Tech focus

This month's section highlights some regional/business aircraft, as well as the engines powering them.

by **Ryan Gehm**

EMBRAER 190 takes flight with GE engine

The EMBRAER 190, the third of a four-member family of commercial jets designed for the 70- to 110-seat market, took its maiden flight in mid-March from **Embraer**'s Sao Jose dos Campos facility. During the 2:45-hour mission, the aircraft successfully performed a range of systems validation tests.

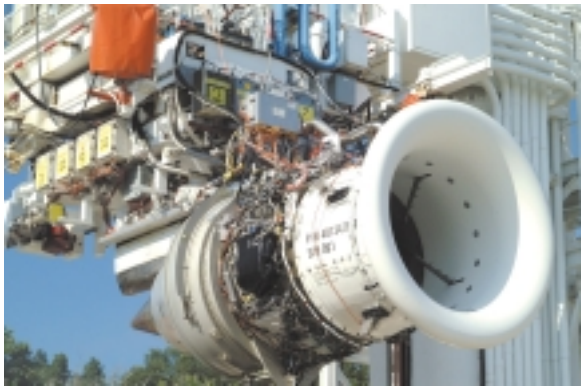
A second EMBRAER 190, which is being used to evaluate **GE Aircraft Engines**' new CF34-10E engine, made its first flight in May. A total of four aircraft will be involved in the flight-test campaign, which will be conducted entirely at the company's facilities at Gaviao Peixoto.

The aircraft can be configured for between 98 and 108 passengers. It seats 100 passengers in a four-abreast, 32-in pitch cabin, or up to 108 in a higher-density configuration at 31-in pitch. As with the other 170/190 family of aircraft, the EMBRAER 190 has four main cabin doors and offers airlines cabin-configuration flexibility for dual-class, single-class, or high-density seating arrangements. According to the company, the "double-bubble" fuselage design enables the widest seats and aisles among airliners of the same class.

The EMBRAER 170/190 aircraft also use fly-by-wire technology, supplied by **Honeywell**, for the flight-control systems, similar to those deployed on advanced military aircraft and larger commercial jets.

The EMBRAER 190 commercial jet took its maiden flight in Sao Jose dos Campos in mid-March (shown). A second EMBRAER 190 made its first flight in May.

Rated at 18,500 lb of thrust, the GE CF34-10E turbofan engine powers the regional aircraft.



Performance testing of a CF34-10E engine at GE's outdoor test operation near Peebles, OH.

Powering the EMBRAER 190 aircraft are twin under-wing GE CF34-10E engines controlled by redundant Full Authority Digital Engine Control. This computerized management system optimizes engine operation during all phases of flight, reducing fuel consumption and maintenance costs. Rated at 18,500 lb of thrust, the CF34-10E turbofan engine features technologies such as a 3-D aerodynamic high-pressure compressor for better efficiency, a single annular combustor (SAC) that reduces NOx emissions by as much as 12% compared with other SACs, a low-solidity high-pressure turbine in which the number of airfoils is reduced, and a chevron exhaust nozzle that reduces jet noise.

Full type certification for the 100-seat EMBRAER 190 is expected in the third quarter of 2005, followed by first deliveries to U.S.-based launch-customer **JetBlue Airways**. The company has ordered 100 jets, with options for another 100.

G350 business jet from Gulfstream

The large-cabin, mid-range **Gulfstream** G350 business jet aircraft will offer the most cabin volume, best performance, and largest number of standard features in its class, according to the company's president, Bryan Moss.

The G350 is similar in design to its sister aircraft, the large-cabin, long-range G450 that was introduced last October. They both share the same physical dimensions, flight control systems, engines, and space in the cabin and baggage area. Shared technical features include the advanced PlaneView flight deck, the **Honeywell** Primus Epic avionics architecture, an updated Honeywell 36-150 APU, and upgraded electrical power and environmental control systems. Because the two aircraft cockpits are so similar, the G350 pilot type rating will be the same as that for the G450.

In addition to increased range, the G450 offers greater outfitting flexibility and more premium standard features than the G350, including the Gulfstream Enhanced Vision System, the Honeywell head-up display, and several in-cabin electronic and communication systems. (Many of these features are available as optional equipment on the G350.)

