BW Offshore

Field development case: Cascade Chinook
by Operations Manager Kirk Barlass

May 2013
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Section 1  BW Offshore
Section 2  FPSO
Section 3  BW Offshore Fleet
Section 4  Gulf of Mexico
           Yùum K’ak’Náab
           Cascade & Chinook
           BW Pioneer
Section 5  Conclusions
BW Offshore’s Background

Founded by Sig. Bergeesen


First gas FPSO in 1982 for Chevron Corp, off the coast of Angola
LPG market entry
Bergesen listing
Dry bulk market entry

LNG market entry

Restructuring and re-branding

Worlds biggest FPSO and first insourced process operations
First FPSO in US GOM and deepest production unit WW

2005

2005 2006 2007 2008 2009 2010

Acquisition of APL
Sale of APL
Acquisition of Prosafe

BW Offshore listing

Integrated Management Team formed for shipping business

Founded by Y.K. Pao

First VLCC: World Chief

Largest independent shipping group in the world: 200 vessels of 20 million dwt

Bergesen acquisition and de-listing

Acquisition of N&T Argonaut

Acquisition of APL

Prosafe Production
BW Group Corporate Structure

- BW Group Limited
  - BW Gas Limited (99%)
    - BW Gas AS (100%)
    - BW Fleet Management AS
  - BW Tankers Limited (100%)
  - BW Shipping Limited (100%)
  - BW Offshore Limited (48%)
  - BW Maritime Pte Ltd (100%)

Legend:
- Provide ship management services
- Privately owned
- Publicly listed associate
Floating production units - installed

- FPSO 160 64%
- Semi 43 17%
- Spar 18 7%
- TLP 22 9%
- Other 8 3%

Source: IMA

FPSO - The preferred solution for offshore

- Flexible, safe and well proven solution
- Deck space and deck load capacity
- Storage capacity with simple off loading
- Versatile
- Relocatable thus leasable
- Option to make disconnectable
FPSO – The preferred solution for offshore
BW Offshore - Fleet and offices
Recognized ‘Technical’ FPSO contractor

Technical milestones and innovations

- The first FPSOs in both Mexican & US Gulf of Mexico (YKN & BW Pioneer)
- The deepest moored FPSO at 2,500 meters (BW Pioneer)
- The world’s largest FPSO throughput with 600,000 bbl per day (YKN)
- The first FPSO with drilling equipment (FDPSO) (Azurite)
- Two very large gas throughput FPSOs / FPUs (TSB & CSM 340-350mm/scfd)
- Unique high off loading rate, DP assisted, North Sea, mini-FPSO (Athena)
Recognized ‘Technical’ FPSO contractor

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BW Offshore’s management has established policies for occupational health, safety, security, and environmental management. HSSEQ have the highest priority in everything we do. Measurable targets are defined and monitored for all onshore and offshore facilities to ensure compliance with the adopted policies and a continuous improvement cycle. Personnel training and familiarisation with the policies are recognised as key activities in order to achieve a HSSEQ culture of the highest standard.
Fleet HSE Statistics

12 months rolling average

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<td>0.63</td>
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Descriptions

<table>
<thead>
<tr>
<th>Lost Time Injury Frequency (LTIF) per million manhours</th>
<th>Frequency</th>
<th>No. of incidents for this year</th>
<th>Incidents for the month</th>
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<tr>
<td>0.36</td>
<td>0</td>
<td>No LTI in 2013</td>
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<table>
<thead>
<tr>
<th>Total Recordable Injury Frequency (TRIF) per million manhours</th>
<th>Frequency</th>
<th>No. of incidents for this year</th>
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<tr>
<td>2.50</td>
<td>6</td>
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</table>

<table>
<thead>
<tr>
<th>Total High Risk Incident Frequency (HRIF) per million manhours</th>
<th>Frequency</th>
<th>No. of incidents for this month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.55</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>
Operational highlights - 2012

- HSSEQ performance
  - Lost time injuries (LTI) of 0.8
- Fleet uptime
  - 98.8% in 2012
  - 373 crude oil cargos delivered
- Regularity on all units improved
- Strengthened technical and commercial support functions
- Start-up of three units
  - FPSO BW Pioneer
  - FPSO BW Joko Tole
  - FPSO BW Athena
- Assumed responsibility for Statoil’s FPSO Peregrino in Brazil
BW Offshore - Gulf of Mexico

YKN

Pioneer

Hurricane Rita
Yuum K’ak’Náab
Largest throughput FPSO in the world

200,000 BOPD Production
600,000 BOPD Throughput
2,200,000 bbls storage

Since June 2007
702+ MMbbls off-loaded in 5 Yr
1,212+ off-loadings (20 per mnth)
YUUM K’AK’ NÁAB (YKN)

