CONTROL

WHITE PAPER

Operator Effectiveness: The Next Frontier of Process Automation

Apply this Potent Mix of Methodology and Technology, and Transform Your People into Strategic Assets

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The same scenario plays out every day in control rooms around the world. From the start, little thought has been given to human factors in the control room layout, the operator stations and even less to the user interface design. Operators may be oriented to "normal," steady-state plant operations, but are ill-prepared to deal with abnormal situations when they arise. This includes scheduled shutdowns and start-ups that today happen at increasingly infrequent intervals. And, all too often, the information operators need to make quick, intelligent decisions does not exist within the operations environment—requiring operators to juggle walkie-talkies, telephones and other system interfaces at the precise moment the process demands their undivided attention.

Is it any wonder that operators' inability to react correctly and confidently to the unexpected is responsible for an enormous loss of productivity, money, and even life and limb across industry? Indeed, research indicates that nearly 80% of production downtime is preventable. And half of this is due to operator error. The monetary costs of this failure in the petrochemical industry alone are estimated at $20 billion per year.

In addition to avoiding downtime, damage, injury and environmental emissions, the lost "opportunity cost" due to operators functioning at less than peak effectiveness looms large. In an exclusive joint research project by *Control* and ABB across *Control*'s global database of process automation professionals, respondents agreed that operators also have the potential to significantly impact quality and economic performance metrics. A full 86% of respondents indicated that operators' impact on product quality was significant. Further, 78% indicated that operators could have a significant impact on a plant's economic performance.

From Frying Pan to Fire

Clearly the need—and potential payoff—for more effective operators is enormous and intuitively understood. But rather than reversing course and simplifying operators' tasks, industry is only increasing the pressure. Satellite control rooms are giving way to central operations centers as companies struggle to improve financial performance by increasing the utilization of operations resources. And at greenfield processing sites around the world, plants and units that once operated in a standalone fashion—with dedicated control rooms, interim holding tanks and buffer capacity—now are built as integrated, mega-plants with intricate unit dependencies that must be understood, controlled and optimized in real-time. In the end, fewer operators are responsible for more functional areas, more interconnected processes and more sophisticated control strategies.

Further complicating matters, experienced Baby Boomers are retiring in droves, and companies find it harder than ever to recruit and retain qualified individuals willing to devote themselves to a career in

"their grandfather's control room"—without ready access to the information and collaboration tools they need to succeed, and scarcely a nod to modern principles of ergonomic and human-centered design principles.

From Operator to Process Pilot

Fortunately, an array of best practices and technologies is available to help operators perform their best. At the core of them all is a fundamental shift in philosophy that places a considered evaluation of the operator's needs, abilities and limitations—including their individual characteristics—front and center in the design process.

As with other user-centric design endeavors, the essential goal of operator effectiveness measures is for the technology to effectively "disappear," so the operator can quickly gather and assess input, collaborate as necessary, and steer the process through turbulent patches or unanticipated conditions as smoothly and intuitively as possible.

From a brass-tacks perspective, operators can be made more effective primarily through the application of four essential disciplines, each of which is a combination of technology and business practice:

- *Plant system integration:* Raw data and other inputs must be transformed into actionable information in context—easily viewed, listened to, or otherwise sensed in an integrated environment regardless of source. The challenge is to provide seamless access to multiple sources of information, but at the same time not overload the operator with irrelevant data.
- *High performance human-machine interface (HMI)*: The user interface must be intuitive and allow the operator to manage views dynamically and efficiently. A high performance interface not only tailors what information is (or is not) conveyed, it supports advanced filtering and consolidation strategies such as for alarm management.
- *Human factors and ergonomics:* Just as process conditions are carefully controlled and manipulated to achieve desired outcomes, control rooms and operator station conditions must be adjustable to the preferences of individual operators, and be automatically changed in response to a process situation.
- *Integrated simulation environments*: The global airline industry boasts an enviable safety record, due in no small part to the extensive use of simulators in training its pilots. Should we provide any less for our process pilots? High fidelity simulator training is all about ensuring operator competence and instilling confidence, especially in situations seldom encountered in the course of routine operation.

