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Contents

**Operator Effectiveness:
The Case for Investment 4**

It happens every day in thousands of plants around the world. Operators report to work, eager to contribute to their companies' success—but often find the deck stacked against them.

**Seamless Integration
Promotes Collaboration. 8**

Raw data, alarms and other inputs must be transformed into actionable information in context in real-time—easily interpreted in an integrated environment regardless of source.

**Putting the 'Human'
First in HMI Design 12**

The challenge for designers of human-machine interfaces remains a balancing act: How do you present operators with all the information they need, while excluding what they don't?


**Control Center Design Can
Boost Operator Performance 16**

Incorrectly planned control environments often are depressing, unwelcoming and uncomfortable at best—and at worst a recipe for operator fatigue and boredom.

**Simulator Training Boosts
Competence, Confidence 20**

'On-the-board' operator training on the real process does have real limitations—especially when it comes to dealing with abnormal situations that you hope the actual process never goes through.


OPERATOR EFFECTIVENESS: The Case for Investment



It happens every day in thousands of plants around the world. Operators report to work, eager to contribute to their companies' success—but often find the deck stacked against them.

In an all-too-typical operations center, human factors rank as afterthought at best, with little attention paid to traffic patterns, operator station ergonomics and even less to 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 act capably and confidently is responsible for an enormous loss of productivity, money, and even life and limb across



industry? Indeed, research indicates that nearly 80% of unscheduled 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* magazine and ABB across *Control's* global database of process automation professionals, respondents agreed that operators have an outsized potential to impact quality and economic performance metrics (see sidebar article).

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 has only ramped up the pressure in recent years.

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 green-field 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.

THE FOUR PILLARS OF OPERATOR EFFECTIVENESS

Fortunately, an array of best practices and technologies is available to help operators perform to their potential despite escalating complexity. 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.

ABB, the global leader in automation and power

technology, is at the forefront of this new way of thinking, bringing together the necessary technology and business practices as four essential disciplines, each of which is described in greater detail in the articles that follow:

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 supports situation awareness through how information is displayed as well as abnormal situation handling through advanced filtering and consolidation strategies.

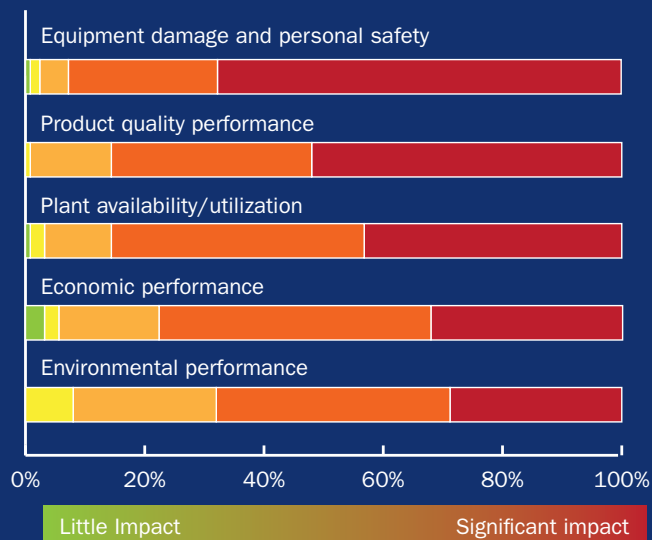
Human factors and ergonomics: Just as manufacturing processes are designed to be carefully controlled and manipulated to achieve desired outcomes, high-performance control rooms and operator stations must be designed from the beginning with operator performance in mind.

THE STATE OF OPERATOR EFFECTIVENESS

In order to gauge current industry views on operator effectiveness, *Control* together with ABB conducted in January 2012 a reader survey across *Control’s* email database of process automation professionals. Survey respondents acknowledged the potential for operators to significantly influence plant performance, as well as an ongoing need to implement measures that would make them more effective in their jobs. Other data from this exclusive study is included throughout this special report.

When asked to what extent better prepared operators could positively influence key performance metrics, respondents placed significant accountability in the hands of

Potential Operator Influence on Plant KPIs Is Enormous...

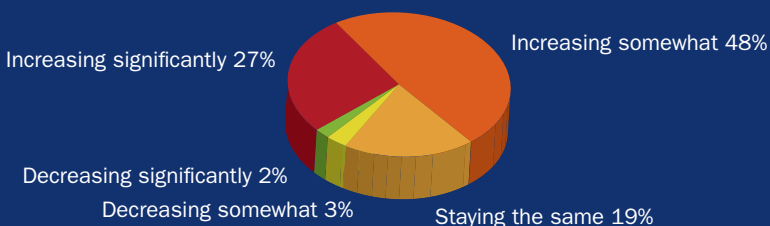


Integrated simulation environments: The global airline industry boasts an enviable safety record, due in no small part to the extensive use of training simulators. Should we provide any less for our process pilots? High fidelity simulator training is all about ensuring operator competence and instilling confidence, especially in situations seldom encountered in the course of routine operation. Integrated simulation environments further leverage the graphics and logic developed for the control system itself, providing a more realistic, easily maintained simulation environment.

