

Drilling & Measurements Technology Portfolio 2020





We invest into research, development and manufacturing of our own innovative and cost-effective technology products which forms the basis of our competitive advantage.

Our Original Equipment Manufacturers develop best-in-class drilling and measurement technology products.

ORIGINAL EQUIPMENT MANUFACTURERS

Wolverine Oilfield Technologies

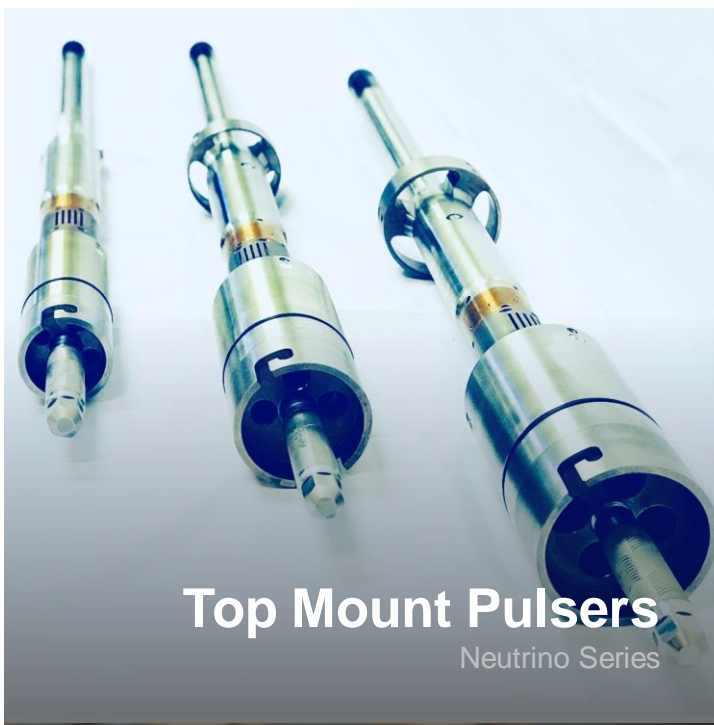
- Rotary Steerable Systems
- Neutron Density LWD
- Continuous Inclination & Azimuth
- High-speed MWD Systems

Remote Measurement Systems

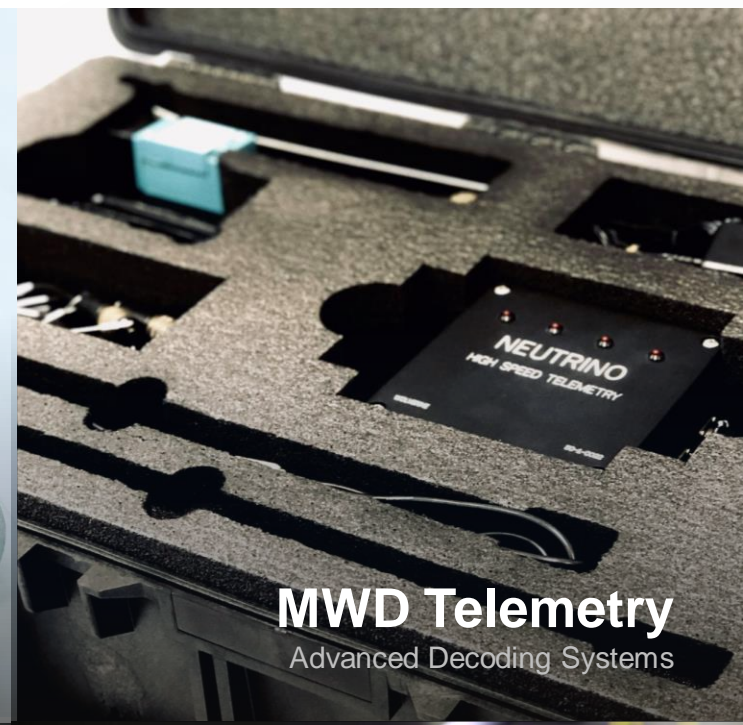
- Resistivity LWD
- Pressure During Drilling
- Turbine Generators
- Drilling Sensors

We Deliver High Tech Tools

Our team of engineers work to create some of the industry's most technologically advanced drilling systems. Wolverine OFT has specialized engineers and technicians supporting you through every turn.



