



Short Course on Deepwater Technology

LEMIGAS – CCOP – Petrad

Carita, Banten, Indonesia
13-14 December 2005

Prof. dr. Arnfinn Nergaard

University of Stavanger
Smedvig Offshore



Petrad - Deepwater Technology

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- Part VIII Authority and Management issues





Part I

History and trends in deepwater development

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I - History and trends in deepwater development

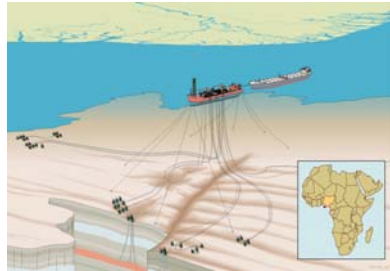
Part 1 Definition and clarifications

Part 2 From Brazil to the Golden Triangle
to Ormen Lange





Bonga field development



- Transportation system
- Production unit
- Flowlines, umbilicals and risers
- Subsea production system
- Wells



Technology vs time vs WD

Access to deep resources

requires

technology development

in terms of

- Drilling technology
- Field development technology
- Intervention technology

The drilling pioneers

Project Mohole
1958 - 1966

The American
Miscellaneous
Society

Deep Sea
Drilling Program
(DSDP)
1968 - 1985

Ocean Drilling
Program (ODP)
1985 - 2003

Integrated
Ocean Drilling
Program (IODP)
Oct. 2003



Cuss 1
USA



Glomar Challenger
USA
F, UK, Jp, USSR (1975)



Joides Resolution
(Sedco/BP 471)
20 countries



Chikyu
+ US conversion
Japan, USA

Oil industry historic perspective

- Oil industry 1850 155 years
- Offshore industry 1950 55 years

Deepwater industry

- Exploration 1975 30 years
- Production 1995 10 years

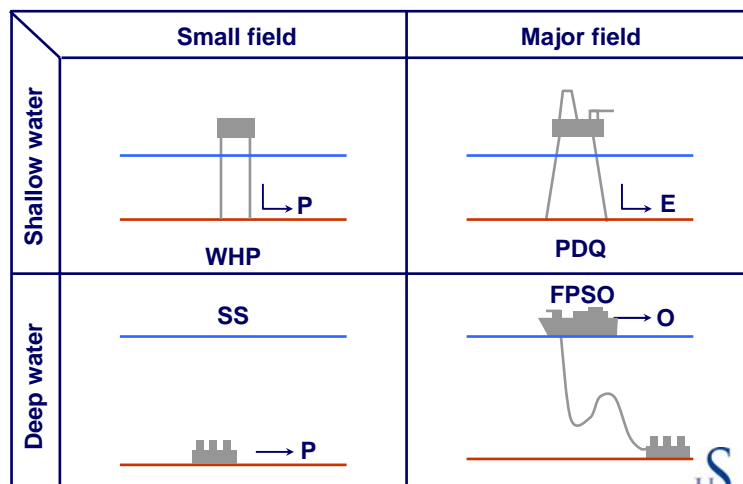


Deepwater definition

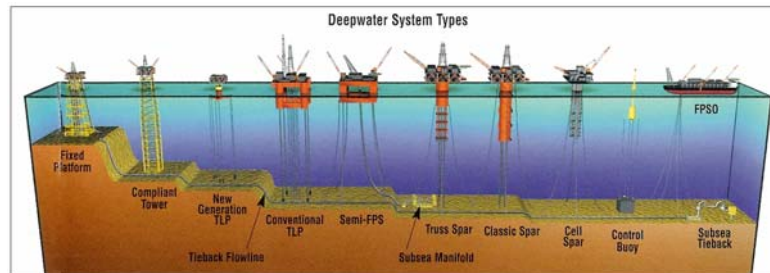
- Deepwater + 3000 ft (900 m)
- Ultra deepwater + 7000 ft (2100 m)
- Exploration today 10 200 ft 3100 m
- Production today 8000 ft 2400 m



Four major development concepts



Deepwater System Types



Source: Offshore Magazine

Six critical technology elements

- Vessel positioning
- Remote control
- Risers and umbilicals
- Installation methods
- Intervention methods
- Inspection, maintenance and repair

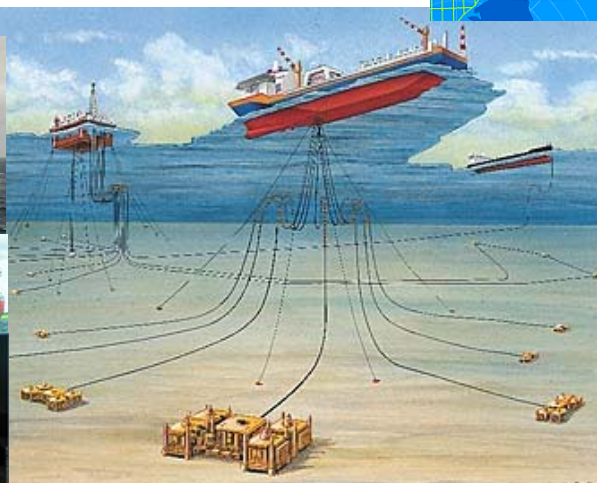


Three different concept categories

- **With surface units**
 - subsea wells (FPSO, FPU)
 - dry wells (TLP, Spar)
- **Hybrid development**
 - deep subsea wells tied back to shallow platform (hub platform)
- **All boy's dream**
 - subsea to shore - S2S

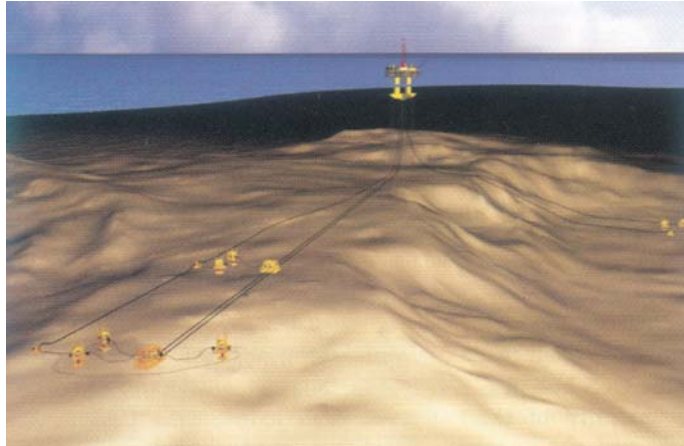


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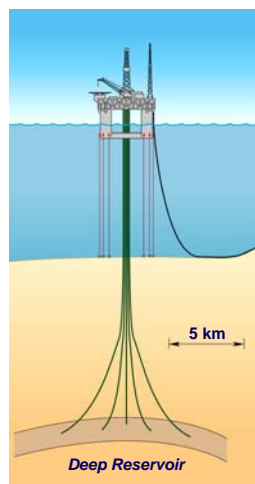




Marco Polo deepwater hub platform



Deepwater TLP development



Features

- Medium/deep reservoir
- Centralised wells
- Surface trees
- Integral workover facilities
- Pipeline/FSO for export

Technological breakthrough - Subsea to shore

Prerequisites

- Reservoir assessment
- Modelling, simulation, training
- Remote instrumentation
- Online production control
- Intervention & maintenance
- Subsurface & facilities integration