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. ●



...Yet the Scope of Operator Responsibilities Continues to Increase



the operators. Operators not only have a big impact on availability, equipment damage and personnel safety, but can play a big role in quality, environmental and economic performance as well (chart), according to survey respondents. But an overwhelming majority of survey respondents also confirmed the increasing scope of board operator responsibilities, with more than three-fourths

indicating a growing workload (chart). This trend indicates an already urgent and growing need for companies to do all they can to make their operators more effective in their daily tasks. In terms of survey demographics, a total of 123 responses were received from a range of process industry verticals, including chemicals manufacturing (27%), mining, metals and

materials (11%), oil and gas production (10%), life sciences and pharmaceuticals (10%), electric power generation (10%), food and beverage manufacturing (9%), pulp and paper manufacturing (8%), petroleum refining (7%) water and wastewater treatment (5%) and engineering services (4%).

And while other world regions are represented in the study, the majority of respondents (85%) were from North America; 8% were from Europe, Middle East and Africa (EMEA); 6% from Asia; and 2% from South America. The majority of respondents' titles were engineering related (62%), with maintenance (9%), operations (9%), administration (7%), technician (7%) and unspecified (7%) titles also represented.

Seamless Integration Promotes Collaboration



When push really comes to shove, what operators most need to succeed is access to the information they need, when they need it—and ideally nothing more. Process upsets and other crises draw these priorities in stark relief: raw data, alarms and other inputs must be transformed into actionable information in context in real-time—easily viewed, listened to, or otherwise sensed and interpreted in an integrated environment regardless of source.

This includes traditional data, such as from the control system itself and secondary plant and business systems, as well as voice and video communication with field operators and other personnel. The challenge is to provide seamless access to these multiple sources of information, but at the same time not overload the operator with information that's irrelevant or data that's too granular.

ABB's approach to improving operator effectiveness through plant systems integration is based on the premise that an integrated operations environment, such as the company's System 800xA platform, must enable vertical, horizontal and functional information integration as well as seamless integration of collaboration and communication tools.

Vertical integration entails access to all information relevant to plant operation such as production orders, schedules and other business system information. Horizontal integration means access to information from other control systems and field devices, independent of vendor or vintage. Functional integration implies the availability of information from complementary plant



systems not directly related to automation, such as for managing safety, power, maintenance, laboratory information and documents. And the ability to seamlessly integrate video, voice and other telecommunications systems directly into the unified operations environment provides an especially powerful tool for collaborative problem solving—while minimizing operator distraction.

Further, the ease with which these integration tasks can be accomplished depends to a large degree on a plant's choice of automation and information management architecture. The infrastructure should function as a seamless middleware, allowing the creation of ad hoc reports and decision-support mash-ups that combine individual pieces of information no matter where they may reside. ABB's System 800xA makes this possible because it's built from the ground up on an object-oriented architecture that effectively separates all the thousands of physical and logical entities that make up a plant from the information that describes them.

INTEGRATION REDUCES ERRORS AND DELAYS

When it comes to boosting operator effectiveness, the integration of information from complementary plant systems reduces the risk of manual data entry errors and delays. For example, the seamless flow of sales order information into raw material purchasing, production planning and process control systems means more accurate planning as well as improvements in process stability and production output. A

delay of just one or two hours in reporting the quantities of ingredients consumed in one process step may mean that there isn't enough material for an upcoming batch. Handling these and other types of information in an integrated fashion means that all reporting is automatic, correct and instantaneous.

Process operators also require on-demand access to CAD drawings, user instructions and other plant documentation. During a process upset, a frantic search for a misplaced binder ranks high on the list of scenarios to be avoided. And once located, there's always the risk that the information is outdated and incorrect. Indeed, inability to access correct procedures or operating instructions has been cited as a contributing factor to a range of plant safety incidents.

But with the System 800xA's Aspect Object technology, calmly right-clicking a context menu immediately gives operators the correct documentation for the task at hand, such as instructions and drawings for a planned shutdown. A single version of the latest documentation is directly linked to the specific process object on the screen.

