MANAGING RISK

Semi Submersibles

Semi-submersible Basic Principles

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- Basic purpose of a semi-submersible:
  - to reduce the motion and hydrodynamic forces of the unit by locating major buoyancy members deepest possible in the water, i.e. out of the major wave action.
- Consequently the motions are moderate even in extreme weather conditions.
- The working deck sits on top of large pontoons and hollow columns.
- These float high in the water when the rig is moved.
- At the drill site, seawater is pumped into the pontoons and columns to partially submerge the rig, hence the name semi-submersible.
- With much of its bulk below the water's surface, the semisubmersible becomes a stable platform for drilling, moving only slightly with wind and currents
- Because of their exceptional stability, "semis" are well suited for drilling in rough waters.

Semi-submersible Basic Principles

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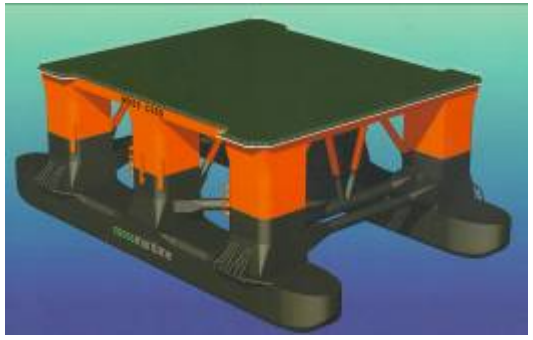
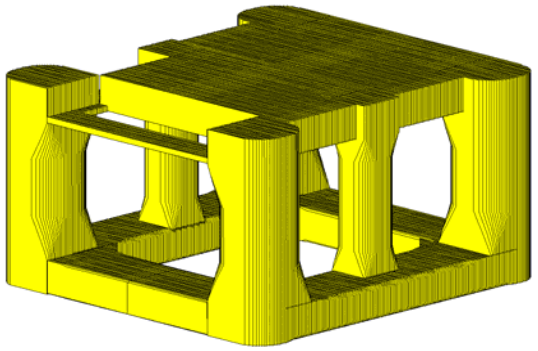
- The semi-submersible platform is today available in a number of configurations.
- Traditionally, the two-pontoon conventional platform has dominated the market with well-established designs such as Pacesetter, H-3, GVA4000, Bingo and more.
- Recently, with the industry drive towards larger production platforms, the ring-pontoon configuration has gained popularity





