

Changing the Game – Dockwise Vanguard



Malou Wagner & Taco Terpstra | April 10th, 2014 | Kivi Niria Martec



- Boskalis
- Dockwise
- Market Developments
- Dockwise Vanguard
 - Movie + backlog
 - Technical details
 - Ocean Transport
 - Quayside Dry-docking
 - Offshore Dry-docking
- Q&A



Boskalis Company Profile



Offshore Energy | Dredging & Inland Infra | Towage & Salvage

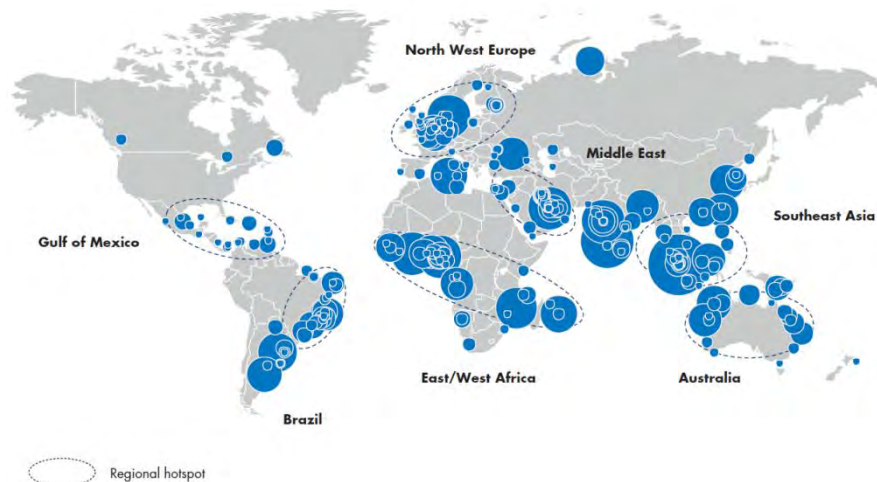
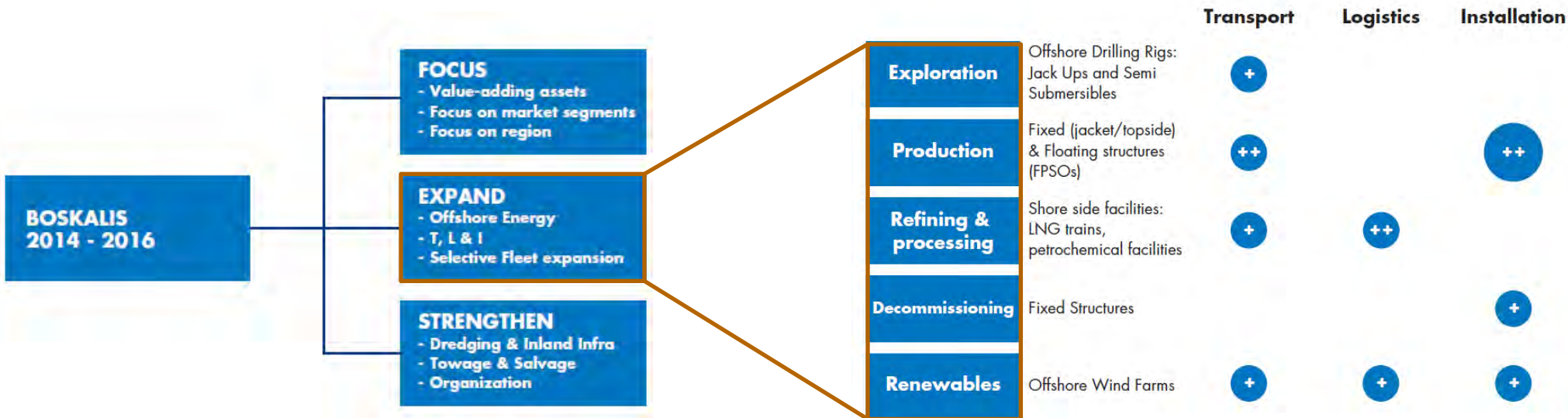
Global dredging and marine experts serving the Energy, Ports and Infra industries

- Headquarters Papendrecht, the Netherlands
- Workforce 11,000
- Fleet 1,000
- Revenue* 3.5 billion
- EBITDA* 800 million
- Net Profit* 366 million
- Backlog 4.0 billion
- Website boskalis.com



* Based on 2013 figures
Note: Figures in EUR

Boskalis Strategy



Transport

- Leverage on leading position and unique assets

Logistics

- Combine versatile asset base with project management know-how

Installation

- Combine assets, engineering and contracting competencies
- Climb up S curve with existing assets

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Dockwise under the Boskalis Offshore Umbrella



Boskalis



Division	Sub-division	Image	Description
Offshore Energy	Marine Contracting		<ul style="list-style-type: none"> Offshore T&I contracting for fixed & floating infrastructures, with focus on FPSO/FLNG mooring installations (tow out & hook up), WTG foundations and decommissioning.
	Marine Services		<ul style="list-style-type: none"> Offshore T&I services for EPCI- and T&I contractors (AHT's, sheerlegs & barges).
	Subsea Contracting		<ul style="list-style-type: none"> Seabed preparation & rock dumping for fixed offshore production structures, pipelines, WTG foundations & landfalls. Offshore cable laying (VSMC) for, wind farms, fixed O&G production structures and inter-connectors.
	Subsea Services		<ul style="list-style-type: none"> Subsea IRM of offshore production structures and offshore drilling rigs up to 300m water depth. Light subsea construction for fixed & floating offshore production structures.
	HMT ST		<ul style="list-style-type: none"> Marine transport of extremely large and heavy structures.
	HMT LT/T&I		<ul style="list-style-type: none"> Marine transport of floating production structures (TLP's, Semi's, Spar's, FPSO's). Offshore T&I contracting for fixed & floating infrastructures with focus on float-over topside installation, jacket launching and offshore dry docking.
	Logistical Management		<ul style="list-style-type: none"> Turn-key logistical operations for transportation of modules for onshore industrial projects.

Matching the Oil & Gas Industry

Oil & Gas Phases

Exploration & Development

Production

Refining & Processing

Strategic Focus

Maintain Leadership Heavy Marine Transport

- High drilling activity since 2004
- Globally > 800 rigs by 2014
- Higher global rig utilization
- Higher complexity wells
- Increase in deepwater activity

Market Drivers

Expand Offshore Transport & Installation

- Continued development drilling
- Deepwater platforms installations
- Increase in size & weight
- Higher complexity in structures
- Greater global activity
- Increase in float-over installations

Develop Logistical Management Solutions

- Increasing investments in:
 - LNG/LPG/Refineries
 - Mining/Power plants
- More remote construction sites
- Environmentally sensitive locations
- Greater use of modular concepts
- Increase of module **size & weight**

OFFSHORE TRANSPORT & INSTALLATION

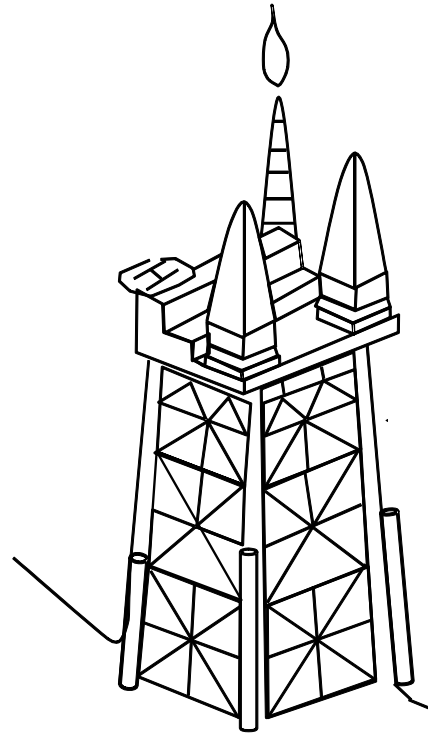
Total marine scope for jacket launch
and topside float-over installations



Dockwise Approach to Transport & Installation



Jacket Launch



Deck Mating



Float-over Installation





CPOC DECK
19,000 mT topside float-over (2009)



Technip TOTAL Ofon Deck
16,000 mT float-over (2014)



GAZFLOT MOSS CS-50
Two 19,000 mT semi drilling rig
float-over installations (2010)



