Total’s upstream exploration and production (E&P) operations use immersive training simulators to solve remote training challenges for floating production storage and offloading (FPSO) vessel operations. This Insight discusses how the company uses the technology to reduce environmental, health, and safety risks and improve operational and maintenance efficiencies.

AUGUST 14, 2014

Immersive Training Simulator Enhances Safety on Total FPSOs

By Janice Abel

**Keywords**

Immersive Training Simulators, FPSO, Operator Training Simulators (OTS), Console Operator Training, Field Operator Training, Virtual Reality (VR)

**Overview**

The need to improve both operational efficiency and safety prompts companies across many different process industries to consider new ways to improve training for both console and field operators. This has increased the use of immersive training simulators, particularly for offshore and upstream oil & gas companies whose employees must manipulate or work in close proximity to hazardous materials.

Unlike conventional operator training simulators, immersive simulators provide a 3D virtual environment in which graphical representations of the user (avatars) interact with the virtual plant or upstream production assets, in many cases, even before they are built. The objective is to train plant personnel ahead of commissioning to enable them to confidently start up and shut down units, perform process procedures transitions, and respond faster and more effectively to unplanned abnormal situations.

ARC Advisory Group research indicates that this virtual learning environment can improve knowledge transfer, learning, and retention by enabling operator-trainees to respond to real-world issues -- both day-to-day and abnormal -- in a highly realistic and faithful, yet safe environment in which operators’ mistakes will not result in catastrophes, as could occur in actual settings. Our research also indicates that the generally tech-savvy Millen-
nial generation of workers responds particular well to this type of training due to its familiar game-like navigation.

Executives from Total, a leading global energy company with almost 99,000 employees and operations in 130 countries, recently briefed ARC Advisory Group on its use of immersive training simulators. These enable the company's engineers and operator trainees to interact with a virtual reality (VR) representation of the physical plant and the processes they control. Company executives also gave presentations on these implementations at the ARC World Industry Forum in Orlando, Florida earlier this year.

According to Nicolas Tarisse, Field Operations Training Manager, Total E&P, one of the organization's goals is to provide training for all personnel, wherever they work in upstream operations – onshore or offshore. With over 5,000 people in operations, many are doing rotations for four weeks on and four weeks off; and one of the goals for VR training is that all employees be equally trained and have equal access to training regardless of location.

To meet these goals, the company has invested in all types of training, including e-learning, high-definition Visio learning studios, internet on-line courses, conventional operator training simulators, and immersive training simulators.

For its two newest and largest floating production storage and offloading (FPSO) projects – in the Pazflor and CLOV offshore oil fields -- Total E&P Angola implemented Siemens COMOS Walkinside immersive reality training simulators to enhance and speed training efforts and enable operators to familiarize themselves with the FPSO equipment, processes, and control systems prior to actual production startup.

**FPSO's Represent Unique Training Challenges**

With most new offshore oil & gas production assets (and particularly FPSOs), located in increasingly remote and inaccessible locations, it's often not practical or safe to train all personnel on site, which could also interfere with normal operations. This is particularly true since owner-operators typically face intense pressure to achieve "first oil" as quickly as possible to start recouping the enormous capital investments involved. Instead, operator training should be performed remotely at corporate headquarters or
other central facility, so field and panel/control room operators can be brought "up to speed" on the technology before ever setting foot on the production asset itself - whether it’s a fixed or floating platform or an FPSO vessel.

In Total’s case, because not all of the operators would be available during onshore commissioning of these two FPSOs in Korea, it was important to be able to start training while the vessels were being constructed and during the months-long journey under tow from Korea to the appropriate sites located off the coast of Angola.

The compactness of topside modules and the installation scaffolding constraints and restricted areas, also make it difficult for personnel on FPSOs to locate modules and equipment, creating yet another unique training challenge.

**FPSO Operator Training Projects**

Total E&P Angola uses Siemens COMOS Walkinside 3D Immersive Training Simulators on two of its largest and newest offshore FPSOs, Pazflor and CLOV.

Because the company places high importance on health, safety and environmental (HSE) training, training in this area receives particular attention. Adding business intelligence to 3D visualization and virtual reality models, the company was able to pre-stage the operator’s ability to view the tags of equipment and instruments such as pressure gauges, valves, and safety valves with their locations, and access relevant associated information – even before the operators ever stepped foot on the vessels.

The technology enabled the company to develop diverse immersive scenarios for operators. Once built, the 3D models were enhanced with interactive
simulated assets, such as valves, pumps, fire extinguishers, etc. Trainers can use these live-action items in their training scenarios. To represent the operation realistically in three dimensions, Total used the engineering 3D models provided by its EPC contractor in conjunction with the Siemens COMOS Walkinside converter capabilities to transform existing 3D engineering CAD drawings into photo-realistic 3D virtual reality representations. With this technology, operators can rehearse plant startups and shutdowns, enabling them to learn from their mistakes in a controlled environment without any real risks. Knowing how the equipment operates, where safety valves and pumps are located, and how to operate the equipment has tremendous value to the operator and the company.

The subsea gas/liquid separation – an industry first – represented the culmination of several years of R&D work and a rigorous qualification program to ensure the optimum efficiency and reliability.

**Pazflor Project**

For the Pazflor project that commenced production in August 2011, the immersive training simulator simulated real-life workflow situations using immersive scenarios for planning, scheduling, and executing standard operating procedures. Operators training included scenarios for abnormal conditions, black start procedures, startups and shutdowns, and routine operations.

