The Benefits and Limits of FPSO Standardisation

Andrew Newport
Schiedam, 13th December 2018
Objectives and approaches to standardisation
Historical examples and lessons learnt
System approach to standardization
Objectives and approaches to standardisation

- Historical examples and lessons learnt
- System approach to standardization
Objectives of standardisation

- **Reduction in project CAPEX:**
  - Reduction in man-hours (and smaller project teams)
  - Reduction in rework
  - Use of frame agreements
Objectives of standardisation

- Reduction in project CAPEX
- Reduction on project OPEX:
  - Incorporation of lessons learnt from one unit to another
  - Common spare parts inventory
  - Reduction in training costs
Objectives of standardisation

- Reduction in project CAPEX
- Reduction on project OPEX
- **Reduction in project schedule:**
  - Improved NPV
  - (reduction in CAPEX)
Standardisation of an entire FPSO: A number of generic FPSO’s have been developed in the past, often as a mechanism to build versatile production units on speculation
Approaches to standardisation

- Standardisation of an entire FPSO
- **Standardisation of selected systems within an FPSO**: The degree to which different systems can be standardised is dependent upon the design envelope which they must accommodate.
Approaches to standardisation

- Standardisation of an entire FPSO
- Standardisation of selected systems within an FPSO
- **Standardisation of equipment**: Use of supplier’s standard equipment, typically procured through frame agreements, can reduce equipment costs and delivery schedule
Approaches to standardisation

- Standardisation of an entire FPSO
- Standardisation of selected systems within an FPSO
- Standardisation of equipment
- **Standardisation of equipment interfaces:** System layout is affected by the footprint of the equipment incorporated, particularly by the location and design of the interfaces between the equipment and remainder of the system.
Approaches to standardisation

- Standardisation of an entire FPSO
- Standardisation of selected systems within an FPSO
- Standardisation of equipment
- Standardisation of equipment interfaces
- **Standardisation of the project execution plan:** Executing projects using the same project organization, even when there are differences in the FPSO design, improves communication and reduces ambiguity and project schedule by capitalizing on existing relationships with suppliers and fabrication yards. The more standardised the design, the greater the standardisation that can be achieved in the project execution plan.
The Functional Specification approach: The client specifies the functionality required from the FPSO, but leaves the FPSO contractor to use their own detailed specifications to perform the EPCI work.

The Prescriptive Specification approach: The client specifies not only the functionalities required, but also how the project is to be executed, typically in accordance with the client’s in-house engineering standards. The ‘standard’ product must then be customized.
- Objectives and approaches to standardisation
- Historical examples and lessons learnt
- System approach to standardization - FAST WARD
**Generic FPSO Failures**

<table>
<thead>
<tr>
<th>Project</th>
<th>Contractor</th>
<th>Launch Date</th>
<th>Closure Date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nexus 1 FPSO</td>
<td>Nexus</td>
<td>2006</td>
<td>2009</td>
<td>Nexus 1 FPSO built on speculation, laid up and finally sold to OSX and reconverted to OSX1 FPSO. Programme cancelled.</td>
</tr>
<tr>
<td>Deep Producer</td>
<td>FPSOcean</td>
<td>2007</td>
<td>2009</td>
<td>Bankrupt. FPSO abandoned part constructed, later sold.</td>
</tr>
<tr>
<td>Aker Smart FPSO</td>
<td>Aker Floating Production</td>
<td>2006</td>
<td>2010</td>
<td>The first generic unit was modified to include a turret mooring and a major topsides upgrade. Programme for 4 FPSOs cancelled after first FPSO.</td>
</tr>
</tbody>
</table>
## Generic FPSO successes

<table>
<thead>
<tr>
<th>Project</th>
<th>First Oil Date</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPSO Falcon</td>
<td>2002</td>
<td>Produced on Yoho field in Nigeria</td>
</tr>
<tr>
<td>FPSO Serpentina</td>
<td>2003</td>
<td>Producing on Zafiro field in Equitorial Guinea</td>
</tr>
<tr>
<td>FPSO Xikomba</td>
<td>2003</td>
<td>Produced on Xikomba field in Angola until 2011 then redeployed to N’Goma field in Angola for Eni</td>
</tr>
<tr>
<td>FPSO Mondo</td>
<td>2007</td>
<td>Producing on Mondo field in Angola</td>
</tr>
<tr>
<td>FPSO Saxi-Batuque</td>
<td>2008</td>
<td>Producing on Saxi and Batuque field in Angola</td>
</tr>
</tbody>
</table>

