

# Presalt Perforating Using XR-Perf System with TuffLINE Cable Saves 30 Hours of Rig Time, Brazil

Forty-meter interval perforated in three runs with improved shock mitigation in a high-shock deepwater environment

## CHALLENGE

Improve the operational efficiency of perforating in the deepwater presalt environment for large pay zones with elevated formation and hydrostatic pressures while reducing operational risk.

## SOLUTION

Push through conventional limits by perforating using the XR-Perf\* expanded-range wireline perforating system pairing 7-in HSD\* high shot density perforating gun systems with PowerJet Omega\* deep penetrating perforating shaped charges for conveyance on TuffLINE\* 18000 torque-balanced composite wireline cable.

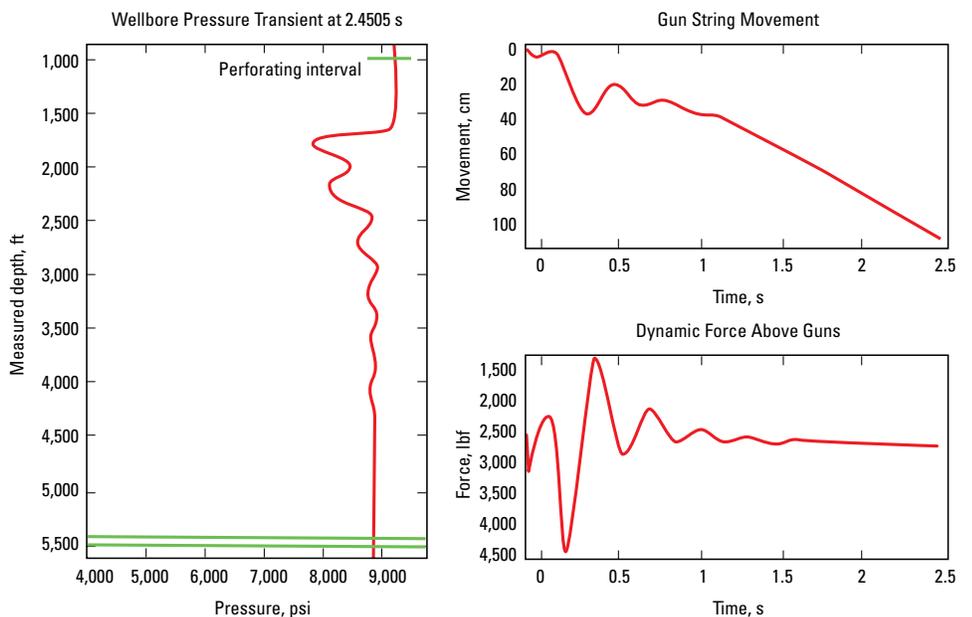
## RESULTS

Saved 30 h of deepwater drillship rig time — worth USD 1 million — by perforating 40 m in three runs at 18 h of total operating time and with better management of shock transmission to avoid unintentional pull-off.



## Perforating challenges and risks in high-shock presalt environment

Deepwater fields have become common but still pose many challenges in terms of risk, cost, and productivity. An operator sought to improve perforating efficiency in its deepwater presalt wells, which in turn would positively address these challenges. For long intervals, the perforating guns were typically conveyed on pipe. Even in wells with known and established reservoir pressure characteristics and low gas/oil ratios (GORs), pipe-conveyed perforating took several days at expensive deepwater rig rates. However, perforating on wireline also posed challenges because multiple runs were required for long intervals, taking into account the maximum payload that can be conveyed while withstanding the perforating shock. The combination of elevated formation and hydrostatic pressures can generate high shock loads on the wireline cable's weakpoint.



Simulation of a typical perforating job in the Brazil presalt demonstrates the high-shock response.

## High-tension risk mitigation to improve safety, efficiency, reliability, and sticking avoidance

Withstanding the intense peak shock loads generated downhole called for the combination of a strong weakpoint, high-tension logging unit, and ultrahigh-strength cable. The XR-Perf expanded-range wireline perforating system provides these robust capabilities by integrating the latest industry-leading cables, units, and perforating accessories to streamline perforating logistics while avoiding conventional reliance on pipe conveyance.

## CASE STUDY: Deepwater presalt perforating using the XR-Perf system and TuffLINE cable saves 30 hours of rig time, Brazil

To address the expected high pull and shock, TuffLINE 18000 torque-balanced composite wireline cable was specified. Encapsulation of the cable armor in polymer prevents rotation, effectively permanently fixing the ends of the cable to raise the ends-free breaking strength to 27,000 lbf. A high-tension offshore logging unit using TuffLINE 18000 cable can provide instantaneous pull of up to 18,000 lbf for stick prevention and mitigation without a capstan. Multiple high-tension operations can be conducted, including cycling and jarring, without compromising the integrity of the cable or having to interrupt operations to balance the torque of the cable's inner and outer armors.

