Dry trees for cost effective solution with the Wellhead Barge: WHB®
Dry Tree Solution for Mild Environments

Dry Tree solutions have been developed and mainly used in harsh offshore environments (North Sea, Gulf of Mexico).

For mild environments (like **Gulf of Guinea**):
- **Reduced hull motions** resulting from mild
- Possibility to use a **simple spread-moored barge**:
  - With a large central wellbay suited to support surface trees and perform all drilling operations,
  - Barge-type standard construction **insensitive to topsides weight**,
  - That can accommodate optimized, naturally ventilated and **segregated topsides layout** thanks to its wide deck.
Typical Application Cases

**WHB full Process (+ FSO or export line)**
- WHB + FPSO (or FPU)
  - WHB functions:
    - Surface trees
    - Drilling rig and utilities
    - Risers from subsea trees
    - Living quarter
    - Full process
    - Standard export line to FSO or to shore

**WHB + FPSO or FPU**
- WHB functions
  - Surface trees
  - Drilling rig and utilities
  - Living quarter
  - Manifold and tests only
  - Poly-phase export to FSO / FPU through fluid transfer lines

**WHB satellite**
WHB Concept Introduction

Combination of field proven technologies:

- Drilling Rig
- Topsides
- Hull & mooring
- High Pressure risers
- Wellbay area

Saipem 12000 drilling vessel
Spread-moored FPU Hull & Topsides
Surface BOP
Aircans
General Overview

**Hull dimensions for a full processing WHB (Topsides weight: 18,000 tonnes)**
- Length: 274 m
- Width: 60 m
- Height: 19 m
- Moonpool: 78 x 18 m

Comparison with Saipem 10,000:
- Length: 228 m
- Width: 42 m
- Height: 19 m
- Moonpool: 25 x 10 m

Segregation of operational zones ⇒ **High safety level**
Key Technical Features

A **drilling** and **production** floating unit

- Large Water depth range from **500m to 3,000m**
- **WD**
- **Number of slots in the wellbay from 6 to 36+** to integrate free standing top-tensioned dry-tree risers
- Oil production from **50,000 bopd to 250,000 bopd+** ⇒ **Large topsides carrying capacity**
- **Flexibility in rig selection**
  - From full drilling rig to completion and work–over rig
  - Purchased or leased
  - Also configurable for Tender Assisted drilling
- **Adaptability to different field architectures**
- **Safety and reliability**
Production Risers Description

Principles & Arrangement

- **Aircans:**
  - Design optimized for minimum SCF and longer fatigue life
  - Non-integral design: pressure containing element is not the inner shell of aircans

- **Stiffener joint:**
  - Ensure the interface between the production riser and the riser guiding system

- **Flexjoint:**
  - Rotations and vertical relative motions between the risers and the hull are unconstrained

- **Riser strings**

- **Subsea connector**
  - Tapered joint & connector

- **Dry-tree Christmas tree**
- **Surface**
- **Guiding system**
- **Aircans** (3 parts)
- **Roller guiding system**

Diagram:
- Christmas tree
- Surface
- Dry-tree Christmas tree
- Stiffener joint
- Guiding system
- Aircans (3 parts)
- Roller guiding system
- Flexjoint
- Riser strings
- Subsea connector
- Tapered joint & connector
- Mud line
Wellbay and Mudline Pattern

**Subsea pattern defined according to exclusion zone**
- Lowering operations performed with the WHB at the centre of the subsea pattern
- Prevent clashing issues between risers in production and deployed riser

**Exclusion zone definition**
- WHB offset (1.5% of the WD)
- Deflection of the riser base during deployment
Taking Advantage of a Barge Type Floater

- A **barge-type hull** of standard shipyard construction
- **High carrying capacity** and **large deck space**
- A **moonpool as a drillship**
- A **spread moored** barge with **active mooring system** as on Saipem’s Scarabeo 8 drilling semi-submersible
- Machinery, consumables and process tanks integrated into the hull
Hydrodynamic – Tests Campaign

Extensive model test campaign to check:
- Global motions behavior of the barges
- Moonpool hydrodynamics without and with risers
- Risers integration in the wellbay

Specific model tests for current/risers interactions:
- Confirmation of riser design regarding fluid/structure interactions
- Improved predicting tools for clearance and dynamic analyses
High Flexibility in Drilling Facilities Design

- **Fixed drilling rig dissociated from other topsides functions** (LQ, utilities and process)
- **Drilling operations derived from those of deep offshore drilling vessels**
- **Fixed drilling rig** at the centre of the wellbay
- Configurable with both permanent purchased/leased rig or Tender Assisted
- **Surface BOP drilling** (with mini-subsea BOP if required)
- Hydro pneumatic tensioners for the handling of the BOP and the drilling riser tensioning
- **Suited also for direct access to subsea wells instead of or in addition to dry-trees**
- Possibility to have significant expanded storage of drilling/completion fluids
- Ability to have significant additional tubulars storage capacity

**LESS TIME REQUIRED TO DRILL A WELL**
**CAPACITY TO DRILL TOP HOLE SECTIONS**
WHB Typical Execution Plan

- Small modules + Vendor packages \(\rightarrow\) **Easy fabrication**
- **Limited lifting capacity** required at integration yard
- Drilling facilities built and integrated in topsides fabrication yard (modular construction)

Integration & commissionning at quay

NO OFFSHORE LIFT & OFFSHORE HOOK UP
Conclusions

The **WHB** is a **cost-effective, robust and flexible** dry-tree solution for a field development in mild environments:

**CAPEX savings:**
- A **single drilling & production floater** with:
  - Standard barge-type hull construction
  - High carrying capacity and large deck space
  - Spread mooring
- **Topside integration alongside quay, no offshore lift & no offshore hook-up**

**DRILLEX – OPEX savings:**
- Drilling time savings thanks to **permanent drilling riser installation with parking slots**
- Possibility for **simultaneous drilling/Completion/work-over** operations and **production** (with SIMOPS analysis)
- Marginal cost of work-over and infield drilling → **Higher oil recovery**
- Faster intervention on wells
- Reduction of overall manning on site, all functions on the same vessel

**Innovative concept using field-proven systems & procedures**

**Flexibility in the field application case and the drilling facilities design**
Thank you for your attention

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