



## CHALLENGES

To optimize rate of penetration using the KAIZEN drilling optimization application with AlphaAutomation

## SOLUTION

Engage Drilling Optimization Team to pursue rate of penetration gains while utilizing the Kaizen app

## RESULTS

- Set new operator drilling performance benchmark at 6337 ft/day in the lateral - 264 ft/hr
- 17% improvement in penetration rates
- AFE time savings of 4 hours resulting in \$10k savings for operator

## *AlphaApps™ Improves Rate of Penetration in the Marcellus Shale*

### **Marcellus Shale Case Study**

#### **THE APP**

The Precision Drilling AlphaApp KAIZEN is a third-party drilling optimization application that uses algorithms to derive a parameter roadmap and applies continuous learning capabilities in real-time. Enabling this application allows for proactive drilling dysfunction mitigation, maximum rate of penetration (ROP), and optimization of mechanical specific energy (MSE). The app uses artificial intelligence to continuously evaluate drilling performance based on wellbore conditions, compare it to offset well data, and recognize environmental changes. This enables the KAIZEN system to instantly respond to changing conditions and provide an optimal set of parameters. These optimal setpoints are then sent directly to Alpha Automation's advanced auto driller where the continuous and automatic adjustment of these setpoints leads to optimized, repeatable, and consistent drilling performance.

#### **CASE STUDY**

An operator in the Marcellus Shale recently engaged Precision Drilling (PD) to optimize rate of penetration in the lateral section for their pad drilling program which included the use Alpha Apps, Alpha Automation and directional technology including a rotary steerable system driven by a mud motor.

The operator drilled the first well, Well 1, using operating parameters defined by their drilling program of  $117 \pm 2.5$  RPM and  $38 \pm 2$  klbf WOB and achieved an average ROP of 225 ft/hr as shown in Figure 1 on page 2. The PD Optimization Team then reviewed the drilling roadmap including the well geology and the operating parameters for weight on bit (WOB), rotation speed (RPM), torque and differential pressure. The recommendations were to increase the planned RPM setpoint, to increase the operating windows for both RPM and WOB, and to adjust the response tuning of the KAIZEN application and the advanced auto driller to focus on ROP while controlling MSE. Increasing the operating windows for RPM and WOB allows the KAIZEN algorithm greater latitude for adapting optimization strategies and parameter changes throughout the lateral section.

As a result, Well 2 was drilled using operating parameters of  $145 \pm 15$  RPM and  $38 \pm 3$  klbf WOB and achieved a record ROP of 264 ft/hr for the operator, saving 4 hours of drilling time and producing additional footage of 940 ft/day. (see Figs 1 & 2 on page 2).

**RATE OF PENETRATION**

17%

Improvement over offsets on same pad

**FOOTAGE PER HOUR**

264

New drilling performance benchmark for the operator

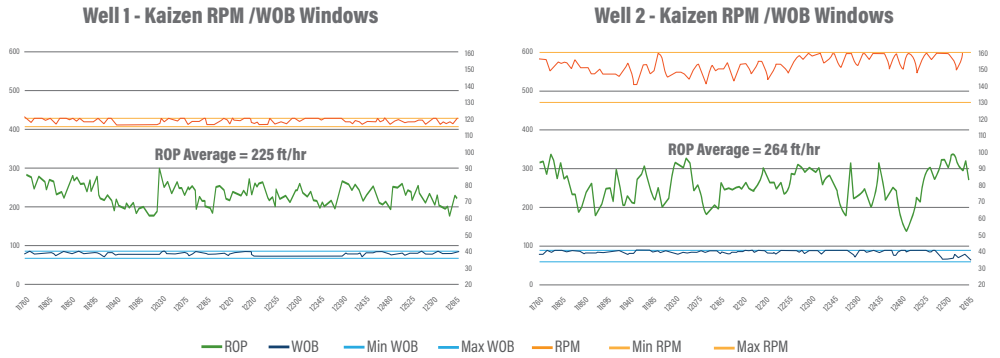
**LATERAL SECTION TIME**

4

Hours reduction in drilling time

**FIGURE 1**

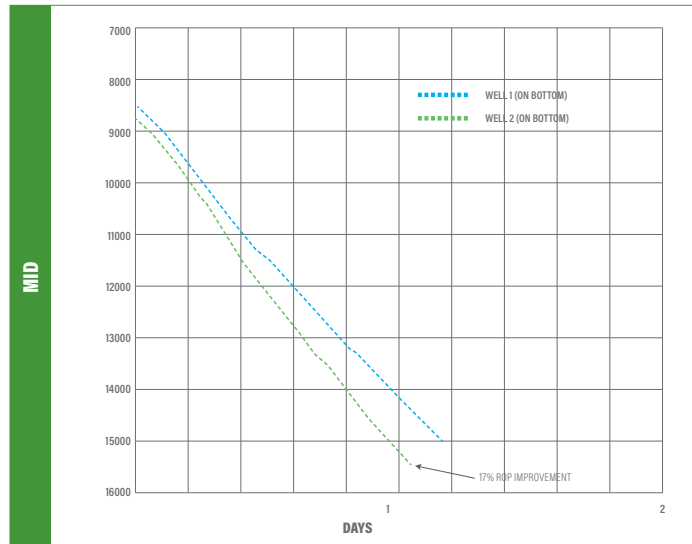
Fig 1 compares the Well 1 and Well 2 parameters applied by the KAIZEN system. Well 1 was drilled with the operators original planned parameters of  $117 \pm 2.5$  RPM and  $38 \pm 2$  klbf WOB and Well 2 was drilled with the optimized parameters of  $145 \pm 15$  RPM and  $38 \pm 3$  klbf WOB which included both an increase in RPM and expanded operating windows for both RPM and WOB. The result of using the expanded operating windows was an average ROP increase of 39 ft/hr.



**FIGURE 2**

Fig 2 compares the Days vs Depth and the On Bottom ROP vs Depth between the lateral sections for Wells 1 & 2. The On Bottom ROP curve shows a 17% improvement in ROP from Well 1 to Well 2 with an increase in ROP from 225 ft/hr to 264 ft/hr.

**KAIZEN PAD A - DAYS VS DEPTH**



**CASE CONCLUSION**

This case study demonstrated that optimizing the operating parameters by using AlphaApp, Kaizen application with Alpha Automation, Advanced auto driller delivered a 17% faster on bottom ROP and set a performance benchmark of 264 ft/hr in the lateral section. This also setup a case where drilling parameter roadmaps can be optimized using AlphaApps with the oversight of our optimization engineers.



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HIGH VALUE