

# PREPARATION FOR FPSO OPERATIONS

Paris, Dec 2016

## Agenda – Preparations for FPSO Operations

Operations Philosophy  
Choosing the Operating Model  
Operations Contracts  
Design Input  
Maintenance and Operating Documentation  
Operating in a Low oil price environment  
Management and Advice

## Operation Philosophy & Objectives

### Operations objectives

- Operate safely with no accidents & with minimal environmental impact
- Deliver hydrocarbons on plan, by effective management of the reservoir and facilities
- Ensure the integrity of the equipment and people and that work processes meet the appropriate standards

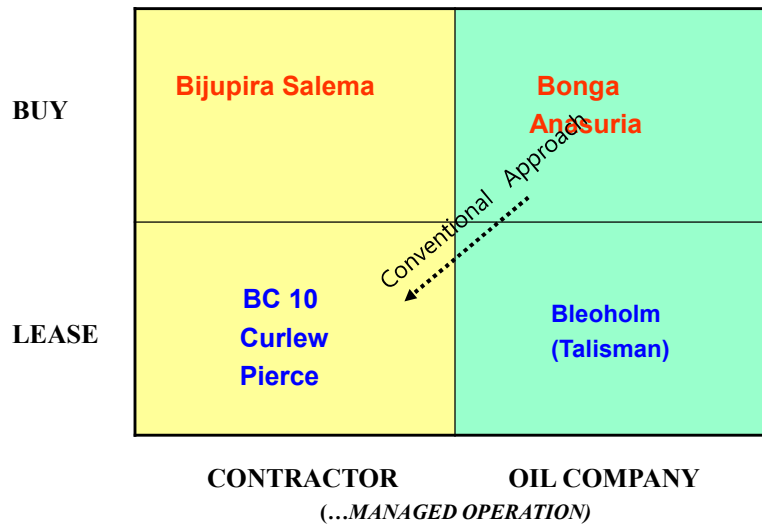
*Note the Contractors objectives may be different !*



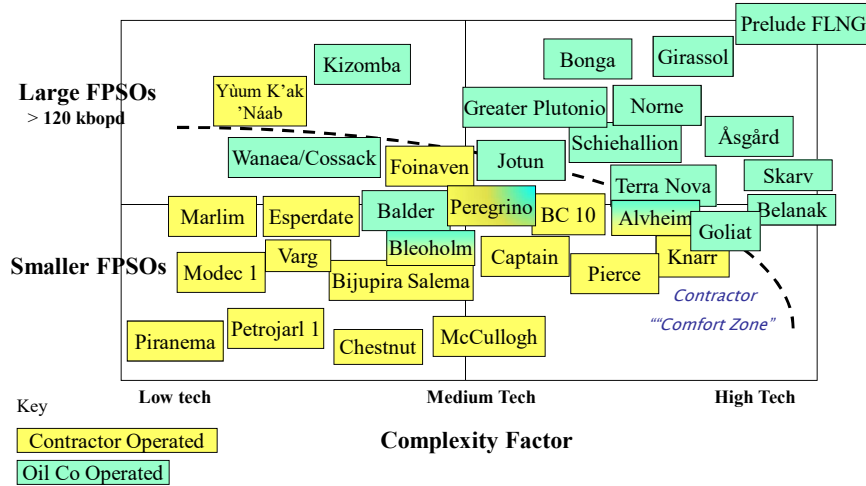
### Key success factors

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>- Assurance facilities and people are operating safely</li> <li>- Aligning all staff and contractors towards shared goals.</li> <li>- Building a competent, motivated team</li> </ul> | <ul style="list-style-type: none"> <li>- Obtaining best value from reservoir and reacting to changes/ surprises</li> <li>- Operating the facilities: performance meets or exceeds expectations</li> <li>- Operating the field at the lowest reasonable cost</li> </ul> |
|--|--|

