Typical Operators' Performance Expectations for FPSOs in GoM

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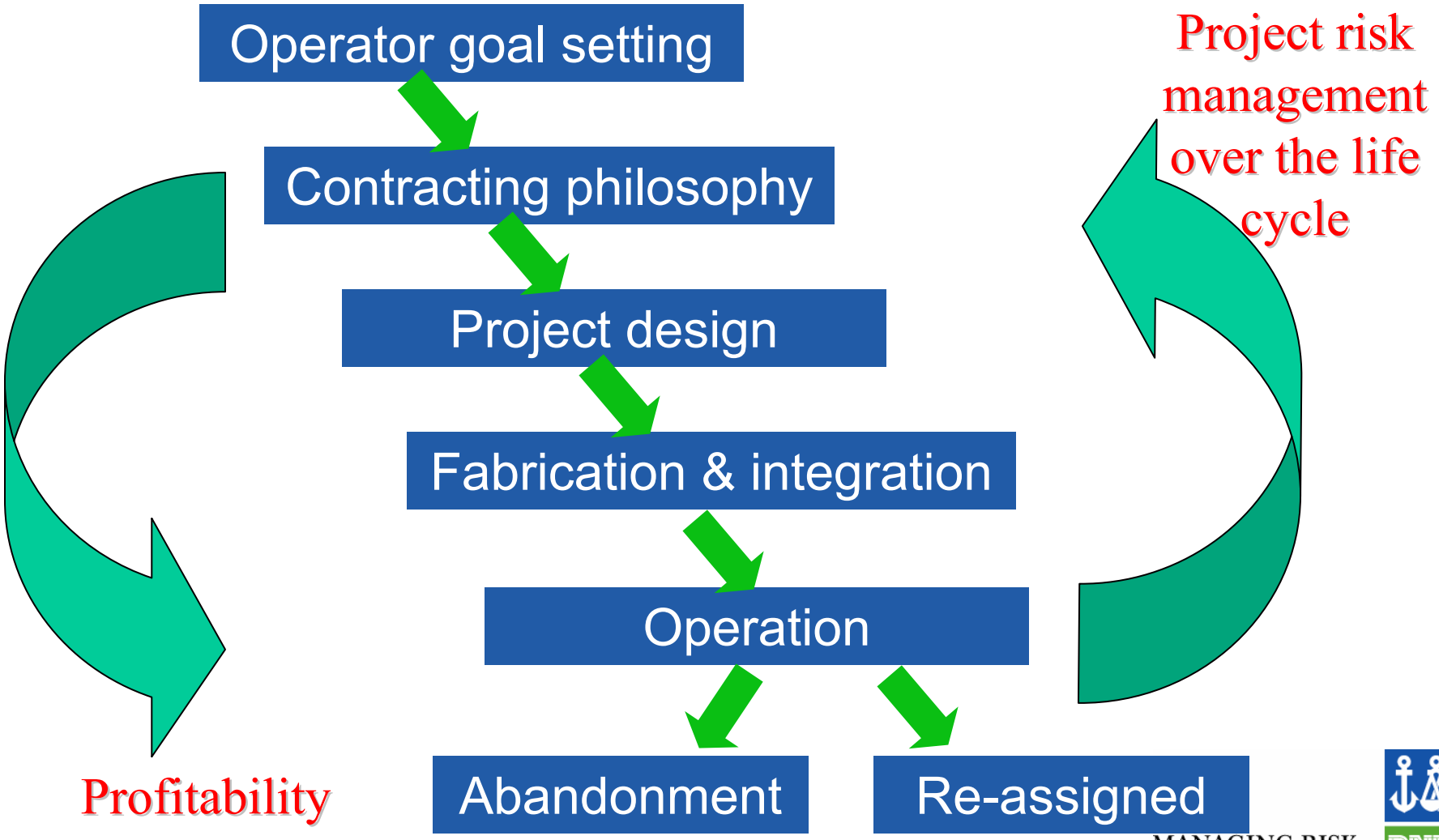
Key factors for GoM FPSO success



Focus for the presentation

- Look at some key factors that we have seen as important for the success of FPSO projects — from operators goal setting through contracting, project design, construction and operation
- Experience gained from DNV Classification/ verification of more than 50% of the world's newbuilt FPSOs

Assumptions as to GoM FPSO particulars

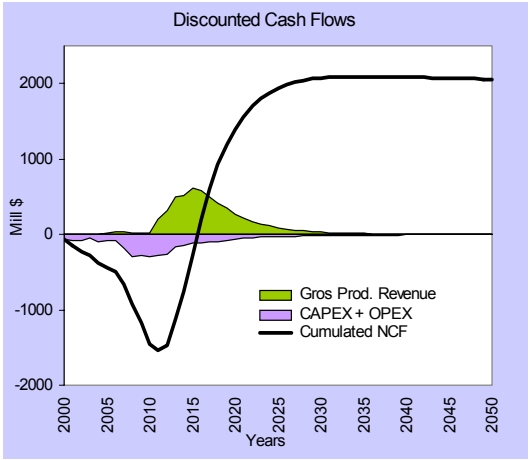
- Newbuilding to OPA 90 regulations
- Deepwater
- Large field with a considerable number of subsea wells
- Must be able to survive hurricane loading, e.g. with extreme 100-year environmental conditions similar to North Sea
- Satisfactory handling of associated gas
- Infrastructure is in place: emergency support, shuttle tankers, security threats, etc.

