Bombardier Challenger 300

No-surprises

Simple sophistication and wide-body comfort are among this jet's winning ways

BY THOMAS A. HORNE

super-midsize

For the past few years, business jet manufacturers have prayed heavily at the altar of a relatively new market niche: the super-midsize. Super-midsize business jets fill the gap between conventional mid-size jets such as Raytheon's Hawker 800XP, Gulfstream's G100 (nee IAI's Astra Jet), Cessna's Citation VII and Citation Excel, and the Bombardier/Learjet 60 and the truly huge, long-range jets such as Bombardier's Global Express and Challenger 604, Gulfstream's G550 (formerly the GV-SP), and Dassault Falcon Jet's Falcon 900EX.

So far, the super-midsize competitors include Cessna's Citation Sovereign and Citation X, Dassault Falcon Jet's Falcon 50EX, and Gulfstream's G200. Raytheon's Hawker Horizon is set to soon join the fray, but the latest entrant—Bombardier's Challenger 300—may prove the strongest competitor of all.

The Challenger 300 was certified last summer after a two-year market research effort. Bombardier wanted to know exactly what its prospects desired in a super-midsize jet, and polled a wide sampling of corporate executives and flight departments. The company learned that prospects wanted a $15 million price (in 1998 dollars—when development began), a 3,000-nm range at 41,000 feet and Mach-0.80 cruise speeds, takeoff and landing performance requiring less than 5,000 feet of runway, and an eight-seat cabin with a flat floor. Bombardier says that other super-midsize jets can't meet all of those requirements. Prospects also said they

super-midsize

For the past few years, business jet manufacturers have prayed heavily at the altar of a relatively new market niche: the super-midsize. Super-midsize business jets fill the gap between conventional mid-size jets such as Raytheon's Hawker 800XP, Gulfstream's G100 (nee IAI's Astra Jet), Cessna's Citation VII and Citation Excel, and the Bombardier/Learjet 60 and the truly huge, long-range jets such as Bombardier's Global Express and Challenger 604, Gulfstream's G550 (formerly the GV-SP), and Dassault Falcon Jet's Falcon 900EX.

So far, the super-midsize competitors include Cessna's Citation Sovereign and Citation X, Dassault Falcon Jet's Falcon 50EX, and Gulfstream's G200. Raytheon's Hawker Horizon is set to soon join the fray, but the latest entrant—Bombardier's Challenger 300—may prove the strongest competitor of all.

The Challenger 300 was certified last summer after a two-year market research effort. Bombardier wanted to know exactly what its prospects desired in a super-midsize jet, and polled a wide sampling of corporate executives and flight departments. The company learned that prospects wanted a $15 million price (in 1998 dollars—when development began), a 3,000-nm range at 41,000 feet and Mach-0.80 cruise speeds, takeoff and landing performance requiring less than 5,000 feet of runway, and an eight-seat cabin with a flat floor. Bombardier says that other super-midsize jets can't meet all of those requirements. Prospects also said they

wanted simple aircraft systems, a long list of standard cabin features, low direct operating costs, easy maintenance, and none of the teething pains that usually accompany a new design's entry into service. That's a tall order, but Bombardier says the Challenger 300 fills the bill.

Cabin comforts

Pilots view an airplane from the cockpit's perspective, but to big-jet customers the cabin's the most important feature. Drawing on the success of its bigger brethren in the Challenger line, the 300's cabin gives the impression of belonging to a global-range jet. Bombardier says that the cabin's height and width are just tenths of inches less than those of a Gulfstream 400.

An eight-seat, double-club interior is standard, and so is a MagnaStar C-2000 in-flight telephone with two handsets, a DVD/CD player, four 110-volt AC electrical outlets, an Airshow 400 in-flight mapping display system, two 15-inch personal entertainment monitors, a crew closet, a galley area, and—of course—an aft flushing lavatory with hot and cold water. All seats have 180 degrees of swivel and 90-degree reclinability, and a three-place, side-facing divan can be ordered as part of three optional floor plans.

The cabin's flat floor adds extra comfort because there are no dropped center aisles for passengers to negotiate, and another convenience is the passengers' unrestricted in-flight access to the aft baggage bay.

Interior installations are done at Bombardier's Tucson, Arizona, completions center.

Maintenance and reliability

To keep maintenance surprises to a minimum while keeping the certification schedule on track, Bombardier tested all aircraft systems on 31 ground development test rigs. Extended function and reliability (F and R) testing was also done, including simulations of aircraft-on-ground scenarios where speedy repairs are vital to returning an airplane to service.

