




Schlumberger

Platform Express



It's about time

Applications

- Reservoir delineation
- Hydrocarbon saturation determination and imaging
- Movable hydrocarbon determination
- Location of porous and permeable zones
- Gas detection
- Porosity analysis
- Lithology determination
- Well-to-well correlation
- Thin-bed analysis

Benefits

- Less rathole needed for the shorter length, lowering drilling time and cost
- More reliable performance for reduced downtime, which saves rig time
- Real-time, depth-matched logs for improved interpretation and accurate reserves interpretation
- Better-quality logs, more data and higher resolution, revealing hard-to-find pay zones
- Fifty percent reduction in time spent on location, significantly lowering operating costs
- Short-radius wells readily logged

Features

- Overall length greatly reduced through the use of integrated sensors and reengineering
- Extremely robust electronic packaging and mechanical design
- All components built to rigorous LWD shock standards
- Real-time speed correction
- Thirty percent shorter skid with improved pad application
- Integrated R_{xo} measurement
- Density, R_{xo} and R_t measurements, and deep and shallow azimuthal images
- Real-time depth matching and borehole correction

Revolutionary wireline logging technology

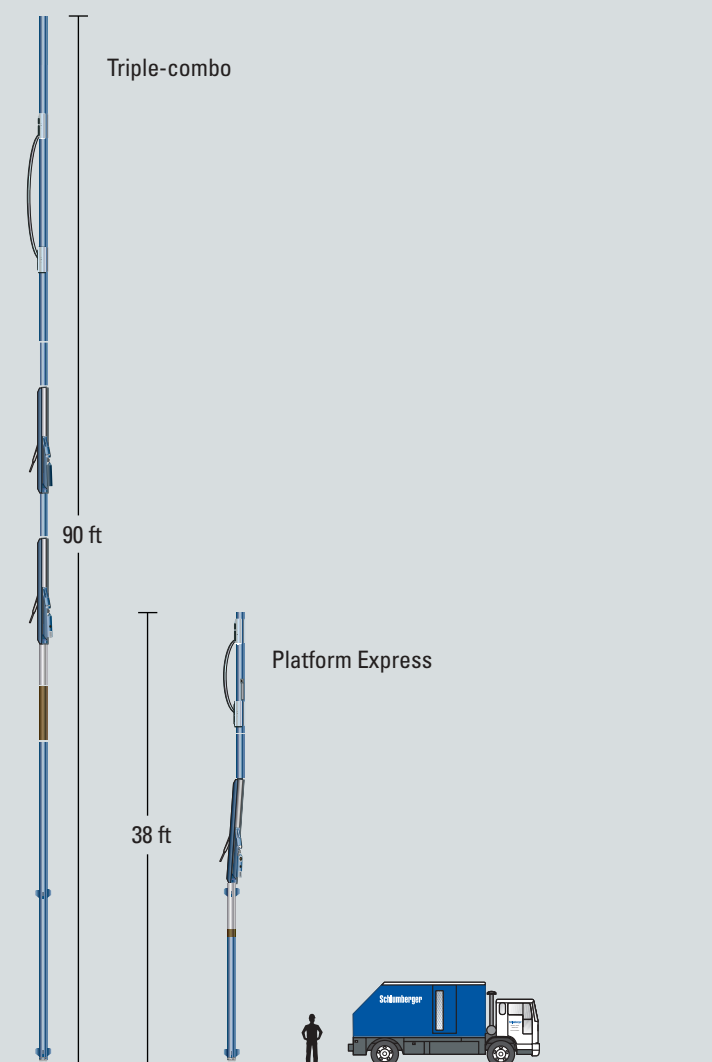
Platform Express* technology is a revolutionary reengineering of wireline logging. Compared with the triple-combo, Platform Express logging is about twice as fast, gives you better answers and it is more cost effective to run because it requires significantly less rig time. Higher logging speeds, reduced set-up and calibration time, and faster turnaround on wellsite processing all contribute to increased efficiency.

The Platform Express system is less than half as long as a triple-combo and weighs about half as much, yet it gives you better, quicker and more accurate answers—in real time. The use of integrated sensors, flex joints that improve pad contact and other innovative

technologies upgrade and expand traditional resistivity and porosity measurements to include high-resolution microresistivity and imaging measurements, plus tool movement measurements for speed correction and depth matching.

In field tests conducted over a wide range of environmental conditions in Argentina, Canada, Indonesia, Saudi Arabia and the United States, rugged Platform Express equipment achieved the most trouble-free wireline performance ever. The major reason for this outstanding reliability is that all Platform Express components must pass the same rigorous shock and cyclical temperature tests used for logging-while-drilling (LWD) tools. The resulting reliability is 3 times greater than that of conventional triple-combo tools.

The Platform Express system is less than half as long as a triple-combo, and the logging speed is twice as fast. Set-up time is greatly reduced, and operating efficiency is improved.



