CONTROL

MOBILITY RISES ABOVE

Soaring freedom is inspiring users to expand their range—and even to take flight.

SALARY SURVEY

COOLING SYSTEM ENERGY EFFICIENCY

HYDROGEN MASS FLOW

MODEL PREDICTIVE VS PID

IF you can't see the forest for all the trees, it's time get up above those trees.

Because the need to know what's going on in process applications always demands more data and finer resolution from more places, one useful indicator just sparks the desire for more. That's why, after process control engineers and other plant-floor professionals gain mobile tools and software, they still want to accelerate and diversify their capabilities even further, and extend them to new locations and applications.

"We had one user with a telescope pointed at a level instrument on an elevated water tower across town, which he used regularly until we added a supervisory control and data acquisition (SCADA) system and radio," says Robert Touchton, chief design officer at MR Systems (www.mrsystems.com), a CSIA-certified system integrator in Norcross, Ga. "He even kept the telescope for awhile during the transition period."

Similarly, when human-machine interface

(HMI) and SCADA systems gained Ethernet and Internet networking that let them move out of the control room, and bring data in and send instructions out via handheld interfaces, tablet PCs and smart phones, it was logical and probably inevitable that they'd keep going. Recently, they've been going beyond fixed wireless devices to take to the skies with multi-rotor drones, also known as unmanned aerial vehicles (UAV), which are typically equipped with cameras, video recorders, laser or radar measuring instruments, and other support devices.

"We use drones because they can give us more information about sites," says MR's Touchton. "We'd already been doing 3D renderings of facilities, but drones can add a lot of data because many water/wastewater plants don't have any aerial pictures, which can help them orient and place equipment during design and installation, or show, for example, where special mounting brackets need to be installed."

Information on the move

In the past, if the proverbial mountain of data couldn't come to its users, then they'd have to go to the information. However, some recent mobility solutions are loosening up the constraints of that old reality, and just as often putting "wheels" on data and bringing information back to users.

"Mobility can be transformative because it gives more data to the right individuals, brings in transparency and visibility to show what's going on, lets managers see from a high level how efficiently their operations and facilities are running, and lets users interact with each other more effectively," says John Lee, manager of the Manufacturing Systems and Solutions division at Matrix Technologies (www.matrixti.com), a CSIA-certified system integrator, this time in Maumee, Ohio. "Mobility can assist maintenance rounds, data collection and commissioning. Where users previously gathered information on Excel spreadsheets and sampled, audited and validated it, mobile

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by Jim Montague

Defined, tailored, protected mobility

Eric Lauber, project engineer at Matrix Technologies (www.matrixti.com), a CSIA-certified system integrator in Maumee, Ohio, reports that, "Mobility means different things. Within a plant, it can mean not being tied to a particular station, and being able to move around. Or, it can mean not being in a plant at all, and accessing applications via tablet PCs and mobile phones off-premises. More recently, some of those tablets can be rated for Class I, Div. 2 safety environments, or comply with non-intrinsically safe (IS) requirements, which are often needed in food processing and petrochemical facilities. The point is, each situation is unique, and we have to ask questions to learn what each one needs."

Before buying and installing mobility devices, Lauber explains, it's important for users to ask and answer several questions:
- In what operational area are mobile devices going to be used?
- What restrictions exist in those areas?
- What safety levels are required?
- How durable must mobile devices be to be viable in those settings?
- If durability is unavoidably limited, how many spare devices will likely be needed?

"If you're going to use mobile devices in tank fields and other outdoor applications, they'll also have to deal with inclement weather and need protection," says John Lee, department manager of the Manufacturing Systems and Solutions division at Matrix. "These are the same questions we have to answer for cabinets, panels, electronic components and any other equipment in those environments."

Lauber explains, "It may turn out that a mobile device requires a hot work permit to be used. In these scenarios, its use must be treated like welding or similar actions. Some recent consumer devices, like the Galaxy Note 7 mobile phone, are known to catch fire, so devices need to be tested and certified for use in industrial areas."

Lee adds that Matrix has always interviewed clients and onsite stakeholders about their business needs, pain points and what they're trying to accomplish before trying to standardize their work processes and further digitize their applications, and that mobility is a logical add-on to this process.