INTEGRATION ENABLES TEAM COLLABORATION

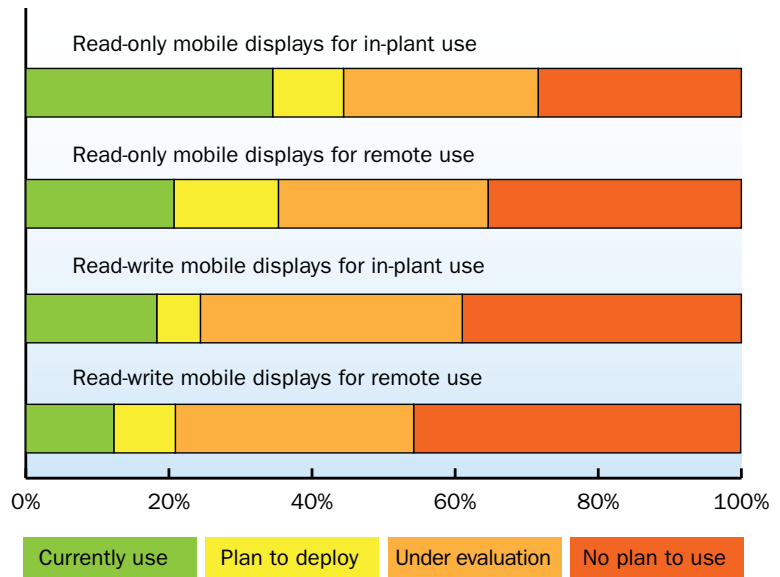
The direct integration of voice communication, public address and video systems in the ABB System 800xA environment enables more effective collaboration with other operators, field technicians, shift supervisors, maintenance staff and even offsite personnel—resulting in improved process stability, productivity and safety.

In their daily work, control room operators communicate extensively with other people in a variety of ways—through landlines, cell phones and walkie-talkies to name a few. But instead of having an assortment of communication tools lying on workstation desks, each of which requires the operator to take her eye off the board to initiate communication, 800xA allows operators to rely on the system to connect them to any person needed. In more critical situations, the system will see that preconfigured messages (translated into several languages if needed) are sent out as voice messages over the public address system. Equivalent typed messages also can be sent out at the push of a button.

Live video, too, plays a key role in today's plant operations, and a modern facility may have hundreds of cameras in use simultaneously. With ABB's approach to integrated video, any live feed is available from within the operations environment. Video feeds can be embedded in process displays, and images shared with other individuals in the plant or on the outside.

Another benefit to the System 800xA's object-oriented architecture is that a relatively simple, browser-based thin client can be used to seamlessly retrieve and display everything that the operator sees, as well as ad hoc dashboard, trend and other reports. Displays are available inside or outside of the plant facility, as long as a secure connection to the plant network exists. Called the cpmPlus Smart Client, this application provides intelligent data access and view-

CURRENT & PLANNED USE OF WIRELESS OPERATOR INTERFACES



A recent survey of *Control* readers indicates a range of evolving attitudes toward using wireless human-machine interface (HMI) devices to access and/or interact with plant data. (See p.7 for more information on the survey methodology and respondent demographics.)

ing functions to assist all levels of personnel—including operators—in making quick, informed decisions to improve overall plant performance. Among the configurable dashboards that can be easily deployed are trending and statistical process control charts, alarm and event notifications, and even a Microsoft Excel interface for exporting plant data.

POWER, SAFETY AND MAINTENANCE

While integration and collaboration's broad-ranging benefits carry into every corner of a process plant's performance, a closer look at the power of integration along three specific dimensions helps to illustrate integration's true potential to boost operator effectiveness, namely, in the integration of process automation with electri-

cal power, process safety and maintenance management tasks.

As a leading supplier of energy infrastructure, ABB is uniquely positioned to bring power management, substation automation, process electrification and process automation together in one integrated system. Having one common operating interface improves visibility for electrical and process operators, streamlining plant-wide operation and generating savings in downtime, maintenance, energy and personnel costs.

Operators enjoy a complete view of plant energy loads and are able to effectively balance availability and consumption. Common event and alarm lists on a millisecond level simplify and speed up trouble-shooting and maintenance work, resulting in reduced disturbances and downtime. Other applications enabled include load-shedding;

operators can safely—even automatically—trigger the shutdown of select processes in the case of a power supply shortage or to avoid a peak consumption penalty.

Improved visibility also allows the exploration of new energy saving opportunities and the enhancement of existing energy reduction programs. For example, an increase in power consumption by a unit or an area can indicate equipment malfunction or wear. In fact, the ARC Advisory Group has reported that simply increasing visibility into energy consumption can lead to as much as a 10% reduction in use.

