Reinventing intervention: a new approach to shallow water subsea well intervention

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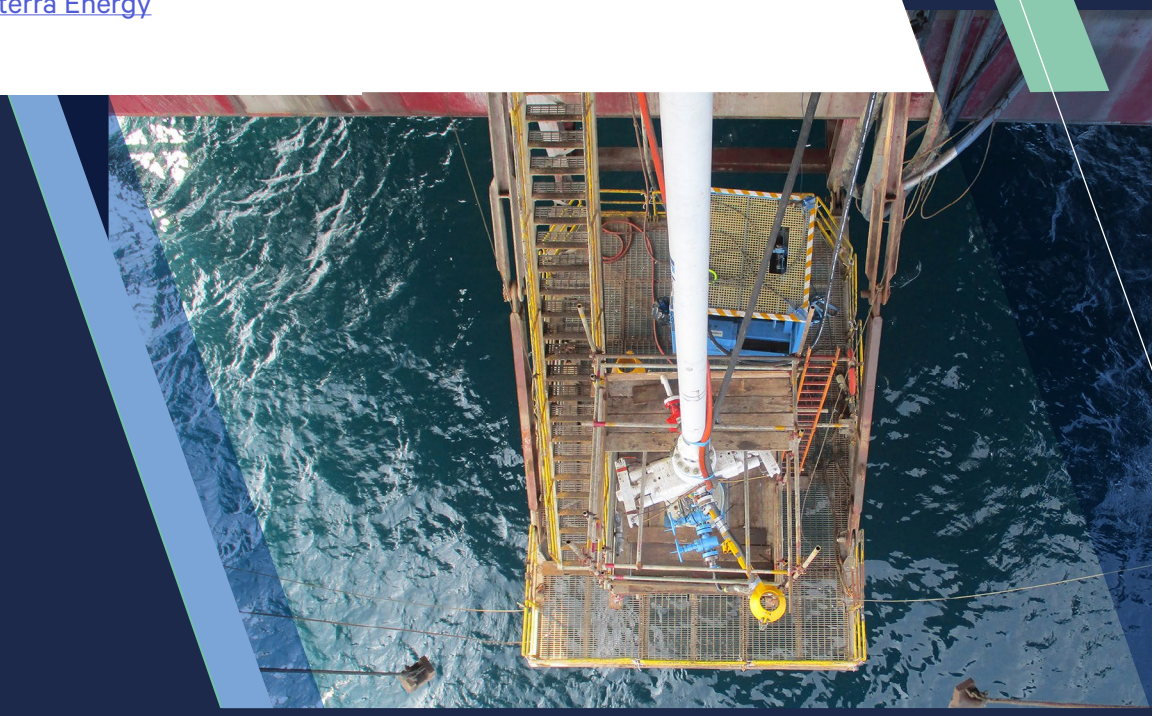

Shallow water subsea well intervention (to increase or restore production, or to plug and abandon the well) is neither new nor especially exciting, as offshore engineering goes.

However, it is a prime opportunity to burn cash if not approached optimally - which is increasingly common as the economic environment pushes operators to work assets harder and for longer, all while ensuring safe abandonment. Therefore, now is the right time to reassess the 'standard' approach to shallow water subsea well intervention.

Appetite for intervention

Best practice for well intervention must be informed by the profile of the well stock. Today, most subsea wells are decades old. In the UK, the North Sea Transition Authority (NSTA) cites an average subsea and platform well age of 22 years for the UK Continental Shelf (UKCS). Most wells, especially oil producers, require some sort of intervention approximately every 5 years. Over the last 15 years, more than 1,500 subsea trees have been installed in shallow water depths (<500m) globally, with 50% of these in jack-up drilling depth (<150m). Looking at the forecast for the next 10 years, over half (54%) of all expected shallow water subsea tree installs are expected to be jack-up rig accessible.

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This tells us that there are a vast number of subsea wells of a prime age for intervention or abandonment work, mainly located in shallow waters. We can also deduce – given the age profile – that many of these would have been installed using a moored semi-submersible with an early generation blowout prevention (BOP) system, which are much lighter than today's equivalents and therefore able to have acceptable operational envelopes.

This is a cause for concern. Many of these wells may not be designed for the operational loads exerted by a current generation semi-sub deployed system with its significantly heavier BOP stack – even light well intervention vessels may be on the borderline of suitability with subsea pressure control stacks often extending 60 TE. There may prove to be a rather limited supply of suitable semi-sub and vessel deployed intervention options for shallow water subsea wells.

This would not necessarily be a major problem if well intervention work remained a niche activity. However, the opposite is true. In the UKCS, for example, the NSTA reports that 2022 saw an overall decrease in wells from 2,650 to 2,567, but notably, the number of shut-in wells also decreased from 785 to 743, indicating that operators are responding to higher commodity prices by restoring existing

wells for production. And we'd expect this trend to continue – well re-entry and intervention can be a far more cost (and emission) effective approach than fresh projects. What's more, they are faster with time taken to deliver a project measured in months rather than years.

