Conceptualising a new Infrastructure Hub West of Shetland (WoS)
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Presentation overview

• Introduction
• Background to Hurricane’s CPR concept selection
• Optimising the Lancaster story
• An option for a Hub West of Shetland
Acknowledgements

• Thanks to all the Service Companies that have supported, offered guidance and had input into our concept selection process over the last 36 months

• In particular a special thanks to:
  - Costain Upstream – Peter Kirkbride and his team
  - SPD Ltd – Mohammad Pajouhesh and his team
  - AGR – Patrick Tawse and his team
  - RPS Energy – Ian Linnett and his team

• In addition, thanks to the Regulator and OGA for their encouragement and direction
Introduction – who are we?

• Neil Platt – COO
  - Undertaken a number of operational and commercial roles in Amoco, BG and Petrofac
  - Joined Hurricane in 2011
  - Responsible for daily operations and asset delivery

• Hurricane
  - An E&P company listed on AIM
  - Specialising in the discovery and development of hydrocarbons from naturally fractured basement reservoirs
  - Currently focussed on West of Shetland (WoS)

• Topic of presentation
  - In the challenging environment we live in today, an approach on how field collaboration can deliver a hub concept rather than a field specific solution WoS
Hurricane overview

• Awarded our first licence (P1368) in 2005
• During an 8 year drilling program, concentrating on basement plays WoS we have;
  - Discovered over 400 million barrels of 2C resource
  - Identified over 400 million barrels of P50 prospective resource
  - Demonstrated a commercial flow rate on Lancaster c. 10,000 bopd (constrained)
  - Conceptualised a phased development for a Lancaster hub
Significant resource discovered and large upside potential to confirm

Hurricane’s assets:
Contingent and Prospective Resources
Source: CPR November 2013
MMboe

Figures based on arithmetic addition of individual assets, assumes Whirlwind oil case
Infrastructure and fields
West of Shetland
(existing and proposed)
Physical challenges we face...

- Location
- Environment
- Lack of Infrastructure
- We don’t know, what we don’t know
“Instead of thinking outside the box, get rid of the box”  Deepak Chopra
Moving forward...

• Given our resource base, we:
  - Worked with Costain Upstream to undertake a concept selection process over 18 months, during which we:
    • Assessed over 45 possible concepts
      ➢ Floating vs platform
      ➢ Owned vs leased vs 3rd party host
    • Shortlisted 10 for further evaluation
Technical considerations

- Platform vs FPSO
- Artificial Lift
- Gas Handling
- Phased vs Pre-invested
- Leased vs Purchased
- Hub vs 3rd Party Host
- Oil Export
- Flow Assurance
### Evaluation Criteria & “perfect score”

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Perfect Score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health &amp; Safety</td>
<td>20.0</td>
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<tr>
<td>Environmental</td>
<td>16.7</td>
</tr>
<tr>
<td>Technical viability &amp; functionality</td>
<td>14.4</td>
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<tr>
<td>Compatibility</td>
<td>11.1</td>
</tr>
<tr>
<td>Scale-ability</td>
<td>3.3</td>
</tr>
<tr>
<td>Construction, installation &amp; commissioning</td>
<td>5.6</td>
</tr>
<tr>
<td>Operability &amp; production efficiency</td>
<td>12.2</td>
</tr>
<tr>
<td>Decommissioning &amp; dismantling</td>
<td>1.1</td>
</tr>
<tr>
<td>Contractual influences</td>
<td>3.3</td>
</tr>
<tr>
<td>Schedule</td>
<td>12.2</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100.0</strong></td>
</tr>
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</table>
10 Full Field concepts further evaluated

Selected CPR Base Case (2 phases)
Phase 1 - objectives

- Provide long term production data to support Full Field Development planning
- Deliver an acceptable return on capital invested with appropriate allowance for development risks and production efficiency
- Minimise CAPEX spend and any associated lease costs, without compromising Full Field Development planning
- De-risk and optimise the Lancaster Full Field Development
- Duration c. 5 years
  - 2 years subsurface evaluation
  - 3 years delivery of Full Field solution
Lancaster Field Phase 1

Lancaster

LDC5
1.6 km
LDC1
3.2 km
LDC2
1.4 km

Pipeline Key
- Black: Production
- Orange: Gas Lift
- Purple: Umbilical
- Red: Gas Export

Riser Base Structure
Manifold
Inclined Well
Horizontal Well
Surveillance Well

Hurricane

Gas Export Pipeline
Gas Export SSIV

Hurricane 1 Ocean 31 May 2015
Phase 2 - objectives

- Maximise Full Field economics
- Ability to handle Lancaster upside volumes
- Flexibility to handle uncertainties of production from basement
- Potential to be used as a hub for future area developments
Technical considerations

- FPSO
- Phased
- Hub

- Artificial Lift
- Leased vs Purchased
- Gas Handling
- Oil Export
- Flow Assurance