SBM’s ‘Generic FPSOs for ExxonMobil"
Extent of standardization of the series for ExxonMobil

- Generic FPSO functional specification
- The FEED for a generic design provided a starting point for each project specific application

1  FPSO Falcon
2  FPSO Serpentina
3  FPSO Xikomba
4  FPSO Mondo
5  FPSO Saxi Batuque
Project specific application introduced considerable differences

6 key systems reviewed for level of standardization: Hull, Power generation, Oil processing, Water injection, Gas processing, Mooring system

System parameter deviation around mean, \( \text{Devi} = \frac{\text{maximum} - \text{minimum}}{2 \times \text{mean}} \)

\[ \text{Extent of Standardization} = 1 - \frac{\sum_{i=1}^{j} \text{Dev}_i}{j} \]
Extent of standardization of the series for ExxonMobil
Other successful series of FPSO based on generic hulls

- **Bluewater series** (Bleo Holm, Glas Dowr and Aoka Mizu)
  - Based on new build Aframax sized hull
  - North Sea applications

- **Teekay Offshore series** (Piramena 1, Hummingbird Spirit and Voyageur Spirit)
  - Based on new build circular hulls of the Sevan Marine design.
  - North Sea applications
Extent of standardization of 3 series of FPSO
Ease of standardization of FPSO systems
Cidade de Ilhabela (CDI) delivered to Petrobras in 2014

Two near identical units then awarded by Petrobras

- Oil (bpd) 150,000
- Prod Water (bpd) 120,000
- Water Injection (bpd) 200,000
- Gas Compression (MMscfd) 212
- CO2 Compompression (MMscfd) 100
- Re-injection Pressure (Barg) 550

Topsides weight 25,000 tonnes

Storage requirement 1,600,000 barrels
Mismatch between topsides bay spacing and vessel framing

Integration solutions considered:
- Reinforcement above deck
- Intermediate web frames
- Additional longitudinal girders
Longitudinal girders to support modules

‘Upper Deck Renewal and Topsides Integration, the Example of Cidade de Maricá and Cidade de Saquarema’
Arselin, Jarry, Marchalot, d’Este, DOT 2015
Deck renewal to incorporate additional framing aligned with CDI topside module supports
New accommodation block with transition piece
Cidade de Maricá and Cidade de Saquarema during conversion
- Objectives and approaches to standardisation
- Historical examples and lessons learnt
- System approach to standardization -
In 2015, SBM launched an FPSO project called Fast4Ward™, including standardization as a key element.

The standardisation is based on three pillars:

- A generic new build VLCC sized hull optimised for West African and Brazilian conditions
- A catalogue of Topsides modules covering a range of capacities and product specifications
- A catalogue of Mooring Systems covering a range of water depths, environments and risers.
Our ambition is to transform the business by reducing cycle time to energy delivery, de-risking projects, and improving quality & safety. This is what we refer to as **Fast4Ward™**

**Fast4Ward™** is based on five key principles:

1. Client first
2. Standardization
3. Flawless execution
4. Integrated supply chain
5. Enabling digital solutions

**Fast4Ward™** Better Performance, Delivered Faster
Fast4Ward™ Better Performance, Delivered Faster

- Reducing cycle time: Up to 12 months faster; Up to US$1 bn NPV gain
- De-risking projects: Standardized hull and topsides
- Enabling lower break-evens: Lower Capex and Opex

- Fewer engineering hours
- Integrated supply chain
- Greater safety and reliability
Next Generation FPSO

- Standardised Hull: the Multi Purpose Floater
- Topsides Modules, Vessel & Mooring Components: Catalogue Approach
Mooring – Flexible Solutions

External turret

Internal turret

Spread moored

A generic design compatible with different types of mooring systems
Next Generation FPSO: Guyana

- FEED contract awarded for 2nd FPSO Liza field offshore Guyana
- Construction and Installation, Lease and Operate contracts awarded for a period of up to 2 years, subject to project sanction
- Oil production capacity of 220,000 bbls/day

(source: SBM Offshore (general Fast4Ward™ rendering))

> 4 billion boe discovered since 2015

(source: ExxonMobil)
Questions ?