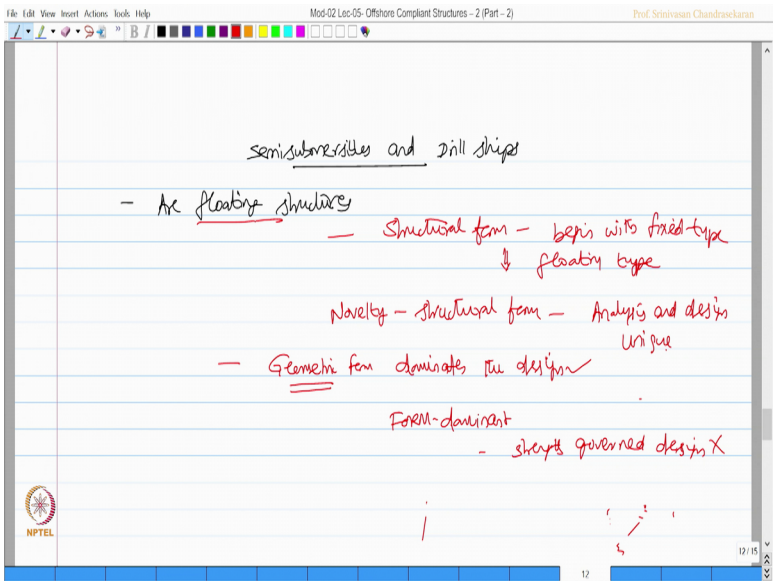
Computer Methods of Analysis of Offshore Structures
Prof. Srinivasan Chandrasekaran
Department of Ocean Engineering
Indian Institute of Technology, Madras

Module – 02
Lecture – 05
Offshore Compliant Structures – 2 (Part – 2)

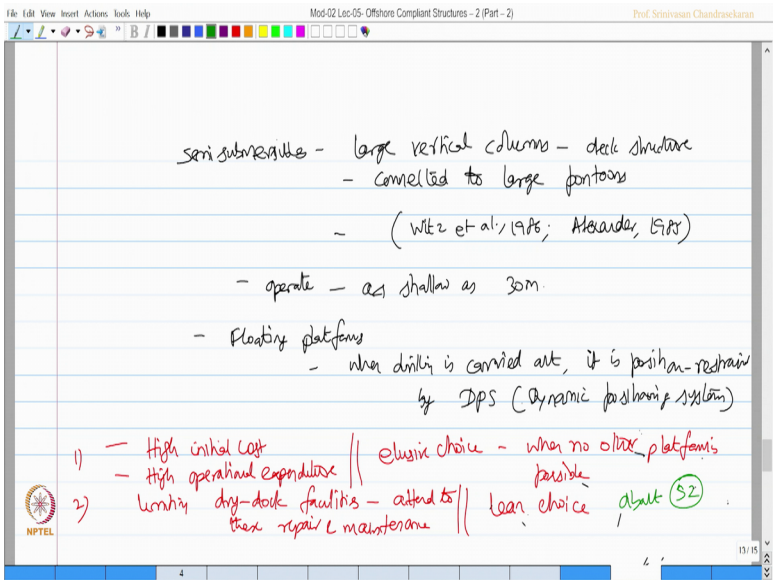
The next structural form which was also useful for offshore drilling purposes was semisubmersibles and drill ships, essentially they are completely floating structures.

(Refer Slide Time: 00:30)



So, friends please realize that the structural form of offshore platform begin with fixed type and landed up in completely floating type. So, one can see here, there is an extreme novelty in the structural form of offshore platforms which makes its analysis and design highly unique. So, the important key factor which was remembered is the geometric form dominates the design it is unlike, conventional structures, offshore structures do not have a standard symmetric form they have a very novel geometric form which can dominate the design, so it is form dominated which we reinsist again. Essentially they may not be strength governed, but I am not saying strength is not important, it is essentially not a strength governed design.

(Refer Slide Time: 02:37)



The moment you have compliant structures or floating structures, you will see that the displacements are much larger, which enables them to counteract the forces acting on them which is the concept in the design of these kinds of platforms. So, semisubmersibles have large vertical columns which are connected to large pontoons, columns actually support the deck structure.

More details can be seen in researchers like, Witz et al., 1986, Alexander 1985, they can operate as shallow as 30 meters; essentially it is a floating platform. But when drilling is carried out, it is position restrained by dynamic positioning systems, one important point we must remember in this context is that high initial cost and high operational expenditure makes these kinds of platforms as an elusive choice, when no other platform is possible that is one issue.