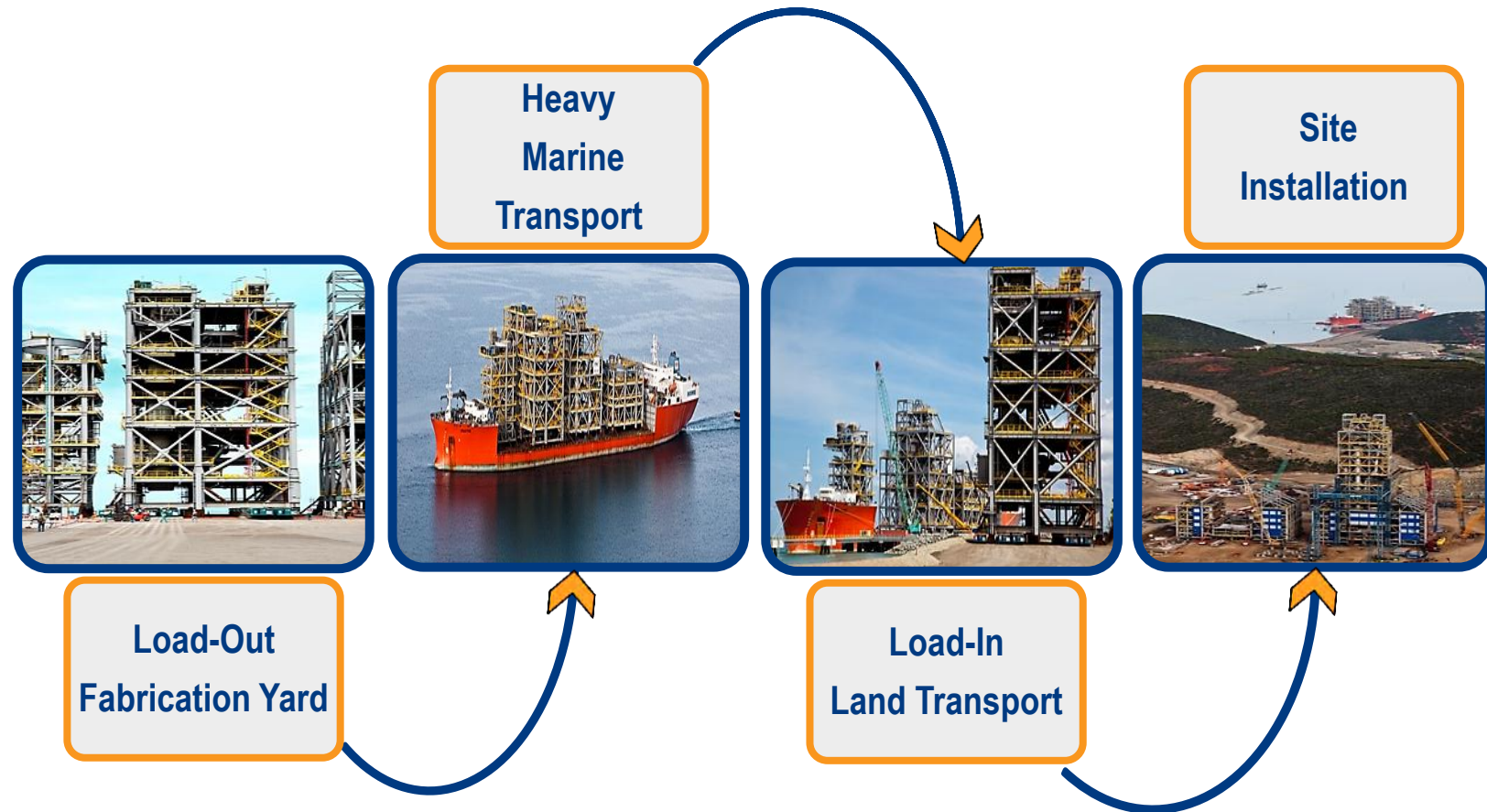
SHWE Jacket and Topside
22,000 mT float-over (2012)

Logistical Management Solutions

Turnkey logistical services for
onshore industrial projects



Dockwise Approach to Logistical Management



Koniambo - Hatch Technip
(2010)



HAY POINT EXPANSION 3
Coal plant modules (2012)



Methanex - Mammoet (2013)



Gorgon project
Chevron, KJV (2014)



HEAVY MARINE TRANSPORT

Ocean transport solutions
for large & heavy structures



Dockwise Approach to Heavy Transport Vessel



**Loading
Types**



Float



Skid



Roll

**Float-on
Example**



Ballast



Cargo positioning



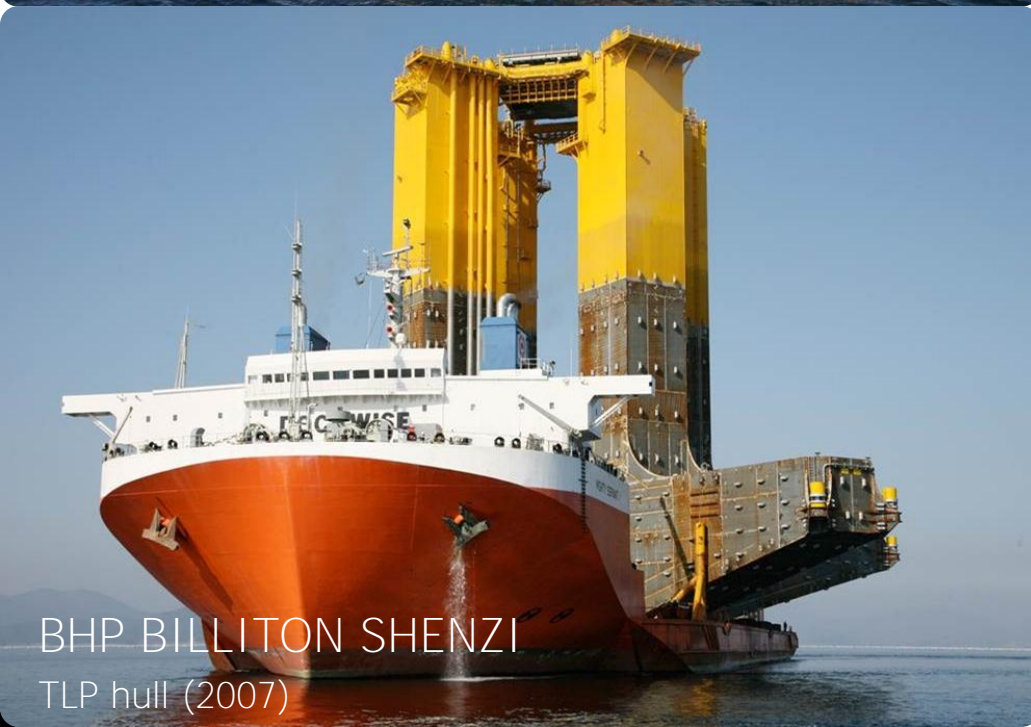
De-ballast



CHEVRON JACK & ST. MALO
Semi production unit hull (2013)



CHEVRON BIG FOOT
TLP hull (2013)



BHP BILLITON SHENZI
TLP hull (2007)



SHELL MARS B
TLP hull (2013)



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Transporting Tomorrow's Energy Needs



Left to right: Mars B | Lucius Spar | Big Foot | Jack St. Malo



Offshore Platform Types in Deeper and Harsher Environment

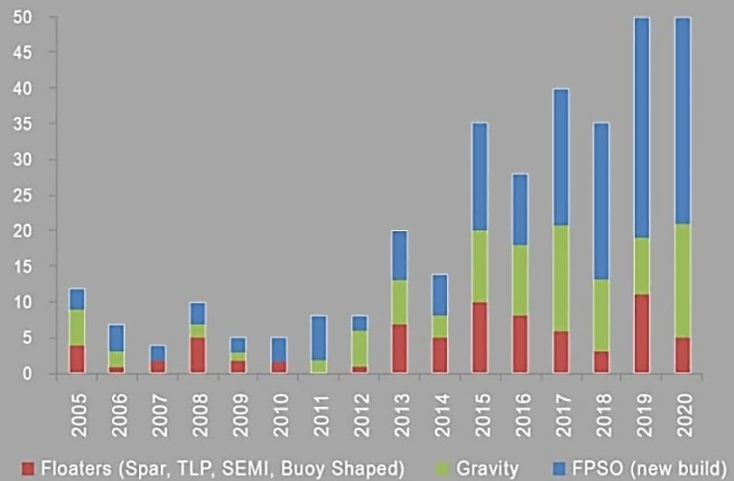


Market Drivers: Increase in size & weight | New technology & methods | Larger vessels & carrying capacity

Fixed Tower | **Compliant Tower** | **Tensioned Leg** | **Spar** | **Semi-Submersible** | **FPSO**



FPU Market Development



Infield March 2011 - Floating production structures - Dryweight > 25,000 mton



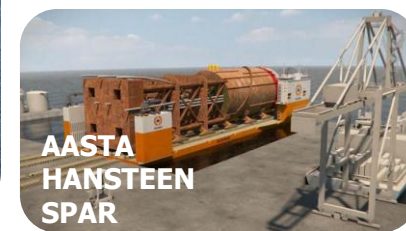
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The Dockwise Vanguard



Flagship vessel | World's largest semisubmersible heavy transport vessel



Technical details of the Dockwise Vanguard



Overall length: 275.00 meters
Deck breadth: 70.00 meters
Breadth maximum: 78.75 meters
Hull Depth: 15.50 meters
Water above the deck: 16.00 meters

Maximum carrying capacity around: 110.000 metric tons

Buoyancy casings: Repositionable to maximize deck space

Propulsion Power: 27 MW (diesel electric)

Propulsion configuration:
2 Main propellers, controllable pitch
2 Retractable fixed pitch azimuth thrusters
1 bow thruster

Maximum Speed : 14 knots

Offshore loading / discharge at sea states of: 1.5 – 2.0 meter Hs
(wave period & direction dependant)