"If a customer wants to start using iPads, then we also talk about security because home use is different than the proper execution, requirements, solutions, safety and protecting intellectual property needed in manufacturing," he explains. "If staff wants to take tablet PCs home from work, is critical information going with it? There's a lot to be gained with mobility, but users have to follow sensible procedures and best practices."

devices let them collect and analyze data much closer to real-time for almost immediate feedback and distribution to other users. In one large refinery where we worked with thousands of instruments, mobility enabled better maintenance accuracy, less errors due to manual entry, and immediate and thorough data tracking."

To aid these efforts, Lee reports that Matrix produces software for tablet PCs and other mobile tools that queries operators for their one- or four-hour checks, data reads and log entries for their processes, and asks dynamic questions based on the different shifts peculiar to each application. "As production workflows get more digitized, mobility can help enforce them, and make sure that standardized, required steps and action sequences are performed, tracked and followed up," he adds. "This also gives users better analytics about operations per day, overall process performance, or how long future installations or other changes will take."

Eric Lauber, project engineer at Matrix, adds that mobile interfaces also make it easier for users to employ metadata—or information about other data collections—to improve their decisions. "Previously, we might know how many process inspections were made for scheduling and staffing," he says. "But now, we access central data repositories with mobile devices, put that data into historical and future contexts, compare the performance of different sequences and teams, gain insights and find bottlenecks we couldn't expect to know about before, and make adjustments for individual applications and clients."

Mariana Dionisio, product manager for DeltaV Mobile at Emerson Automation Solutions, adds that, "From surveying our end users, about half use mobile devices to access process or asset data, and that's why we've developed mobile solutions, including apps for viewing data for operations, reliability and lifecycle health. Just this past month, we introduced DeltaV Mobile that gives users read-only access to operations data. It leverages existing DeltaV configurations to securely provide the same data that's viewable on operator workstations, such as alarms, real-time data, historical trends and more, but displayed on mobile screens. Getting data securely 24/7 with DeltaV Mobile on any mobile device lets users anticipate changes, become aware of, and respond faster to abnormal situations. Users may also have expertise gaps onsite,

and DeltaV Mobile via VPN or WiFi lets them connect engineers and operators from multiple sites with remote experts to close those gaps and improve decision making."

HMIs everywhere

Not surprisingly, mobility these days often means proliferating interfaces in new sizes and formats, putting more cameras, monitors and eyeballs in the field or close to it, and sometimes supplementing displays with virtual-and/or augmented-reality overlays containing useful support information.

To manage increasing demands on their water/wastewater, transportation, environmental and renewable power systems more efficiently, Carson City Public Works (www.carson. org/government/departments-g-z/public-works) recently deployed several mobile and virtualization technologies. The utility daily purifies and delivers more than 22 million gallons of water and recycles 6.9 million gallons of wastewater, controls solar plants that generate 748,000 kwh per year, and manages the municipality's truck fleet and traffic signals.

New technologies adopted include iPads and smart phones that allow the utility's operators and managers to increase their remote monitoring capabilities across three Nevada counties. The devices were integrated with Wonderware SCADA software that Carson City has used since 1992, and with its Wonderware InTouch HMI software, both from Schneider Electric (www.schneider-electric.com).

Remote operations were brought to the mobile interfaces by implementing the Wonderware Mobile Reporting application with SmartGlance software, which makes their information, key performance indicators (KPIs) and Wonderware Historian data easy to read and manipulate using smart phone screen navigation (Figure 1).

"SmartGlance gives our staff instant access to KPIs and process information on their iPads and smart phones, which increases situational awareness and allows us to be more efficient," says Darren Schulz, deputy director at Carson City Public Works.

James Jacklett, electrical/signal supervisor at Carson City Public Works, adds that, "Integrating with Wonderware also gives us real-time status indications, alarm notifications and communications historization for effective monitoring of our transportation, power and water systems, providing better operational readiness."

So far, Schulz and Jacklett say their Wonderware-enabled iPads and smart phones have reduced operations staff hours by 15% due to drive-time savings, and allowed the department's more than 120 staffers to transition their workweek schedules from five eight-hour days to four 10-hour days.