Coupling the high-tension unit and TuffLINE cable with the strongest possible weakpoint specifically designed for the operation enables the conveyance of heavy gun strings while still providing the option to release in the event of a stuck gun situation.

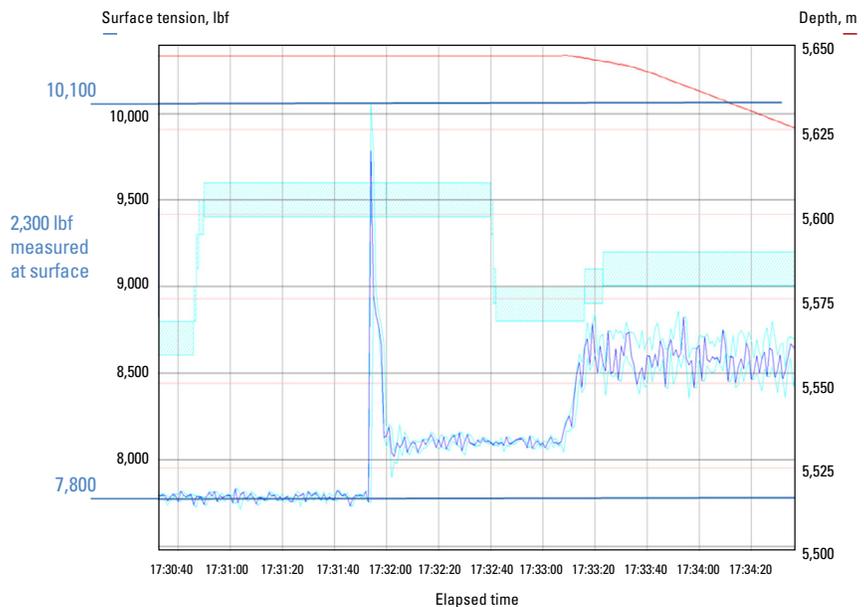
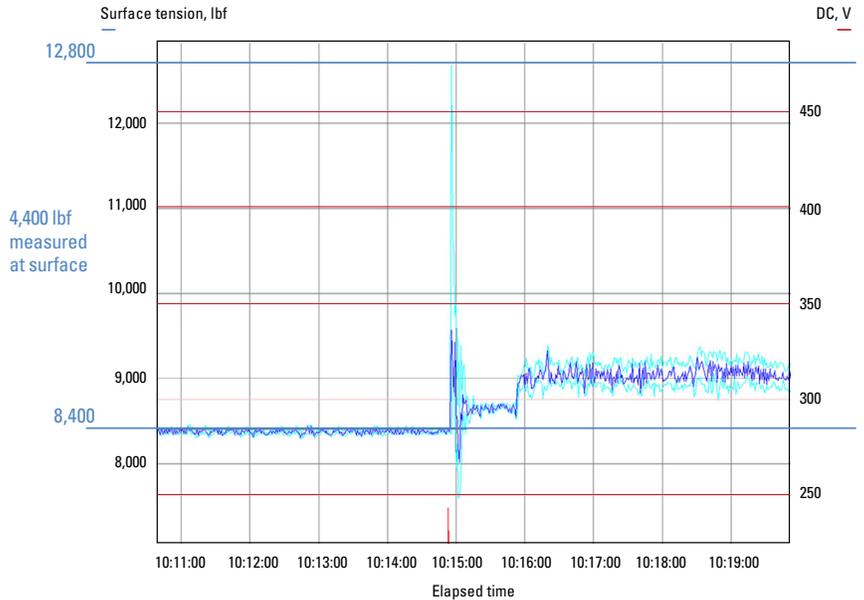
### Thirty hours of deepwater rig time saved with TuffLINE cable conveyance

The interval to be perforated was from 5,625 to 5,665 m in a 9.9-lbm/galUS borehole fluid and 9,500-psi hydrostatic pressure environment.

Schlumberger engineers used proprietary modeling to accurately calculate the maximum payload and number of guns to be conveyed per trip by the XR-Perf system for perforating the 40-m interval without compromising safety or service quality.

The field crew completed the entire operation including rig-up and rig-down and three perforating runs in a total operating time of only 18 h. This saved the operator approximately 30 h of rig time, which is worth USD 1 million in this deepwater environment.

In addition to greater efficiency, this first perforating job with the XR-Perf system and TuffLINE 18000 cable for the operator also reduced risk. TuffLINE cable's high stretch coefficient significantly lessened the amount of shock transferred to the weakpoint in comparison with conventional 7-48 high-strength cable, improving shock mitigation and reducing the likelihood of an unintentional pull-off as a result of gun shock.



Perforating conducted on conventional high-strength cable (top) experienced 4,400 lbf of shock at a cable-mounted tension device at surface whereas TuffLINE cable deployed on the XR-Perf system (bottom) reduced the peak shock load to 2,300 lbf.

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