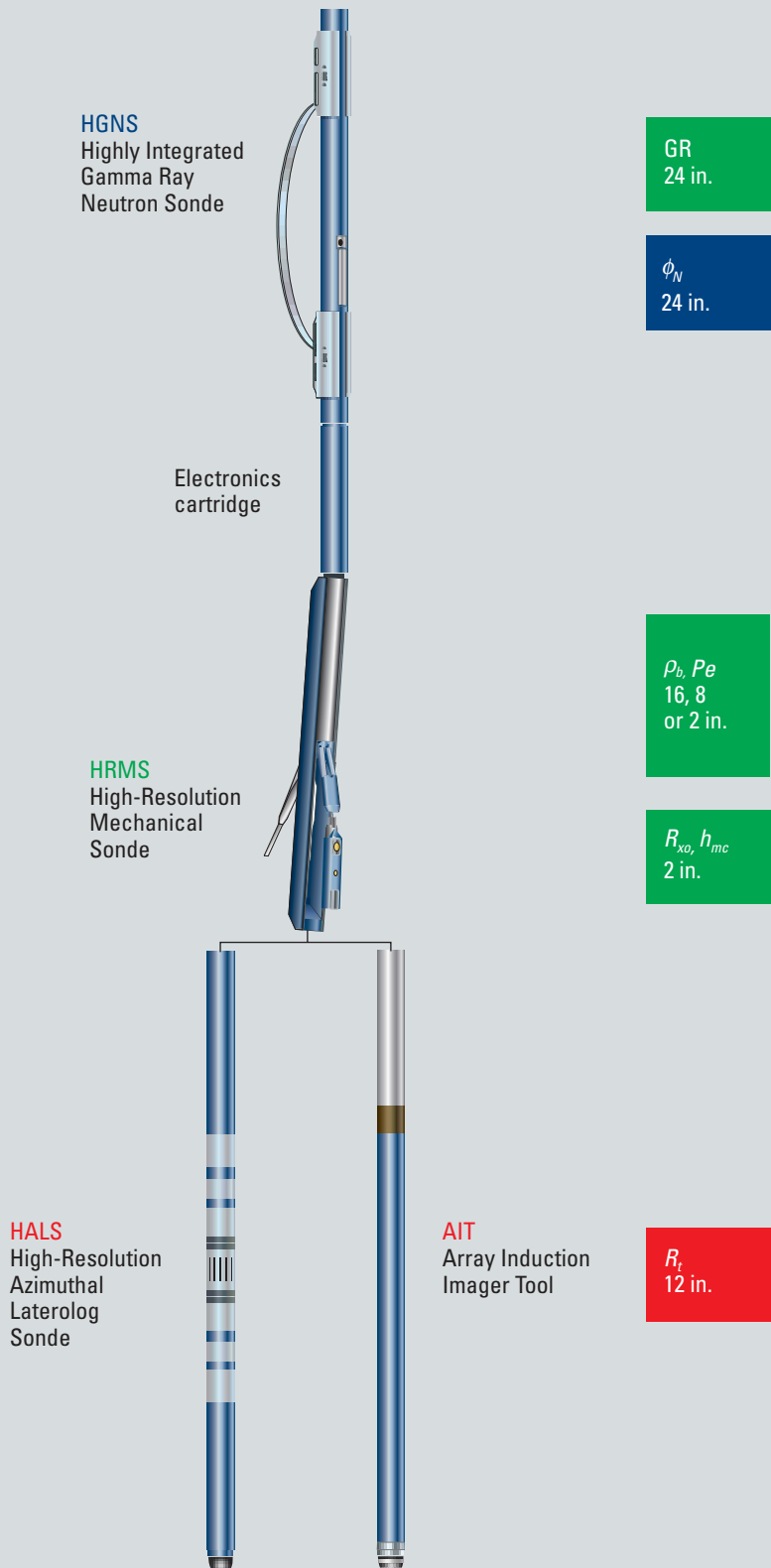
Platform Express measurements

Platform Express sensors set new standards in formation evaluation accuracy. Resistivity measurements are made with either the AIT* Array Induction Imager Tool or the High-Resolution Azimuthal Laterolog Sonde (HALS), both with a 12-in. maximum vertical resolution.

Sensors for the Three-Detector Lithology Density (TLD) and Micro-Cylindrically Focused Log (MCFL) measurements are integrated in the single pad of the High-Resolution Mechanical Sonde (HRMS), which presses against the formation. The TLD log is a backscatter-type density measurement with 16-, 8- or 2-in. vertical resolution. The MCFL microresistivity measurement, which investigates the same volume of the formation as the density measurement, has 2-in. vertical resolution. Flex joints greatly improve pad application in rough holes. The Highly Integrated Gamma Ray Neutron Sonde (HGNS) provides gamma ray and neutron porosity measurements with a standard vertical resolution of 24 in. Alpha processing is available to achieve 12-in. vertical resolution of the neutron log.

Real-time speed correction and automatic depth matching of all measurements are provided by an accelerometer for much faster turnaround on wellsite processing.

Two Platform Express logging configurations are available for resistivity measurement. The vertical resolution for each measurement is shown in the blocks on the right. These, in combination with the new sensor design, provide better, more accurate measurements, leading to improved interpretation and reserves calculations.

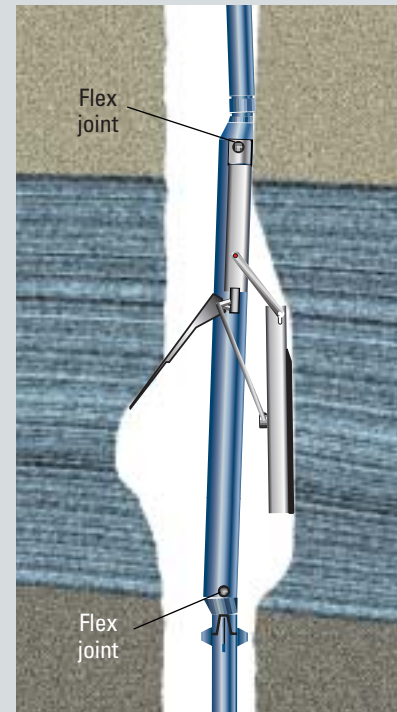
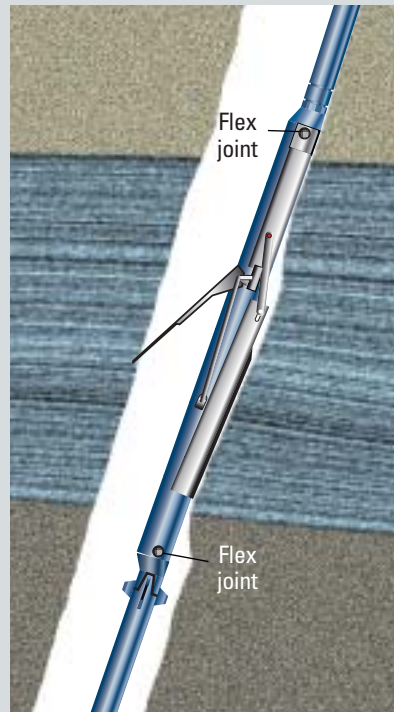


Articulated tool design for enhanced pad-to-borehole wall contact and tool descent

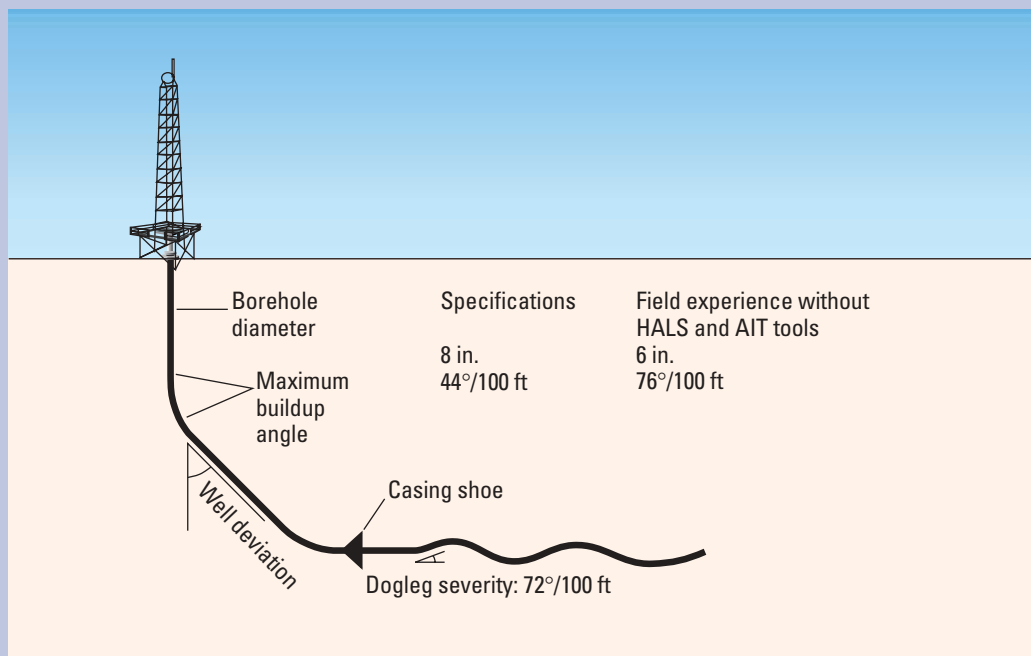
Flex joints enable the Platform Express sonde to hinge or rotate slightly as the tool body travels into and out of rough hole sections. A second pair of arms applies force directly to the back of the skid, below its center, to keep the skid face pressed against the wall when the caliper arm hits a ledge. Together with the shorter pad, the additional backup arm and flex joints deliver significantly improved measurements in rough and deviated holes.

