

Dry trees for cost effective solution with the Wellhead Barge: WHB[®]



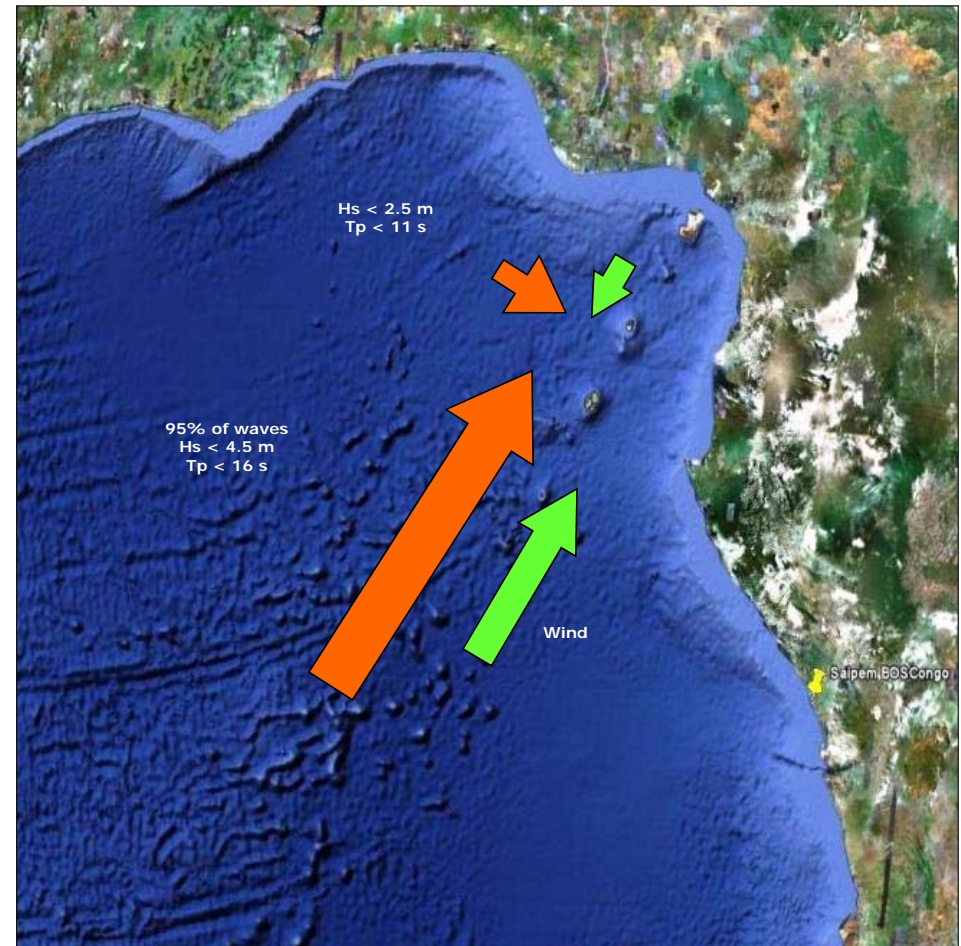
Dry Tree Solution for Mild Environments

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)

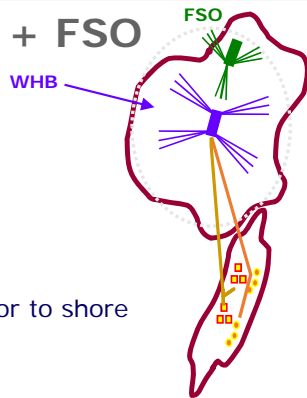
WHB + FPSO (or FPU)

WHB satellite

WHB full process + FSO

WHB functions:

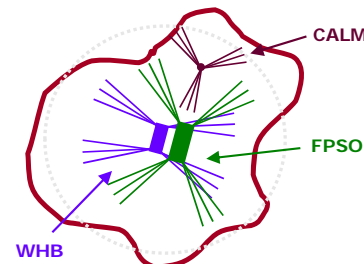
- Surface trees
- Drilling rig and utilities
- Risers from subsea trees
- Living quarter
- Full process
- Standard export line to FSO or to shore