Safety systems that are entirely separated from process control mean that operators often are left in the dark when a safety circuit alarm is triggered. System 800xA High Integrity provides an unprecedented level of integration with the operations environment, allowing operators to enjoy a familiar, all-in-one process overview with full visualization and common alarm lists that improve the understanding of process events and reduce risk. An integrated environment also can help to validate the accuracy and function of safety instrumentation against instrumentation used for process control.

Similarly, the ability of operators to easily submit fault reports from an embedded condition monitoring application to an integrated computerized maintenance management system (CMMS) speeds repairs, since maintenance staff receives more timely input about what corrective measures may be needed. Furthermore, since the equipment information is automatically filled in, manual errors are drastically reduced and much time is saved. The fault report is available for the maintenance department at the very same moment the operator presses submit, streamlining collaboration and improving the ability to address an anomaly before it affects production. ●





Putting the ‘Human’ First in HMI Design

While the first distributed control system (DCS) represented a step-change in process control capabilities, it was a mixed bag at best for the process operator.

Gone was his familiar wall-full of analog electronic controllers, immediately recognizable as all “lined out” when the plant was running properly. Instead, he peered with reduced visibility through a much smaller CRT, toggling among simulated controller faceplate displays and process graphics peppered with alphanumeric data, granular detail sometimes obscuring the big picture view of overall process conditions. Instead of encouraging collaboration like the old wall did, others had to crowd over his shoulder just to see what was going on. And if something actually did go wrong, cascades of too many alarms (that now came “free” with every measurement) made it even more difficult to determine just what was really causing the upset—and what corrective action to take.

Today, the amount of raw data available to operators continues to explode even as the scope of operator responsibilities increases. Now as then, the challenge for designers of human-machine interfaces (HMIs) remains a balancing act: How do you make sure that operators are presented with all the information they need to make a timely decision, while excluding what they don’t? How do you make deeper levels of process and plant data readily available, but prevent the obscuration of critical alerts? How do you make navigation of integrated information from the process control system—as well as dozens of complementary plant information systems—intuitive, seamless and context-sensitive?

TOWARD ‘HIGH-PERFORMANCE’ HMI

ABB’s approach to improving operator effectiveness through high-performance HMI includes a range of technologies and industry best practices implemented in its System 800xA Operations environment.



All are focused on boosting operators' situation awareness—and their correct and effective response to abnormal conditions. Better situation awareness can reduce the time it takes plant operators to complete required tasks during a process upset, and even allow operators to detect and intercept unfavorable process trends before alarm bells sound.

System 800xA allows customization based on users' preferences and needs with individualized menus, toolbar contents and display locations. Custom, role-dependent workplaces present information consistent with individual work processes and appear automatically on user log-in.

Windows management functions such as safe areas and the pinning and stacking of priorities help manage multiple process views. A new trend display always opens in the same window as the previous, and an alarm list is never covered by another view. As well as saving time and minimizing stress, this no-surprises view-handling simplifies the use of multiple monitors so that operators

can supervise and control larger process areas with the same efficiency and safety. Within the displays themselves, information can be mixed and matched regardless of source.

Today's System 800xA process graphics not only provide graphics builders with better engineering tools, they also give process operators a much-improved image to view. True vector graphics, for example, enable scaling with maintained resolution. This effect is especially appreciated when operators need to scale-down graphic image windows to fit several on one screen.

Through the system's underlying Object and Aspect technology, the 800xA provides intuitive and easy access to all integrated information through a simple right mouse-click. Consistent, one-click navigation gives process operators more time to act: instead of spending time and energy looking for information, they can concentrate on informed decision-making and can share data with colleagues and field operators.

TRENDS ANALYSIS AND ALARM MANAGEMENT

Recent performance visualization is yet another System 800xA feature that improves operator insight. This HMI function displays the recent performance data of an object right next to the object graphic and its current status. Having recent operating values side-by-side with real-time status can alert operators to deviations before they develop into something more serious. Recent performance graphics can be shown at all times and for all objects — operators don't have to call up dedicated trend display windows.

Further, System 800xA provides support for the implementation of high-performance alarm-management strategies with features such as alarm grouping, alarm shelving (operator-driven alarm suppression) and alarm hiding (condition-based alarm suppression). "Alarm Response" is an 800xA feature that allows up to four relevant operator displays to be invoked by simply clicking on an alarm in an alarm list. These displays should be selected based on operator best practices and can be configured consistently across the entire system, or individually on an instance or single tag object. This functionality is designed to give the operator a contextual "head start" on solving a problem regardless of his or her experience level. These features reduce the number of nuisance and non-critical alarms and so help end users meet or exceed current guidelines and standards such as those from

Europe's Engineering Equipment and Materials Users Assn. (EEMUA) and the International Society for Automation (ISA).

