New Screens for Old Systems

Obtaining Operator buy-in on high-performance Graphics

by Jason Hamlin and Carter Farley

"In God we trust; all others bring data." A sentiment, often attributed to engineer and statistician William Edwards Deming, holds a fundamental truth for process control; you must have data to control the process. How industrial process operators receive their data has changed through the decades with most modern control rooms delivering data through a variety of computers and electronic sensors.

Engineering staff can add new data points to modern supervisory control and data acquisition (SCADA) systems cheaper and faster than ever before, and increasingly do so with impunity. But is this flood of data helping the modern operator?

Today's operators are being asked to bear greater responsibilities and face tighter regulations, larger financial penalties, and more critical public scrutiny. How then do you increase their awareness of the process conditions without overwhelming them with data?

Design the interface right

Enter a SCADA design methodology variously called high- performance human-machine interface (HMI), high-performance graphics (HPG), situational-awareness graphical displays, or some variation of those titles based on whose book you are reading, (There are some amazingly great resources to be found searching these titles.)

Briefly summarized, HPG focuses on enhancing awareness of approaching abnormal conditions through pattern recognition and rapid data-comprehension techniques. Resources on HPG use a form of this statement: "Information is data made relevant."

Does hearing the term SCADA produce a mental image of a process diagram with live numbers on it? Or perhaps an overview of the facility with animations, lots of colors, and live numbers? These types of displays provide data. Though without context, the data aren't relevant.

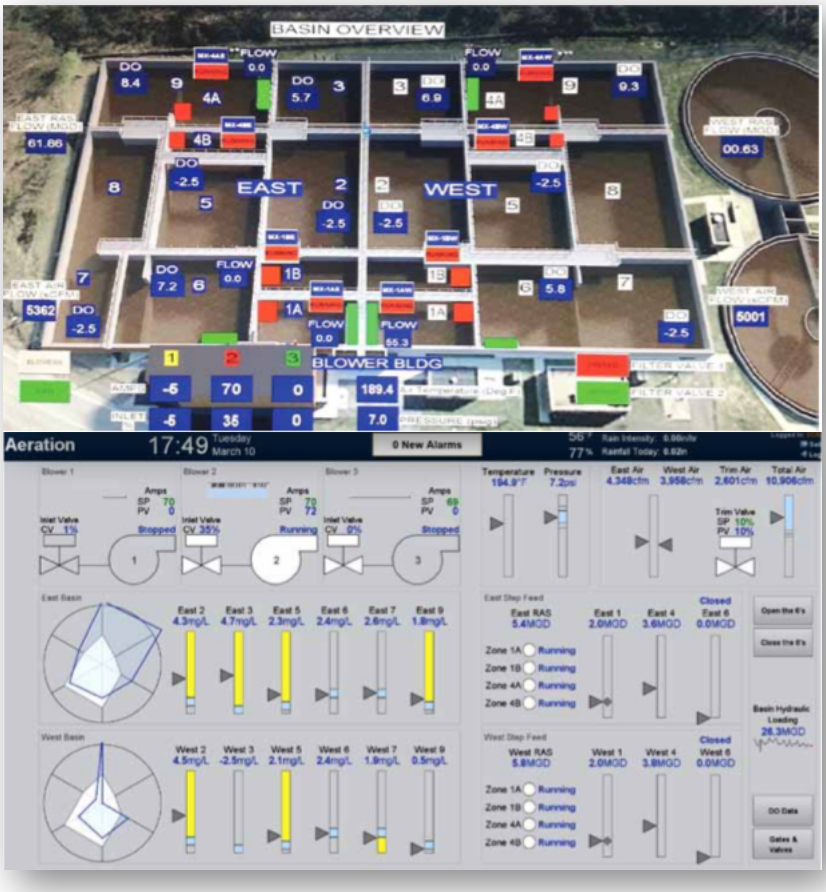
An operator can be taught to run a facility using these tools, but there is a learning curve and increased mental burden to process the data. How quickly can an operator scan a list of numbers and decide what action to take? How is this mental processing affected if the process is going into upset, alarms are ringing, and it's raining?

On the flipside, consider if the SCADA screen were designed to show ranges and trends at a glance. Remove all the extraneous animations and colors, and use color only sparingly to show upsets.

A car's dashboard provides a common reference to this type of enhanced display. The dashboard does not show a diagram of a motor — unless there's a warning indicated — and the fuel display is not just a number of gallons. Instead, for fuel there is a simple analog gauge displaying fuel level somewhere between empty and full. The driver can quickly scan and process this. This is information — data made relevant.

The Same Basin before and after high performance graphics

These photos show the same water resource recovery facility basin before and after conversion to HPG.



Without knowing the facility or its operation, potential process upsets still stand out using HPG methodology (bottom photo). Values have physical range indicators. Color is used sparingly and with consistent purpose. The operator can scan the screen quickly to identify trouble.

Yet operators tend to be averse to change. With so much to manage and monitor, why would an operator want to fix what he or she doesn't perceive to be broken? Mandating change from the top down makes projects feel forced. The smoothest path forward is to involve operators in such a way that they welcome change. Before the start of the project, engage operators and achieve buy-in of HPG.

