

BOMBARDIER

BOMBARDIER AEROSPACE

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 DESIGN DIVISIONS:

Bombardier Aerospace Montreal: formerly Canadair; follows Bombardier entry
Bombardier Aerospace Toronto: formerly de Havilland; follows Bombardier Aerospace Montreal entry
Bombardier Aerospace Learjet: see US
Bombardier Aerospace Belfast: formerly Shorts

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Bombardier Inc, a diversified Canadian corporation with 79,000 employees, formed Bombardier Aerospace in 1986, subsequently combining design and manufacturing activities

of Canadair (1986), de Havilland (1992), Learjet (1990) and Shorts (1989). Sales, marketing and support are conducted by the Amphibious Aircraft, Regional Aircraft and Business Aircraft units.

Bombardier Aerospace also designs and manufactures components for Airbus and Boeing.

Bombardier Aerospace's revenue for the year ended 31 January 2002 totalled C\$12 billion. Deliveries in 2001 were 370 aircraft, the same as 2000, but a reduction of 40 over target figure projected at the start of the year. Total for 2001 comprised 206 regional aircraft, 162 business jets and two amphibians. Previous deliveries in company's financial years were 146, 168, 178, 227 and 292 in 1995-99.

UPDATED

BOMBARDIER AEROSPACE MONTREAL OPERATIONS

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Acquired by Bombardier Inc 23 December, 1986, Bombardier Aerospace Montreal (formerly Canadair) has manufactured more than 4,500 aircraft since 1944. Mirabel plant, adjacent to Montréal International Airport, until recently comprised 27,870 m² (300,000 sq ft) of floor space for manufacture and assembly of the Challenger and Regional Jet. However, 27,870 m² (300,000 sq ft) final assembly building for CRJ700 and CRJ900 formally opened on 22 October 2001, having begun operations in previous August. An 18,580 m² (200,000 sq ft) interior outfitting, flight testing, inspection and delivery centre is also part of the Mirabel facility. Parts, components and spare parts for various aircraft, including Challenger, Regional Jet series, Global Express and Bombardier 415, are manufactured at St Laurent plant, 214,350 m² (2,307,275 sq ft) in Québec. Structural components for other aircraft builders, such as Boeing and Aerospatiale Matra, are also manufactured in this plant.

Global Express is completed at the 38,590 m² (415,400 sq ft) Bombardier Completion Center, Montréal, beside the Bombardier Aerospace headquarters at Dorval. Total workforce in the Montréal area is more than 15,000.

UPDATED

BOMBARDIER CRJ200 and CHALLENGER 800

TYPE: Regional jet airliner.

PROGRAMME: Design studies began in third quarter of 1987; basic configuration frozen June 1988; engineering designation CL-600-2B19; formal programme go-ahead given 31 March 1989; extended-range CRJ100ER announced September 1990. Three development aircraft built (c/n 7001-7003), plus static test airframe (c/n 7991) and forward fuselage test article (7992); first flight of 7001 (C-FCR1) 10 May 1991; 7002 (C-FNRJ) first flew 2 August 1991 and 7003 on 17 November 1991; all three in 1,400-hour flight test programme in Wichita, USA. CF34-3A1 engine obtained its US type certificate 24 July 1991. Transport Canada type approval (CRJ100 and CRJ100ER) 31 July 1992. Japanese Civil Aviation Bureau certification 23 May 2000.



Bombardier CRJ200 of Midway Airlines, based in North Carolina, USA (Paul Jackson)

NEW/0546839

First delivery aircraft (c/n 7004) flew 4 July 1992, and to Lufthansa CityLine of Germany (as D-ARJA) 29 October 1992; European JAA and US FAA certification 14 and 21 January 1993 respectively; long-range CRJ100LR certified 29 April 1994; CRJ200 with CF34-3B1 engines announced in 1995. Replaced CRJ100 after 226 of the latter had been delivered. Total fleet time at May 2002 (not including corporate aircraft) was 4,961,012 flight hours and 4,374,564 cycles, with 98.6 per cent dispatch reliability rate. 200th aircraft delivered (to Lufthansa) 24 October 1997; 300th to Atlantic Coast Airlines in April 1999. 400th to Delta Connection/SkyWest in July 2000. 500th to Atlantic Coast Airlines 26 April 2001, and 600th to Atlantic Southeast Airlines 29 January 2002, and 700th to Air Nostrum 30 October 2002. Production of CRJ200 running at 9.5 per month in 2000, rising to 12.5 per month by late 2001, and 14.5 per month by 2003, with annual targets of 165 in 2003 and 174 in 2004.

CURRENT VERSIONS: **CRJ100:** Original standard aircraft. Engineering designation CL-600-2B19.

CRJ100ER: Replaced by CRJ200ER.

CRJ100LR: Announced March 1994; launch customer, Lauda Air of Austria; replaced by CRJ200LR.

CRJ200: Standard aircraft; designed to carry 50 passengers over 985 n mile (1,824 km; 1,133 mile) range; CF34-3B1 engines with 2.8 per cent lower specific fuel consumption than CF34-3A1 of CRJ100, increasing initial cruise altitude by 213 m (700 ft), cruising speed by 2.5 kt (4.5 km/h; 3 mph), and range typically by 1.5 per cent; Class C baggage compartment as standard. First delivery, to Tyrolean Airways as OE-LCF, 15 January 1996. Further improvements in development for introduction on CRJ200 variants during early 1996 included 3 kt (5.5 km/h; 3.5 mph) reduction in V_2 speed to provide 91 m (300 ft) reduction in T-O run at maximum T-O weight; 1 kt (1.8 km/h; 1.2 mph) reduction in V_{REF} to provide 15 m (50 ft) reduction in landing run at typical landing weights;

new 8° flap setting to improve second-segment climb performance; and GPS integrated with an upgraded FMS.

CRJ200ER: Extended-range capability with optional increase in maximum T-O weight to 23,133 kg (51,000 lb) and optional additional fuel capacity, for range of 1,645 n miles (3,046 km; 1,893 miles).

CRJ200LR: Longer-range version of CRJ200ER (more than 2,005 n miles; 3,713 km; 2,307 miles); maximum T-O weight increased by 907 kg (2,000 lb) to 24,040 kg (53,000 lb).

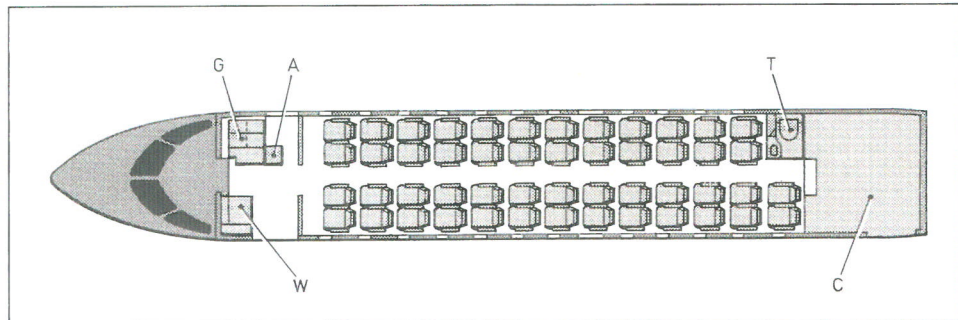
CRJ200B, CRJ200B ER and CRJ200B LR: As above, but with optional hot-and-high CF34-3B1 engines providing normal T-O thrust up to ISA+7.8°C (ISA+6.1°C for standard engines), and APR thrust up to ISA+15°C (ISA+6.1°C for standard engines).

CRJ440: Engineering designation CL-600-2B19. Version seating 44 passengers in standard configuration. Launch customer Northwest Airlines has ordered 75.

CRJ700: Described separately.

Corporate Jetliner: Company shuttle version with more spacious cabin accommodation for 18 to 30 passengers. One delivered June 1993 to Xerox Corporation. Five ordered by the People's Republic of China in January 1997; operated on behalf of PRC government by China United Airlines' crews; contract value C\$116 million, including outfitting, pilot and maintenance staff training and spares. Supplanted from September 2002 by corporate version of Challenger 800 (see below).

Challenger 800: Corporate version developed in consultation with launch customer TAG Aeronautics Ltd to meet requirement for non-stop flights, London to Jeddah or equivalent, with three crew and five passengers; or between Middle East city pairs with 15 passengers. First flown 26 May 1995 and formally announced at Paris Air Show in the following month; initially designated **Canadair Special Edition**; first delivery (N877SE) to TAG during Dubai International Aerospace Show in November 1995; second TAG aircraft delivered November 1997. Accommodation for up to 19 passengers in customised cabin; additional 1,814 kg (4,000 lb) of fuel carried in two auxiliary tanks behind main cabin, extending range to more than 3,000 n miles (5,556 km; 3,452 miles); maximum T-O weight 24,040 kg (53,000 lb); first aircraft powered by standard CF34-3A1 turbofans, but subsequent examples are equipped with CF34-3B1s increasing range to 3,120 n miles (5,778 km; 3,590 miles); Rockwell Collins Pro Line 4 avionics as on RJ, but with third FMS, third VHF, dual Collins HF and Selcal. Manufactured to special order only. Recent customers include Poly Technologies Inc, which ordered two on 16 August 2001 for operation by China Ocean Aviation Group, with deliveries scheduled for 2002. Renamed Challenger 800 on eve of NBAA Convention at Orlando, Florida, 8 September 2002.



Bombardier CRJ standard 79 cm (31 in) pitch 50-seat layout (Jane's/Mike Keep)
 A: attendant's seat, C: cargo, G: galley, T: toilet, W: wardrobe

For details of the latest updates to *Jane's All the World's Aircraft* online and to discover the additional information available exclusively to online subscribers please visit
jawa.janes.com

CUSTOMERS: See table.

