Tender Moments in the North Sea

One of the most significant trends over the past five years has been the dramatic reduction in offshore field development costs. As platforms have been slimmed down and simplified, interest has intensified in using tender vessels to support drilling operations and cut project costs.

Tender-assisted drilling (TAD) is not new. Simple barges in mild environments and jackups in up to 80-meter (260-foot) water have been used as tenders for many years. But now attention is increasingly turning to sophisticated semisubmersible tenders for use in deep water and harsh conditions.

A good example of how TAD has improved development economics is the UK North Sea Gannet field which is being developed by Shell UK Exploration and Production (Shell Expro). In 1985, conventional development philosophy called for four large platforms and one subsea satellite for Gannet. This plan was shelved in 1986 because of falling oil prices, although one part of the field has since been developed as the Kittiwake field using a single platform. The new design for the rest of the field involves only one minimum facilities platform with three subsea satellites, two platforms fewer than the original plan.

The Gannet platform will also be considerably smaller than those envisaged in 1985 (next page). A key factor in this size reduction is use of a semisubmersible tender support vessel (TSV) for the two-year drilling phase. Unlike conventional platforms, which have permanent, heavy drilling modules, only essential drilling equipment will be sited on the platform in one removable module. This leaves mud, cement, water and chemical mixing, storage and pumping equipment on the TSV, along with power generation, utilities, tubular storage and accommodations for 98 people. Platform and tender will be linked by a motion-compensated personnel gangway, catenary umbilicals to carry mud, cement and electrical power to the platform and a mud return boom.

This approach cuts dry topsides weight by 2,000 metric tons (t) [2,200 tons] and operating weight by 5,000 t [5,500 tons]. This not only reduces the overall amount of fabrication required but also simplifies installation and reduces offshore commissioning requirements. Platforms are traditionally installed offshore as a series of modules which then have to be linked together. Over the past few years, the lift capability of semisubmersible crane vessels has increased and Gannet's topsides, with a lift weight of 9,500 t [10,450 tons], is within lifting limits and will be installed as a single integrated deck.

Increased crane capacity also permits lift-installation of the substructure (jacket). Set in 95-meter [312-foot] water, the platform will have a single
Shell Expro is engineering the platform-based drilling equipment—derrick, drawworks, substructure, skid base and blowout preventers—most of which will be contained in a skid-mounted module and placed by the crane barge during installation. After drilling, the module may be removed.

For mud treatment, only shale shakers and degassers will be located on the platform. These will partially clean the mud before it flows to the TSV via the mud return boom—a hydraulically controlled boom and carrier with a flexible hose for the mud, together with a low-pressure rig service air line. Mud treatment will be completed on the TSV using desanders, desilters and centrifuges.

Catenary links provide power, control signals and transfer of high pressure mud and cement at 5,000 psi. These loop some 70 meters (230 feet) into the water to allow for relative movement between the TSV and platform and also to enable the TSV to move some 100 meters (328 feet) from the facility without complete disconnection.

The motion-tolerant telescopic gangway is mounted on, and controlled primarily from, the TSV. This gangway will also be used to transfer low-pressure fluids (salt water, diesel oil and potable water). It is designed to disconnect automatically in rough conditions. To speed up reconnection, a target and guide cone on the platform cellar deck will help land and lock the gangway in place.

Modifications to prepare the drilling rig for TAD duties are minimal. Apart from installing the gangway, modifying pipework to connect with the catenary systems and converting electrical systems to supply 4,160 volts to the drilling package, few additional modifications are envisaged. The lifeboats will be moved so that they all point away from the platform, but the drilling mast will be left intact and, if necessary, Shell Expro will be able to switch the rig from TAD to normal drilling in only a few days.

Most of the TSV engineering effort centers on integration rather than innovation to ensure that the semi is compatible with platform topsides. The aim is to pull alongside the platform and plug in. For
example, only a few valves need be operated to divert the mud and cement to the catenaries and thence to the platform. Communications between TSV and platform also epitomize this approach. A sophisticated electrical cable will convey power and carry a fiber-optic link and small instrument cables. Communications are also backed up by a microwave system. The telephone switchboard on the semi requires a single connection with that on the platform for complete integration.

The fire and gas systems will remain independent, with status relayed to control rooms on both the platform and the TSV. This retains the integrity of each system but also ensures that all parties are aware of the status on both installations at all times. The management system will be developed jointly by Shell Expro and Sedco Forex and will take into account the recommendations of the Cullen Report on the Piper Alpha disaster, dated November 1990. This system will define clearly the procedures to be used during an emergency and will also set out the respective responsibilities of the offshore installation manager and the TSV barge superintendent.
If weather permits, the Gannet platform is large enough for all the tubulars to be lifted straight onto it and stored there. Otherwise, everything will transit via the TSV.

The seabed conditions in the area are not ideal for anchoring. Ten pipelines in the vicinity further complicate the process. The tender will be moored using its conventional eight-point chain anchoring system. The mooring chains will be attached to preinstalled piled anchoring points. There is also the option of using the vessel's four thrusters to assist the mooring system in keeping over a fixed point on the seabed during difficult operating conditions. The anchoring system will be upgraded to meet the new and more rigorous Posmooir V mooring standard established by Det norske Veritas, an internationally accepted certifying authority that formulates and enforces regulations governing marine vessels and offshore installations.

The only semisubmersible TSV operation so far to have completed drilling in the North Sea has been in the Norwegian sector. The Odin field, operated by Esso Norge a/s, was developed using the converted drilling rig Treasure Hunter. Data on disconnection because of bad weather paint an optimistic picture. Only 0.4 percent of drilling interruptions have been attributable to TSV/hose disconnection because of bad weather or hose malfunction.

According to the Norwegian Petroleum Directorate, drilling interruptions in the TSV operation between December 1983 and January 1985 were 12.5 percent of total time. Average for production drilling operations in offshore Norway during that period was 14.2 percent.

Estimates for Gannet predict a better performance than in Odin. Sedco 704 will normally be stationed about 30 meters [100 feet] from the platform. The tender will be disconnected when conditions deteriorate into what is called a one-year storm. This is the most severe storm expected in a year with a significant wave height, which is the average of the highest third of the waves encountered by a structure, of 10 meters [33 feet]. Disconnection will also start in wind speeds of 70 knots [130 kilometers per hour]—the safe lifting limit of the gangway, when telescopic movement of the gangway approaches plus or minus 8 meters [26 feet] or when anchor line tensions reach 400 kips [1,800,000 Newtons].

Disconnection of the gangway and mud return boom is almost instantaneous. Within about 30 minutes the anchor winches can be manipulated so that the TSV is moored 100 meters from the platform with the electrical/instrumentation line and the mud and cement hoses still connected. Once in this position, the TSV is designed to withstand the most extreme conditions in the North Sea—a 100-year storm with a significant wave height of 13.6 meters [44.5 feet] and a maximum wave height of 25.1 meters [82.3 feet].

Risk assessment carried out for Shell Expro shows that drilling using TAD on Gannet is no more hazardous than from an integrated platform. Safety is also enhanced because Sedco 704 will be moored with its aft adjacent to the platform, placing the living quarters and helideck farthest from the production and drilling modules.—CF

Further Reading and Acknowledgements


“Tenders Come into the Reckoning But Not Across the Board,” Offshore Engineer (June 1989), 22-23.

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