## FPSO Lease vs Buy and Operating Options



## FPSO Complexity and Size



## Selection the best Operating Model for your project

<b>Lease Operation</b>	<b>Strengths</b> <ul style="list-style-type: none"> <li>- Capex reduction</li> <li>- Less interfaces</li> <li>- Contractor reputation</li> <li>- Contractor expertise</li> </ul>	<b>Weaknesses</b> <ul style="list-style-type: none"> <li>- Less experience gained</li> <li>- Less cost control</li> <li>- Tie back/ debottlenecking complex</li> <li>- Need incentives</li> </ul>
	<b>Opportunities</b> <ul style="list-style-type: none"> <li>- Synergies other Ops</li> <li>- High uptimes/volumes</li> <li>- Can reuse facilities elsewhere</li> </ul>	<b>Threats</b> <ul style="list-style-type: none"> <li>- Limited competition</li> <li>- Contractor competence and continuity?</li> <li>- End of field life uncertainty</li> </ul>
<b>Company Managed Operation</b>	<b>Strengths</b> <ul style="list-style-type: none"> <li>- Facilities built to company specs</li> <li>- Design input controlled</li> <li>- Can select contractors</li> <li>- Day to day control</li> <li>- Less sensitive to reservoir uncertainty</li> </ul>	<b>Weaknesses</b> <ul style="list-style-type: none"> <li>- Need detailed design SOR</li> <li>- Need Ops experience input</li> <li>- Require full Ops organisation</li> <li>- Must deal with regulator</li> <li>- Find experienced contractors</li> <li>- Need engineering back-up</li> </ul>
	<b>Opportunities</b> <ul style="list-style-type: none"> <li>- Control of options for tie backs and extra capacity</li> </ul>	<b>Threats</b> <ul style="list-style-type: none"> <li>- Capex/Opex growth</li> <li>- Schedule risk -</li> </ul>

## Some numbers to indicate priorities



### Typical West Africa Mega field

<b>Reserves</b> (35% recovery)	<b>500 Mbbls</b>	<b>Value at \$50/bbl</b> <b>=\$25bn</b>
<b>Opex</b>	<b>\$125m/yr</b>	<b>20 yrs</b> <b>=\$2.5bn</b>
<b>3.5% extra recovery</b>	<b>= \$2.5 bn</b>	<b>Pays for field life Opex</b>
<b>First yr prodn</b>	<b>200mbd</b>	<b>= 30 times Opex</b>
<b>1% extra prodn</b>	<b>In year 1</b>	<b>Pays for 30% of Opex</b>

**Conclusion:** Production performance is many times more important than any consideration of Opex

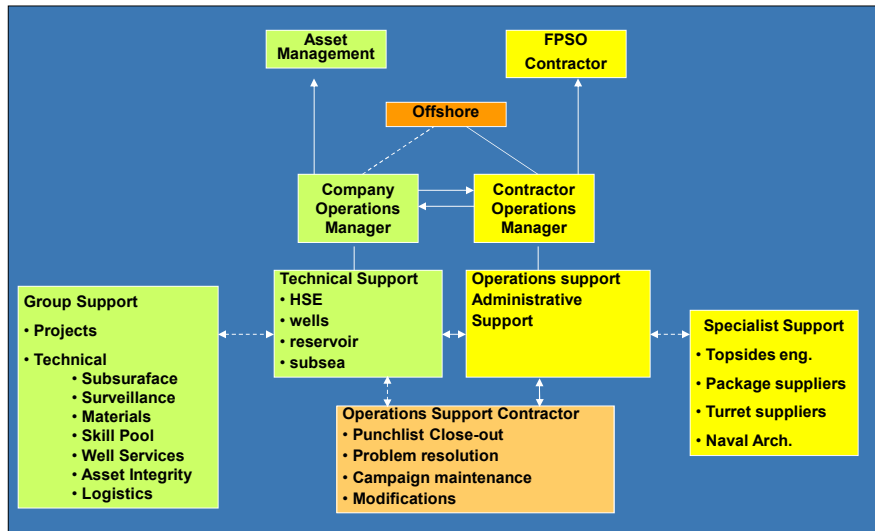
## How an FPSO Operator can add value (& profit?)



- ❑ **Stable and predictable production**
  - Meeting company targets, for volumes and quality. Optimising facility throughput. Managing costs down but only when appropriate. Exceeding first year production performance target
- ❑ **Providing information**
  - Giving production information to reservoir engineers (high quality test and metering data), early warnings of problems and responsive to new data requests
- ❑ **Interface management**
  - Managing FPSO interfaces with well and subsea operations to minimise downtime, actively assisting contractors with planning and resources, taking on client tasks where appropriate
- ❑ **Modifications**
  - Being ready to de-bottleneck the facility or adjusting production settings for changing reservoir conditions. Proactive support for tie-back studies and general upgrades ( eg SBM –ESP service).