Project Goals: Get both field development and operation successful

- *Historical*: Minimize CAPEX and time to first oil/revenue

  Consequence: High degree of concurrent engineering and construction

  Experience: Errors, rework, delays, human stress



- *Possible improvements:* Set goals to maximize life-cycle field economy and giving more weight to risk and cost factors throughout project execution and operation

Project goal: Life cycle economy: Key issues

- Will the FPSO be suitable for engagement on other fields after decommissioning?
- Will optimizing the production system for peak production performance sacrifice life-cycle economy and flexibility for redeployment or adding potential future satellites?

Contracts: Ensure that all participants work to a successful project w.r.t. schedule, quality and cost

- Contract model is key to achievement.

  Possible pitfalls:

  - *Lump sum:* Conflicts on what extras are due to contractor's fault and what are due to operator's involvement and changes
  - *Reimbursible:* Contractors may not share the same project goals as the Operator
  - *Alliance:* It is easy to share profit but not losses
- Proper selection of contract model and management may be one of the most important aspects of a successful project.

Contract: One contract or split hull and topside contract?

- Decision may be based on various criteria:
  - Spreading of financial risk
  - Reduce schedule impact
  - Increase local content
  - Improve quality (specialized fabricator)
  - etc.

Contract: One contract or split hull and topside contract?

Risk factor often overlooked:

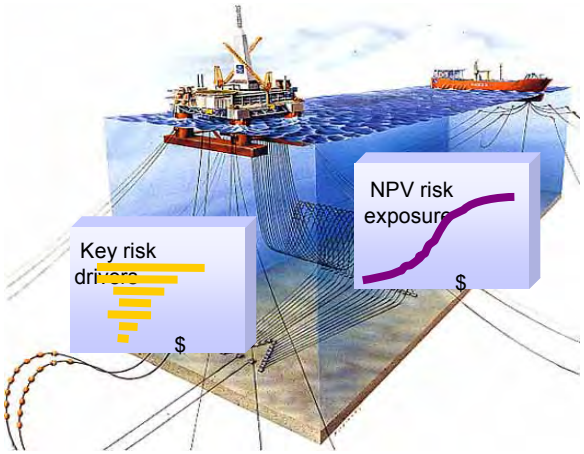
- A production volume of 100 000 bbd may give 2.5 MM$ daily revenue, which is 50-100 times the revenue for a large tanker and way above what a yard would accept as late delivery penalties
  - *Consequences*: The yard has a strong negotiating power for delays and in case of split responsibility for hull and topside, the yard may more easily load over unfinished work to the topside yard
  - *Possible risk mitigation*: Focused interface management; be very clear on agreed deliveries; minimize changes; improve information and competence flow among contract partners

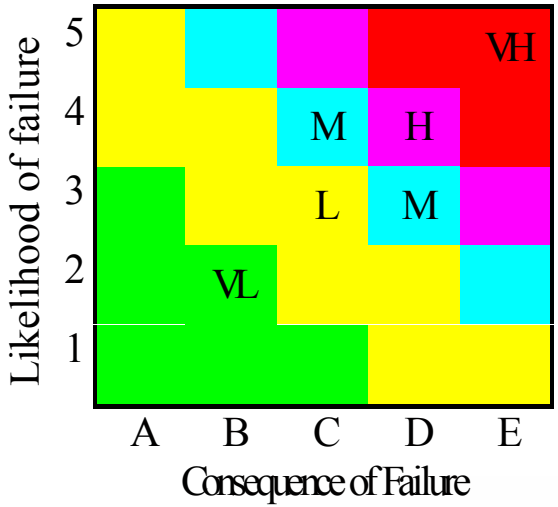
Contract: Get smooth interaction among manufacturers

- *Normal approach:* A modular topside with a few large contractors for the different systems
- *Challenge:* Systems engineering is done by the the various manufacturers for their deliveries including safety systems. Will the integration and interfaces work ?
- *Any mitigation:* Comprehensive interface management prepared early enough in the project and make them contractural. Clearly define the responsibility for leading interface management with key vendor and make the support by subvendors contractural, e.g. control system vendor and compressor module vendor.

