

## Case Study: Virtual Rig Simulator

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### The Client

A multi-billion dollar net worth company that provides oil well drilling equipment and services to major oil producing companies across the world.

### The Problem

Our client was working with Quarkonics to develop the world's first real-time automated drilling solution. The solution used downhole sensor data to make drilling decisions in real-time, thus improving efficiency and making drilling faster, safer and more efficient (by about 46%). Prior to implementing the automated drilling solution on a real rig, it was necessary to thoroughly test the system to ensure safety and to observe the behavior of the system under multiple drilling scenarios. However, this being the first time implementing a software solution to

drilling automation, there was a lack of tools to support the automated testing that would be required to truly put the system through its paces.

The initial test suggested by the client was to install the system on a test rig that was being readied for the client to test its various products. The problem with this approach was that any issue discovered in the system would require halting the drilling operations while the system was uninstalled, fixed, and re-installed with the patch. As the test rig was in use by other groups in the client's organization, we were constrained by both time and scheduling conflicts.

## The Solution

While the real time automated drilling solution was being developed, Quarkonics scientists began to give thought to how the system could be tested in the most efficient manner, without exceeding the client's budget. Our data analysts and physicists came up with an elegant solution to the problem – a software based virtual rig that uses legacy drilling information as input to simulate various drilling conditions and monitor the behavior of the test system. With the simulator, the scientists could provide any combination of drilling conditions and check the system for its response and for any anomalies. Each test cycle would complete in a few hours, and there was no need for specialized drilling equipment for testing. The simulator was used to measure the savings in efficiency, and the simulated results were very close to the actual system efficiency that is now being observed with the system in production.

The virtual rig simulator was offered to the client along with the automated real time drilling system. The simulator is being used by scientists to test out improvements in the system and to simulate what-if scenarios. It can also be used as a stand-alone testing tool to help engineers test out the behavior of their control systems. The simulator is not provided as an alternative to test drills, rather, it is a useful tool that can help identify problems in the drilling applications and allow engineers to fix them, before using the system on an expensive test rig. The probability of encountering defects while testing on an actual rig, along with the expenses incurred in fixing defects at that stage, is greatly reduced when the system has been pre-tested on the simulator. Usage of this simulator has saved

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thousands of dollars and person-hours that would have otherwise been lost, if the initial tests had to be conducted on an actual rig.

## Key aspects of the virtual rig simulator:

- World's first software-based virtual rig
- Can be easily adapted to incorporate additional drilling parameters
- Reduces cost and time by testing system behavior prior to actual rig testing.