## Organisation Strategy – Partnership

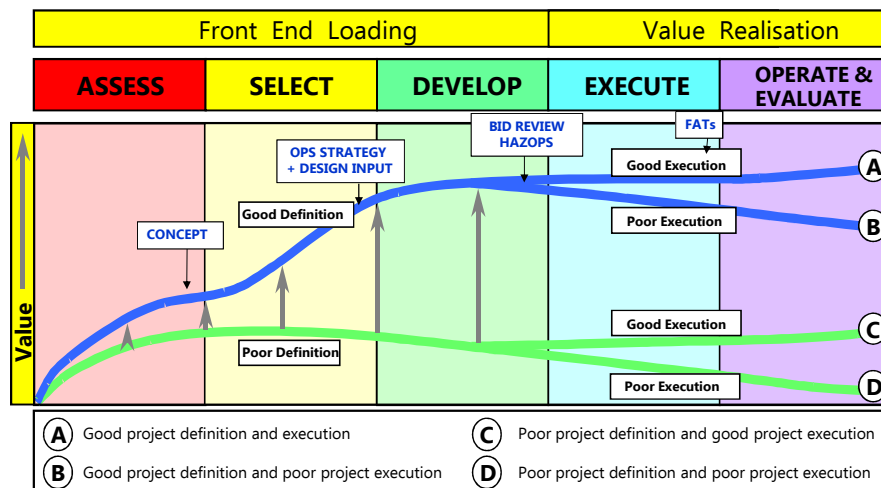


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## DESIGN INPUT Front End Loading – Getting It Right Early On



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## FPSO Operations Design Input



### Critical Areas

- Power generation, load sharing and distribution
- Process control system, F&G and ESD/PSD logic
- Gas Compression system
- Accommodation layout and functionality
- Mechanical handling and storage/laydown/workshops
- Flare, scrubbers, HP and LP drains
- Crude loading/offloading system and tank access

### Key Opportunities for Ops input

- Concept design review
- Bid selection
- Design
- Hazops
- FATs and MC checks
- Commissioning and formal handover

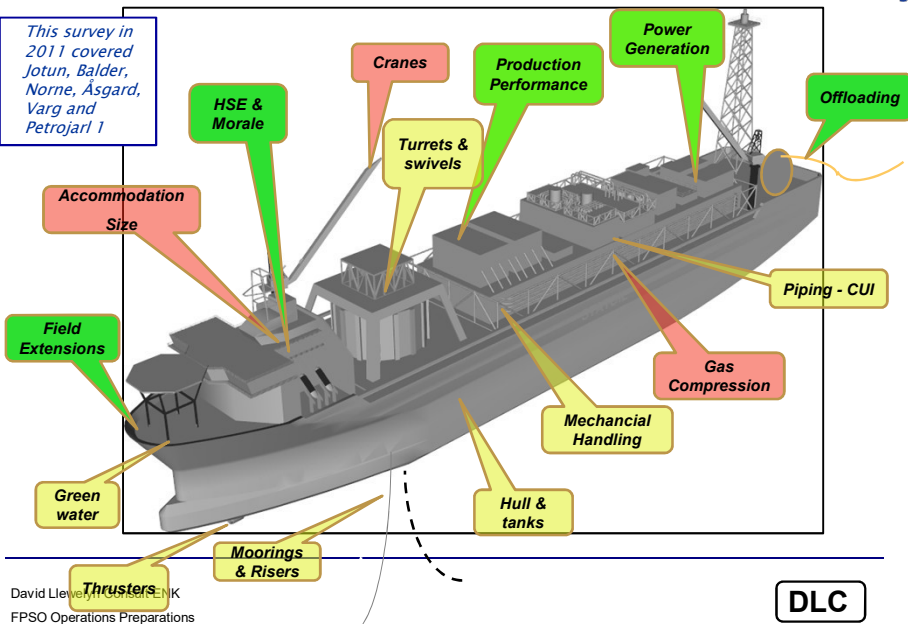
**Recommendation :** visit site <http://www.norskoljeoggass.no/no/FPSO-Experience-Transfer/>  
Over 50,000 hits a year!