The short length and articulated design of the sonde enable it to successfully traverse wells with a short radius of curvature and wells containing severe doglegs.

The HRMS skid is innovatively linked with flex joints for improved pad application.



The short length and articulated design make descent in short-radius and crooked wells easy.



Efficiency comparison

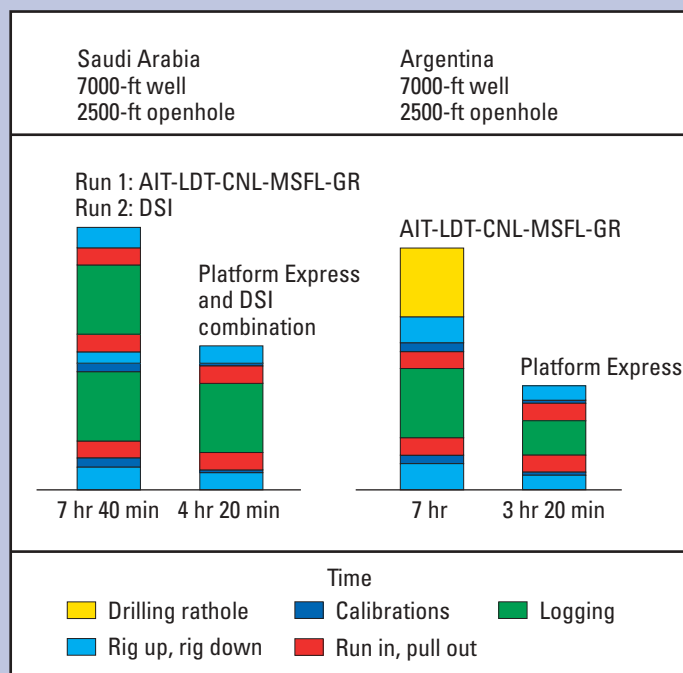
Two 7000-ft wells, each with a 2500-ft openhole section, show the large reduction in rig time made possible by the higher logging speeds and streamlined operations of the Platform Express system. In the Saudi Arabia well on the left, Platform Express equipment was run in combination with the DSI* Dipole Shear Sonic Imager tool to save more than 3 hr of rig time compared with two runs of the triple-combo, MicroSFL* and DSI tools. Two hours of drilling were saved in the Argentina well at right because less rathole had to be drilled to accommodate the shorter length of the Platform Express tool string.

Reliability

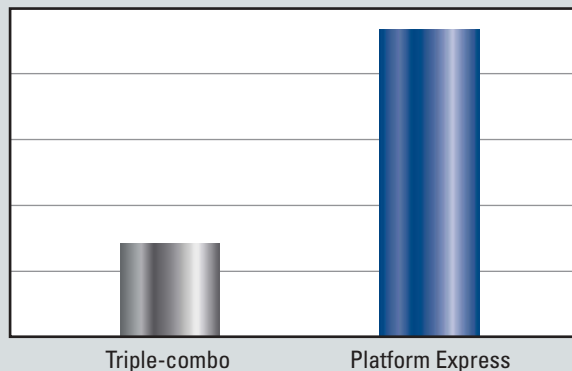
Extensive field testing was conducted around the world in a wide variety of geologic settings and well conditions. Reliability was more than 3 times higher than that of conventional triple-combo tools.

Unequaled reliability results from the system's unique design and new, tough temperature and shock qualification standards. Platform Express standards include a 40-day heat test and more than two thousand 250-g shocks, making it the first wireline tool in the industry that meets LWD tool standards.

Platform Express system saves a substantial amount of rig time over the triple-combo.



Platform Express reliability is threefold that of the triple-combo.