Top Mount Pulsers
Neutrino Series



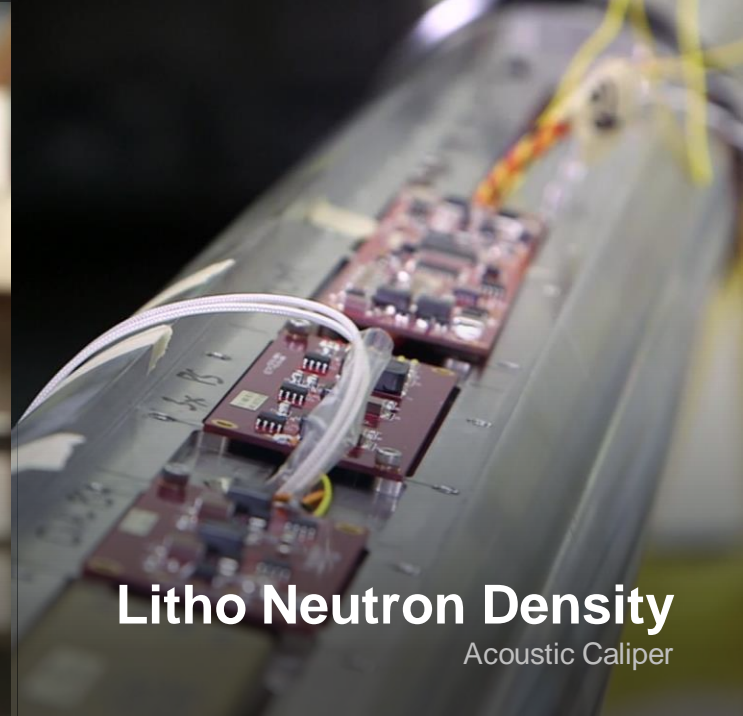
MWD Telemetry
Advanced Decoding Systems



Rotary Steerable Tools
475 RST



Resistivity
Propagation Wave



Litho Neutron Density
Acoustic Caliper

NEUTRINO PLATFORM

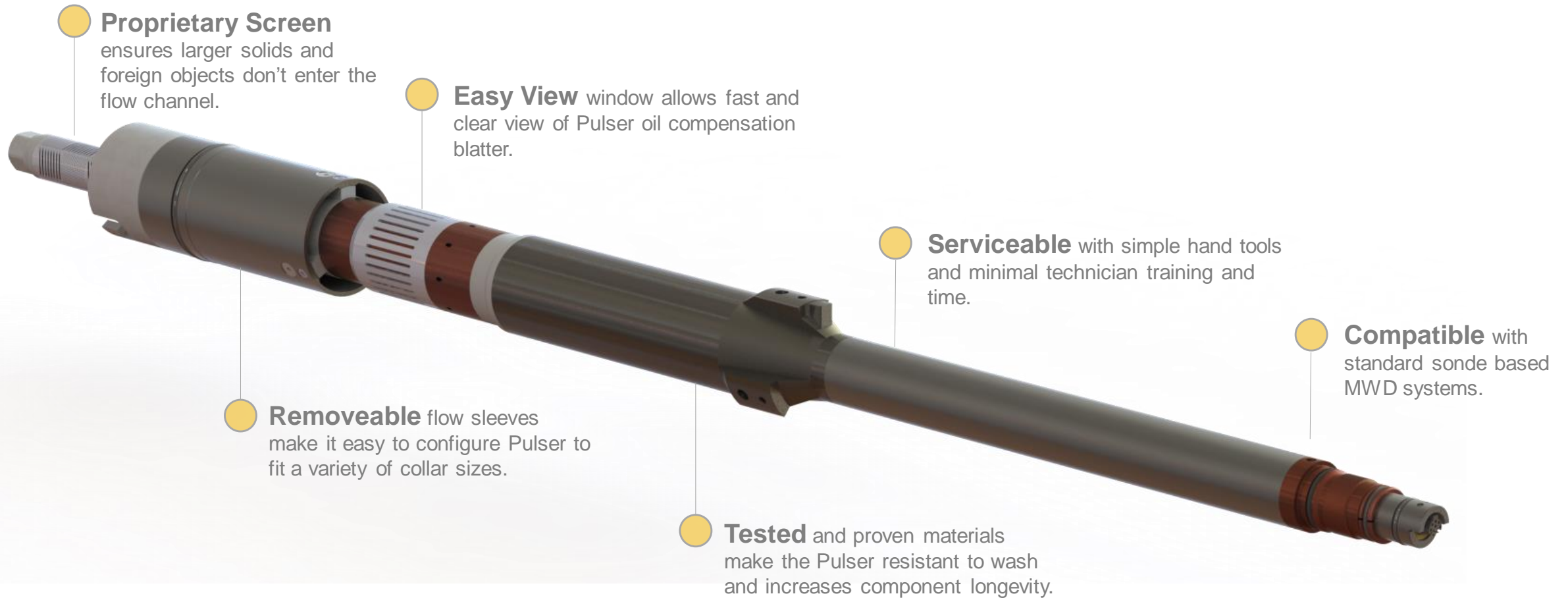
[LEARN MORE](#)

Neutrino MWD Platform includes upgraded components for your downhole tool and surface system that allow you to receive data up to 5 bits per second. You get differentiation while your customers get to drill faster, save time, and stay on plan.

Neutrino Top Mount Pulser

Rugged and robust mechanical and electrical design, tested far beyond industry standards for years of dependable use.

UNIQUE DESIGN FEATURES



Battery Usage

Get up to two times more distance drilled with your batteries. *Depending on bit rate programed.*

4X

Neutrino Top Mount Pulsers

Proprietary design and special algorithms are utilized to make a Pulsar that is smarter and can anticipate the position of the poppet shaft to utilize less power to drive the data to surface at 4 times the rate of other Pulsar models.



40%

Less Power consumption due to revolutionary design and pulse pattern recognition that sends 4 times more data per pulse than legacy top mount designs.