The G350 incorporates Gulfstream's PlaneView flight deck with four 14-in liquid-crystal displays in landscape format for improved pilot situational awareness and reduced workload.

The mid-range Gulfstream G350 business jet is similar in design to the long-range G450 but has fewer standard features and a maximum range that is 550 nmi shorter.

An integrated avionics suite, the PlaneView flight deck features four 14-in liquid-crystal displays in landscape format. Using the Gulfstream cursor control device (CCD), pilots can integrate the flight management system and display map to produce true graphical flight planning. The integrated navigation map displays the flight plan along with terrain, airways, airports, navigational aids, and radar data. The CCD also provides the natural interface for display selection, configuration, checklist, and other functions. Traditional dedicated flight controls also have been retained.

The G350 cockpit is 1 ft longer than the GIV/G400/G300 cockpit, and the avionics equipment has been placed forward of the cabin door to improve access to the cabin and create more usable space for passengers. At slightly more than 45 ft long, the cabin can accommodate up to 16 passengers in three distinctive seating areas. Five optional floor plans are available—two with aft galley configurations and three with forward galley configurations.

The G350 can fly 3800 nmi nonstop (vs. 4350 nmi for the G450) thanks to two **Rolls-Royce** Tay 611-8C engines, each producing 13,850 lb of thrust. The engines feature Full Authority Digital Engine Control, a large diameter fan, modified high-pressure turbine, and new bypass/core mixer, resulting in improved fuel efficiency and extended maintenance intervals to 6000 h midlife and 12,000 h for full overhaul. The jet can climb to an initial cruise altitude of 41,000 ft in 20 min, with a maximum cruise altitude of 45,000 ft, and can take off from a 5000-ft runway with a full load of fuel and eight passengers on board, says Gulfstream.

The company expects to receive certification of the G350 by the **Federal Aviation Administration** in the fourth quarter of this year, with first customer delivery in the third quarter of 2005.

Dassault Falcon 7X enters production

Production of the Falcon 7X business jet started earlier this year, and most of the primary parts have already been built in the various facilities of **Dassault Aviation** and its partners, according to the company. All Dassault Aviation production plants are currently involved, assembling among other parts, the fuselage, wing, and fin.

One year after implementing a virtual product-development platform—called the "Virtual Plateau"—based on **Dassault Systèmes**' Product Lifecycle Management (PLM) solutions, Dassault Aviation has cut the time required to assemble its new Falcon 7X business jet by 50%.

The Falcon 7X is the first aircraft in industry history to be entirely developed in a virtual environment, from design to manufacturing to maintenance, says Dassault Aviation. The single, integrated PLM environment, based on Dassault Systèmes' CATIA, ENOVIA, and DELMIA, enables Dassault Aviation and its 27 partners in seven countries to work on a common, collaborative, 3-D virtual platform. In

addition, SMARTEAM was used to manage and track airplane systems.

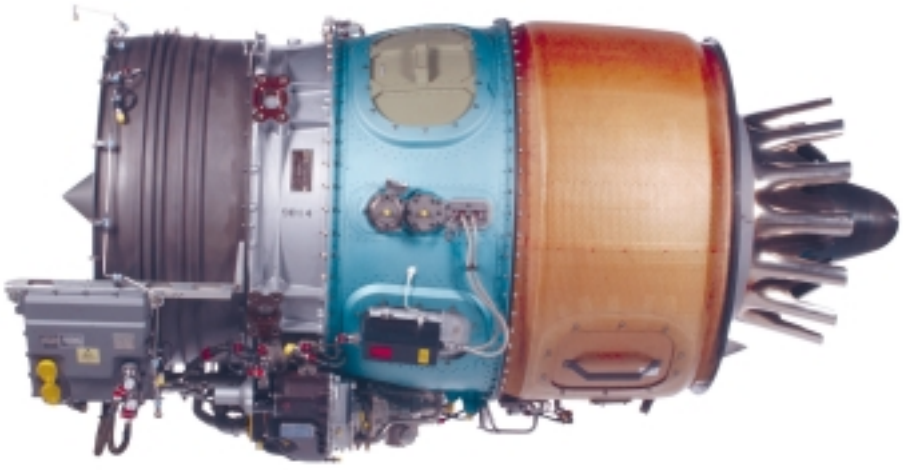
The jet's 30,000 parts were designed with CATIA, and more than 1000 engineers exchange data and work in real time on up-to-date designs, including interface data for partner-designed sections, through ENOVIA. With DELMIA and its human-modeling modules, specialists analyze and optimize the design of the Falcon 7X for aircraft maintenance and repair procedures.

