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The Development of an FPSO for the Deepwater Gulf of Mexico

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Abstract

This paper presents the issues specific to the engineering and operation of FPSOs in the US Gulf of Mexico, and discusses the design of one FPSO currently under development and how it addresses those issues.

The areas of the FPSO design which are discussed in this paper include:

- Regulatory and environmental requirements
- Vessel selection and refurbishment for design life extension
- Riser and station keeping/mooring design for hurricane and loop current conditions in deepwater
- Topsides design including associated gas disposal
- Oil import and export facilities
- Shuttle tanker requirements

The design basis of this FPSO has been developed with the intent of enabling the unit to be easily redeployable in different locations, either as an Early Production System (EPS) for large fields, or a Full Field Development on marginal or medium size fields (30- 80,000 bopd).

Different technologies are compared and their design and operational limitations identified, for riser design (flexible risers, hybrid riser towers, top tensioned risers, single well riser towers, permanent and disconnectable) and station keeping design, (permanent or disconnectable, dynamic positioning or anchor leg moorings, polyester or wire rope mooring systems). Those aspects of the design which require technology new to the Gulf of Mexico, will be highlighted and comparable applications of the technology elsewhere in the world, if applicable, identified.

There has been an increased interest recently in the application of FPSOs for the development of deepwater fields in the Gulf

of Mexico. Damage to offshore facilities and the pipeline infrastructure during recent hurricane seasons, has made the benefits of the FPSO concept more apparent, with its large onboard oil storage capacity and capability to offload via shuttle tankers or pipelines, and its ability to disconnect from risers/moorings and avoid the hurricane conditions design case. Understanding the issues relative to the use of FPSOs in the Gulf of Mexico and developing a design, which utilizes the proven technology of FPSOs elsewhere in the world, is key to applying this concept successfully in this region.

Introduction

So far there have been no FPSOs installed in the US portion of the Gulf of Mexico (GoM) even though the concept has been increasingly selected for field developments elsewhere in the world. What are the key issues when reviewing the suitability of an FPSO for this region, and what has changed recently to affect the selection process? The damage caused to the offshore units and pipelines system by hurricanes Ivan, Katrina, and Rita, plus the continuing exploration success in the ultra deepwater beyond the continental shelf, are two of the main drivers towards the current interest in FPSOs in the Gulf of Mexico.

The ability of the FPSO to be designed to disconnect and sail away prior to the arrival of a hurricane, and the fact it is not dependent on the pipeline network to transport oil, makes it an inherently more robust and safe design concept. Recent increases in the hurricane wind speed and wave height design criteria, by the operating companies, further enhances the benefits of the FPSO concept, particularly if the FPSO is disconnectable to avoid the hurricane condition.

Special Design Issues for GoM FPSO

There are special issues to be considered when developing the design and the schedule for the FPSO and hence the price. Individually these issues are not unique to the USA GoM, but the combination of all of them in one region is.

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