The main goal for immersive training was to train operations and maintenance personnel using a safe virtual environment that references up-to-date asset data and complement this with other process and operator training simulation.

Total worked with Siemens to develop the immersive training configuration and functionality. The energy company’s goal was to have operators trained in this virtual environment one year before the vessel was completed.

At the end of the training, the company surveyed the Pazflor operators about their impressions of the new immersive training simulator program. Most thought it was very useful.
According to Mr. Tarisse, “Even though it’s still early to quantify the ROI, the ease of takeover by the trainees and their feedback was very positive. The value was confirmed by experienced operational personnel whose comments included: ‘I was on the FPSO when the first trained operators arrived and observed that they were familiar with the environment and not lost when they arrived because of their simulator training.’”

**CLOV Project**

Due to the success of the initial Pazflor implementation, Total implemented a second immersive training simulator for the CLOV FPSO, a joint partnership with Statoil, ExxonMobil, BP, and Sonangol. According to a Total news release, CLOV started up on June 12, 2014. The constraints for this FPSO were similar to the first project, with the same strict HSE requirements.

The CLOV training included adding additional immersive training simulator capabilities. The objective of the CLOV-specific training is to teach and help understand the operation of the process equipment from the wells to the export systems, including safety-specific activities. All 130 operations and maintenance personnel in production received ITS training; four to five weeks for operations personnel, and two to three weeks for maintenance personnel.

To improve the operator’s understanding, theoretical training courses were combined with the virtual reality immersive training simulator, traditional operator training simulators, and other operations and control training.

**CLOV Phase 1 Training**

During the first phase of training, the aim was to familiarize operators with CLOV FPSO facilities before being assigned offshore. The CLOV immersive training simulator was also developed by Siemens (VRcontext) with assistance and inputs from Total’s corporate organization, once again using the 3D engineering models provided by the EPC contractor.

**Phase 2 Training**

The second phase of immersive simulator training will involve employing multiple avatars for each of the individuals being trained. This will include multi-avatar scenarios for interactive work orders and to train workers how to communicate and coordinate actions particularly for potential HSE incidents. “Avatars can be used to move around the FPSO, emphasizing the
importance of communicating between them; the avatars can speak to one another, just like in real life,” stated Mr. Tarisse. “For example, if one avatar ‘sees’ another avatar in trouble on the platform, the avatar can ‘walk’ to the platform location in real time to assess the problem and do whatever is needed to remedy the situation.”

In his presentation, Mr. Tarisse illustrated how the training software enhances HSE-related behavior, including responses to simulated fire, smoke, gas leaks, liquid leaks, and man down situations requiring the trainees’ avatar to respond according to pre-established procedures. Immersive effects include the feeling of directional sounds associated with alarms, and finding the location of fire extinguishers, alarms, phone booths, showers, masks, warning screens, mustering points, and more.

Field Operators will Use Avatars and Link to Electronic Document Management Systems

New capabilities included for the CLOV immersive simulator include linking the immersive training simulator the electronic document management system. Total will continue to create and validate more scenarios in the future.

Future of Immersive Training Simulators at Total

According to Mr. Tarisse, Total intends to continue to develop additional realistic immersive training simulator scenarios. The company’s experience with training simulators has been very good to date. However, headquarters has employed most of the training for new field operators and plans to link this capability to console operator (DCS) training. In the future, the company intends to develop additional realistic scenarios on specific topics in routing procedures (e.g. pigging operations), with an emergency man-
One of the biggest deterrents to using immersive training simulators is the concern about the cost of implementing a 3D solution. However, the cost and time to implement continue to decline as the technology becomes mainstream. According to Marc de Buyl, Vice President, Siemens Client Solutions for North America, for a new project, “Using EPC’s laser scans, the technology can be implemented faster and the total cost can become even less expensive than implementing traditional operator training simulator models.”

**Recommendations**

Despite traditional conservatism in many industrial sectors, immersive 3D virtual reality training is becoming more readily accepted and even a best practice for some operations. Suppliers are seeing more project specifications that require 3D simulation for training.

ARC recommends that training in the oil & gas, chemical, and other high-risk industrial sectors include immersive operator training simulators. This could:

- Help improve HSE performance to a significant degree
- Train workers for remote and harsh working environments prior to actual plant start-up
- Adapt well to the tech-savvy millennial generation of workers because of its game-like navigation capabilities
- Include avatars to improve communication and interaction between individuals and teams
- Make operators more versatile, by linking the console DCS operators to the field operations training environment

A dedicated session at ARC’s 15th Annual Industry Forum in Orlando, Florida February 9-12, 2015, will continue this discussion in greater depth. ARC invites readers to join us in Orlando to learn more and participate in the discussion.
ARC has also prepared numerous reports and an in-depth market outlook study on operator training and training simulators. These include:

- Strategies for Operator Training Simulators – Cost Justification
- Strategy for Operator Training Simulators Part 2: Implementation
- Best Practices and Strategies for Operator Training – Part 1
- Best Practices and Strategies for Operator Training – Part 2
- Operator Training Simulator Market Outlook Study

For further information or to provide feedback on this Insight, please contact your account manager or the author at jabel@arcweb.com. ARC Insights are published and copyrighted by ARC Advisory Group. The information is proprietary to ARC and no part may be reproduced without prior permission from ARC.