FPSOs

Concordia Consultancy Ltd

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FPSOs

1. Introduction
2. Types of FPSO
3. Mooring FPSOs
4. Risks Associated With FPSOs
5. Environmental Factors
6. Repair Challenges
7. Technical & Engineering Observations
8. Future of FPSOs

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Good Morning !

Please raise your right hand if you think San Diego is a suitable choice of venue for an IUMI conference?

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Keep your hand up if:

You have heard of FPSOs before?

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Keep your hand up if:

You know what FPSO stands for?

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Keep your hand up if:

You have ever been involved with FPSO claims before?

1. INTRODUCTION

What is an FPSO...?

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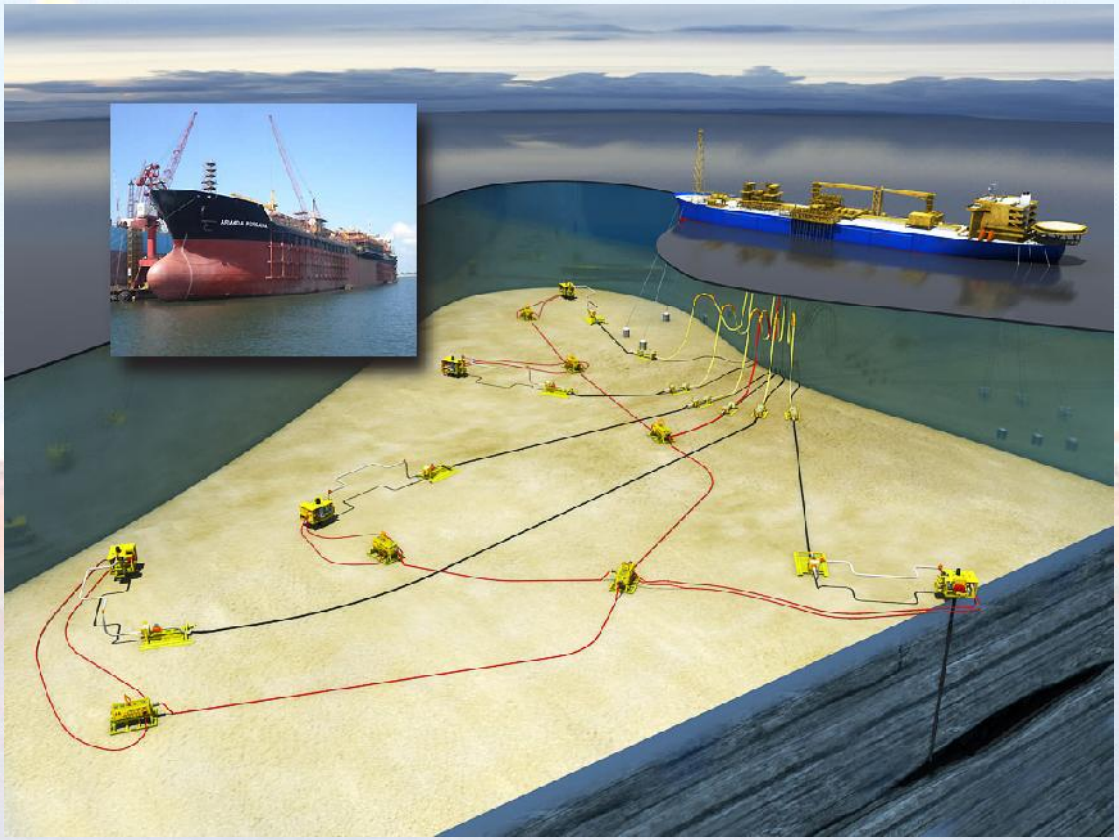
What Does an FPSO Do?



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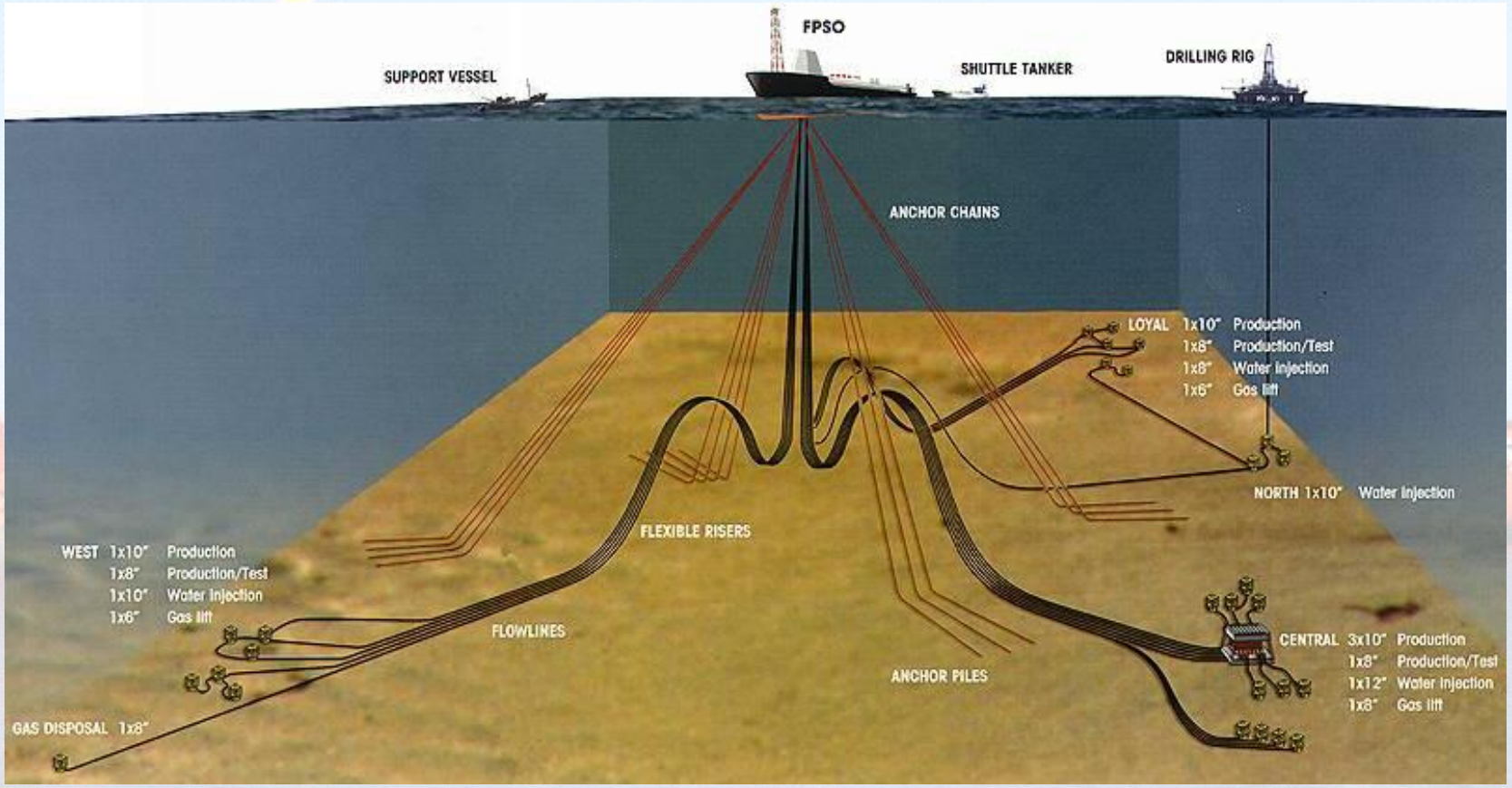
FPSO Subsea Arrangements



