

Offshore structures for oil and gas production

- not discussed here
- drilling vessels, ships
- vessel to lay equipment pipes,
- tankers
- supply vessels

- Drilling package: facilities for well drilling and intervention. drilling tower, BOP, mud pumping and processing system, cementing system

mud package
storage deck for tubulars, drilling risers

- facilities for light well intervention. { wireline, coiled tubing }
- Processing facilities {
 - gas processing train
 - oil separation train
 - water processing train (polishing unit)

- gas injection system { compressor trains }
- gas compression system for pipeline transport
- gas lift system { compressor trains, pipes, valves }
- water injection system { seawater treatment, pumping }

- Living quarters

- Helideck or access points

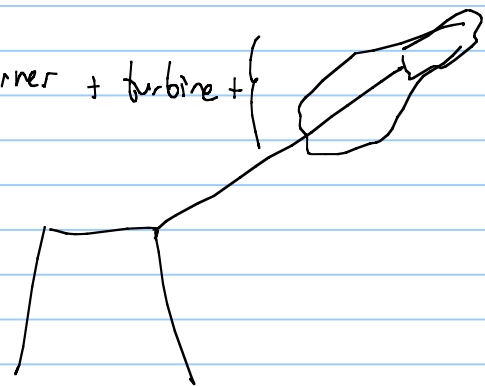
- Power generation { gas turbines { compressor + burner + turbine + }

flare system: burn gas when needed

- Utilities: hydraulic power fluid, compressed air

drinking water, air condition
ventilation and heating system

seals of
rotating machinery



- well bay
- production manifolds
- metering
- oil storage

- facilities for oil offloading
- Control system
- monitoring system
- System to recover production chemicals (corrosion, scale, wax, demulsifier, hydrate)
- Repair workshop