The potential benefits of an integrated approach to operator effectiveness are essentially the flip sides of all the problems already attributed to less well equipped operators. All have to do with improved decision-making: when operator effectiveness rises, so do productivity, efficiency, asset utilization, safety, environmental compliance—and profits.

Integrated Information in Context

Imagine that with one click an operator can access any information required to make an informed decision—regardless of where the data resides. Or that a maintenance technician can access from her wireless tablet the commissioning displays, diagnostics and active work orders for the transmitter she is troubleshooting.

The most effective operators work in a seamless environment with vertical, horizontal as well as functional information integration. Vertical integration gives the operator access to all information relevant to plant operation such as production orders, production reports and financial performance. Horizontal integration gives the operator detailed access to all types of devices and all types of control

systems, independent of brand. Functional Integration makes functions located in separate systems, normally not related to automation, available seamlessly in the operator environment. Examples include traditionally disparate systems for managing plant power, maintenance, laboratory information and documents. The ability to integrate video, voice and other telecommunications systems directly into the operator's unified environment provides an especially powerful tool for collaborative problem solving.

The ease with which these integration tasks can be accomplished depends to a large degree on the plant's choice of automation and information management architecture. The infrastructure should function as a seamless middleware, allowing the easy creation of decision-support "mash-ups," that combine individual pieces of information on the fly, no matter where they may reside. The goal is to deliver all the information an operator needs to make a particular decision—and ideally nothing more.

Workplace layouts should be adjustable to individual users' preferences and needs with individualized menus, toolbar contents and display locations. Windows management functions such as safe areas and the pinning and stacking of priorities can help minimize operation errors by prioritizing the presentation of material. Navigation should be simple and independent of where the information is located.

Consolidated alarm and event lists, for example, should be presented without the operator needing to know what application or controller supplied the information. Implementations of standards in the area of display design (such as from the ASM Consortium, EEMUA and the ISA's 101 working group), also can help operators to perform more consistently and effectively.

Human Factors in the Control Room

Instead of being designed with operator performance in mind, many control centers, control rooms and operator stations are designed without respect to human factors. Incorrectly planned environments intended for 24x7 use often are depressing, unwelcoming and uncomfortable at best—and at worst create fatigue and boredom.

Operators' effectiveness is enhanced by optimal ergonomic and presentation technologies at the control console, including personalized climate controls, advanced keyboards with hotkeys, directional sound systems, integrated and adjustable lighting, and motorized/adjustable workstation configurations.

The larger control room layout should include a dedicated operations space that is free from distractions. A separate area for visitors should be provided so that non-essential personnel are kept out of the control area. A dedicated collaboration space should be provided for meetings and group troubleshooting, with A/V tied to control center visualization. Further, a relaxation area should be provided to help operators not actively engaged in operational duties to recharge without distracting on-duty personnel.

In addition to better decision-making by operators, this attention to human factors in the control room can help attract and retain new operators, reduce turn-over and even reduce workplace health issues.

Simulation Boosts Competence and Confidence

A closely integrated training environment makes it possible to train operators on simulators that behave essentially identically to actual plant systems, instilling confidence that they can respond correctly to abnormal situations when they arise. An integrated simulation environment also provides a platform for optimization studies and knowledge capture.

For a new plant, use of an operator training simulator can contribute to shorter initial start-up, enhanced operator performance as well as trip and incidence avoidance. It also allows the testing of operational procedures and the tweaking of display and control strategies before initial start-up, when changes are always easier and less risky to make.

Operator training simulators also are important to the effective operation of existing plants. Many high-reliability plants are having difficulty maintaining performance during turnarounds because workers deal with these procedures only infrequently. And the ongoing retirement of experienced operators has only made this situation worse.

While the direct benefit of using a simulator is difficult to quantify, a recent survey by the Electric Power Research Institute (EPRI) indicated an average yearly saving of about $4,500 per megawatt of generating capacity. These savings are attributed to reduced training costs, improvements in plant availability, fewer environmental excursions and reduced damage to equipment. A bit of quick math indicates a three-month payback for a typical power plant, and begs the question: in what situation would you *not* invest in a training simulator?
