



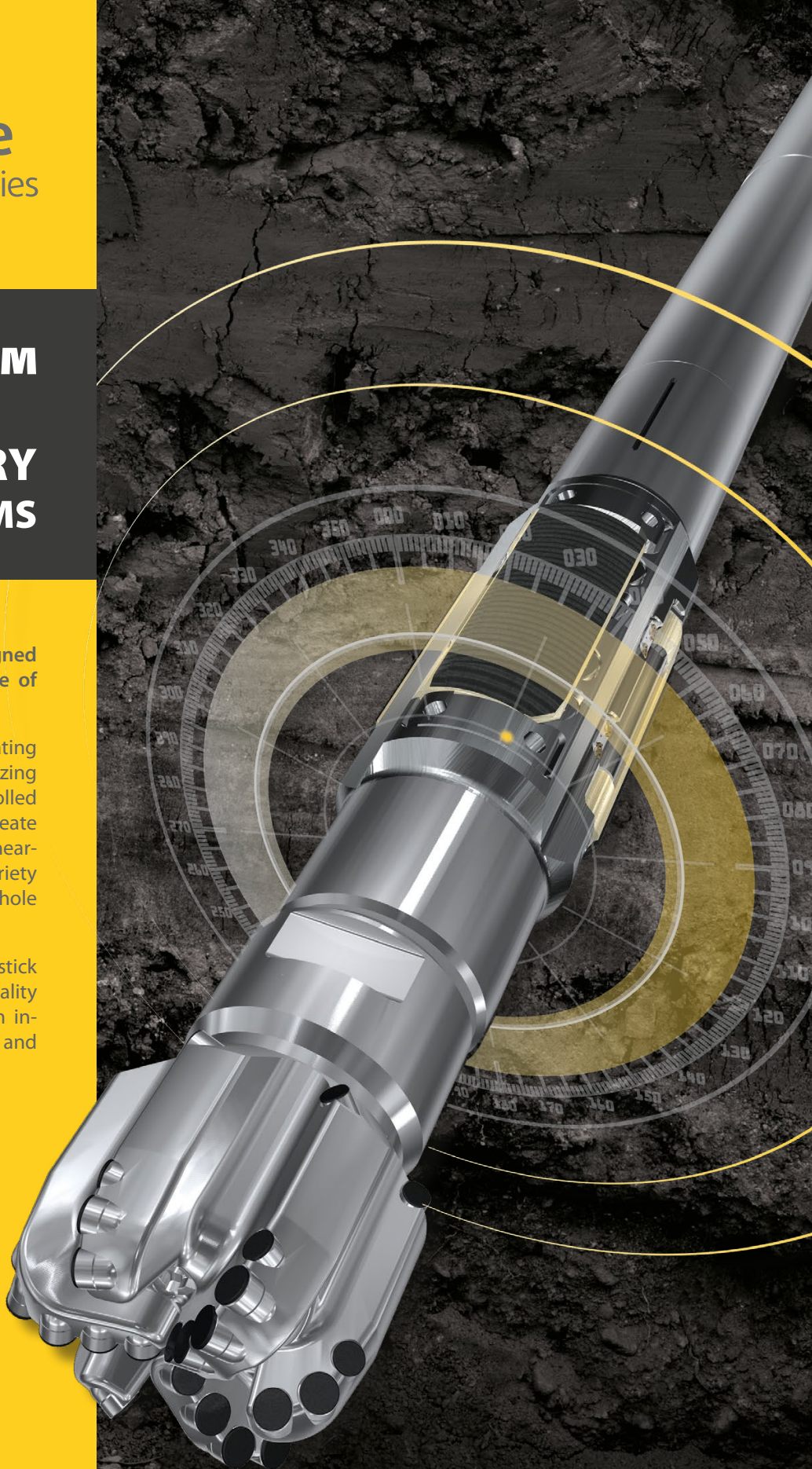
ZENITH™

475 & 675 ROTARY STEERABLE SYSTEMS

The Zenith™ RSS was specifically designed to provide a cost-effective tool capable of producing complex well trajectories.

The Zenith™ RSS is a continuously rotating push-the-bit rotary steerable system, utilizing mud-powered electronically controlled thrust pads located close to the bit to create the steering vector. The RSS is run with a near-bit stabilizer to allow it to be run in a variety of borehole diameters, and bottom hole assemblies.

