

MARTECH 2016

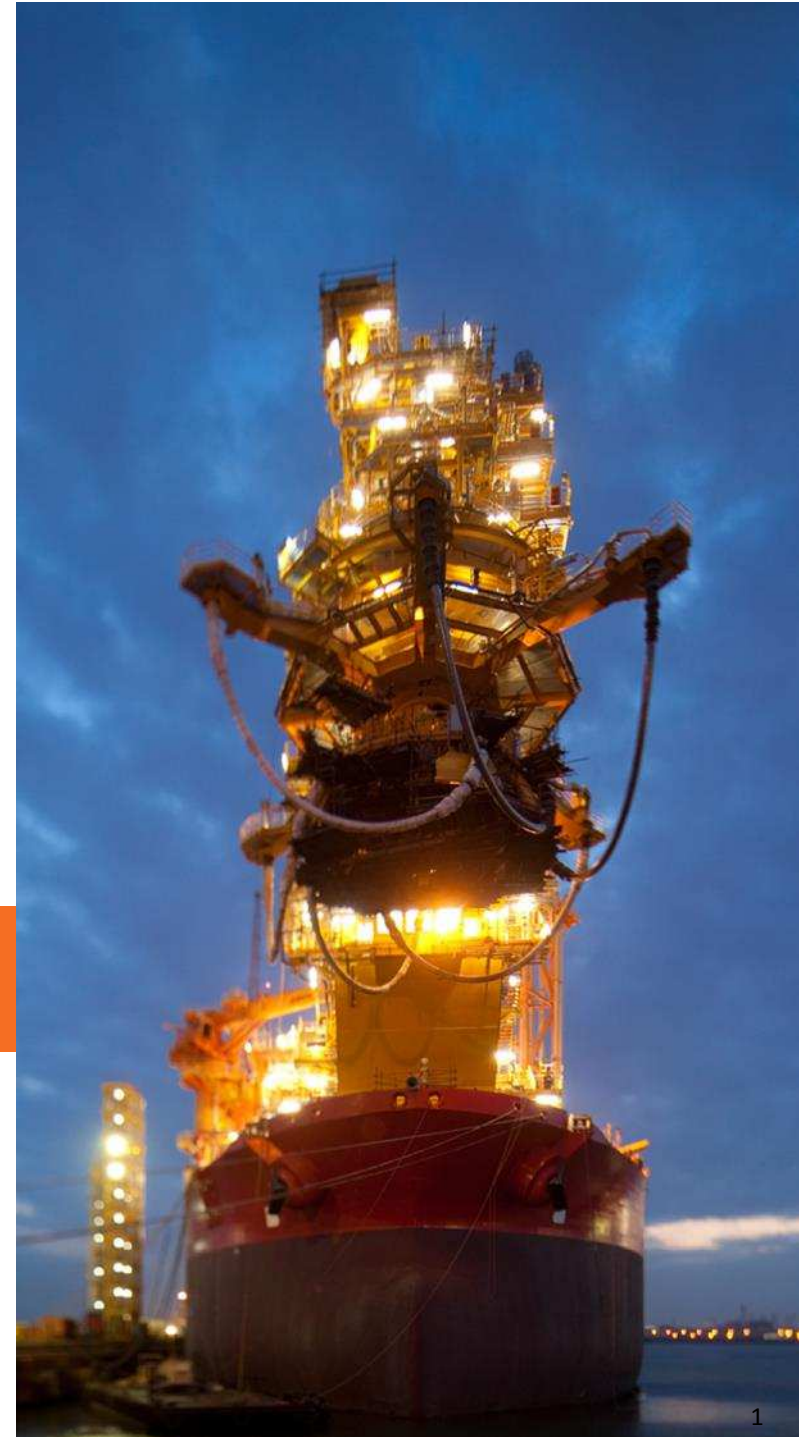
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Advances in FPSO Technology

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FPSO Evolution:

from Generation 1 to Generation 3





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Our FPSO topsides have steadily grown more complex since our first FPSO in 1981

Generation 3 FPSO

Topside Weights: 18,000t – 23,000t

+150% increase in average size of topsides and machinery shaft power; transition to advanced process technology