- Client: PEMEX
- Field: Ku-Maloob-Zaap (KMZ) field, Mexico
- Contract: 15 years lease and operation.
- First oil June 2007.
- Water depth: 100 m
- Designed to operate in hurricane conditions
- Cargo storage capacity: 2,200,000 BBLs
- Crude handling capacity: 600,000 BPD
- Oil processing: 200,000 BPD of API 13
- Gas compression: 120 MMSCFD
- Mooring system:
  - Internal turret (STP)
  - 8 flexible risers, 15”
  - 12 mooring lines with piled anchors in 3 clusters
- Installed power: 2x30 MW
CASCADE & CHINOOK – BW PIONEER
Site map Cascade & Chinook Fields

- New Orleans (Operations and support office)
- Port Fourchon (Logistics base)
- Houston (Admin.)
- FPSO
BW Pioneer – 2,500m depth. 
DEEPEST FPSO IN THE WORLD
BW Pioneer - History

- Arrived US GoM 28\textsuperscript{th} of March 2010.
- Connected to the buoy 13\textsuperscript{th} of October 2010.
- Riser pull-in, umbilical installation and subsea commissioning.
- 1\textsuperscript{st} Oil 23\textsuperscript{rd} of March 2011.
Subsea failure 24\textsuperscript{th} of March 2011.

Standby for 11 months.

Restart of Oil production 26\textsuperscript{th} of February 2012.

1\textsuperscript{st} gas export 22\textsuperscript{nd} of March 2012.
BW Pioneer

- Client/Operator: Petrobras America Inc.
- Area: Walker Ridge 249
- Field: Cascade & Chinook
- Contract term: 5 year fixed + 3 x 1 year optional
- Water Depth: 2,500 meter
- Hull: Aframax, full double hull
- Storage: ~ 600 kbbl
BW Pioneer Topsides

- Separation: 80,000 bpd (2 x 50,000 bpd inlet separators)
- Produced water: 16,000 bwd
- Gas export: 16 MMSCFD (2 x 100%)
- Gas turbines: 3 x 12 MW dual fuel (3 x 50%)
- Utilities: Normal, but with significant heating requirements
- Fiscal metering
- Emergency flaring only
Disconnection time:
- Planned: 24 hours
- Emergency: 6 hours

Connection time:
- Planned: 12 hours

STP BUOY allows for disconnect and sail away, providing protection of personnel, topsides facilities and subsea infrastructure.
BW Pioneer heavy weather criteria

Motion Limitations Hs
• Operating: 5.2m
• FPSO Weather: Disconnect: 4.5m, Reconnect 2.5m
• ST Offloading: Disconnect: 4.5m, Reconnect: 2.5m
• Vessel speed: 10kts
BW Pioneer Turret/mooring system

- **Turret:** Internal STP, disconnectable during “named storms”
- **Mooring:** 3+4+4 polyester mooring configuration with suction anchors
- **Depth:** 2,500m
- **Swivel/risers:**
  - 4 x production flowlines
  - 1 x gas export
  - 2 x power umbilicals
  - 2 x utility/control umbilicals
- **Others:**
  - Coiled tubing facility (PAI provided)
  - Chemical injection
  - Pigging facilities
  - Subsea controls (PAI provided)
BW Pioneer Buoy - STP
BW Pioneer Swivel
BW Pioneer Swivel 101
BW Pioneer Swivel 101
BW Pioneer Swivel 101

- 1 x 8” Chinook MAOP 740 psi
- 1 x 8” Cascade MAOP 740 psi
- 1 x 6” Test MAOP 740 psi
- 1 x 4” Gas export MAOP 3,705 psi
- 1 x 4” Service MAOP 4,000 psi

- High Voltage
  - 11 kV, 60 HZ, 250 A
  - 4 x 3 phases, + 2 = 14 rings

- Low Voltage
  - 440V, 60 HZ, 500 A
    - 2 x 3 + 1 = 7 rings

- Fiber
  - No. of paths (Fibers):
    - 21 single
  - 48 rings rated Ethernet, CAT-5
  - 51 rings for ESD valves cables
  - 48 rings feedback
  - 24 rings for transmitters
  - 24 rings as spare
  - 12 rings for loudspeakers
  - 1 ring for IE earth
  - 3 ring for PE Bonding
## BW Pioneer Swivel 101 - Utility Swivel