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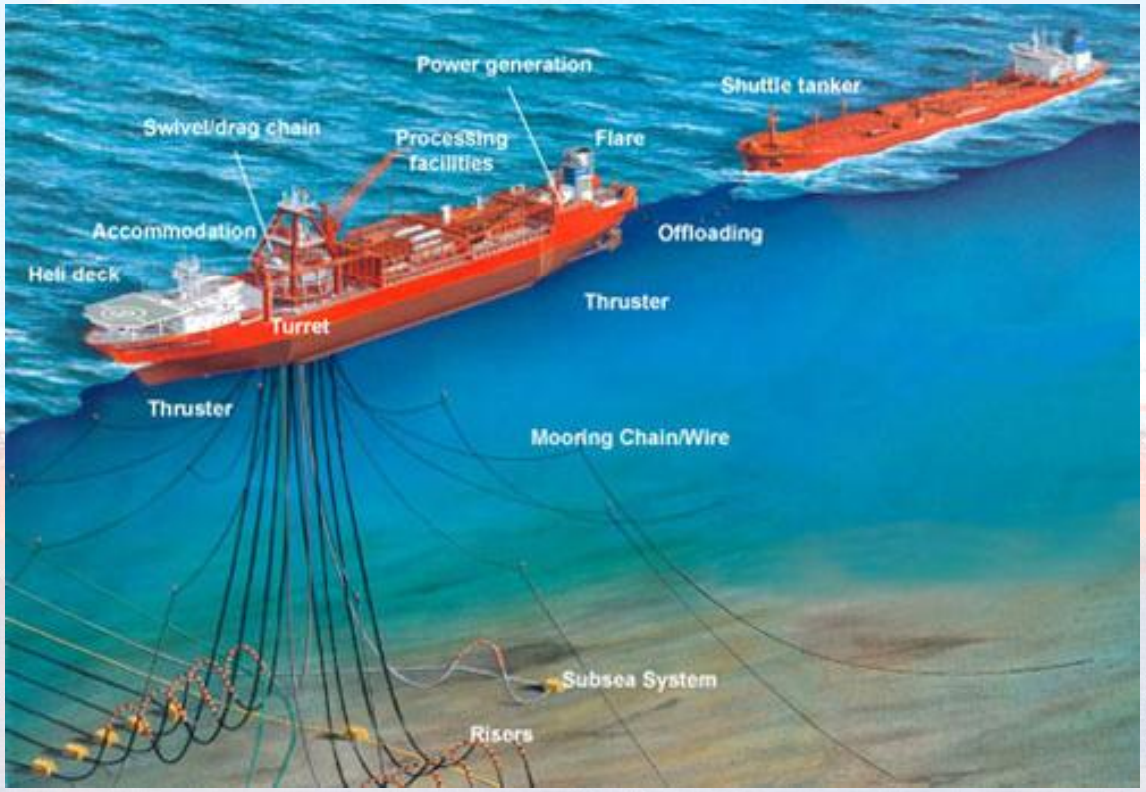
Why use an FPSO?



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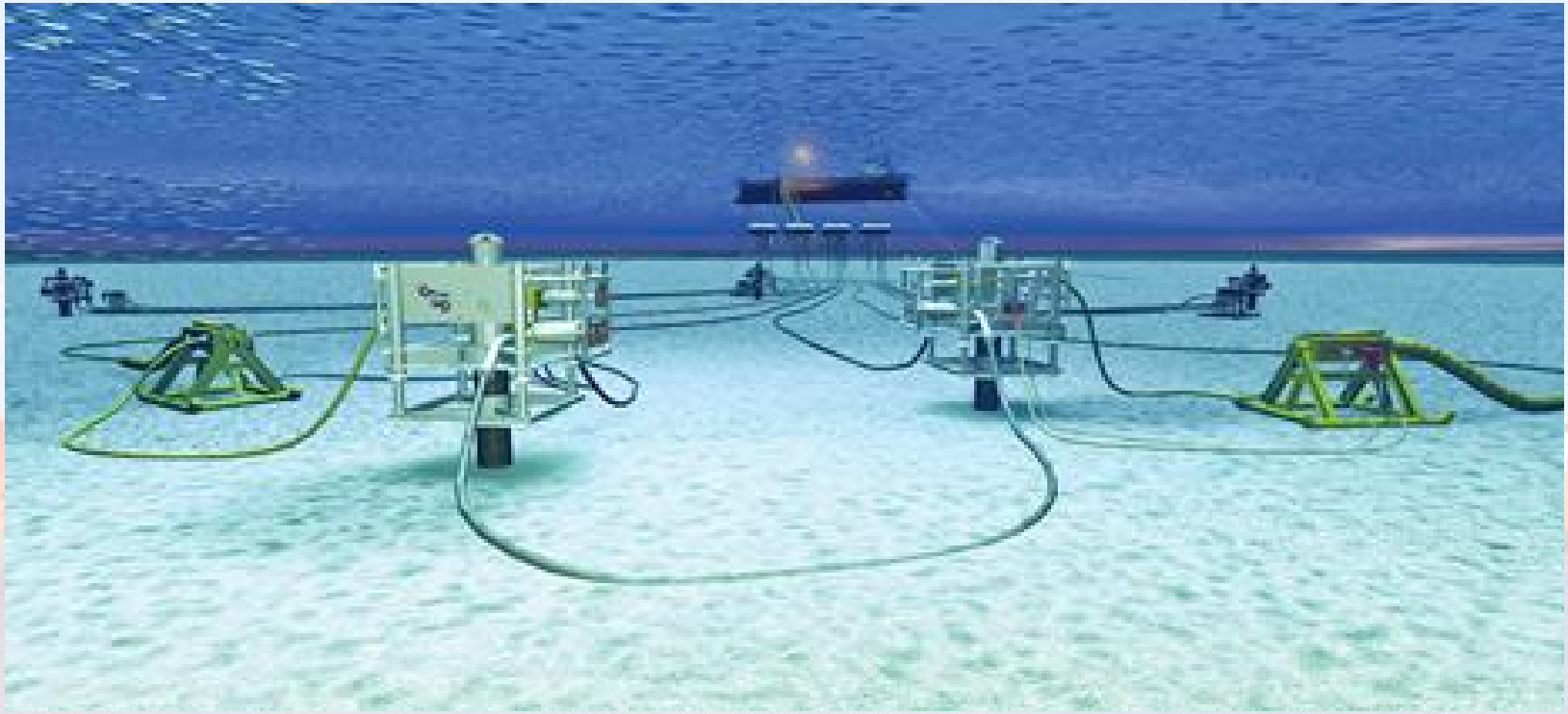
Marginal Field Exploration



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FPSO Advantages

Marginal field exploitation

Ability to disconnect

Operate in remote locations

Flexibility to move to a new field

Oil storage capability

Good safety record to date

Can be leased = lower up front costs

Cost amortised over several fields

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Types of Processing Units

They look the same but – the risks are different

2. Types of FPSO

Early FPSOs

The first oil FPSO was the Shell Castellon, built in Spain in 1977

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FPSO “Armada Perkasa”

FPSO “Crystal Ocean”

FPSO “Pioneer”

FPSO “Girassol”

FPSO “Alisa Craig”

