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
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

Focus | Expand | Strengthen

BOSKALIS 2014 - 2016

FOCUS
- Value-adding assets
- Focus on market segments
- Focus on region

EXPAND
- Offshore Energy
- T, L & T
- Selective Fleet expansion

STRENGTHEN
- Dredging & Inland Infra
- Towage & Salvage
- Organization

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
Boskalis

Dockwise

Market Developments

Dockwise Vanguard
  - Movie + backlog
  - Technical details
  - Ocean Transport
  - Quayside Dry-docking
  - Offshore Dry-docking

Q&A
Dockwise under the Boskalis Offshore Umbrella

<table>
<thead>
<tr>
<th>Offshore Energy</th>
<th>Dredging &amp; Inland Infra</th>
<th>Towage &amp; Salvage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine Contracting</td>
<td>- Offshore T&amp;I contracting for fixed &amp; floating infrastructures, with focus on FPSO/FLNG mooring installations (tow out &amp; hook up), WTG foundations and decommissioning.</td>
<td></td>
</tr>
<tr>
<td>Marine Services</td>
<td>- Offshore T&amp;I services for EPCI- and T&amp;I contractors (AHT’s, sheerlegs &amp; barges).</td>
<td></td>
</tr>
<tr>
<td>Subsea Contracting</td>
<td>- Seabed preparation &amp; rock dumping for fixed offshore production structures, pipelines, WTG foundations &amp; landfalls.</td>
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<tr>
<td></td>
<td>- Offshore cable laying (VSMC) for, wind farms, fixed O&amp;G production structures and inter-connectors.</td>
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</tr>
<tr>
<td>Subsea Services</td>
<td>- Subsea IRM of offshore production structures and offshore drilling rigs up to 300m water depth.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Light subsea construction for fixed &amp; floating offshore production structures.</td>
<td></td>
</tr>
<tr>
<td>HMT ST</td>
<td>- Marine transport of extremely large and heavy structures.</td>
<td></td>
</tr>
<tr>
<td>HMT LT/T&amp;I</td>
<td>- Marine transport of floating production structures (TLP’s, Semi’s, Spar’s, FPSO’s).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Offshore T&amp;I contracting for fixed &amp; floating infrastructures with focus on float-over topside installation, jacket launching and offshore dry docking.</td>
<td></td>
</tr>
<tr>
<td>Logistical Management</td>
<td>- Turn-key logistical operations for transportation of modules for onshore industrial projects.</td>
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</tbody>
</table>
Dockwise Strategic Focus

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

**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

**Market Drivers**
OFFSHORE TRANSPORT & INSTALLATION
Total marine scope for jacket launch and topside float-over installations
To change slide layout:
1. Select slide and right click,
2. Choose Layout,
3. Select a layout from options available.
GAZFLOT MOSS CS-50
Two 19,000 mT semi drilling rig float-over installations (2010)

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

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

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

1. Load-Out Fabrication Yard
2. Heavy Marine Transport
3. Load-In Land Transport
4. Site Installation
To change slide layout: 1. Select slide and right click, 2. Choose Layout, 3. Select a layout from options available.

3. HAY POINT EXPANSION 3 Coal plant modules (2012)
4. 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)
Boskalis
Dockwise
Market Developments
Dockwise Vanguard
- Movie + backlog
- Technical details
- Ocean Transport
- Quayside Dry-docking
- Offshore Dry-docking
Q&A
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

<table>
<thead>
<tr>
<th>Fixed</th>
<th>Compliant</th>
<th>Tensioned</th>
<th>Spar</th>
<th>Semi-Submersible</th>
<th>FPSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tower</td>
<td>Leg</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Overview of platforms at different offshore depth
To change slide layout: 1. Select slide and right click, 2. Choose Layout, 3. Select a layout from options available.

Sources: Infield March 2011 Floating Production Structures Estimates
Boskalis

Dockwise

Market Developments

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  o Offshore Dry-docking

Q&A
The Dockwise Vanguard

Flagship vessel | World’s largest semisubmersible heavy transport vessel
## Technical details of the Dockwise Vanguard

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall length</td>
<td>275.00 meters</td>
</tr>
<tr>
<td>Deck breadth</td>
<td>70.00 meters</td>
</tr>
<tr>
<td>Breadth maximum</td>
<td>78.75 meters</td>
</tr>
<tr>
<td>Hull Depth</td>
<td>15.50 meters</td>
</tr>
<tr>
<td>Water above the deck</td>
<td>16.00 meters</td>
</tr>
</tbody>
</table>

### Maximum carrying capacity around:

- **110,000 metric tons**
- Repositionable to maximize deck space

### Propsion 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 – KEPEL 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
To change slide layout: 1. Select slide and right click, 2. Choose Layout, 3. Select a layout from options available.

Dockwise Vanguard - FPU Services

Transport

Dry-docking Quayside

Dry-docking Offshore
To change slide layout: 1. Select slide and right click, 2. Choose Layout, 3. Select a layout from options available.

Dockwise Vanguard - FPU Services

- 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 build onshore & outside dock
    - Longitudinal and transverse load-out capabilities

- **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
Transport Advantages (2/2)

• 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.

<table>
<thead>
<tr>
<th></th>
<th>Vessel</th>
<th>2 x 200TBP</th>
<th>3 x 200TBP</th>
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<tbody>
<tr>
<td>Speed [kn]</td>
<td>Vanguard</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Transit Time [days]</td>
<td>26</td>
<td>56</td>
<td>56</td>
</tr>
<tr>
<td>Daily HFO [t]</td>
<td>95</td>
<td>87</td>
<td>131</td>
</tr>
<tr>
<td>Total HFO [t]</td>
<td>2439</td>
<td>4842</td>
<td>7262</td>
</tr>
<tr>
<td>Nox* [t]</td>
<td>152</td>
<td>299</td>
<td>449</td>
</tr>
<tr>
<td>CO** [t]</td>
<td>68</td>
<td>136</td>
<td>204</td>
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* NOx Emission based on emission of 11 g/kWh
** CO emission based on emission of 5 g/kWh
Transport Services

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 "

"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

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<tr>
<td></td>
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<tr>
<td></td>
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<tr>
<td>Korea – Brazil</td>
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<tr>
<td>Korea – WAF</td>
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<tr>
<td>Korea – Murmansk</td>
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- 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
<table>
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Dockwise Vanguard - FPU Services

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Dockwise Vanguard - FPU Services

Transport

Dry-docking Quayside

Dry-docking Offshore
Offshore loading of the FPSO

To change slide layout: 1. Select slide and right-click, 2. Choose Layout, 3. Select a layout from options available.
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
Quayside Dry-Docking

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
To change slide layout: 1. Select slide and right click, 2. Choose Layout, 3. Select a layout from options available.
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
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*

*Project Specific
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.
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/cm$^2$;
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

<= Approval in Principle received by ABS based on a HAZID performed witnessed by 2 major Oil & Gas companies.
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**
Innovative solutions changing the game for exceptional ocean transport and dry-docking of floating production structures.

Q&A
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