2013

Generation 2 FPSO

Topside Weights: 5,000t – 10,000t

Conventional topsides, transition from marine to process know-how



1999

Generation 1 FPSO

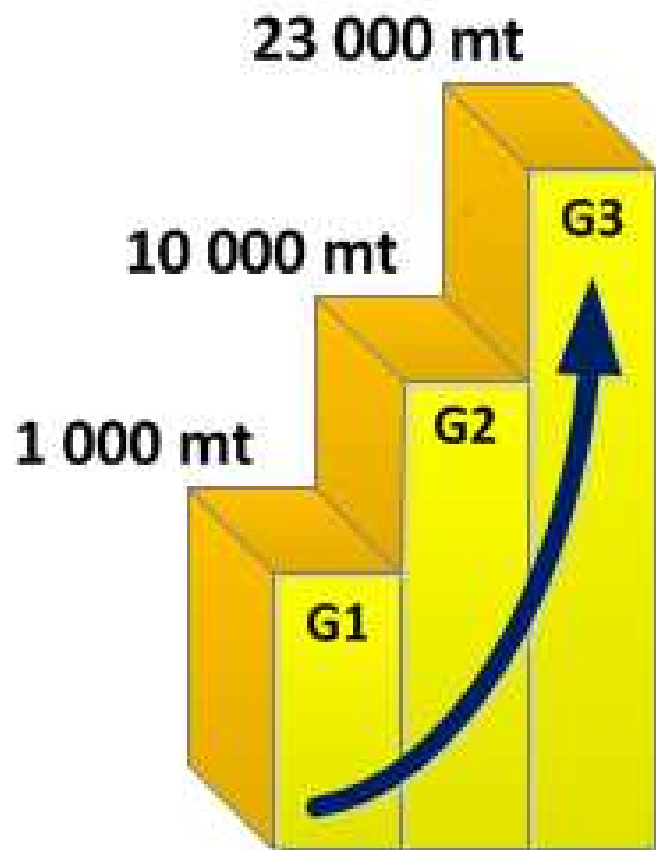
Topside Weight: < 1,000t

Simple topsides, marine focus

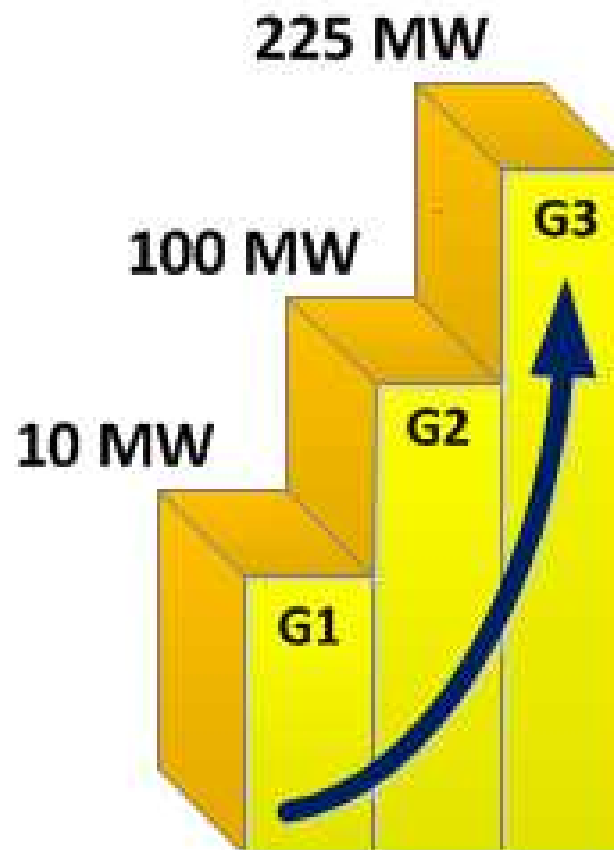




Generation 3 FPSO's - Measure of complexity



Topsides Weight



Shaft Power



Topside Technology Advances



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Technology Answers to reducing FPSO Topsides Costs: a few examples

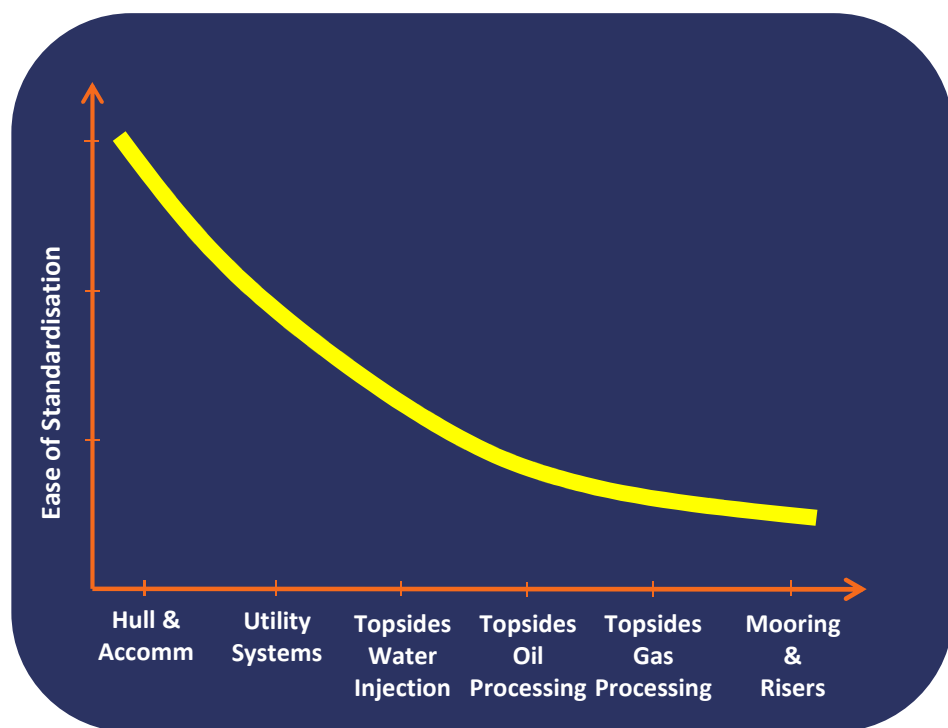
Weight Reduction

Standardisation

What?

