

XR-Perf

Expanded-range wireline perforating system

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Applications

- Deployment of long or heavy perforating gun systems
- Offshore or remote perforating operations
- Highly deviated, horizontal, and complex well trajectories

Benefits

- Improved efficiency by conducting fewer runs of heavier, longer gun strings
- Direct reduction in total operating time without compromising HSE or service quality
- Lower rig costs and streamlined logistics compared with traditional conveyance methods

Features

- Compatible with all Schlumberger HSD* high shot density perforating gun systems and a wide range of heptacables and monocables
- Compatible with the PURE* clean perforations system and P3* postperforating treatment
- Applications up to 400 degF



An offshore oil rig is visible on the left side of the image, partially obscured by the text. The rig is a complex structure with various equipment, including a large red crane arm extending outwards. The background is a vast expanse of blue ocean under a clear sky.

Advanced wireline conveyance for expanding perforating operations

XR-Perf* expanded-range wireline perforating system integrates recent industry-leading developments in ultrahigh-strength cables and units, tractor conveyance, and perforating accessories, backed by our global network of experts, to push through the conventional limits of well angle and complexity. Especially for long toolstrings, for which weight is also a concern, XR-Perf perforating system makes it possible to efficiently and effectively conduct perforating operations on wireline, instead of routinely relying on pipe-conveyed perforating.

The result is streamlined logistics, operational versatility, and reduced rig time and costs.

Enabling technologies

MaxPull* high-pull wireline conveyance system integrates components specifically engineered to maximize wireline payloads and minimize operational risk in deploying wireline tools and perforating guns. Incorporating high-strength weakpoints, electronic release devices, and **TuffLINE** torque-balanced composite cables, the MaxPull system delivers perforating efficiency with unparalleled safety, reliability, and sticking avoidance, even in well trajectories and conditions that were not previously wireline accessible.

Ultrahigh-strength TuffLINE torque-balanced composite wireline cables employ the breakthrough technology of polymer-locked armors to effectively manage what are otherwise the fundamental limitations of conventional high-strength cables. Because polymer locking the armors prevents rotation, TuffLINE cable is effectively in a permanently ends-fixed situation, which significantly raises the ends-free breaking strength. A MaxPull system using TuffLINE cable can provide instantaneous pull of up to 18,000 lbf for stick prevention and mitigation without a capstan.

If operating conditions will result in tension exceeding 18,000 lbf, the system can be interfaced with a capstan rated to 24,000-lbf pull capacity with TuffLINE 18000 cable or rated to 26,000 lbf with TuffLINE 26000 cable. The MaxPull 30000 system teams TuffLINE 30000 cable, OSU-N high capacity unit, Capstan 30000, and ultrahigh-strength drum to provide a pull capability of 30,000 lbf. Multiple high-tension operations can be conducted, including cycling and jarring and the shock attendant with perforating, without compromising cable integrity.

UltraTRAC* all-terrain wireline tractor delivers the highest force available in the industry to readily convey large payloads in challenging borehole conditions and across high-angle, extended-reach wells. The robust maneuverability of the UltraTRAC all-terrain tractor in challenging well environments, whether open hole or cased hole, results from the three exclusive design features of real-time traction control, dynamic suspension that maintains constant radial force independent of borehole size, and