The 300's development team focused heavily on designing with service in mind. Thanks to system architecture and ground-level access panels, most line replaceable units (LRUs) such as environmental control units, pressurization outflow valves, nosewheel steering computers, and hydraulic pumps can be removed and replaced in 20 minutes. An auxiliary power unit can be replaced in an hour, an engine in three hours. Two mechanics can do a 400-hour inspection in one hour. (Challengers, like other large aircraft certified under FAR Part 25, adhere to progressive maintenance intervals rather than the annual inspections required of smaller general aviation aircraft.)

To help dispatch reliability, the 300 has very few single-path systems, switches, or control units. Even such seemingly small items as navigation and cockpit lights have backup bulbs and dual channels. "This keeps you from being grounded in Timbuktu because of a blown nav light," a Bombardier demonstration pilot said. "Same thing with the dual NiCad batteries. These let you dispatch with any one of the airplane's three generators failed."

Systems

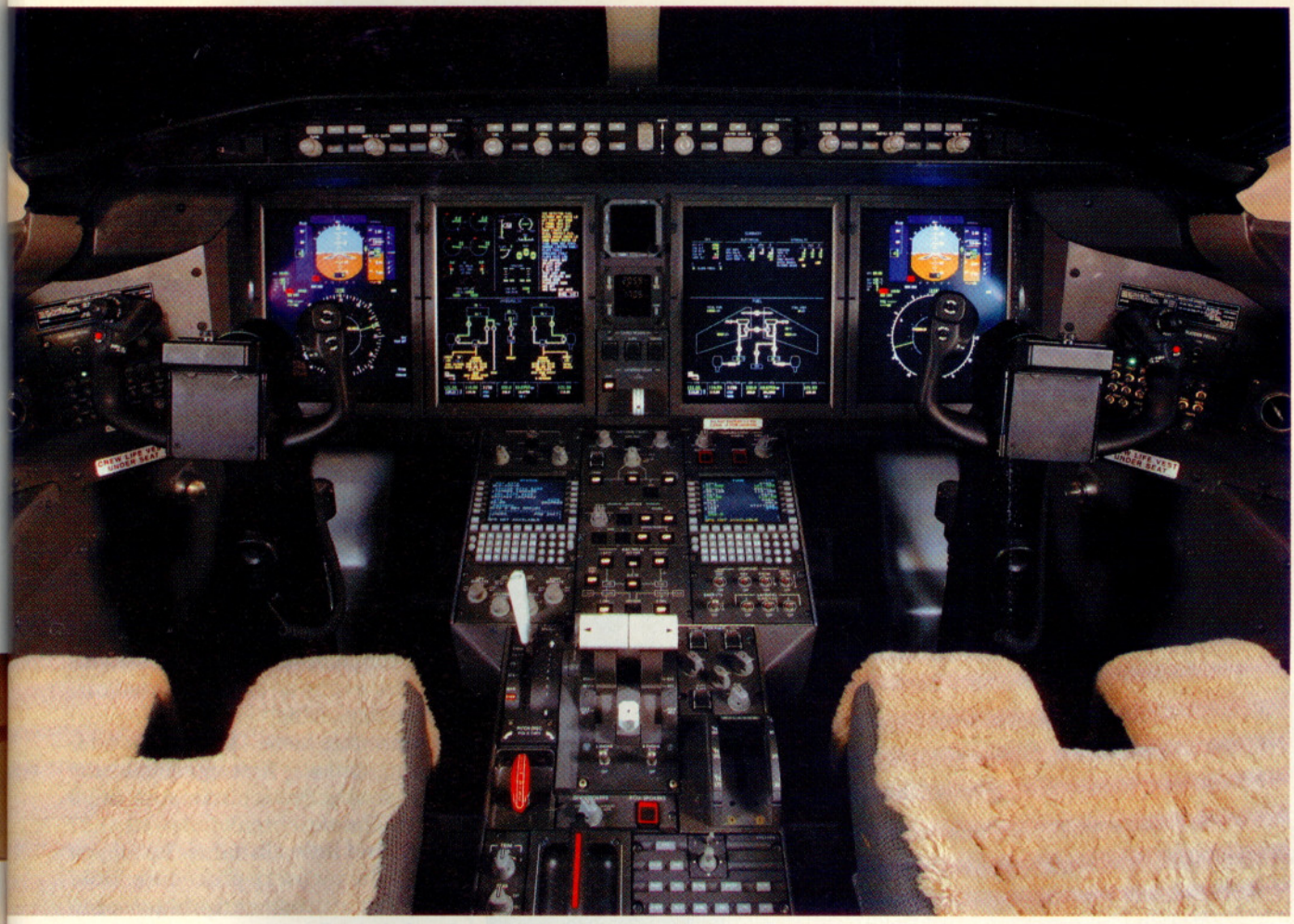
The 300's wing is relatively simple. Computational fluid dynamic modeling let Bombardier's designers come up with a fattish cross section that lets all fuel reside in the wings, and give the leading edge a large radius that enhances low-speed flying characteristics. Leading-edge vortilons help preserve and energize airflow at low airspeeds by preventing spanwise flows at high angles of attack (much like a conventional stall fence). A small inboard "kink" in the leading edge serves the same purpose. Outboard of the kink, the leading edge is slightly drooped. All of this gives the 300 good slow-flight behavior without the need for the complexity of leading-edge slats.