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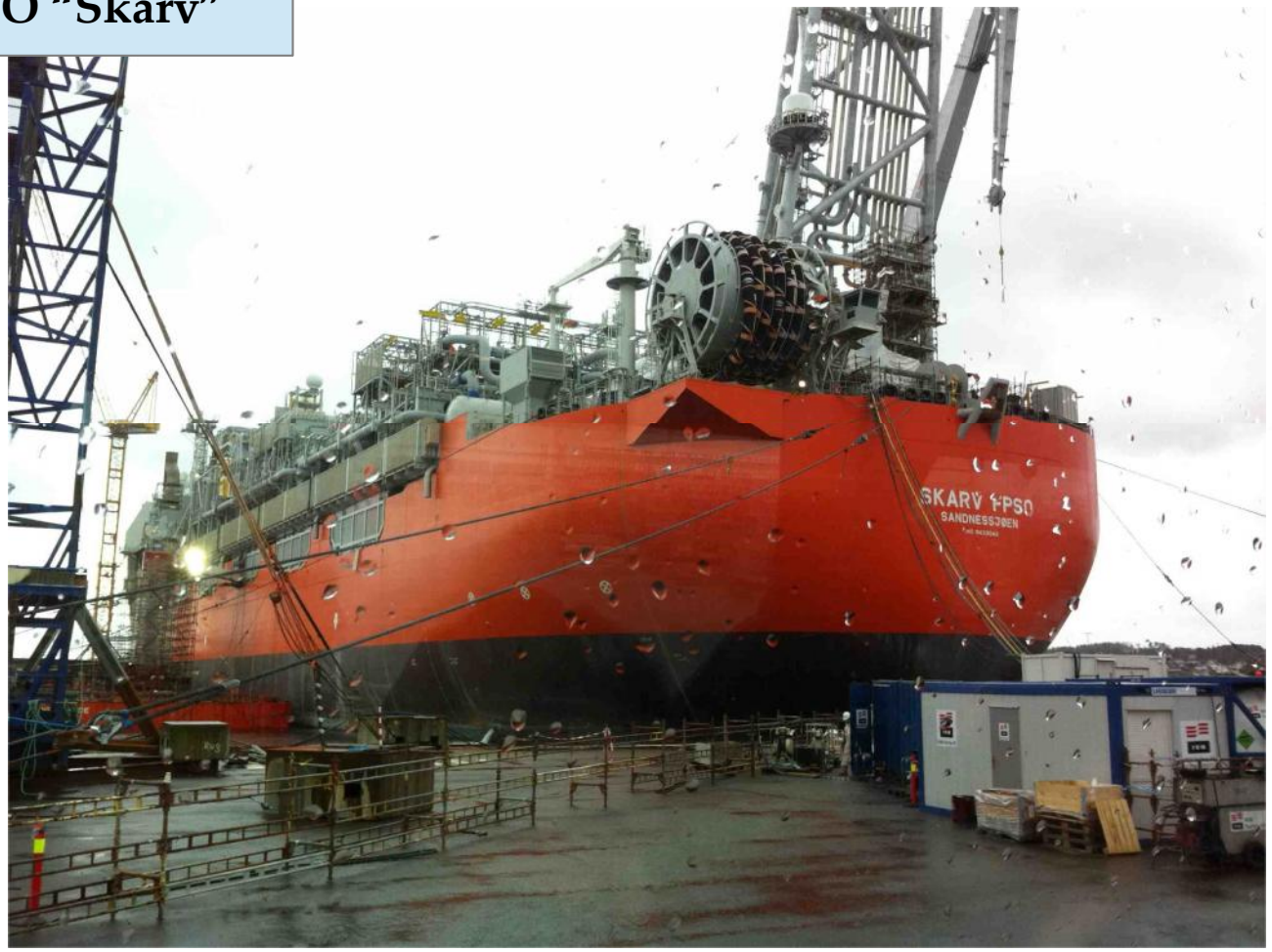
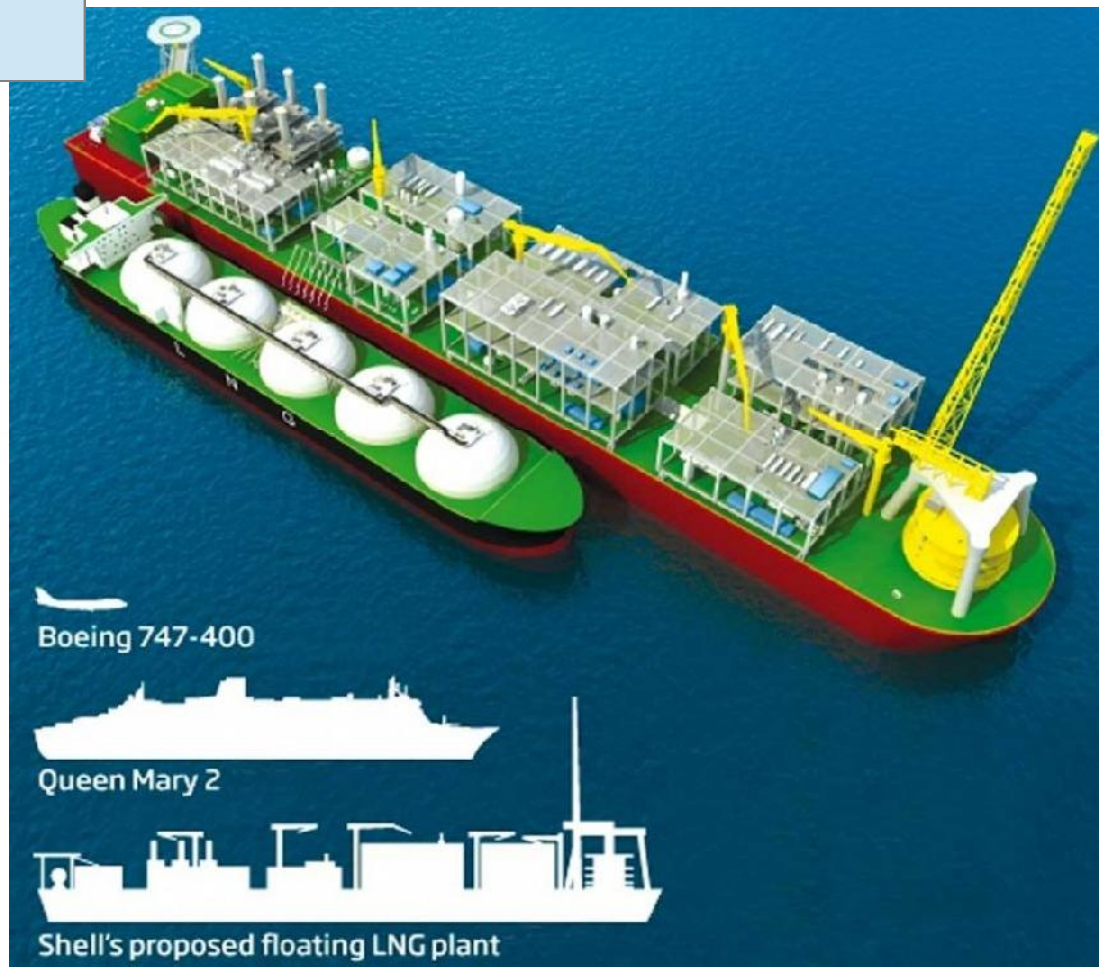
FPSO “Kizomba”

FSO “Khalij-E-Fars”

FPSO “Skarv”