Example single-descent deployments

BRAZIL

105-ft
7-in

HSD gun system
on TuffLINE 18000
cable

BRAZIL

150-ft
4.72-in

HSD gun system
on TuffLINE 18000
cable

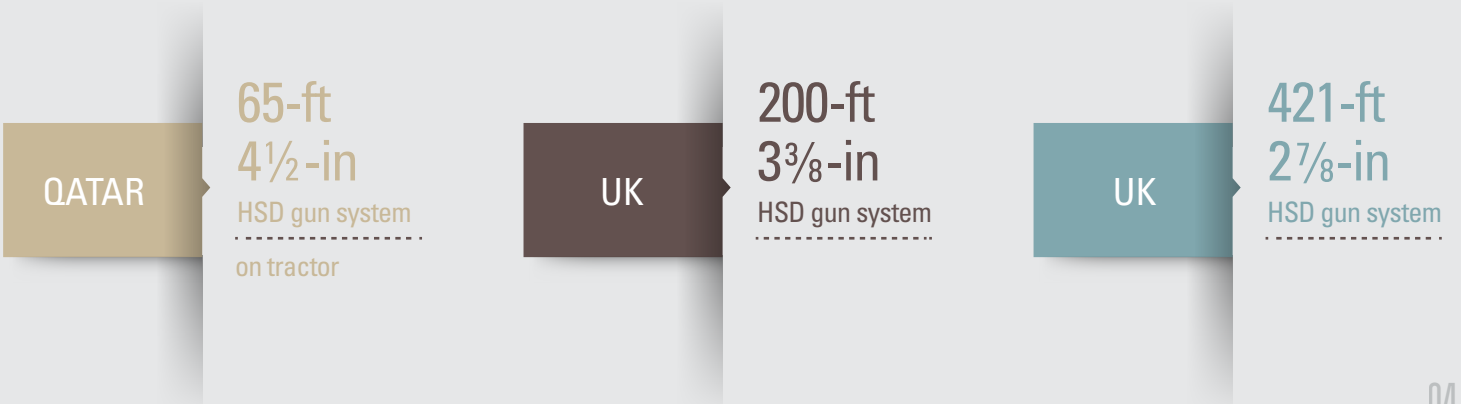
bidirectional capability. Engineered to withstand the impact of perforating gun detonation as well as the vibration generated in rugose boreholes, the modular UltraTRAC all-terrain tractor also benefits operations through its low sensitivity to well conditions.

TuffTRAC* cased hole services tractor is the shortest tractor available, providing reverse tracting and traction control capability in highly deviated wells. With low sensitivity to well conditions, the compact TuffTRAC tractor has multiple built-in systems for electrical

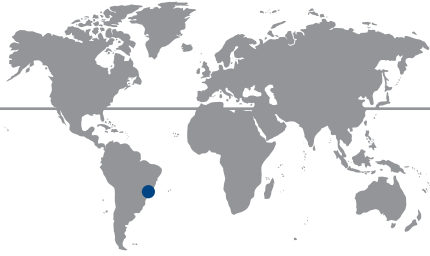
release, head tension, shock absorption, casing collar log, and addressable tractor perforating safety switch.

The result is increased safety, reliability, and operational versatility. By electromechanically driving the tractor wheels, the TuffTRAC tractor optimizes the available surface power, achieving more than 45% conversion efficiency from the supplied electrical power. The low power requirements do not stress auxiliary systems and the tractor does not have to be stopped to cool down, even in dry gas wells.

PURE Planner* perforation job planning application models the dynamic underbalance and simulates the perforating shock for the optimal job design without compromising safety or service quality. Productivity comparison and prediction are conducted using the extensive database of stressed-rock test shots in SPAN Rock* stressed-rock perforating analysis.



