TACKLING THE INDUSTRY’S RELIEF WELL PLANNING CHALLENGE

Due to events in the Gulf of Mexico a few years ago, existing industry rules on relief well planning have been revised. The U.S. government now requires operators to submit two complete relief well plans to obtain a deepwater drilling permit.

Historically, few operators bothered to create a formal relief well plan prior to an actual blowout. Why? Partly because no one could predict where a wellbore might rupture, and partly because blowouts were—and still are—relatively rare. Statistically, there are fewer than five topside or subsea blowouts per 1,000 offshore exploration and development wells worldwide.*

When a blowout occurs, however, operators and service companies have to scramble. “Following an incident several years ago, we helped an operator design a relief well from scratch,” says Chakrapani Siruvuri, Landmark’s Technical Advisor for Well Planning. “Unfortunately, using conventional directional drilling software, it took two full days to find appropriate intercept points and come up with a viable strategy.”

That’s a long time, he adds, in an emergency situation where every minute increases potential health, safety, environmental, legal, financial and political liabilities.

Because blowouts are so uncommon and few drilling engineers have much experience designing relief wells, operators depend largely on contractors. Proprietary tools and arcane techniques make relief well planning appear unnecessarily complex and mysterious. Every plan, indeed, the planning process itself varies from one drilling team, or one incident, to the next.

To meet the new regulatory requirements, many oil and gas companies are looking for ways to bring reliable relief well planning in-house, without wasting engineers’ time generating an

New Collaborative Well Planning Tools
Optimize Relief Well Designs in Gulf of Mexico

**DecisionSpace® Well Planning**

**CHALLENGE**
Bring a reliable relief well planning process in-house to meet new government regulations for deepwater drilling permits. Minimize the time and trouble required for drilling engineers and geoscientists to design initial relief well trajectories.

**SOLUTION**
Operator established a standard five-phase relief well planning process. Pilot tested Landmark’s new automated, multi-scenario relief well trajectory design and optimization tools, combined with Landmark’s advanced well engineering software.

**RESULTS**
Reduced time to the final relief well trajectory from days to minutes. Decided to standardize on specialized relief well planning and integrated well engineering applications to ensure consistent, automated, and auditable results.

DecisionSpace® Well Planning software automatically generates multiple relief well trajectories (tan lines). Here, viable paths from three surface locations intercept the blowout well (green) above a major fault (orange).
excessive number intercept plans for every casing section from the conductor all the way to total depth.

One international oil company operating in the Gulf of Mexico, for example, decided to make relief well planning more transparent, efficient and consistent across its drilling organization. To do so required two steps. “Initially, we needed a systematic, repeatable relief well planning methodology that would establish a standard range of boundary conditions,” recalls the operator’s Technical Expert in Directional Drilling & Well Positioning. “Next, we needed to find a specialized set of engineering tools that would enable teams across the organization to generate similar results.”

To that end, the company decided to standardize on the industry’s first automated, multi-scenario relief well trajectory planning technology, now an integral part of Landmark’s collaborative DecisionSpace® Well Planning solution.

DEVELOPING A COLLABORATIVE RELIEF WELL PLANNING SOLUTION

First, the operator came up with standard relief well planning guidelines based on five common phases, beginning with comprehensive data capture and ending with a design that would intersect the blowout well at the optimum kill point.

1. **Identify Surface Locations.** In phase one, a team of geoscientists and engineers consolidates the subsurface models, seafloor topography, and shallow hazard data. The goal is to identify primary and secondary surface locations, avoiding steep or unstable slopes, faults, and no-go zones such as offset wells, pipelines, or shipping lanes.

2. **Determine Drilling Feasibility.** In phase two, the cross-functional team determines the drilling feasibility of the relief well design, taking into account surface location, positional accuracy, torque and drag, sail angle, angle of approach, tangibles, and kill modeling.

3. **Locate Target Well.** In phase three, they define directional drilling parameters and an initial well trajectory that uses magnetic ranging technology to locate and “fly by” the target wellbore at a specified distance—approximately 1,000 ft MD—above the intended intercept point, taking precautions to avoid an unintentional collision.

4. **Track Target Well.** In phase four, they design a well trajectory that can track the located target well, again using magnetic ranging. Before lining up for intercept, a second “fly by” may be considered—within about 100 ft. MD above the ultimate kill point.