BOMBARDIER CRJ ORDERS AND DELIVERIES
(at 1 January 2004)

Customer	Variant	Ordered	Delivered	Backlog
Adria Airways	200	4	4	
Air Canada	100	24	24	
	200	2	2	
Air Dolomiti	200	5	5	
Air Littoral	100	19	19	
Air Nostrum	200	28	22	6
Air Wisconsin	200	64	57	7
American Eagle	701	25	19	6
Atlantic Coast Airlines	200	121	87	34
Atlantic Southeast (ASA)	200	45	45	
	701	12	12	
*Austrian arrows	200	15	12	3
Brit Air	100	20	20	
	701	12	10	2
British European	200	4	4	
China Eastern	200	6	6	
Yunnan				
Cimber Air	200	2	2	
COMAIR	100	110	110	
	701	20	17	3
DAC Air	200	2	2	
Delta Connection	200	84	84	
	701	26	6	20
GECAS	200	5	5	
Horizon Air	701	28	18	10
Japan Air Lines (J-AIR)	200	6	6	
Kendell/Ansett	200	12	12	
Lauda Air	100	8	8	
Lufthansa	100	35	35	
CityLine				
	200	10	10	
	701	20	20	
Lufthansa/Euroings	200	15	10	5
Maersk	200	11	11	
	701	5	5	
Malev	200	4	4	
Mesa Air	200	32	32	
	701	15	15	
	900	25	10	15
Midway	200	24	24	
Northwest Airlines	200	54	35	19
	440	75	41	34
Saega Airlines	200	1	1	
Shandong Airlines	200	5	5	
	701	2	2	
Shanghai Airlines	200	3	3	
SkyWest	100	10	10	
	200	90	88	2
	701	30	-	30
South African Express	200	6	6	
Southern Winds	200	2	2	
The Fair Inc	200	2	2	
US Airways	200	60	7	53
	705	25	-	25
Challenger 800	SE	19	19**	
Totals		1,289	1,015	274

* Formerly Tyrolean
** Comprising 18 Series 200 and one Series 700
Does not include Air Canada memorandum of understanding signed 19 December 2003 for 15 CRJ200s and 30 CRJ705s, plus options on 15 CRJ200s and 30 CRJ 705s, for delivery commencing third quarter 2004 for CRJ200s and second quarter 2005 for CRJ700s.

COSTS: Programme development costs C\$275 million. Atlantic Coast Airlines order for 10 CRJ200ERs valued at US\$200 million (September 1998). Order for two Special Editions valued at US\$54.2 million (August 2001).

DESIGN FEATURES: Evolved from Challenger (which see), designed expressly for regional airline operating environment. Advanced transonic wing design, with winglets for high-speed operations; fuel-efficient GE turbofans; options include higher design weights, additional fuel capacity, more comprehensive avionics, and maximum certified altitude raised to 12,500 m (41,000 ft).

Wings, designed with computational fluid dynamics (CFD), have 13.2 per cent (root) and 10 per cent (tip) thickness/chord ratios, 2° 20' dihedral, 3° 25' root incidence and 24° 45' quarter-chord sweepback.

FLYING CONTROLS: Conventional and power-assisted. Primary controls with cables and push/pull rods for multiple redundancy; hydraulically actuated ailerons, elevators and rudder with at least two hydraulic power control unit actuators per surface (three on rudder and elevator); ailerons and elevators fitted with flutter dampers (dual on elevators); rudder with dual-channel control yaw damping; artificial feel and electric trim for roll and yaw; electronically controlled, variable incidence T tailplane for pitch trim and electronically controlled artificial pitch feel. Double-slotted electromechanical flaps with electronically controlled Datron electric motors; BAE fly-by-wire spoiler and spoileron system, four spoilers each side, with inner two functioning as ground spoilers, outer two comprising one flight spoiler and one spoileron, both also providing lift dumping on touchdown. Avionics suite includes engine indication and crew alerting system (EICAS).

STRUCTURE: Semi-monocoque fuselage is damage tolerant FAR/JAR 25 certified airframe with chemically milled skins; flat pressure bulkheads forward of flight deck and aft of baggage compartment; extensive use of advanced composites in secondary structures (passenger compartment floor, wing/fuselage fairings, nacelle doors, wing access door covers, winglets, tailcone, avionics access doors and landing gear doors); comprehensive anti-corrosion treatment and drainage. Wing is one-piece unit mounted to underside of fuselage; two-spar box joined by ribs, covered top and bottom with integrally stiffened skin panels (three upper and three lower each side) for smooth flow; machined or built-up spars and shearweb-type ribs. Short Brothers (UK) manufactures fuselage central section, fore and aft fuselage plugs, wing flaps, ailerons, spoilerons and inboard spoilers.

LANDING GEAR: Hydraulically retractable tricycle type, manufactured by Dowty. Inward-retracting main units each have 15 in Aircraft Braking System (ABS) wheels with H29x9.0-15 (16 ply) Goodyear tubeless tyres, pressure 11.17 bar (162 lb/sq in) unladen. Nose unit has 18x4.4 (12 ply) tyres (deflector type) and Dowty Canada steer-by-wire steering; unladen tyre pressure 8.62 bar (125 lb/sq in). Aircraft Braking System steel multidisc brakes and fully modulated Hydro Aire Mk III anti-skid system. Minimum taxiway width for 180° turn (with 3.35 m; 11 ft 0 in safety margin) is 22.86 m (75 ft 0 in).

POWER PLANT: Two General Electric CF34-3B1 turbofans, each rated at 41.0 kN (9,220 lb st) with APR and 38.8 kN (8,729 lb st) without. Nacelles produced by Short Brothers. Pneumatically actuated thrust reversers. Fuel in two integral wing tanks, combined capacity 5,300 litres (1,400 US gallons; 1,166 Imp gallons); increaseable to 8,080 litres (2,135 US gallons; 1,778 Imp gallons) with optional centre-wing tank. Pressure refuelling point in starboard leading-edge wingroot; transfer rate 474 litres (125 US gallons; 104 Imp gallons)/min at 3.45 bar (50 lb/sq in); two gravity points on starboard wing (one for centre tank) and one on port wing.

ACCOMMODATION: Two-pilot flight deck; one or two cabin attendants. Main cabin seats up to 50 passengers in standard configuration, four-abreast at 79 cm (31 in) pitch, with centre aisle; maximum capacity 52 seats. Various configurations, from 15 to 50 seats, available for corporate version. Downward-opening front passenger door with integral airstairs on port side; plug-type forward emergency exit/service door opposite on starboard side (inoperative on Challenger 800). Inward-opening baggage door on port side at rear. Overwing Type III emergency exit each side (port side door inoperative on Challenger 800). Entire accommodation pressurised, including rear baggage compartment.

SYSTEMS: Cabin pressurisation and air conditioning system (maximum differential 0.57 bar; 8.3 lb/sq in). Primary flight control systems powered by hydraulic servo-actuators with distinct, alternate paths cable and pushrod systems. Electric trim and dual yaw dampers. Three fully independent 207 bar (3,000 lb/sq in) hydraulic systems.

Three-phase 115 V AC electrical primary power at 400 Hz supplied by two 30 kVA engine-driven generators; alternative power provided by APU and air-driven generator. Conversion to 28 V DC by five transformer-rectifier units. Main (Ni/Cd) battery 17 Ah, APU battery 43 Ah. Honeywell GTCP 36-150 (RJ) APU and two-pack air conditioning system in rear of fuselage. Wing leading-edges and engine intake cowls anti-iced by engine bleed air. Electric anti-icing of windscreen and cockpit side windows, pitot heads, air data vanes, static sources and sensors. Ice detection system standard.

AVIONICS: Comms: Dual VHF nav/com radios. Options include HF radio, single Selcal and 8.33 kHz VHF.

Radar: Rockwell Collins digital weather radar system; split-scan weather radar and radar with turbulence mode optional.

Flight: Dual flight management systems optional. GPWS, windshear detection system and TCAS. EGPWS optional in place of GPWS. L3 flight data recorder and CNE. Dual FMS 4200 and dual IRS in Corporate Jetliner and Challenger 800.

Instrumentation: Rockwell Collins Pro Line 4 integrated all-digital suite, including dual primary flight displays, dual multifunction displays, dual EICAS, dual AFCS, dual AHRS, dual air data system and Cat. II capability with Cat. IIIa optional using head-up guidance system. Dual inertial reference system optional in lieu of AHRS. Flight Dynamics Inc HGS 2100 HUD approved by Transport Canada November 1995, permitting Cat. IIIa operation.

DIMENSIONS, EXTERNAL: As for Challenger 604 except:

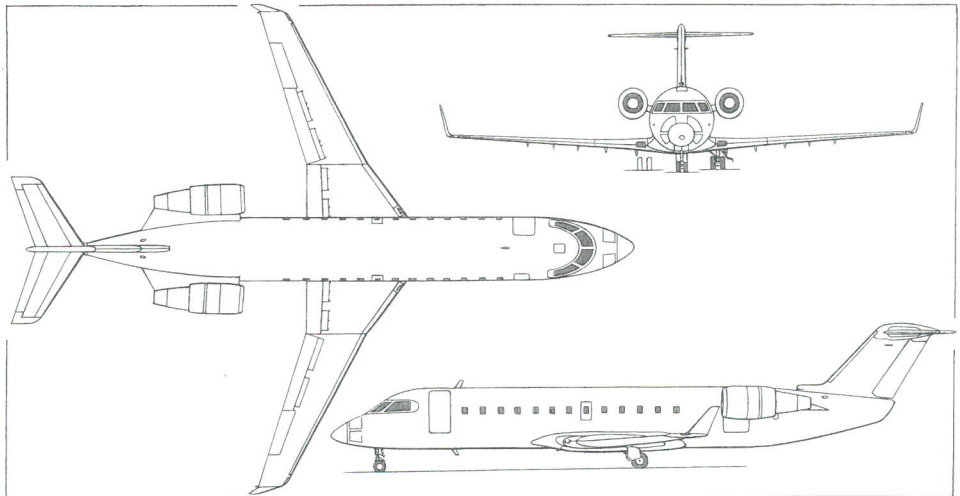
Wing span over winglets	21.21 m (69 ft 7 in)
Wing chord: at fuselage c/l	5.13 m (16 ft 10 in)
at tip	1.27 m (4 ft 2 in)
Wing aspect ratio (excl winglets)	8.9
Length: overall	26.77 m (87 ft 10 in)
fuselage	24.38 m (80 ft 0 in)
Height overall	6.22 m (20 ft 5 in)
Fuselage max diameter	2.69 m (8 ft 10 in)
Wheel track	3.17 m (10 ft 5 in)
Wheelbase	11.41 m (37 ft 5 in)
Passenger/crew door (fwd, port):	
Height	1.78 m (5 ft 10 in)
Width	0.91 m (3 ft 0 in)
Service door (stbd, fwd):	
Height	1.22 m (4 ft 0 in)
Width	0.61 m (2 ft 0 in)
Height to sill (crew/service)	1.63 m (5 ft 4 in)
Baggage door (port, rear):	
Height	1.09 m (3 ft 7 in)
Width	0.84 m (2 ft 9 in)
Height to sill	1.63 m (5 ft 4 in)
Emergency exit (overwing, stbd):	
Height	0.96 m (3 ft 2 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL: As for Challenger 604 except:

Cabin (incl baggage compartment, excl flight deck):	
Length	14.76 m (48 ft 5 in)
Max height	1.85 m (6 ft 1 in)
Width: at centreline: except 800	2.57 m (8 ft 5 in)
800	2.49 m (8 ft 2 in)
at floor level	2.18 m (7 ft 2 in)
Floor area: except 800	32.1 m ² (346 sq ft)
800	30.3 m ² (326 sq ft)
Volume: except 800	57.1 m ³ (2,015 cu ft)
800	53.8 m ³ (1,900 cu ft)
Stowage volume:	
main (rear) baggage compartment	9.0 m ³ (318 cu ft)
wardrobes/bins/underseat (total)	4.7 m ³ (165 cu ft)

AREAS:

Wings: gross (excl winglets)	54.54 m ² (587.1 sq ft)
net	48.35 m ² (520.4 sq ft)
Ailerons (total)	1.93 m ² (20.8 sq ft)
Trailing-edge flaps (total)	10.60 m ² (114.1 sq ft)
Spoilers (total)	2.26 m ² (24.3 sq ft)
Winglets (total)	1.38 m ² (14.9 sq ft)
Fin	9.18 m ² (98.8 sq ft)



Bombardier CRJ200 (two General Electric CF34-3B1 turbofans)



Bombardier Challenger 800 business jet

0533371

Rudder	2.03 m ² (21.9 sq ft)
Tailplane	9.44 m ² (101.6 sq ft)
Elevators (total)	2.84 m ² (30.52 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty:	
200	13,236 kg (29,180 lb)
200ER, 200LR	13,243 kg (29,195 lb)
800 Corporate	11,703 kg (25,800 lb)
Operating weight empty: 200	13,730 kg (30,270 lb)
200ER, 200LR	13,835 kg (30,500 lb)
800 Corporate	14,424 kg (31,800 lb)
800	15,377 kg (33,900 lb)
Max payload (structural): 200	5,411 kg (11,930 lb)
200ER, 200LR	6,124 kg (13,500 lb)
800 Corporate	5,533 kg (12,200 lb)
800	2,540 kg (5,600 lb)
Max fuel: 200	4,254 kg (9,380 lb)
200ER, 200LR, 800 Corporate	6,489 kg (14,305 lb)
800	8,303 kg (18,305 lb)
Payload with max fuel: 200	3,651 kg (8,050 lb)
200ER	2,923 kg (6,445 lb)
200LR	3,831 kg (8,445 lb)
800 Corporate	2,333 kg (5,145 lb)
800	474 kg (1,045 lb)
Fuel with max payload: 800	6,237 kg (13,750 lb)
Max T-O weight: 200	21,523 kg (47,450 lb)
200ER, 800 Corporate	23,133 kg (51,000 lb)
200LR, 800 Corporate (optional), 800	24,040 kg (53,000 lb)
Max ramp weight: 200	21,636 kg (47,700 lb)
200ER	23,246 kg (51,250 lb)
200LR, 800	24,154 kg (53,250 lb)
Max zero-fuel weight: 800	17,917 kg (39,500 lb)
200	19,141 kg (42,200 lb)
200ER, 200LR, 800 Corporate	19,958 kg (44,000 lb)
Max landing weight: 200	20,275 kg (44,700 lb)
200ER, 200LR, 800 Corporate, 800	21,319 kg (47,000 lb)
Max wing loading: 200	394.6 kg/m ² (80.82 lb/sq ft)
200ER	424.1 kg/m ² (86.87 lb/sq ft)
200LR, 800 Corporate (optional), 800	440.8 kg/m ² (90.27 lb/sq ft)
Max power loading (APR rating):	
200	263 kg/kN (2.57 lb/lb st)
200ER, 800 Corporate	282 kg/kN (2.77 lb/lb st)
200LR, 800 Corporate (optional), 800	293 kg/kN (2.87 lb/lb st)

PERFORMANCE:

Max operating speed:	
above FL314	M0.85
below FL254	335 kt (621 km/h; 386 mph)
High-speed cruising speed: CRJ200 at FL370	
M0.81 or 464 kt (859 km/h; 534 mph)	
800 Corporate, 800	
M0.80 or 459 kt (850 km/h; 528 mph)	
Normal cruising speed: CRJ200 at FL370	
M0.74 or 424 kt (785 km/h; 488 mph)	
800 Corporate, 800	
M0.77 or 442 kt (819 km/h; 509 mph)	
Long-range cruising speed, 800 Corporate, 800	
M0.74 or 424 kt (785 km/h; 488 mph)	
Approach speed, 45° flap, AUW of 19,504 kg (43,000 lb)	
135 kt (250 km/h; 155 mph)	
Max rate of climb at FL15, 250 kt CAS/M0.74 climb	
schedule: 200	1,128 m (3,700 ft)/min
200LR	1,036 m (3,400 ft)/min
800	1,034 m (3,395 ft)/min
Max certified altitude	12,500 m (41,000 ft)
FAR T-O field length at S/L, ISA:	
200	1,527 m (5,010 ft)
200ER	1,768 m (5,800 ft)
200LR	1,917 m (6,290 ft)
800 Corporate	1,765 m (5,790 ft)
800	1,918 m (6,295 ft)

FAR landing field length at S/L, ISA, at max landing	
weight: 200	1,423 m (4,670 ft)
200ER, 200LR	1,478 m (4,850 ft)
800 Corporate, SE	887 m (2,910 ft)
Range with max payload at long-range cruising speed,	
FAR Pt 121 reserves:	
200	965 n miles (1,787 km; 1,110 miles)
200ER	1,645 n miles (3,046 km; 1,893 miles)
200LR	2,005 n miles (3,713 km; 2,307 miles)
Corporate (30 seats), NBAA IFR reserves	
2,017 n miles (3,735 km; 2,321 miles)	
800 with 3,674 kg (8,100 lb) payload	
1,541 n miles (2,853 km; 1,773 miles)	
Range with max fuel:	
800 Corporate	2,250 n miles (4,167 km; 2,589 miles)
800	3,120 n miles (5,778 km; 3,590 miles)

OPERATIONAL NOISE LEVELS: (CRJ200, FAR Pt 36):

CRJ200:	
T-O	77.6 EPNdB
Approach	92.1 EPNdB
Sideline	82.4 EPNdB
800 Corporate, 800:	
T-O	78.7 EPNdB
Approach	92.1 EPNdB
Sideline	82.2 EPNdB

UPDATED

BOMBARDIER CRJ700

TYPE: Regional jet airliner.

PROGRAMME: Design and market evaluation began in 1995 in consultation with 15-member advisory panel of airline operators; stretched derivative of Regional Jet; originally designated CRJ-X; engineering designation CL-600-2C10. GE CF34-8C1 engines selected February 1995; low-speed wind tunnel testing began early 1995 at Institute of Aeronautical Research, Ottawa; high-speed wind tunnel testing began November 1995 at Rockwell facilities in California. More than 650 hours of wind tunnel testing completed by September 1996. Bombardier Board gave approval for launch on 21 January 1997, at which time orders included four from launch customer Brit Air of France. Aerodynamic configuration frozen 14 March 1997; design frozen 17 July 1998. New version of CF34 engine first ground run in February 1998, followed by flight tests on GE-owned Boeing 747 testbed in first quarter of 1999 and certification in November 1999. First flight (C-FRJX c/n 10001) 27 May 1999; official roll-out 28 May 1999; public debut (c/n 10004) at Farnborough International Air Show 23 July 2000; Transport Canada certification achieved 22 December 2000; first delivery, to Brit Air of France, in February 2001, followed by deliveries to Horizon Air and Lufthansa CityLine in May.

Four flying aircraft and two static test airframes participated in the certification programme; one static test airframe was used for Complete Aircraft Static Test (CAST), while the other underwent Durability and Damage Tolerance Test (DDTT), and was subjected to the equivalent of 160,000 flight cycles. Test programme was conducted at the Bombardier Flight Test Centre at Wichita, Kansas, totalling 1,600 flight hours on four aircraft: C-FRJX (handling and performance evaluation), 10002/C-

FJFC (systems), 10003/C-FBKA (avionics) and 10004/C-FCRJ, the first to be fully furnished (function and reliability testing), which initially flew on 16 December 1999. In December 2002 Bombardier signed a tentative agreement with China Aviation Corporation I (AVIC I) that could lead to final assembly of the CRJ700 and CRJ900 (which see) by Shanghai Aviation Industrial Corporation.

CURRENT VERSIONS: **CRJ700:** 68-seat version in standard and extended range (ER) weight options.

CRJ701: 70-seat version in standard and extended range (ER) weight options.

CRJ900: further stretch, *described separately*.

CUSTOMERS: See table in CRJ200 entry. Total 187 firm orders, of which 85 delivered, by 31 March 2003.

COSTS: Development cost C\$645 million, of which C\$440 million provided by Bombardier and balance by risk-sharing partners. Unit cost US\$26.8 million (1998). Break-even point is at 200th of 400 aircraft production run.

DESIGN FEATURES: Commonality (including crew training and type rating) with CRJ100/200; direct operating cost per seat-mile to be 20 per cent lower than that of CRJ100/200 and lowest of any airliner in its class. Fuselage stretched 4.72 m (15 ft 6 in) by plugs fore and aft of centre-section to seat 70 passengers; rear pressure bulkhead moved aft by 1.29 m (4 ft 3 in); cabin 6.02 m (19 ft 9 in) longer; APU moved to tailcone; cabin floor lowered by 2.5 cm (1 in) and ceiling raised by 1.3 cm (½ in) to provide 1.89 m (6 ft 2½ in) headroom; cabin windows raised 11.5 cm (4½ in); new underfloor baggage compartment, volume 3.09 m³ (109 cu ft) to facilitate ramp check-in; wing span increased by 1.83 m (6 ft 0 in) by wingroot plug; wing leading-edge extended and equipped with high-lift devices; larger horizontal tail surfaces; new pitch control system; main landing gear lengthened; new wheels, tyres, brakes; air conditioning and anti-icing systems upgraded; new engines; new underfloor baggage compartment on forward port side; overhead stowage bins redesigned.

Incorporation of CRJ900's strengthened wing and avionics software upgrades under consideration in mid-2001 to increase commonality between CRJ700 and CRJ900, affording a 200 n mile (370 km; 230 mile) increase in range for CRJ700.

FLYING CONTROLS: Sextant and Menasco primary and secondary flight control system; flying controls are actuated via a dual network of cables, pulleys and pushrods which operate hydraulic power drive units; secondary controls are fly-by-wire.