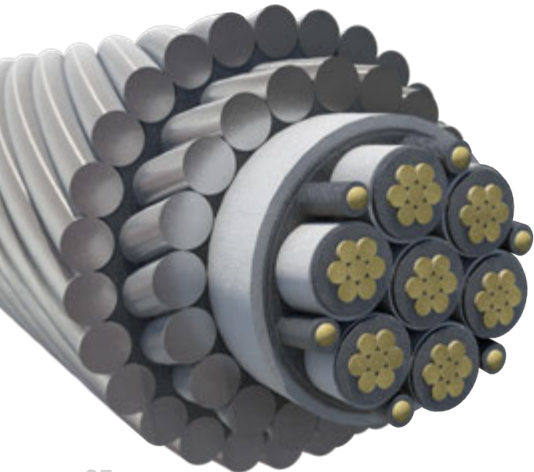
Case Studies



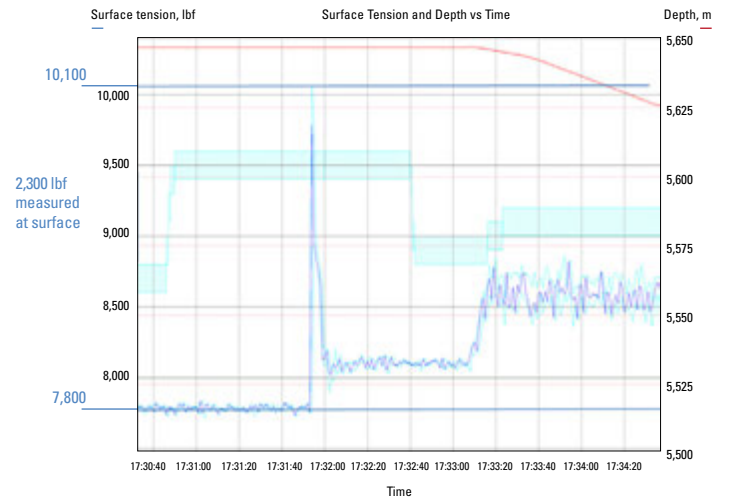
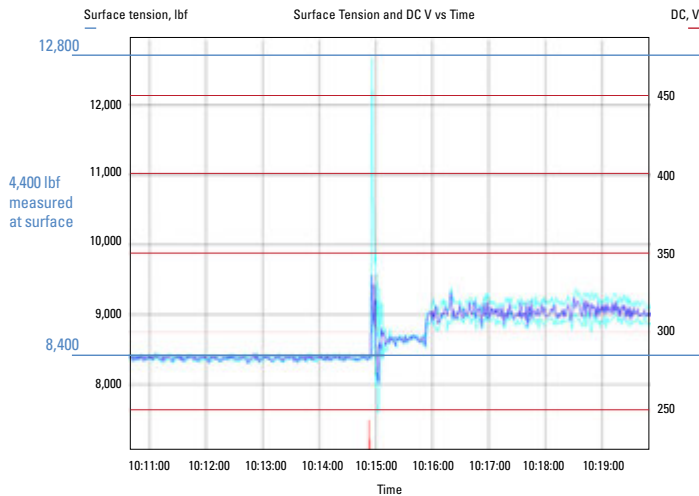
XR-Perf system on TuffLINE cable saves USD 1 million and 30 hours of rig time

An operator needed to perforate a 40-m zone in a deepwater presalt well offshore Brazil. The combination of elevated formation and hydrostatic pressures—on the order of 8,000 to 10,000 psi—was a concern because the long gun strings required for perforating the large pay zone could generate high shock loads. The operations team worked closely with Schlumberger modeling and perforating experts to perform simulations that took the 9.9-lbm/gal US fluid and 9,500-psi hydrostatic pressure into consideration. The shock was modeled with the PURE Planner application to ensure it would be at an acceptable level.

Designed for conveyance on TuffLINE 18000 composite cable, the operation comprised three runs to cover the 40-m interval. The total operating time of 18 hours represents a 30-h reduction from the equivalent operation conveyed on pipe, which in turn translates to a cost savings of USD 1 million for the operator. In addition, TuffLINE cable's higher stretch coefficient significantly reduced the shock transmitted to the weakpoint in comparison with conventional high-strength cable.

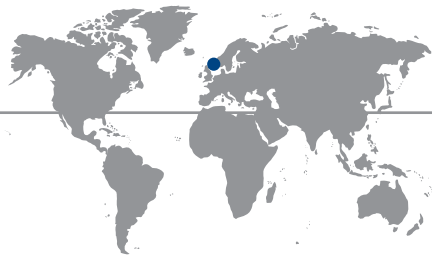


The industry's first and only polymer-encapsulated high-tension cable, TuffLINE 18000 torque-balanced composite cable delivers an unprecedented overpull safety margin.



Perforation conducted on conventional high-strength cable (left) experienced 4,400 lbf of shock at the cable-mounted tension device at surface whereas using TuffLINE 18000 cable (right) reduced the peak shock load to 2,300 lbf, significantly lessening operational and safety risk.