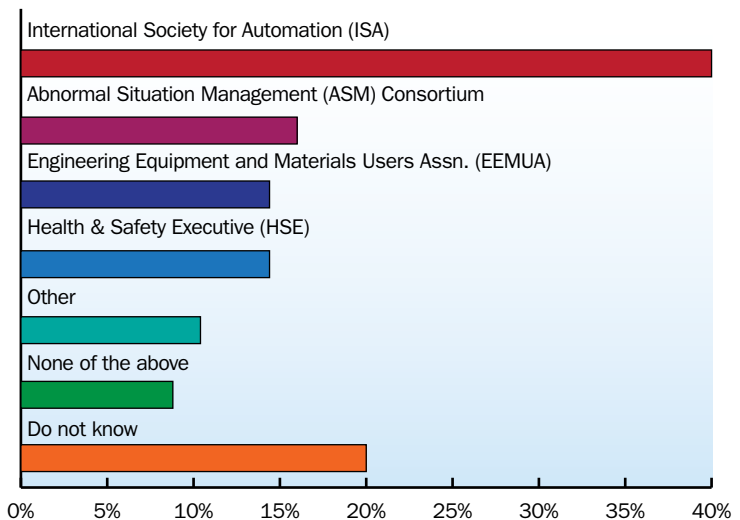
ABB's alarm management is fully built into System 800xA, which improves navigation, analysis and handling; it also costs much less than running and maintaining a standalone or integrated alarm management system. Without a separate system to distract them, operators can devote more time to running a safe and efficient process. Plus, the operator need only point to any alarm list in the system to generate alarm performance metrics—no rules files, parsing of data or connecting of OPC interfaces.

And because every relevant fact and event is accessible in

one system, operators get consolidated time-stamped alarm lists that include information from power systems, safety systems and all controllers irrespective of brand or supplier. This all leads to an improved overview of what has happened in the process (and in exactly what order) plus what is happening right now. Troubleshooting is faster and more effective.

System 800xA also gives operators full insight into current alarm management key performance indicators (KPIs) including the 20 most-frequent alarms, 20 longest-standing alarms, average time to acknowledge, and alarm priority distributions. Furthermore, these calculations are presented as easy-to-understand graphics, helping users identify

HMI GUIDELINES MOST OFTEN USED



Respondents to a recent survey of *Control* readers (see p.7 for more information and demographics) report using a broad range of industry standards to guide their HMI development efforts. The International Society of Automation's guidelines were most widely cited, reflecting the preponderance of U.S. respondents in the survey sample, but European standards also ranked highly. The reliance on internal standards and guidelines for HMI development also was mentioned by a number of respondents.

troublesome alarms and address—once and for all—underlying process problems.

Of course, the mere possession of tools does not a mechanic make. To that end, ABB provides a range of Consulting Services—from help implementing alarm management strategies to educational programs on how to run successful alarm management programs and projects. The company’s “packaged” services are designed to be purchased with an 800xA license and provide continued training on the system’s extended functionality and possible ways to implement them. This relieves the initiative burden from the end user, and sets them up for success. ●



Control Center Design Can Boost Operator Performance

The control room is no less than the nerve center of process performance, the place where daily decision-making affects corporate goals of operational excellence and a high return on plant assets. So why are many control centers and operator stations designed without respect to human factors? Indeed, incorrectly planned environments intended for around-the-clock use often are depressing, unwelcoming and uncomfortable at best—and at worst a recipe for operator fatigue and boredom.

Conversely, disciplined attention to human factors and ergonomics in the control room can not only boost operator effectiveness, but signal to operations staff that they are respected contributors to the organization's goals. From the process graphics they view to the ways they communicate, operators expect—and deserve—to work in an environment that acknowledges this important role, and to be equipped with the tools they need to help the organization succeed. Attention to human factors in the control room can also help attract and retain new operators, reduce turn-over and even reduce workplace health issues.





ABB has a long history of involvement with human factors and ergonomic research, and its operator effectiveness approach is designed to deliver the best and most efficient control room environment possible today. By tackling not only the operator console and control room, but the entire operations center as well, ABB is working to enable greater productivity and new levels of collaboration in plants around the world.

