Technological and Logistical Challenges during Construction & Installation of Deepwater Mega Subsea Development in West Africa
Content

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Installation Market – Going Deeper...

Water Depth Progression for Offshore Drilling and Production

Source: 2014 Deepwater Solutions & Records For Concept Selection, Offshore Magazine, May 2014

Global capital expenditure (%) by water depth (m)

Source: Infield

Typical field development - artist impression

* FPSO – floating, production, storage and offloading
Component parts Facts:
No. Vessels – **50** (installation, tugs, barges and support)
Umbilicals – **80 km**
Water injection flow-line – **60 km**
Production flow-line pipeline – **40 km**
Mooring lines – **10’s km**
No. Spools – **37**

800km²
Recognition of the project footprint - Global Supply Chain

With the increase in size of projects we have seen a significant increase in the footprint of the global supply chain.

The variability in the supply chain poses particular challenge for consistency in the offshore operations experience and local content during the design, planning and execution of the project.
Project A. Topside Integration – Flare Tower

- Language barrier – English to Korean to Japanese for Floating Crane Operator
- Two booms of cranes are manually controlled

Our Solutions
- Identifying problem at an early stage
- Making the crane operator aware of difficulties and precautions they need to take while operating two booms manually in tandem
Project A. FPSO Sailaway

- Initial refusal of yard to complete all seafastening before start of the voyage as they wanted to start sailaway as early as possible
- This was not acceptable to MWS

Our Solutions

- Seafastening needs to be completed prior to departure
- Working in coordination with CPY we made yard to accept this which is a vital requirement for sailaway and safe voyage
Project A. FPSO Sailaway

• Is it strong enough?
• Is it stable enough?
• Are the marine procedures adequate and safe?
Project A. Berthing Technical Challenges

- Mooring analysis did not satisfy our requirements
- Berth was not designed for large vessels as FPSO
- No mooring winch and other required infrastructure
- FPSO has to moor at shallower draft
- Mooring line broke

Our Solutions

- Helping in developing emergency procedure
- Stationing a surveyor to help
- Advise on daily basis by tele-conference
- FPSO remain berthed without any incident till its voyage to field
Installation Technology

- Technical challenges moving to deeper water –
  - Higher CAPEX
  - Higher loads
  - Higher pressure
  - Extreme temperature
  - Complex installation procedures
  - Challenging installation tolerances
  - Complex subsea field layout
- Drive by industry → REDUCE COST
  - Oil Majors cost saving and redundancies
  - Contract larger packages and even whole projects to the mega SE Asia EPC contractors
  - Smaller companies to enter deep water pipelay market
  - Pipe technology improvements (weight)

= Potential for Increased Risk
Standardization of Subsea Equipment and Components

- **Installation JIP**
  - Bring together installation contractor knowledge and best practice to develop guideline:
    - For installation analysis
    - Limit state criteria
    - In completion phase
- **Certification of deepwater installation systems JIP**
  - Develop DNV certification for fibre rope based deep water installation systems based on technology qualification principles
  - Currently in the third and final phase
  - Advantages of using fibre ropes: strong and light that is easier to handle and more environmentally friendly
Project A. Logistical Challenges

- Suitability Survey 48 vessels in SURF & FPSO
- Suitability Survey are performed at 11 different countries across the globe in Europe, Africa, Asia
- 50 Surveyor mobilisation in SURF
- 500 Days of attendance in SURF and 120 days of travel
- For FPSO 270 days of attendance and 75 days of travel
- For SURF Surveyor mobilisations are in 12 different countries while for FPSO it is 9 different countries
- Different travel and visa regulations
- Personal Security
- Local Cultural Sensitivities
- Managing internal travel without an office in the country concerned
- Limited notice period for surveyor mobilisations
- Coordinating surveyor requirement vis-à-vis those of other projects
Surveyor Mobilisations Worldwide
Project A. Logistical Challenges

SOLUTIONS

- Close coordination between COMPANY Installation Manager and MWS Project Manager
- Tracking weekly update of project schedule and monthly look ahead
- Anticipating visa and other travel requirements
- Taking advance step to meet those requirements
- Anticipating possible security issues and discussing this with COMPANY
- Advance planning of meet and greet and accommodation of surveyors with the help of COMPANY logistic coordinator.
- Dedicated logistic coordinator working closely with COMPANY and in cases with Installation Contractor’s logistic coordinator
- Proper planning of offshore transfer on arrival at mobilisation point in tandem with COMPANY representative
Project A. Technical Challenges SURF