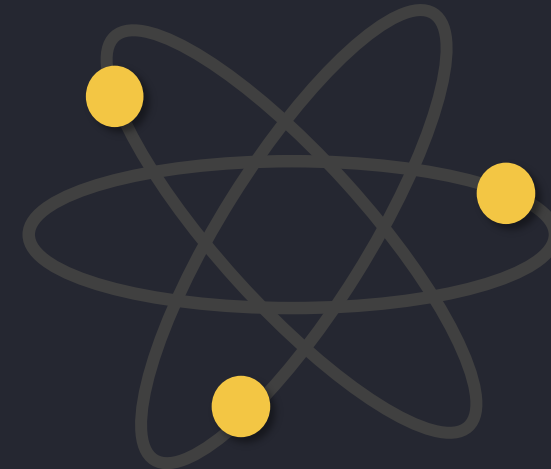
CONTINUOUS INC-AZI DATA

The Wolverine R-Nav™ tool provides continuous real-time inclination and azimuth while drilling to give the drilling team the information needed to accurately position the well.

- Mechanical: 1.875" diam. x 39" length
- Full Directional Survey on Connection

Data Logging - Every Minute	Data Logging – Every Second
Battery Voltage	Inclination
Temperature	Azimuth
Flow Vibration	RPM
Stick-Slip Severity	





Integrated Logging Solutions

Powerful logging suite fit for any and all project needs.



Wolverine Oilfield Technologies Integrated Logging Suite

Quantum db™ is a fully integrated logging suite, capable of producing professional, accurate and complete data logging for any geological needs.



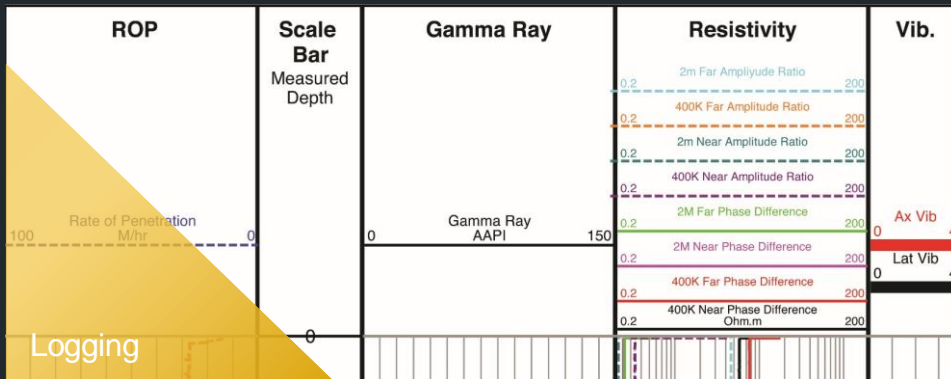
IMMEDIATE INSIGHT
Neutrino Logs offer real time analysis of logging and drilling dynamic data.



HIGH QUALITY
Quantum db allows users to locate historic logs and tool service information at the push of a button.

COMPLETE PLATFORM

Wolverine Oilfield Technologies offers a complete tool suite, perfectly assembled to offer a total package for any drilling need. A combination of tools can be run to match logging and drilling asset needs.



Neutrino MWD



Neutrino WPR




Neutrino RST



Innovative Combinatorial Encoding

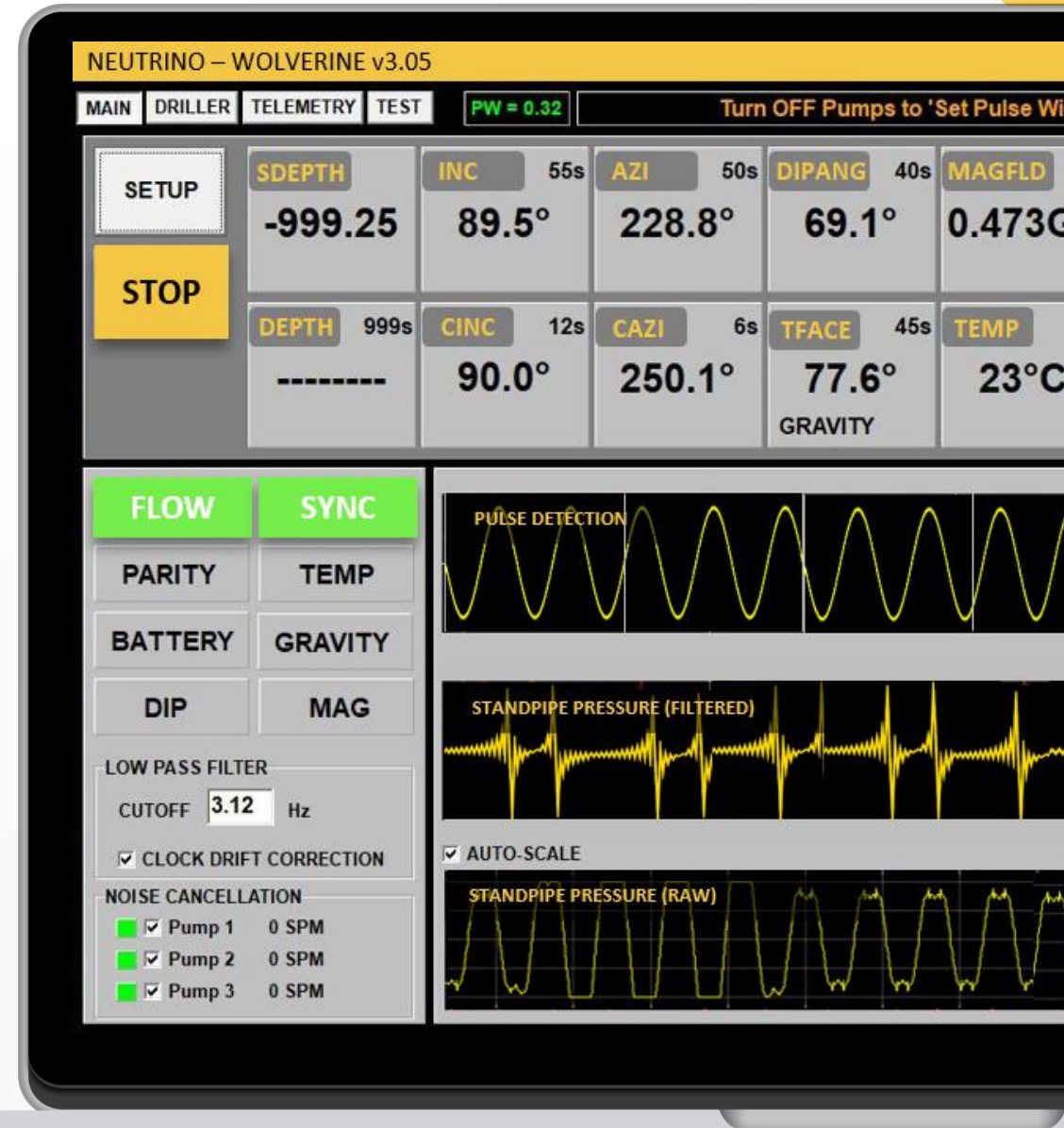
Introducing a smarter, more capable
MWD surface telemetry system.