WHB + FPSO or FPU

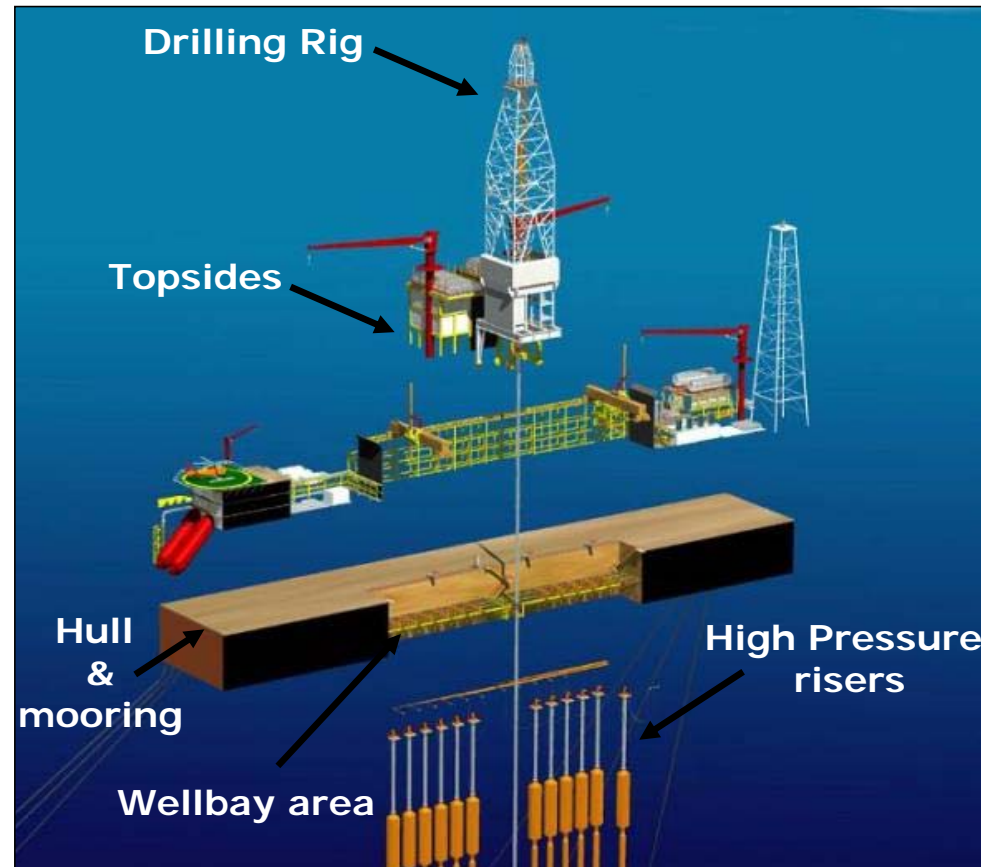
WHB functions

- Surface trees
- Drilling rig and utilities
- Living quarter
- Manifold and tests only
- Poly-phase export to FPSO / FPU through fluid transfer lines



WHB Concept Introduction

Combination of field proven technologies:



Saipem 12000 drilling vessel



Surface BOP



Aircans



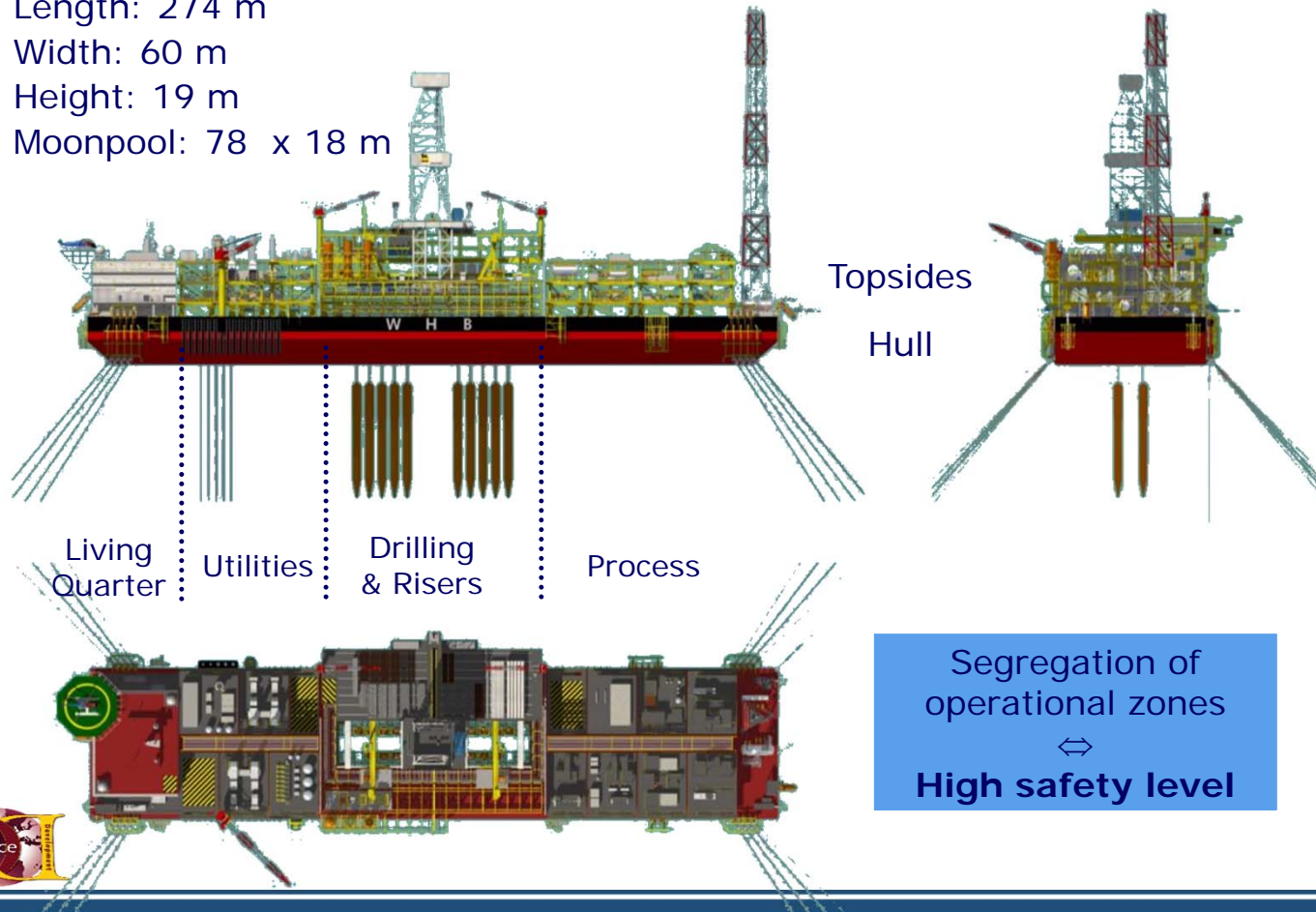
Spread-moored FPSO Hull & Topsides



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:



Saipem 10 000:

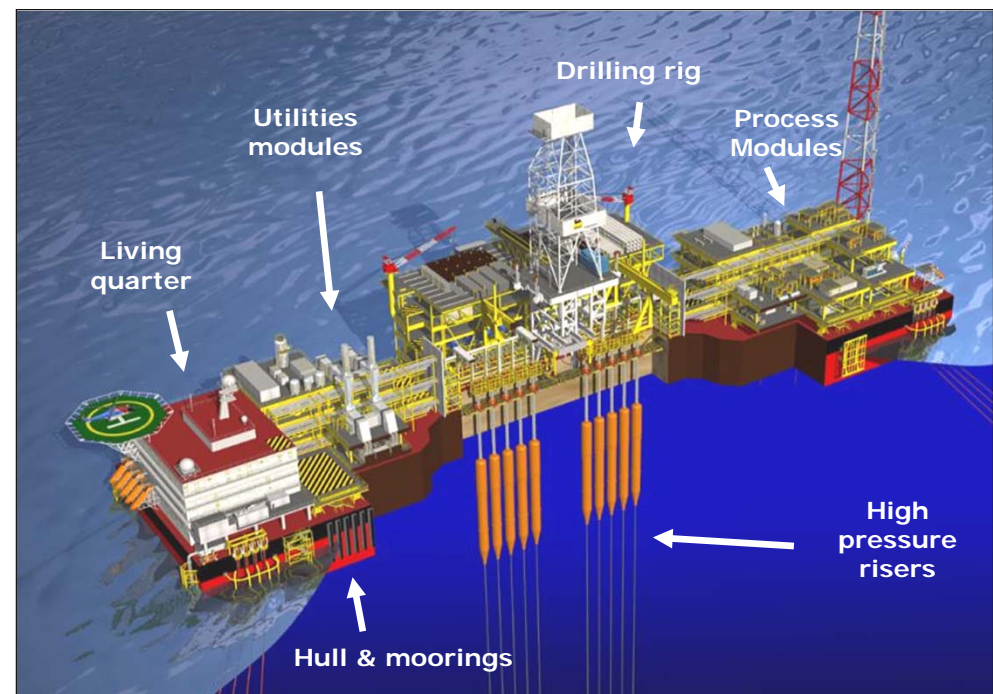
Length: 228 m
Width: 42 m
Height: 19 m
Moonpool: 25 x 10 m



Key Technical Features

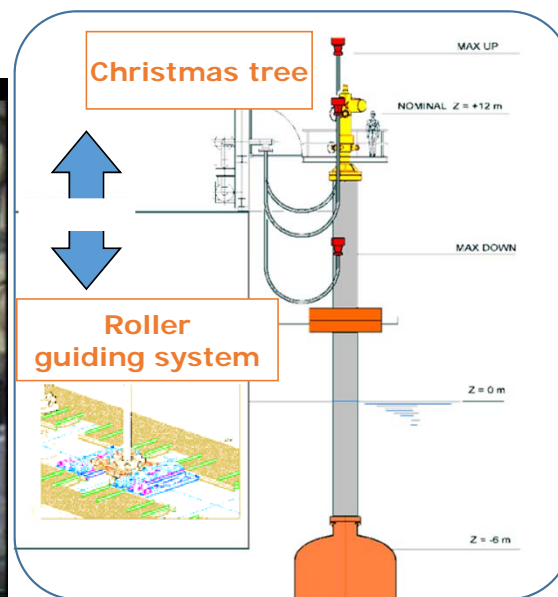
A **drilling** and **production** floating unit

- 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+ \Rightarrow 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