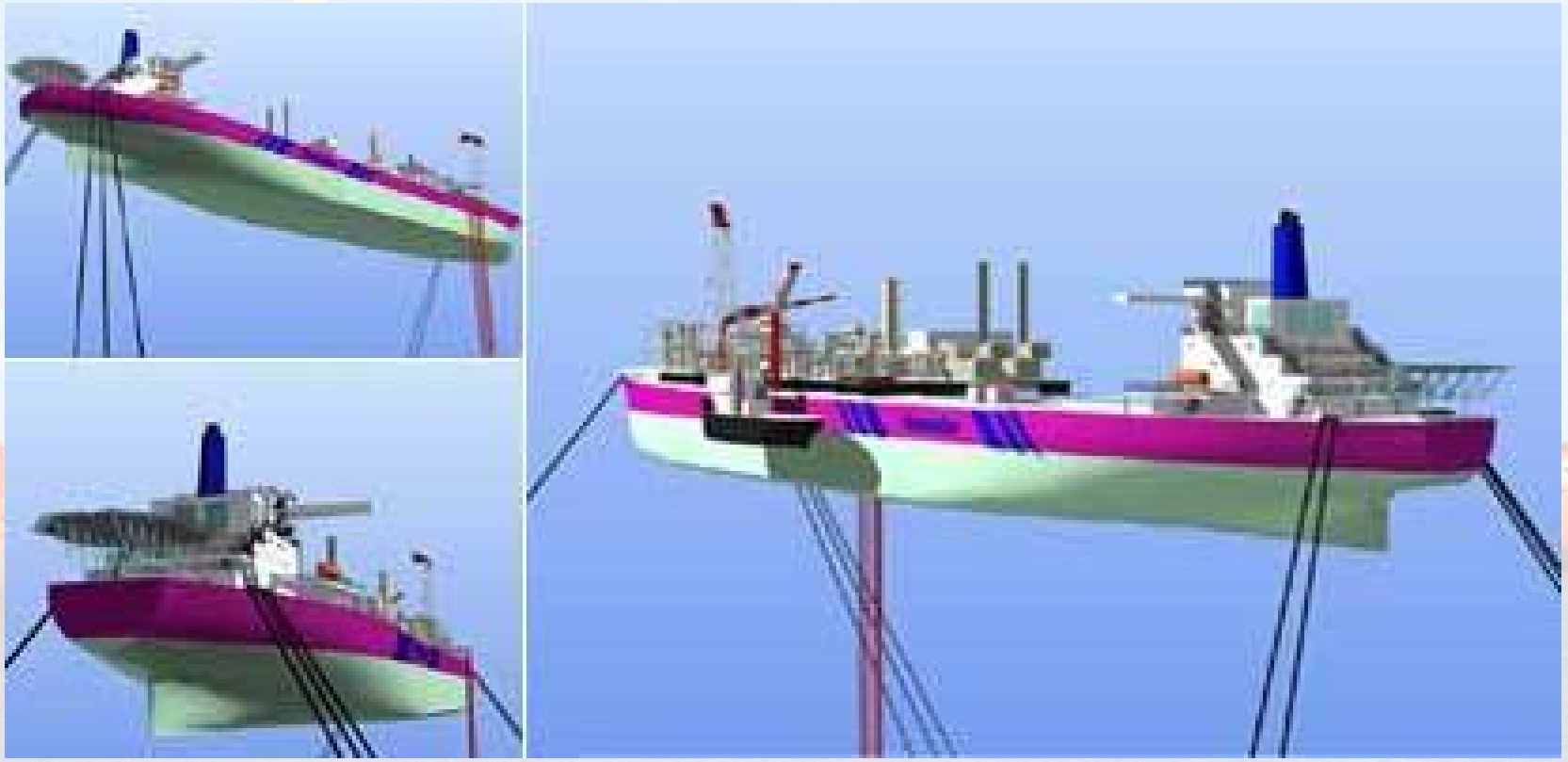


"Shell Prelude" FLNG



3. Mooring FPSOs

Spread Mooring



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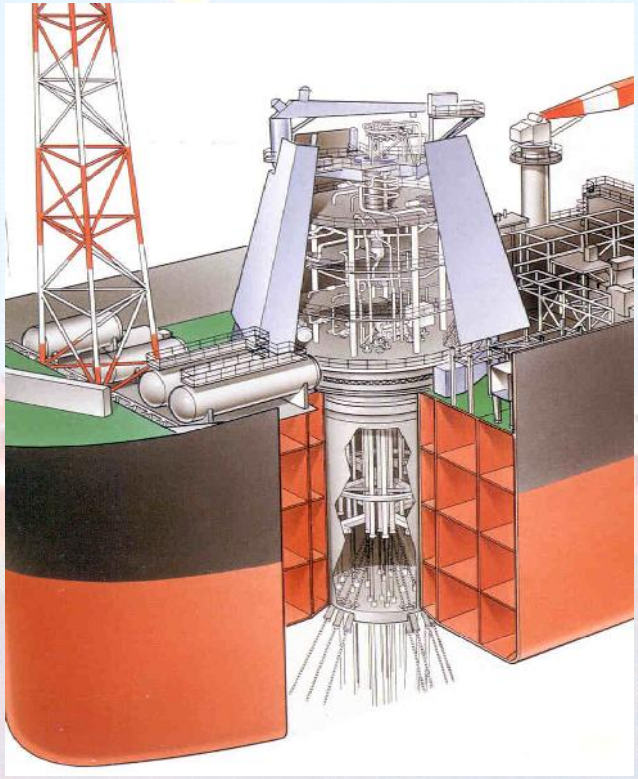
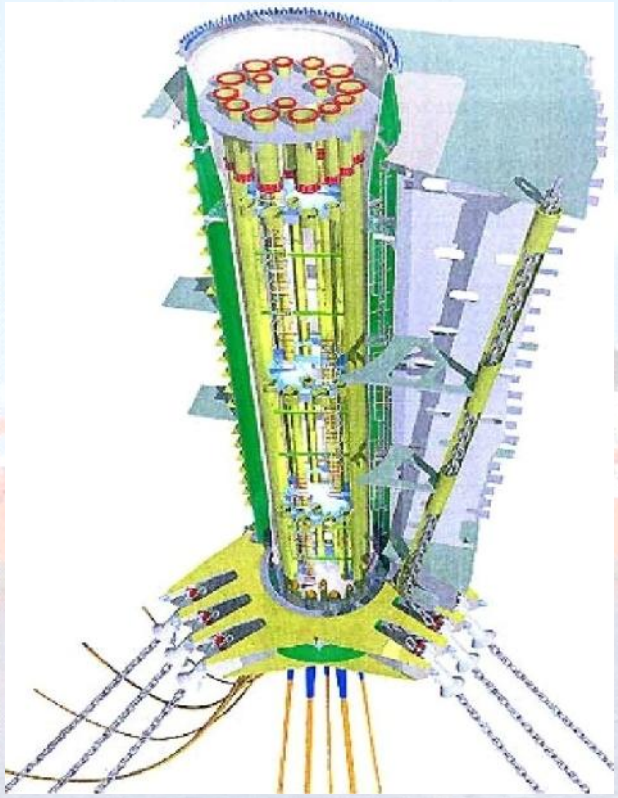
FPSO Mooring Systems





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FPSO Mooring Systems

Single Point Mooring (SPM) Systems

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FPSO Mooring Systems

Tugs

Dynamic Positioning

Main engine propulsion

Bow / Stern Thrusters

Hold back moorings

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FPSO Mooring Systems

Dynamic Positioning (DP)

