Why Flow Assurance can contribute to deepwater project cost reduction

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DORIS Engineering
AGENDA

- Flow Assurance discipline image in oil and gas industry
- Main FA requirements for Contractors at the end of FEED Phase
- Typical organization of FA during FEED phase within Doris
- Excesses of Flow Assurance activities and consequences for FEED
- How FA can participate to cost reduction in oil & gas industry?
Flow Assurance discipline image in oil and gas industry:

- FA engineers = only OLGA users
- A lot of complicated calculations
- A lot of (very long) reports
- Results / conclusions are changing all the time
- Always late in the project
- Typical FA answer is: “It depends…”
- Some “bad feedback”: PIP specified instead of wet insulated, large slug volume specified very late (during Detailed)

Perception = Discipline which may participate to cost increase during the project
BUT Flow Assurance

- Is involved in all phases of a field development (from conceptual to start-up)
- Interacts with many other disciplines
BUT Flow Assurance
- Is involved in all phases of a field development (from conceptual to start-up)
- Interacts with many other disciplines

AND
- CAPEX definition is mainly done during conceptual / FEED phase with field architecture / insulation selection

THUS
- Flow Assurance is a **key discipline** particularly during FEED phase
Main FA requirements for Topside/SPS Contractor at the end of FEED (oil field)

- Umbilical results
- Liquid surges
- Preservation results (depressurisation and dead oil circulation)
- Equipment design data (flowing conditions)
- Flowing P & T conditions
- Subsea design pressure & temperature
- Insulation
- Umbilical results

Topside

SPS
Main FA requirements for SURF Contractor at the end of FEED (oil field)

- Insulation
- Preservation results
- Equipment design data (ID, MPP operating points)
- Subsea design pressure & temperature
- Input data for SURF analysis
- Umbilical results
Typical organization and planning of FA within Doris during FEED (oil field)

**Typical FEED**

- Typical deliverables:
  - 1 Basis of Design
  - 20 calculation notes / philosophies
  - 3 interface reports

- Initial FEED FA planning:
  - 6 months
  - Start of FEED: BOD, Steady state, Transient

- Extension:
  - 2 months
  - New reservoir model or new layout
  - SPS CFT, Topside / SURF CFT, Transient

- ~4-7 FA engineers

- ~6-8 months
Excesses of Flow Assurance activities and consequences for typical FEED

- Main excess: The number of scenarios and simulations requested
  - For operability BUT not required for design (Start-up, Flow map...)
  - For SURF Contractor (operating / design pressure and temperature profiles, transient temperature profiles...)

- Consequence:

Available OLGA model → More and more simulations requested → Risk of planning extension
Excesses of Flow Assurance activities and consequences for typical FEED

Main excess: The number of scenarios and simulations requested
- For operability BUT not required for design (Start-up, Flow map...)
- For SURF Contractor (operating / design pressure and temperature profiles, transient temperature profiles...)

Consequence:

Diagram:
- Initial FEED FA planning: 6 months
  - Start of FEED
  - BOD Steady state
  - Transient
  - Philosophies & guidelines
- Extension: >2-3 months
  - New reservoir model or new layout
    - SPS CFT
    - Topside CFT
  - Additional transients for SURF
  - Additional transients for FOP
  - BOD Steady state
  - Transient
  - Philosophies & guidelines
How can FA participate to cost reduction in oil & gas industry?

- Performing a fast Track FEED in FA

Fast Track FEED

- ~4-5 experienced FA engineers
- ~3 months

Deliverables:
- 1 Basis of Design
- 7 technical notes

Possible only if:
- Good quality of pre-project
- No change in input (res. model, layout…)
- No FA spec report to be issued
- No FA analysis for SURF Contractor, for field op
How can FA participate to cost reduction in oil & gas industry?

- Developing a fit for purpose FA scope for FEED

- Removal of analysis not performed for design
- Development of methodologies
- Limitation of cases selected
- Development of tools to simplify calculations
- Reduction of working area (wells not modelled)
- Reduction of size of reports
- Optimisation of internal organisation
- Strong cooperation with CPY
How can FA participate to cost reduction in oil & gas industry?

- Optimizing the FA analysis planning during FEED
  - FA team fully integrated to the project team
  - FA planning defined in accordance with the project planning
  - FA engineer mobilization adapted to respect this planning
  - FA data for SURF / FOP (including philosophies, guidelines) to be performed after FEED
  - FA inputs (reservoir model, well data, layout) frozen by CPY

**The most likely today**

**Initial FEED FA planning**
- 6 months
- Start of FEED
- Steady state
- Transient
- Philosophies & guidelines

**Extension**
- >2-3 months
- New reservoir model or new layout
- SPS CFT
- Steady state
- Transient
- Philosophies & guidelines

**Additional transients for SURF**
- SURF CFT

**Additional transients for FOP**
- Topside CFT

**Objective**

**Initial / Final FA planning**
- 6 months
- Start of FEED
- SPS CFT
- Topside / SURF CFT
- Steady state
- Transient
- Philosophies & guidelines
- Philosophies & guidelines
How can FA participate to cost reduction in oil & gas industry?

- Typical optimised planning in FEED

<table>
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<tr>
<th>All subsea lines</th>
<th>FA analysis</th>
<th>Subsea Design P&amp;T</th>
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<tbody>
<tr>
<td>Required by</td>
<td>SURF / SPS</td>
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<table>
<thead>
<tr>
<th>Umbilical</th>
<th>FA analysis</th>
<th>Subsea lines number / size, pressure, flowrate, storage</th>
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<td>Required by</td>
<td>Process / SURF / SPS</td>
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<tr>
<th>Production</th>
<th>FA analysis</th>
<th>Flowing arrival P&amp;T</th>
<th>ID</th>
<th>MPFM / Choke</th>
<th>Cooldown</th>
<th>Depress</th>
<th>Dead oil circ.</th>
<th>Temperature profiles (op, design, transients)</th>
<th>Slug data</th>
<th>FA for Fop</th>
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<tr>
<td>Required by</td>
<td>Process</td>
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Reservoir model, well data, layout frozen

SPS CFT

Topside/SURF CFT

FEED Effective date

FEED completed

Effective date

Reservoir model, well data, layout frozen

SPS CFT

Topside/SURF CFT

FEED completed
Conclusion:

- FA can clearly help for cost reduction on deepwater projects by optimising the planning of FA studies to be completed during the FEED to avoid late results that would impact detailed engineering.
  - Analysis required for design only shall be identified and performed first
  - Level of priority of data required by other disciplines during the project shall be defined and planning of FA analysis built accordingly

Recommendation = Perform less runs but at the right time in the project
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