Simplification

How?



Opportunities

- Standard FPSO and FPU Hulls
- Standard water injection modules
- Range of standard oil/water separation modules

Challenges

- Wide range of gas processing requirements:
 - GOR
 - Impurities
 - Pressures
- Mooring loads and riser interfaces: Field specific



Mooring Technology Advances

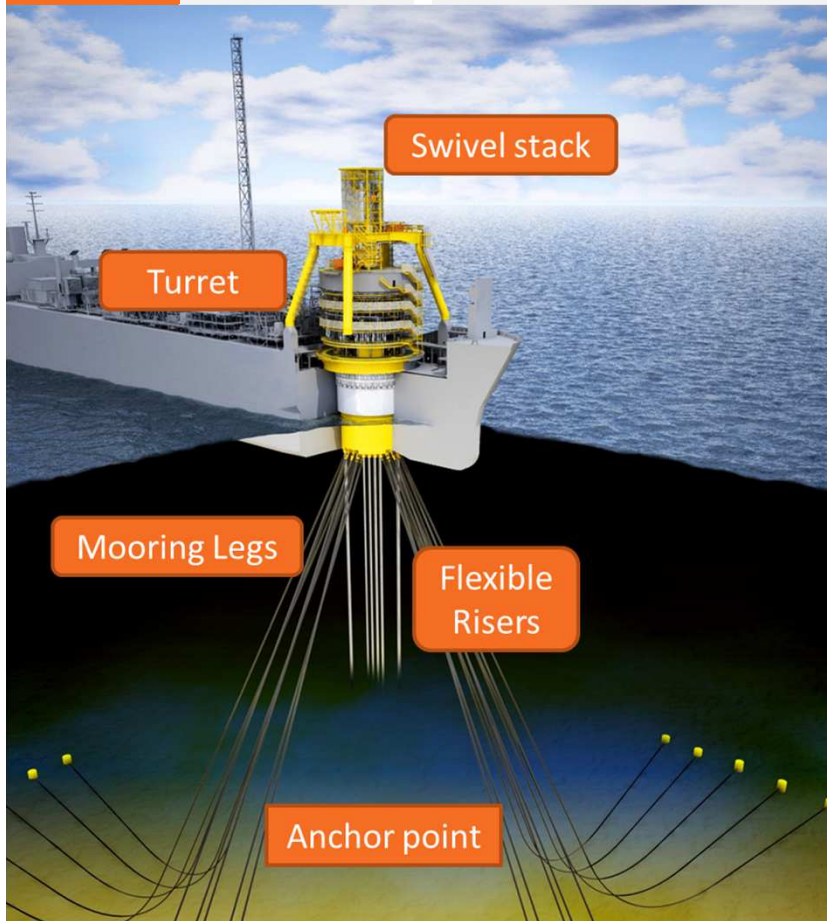


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58 deployed mooring systems by SBM