Classification of offshore structures

Fixed

Compliant

Bottom supported

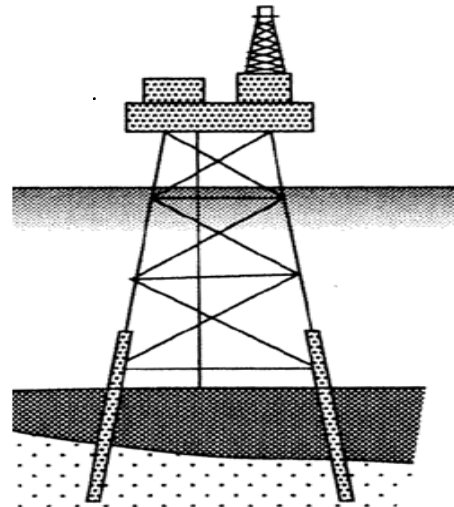
Jacket

Gravity Based structures

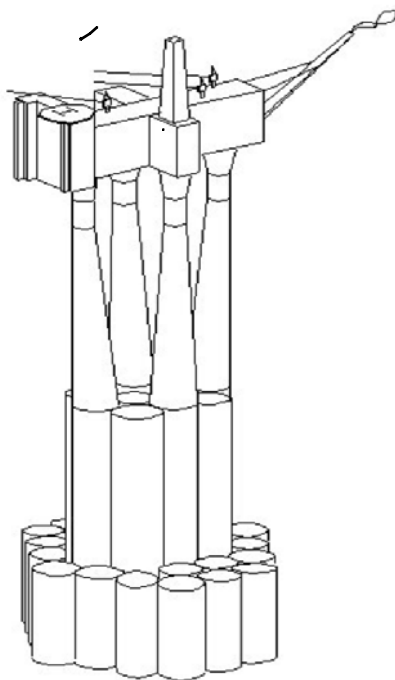
Compliant tower

most of the loads are transferred to seabed, soil

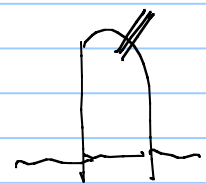
Jacket



Gravity based structures



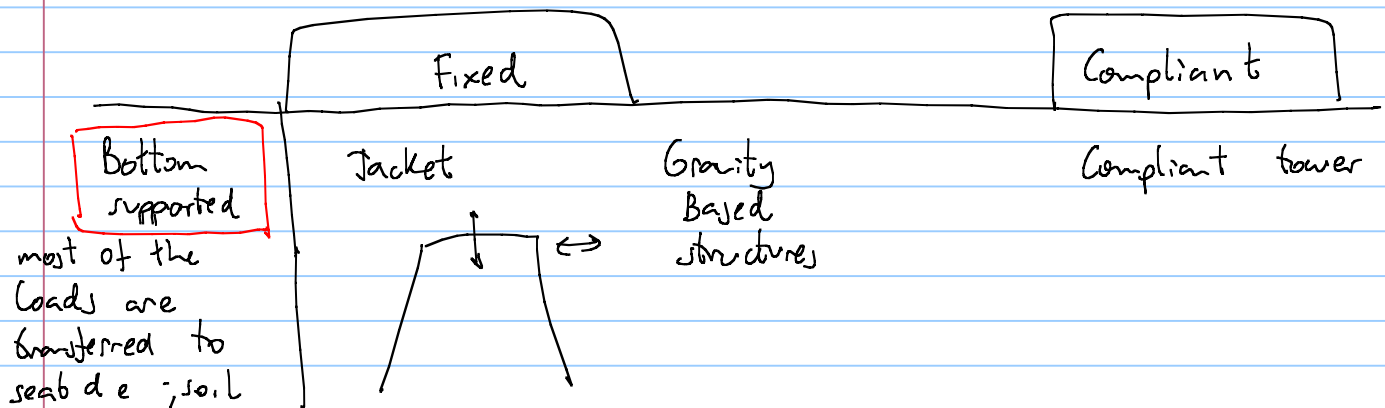
suction anchor



Compliant tower



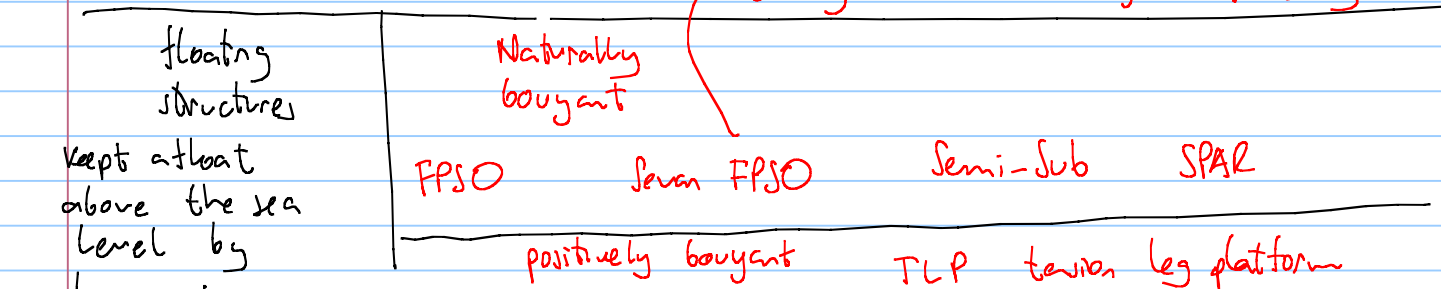
guyed tower



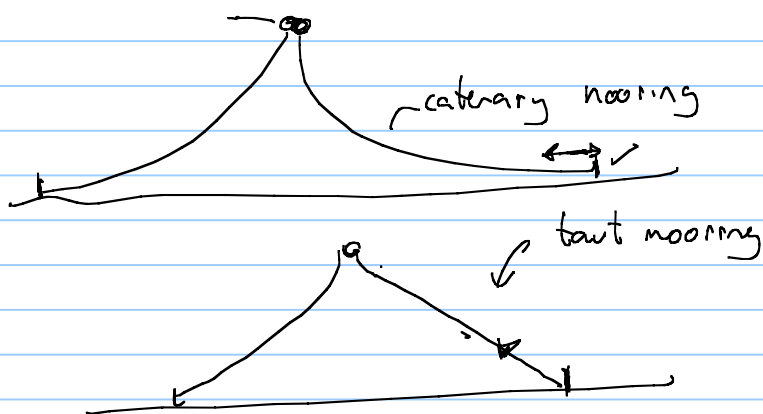
have reduced movement in the vertical and horizontal direction