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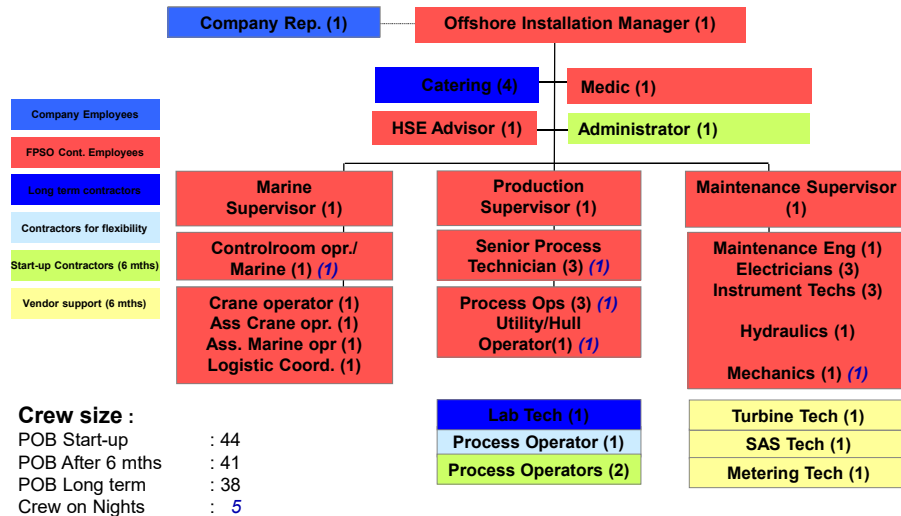
## 10 years Norwegian FPSO Experience vs Expectations



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## Offshore Organisation (Typical)



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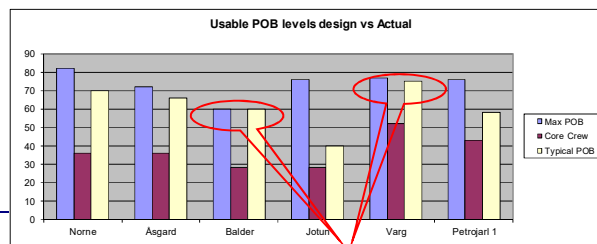
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## Accommodation Size



- There is always extensive debate about POB numbers on FPSOs
- General acceptance now that beds for a typical FPSO, 100 POB is optimum (OLF FPSO Lessons learned report 2002):
  - Provides for 40 core crew and all service contractors,
  - Facilitates rapid start-up with opportunity to carry work offshore
  - Offers capacity for first year trouble shooting, training (specially locals for overseas projects), punch list close-out and visitors/regulators
  - Allows beds for campaign and major maintenance/repairs or plant upgrades while minimising impact on production
  - Provides for life extension and new tie back projects
- Key issues are room sharing policy, temporary beds and lifeboat capacity

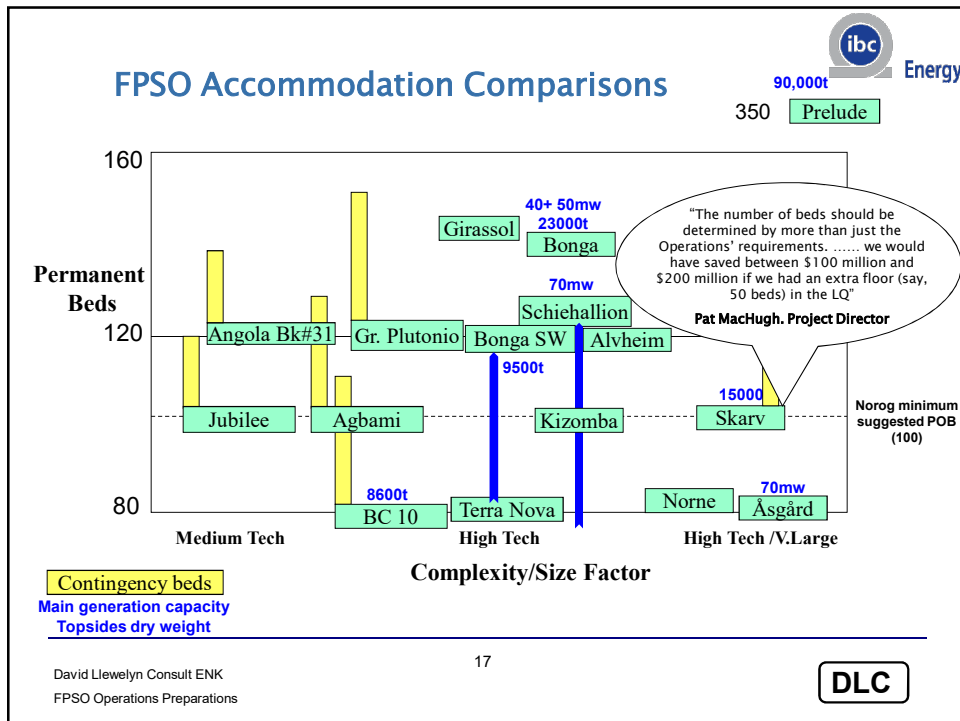


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Indicates severe bed shortages