Case Studies

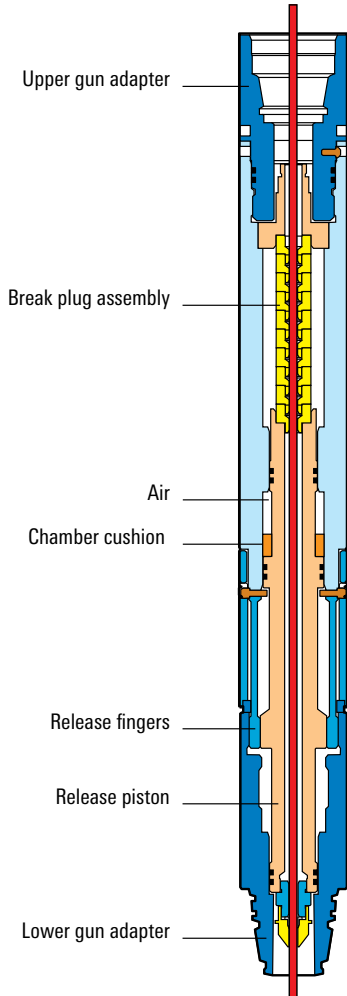


XR-Perf system shoots 90-ft interval in highly deviated North Sea well in a single underbalanced run

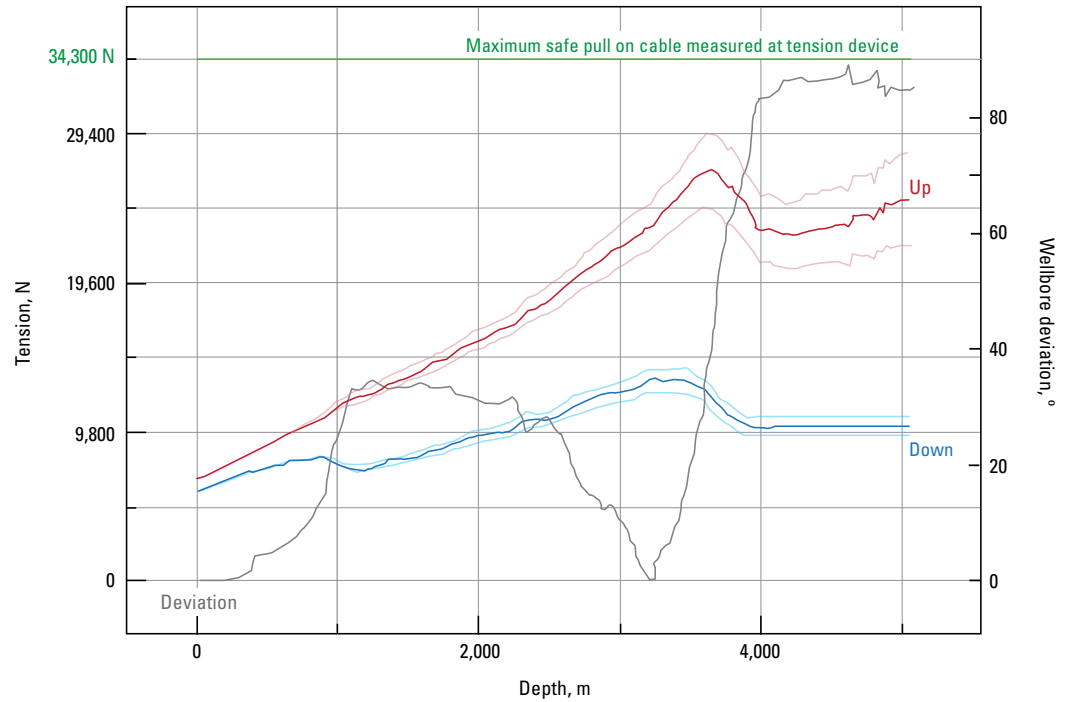
A North Sea operator wanted to perforate a 90-ft interval in a well section at 86° deviation. However, the offshore platform had restricted deck space and only limited crane capacity for rig-up height and lifting capacity. A rig was not available, therefore coiled tubing could not be used for conveyance.

