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Boeing Scrambles to Repair Problems With New Plane

Layers of Outsourcing

By J. Lynn Lunsford

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EVERETT, Wash. -- On Tuesday, Boeing Co. will give Wall Street a progress report on its 787 Dreamliner, as it scrambles to overcome a six-month delay in producing the new jet. A look inside the project reveals that the mess stems from one of its main selling points to investors -- global outsourcing.

When the Chicago aerospace giant set out four years ago to build the fuel-sipping jet, it figured the chief risk lay in perfecting a process to build much of the plane from carbon-fiber plastic instead of aluminum. Boeing focused so hard on getting the science right that it didn't grasp the significance of another big change: The 787 is the first jet in Boeing's 91-year history designed largely by other companies.

To lower the \$10 billion or so it would cost to develop the plane solo, Boeing authorized a team of parts suppliers to design and build major sections of the craft, which it planned to snap together at its Seattle-area factory. But outsourcing so much responsibility has turned out to be far more difficult than anticipated.

The supplier problems ranged from language barriers to snafus that erupted when some contractors themselves outsourced chunks of work. An Italian company struggled for months to gain approval to build a fuselage factory on the site of an ancient olive grove. The first Dreamliner to show up at Boeing's factory was missing tens of thousands of parts, Boeing said.

Today, the Dreamliner is at least six months late, and the goal of delivering 109 planes by the end of 2009 is threatened. Rather than being well into flight tests, Boeing is rushing to get the first planes airborne while it helps suppliers around the world bring their factories up to speed.

Boeing has said the delays have affected 19 of the 52 airlines that have ordered the 787, some of which were counting on using their planes during the 2008 Summer Olympics. If delays mount, the company could face millions of dollars in penalty payments to customers, as well as pressure from suppliers, many of which have agreed not to be paid until planes get delivered.

The missteps underscore the hazards and limits of outsourcing -- especially with a brand-new airplane, the most complex machine in mass production. Lessons that Boeing is learning the hard way could end up helping rival Airbus, a unit of European Aeronautic Defence & Space Co. Airbus has said it plans to use a similar model of global suppliers to build a competing plane that should be ready in about five years.

Boeing overestimated the ability of suppliers to handle tasks that its own designers and engineers know how to do almost intuitively after decades of building jets. Program managers thought they had adequate oversight of suppliers but learned later that the company was in the dark when it came to many under-the-radar details.

"In addition to oversight, you need insight into what's actually going on in those factories," says Scott Carson, the president of Boeing's Commercial Airplanes unit. "Had we had adequate insight, we could have helped our suppliers understand the challenges."



Scott Carson

The 787 is a hit with airlines. Boeing has 762 orders from 52 carriers for the plane, which will carry between 225 and 300 passengers. The combination of lightweight materials and fuel-efficient engines is expected to make it 20% cheaper to fly and a third less costly to maintain than older jets. Boeing says it has sold out of delivery slots until almost 2014, making it critical to get the jet into production without further setbacks.

Boeing set out to bring the plane to market in just over four years, two years less time than such projects have taken in the past. It has responded to bottlenecks by throwing both money and people at them, parachuting in dozens or hundreds of its own employees to attack problems at plants in Italy, Japan and South Carolina. Boeing said in September that it had set aside nearly \$2 billion in additional research-and-development money for increasing costs associated with the delays.

The plan calls for suppliers to ship mostly completed fuselage sections, already stuffed with wiring and other systems, to Boeing facilities around Seattle so they could be put together in as few as three days. Existing production methods can keep a plane the size of the Dreamliner in the final-assembly area for a month.

But many of these handpicked suppliers, instead of using their own engineers to do the design work, farmed out this key task to even-smaller companies. Some of those ended up overloading themselves with work from multiple 787 suppliers, Boeing says.

The company says it never intended for its suppliers to outsource key tasks such as engineering, but that the situation seemed manageable at the time. "We tended to say, 'They know how to run their businesses,'" says a Boeing executive familiar with the company's thinking.