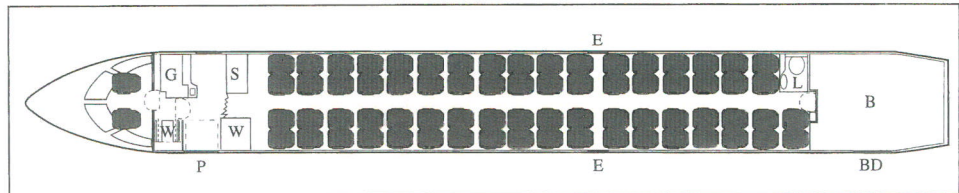
STRUCTURE: Programme participants include Bombardier Canadair operations (wing, cockpit, rudder and doors, electrical system, primary flight controls, plus final assembly and interior completion), C & D Interiors (cabin interior), Gamesa (vertical and horizontal stabilisers), General Electric (power plant), GKN Westland (tailcone and doors), Hella Aerospace GmbH (lighting system), Honeywell (APU), Intertechnique (fuel system), Liebherr Aerospace Toulouse (air management system), Menasco Aerospace (landing gear), Mitsubishi Heavy Industries (aft fuselage), Parker Abex (hydraulic system), Rockwell Collins (avionics), Sextant Avionique (flight control system), Shorts (nacelles and thrust reversers) and Hamilton Sundstrand (flaps, leading-edge slats and electrical system).

LANDING GEAR: Hydraulically retractable tricycle type by Menasco with twin wheels on each unit. Mainwheel tyre size H36x12.0-18, pressure 10.55 bar (153 lb/sq in); nosewheel tyre size H20.5x6.75-10, pressure 9.24 bar (134 lb/sq in).

POWER PLANT: Two General Electric CF34-8C1 turbofans with dual-channel FADEC. Engine rating 56.4 kN (12,670 lb st), or 61.3 kN (13,790 lb st) with automatic power reserve, flat rated to ISA + 15°C. Intertechnique fuel management system with Ratier-Figeac controls. Fuel capacity 10,989 litres (2,903 US gallons; 2,417 Imp gallons).

ACCOMMODATION: Two-pilot flight deck. Main cabin seats 70 passengers, four-abreast at 79 cm (31 in) pitch. Baggage compartment and lavatory at rear of cabin; underfloor baggage compartment; various combinations of galleys, wardrobes and lavatory at front of cabin according to seating capacity. Passenger door, forward emergency exit/ service door, overwing emergency exits and baggage door as for Regional Jet.

SYSTEMS: Hamilton Sundstrand electrical generation system comprising two 40 kVA integrated drive generators; tailcone-mounted Honeywell APU approved for operation up to 12,500 m (41,000 ft); Liebherr air management system; Intertechnique fuel system; Walter Kidde fire detection system; Goodrich potable water system; Hella



Typical CRJ700 seating plan for 70 passengers at 79 cm (31 in) pitch, with 15.7 m³ (555 cu ft) of baggage
B: baggage, BD: baggage door, E: emergency exit, G: galley, L: lavatory, P: entrance, S: stowage, W: wardrobe

lighting system; Parker/Abex Hydraulics hydraulic systems, and Teleflex anti-icing system.

AVIONICS: Radar: Rockwell Collins digital weather radar.

Flight: Rockwell Collins AHRS and TCAS.

Instrumentation: Rockwell Collins Pro Line 4 EFIS with six 127 × 178 mm (5 × 7 in) CRT displays, including dual PFD, dual MFD and dual EICAS; Flight Dynamics HGS 2000 head-up guidance system. Autopilot, FMS and centralised avionics maintenance functions are provided by integrated avionics processing system (IAPS). Windshear detection and recovery system standard. Equipped for Cat. II landings.

Following data are provisional.

DIMENSIONS, EXTERNAL:

Wing span	23.24 m (76 ft 3 in)
Wing aspect ratio	7.4
Length overall	32.51 m (106 ft 8 in)
Max diameter of fuselage	2.69 m (8 ft 10 in)
Height overall	7.57 m (24 ft 10 in)
Tailplane span	8.53 m (28 ft 0 in)
Wheelbase	13.67 m (44 ft 10 in)
Turning circle	22.86 m (75 ft 0 in)
Passenger door (port, fwd):	
Height	1.78 m (5 ft 10 in)
Width	0.91 m (3 ft 0 in)
Height to sill	1.73 m (5 ft 8 in)
Baggage door (port, aft): Height	0.84 m (2 ft 9 in)
Width	1.09 m (3 ft 7 in)
Height to sill	2.31 m (7 ft 7 in)
Baggage door (port, fwd): Height	0.51 m (1 ft 8 in)
Width	1.07 m (3 ft 6 in)
Height to sill	1.28 m (4 ft 2½ in)
Service door (starboard, fwd): Height	1.22 m (4 ft 0 in)
Width	0.61 m (2 ft 0 in)
Height to sill	1.73 m (5 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin (excl flight deck):	
Length	17.27 m (56 ft 8 in)
Max width: at centreline	2.55 m (8 ft 4½ in)
at floor level	2.13 m (7 ft 0 in)
Max height	1.89 m (6 ft 2¼ in)
Floor area, excl cockpit	36.88 m² (397 sq ft)
Volume	75.95 m³ (2,682 cu ft)
Baggage volume (total)	23.3 m³ (824 cu ft)

AREAS:

Wings, net	68.63 m² (738.7 sq ft)
Horizontal tail surfaces (total)	20.74 m² (223.3 sq ft)
Vertical tail surfaces (total)	13.36 m² (143.8 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	19,731 kg (43,500 lb)
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CRJ700 in the colours of Horizon Air

NEW/0546927

BOMBARDIER CRJ900

Engineering designation: CL-600-2D24

TYPE: Regional jet airliner.

PROGRAMME: Announced October 1999; stretched derivative of CRJ700; wind tunnel testing began November 1999; partner/supplier selection finalised second quarter 2000; interior mockup completed March 2000; formal launch at Farnborough International Air Show 24 July 2000; prototype, modified from CRJ700 prototype C-FRJX, with fuselage plugs but retaining CRJ700 wings, landing gear and engines, first flown 21 February 2001; public debut at Paris Air Show 14 June 2001; first production aircraft, c/n 15001/C-GRNH, first flown 20 October 2001; Transport Canada certification achieved 9 September 2002, followed by FAA approval 25 October 2002 and JAA certification 23 December 2002; first customer delivery (c/n 15002) to Mesa Air on 3 February 2003.

In December 2002 Bombardier signed a tentative agreement with China Aviation Industry Corporation I (AVIC I) that could lead to final assembly of the CRJ700 and CRJ900 by Shanghai Aviation Industrial Corporation. CURRENT VERSIONS: 900: Standard version.

900ER: Extended-range version.

900ER European: As 900ER but with maximum T-O weight limited to 36,995 kg (81,560 lb) to minimise weight-related charges when operating in European airspace.

900LR: Long-range version.

900LR European: As 900LR but with maximum T-O weight limited to 37,995 kg (83,764 lb).

CUSTOMERS: Firm orders for 25 by 31 March 2003, from Mesa Air (25). Estimated market for 800 aircraft in CRJ900 class over 20-year period.

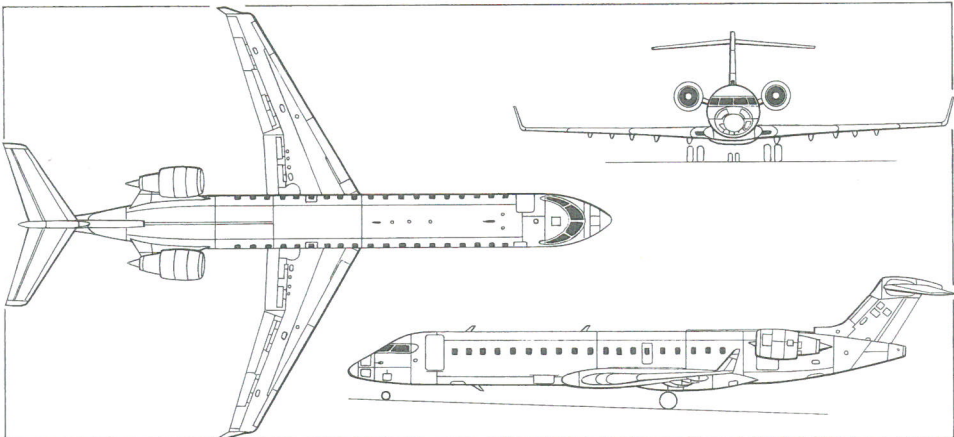
COSTS: Development cost C\$200 million; unit cost C\$30 million (2002).

DESIGN FEATURES: Compared to CRJ700, has fuselage stretched – by means of 2.29 m (7 ft 6 in) plug forward of centre-section and 1.57 m (5 ft 2 in) plug aft of centre-section – to accommodate 86 to 90 passengers in four-abreast configuration with fore and aft lavatories; 5 to 10 per cent higher thrust engines; strengthened main landing gear with upgraded wheels and brakes; strengthened wing; two additional overwing emergency exits; increased volume in forward underfloor baggage hold, and an additional underfloor baggage door and aft service door on starboard side. Common crew qualification with CRJ200/700 series.

STRUCTURE: Programme partners as for CRJ700. Final assembly and completion by Bombardier at new CRJ700/900 facility at Montréal-Mirabel Airport.

LANDING GEAR: As for CRJ700.

POWER PLANT: Two General Electric CF34-8C5 turbofans. Engine rating 58.4 kN (13,123 lb st) or 63.4 kN (14,255 lb st) with automatic power reserve, flat rated to ISA +15°C. Fuel capacity 10,989 litres (2,903 US gallons; 2,417 Imp gallons).



Bombardier CRJ700 regional jet airliner (James Goulding)

0131848



Cabin of CRJ700

0137404

The Bombardier CRJ700 flight deck is based on that of the CRJ100/200

0131796

ACCOMMODATION: Standard dual-class accommodation for 86 passengers in four-abreast configuration at 79 cm (31 in) seat pitch with fore and aft lavatories and forward galley; alternative configurations include high density with accommodation for 90 passengers at 79 cm (31 in) seat pitch, dual-class with 15 business class seats three-abreast at 86 cm (34 in) seat pitch in forward section and 60 economy class four-abreast at 79 cm (31 in) seat pitch at rear, and dual class with 55 business class seats in four-abreast configuration at 84 cm (33 in) seat pitch in forward section and 24 economy class at 79 cm (31 in) seat pitch at rear. Standard additional floor beam facilitates offset seat rail for three-abreast seating throughout cabin.

