Human Centered Design

Supports Improved Job Performance

Putting it as simply as possible, application of new design principles in capacity-assurance technologies is boosting usability and productivity.

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It's a fact of life. Tools of the capacity-assurance trade have grown increasingly complex over the years. Advanced hand-held field communicators, vibration analyzers and predictive maintenance software provide a wonderful means for managing automation systems and the assets they control in order to prevent breakdowns and avoid unexpected shutdowns. At the same time, it's often been difficult for users to understand—*and respond appropriately in a timely manner to*—ever-growing streams of information that come out of many advanced technologies. The application of new, human centered design techniques to these tools, though, is changing all that. Applying such principles in the tools' design can lead to easier commissioning, configuring and maintaining of plant assets than ever before.

Identifying and delivering the essentials

The human centered design concept is aimed at identifying the information most needed by plant personnel and getting it to them in an easy-to-use format. This requires understanding the tasks frequently performed by end-users and presenting helpful information in a consistent fashion.

Years of professional analysis of industry work practices show that personnel are often overwhelmed with multiple systems and user interfaces, making it difficult to find critical information, especially while on a job in the field. The need for easier access to the diagnostics available in smart field instrumentation was apparent, along with clear presentation of that information and reliable troubleshooting procedures to follow in case trouble is indicated.

Human centered solutions now

New device dashboards. . .

Emerson's commitment to human centered design and reducing product complexity (see Sidebars) is evident in intuitively designed interfaces known as Device Dashboards for more than 50 field devices. The new screens for our AMS™ Suite: Intelligent Device Manager PdM software give workers an instant view of the critical items they need to evaluate, diagnose, and configure each device. Expert guidance is also provided to streamline the most important and frequently performed tasks by plant operations, engineering and maintenance personnel.

Powered by enhanced Electronic Device Description Language (EDDL), these human-centric dashboards function independent of communications protocols such as HART®, WirelessHART™ and FOUNDATION™ fieldbus. Their role is simple: Provide a framework for the uniform display of device information to make complex information easier to understand.

Creating the basic structure for the new graphical interface (shown in Fig. 1) was a major step in implementing the human centered design concept to aid maintenance personnel. Following identification of the most common

tasks performed by technicians in the field, application of human centered design principles led to screen displays that provide information on 80% of those common tasks by telling if the device is working (or not), if alerts are present and if the device is communicating and providing access to calibration functions. The information presented is simple to understand—*with no confusing technical jargon to interpret.*

The design of the new dashboards features noticeable improvements in the navigation structure, which has been revamped to group information and functions into three primary areas: "Overview," "Configure" or "Service Tools" (depending on the job at hand). When first checking out a device, a technician will see the "Overview" screen that contains the "Status" condition of the selected device. If the status displays as "*Good*," he/she knows there is no problem with that device, but can also check the gauges in the "Primary Purpose Variables" area to confirm that the device is operational. A "Shortcuts" section provides more information and links to commonly used device capabilities, such as "Calibration" methods.

If there is a problem (as shown in Fig. 2), the word "*Maintenance*" will appear in the "Device" box, along with a button for further evaluation. This will provide guidance for further action to determine the nature of the problem and whether the device needs to be replaced or repaired. In this case, the temperature transmitter indicates that it automatically switched to a back-up sensor when the primary sensor failed—*and a pop-up window is available with problem-solving instructions.*

Revised device descriptions. . .

Every smart field device stores diagnostics, but not all devices have the same information—*which may cause wildly different displays depending on the Device Descriptions (DD) provided by the manufacturer.* Device Descriptions are essentially files of field device attributes residing in a host (such as Emerson's AMS Device

The Time Has Come…

"*In evaluating how people use maintenance tools, we found a common problem,*" says Peter Zornio, chief strategic officer at Emerson. "*The routine steps required by plant personnel to work through automation system issues were often cumbersome and confusing, and the interfaces were very product and feature oriented instead of task-centric. They assumed the user had a detailed knowledge of the product. Based on the inputs of many process-industry workers, we have initiated an* across-the-board overhaul of our products intended to improve the speed and accuracy of their job performance and to increase each individual's productivity."