At 522 square feet, the 300's wing is a big one, and this is the main reason for the airplane's sub-5,000-foot runway capabilities. The flaps take up a good bit of the trailing edge, leaving less room for the ailerons. Two benefits come from this setup: The flaps keep landing speeds low, and the small ailerons use manual actuation. They don't require complex power control units.

On the other hand, the wing's 27-degree sweep, tapered planform, transonic airfoil, and winglets also optimize it for flight just below the speed of sound.

The ailerons are backed up by spoilers. Move the ailerons beyond 8 degrees of deflection and the outer, fly-by-wire spoiler panels deploy for added roll control. Outboard spoilers function as speed brakes to slow the airplane and increase descent rates, and inboard ground spoilers improve braking and reduce landing distances.

The rest of the airplane's systems are conventional in design, with redundant power sources and fairly simple (for a large business jet) controls and functionality. Some features, however, will stand out—especially for newcomers stepping up from smaller jets. One is the fueling/defueling panel in the wing leading edge. You can set the controls to fuel the airplane to a certain level, and the system automatically stops fueling when the level is reached. Same thing with defueling. Another is rudder-travel limitation logic for takeoff. As speed builds during the takeoff run, rudder travel is automatically limited to prevent overstressing the tail structure. Still another is the brake-by-wire system. The brakes are designed for 2,000 cycles, and have wear indicators that are checked during the preflight inspection. They're astoundingly effective, and can seem awfully "grabby" until you become accustomed to their power and feedback sensations—a process that takes just a few minutes. Stand on those brakes while you taxi, and you'll stop *right now.*



The four-tube Rockwell Collins Pro Line 21 avionics suite is standard, and can display systems status, along with numerous alerts, in its crew advisory displays. Should an engine fail just after takeoff, an automatic power reserve feature kicks in, boosting the thrust of the good engine. Like all Challengers, the 300 has an airliner-like presence, a well-appointed cabin, and a competitive price tag. Designed with maintenance in mind, the 300 has strategically-placed access panels that let technicians swap out faulty components in minimal time.

Flying

Step into the 300's roomy cockpit and you're faced with the Rockwell Collins Pro Line 21 avionics suite, a setup dominated by four 10-by-12-inch display screens. There's a crew alert system (CAS) that can annunciate 425 system faults of varying severity, but to avoid distractions during takeoff and landing all but the most crucial alerts are inhibited.

For my familiarization flight with Bombardier director of flight operations Robert Agostino, our Challenger's takeoff weight was 32,500 pounds. Flaps were set to 10 degrees for takeoff, and our speeds computed: V_1 (takeoff decision speed) was 114 knots, V_R (rotation) was 116 knots, and initial climb speed was 122 knots.

Setting power was a breeze. The engines—Honeywell's 6,826-pounds static thrust AS907s, which have 7,000-hour time between overhauls (TBOs)—use dual channel digital FADEC (full authority digital engine control), so you hold the brakes, move the power levers to the TO (takeoff) click-stop, and power is set. After that, it's a brief ride to V_R, then a 4,000-fpm climbout at 220 knots. Once in the climb, power can be reduced to the CLB (climb) stop, although fine adjustments can be made by moving the levers to intermediate settings.

We were cleared to Flight Level 430, and by the time we passed through FL410 a glance at our airspeed tape showed a climb speed of Mach 0.80 and a climb rate of 1,200 fpm. Not bad.

In cruise at FL430 and 1 degree below standard temperature, we trued out at 457 knots, or Mach 0.80. Fuel flow was 770 pph each side, for a total fuel burn of about 232 gallons per hour. Eventually, we reached the high-speed cruise target of Mach 0.83, using a fuel burn of 880 pph. Meanwhile, the pressurization system kept the cabin at the 7,800-foot level.

