new design for spar platform

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1 author:

Adel Aissaoui
Ivano-Frankivsk National Technical University of Oil and Gas

A floating platform alternative that can support drilling, production and storage operations, the spar consists of a large vertical cylinder bearing topsides with equipment. Similar to an iceberg, the majority of a spar facility is located beneath the water's surface, providing the facility increased stability.

Mad Dog Spar

Originally designed as a floating buoy to acquire oceanographic information, the main component of a spar facility is the deep-draft floating chamber, or hollow cylindrical hull. Characteristically, the hull is encircled with spiraling strakes to add stability. Additionally, the bottom of the cylinder includes a ballasting section with material that weighs more than water, ensuring the center of gravity is located below the center of buoyancy.

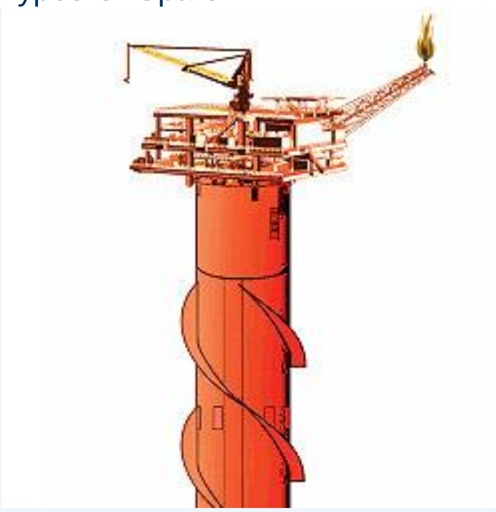
The deep-draft design makes the spar less affected by wind, wave and currents, enabling the facility to support both subsea and dry tree developments. Additionally, the enclosed cylinder acts as protection for risers and equipment, making spars an ideal choice for deepwater developments. Furthermore, the hull can provide storage for produced oil or gas.

Neptune Spar

Atop the spar hull sits the topsides, which can be comprised of drilling equipment, production facilities and living quarters. Drilling is performed from the topsides through the hollow cylinder hull; and drilling, import/export and production risers are passed through the enclosed hull, as well. The whole spar facility is then moored to the seafloor.

While the hull is fastened to the sea bed through various mooring techniques, spar facilities do not require moorings to stay upright. The unique design of the spar ensures that the facility will not topple even if the moorings are not connected because the center of gravity is located below the center of buoyancy.

Types Of Spars



Traditional Spar

There are three types of spars, including the original spar design, truss spars and cell spars. Consisting of a single cylindrical hull, the original design for spars was created in the mid '90s with the first developed for the Neptune field in the Gulf of Mexico.

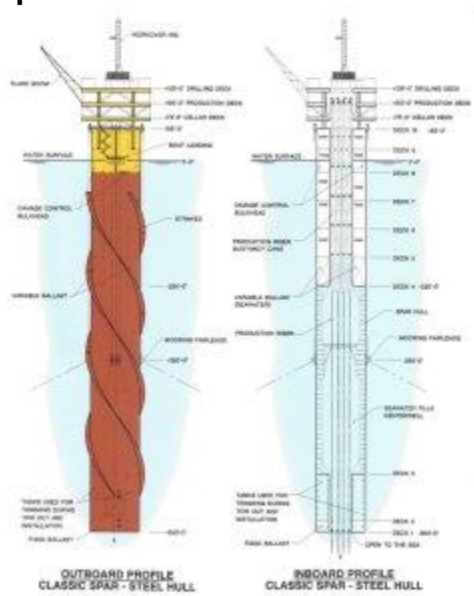
Truss Spar

The next rendition of the spar was the truss spar, which is similar to the original spar design, but the cylindrical hull is shorted and a truss is incorporated below it. The truss usually includes horizontal plates that help to decrease vertical movement. The truss spar is advantageous because it weighs less than the original design, and because it requires less steel, which costs less.

