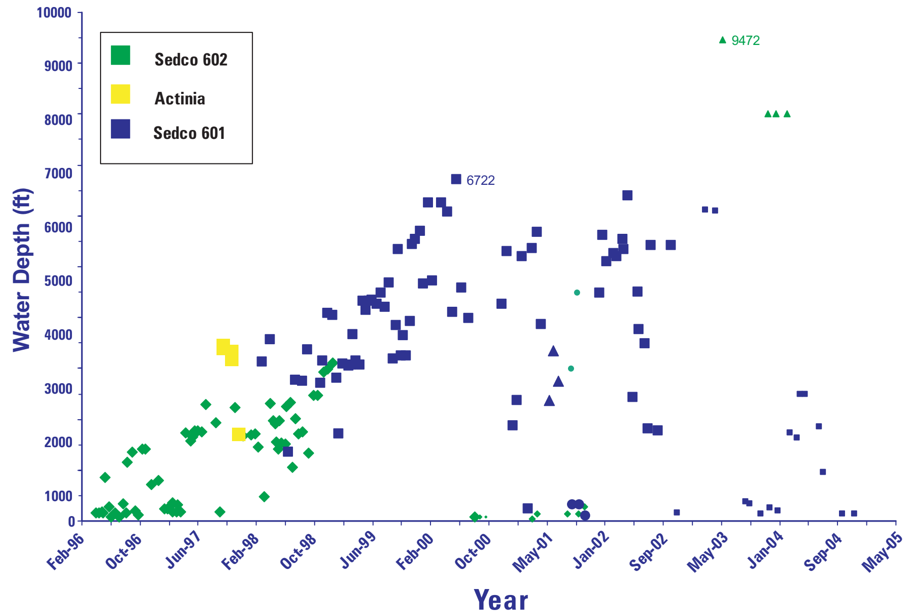
SBOP technology results in better efficiency, safety



The industry began drilling with SBOPs in about 100 ft of water or less in early 1996 but quickly moved into ever increasing water depths, including several wells in water greater than 8,000 ft and one approaching the 10,000 ft water depth mark. Chart courtesy of John Kozicz, Transocean.

SINCE UNOCAL FIRST utilized surface BOP (SBOP) technology offshore Indonesia, the method has gained acceptance in virtually every benign climate area where deepwater and deep exploration is taking place.

An IADC Task Force began developing SBOP specific guidelines in 2002. Surface BOP Guidelines for Floating MODUs is now available on CD from IADC.

In addition to affording the operator the opportunity to utilize an earlier generation and less expense semisubmersible, SBOP technology also results in better safety and well control capability. Several speakers at the IADC Surface BOP Conference last December presented drivers, barriers and case histories of successful SBOP operations.

SBOP AND SX STRATEGY

In the early 1990s, conventional exploration drilling was very expensive, with drilling time and budget constraints limited the number of wells that could be drilled annually. To alleviate these obstacles, **Unocal** developed its saturation exploration (SX) strategy to maximize the number of wells drilled while minimizing well time and cost.

The strategy included accepting expendable wells, utilizing minimum casing strings, optimizing data collected and balancing wants versus needs. A drilling system was also developed to meet the SX strategy.

The SX strategy includes several features such as a simple well design, a fast and efficient drilling rig and drilling services, a surface BOP and riser system, and pre-laid mooring system.

Risk management during the SX program offshore Indonesia included standard operating procedures with regards to kick tolerance, casing design and pressure testing. The drilling foreman had the authority to abandon any well. The rig was secured when a 2% well offset occurred, during bad weather and severe storms and no riserless drilling occurred during the night.

SBOP DRIVERS

SBOP drivers, according to **Graham Brander** with **Shell**, include:

• Many small reservoirs still to be developed in deeper and ultra-deepwater;

• Project costs increasing significantly;

• First oil dates may be compromised due to the lack of available rigs;

• Excessive costs of newbuild rigs;

• How long does oil price stay high?

HSE is also a factor. An SBOP can have a lower risk of blowout compared with a subsea BOP on a case by case basis, according to Mr Brander. Well control management is improved, particularly in shallow prospects, and they result in better hydrate management in the well. Additionally, there is less discharge to the environment in the event of an emergency disconnect. SBOPs result in better sustainable development solutions, using less fuel, mud volume, etc.

Despite SBOP's glowing reviews, there are some barriers to its use. Among them is the saturated rig market, with its low rates stifling the need to use SBOP in some cases. Initial startup costs and break even point for SBOP are high. Drilling contractors are sometimes concerned with the learning curve. Additionally, SBOP requires a paradigm shift on the part of the operator as well as the contractor.

The real prize for drilling contractors in the future, Mr Brander noted, lies in combining SBOP with other technologies such as deepwater managed pressure drilling that can result in better well production and more aggressive well designs. Deepwater near balance drilling can cure loss zones and improve drilling rates. Incorporating high pressure risers and connectors can extend the operating envelop of SBOP with the use of large diameter high pressure drilling risers that will increase options for development wells. Additionally, expandable tubular technology combined with SOP technology will also result in more aggressive well design.

IMPLEMENTATION BARRIERS

John Kozicz with **Transocean** illustrated the progression of SBOP operations toward deepwater, noting that in early 1996, SBOP was utilized in only about 50-100 ft of water. The technology quickly moved further offshore into ever deeper waters, and by mid-1996 wells drilled with SBOP technology had moved beyond 1,000 ft waters. Four years later, wells utilizing SBOP were drilled in more than 6,700 ft of water, with one well drilled in nearly 9,500 ft of water in 2003.

