

A REGULAR TECHNICAL REVIEW FOR CLIENTS OF PROTECHNICS, A DIVISION OF CORE LABORATORIES

WATER, WATER EVERYWHERE

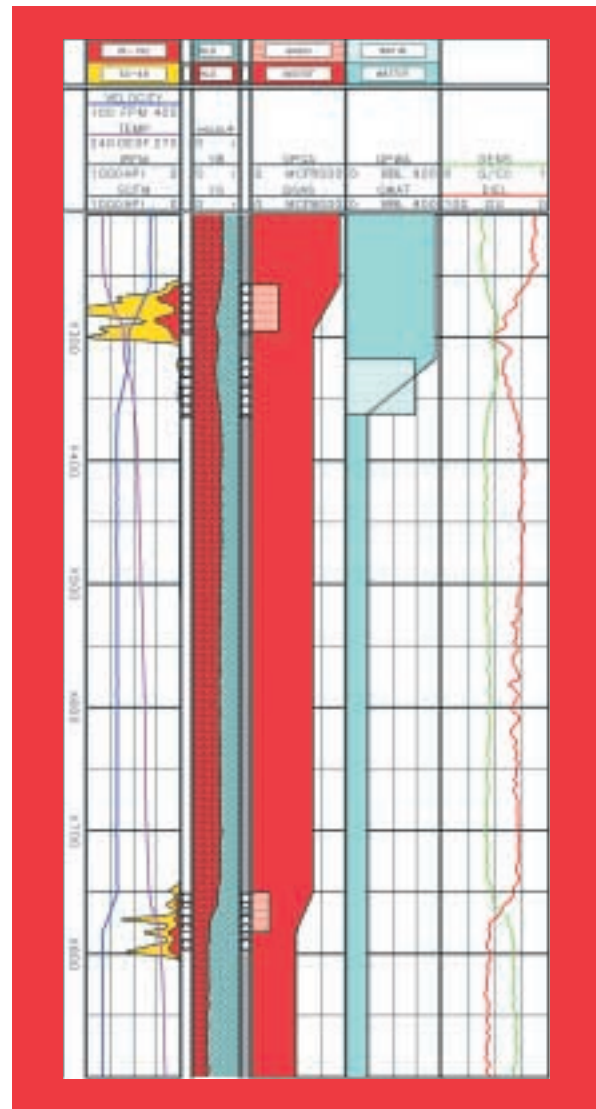
with nary a drop to drink!

The combination of tracer spectral images and production profiling data can be a powerful tool in diagnosing the placement of a stimulation treatment by determining how a well is producing as a result of that treatment.

The image on the right combines tracer and production data used to diagnose a production problem following a fracturing treatment in south Texas. The tracer data indicates good placement of proppant in the uppermost set of perforations (X250-X300) and also in the lowest set of perforations (X750-X800), but no proppant in the middle perms at X320 - X360. Until the production data was obtained, the operator had planned on a re-frac of the unpropped middle zone since it had the best pressure increase after perforating.

Analysis of the production data indicates water and gas production from a set of perforations (not shown) below X850 and gas production from both the upper and lower intervals seen on this image. Interestingly, the middle set of unstimulated perforations appears to be producing the majority of water as seen in track 2 (calculated water holdup fraction, Y_w) and on the Fluid Dielectric and Density measurements in Track 5.

Additional reservoir data suggested that the middle zone was likely a water-bearing interval and at original pressure, while the gas zones had been slightly pressure depleted. This led to a higher fracture closure pressure



in the middle zone, preventing it from being propped by the fracture treatment. A subsequent cement squeeze operation controlled the water production from this zone leading to much better well performance. The combination of tracer and producing profile data is unmatched in diagnosing well completions and prevented this operator from performing an unnecessary and expensive re-frac on this well.

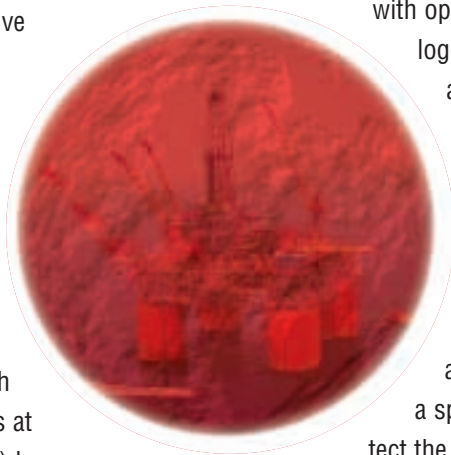
TRACERS ON MARS

Starting with the first wells at Mars in 1996, Shell began to look at tracing procedures as a method of evaluating frac-pack effectiveness. The company found that the total cost for spectral logging operations was prohibitively expensive due to rig time requirements. To speed operations and reduce costs, Shell proposed that ProTechnics build a washpipe-conveyed version of its SpectraScan™ Imager.

By August of 1996, that proposal had become a reality. Beginning with the A-2 completion, most frac packs at Mars (and other deepwater projects) have been traced and logged with the Washpipe-Conveyed SpectraScan Imager. The tool received Petroleum Engineer International's 1997 Special Meritorious Award for Engineering Innovation.

In operation, the tool is first put into a sleep mode to conserve batteries and downhole memory, and then placed inside the bottom joint of washpipe prior to running in the hole. During the data frac operation, a pressure switch in the tool senses the pressure increase and activates the tool's logging mode. After completing the frac and pack, the spectral log is obtained as the washpipe is retrieved from the well, a process that requires no additional rig time.

Information from these traced procedures has been instrumental in re-engineering completion procedures, has led to repacking of suboptimal gravel packs in order to prolong the life of the well, and is used to better understand the mechanics at work in today's stimulation/sand control procedures.