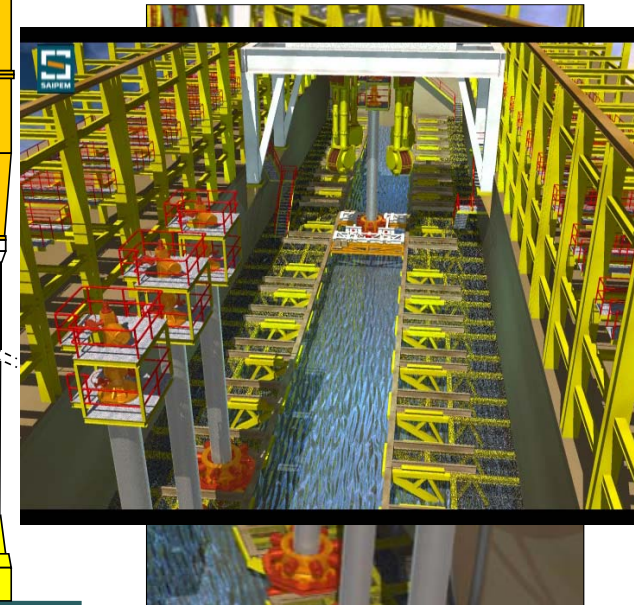
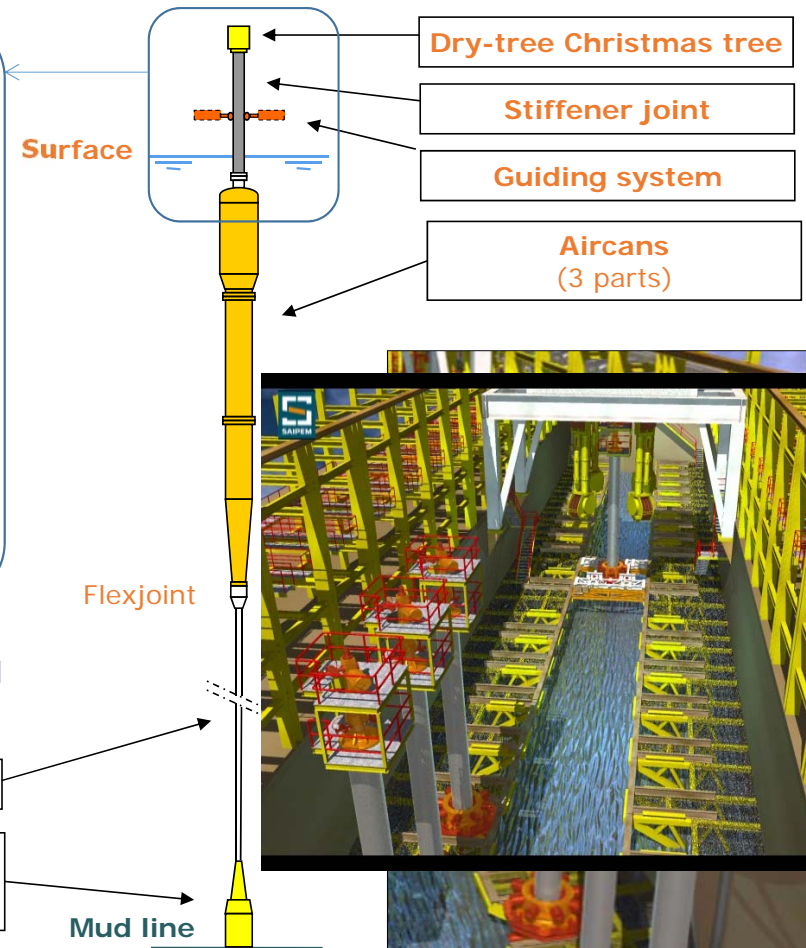
Principles & Arrangement



Rotations and vertical relative motions between the risers and the hull are unconstrained

Aircans :