Semi-submersible – DNV Involvement

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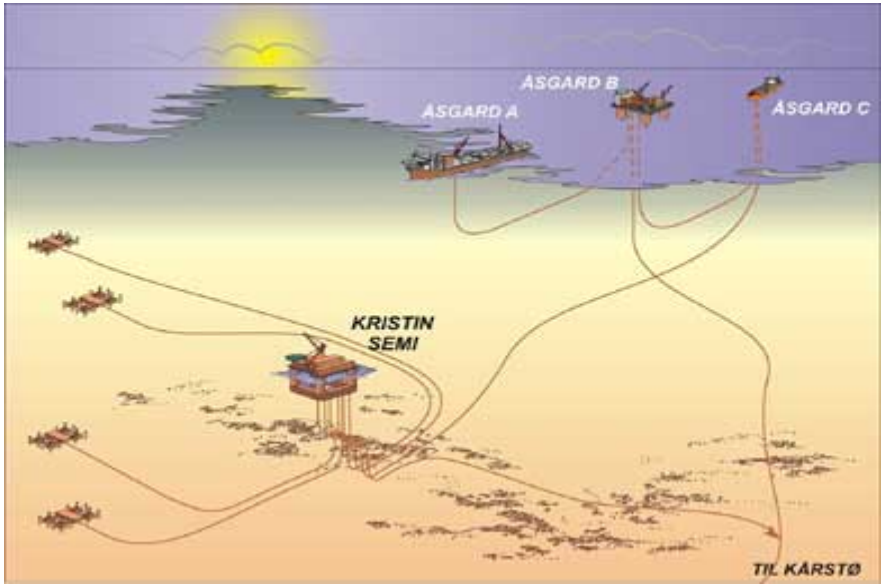
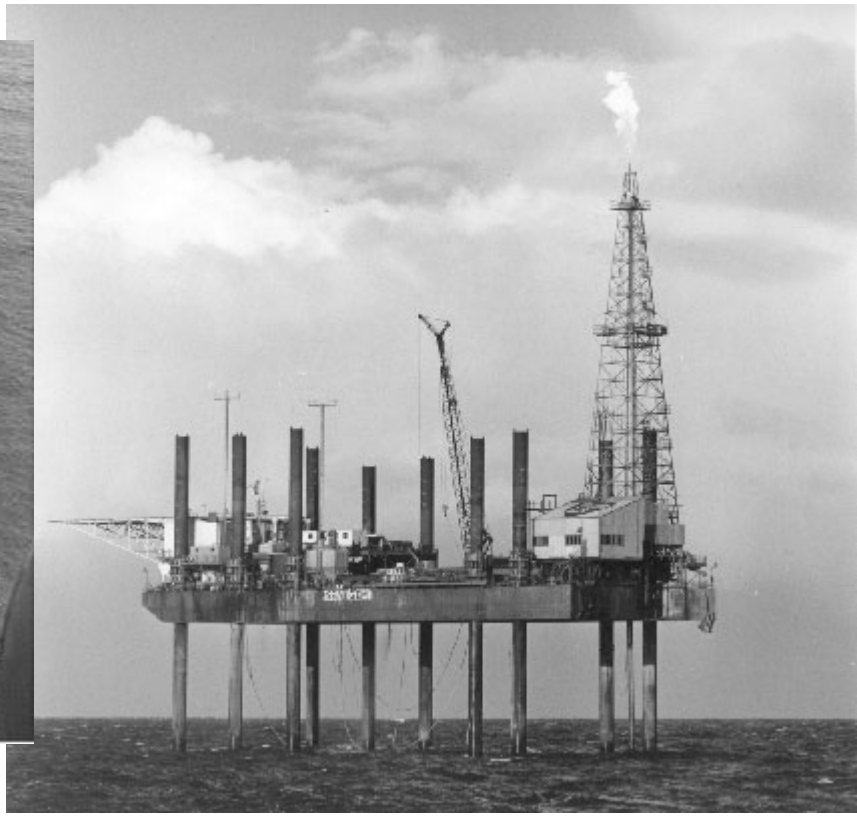
- For three decades DNV has been engaged in classification and certification of mobile offshore drilling rigs built and operated world wide, with nearly half the fleet of drilling units built during the last decade to DNV class,.
- DNV takes great pride in being a contributor to the successful construction of the world's largest production semi, the Åsgard B platform designed by GVA of Sweden.



Historical Overview

The semi-submersible rig Sea Quest



5600 ton Drilling Barge "***Sea Gem"*** 42 miles off the Mouth of the River Humber in 1965 and was the first rig ever to find hydrocarbons in the British North Sea sector.

Rig development

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Year	Rig Name	Features	Designer	No. Built
1961	Bluewater I	First semisubmersible, converted from existing 4 column submersible	Shell Oil	1
1963	Ocean Driller	First new build; 3 col. Vee shaped structure	ODECO	2
1965	Sedco 135	3 footed columns; arranged in a triangular shape	Friede & Goldman	12
1969	Pentagone 81	5 footed columns arranged in pentagon shape	Neptune	11
1971	Ocean Prospector	First self-propelled, 12 columns; 2 main tubular hulls; Ocean Victory class	ODECO	11
1973	Sedco 700	Twin pontoon hulls; 8 columns thruster propulsion	Earl & Wright	15
1973	Western Pacesetter	Twin pontoon hulls; 6 columns design licensed to all	Friede & Goldman	39
1974	Aker H-3	Twin pontoon hulls, 8 columns (known as Aker H-3 Design)	Aker Mek Verksted	29