Likewise, when Prima Frutta (www. primafrutta.com) in Linden, Calif., sought to revamp its cherry production line in 2015 to make it the world's largest by increasing throughput 50% without increasing staff, it enlisted Industrial Automation Group
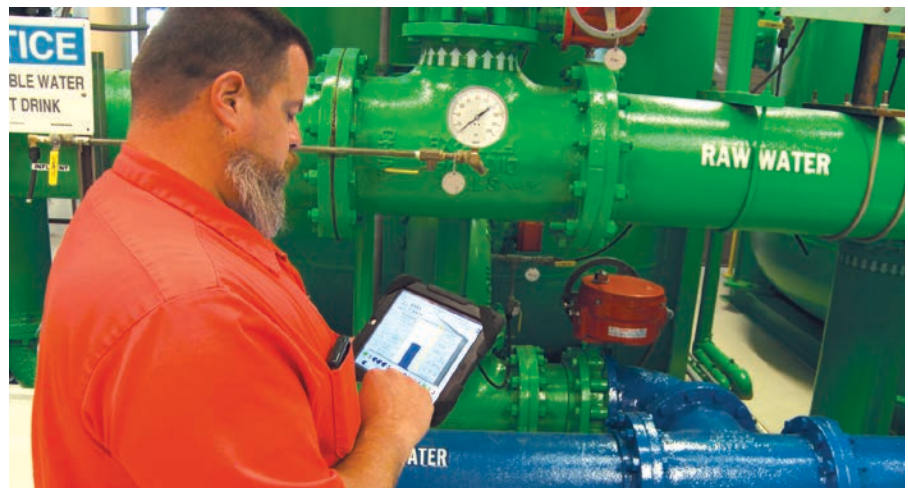
ALWAYS-ON AWARENESS

Figure 1: Operators and managers at Carson City Public Works use iPads and smart phones with Wonderware by Schneider Electric's SCADA, HMI and SmartGlace software to improve operational awareness and efficiency of their water/wastewater, solar power and transportation applications, and save 15% on drive-time hours. Source: Schneider Electric

(IAG, www.automationgroup.com), a CSIA-certified system integrator in Modesto, Calif., to help with the upgrade and expand its existing implementation of Ignition SCADA software from Inductive Automation (https://inductiveautomation.com) to the new cherry line. Ignition lets Prima Frutta to share line data with 10 managers and 900 workers via more than 120 screens scattered throughout the facility.

"Every second counts, so it's very important to provide data to our staff on the plant floor," says Tom Augello, production manager at Prima Frutta. "If a change is coming, whether it's in size, quality or variety, our people have a very short time to react, so we put that information up, flash alerts or use different colors to make sure everyone sees it. The large productivity increase we've seen with Ignition is from these added screens."

Beyond its larger, fixed monitors, Prima Frutta uses 10 tablet PCs from Dell to directly control the cherry line. The tablets have stationary holders, but they can also be carried around the plant for full SCADA with Ignition and networking via four wireless access points from Moxa (www.moxa.com).

Jason Kieffer, project manager at IAG, reports that Prima Frutta could have used industrially hardened tablet PCs, but chose less costly, consumer-grade tablets because they're easy to replace if needed, and were easy to implement with Ignition. IAG also mimicked Prima Frutta's existing servers by building a digital twin of them at IAG's office, which let the integrator develop the new application in its native environment, and accelerated its installation and accuracy. "It was so quick. Within two hours of pulling a tablet out of the box, we were running the application on it," says Kieffer. "We were really surprised at how quickly it went."

Greg Sinigaglia, production manager at Prima Frutta, confirmed that using Ignition on the tablets and larger monitors saves time and money. "Let's take grading of the fruit as an example," says Sinigaglia. "Before, we had to walk down and look at the quality and see what the sorters were doing. Now, with Ignition, we have all this information displayed on screens. There's no more running around from spot to spot."

Simplicity = usability

Just like a hiker with a lighter backpack, mobility in process facilities is greatly aided by newer tools that are simpler and lighter, which allows them to be used more frequently. For instance, Kice Industries (www.kice.com) in Wichita, Kan., designs and builds industrial air systems for the flour milling, biofuels, food and energy industries, and staff in its system integration division always welcome better ways to migrate large distributed control systems (DCS), building panels, and implementing numerous valves, instruments and other components.

"We just installed a good-sized biofuel project with 600-700 instruments and valves, and expanded another biofuel plant with 1,200-1,400 instruments and valves, and we thought there had to be a better way than the outdated, 15-pound, $6,000-$7,000 handheld we'd been using to program, test and commission HART valves, check instruments and do loop checks," says Peter Love, senior systems engineer for automation at Kice. "Eventually, we came across DevComDroid smart device communicator from ProComSol (https://procomsol.com), which costs $1,000-$2,000, and includes a Bluetooth HART modem and app for doing complete HART device configurations with an Android smart phone."

