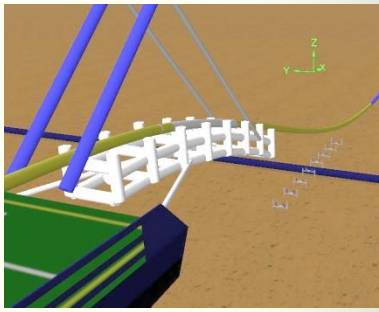
ORCAFLEX

Potentials

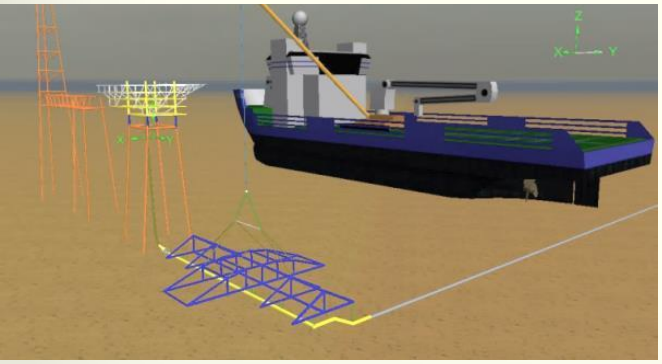
- Riser, Cables; SCR, TTR, hybrid, flexible, umbilical.
- Anchor Pattern: spread, turret, SPM, jetty, etc.
- Anchor Calculation; Drag and Penetration.

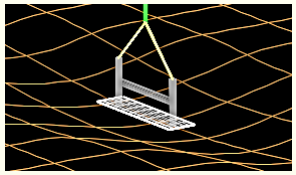


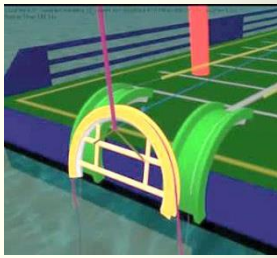




- Installation planning, full range of scenarios
- Towed systems: bundle dynamics, towed bodies, etc.
- Seabed stability and other types of system







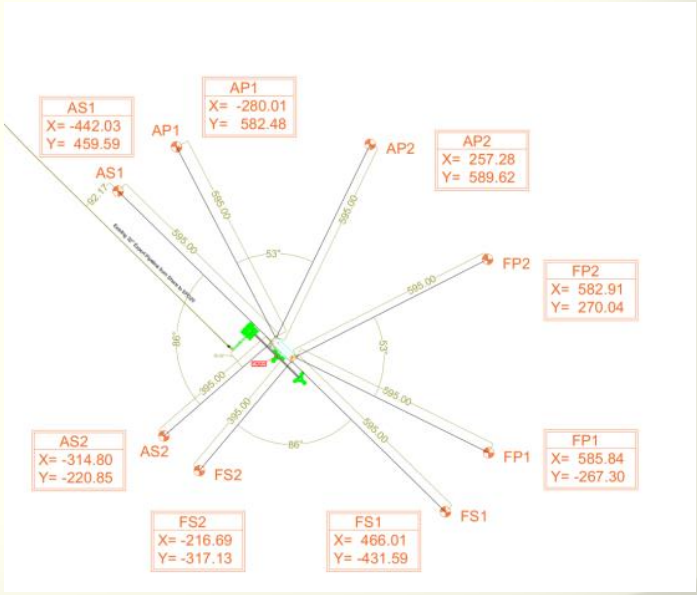
Engineering

Sample of Works

Anchor Pattern and Mooring Analysis

- Hydrostatic Modeling and Stability Check
- Hydrodynamic Modeling and RAO Calculation
- Anchor Pattern, Intact, Damage Analysis

	Line ID	Max. Tension (kN) Top End	Max. Tension (t) Top End	Max. Tension (t) Bottom End	Max. Tension (kN) Bottom End	Mooring Lines				Anchor								
						MBL (t)	SF	API Rec. SF	Remark	Anchor Holding Cap. (t) Soft clay	SF	API Rec. SF	Remarks	Anchor Weight (t)	Wire Length (m)	Uplift Force (t)	SF	Remarks
W-E wave heading 1.5m 4.5s	S1	104.1575	10.62	113.34	11.56	114	10.73	1.67	OK	45	0.26	0.8	OK	3	306.22	2.64	1.135494	OK
	S2	77.1815	7.87	74.00	7.55	114	14.48	1.67	OK	45	0.17	0.8	OK	3	311.25	1.70	1.767494	OK
	P1	323.0769	**32.95**	320.54	**32.69**	114	**3.46**	1.67	OK	45	**0.73**	0.8	OK	3	393.58	**5.81**	**0.516026**	Not OK
	P2	276.8021	28.23	274.08	27.95	114	4.04	1.67	OK	45	0.62	0.8	OK	3	376.75	5.19	0.577688	Not OK
NW-SE wave heading 1.5m 4.5s	S1	138.1038	14.08	135.43	13.81	114	8.09	1.67	OK	45	0.31	0.8	OK	3	306.22	3.16	0.950215	Not OK
	S2	132.0865	13.47	129.18	13.17	114	8.46	1.67	OK	45	0.29	0.8	OK	3	311.25	2.96	1.012561	OK
	P1	211.3347	**21.55**	208.89	**21.30**	114	**5.29**	1.67	OK	45	**0.47**	0.8	OK	3	393.58	**3.79**	0.791823	Not OK
	P2	123.395	12.58	120.60	12.30	114	9.06	1.67	OK	45	0.27	0.8	OK	3	376.75	2.29	1.312872	OK
N-S wave heading 1.5m 4.5s	**S1**	321.7245	**32.81**	319.59	**32.59**	114	**3.47**	1.67	OK	45	**0.72**	0.8	OK	3	306.22	**7.45**	**0.402672**	Not OK
	S2	304.1057	31.01	301.45	30.74	114	3.68	1.67	OK	45	0.68	0.8	OK	3	311.25	6.91	0.433915	Not OK
	P1	188.2715	19.20	185.70	18.94	114	5.94	1.67	OK	45	0.42	0.8	OK	3	393.58	3.37	0.890732	Not OK
	P2	94.8809	9.68	90.88	9.27	114	11.78	1.67	OK	45	0.21	0.8	OK	3	376.75	1.72	1.742162	OK