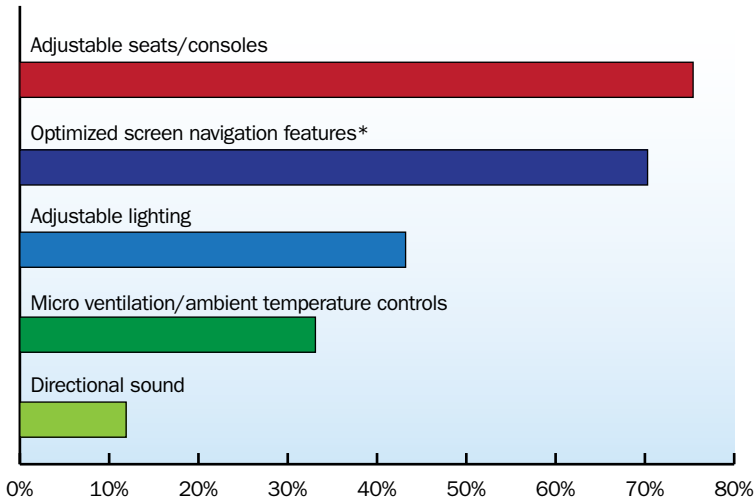
The cornerstone of ABB's operator effectiveness offering is its Extended Operator Workplace (EOW). Developed in conjunction with ergonomics specialist CGM, the EOW is essentially an ergonomic visualization and communication solution for operators. From the ground up, it's designed to support pro-active responsiveness, interaction and collaboration.

AT THE OPERATIONS CONSOLE

Just as process conditions are carefully controlled and manipulated to achieve desired outcomes, operator station conditions must be adjustable to the preferences of individual operators, and even be automatically changed in response to a process situation.

As well as smaller, personal screens, EOW operators have at their disposal large-screen overview displays designed to complement traditional back-wall display technologies. By not having to share a large display with others, operators can arrange graphics for an optimal view of the process under their control. Meanwhile, operators can readily show any information relevant to any situation to anyone they choose — either in the control room or elsewhere. This facilitates collaborative problem solving by ensuring that key personnel groups always have a clear view of what is happening, and can see what needs to be done.

ERGONOMIC FEATURES IN CURRENT USE

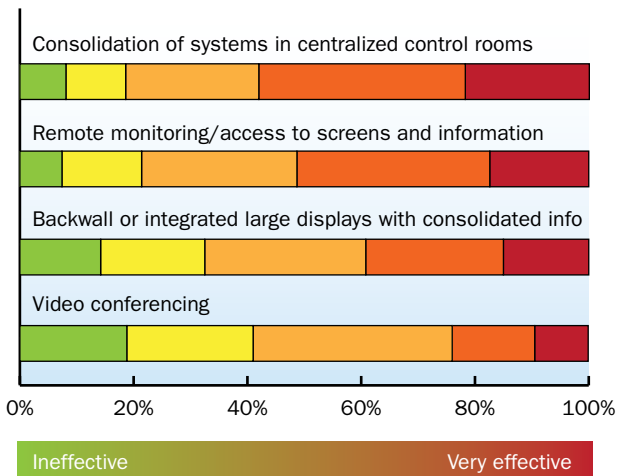


In a recent survey sponsored by ABB, *Control* readers were asked what ergonomic features currently are used in their plants' control room operator stations. Adjustable seating and configurable navigational keys were the only features used by a majority of respondents; climate controls and directional sound were used by a relative few.

* Including configurable short-cut keys, single keyboards for multi-screen displays, etc.

See p.7 for more details on survey respondent demographics.

PERCEIVED EFFECTIVENESS OF COLLABORATION TECHNOLOGIES



Control readers rank the consolidation of systems in centralized control rooms as well as remote access to operations data as the most effective tools for enhancing collaboration. Large back-wall displays and video conferencing are viewed as less effective.

The Advanced Operator Keyboard features hotkeys, digitally configured and labeled, for easily navigating among three or four different monitor clients. The motorized overview unit includes a directional sound system as well as a high frequency dimmable lighting system. The console has a live video camera system with speaker system for public announcements. Micro ventilation capabilities allow each operator to personally adjust ambient temperature conditions. Further, the EOW can include context-sensitive lighting sidewalls and ceiling tiles that dynamically reflect plant conditions: when ambient lighting shifts from green to red, non-essential personnel get the hint that the process needs the operator's undivided attention.

IN THE EXTENDED CONTROL ROOM

In ABB's view of plant operations, the whole control infrastructure should enhance operator performance via improved information flow and collaboration. The company's attention to operator well-being and efficiency thus extends beyond the control room walls to encompass the entire operations center.

The larger operations center 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.