A more balanced approach

There is an obvious but, so far, underutilised alternative: subsea well intervention from jack-ups or lift boats.

Jack-ups offer a number of inherent advantages for shallow-water work. Notably, they offer greater control over the operational load transferred to the well than semi-subs or light well intervention vessels (LWIV) equipped with a riser system. Floating vessel or semi-sub intervention by nature creates greater dynamic riser movement and offset to the well, which in turn creates high bending moments and fatigue damage into the subsea production assets.

These dynamics and vessel offsets are greatly exaggerated in shallow water due to the short span between the riser at the top of the subsea pressure control equipment and the vessel or semi-sub.

For some projects the increased fatigue damage and bending moments may not even be the most limiting factor – emergency subsea closure and disconnection reaction speed often is operationally prohibitive in shallow waters or necessitates a vanishingly small operational weather window to complete the planned intervention activities. Such emergency shut ins and disconnections, whilst they prevent overloading critical subsea equipment, pose an environmental hazard.

By anchoring to the seabed, a jack-up or lift boat is inherently more stable, with very little offset from the well. This reduces loading and fatigue damage to an extent that can be difficult to match with even the best semi-sub or vessel dynamic positioning systems. Further, as a jack-up or lift boat has no drift off hazard, subsea well shut in and disconnection reaction time is not a restrictive consideration, greatly improving operational uptime.

This can also make jack-ups cheaper (dynamic positioning systems and anchoring are expensive) and potentially safer with lower environmental risk. The lower downtime and bigger operational window can also mean less overall rig time, reducing costs and emissions.

And, crucially, they are plentiful. At the time of writing, Westwood Global Energy Group counts 409 jack-ups in operations worldwide, versus 152 floating rigs. It is relatively easy and cost-effective to rent and mobilise a jack-up or lift boat for shallow-water work anywhere in the world.

Jack-ups and lift boats therefore may often be the sensible option for subsea well intervention work. However, unlike semi-subs and LWIVs, they are not often readily equipped and crewed to carry out such intervention work. Therefore, they require fitting out by specialist engineering service companies offering subsea intervention equipment tailored for this niche environment.

To bridge this gap, Aquaterra Energy has developed a 5" to 14" ID, access riser-based intervention system designed to be deployed from jack-ups, LWIVs, and semi subs fully, compliant with ISO1368-7 and API 17G, the completion and workover codes. We also provide specially designed jack-up and lift boat compatible subsea intervention pressure control equipment, surface control equipment, tensioning and other rig interface equipment and services. Our CWOR system, complete with proprietary AQC-CW connectors, is one of very few systems that meets or exceeds the requirements of ISO1368-7 and API 17G and is unique in its simple radial bolt seal ring design that does not require specialist make up crews or equipment.

Beware false economy

Of course, other approaches are possible, and the temptation is to go as lean as possible to keep costs low. However, operators must balance this with the risk of unforeseen circumstances, which may tip such approaches into false economy.

For example, wire through-water and riserless set-ups are extremely cost effective and can be deployed via light well intervention vessels – assuming all goes smoothly, that is. If, however, the operator re-enters the well on slick line or E-line and finds issues that call for some pumping or coil tubing work, then a riser is needed.

This means demobilising and returning with a riser-based system, incurring substantial costs plus delays. When the bulk of the cost is tied up in the time taken to mobilise and demobilise (the intervention work itself is typically relatively quick), this can majorly skew project economics. Other risks are present with wire through water operations, especially where riser systems are not deployed.

By contrast, a jack-up or lift boat deployment, or LWIV or semi-sub deployed CWOR means the operator is prepared for such eventualities while still running a relatively lean operation – a balanced approach that accounts for the high number of unknowns when re-entering a well. This is important on a single well intervention campaign where such mobilisation and demobilisation costs cannot be split between multiple wells or companies.

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A new best practice

Subsea development from jack-ups is now a standard approach for NOCs, Oil majors and independents. The conversion equipment, riser systems and well control systems are well known and understood by regulators, drilling contractors and operators. However, standardised jack -up or lift boat subsea intervention pressure control equipment and riser systems is a much less developed area.

With project economics relentlessly tight and re-entry and intervention work unlikely to subside anytime soon, operators must be alert to where business-as-usual diverges from updated best practice. Agility of deployment and flexibility of function are the name of the game for cost-effective subsea well intervention and abandonment. Currently, jack-up and lift boat deployed solutions are underutilised within the industry but are a potent approach to project success.

For more information on how our completion and workover riser systems can support your project, get in touch

Contact us

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From seabed to surface, oil and gas to wind and hydrogen, Aquaterra Energy is the offshore energy industry's first choice for offshore products, systems, and projects around the world. Swift, flexible, and responsive, Aquaterra Energy's engineers and analysts create the solutions customers need, while delivering operational improvements, efficiency gains and supporting decarbonisation efforts – whatever their circumstances.

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