According to Zornio, by putting increased emphasis on ease-of-use, Emerson can help its customers meet the demographic challenge as knowledgeable maintenance veterans retire and their places are taken by less experienced personnel. "The time has come," he says, "for technology to begin serving people."
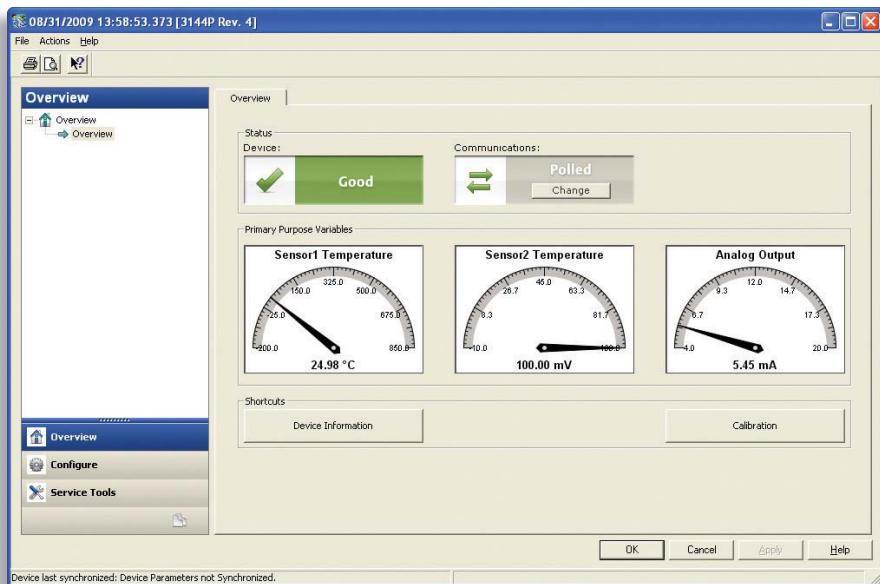
Fig. 1. In the basic structure for the new graphical interface, application of human centered design principles led to screen displays that provide information on 80% of the most common tasks performed by technicians in the field. These displays tell if a device is working (or not), if alerts are present and if the device is communicating and providing access to calibration functions, with no confusing technical jargon to interpret.
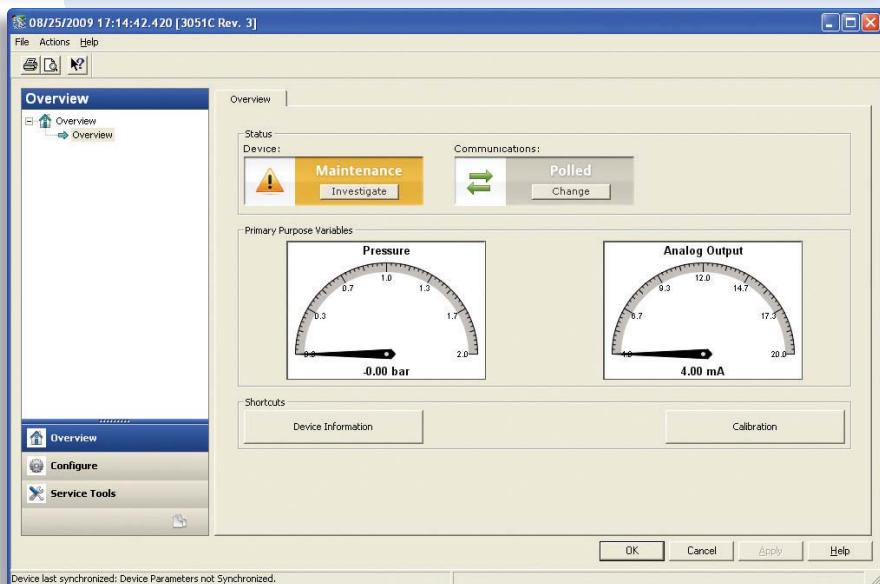

Fig. 2. If there is a problem, the word "Maintenance" appears in the "Device" box, along with a button for further evaluation. This will provide guidance for further action to determine the nature of the problem and if repair or replacement is necessary. A pop-up window leads to problem-solving instructions.

Manager PdM software). These DDs vary from manufacturer to manufacturer with respect to how information is extracted and presented. As a result, multiple, often confusing instrument displays confront plant maintenance personnel.

Revising the DDs on Emerson field devices has been another part of implementing the human centered design concept. This is especially important in giving the same "look" or appearance to the screens for HART and fieldbus devices. This type of technical achievement will help field personnel be more productive because they can use the same procedures to manage devices regardless of communication protocol.