Neutrino™ includes simple upgrade components for your downhole tool and surface system that allow you to receive data at 2 bits/sec. You get differentiation while your customers get to drill faster, save time, and stay on plan.

 Research Tech

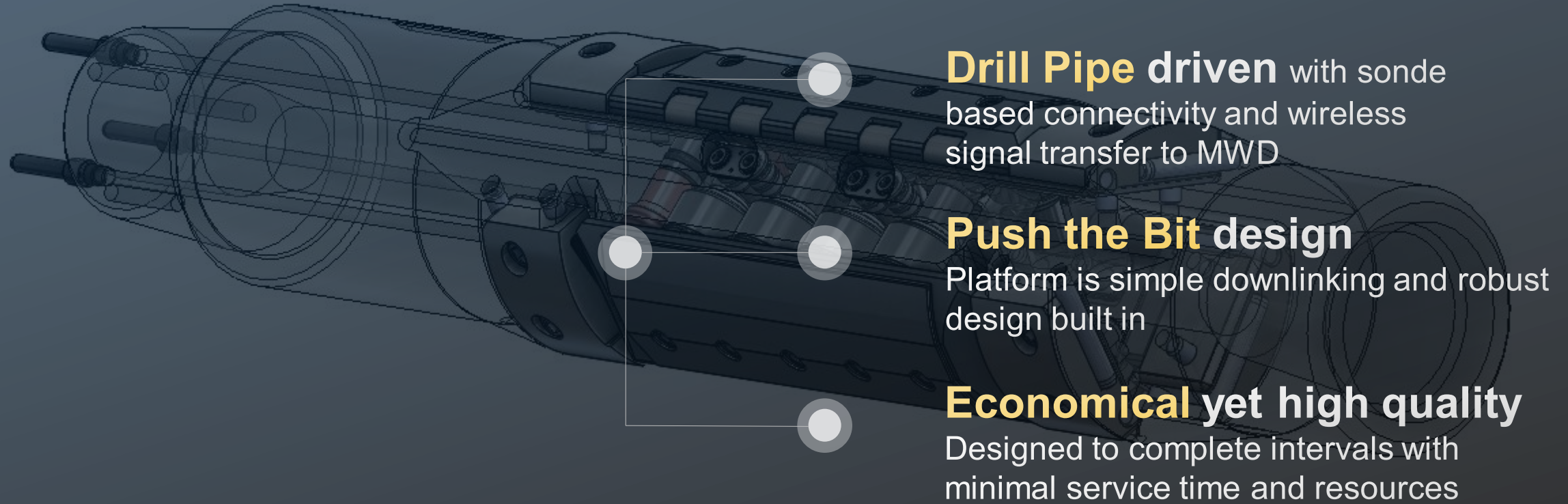
 Advanced Features

 Technical Support



Rotary Steerable

475 RST



Drill Pipe driven with sonde based connectivity and wireless signal transfer to MWD