"Now Boeing is hostage to the suppliers, and there's very little they can do about it," says Tom Wroblewski, president in the Seattle region for the International Association of Machinists and Aerospace Workers, which was critical of all the outsourcing.

Despite the start-up problems, Boeing and its suppliers still say they believe this new method of developing planes is the model for future projects. Once the production line is running smoothly, they argue, it will be more efficient and profitable than existing construction methods.

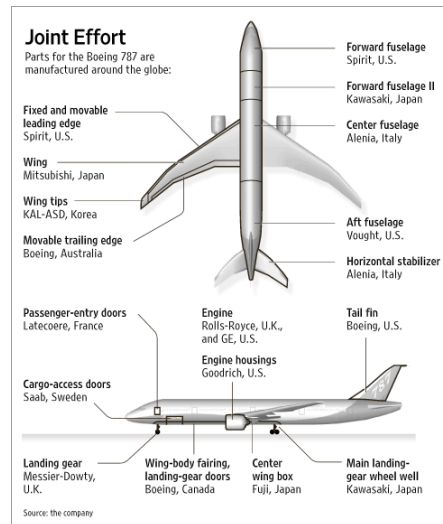
The companies brought in to design and supply the 787 circle the globe. Vought Aircraft Industries Inc., based in Dallas, makes the rear fuselage section at a factory in Charleston, S.C. Alenia Aeronautica produces the middle fuselage sections and horizontal tailpieces in Grottaglie, Italy. Vought and Alenia, which is a unit of Italy's Finmeccanica SA, formed a venture to attach their sections at a new facility in Charleston.

Three Japanese heavy-industry companies, Fuji, Kawasaki and Mitsubishi, produce the new plane's elegantly swooped wing. Spirit Aerosystems Inc., a former Boeing facility now owned by Toronto-based Onex Corp., is responsible for the 43-foot-long nose section.

All of these bulky pieces are shipped to Everett for final assembly, aboard heavily modified Boeing 747s that Boeing calls "Dreamlifters."

Early optimism about the new process was quickly undercut. Several suppliers say Boeing was three to eight months late in giving them final specifications for structures and systems. Boeing says its engineers were trying to cram as much technology into the plane as possible without making it too heavy.

Besides designing their sections of the plane, the structure suppliers had to build cavernous factories to house the giant carbon-tape applicators and ovens that are used in the new manufacturing process.



In Grottaglie, Alenia chose to build its factory on a 300-year-old olive grove. Before it could build, it faced months of haggling and had to agree to replant the trees elsewhere. Alenia was in "catch-up mode from the get-go," says a Boeing official. Compounding the problems: The Italians' first couple of test-fuselage sections didn't meet quality standards.

One of the worst problems cropped up at Vought, a longtime Boeing supplier. Its job was to build the rear section of the fuselage. Vought retained design responsibility for the complicated carbon-fiber exterior, but it hired Israeli Aerospace Industries Ltd., of Tel Aviv, to design and build the section's floor. Although relatively simple, the task involved fabricating and assembling more than 6,000 components, from lightweight beams to tiny brackets.

Problems arose in getting many of the items to conform to a tight set of engineering tolerances set by Boeing. Normally, this could be addressed by taking each part through a review process involving a series of sign-offs that typically generate a stack of paperwork approaching an inch thick per part.

But Israeli Aerospace was halfway across the world and in the third rung of the new bureaucratic ladder. The sign-off process would have required each document to travel multiple times between Israel, Charleston and Seattle. When it became apparent that this was threatening Vought's ability to deliver its fuselage section, teams of experts from Boeing and Vought were sent to Tel Aviv to walk each part through the process.

The snafu led Vought to replace its executive in charge of 787 work, in part because angry Boeing managers believed they had been misled about how serious the situation was.