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



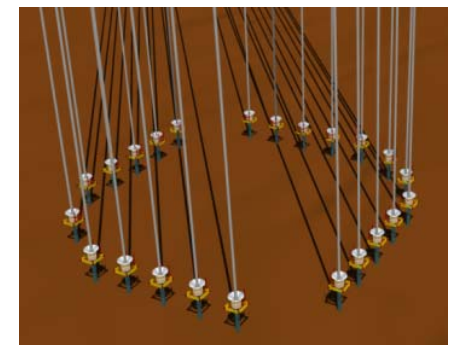
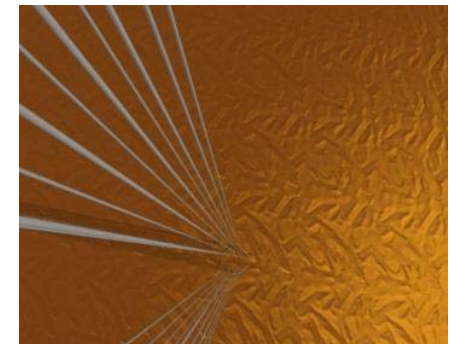
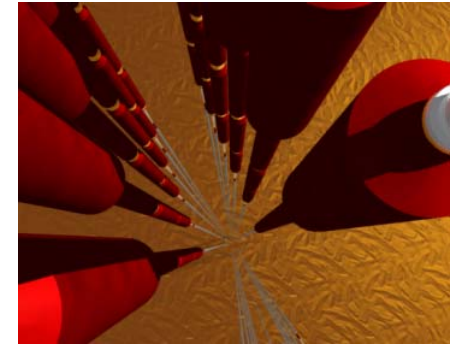
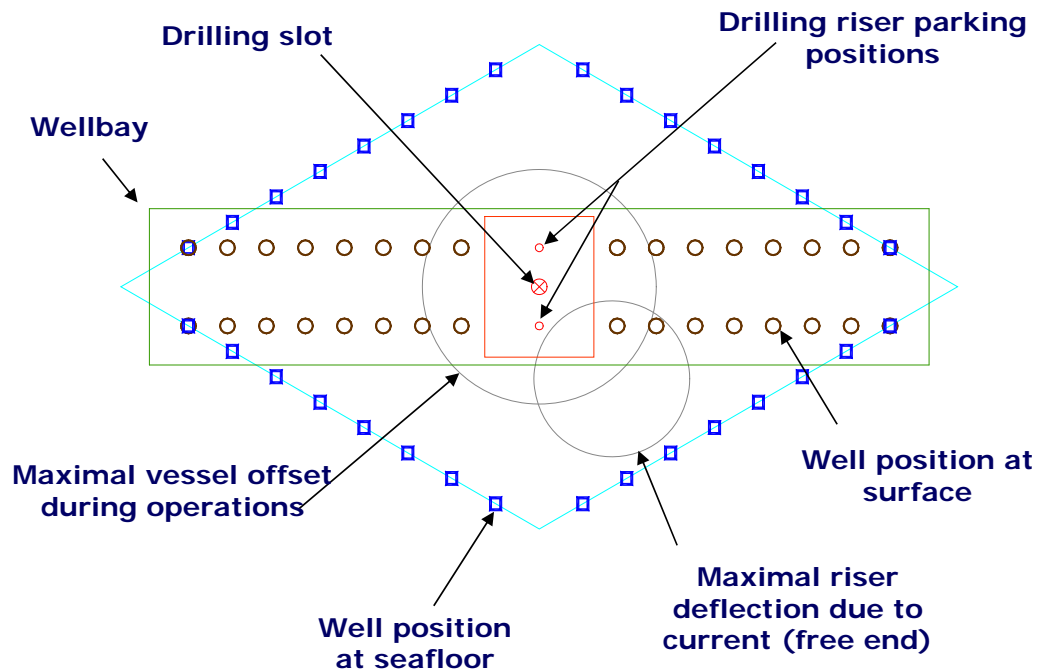
Wellbay and Mudline Pattern

● 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



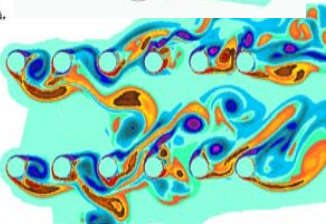
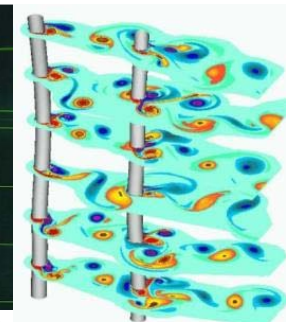
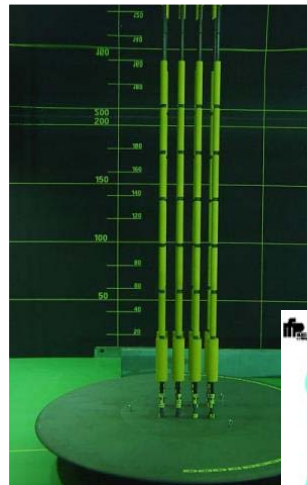
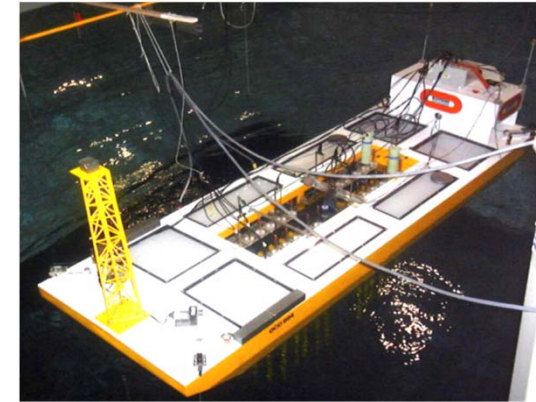
Hydrodynamic – Tests Campaign