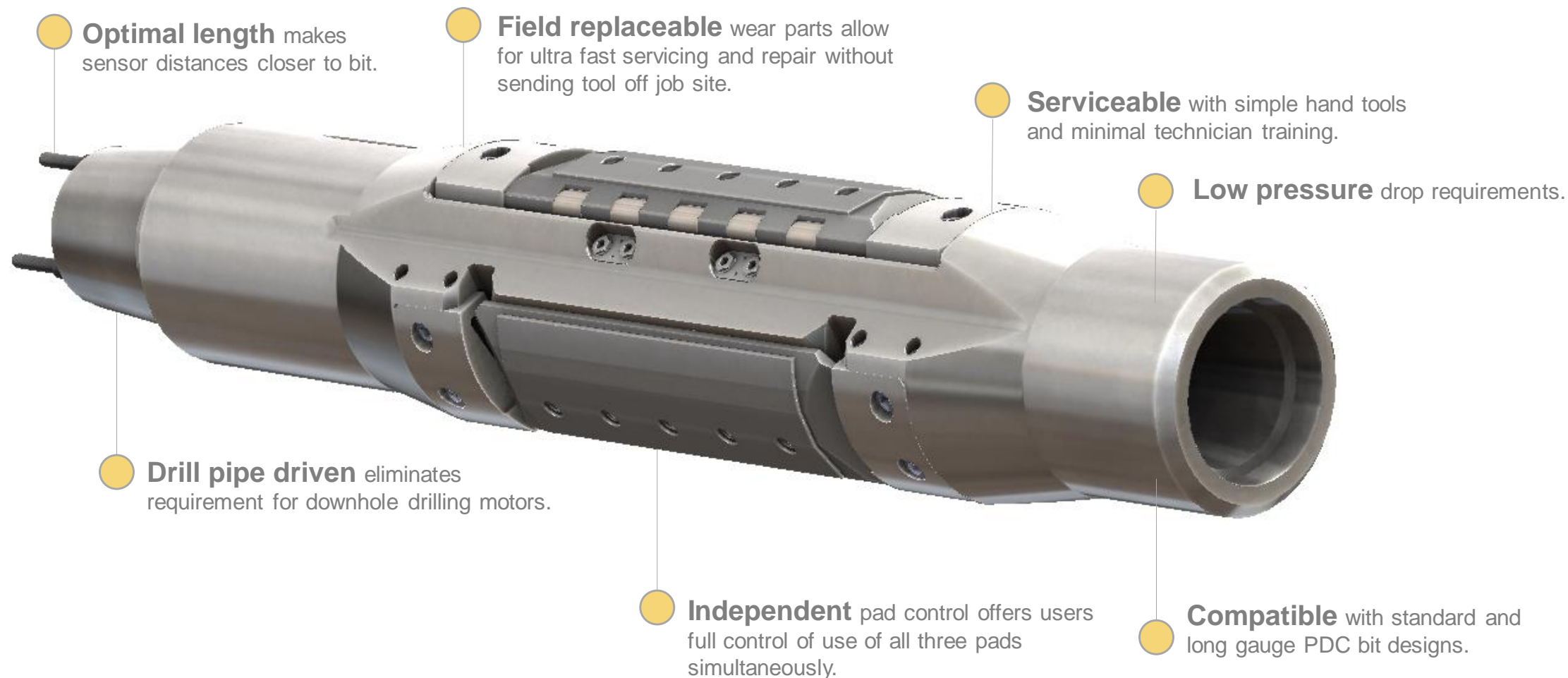
Push the Bit design
Platform is simple downlinking and robust design built in

Economical yet high quality
Designed to complete intervals with minimal service time and resources

High Quality Design

Rugged and robust mechanical and electrical design, tested far beyond industry standards for years of dependable use.

UNIQUE DESIGN FEATURES



475 ROTARY STEERABLE

DESIGN BENEFITS

Push the Bit Rotary Steerable

The Wolverine RST (Rotary Steerable Tool) was specifically designed to provide a cost effective tool capable of producing complex well trajectories. The RST is continuously rotating push-the-bit tool, utilizing mud powered electronically controlled thrust pads located close to the bit to create the steering vector.



Drill Pipe Driven

Eliminates the need for downhole mud motors. 120-160 RPM



Communication

RST has bi-directional communication with surface system for continuous updates and control.



Downlinking

No need to stop drilling to change steering vector. Steer on-the-fly.



Wireless Link

Connects and communicates to MWD sonde wirelessly. Reducing risk of mechanical connection failures.