DevComDroid uses registered device description (DD) files from the FieldComm Group (https://fieldcommgroup.org) for complete access to all features of a HART device. All members of Kice's onsite teams can use it, including electricians, field commissioning staff and plant DCS operators.

"The main advantage for everyone is that DevComDroid is a lot less weight because all we're carrying is an Android smart phone and the 2 x 3 x 3 in. modem in our pockets. This portability means we can have it with us at all times, and use it more often," explains Love. "Also, the battery on the old communicator only lasted two or three hours, so we had to haul a spare around. DevComDroid lasts as long as our smart phone battery, which is usually all day. The modem also has wire leads that allow it to be clipped to a scissor lift, or otherwise brought close to an instrument, while we make changes from a safe distance. With the old communicator, we'd have to be right at the device."

Beyond the benefit that HART data appears the same on a smart phone as it does on the older communicator, Love adds it's easier to apply software updates to DevComDroid and store information by just plugging in the smart phone. "A multivariable flow transmitter has a commissioning process, so you have to backup data from the communicator to a PC. However, most communicators have been limited in how much configuration data they could store—maybe 100 procedures—so active-stop and storage operations were needed to free space," says Love. "With smart phones and tablet PCs, we have far more data storage available, and transfers are easier to file servers, other PCs and the cloud. Plus, we can backup configurations, store them a PDF documents, and email them. With the old communicator, we also had to deal with complex file formats and proprietary software to handle configurations.

"In all, I think we've saved 25-30% on our commissioning time based on what we do all day, added portability and battery life, and the fact that we can do more by having our smart phones with us all the time. Plus, an old communicator can't email you at 1 a.m., but a smart phone can do it. Also, a lot of system integration work is done remotely these days, so we're also saving on travel and achieving a better quality of life."

Stay safe out there

Beyond keeping networks and communications secure, many users and suppliers stress that effective mobility tools must also be employed to keep users and applications safe, often by continuously monitoring their locations.

To keep better track of its remote workers, for example, pump and valve supplier KSB Industrial Services (www.ksb.com) recently adopted Spot LLC's (www.findmespot.com) Tracker device with satellite-based global positioning system (GPS) chip to keep track of staffers servicing equipment in remote areas where there are often no cellular signals. Usually employed by backpackers, Tracker was configured by KSB to transmit GPS data in XML format. Next, Inductive's FactorySQL software collects the XML data into an SQL database, and prepares it for use by Inductive's FactoryPMI software, which can create dynamic applications for analyzing lone worker whereabouts. KSB calls this solution its Personnel On Site Tracking System (POSTs). It's now set up on KSB's servers, and users only have to pay $100 per GPS unit and $80 per month for unlimited monitoring, alerts and reports.

To protect mobile users wherever they're

UP, UP AND UAV

Figure 2: MR Systems uses its Phantom 3 quad-copter 4K camera with 1,920 x 1,080 pixels to fly at less than 300-400 feet and conduct surveys for wireless/radio installations. The drone can stay up for about 30 minutes on one battery charge, and can travel at up to 50 mph. Source: DJI

located, Jason Schexnayder, sales director for the ecom division of Pepperl+Fuchs (www.pepperl-fuchs.com), reports it recently launched the world's first explosion-proof tablet PC approved for use in Zone 1/Div. 1 and Zone 2/Div. 2 settings. Developed in cooperation with Samsung, Tab-Ex 01 can retrieve data in real time, interact with remote experts and backend systems, and use optional cameras to capture and respond to maintenance errors and other issues.

"All kinds of technologies related to mobility, such as Bluetooth, RFID, tablet PCs, smart phones, cameras, WiFi and cellular, are combining to provide more data and enable better decisions," says Schexnayder. "However, if you need redundancy, then you're going to need at least a couple of them."

Driven to drones

Though remote-controlled, multi-prop, miniature helicopters or drones for exploring and monitoring process applications may seem exotic, some plants report they've been used for years to examine equipment in especially inaccessible locations, such as towers and remote pipelines and cables. Instead of using cranes or building scaffolding to reach the top of a flare stack with no ladder, for example, they simply fly a drone to the top, and use its high-resolution video camera to gather detailed equipment health data and wear-and-tear status. Similarly, power companies have long used full-size helicopters to let technicians check power lines, and many of them now use drones, too.