The System 800xA/EOW combination can even save on control room real estate. Because operators always have personalized, interactive displays close at hand, the need for huge, full-wall screens can be reduced or eliminated. Directional sound, which targets only the operator at a specific console, means that they can sit closer to one another yet still enjoy a quiet workplace free from distraction. Compared with many older control room solutions, floor space requirements can be cut by a third or more. In any case, control center designers need to consider how their decisions impact operator performance early in the overall process. ●



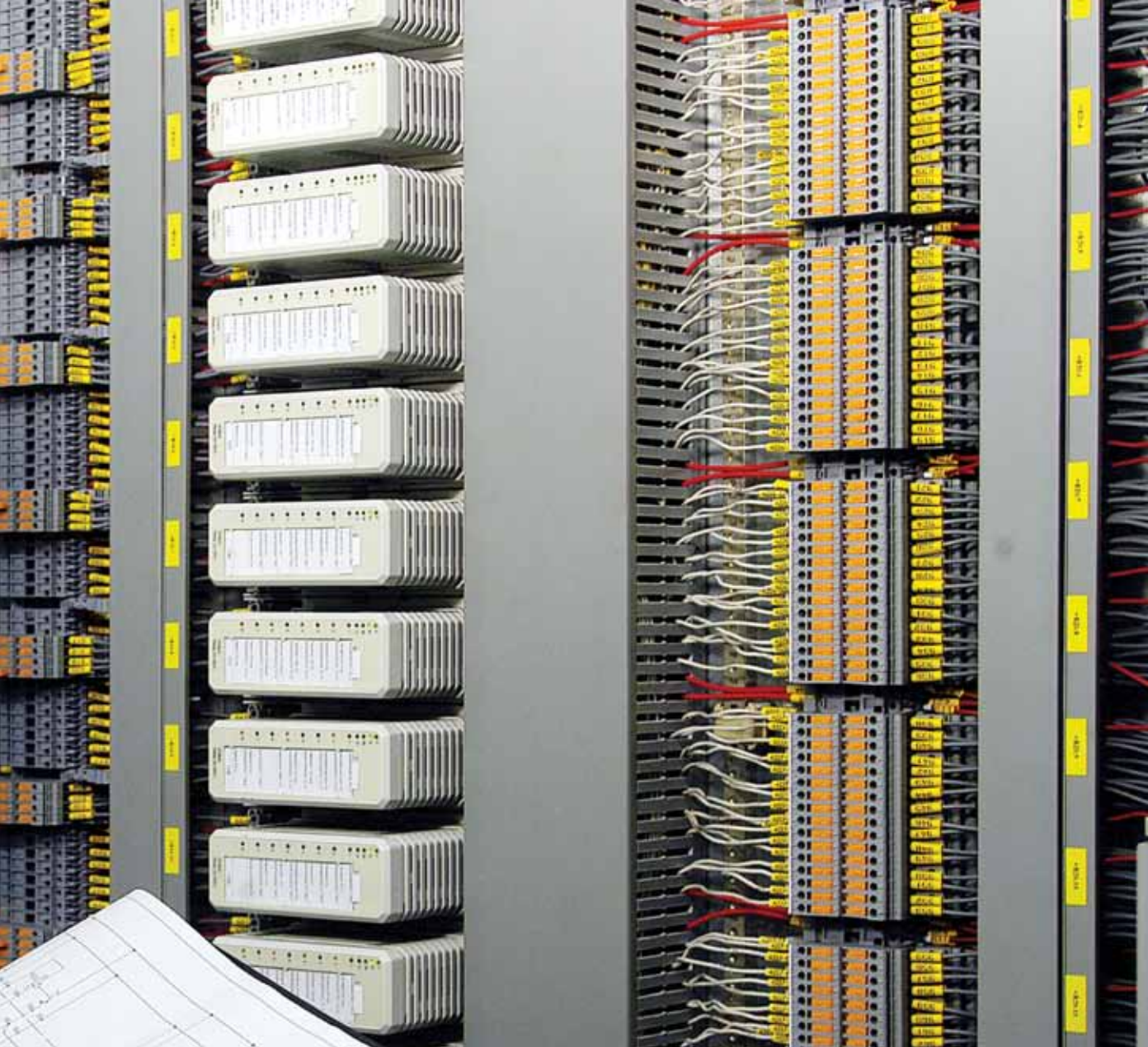


Simulator Training Boosts Competence, Confidence

Your most seasoned operators are an indispensable source of operational insight. As such, their role in orienting new operators to an unfamiliar process is not to be underestimated. Indeed, “on-the-board” training with more experienced operators remains the dominant methodology for operator training used in the process industries today (see figure).