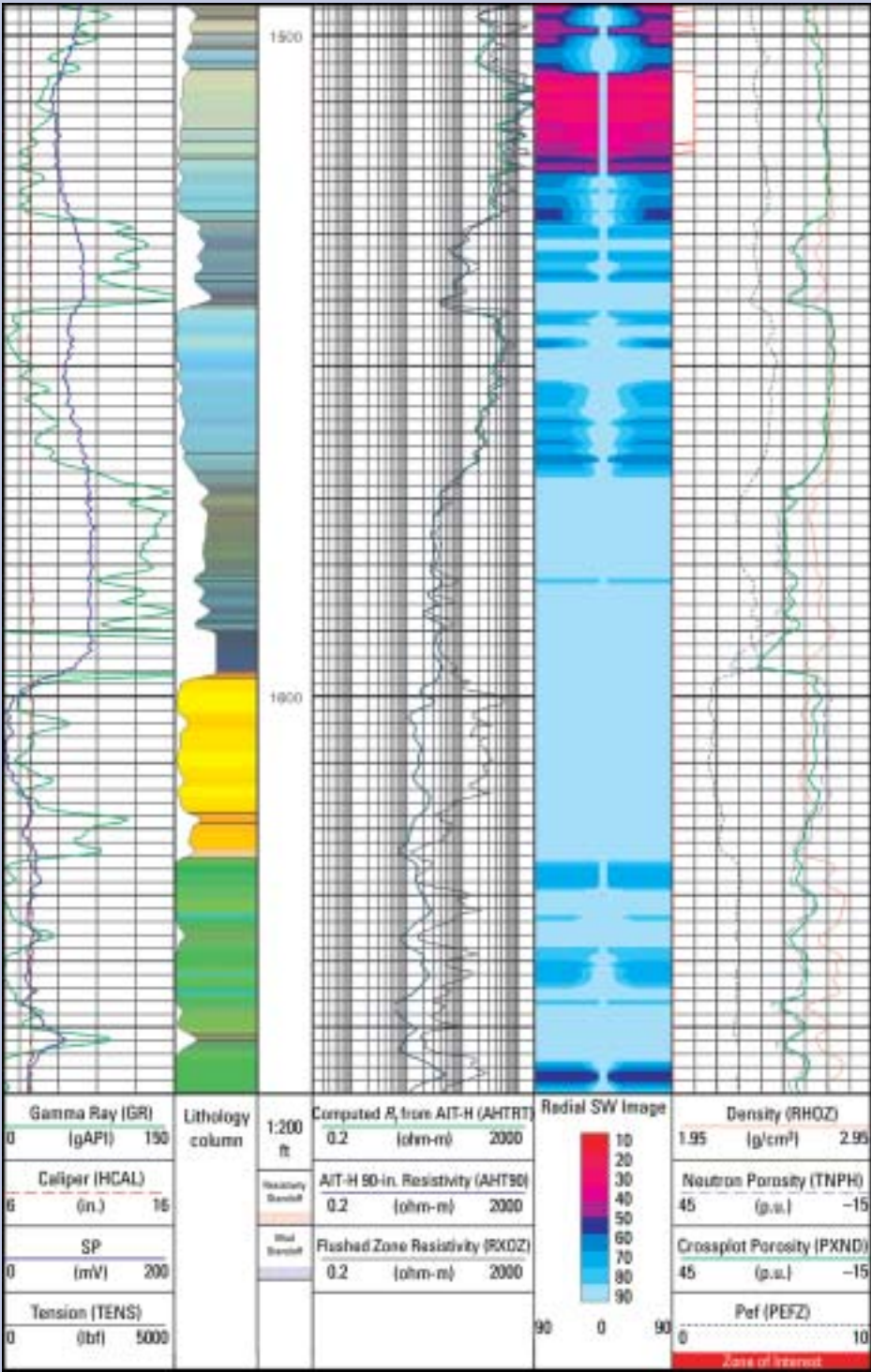
Platform Express quicklook

The Platform Express quicklook interpretation, available in real time during logging, displays resistivity, porosity and correlation curves with a lithology column and water saturation image. True resistivity, invaded zone resistivity and crossplot porosity are computed

for display with the other curves. A zone-of-interest flag appears on the left side of track 6 whenever the effective porosity is greater than 3% and water saturation is less than 40%. Real-time depth matching and speed correction of the data make this presentation much more accurate than

quicklook interpretations produced at the wellsite from triple-combo data. The Platform Express quicklook presentation is also available as a postjob playback. This log was recorded with the AIT resistivity configuration in the Amoco test well in Catoosa, Oklahoma.

Platform Express quicklook incorporates environmental correction in real time.



A very powerful answer results when Platform Express equipment is oriented in the hole with an inclinometer tool that provides tool face orientation and the hole deviation and azimuth. The high-resolution azimuthal laterolog

data are used to compute the dips presented in track 5 and the polar plots in track 6. Because the tool orientation is known, the pad direction curve appearing in the image in track 3 shows the tool turning as it is pulled uphole. This log was recorded in Texas.

The well log for PAD1AZ displays the following data series from top to bottom:

- Depth Scale:** 700, 750, 800, 850, 900 meters.
- Resistivity Curves:**
 - Deep Resistivity (HRLO):** 0.2 (ohm-m) 2000 scale.
 - Shallow Resistivity (HRLS):** 0.2 (ohm-m) 2000 scale.
 - Microresistivity (RXOB):** 0.2 (ohm-m) 2000 scale.
- Lithology:** A color-coded column representing different rock types, with colors ranging from blue/green to yellow/red.
- Density (RHOD):** 1.85 (g/cm³) 2.95 scale.
- Neutron (TNPH):** 45 (p.u.) -1 scale.
- Crossplot Porosity:** 45 (p.u.) -1 scale.
- Other Data:** Includes a 'Pad' track, a 'Gamma Ray' track, and a 'Caliper' track.

A compass rose indicates North (N) is towards the top-right of the log.

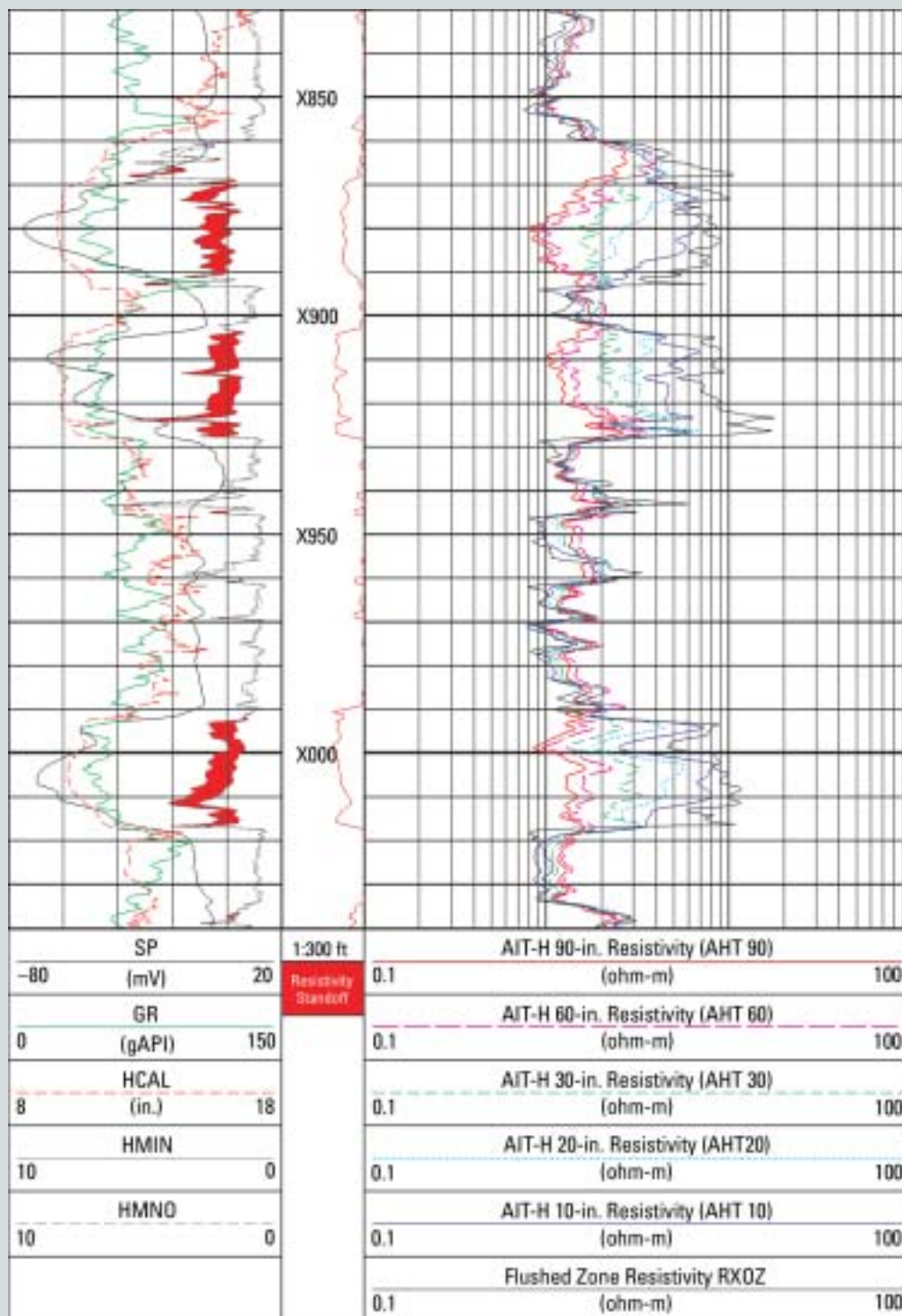
Permeable zones

This Texas example shows the 2-ft vertical resolution curves with five depths of investigation across several permeable zones. The Platform Express mud resistivity measurement is used for

real-time environmental corrections. The MCFL log is plotted to confirm the AIT readings, and the resistivity standoff—another exclusive measurement of the Platform Express system—is computed from the MCFL.