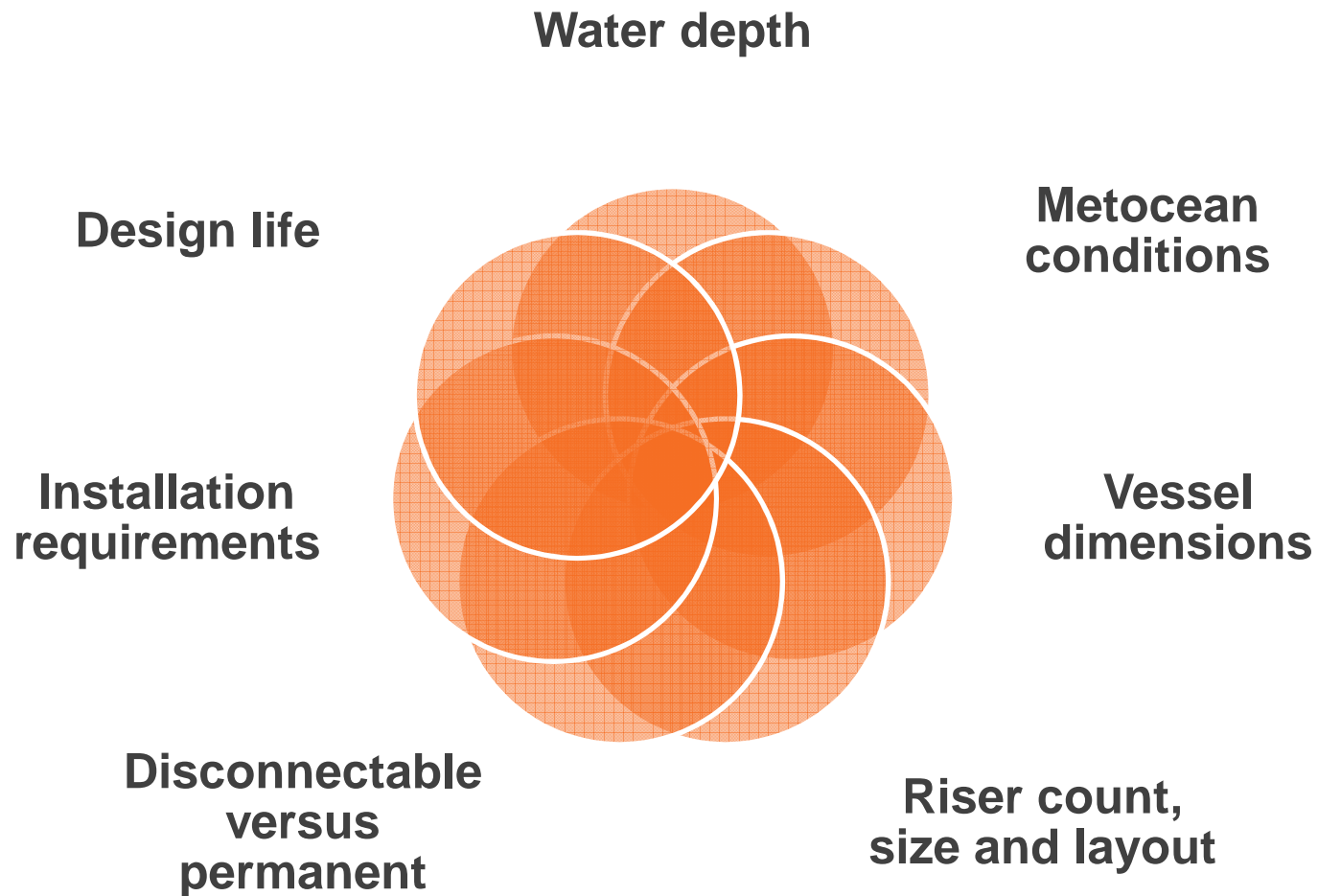
Turrets Moorings
47 delivered



Spread Moorings
11 delivered



Mooring System Selection Drivers





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External Turret: an economic solution when viable

Cantilevered turret

Rigid arm of cut bow

3 race roller bearing

21 Systems Delivered





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Top Mounted Internal Turret (TMIT): the heavy duty solution

Virtually no limit on riser number

Virtually no limit on mooring loads
(>5000t)

Bogies and radial wheels are standard components

Bogies and radial wheels are inspectable and replaceable

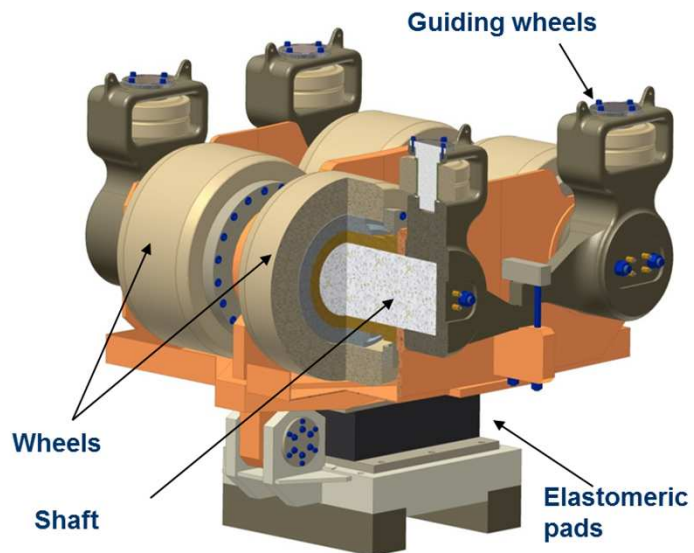
10 systems delivered





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Top Mounted Internal Turret (TMIT)



The bogie design is standard and patented by SBM

The number of bogies is selected to accommodate the design loads (N+1 philosophy)



Dry access in turret for inspection and maintenance



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World Deepest Production Unit: a technological prowess