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Port size (in/out)</th>
<th>Working Pressure</th>
<th>Design Pressure</th>
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<tbody>
<tr>
<td>Methanol, Cascade</td>
<td>2 x1&quot;, MP</td>
<td>12 200 PSI</td>
<td>15 000 PSI</td>
</tr>
<tr>
<td>Methanol, Chinook</td>
<td>2 x1&quot;, MP</td>
<td>12 200 PSI</td>
<td>15 000 PSI</td>
</tr>
<tr>
<td>LDHI</td>
<td>3/4&quot;, MP</td>
<td>11 500 PSI</td>
<td>15 000 PSI</td>
</tr>
<tr>
<td>Scale Inhibitor</td>
<td>3/4&quot;, MP</td>
<td>9 000 PSI</td>
<td>15 000 PSI</td>
</tr>
<tr>
<td>Corrosion Inhibitor</td>
<td>3/4&quot;, MP</td>
<td>9 000 PSI</td>
<td>15 000 PSI</td>
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<tr>
<td>Asphaltene Inhibitor</td>
<td>3/4&quot;, MP</td>
<td>11 500 PSI</td>
<td>15 000 PSI</td>
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<tr>
<td>Asphaltene/Paraffine Inhibitor Cocktail</td>
<td>3/4&quot;, MP</td>
<td>11 500 PSI</td>
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<tr>
<td>Annulus monitoring line</td>
<td>3/4&quot;, MP</td>
<td>0 PSI</td>
<td>15 000 PSI</td>
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<tr>
<td>Spare</td>
<td>3x1&quot;, MP</td>
<td>12 500 PSI</td>
<td>15 000 PSI</td>
</tr>
<tr>
<td>Leak test line (sea water)</td>
<td>1&quot;, MP</td>
<td>12 500 PSI</td>
<td>15 000 PSI</td>
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<tr>
<td>Methanol STP lines</td>
<td>1&quot;, MP</td>
<td>10 000 PSI</td>
<td>15 000 PSI</td>
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<tr>
<td>Fire water</td>
<td>6x1&quot;, BSP</td>
<td>150 PSI</td>
<td>300 PSI</td>
</tr>
<tr>
<td>Nitrogen (N2)</td>
<td>1&quot;, BSP</td>
<td>150 PSI</td>
<td>300 PSI</td>
</tr>
<tr>
<td>Instrument air</td>
<td>1&quot;, BSP</td>
<td>150 PSI</td>
<td>300 PSI</td>
</tr>
<tr>
<td>Carcass bleed</td>
<td>1&quot;, BSP</td>
<td>0 PSI</td>
<td>300 PSI</td>
</tr>
<tr>
<td>Vent to flare</td>
<td>2x1&quot;, BSP</td>
<td>0 PSI</td>
<td>300 PSI</td>
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<tr>
<td>Spare</td>
<td>1&quot;, BSP</td>
<td>150 PSI</td>
<td>300 PSI</td>
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Experience after 2 years operation in GoM (BW Pioneer)

- HSE record
  - Fatalities - 0
  - Lost Time Injuries (from Singapore Feb 2010) - 0
  - Recordable Incidents - 0
  - Overboard Oil Spills - 0

- Production availability
  - Gas Compression 2012 – 95.0%  2013 – 98.9%
  - Oil Processing 2012 – 98.1%  2013 – 98.9%
Experience after 2 years operation in GoM (BW Pioneer)

- 3 Wells producing
- 2 More wells for 2013
- 14 Off loadings
- Regulatory Compliance
  - BSEE (Bureau of Safety and Environmental Enforcement)
    - Incidents of Noncompliance – 0
  - USCG (US Coast Guard)
    - Notices of Violations – 0
Conclusion

- BW Offshore has operated the YKN in Mexico for 6 years and the BW Pioneer in the US for 2 years respectively with a high level of HSE and production performance.

<table>
<thead>
<tr>
<th></th>
<th>BW Pioneer</th>
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<th>YKN</th>
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<tr>
<td></td>
<td>2012</td>
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<tr>
<td>Gas Compression</td>
<td>95.0%</td>
<td>98.9%</td>
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<tr>
<td>Oil Processing</td>
<td>98.1%</td>
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<td>Offloadings</td>
<td>8</td>
<td>7</td>
<td>221</td>
<td>50</td>
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</table>

- BW Offshore has met the challenges of stringent local regulations and has set a high standard for FPSO operations in the GoM as well as around the world.

- BW Offshore’s experience shows that the FPSO is a feasible and preferred solution for the deep water development in GoM.
BW Offshore, the specialist of offshore floating production
BW OFFSHORE, THE SPECIALIST OF OFFSHORE FLOATING PRODUCTION

BW OFFSHORE consistently provides record breaking technology and class leading uptime. While building on more than 30 years of experience, BW Offshore has a long track record of project execution and will operate a fleet of 16 FPSOs and 1 FSO in 2013.

For more information, please contact: bwoffshore@bwoffshore.com or visit our website: www.bwoffshore.com