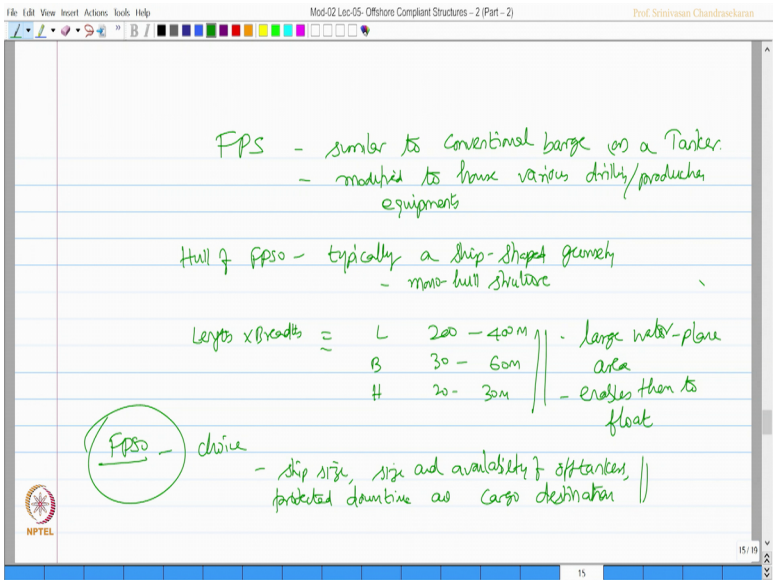
The second issue is there are only limiting dry dock facilities available in the world, which can attend to these repairs. So this also leaves a very lean choice of using them for continuous exploration, production, drilling. Just for a statistics about 52 semisubmersibles or so far commissioned in the world. Brazil tops the maximum number of semi submersibles commissioned in Brazil waters in North America.

The next kind of platform which is also important for offshore drilling production is FPSOs, which abbreviates for floating, production, storage and offloading platforms FPSOs. Essentially FPSOs are actually converted form of large vessels, ships they are

completely floating type so the structural forms of these vessels of large vessels are modified.

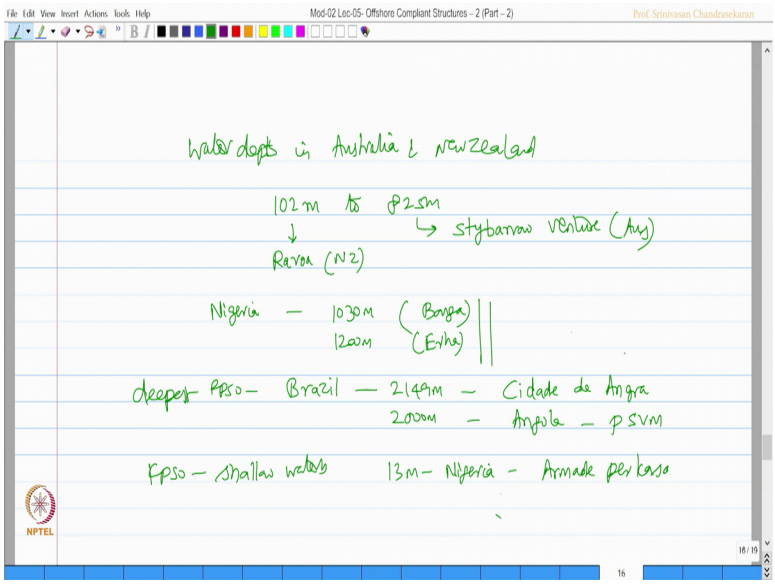
What modification you do is, you modify them from bottom supported system to completely floating system, most of them are self propelled. Therefore, this has got a very great advantage; the great advantage is they have high versatility that is mobility. Two they have decrease the downtime for commissioning and of course for de installation as well, if necessary. So that is a major advantage you have with FPSOs.

Refer Slide Time: 07:45)



Essentially FPSOs or FPS are similar to conventional barge or a tanker. They are of course modified to house various drilling and production equipments. Generally, Hull of an FPSO is typically a ship-shaped, geometry, usually with the mono-hull structure. Typical dimensions of an FPSO could be about 200 to 400 meter long and breadth can vary anywhere from 30 to 60 and the height can varies anywhere from 20 to 30 meter, which imposes a very large water plane area which actually enables them to float.