Touchton reports that MR has employed drones for about a year in more than 10 projects. It often helps conduct surveys for wireless/radio installations, which means it's no longer necessary for MR to bring in and raise a tower. The system integrator typically uses a Phantom 3 quad-copter from DJI (www.dji.com) with 4K (four times high-definition) camera with 1,920 x 1,080 pixels, which costs about $1,500, though overall UAV prices have been dropping recently (Figure 2).

MR's drone usually flies at less than 300-400 feet, and can stay up for about 30 minutes on one battery charge. Though the system integrator doesn't race its drones like many recreational users, Touchton adds that DJI's drones can travel at up to 50 mph. These drones usually operate at a maximum distance of three miles, but Touchton reports that adding an amplifier to MR's has given it a range of up to 20 miles. *[A video showing how MR uses drones to develop SCADA graphics is at www.mrsystems.com/videos.]*

"At height, the 4K camera's real-time feed shows the operator where the drone is, and lets us zoom in but still maintain resolution, so we can see what's happening," he explains. "The drone is controlled by an app on an
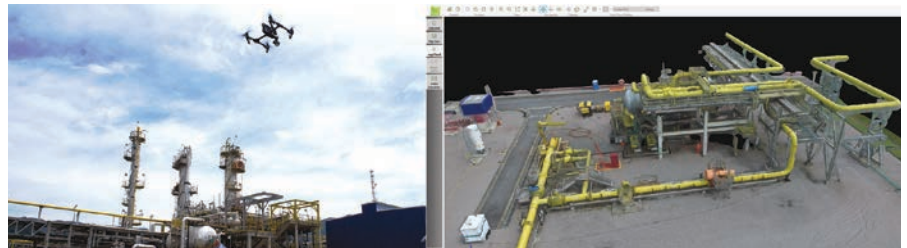
iPad, and it can be guided manually, or it can execute a predefined flight. We're using it mostly for video surveys of projects, so we're not using it to help assist any operations yet, though it could be used for that purpose."

However, as MR's operators gain experience with their Phantom 3 drone and its controls, the applications where it can be applied will almost certainly multiply. For example, a drone with a tether and power cable could remain aloft 24/7, and serve in place of a tower. "For now, we just want to rent a laser or radar unit for the drone, put it in the middle of a room or facility, let it scan,

and automatically pull readings into 3D Max software to generate renderings. This would let us scan and measure buildings that we usually have to measure and model manually."

Touchton's advice to other potential drone users is to buy or rent an affordable model, practice with it, and learn where it might be most useful in their own projects and applications. "My eight- and 11-year-old kids have flown ours, and even I haven't crashed yet," he adds. "One of our other operators did crash recently, but all we had to do was replace a rotor."

Likewise, IATEC Plant Solutions, an engineering and construction firm in Sao Paulo, Brazil, recently used a DJI Inspire 1 UAV with 12-megapixel Zenmuse X3 camera controlled by Pix4Dcapture flight-planning software and compatible DJI SDK software to conduct an aerial, photogrammetric survey of a large Petrobras-UTGCA gas-treatment plant in Brazil. The survey was needed to update 3D models, drawings and databases of the plant, but the job needed to be done

SKY-HIGH SURVEYING

Figure 3: E&C firm IATEC used a DJI Inspire 1 UAV with 12-megapixel Zenmuse X3 camera controlled by Pix4Dcapture flight-planning software and compatible DJI SDK software to conduct an aerial, photogrammetric survey of a Petrobras-UTGCA gas-treatment plant in Brazil, fly automatic routes in 10 areas, and capture 2,588 images of the 750,000-sq-m plant in just three days. Source: IATEC and Pix4D

without costly laser scanning or a risky, time-consuming visual inspection (Figure 3).

"Using telemetry data from GPS and GloNaSS satellite systems, Pix4Dcapture's app allowed Inspire to automatically fly routes optimized for mapping," stated IATEC's Luciano Araujo and Henrique Marques. "In just three days, Inspire 1 captured 2,588 grid-based nadir and free-flight oblique images in 10 sub-sections of the 750,000-sq-m plant, and stitched them together with Pix4Dmapper software, which is compatible with IATEC's CAD/CAE software and configuration settings." ∞