Rig development

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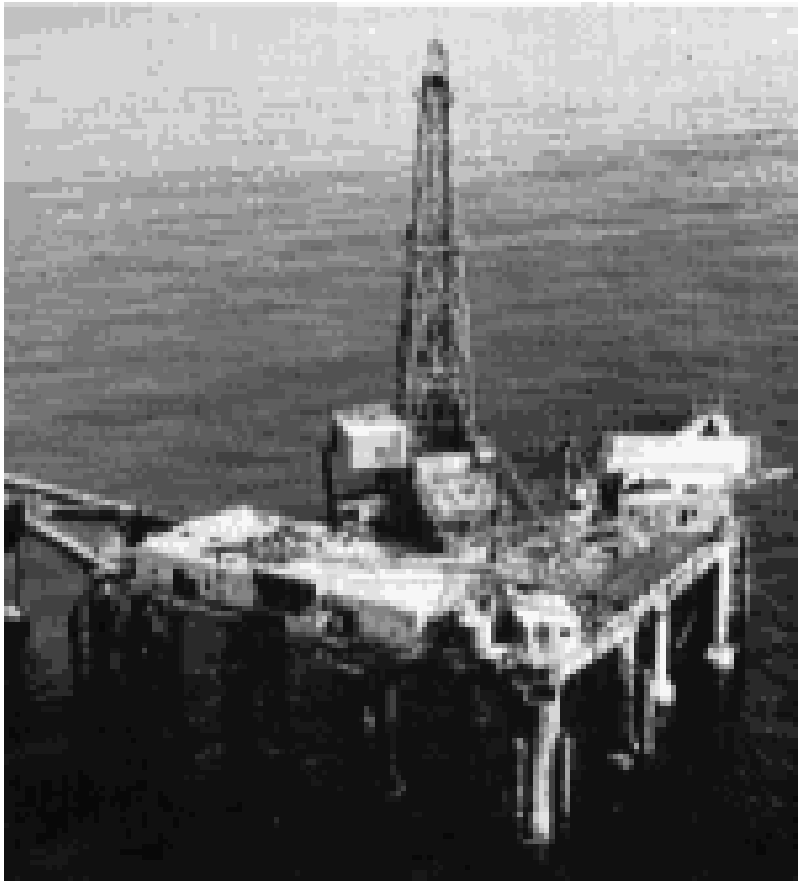
- 1st and 2nd generation:
  - Relatively simple w.r.t. drilling systems and mooring
  - Typically 1960'ies units from GoM
  - Max water depth up to 600 ft

Ocean Drillier –
world's first purpose built semi-submersible platform

Built in USA 1963



Rig development

- 1st and 2nd generation:

Sedco 135 - 1965

Sedco 700 - 1973

Rig development

- 1st and 2nd generation:

Ocean Traveler

Drilled the first hole on the Norwegian shelf 19. juli 1966

Rig development

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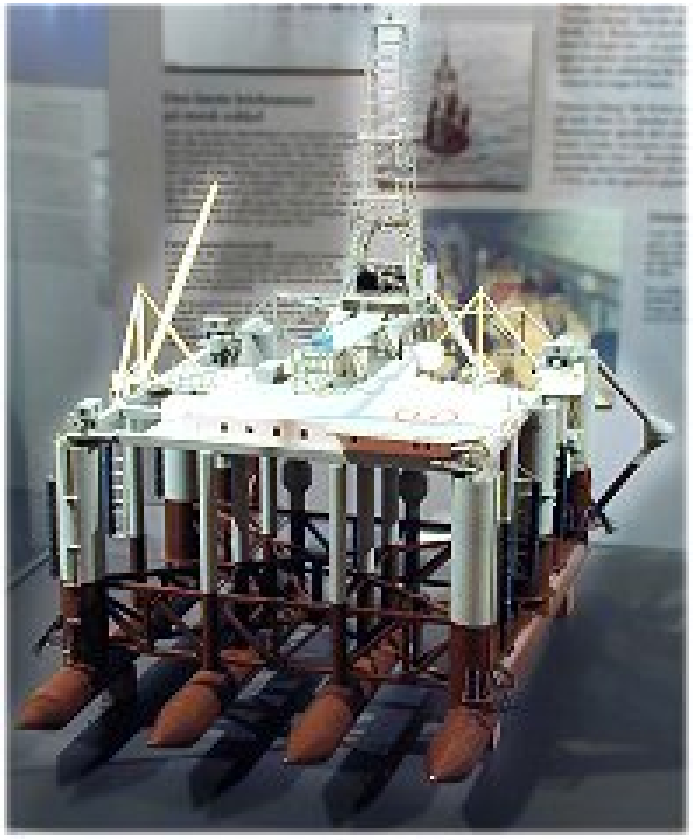
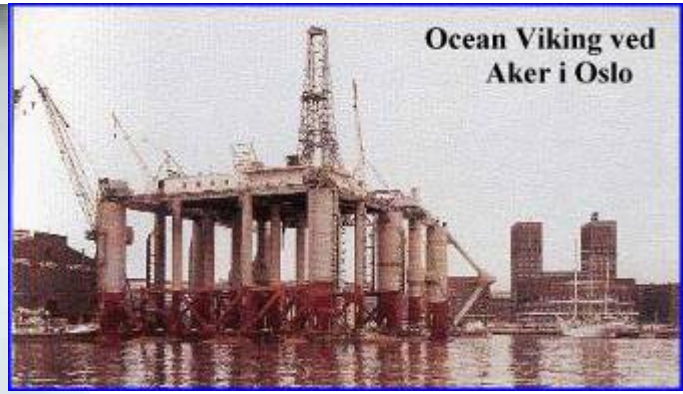
- 1st and 2nd generation:
  - Ocean Viking – first Norwegian built rig
  - Built at Akers Mek. Verksted in Oslo i 1966





Ocean Viking

Rig development

- 3rd generation:
  - From early 1970'ies
  - Built for harsh environment – typically North Sea
  - Aker H-3.2

1973 - 1984

Aker H-3 and H-3.2

Rig development

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- 3rd and 4th generation:

Examples of Aker H-3 and H-4 design.
*Per date **27** H-3 and H-4 rigs have been built*

Source: AkerKvaerner.com

Rig development

- 4th generation:
  - 1980'ies
  - Introduced thruster assisted mooring
  - winterization
  - Increased water depth (7-800 meter)

Stena Don

Aker H-4.2

PRINCIPAL CHARACTERISTICS

2 Pontoons & 8 Columns

Length Overall: 105 m

Breadth Moulded: 73.8 m

Derrick Height: 48.8 m

Elevation Tower Deck: 36.5 m

Draft Operating: 23.5 m

Displacement: 39,600 MT

Drilling Depth: 25,000' (7,600m)

Payload Operating: 5,500 MT

Ocean Viking

Rig development

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- 5th generation:
  - Dynamic positioning
  - Possibility for simultaneous operasjon from double drilling towers
  - Large areas for preparation of wellheads in relation to production drilling (from mid 1990'ies)
  - Automation of drillfloor operations

West Venture

Rig development

- 6th generation an evolution for ultra-deep water (3000 meter) and very fast and effective drilling