HMIN and HMNO are the two micro-log curves computed from the MCFL data. The red shading indicates thick mudcake over these highly permeable zones.

Platform Express system accurately and quickly measures resistivity and shows permeable zones.

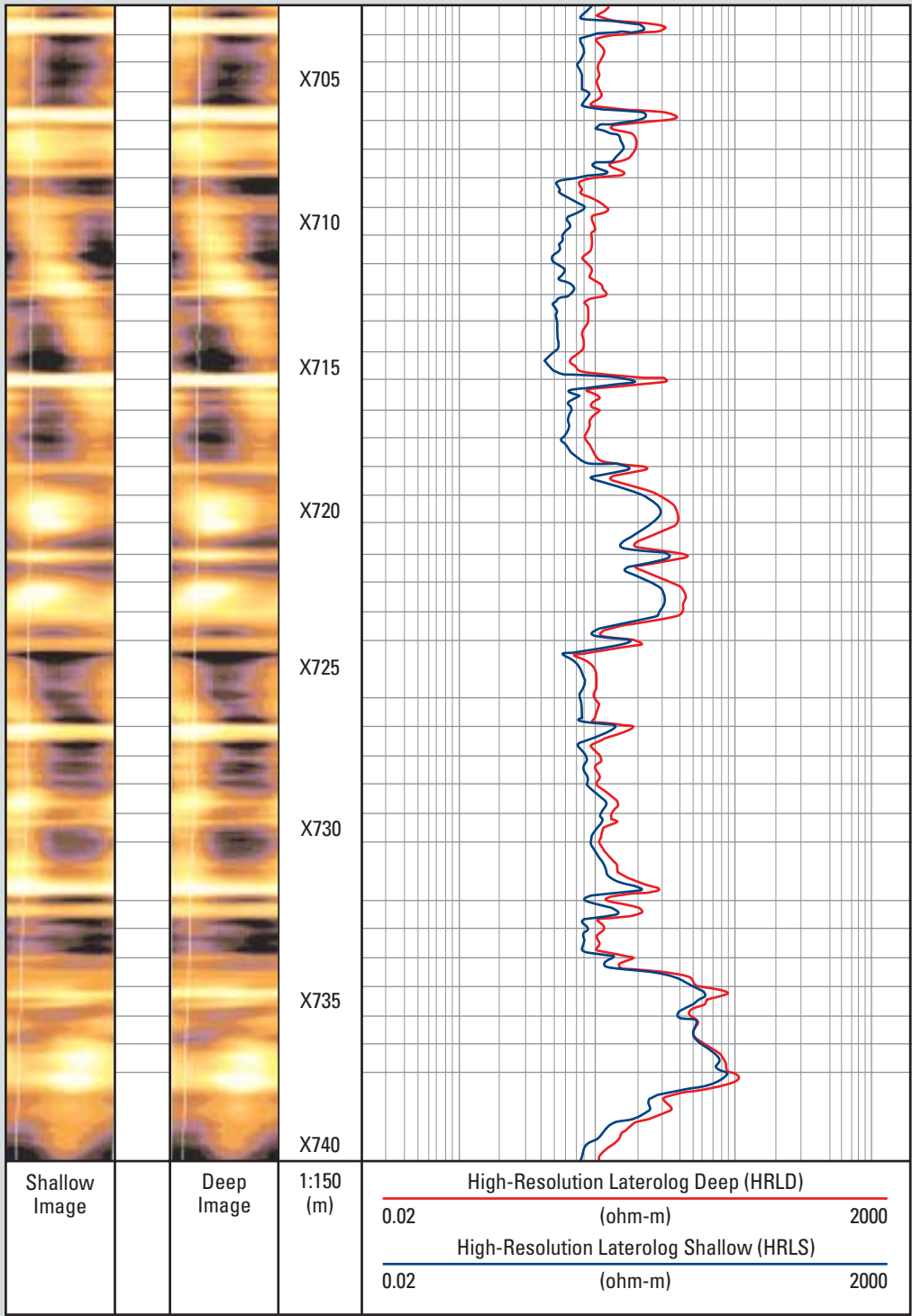


HALS resistivity

The ability to plot both shallow and deep high-resolution azimuthal images is another unique Platform Express feature. In this log, recorded in a test

well in France in combination with an inclinometer tool, the pad orientation curves appear in the image tracks. Dip estimates can be made where the tool face orientation and hole deviation and azimuth are known.

HALS images bring greater precision to bedding analysis.