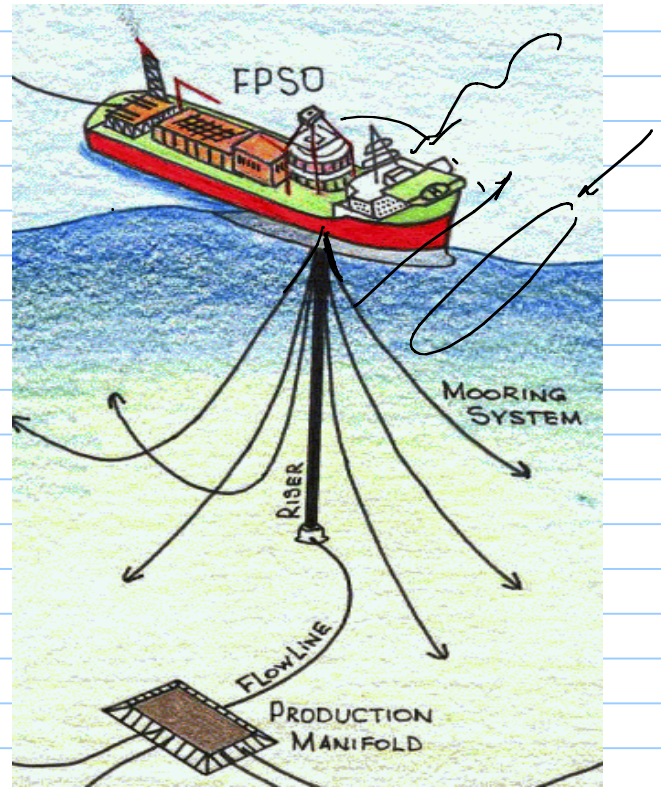
Floating Production Storage Offloadings



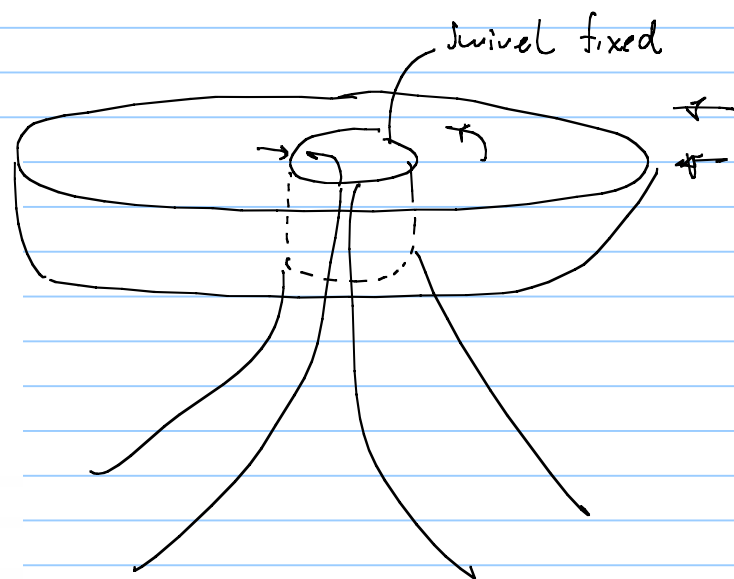
ballast tanks allow to control buoyancy
the one typically moored with steel chains or pretensioned composite lines



FPSO-ship



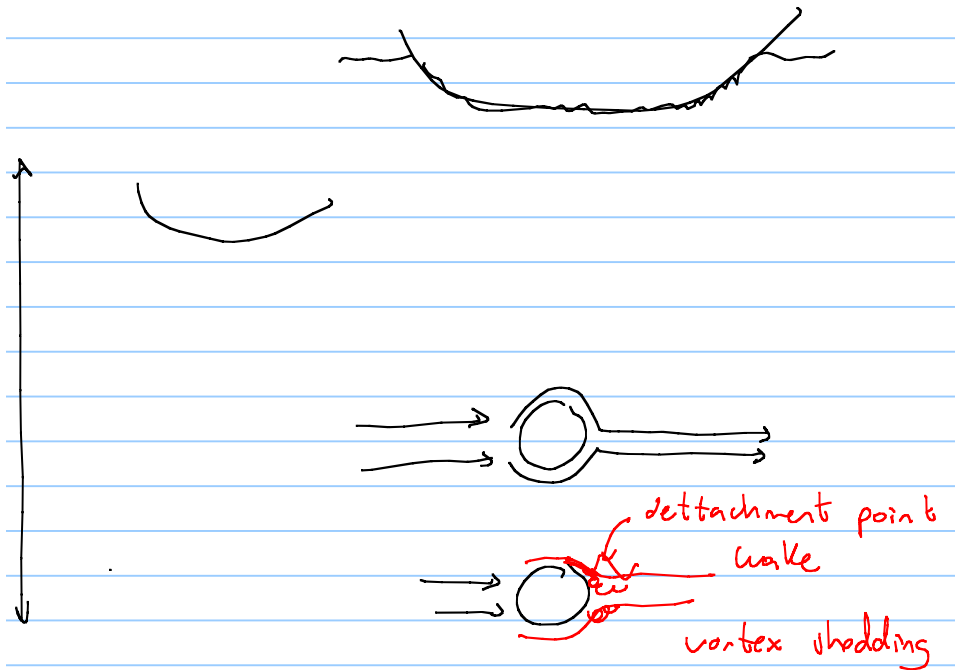
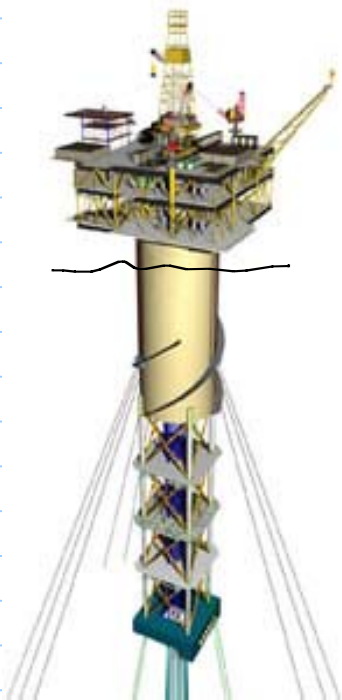
Sevan type FPSO