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Risers

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Risers

Emergency Disconnect Damage Risks

Maximum Bend Radius

Uncontrolled Disconnections

Pollution Risk

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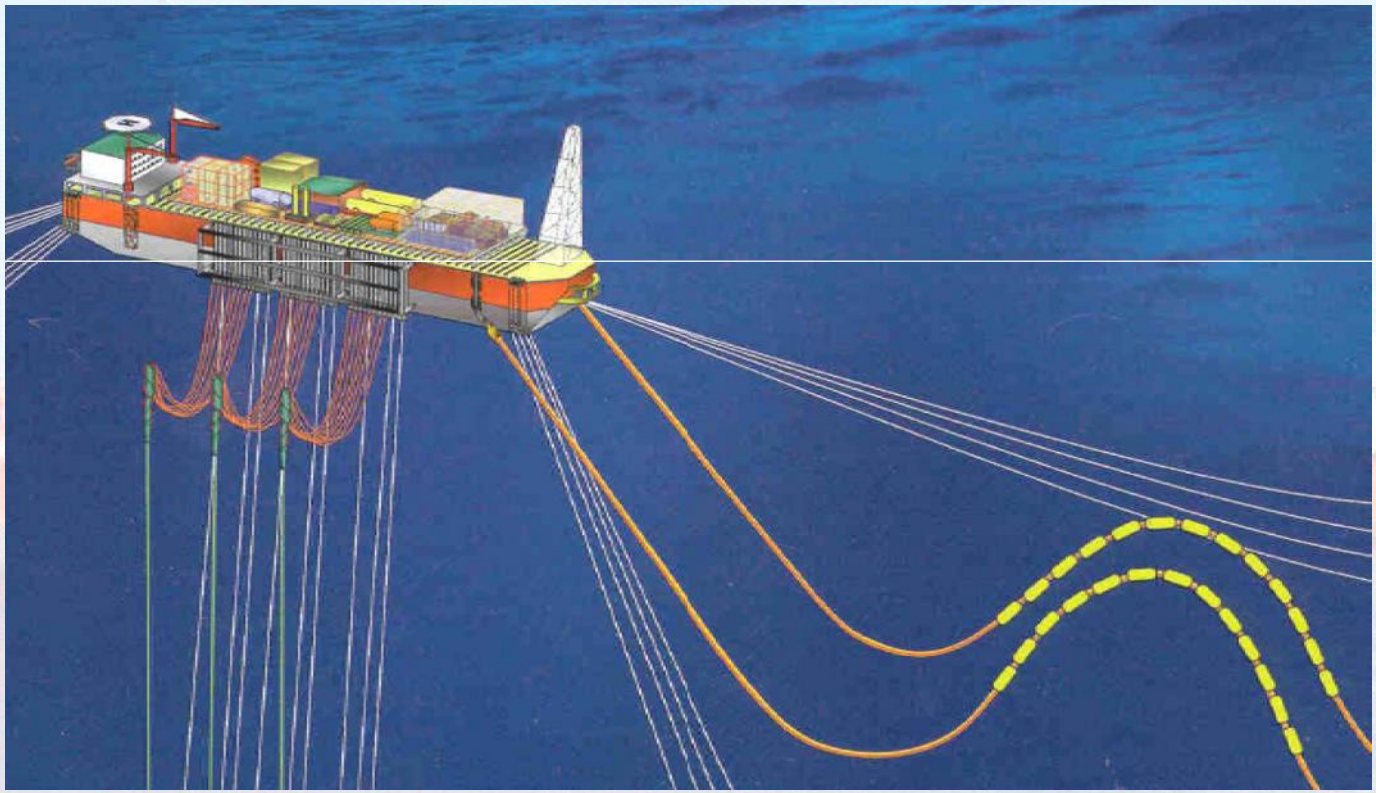
Deep Water Riser Technology



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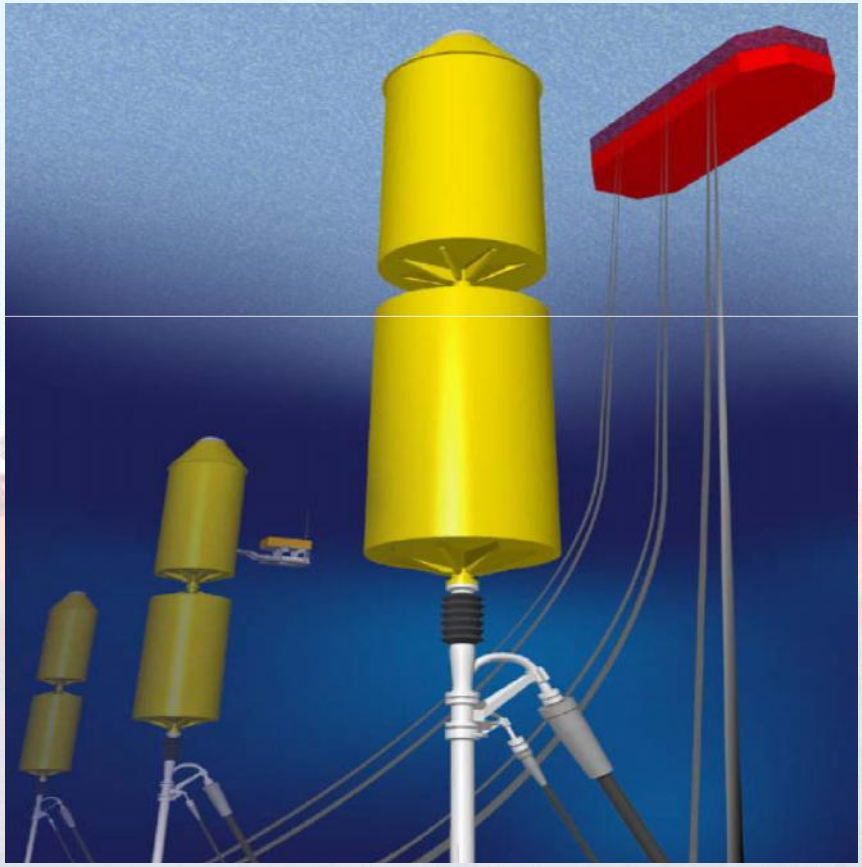
Deep Water Riser Technology



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Deep Water Riser Technology

4. Risks Associated With FPSOs

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Risks

Impossible to remove risk

Important to identify risks and manage / mitigate

Humans involved

No blame culture should be adopted

Near misses should be reported and recorded

Risks

Hull structural damages, hull envelope
COT & WBT, plating and stiffness
Corrosion, fatigue, contract incidents
Power generation and compressor systems
Paint coating systems (external & internal)
Risers
Turret system including swivels and chain table
Mooring system damages
Subsea equipment
Offloading Equipment
Operational Errors