13 FT

Sensor to Bit

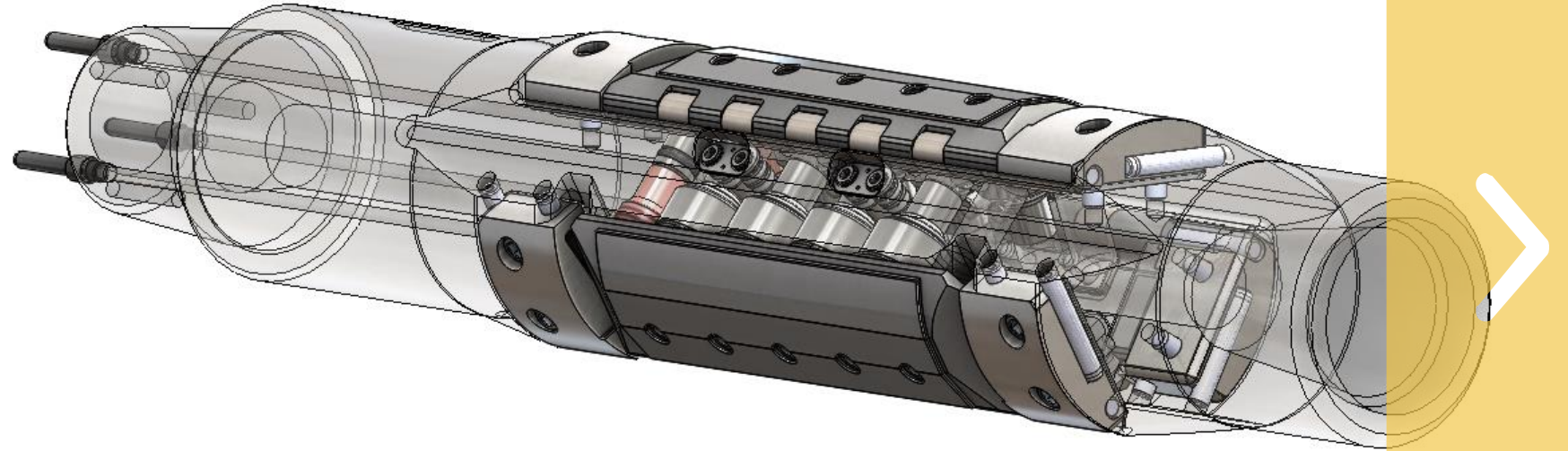
When distance matters, the 475 Series Directional Sensors will get you near bit measurements you can count on.

12 FT

Gamma Location

With precise and near bit Gamma sensors, your team can make accurate steering decisions.

475 PILOT SERIES CAPABILITIES



Operational Parameters

- Operating Temperature: 150°C
- Survival Temperature: 175°C
- Rotation Speed: 40 - 120 rpm
- Weight on Bit: 2,000 - 25,000 lbs
- Flow Rate: 100 - 450 gpm
- Pressure drop (Bit): 200 - 600 psi

Mechanical

- 4.75" Collar Size
- 5.875 – 6.75" Integral Stab Sizes
- Design Scalable to 6.75" & 8.00"
- Fully Rotatable
- Does not rely on thrust bearings.
- Length: 33 Feet
- Weight: 1,400 lbs

Capabilities

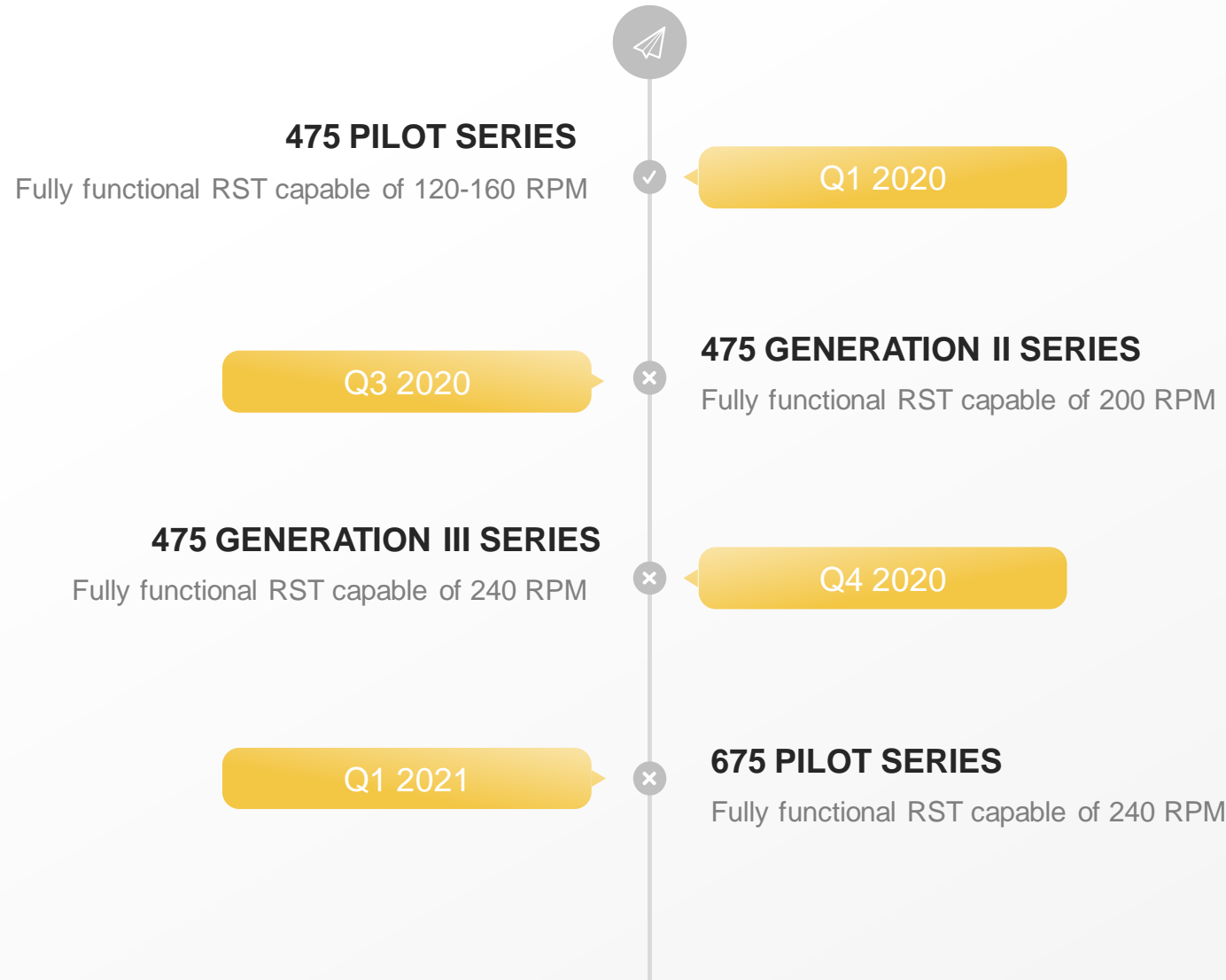
- Dogleg Severity: 0 - 8deg / 100ft
- Dogleg Max (Rot): 15 Degrees
- Dogleg Max (Pass): 18 Degrees
- Overpull Max: 1.1 Million Pounds
- Pressure: 20,000 PSI
- Torque: 10,000 lbs/ft