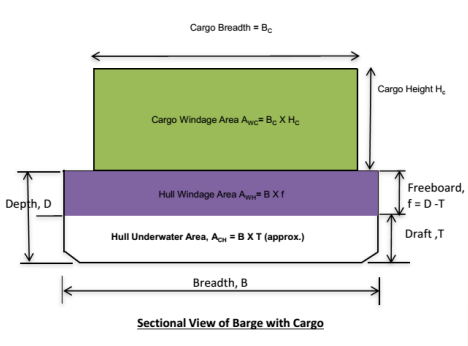


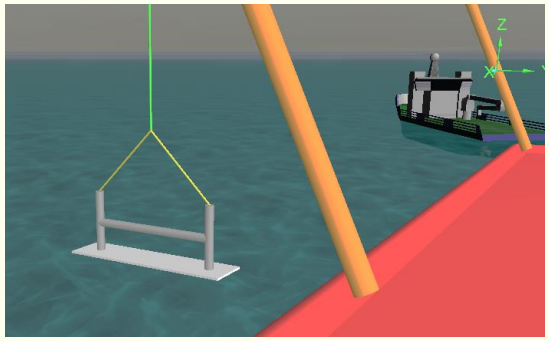
Engineering

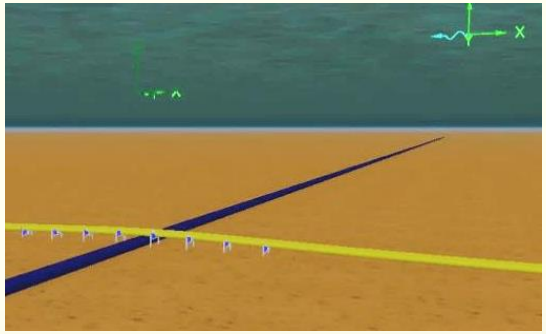
Sample of Works

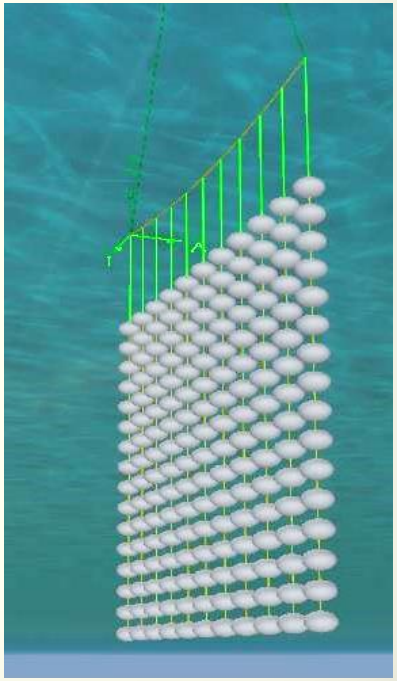
Crossing Support and Mattress Installation

- Loading Arrangement
- Bollard Pull Calculation
- Transferring and
- Installation Procedure









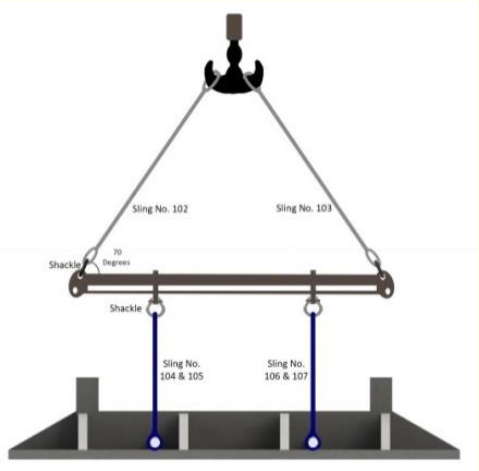
Engineering

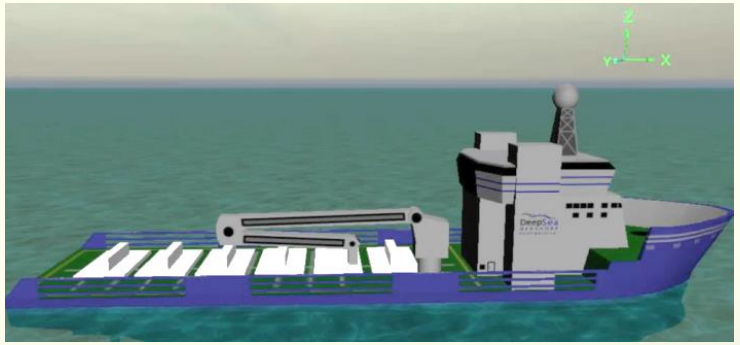
Sample of Works

Crossing Supports Inst.