SYSTEMS: Honeywell RE220 APU.

Following data are provisional.

AVIONICS: As for CRJ700.

DIMENSIONS, EXTERNAL: As for CRJ700 except

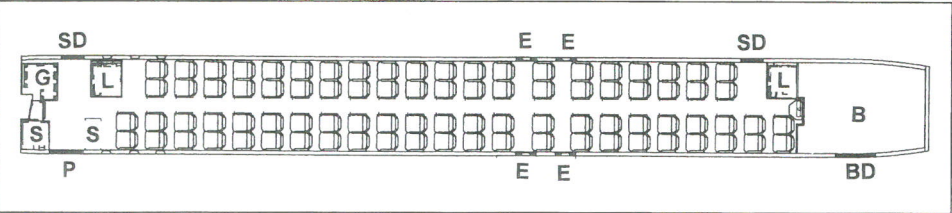
Wing span	23.24 m (76 ft 3 in)
Length overall	36.19 m (118 ft 9 in)
Height overall	7.49 m (24 ft 7 in)
Wheelbase	14.73 m (48 ft 4 in)
Aft service door (stbd):	
Height	1.22 m (4 ft 0 in)
Width	0.61 m (2 ft 0 in)
Height to sill	2.39 m (7 ft 10 in)
Emergency exits (four, overwing):	
Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin (excl flight deck):	
Baggage volume: checked total	16.81 m ³ (593.5 cu ft) 25.57 m ³ (903 cu ft)

WEIGHTS AND LOADINGS:

Operating weight empty	21,546 kg (47,500 lb)
Max payload	10,206 kg (22,500 lb)
Payload with max fuel: 900	6,178 kg (13,620 lb)
900ER	6,972 kg (15,370 lb)
Max fuel weight	8,822 kg (19,450 lb)
Max T-O weight: 900	36,514 kg (80,500 lb)
900ER	37,421 kg (82,500 lb)
900ER European	36,995 kg (81,560 lb)
900LR	38,328 kg (84,500 lb)
900LR European	39,808 kg (87,763 lb)
Max ramp weight: 900	36,627 kg (80,750 lb)
900ER	37,535 kg (82,750 lb)
900LR	38,442 kg (84,750 lb)
Max landing weight	33,339 kg (73,500 lb)
Max zero-fuel weight	31,751 kg (70,000 lb)
Max wing loading: 900	532.1 kg/m ² (108.98 lb/sq ft)
900ER	545.3 kg/m ² (111.68 lb/sq ft)
900ER European	539.1 kg/m ² (110.41 lb/sq ft)
900LR	558.5 kg/m ² (114.39 lb/sq ft)
900LR European	580.1 kg/m ² (118.81 lb/sq ft)
Max power loading: 900	313 kg/kN (3.07 lb/lb st)
900ER	320 kg/kN (3.14 lb/lb st)
900ER European	317 kg/kN (3.11 lb/lb st)
900LR	328 kg/kN (3.22 lb/lb st)
900LR European	325 kg/kN (3.19 lb/lb st)



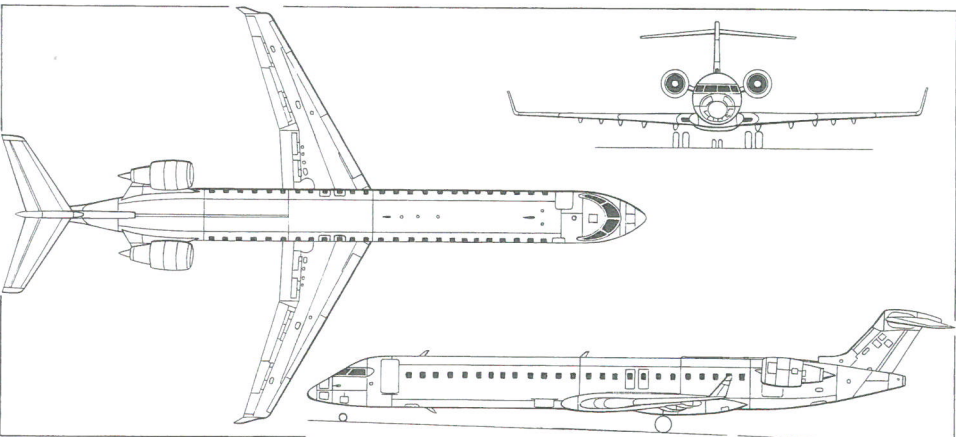
Bombardier CRJ900 seating 86 passengers

B: baggage, BD: baggage door, E: Type III exit, G: galley, L: lavatory, P: Type I passenger door, S: Stowage, SD: Type I service door



Prototype Bombardier CRJ900 wearing house colours

0130587



Bombardier CRJ900 (James Goulding)

0131847

PERFORMANCE:

Cruising Mach No:	
high speed	0.83 (476 kt; 882 km/h; 548 mph)
for max range	0.78 (444 kt; 822 km/h; 511 mph)
Max certified altitude: 900, 900ER	12,500 m (41,000 ft)
Service ceiling, OEI: 900	4,968 m (16,300 ft)
900ER	4,755 m (15,600 ft)
FAR T-O field length:	
900	1,871 m (6,140 ft)
900ER	1,969 m (6,460 ft)
900LR	2,068 m (6,785 ft)
FAR landing field length at S/L, ISA, at max landing weight:	
900, 900ER, 900LR	1,660 m (5,445 ft)
Range, 86 passengers, at M0.77:	
900	1,540 n miles (2,852 km; 1,772 miles)
900ER	1,777 n miles (3,291 km; 2,045 miles)
900LR	1,941 n miles (3,594 km; 2,233 miles)

UPDATED

BOMBARDIER BD-100 CHALLENGER 300

TYPE: Business jet.

PROGRAMME: Design study, then known as 'Bombardier Model 70', revealed at the Paris Air Show in June 1997; formally announced at NBAA Convention at Las Vegas 18 October 1998; launched at Paris Air Show 13 June 1999; initially named Continental; engineering designation BD-100-1A10; first metal cut 21 October 1999 following completion of joint definition phase; AS907 engine first flown 29 January 2000, engine certification achieved 25 June 2002; wing/fuselage mating of first aircraft achieved 19 November 2000; first flight (c/n 20001/C-GJCF) from the Bombardier Flight Test Center at Wichita's Mid-Continent Airport 14 August 2001, followed by second aircraft (c/n 20002/C-GJCF) on 9 October. These and three further aircraft (c/n 20003/C-GIPX, dedicated to avionics test and flown 6 December 2001; c/n 20004/C-GJCV for systems testing and the first to be fully outfitted with standard interior, flew 5 April 2002; and c/n 20005/C-GIPZ, for function and reliability testing (including cabin systems), originally due to fly in May 2002 but delayed until 8 March 2003; is participating in the flight test and certification programme scheduled to last for more than 1,500 flight hours, culminating in Transport Canada 525 approval, FAA FAR Pt 25 and JAA JAR 25 certification, with RVSM approval, FAR Pt 36 Stage 3 noise compliance, and first customer deliveries in 2003. By 23 April 2003 the five aircraft then flying had accumulated 2,126 flight test hours in 1,039 sorties.

Public debut at NBAA Convention, New Orleans, 11 December 2001 (formal presentation 12 December). European debut (C-GJCV) at EBACE 2003 at Geneva 5 May 2003. Re-named Challenger 300 on 8 September



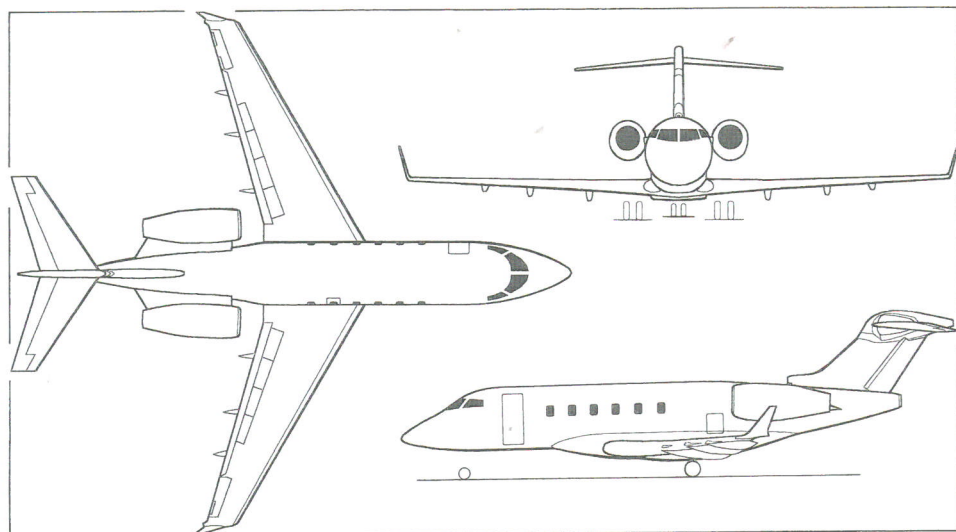
Bombardier Challenger 300 flight deck

0126928



Bombardier Challenger 300 cabin mockup

0126929



Provisional general arrangement of the Bombardier Challenger 300 (Paul Jackson)

0085636

2002, immediately prior to NBAA Convention at Orlando, Florida. Customer deliveries scheduled to begin in late 2002, with up to five aircraft expected to be handed over to operators by the end of the year. Target production up to 15 in 2003, rising to 40 in 2004 and the maximum planned rate of 60 per year from 2005.

CUSTOMERS: Two orders signed at time of launch, by customers in Germany and United Arab Emirates; total of 125 firm orders received by 5 May 2003, including 25 for Bombardier's Flexjet fractional ownership programme, 15 for European customers and five for its Middle East and Arab nations distributor TAG Aeronautics. Bombardier anticipates gaining 30 per cent of estimated 1,200-aircraft market in this class by 2012, with fractional ownership operations especially targeted.

COSTS: Development cost C\$500 million (1998); break-even estimated at 300th aircraft. Unit cost US\$16.29 million typically equipped (2002). Direct operating cost estimated at US\$1,329 per hour (2002).

DESIGN FEATURES: Design goals included coast-to-coast range across USA with eight passengers in cabin with stand-up headroom and take-off field length less than 1,525 m (5,000 ft). General configuration is as shown in the accompanying illustrations; supercritical wing with winglets, sweepback 27° at quarter-chord.