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



Surface BOP

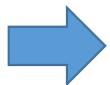


Permanent rig



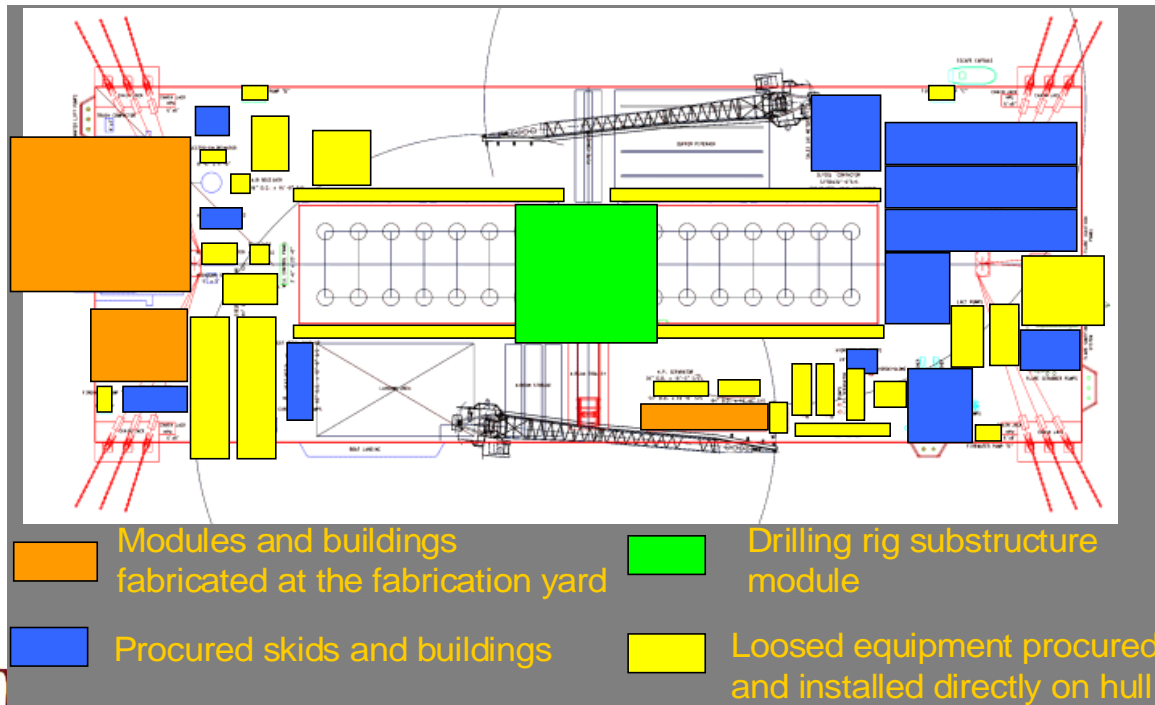
Saipem 10,000

LESS TIME REQUIRED TO DRILL A WELL
CAPACITY TO DRILL TOP HOLE SECTIONS



WHB Typical Execution Plan

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

Contacts: benjamin.mauries@saipem.com
stephanie.abrand@saipem.com
paolo.allara@saipem.com