Loading and Transportation Procedure

- Transferring and Installation
- Hydrodynamic Calculation of the Vessel Body
- Lifting Analysis of the Support
- Min. Req. Rigging Specifications



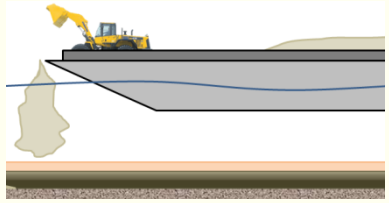


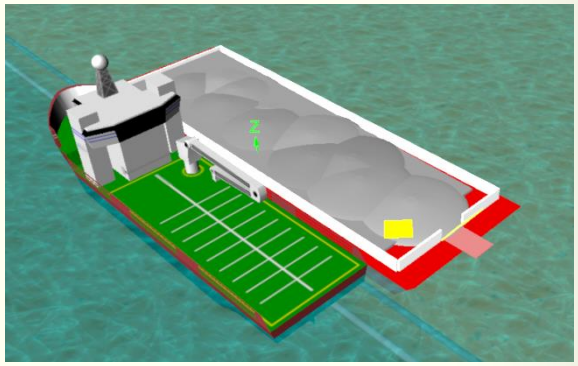
Engineering

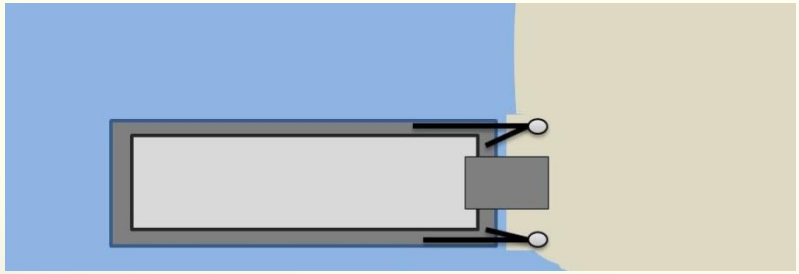
Sample of Works

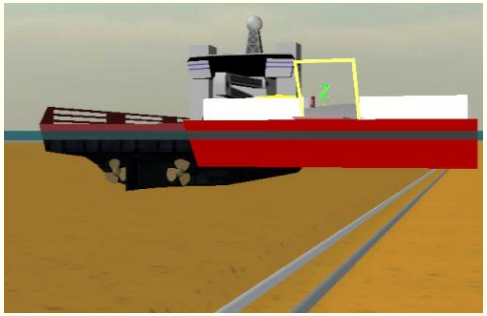
Backfilling Offshore Operation

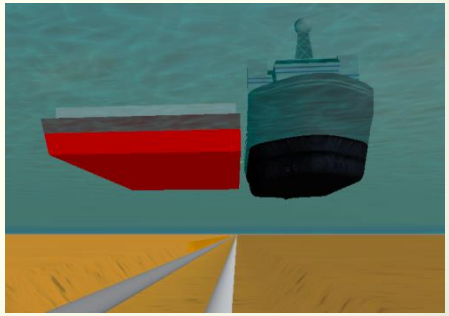
- Barge, DP Vessel, Stability check
- Hydrodynamic Analysis
- RAO Calculations
- Bollard Pull Calculation
- Towing Analysis