The Schlumberger perforating team designed the XR-Perf system job to use the TuffTRAC cased hole tractor to first isolate the previously perforated zone by setting two bridge plugs. Then well pressure was then bled down and the subsurface safety valve closed to form an additional barrier. With the pressure relieved, the space above the Christmas tree could fit a perforating gun string incorporating the WXAR automatic gun release. The total length of guns and tractor to be run on wireline was more than 150 ft.

After the guns were positioned at shooting depth using TuffTRAC tractor conveyance, the well was pressurized with nitrogen gas to achieve the desired underbalance. Once the guns had detonated and were released with the WXAR release, the TuffTRAC tractor pushed the guns below the newly perforated interval and then pulled the significantly shorted string out of the hole for conventional rig-down with open perforations and wellhead pressure. The XR-Perf system made it possible for the operator to intervene in a highly challenging borehole environment, isolate old perforations, and shoot a new interval in a single tractor-conveyed wireline run—all at the desired underbalance.

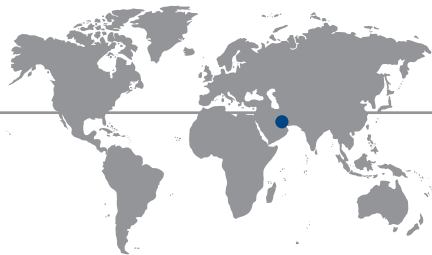


The WXAR automatic gun release automatically drops perforating guns at the instant of detonation. This enables extending the length of the gun strings that can be conveyed into the well to much longer than what the available wellhead pressure lubricator can accommodate. By using the WXAR, long intervals can be perforated at underbalanced pressure without killing the well.



Despite the high deviation and a tortuous well path, the maximum cable tension was never exceeded. The TuffTRAC tractor easily conveyed the long gun string to the required perforation depth.

Case Studies



TuffTRAC tractor-conveyed XR-Perf perforating system saves 13 hours of rig time in Qatar

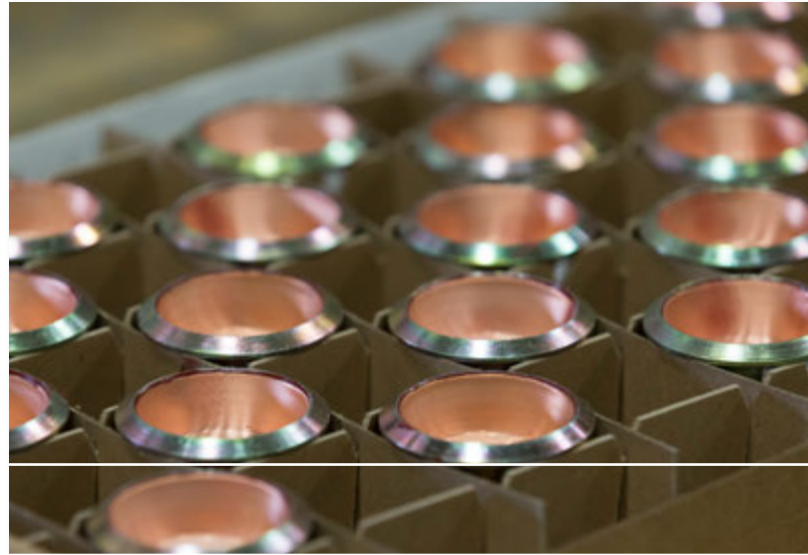
A horizontal wellbore in Qatar had a 387-ft interval to be perforated. The PURE Planner application was used to design an XR-Perf perforating system operation conveying the 4½-in HSD perforating gun system on wireline with the TuffTRAC tractor. Six runs were completed, including a descent with a 65-ft gun string. The perforating operation was completed without compromising any safety or service quality standards to save the operator USD 23,000 and 13 hours of rig time in comparison with a conventional pipe-conveyed operation.

This efficient and effective perforating operation has established the XR-Perf perforating system with tracted long guns as the operator's standard approach for land operations in Qatar.



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