Executed Projects – Jack St. Malo FPU



2013 – CHEVRON – 56,000 MT WORLD'S LARGEST HULL



Executed Projects – Noble Paul Romano Rig



2013 – NOBLE – FIRST DRY-DOCKING FOR THE VANGUARD



Executed Projects – Ocean Quest Rig



2013 – DIAMOND OFFSHORE SERVICES – HEAVY MARINE TRANSPORT



Executed Projects – Integrated Lower Hull



2013 – BLUE WATER SHIPPING – KEPPEL DSS38E DP3 SEMI



Backlog – Goliat FPSO



2014 – ENI – 66,200 MT – LARGEST CIRCULAR FPSO



Backlog – Costa Concordia



2014 – COSTA – FIRST CRUISE SHIP TO BE DRY-TRANSPORTED EVER



Backlog – Aasta Hansteen SPAR



2015 – STATOIL – SPAR >250M LONG



Backlog – Moho Nord FPU



2016 – TOTAL – 82,200 MT – HEAVIEST CARGO DRY TRANSPORTED



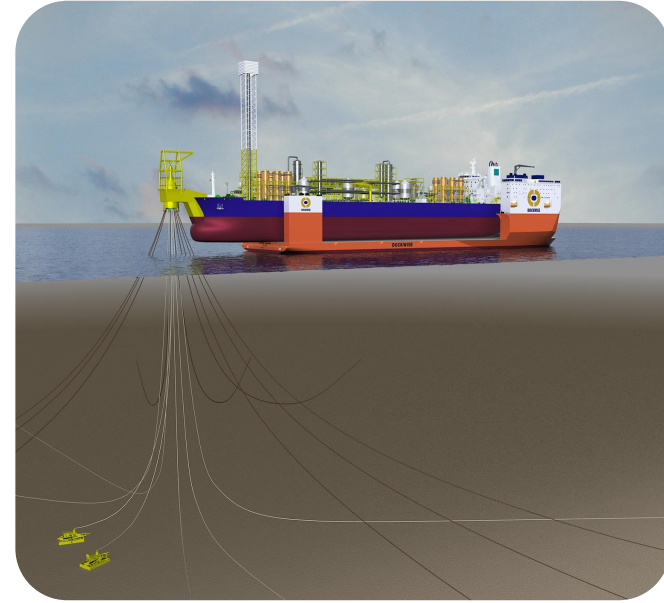
Dockwise Vanguard - FPU Services



Transport



**Dry-docking
Quayside**

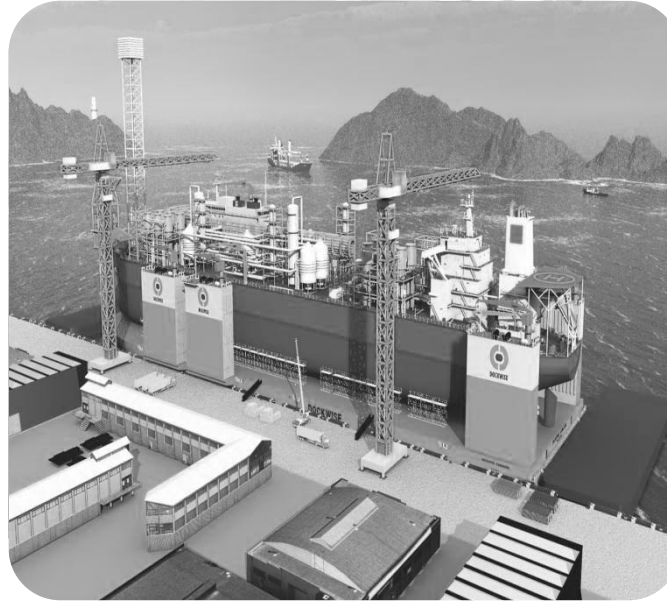


**Dry-docking
Offshore**

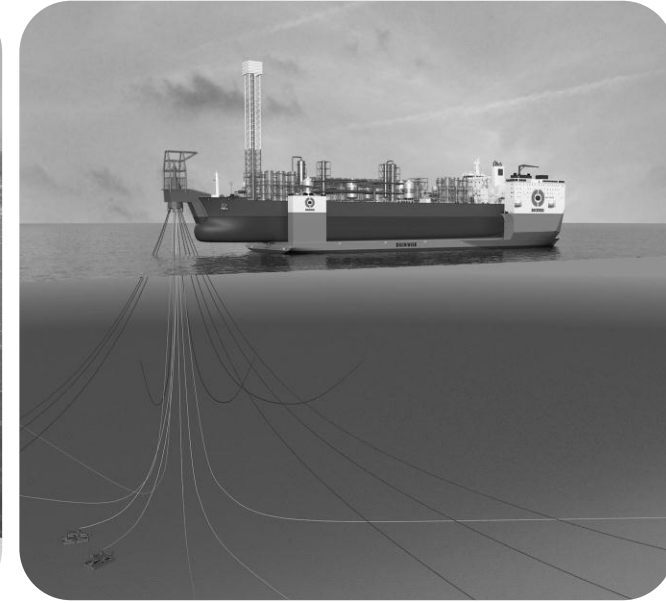
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Transport



**Dry-docking
Quayside**



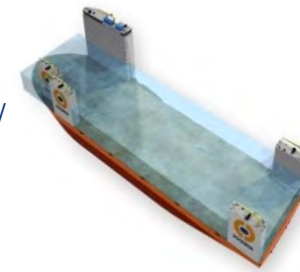
**Dry-docking
Offshore**

Transport Advantages (1/2)



- Vessel Capacity

- Vessel capacity that currently matches growth trends
 - Allows fully integrated structures to be built and completely commissioned onshore, reducing offshore exposure hours
- Load-out capabilities
 - Allow fabricators to built onshore & outside dock
 - Longitudinal and transverse load-out capabilities



16m Water Above Deck



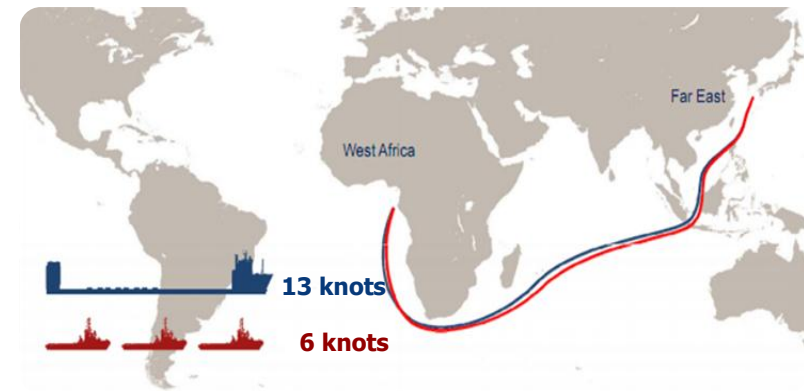
Deck Strength & Carrying Capacity

- Time Reduction

- Reduce ocean transit times with more than 50%
 - Far East – West Africa takes less than 35 days
 - Far East – Gulf of Mexico takes less than 52 days

- Lower Insurance Premium

- Insurance premiums are 10-15% of the wet-tow premium



- Riders on Board

- Accommodates large number of riders on the cargo unit during ocean transit
 - Case by case assessment of live saving equipment
 - Evacuation & emergency procedures providing 100% redundancy in escape routing



- Offshore Discharge

- Offshore discharge of floating equipment
 - Avoids intermediate wet tow and extensive marine spread requirements
 - Marine support spread can be used for both offshore discharge as well for the actual offshore installation operation.



- Reduced Environmental Impact

- When compared to wet tow, the impact on the environment using the Dockwise Vanguard is noticeable.

TRANSIT SINGAPORE to WEST AFRICA				
Vessel		Vanguard	2 x 200TBP	3 x 200TBP
Speed	[kn]	13	6	6
Transit Time	[days]	26	56	56
Daily HFO	[t]	95	87	131
Total HFO	[t]	2439	4842	7262
Nox*	[t]	152	299	449
CO**	[t]	68	136	204

* NOx Emission based on emission of 11 g/kWh
 ** CO emission based on emission of 5 g/kWh

BENEFITS OF DRY TRANSPORT OVER WET TOW

- Speed
 - Earlier first oil | Longer in shipyard
- Redundant Propulsion
 - Maximum heading control | Avoid high sea states
- Lower insurance premium
- Reduced Environmental Impact

" Reduced overall project costs "



Benefits to FPSO Transportation

Reduced Design Wave as a Consequence of Speed



- Due to increased speed, transit duration at sea significantly reduced
- Reduced sea exposure results in lower design wave height

Significant Design Wave [m]

	Worst Season		Best Season	
	Vanguard @ 13 knots	Wet Tow @ 6 knots	Vanguard @ 13 knots	Wet Tow @ 6 knots
Korea – Brazil	9.88	12.93	7.22	8.78
Korea – WAF				
Korea – Murmansk				

- Typically a reduction of 18 to 24% can be achieved in comparison to wet tow
- For the major routes, passage of Cape of Good Hope is considered critical
- Application of heading control will reduce beam seas conditions further

Benefits to FPSO Transportation

Reduced Design Wave as a Consequence of Speed



- Typically Cape Passage is considered worst stage during transit Singapore Atlantic Basin
- Duration on board dry transport vessel @ 13 knot speed takes ~72 hours
- According to DNV's Rules for Planning and Execution of Marine Operations this would qualify for a weather restricted operation

3.1.3 Unrestricted operations

3.1.3.1 Marine operations with a operation reference period, exceeding 72 hours are normally defined as unrestricted operations. Environmental criteria for these operations shall be based on extreme value statistics, see *Pt.1 Ch.3 Sec.2*. The operation criteria for these operations may be taken equal to the characteristic environmental conditions.