5. **Intercept Target Well.** In the fifth planning phase, the team designs a final relief well trajectory that can intercept the blowout well at a low angle of incidence—less than five degrees—and successfully breach it near the last casing shoe above the target hydrocarbon-bearing zone.
Learning from the operator’s well placement specialists, Dan Colvin, Landmark Senior Technical Advisor for Well Planning, developed new relief well trajectory planning functionality as part of Landmark’s DecisionSpace Well Planning software. Innovative manual and automated options effectively capture, accelerate, and optimize all five phases of the typical planning process.

Now, instead of laboriously building a single relief well path one piece at a time, DecisionSpace Well Planning automatically generates multiple scenarios, based on a choice of three different intercept methods—simple, oriented, or parallel track.

The software combines all relevant surface data, drilling parameters and subsurface interpretations in a collaborative 3D workspace. Geoscientists and engineers apply advanced filtering and selection tools to evaluate scenarios, avoid hazards in the surface and subsurface, and rapidly identify optimum relief well trajectories.

Finally, using integrated, high-end directional drilling and well engineering applications, such as Landmark’s COMPASS and DecisionSpace Well Engineering, they can design a full, detailed relief well contingency plan that meets both governmental regulations and organizational requirements.

**PILOT TESTING NEW RELIEF WELL PLANNING CAPABILITIES**

To pilot test Landmark’s new relief well planning capabilities in the Gulf of Mexico, the operator chose a deepwater subsalt project on a fairly short fuse—similar, in some ways, to a blowout situation.

An outside contractor had already used its proprietary software to design initial relief well paths. Chakrapani Siruvuri of Landmark and Jose Patino of Halliburton Consulting quickly set up an OpenWorks project, and loaded all the deepwater pilot data. Visualizing the contractor’s relief well paths and the operator’s subsurface interpretations in DecisionSpace Well Planning, it was immediately obvious that the current design would entail locating and tracking the target well inside a large salt body, which would interfere with magnetic ranging technology. The operator wanted the kill point to occur below the base of the salt.

Landmark used automated multi-scenario trajectory planning tools to investigate all viable alternatives for intercepting the target well about 200 ft below the salt and 100 ft above the 14-inch casing shoe. Two optimum relief well trajectories were identified within about 30 minutes.

“We reviewed our design with the client’s entire geoscience, drilling and completions team, visualizing the subsurface and drilling parameters in 3D,” says Patino. “What we planned met all their requirements, so they accepted it, completed the full well engineering design, and submitted the final relief well contingency plan to the government.”

Based on successful completion of the pilot project, this international oil company’s Gulf of Mexico division decided to...
standardize on DecisionSpace Well Planning software to tackle its relief well planning challenges.

**OPTIMIZING PLANS, REDUCING CYCLE TIME, ENSURING CONSISTENCY**

“The relief well planning industry leads you to believe you can’t do this yourself, so you should just hire them to do it for you,” explains the operator’s Technical Expert, Directional Drilling & Well Positioning. “The reality is, most of the engineering tasks are similar to what we do every day.”

Any competent engineer, he notes, could punch in surface locations, boundary conditions and potential kill zones into a high-end engineering application like COMPASS. “But we would have to design each piece manually, one by one, which is tedious and time consuming. We wanted not only to optimize the relief well trajectory itself, but also the amount of time and effort our drilling engineers spend doing this work.”

Instead of requiring several days to come up one or two relief well trajectories, DecisionSpace Well Planning software generates literally hundreds of scenarios in a mere half hour or less. “Automated, multi-scenario trajectory planning tools from Landmark simplify and expedite the whole process, so we get an optimized solution in a fraction of the time it took before.”

Speed and ease of use, of course, are only two of the ultimate payoffs.

“Without a systematic, repeatable approach based on boundary variables that ensure consistent results,” the Technical Expert stresses, “every engineer or asset team might come up with a wildly different plan. This formalized five-phase methodology and Landmark’s unique engineering tools take the mystery out of relief well planning.

“Every design is more mature, robust and, in fact, auditable,” he concludes. “We can see exactly what assumptions went into each plan. For the first time, we should be able to get similar results from across the organization.”

*Blowout Frequencies, International Association of Oil & Gas Producers, Report No. 434-2, March 2010.*