

# Analytical Drilling Services

## Our Competency

### Deep Oil and Gas Industry Experience

MSC Software's Oil and Gas industry simulation specialists have deep expertise in applying Computer Aided Engineering (CAE) to solve engineering problems. With a track record of success in enabling our customers to meet their design objectives, you can rely on us to get the job done right.

### Cutting Edge Simulation Technology

Using Adams, the gold standard for Multibody Dynamics simulations and Adams Drill, a unique toolkit that enables simulation of drilling dynamics. Our extremely skilled engineers are experts at utilizing Adams Drill to solve critical engineering problems related to the dynamic behavior of drill strings.

## Our Tailored Services Offerings

We provide consulting support in various formats based on your specific requirements. This could range from performing analysis for you on a project basis to providing full time staff members to help you create repeatable processes in-house.

- Quick Start Project
- Knowledge Transfer
- Mentoring
- Staff Augmentation
- Onsite Support
- Methods Development
- Training
- Hotline Support
- Scripting & Process Automation

We provide consulting support on a wide range of technical topics related to Analytical Drilling

### BHA Design

Our analysts have helped customers improve BHA designs by adjusting stabilizer size, quantity, and placement, agitator placement, motor bend angle, motor power, and bit aggressiveness. These parameters are known to impact string dynamics and our simulation tools are well suited to study these impacts.

### Drilling Optimization

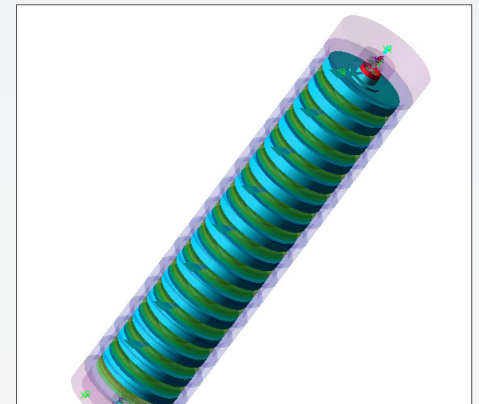
Drill string simulation allows drilling engineers to conduct numerous what-if scenarios and identify combinations of surface parameters, control systems, or other BHA or downhole tool design parameters to avoid drilling dysfunctions. Large simulation datasets can be reduced to heatmaps or other visualization tools to help engineers balance risk vs performance.

### Root Cause Analysis

High fidelity time domain modeling of NPT events provides insight into the drill string behavior in order to understand the events leading to failure and identify signatures of impending dysfunction. RCA Findings help engineers evaluate various methods of risk mitigation and dysfunction identification in order to implement best practices and improve monitoring, early warning, and real time analytics systems that ultimately reduce future NPT events.

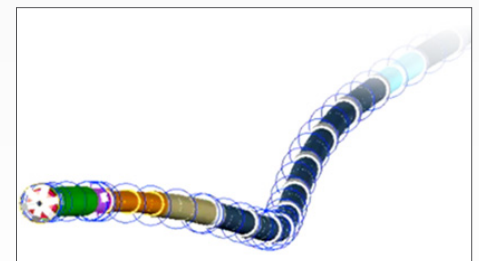
## Adams

As the world's most powerful and widely used Multibody Dynamics (MBD) software, Adams improves knowledge and understanding about complex system behavior through high fidelity modeling of the underlying physics. Engineers can evaluate and manage the complex interactions between disciplines including motion, structures, fluids, and controls to better optimize system designs for performance, safety, and comfort. Adams enables engineers to explore unknowns, reduce risks, and increase confidence in design.



## Adams Drill

Adams/Drill is a vertical application of Adams used to predict the dynamic behavior of a drill string including any non-linear and fully coupled axial, lateral and torsional responses to various sequences of surface control parameters. The computationally efficient MBD approach provides high fidelity results in minutes. It enables engineers to determine forces and motions at every location along the drill string and explore system level sensitivity to well planning, operational, and environmental considerations.



## Dysfunction Mitigation

A comprehensive drill string model, including the effects of BHA design, drilling parameters, control systems, wellbore trajectory, drilling fluids, and operating procedures can be used to explore various methods of dysfunction mitigation. Time domain simulation results are reduced into key metrics to balance performance with risk of dysfunction.

## Controls System R&D

The drill string model can be coupled with control systems from surface or downhole equipment in order to explore how the control system influences and responds to the dynamic behavior of the drill string. The model provides a virtual lab test environment for rapid design cycles that significantly reduce the risks associate with testing new controls on a production drilling rig. Systems that can be evaluated include drawworks, top drives, rotary steerables, auto drillers, stick slip mitigation, weight on bit management, tool face control systems, or any actively controlled device.

## Downhole Tool R&D

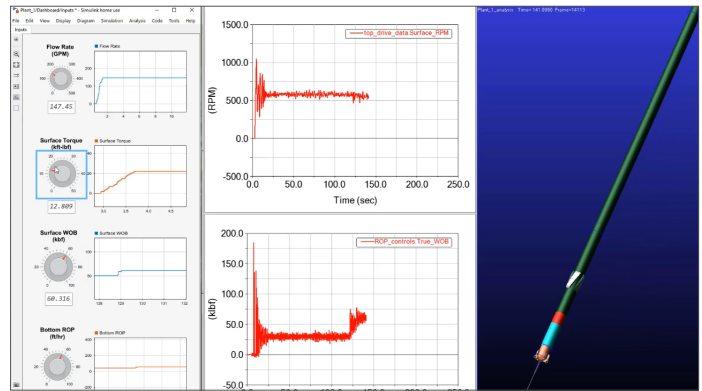
Design and optimization of downhole tools with respect to dynamic response, structural stability, fatigue, and materials selection. Detailed models of downhole tools can be incorporated into a full drill string analysis to study their influence on dynamic string behavior.

## Model Validation

Plan and support lab testing and instrumented well testing for validation of downhole tool, control system, and full-scale drill string models. Correlation with physical test data provides confidence that models will reproduce observed physical behavior.

## Drilling Data Analysis

Cleaning, aggregating, and analyzing drilling data from various sources such as EDR, downhole subs, MWD, and surface. Analysis of this data provides insight into the dynamic response of the drill string and sources of dysfunction.



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*The comprehensive application being developed allows users to vary the drill string components, operating parameters, wellbore geometry, lithology and control algorithms being used to understand the effect on drilling dynamics.*

*Chris Cheatwood, Chief Technology Officer, Pioneer Natural Resources*

For more information on drilling simulation and for additional Case Studies, please visit: [www.mscsoftware.com](http://www.mscsoftware.com) and request more information