Table 3.1 - Significant wave height - α values

Operational Period [hours]	Design Wave Height [m]		
	$1 < H_s \leq 2$	$2 < H_s \leq 4$	$H_s > 4$
$T_R < 12$	0.68	0.76	0.80
$T_R < 24$	0.63	0.71	0.75
$T_R < 48$	0.56	0.64	0.67
$T_R < 72$	0.51	0.59	0.63

Note: Table 3.1 is based on DNMI report DSO265/LUND-95/15325, dated 95-05-04 verifying forecasted wave heights at Ekofisk and Statfjord.

Benefits to FPSO Transportation Environmental Impact



TRANSIT SINGAPORE to WEST AFRICA

Vessel		DWV	2x200 t	3x200 t
Speed	[kn]	13	6	6
Transit Time	[days]	26	56	56
Daily HFO	[t]	95	87	131
Total HFO	[t]	2439	4842	7262
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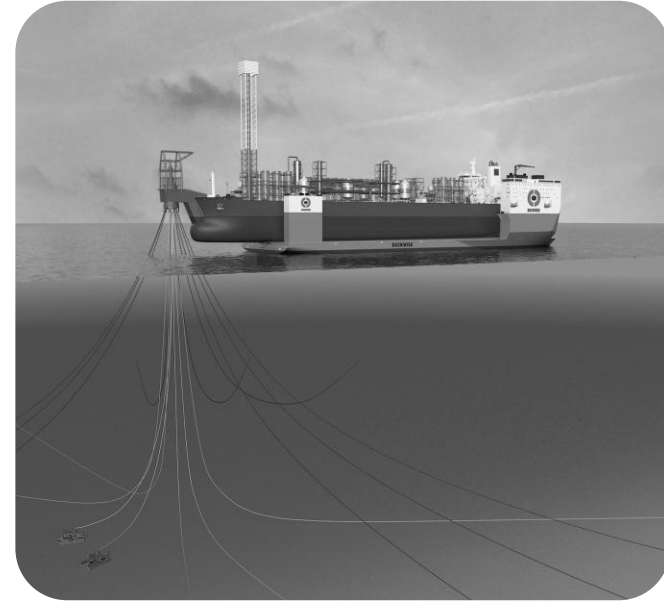
Dockwise Vanguard - FPU Services



Transport

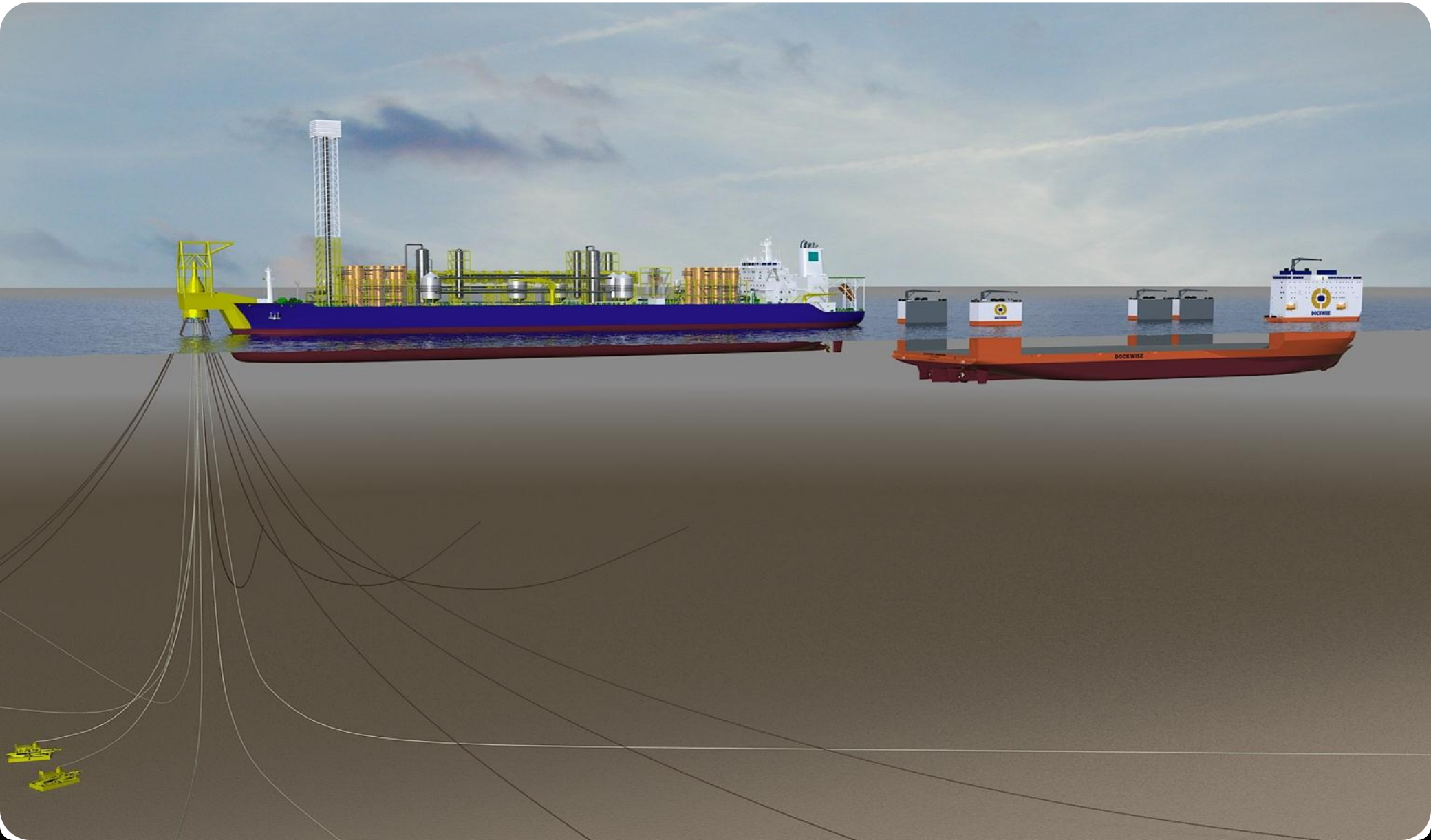


**Dry-docking
Quayside**



**Dry-docking
Offshore**

Offshore loading of the FPSO



Transit from the Field to the closest yard at 13 knots



Approach Quayside at the closest yard in the area Quayside Dry-Docking

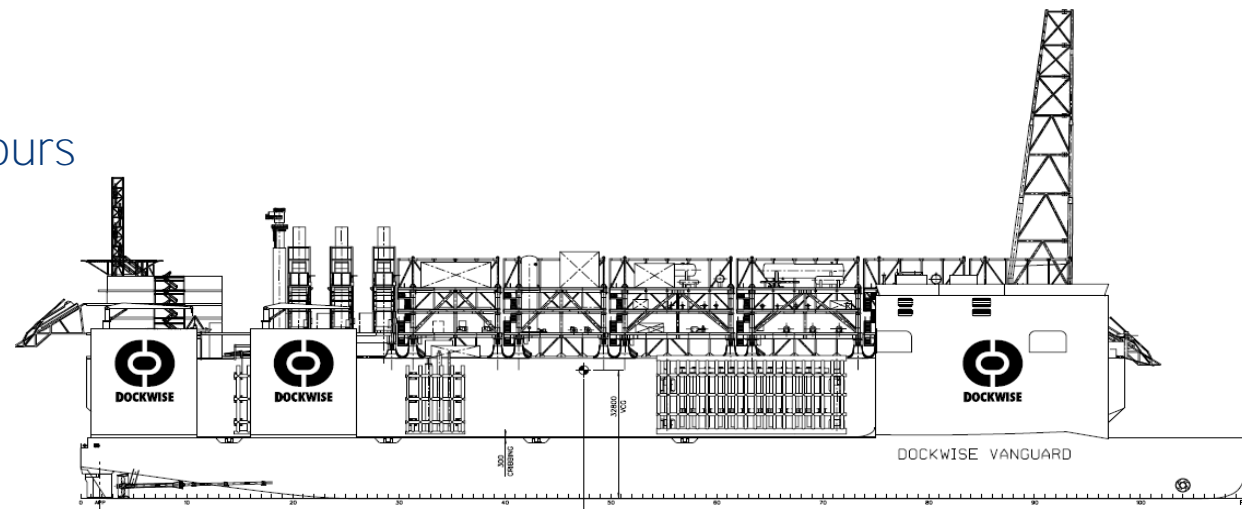


Quayside Dry-Docking with all the support of the yard in the Area



BENEFITS OF DW VANGUARD OVER CONVENTIONAL DRY-DOCKING

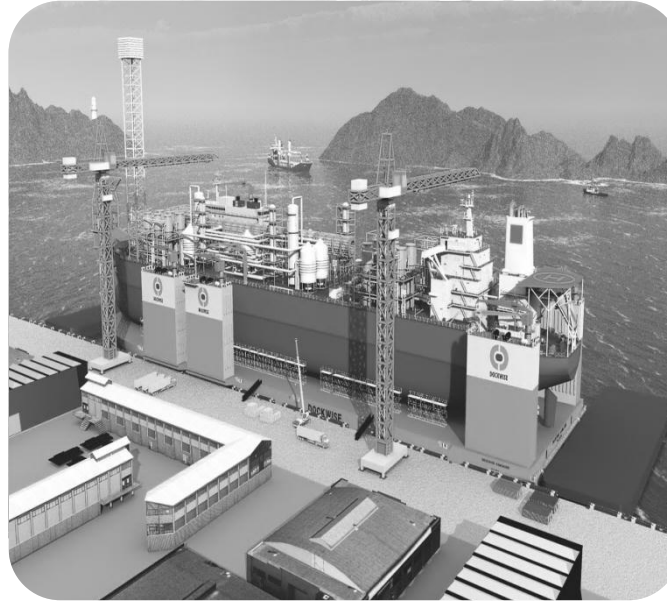
- Ability to dry-dock in the area
- Reduction of transit time during dry-docking project
- Less consequential off hire & production losses
- Full support of local content
- Extensive use of local man-hours