Mr Kozicz noted, however, that the initial perceptions of SBOP risks were very negative in terms of HSE. He explained that a number of published and proprietary studies concluded that SBOP risks are no greater than, or less than, conventional subsea BOP operations. Additionally, regulatory agencies, although having issues with establishing precedents, were supportive of SBOP operations.

A number of items should be considered when utilizing SBOP technology, including metocean data collection and analysis, mooring and riser design assessment, a review of hazardous operations and finally, but not least, proper training.

Increased cost to utilize SBOP is no small matter, either. Vessel upgrade costs for the tensioner system, load path, derrick and substructure and BOP integration can be extensive. The rig's out of service time for the upgrades also should be factored into the total cost.

Capital costs for a prelay mooring system should also be factored into the project costs, Mr Kozicz noted, as well as vessels utilized for installation of the mooring pre-lay system and hookup and deployment. Finally, very little of the necessary equipment can be obtained off the shelf, so long equipment lead times are a critical and costly factor.

Mr Kozicz pointed out, however, that SBOP operations also have shallow water application in certain areas where jackups are prone to shallow geo-hazards and punch-through risk.

He agrees with Mr Brander in the potential future of SBOP applications, pointing out that SBOP and rotating control heads at the surface can facilitate mudcap drilling and dynamic annular pressure management operations. Through tubing rotary drilling with SBOP can provide a "lightweight" alternative to subsea BOPs by reducing wellhead loading.

SOME LESSONS LEARNED

Tim Newman, **Shell E&P**, presented lessons learned for SBOP drilling from a dynamically positioned semisubmersible. Most SBOP drilling operations have been conducted from moored semisubmersibles. Among the lessons learned, according to Mr Newman, is to contract a good quality rig. Shell's rig of choice was the Stena Tay, a 5th generation unit rated for 7,500 ft of water with state-of-the-art pipe handling equipment and over 3 million lbs riser tensioner capability.

Another lesson learned is to start simple. The four wells drilled with the Stena Tay were all hydrostatically pressured with no H2S prognoses and all with total depth less than 7,000 ft below the mud line.

Early involvement of the drilling contractor is important, with a kick-off meeting with the drilling contractor and other service contractors scheduled immediately after project sanction. Mr Newman said, however, that the ROV contractor should have been involved earlier when planning subsea equipment that requires an ROV to operate and maintain.

Mr Newman said controlling pressure surges was another lesson learned. The Stena Tay utilized a novel system with no hydraulic charge line. Rather, the accumulator was charged by the ROV. Relief valves were utilized early in the project, but the crew and service companies preferred the use of rupture disks over the relief valves. A combined relief-isolation valve arrangement solved the hydraulic charge problem.

COMPARING SYSTEMS

Mark Childers with **Atwood Oceanics** compared standard subsea drilling with slim riser and SBOP technologies.

The options for ultra-deepwater drilling include a conventional 21-in. riser and 18 ¾-in. BOP with a 5th generation rig; an SBOP with a 2nd to 5th generation rig; an SBOP with a subsea disconnect system (SDS) with a 4th or 5th generation rig; or a slim riser concept with a 3rd or 4th generation rig. Each has advantages and disadvantages.

An ultra-deepwater conventional 21-in. riser concept utilizes an 18 ¾-in. BOP and 21-in. OD riser with kill and choke lines and riser circulating line. This requires a 5th generation rig costing approximately $200,000 daily. There are comparatively few units available. This set up is the industry standard and is the most prevalent subsea system available with many equipment and system options for drilling and completion.

It provides the ability to set many casing strings below the BOP stack setting. The large drift ID allows for setting and completing with large production tubing and space for control lines. Due to the type of rig required and the larger amounts of expendables such as mud, casing, bits, etc, it is the most expensive. However, it offers flexibility, which is attractive to operators in the Gulf of Mexico who drill complex wells.

Key features for ultra-deepwater SBOP without an SDS is that wells can be drilled from a semisubmersible with BOPs at the surface under the rotary with a high pressure riser. This set up has the ability to use a modified, inexpensive 2nd or 3rd generation rig that could save up to 70% over conventional 21-in. riser concepts, according to Mr Childers. Additionally, this concept provides for better well control due to the fact that nothing is flowing through small diameter choke and kill lines.

However, modifications for an ultra-deepwater SBOP with an SDS requires CAPEX of approximately $7 million or more, according to Mr Childers, plus long equipment lead times of 7-11 months. Consequently, an operator should have a term drilling program planned to justify the costs.

This concept also requires a pre-laid taut or semi-taut mooring system, also at significant cost. The rig offset must be 2% of the water depth or less to reduce stress on the high pressure riser. This concept requires drilling of normal pressured wells that are simple and use slim hole technology, and the wells are usually considered expendable.

Slim riser concepts utilize 18 ¾-in. BOP stacks, 21-in. slipjoint/diverter system and 16-in. riser with kill and choke lines with no riser circulating line. This set up requires a capable 3rd or 4th generation rig at approximately 25%-50% below the dayrate of a 5th generation ultra-deepwater semisubmersible.

There are a relatively large number of available rig candidates. The small riser concept has been used extensively in the 1960s and early 1970s so it is a proven technology with all applicable equipment available, according to Mr Childers.

Slim hole technology results in smaller casing, mud volumes, bits and other expendables. Only 2-3 casing strings can be set under the BOP and, except for the Gulf of Mexico and North Sea, the vast number of wells drilled worldwide can use slim hole technology. Little rig modification is required, however, subsea equipment requires long lead times of approximately 6-9 months and CAPEX of approximately $14-$18 million.

Consequently, a term contract is required to payout the cost of modifications. The slim riser concept extends a 5,000 ft water depth rated 3rd or 4th generation semisubmersible to 7,500-8,000 ft with little modification. An advantage is that the slim riser concept is a "kit" and can be moved from rig to rig.