Converted Farm Machine Improves Boeing Production Process

Humble hay loader finds a new career

Innovators sometimes find their inspiration in the most humble of places.

In the spring of 2001, Larry Larson and his colleague, Bob Harms, who help build Boeing 757 airplanes in a factory near Seattle, found theirs in a barnyard in rural Washington state.

The two men are part of a factory team called the "Moonshine Shop" at The Boeing Company, which is charged with discovering new ways to decrease the costs and time required to build Boeing jetliners. (The Moonshine Shop gets its name from a Japanese lean manufacturing philosophy where innovators develop new methods clandestinely -- by the light of the moon late at night.)

That spring, the two colleagues had set off on a mission: find a simpler way to lift heavy parts and assemblies, especially passenger seats, from the factory floor to the airplane door. The pair went looking for existing machines they could adapt for that task.

"We stopped at a carnival and watched the way Ferris wheel seats move upwards," said Larson. "We looked at ski lifts and considered roofing material loaders. We went to see how sugar beets are loaded, and then we started looking at farm equipment."

Rows of seats easily load into this Boeing 737 during final assembly at the Renton, Wash., factory. The seat loader concept was modeled after hay loaders (or hay elevators) used in eastern Washington, and has dramatically reduced production time. - Ken DeJarlais photo

Larson, who lives in rural Washington, had seen hay elevators (also called hay loaders) in operation on neighboring farms ? lifting individual hay bales up into barn lofts. He knew the elevators had potential for other uses and began visiting farm equipment dealers and scrap yards to see what was available.

"We saw a lot of hay elevators both new and used," reported Larson. "They were lightweight, easy to move, had a proven track record and could lift 125-pound (56-kilogram) bales of hay up into barns. They were very simple to modify, too."

The quest for the right one that could be modified to lift airplane parts eventually led to the Level Best Ranch, a hay farm that is a two-hour automobile ride east and over the Cascade Mountains from Seattle, and to Jack Wheatley, a rancher who also likes to tinker with machines.

"We took a look around his shop, which was heated with a homemade furnace, and we could see right away that Jack was a moonshiner," said Larson. "When Harms explained what we were looking for, Jack scratched his chin and thought for a while. Then he said he could make a hay elevator to our specifications."

Meanwhile, back in the airplane factory, Harms was calculating just what adaptations a hay loader would need before it could load the airplane seats, which each weigh 50 to 100 pounds (22 to 44 kilograms).

"Once Jack got our specifications, he made our custom elevator in three days," said Larson. "It was 24 feet (7 meters) long, so we borrowed a neighbor's truck to deliver it from Jack's ranch to the 757 final assembly line."

To meet safety requirements, Harms added guards to the elevator. He also added a top and a bottom fixture ? and tracks ? so the seats, which had wheels attached, could be rolled onto the elevator and up to the airplane.

Other employees in the factory were skeptical.

"People thought we were stark-raving nuts," recalled Larson. "They thought we were wasting the company's money."

However, when the team used the modified hay elevator to move seats the first time that summer, that attitude quickly changed.

"Now people were amazed; mouths dropped open," Harms chuckled. "It was like a party atmosphere."

Before the team's efficiency efforts, the process for loading passenger seats onto each airplane was cumbersome. After seats would arrive at Boeing, wheels were attached to each seat, and then the seats were delivered to the factory floor in a large container. An overhead crane lifted the container from the factory floor to a mezzanine. Seats were unloaded and rolled into the airplane door, where wheels were removed before seats were installed inside the passenger cabin. The crane then delivered the empty container to the factory floor, lifted the next container onto the mezzanine and repeated the process until all seats were in. The process took 12 hours.

Today, using the hay loader concept, seats roll across the floor to a holding area on the factory floor near the airplane. When it's time for installation, the seats are rolled to the seat loader, which carries them up to the airplane door. The process takes about two hours and eliminates the need for cranes, a common factory bottleneck.

Once the 757 seat loader was in operation, word reached the Boeing 737 assembly line in the next building. Soon, members of the 737 Moonshine Shop team came to watch it operate.

"They said, 'We think we could use that on the 737,'" Larson recalled. "So, we brought the 737 Moonshine guys across the mountains to visit Jack Wheatley. The team suggested some improvements to the design, and it wasn't long before he had built one to their specifications."

Eventually, the news about the hay elevator that became a successful seat loader traveled 40 miles north to the factory where the larger Boeing commercial airplanes are assembled.

Soon, moonshine teams for the Boeing 767 and 777 were working with Jack Wheatley to build seat loaders based on the 737 and 757 prototypes. These much larger elevators are about 43 feet (13 meters) long and incorporate improvements which make the loader even more efficient.

Two years later, the airplane production lines are still using the modified farm machine. However, continuous improvement is the goal of the Moonshine Shops. And today, Harms is at work on a new seat loader that will cut production time by eliminating the need for wheels to be attached and removed from the seats before they are loaded onto the airplane.

"The philosophy of lean manufacturing is lifelong improvement," said Larson. "The need for innovation never ends."

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