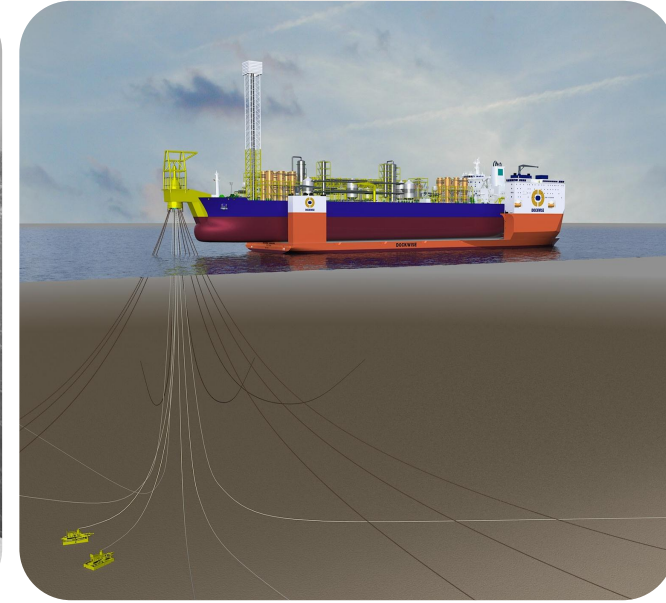
Dockwise Vanguard - FPS Services



Transport

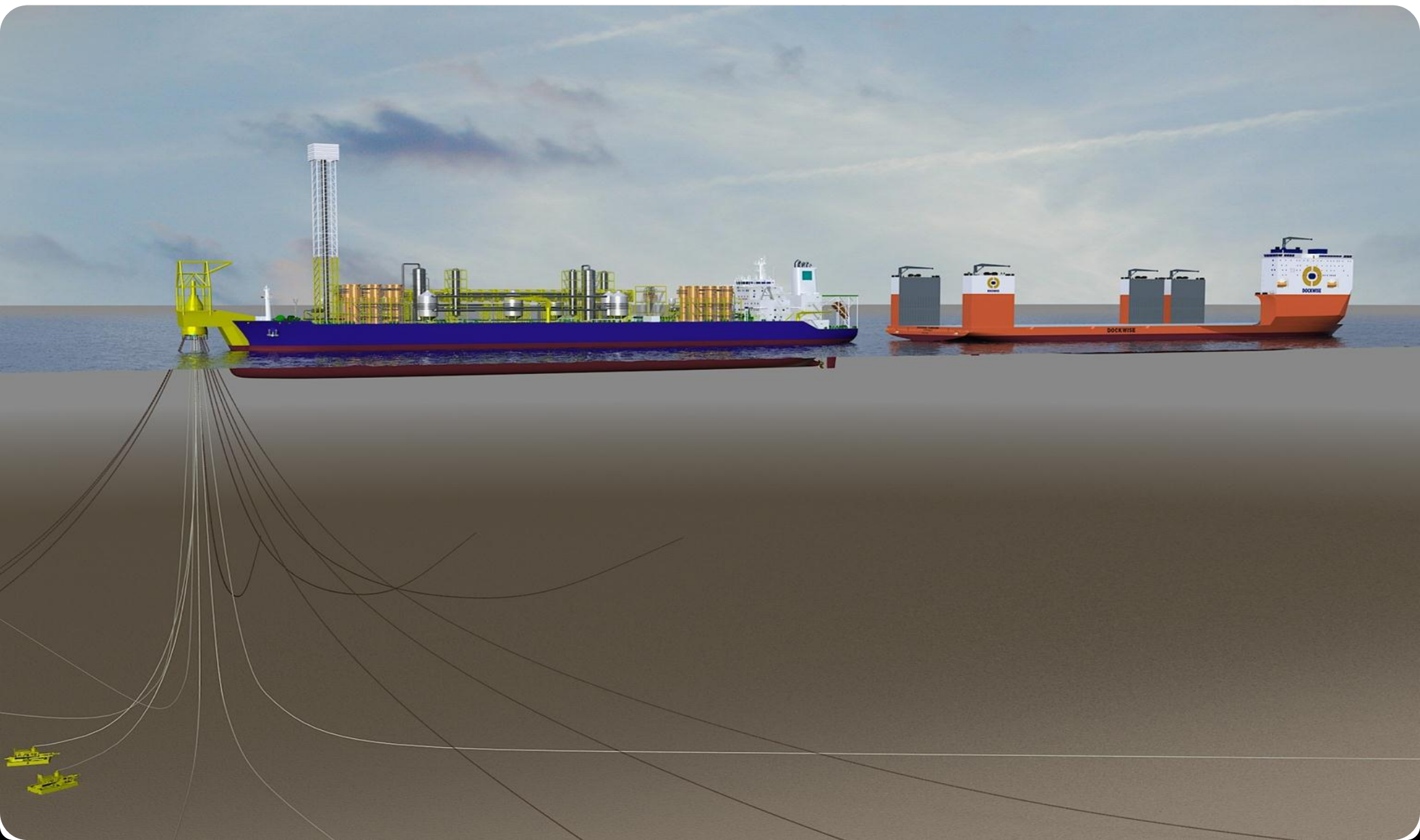


**Dry-docking
Quayside**

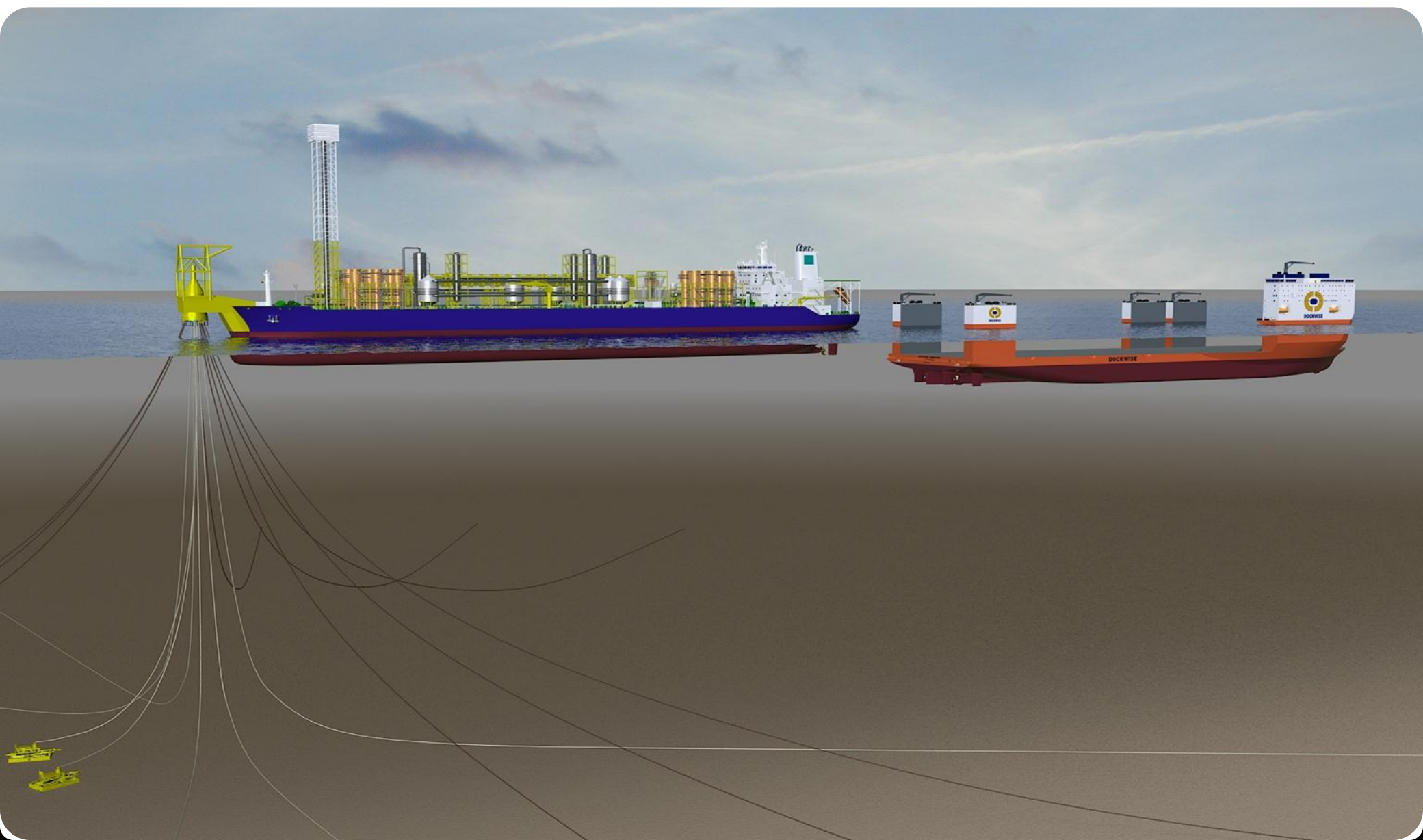


**Dry-docking
Offshore**

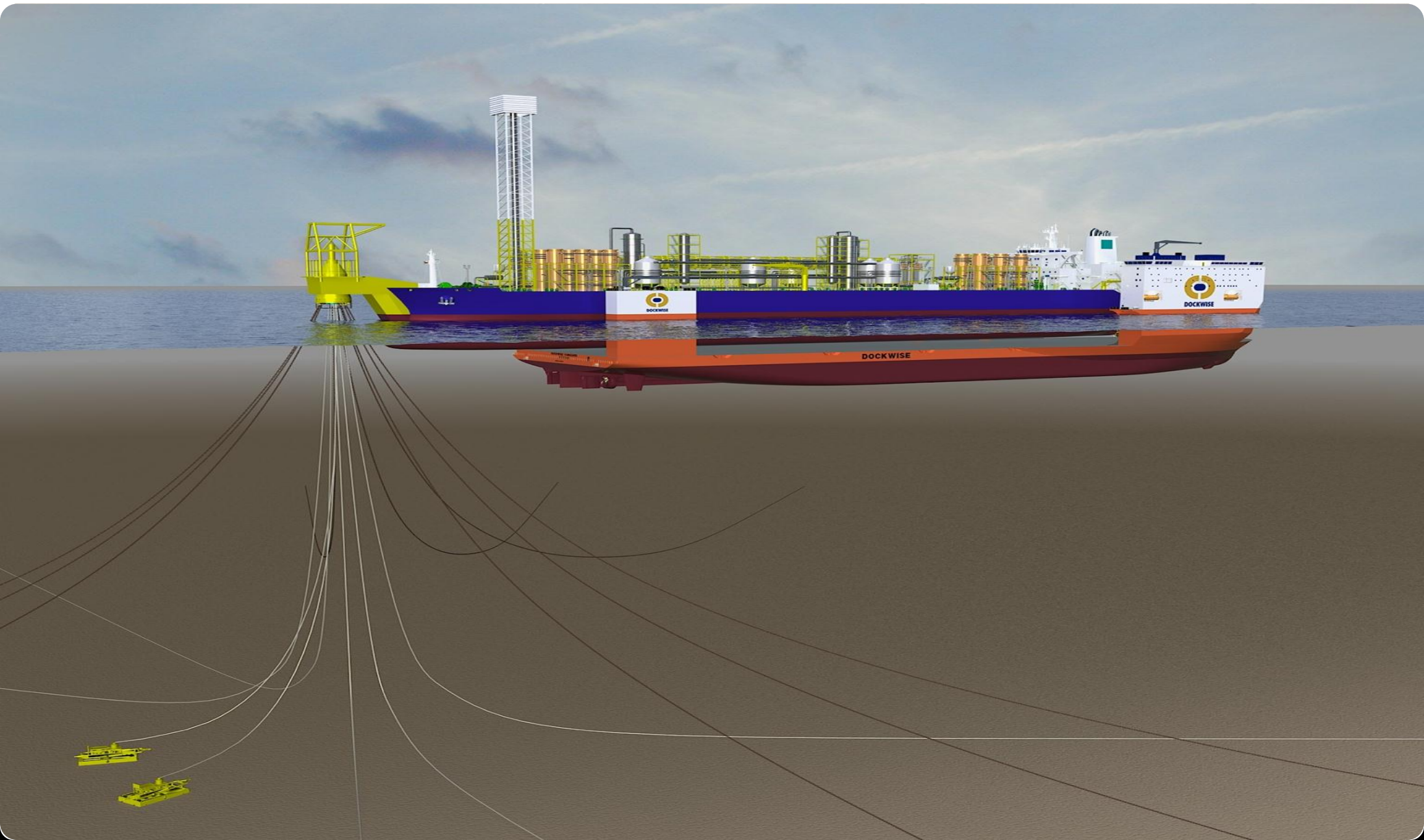
Alignment of both objects
Offshore Dry-docking & still connected to the seabed