Benefits

- Reduced Stick-slip
- Improved ROP
- Lower Wellbore Tortuosity
- Improved Wellpath Positioning
- Improved Hole Cleaning
- Reduced Service Costs
- Faster Maintenance Times
- Low Cost Ownership
- Integrate to any MWD System

Rotary Steerable Model Timeline

Commercial Deployment Schedule



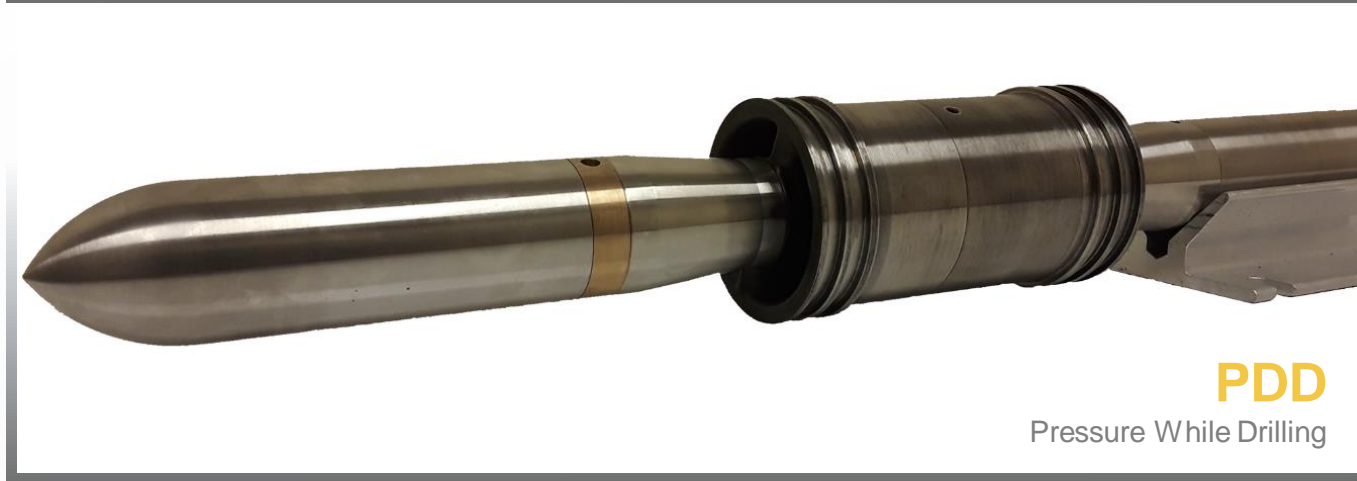
We Deliver High Tech Tools

Our team of engineers work to create some of the industry's most technologically advanced drilling systems. RMS has specialized engineers and technicians supporting you through every turn.

D-Sensor
Directional Sensor



MFPWR
Resistivity LWD



PDD
Pressure While Drilling



Turbine Generator
MWD Power Supply

MFPWR Resistivity®



Description

MFPWR Resistivity® is a spatially compensated, dual frequency (2 MHz & 400 kHz), dual spacing device designed for wireline-equivalent Logging-While-Drilling (LWD) services in all well types.

Applications

- Geosteering
- Correlation
- Casing point selection
- Logging while tripping
- Reservoir evaluation

Capabilities

- Operates in all mud types including oil-based and salt-saturated and provides real-time resistivity to surface via mud pulse or EM transmission
- Quad Transmitter/Dual Receiver arrangement provides 16 individual resistivity measurements which are combined to produce 8 compensated measurements
- 3 curves transmitted in real time (user selectable)
- 5 additional curves available from tool memory
- Tools available in 3 ½", 4 ¾", 6 ¾", 8 ¼" & 9 ½" sizes
- Tools are powered by Lithium Thionyl Chloride Batteries which can be replaced at the rig site or by RMS/Strata Turbine Generator

PRESSURE DURING DRILLING

Real Time & Memory
MWD / LWD Service



Description

The RMS PDD sensor increases drilling efficiency by providing real-time down hole annular pressure information that allows the driller to make faster and better decisions.