But training on the real process does have real

limitations—especially when it comes to dealing with abnormal situations that you hope the actual process never goes through. The same goes for occasional planned activities, such as plant shutdowns and start-ups, which today happen increasingly infrequently as companies push for ever higher asset utilization rates. And the ongoing retirement of experienced operators has only made this situation worse.



INTEGRATION KEY TO REALISM

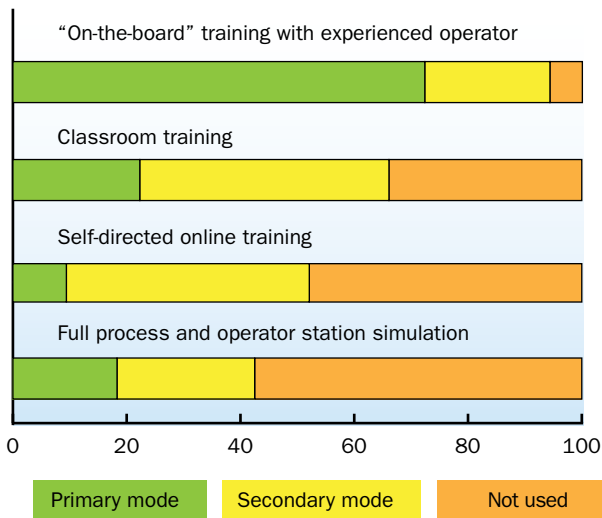
Like the flight simulators airlines use to train pilots in routine tasks and not-so-routine eventualities, high fidelity process simulators are used by a growing number of process manufacturers to ensure operator competence and to instill confidence in dealing with both the planned and unexpected. A training platform that is closely integrated with a plant's operations platform makes it possible to closely replicate process behavior and response within a safe, simulated environment.

High resolution training simulators present an added benefit in that new ways of controlling the process can be shaken down prior to implementa-

tion. New code, new control scenarios and new approaches to user interface design can all be tested and tweaked in a realistic environment a step removed from the actual process.

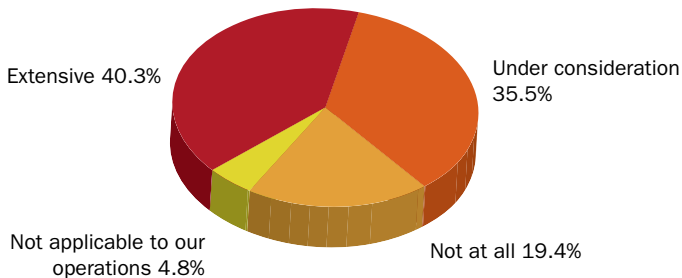
Better trained operators can help increase overall plant safety, reduce start-up time as well as the number of unplanned shutdowns. With a simulator, process operators and instrument technicians can learn to master the process in a safe and realistic environment. A simulator is also a powerful tool for engineering testing and optimization studies to improve productivity and energy savings. Trained operators and tested process control result in higher returns as both product quality and productivity are improved.

OPERATOR TRAINING METHODOLOGIES



"On-the-board" training with more experienced operators remains the dominant operator training methodology, outranking classroom instruction, self-directed online courses and the use of process simulators. While the importance of on-the-board and classroom training is not to be minimized, research also shows that the use of high definition simulators in the training of operators to cope with infrequently encountered situations has tremendous upside in making them more confident and effective.

EXTENT OF PROCEDURAL AUTOMATION IMPLEMENTATION



Another way to better deal with infrequent manual tasks such as start-ups and shutdowns is through the implementation of procedural automation logic, as supported by the ABB System 800xA. But in *Control's* recent survey of process automation professionals, only 40% of respondents reported using this approach. In the survey, low volume, batch operations were most often cited as reasons for "not applicable to our operations." See p.7 for more information on the study.

Tight integration of a simulator with the actual plant control system leads to the most faithful representation of process performance—both initially and over time. The ABB System 800xA Simulator, for example, uses the same engineering data, visualization and control logic as the System 800xA environment, but connected to a dynamic process model. This means that the simulation environment more precisely reflects the control system's real-world performance, and is much easier to maintain as changes are made. In addition to being able to simulate the various functions of the control system, it supports essential simulator functions for training purposes, including the ability to set initial conditions, capture snap shots and freeze/resume process dynamics.

SIMULATION'S REAL ROI

For a new plant, use of an operator training simulator can contribute to shorter initial start-up, better operator performance and help to prevent trips and incidents. It 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. Further, an integrated simulation environment provides a platform for optimization studies and knowledge capture.

And while the direct benefit of using a training 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 little bit of math indicates a three-month payback for the typical power generation facility and begs the question: In what scenario would you not invest in a training simulator? ●





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