



**AccuSteer<sup>®</sup>**  
**Measurement While  
Drilling (M/LWD) Suite**

**Optimize wellbore  
placement with advanced  
downhole measurements**

 **NABORS**

# Nabors' AccuSteer<sup>®</sup> Measurement While Drilling (M/LWD) Suite is a premier dynamics evaluation MWD system for performance drilling with integrated advanced geosteering measurements.

## ▶ ACCUSTEER<sup>®</sup> M/LWD SUITE

AccuSteer™ is a collar based M/LWD system designed specifically for the unconventional market. It encompasses all of the measurements necessary to address the needs of directional drilling, drilling efficiency, and geosteering in a 30' package—shortest in the industry. Through utilization of the latest technology and design techniques, we created a system that brings advanced measurements to the land market in an economical package.

## ▶ ACCUSTEER<sup>®</sup> SYSTEM FEATURES

- Utilizes the latest technology to reduced circuit board count and eliminate connectors
- Geosteering measurements located as close to the bit as possible
- All measurements are recorded at high frequency, all the time
- Flex section incorporated to reduce stress on connections in high doglegs and allow for maximum mud motor build rates
- Compression mounted inside collar to better handle shock and vibration
- Proprietary electronics mounting to mitigate shock and vibration
- Capable of operating at 175°C (347°F) temperatures at 100 G's shock / vibration levels

## ▶ ACCUSTEER<sup>®</sup> SYSTEM MEASUREMENTS

- Directional Measurements
  - Standard Survey
  - 6 Axis Vector Survey
  - Gravity and Magnetic Toolface
- Near Bit Continuous Inclination
- Azimuthal Gamma
  - 16 Sector Azimuthal Gamma Image
  - API Gamma Ray
- Drilling Dynamics (50Hz)
  - Weight On Bit
  - Torque On Bit
  - Bending Moment
  - Instantaneous Dogleg Severity
- Downhole RPM (500Hz)
  - Max/Min/Avg RPM
  - Stick Slip Index
- Pressure While Drilling (17Hz)
  - Annulus and Bore Pressure
  - Downhole Differential Pressure
  - Equivalent Circulating Density (ECD)
  - Equivalent Static Density (ESD)
- Shock and Vibration (1000Hz)
  - Axial and Lateral—Peak, RMS, Average
- Propagation Resistivity
  - Frequencies - 2Mhz, 400kHz, 152kHz
  - Spacings - 48", 28", 18"
  - Phase Shift and Attenuation
  - 16 Independent Resistivity Curves

## ▶ BENEFITS

- Downhole Differential Pressure brings visibility to true mud motor operating condition
- Increase sliding efficiency with downhole Weight on Bit measurements
- Hi-Resolution Azimuthal Gamma Imaging can be used to identify faults and fractures for optimizing completions
- Downhole Dynamics measurements can be utilized for more accurate MSE calculation

- Identify abnormal pressure and pack off conditions with Annulus and Bore Pressure
- Instantaneous Dogleg Severity reveals tortuosity not captured by surveys
- Near Bit Continuous Inclination provides constant awareness of wellbore trajectory
- Azimuthal Gamma Imaging enhances geosteering confidence
- Identify drilling inefficiencies with downhole Shock, Vibration, Stick Slip and RPM measurements
- Collar mount design makes for quick BHA makeup and reduced HSE risk

## ▶ SMART TELEMETRY

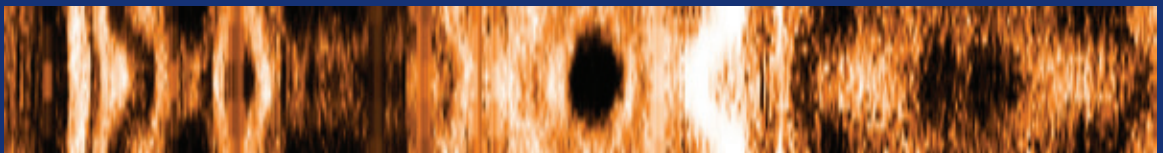
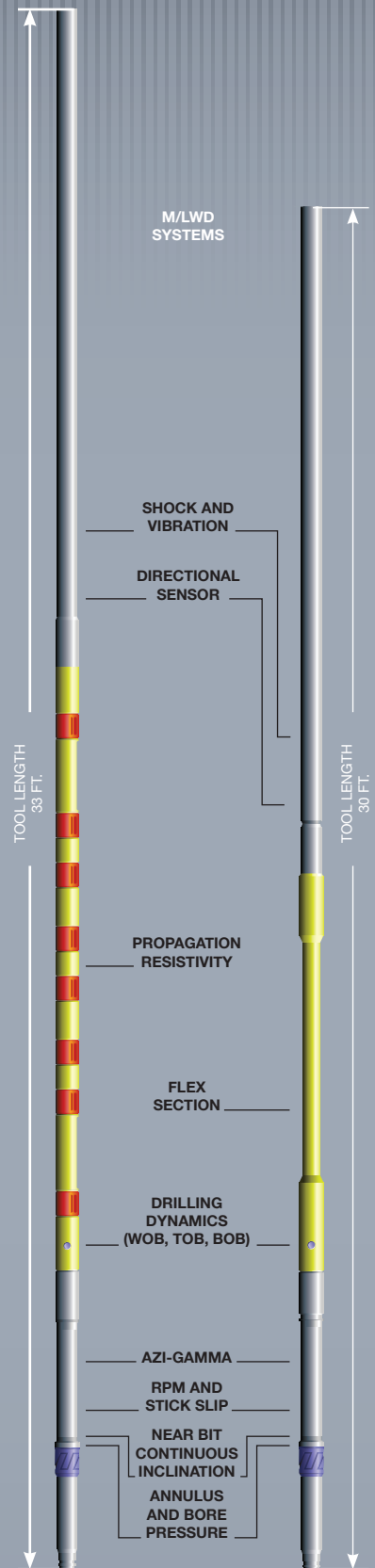
AccuSteer<sup>®</sup> system incorporates a telemetry switching scheme to maximize bandwidth use during rotating and sliding operations. This eliminates toolfaces while rotating when they are not needed to maximize log quality without sacrificing steerability while sliding.