Semi-submersible

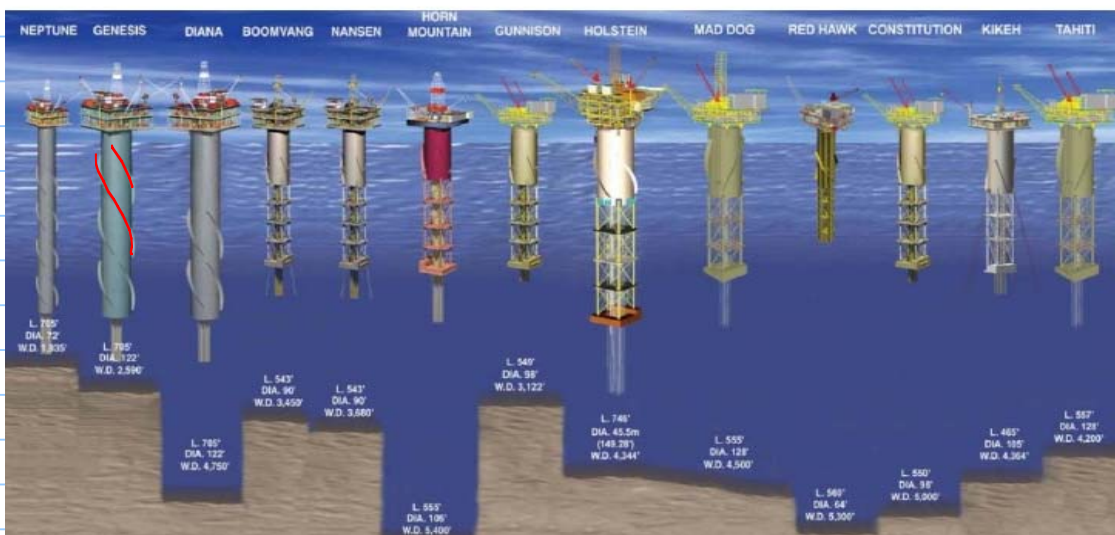


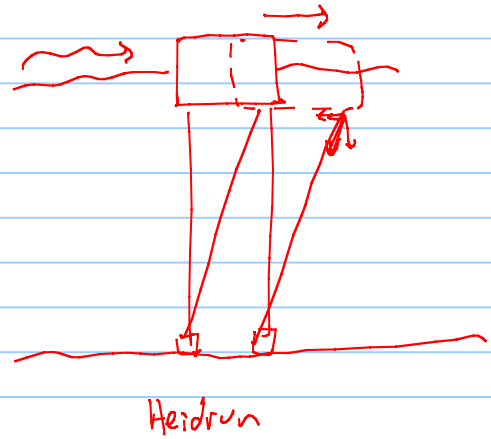
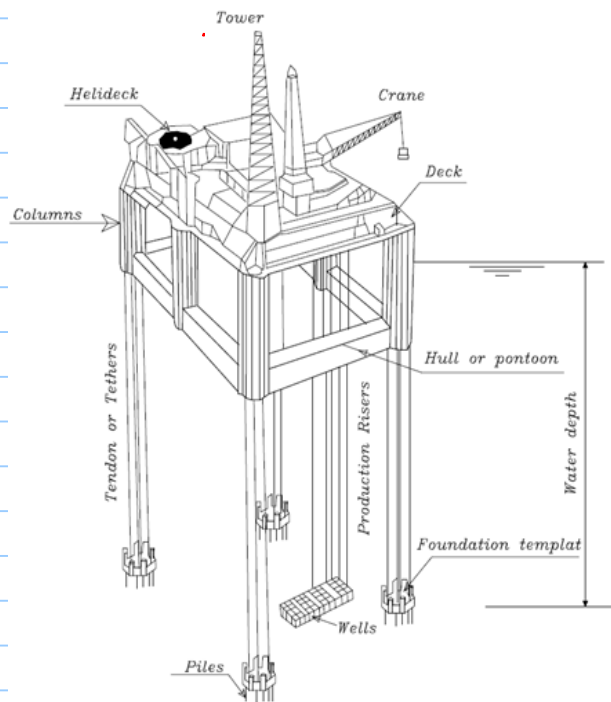
SPAR → deep hull structures



