EVERYBODY LOVES ALMONDS. From the foil-pack bags passengers munch on airplanes to the bowls of nuts people dip into while watching sporting events on television, almonds have been a favorite snack and cooking ingredient for centuries.

Originating in ancient China and central Asia, explorers brought almond trees across the “Silk Road” to the Mediterranean. By the 1700s, Franciscan padres had brought almond trees to California. California is now the only place in North America where almonds are grown commercially. The largest processor of almonds today is the Blue Diamond Growers Cooperative, based in the capital city of Sacramento.

Blue Diamond was founded in 1910 as a cooperative of about 230 almond growers, who raised a few thousand pounds of almonds each year. In the past 91 years, Blue Diamond has grown to nearly 4,000 growers, and the co-op is now the largest tree nut processing and marketing company in the world. Blue Diamond growers help make almonds California’s largest food export and the sixth largest food export produced by the United States. Blue Diamond almonds are marketed to all 50 states and more than 90 foreign countries. That’s a lot of nuts.

And as one can imagine, it’s a massive job to take in an entire year’s harvest and process it in a timely fashion. The only way that Blue Diamond has been able to handle this tremendous growth has been for the company to become a model of factory automation technology. For 10 years now, this giant cooperative has been using factory automation systems based on Wonderware’s FactorySuite™ software products to keep up with industry growth.

Blue Diamond was, in fact, one of the earliest customers for the InTouch® human-machine interface (HMI) package, installing its first HMI system in 1991. It has since added the IndustrialSQL Server™ (InSQL) plant historical system and statistical process control (SPC) applications throughout its processing facilities. Now, it can maintain ingredient data on every batch of almonds that comes in each year as well as constantly monitor the meat quality to maintain its outstanding reputation as the supplier of high-quality nuts and nut-based food products.

“We almost had to install the InTouch HMI system 10 years ago because we had one worker on each shift whose job it was to literally run up and down the stairs in our plant to monitor nut levels in surge bins on each floor of our main production line,” says Kurt Huebner, Blue Diamond senior programmer/analyst in the information services department. “We had no other way to check bin levels and there was no convenient way to control product flow from each floor down to the next. So we simply had someone doing it live. InTouch was a wonderful change when we installed it because it meant machine operators spent more time monitoring the quality of the product and it eliminated the need to run between floors.”

TIMELY AND QUALITY PRODUCTION NOBODY RUNS THOSE STAIRS SINCE IN TOUCH WAS INSTALLED.
Operators now can monitor any part of the complex process from any point within the production flow from workstations placed strategically around the plant. Operators can monitor any part of the complex process of almond sorting from workstations located around the plant.

The main production facility has been designed to allow product to flow from the top of the five-story plant to the bottom—from incoming silos to outgoing 50-pound boxes. Tractor-trailer trucks bring in the harvest from September to January, from growers located between Bakersfield in central California to Mt. Shasta in the north. The nuts have already been hulled and shelled by the growers prior to delivery. The raw nut meat is first stored and fumigated in huge silos. A series of destoners, air separators, and graders remove foreign material brought in from the fields.

The almonds are then graded into eight different and distinct sizes before being gravity-fed to the fourth floor. Here, electronic sorting machines use modern laser techniques to identify chipped or broken nuts that fly past sensors at high speed. Any broken nuts are ejected from the high-speed flow with precision blasts of air. Ultrasonic sensors monitor the level of meats in each bin, then feed that data to InTouch screens on each floor. This gives operators instant visibility into the nut levels in each of the gravity-fed bins so that no bottlenecks are created that back up the system.

From the fourth floor, the almonds are then fed to the third floor where more electronic sorting machines sort out additional foreign material such as twigs and hulls that were missed from the fifth floor. Here, a Siemens programmable logic controller (PLC) is used to control the flow of meats between floors. If one of the surge bins becomes nearly full, a signal is sent to the appropriate sorting machines to shut off. Once the bin level has dropped to a predetermined level, then the sorting machine automatically restarts. All of this can be viewed by operators using InTouch in their respective areas.

