Launching Into the 21st Century

The end of the 20th century launched an amazing opportunity for The Austin Company — a chance to further its longtime partnership with Boeing by designing and building facilities needed for their new Delta IV family of rockets.

Early in 1998, Boeing awarded Austin a contract to design, engineer and construct a 2.5-million-square-feet facility that would be used to build the largest structural component of the Delta IV rocket series. The Delta IV is an expendable launch system in Boeing's Delta series, and the rockets are used for commercial satellite and U.S. defensive purposes (U.S. Air Force Evolved Expendable Launch Vehicle (EELV)). The new Delta IV would have the capability of carrying a much heavier payload — up to 28,000 pounds.

Through its contract with the U.S. Air Force, Boeing was required to implement the Focused Factory concept in the production of the EELV. To comply with the contract, Boeing needed a new factory — and they needed it quickly. The first of the Delta IV rockets was due to be in production in 2000.

By early March of 1998, much of the initial engineering and site work had been completed for the 175-acre facility located on a 400-acre site in Decatur, Alabama. Just a few days later — in mid-March — Boeing gathered its engineers and Austin's team of designers, engineers and constructors to announce they were implementing LEAN manufacturing practices.

"Boeing called it their "Men In Black" exercise — like the movie that was popular at the time," says Matt Eddleman, Austin's Senior Vice President of Sales and Marketing. "With the new LEAN principles, we were told to forget our pre-conceived ideas for the facility." Eddleman served as the purchasing agent for the Delta IV building project.

The 2.5-million-square-feet facility was being reduced to 1.5-million-square-feet.

"It was a drastic reduction in the size of the facility, and we had already started the underground tunnels. Some things were already fixed in place," said Eddleman.

Construction of the Delta IV plant began in the spring of 1998. Early in the project, Boeing revised its original plans — reducing the facility from 2.5 million-square-feet to 1.5 million-square-feet.

Despite the change in the square footage of the plant, the deadline to complete the facility didn't shift. Austin and its joint venture partner, J.S. Alberici, collaborated to build the mammoth

Boeing's family of Delta IV rockets are assembled in its 1.5 million-square-foot facility in Decatur, Alabama.

Construction of the state-of-the-industry facility began in the spring of 1998 and was completed in late 1999.

facility by late 1999. This project was an ideal candidate for ***The Austin Method®*** — a vastly successful method of combining design, engineering and construction that Austin had been applying to its manufacturing site projects for nearly 100 years.

While Boeing could produce nearly all of the Delta IV rocket components at its other facilities across the United States, it needed portions of the new factory for certain components of the rocket: a chemical processing plant where the metal components were cleaned, etched and coated; and a weld shop large enough to perform vertical and horizontal welding of the rocket booster.

The Decatur plant was designed with the critical manufacturing areas being located in the center of the building, so the plant was constructed from the center out to the north and south simultaneously. The facility was designed around four product centers:

1) Skin, Ring and Dome Center — machining, inspection and anodizing of the skins and rings
2) Tank Center — welding, inspection, pressure testing and application of thermal protection
3) Major Structure Center — assembly of the metallic and composite structures
4) Stage Center — final assembly and testing

The Delta IV rocket is composed of five vehicles based on a common booster core (CBC) first stage. The CBC is 125 feet in length and 16 feet in diameter — roughly the size of a Boeing wide-body airplane fuselage.

To accommodate the production of the enormous CBCs and the assembly of the rocket, the building includes 33 bridge cranes, some spanning up to 220-feet and some capable of lifting 30 tons. A crane system is used for three phases of the assembly: skin and ring material delivery, chemical processing of the tank line, and skin/ring/dome delivery. (The curved sections of the booster are called skins.)

Eddleman notes that the system includes manual cranes for transporting the skin/ring assembly, while automated cranes are required for chemical processing. The cranes are vital to the entire assembly process, from the initial loading of raw materials, such as giant slabs of aluminum, to the chemical treatment processing, and then to testing and finally to vertical and horizontal assembly.

"Once the components complete the testing phase, they come out to the vertical weld area," he explains. The skins are assembled to make a cylinder, using a friction skin welder to fuse them together.

The cylinder is then placed on its side and two domes are attached — one at each end. "It looks like a giant medicine capsule, but it's one of the gas tanks for the rocket," says Eddleman. Pneumatic

Major components of the Delta IV are produced in the facility – including the common booster core (CBC).

and hydrostatic tests are conducted to ensure there are no leaks.

Following the pneumatic testing and application of a foam insulation, the components are moved through to the integrated assembly and check out (IACO) work center. There, the components and rocket engine are connected and prepped for loading onto a custom vehicle that delivers the rocket to the Tennessee River, where it will be shipped south to the Gulf of Mexico for its destination at Cape Canaveral, Florida.

The first Delta IV rolled out of production from the Decatur site by mid-2002 and was launched on Nov. 20, 2002, delivering a communications satellite into orbit for Eutelsat.

Eddleman says the Boeing Delta IV project was very rewarding — recognizing Austin's longtime partnership with Boeing and for the joint venture opportunity with J.S. Alberici Construction Company. "It's a partnership that continues today," he adds.

Boeing required that the building to be as environmentally friendly as possible, and they implemented numerous state-of-the-art practices to reduce hazardous waste. One of the practices is the use of a trench system that gathers scrap aluminum from the milling phase. Enormous sheets of aluminum, weighing more than four tons, are milled with a grid pattern and then curved in huge presses. The pieces, called skins, are then welded together to form the sections of the rocket.

"At one end of the plant, the flat aluminum plates are processed in the milling area, where they mill the sheets in an isogrid pattern to remove much of the weight of the metal," Eddleman explains. As a result, thousands of pounds of aluminum are collected in flumes located beneath the floor to carry the scrap metal to a chip recovery building. The scrap metal is then transported to a recycling plant.

Rocket Factory Facts

- More than 2,000 design and engineering drawings were developed for the project
- Six cranes, each more than 250-feet high and with capacities of 250 and 450 tons, were used to lift the trusses and steel beams in erecting the building
- 10 semi-trailer loads of bolts — more than 115 tons — were used in construction
- The floor system used more than 35,000 cubic yards of 4,000-psi steel-reinforced concrete. Nearly 2 million pounds of steel fibers were manufactured specifically for the concrete reinforcement.
- The entire 1.5-million-square-feet facility is environmentally controlled and air conditioned to 72 degrees Fahrenheit, 24/7/365.
- At its peak, the construction work force numbered 1,400 employees

The first launch of the Delta IV for Eutelsat at Cape Canaveral, Florida on November 20, 2002.

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