Why use simulators to train operators?

Complexity and an aging workforce addressed with reality-rich models that allow comprehensive approach

By Liliana M. Pereira, Simulation Engineer, Honeywell Process Solutions

In the airlines industry, pilots take responsibility not only for complex and expensive equipment but also hundreds of lives. Flight simulators train pilots for non-typical events like engine failures and water landings, and pilots clock specified amounts of time in simulator training to maintain certifications.

In similar fashion, the process industries leverage training simulators to ensure employees are well trained. The console-operator or controller role in process industries has evolved to encompass more equipment and more control loops. Its responsibilities are similar to those of a pilot, with similar levels of consequences if a failure occurs.

“In the last 30 years, digital control systems have fundamentally changed the way work is accomplished in the process industry. These remarkable machines have become supremely complex, inexorably automated and increasingly challenging to learn,” says Dr. Richard C. Ortloff, ExxonMobil Chemical Co.

While most “abnormal” situations may not involve threat to life or limb, they can raise safety challenges and performance issues that lead to production loss, either through poor quality, schedule delays or other conditions. Operator performance is critical to both safety and operating profit.

“Commonplace understanding of how learning occurs has simply not kept pace with increased technical complexities,” says Ortloff. “Therefore, as workplace educators, we must renew our understandings and adopt more contemporary methodologies if we are to be effective within this maelstrom of technical change.”

Both routine & abnormal

In fact, a growing number of companies have operator training simulators (OTS) for both routine operations and abnormal situations. They are becoming a primary tool for systematically addressing operator competency and due diligence issues.

“We often attempt to teach people to operate these systems by employing powerful and innovative process simulators,” says Ortloff, who uses Honeywell’s UniSim simulator to apply experiential learning cycles in training simulations.

A high-fidelity customized process model is derived from the detailed design of specific process units. High-fidelity simulations model production capacity, equipment performance, feed and product requirements and production cases. Integration with actual DCS/logic configuration creates an OTS that includes the same configuration, tags, and logic as in the plant. The training experience associated with this type OTS is nearly identical to that of the actual control room and possesses a high level of realism.

Just as a flight simulator with a full cockpit mockup delivers an immersive experience that translates into very specific and near-instantive pilot responses, a highly customized DCS-connected training simulator is the most realistic training experience to ensure knowledgeable and confident operators, with process and control system familiarity and experience.

Caltex Australia launched an intensive refining-performance improvement program (RPIP), aiming for increased profitability and improved throughput. The need to...
increase production capacity for ultra-low sulphur diesel resulted in the installation of a new Diesel Hydrotreater Unit (DHTU) at the Lytton Refinery.

Caltex employed the UniSim simulator in achieving program objectives, comparing its DHTU-2 unit and one similar, previously upgraded without use of an OTS. The simulated unit took six days to be online and on-spec, whereas the non-simulated unit took six weeks to reach full production.

Above and beyond

Besides OTS productivity benefits, in a typical facility, training challenges come with new construction and system upgrades. Changes take time to adapt to, even for experienced operators. In some cases, operators have no prior experience with a modern DCS.

By integrating the dynamic model and simulated I/O with the actual process and logic, the configuration of logic, graphics, alarms and other parameters is fully exercised, prior to commissioning and startup. Errors and usability issues are resolved earlier, with the least impact to the start-up schedule.

Process industries stand to lose more than half their skilled personnel to retirement during the next five to ten years. Companies are looking to capture valuable experience before it leaves the workforce. OTS can quickly bring a new generation of operators up to speed.

“Safe, reliable and efficient operation of a refinery means more than simply running a process — it involves analyzing how that process performs and enabling our operators to become competent on it before they enter the control room,” says Allan Gunn, a Caltex development specialist.

Details and start-ups

Detailed operating procedures and work instructions are a key enabler in ensuring a safe and efficient startup and ongoing operation. OTS is a tool for engineering and operations staff turning operating procedures into valid, tested work instructions and detailed procedures. The development and validation period can identify missing steps, unclear instructions and incorrect actions in a systematic manner, reducing costly incidents and inefficient transitions.

The result is faster and more stable startups, with reduced off-specification material. Accredited reduction in startup time in terms of days and weeks will yield significant measurable benefits by generating on-specification product early.

For example, Petro-Canada Lubricants recently executed an OTS project on a Hydro Treating Unit (HTU) at their Mississauga site. This project was intended to accelerate the capability development of operations, transfer best practices with hands-on experiences, and assist with knowledge retention.

Petro-Canada implemented an Experion PKS based training system using UniSim software, to increase operator confidence in a safe learning environment with the actual dynamic response of the real plant, enabling faster skills development, better long-term skills retention and a deep understanding of the process.

A well-maintained OTS system generates significant benefits well beyond start up. Malfunctions are reduced as operating conditions improve based on key performance indicators. But one of the biggest benefits of better-trained operators will come from the reduction in unplanned downtime or incidents caused by human error.

Two examples

For example, FertiNitro (Fertilizantes Nitrogenados de Oriente), Venezuela’s largest fertilizer company, needed to train employees for improved response time and actions for plant operational continuity.

“The project has provided incredible benefits to us in terms of training operators, improving response time, and making available back-up employees for any situation that may arise. And, with the development and training, we have reduced plant shutdown due to operational mistakes,” says Natalia D’ambrosio, Superintendent FertiNitro.

A UniSim simulator has been used to train over 80 operators with no risk to the continuous production process at FertiNitro and allowing engineering-improvement evaluations.

Petro-Canada refinery engineers use simulator scenarios to support plant optimization strategies such as tuning regulatory controllers, validating safety system performance, rationalizing process alarms and optimizing procedures.

Production teams rely on procedures, controls and operators to maintain reliable and optimal plant operations, and as facilities continue to prepare each of these assets for production, more and more of them are planning to have their operators clocking time in the cockpit of an operator training simulator, methodically preparing prior to initial plant operation and periodically reassessing performance.

“Console operators often view the controls system as a black box, shrouded in mystery, and typically only possessing a rudimentary understanding of how the system they are controlling operates,” concludes Dr. Orloff. “Yet these digital control systems now electronically control almost every aspect of the complex processes of the chemical plants, power plants, and refineries in which they are installed.”

Honeywell
www.honeywell.com

As seen in Processing January 2014