Full and continuous rotation will reduce stick and slip risks, will increase ROP and the quality of wellbore cleanout, and will ensure an in-gauge wellbore for better log quality and faster casing and completion running.



www.wolverineoft.com
1-713-589-2035
info@wolverineoft.com



PUSH-THE-BIT
3 THRUST PADS



DOGLEG SEVERITY
10°



NEAR-BIT INCLINATION &
AZIMUTH 475
13 FT



NEAR-BIT GAMMA 475
12 FT



NEAR-BIT INCLINATION &
AZIMUTH 675
8.9 FT



NEAR-BIT GAMMA 675
5.7 FT



RSS/MWD
1 COLLAR

ZENITH™ 475
TECHNICAL SPECIFICATIONS

SENSORS		
MEASUREMENT	OFFSET	ACCURACY
PRESSURE (BORE AND ANNULUS)	84.6" [2149]	± 10 PSI [± 0,68 ATM]
GAMMA	145.6" [3698]	± 5%
INCLINATION		± 0.2°
AZIMUTH	164.6" [4181]	± 2° @ 90°

CONFIGURATIONS		
HOLE SIZE	PAD OD	STABILIZER OD
5 7/8" [149,2]	5 3/4" [146]	5 3/4" [146]
6" [152,4]	5 7/8" [149,2]	5 7/8" [149,2]
6 1/8" [155,6]	6" [152,4]	6" [152,4]

MECHANICAL PARAMETERS	
OVERALL LENGTH	27.96" [8522]
UPPER CONNECTION	NC 38 (3 1/2" IF) BOX
LOWER CONNECTION	3 1/2" REG BOX
TOOL WEIGHT (IN AIR)	1400 LB [635 KG]
TOOL OD (NOMINAL)	4 3/4" [120,6]
FLEX SECTION OD	3 7/8" [98,4]

ENVIRONMENTAL CAPABILITIES	
MAX TEMPERATURE	150 °C, 175 °C SURVIVAL
MAX PRESSURE	20,000 PSI [1360 ATM]
MAX VIBRATION	20 G RMS 50-500 HZ RANDOM

OPERATIONAL PARAMETERS	
BUILD RATE	8° / 100' [8° / 30 M] PLANNED 10° / 100' [10° / 30 M] MAXIMUM
ROTARY	160 RPM
WEIGHT ON BIT	BIT LIMITED
TORQUE	10,000 FT-LBS [13558,17 NM]
PRESSURE THROUGH BIT	250 - 500 PSI [17 - 34 ATM]
FLOW RATE	450 GPM [28,39 L/S] MAX
LCM	20 LB/BARREL [57 KG/M3] MAX
SAND	1% MAX
COMPATIBLE MWD	Frontier MWD, TOLTEQ, NEUTRINO
PASS THROUGH SLIDING	15° / 100' [15° / 30 M]
PASS THROUGH ROTATING	18° / 100' [18° / 30 M]
OVERPULL	300,000 LBS [136 T]

Imperial UOM [Metric UOM]

ZENITH™ 675
TECHNICAL SPECIFICATIONS

SENSORS		
MEASUREMENT	OFFSET	ACCURACY
PRESSURE (BORE AND ANNULUS)	35.3 [897]	± 10 PSI [± 0,68 ATM]
AZIMUTHAL GAMMA	67.9 [1725]	± 5%
INCLINATION		± 0.2°
AZIMUTH	106.5 [2704]	± 2° @ 90°
VIBRATION (3 AXIS)	77.5 [1969]	±200g (RANGE)

CONFIGURATIONS		
HOLE SIZE	PAD OD	STABILIZER OD
8 1/4" [209,55]	7 3/4" [196,85]	8 1/8" [206,37]
8 1/2" [215,9]	8" [203,2]	8 3/8" [212,73]
8 7/8" [225,43]	8 1/4" [209,55]	8 3/4" [222,25]

MECHANICAL PARAMETERS	
OVERALL LENGTH	27.79' [8471 MM]
UPPER CONNECTION	NC 50 (4 1/2" IF) BOX
LOWER CONNECTION	4 1/2" REG BOX
TOOL WEIGHT (IN AIR)	2600 LB [1179,3 KG]
TOOL OD (NOMINAL)	6 3/4" [171,45]
FLEX SECTION OD	5 7/8" [149,22]

ENVIRONMENTAL CAPABILITIES	
MAX TEMPERATURE	150 °C, 175 °C SURVIVAL
MAX PRESSURE	20,000 PSI
MAX VIBRATION	20 G RMS 50-500 HZ RANDOM