Hurricane | Devex | 21 May 2015
Transition point between leased & purchased c. 8 years
(Calculated by Costain Upstream (EPC Offshore) during conceptual evaluation c. 2012)
Technical considerations

- FPSO
- Phased
- Hub
- Artificial Lift
- Oil Export
- Gas Handling
- Flow Assurance
- Phase 1 – Leased
- Phase 2 - Purchased
Technical considerations

- Artificial Lift
- Gas Handling
- Phase 1 – Leased
- Phase 2 - Purchased
- Shuttle Tanker
- Flow Assurance

File types:
- FPSO
- Phased
- Hub
Flow assurance

• Flow assurance studies were undertaken with respect to the management of reservoir fluids within:
  - The wellbore
  - Subsea facilities; and
  - FPSO topside design

• Specific studies looked at the impact and requirement for:
  - Insulated tubing, downhole chemical injection and artificial lift methods
  - Insulated and/or heated & insulated flowlines / pipelines and chemical injection
  - Topside chemical injection and process heating
Artificial lift

• Various artificial lift methods were studied to:
  - Support reservoir management on the Lancaster field, characterised today by:
    • Shallow, normally pressured oil reservoir
    • Reservoir near bubble point
    • Reservoir where there remains uncertainty over effective aquifer pressure support
  - Consider later life production where the potential for increasing water cut exists

• Artificial lift options for Lancaster considered; subsea pumps, gas lift, ESP lift and jet pumps
Technical considerations

- FPSO
- Phased
- Hub

- Gas Lift
- Shuttle Tanker

- Gas Compression for: Gas Lift, Export & Fuel Gas
- Phase 1 – Leased
- Phase 2 - Purchased

- Heated Flowlines & Chemical Injection

Hurricane | Devex | 21 May 2015
# FPSO capacities

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Phase 1</th>
<th>Phase 2</th>
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<tbody>
<tr>
<td>Name Plate Gross Fluids Capacity</td>
<td>bpd</td>
<td>75,000</td>
<td>181,000</td>
</tr>
<tr>
<td>Name Plate Oil Capacity</td>
<td>bopd</td>
<td>37,500</td>
<td>80,000</td>
</tr>
<tr>
<td>Name Plate Prod Water Capacity</td>
<td>bpd</td>
<td>50,000</td>
<td>150,000</td>
</tr>
<tr>
<td>Name Plate Gas Export Capacity</td>
<td>MMscfd</td>
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<td>23</td>
</tr>
<tr>
<td>Fuel Gas</td>
<td>MMscfd</td>
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<td>9</td>
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<td>Name Plate Gas-lift Capacity</td>
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<td>Name Plate Water Injection Capacity</td>
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<tr>
<td>Sour Gas Treatment</td>
<td>MMscfd</td>
<td>None</td>
<td>9 (Note 2)</td>
</tr>
<tr>
<td>Separation Train Arrangement</td>
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<td>1 x 100%</td>
</tr>
<tr>
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</table>

**Notes**

1) ‘Name Plate’ capacities
2) If imported gas is required in later field life for fuel gas and/or production well kick-off
3) Phase 2 capacities are not incremental to Phase 1
4) Fuel gas based on associated gas
# Cost estimating methodology

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Methodology</th>
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</thead>
<tbody>
<tr>
<td>Wells</td>
<td>Budget estimates / quotes (if available) / historical performance plus WMC databases</td>
</tr>
<tr>
<td>Procurement</td>
<td>Budget estimates / quotes (if available) plus Costain Norms database</td>
</tr>
<tr>
<td>Fabrication</td>
<td>In-house Costain Norms database</td>
</tr>
<tr>
<td>Logistics</td>
<td>Based on installation schedules and % of total procurement and fabrication</td>
</tr>
<tr>
<td>Storage</td>
<td>% of total procurement and fabrication</td>
</tr>
<tr>
<td>Project Management</td>
<td>% of total procurement, fabrication, logistics and installation</td>
</tr>
<tr>
<td>Engineering</td>
<td>% of total procurement, fabrication, logistics and installation</td>
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<tr>
<td>Installation</td>
<td>Based on installation schedules and vessel rates from Costain Norms database</td>
</tr>
<tr>
<td>Growth Allowances</td>
<td>Waiting on Weather, NPT (drilling only) and project contingency</td>
</tr>
</tbody>
</table>

**Notes**

1) Pre 1st February 2014 transfer of EPC Offshore trade and assets to Costain Upstream, EPC Norms database used
CPR phased development

Triangle colours represent Hurricane’s perception of challenge in today’s oil price and financial environment and do not reflect Hurricane’s view on project viability and delivery.
Optimising the Lancaster story

• Over the last c. 18 months, with a declining oil price and increasing financial market constraints, we challenged ourselves to deliver an alternative to the CPR Phase 1 at reduced CAPEX, but one that provided the same reservoir data set for Full Field planning.
Early Production System (EPS) - objectives

- Provide long term production data to support Full Field Development planning
- Deliver an acceptable return on capital invested with appropriate allowance for development risks and production efficiency
- Minimise CAPEX spend and any associated lease costs, without compromising Full Field Development planning
- De-risk and optimise the Lancaster Full Field Development
- Duration c. 5 years
- Potential to accelerate first oil
- Ability to use on our other assets WoS
To provide long term production data to confirm the productivity of the Lancaster Reservoir to enable full field development planning and sanction.