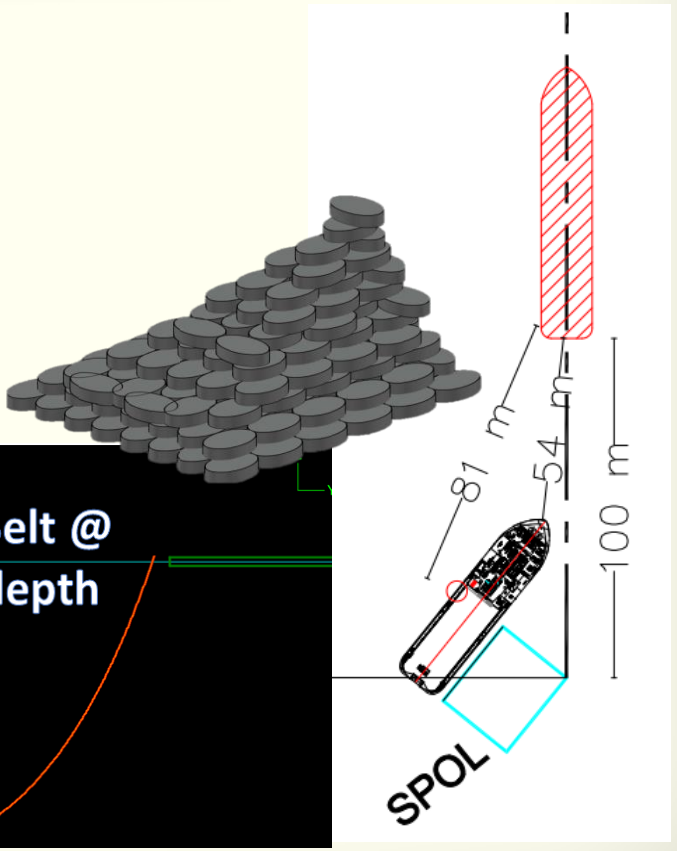


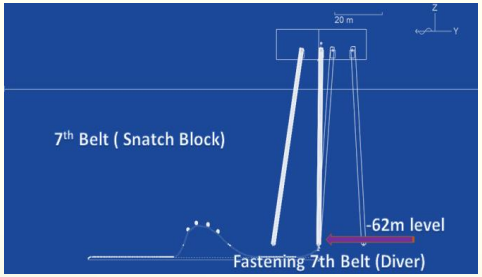
Engineering

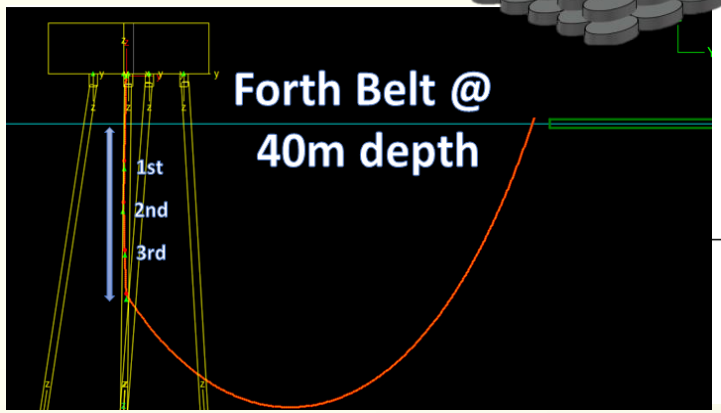
Sample of Works

FO Cable Pulling

- Hydrostatic Modeling and Stability Check
- Hydrodynamic Modeling and RAO Calculation
- Cable Floatation Analysis
- Rigging Requirement Specification
- Project Execution Plan





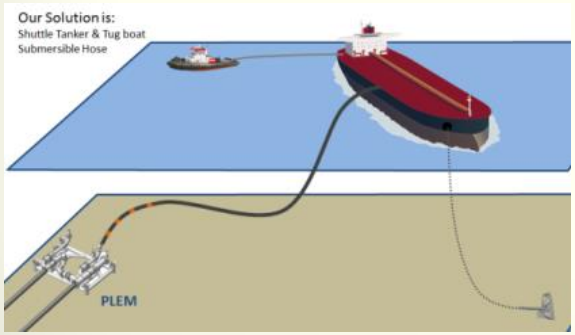


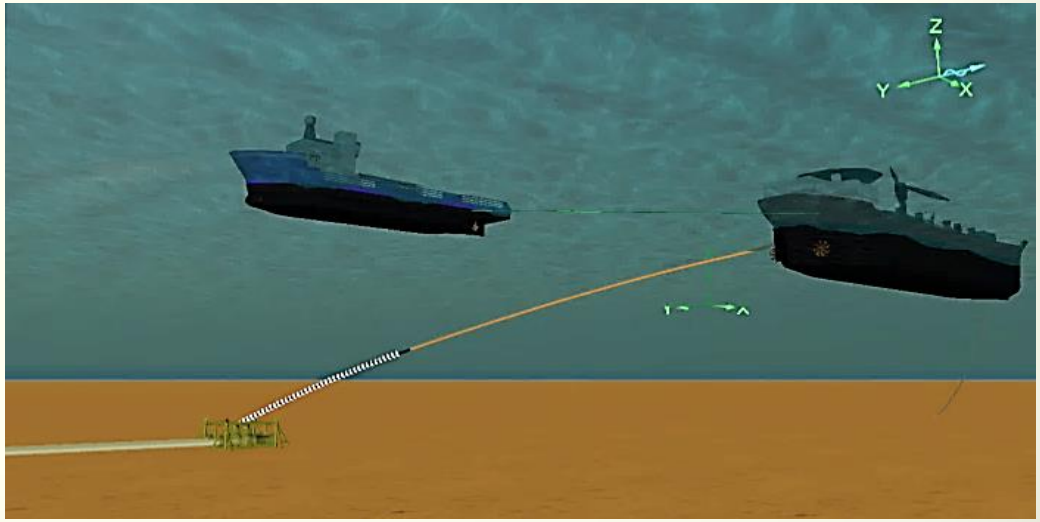
Engineering

Sample of Works

SPM Recovery Modeling

- Loading Arrangement
- Flexible Hose Modeling
- DP Vessel Modeling
- Installation Procedure



