Distillery Undergoes Control System Upgrade

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Since the late 1880s, the smooth and mellow taste of Four Roses Bourbon has been a favorite among whiskey lovers. Over the decades, the spirits distiller has seen numerous management and political changes — including being one of only six distilleries granted permission to operate through prohibition to produce bourbon for medicinal purposes.

Speaking with the people who work at the Four Roses Distillery in Lawrenceburg, Kentucky, it is clear one thing has never changed — a passion for quality and pride in creating and producing the award winning bourbon that is the legacy of founder Paul Jones, Jr. Four Roses is the only bourbon distillery that combines five proprietary yeast strains with two separate mashbills to produce ten distinct and handcrafted bourbon recipes. Each bourbon recipe has its own unique character, spiciness and flavor.

Ensuring uninterrupted production consistency and quality at the 24/7 distillery is top priority for Ryan Ashley, Four Roses director of Distillery Operations. He says, since 1999, the distillery has relied on an APACS+ automation system. Although the APACS+ controllers, I/O, software, and HMI all worked perfectly, the hardware and software would soon be phased out.

Upgrade for the Future

The distillery began a migration strategy in 2008 that upgraded to Siemens SIMATIC® PCS 7 distributed control system, while retaining the existing APACS+

controllers, I/O and field wiring. The APACS+ HMI was replaced with a PCS 7/APACS+ OS HMI that allowed Four Roses to continue to use its APACS+ controllers without making modifications to the application software.

“By putting PCS 7/APACS+ OS on top of the APACS+ controllers, we saved thousands,” Ashley says. “We also cleared the way for the next phase that would replace the APACS+ controllers with PCS 7 controllers.”

In 2010, Ashley installed APACS+ DP I/O Bus Link from Siemens Industry, Inc., which allowed Four Roses to upgrade its existing APACS+ controllers and continue to use the remaining APACS+ I/O modules and field wiring.

Ken Keiser, Siemens process automation migration manager, said “Rather than rip out and replace the existing APACS+ system, Four Roses used the I/O with the wiring in place. They also had significant savings in the check out because they eliminated the engineering work to make sure that every loop was correct. Typically, you would need to replace the entire system, but now you can get the advantages of PCS 7 at a fraction of the cost.”

Four Roses now has the enhanced process control capabilities of the PCS 7 DCS, including the flexibility and added capacity of multiple scan rates (up to 10 milliseconds). The modernization also provides higher fault tolerance, flexible modular redundancy, higher safety (SIL 3 independent of redundancy), integrated asset management, integrated safety fieldbus, and integrated Ethernet.

Ashley, who also has received international awards for brewing beer, said nearly every element of the distillation process is automated by the PCS 7 DCS because of the APACS+ DP I/O Bus Link upgrade. “We’ve been making the same bourbon since 1888 and we didn’t want to change what worked in the past,” Ashley says. “Some of our operators have been here more than 40 years. It was important that the changeover was a non-issue for them and we didn’t miss a beat.” Operators monitor and control the distillery process from one central control room and two workstations located at different levels of the facility. “The screens at each workstation are the same as before the APACS+ DP I/O Bus Link installation,” Ashley says.

Making Award-Winning Bourbon

“While the fermentation process involves manually opening and closing valves, operators use the PCS 7 DCS to control the grain handling system, the mills, the cooker, temperatures, agitators and pumps. Everything is tied into the PCS 7 system,” Ashley says. The distillation process begins when corn, malted barley, and rye undergo two different mash cooks. Ashley says Four Roses has a higher percentage of rye in the rye mash than any other distillery, giving the final product a very spicy finish. The process cooks these cereal grains, making starches and carbohydrates available for yeast to metabolize later in the process.

“We are hitting upward of 212°F to 146°F to activate certain enzymes that are available in the grain and ultimately make those starches available. Starches are

long chains of carbohydrates or sugars that the yeast will want to eat later to produce the alcohol."

The mash is cooled and sent to Cyprus wood fermentation tanks where one of five different yeast strains is added.

"Yeast is a living organism and needs a certain temperature and environment," Ashley says. "So it is critical to hit the right temperature and concentration of cereal grain and water."

The fermentation byproducts are known as thick and thin stillage. The distillery puts the thin fluid — which is very acidic — back into the fermentation tanks to adjust the ph. In four days the mash will ferment (distillers beer) to about an 8-10 percent alcohol content. The mash is then run through a column still where it cascades down over plates. While the mash travels down, the still steam percolates through the perforated copper plates and carries the vaporized alcohol to the top of the still. The vapor leaves the still and enters a heat exchanger where it is introduced to cold water. The steam is condensed back into very clear and concentrated alcohol at approximately 132 proof. The alcohol enters a doubler that increases the proof to approximately 140 by separating and removing the remaining water. De-mineralized water is manually added to the distillate reducing the proof to 120. The distillate is then poured into charred oak barrels where it will remain for the next five to 20 years, depending on the final product.

Benefits of Latest, Greatest DCS

"The APACS+ controllers configuration was transferred to the PCS 7 controllers using a controller migration tool from Siemens Spring House Migration Center of Excellence. This migration tool helped Four Roses speed up the transition to get online using the more modern controller, PCS 7. This tool also eliminates manual steps, giving a more accurate configuration transfer," Keiser says.

According to Ashley, the greatest benefit from the DCS upgrade is that the programming is much more user friendly when it comes to finding data, making changes or adding and modifying screens.

“For me, not being a programmer, I can say we need a meter on this or need to graph this or go in and take a look at the history of these specific items,” Ashley says. “This allows us to fine tune our quality and increase our production. It has also helped us keep our standards at the necessary level.

“Everything is there,” Ashley continues. “Just point and click. Put in your variables and you are off and running. The trending capabilities of the PCS 7 system are much more advanced than the APACS+ system. “It is remarkably easy for me to dial into the system from home and question why did this happen or how did it happen?”

Partnership Pays Off

Ashley sums up the project this way: “The whole crew at Siemens has been fabulous to work with. We’ve had great feedback, communication and customer service. When we had an issue they were out here on site troubleshooting and the problem was usually solved that day. The people really made the difference.”

“The system worked perfectly before and it works perfectly now,” Ashley continues. “But today, we have the latest and greatest supported software. I don’t anticipate that changing.”

For more information, please visit www.siemens.com *[1].*

http://www.chem.info/articles/2011/10/distillery-undergoes-control-system-upgrade?qt-most_popular=1

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[1] http://www.siemens.com/