FLYING CONTROLS: Conventional. Ailerons manually actuated via cables, pulleys and pushrods, each with a geared tab and fixed tab, plus trim tab on port aileron only; maximum aileron deflections +23/-19°. Horn-balanced elevators, maximum deflections +23/-18°, and single rudder panel, maximum deflection ±30°, hydraulically actuated by cables and pulleys with manual reversion, each with dual PCUs; variable incidence tailplane for pitch trim, maximum travel +2/-13°. Hydraulically actuated Fowler flaps, maximum deflection 30°; each wing has two-segment multifunction spoiler outboard, maximum deflection 45°, and two-segment ground spoiler/lift dumper inboard, maximum deflection 60°; yaw damper standard.

STRUCTURE: Primarily light alloy, with composites for some non-structural fairings; fuselage of semi-monocoque construction with frames and stringers; two-spar wing; three-spar fin. Programme suppliers include: AIDC Taiwan (rear fuselage and tail unit); Canadair (cockpit, forward fuselage and primary flight controls); DeCrane Aircraft (cabin interior) ECE (electrical system and cockpit lighting); Fischer Austria (wing-to-fuselage fairings); GKN Westland (engine nacelles); Goodrich (wheels and brakes); Hawker de Havilland Australia (tailcone and APU installation kit); Hella (lighting); Honeywell (power plant and APU); Hurel-Dubois (thrust reversers); Intertechnique (fuel system); Liebherr Aerospace-Toulouse (environmental control and anti-icing systems); Liebherr Aerospace Lindenberg (flap control system); Messier-Dowty (landing gear); Mitsubishi Heavy Industries (wing); Moog (secondary flight controls); NLX (flight training device and level C/D flight simulator); Parker Aerospace (hydraulic system); PPG Industries (cockpit windshields and cabin windows); Rockwell Collins (avionics); Scott Aviation (oxygen system); Shorts (centre fuselage), and Walter Kidde (fire detection and suppression system). Final assembly will be at Bombardier's Learjet facility in Wichita, with interior completion in Tucson.

LANDING GEAR: Hydraulically retractable tricycle type by Messier-Dowty, with two wheels on each unit; trailing-link-type main units retract inwards, nosewheel forwards. Steerable nosewheel, maximum deflection ±65°. Mainwheel tyre size 26.5x8.0-18, nosewheel tyre size 18x5.5-10. Goodrich carbon composites multiple disc brakes. Turning radius 17.68 m (58 ft 0 in).

POWER PLANT: Two Honeywell AS907 turboprops with FADEC, each with thermodynamic rating of 35.81 kN (8,050 lb st), flat-rated to 28.91 kN (6,500 lb st) with APR

at ISA+15°C. All fuel contained in two integral wing tanks, combined capacity 7,684 litres (2,030 US gallons; 1,690 Imp gallons). Gravity fuelling point in top of each wing, near leading-edge, plus single-point pressure refuelling/defuelling port in starboard wingroot near leading-edge. Target-type reversers standard.

ACCOMMODATION: Two crew flight deck; cabin, with flat floor, accommodates eight passengers in standard 'double club' arrangement on tracking, swivelling and reclining 16 g seats with retractable headrests, cabin management controls, cupholders and shoulder harnesses; three-seat 16 g take-off and landing-certified divan with extending backrest optional as interchange for two club seats. Standard cabin equipment includes fold-out work tables; one 110 V electrical outlet per club seat group; hot drinks dispensers; DVD/CD player with hi-fi grade audio speakers and two 381 mm (15 in) flat screen monitors; Airshow 400 system; Magnastar 2000 in-flight telephone with two handsets and switchable locations; extended-life LED lighting; forward galley with microwave oven; forward passenger wardrobe and crew coat closet; aft lavatory and vanity unit with hot and cold water and removable waste tank, and flight-accessible baggage compartment. Free-fall opening/power-assisted-closure, semi-plug-type airstair cabin door, on port side immediately aft of flight deck, also serves as Type I emergency exit; single plug-type overwing Type III emergency exit on starboard side, between rearmost pair of club seats. External baggage door aft of port wing trailing-edge. Cabin and baggage compartment pressurised, air-conditioned and heated.

SYSTEMS: Two independent phosphate-ester hydraulic systems with one engine-driven pump and one DC motor

pump per system, pressure 207 bar (3,000 lb/sq in), plus one auxiliary system powered by an accumulator. Pressurisation system, differential 0.60 bar (8.78 lb/sq in), with auxiliary system providing pressurisation up to 10,670 m (35,000 ft). 28 V DC electrical system comprises three 400 Ah DC brushless generators (one each on the engines and one on the APU) and two 24 V 44 Ah Ni/Cd batteries which provide power for APU starting, in-flight emergency power and ground power. APU generator can carry load of a failed engine generator, and one battery can supply power for APU starting. Oxygen system, capacity to suit customer requirements, with demand-type masks for crew and drop-down masks for passengers.

Engine bleed air automatically controlled anti-icing for wing leading-edges and nacelle lips; electrically anti-iced windscreen; heated angle-of-attack vanes and pitot probes. Honeywell tailcone-mounted RE220 APU, with FADEC, will be certified for operation up to 11,280 m (37,000 ft) and in-flight starting to 9,150 m (30,000 ft).

AVIONICS: Rockwell Collins Pro Line 21 as core system.

Comms: Dual VHF com with 8.33 kHz frequency spacing capability; dual integrated radio control and display units; dual transponders, all standard. Third VHF com; dual HF com, satcom, VHF/satcom datalink capability, Selcal and ELT optional.

Radar: Dual-scan digital weather radar with optional turbulence detection.

Flight: Standard equipment includes dual ILS/VOR/markers, AHRS and air data computers; single ADF, DME, FMS/CDU, GPS sensor, EGPWS, TCAS II, EICAS, radio altimeter, CVR and flight deck aural warning system. Second ADF, DME, FMS/CDU and GPS, three-dimensional flight plan maps, FDR and lightning sensor optional.

Instrumentation: EFIS with four 305 x 254 mm (12 x 10 in) colour LCDs providing liquid PFD and MFD functions for pilot and co-pilot.

DIMENSIONS, EXTERNAL:

Wing span over winglets	19.46 m (63 ft 10 in)
Length overall	20.93 m (68 ft 8 in)
Height overall	6.17 m (20 ft 3 in)
Fuselage max diameter	2.34 m (7 ft 8 in)
Tailplane span	7.23 m (23 ft 8½ in)
Wheel track	3.20 m (10 ft 6 in)
Wheelbase	8.46 m (27 ft 9 in)
Passenger door: Height	1.89 m (6 ft 2½ in)
Width	0.76 m (2 ft 6 in)
Baggage door: Height	0.76 m (2 ft 6 in)
Width	0.61 m (2 ft 0 in)
Height to sill	1.63 m (5 ft 4 in)
Emergency exit: Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin (excl cockpit):	
Length	8.71 m (28 ft 7 in)
Width: at centreline	2.18 m (7 ft 2 in)
at floor	1.55 m (5 ft 1 in)
Max height	1.85 m (6 ft 1 in)
Floor area	13.5 m² (146 sq ft)
Volume	24.35 m³ (860 cu ft)
Baggage compartment volume	2.99 m³ (105.50 cu ft)



Challenger 300 wearing its new name for the first time at NBAA Convention, Orlando, Florida, September 2002 (Paul Jackson)

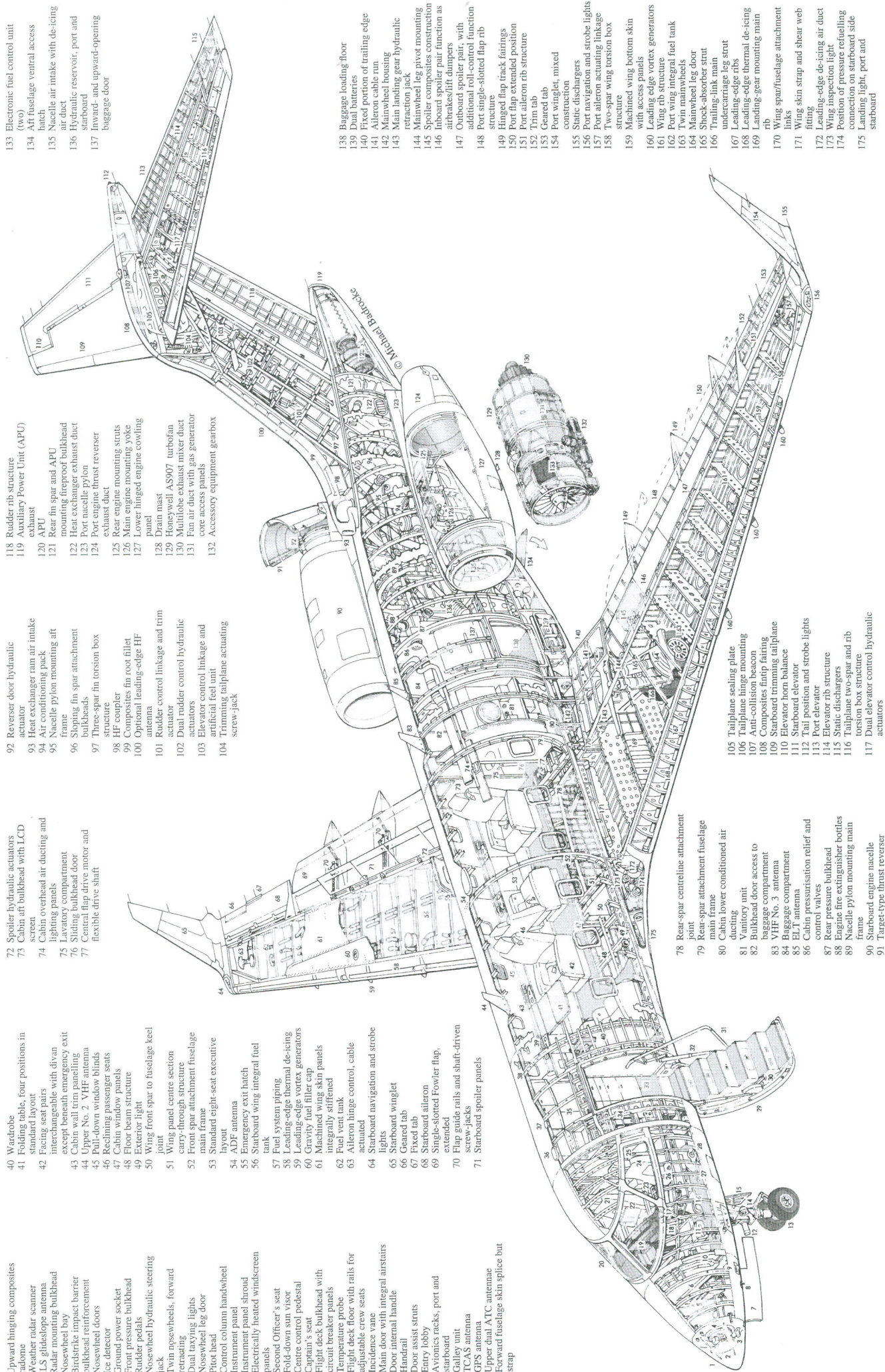
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Fifth Bombardier Challenger 300 taking off for the first time on 8 March 2003