vortex shedding
induces big
vibrations in
the structure
that is why
we have the
spinals

SPAR Projects



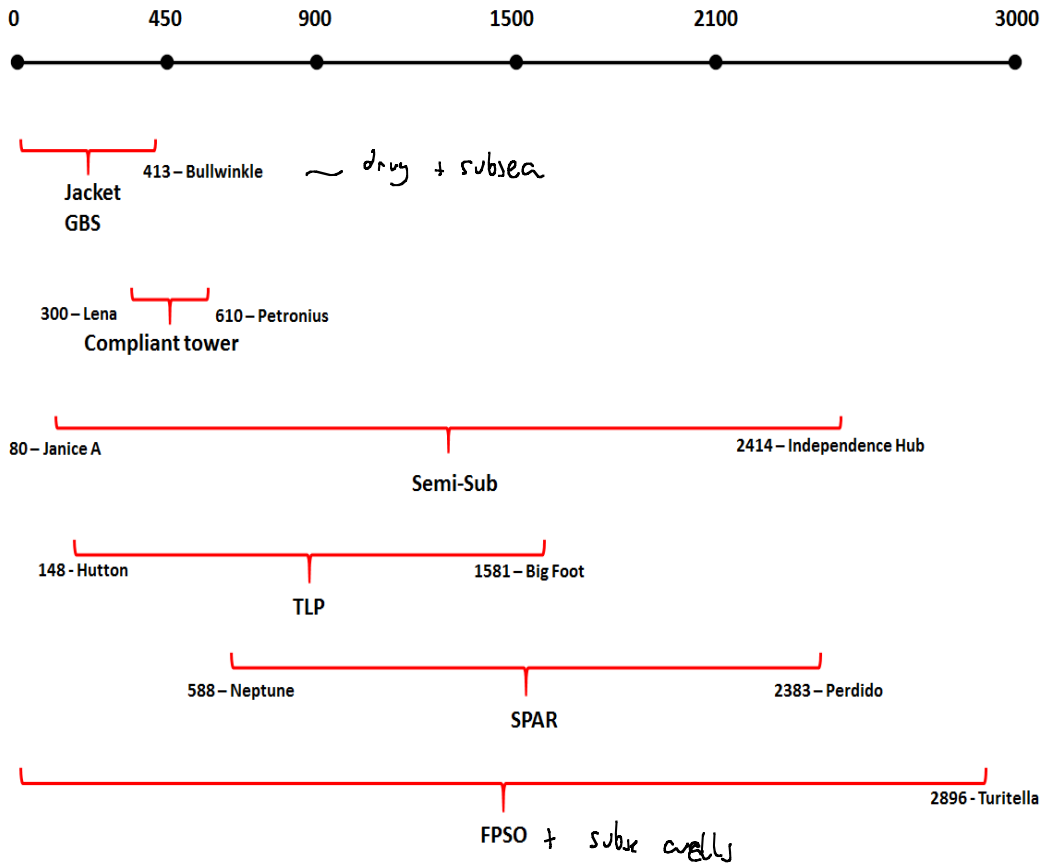


How do we choose offshore structures?

- water depth ✓
- reservoir structure and extent ✓
- Ocean conditions → loads
wind ✓
waves ✓
current ✓
- soil characteristics
- well artificial lift ✓
- dry vs. subsea wells ✓
- storage ✓
- future development plans
- delivery time availability
- experience of the company.

