An Overview of SBM Mooring Systems
OTEQ Conference
Cédric STELLA 10 May 2012, Porto
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• Development of technologies for marine renewables
SBM Offshore Introduction
Corporate Profile

- SBM Offshore N.V.  
  Dutch Public Company
- 2011 Turnover  
  $3.1 Billion
- Employees  
  6,200
- In business since  
  1959
- Cumulative operating experience  
  + 200 years
- Average production uptime  
  99%
- Total throughput  
  1,000,000 Barrels per day
SBM Offshore Introduction
SBM Offshore Group Main Offices

The Company
- 4 Project execution centres
- 9 Shore bases
- 4 Representative offices
- 6,220 Employees
SBM Offshore Introduction

Company Structure

SBM Offshore NV
All of the following companies are 100% owned by SBM Offshore NV

SCHIEDAM
SBM Gusto MSC
Eng. Process, crane barge, Semi-sub, DP vessels, Jack-up modules...

MONACO
Single Buoy Moorings Inc
EPCI contracts for FPSO, Sales
SBM Offshore Services
EPCI contracts for Mooring Systems, After Sales, Installations
SBM PC
Operations of SBM Offshore leased FPSO’s.

HOUSTON
SBM Atlantia Inc
Wheel and Rail Buoys, Deep Water Platforms, etc. Sales and After Sales

KUALA LUMPUR:
SBM Malaysia Sdn Bhd
EPCI FPSO’s, Sales and After Sales
SBM Offshore Introduction

SBM Offshore Activities & Products

Turnkey Supply & Installation

Floating (Production) Storage and Offloading Systems
F(P)SOs

Floating Production Units
TLPs / Semi-Submersibles

Wide range of Mooring Systems
Single Point Mooring Terminals

Drilling Units
Turnkey or Design & Components

Offshore Contracting
Services / Overhauls / Spare Parts
SBM Offshore Introduction

SBM Offshore’s Lease Fleet

Norway
- MOPUstor / YME

Canada
- MOPU / Deep Panuke

USA
- Semi-Sub / Thunder Hawk

Congo
- LPG FSO / Nkossa II

Brazil
- FPSO / Brasil
- FPSO / Marlim Sul
- FPSO / Espirito Santo
- FPSO / Capixaba
- FPSO / Cidade de Anchieta
- FPSO / Cidade de Paraty
- FPSO / Cidade de Ilhabela

Equatorial Guinea
- FPSO / Aseng

Asia
- FSO / Yetagun
- FPSO / Kikeh

Angola
- FPSO / Mondo
- FPSO / Saxi Batuque
- FPSO / Kuito
- LPG FPSO / Sanha
- FPSO / Xikomba
- FPSO Falcon

- Under Construction
- Lease in operation
- Laid up
SBM Mooring Systems Overview - CBM

• Conventional Buoy Mooring System (CBM)

When no tanker is connected, the hose will be abandoned on the seabed

• Mooring function (assistance of a service vessel) achieved by a spread mooring system - x4 mooring buoys secured to the seabed. Each buoy incorporates a quick release mooring hook and navigation aids.

• Transfer of fluids function: achieved by a subsea hose connected to a Pipeline End Manifold (PLEM)
• Single Point Mooring Systems (SPM)

• In opposition to a fixed heading system like CBM, the SPM allows the moored tanker to weathervane. With this principle, the tanker offers to environment (waves, current & wind), the least resistance, thus the system can operate in much higher conditions than the previous systems.

• The SPM system reacts against the force created by the environment on the hull & accommodations of the moored tanker by a set of 2 spring effects, the nylon mooring hawser & the buoy mooring legs, which are installed in a Catenary configuration.
SBM Mooring Systems
Overview - SPM

• Catenary Anchor Leg Mooring System (CALM Buoy)

The floating buoy comprises:
• A fixed part, anchored to the seabed by an array of anchor legs that are to fixed anchor points.
• A rotating part from where one or two mooring hawsers that hold the tanker are connected. This turntable is mounted on top of the buoy by means of a slewing bearing and allows the tanker to weathervane freely.
SBM Mooring Systems Overview - SPM

• Single Anchor Leg Mooring (SALM)

• Fixed Tower Single Point Unit (FTSPM)

Piled Tower (FTSPM)

Floating Loading Platform (FLP)

Articulated Loading Platform (ALP)
SBM Mooring Systems
Overview - Turret

• INTEGRATED Mooring SPM into vessel = TURRET

The vessel is anchored to the seabed via the Turret by means of mooring legs (either chain legs or composite legs [assembly of chains and cables]) and anchor points.

The fluids from the subsea wells / production facilities flow through flexible risers to the swivel stack.
SBM Mooring Systems
Overview - Turret

• 2 types of turrets: external or internal, both for the same purposes.

EXTERNAL
- mild to medium environments
- Limited numbers of risers (up to 20 according to dia.)

INTERNAL
- harsh environments (North sea)
- Large number of risers

EXTERNAL DISCONNECTABLE

INTERNAL DISCONNECTABLE
SBM Renewables

**Offshore wind**

*Schiedam (NL)*
- Design of Transportation & Installation vessels, cranes and jack-up systems
- Sale and licensing of proprietary floater design
- Joint Industry Project on floating wind design software development

**Ocean Thermal Energy Conversion**

*Houston (US)*
- First study completed in 2003
- Concept development of 10MW prototype plant
- Development of Cold Water Pipe, mooring and floater technology

**Wave energy**

*Monaco (MC)*
- Development of wave energy conversion technology
- Evolvement of concepts
- Significant part of Company R&D budget since 2005
- Dedicated staff
THANK YOU

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