Red Hawk Cell Spar[*Source: www.anadarko.com*]

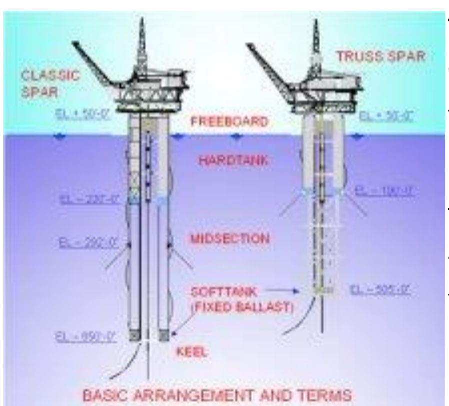
The most recent variation of the spar is the cell spar, which is a scaled-down version of the original design. The cell spar includes six pressure vessels gathered around a seventh vessel. Resembling massive hot dogs, these pressure vessels are more easily and cost-effectively generated through mass production. Providing the buoyancy for the facility, the vessels are held in place by structural steel, which extends below the vessels and keeps with the deep-draft design by providing stability.

Spar Platform



A spar is a deep-draft floating caisson, which is a hollow cylindrical structure similar to a very large buoy. Its four major systems are hull, moorings, topsides, and risers. The spar relies on a traditional mooring system (that is, anchor-spread mooring) to maintain its position. About 90 percent of the structure is underwater. Historically, spars were used as marker buoys, for gathering oceanographic data, and for oil storage. The spar design is now being used for drilling, production, or both. The distinguishing feature of a spar is its deep-draft hull, which produces very favorable motion characteristics compared to other floating concepts. Low motions and a protected centerwell also provide an excellent configuration for deepwater operations. Water depth capability has been stated by industry as ranging up to 10,000 ft.

The hull is constructed by use of normal marine and shipyard fabrication methods. The number of wells, surface wellhead spacing, and facilities weight determine the size of the centerwell and the diameter of the hull. In the classic or full cylinder hull forms, the upper section is compartmentalized around a flooded centerwell containing the different type of risers. This section provides the buoyancy for the spar. The middle section is also flooded but can be economically configured for oil storage. The bottom section (keel) is compartmentalized to provide buoyancy during transport and to contain any field-installed, fixed ballast. Approximate hull diameter for a typical GOM spar is 130 feet, with an overall height, once deployed, of approximately 700 feet (with 90% of the hull in the water column).



The first Spars were based on the Classic design. This evolved into the Truss Spar by replacing the lower section of the caisson hull with a truss. The Truss Spar is divided into three distinct sections. The cylindrical upper section, called the "hard tank," provides most of the in-place buoyancy for the Spar. The middle truss section supports the heave plates and provides separation between the keel tank and hard tank. The keel tank, also known as the "soft tank," contains the fixed ballast and acts as a natural hang-off location for export pipelines and flowlines since the environmental influences from waves and currents and associated responses are less pronounced there than nearer the water line.

A lateral catenary system of 6 to 20 lines keeps the spar on location. The mooring lines are a combination of spiral strand wire and chain. Because of its low motions, the spar can use a taut mooring system at a reduced scope and cost compared with a full catenary system. Each mooring line is anchored to the seafloor with a driven or suction pile. The hullend of the line passes through a fairlead located on the hull below the water surface, then extends up the outside of the hull to chain jacks at the top, usually 50 ft or more in elevation. Excess chain is stored in the hull. Depending on hull size and water depth, the moorings can vary in number up to 20 lines and contain 3,700 ft of chain and wire. Starting at the seafloor, a typical mooring leg may consist of approximately 200-ft long, 84-inch diameter piles; 200 ft of 4¾-inch bottom chain; 2,500 ft of 4¾-inch spiral strand wire; and 1,000 ft of 4¾-inch platform chain. The footprint created by the mooring system can reach a half-mile or more in diameter measured on centers from the hull to the anchor piles.

The topsides configurations follow typical fixed platform design practices. The decks can accommodate a full drilling rig (3,000 hp) or a workover rig (600-1,000 hp) plus full production equipment. Production capacities range up to 100,000 BOPD and 325 MMcfgpd. The type and scale of operation directly influence deck size. The larger topsides would be consistent with drilling, production, processing, and quarters facilities, and could also include remote wells/fields being tied back to the spar for processing. Total operating deck load, which includes facilities, contained fluids, deck structural and support steel, drilling/workover rig, and workover variable loads, can be 6,600 tons or more. Crew quarters on a production/workover spar may accommodate 18 workers, while a full drilling and production facility may house 100 people.