MCFL with FMI image

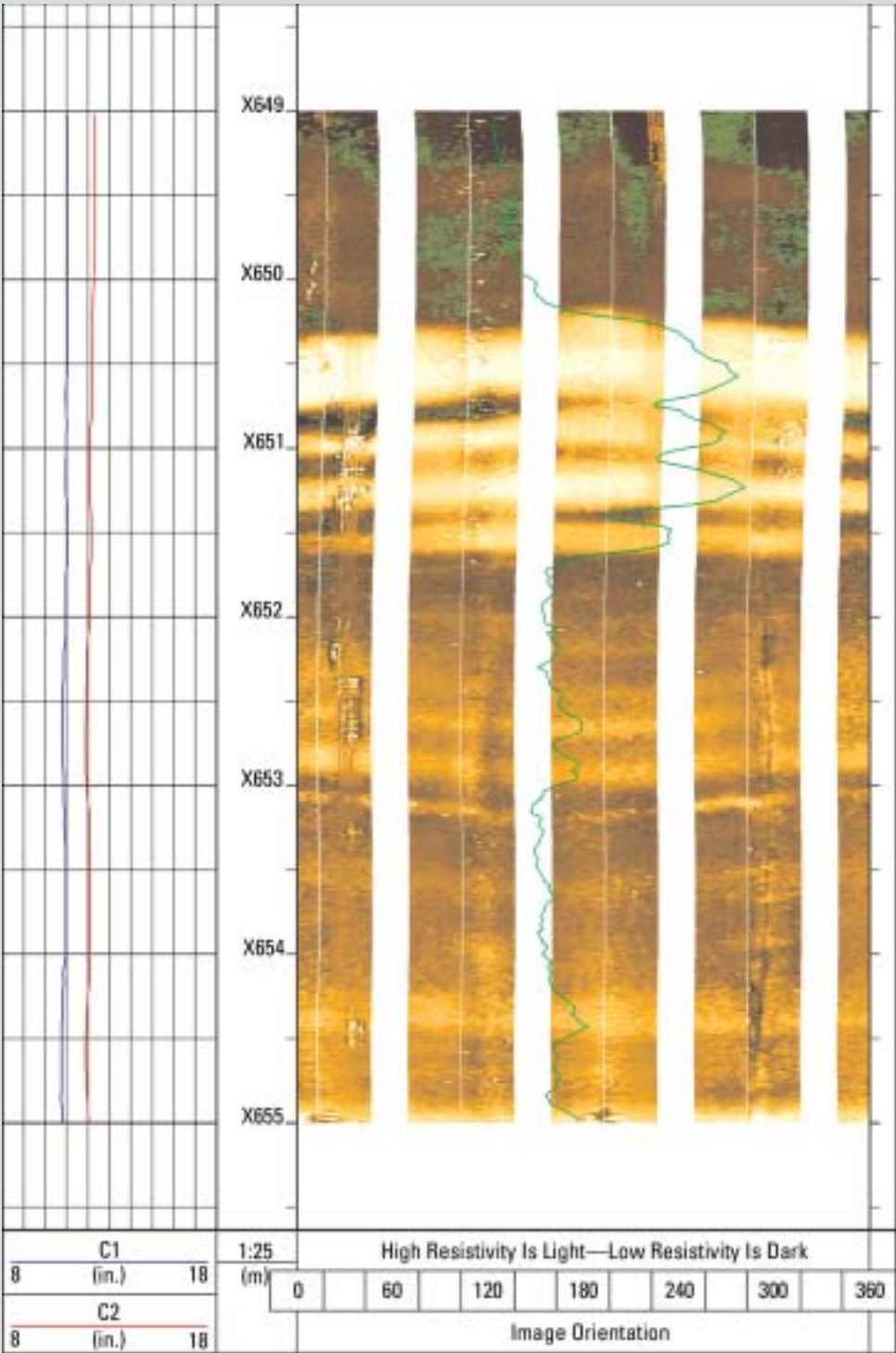
Overlay of the MCFL curve with the borehole image derived from the FMI* Fullbore Formation MicroImager confirms the high vertical resolution of Platform Express data. Conductivity variation in the zone between X652

and X655 m in this Argentina well is visible on both the MCFL data and the FMI image.

Core photograph comparison

The high-resolution data obtained by the Platform Express tool can be used to identify impermeable laminations in the formation that can act as flow barriers to production. In this well, there was concern about the continuity

MCFL measurements correlate well with FMI images for the identification and characterization of thin beds.



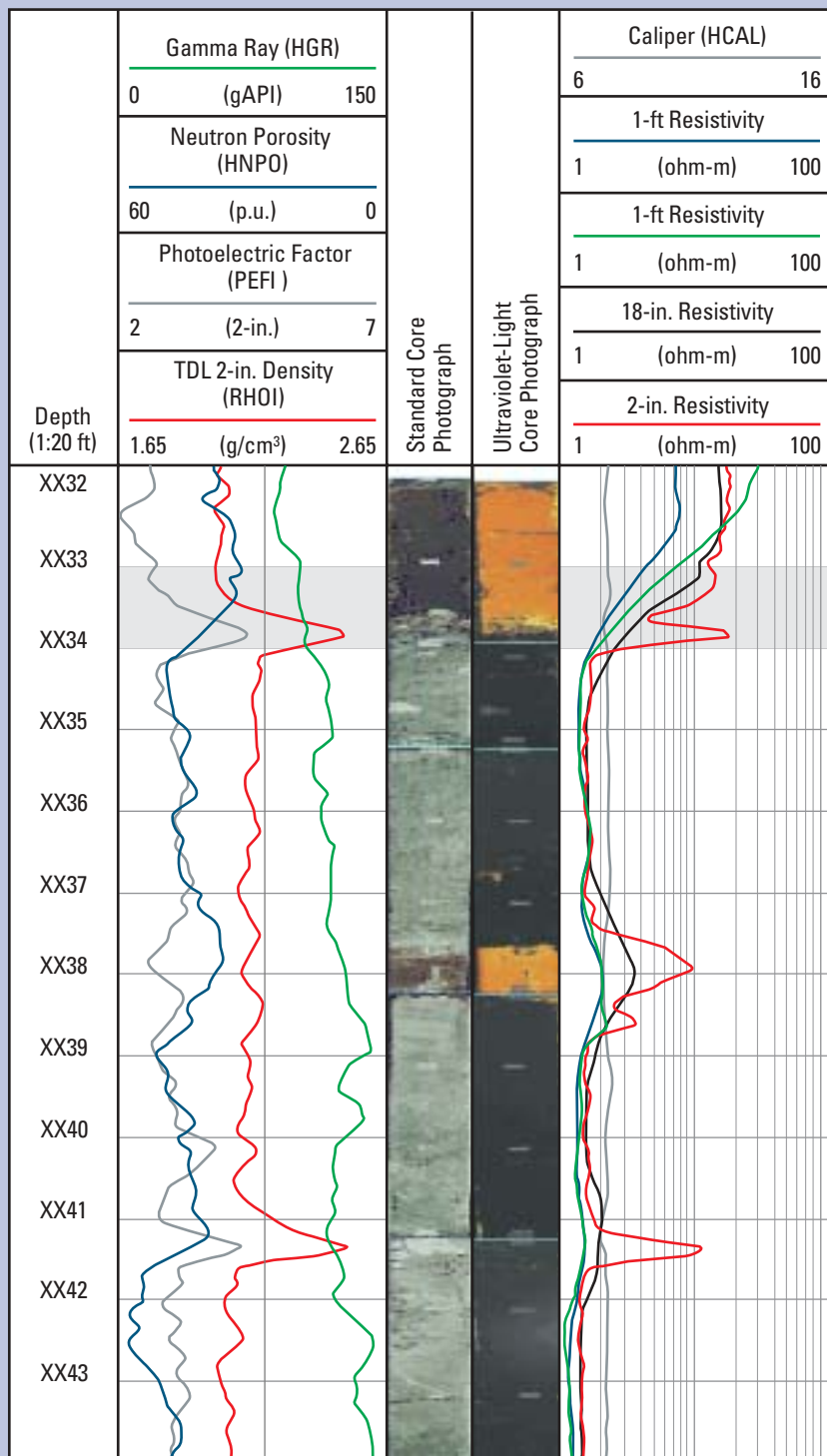
of limestone streaks in the formation, which would help contain water below the reservoir section and enhance the steamflood of the reservoir. The core data are not definitive: only limestone cobbles were recovered, and they could represent either the nature of the deposition (nonbarrier cobble layer)

or the nature of the coring operation (the coring process created rounded fragments of a thin layer). However, the consistent response of the TLD and MCFL to these thin layers revealed the continuity of the laminations, and the operator was able to complete the zone closer to the known water contact

of the reservoir with no additional water cut.

