

UPSTREAM TECHNOLOGY

A Focus on the Full Spectrum of IT Solutions for Oil & Gas



New Virtual Reality Technology for Asset Owner-Operators

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Remember when the price of oil was below \$20 a barrel? It wasn't so long ago. Operators and their partners were focused then on realigning their asset portfolios to preserve profitability by disposing of lower-performing properties and by cutting Capex, Opex, and in turn, headcount.

The mottos then were "leaner and meaner" and "cheaper, faster, better," and they appeared frequently in position statements, press releases, analyst forecasts and trade journal articles. And these mottos still apply today, as

- Oil and gas producers endeavor to meet surging global demand;
- Our industry works to improve its image following highly publicized accidents and as we are being blamed for escalating fuel prices; and
- There is growing public pressure for reinvestment of record profits into searches for new reserves.

Add to that the challenge of equipment and skilled personnel shortfalls, and once again, the oil and gas industry must focus on accomplishing "more with less."

3D Virtual Reality

Fortunately, new technology is available to maximize the value of critical expertise for more intelligent operations and to enable "lean" environments in which limited resources can be shared across multiple projects. This technology is based on Virtual Reality (VR) software that delivers ready-to-use solutions for the oil and gas sector, as well as for energy and process markets.

Advanced VR software allows production asset and operation managers and maintenance and safety engineers to fully integrate competencies, information and applications in real time to create a smarter-decision environment in which to optimize operation economics and crisis management planning and response, particularly in deepwater offshore basins.

The unique Walkinside® VR-based



solution from VRcontext captures all CAD geometry data of an asset, engineering information, laser-scanned data, aerial photography and digital terrain data, and assembles a mockup of the complete asset in a virtual 3D world. The resulting 3D model communicates with existing information management systems, engineering databases, real-time sensors, equipment and process simulators using available tags. This enables instantaneous bi-directional queries of data and virtual objects in 3D.

Closed-loop systems for production optimization can now be implemented from the topside infrastructure to subsea equipment and subsurface information, including complex reservoir models, production lines and in-situ sensors.



Figure 1. Surface facility in 3D with a human avatar, whose movements are subject to physical constraints, such as gravity and collision.

Quickly Learned and Applied

Current users have been impressed by how quickly and simply they were able to learn, use – and benefit from – the Walkinside 3D VR solution. It has been compared with popular video games and with the flight simulators that have enabled the airline industry to address its skilled resource shortage as demand increased rapidly for air travel.

It has even been suggested that 3D VR may help resolve a skills shortage in our industry because next-generation professionals, already proficient with video games, may choose to enter the oil and gas industry because we “made engineering fun.”

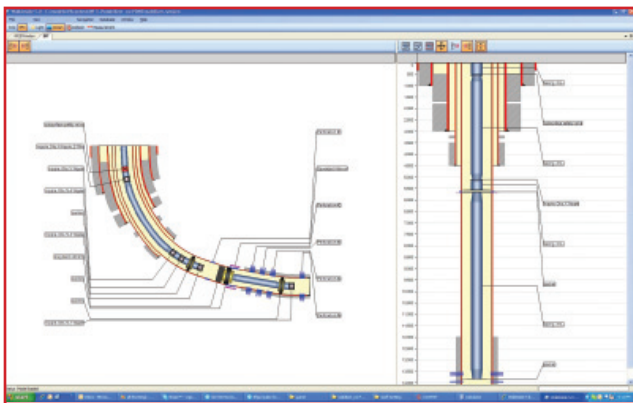
Early Success Stories

The three implementation examples presented here demonstrate the value and maturity of VR technology for topside, subsea and reservoir management applications.

Petrobras

In surface operations infrastructures both onshore and offshore, Petrobras has been a pioneer in leveraging VRcontext’s technology to improve personnel safety in hazardous environments and to optimize large platform and FPSO deployment. Petrobras very effectively uses immediate access to the full model, its associated engineering information, and real-time data to assess, resolve and remediate critical events. “Jump-to” functionality enables instantaneous contextual diagnostics that alleviate ambiguities and accelerate and improve critical decision-making.

Petrobras selected the Walkinside solution to integrate safety, planning, engineering and operations information in a single asset model that can be used in a collaborative, interactive, 3D visualization environment. It uses its engineering files to develop virtual environments (see Figure 1). In this case, facilities models are typically converted from standard 3D CAD formats, such as PDMS, to virtual environments in a matter of minutes.



Figures 3a and 3b. Depth-specific well equipment information is linked with a deviated well track in the Shell Bonga field model.

