Tech focus

This month's focus is on some recent activity in the development, production, and sale of business jets.

HondaJet begins FAA certification as initial sales soar

Having booked more than 110 customer orders for its $3.65 million HondaJet at October's **National Business Aviation Association** (NBAA) convention in Florida, the fledgling **Honda Aircraft** is considering increasing its original 70-planes-per-year production plan, said company President and CEO Michimasa Fujino.

"We did not expect so many individual sales orders at NBAA," Fujino told *Aerospace Engineering* at a recent meeting in Detroit. "Although it is not yet decided, we will probably adjust and increase the production plan. We'll respond to customer needs."

He said Honda Aircraft also is negotiating fleet sales for the six-to-eight-passenger, twin-engined aircraft, which Fujino said will also be aimed at air-taxi work. HondaJet sales and service will be handled collaboratively in the U.S. by a business venture established between **Honda** and **Piper Aircraft**.

Fujino, who in 1986 was hand-picked to establish Honda's aircraft research—he led steering system engineering on the NSX sports car program—said his company expects to announce the location of its U.S. manufacturing facility "in the near future."

Application for **FAA** type certification for the HondaJet was submitted in October 2006. It is Honda Aircraft's goal to deliver the first production aircraft in 2010.

The prototype HondaJet has logged more than 190 test flights, 250 hours total, since its maiden flight in December 2003, according to Fujino.

The prototype currently is powered by a pair of HF120 turbofans, developed by **GE Honda Aero Engines**, a 50:50 partnership between Honda and **General Electric** to jointly engineer, certify, manufacture, and market the HondaJet's turbines.

The HF120 is a considerable improvement over the Honda-developed HF118 fitted in 2003, said Fujino.

"They are very different engines," he said. "The 120 is lighter [installed mass is less than 400 lb], smaller and produces higher static thrust—2050 lb vs. 1650 lb on the HF118."

With a maximum rated takeoff weight of about 9200 lb, the HondaJet is claimed to be capable of 420 knot cruise at 30,000 ft. Maximum ceiling is 43,000 ft.

"HondaJet is really closer to an LJ [light jet] than a VLJ [very light jet] in terms of price point, cabin, and capabilities," said Richard Aboulafia, an aerospace industry analyst with **The Teal Group**. "But Honda is definitely offering a fair amount of capability for the price."

Honda Aircraft President and CEO Michimasa Fujino was a young steering- and braking-systems engineer on the NSX sports car program when Honda CEO Nobuhiko Kawamoto selected him to begin aircraft R&D.

HondaJet production is slated to begin in the U.S. before 2010. Its HF120 turbofans developed by GE Honda Aero Engines are much more powerful and efficient than the earlier Honda-built HF118s.

Overall, HondaJet is designed to be the flying equivalent of the Honda Civic small car—fuel efficient, smooth, quiet, but also fun to drive (or fly in this case). With external dimensions that are slightly smaller than a **Cessna** CJ1+, the HondaJet has a cabin that is roughly 30% larger. Range, at 1100 nmi, is roughly 40% greater than the Cessna's on roughly 14% less thrust.

"In the small business jets we studied, it was clear that the cabins are too small," Fujino said. "I thought if we could completely eliminate the structure in the fuselage that supports the engines, we could make the cabin space larger."

The solution was to mount the turbines on pylons atop the wings, rather than on the rear quarters of the fuselage. Fujino had studied the **VFW-Fokker** 614, Germany's first short-haul regional jet. Built in small quantity in the 1970s, the 44-seat Fokker mounted its twin engines atop the wings to reduce drag—and also reduce the intake of foreign objects from the runway. A benefit of this was reduced cabin noise.

"After I set up the differential equation to find the optimized position of the engines, we ran a computer simulation, which showed their 'sweet spot' location where efficiency is about 5% better," Fujino recalled. "We then validated our calculations on 1/5-scale models in **Boeing**'s trans-sonic wind tunnel."

Other keys to HondaJet's efficiency are its natural laminar-flow nose and wing sections and its co-cured composite fuselage, a design that Fujino said eliminates secondary bonding or fasteners, greatly speeds the manufacturing process, and reduces cost.

With the FAA and industry analysts predicting steady growth for the U.S. business jet market through 2015, Honda Aircraft's 20 years of development may eventually pay off.

Lindsay Brooke

Milestones for Eclipse, Cessna in VLJ arena

The first very light jet (VLJ) production units from **Eclipse** and **Cessna** have been delivered to customers.