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**ibc Energy**

## Central Control Room Location

**Preferences:**

- Ship owner Operators like the CCR on the bridge
- Oil Company Operators prefer the CCR at the process deck level

**Why Process deck level?**

- Easy of access for process Operators
- Facilitates the work permit process
- Easy to locate offices / MRs nearby
- Reduced roll motions, glare
- Shorter cable runs
- Better for incident co-ordination
- Keeps work / living areas isolated from sleep areas
- Allows space for heli reception, hospital, observation bridge

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## Mechanical handling

**Mechanical handling is biggest operational concern of all FPSOs (OLF)**

- Mechanical handling plan should include lay down area, and access routes to store, helideck, kitchens and workshop
- Increasingly operators prefer hydraulic manipulator/arms for specific roles in combination with local lifting beams
- Central walkway should be provided for use with forklift/trolleys
- Consider tank deck & machinery rooms
- Offloading cranes must be rated relative movement, have independent shutdown systems, slew limiters and designed for easy inspection
- Need to make provision for ROV hull inspection, thruster replacement and sea chest blanking



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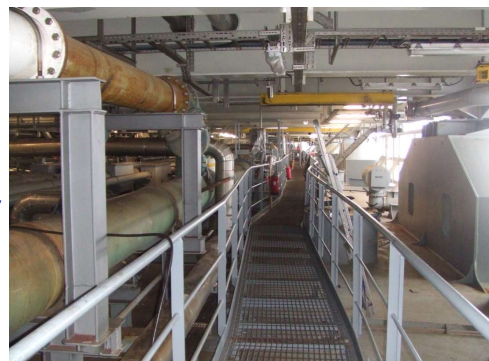
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## Layout issues

The layout of equipment on an FPSO equipment is a critical design task.

Concerns noted include:

- Placing main generators too close to the accommodation,
- Poor mechanical handling solutions,
- Exhaust and flare radiation problems,
- Module overcrowding when others are very spacious,
- Poorly placed vents,
- Access and escape routes restricted by cables & pipework,
- Poor Maintenance access solutions
- Poor workshop and store locations



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## Tank Work

- There are significant risks to personnel engaged in inspection, maintenance and repair activities within cargo tanks (*UKOOA*)

These include: Oxygen deficient atmospheres, Hydrocarbon contamination, Inert gas contamination, Flooding, Steam, Falls from a height, Dropped objects, Noise, Toxic, carcinogenic, radio active LSA scale, Hot work, Consequential risks including structural, marine and process, Etc.

- Issues to be addressed include:

- Tank Isolation
- Cleaning / Inerting / Purging
- Tank Access
- Atmosphere
- Working Environment
- Work supervision in Tanks



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## Protective Coatings: Coating failures

- ❑ 95% of coating failures occur due to:
  - Incorrect specification choice
  - Poor surface preparation
  - Poor application
  - Mechanical damage not being repaired quickly
- ❑ 85% of coating failures appear within the first 1–3 years
- ❑ Maintenance issues
  - Delay and backlogs on fabric maintenance work due to lack of bed capacity
  - Inspection program for coatings, integrity of passive fire protection and corrosion under insulation often lacking
  - Scaffolding, dry abrasive blasting, and air less spray will provide best work efficiency and result



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## Maintenance Preparations– Key Issues

- **Primary drivers for Maintenance;**
  - **Safety – Maintaining integrity of Safety Critical Equipment**
  - **Class – Maintaining the vessel in Class (or company equivalent)**
  - **Production Reliability – Keeping production, water injection on plan and hydrocarbon quality at specification**
- **Implementation depends on the level of complexity\*;**
  - **FPSO core crew (routine checks, emergency & repair or assessments)**
  - **Maintenance Crew ( major breakdowns, campaigns, unit removals)**
  - **Onshore support (onshore rebuild & replacement for more complex equipment)**
- **For high complexity, operators prefer to utilise onshore maintenance work**
- **For less complexity, the offshore crew will do most maintenance on board**