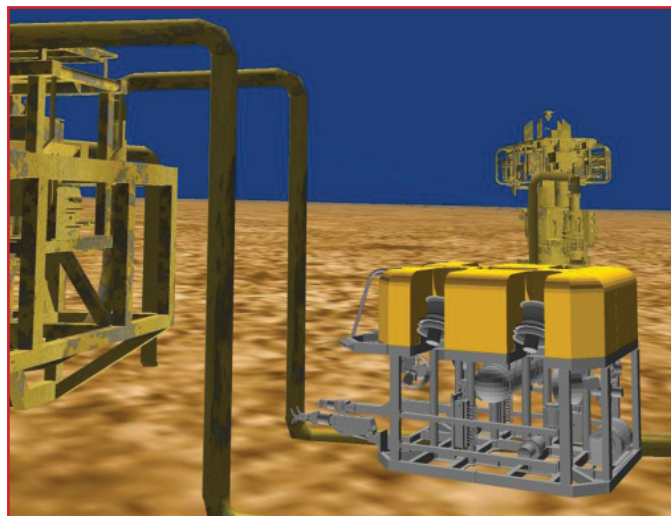


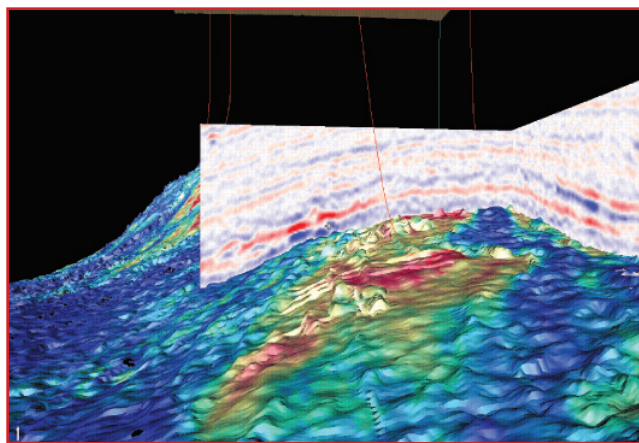
Figure 2. An ROV maintains North Sea Schiehallion field subsea equipment in a 3D VR environment.

Models can include hazard mitigation information from computational fluid dynamics (CFD) outputs for prevention and planning, as well as real-time data for remote operations requirements.

BP

Deep offshore producing fields typically involve complex subsea equipment – difficult to maintain and operate effectively – along with remotely operated vehicles (ROVs), such as ocean-bottom robots and submarines that are dangerous and tricky to navigate around Christmas trees, risers and umbilicals. Further, the narrow, fuzzy video feed streamed to the surface by ROVs is not adequate for the required level of integrity management.

Seeking an improvement, BP applied VRcontext’s VR technology in its North Sea Schiehallion field to determine how it could help steer an ROV around complex seabed equipment, monitor real-time pressure and temperature displayed on equipment gauges, and manage asset integrity data, such as corrosion and equipment maintenance schedules. BP was pleased with the results (see Figure 2).



According to Jim Thomson, visualization theme lead, BP Information Management Solutions: “The VR-context solutions enabled intuitive, real-time manipulation for 3D model review without the special training required for other powerful CAD viewers. They also offer an alternative to less sophisticated 3D viewers that generally cannot handle very large models and are not connected via tags to supporting databases.”

Interactive Network Technologies (INT)

INT’s commitment to understanding how emerging VR solutions can be leveraged for subsurface visualization led to a proof-of-concept project with VRcontext, wherein reservoir models and production and bottomhole equipment were represented in a single model. The Walkinside solution was used to develop a single, all-encompassing asset view, focusing this time on the reservoir.

The results were first revealed at the SEG 2007 Annual Meeting in San Antonio, where a comprehensive Walkinside model integrated INT’s wellbore production graphical information with subsurface, seabed and topside data from all relevant external applications and data sources. Users simply clicked on wellbore locations in the 3D virtual environment to access depth-specific information in the INT Wellbore Viewer™ application (see Figures 3a and 3b).

The INT example demonstrated how the flexible Walkinside solution can support multi-discipline needs and access specialty applications for domain-specific workflows. This illustrates how two-way functionality links between separate software applications can be implemented quite readily.

Through distributed network access to the model, a common knowledgebase is established that helps the workforce make better and more timely decisions and facilitates their management of global resources in a powerful collaborative environment.

No Backtracking Required

Having been developed on top of existing application tools, the VRcontext solution protects investments already made in knowledge management and training by providing ready-to-use integration that graphically combines all input from static and near-static databases, engineering design and maintenance data, SCADA and ERP systems, process simulation software, and all subject matter expertise applications in a single, powerful and extremely intuitive environment (see Figure 4).

The solution also promotes real-time collaboration among project team members and partners, while reducing possible confusion in critical event management situations and optimizing emergency response and remediation. This benefits owner-operators who are seeking to boost operational efficiencies, while reducing risk and managing field integrity in an enhanced safety environment.

Lessons learned from the projects implemented by



Figure 4. A collaborative work session using a 3D virtual model in the control room. (Courtesy of Newport Shipbuilding Inc.)

Petrobras, BP and INT demonstrate that the oil industry can easily and quickly capitalize on data transparency and the ability to share identical views of 3D models – and that this can be done across all disciplines and all business activities focused on complex, deepwater offshore assets.

The Ultimate Promise

Presentations made during the February 2008 SPE-sponsored Intelligent Energy Conference in Amsterdam, including those by BP, shared user experiences deploying intelligent technologies in various projects. Notable impacts on asset profitability profiles were a 5% increase in daily production and a 10% increase in ultimate recoverable reserves.

These actual experiences corroborate projections from the 2003 Cambridge Energy Research Associates Study that anticipated the ultimate benefits of real-time access by all workforce members to information from all external applications and data sources provided by VR operations would include:

- A global oil and gas reserves increase of nearly 125 billion boe, or an increase of more than 10%;
- A savings in industry operations expenditures of roughly \$8 billion per year;
- A reduction in ongoing operating costs of as much as 10%; and
- A boost in total ultimate hydrocarbon output of about 6%.

In addition, improved levels of operational safety, preventive maintenance, personnel access monitoring and environmental crisis management can help reduce personal injuries, equipment-related catastrophes and legal liabilities, thereby helping to restore the image of the oil and gas industry.

Acknowledgments

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