There are three basic types of risers: production, drilling, and export/import. Production - Each vertical access production riser is top tensioned with a buoyant cylinder assembly through which one or two strings of well casing are tied back and the well completed. This arrangement allows for surface trees and a surface BOP for workover. The drilling riser is also a top-tensioned casing with a surface drilling BOP, which allows a platform-type rig to be used.

Export/import risers can be flexible or top-tensioned steel pipe or steel catenaries. Production risers consist of a conventional subsea wellhead at the mudline and a tieback connector with a stress joint for taking the stresses associated with environmentally imposed displacements. The seafloor pattern (footprint) depends on the number of risers. For example, a riser pattern may consist of 16 risers in a parallel 8 by 2 pattern, on 15-ft centers within each row and 20 ft between rows, thus having a rectangular footprint approximately 100 ft long by 20 ft wide. Other patterns (e.g., circular or square) are available. An example production riser for a spar could be either a single or dual-bore (concentric pipe) arrangement. Low motions of the spar allow the use of the economical steel catenary riser technology for subsea production trees.

Installation is performed in stages similar to those of other deepwater production systems, where one component is installed while another is being fabricated. Installation schedules heavily depend upon the completion status of the hull and topsides.

Prior to the delivery of the hull to location, a drilling rig might predrill one or more wells. During this time, export pipelines are laid that will carry production either to another platform (host) or to shore after processing. A presite survey is performed and includes the following: onbottom acoustic array installed for the mooring system, identified obstructions removed, anchor pile target buoys preset, and a final survey of the mooring lay down area performed. Once on location, a derrick barge installs the anchor piles and mooring system. The installation of the anchor piles is performed using a deck-mounted lowering system designed for deepwater installations and an underwater free-riding hydraulic hammer with power pack. Remotely operated vehicles (ROV's) observe the hammer and umbilical as the pile is lowered and stabbed into the seafloor.

In conjunction with pile installation, the mooring system is laid out and temporarily abandoned. A wire deployment winch with reels specifically designed for this type of work handles each wire. An ROV monitors the wire lay-down path as the derrick barge follows a predetermined route until it reaches the wire end on the deployment reel. The end of the mooring wire is then connected to an abandonment/recovery line and marked for later use in attaching the mooring system to the hull.

To date, all GOM spar hulls have been built in Finland. Upon completion of the hull, it is shipped to the Gulf of Mexico on a heavy-lift vessel such as the Mighty Servant III. Because of its size and length it is necessary to divide the spar hull into two sections. Upon arrival at an onshore facility, the sections are connected together using a wet mating technique, which allows for lower cost and ease of handling and positioning, and eliminates the need for special equipment. The hull is then ready for delivery to location.

Depending on the proximity of the onshore assembly location to the open sea, smaller tugs (2,000 to 4,000 hp) may be used first to maneuver the hull into deeper water, and then larger oceangoing tugs (7,000 hp) tow the spar to its final destination.

A derrick barge and a pump boat await arrival of the hull on site. The barge and boat up-end the hull. While the hull is being held loosely in place, the pump boat fills the hull's lower ballast tank and floods the centerwell. The hull self-up-ends in less than two minutes once it is flooded. Next, the derrick barge lifts into place a temporary work deck brought to the site on a material barge. Tasks performed using the temporary work deck are basic utility hook up, mooring line attachment, and riser installation.

The hull is positioned on location by a tug and positioning system assistance. Then the mooring system is connected to the hull. After the mooring system is connected, the lines are pretensioned. Then the hull is ballasted to prepare for the topsides installation and removal of the temporary work deck.

Topsides are transported offshore on a material barge and lifted into place by the derrick barge. An important characteristic is that the derrick barge can perform the lift in dynamic positioning mode. The topsides consist of production facilities, drilling/workover rigs, crew living quarters, and utility decks. Installation of miscellaneous structures such as walkways, stairways, and landings are also set in place by the derrick barge.