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Operational Errors

Captain and station keeping

Offloading hose entanglement

Shuttle tanker contact damage

Crew language barriers

5. Environmental Factors

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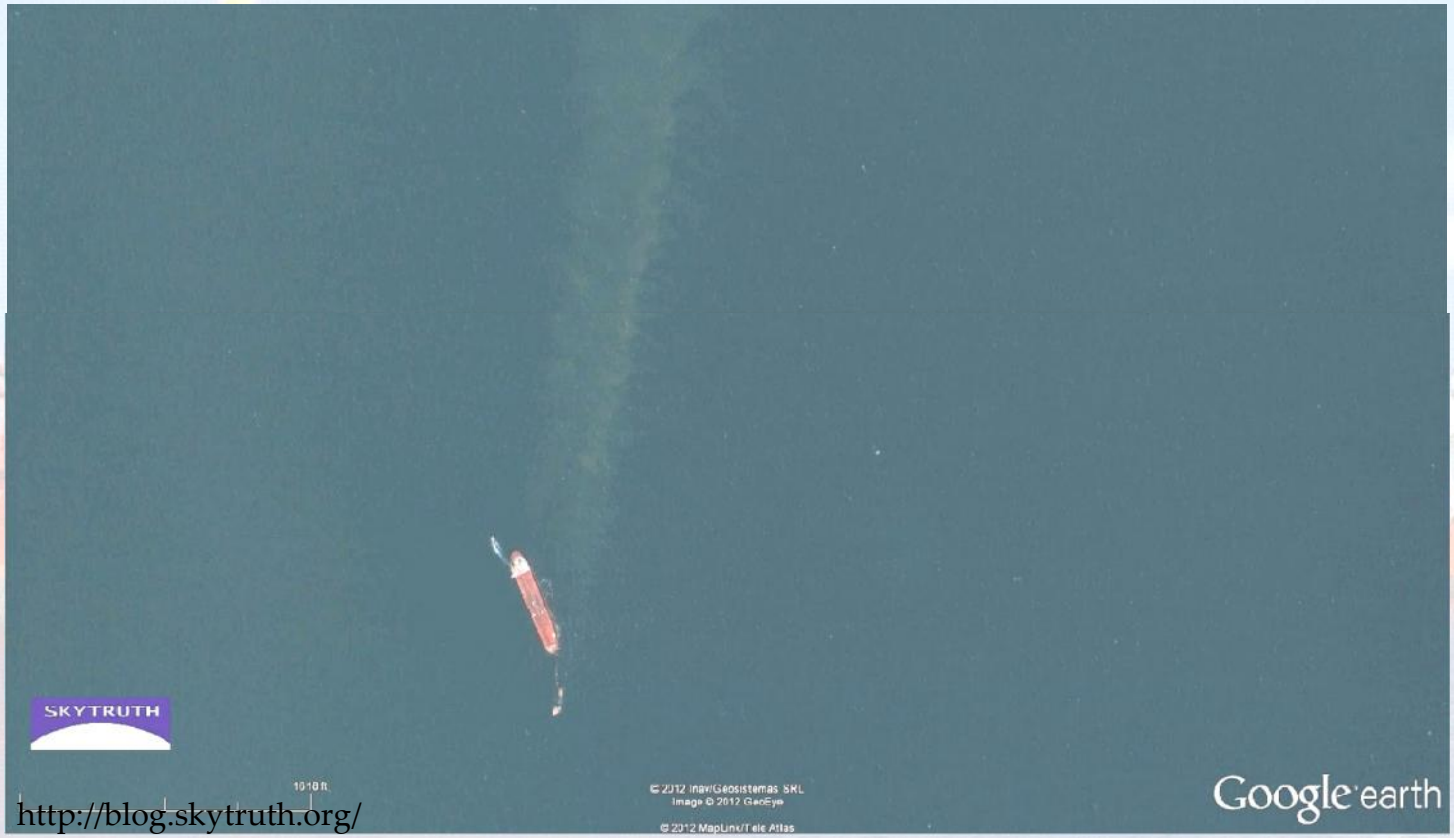
Environmental Factors



http://blog.skytruth.org/

6. Repair Challenges

Offshore Repairs

Offshore intervention $,$$$,$$$!!!

Heavy Lifting Equipment Offshore is costly

In service repairs vs production outage

Offshore Repairs increases headcount on FPSO

Accommodation problems - Beds!

Temporary Flotels

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7. Technical & Engineering Observations

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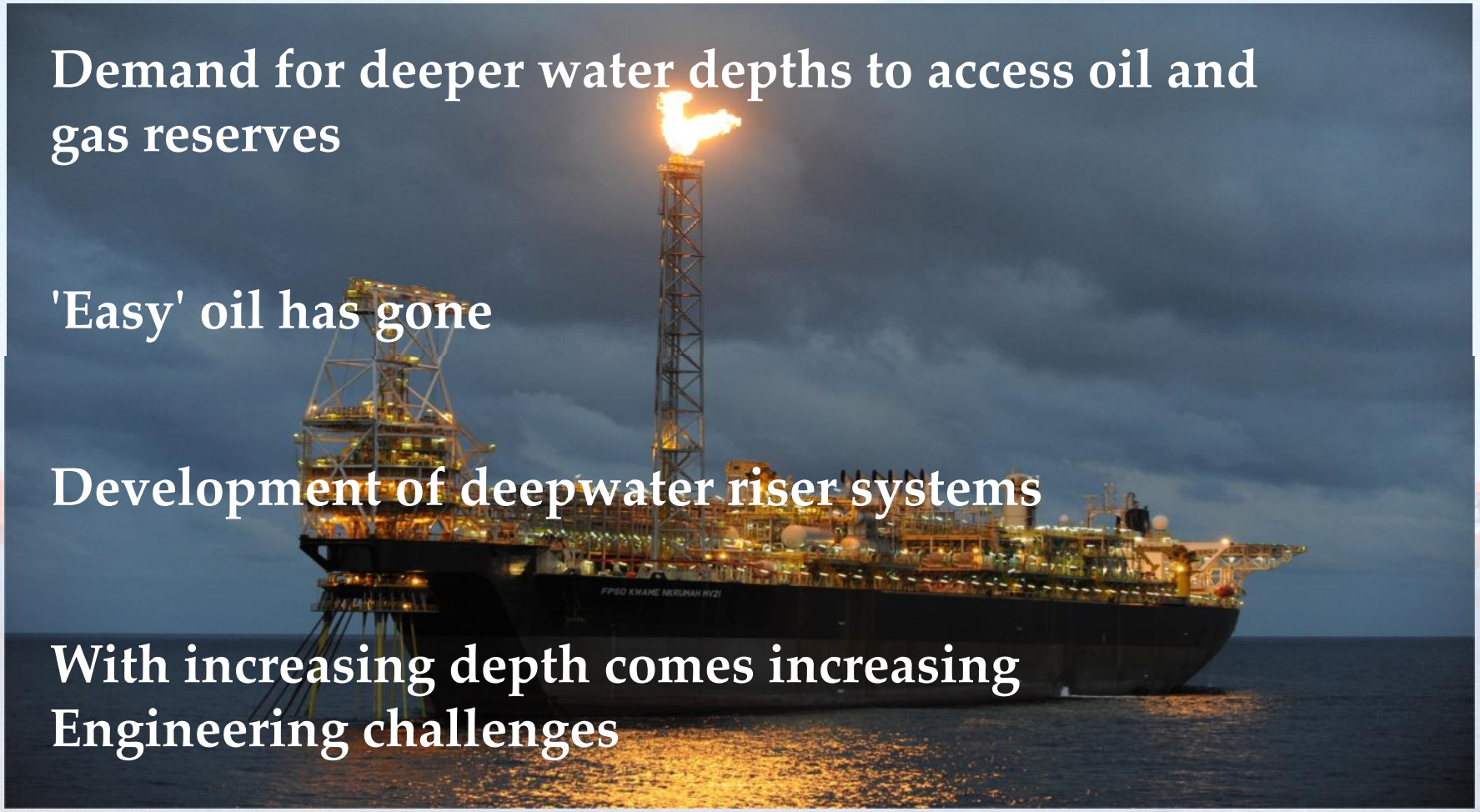

Demand for deeper water depths to access oil and gas reserves

'Easy' oil has gone

Development of deepwater riser systems

With increasing depth comes increasing Engineering challenges

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Technical and Engineering Observations