(Refer Slide Time: 09:01)

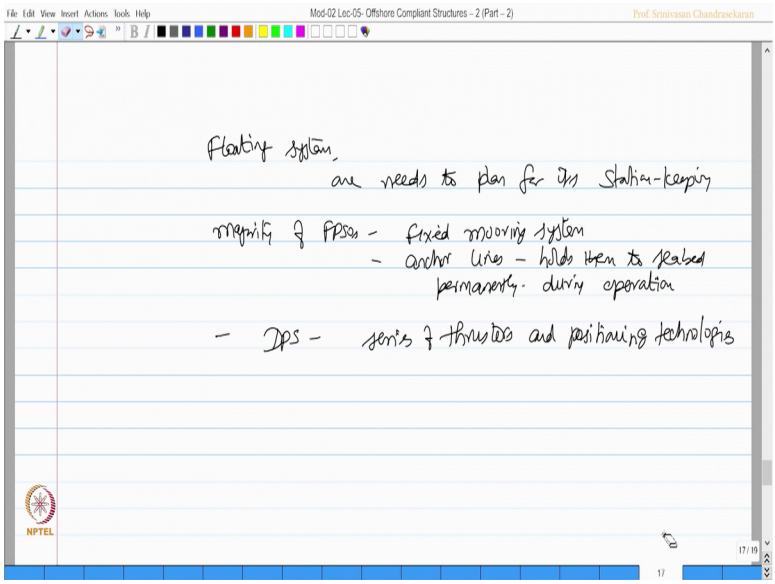


So, FPSOs are governed by choice of various parameters those parameters could be the ship size, size and availability of off tanks, projected downtime and Cargo destination. I mean these can be some of the factors which can govern what FPSOs geometric form will you choose for oil exploration? Essentially, large FPSOs have been deployed at various water depths in Australia and New Zealand they vary anywhere from as deep as 102 meters to that of 825 meters.o

For example, at 102 meter we have an FPSO which is Raroa which is in New Zealand and 825 meter we have an FPSO which is, Stybarrow Venture which is in Australia. You also have FPSOs in Nigeria at greater depths of 1030 meters. For example, Bonga you also have something at 1200 meters which is Erha and so on. More details can be seen in the reference books which we have listed in the NPTEL website.

The deepest FPSO, as a set is commissioned in Brazil at 2149 meters which is Cidade de Angra closer one is about 2000 meters in Angola which is PSVM. Of course, you will see FPSOs are also commissioned at shallow waters. For example, just in 13 meter in Nigerian Coast we have Armade Perkasa commissioned as an FPSO in Nigeria.

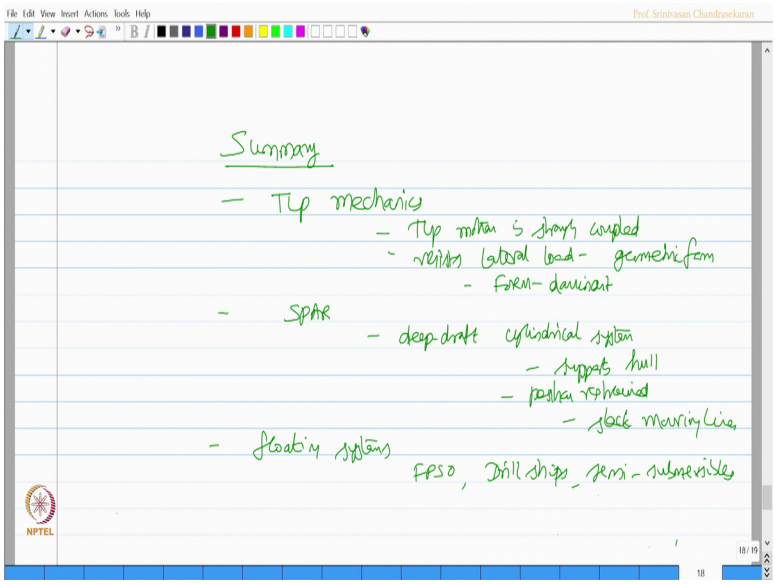
(Refer Slide Time: 12:20)



So as we all agree, now if you are deploying a floating system one needs to plan for its station keeping during, drilling and production. Majority of FPSOs, depend on fixed mooring system, they have anchor lines, which holds them down to the seabed permanently during operation.

Alternatively, you have dynamic positioning systems which can also be useful, which employees actually series of thrusters and positioning technologies. More details can be seen in the references, what we are discussing in the NPTEL website. There are parallel courses which also throw more light on types of offshore platforms, the focus of this course actually analysis. So we need to know the structural forms we are discussing at brief various structural forms which can be useful for oil and gas exploration.

(Refer Slide Time: 14:17)



So friends, in this lecture we have overview the TLP mechanics and understood the form dominance characteristics of TLP, we realize that TLP motion is strongly coupled and it resists lateral load by geometric form. So, we say it is Form-dominant design. Further, we also discussed about spar platforms which has got a deep-draft cylindrical system which supports the hull it is positioned restrained by slack moored tethers.

We also understood that the offshore platform design move to completely floating systems which are actually modified forms of sea going vessels like, FPSOs, Drill ships, semi-submersibles etcetera. So, in the next lecture we will talk about new generation platforms which are further modified structural forms of geometry which are more useful and I have got induced novelty and uniqueness in the structural form.

Thank you very much.