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# SURVEYOR



**ABS**

*From Temporary Solution to Project Centerpiece —*

# THE EVOLVING ROLE OF THE FPSO



*A quarter-century on, FPSOs have achieved the recognition and the opportunities that their inventors envisioned.*

**N**othing reflects a concept's acceptance better than its adoption as part of a billion-dollar project. In January 2001, ConocoPhillips announced a plan to spend over \$2.5 billion in Indonesia's oil and gas sector during the following nine years, as part of a total planned investment of some \$3.4 billion between 1998 and 2010.

The overall goal, said ConocoPhillips, Indonesia, President/General Manager Patrick Meyer at the time, was to double crude output and quadruple gas production by the end of the decade. Current ConocoPhillips production is about 40,000 barrels oil per day (bpd) and 100 million cu ft gas per day (cfd). The massive infusion of technology will fuel Indonesia's first gas exports, and involves a gas pipeline, subsea completions, drilling operations, additional platforms, an LPG storage tanker and, as the project's centerpiece, the nearly \$600 million floating production/storage/offloading (FPSO) unit *Belanak*.

The ABS-classed *Belanak* is 1,000 ft long, stores a million barrels of oil, and will have a daily output of up to 350 million cu ft gas,



100,000 barrels oil and condensate, and 23,000 barrels of LPG. Built on the back of long-term natural gas contracts between Indonesian national petroleum company Pertamina and Singapore's SembCorp Gas (for 22 years) and Malaysia's state-run energy company Petronas (for 20 years), the FPSO will produce five products: natural gas, propane, butane, naphtha and oil.



Peter Noble,  
Director, Engineering,  
Floating Systems,  
ConocoPhillips

ment of FPSO technologies. It also encouraged a convergence in lines of thought regarding standards, regulation and, to an extent, design and engineering.

Sid Sircar, ConocoPhillips's EPC (engineering/procurement/construction) manager for the *Belanak* project, is a 27-year industry veteran who has worked with FPSOs throughout their evolution. He notes a genuine convergence in standards indicating a level of maturity in the industry.

"Each class society developed its own rules for floating production systems, and they have ended up quite similar to each other," he says. "The same has happened with company specifications and minimum standards across the industry. It is the kind of technical evolution that every industry goes through, and it is having a standardizing effect on FPSOs."

Because FPSOs are site-specific systems – the reservoir characteristics and the environment determine critical system features – the standardizing effects occur in very broad strokes.

Karve sees this convergence as an alignment of design philosophies regarding the two basic elements of an FPSO, mooring and facilities. "We have come to the point where we pretty well know which direction to go at the very start of a project," he says. "We've done enough mooring systems, for example, to be able to determine very quickly, for any particular site, what the mooring system should look like.

"And on the topsides," he adds, "the industry has developed a modular approach, with whole elements of the facility located in skids. Say you want to add gas compression to your 100,000-barrel production train. You pull one module out and add the gas compression skid. If you need water injection, you add that block of modules. This approach has been developed to adapt the units to changing field applications."

It also gives them a versatility that amplifies the opportunity in a new business line: relocation.

It was a dream of the first FPSO designers that evolution would bring off-the-shelf FPSOs that could be easily adapted for service in an offshore oilfield anywhere in the world. While that isn't a likely scenario for an industry of site-specific systems, something in that spirit is happening. "The relocation market, which was talked about quite a lot in the 1980s and 1990s, is here," says Francis Blanchelande, President of SBM Production Contractors. SBM, with a growing fleet of owned/operated units, has already had several older FPSOs relocate, some multiple times. "In 2003, we have four units going into production, and three coming out," he says. "These will be reconverted and go to other jobs. It's the beginning of a cycle, and a growing market."

Forecasters expect that, over the next decade, some eight to ten development projects a year will have FPSO slots to fill. And a growing tendency of oil companies to simplify operations by leasing their FPSO from a contractor adds to the opportunity.



*Belanak* is one of three "Ultra-Large FPSO" projects currently underway. The others, destined for elephant fields offshore West Africa, are TotalFinaElf's *Girasoll* (200,000 bpd) and ExxonMobil's *Kizomba* (250,000 bpd). Together, the three different units in two different regions confirm one significant fact: the FPSO has become an integral element in the development of offshore energy resources.

"The FPSO has evolved from being a technology for marginal fields to one for larger discoveries," says Shashank Karve, President and CEO of Houston-based Modec International, a leading engineering contractor and owner/operator of FPSOs. "They are now accepted by all oil companies for most situations. Over the last eight years, in fact, FPSOs have become the primary choice for field development in many areas of the world."

The technology got a slow start. The first FPSO came on line in 1977, to produce a small field for Shell in the Mediterranean Sea; the second in 1979, for Petrobras' Garoupa field offshore Brazil; and the third in 1981, for Amoco in the Philippines. Neither ship

nor platform, they cut a strange figure to both maritime and offshore eyes.

For a long time, the industry viewed these floating refineries as a hybrid technology for marginal fields, with reservoirs too small and remote to be profitably developed by standard means. The technology was proven in such service, and continues to bring many marginal fields into production. But now FPSOs do much more than that, and are making an ever-increasing contribution to world oil supply.