For airwork, we banked 45 degrees and did some steep turns. There was no sign of stall buffet—always good news up in the altitudes where stall margins narrow, even though indicated airspeeds remain high.

Stalls were tame. The approach-to-landing stall was first signaled by the stick shaker, which came on at 98 knots. The stall break followed at 87 knots, and little altitude is lost if you follow the recovery procedure: Hold the pitch attitude and add power to break the stall.

SPECSHEET

Bombardier Challenger 300
Average equipped price: $17,454,000

Specifications

Powerplants	Two Honeywell AS907, 6,826 lbst ea
Recommended TBO	7,000 hr
Length	68 ft 7 in
Height	20 ft 3 in
Wingspan	63 ft 11 in
Wing area	522 sq ft
Wing loading	73.8 lb/sq ft
Power loading	2.82 lb/hp
Seats	2 crew + 8-9 pax
Cabin length	28 ft 7 in
Cabin width	7 ft 2 in
Cabin height	6 ft 1 in
Basic operating weight	23,350 lb
Max ramp weight	38,650 lb
Max takeoff weight	38,500 lb
Max zero fuel weight	26,100 lb
Max payload	2,750 lb
Max payload w/full fuel	1,150 lb
Max landing weight	33,750 lb
Fuel capacity	2,096 gal (14,150 lb)
Baggage capacity	105.5 cu ft

Performance

Balanced field length, SL @ 15 deg C/59 deg F	4,720 ft
Time to climb, SL to 39,000 ft	16 min
Time to climb, SL to 41,000 ft	19 min

For the landing at Wichita Mid-Continent Airport we came down Runway 19L's back-course approach, and used 30 degrees of flap and a final approach speed of 113 knots. Our available runway distance was 6,301 feet but in a testimony to those flaps, spoilers, and brakes, I got it flared, down, and stopped in 2,200 feet. The biggest landing quirk is getting used to the airplane's flat attitude in the flare. Like others in the Challenger line, you have to fight the urge to flare too much. It may look like you're uncomfortably nose-low on short final, but you have to remember that this is normal.

I'm always amazed by some of the low landing speeds possible in airplanes this large and heavy (our landing weight was 28,100 pounds). The fact is that after a few takeoffs and landings, a competent newcomer quickly learns the basic stick-and-rudder ways of airplanes as well thought out as the Challenger 300. For total competence, though, a three- or four-week session of pilot initial training at Bombardier's training center in Dallas-Fort Worth, Texas, will, of course, be essential.

Late developments

The Challenger 300 shows early signs of popularity. Five have been delivered to Bombardier's Flexjet fractional ownership organization, and the first corporate owner—Dean Phillips Inc., a multinational banking, natural gas, and food-processing firm—took delivery of its 300 in April.

With an order book reportedly hovering near the 100-airplane mark, it appears the market for this $17.85 million eight-seater is off to a good start. That price sounds steep—and it is!—but it's just over half of the $30 million-plus commanded by the large 5,000- to 6,000-nm jets.

For the scores of companies that want the comfort of a much bigger jet and the operating costs (Bombardier says $1,444 per hour) of a much smaller one, but don't need the range, airplanes like the Challenger 300 make sense.

E-mail the author at tom.horne@aopa.org

i Links to additional information about larger business jets may be found on AOPA Online (www.aopa.org/pilot/links.shtml). Keyword search: business jet.

Cruise speed/range w/NBAA fuel rsv for 200-nm alternate, 2 crew, 8 pax, zero wind @ Long-range, Mach 0.80 cruise .....459 kt/ 3,100 nm
Max operating altitude.....45,000 ft
Sea-level cabin .....23,500 ft

Limiting and Recommended Airspeeds

V_R (rotation), 20-deg flaps .....126 KIAS
V_2 (takeoff safety speed), 20-deg flaps.....129 KIAS
V_{ref} (reference speed, final approach), flaps 30-deg .....124 KIAS
V_{MO} (max operating speed), SL to 8,000 ft .....300 KCAS
V_{mo} (max operating speed), 8,000 to 29,475 ft .....320 KCAS
M_{mo} (max Mach number), above 29,475 ft .....0.83 M

For more information, contact Bombardier Aerospace, 400 Cote-Vertu Road West, Dorval, Quebec, Canada H4S 1Y9; telephone 1/800/268-0030; Web site www.aero.bombardier.com

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, maximum weight conditions unless otherwise noted.