An innovative perforating system for plug-and-perf completions in unconventional wells demonstrates that operations can be made more efficient, safe and reliable. Results from extensive modeling, testing and field tests demonstrate that the entire perforating process, including gun loading, arming, running, perforating, maintenance and disposal, is made more robust by eliminating traditional approaches to selective perforating, detonators, gun hardware and accessory equipment.

The new system optimizes perforating operations with fully assembled gun modules delivered to the wellsite. An innovative integrated switch-detonator design replaces all wiring and crimping, eliminates human error and significantly reduces the risk of inadvertent detonation. Arming a gun is now as efficient, safe and reliable as placing a battery in a flashlight. Intrinsically safe microprocessor switch-detonators achieve measurably higher reliability and are immune to potential hazards that can impact standard switch-detonator combinations in use today. Surface test equipment detects malfunctions before running in hole, and the software allows continuous monitoring of all downhole components until initiation and between shots. All wellsite operations can continue without interruption, and full selectivity, stage-skipping and gun redundancy are enabled for the most complex completions. Gun length, shot phasing, shot density and charge type are fully customizable with injection-molded gun parts that eliminate unwanted debris after perforation.

The design targets a 10X improvement in reliability over existing plug-and-perf equipment. Wireline service companies traditionally experience reliability ranging from 30 to 100 runs/misrun. Early results suggest the new system may exceed 1,000 runs/misrun. By reducing the risk of mishaps, misruns and misfires, rig time is saved, frack costs are lowered, and every stage can be successfully perforated.

Field tests demonstrate the advantages of a fully integrated perforating gun system. The new technology leverages innovative component-level features and a system design that eliminates many of the causes for misruns, increases simplicity and safety of operations, and delivers higher well productivity.