Petrobras Integrates Seismic with Surface Data to Optimize Onshore Well Positioning

Customer: Petróleo Brasileiro S/A
Location: Vitória, Brazil

**CHALLENGE** – Shorten the internal process of obtaining environmental approvals for proposed onshore well locations, to fulfill exploratory concession contracts with the government under very short timeframes

**SOLUTION** – Import satellite images and aerial photos into Landmark’s GeoProbe® software; integrate surface data with subsurface to validate well locations that hit reservoir targets while satisfying environmental restrictions

**RESULTS** – Reduced approval cycle time by at least 50 percent; reduced costs and safety risks; enhanced collaboration between Exploration and the Health, Security, and Environment department within Petrobras

Geoscientists at Petroleo Brasileiro S/A (Petrobras) with the help and guidance of Wilson Ney, a Landmark onsite consultant, recently developed a simple, yet effective technique that dramatically accelerates the environmental licensing process for new exploratory well locations in onshore basins. Because Petrobras is widely recognized as a world leader in deepwater production and offshore technology, it’s easy to forget they have considerable assets onshore, as well. Brazil is currently on the verge of petroleum self-sufficiency (i.e., average annual production should soon surpass demand), and onshore operations will continue to play a critical role in the company’s future.

“The technique of integrating seismic with surface data created by Wilson Ney and the G&G team in the Espírito Santo Business Unit is extremely important in four areas,” said Fernando Taboada, Asset Exploration Manager for the unit, which is based in Vitória. “First, it optimizes the area of Health, Security, and Environment by minimizing impact on the environment with fewer safety risks. Second, it reduces costs, as a function of more effective planning and well positioning. Third, it reduces cycle time, which is vital for exploratory concession contracts with very short timeframes. Fourth, the search for analogs between recent geological environments and subsurface models of oil fields from onshore basins can help us better characterize reservoirs.”

**THE ENVIRONMENTAL LICENSING PROCESS** – In the past, after exploration geoscientists completed seismic and geological analysis and interpretation, they would pick ideal well locations and send the proposed coordinates to the Health, Security, and Environment (SMS) department in Petrobras via paper or e-mail. Since most onshore wells in Brazil are vertical, it is critical for the SMS group to determine where those subsurface targets appear at the surface before approvals can be
issued. First, they would plot location points on environmental maps and aerial photos—either in hardcopy form, or electronically using a Geographic Information System (GIS). Next, they would send someone out to the field to mark the exact surface location, which posed a safety hazard at times.

Often, a proposed well location would occur within an area that could not be drilled—for example, a river channel, canyon, swamp, road or highway, urban area, or environmental reserve. In that case, SMS would inform the Exploration asset that the location was unacceptable, and suggest a valid alternative location. However, lacking subsurface information, there was no way to know if their alternative was viable. Exploration would determine another set of coordinates based on detailed understanding of the reservoir. But without access to the surface information, geoscientists did not know if their next location point would satisfy the environmental restrictions.

“It was like each department was blind in one eye, “ explained Renato Gonzales, G&G Interpretation Manager for the Exploration asset in the Espírito Santo Basin where the new workflow was first developed. “Neither group had all the surface and subsurface information in one place. Each cycle of the former process—defining the well location, sending it to SMS, going out to the field to validate it, suggesting another location—would take from one to two weeks. And there were two or three cycles for every well!” Finalizing a single well location, therefore, could take up to six weeks. And this was just for internal approvals.

Next, Petrobras would submit its plans to Brazil’s National Petroleum Agency (ANP), which is allowed to take up to six months to grant permission to drill. Afterward, even more time was required to build the necessary access roads and derrick bases.

“As a concessioner with the ANP, Petrobras has very strict time commitments,” said Gonzales. “So our goal for the new process has been to reduce the time it takes to get well locations approved, to avoid serious problems in fulfilling our contracts with the government.” Occasionally, he noted, the approval process took longer than desired and Petrobras had to drill a secondary location in order to stay on schedule.

“Our partnership with Landmark onsite has been great for empowering the subsurface group, improving current techniques, and creating new workflows. As a result, we save time and we save money.”

