

Contact:

Zebra Communications

805-955-0009

www.zebracom.net

Blue Bell Creameries Streamlines Sub-Zero Automated Storage and Retrieval Equipment with Integrated Controls System by Siemens

Optimizing performance of Blue Bell's automated storage and retrieval equipment, Siemens turns the ice cream producer's breadboard PLC controls into a showpiece of smoothly integrated controls technology within the company's minus 18 degree F warehouse.

Some companies will go to great lengths to get the most out of their machine controls, even if they are antiquated, difficult to program and high on maintenance. But there comes a time when cost efficiencies mandate that new controls be put in place.

Upgrading and optimizing the controls system on equipment that has been in operation for some time can yield considerable benefits, turning an older piece of equipment into a streamlined asset, increasing speed of production, reducing maintenance, and lowering cost of ownership.

This was the case with Blue Bell Creameries (Blue Bell), when in spring 2006, the time had come to upgrade the control systems on the three automated storage and retrieval systems (ASRS) used in its main production facility warehouse in Brenham, Texas. Although the 19-year-old breadboard PLCs, old keyboards and six-inch HMI screens were still functional on the ASRS units, Blue Bell opted to completely upgrade the controls systems to improve the equipment's performance, speed and efficiency. The ice cream producer went a step further, however, and had a seamlessly integrated controls system put in place, with wireless Ethernet, PLCs, touch panels and drives from Siemens. The controls gave Blue Bell's ASRS the needed speed and capability to precisely

position pallets within the company's main warehouse, even in minus 18 degree F temperature.

From the Farm to the Store Shelf

Blue Bell considers itself the "Little Creamery in Brenham" because of its 100-year heritage in a small Texas town, even though the company distributes its products across 17 southern states. In reality, however, Blue Bell is the number three ice cream brand in the United States, available in 20 percent of the nation's supermarkets. Although the privately-held company keeps its production volumes close to the vest, it is not shy in saying that it takes approximately 60,000 dairy cows to produce enough milk to meet Blue Bell's ice cream production needs for just one day.

The creamery opened its doors in 1907 as the Brenham Creamery Company, originally to make butter from the excess cream brought in by area farmers. A few years later the creamery began making ice cream and delivered it to neighbors by horse and wagon. In 1930, the company changed its name to Blue Bell Creameries. Today, Blue Bell no longer produces butter, but it does make about 50 different varieties of ice cream and many frozen snack items.

Its product line-up includes approximately 20 year-round ice cream flavors, such as *Pecan Pralines 'n Cream*, *Banana Split* and *Moo-llennium Crunch*. It also produces 25 to 30 "rotational" ice cream flavors, like *Caramel Turtle Fudge*, *Strawberry Cheesecake* and *Southern Blackberry Cobbler*, which are released throughout the year. Also, a variety of sherbets, frozen yogurts, low fat/low calorie and no-sugar-added products are available. Blue Bell has a broad line of frozen snacks that come in cups, cones, on sticks and in mini-sizes, available in 12- and 24-count packs. These products include *Mooo Bars*, *Mini Country Cones*, *Oatmeal Country Cookie* and *Dutch Chocolate and Homemade Vanilla Cups*.

Aside from the main production facility, a smaller frozen snack plant is also located in Brenham. In addition, Blue Bell has two other supporting production facilities, one in Broken Arrow, Oklahoma, and one in Sylacauga, Alabama. The two plants provide mainly half-gallon ice cream, in addition to other Blue Bell products such as pints, cups and sherbet quarts, to the creamery's northern and southeastern distribution areas.

Blue Bell handles every aspect of its ice cream business in house, running tight product control from manufacturing through distribution to the retailer's shelf. The production process starts out with fresh milk brought in daily, blended with cream and sugar to make an ice cream mix. Next, the mix is then pasteurized by being heated to 180 degrees F for 25 seconds. It is then quickly cooled, brought down to 40 degrees F, and homogenized to create a smooth and creamy uniform consistency. Flavors, like strawberry or peppermint (liquid flavorings), are blended in as the mix runs through continuous freezers.

Ingredients are added, like nuts, berries, bananas, fudge and peaches, just as the ice cream is filled into cartons, spinning them for uniform filling. The ice cream then travels into a hardening tunnel where the product is brought down to zero degrees F core temperature. The finished ice cream is then palletized, stretch wrapped and inventoried into its 125,000 square-foot, cold-storage main warehouse with 13,000 pallet locations, where it is kept at minus 18 degrees F (85,000 square feet of the warehouse is used for finished products). Approximately 24,000 square feet is serviced by ASRS units handling 8,000 pallet locations.

Its ice cream is delivered from cold storage direct to retailers in 17 states - direct store delivery (DSD). The company transports its products with its own delivery trucks to retailers. Some of the product is first sent to one of the company's 46 sub-distribution facilities, using a fleet of its own 18-wheelers, where it is then put onto its own local trucks that provide store-to-store delivery.

The Problem with Blue Bell's ASRS Controls

Blue Bell wanted to improve its ASRS accuracy and tracking speed, but also wanted to improve its controls operability. The controls system was quite outdated, still using the original PLCs that came with the ASRS units 19 years earlier. Added to the system was a hodgepodge of other PLCs handling different functions on the ASRS units. Although the system was still functioning, it was difficult to work with, time consuming to maintain and would occasionally shut down causing production delays.