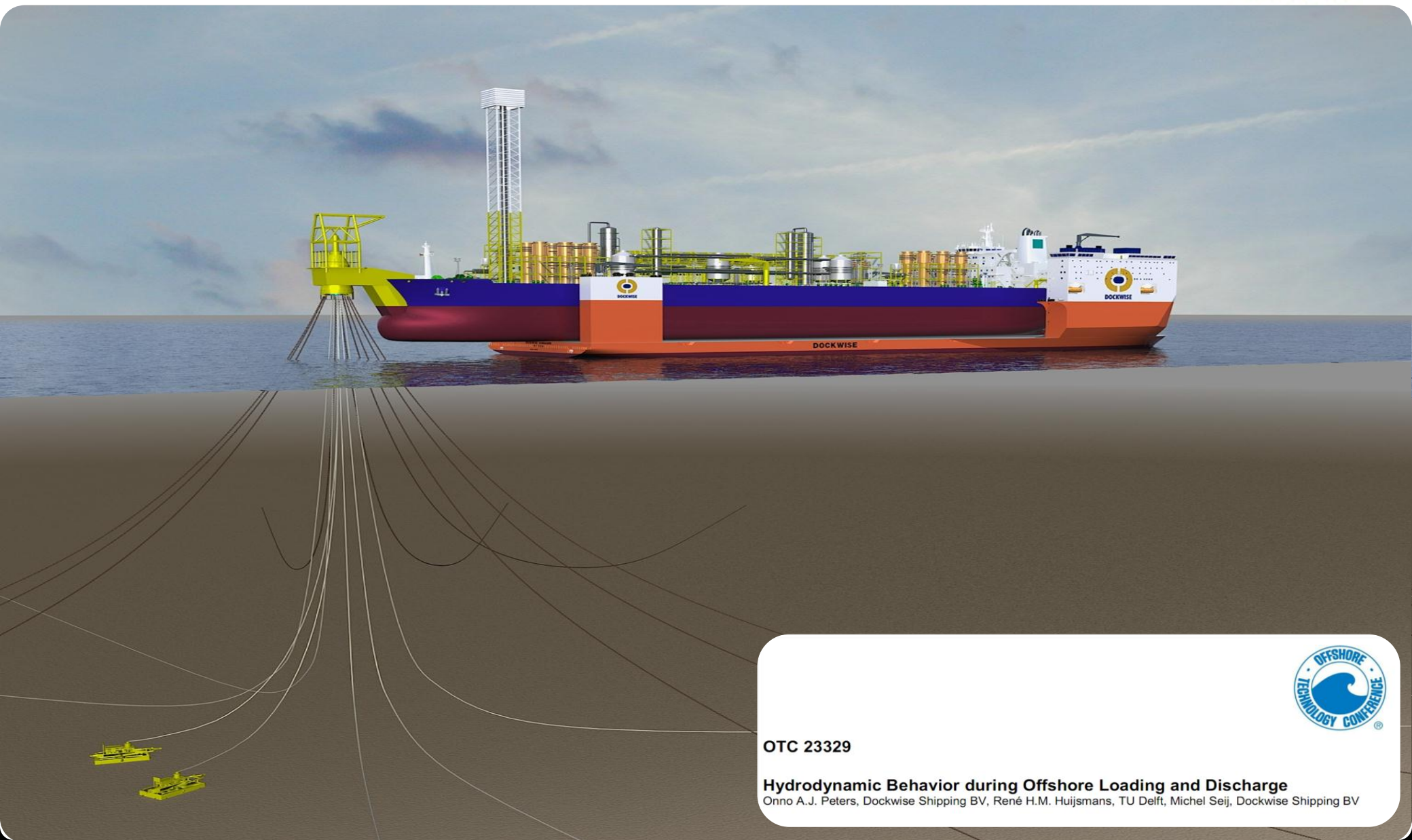
Submerge Dockwise Vanguard Offshore Dry-docking & still connected to the seabed



Position Dockwise Vanguard under FPSO Offshore Dry-docking & still connected to the seabed



Final position of Vanguard & FPSO Offshore Dry-docking & still connected to the seabed