By 1992, 28 FPSOs had been built, with an aggregate production capacity of about a million bpd. A decade later, there are 84 in service, with a total production capacity approaching six million bpd – about half of that coming online in the last five years.

When units now building enter service, there will be around 100 FPSOs in the world. More importantly, current data indicate that over 200 additional FPSO development projects are in various phases of study, planning or commitment.

The rapid succession of projects in less than a decade gave an adrenaline boost to the refine-



Shashank Karve,  
President & CEO,  
Modec International



At the moment, first-wave FPSOs are coming off contract and finding relocation work, but usually after major facility upgrades to meet new project demands. Many older units are even being upgraded on site, reflecting changing expectations of the technology. Amoco's *Nan Hai Fa Xian* in the South China Sea, for example, went online in 1991 at 30,000 bpd. Over the ensuing decade, production was upgraded to 130,000 bpd. This rising sophistication brings a rising opportunity.

"In the beginning, FPSOs were basically just separating oil, water and gas by gravity, without water injection, gas lift or gas injection," recalls Blanchelande. "So, changing fields meant changing equipment to meet the criteria of the new field. Today, systems are much more sophisticated. I would say units built within the last seven years will be easier to relocate than even units built ten years ago because they are so versatile."

According to Karve, the influx of units-for-hire will alter the FPSO market to resemble that of drilling rigs. "In a few years, between Modec and SBM, there will be a pool of maybe 20, 30 systems that, as lease periods or commitments expire, are ready to move to another application on very short notice."

The relocation concept isn't limited to contractors. It was at the heart of the industry's first "series" FPSO order, ExxonMobil's recent "Generic" FPSO program for use in and around West Africa. With topsides able to handle a range of crude oils, and the hull set up for a range of moorings, the unit becomes adaptable to a variety of locations with similar climates.

Peter Noble, Director, Engineering, Floating Systems, ConocoPhillips, says oil companies planning a number of FPSO projects may adopt such lines of thought. "If you're planning to build an FPSO each year, there is a possibility to negotiate a kind of series production; even if they aren't identical, there is enough commonality in accommodation units, seawater pumping systems, power generation systems, etc., to make savings through repetition possible."

Basic systems are already starting to converge, he says. "On older FPSOs, the cargo systems



typically followed those of tankers: big pumps in a pump room, with pipes connecting all the tanks together," he points out. "But in the latest newbuilds, it's becoming common to have deep-well pumps in every tank, which makes maintenance and offloading easier. In such ways, you could see basic systems becoming more or less standard over time."

"The concept that the FPSO is, by nature, a temporary solution has changed," says Sircar. "So the basic assumptions behind the traditional choice of a hull conversion have gone away. Economic analysis shows that on a project to be producing for more than 15 years, there is little cost difference between a new-build hull or a conversion. As a consequence, we're seeing much more newbuilding than in the past."



"There may be more newbuildings at present because there are fewer old VLCCs around right now, or because yard prices have been pretty good, because there are more projects looking at double-hull units, or because people haven't been in that much of a hurry. There are many considerations that go into the choosing."

Sometimes, politics and perception become bigger issues than the technology. There are cases where the risk presented by regional instability – or the memory thereof – or other local uncertainties has decided offshore production in favor of the FPSO.

In the US Gulf of Mexico, political considerations, plus memories of dramatic oil spills, kept FPSOs out of the game until last year. In December 2001, the US Minerals Management Service (MMS) issued a Record of Decision clearing FPSOs for the US Gulf. The decision was based in part on an analysis of a double-hull FPSO, virtually locking in that configuration for any future FPSO solutions there. Though double hulls have not yet been internationally mandated for FPSOs, regulatory evolution may tend that way, if coastal states take the MMS approach as a lead.

There are good reasons to choose a double hull. For one, the smooth-sided cargo tanks are easily cleaned, inspected and maintained. And as the vessel ages, it becomes very handy to be able to inspect and repair the underside of the cargo area from inside. Even so, many proponents of double hulls consider that this should be a project decision rather than a regulatory mandate.

A comprehensive look at the issues facing US Gulf FPSO projects was taken at last September's FPSO Global Workshop. Organized by Lovie, it was the first gathering of FPSO mavens since the MMS decision came down. "The general feeling about the situation was summed up pretty well by a slide in one presentation that said, 'Economics, economics, economics,'" he says. "The conference participants generally agreed that the FPSO is now regarded as just another tool in the toolkit. Now it's just a matter of time, to find a field where the economics say it can be used."

The first newbuild FPSO, *Anoa Natuna*, came online in 1990, built by Modec for Amoco's Indonesian activity. For a long time, most FPSOs were based on converted tanker hulls, and newbuilds were regarded as something of an anomaly. While most FPSOs in the fleet are conversions, the percentage of newbuilds has risen over the last five years to about a third of the population.

Peter Lovie, American Shuttle Tankers Vice President, thinks this is more coincidence than trend. "Timing is often the major influence on the hull choice," he says. "If the project demands you move quickly, you might go for an existing hull. I've seen conversions chosen where they didn't save anything but time.