

FSO to feature simultaneous offloading to two tankers

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Permanently moored unit nearing completion

A floating storage and offloading vessel is being fabricated for installation in the Cantarell Field in the Mexico sector of the Gulf of Mexico. Three FMC business units - Sofec, Loading Systems, and Smith Meter - have combined capabilities and product lines to deliver the first permanently moored floating storage and offloading (FSO) vessel in the Gulf of Mexico.

The business units supplied the external turret mooring system, ship-mounted marine loading arms, and metering systems to Modec (USA), the prime contractor for Pemex, the Mexican national petroleum company. The project, which called for the FSO to be completed on a fast-track basis, incorporates new technology developed especially for the job.

The Cantarell Field in the Gulf of Mexico off the coast of the Yucatan Peninsula is one of the largest oil fields in the world. Pemex is expanding its crude oil export systems to include a 350,000 dwt (deadweight ton) FSO that will be permanently moored in 246 ft of water near the field facilities. The FSO will be constructed, owned, and operated by Modec (USA) under a long-term charter contract arrangement with Pemex.

The FSO will provide 2.3 million bbl of crude oil storage capacity. It is designed to offload two shuttle tankers simultaneously, one moored in tandem with the FSO and one moored side-by-side with the FSO.

Simultaneous offloading of two shuttle tankers has not been done anywhere else in the world. Side-by-side offloading is made possible

by three deck-mounted Chiksan marine loading arms supplied by FMC's Loading Systems. A single receiving metering skid and two independent offloading metering skids provided by FMC's Smith Meter will confirm oil import and export rates. The FSO is scheduled for installation in the summer of 1998.

FSO technology

The Pemex FSO is a unique vessel in many ways. Sofec provided design, procurement, fabrication, installation, and commissioning of the turret mooring system to meet rigorous and exacting customer requirements.

Based on time constraints, environmental conditions, and production data, Sofec recommended to Modec (USA) the selection of an external turret mooring system for the project.

State-of-the-art frequency and time-domain simulations were conducted by Sofec to accurately predict mooring system motions and forces under 100-year storm conditions. Verification came through extensive model basin tests including tandem and side-by-side offloading simulation.

Construction and installation of the turret system were performed in Singapore where Modec (USA) undertook the tanker conversion. Many of the key elements for the project, including the fluid swivel were shipped from the US. The main bearing was manufactured in Europe and shipped to Singapore for installation.

Loading systems

The FSO project called for a bank of three ship-mounted 16-in. loading arms capable of performing side-by-side offloading operations in sustained winds to 25 mph and maximum wave heights to 13 ft. Additionally, the arms required an emergency release system and means for storage during vessel motion or hurricane conditions.

The vast majority of the world's marine loading systems are dock mounted. In the case of ship-mounted loading arms, there is constant motion and forces at work between two moving bodies. To accommodate these demands, the loading arms for this project utilized multiple swivels and an extra-long arm length of 93 ft. When necessary, the arms can be stored horizontally on the ship deck.

Since a traditional emergency release system would make the loading arms too heavy for the FSO, FMC's Loading Systems developed a new generation of fully powered piggable marine loading arms that minimized weight while accomplishing the emergency disconnect requirements. The new arms feature a hydraulic coupler and automatic pigging system for fast connection and disconnection on the shuttle tanker. A state-of-the-art position monitoring system with a microprocessor and special sensors monitors the position of the arms at all times. If a shutdown is required, the system shuts the pumps down and the automatic pigging system empties the arms prior to any disconnection.

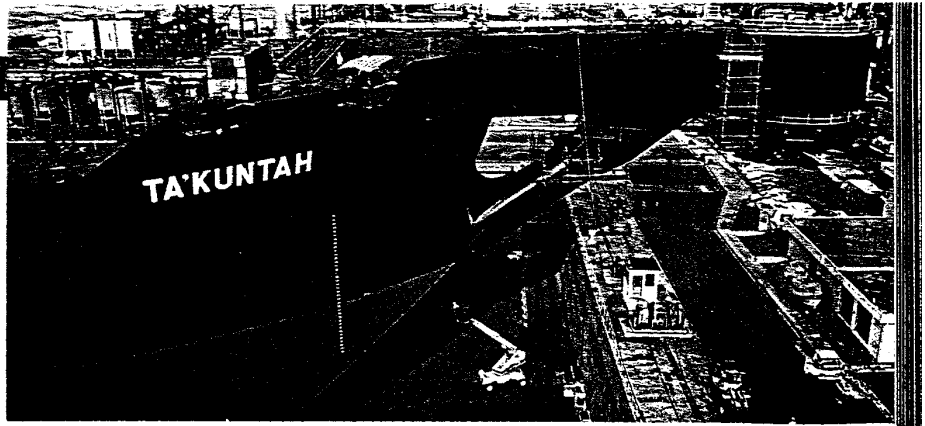
Custody metering

The PEMEX FSO called for three metering systems, one skid-mounted system for the measurement of incoming oil and two skid-mounted systems for the simultaneous measurement of outgoing oil to separate shuttle tankers.

A total of twenty 16-in. PD (positive displacement) meters and 11 SyberTrol flow computers were required. To deliver the equipment on schedule, normal lead times had to be reduced 75%. As a result of product simplification by Smith Meter, the PD meter design had been changed to reduce both cost and lead time.

The PD meters, the largest and most advanced of their kind in the world, each weigh over 6,500 pounds and stand over 5-ft tall, were shipped in batches of 3, 4, or 5 meters at a time. The outgoing metering skids each had eight PD meters with a measurement capacity of 80,000 bbl of oil per hour. The incoming skid has four PD meters.

The completion of the Pemex project marks the first use of a permanently moored FSO in the Gulf of Mexico.Δ



The Ta'Kuntah FSO currently under construction.