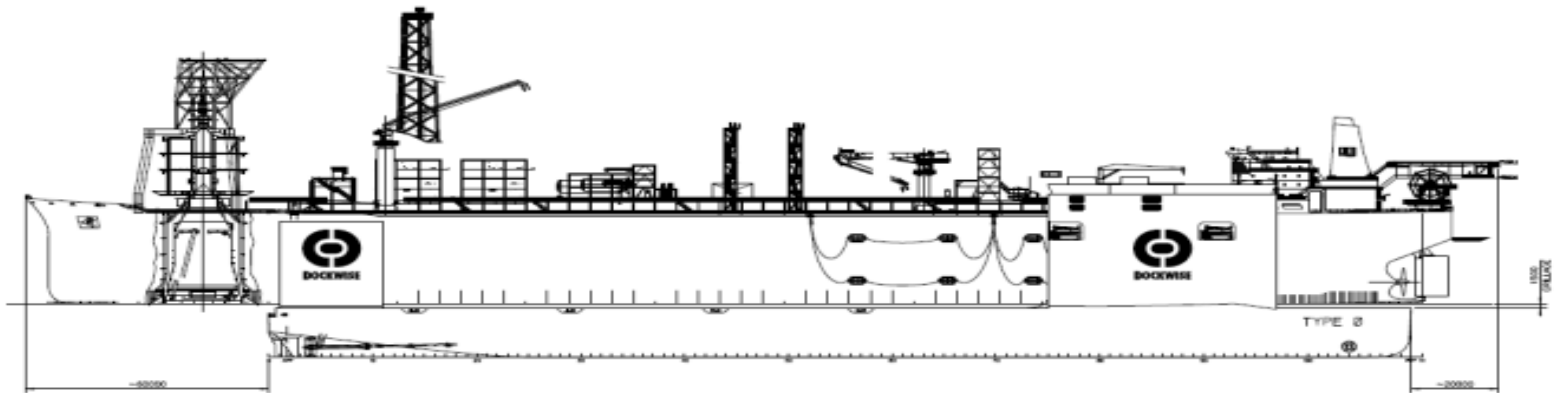
OTC 23329

Hydrodynamic Behavior during Offshore Loading and Discharge

Onno A.J. Peters, Dockwise Shipping BV, René H.M. Huijsmans, TU Delft, Michel Seij, Dockwise Shipping BV

BENEFITS OF DW VANGUARD OVER CONVENTIONAL DRY-DOCKING

- No need to disconnect turret mooring systems*
- No need to disconnect riser systems*
- No need for complete shut down of production*

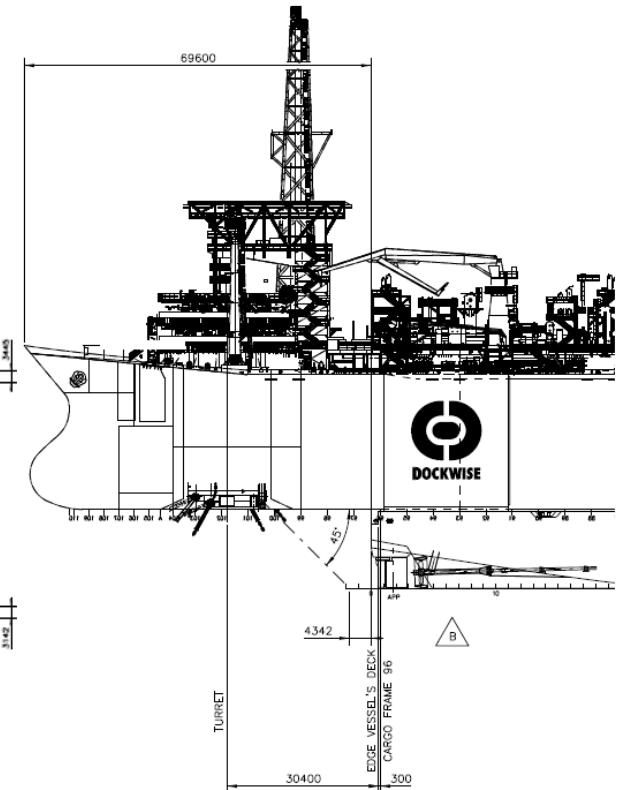
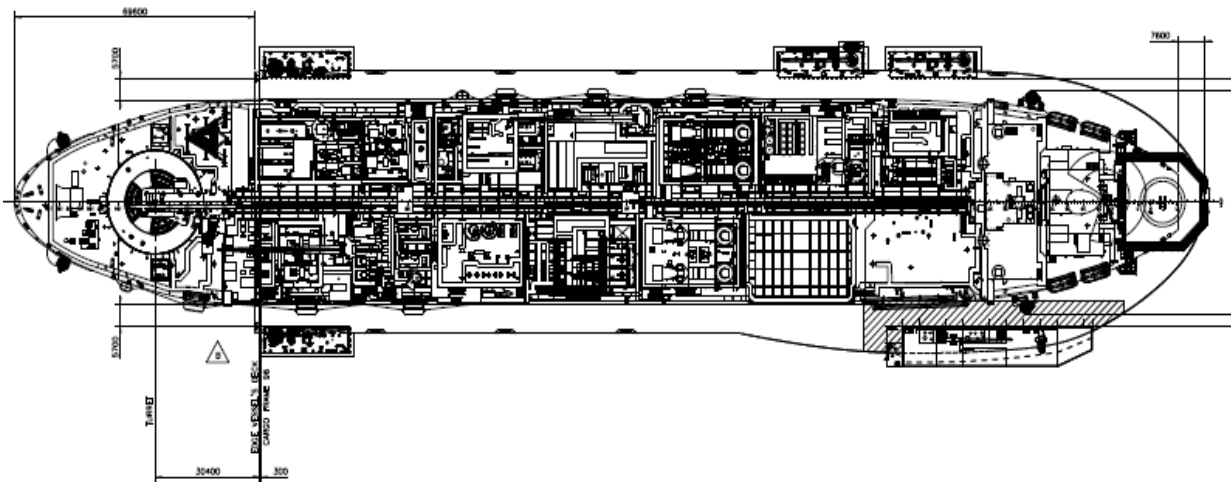


Offshore Dry-Docking Maintenance / Repair & Inspections



Case Study

- Turret moored FPSO, risers & mooring connected;
- Mooring & riser static loads 4,500 tonnes;
- Lightweight of overhang 11,000 tonnes;
- CL Turret @ 30m from vessel transom.

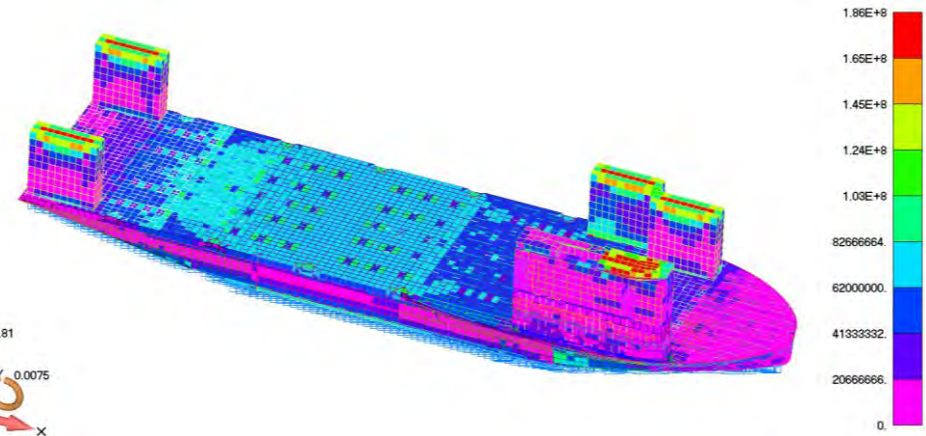
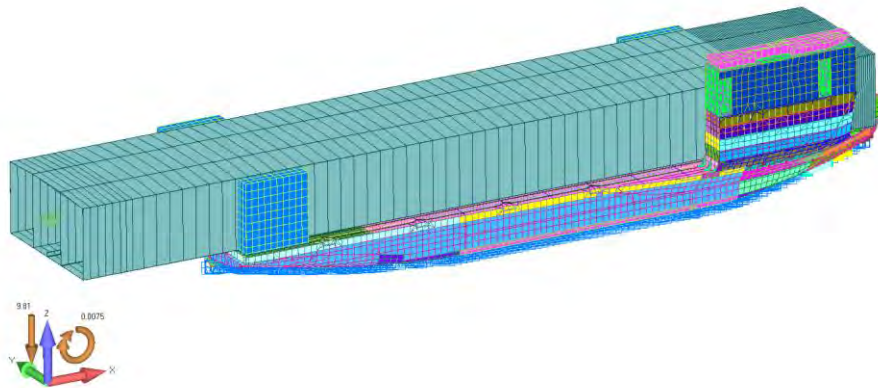
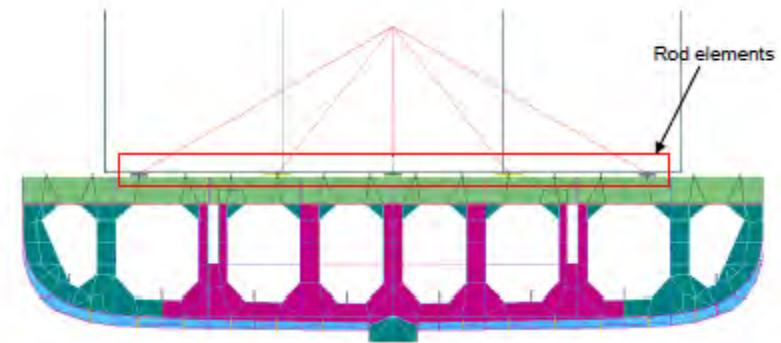