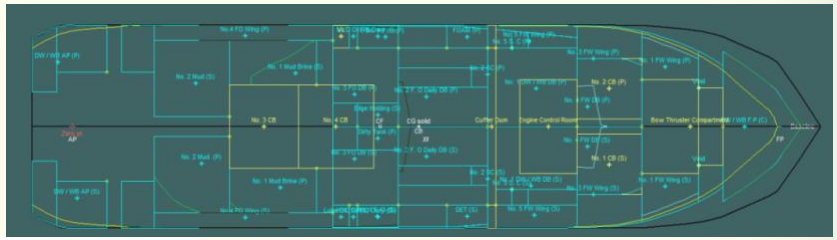


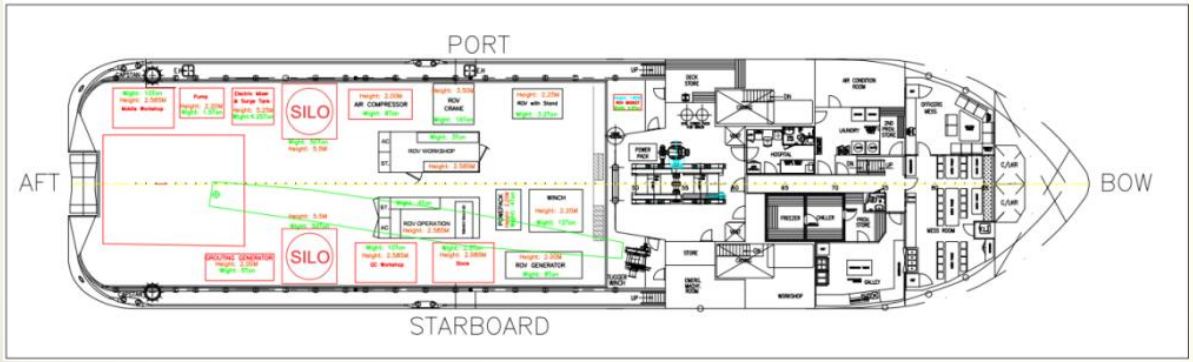
Engineering

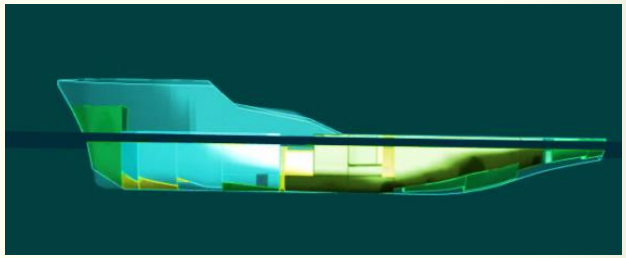
Sample of Works

Free Span Rectification

- Hydrodynamic Calculation of the Vessel Body
- Sea-fastening Analysis of Cement Bunkers
- Lifting Analysis of the Basket
- Min. Req. Rigging Specifications



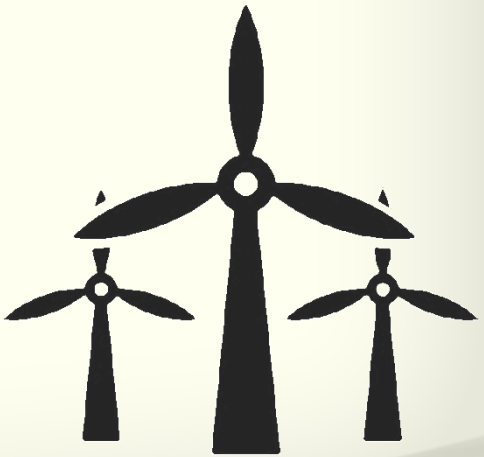




Engineering for Cable Removal

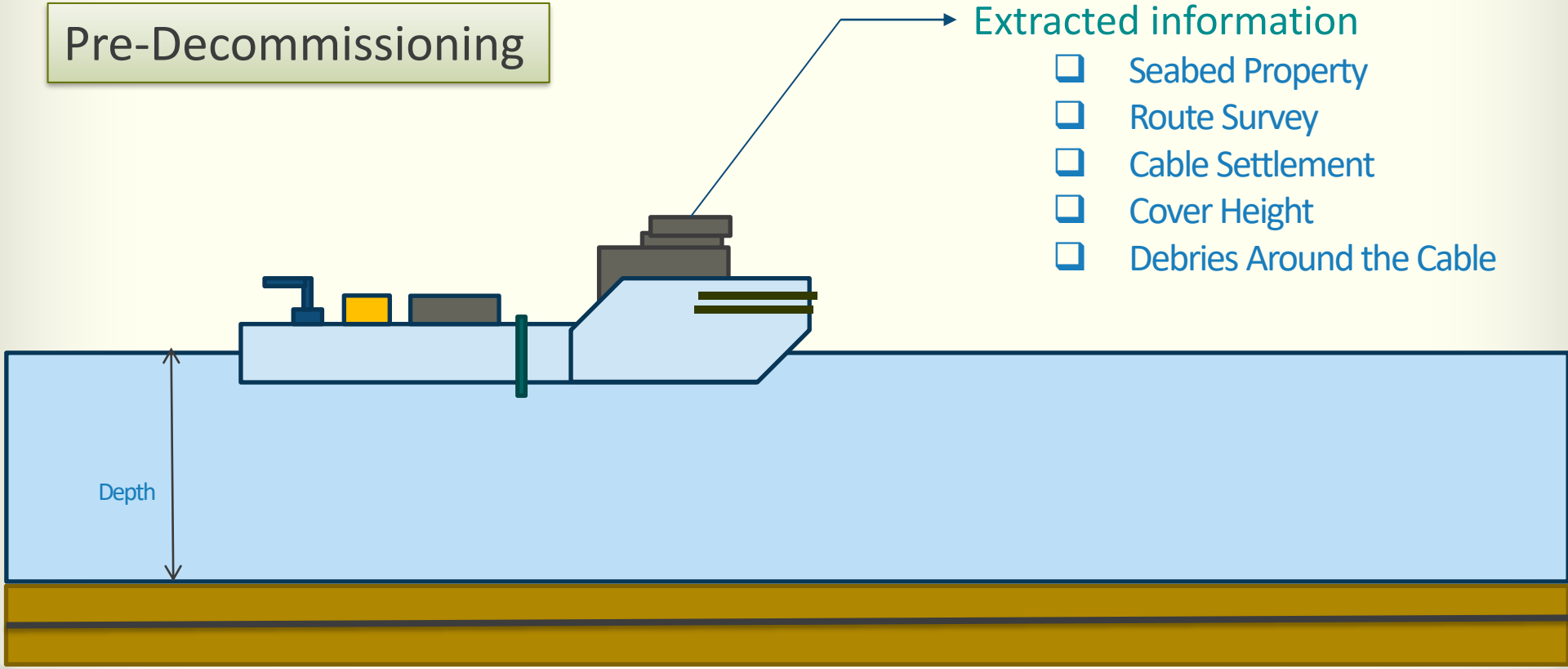
Objectives of Engineering:

- Calculation and Analysis for Safe Recovering of Cable
- Simulation/Modeling of Recovering of Cable
- Engineering Report/Procedure for Recovery of Cable



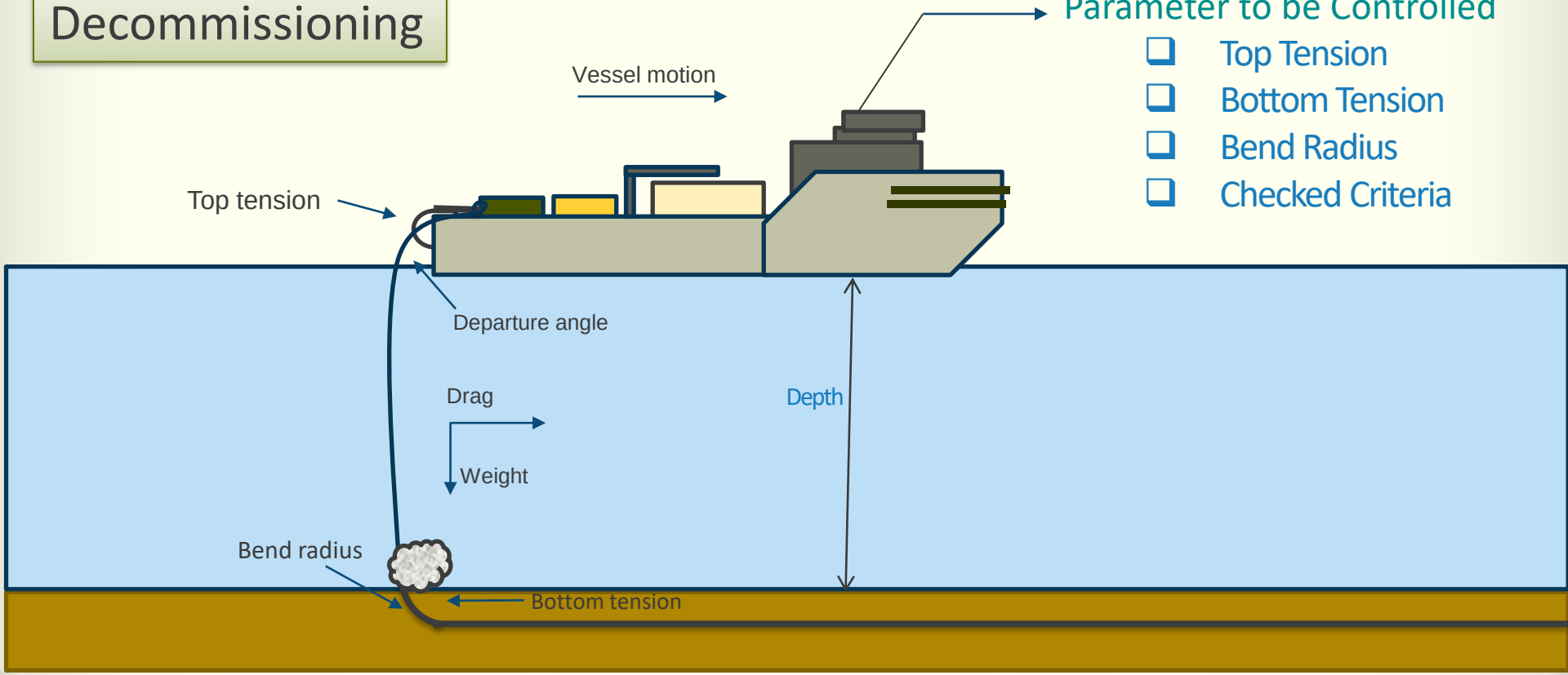
Engineering for Cable Removal

Pre-Decommissioning



Engineering for Cable Removal

Decommissioning



Parameter to be Controlled

- ❑ Top Tension
- ❑ Bottom Tension
- ❑ Bend Radius
- ❑ Checked Criteria

Engineering for Cable Removal

Effective Parameters

orcina
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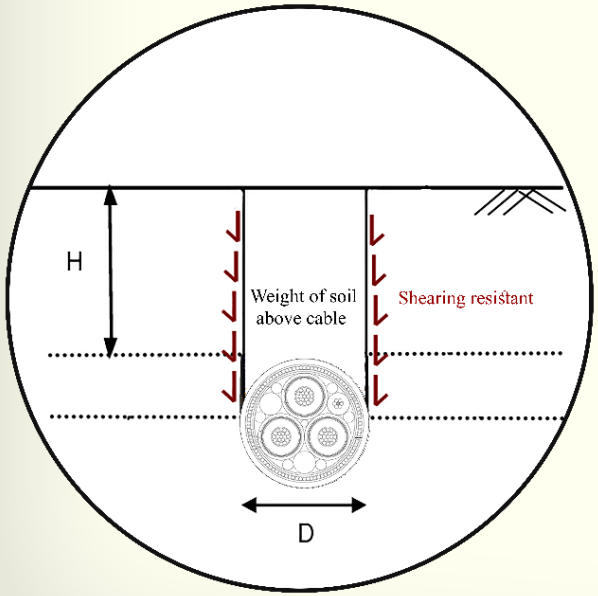
SOIL RESISTANCE