Project Risk Management

- Management system to support managers to identify, assess, mitigate and monitor project risk
- Analysis tools
  - *Qualitative* - Risk Matrix
  - *Quantitative* - Monte Carlo simulation
- Communication of results
  - Risk register, Risk matrix,Tornado diagrams, S-curves, action lists, etc.

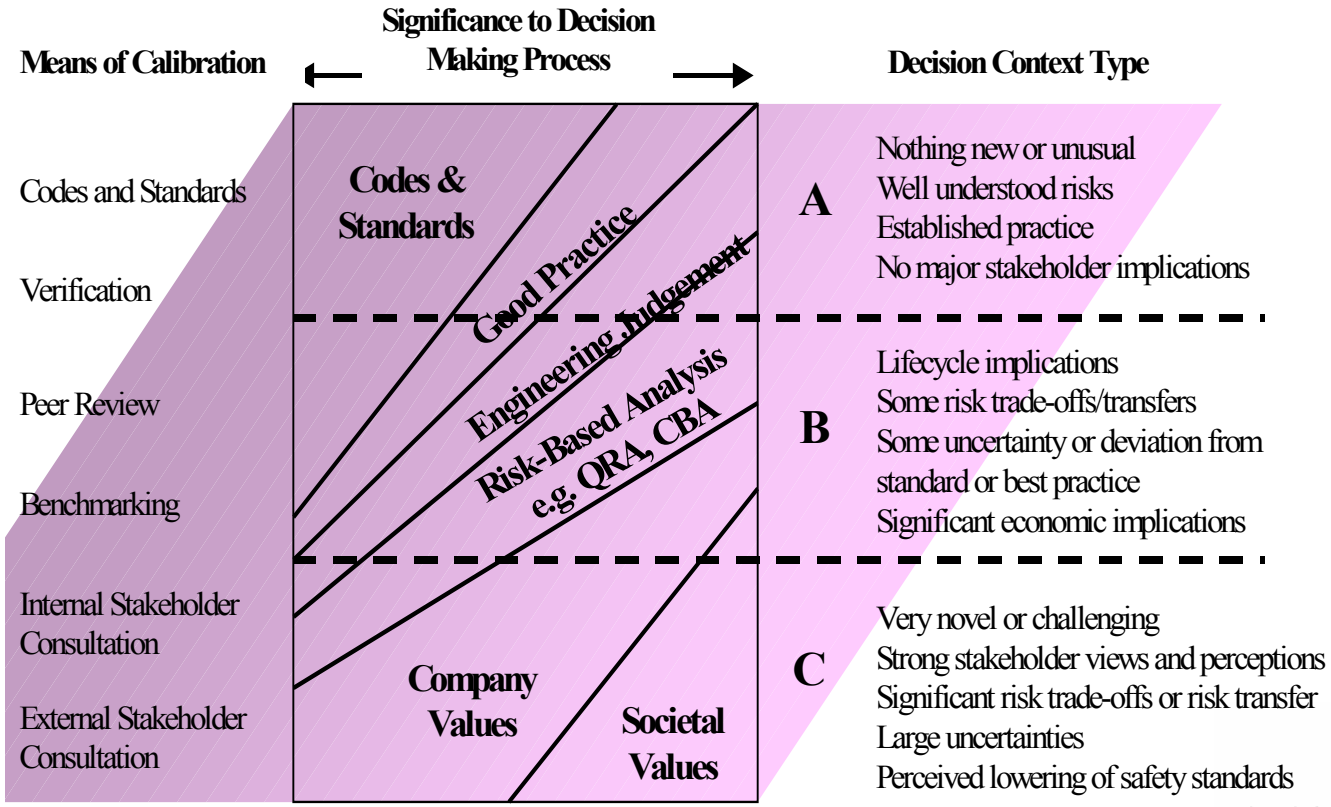




Field Development: Get it right

- Risk based or prescriptive approach?

  One guidance for sophistication of decision making approach, UKOOA 1999:



Field Development: Satisfy Regulatory bodies

- Avoid multiple design iterations caused by risk-based regulations
- Transform functional requirements into practical specifications prior to fixed price contracts
- Ensure that designers, yards and suppliers better understand the technology requirements and shelf state regulations

Operations: Maximize production volume

Minimize downtime?. . . but ongoing discussion:

- There will be need for large purpose-built FPSOs, e.g. for North Sea.
  - A high degree of duplication of systems (to ensure production in case of maintenance and failure) and resulting installation of equipment that are rarely used and require costly maintenance. *Where is the balance for life cycle economy and safety?*

Conclusions

- Application of FPSOs today is proven technology and used successfully in harsh environments similar to hurricane conditions in GoM.
- Based on past experience from building FPSOs we can learn from specific critical issues to ensure that future projects meet the operators performance expectations throughout all stages of field development and operation.

Thank you for your attention.