The high-resolution (2-in.) density and photoelectric factor measurements clearly resolve the carbonate layers and, with the addition of the 2-in. resolution R_{xo} from the MCFL, also identify thin oil-bearing layers.

Detailed comparison to core photographs confirms the resolution of the Platform Express system.



Customized answers

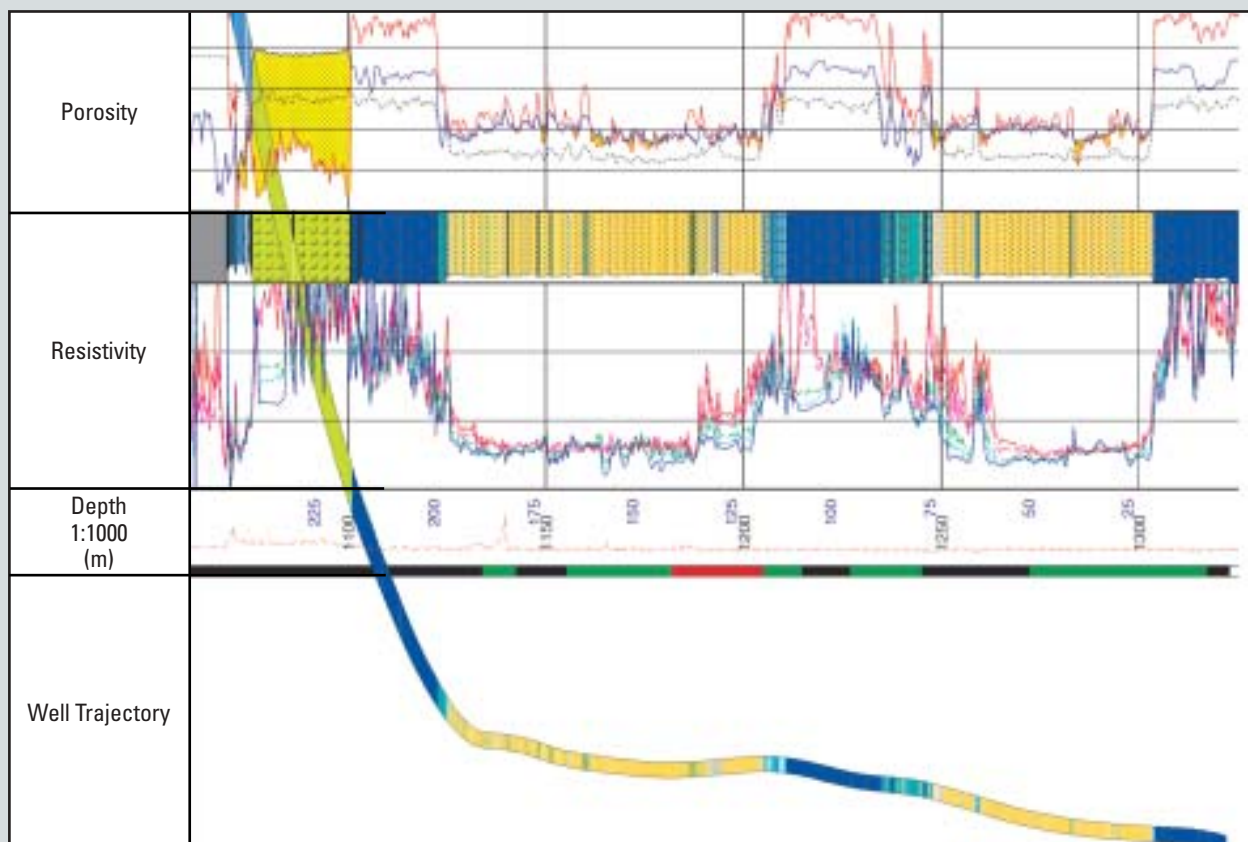
The integrated z-axis accelerometer in the Platform Express system enables speed correction of all data and determination of the wellbore deviation, which is used to compute true vertical depth (TVD) logs and plot the wellbore position of highly deviated and horizontal wells. This customized plot combines the measured-depth data with a horizontal depth coordinate system originating at the bottom of the well. The color-coded bar next to the depth track indicates the direction of the well relative to horizontal (90° deviation)—green to black where

descending and red to orange where climbing in angle. Displaying the computed lithology color plot on the well trajectory is ideal for showing not only the position of a horizontal well but also its attitude in reference to intersected lithologic features.

In this example, the well penetrated salt and anhydrite layers out of casing and entered the sand reservoir. After 75 m in the sand, the well entered an anhydrite layer and then went back into a sand. Were there two anhydrite layers or one displaced by a fault? Or did the well turn up and reenter the anhydrite layer above the reservoir?

The well trajectory plot clearly shows the well turning up before it enters the anhydrite layer. A line drawn along the sand/anhydrite contact indicates that the boundary has a uniform structural dip along the section, which effectively eliminates the possibility of a second anhydrite bed and the fault theory. The well simply reentered the caprock anhydrite and then went back into the sand reservoir. Without the Platform Express well deviation data, this analysis would have been delayed until other well deviation data could be correlated to the log data to explain the lithology changes.

The real-time display of Platform Express data is easily customized.



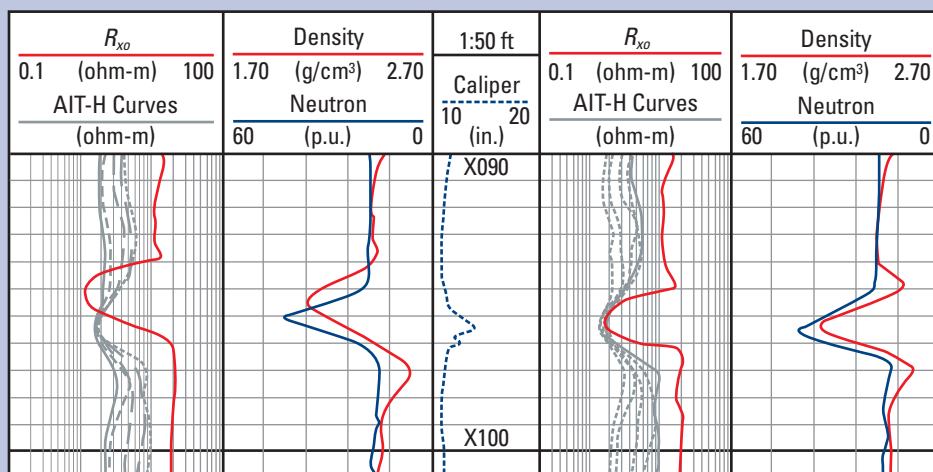
Speed correction

The importance of real-time speed correction from the accelerometer data is shown in this Texas example. Despite the rough hole conditions and irregular tool movements, the curves after speed correction (on the right) are consistent. The MCFL, AIT and porosity curves track, resulting in more accurate water saturation calculations—especially in thin permeable beds. Improved depth matching at about X095 shows clearly on the enlarged depth scale. The off-depth data to the left are without speed correction.