In the old system, the operator would direct the controls system to move the crane to a specific X/Y coordinate where a pallet would be located. It required several different keystrokes to execute a motion of the crane. To arrive at the exact location, and then perform the various motions of loading or unloading the pallets required a multitude of keystrokes. Training an operator was time consuming because of all the different combinations of keystrokes that had to be learned.

Also, when selecting a pallet location, if the wrong keystroke combination was put in then the ASRS would arrive at the wrong location. Considering that the ASRS had 8,000 pallet locations to select from, spread out over 24,000 square feet of floor space, a simple keystroke mistake would add unnecessary time into the production flow.

“The original crane systems were using breadboard PLCs,” says Keeter Jenkins, Systems Designer with Blue Bell. “We were using keyboards and little black and white six-inch monitors. We had difficulty getting into and out of the PLCs, and sometimes they would lock up requiring re-booting.”

“Additionally, we were having major problems with our infrared units because the units were obsolete,” continues Jenkins. “The infrared units are what we use to communicate with the warehouse database, which tells the operator where to place incoming pallets of ice cream and where to retrieve pallets to be shipped. So, the decision was made in

spring, 2006 to do a complete controls retrofit before something died on us, and we would need to scramble to get it fixed.”

Controls Solution to Fit a Sub-Zero Environment

The controls upgrade was complicated by the sub-zero, minus 18 degree F temperature of the warehouse where the ASRS equipment operates. Blue Bell’s ASRS are semi-automated, with an operator that rides in a heated cab in the crane. But outside of that cab the temperatures are extreme. The warehouse wind chill factor, radiating cold air from the concrete walls and the massive refrigeration fans on the ceiling create a cold wind that can exceed the ambient 18 degrees below zero. In some sections of the facility, like the ice cream hardening tunnels, the wind chill factor is 100 degrees F below zero.

Blue Bell brought in AWC Corp. to help configure a controls package, who then selected a Siemens controls solution that was fitted to the sub-freezing environment and Blue Bell’s application needs. “The solution encompassed a Siemens PLC and HMI that would be located within the operator cabs, and a wireless remote and drives on the sub-zero cab exterior,” says Brad Rosenhagen, Regional Director of AWC, responsible for managing the company’s Engineering Success Assurance Team for the ASRS controls installation. “The temperature was a concern, but not an insurmountable problem because we knew we could put small heaters in the crane cabs.”

“Our engineering staff decided on a Siemens SIMATIC® S7-300 modular PLC platform,” continues Rosenhagen. “The unit facilitates an integrated system solution in both centralized and distributed architectures, and has the ability to integrate powerful CPUs with industrial Ethernet/PROFINET interface. Siemens SCALANCE® industrial Ethernet network components are also being utilized, which provide rugged connectivity, reliable data communications and comprehensive diagnostics. This system is particularly adapted to operating in Blue Bell’s harsh, sub-zero environment.”

The system is also outfitted with a Siemens SCD 1297 operator HMI, based on the Windows CE operating system. It has a fully graphics-capable 12-inch LCD display with 256 colors. Resolution is 320 x 240 pixels. Integrated MPI/DP interface and Ethernet interface for operation at PROFINET and PROFIBUS. A multi media card slot enables memory expansions for archives, recipes and backup and restore functions.

Improved Operability

Several significant improvements have come about from retrofitting the ASRS controls. One is the reduced the time it takes to position and move the crane, and manipulate pallets into and out of the storage racks.

Additionally, the speed of the touch screens over the old keyboard system has cut the time considerably for each location decision executed by the crane operator. The time has reduced by 66 percent, from 15 seconds to 5 seconds per decision. Considering the cranes are running daily from 4:30 a.m. to 11 p.m., this saves 90 minutes in command efficiency per crane each day.

Training time on ASRS handling has also been diminished. Because the new system is much more intuitive than the old one, Blue Bell operators can train a new person in one-third the time. In just three days an operator can be trained and ready to run the crane on his or her own, whereas before it would take two weeks of training. The new controls have made their jobs much easier, less stressful, and much more efficient.

The new Siemens controls system not only enables optimized speed and precision with Blue Bell's ASRS positioning, it also provides a seamless integration of wireless Ethernet, PLCs, touch panels and drives connected by a common functionality and control capability. Even the inventory control program now talks directly to the Siemens PLCs through wireless Ethernet. The once antiquated ASRS controls equipment with its

limited capabilities has now enabled the cranes to take on a new role as a highly streamlined production asset for Blue Bell Creameries.

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For more information on Siemens automation solutions please contact Siemens Energy & Automation, Inc.; 5300 Triangle Parkway, Norcross, GA 30092; Phone 800-964-4114; or visit their website at www.sea.siemens.com.

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Blue Bell Creameries, which last year celebrated its 100th year anniversary, can be reached by contacting Jenny Anderson, Public Relations Coordinator; P.O. Box 1807, Brenham, TX 77834; Phone 979-830-2180; email jenny.anderson@bluebell.com; or visit their website at www.bluebell.com.

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Jim McMahon writes on industrial automation.