

OILFIELD TECHNOLOGY

EXPLORATION | DRILLING | PRODUCTION SEPTEMBER 2016

Automated Rig Controls™

Tesco presents the latest in drilling rig optimization software.



DRILLING IN THE DIGITAL AGE

**DOUG GREENING & RYAN GRAHAM,
TESCO CORPORATION, REVIEW
A NEW SUITE OF SOFTWARE
DESIGNED TO SIGNIFICANTLY
ENHANCE THE EFFICIENCY OF
DRILLING PROGRAMMES.**

The path towards the fully automated unmanned rig – a picture that has been painted time and time again in the energy industry. This ideal is touted as the inevitability of the future by the innovators and praised as an opportunity to reduce accidents by the HSE milieu. However, it is met with apprehension from those all too familiar with the beasts that lay within the stratifications of the rock formations. This vision of the hands-off, fully automated rig causes a dichotomy of thought between industry experts and a clear roadmap to accomplish this has yet to be determined.

Skimming research available today, anyone will find there exists a wide sandbox between zero automation and fully automated operations. It is within this creative space where proactive, forward-thinking companies can trial new technologies to further advance rig efficiencies. The industry downturn has encouraged this as many companies demand streamlined operations with maximum results, and minimal downtime.

It is unrealistic to think human interaction will be vacant from rig operations in the near future. The industry, combined with current market conditions, simply does not accommodate revolutionary overhauls, such as the unmanned rig, overnight. However, the benefits of such operations are obvious. Energy service providers like Tesco Corporation, work to achieve this ideal one technological development at a time.

Wells are getting longer as drilling companies press to procure maximum rewards from each job, and everyone involved in the drilling process is now under more stress than ever to perform these complicated

processes as accurately and efficiently as possible. Hence, out of the sandbox has arisen the idea of advanced drilling and equipment monitoring, arming drillers with rig environment and wellbore information vital to the operational success of the well.

Recently, through software called Automated Rig Controls™ (ARC™), this has been made available by Tesco Corporation. Through research and discussion with operators, it became clear that major feature opportunities were being missed by existing equipment monitoring software, and a series of tools with the purpose of filling these voids was developed. The software does more than simplify the driller's job; ARC software integrates into both existing rig equipment as well as new builds to significantly enhance and optimise the drilling process for any drilling application. The benefits of this software include mitigation of drill string stick-slip anomalies, increased rate of penetration (ROP), extended drill bit life, enhanced features to aide in directional drilling, increased weight on bit (WOB) in long-reach horizontals and predictive and preventative maintenance programmes.

Equipment monitoring modelling

Just as a vehicle must be regularly maintained to keep it operating optimally and avoid breakdowns, the same reasoning applies to equipment on drilling rigs. Mechanical parts by their nature require maintenance in order to perform to expected specifications, especially those built for movement and the expectation that they will be exposed to constant wear and stress. Following manufacturer recommended guidelines is a step in the right direction towards getting the most out of equipment however, the importance of routine checks can sometimes be forgotten when day rates are in the tens or hundreds of thousands of dollars.

ARCFit™, one element of the software suite, is designed to provide real time information on the performance and condition of equipment, removes the burden of tracking equipment conditions manually. Its features fall into three categories: asset management, maintenance tracking and predictive health monitoring.



Figure 1. ARC software provides operators with real time information on the global location, operating status and maintenance history of their equipment.



Figure 2. ARC software uses well plan details and live rig data to accurately model drill string characteristics and adjust top drive parameters in real time to enhance and optimise the drilling process.

Regarding asset management, manually tracking equipment is no longer an issue. Clients can view the locations of various equipment using GPS. Historical operating records are catalogued and easily accessed for utilisation reporting.

Maintenance alerts let the driller know when equipment reaches maximum performance capacities, or other custom alert settings, to avoid damage to equipment. Additionally, seeing actual equipment health statuses keeps drillers from interrupting timelines to have equipment inspected and checked unnecessarily.

ARCFit enables users to view historical data and real time data to provide a diagnosis of rig equipment. Alarms can be programmed at a specified threshold to notify when the equipment is exceeding an acceptable limit. The driller is then able to modify operations to prevent any unnecessary non-productive time (NPT).

In order to avoid taking up rig space, ARCFit and its physical components were designed to integrate into rig equipment already operating in the field. This also allows drilling crews to continue working on equipment already familiar to them. Utilising a set of small sensors placed on and around drilling equipment, including the top drive, catwalk, mud pump, etc., the condition of these tools is continuously tracked. Through wireless technology, the sensors communicate to a CPU local to the rig. With a connection to the internet, the well site interface can connect the office to the rig, allowing for real time monitoring.

ARCFit is designed to be open-source, meaning it is available for installation on most other manufacturers' drilling equipment, not just Tesco products. However, customers using the software on Tesco equipment will see the benefits of maintenance scheduling based on the company's global preventative maintenance programme. This programme will alert personnel of upcoming and past-due maintenance events. Documentation and checklists are easily accessible from the portal, and clients can use it to identify parts and order the necessary replacement.

Stick-slip reduction

Stick-slip is a drill string phenomenon that occurs when the string is wound up. One cause of this occurs when the drill bit catches on the formation and becomes stuck while the string behind it continues to rotate. When enough rotational force has built up behind the bit, it then releases and spins, causing a sudden burst of energy that travels up throughout the drill string. Essentially, the same reaction can be seen when winding up a mechanical toy and then letting it go.