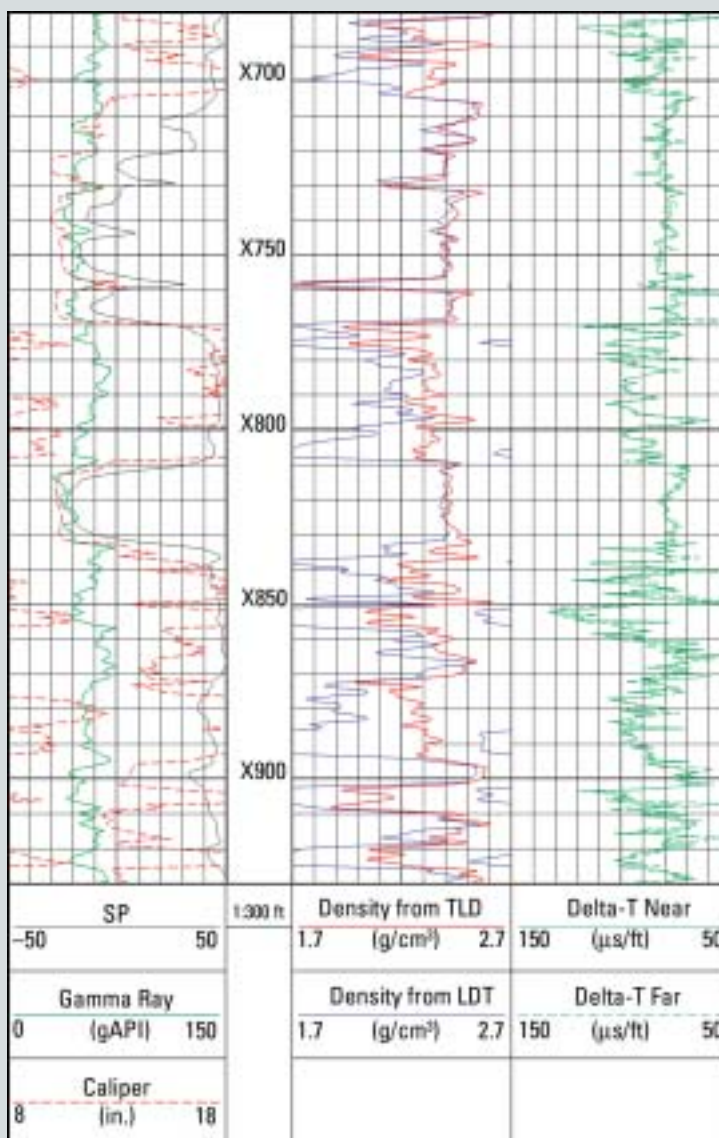
Density in bad hole

This Texas well was drilled with barite—a heavy mud that presents problems for Litho-Density* tools. Comparison of the Platform Express density values with Litho-Density data in the washouts clearly demonstrates how Platform Express technology greatly improves log quality in rough holes. The TLD results are in excellent agreement with the DSI data (shown in green on the right), which are relatively unaffected by washouts. The better quality density measurements also facilitate petrophysical and seismic analyses.

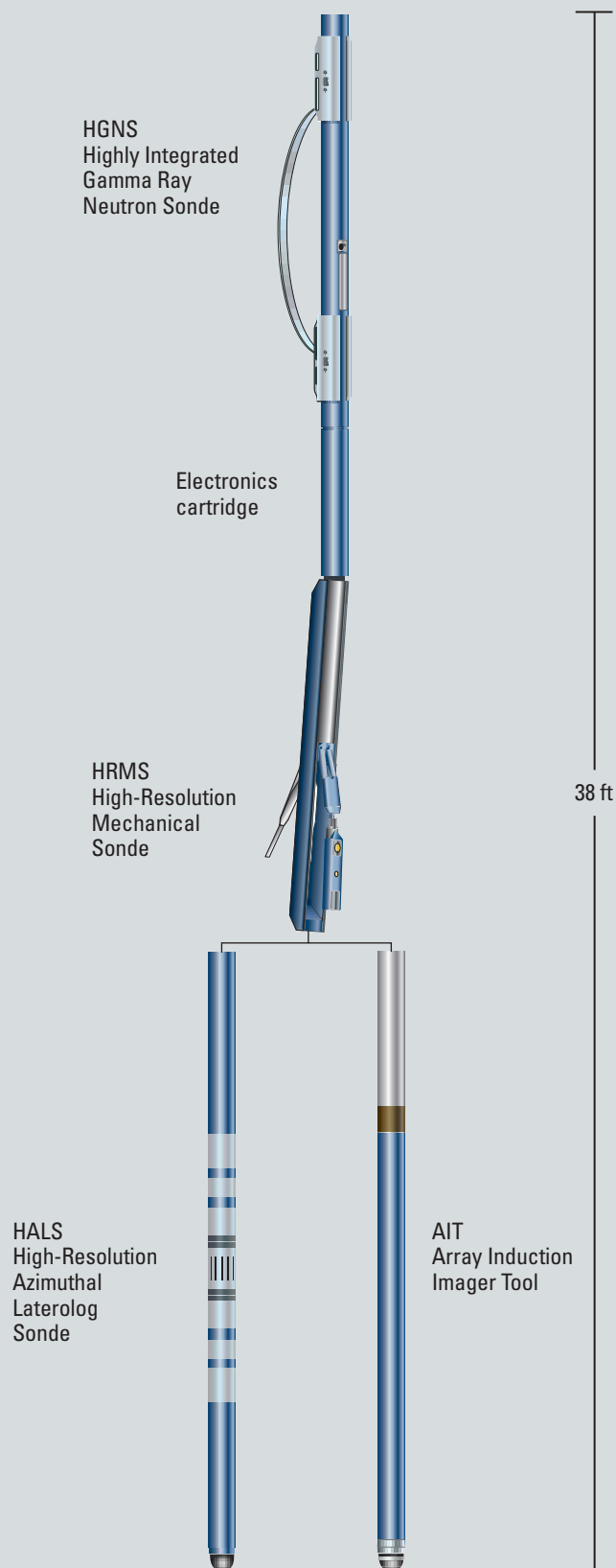
Oriented HALS images provide valuable measurements in wells where no dipmeter data have been recorded.



Substantially improved density measurement in bad hole conditions is possible with the Platform Express TLD tool.



Platform Express revolutionary reengineering of wireline logging is only 38 ft long and weighs 600 lbm.



Specifications

Length	38 ft
Weight	690 lbm
Max OD	3 $\frac{3}{8}$ in
Min OD	4 $\frac{5}{8}$ in
Temperature rating	260°F
Pressure rating	10,000 psi
Hole size	6 to 16 in.
Max logging speed	3600 ft/hr

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SMP-5177

September 2001

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