Eclipse held a first-delivery ceremony at its Albuquerque, NM, headquarters on December 31 for the Eclipse 500. Two customers will share the twin-turbofan that seats five or six people including pilot(s): **Jet-Alliance** and an individual, David Crowe. Jet-Alliance is a shared jet ownership company in Westlake Village, CA.

Very light jets are jet-powered aircraft under 10,000 lb. Two of the more important entries in the category are the Eclipse 500 (above) and the Cessna Citation Mustang.

"Although the vision of an affordable jet may have seemed like a risky investment to some back in 2000, I never doubted this day would come," said Crowe.

Eclipse has a backlog of more than 2500 aircraft. The company has several dozen aircraft in various stages of assembly, with production ramping up. As of the beginning of 2007, assembly was completed on seven units, which were being prepared for delivery.

The company's current facilities are designed to support the production of approximately 1000 aircraft a year, or four per day. Eclipse says it is employing manufacturing methods not commonly used in the aviation industry, including moving assembly lines and robotics.

The first customer for Cessna's Citation Mustang is Mustang Management Group, which initially will lease the plane back to Cessna for use as a demonstrator before using it for flight-training purposes. Delivery was made November 22.

The first delivery of the six-seat Mustang for regular service is expected to take place soon. Cessna estimates that it will deliver 40 aircraft in 2007, ramping up production through 2009.

On the same day as first delivery, Cessna received production certification from the **FAA**. "Cessna and the FAA have been working together for months, using our vast jet-building experience as a foundation, and developing new, advanced production and tooling systems to ensure an efficient ramp-up to full production," said Cessna Chairman, President, and CEO Jack Pelton.

To bring the Mustang to production at its assembly plant in Independence, KS, Cessna invested more than $20.4 million for an expansion there, adding more than 120,000 ft^2. The expansion includes a new flight test building, new paint facility, and a new customer center with a showroom hangar where customers are first presented the keys to their new airplane.

About 60 Cessna employees from plants in Independence and Columbus, GA, relocated for more than a year to Wichita, KS, to learn how to build the Mustang. Cessna's most advanced tooling is being used for the Mustang. Unlike conventional manufacturing in which the exterior shell is built around the interior components, Mustang manufacturing proceeds from the exterior inward, according to Cessna. This approach allows for less process variation, the company noted.

Patrick Ponticel

All systems go for Dassault Falcon 7X certification

Dassault Aviation used the October **National Business Aviation Association** (NBAA) convention in Orlando, FL, to announce that it had moved further toward certification with completion of hot-weather tests. The performance of the engines, auxiliary power unit, and air-conditioning system were tested in an extended ground run-up. The aircraft tested, s/n 03, was also flown at low altitude and high speed in the Tunisian desert for further hot-weather validation.

Falcon 7X deliveries are expected to begin in the second quarter of 2007.

Expectations were met in each test, the company reported. Dassault says it expects the plane to be certified to operate in conditions up to 124˚F. **FAA** certification is expected early this year, with deliveries beginning in the second quarter.

The plane has three HVAC zones. In testing, the variation in temperature between zones was held to within 1˚C, the company said.

Also announced at the NBAA show is the maintenance check schedule. The "A" check will be nine months or 600 flight hours, an improvement over the six months or 300 flight hours for other Falcon aircraft. The "B" check has been extended from the conventional 1500 flight hours to 2400, and the "C" check from the conventional 3750 flight hours to 4000 (or eight years, compared to the conventional six).

Since the NBAA convention, Dassault has completed high-altitude testing for validation of performance in terms of aircraft pressurization and air conditioning, as well as engine operations. Aircraft s/n 0-WSKY was tested at two airports of high elevation: 7678-ft Gunnison Airport and the U.S.'s highest-elevation airport in Leadville at 9927 ft. Both airports are in Colorado.

"In addition to the high altitude, the narrow and short runway at Leadville led to some very challenging flying conditions," said Yves "Bill" Kerherve, Senior Chief Test Pilot for Dassault Aviation. He reported that the plane flew very well despite the conditions. The runway at Leadville is 6400 ft long and 75 ft wide.

The Little Rock Completion Center in Arkansas recently received the first Falcon 7X (s/n 05) for completion. What Dassault calls "the world's first purpose-built by-wire business jet" was flown to Arkansas from the company's production center in

At October's NBAA convention, Dassault for the first time displayed a full interior of the Falcon 7X.

Bordeaux-Merignac, France. It traveled in company with a Falcon 2000EX EASy escort, also destined for completion at the company's largest worldwide facility (700,000 ft² of work area). Four additional 7X aircraft were expected to be delivered by the end of 2006, and many more this year.

Four hangars have been dedicated for 7X completion.

Patrick Ponticel