NEW/0547101

Bombardier Challenger 300 cutaway drawing key



AREAS:

Wings, net	48.49 m ² (522.0 sq ft)
Ailerons, total	0.93 m ² (10.00 sq ft)
Trailing-edge flaps, total	7.56 m ² (81.40 sq ft)
Spoilers, total	3.55 m ² (38.26 sq ft)
Rudder, incl tabs	1.89 m ² (20.40 sq ft)
Tailplane	11.39 m ² (122.55 sq ft)
Elevators	4.22 m ² (45.40 sq ft)

WEIGHTS AND LOADINGS (provisional):

Operating weight empty	10,138 kg (22,350 lb)
Outfitting allowance	1,315 kg (2,900 lb)
Payload: max	1,360 kg (3,000 lb)
with max fuel	725 kg (1,600 lb)
Max fuel weight	6,214 kg (13,700 lb)
Fuel with max payload	5,579 kg (12,300 lb)
Max T-O weight	17,010 kg (37,500 lb)
Max ramp weight	17,078 kg (37,650 lb)
Max landing weight	15,308 kg (33,750 lb)
Max zero-fuel weight	11,498 kg (25,350 lb)
Max wing loading	350.8 kg/m ² (71.84 lb/sq ft)
Max power loading	294 kg/kN (2.88 lb/lb st)

PERFORMANCE (estimated):

Max level speed	476 kt (882 km/h; 548 mph)
High cruising speed	M0.82 or 470 kt (870 km/h; 541 mph)

Normal cruising speed

	M0.80 or 459 kt (850 km/h; 528 mph)
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Max rate of climb at S/L	1,097 m (3,600 ft)/min
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Rate of climb at S/L, OEI	205 m (673 ft)/min
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Initial cruising altitude	12,500 m (41,000 ft)
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Max certified altitude	13,715 m (45,000 ft)
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T-O balanced field length	1,509 m (4,950 ft)
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Landing run at max landing weight	792 m (2,600 ft)
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Range with eight passengers, NBAA IFR reserves	3,100 n miles (5,741 km; 3,567 miles)
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UPDATED

BOMBARDIER CL-600 CHALLENGER 604

Canadian Forces designations: CC-144, CC-144B and CE-144A

TYPE: Business jet.

PROGRAMME: First flight of first of three prototypes (C-GCGR-X) 8 November 1978; first flight production Challenger 600 with AlliedSignal ALF 502L-2 turboprops 21 September 1979; first customer delivery 30 December 1980; first flight Challenger 601 with GE CF34s 10 April 1982; first 601-1A delivered 6 May 1983; first 601-3A 6 May 1987 and first 601-3A/ER 19 May 1989; first 601-3R 14 July 1993; first 604 25 January 1996. Challenger certified for operation in 40 countries by 1998. By 31 December 2002 the Challenger fleet had flown 2,300,000 hours, with a despatch reliability of 99.7 per cent. 500th Challenger rolled out 'green' 25 May 2000 and handed over (as N816CC) 1 September 2000; 600th was undergoing interior outfitting in March 2003.

CURRENT VERSIONS: **Challenger 600:** Total 84 built after certification in 1980 (76 since retrofitted with winglets); 12 delivered to Canadian Department of National Defence as CC-144 (three) and CE-144A (three), plus three for coastal patrol, two for general transport and one test aircraft. Production completed with final delivery on 22 June 1983.

Challenger 601-1A: First production version to have CF34 engines; first flight 17 September 1982. Deliveries (66, including four CC-144Bs) between 6 May 1983 and 29 May 1987.

Challenger 601-3A: Version with 'glass' cockpit and CF34-3A engines; first flight 28 September 1986; Canadian and US certification 21 and 30 April 1987; also certified for Cat. II and in 22 other countries; improvements include CF34-3A engines flat rated to 21°C,



Bombardier Challenger 604 business jet (Paul Jackson)

NEW/0546840

and fully integrated digital flight guidance and flight management systems. Total of 134 delivered between 6 May 1987 and 29 October 1993.

Challenger 601-3R: Extended-range option available on new 601-3As since 1989 (c/n 5135 and onwards) and as retrofit to 601-1As and 601-3As; range increased to 3,585 n miles (6,639 km; 4,125 miles) with NBAA IFR reserves; first flight 8 November 1988; Canadian certification 16 March 1989; tail fairing replaced with conformal tailcone fuel tank which extends fuselage length by 46 cm (1 ft 6 in) and adds 118 kg (260 lb) to operating weight empty; maximum ramp weight increased by 680 kg (1,500 lb). Optional gross weight increase of 227 kg (500 lb). Total of 92 modification kits supplied between March 1989 and October 1993. Challenger 601-3ER, incorporating extended-range modifications, CF34-3A1 engines and 20,457 kg (45,100 lb) max T-O weight, was standard production version from 14 July 1993 (first delivery); 59 new-build aircraft delivered by early 1996; no further production.

Challenger 604: Has range of 4,077 n miles (7,550 km; 4,691 miles) at M0.74 and is powered by General Electric CF34-3B engines each rated at 38.8 kN (8,729 lb st) T-O power at ISA + 15°C. Prototype (C-FTBZ) modified on the production line from a Challenger 601-3R; engineering designation CL-600-2B16; first flight (with CF34-3A engines) 18 September 1994; first flight with definitive CF34-3B engines 17 March 1995. Exploits systems developed in Regional Jet programme. Rockwell Collins Pro Line 4 EFIS; extra 1,242 litres (328 US gallons; 273 Imp gallons) of fuel in aft equipment bay, forward fuselage tank and tail tank. Automatic aft-CG control to reduce trim drag for longer range. New landing gear, carbon brakes and anti-skid system; strengthened tail unit; new wing-to-fuselage and underbelly fairings. Maximum T-O weight 21,863 kg (48,200 lb). Transport Canada certification achieved 20 September 1995; FAA certification 2 November 1995; 100th delivery to a customer was made in mid-1999.

From June 2001, Challenger 604s have been delivered with upgraded PrecisionPlus Collins Pro Line 4 avionics, intended to reduce pilot workload and make the aircraft more compatible with future air traffic environments. Standard PrecisionPlus features include automatic look-up and display of take-off, approach, landing and missed-approach speeds, eliminating the need to refer to manual charts; automatic look-up and display of thrust setting (N₁) for take-off, climb, cruise and go-around; blending of actual observed wind and entered wind to improve the

prediction of flight time and fuel requirements; position reporting in non-radar environments such as the North Atlantic; improved polar navigation, enabling the crew to navigate and steer the aircraft at latitudes over 89°; full-time DME reporting on the pilot's MFD; EICAS improvements including the addition of metric fuel indication capability, logic enhancements and FMS performance enhancements; and full integration with the Flight Dynamics HUD and Safe Flight AutoPower autothrottle system. Optional features include flight plan map feature providing an intuitive, three-dimensional graphic representation of the programmed flight plan and predicted flight path for the pilot's and co-pilot's MFDs; long-range cruise feature allowing pilots to select a cruise speed computed by the FMS for either maximum range or maximum speed; search pattern feature offering automatic generation of waypoints; and expanded FDR to meet FAA FAR Pt 135.152 requirements. The PrecisionPlus avionics upgrade is also available for retrofit to earlier Challenger 604s.

Max-Viz EVS-1000 enhanced vision system received FAA certification on 13 March 2003 for installation on Challengers.

Detailed description applies to Challenger 604.

Special Missions: One Challenger 604 delivered in late 2000 to (South) Korean National Maritime Police with unspecified sensor and communications suite. First of two maritime surveillance 604s entered service with Royal Danish Air Force in late 2002.

CUSTOMERS: See under individual headings in Current Versions. More than 600 Challengers of all versions delivered (including to completion centres) by 31 December 2003, including 262 Challenger 604s. Recent customers include the Royal Jordanian Air Force, which ordered two in VIP configuration for delivery during 2000; the Australian government, which ordered three on 16 August 2000 for delivery in 2001 to Qantas Airways, which operates them on behalf of the Royal Australian Air Force for transport of senior government officials; REGA Swiss Air-Ambulance Ltd, which ordered three on 26 September 2001 for delivery in September and November 2002 in air ambulance configuration, and Shandong Airlines of China, launch operator of Bombardier's Flexjet Asia-Pacific fractional ownership programme, which has ordered four. Annual deliveries have included 33 in 1997, 36 in 1998, 40 in 1999, 38 in 2000, 41 in 2001, 31 in 2002, and five in the first three months of 2003.

costs: Unit cost (604), US\$4 million, typically equipped (2002).



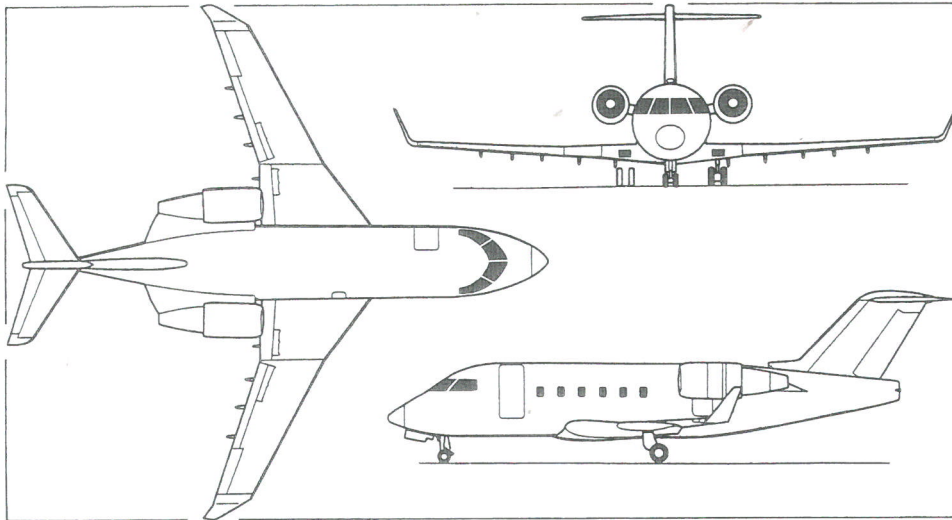
Bombardier Challenger 604 flight deck with PrecisionPlus upgraded Rockwell Collins Pro Line 4 integrated avionics

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Interior of a Challenger 604

0137419



Bombardier Challenger 604 (Paul Jackson)

0085635

DESIGN FEATURES: Advanced wing section; quarter-chord sweep 25°; thickness/chord ratio 14 per cent at root, 12 per cent at leading-edge sweep break and 10 per cent at tip; dihedral 2° 33'; incidence at root 3° 30'; fuselage circular cross-section, pressurised.