Moss Maritime – CS50 MkII

Kilde: mossww.com

Rig developmnt

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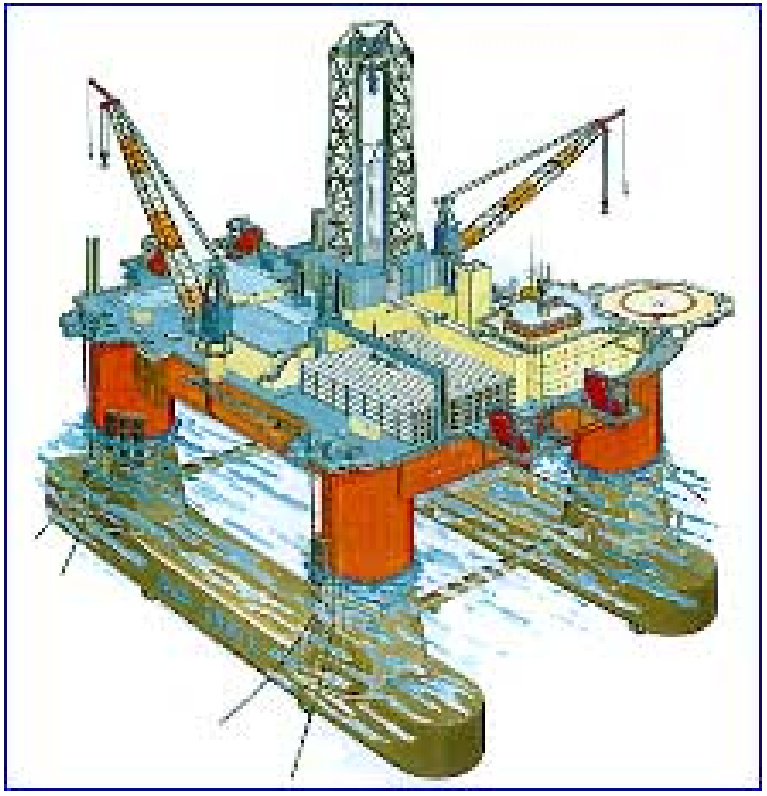
- 6th generation