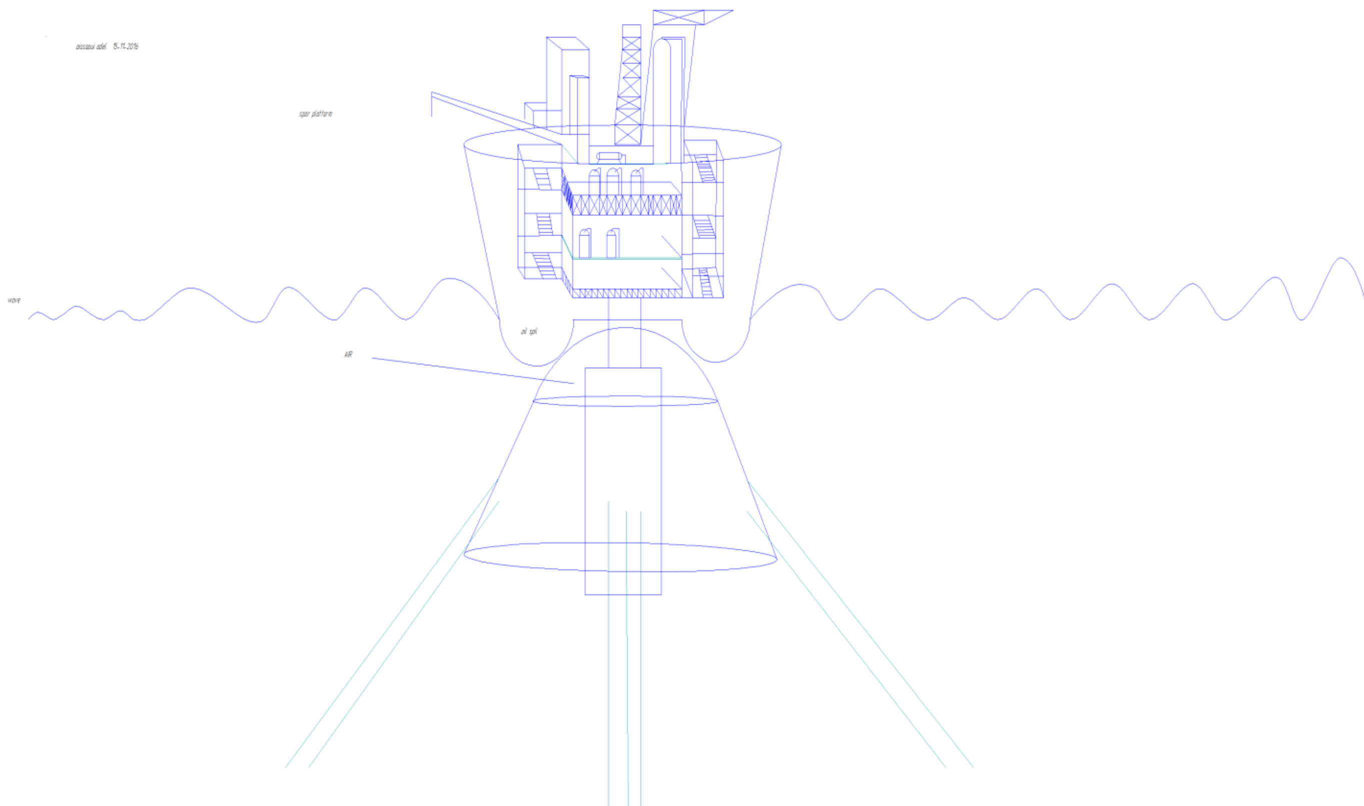
The last pieces of equipment to be installed are buoyancy cans and the associated stems. The cans are simply lifted off the material barge and placed into slots inside the centerwell bay. Next, the stems are stabbed onto the cans. To prepare for riser installation, the cans are ballasted until the stem is at production deck level.

A new design for the oil platform from the work of researcher AISSAOUI ADEL

A new design for a floating oil platform consists of a separation wall that there was an oil spill fall in oil platform basin

The bottom of the podium there Archimedes apply the theory to use the air pressure beneath the platform oil

To get the air pressure to install the platform and leveled the surface of the water



Cantact :
Mr ADEL AISSAOUI
Adel_a1983@yahoo.fr
RUE RIGHI BRAHIM BATNA ALGERIA 05021
+2130666442892
+213 0550149101