Soil Parameter	Soil Type
RESISTANCE, Calculation	
γ'	Submerged weight of soil
H	Cover height
s_u	Average undrained shear strength at from center of cable to top of trench
φ	Angle of internal friction
k	Coefficient of lateral earth pressure.
f	Uplift resistance factor
Nc	Theoretical bearing capacity coefficient
η	Empirical factor based on field tests

Engineering for Cable Removal

Effective Parameters

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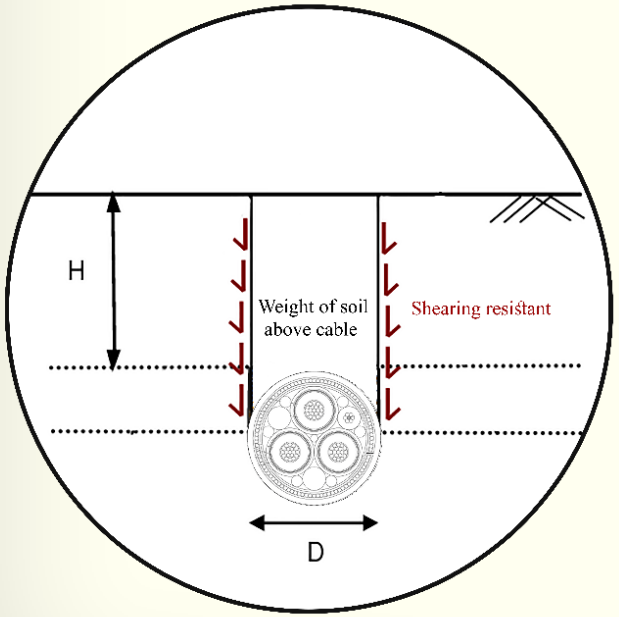
Cable Specification



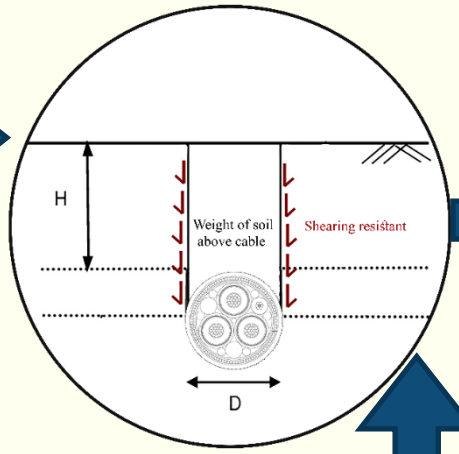
Cable Parameter		
	D	Cable diameter
	m	Mass per Unit Length
	EI	Bending stiffness
	AE	Axial Stiffness
	MBR	Minimum allowable bending radius
	r	Roughness factor
	CBL	Cable breaking load