OPERATIONAL PARAMETERS	
BUILD RATE	10° / 100' [10° / 30 M]
ROTARY	350 RPM
WEIGHT ON BIT	BIT LIMITED
TORQUE	16,500 FT-LBS [22371 NM]
PRESSURE THROUGH BIT	250 - 500 PSI [17 - 34 ATM]
FLOW RATE	300 - 600 GPM [22,73 - 45,46 L/S]
LCM	20 LB/BARREL [57 KG/M3] MAX
SAND	1% MAX
COMPATABLE MWD	Frontier MWD, TOLTEQ, NEUTRINO
PASS THROUGH SLIDING	16° /100'
PASS THROUGH ROTATING	10° / 100'
OVERPULL	500,000 LB [2,224,000 N] [226,79 T]

Imperial UOM [Metric UOM]

RUGGED & ROBUST
DESIGN

HIGH-SPEED MWD
INTEGRATION

UNPARALLELED
ECONOMICS

INCREASED
DURABILITY

HIGH PERFORMANCE
DRILLING

PRECISE DIRECTIONAL
CONTROL

POWERED BY
DRILLING FLUID

FIELD
SERVICEABLE

ON-PLAN & ON-BUDGET
EXECUTION

FULLY ROTATING PUSH-THE-BIT

FEATURES

- Simple and robust
- Full and continuous rotation
- Push-the-bit configuration
- Thrust pads close to the bit
- Mud-powered and electronically controlled
- Adjustable stabilizer configuration
- Compatible with numerous BHA configurations
- Compatible with a mud motor BHA to increase ROP
- Integration with any MWD system
- Tool setup and control software
- Near bit real-time gamma, inclination, and azimuth

BENEFITS

- Applicable in wells of any complexity on land and offshore markets
- Assembled and programmed in the shop
- Picked up at the rig as one collar
- Optimized steering, drilling performance, and directional control
- Better borehole quality and clean-out
- Increased ROP
- Reduced stick and slip risks
- Target depth on time and on budget
- Smooth and in-gauge wellbores for better log quality and faster casing and completion

475 GENERATION II SERIES

Fully functional RSS capable of 200 RPM

Q3 2020



475 PILOT SERIES

Fully functional RSS capable of 120-160 RPM

Q1 2020



675 PILOT SERIES

Fully functional RSS capable of 240 RPM

Q1 2021



475 GENERATION III SERIES

Fully functional RSS capable of 240 RPM

Q4 2020

ROTARY STEERABLE SYSTEM

TECHNOLOGY DEVELOPMENT TIMELINE

The company invests into research, development and manufacturing of its own innovative and cost-effective technology products, which forms the basis of our competitive advantage. Our highly professional in-house engineering team is in charge of design and improvement of new patented equipment.

The Zenith™ RSS is a unique, original design developed by our in-house engineering and manufacturing teams using components sourced or machined only in the US & Canada.

The development launch started with the evaluation of the RSS type based on specification attributes such as maximum deflection versus reliability.

PUSH-THE-BIT vs POINT-THE-BIT

We chose **push-the-bit** based on simplicity and reliability, giving up some dogleg capability. Then we selected the type of the push-the-bit system that would achieve high reliability and low cost of ownership.

FULLY ROTATING vs NON-ROTATING SLEEVE

Having prior experience with the problems associated with the non-rotating sleeve design, such as low bearing life and unreliable precession control, we decided on the simpler concept of a **fully rotating** system.



COMPLETE TECHNOLOGY STACK

Wolverine Oilfield Technologies has developed its own complete technology stack for drilling directional wells of any complexity and offers directional drilling, measurements, and logging while drilling products and services using the company's own equipment as well as geosteering services.

We offer a complete proprietary technology stack for horizontal drilling to optimize drilling performance and directional control, increase ROP, improve wellbore stability and hole quality, optimize well placement and reservoir exposure for maximum production at lower cost while drilling.

Each of the development projects were taken from initial concept to final product by drawing upon the extensive experience of our multi-disciplinary team members.

- Rotarty Steerable Systems
- Resistivity LWD
- Porosity / Density / Acoustic Caliper LWD
- High-Speed MWD & Pulsers
- Pressure While Drilling
- Logging/Plotting Surface Software