In the case of stick-slip experienced downhole, there is an excessive amount of force due to the weight of the pipe and bottom hole assembly (BHA). This release of energy causes the components of the BHA (MWD, LWD, stabilisers) to slam violently against the borehole. Damage to the BHA is common in these instances and can lead to tripping out of the hole to replace components.

The drill bit also takes punishment in instances of stick-slip. The constant off/on motion of the drill bit can lead to wear on the bit. This can cause poor performance and delays, as the bit is no longer able to achieve maximum ROP. When the sides of the bit are worn down, holes become out of gauge. Worse, a cone can come off the bit, requiring a fishing operation and halting operations altogether until the problem is resolved.

Drill pipe connections, as well as all the BHA tool connections take a beating. Connections can be over torqued leading to a twist off, reducing the lifetime of the drill pipe. Third party service companies will want compensation when damage is done to their tools.

Today, downhole tools may have sophisticated sensors to monitor speed and/or torque of the drill string. However, these methods only enable operators to react to stick-slip, which can persist through a formation or even a well. Conversely, ARCTork™ reduces the opportunity for stick-slip to occur before it starts. Algorithms accurately calculate

readings of the top drive, well plan parameters and drill string data to mitigate the vibrational effects that create problems for well site operations.

With the mitigation of unwanted vibrations, the transfer of energy from the top drive to the drill bit provides a better instantaneous ROP. A reduction in stick-slip will account for a BHA and bit with a longer drilling life, resulting in fewer trips in and out of the hole to replace damaged tools. These factors increase overall ROP speed and reduce costs for the well.

Horizontal drilling assistance

As well programmes increase in complexity, so must the technology needed to drill these wells safely and cost-efficiently. Slide drilling is a critical operation for these horizontal wells. During the sliding operation, the vertical section kicks off and builds an angle for the desired lateral section.

Traditional sliding happens when the drill string stops rotating while the directional driller horizontally re-orientates the toolface. The mud motor in the BHA spins the bit, while the drill string is moved back and forth, or rocked, to reduce drag force of the drill pipe laying on the bottom of the wellbore. The oscillating drill string creates issues for drillers who aim to keep the toolface on target and build angles according to the well plan. In most cases, drillers rely on years of experience to give the dial the right touch and avoid error.

An agitator may also be incorporated into the BHA to assist slide drilling. This tool uses the circulation of the mud to break up the drag forces of the drill string, but it comes with a price. Not only is the agitator an additional daily financial cost, but excessive use can limit the life of the bit and the BHA itself or lead to tripping out of hole prematurely if a tool fails.

Neither option is ideal, which is where ARCSlide™ comes in.

This system is designed to minimise the risks associated with sliding. First, the software maximises the weight on bit during the oscillations while maintaining toolface. The ARCSlide screen shows current and recent toolface positions to ensure the oscillations are not impacting the steering of the bit.

When the toolface needs to change, the driller can enter the new desired toolface angle. The guesswork is eliminated as the software automatically orients the drill string to the proper mark. Second, ARCSlide utilises only surface components, so there is no need to add additional tools to the BHA.

The driller and directional driller still control operations, while using the software to achieve the necessary well path in an optimised manner. The system adds an extra layer of safety and efficiency by taking intelligent action downhole when operational parameters are crossed, before human action is necessary. This is the balance Tesco achieves when taking an evolutionary approach to drilling automation.

Planning ahead

ARCGuide™ allows the driller to upload the well plan, which the software will then follow, making drilling corrections as needed. Working with other components of the ARC software, it will automatically adjust the top drive to maintain proper downhole tool positioning. This will increase accuracy and drilling efficiency by minimising the need for well path course corrections.

The necessary change

With the driller in the driver's seat, automation software allows people to do their job more safely, more reliably, in a more cost-effective manner and with fewer mistakes. In this market it is important to develop and deploy tools that prolong horizontal drilling programmes, as well as the teams that execute them. ■

Automation is closer than you think.

Tesco presents Automated Rig Controls (ARC),
the latest in drilling optimization software.



ARCTork™

Mitigate stick-slip and torsional vibrations with ARCTork. This system uses drill string, well plan and live data parameters to auto tune and enhance the performance of your rig. ARCTork reduces the negative effects of stick slip and lowers the cost of drilling by extending the life of your bit and BHA tools.



ARCSlide™

Intelligent control algorithms automate drill string oscillation during slide operations with the ARCSlide solution. This system reduces friction between drill pipe and the well bore, increasing weight on bit and boosting rate of penetration. ARCSlide also allows fine tuned control of the toolface to keep you on target throughout the well.



ARCFit™

Critical rig conditions are readily monitored with the ARCFit solution for your Top Drive or rig. Pressures, temperatures, shock, vibration and more can be displayed and viewed anywhere on a computer or mobile device. Data tracking and limit alerts ensure equipment operates optimally and provides customers with a more effective predictive and preventative maintenance solution.



ARCGuide™

Upload your well plan and let ARCGuide do the rest. This software automatically calculates the proper amount of top drive movement needed to optimize well bore construction. This increases accuracy and drilling efficiency by minimizing well path course corrections and limiting the need for driller interaction.

Drillers, you're going to love this.

And we're willing to prove it. For a limited time, contact us to arrange a trial of Tesco's ARC software at no cost to you and experience the efficiencies and savings for yourself.

Visit www.tescocorp.com/ARC or contact your Tesco representative to inquire about trial details or learn how ARC software can enhance your drilling operations and reduce costs.

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