The electronically sorted almonds are then sent down to the second floor, where skilled sorters manually inspect and sort every nut so that no foreign material makes it to the customer. Operators work to remove any additional foreign material and meats that do not pass the stringent requirements of their customers. Quality control (QC) inspectors are constantly examining samples to ensure product is within grade and specifications.

Modern laser techniques are used to identify chipped or broken almonds during automated sorting.

Experienced almond packers are still an integral part of processing almonds for distribution.

“Because of the unique nature of our production operations, we developed our own SPC system for monitoring meat quality,” Huebner says. “Our operators check meat quality, size, consistency, volume of nuts by weight, and other characteristics. We categorize all the ‘pick-outs’ so we know what our primary quality problems are and what our true output is. Quality control inspectors enter all this manual inspection data into our statistical process control system and in the InSQL database. The database also collects data automatically from 1,800 data points and from six Siemens S5 PLCs on the plant’s 70 production lines.
“Our main production line runs close to 1 million pounds of almonds a day during the peak season, six to nine months of the year, depending upon crop size for a given year,” Huebner explains. “Having such good data on product quality is important to product grading, since almonds are packaged according to their quality and may require additional processing for different purposes.

“One of the keys to our SPC success here is that because all data is stored on one central set of servers, any information from any part of the production process is available to any of the opera-
tors, QC inspectors, and management,” Huebner says. “We installed the Quality Analyst software from Wonderware’s partner company, Northwest Analytical, to be able to chart trends and control parameters. Inspectors can instantly call up quality control charts to be sure production is within control limits. Operators can right-click on any data point of interest and bring up a control chart or histogram. This allows them to compare inspection data with historical records and to spot patterns in almond quality. They have the ability to view charts from their own production area or examine how similar products ran on other processing lines in order to minimize variation between production runs.”

Multi-Faceted Packaging

Once the almonds have reached the first floor, they’re either packaged for bulk delivery to customers for use in products such as cereal and candy bars, or they are stored in bulk containers for additional processing in the manufacturing department. The blanching process first super heats the nuts in a scalding solution to loosen and remove the brown skins. The nuts are then conveyed past dryers to remove excess moisture. They go through another set of electronic sorters, pass through another manual sorting, and then are processed for slicing, dicing, or packaging whole. At the same time, the cook room is creating the salted and flavored almonds that make the snack foods everyone enjoys, such as Blue Diamond’s famous Smokehouse brand almonds.

It all comes together at the packaging line, where different configurations of packing machines prepare the finished almonds for shipping in foil vending packs and custom packages for airlines, in plastic bags of sliced or diced almonds, for use in cooking and baking, and in 4-pound cans of snack almonds for retail and commercial users.

In the peak season each fall, Blue Diamond processes well over a million pounds of almonds a day, working two shifts a day, six days a week. Many Blue Diamond people have worked at the plant for 20 to 30 years or more and have become experts in their field. No matter what market segment is targeted, all almonds are tracked by InTouch, IndustrialSQL Server, and the SPC program, which is the heart of a process improvement program that focuses on improving quality in each area. Teams analyze control charts to determine where improvements can be made to produce a more consistent and higher quality product.

“As one example of actual cost savings, prior to this system, our scheduling department used many raw materials for the production of blanched products,” Huebner says. “We’ve since proven from SPC data that our yields could be improved by as much as 3 percent just by using only two raw materials. This reduced variation in the product and resulted in an increased finished product pounds each day—with a cost saving of $72,000 and no impact on product quality.”

That last element is the most important to Blue Diamond and its 4,000 member growers. They like to think of their products as one of nature’s original health foods—which is why consumers love to eat almonds. It isn’t often that such a delicious snack food is also considered good for you. THE END