Disconnectable FPSO in 2,900 meters water depth

Steel lazy wave risers on a disconnectable turret

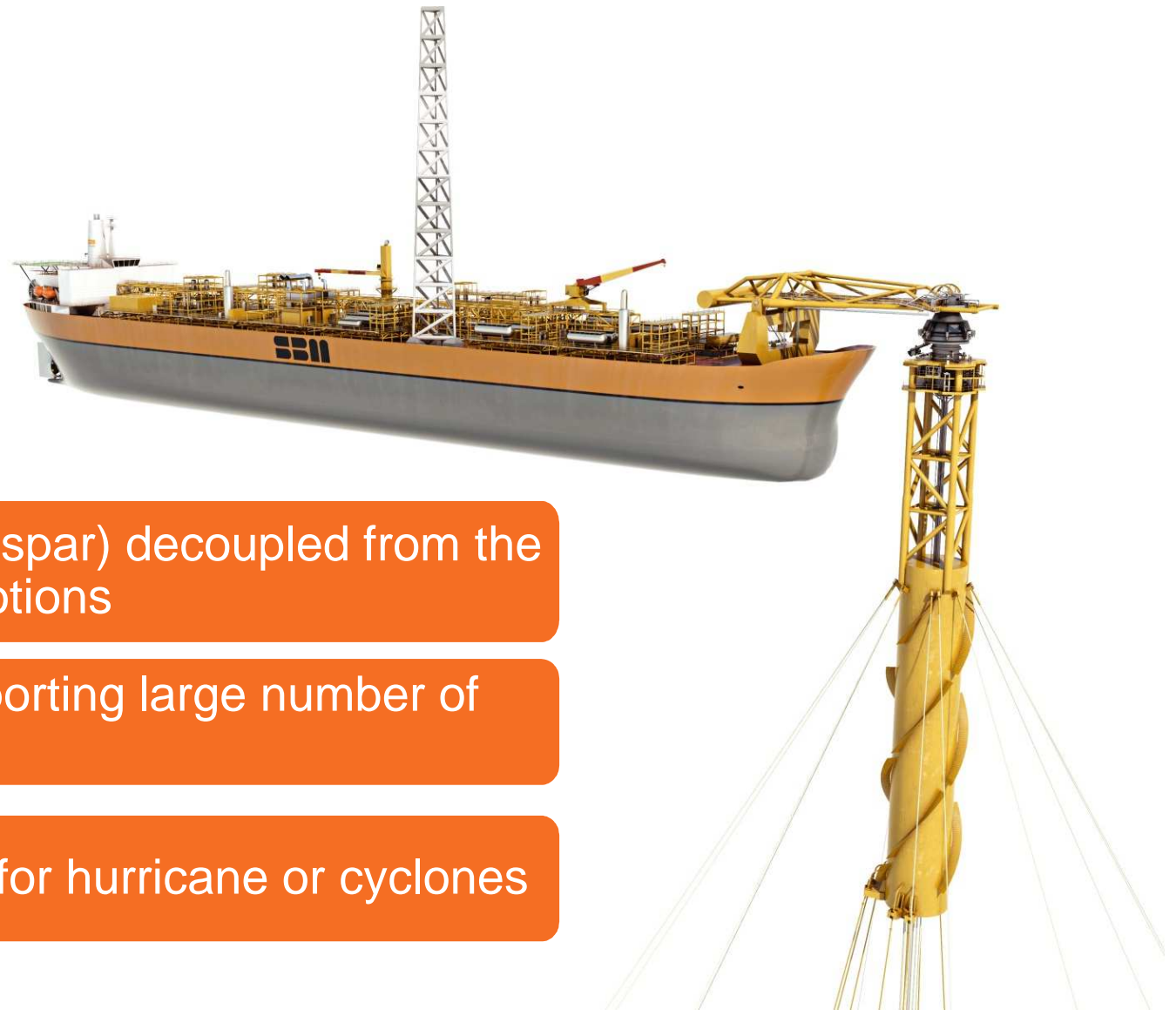
Large Mooring capacity thanks to SBM structural connector





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MoorSpar™ – Patented and Under Development



A slender buoy (spar) decoupled from the FPSO heave motions

Capable of supporting large number of steel risers

Disconnectable for hurricane or cyclones



Hull Technology Advances



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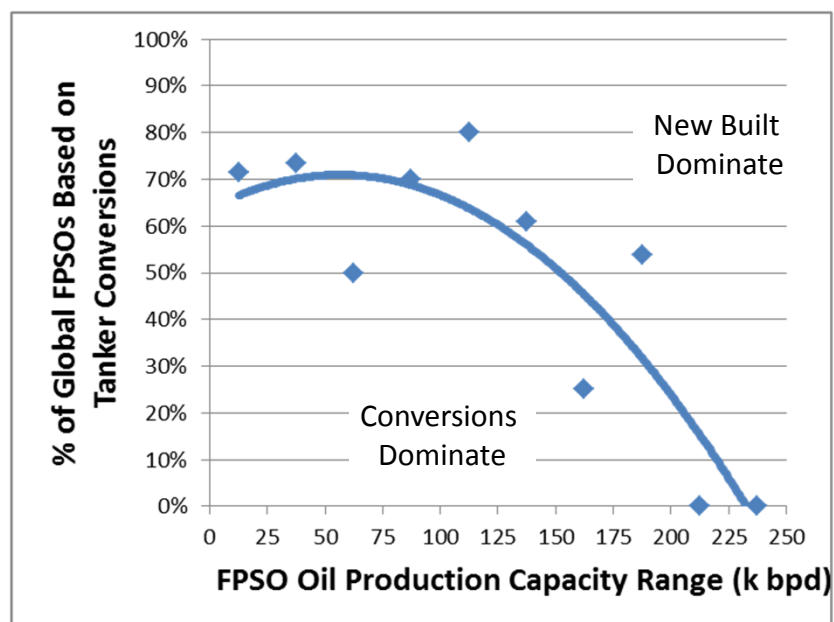