Conceding the company's travails on the Dreamliner, Vought Chief Executive Elmer Doty said on a recent conference call with investors: "I don't think you need rumors to assume we are among the riskiest, if not the riskiest," of suppliers who make fuselage sections. He said Vought had asked for help and was pleased Boeing recently assigned a top manufacturing expert to help it get up to full production.

Not until the first Dreamliner was unveiled in July did Boeing realize the magnitude of its troubles. In an effort to meet the rollout target for the 787 of

7/8/07, Boeing told suppliers to ship partly completed sections to its final-assembly bay in Everett.

Boeing believed that the first plane's biggest problem was a shortage of specialized nuts and bolts needed to put it together. The industry-wide shortage was worse on the Dreamliner because it required dozens of new fasteners not used on other planes. At the rollout ceremony, thousands of employees and invited guests milled around beneath a Dreamliner that had more than 1,000 temporary fasteners embedded under its shiny coat of Boeing blue and white paint.

When mechanics later opened boxes and crates accompanying the fuselage sections, they found them filled with thousands of brackets, clips, wires and other items that already should have been installed. In some cases, officials say, components came with no paperwork at all, or assembly instructions written in Italian, requiring translation.

Boeing officials thought they could work through this unexpected twist in a couple of weeks. Instead, they had to put the plane up on jacks and remove its engines and tail to get to tight spots.

On Sept. 6, Boeing said the problems had forced it to delay the Dreamliner's first test flight by four months. But officials remained optimistic that they could deliver the first plane on time to Japan's All Nippon Airways Co. in May.

A month later, though, the first plane was still on jacks, and Boeing was in the midst of finding out that its suppliers' underlying problems were worse than expected. During a meeting with his Dreamliner managers on Oct. 4., Mr. Carson, Boeing's president of commercial airplanes, concluded there was no way to get the first plane delivered on time.

He called Boeing Chief Executive Jim McNerney at the company's corporate offices in Chicago. Mr. McNerney flew to Seattle the following Monday for a detailed briefing. That Wednesday, the two announced that the first airplane delivery was being pushed back until November or December of 2008.



Pat Shanahan

A few days later, they replaced Mike Bair, the visionary executive who had been in charge of the program from its early days. His successor is Pat Shanahan, an intense detail-man with a reputation for pulling troubled programs out of the fire. Mr. Shanahan is expected to give his first update on the status of the program on Tuesday.

Mr. Bair, who remains at Boeing, caused a stir a short time later when he gave a speech to a Seattle business council that touched on the lessons Boeing had learned. He suggested that some suppliers had stumbled so badly that "some of these guys we won't use again" on future programs.

His frank assessment didn't sit well with Boeing and its suppliers, considering that the company has agreements with most of them that extend through the 30-year-plus life of the program. Boeing noted that Mr. Bair also "strongly emphasized the company's overall belief in the 787 Dreamliner's global production model."

Nevertheless, Mr. Bair gave a revealing description of the disarray on the factory floor when he said the Dreamliner's final-assembly process had been designed to bring together about 1,200 components. Instead, he said, the first airplane had come to the factory in 30,000 pieces. Boeing declined to make Mr. Bair available for an interview.

Although the company says it is confident it can deliver 109 Dreamliners by the end of 2009, some suppliers are skeptical. Boeing's plans call for 14 airplanes to be completed by the end of June 2008. In the following six months, it wants suppliers to crank out an additional 42 planes. Even under the best of circumstances, a ramp-up of this magnitude is daunting, all involved agree.

"From where we stand, it's still chaos," says an executive at one major supplier.

Boeing's Mr. Carson says company officials believe it is possible to meet the goal. "We did not conjure that schedule in a vacuum in Seattle, we did it in conjunction with our suppliers," he says. He adds that Mr. Shanahan is identifying the threats to the production schedule and working to resolve them.

Rejecting the idea that Boeing might be better off increasing production more slowly, Mr. Carson says, "I couldn't stand the pain of telling a customer it's going to be worse for them, just to make my life easier."

Write to J. Lynn Lunsford at lynn.lunsford@wsj.com

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