



A BIG YEAR

2016 is a critical time for the Bombardier CSeries with first deliveries scheduled.

BY GRAHAM WARWICK



Behind the public debate over the future of Bombardier and government support for its CSeries airliner, the company is hard at work ramping up production and preparing the all-new narrowbody for entry into service.

Following Transport Canada certification of the initial 100- to 130-seat CS100 in December, the first aircraft for launch operator Swiss International Air Lines is completed and set to enter service in June. The 130- to 160-seat CS300 is on track for certification by mid-year and the first aircraft for launch operator airBaltic is in final assembly for delivery in the second half of 2016.

European route-proving flights began March 7,

with the first production CS100—aircraft P1—operating from Swiss' base in Zurich. Flown by Bombardier crews, but supported on the ground by airline personnel, the month-long trials began with roundtrip flights to Hannover, Brussels and Vienna, but ultimately the aircraft will complete six daily flights linking different destinations, typical of the operations planned by Swiss.

The CS100 is not yet certified in Europe, but the proving flights are carrying 25 company personnel as passengers to simulate commercial operations from boarding to deboarding, including loading and unloading baggage, and towing to and from the gates at the airports to be served, as well as in-flight service.

European proving flights are contributing to Bom-

bardier's 600-hour extended function and reliability (F&R) test phase. This is four times the F&R flying required for Canadian certification, and twice that needed for European approval, but is intended to build maturity and reliability before entry into service. P1 has flown 450 hours of the total and there have been snags, but no dispatch interruptions so far, Bombardier VP-Cseries program Rob Dewar said during media briefings in March.

Bombardier's CSeries customer response center is operational, supporting the route-proving flights. While Airbus has suffered service-entry problems with the larger Pratt & Whitney PW110G geared turbofan powering the A320neo, "the engine is performing very well for us," Dewar said. "Reliability is very good and it is meeting its fuel burn [guarantees]."

P1 is flying in the certification standard, Build 6, and Bombardier is about to begin flight testing Build 7, the entry-into-service standard. Dewar describes this as a "clean-up" that eliminates nuisance indications and involves a small capability increase. "It's only about a 25% [software] load." Added functions include Category 3B landing and the steep approach capability required to operate into London City Airport.

Photos: Bombardier



Modifications have been limited, Dewar said, because about 90% of "discoveries" requiring changes were made on system rigs at the suppliers, another 8% in the complete integrated aircraft systems test area at Bombardier, and only 2% during flight tests of the aircraft itself. CS100 structural testing is now complete. The carbon-fiber wing and aluminum-lithium fuselage did not present any issues, he said.

When launched in 2008, the CS100 was scheduled to enter service in 2013. "A lot of our challenges were

THE CS300 is scheduled for certification in mid-2016.

"Air Canada plans to use the full range of the aircraft."

—Rob Dewar, Bombardier VP-CSeries program

Final assembly

The final-assembly line, meanwhile, is gathering pace, with CS100 serial numbers 50012-50015 in the four wing-join and power-on positions at Mirabel, near Montreal, during *ATW's* March 9 visit. The first aircraft for Swiss is complete and being prepared for flight testing, while the fuselage has been joined for the first CS300 for airBaltic. Bombardier plans to deliver 15 to 20 CSeries aircraft this year, ramping up to as many as 120 in 2020.

The ramp-up did not begin until September 2015, to minimize the impact on production of design changes resulting from ongoing flight testing. These have been small, Dewar said, and mainly involve wiring. Only a handful of completed CS100s are going through post-production modification at Mirabel, and the first aircraft for Swiss was rolled off the line with all the mods already incorporated, he said.

in software integration, because of new rules," Dewar said. "There are 10-12 million lines of software code in the aircraft. Validation had to be more rigorous and took much more time than we expected." The CS300—its relatively few differences mainly related to its larger size—is on track to be certified about six months after the CS100.

"The CS300 is running to plan," he said. The first flight-test aircraft, FTV7, is 70% through the test program and the second aircraft, FTV8, joined the program on March 3, completing two flights that day—one of them lasting 5.5 hours. FTV8 has a complete interior, and is the last of eight planned CSeries test aircraft. All but two of the CS100 FTVs have been retired from testing, meanwhile, and will be refurbished for resale, Dewar said.

The European Aviation Safety Agency has completed its flight tests on the CS100, Dewar said, and



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certification is expected shortly, as is FAA approval. The first dozen Swiss pilots completed training in January. Training on the CSeries only takes around 20 days, he said, largely because the aircraft's flight management system—which accounts for half of pilot training—has been simplified. Instead of being operated by function using cascading menus, the FMS operates by phase of flight using tabs.

Orders & commitments

Total commitments for the CSeries now stand at 678, of which 243 are firm orders. Air Canada's letter of intent for 45 firm and 30 optioned CS300s is counted as a commitment, but not yet a firm order. The Canadian flag-carrier's selection was commercial, and not political, Dewar emphasized. "Operating cost trumps any politics, as the wrong decision will have a huge cost impact," he said, adding the order "was heavily competed."

At 3,300 nautical miles, the CSeries beat its range guarantee of 3,000 nautical miles. "Air Canada plans to use the full range of the aircraft," Dewar said. "AirBaltic will also use the full range on vacation routes to southern Europe." So far, customers are specifying the CS100 with around 117 seats in dual-class configuration, and the CS300 with 148 seats single-class and 137 dual-class, he said. CS100 testing has identified potential for higher gross weights, but because of its long range there has been no demand so far.

Air Canada plans to use its CS300s to replace

Embraer E190s, and operate them alongside Boeing 737 MAXs, bolstering Bombardier's claim that there is a distinct niche for the CSeries below the Airbus and Boeing narrowbodies. The CS300 is 12,000 lb. lighter than the A319neo, and offers 10% lower operating costs versus the neo and MAX, Dewar said. Bombardier is also claiming 10% lower operating costs than Embraer's smaller E195-E2, which has been repositioned to compete more closely with the CSeries.

Government investment

Now making progress after a history of development delays and cost overruns, and buoyed by a letter of intent from Air Canada for up to 75 aircraft, the CSeries is being talked up by Canada's new federal government. Justin Trudeau's Liberal government has been asked to match Quebec province's \$1 billion investment in a partnership with Bombardier to complete CSeries development and take the program to cashflow-positive production in 2020.

Announcement of a federal investment in the CSeries could come with the Liberal government's first budget on March 22. "We have not made a decision yet on whether, how much and on what parameters. But if I were to speculate, I would expect to see it in the budget," said David Lametti, parliamentary secretary to the minister of international trade. "We understand the importance of Bombardier to the aerospace sector," he said, speaking to *ATW* in Ottawa March 8. "We are committed to making it work." *ATW*