Rotary Steerable System
Pulser



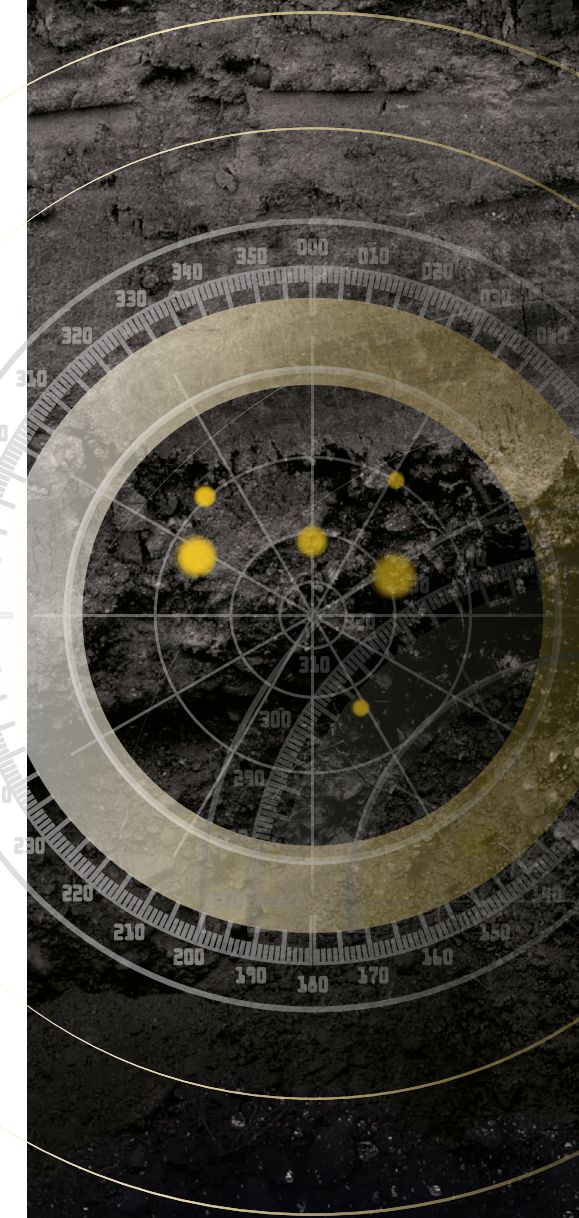
NEUTRINO™ MWD Tool Kit



LWD Tool



MFPWR Resistivity®



ENGINEERING EXCELLENCE

OUR TEAM LEADERS

EXPERIENCE

27 YEARS

- Baker Hughes
- Weatherford
- Several Independents
- Wolverine Oilfield Technologies

EXPERIENCE

30 YEARS

- Sperry Drilling
- Baker Hughes
- Halliburton Director of Technology
- Wolverine Oilfield Technologies

EXPERIENCE

10 YEARS

- Weatherford
- Wolverine Oilfield Technologies

EXPERIENCE

25 YEARS

- Sperry Drilling
- Weatherford
- Several Independents
- Wolverine Oilfield Technologies

EXPERIENCE

8 YEARS

- National Oilwell Varco
- Wolverine Oilfield Technologies

Comprising of industry leading mechanical, electrical and software engineers, Wolverine Oilfield Technologies puts leading-edge technology solutions within the grasp of industry directional services companies and operators.



BRYAN GONSOULIN

Managing Member // Electronics/Software Design

Bryan's technical background is in electronics/software, electro-mechanical actuators, directional sensors, and control algorithms.



MICHAEL WOODS

Managing Member // Mechanical Systems Design

Michael's technical background includes design and development of complex mechanical systems, downhole robotics, downhole and surface mud pulse transmitters, and rotary steerable systems.



ROBERT CONGER

Project Manager // Mechanical Engineer // Lead Test Engineer

Robert's early work that provided significant performance increases of downhole MWD tools and mud pulsers, was followed by a start-to-finish design and development cycle of the first successful Weatherford rotary steerable tool.



JOHN MENCONI

Mechanical Systems Engineer & Advisor

John's role has been the development of novel, high-performance electro-mechanical actuators that allow us to achieve completely independent pad control in our motor-driven, fully rotating RSS.



THUAN VU

Software Engineer // Performance Test & Verification

Thuan began his career at NOV, where, after completing extensive training rotations through field and engineering departments, made outstanding contributions to their product testing and sustaining engineering group. He now develops our software applications that collect and analyze downhole tool data, providing the critical performance measurements that allow us to finely tune our systems for maximum reliability.

Wolverine Oilfield Technologies is a subsidiary of NewTech Services Holding Limited, an international oilfield services company founded in 2009.

NewTech Services Holding Limited develops technology and expertise within 4 Business Divisions: Drilling Services, Completion Systems, Integrated Project Management, and Capital Equipment.

NewTech Services Holding Limited supplies technology products and services to the oil and gas exploration and production industry in Russia and CIS, Europe, Middle East, North and South America.

Wolverine Oilfield Technologies is a subsidiary of NewTech Services Holding Limited specializing in drilling technology products such as MWD/LWD/RSS.



Wolverine
Oilfield Technologies

www.wolverineoft.com
1-713-589-2035
info@wolverineoft.com