The gains in assembly time and part quality stem from the precision attainable on the virtual platform, said Jean-Claude Hironde, Deputy Senior Vice-President, Research, Design and Engineering, Dassault Aviation. The accuracy of the Falcon 7X's digital mockup allows fittings, supports, and tubing developed virtually to fit precisely when the aircraft parts are assembled in the physical world, he said, adding that the process has led to fewer traditional assembly tools being used in the plant.

Another result is that Dassault Aviation will not produce a physical prototype of the Falcon 7X. Scheduled for delivery in March 2005, the first jet will immediately be used for certification, according to the company, which expects to receive certification for the aircraft in 2006.

"The digital mockup was developed with inputs from production people from day one," said Robert de Rocquigny, Falcon Division Vice President for Industrial Operations. "We know all parts are made exactly to the model specification. The whole aircraft is built according to the model, not to the jig, and no adjustments are required. This is the most effective method for aircraft manufacturing."

Powered by three Pratt & Whitney Canada PW307A engines, each producing 7500 lb of thermo takeoff thrust, the Falcon 7X long-range business jet from Dassault Aviation will have a range of 5700 nmi.

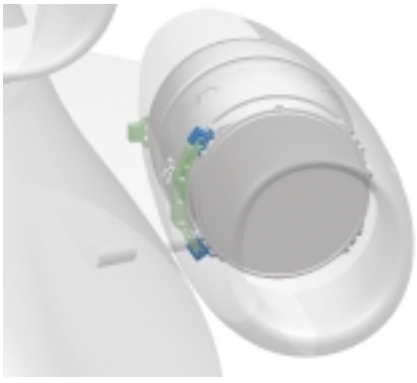


The low-emissions PW307A engine features new fan technology that will help it meet stringent noise standards anticipated for the next two decades. The engine will not need overhaul for 7200 h.

The Argenteuil facility near Paris handles assembly of the front section fuselage, which is assembled vertically. During skin-mating, all rivets are put into place automatically by an advanced, computer-controlled robot. Construction of the front fuselage section of Falcon 7X No. 1 at Argenteuil was finished two weeks ahead of schedule, said Pierre Bru, Production Engineer at Argenteuil.

The Falcon 7X's fuselage is being assembled at Biarritz in southwest France from components delivered from Argenteuil and various partners' facilities. The first elements of the fuselage are currently being put together, and the whole fuselage is scheduled to be delivered by mid-July to the Mérignac facility, where final aircraft assembly and acceptance testing will occur. The Biarritz plant also builds the Falcon 7X's fin box, which is entirely made of carbon. The new-generation vertical stabilizer is 20% larger than that of the Falcon 900EX but is stronger and lighter, according to the company.

At the Martignas facility, the first wing set is currently being assembled. By mid-September, the wing will be delivered to Mérignac, where it will be attached to the fuselage. According to Dassault Aviation, the first airplane should be fully equipped and ready for its first ground tests by mid-October.



The integrated engine mount system (isolators, yokes, and associated hardware), supplied by Lord Corp., uses titanium in place of stainless steel to help reduce the system's mass by more than 25 kg compared to the original design.

"By the end of the certification program, we will have finished 15 aircraft, some of them fully completed with cabin interiors and ready to be delivered to their customers," said de Rocquigny. "By simultaneously building all airframe components while flight testing the aircraft, significant savings in both time and cost can be achieved."

Airframe suppliers including **CASA** (horizontal stabilizer), **Latécoère** (rear fuselage section), **Pratt & Whitney Canada** (integrated power plant system), **Socata** (body fairings, mid-fuselage section), **Sonaca** (slats), and **Stork-Fokker** (moveable surfaces) have already delivered their parts.