Tanker Conversions Dominate the Global FPSO Fleet

2/3 of FPSO projects are Conversions vs. 1/3 Newbuilt

Why Conversions ?

- Faster schedule
- Lower cost by retaining tanker components
- Flexibility in fabrication / integration locations



Conversions dominate in small to mid-scale FPSO oil capacity



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Execution Flow with hull conversion

Select & Purchase vessel



Topside Integration & Commissioning



Ready for Installation and Operation



Refurbishment & Conversion of the Hull



Topside Fabrication





Response to market trends

- Use more recent donor ships
- Twin Hull
- Corrosion analysis and mitigation

New built components

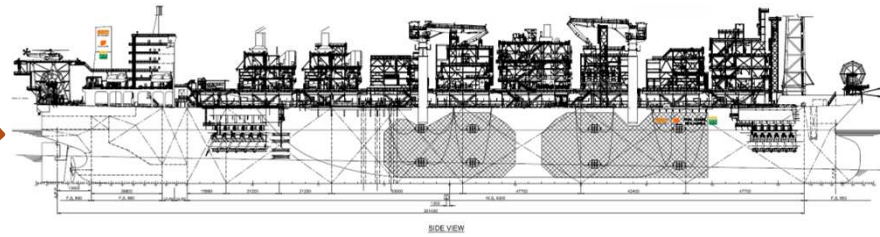
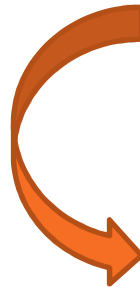
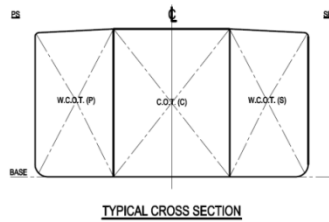
- Deck
- Accommodation

New built FPSO

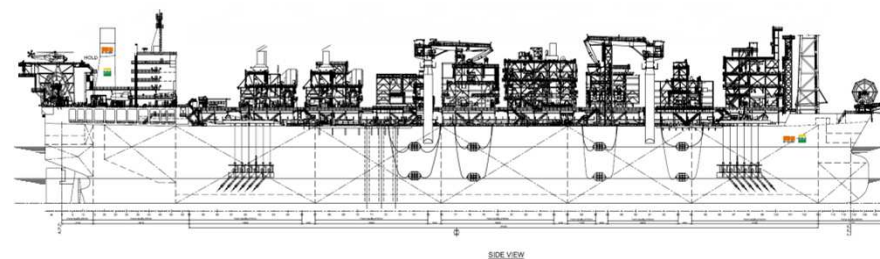
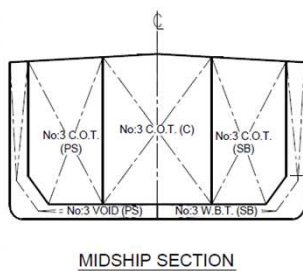
- Adapted VLCC
- Dedicated MPF®