Building champions

Convincing management to try something completely new is hard. Convincing operators to try something completely new to run their facility is almost impossible. Users don't believe their existing SCADA systems are broken, so often they lack incentive to fix it.

Too often SCADA software upgrades begin with the question, "You can make the new system look like the old one, right?" Rarely does a facility willingly choose to embrace the full potential and feature set of the new technology.

To achieve the buy-in of the managers and the operations team at once is hard to accomplish. The better path is to start small and grow; most sources of HPG advice suggest finding a champion— the person who will best advance your case for conversion to HPG. A project team also can fill the role of this champion, but members shouldn't be chosen at random.

It's best to look for a balanced mixture of experienced operators and leaders, those trusted by their peers, and those with a good working knowledge of both the facility and its control systems. To build its team of champions, the Lynchburg (Va.) Regional Wastewater Treatment Plant (LRWTP) used the Goldilocks equation to find the "just right" members.

Some operators are "too cold." *They never want change, or they like to fight against change for the sake of fighting. Not to say there's anything wrong with this type of operator. They tend to be the ones who know what to do when control systems are down. They've seen technology come and go and tend to rely more on their gut instinct for operational decisions. While these operators are solid staples to the facility, they aren't the best choice for a team to advance a technology objective. By nature, they may not give the project a fair chance. They are more apt to give something new a quick try, dismiss any apparent benefits, and go back to their tried-and-true methods. This is not conducive to the developmental stages of any technology upgrade.*

Some operators are "too hot." *These are the early-adopter types. They have the latest gadgets, fearlessly and quickly embrace anything new, and are flexible and willing to work through the early bugs. These operators eagerly ask for new features and changes to the facility and SCADA.*

Again, these aren't bad qualities. These operators adapt quickly and learn fast, but they bore easily and may have a tendency to ignore the tried and true. A big concern with having this group as your team is that they may be viewed as risk takers and lack the trust of their peers. When these operators come on strong, excitedly talking about the latest new thing, many other operators will smile, nod, and immediately decide they aren't ready for whatever new technology this group is pushing.

Some operators are "just right." *These are the amicable, yet cautious operators with pleasant dispositions. They've gained the trust and respect of their peers, and,*

generally, are considered reliable and even-keeled. They may show caution or skepticism to HPG but will listen and give it a chance when asked. When these operators are presented with the benefits of HPG, they will tend to adopt it with an open mind. Once they do, others will be more willing to follow them because they represent the "measured middle" of the Goldilocks spectrum. This group will be able to show the benefit to their peers, explain how to use it, and be leaders of the change. These are your champions.

Achieving buy-in

The team of champions at the LRWTP consisted of the operations supervisor, two shift supervisors, two operators, and the SCADA/control technician. They reviewed screen design and functional concepts, and acted as the go-between for operations and SCADA/controls. They conveyed operator concerns to the SCADA team and held the authority to approve final screen design. It was a collaborative effort in which every operator had the ability to voice his or her concerns during the project. Getting to the finish line took more than just picking the right team. It required achieving the team's buy-in of HPG. This is how we did it.

Get in the control room

Learn the operators' personalities and abilities. Appreciate the large responsibilities they have every day. Be present in the control room during various facility conditions — normal flow, high flow, wet weather events, power issues, etc. Always be watching how the operators interact with their control system and be looking for improvements. Observe what frustrates them, what tasks are hard to accomplish. Note the routine tasks or workarounds they have adopted, and look for ways to improve them.
This interaction is critical to achieving buy-in. When presenting a new screen design to the team, showing how it fixes or simplifies a previously complex process lets the design sell itself. This is buy-in.

Show the difference

Today's technology allows multiple control systems to run side by side. Leverage that. At Lynchburg, the team set up the new HPG screens next to the old system screens to give operations a side-by-side view. The project team deployed the new screens when they were 80% complete. This gave all operators a chance to get comfortable with the screens, make comments on them during the build, and feel involved in the design process. By the time the team decided a screen was final, most operators already had bought into it and were using it actively.

Aside from deploying screens at 80% completion, the team also made a strong effort to build using the operators' mental image of the facility processes. Engineers and control technicians read piping and instrumentation diagram (P&ID) sheets, so it's understandable they would instinctively build their SCADA screens to look like P&ID sheets with live numbers. This is horrible for operator comprehension, as operators don't view the facility in the same way as an engineer. Yes, operators can get used to using these types of screens, and often they do. But build a screen based around the way operators operate and you've achieved comprehension without training. The bulk

of the operators have an almost innate understanding of this better designed SCADA system.

Follow the momentum

A funny thing happened using this formula in Lynchburg: Once a few screens became final, a lot of the operators started asking the project team when the next screen would be done. They also suggested which screen should be next and provided their ideas on improving SCADA workflow. Inadvertently, the project team had built a self-driving change engine. Operators started to embrace the changes, welcomed them, and wanted them.

The take-away message here is to realize the benefits of understanding not just the operation but also the operators. Involving operators at the right point in the design process can be a tremendous benefit. Assembling the right team at outset can further advance the project and create self-driving change.

One final tip for when you hit the inevitable snags and things aren't progressing: Never underestimate the power of bringing food into a meeting.

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