*\* Complexity Example: BP Schiehallion (1998) had 34,000 tagged items*

*BP Skarv (2011) has 154,000 tagged ( or maintainable) items*

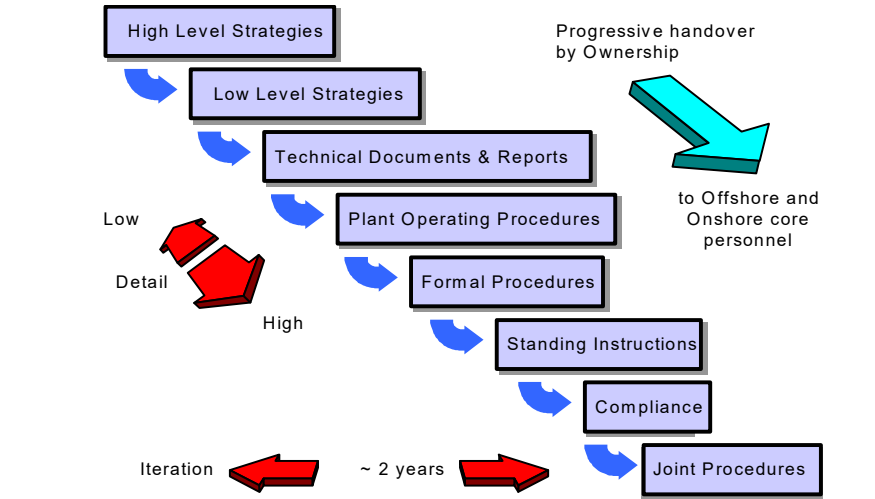
## Maintenance Management System

**Many systems on the market – Maximo, AMOS; RAST, etc**

**Typical features to expect:**

- Tag based with links to P&IDs, and operating documentation
- Inventory Control and Procurement module
- Detailed maintenance routines and parts call-up
- Predictive and condition monitoring interfaces
- Criticality (safety, economic and env.) based
- Performance standards and verification routines in-built
- Status, progress and budget reporting
- Replication onshore and vendor interfaces
- Inbuilt capacity to learn and improve routines

## Development of Operating Procedures



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## FPSO Support Vessel (For *Bijupira Salema Shell Brasil*)

### Secure Support Vessel(s) in pre-ops phase

#### Potential Roles:

- Tanker operations
- Standby Vessel (*Fifi*, pollution control, guard duties)
- Logistics and storage
- ROV Interventions (*SCM*, chokes replacement etc)
- Air diving, Mooring inspections etc



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## Operating in a Low oil price environment



### Production Focus

- Analyse all causes of production loss (Choke Model) inc trips and restrictions
- Initiate campaign to eliminate trips eg . "time since last trip"
- Review and challenge need for maintenance shut downs (eg. on line inspections)
- Implement production incentive program ( if not in place already)

### Cost Focus

- Implement risk based inspection and maintenance program
- Increase levels of condition monitoring (to prolong maintenance intervals)
- Reduce use of Vendors – Conduct Maintenance using the crew
- Share logistics support ( bases, helis and boats) – reduce re-supply frequencies
- Renegotiate materials, chemicals and fuel contracts

## FPSO Preparations for Ops – CONCLUSIONS



### Operations Strategy

- Determine your objectives, decide who should do what and why
- Align contract rewards to value added
- Manage Operations in accordance with Oil price environment

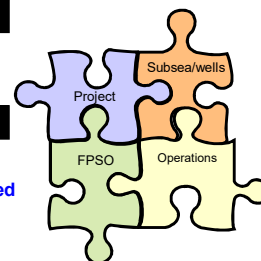


### Operations design Input

- Involve experienced Ops staff with key design decisions
- Take a "life of field" perspective

### Operations Build

- Effective Recruitment, team building and training are critical
- Ensure maintenance and operations procedures are fully owned
- Involve Operations Staff in the Commissioning phase



*Good Luck!*

## Workshop – Commissioning and Start-up

- ☐ Your case FPSO is moving towards Mechanical completion
- ☐ Outline the key elements of your Commissioning strategy
- ☐ Name the key risks (5-10) for your project and suggest mitigations