Visualising the control room of the future

Many control room engineers are working in an uncomfortable environment with outdated equipment. Tightening margins and higher production targets further add to the pressure. It is important that operators have the tools they need to meet the demands of their job, and enable them to add value to the process operation, says Bruce Calder, vice president of Technology at Honeywell Process Solutions.

Gaining quick access to all the data that drives production decisions will help operators add value to the process. However, it is vital that data is presented in a way that allows the operator to understand a situation and to compare it to the bigger picture so they are in a position to make decisions that result in the safest and most profitable operations.

Honeywell has identified that key drivers for the control room of the future include an environment that allows operators to quickly understand a situation and to efficiently carry out the required actions. Broadening the scope of the information on which they base their decisions can help facilitate this. However, operators do not simply need more data. They need the right data, presented in the right way. They also need access to the people that can add perspective and offer the expertise required to allow the best decision to be made in any given situation.

Operators also need to work in an environment that minimises fatigue. They need to be able to move away from the console and to collaborate with others without losing situation awareness or the ability to act.

A mix of information presentation and interaction technology; improved opportunities for collaboration around key decisions; and ergonomics will help operators to be effective. Such a solution can be created around three main elements - the operator’s relation to the production process, to others in and around the control room, and to the control room.

The interface

The control room operator console is the primary manifestation of the HMI, although, it should not be the only one. The role of the HMI is to present the operator with the information needed to understand the current state of the process, how it relates to current and future production goals, as well as to determine what might need to be done to correct process deviation. The HMI should also provide a means of performing and monitoring the progress of corrective actions.

Traditionally, the operator console has been built around schematic displays that present information in terms of the structure of the plant and process. A typical process unit may require an array of monitors, arranged in hierarchies from high-level overview displays and lower level displays to give detailed views and interaction with particular pieces of process equipment. This model has a number of drawbacks. The schematic-based display model presents information in terms of the structure of the process and requires operators to navigate through several displays to find the information to fully understand a situation.

The schematic-based model also makes it hard to integrate information related to production goals and constraints which is not organised in terms of the process structure. Presenting information in an array of monitors creates a disjointed visual experience with operators having to integrate information from separate screens. Interaction using a keyboard and mouse can also be inefficient as operators need to use several devices to navigate information and perform process actions.

The HMI of the future needs to provide operators with the information they need, when they need it. Emerging screen technology allows for more flexible information layouts and a unified visual experience. The information displayed on those screens needs to go beyond the schematic to more compact visualisations of information from a wider scope of responsibility to direct the operator to what needs attention.
A collaborative environment
Operators also need to collaborate with others - field operators, supervisors, and engineering and maintenance personnel. This requires the control room of the future to support collaboration.

The operator console has always been a focus for collaboration around process start-ups, process upsets and equipment failures. However, it is not always the best place for such collaboration, especially if it distracts the operator from their primary task. Instead, there can be other places for people to gather in order to diagnose and resolve an issue. Tools are needed that allow these collaborations to form and dissolve, as situations require, and they need to provide access to information from across the enterprise and across a broad range of disciplines.

Shift handover is a good example of a routine collaboration that could benefit from better tools. Operators today often collect shift notes either in a separate application or with pen and paper. These notes are recorded during the course of an operator’s activities at the console, but it takes them away from the HMI and can lose the operational context in which the notes were made. The console should allow an operator to capture observations as they work through mechanisms - such as voice notes and the capture of information directly from the HMI. This information should then be accessible for use in collaborations such as shift handover.

Honeywell has identified that plant operators want more mobility in the control room environment. A key element of their job is to monitor the process for situations that might need attention and this can trap them at the console. A more flexible relationship with their work environment is needed.

Studies have indicated that even small amounts of mobility can improve the cognitive function of an operator. The proliferation of mobile devices offers an opportunity to unchain operators from the console, allowing them to maintain situation awareness while away from the console.

The technologies needed to realise this vision are available. However, crafting them into consoles and tools that deliver the vision is not an easy task. Honeywell has been working to achieve this goal and its recently launched Experion Orion Console and Experion Collaboration Station, provides two key elements of its vision for the control room of the future.

The Experion Orion Console includes a number of HMI innovations delivered in an ergonomically designed console that provides sit and stand operation. The console features a parametric design that allows it to scale from a single operating position to large multi-position consoles. The console uses large ultra-high definition screens to provide uninterrupted real estate for flexible display layouts. Display colour schemes have been chosen to help reduce eye fatigue.

The console uses large, near-horizontal touch screens as the primary means of interacting with the HMI. The touch screens provide direct manipulation of process parameters and faster navigation through information. To allow greater mobility the console also includes a subtle ambient alarm display that allows operators to determine the alarm state of the console from a distance. A tablet-based mobile device further enhances an operator’s ability to move around without losing situation awareness.

The Experion Orion Console HMI can improve an operator’s ability to run the process closer to optimal operating limits through limit and target-based visualisations that allow an operator to see where the process is in relation to current and future limits and targets, which could include safety and equipment integrity limits, alarm limits, advanced control limits, optimal operating envelope, and production targets. While these are all important to an operator, they are, typically, left to look these up in separate documentation or application.

Integrating all the information needed to run the process closer to optimal operating limits directly into the HMI raises an operator’s level of situation awareness and their ability to proactively manage the process.

The Experion Collaboration Station complements the Experion Orion Console by providing a natural way to collaborate around a broad range of process and production related information from across entire enterprise. The whiteboard-sized screen facilitates face-to-face stand up collaboration and gives supervisors, engineers and operators a place to go to troubleshoot process problems without distracting console operators. It can help provide a global view of process operations that allows users to quickly locate and display real-time process schematics together, with information such as planning, scheduling, maintenance, material, and safety data from across the entire enterprise using familiar touch gestures.

Without a keyboard or mouse, no single person is in charge of the collaboration, making it a more inclusive experience. Collaboration Station can also make shift-handover more efficient by allowing operational staff to quickly find and focus on the information relevant to current operations. It also allows remote experts to join the collaboration through voice and video conference and application sharing.

In conclusion, the control room of the future should enhance the work environment and enable a shift in focus from monitoring and manipulating the process toward decision making that drives business outcomes.