## ▶ RIGLINE 24/7

- Remote directional drilling and MWD operations:
  - Infrastructure capable to perform multiple directional & MWD jobs
  - DD, MWD and drillers trained on remote directional drilling
- Supporting NDS operations with
  - QA/QC of sensor data and reports to ensure consistent and reliable reporting
  - 24/7 support for troubleshooting
  - Standard escalation process to include SMEs, engineers etc. to support field staff
  - As required, technicians/support staff dispatched to ensure fast response

### AccuSteer™ M/LWD System Specifications

<b>Sensor Accuracy</b>	Inclination $\pm 0.1^\circ$ (Range: 0-180°)			
	Azimuth $\pm 0.5^\circ$ (Range: 0-360°)			
	Toolface $\pm 0.1^\circ$ (Range: 0-360°)			
	Continuous Inclination	$\pm 2^\circ$ (0°-5°)	$\pm 1^\circ$ (5°-8°)	$\pm .5^\circ$ (8°-13°)
		$\pm .1^\circ$ (greater than 13°)		
<b>Azimuthal Gamma</b>	Gamma ray $\pm 2\%$ (Range: 0°C-150°C); $\pm 5\%$ (150°C-175°C) $\pm 0.1^\circ$			
	Dual Azimuthal Focused Scintillation Detectors 16 Bin Processed Image 9:1 Front/Back Shield Ratio			
<b>Dynamics</b>	Weight on Bit: 1.6% max error Torque on Bit: 0.9% max error Bending Moment: 0.9% max error			
<b>Pressure</b>	Annulus Pressure $\pm 0.2\%$ (range 0-20,000 psi) Bore Pressure $\pm 0.2\%$ (range 0-20,000 psi)			
<b>Signal Transmission</b>	Positive Mud Pulse and EM			
<b>Collar Size</b>	4.75 in. OD			
	6.75 in. OD			
<b>Flow Ranges</b>	4.75 in.: 150-325 gpm			
	6.75 in.: 300-850 gpm			
<b>Sand Content</b>	< 1% by volume			
<b>LCM Tolerance</b>	25-40 lbs/bbl fine, 30-50 lbs/bbl medium or coarse (well mixed)			
<b>Battery Life</b>	500+ hours			
<b>Onboard Memory</b>	2GB			
<b>Operating Temperature</b>	175°C (347°F)			
<b>Maximum Pressure</b>	20,000 psi			
<b>Dog Leg Capability</b>	Max Dogleg Rotating @ 30 RPM		Max Dogleg Sliding	
	Collar Size	4.75	6.75	4.75
Stabilized BHA	12°/100ft	10°/100ft	17°/100ft	15°/100ft
Slick BHA	15°/100ft	13°/100ft	20°/100ft	18°/100ft
Slick with Flex NMDC BHA	17°/100ft	15°/100ft	22°/100ft	20°/100ft
<b>Max. Vibrations, g</b>	20 (rms, random, 15-1,000 Hz)			
<b>Max. Shock, g</b>	500			
<b>Propagation Resistivity Option</b>	Spacing: 48-, 28-, 18 in. Frequencies: 2MHz, 400kHz, 152kHz			



Right: 16 Sector Hi Res Azimuthal Gamma Image.

# Why choose Nabors' AccuSteer® M/LWD Measurement Suite over the competition?

- ▶ Improve Wellbore Placement
    - Azimuthal Gamma
    - Propagation Resistivity
    - Near Bit Continuous Inclination
  - ▶ Enhance Drilling Program
    - Annulus and Bore Pressure
    - Stick Slip
    - Shock and Vibration
    - Downhole Dynamics Package
  - ▶ Better Characterize the Target Zone
    - Identify like lithology
    - Identify faults and fractures
    - Reduce TVD error with Continuous Inclination
- 

## Enhance your operations

Nabors offers an integrated suite of performance products and services that work with the AccuSteer™ system, including **ROCKit®**, **PILOT™** and **REVit®** systems to maximize efficiency.