Conversions

New Buildings

Routine Inspection & ROV access

Classification Societies

How FPSO's are Built / Converted

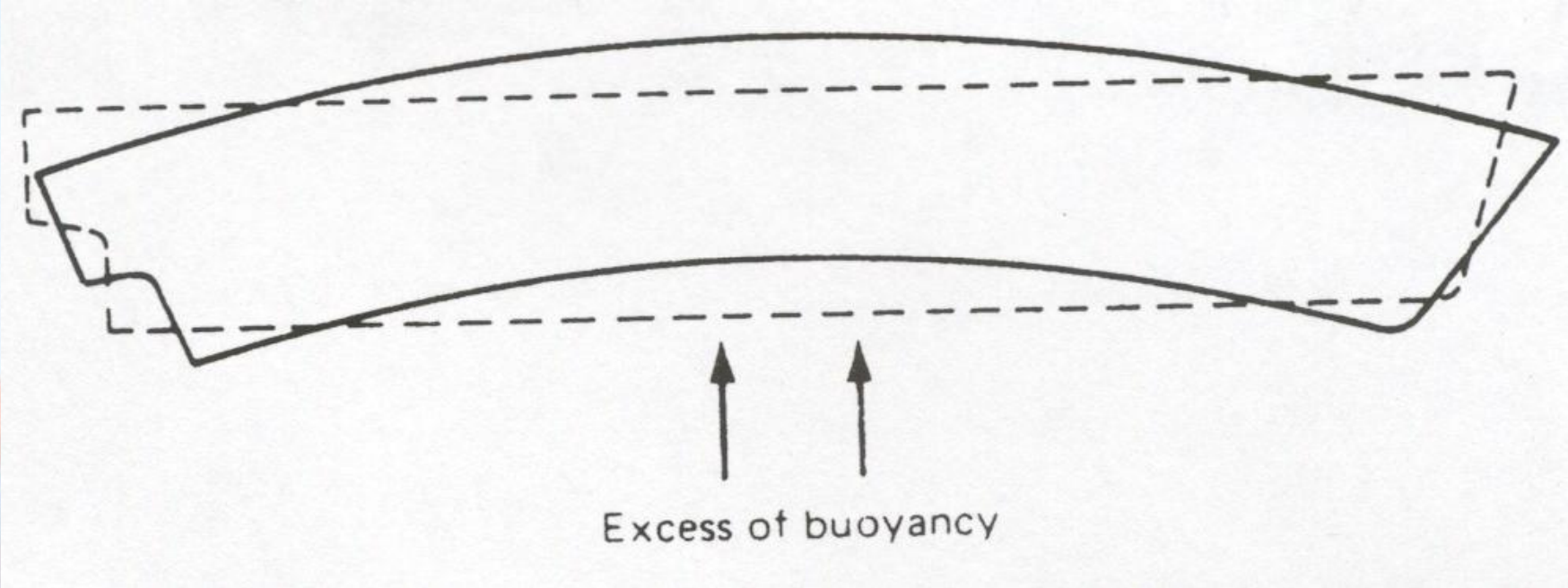
FPSO's are usually ‘ship-shaped’ and resemble a modified oil tanker