Offshore Dry-Docking Maintenance / Repair & Inspections



Case Study

- Maximum unity check $u=0.85$ in FPSO;
- Local strength web-frames governing;
- Maximum unity check $u=0.92$ in Vanguard;
- Cribbing pressures in range 32-34 kgf/cm²;

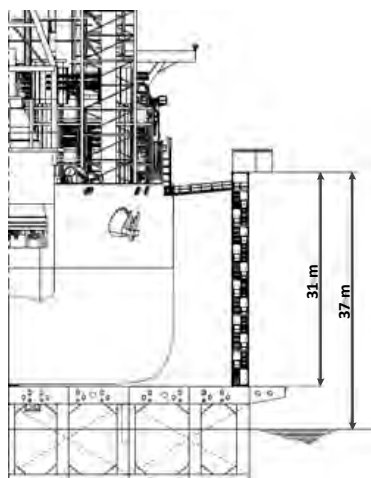
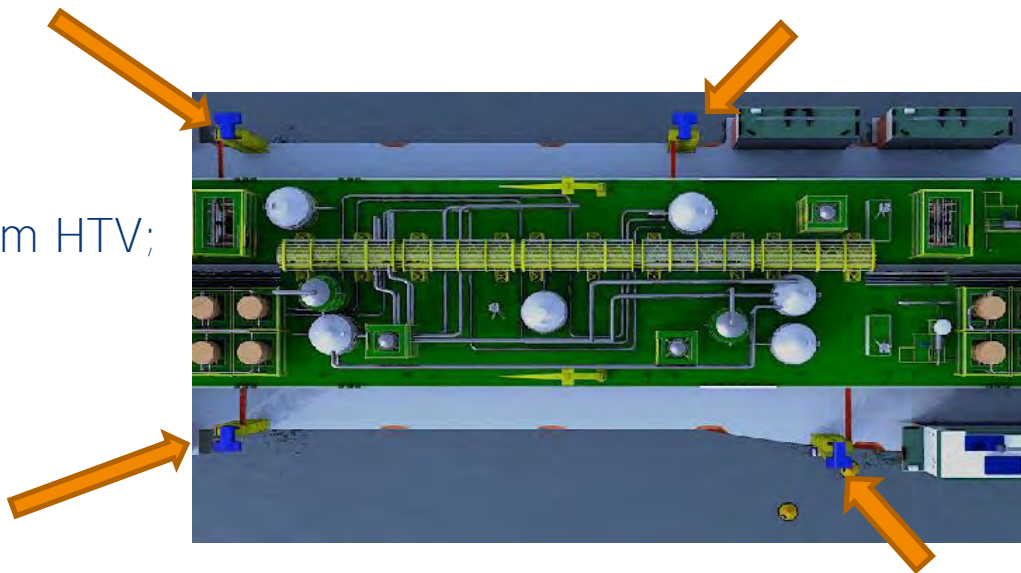


Offshore Dry-Docking Maintenance / Repair & Inspections

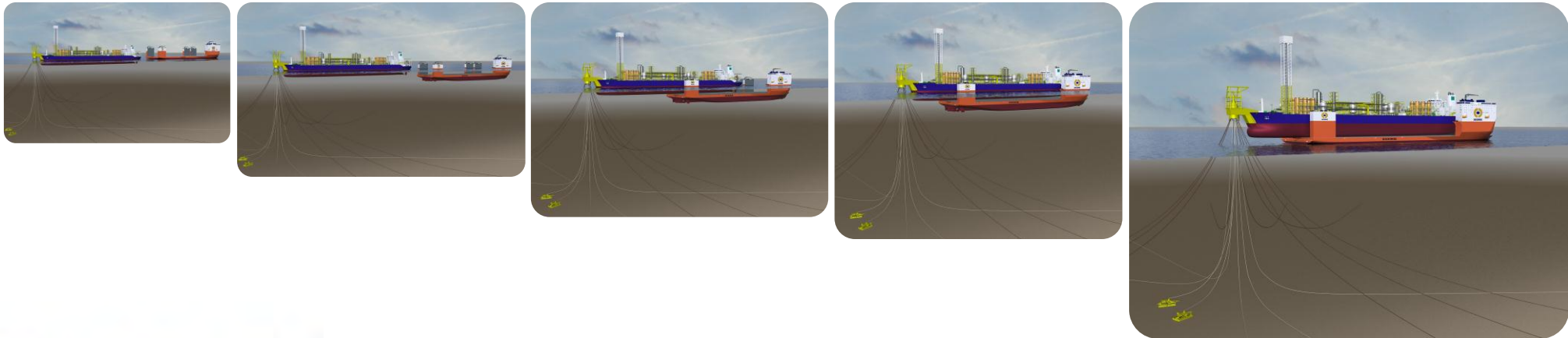


Safe Evacuation and Access Systems

- Evacuation Towers;
- Evacuation independent from HTV;



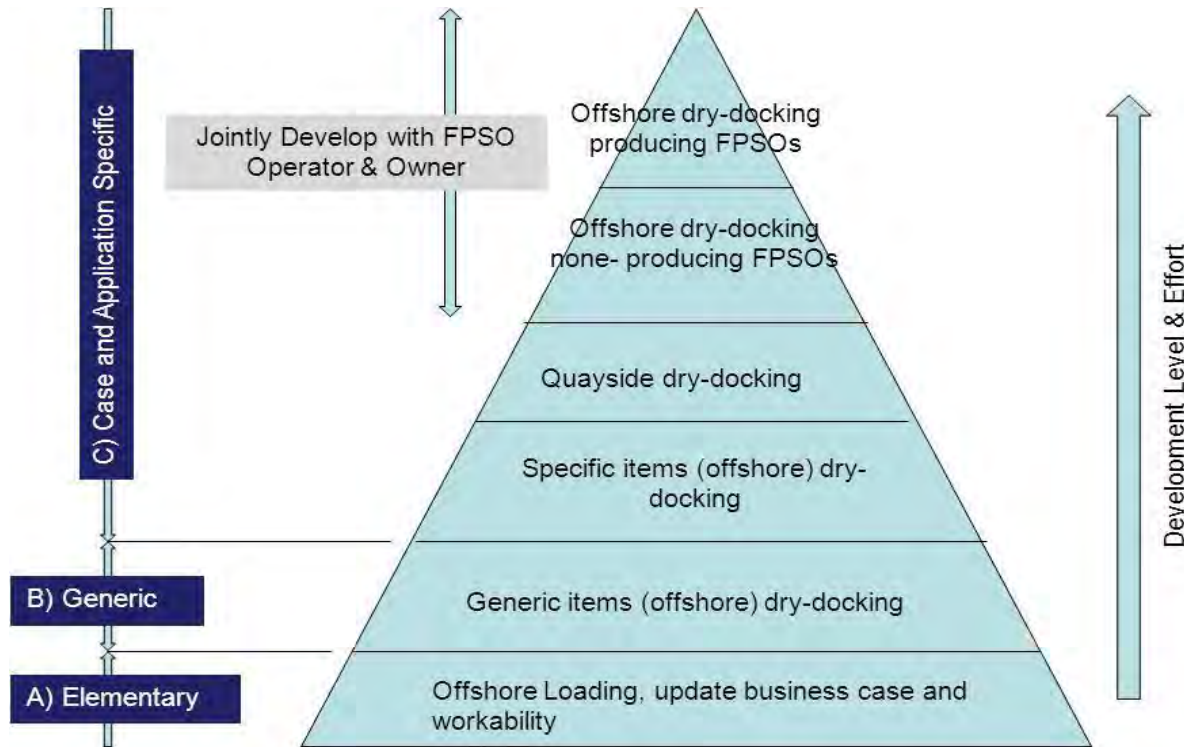
- **Unique Quayside Dry-Docking**
- **Unique offshore dry-docking capabilities of internal/external turret moored FPSOs defined and spread moored under development**



Future Research



Joint Industry Program



Dockwise Vanguard - Joint Industry Program

- Workability analysis determining the uptime and suitable loading window
- Assessment of mooring line & riser integrity
- Update of mooring analysis of combined FPSO and Dockwise Vanguard
- Structural Analysis of two combined bodies
- Traditional cribbing wood will now more be a FPSO dock-block arrangement or a combination between the two.
- **Model Testing**
- ***Start November 2013***
- ***Duration 6-8 Months***



OTC 24330

Offshore Dry-docking of FPSOs; A response to industry needs
T. Terpstra and E.A. Hellinga, Dockwise Shipping BV

Solutions for Tomorrow's Energy Needs



Innovative solutions changing the game for exceptional ocean transport and dry-docking of floating production structures.

Q&A



REALIZING
THE INCONCEIVABLE
TOGETHER



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