Applications

- Logging while tripping
- Real-time downhole hydraulics monitor
- Real-time ECD monitoring and management
- Annulus cuttings overload detection
- Washout detection
- Kick monitoring and control
- Lost circulation detection
- Mud motor performance and control
- Mud rheology control
- Optimization of hole cleaning
- Formation fracturing / loss limitation
- Air and underbalanced drilling well control
- Nitrogen / Air mix control

Benefits

- Early detection of lost circulation
- Early detection of water, gas or oil kick
- Hole cleaning monitoring
- Wellbore pressure maintenance
- Decreasing the likelihood of costly drilling delays

TURBINE GENERATOR

Downhole Power Supply



Description

The RMS turbine generator is a reliable cost-effective solution to downhole power requirements while drilling. It is also environmentally and operationally safe as opposed to lithium batteries.

Features

- Probe based bolt to ensure compatibility with LWD & MWD systems
- Configurable for all BHA sizes
- Mud-powered
- Operating temperatures up to 175C

Benefits

- Cost-effective solution
- Longer MWD life
- Rig maintained
- No battery disposal
- Environmentally and operationally safe

D-SENSOR

Directional Sensor

The RMS D-Sensor provides a highly quality advanced algorithms to subtract bias and scale factor errors from rotating measurements using total field and reciprocal compassing during rotation.

- Rotating measurements based on 4 axis second harmonic fluxgate design combined with 3 axis quartz accelerometers
- Rotating measurements calibrated and synchronized in depth and time to static measurements
- Rotating inclination and azimuth



High quality rotating inclination and azimuth measurements

We Assemble **High Tech MWD**

We provide our customers with the advanced MWD/LWD kits backed by an industry-leading commitment to service and support with Frontier MWD Systems.

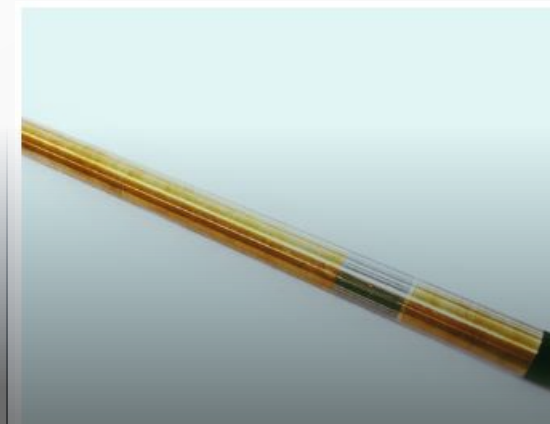
- GE & Tolteq MWD Kit Boxes
- 100% American-made, superior-quality machined parts cut using our very own machines in Houston, Texas.



SURFACE SYSTEMS
Advanced Decoding Systems



COMPLETE MWD KITS



MWD TOOLS

We Provide High Performance Motors

We own a fleet of motors and have access to over 250 power sections ranging from 3-1/2" to 9-5/8" motors, including the latest high flow 5" and 7" motors, high-performance power sections, short bit-to-bend bearing assemblies, adjustable (0-3 degree) or fixed-bend housings.

We are committed to the highest standards of service quality with a dedicated service and support throughout the project lifecycle backed by the best-in-class service expertise and facilities through our strong partnership. We align with all recognized global standards such as ISO and API to meet industry standards and exceed customer expectations.

PDM Specifications

Power Section Size/Configuration	RPG	Max Diff	Max Torque
4 3/4 – 5" 7:8 2.6 HR	0.260	620	5,770
4 3/4 – 5" 7:8 3.8 HR	0.540	900	4,130
4 3/4 – 5" 7:8 4.5 HR	0.463	1,060	5,490
5" 6:7 8.0 HR	0.790	1,880	6,110
6 1/2 – 6 3/4" 6:7 8.1 HR	0.390	1,820	12,040
6 1/2 – 6 3/4" 7:8 2.9 HR	0.160	650	9,600
6 1/2 – 6 3/4" 4:5 7.0 HR	0.494	1,650	8,820
6 1/2 – 6 3/4" 7:8 3.5 HR	0.150	790	13,500
6 1/2 – 6 3/4" 7:8 5.0 HR	0.270	1,180	10,650
6 1/2 – 6 3/4" 7:8 5.7 HR	0.230	1,340	14,200
6 1/2 – 6 3/4" 7:8 6.0 HR	0.270	1,410	12,780
6 1/2 – 6 3/4" 7:8 6.4 HR	0.270	1,510	13,630
7" 6:7 6.5 HR	0.230	1,530	16,690
7" 6:7 8.4 HR	0.300	1,980	16,550
8" 4:5 5.3 HR	0.240	1,250	13,620
8" 7:8 4.0 HR	0.155	940	14,830
8" 7:8 5.9 HR	0.166	1,330	22,020
8" 7:8 3.4 HR	0.087	800	22,530
8" 9:10 3.0 HR	0.112	680	16,580
9 5/8" 5/6 5.0 HR	0.127	1,180	24,290



Thanks
For Your Attention



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