—Renato Gonzales, G&G Interpretation Manager, Espírito Santo Business Unit, Petrobras

THE NEW INTEGRATED WORKFLOW – Working closely with interpreters in the Espírito Santo Business Unit, Wilson Ney observed the approval bottleneck and helped Petrobras come up with a better solution. “Wilson is an onsite technical advisor for our interpreters here in Vitória,” said Gonzales. “Our partnership with Landmark onsite has been great for empowering the subsurface group, improving current techniques, and creating new workflows. As a result, we save time and we save money.”
The new workflow optimizes approval of well locations in onshore areas using proven functionality within Landmark’s GeoProbe®, SeisWorks® and Z-MAP Plus™ applications to integrate subsurface interpretations with surface information—primarily aerial photographs and satellite images—in a single, unified workspace. “It was a very simple idea—to join the two parts of the workflow—using existing software,” Gonzales added. “But no one had thought of it before.”

Interestingly, because the workflow depends on current technology to which almost all Petrobras interpreters have access, it didn’t cost the company anything extra to improve productivity.

Here’s how it works. Digital aerial photographs and satellite images are managed by the SMS department in Petrobras. To utilize those image files in a Landmark seismic project, they are exported from the GIS system and converted to RGB format. Using SeisWorks or Z-MAP Plus software, flat horizon files are created with the same size and geographical coordinates as the aerial photos. It turns out that the macros in Z-MAP Plus software make this step much easier to repeat for many different surface images. Then, flat horizons within any area of interest can be loaded into the GeoProbe application, mapped using the texture option, viewed in any spatial orientation, or zoomed dynamically at any scale. For the Exploration asset where this workflow was developed, about 60 georeferenced aerial photos covering approximately 6,000 sq. km.—and all of the seismic projects in the asset—were loaded into GeoProbe software.

With interactive cursor tracking between the subsurface and surface images, once a promising well location is identified in the 3D seismic data, the corresponding surface location can be checked immediately by the same interpreter. Problematic or environmentally restricted areas can be identified much faster this way, and the proposed well point moved to an optimal location based on all available data.

“By choosing the best location with integrated surface and subsurface information, when we go out to mark the point in the field there is very little risk that we’ll have to change it a second or third time,” explained Gonzales. “So our approval cycle has been extremely reduced.” Environmental approvals now require just one or two weeks, instead of four to six weeks—an overall time reduction of at least one-half to two-thirds per well. “The Espírito Santo Business Unit now uses this process for all of our onshore drilling locations,” he added.

**INCREASING VALUE TO PETROBRAS** – Since the time the new Landmark workflow was implemented in mid-2006, about a dozen wells have been validated in this manner. The business unit, therefore, may have saved as much as 48 weeks. During 2007, they plan to drill approximately 25 more wells onshore, so the potential time savings are enormous. As Gonzales put it, “Time is money. And rig time is a very considerable amount of money.”
In addition, with no need to send technicians out to the field as frequently to check relocated well points, Petrobras is reducing health and safety risks to its personnel.

The integrated surface/subsurface process has proven so successful in the Espírito Santo Business Unit that one geophysicist recently moved into the SMS department, and now uses the same software applications to validate or relocate proposed well points and enhance collaboration with Exploration teams. “We now have synergy between our interpreters and SMS,” Gonzales said. Both departments can look at the same data, discuss potential problems with well locations, and reach a joint decision prior to sending someone out to the field—all in a fraction of the time it used to require. Thus, the new Landmark workflow is helping improve both technical and business processes at Petrobras.

In fact, interest in the technique is spreading among Petrobras users. During a GeoProbe software User Group Meeting in Rio de Janeiro, Ney presented this new process to about 50 geologists and geophysicists, representing perhaps 7 other business units. Petrobras has a large number of onshore fields, and the environmental approval process is common to all of them.

“Petrobras offices elsewhere in Brazil also plan to adopt this workflow,” Gonzales concluded. “It’s very simple, but incredibly powerful.”

Landmark provides a range of services that help clients maximize the use of their technology assets. Our consultants deliver application implementation, deployment, onsite mentoring, and education programs. In addition, innovative technologies, key industry partnerships, and highly experienced domain experts allow Landmark Services to deliver solutions that optimize clients’ existing assets and enable anywhere, anytime collaboration. These services include intelligent operations solutions, IT/data management, and cloud hosting services to support clients’ national or global workforces. For more information, contact your Landmark sales representative or send an inquiry to Landmark@Halliburton.com.

© 2012 Halliburton. All rights reserved. Sales of Halliburton products and services will be in accord solely with the terms and conditions contained in the contract between Halliburton and the customer that is applicable to the sale.