Water depth:

Water depth [m]



• Dry vs. subsea wells

X-mas

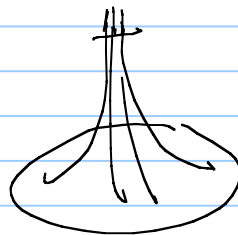
- 1) on the offshore structure
- 1) in the seabed

Dry well ~ max depth
1700 m

I choose dry X-mas trees if:

- frequent well intervention is required

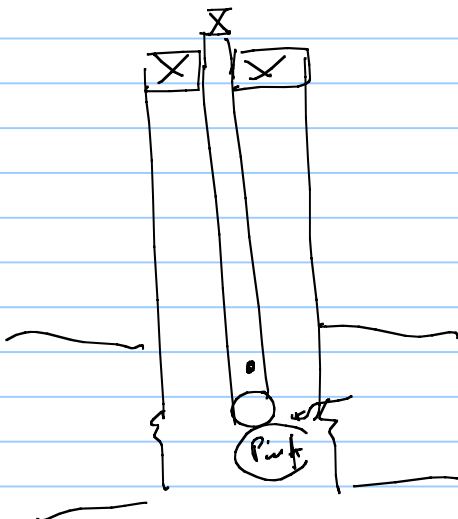
① reservoir structure



compact, not spread

- if well have ESPs
electro submersible pump
lifetime 1-2 years
need to access the wellbore often

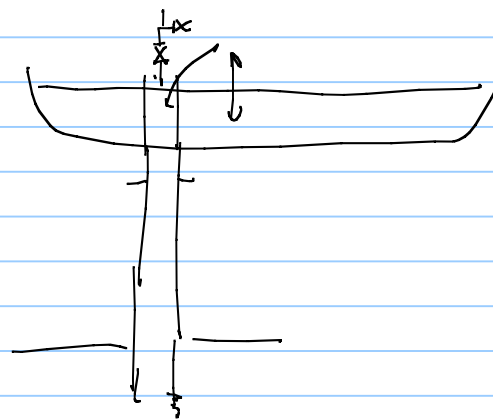
in contrast subsea wells have
an average intervention time of
5 years.



what is the meaning of spread reservoir / localized } depends on the drilling package



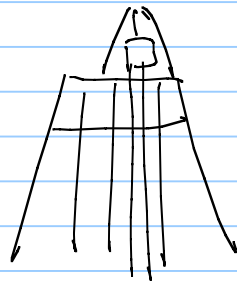
the only structures that have low movement, that allow to have dry wellhead is



bottom supported structures } jacket
GBS
tower

TLP
SPAR } ± 3 m

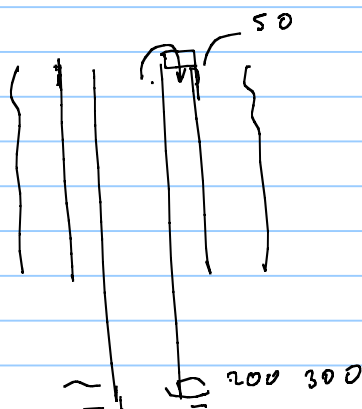
jackets on GBS wells are drilled just like onshore