Purpose built or converted from an existing hull

Modifications to increase the strength or fatigue resistance in particular areas

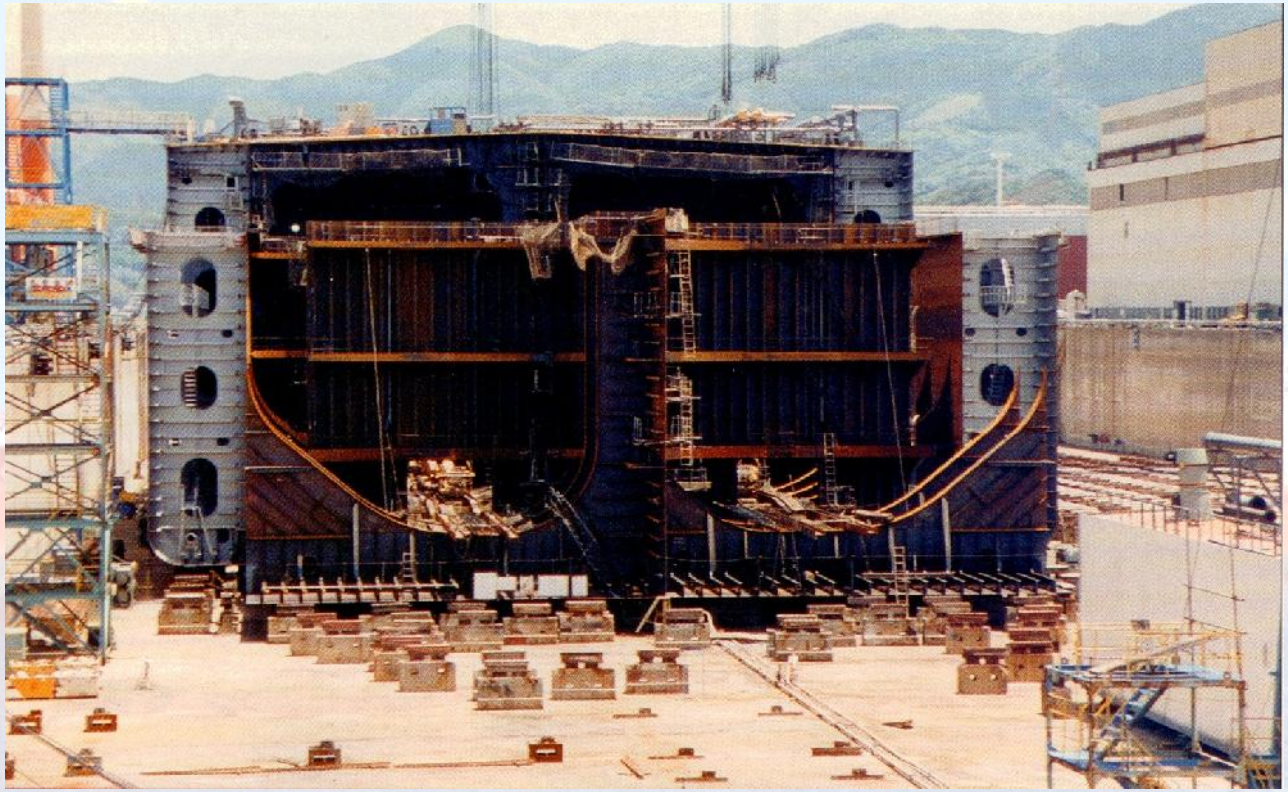
Hull bending - hogging and sagging

Naval Architecture



Buoyancy = Hogging of Hull

FPSO Newbuildings



FPSO Newbuildings

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FPSO Oil Tanker Conversions

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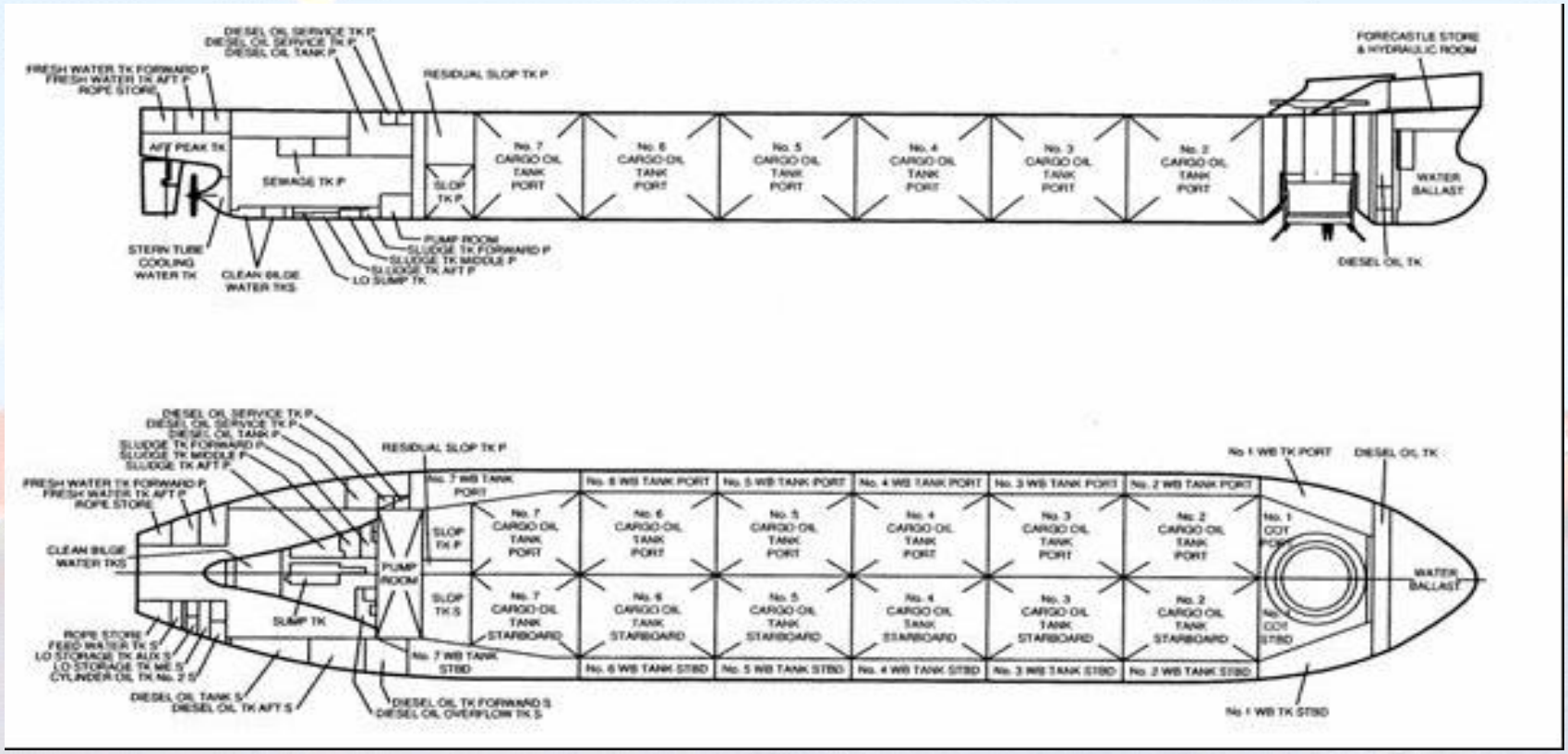
FPSO Oil Tanker Conversions



FPSO Conversions

Decommissioned oil tanker

Availability of suitable second hand ‘donor’ tanker hulls

Avoid in-service fatigue damage

Poor weld quality

FPSO Conversions

Structural loadings encountered by FPSO's

Conversions should improve the local detail design to enhance fatigue performance

Require structural fatigue enhancements

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FPSO Conversions

Cargo Oil Tank (COT) Damage

Damages in way of primary structural members

Cracks at the intersection of the bottom longitudinal stiffeners with transverse web frames in way of the connecting brackets

Damage in way of brackets, e.g. transverse bulkhead lower brackets

Local weld defects - crack initiators

Defects monitored, evaluated and repaired

Repairs require a high level of NDT and strict welding control

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Water Ballast Tank (WBT) Damage

Fatigue cracks detected after 2-3 years of operation as an FPSO

No evidence of failure noted in 13 years as a trading tanker

WBT cracks arrested by drilling & grinding

Damages assessed and repaired on location whilst maintaining production

Hot work required adjacent tank emptying and cleaning

Oil and water levels in adjacent tanks relevant

Tanks then monitored monthly

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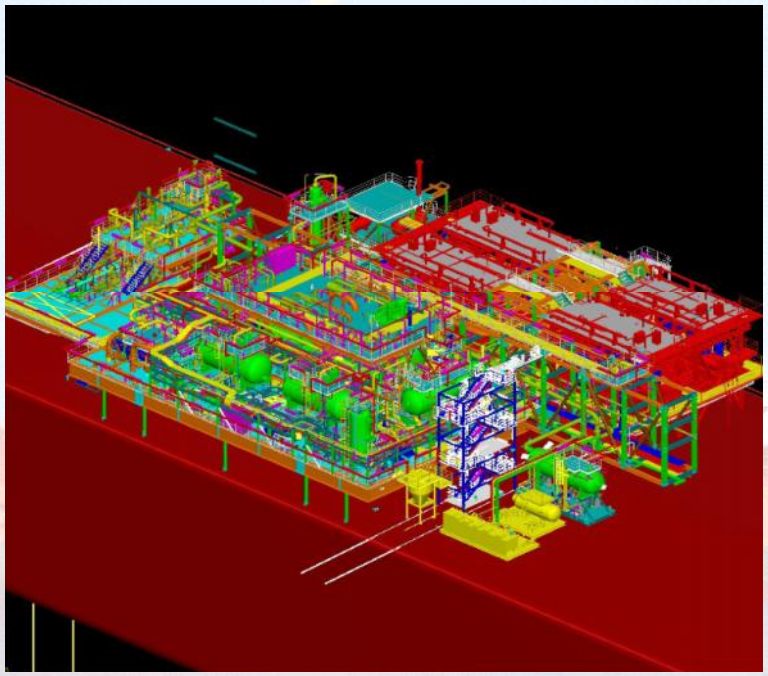
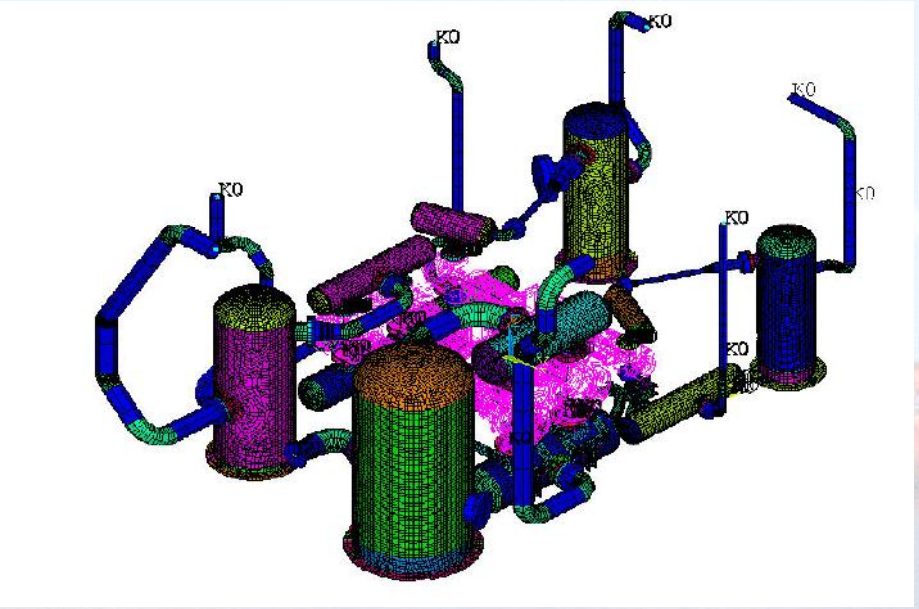
Power Generation / Compressor Systems





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Paint Coating Systems

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Turret System Including Swivels and Chain Table

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Mooring System Challenges

Anchor chain failure

Clump weight detachment

Thrash zone areas

Chain table problems

Catienary mooring spring effect

No Go Zones ("NGZ") on sea bed

Disconnect / Reconnect (emergency and routine)

8. Future of FPSOs

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Future of FPSOs

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10 Reasons Why FPSOs are the Future of Oil & Gas

1. Shorter time to field = Faster revenue generation
2. Reduced investment = less overheads
3. FPSOs do not have to be custom built
4. FPSOs can evade harsh weather
5. FPSOs can move from field to field
6. Abandonment costs are less than for fixed platforms
7. FPSOs can be used in shallow and deep waters
8. Asset integrity costs reduced with FPSOs
9. FPSOs reduce costly and expansive underwater infrastructure
10. FPSOs are more environmentally friendly than platforms

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And Finally…….

It is easy to forget that the devil is in the detail

If Class didn't see it why should I?

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