

## Technical Information & Data Reference

# Surefire Wildfire

Surefire/Wildfire are real-time MWD survey tools designed to provide unmanned monitoring of wellbore deviation and direction\*. These tools provide an intermediate solution between time consuming and inaccurate wireline survey tools and expensive steerable MWD systems.

Built around a proprietary mud pulser, high shock rated solid state sensors and rugged control electronics, the Surefire/Wildfire MWD Survey Tool provides a robust and cost-effective surveying option for vertical wellbores. It dramatically reduces survey times when compared to wireline or memory survey tools and maximizes usable rig time in drilling operations.

The Surefire/Wildfire MWD Survey Tools implement a high torque, high wear rotary shear valve and provide increased reliability and durability in contaminated mud systems. These tools also have significantly superior tolerance to LCM and solids when compared to conventional pulser designs that utilize small screens and inlets which are susceptible to blockages.

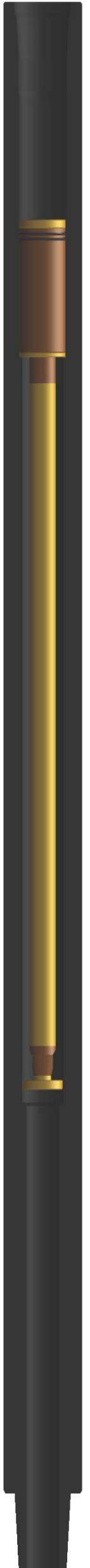
Unlike other currently available survey tools which only transmit wellbore inclination and azimuth to the surface, the Surefire/Wildfire MWD Survey Tools also provide Total Gravity Field, Total Magnetic Field\* and Dip Angle values\*, drastically reducing the risk of bad surveys. System health parameters such as downhole tool temperature and tool battery life are also transmitted. The total survey time is less than 3 minutes.

Data telemetered from the downhole tool is decoded and displayed automatically by the Invictus Surface System. The Invictus Surface System has a small footprint and integrates easily into the crowded workplace in the dog house. It is touchscreen enabled and features an easy-to-use interface that can be mastered in minutes. The driller can view real-time graphs of pressure data and filtered pulse data and can also visualize the wellbore using plots and charts.

The Invictus Surface System has extensive data logging and report generation capabilities. Survey reports can be exported using the built-in USB port in PDF and CSV formats. The entire system can be installed, initialized and operational in less than 30 minutes.

\*Direction, Total Magnetic Field and Dip Angle value provided by Wildfire only.

UNMANNED MONITORING SURVEY - MWD



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Technical Specification Sheet	
Data Transmission Type	Positive Mud Pulse
Available Tool Sizes/ Operating Flow Rate	4.75" (121mm) with 3 1/2" IF, 150-350gpm 6.50" (165mm) with 4 1/2" XH, 250-700gpm 8.00" (203mm) with 6 3/8" Reg, 400-800gpm 9.50" (241mm) with 7 3/4" Reg, 600-1200gpm
Nominal Length	12 ft (Wildfire), 8ft (Surefire)
Power Supply	Lithium thionyl-chloride high temperature batteries
Shock Limit / Vibration Limit	1000g, 0.5ms / 20G RMS random 50-500Hz
Operating Temperature	32 ° to 302 ° F
Survival Temperature	-40 ° to 329 ° F
Hydrostatic Pressure (max)	15,000 psi
Pressure Drop	~50 psi @ 350 GPM water
LCM Tolerance (max)	60-80 ppb medium nut plug, premixed
Sand Content	<5%, <2% optimal
Inclination Sensor Accuracy / Repeatability	± 0.2 ° / ± 0.05 °
Azimuth Sensor Accuracy / Repeatability (Wildfire only)	±1.5° (>5° Inclination) / ±0.5°
Data Telemetered	
Survey Procedure	Pumps off for 60 seconds, pumps on for 3 minutes
Angle Range/ Resolution	0°- 102.3° / 0.1 ° (Wildfire), 0-29.5° (Surefire)
Azimuth Range/ Resolution	0°- 359° / 1°
System Health Data	TGF, battery hours remaining, tool temperature, (TMF, dip, Wildfire only)