GVA 5800

Kilde: gvac.se

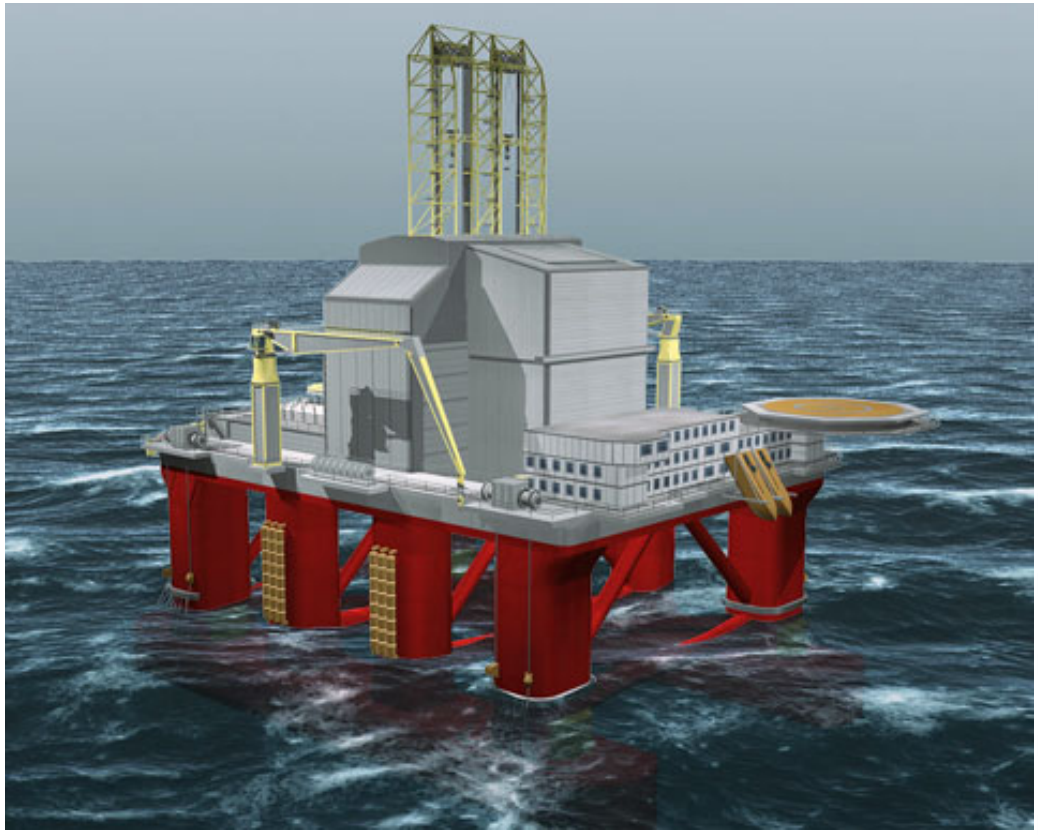
GVA 5800

- **Semi-submersible drilling rig**
- **Variable deck payload:** 6,500-7,000 tonnes
- **Derrick arrangement:** Dual derrick
- **Operation displacement:** 45,800 tonnes
- **Operation water depth:** 2,500 m
- **Station keeping:**
  Dynamic Positioning for 2,500 m plus
  8 point mooring system for 500 m

Rig development

MANAGING RISK

- 6th generation



Aker H-6

Kilde: AkerDrilling.com

Aker H-6

- **Variable Deck load - 7,700mt**
- **Deck area - 90x70m (6,300m2)**
- **Harsh & winterized**
- **Displacement: 56,900 tonnes**
- **Air gap 18.5m**
- **Zero discharge to sea**
- **Accommodation - 140 (160)**
- **Riser stacks 750m**
- **Hook load - 1,000t**
- **Water depth - 10,000 ft**
- **Ready-to-drill**
  - **Feb 2008**
  - **Oct 2008**

Summary of semi-sub generations

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Generation	Design/Owner	MODU Classes (Approx. No. in Class)	MODU Names as Examples	Water Depth (ft.)	Year Built/Up Graded	Comments
1	ODECO SEDCO	Ocean Driller (2) Ocean Queen (5) SEDCO 135 (12)	Ocean Explorer Ocean Digger SEDCO 135F	300 to 600	Mid to Late 1960's	Original Semis built from the keel up. Only a very few of these units have escaped the scrape yard.
2	Forex Neptune & IFP, ODECO, SEDCO, Aker Friede Goldman Korkut Engineers	Pentagone (11) Ocean Victory (11) SEDCO 700 (11) Aker H-3 (30) L-900 Pacesetter (5) New Era (6)	Pentagone 87 Ocean Baroness SEDCO 702 Byford Dolphin Alaskan Star Eagle	600 to 2,000	Mid to Late 1970's	Many of these units are the foundation for upgrades to 4th and 5th Generation units. Many have had moderate upgrades to 2,000 ft. and beyond. The Ocean Baroness is an example, built 2nd and upgraded to a 5th Generation.
3	ODECO Aker Friede Goldman	Odyssey (5) Aker H-4.2 (2) Enhanced Pacesetter (33)	Ocean America Transocean Leader Global Arctic III	1,500 to 5,000	Mid to Late 1980's	Many of these units have had major water depth upgrades. Most were new built units rater than upgrades.
4	Diamond Offshore Atwood Oceanics Noble Drilling	Ocean Victory Upgrade (3) New Era Upgrade (3) EVA-4000 Conversion (4)	Ocean Victory Atwood Eagle Noble Max Smith	3,500 to 5,000	Late 1990's to Early 2000's	These units are spread moored with a few having DP assist. Upgrades include sizeable riser tension, hook load, mud volume, mooring ability increase and other attractive features.
5	Transocean Noble Drilling Smedvig Diamond Offshore Ocean Rig ASA SEDCO Forex	R&B Falcon (2) EVA-4000 Conversion (1) Smedvig ME 5000 (1) Ocean Vicotry Upgrade (2) Bingo 9000 (2) Express Class (3)	Deepwater Nautilus Noble Paul Wolff West Venture Ocean Baroness Levi Eriksson CajunExpress	5,000 and beyond	Late 1990's to Early 2000's	Most of these units are DP with a few being spread moored. They are usually designed for harsh environment and have significant riser tension, hook load, mud volume and VDL capabilities.

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