CARGO BARGE MOBILISATIONS AT ANGOLAN YARD

During our initial attendances at Angola Yard we encountered several challenges

- Problems with ballast management on all three first of series barges. Yard have over-filled nominated tanks which then required de-ballasting.
- The accuracy of the LOPs was noted with a number of missing items. The Management of Change procedure also tended not to trail the operational status.
- Riggings are produced without proper certifications
- Project items loaded out without obtaining necessary approval of attending MWS, exposing COMPANY to risk
- Lifts were planned without considering other marine traffic
Project A. Technical Challenges SURF

SOLUTIONS

- Lift Operation Plan for all lifts to be accepted by attending MWS
- Rigging Certification for rigging items
- Documented Deliverables regarding barge ballast condition and barge draft records. Demonstrating clear understanding of ballasting procedure
- Management of Change
- No load out of project items without attending MWS approval
- Adequate visibility to be ensured during load out at night
- Port traffic and other related activities in the area
- Crane and crane driver certifications
- Continued MWS presence till all issues are sorted to the satisfaction of MWS office
Project A. Technical Challenges SURF

**SINGLE HYBRID RISER FABRICATION AND DEPLOYMENT**

- This was one of the most critical stage of Project A subsea development
- Entire activity of fabrication and deployment was scheduled for 8 days
- To get sufficient weather window and completing the operation was a challenge
- Many activities such as lifting and upending of the LRA, URA and buoyancy tank, pulling and docking of SHR are critically weather sensitive
- Operation close to hull and potential collision issues
- Smooth planning and execution was essential to avoid delay during operation
- Early identification and mitigation of risks also essential for above reasons
- Additional risk is fatigue damage of the SHR during fabrication and deployment
Project A. Technical Challenges SURF

SOLUTIONS

- Activity divided into several steps and relevant documents and supporting critically reviewed for each step
- Making all relevant guidelines, codes, regulations are satisfied. SHR fatigue damage during deployment is within limit.
- A check list is prepared for each step and CoA issued for each such step
- All installation aid design and riggings are carefully checked
- In addition to dedicated HAZID and HIRA, a dedicated workshop is arranged between installation contractor, COMPANY and MWS to run through the entire installation process, closing all MWS comments and concerns
- Every step of this work MWS, Installation contractor and COMPANY worked as team to successfully meet challenges of this operation
- Result was to successfully deploy the SHR a day earlier than the scheduled
- Effective coordination between MWS, COMPANY and Installation Contractor made this happen
Local Content and other Challenges in Angola

Project A was to provide 9 million man-hours work for Angolans which is 20% of global cost of project for local fabrication and assembly. Angola labour will be for 70,548 tons of fabrication and assembly including 8,492 tons for the FPSO and 60% of the SURF package.

Large local content possess various challenges

- As seen during pipe joint load-out, lack of experienced personnel in performing operations such as ballasting
- Lack of required infrastructure to berth large vessel such as Project A FPSO and doing integration work on it
- Adequate crane facility to handle large subsea spools
- In general less awareness of HSE culture required for safe execution of a job
- Visa and work permit issues
Local Content and other Challenges in Angola

SOLUTIONS

- Anticipating the problem ahead and putting alternative solutions in place
- Spending additional time in explaining local personnel MWS requirements
- To consider whether additional calculations, design verification can replace some test / trial requirements where such tests/ trials are impossible due to lack of infrastructure (i.e. lifting trial of a spool without offshore rigging)
- Explaining requirements to produce detailed procedures such as lift plans and to follow accepted procedures
- Advising and explaining requirement to use certified equipment and riggings.
- Adopting above approaches we could help in developing work culture in Angola Yard.
- Yard and other work places for Project A in Angola as per MWS standard.
- For visa and work permit we could overcome the problem in most cases with help of our local agent and taking necessary steps well in time
Conclusions

- Mega subsea development main challenges are:
  - High CAPEX
  - Ensuring consistent local content
    a) Facilities, Vessel & Equipment
    b) Experienced Manpower for execution
      - Technological needs → more cost & more specialist equipment i.e. more need for capable local content
- Standardization → reduce risk and reduce cost
- MWS capable of mobilisation across the Globe
  - Safe execution of the project without major incident and claim
  - Key for component to improve consistency in local content across the whole project installation
  - Expertise on several specialisations and in most challenging environment both technically and logistically