Single hull

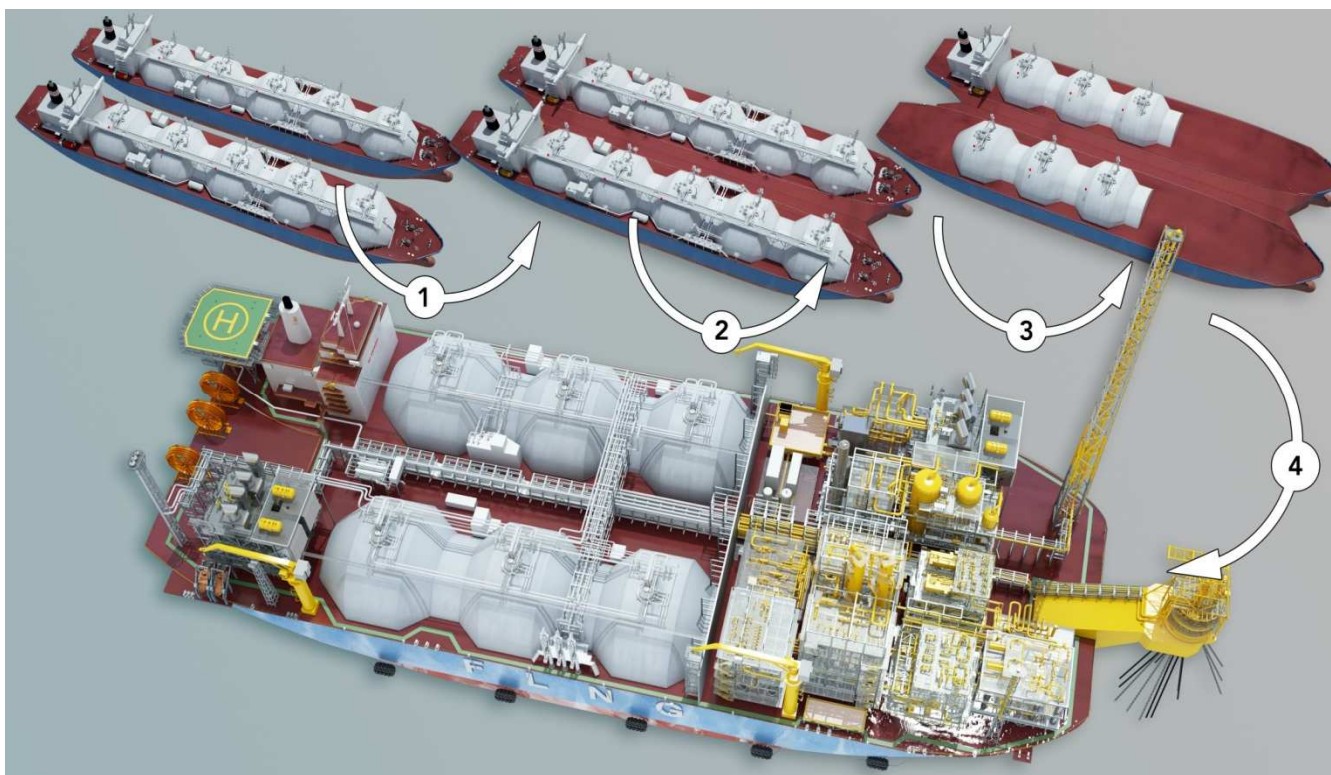


Double hull





Twin Hull FLNG (Floating LNG)



- Low CAPEX solution
- Project Execution flexibility
- Robust and inherently safe technology
- Extensive pre-feed work completed
- Allows local content solutions
- Can be offered as Lease & Operate



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New built Deck: renewal and outfitting

New built
components





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New Built Accommodation

New built
components





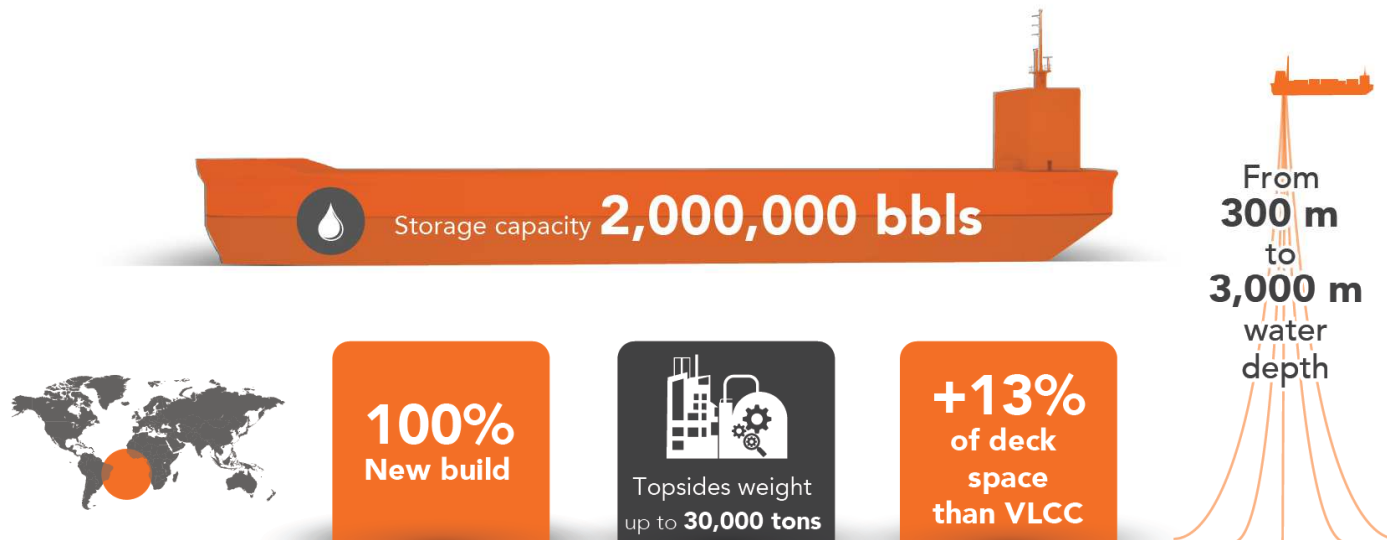
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Newbuilt SBM Hull for next generation projects