The condition of any field device can be displayed in this way as long as the DD is written according to the guidelines. For us, the principal focus has been to update DDs of smart devices including Rosemount, Fisher, Micro Motion, and CSI branded products. A great deal of effort has gone into this project, and the DDs of the most frequently used devices have already been rewritten and stored in the latest versions of AMS™ Device Manager and the DeltaV™ and Ovation™ digital automation system hosts–*and more are underway.*

The road to human centered design

Moving in the direction of human centered design has been a natural and very logical step for our company. Although they invested almost exclusively on technological development over the years, Emerson officials also recognized the need to focus on the people who use those technologies and determine ways to accommodate their needs.

Having acknowledged the importance of human centered design and made the strategic decision to support its application, company management initiated a relationship with Carnegie Mellon University in Pittsburgh, PA—*specifically the university's Human Computer Interaction Institute, a recognized leader in the study of how humans interact with technology.* Dave Parsons, who

The Human Centered Design Institute

Making process control technology easier to use. . .

Emerson's new Human Centered Design Institute was established after more than five years of work-practice analysis, new product development re-engineering and organizational training. The Institute's goal is to bring about a significant improvement in ease-of-use and workforce productivity products that are reliable, compatible and cost-effective. User work practices and improved task completion (usability or workforce productivity) are at the heart of every new Emerson product.

Duane Toavs, director of the Human Centered Design Institute, notes that the corporation had been incubating this HCD process since the early days of its Smart Wireless designs, some years ago. "Collaborating with Carnegie Mellon University helped us set direction and get started, leading to our staffing of this Human Centered Design Institute that spans design teams for all of our brands," he says.

Human Centered Design is a multi-disciplined science. User Personas and Stakeholder Maps, along with intensive observational research, usability testing, and heuristics analysis are key elements of the practice. They provide the insight to blend the disciplines of industrial, graphical and human interface design into products that are easier to use. It's not as complicated as it sounds.

Human Centered Design expert that he is, Toavs quickly (and succinctly) cuts to the chase: "Getting inside the heads of users, including how they interface with each other and our technologies, is the foundation of Human Centered Design."

has extensive human interface design experience, joined Emerson to initiate a new human centered design capability. This led to the study of instrument technician work practices and a greater understanding of their needs.

The first project was development of the new dashboard structure, which Parsons called a "significant cultural change because for once technology did not drive the design of a man-machine interface. Basically, we restructured the underlying information architecture so the presentation makes sense to users."

Now, Emerson has established the Human Centered Design (HCD) Institute with a simple goal of making products that aren't just reliable, compatible and cost-effective; they can also improve usability and increase productivity.

"Carnegie Mellon helped us set direction and get started," say Duane Toavs, director of the HCD Institute. "We have a corporate mandate to interact with the design teams for all of our brands, incorporating human centered design practices in everything they do. We have an ongoing research challenge that we expect will make a profound difference in how people accomplish their tasks when using our technologies."

Design and testing

During the dashboard project, human centered designers worked with marketing personnel and technologists to create prototype Device Dashboard screens for several of Emerson's most popular devices, including pressure and temperature transmitters and digital valve controllers. The conceptual dashboards were then introduced to many customers through usability testing to evaluate the product's straightforwardness of use. This technique helped determine which designs were most helpful to users in completing common maintenance tasks easily and in minimum time.

Usability testing differs from other methods of customer review—*such as market research*—because it shows how efficiently users are able to complete tasks instead of relying exclusively on asking for opinions. Usability testing takes customer opinions into account, but is more concerned with comparing what test participants *do* than what they *say*. This is an important distinction; a participant might remark that he/she likes the way the screen looks, but if the task could not be completed, the visually appealing screen might actually be hard to use.

Usability testing was conducted in a controlled setting with the tests repeated in the same way in order to obtain valid comparisons of multiple users. The data gathered are both quantitative, i.e. task completion rates or the amount of time users spent on certain tasks, and qualitative, including emotional responses, opinions, likes, and dislikes. Usability testing also takes into account the backgrounds and relative levels of experience of the users, and it is important to have a mix of user backgrounds. Video and audio recordings made during usability test sessions were reviewed by design and development staff to pick up anything they might not have observed during a session. *(Editor's Note: A significant round of usability testing was conducted with visitors to the Emerson Exchange in Orlando, FL, in October 2009.)*

Going forward

So far, the focus of the HCD Institute has been on the presentation of device information, but revision of the Device Dashboards is just the beginning of Emerson's work in terms of human centered design. Going forward, this concept will be applied to AMS Suite and the DeltaV and Ovation automation systems with the intention of making every product more intuitive, more specific to the role of each type of user and, overall, simpler to use. **MT**

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