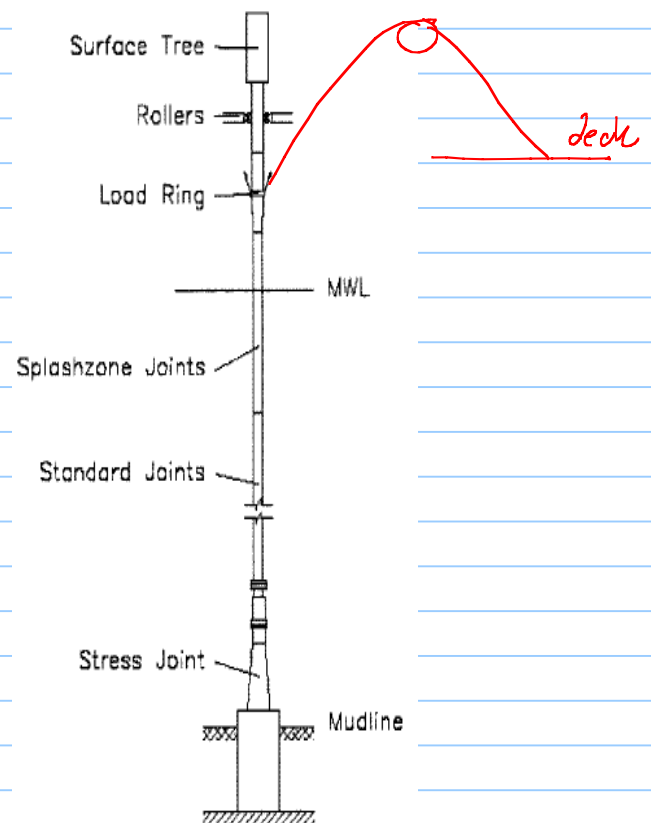
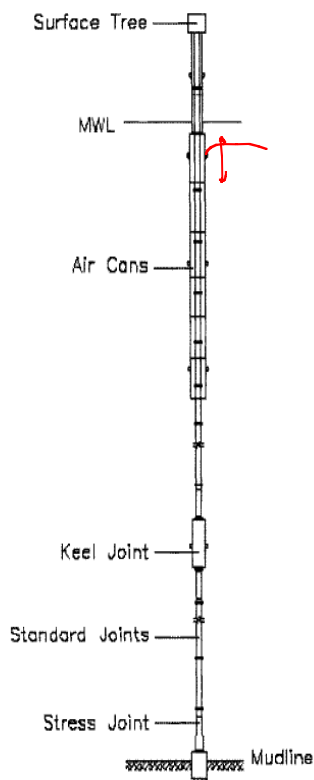
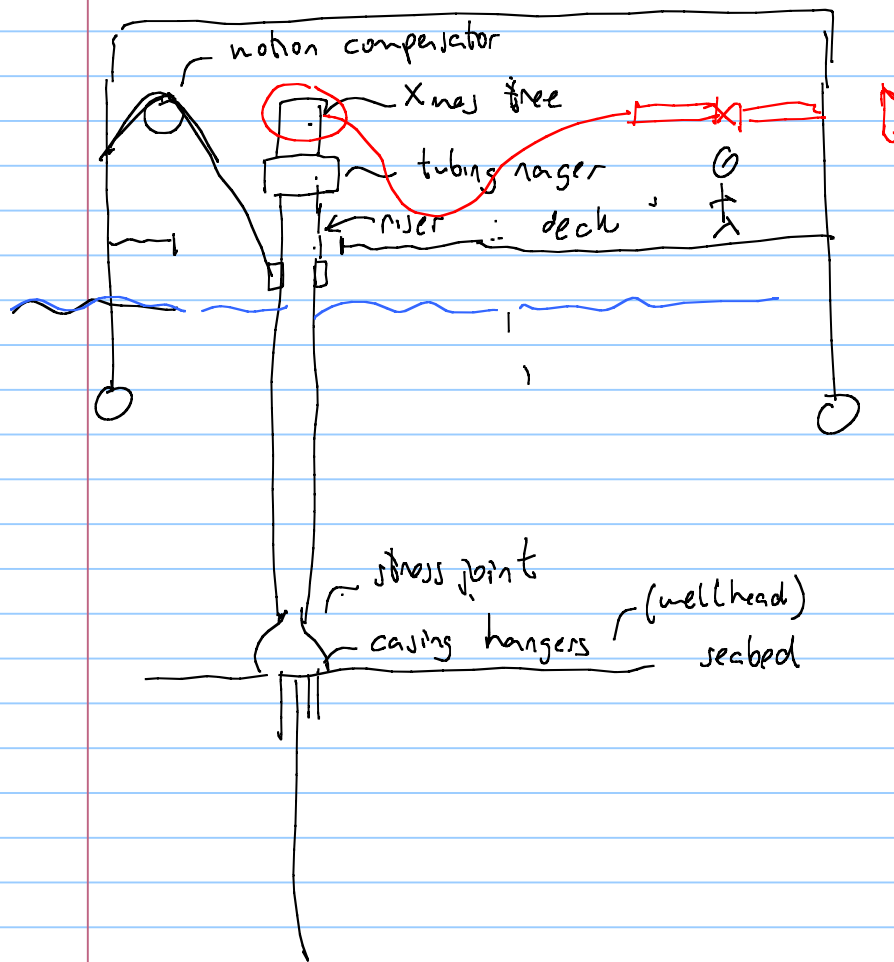


for TLP, SPARs and compliant towers the movement is significant

have a wellhead in the seabed:

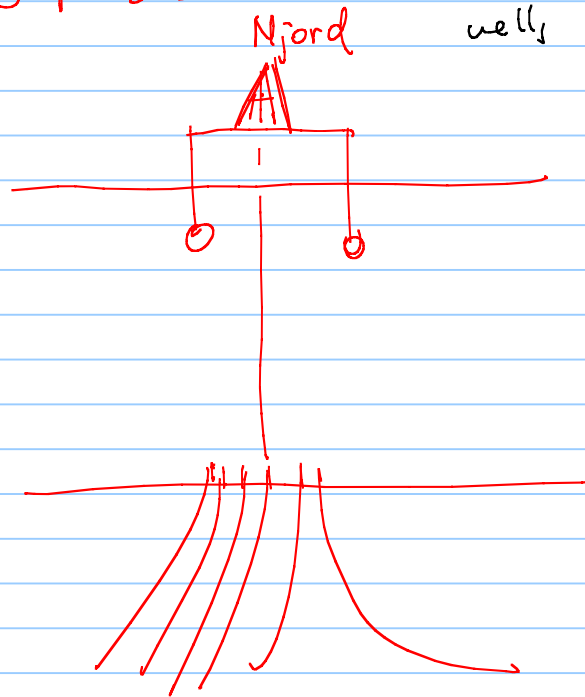
- ↳ support casing
- ↳ transfer load of X-mas tree to conductor (soil)
- ↳ seal between annular spaces in the casing





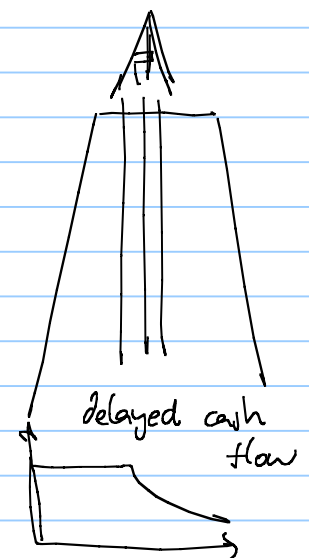
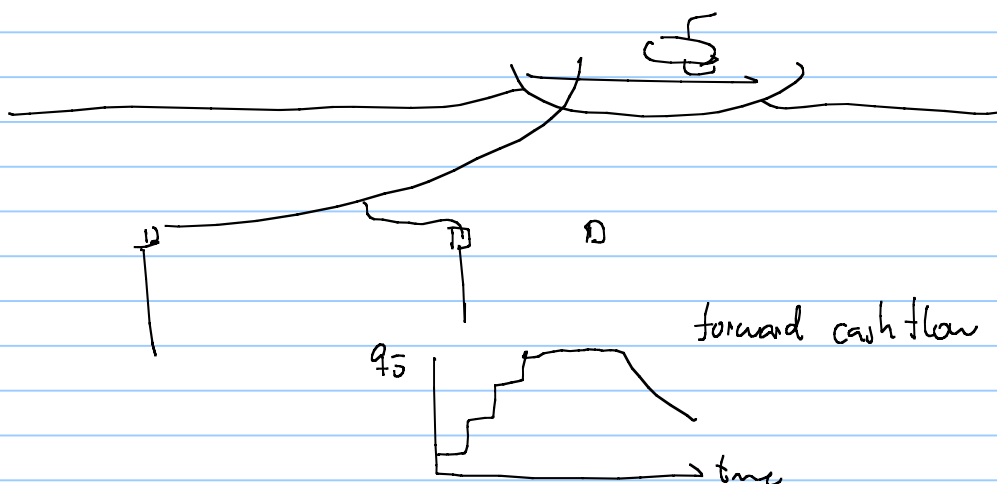
if dry wells are used usually the offshore structure has a drilling package

when wells are subsea sometime (not often) the offshore structure has a drilling package)



wells are exactly below the offshore structure

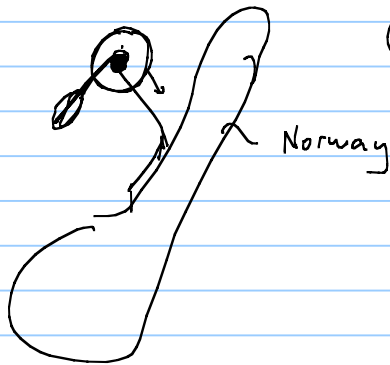
- Dry well structures have limited number of well slots available
not suitable for infill drilling (maintain the production rates)
- Systems with subsea wells: have to perform flow assurance
- in systems with subsea wells production can start gradually as soon as the offshore structure is in place



- Storage of oil : only structures that allow storage are:

FPSO	~ 2.5 mmbbls
GBS	~ 300.000 bbls

SPAR Aasta Hansteen it's the only spar with storage capacity
(up to date) 150.000 bbls



- Marine loads on offshore structure { next class