To deliver an acceptable return on capital invested with appropriate allowance for development risks and production efficiency.

To minimise CAPEX spend and any associated lease costs, without compromising Full Field development planning.

To de-risk the Lancaster Full Field Development (FFD).

Potential to accelerate first oil.

Ability to use on other assets to accelerate them.
205/21a-6 – a high quality dynamic dataset

Lancaster 1km horizontal appraisal well (205/21a-6) drilled 2014

- Max stabilised flow rates:
  - 5,300 bopd (natural)
  - 9,800 bopd (ESP)
  - Both constrained by surface equipment
- No formation water encountered
- World class P.I.
  - 160 STB/d/psi
- Minimal skin
- Excellent quality dynamic dataset
EPS conundrum – implications post 205/21a-6

Triangle colours represent Hurricane’s perception of challenge in today’s oil price and financial environment and do not reflect Hurricane’s view on project viability and delivery.
Optimising the EPS concept...

• Post the 2014 horizontal appraisal well results, Hurricane has been able to:
  - Focus on EPS simplification and capex reductions
  - De-risk EPS project schedule
  - Rely on a single well at first oil (existing horizontal well)
  - Reduce subsea infrastructure workscopes

• In the process:
  - Delivers the required field evaluation data for Full Field optimisation
  - Provides the potential for a 2nd horizontal well to be located optimally and funded from cashflow
  - Achieves the same objectives as EPS “Reference Case”
EPS DP FPSO – solution?

• Evolve a solution from existing proven FPSO technology, combined with dynamic positioning (DP)

• Based on a disconnectable turret system, proven in the North Sea, Gulf of Mexico and Australia
FPSO – simplified process to support EPS
Technical considerations (EPS)

- FPSO
  - Potential to replace Phase 1
- Hub
- Shuttle Tanker
- Gas Lift replaced by ESP’s
- Gas Compression for Fuel Gas only
- EPS – Leased
- Phase 2 – Purchased
- Potential to rely on Chemical Injection only
## FPSO capacities

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  - Rely on a single well at first oil (existing horizontal well)
  - EPS FPSO design optimisation
  - Reduce subsea infrastructure workscopes

• In the process:
  - Deliver the required field evaluation data for Full Field optimisation
  - Provide the potential for a 2nd horizontal well to be located optimally and funded from cashflow
  - Achieve the same objectives as EPS “Reference Case”

• Commence commercial discussions with FPSO providers which do not rely on traditional bank financing routes
EPS conundrum – implications post 205/21a-6

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Early Production System (EPS) - objectives

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- De-risk and optimise the Lancaster Full Field Development

- Duration c. 5 years

- Potential to accelerate first oil

- Ability to use on our other assets WoS
Phased concept today...
Lancaster + Lincoln = GLA

Lincoln

Lancaster

Hurricane's Lancaster & Lincoln assets: Contingent and Prospective Resources
Source: CPR November 2013 MMboe

Depth (m)
- 1000
- 1500
- 2000
- 2500
- 3000
- 3500
- 4000
- 4500

Prospective Resources
Contingent Resources

44
150
339
P90
P50
P10

14
62
1C+P90

2C+P50

207
53
456

142

An option for a WoS Hub concept

• In the challenging environment we live in today an approach on how field collaboration can deliver a hub concept rather than a field specific solution WoS.
An option for a WoS Hub concept

• In the challenging environment we live in today an approach on how field collaboration can deliver a hub concept rather than a field specific solution WoS.
Extending the concept......
The bigger picture WoS & UK Plc

Shared HUB?
Extending the concept......
The bigger picture WoS & UK Plc

Participants generate value from equity in fields delinked from infrastructure ownership

Government incentivises shared “hub” concepts - benefiting all users

Shared infrastructure benefiting numerous fields on an equal basis

Users benefit from shared OPEX and CAPEX from day 1
Extending the concept......
The bigger picture WoS & UK Plc

The Wood Review
WoS Potential
Government Support
Maximising Economic Recovery
Infrastructure Opportunities

The “Perfect” Location

OGA’s “Call To Action”

Industry Support

Shared HUB

Hurricane | Devex | 21 May 2015
Conclusions

• Acquiring a high quality dynamic dataset from the 2014 horizontal well has improved Hurricane’s understanding of the behaviour of the fractured basement reservoir

• The analysis of the well test and subsequent concept simplification provides, a viable EPS solution utilising the existing well stock

• The EPS is a natural precursor to a larger phased development providing the required data to optimise the Lancaster Full Field Development

• For a hub located close to Lancaster, in shallow water, we believe there is a real opportunity for the industry to demonstrate a collaborative approach to maximising the economic recovery of the area
Thank you