Engineering for Cable Removal

Cable Removal Simulation Procedure

ORCAFLEX

Geotechnic



Cable Test

Extract Parameters

Calculation the Soil Resistance

DNV-RP-F110

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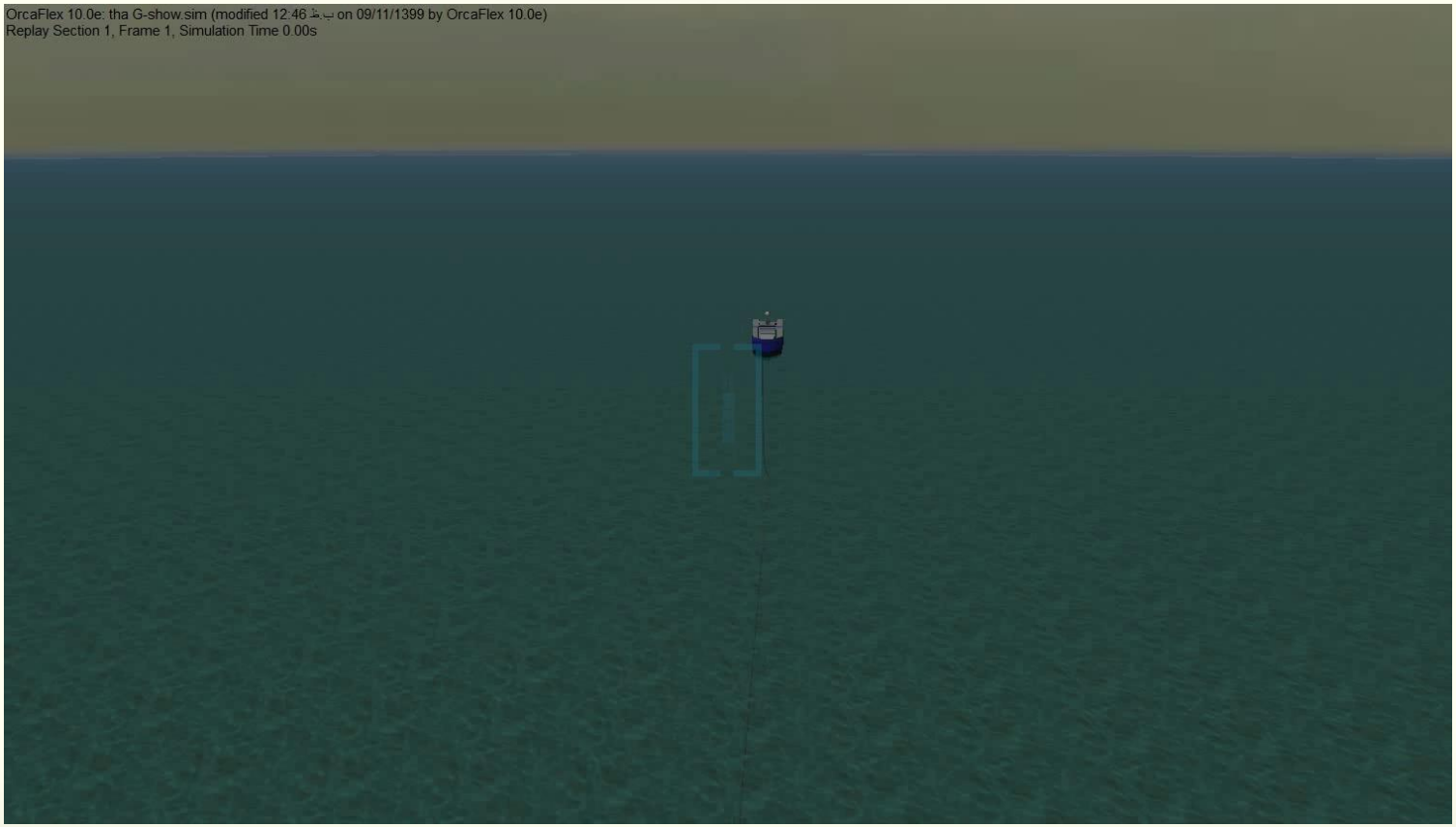
Cable Analysis
- Top Tension
- Bend Radius

Design Criteria

DNVGL-RP-0360

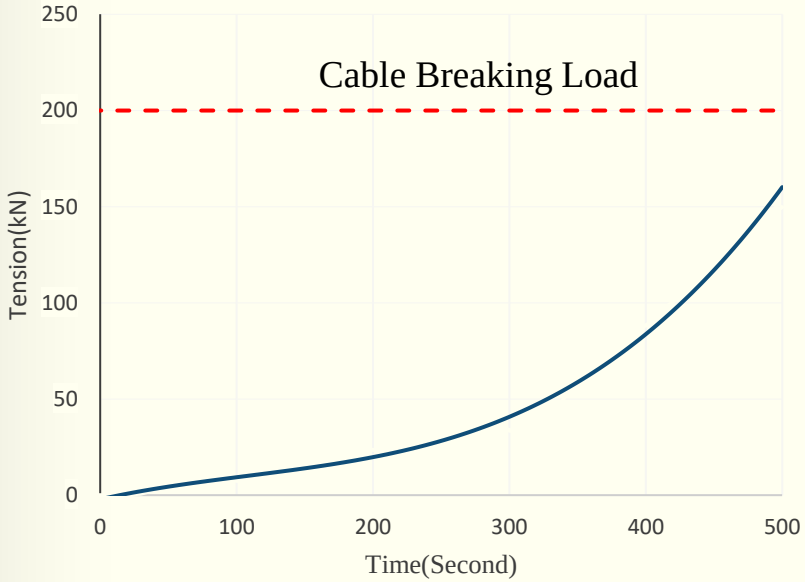
Engineering for Cable Removal

Cable Removal Simulation



Engineering for Removal of Cable

Result and Discussion

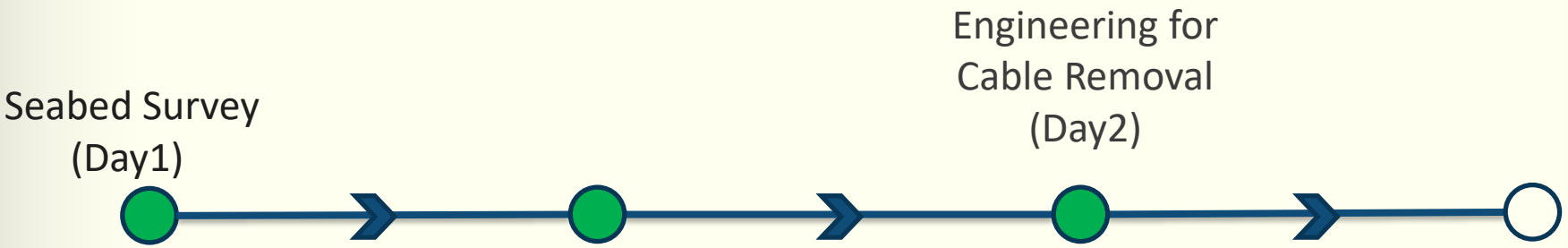


Vessel Displacement =250 m

Unburied Cable = 70m

Cable is safe in this time

Overview of Cable Removal



Question/Answer

Thanks for Your Kind Attention

February 2021