ProTechnics' triple option

ProTechnics continues to evolve our technology as new capabilities are developed and new challenges arise. Today, three options are available.

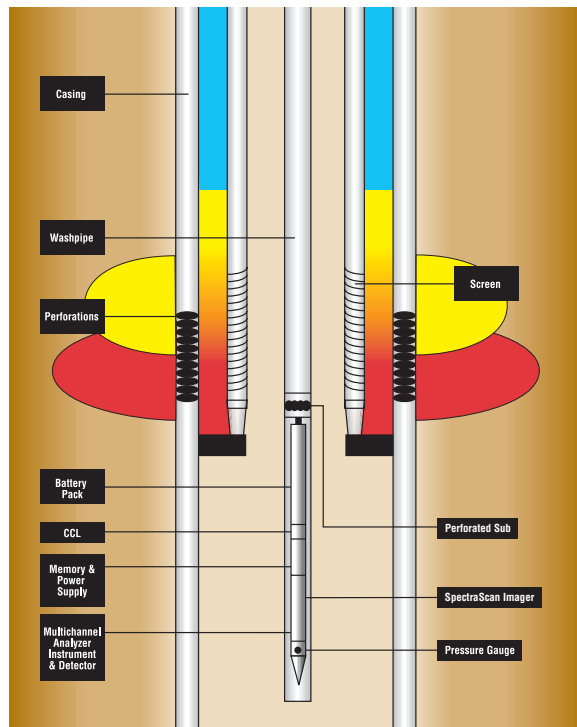
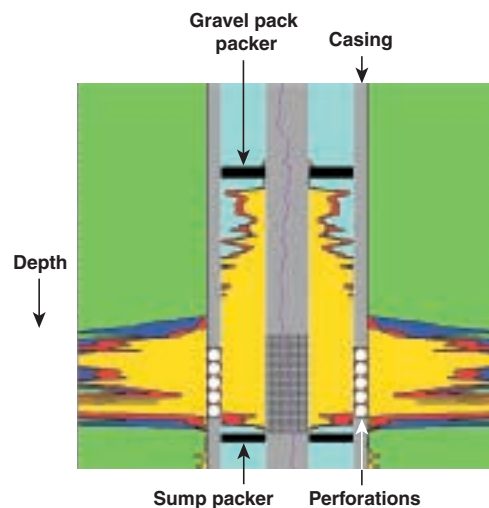
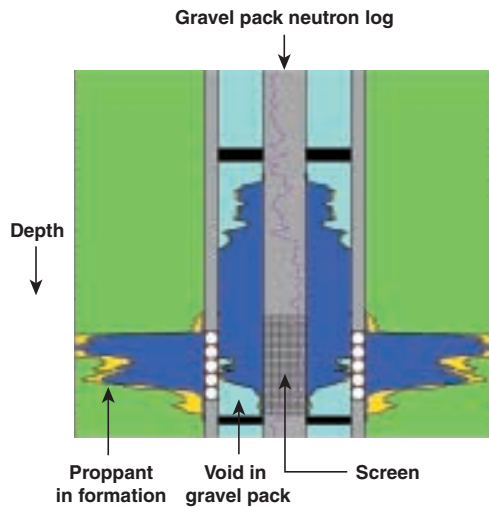
Since it was developed for the Mars project, ProTechnics' Washpipe-Conveyed SpectraScan Imager has been employed on more than 100 frac-pack completions, with operators today using the powerful tracer logging technology on nearly one-third of all frac-pack procedures performed around the world.

Shell's Macaroni project led to the development of a high-pressure version of the washpipe spectral logging tool. Due to the extreme depths and hydrostatic pressures at Macaroni, a special housing was engineered to protect the tool at pressures up to 25,000 psi for extended periods of time downhole—in some cases, more than one week.

A new tool built to Shell's specifications for quantitative gravel-pack evaluation is now being introduced. The PackScan™ Gravel Pack Tool is a gamma-gamma density tool that runs inside washpipe in conjunction with SpectraScan or as a stand-alone device. The PackScan tool measures the bulk density of the gravel-packed region and allows for a log of gravel-pack quality to be made upon retrieval of the washpipe.

ProTechnics provides a wide range of innovative solutions for completion design and diagnostics with unrivaled capabilities in tracer diagnostics, spectral imaging, EOR evaluation and production logging.

Thanks to Hart Publications for permission to reprint this article. It originally appeared in their special supplement, Shell's Mars Mission: A Deepwater Odyssey.



On the Washpipe-Conveyed SpectraScan image (top left), a void can be seen in the gravel packed annulus just above the sump packer on this Mars completion. To confirm the void pinpointed by tracers, a follow-up gravel pack neutron log was run, and the void was again identified. In order to ensure well longevity, the screen was pulled and re-run and the interval repacked. The lower image shows the successful recompletion of this zone evidenced by a good annular pack with no voids and sufficient gravel reserve above the top of screen.

ProTechnics People

Mike Flecker has joined ProTechnics as Director of Technology after more than 20 years with Western Atlas and The Wood Group.

Scott Malone is moving to Denver as Rocky Mountain Business Development Manager.

Dick Leonard has become our new Dallas/Ft. Worth Sales Representative after many years in engineering and management positions with UPR.

Buddy Woodroof, our Technical Manager, has been named to the prestigious SPE Distinguished Lecturer Committee for 2000/2001.

New ProTechnics field personnel include John Beddo (Farmington), Alex Romero (Lafayette) and Frank Garcia (Alice)—welcome aboard!

Come Visit Us

You can catch up on ProTechnics and our new technologies at these upcoming shows:

Southwest Petroleum Short Course
Lubbock, TX April 12-13

National Petroleum Show
Calgary, AB June 12-15

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