New built
FPSO

Dedicated new-built FPSO's (MPF®):

- Extra large storage capacity
- Ready for heavy topsides (G3 and future G4 FPSO)
- Better deck space vs VLCC
- Ready for severe environments
- Long design life (>25 years)





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Newbuilt SBM Hull for next generation projects

New built
FPSO

SBM Multi Purpose Floater[®]

✓ No conversion phase

✓ No dry dock after delivery

✓ 3 Mooring Solutions





Conclusions





TOPSIDES

- Important steps of technology validation have been reached recently waiting for application to new Projects

MOORING

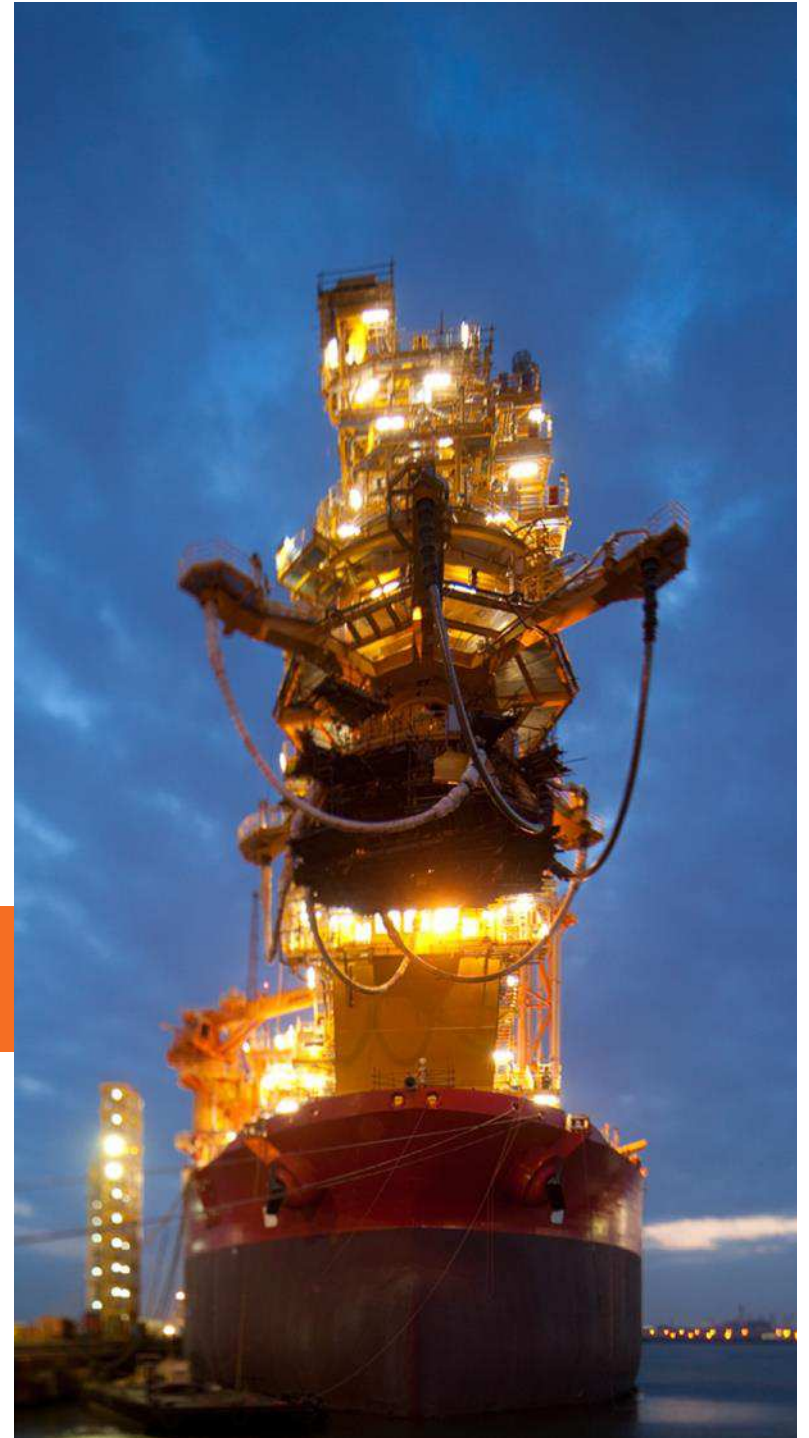
- SBM technology is deployed from small turret solutions from shallow water up to deepest fields with internal or spread moored solutions

HULL

- A range of solutions for conversion and new built hulls are available depending on Clients needs and requirements

Questions ?

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Current SBM Lease Fleet

15 FPSOs, 2 FSOs, 1 Semi-Sub, 1 MOPU – 170+ years of operations

Average remaining lease duration: 10 years (excluding extension options)