FLYING CONTROLS: Conventional, fully powered hydraulic controls; electrically actuated variable incidence tailplane; two-segment spoilers (outboard airbrake panels, inboard lift dumpers); two-segment double-slotted flaps.

STRUCTURE: Two-spar wing torsion box; chemically milled fuselage skin panels with riveted frames and stringers form damage-tolerant structure; multispar fin and tailplane.

LANDING GEAR: Hydraulically retractable tricycle type, with twin wheels and Dowty oleo-pneumatic shock-absorber on each unit. Mainwheels retract inward into wing centre-section, nose unit forward. Nose unit steerable and self-centring. Mainwheels have H27x8.5-14 (16 ply) tubeless tyres, pressure 12.07 bar (175 lb/sq in); nosewheels have Goodrich 18x4.4 (12 ply) tubeless (deflector-type) tyres, pressure 10.00 bar (145 lb/sq in). ABS (Aircraft Braking Systems) hydraulically operated multiple-disc carbon brakes with fully modulated anti-skid system. Minimum ground turning radius 12.19 m (40 ft 0 in).

POWER PLANT: Two General Electric CF34-3B1 turbofans, each rated at 41.0 kN (9,220 lb st) with automatic power reserve, or 38.8 kN (8,729 lb st) without APR, pylon-mounted on rear fuselage and fitted with cascade-type fan-air thrust reversers. Nacelles and thrust reversers by Shorts. Integral fuel tank in centre-section, capacity 2,839 litres (750 US gallons; 624 Imp gallons), one in each wing (each 2,725 litres; 720 US gallons; 600 Imp gallons) and auxiliary tanks (combined capacity 1,181 litres; 312 US gallons; 260 Imp gallons) beneath cabin floor. Saddle tanks, total capacity 999 litres (264 US gallons; 220 Imp gallons); tank in tailcone, capacity 745 litres (197 US gallons; 164 Imp gallons). Total fuel capacity 11,214 litres (2,963 US gallons; 2,468 Imp gallons). Pressure and gravity fuelling and defuelling. Oil capacity 13.6 litres (3.6 US gallons; 3.0 Imp gallons).

ACCOMMODATION: Two-pilot flight deck with dual controls. Blind-flying instrumentation standard. Cabin interiors to customer's specifications; maximum of 19 passenger seats and three crew approved. Typical installations include lavatory, buffet, bar and wardrobe. Medevac version can carry up to seven stretcher patients, infant incubator, full complement of medical staff and comprehensive intensive care equipment. Baggage compartment, with own loading door, accessible in flight. Downward-opening, power-assisted door on port side, forward of wing. Overwing emergency exit on starboard side. Entire accommodation heated, pressurised and air conditioned. Optional extended cabin interior increases cabin length by 0.51 m (1 ft 8 in) and provides two additional cabin windows by removing rear closet and moving the lavatory and baggage compartment bulkheads, with corresponding 0.20 m³ (7 cu ft) reductions in baggage capacity. Ultra Electronics active noise vibration control (ANVC) system optional.

SYSTEMS: Honeywell pressurisation and air conditioning systems, maximum pressure differential 0.63 bar (9.1 lb/sq in). Three independent hydraulic systems, each of 207 bar (3,000 lb/sq in). No. 1 system powers flight controls (via servo-actuators positioned by cables and pushrods); No. 2 system for flight controls and brakes; No. 3 system for flight controls, landing gear extension/retraction, brakes and nosewheel steering. Nos. 1 and 2 systems each powered by an engine-driven pump, supplemented by an AC electric pump; No. 3 system by two AC pumps. Two 30 kVA engine-driven generators supply primary 115/200 V three-phase AC electric power at 400 Hz. Four transformer-rectifiers to convert AC power to 28 V DC; one primary 24 V 17 Ah Ni/Cd battery and one auxiliary 24 V 43 Ah battery. Alternative primary power provided by APU and/or an air-driven generator, latter deployed automatically in flight if engine-driven generators and

APU are inoperative. Stall warning system, with stick shakers and stick pusher. Honeywell GTCF-100E gas-turbine APU for engine start, ground air conditioning and other services. Electric anti-icing of windscreen, flight deck side windows and pitot heads; Hamilton Sundstrand bleed air anti-icing of wing leading-edges, engine intake cowls and guide vanes. Gaseous oxygen system, pressure 127.5 bar (1,850 lb/sq in). Continuous-element fire detectors in each engine nacelle, APU and main landing gear bays; two-shot extinguishing system for engines, single-shot system for APU.

AVIONICS: Rockwell Collins Pro Line 4 with PrecisionPlus upgrade.

Comms: Dual VHF; dual ATC transponders; dual HF; cockpit voice recorder.

Radar: Rockwell Collins WXP-4220 colour digital weather radar with turbulence detection.

Flight: Dual VHF nav with provision for third; dual DME; dual ADF; dual Litton TN-101 laser inertial reference systems (LIRS) with full provision for third; dual flight management system with provision for third; digital automatic flight control system, with dual-channel autopilot and flight director; Mach trim and auto trim; dual digital air data system. Flight Dynamics HGS 2150 HUD received FAA approval on 4 April 2000 and is optional. Space provisions for flight data recorder, ELT, dual GPS, EGPWS, AFIS, TCAS and Safe Flight Instrument Corporation AutoPower enhanced autothrottle system.

Instrumentation: Rockwell Collins digital avionics include Pro Line 4 six-tube EFIS with 184 x 184 mm (7¼ x 7¼ in) CRT displays which include two-tube EICAS display (MFD); standby instruments (artificial horizon, airspeed indicator, compass and altimeter). Systems certified for Cat. II operations.

EQUIPMENT (Medevac version): Includes cardiopulmonary resuscitation unit; physio control lifepack comprising heart defibrillator, ECG and cardioscope; ophthalmoscope; respirators and resuscitators; infant monitor; X-ray viewer; cardiostimulator; foetal heart monitor; and anti-shock suit.

DIMENSIONS, EXTERNAL:

Wing span over winglets	19.61 m (64 ft 4 in)
Wing chord: at root	3.99 m (13 ft 1 in)
at tip	1.27 m (4 ft 2 in)
Wing aspect ratio (excl winglets)	8.0
Length overall	20.85 m (68 ft 5 in)
Fuselage: Length	18.77 m (61 ft 7 in)
Max diameter	2.69 m (8 ft 10 in)
Height overall	6.30 m (20 ft 8 in)
Tailplane span	6.20 m (20 ft 4 in)
Wheel track (c/l of shock-struts)	3.18 m (10 ft 5 in)
Wheelbase	7.99 m (26 ft 2½ in)
Passenger door (port, fwd): Height	1.78 m (5 ft 10 in)
Width	0.94 m (3 ft 1 in)
Height to sill	1.63 m (5 ft 4 in)
Baggage door (port, rear): Height	0.84 m (2 ft 9 in)
Width	0.71 m (2 ft 4 in)
Height to sill	1.73 m (5 ft 8 in)
Overwing emergency exit (stbd): Height	0.91 m (3 ft 0 in)
Width	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:

Cabin: Length, incl galley, lavatory and baggage area, excl flight deck	8.66 m (28 ft 5 in)
Max width	2.49 m (8 ft 2 in)
Width at floor level	2.18 m (7 ft 2 in)
Max height	1.85 m (6 ft 1 in)
Floor area	18.8 m ² (202 sq ft)
Volume	32.6 m ³ (1,150 cu ft)

AREAS:

Wings, gross (excl winglets)	48.31 m ² (520.0 sq ft)
Ailerons (total)	1.39 m ² (15.0 sq ft)
Trailing-edge flaps (total)	7.80 m ² (84.0 sq ft)
Fin	9.18 m ² (98.8 sq ft)
Rudder	2.03 m ² (21.9 sq ft)

Tailplane	6.45 m ² (69.4 sq ft)
Elevators (total)	2.15 m ² (23.1 sq ft)

WEIGHTS AND LOADINGS:

Manufacturer's weight empty	9,806 kg (21,620 lb)
Operating weight empty	12,079 kg (26,630 lb)
Max fuel	9,072 kg (20,000 lb)
Max payload	2,435 kg (5,370 lb)
Payload with max fuel: standard	485 kg (1,070 lb)
optional	757 kg (1,670 lb)
Max T-O weight: standard	21,591 kg (47,600 lb)
optional	21,863 kg (48,200 lb)
Max ramp weight: standard	21,636 kg (47,700 lb)
optional	21,908 kg (48,300 lb)
Max landing weight	17,236 kg (38,000 lb)
Max zero-fuel weight	14,515 kg (32,000 lb)
Max wing loading:	
standard	446.9 kg/m ² (91.54 lb/sq ft)
optional	452.6 kg/m ² (92.69 lb/sq ft)

Max power loading:

standard	263 kg/kN (2.58 lb/lb st)
optional	267 kg/kN (2.61 lb/lb st)

PERFORMANCE (at standard max T-O weight, except where indicated):

High-speed cruising speed	M0.82 (470 kt; 870 km/h; 541 mph)
Normal cruising speed	M0.80 (459 kt; 851 km/h; 529 mph)
Long-range cruising speed	M0.74 (425 kt; 787 km/h; 489 mph)
Time to initial cruising altitude	21 min
Initial cruising altitude	11,460 m (37,600 ft)
Max certified altitude	12,500 m (41,000 ft)
Service ceiling, OEI: at mid-cruise weight 17,373 kg (38,300 lb)	6,920 m (22,700 ft)
at max T-O weight	5,170 m (16,960 ft)
Balanced T-O field length (ISA at S/L) 1,737 m (5,700 ft)	
Landing distance at S/L at max landing weight	846 m (2,775 ft)
Range with max fuel and five passengers, NBAA IFR reserves (200 n mile; 370 km; 230 mile alternate): long-range cruising speed	4,077 n miles (7,550 km; 4,691 miles)
normal cruising speed	3,769 n miles (6,980 km; 4,337 miles)
Design g limit	+2.5

OPERATIONAL NOISE LEVELS:

T-O	80.9 EPNdB
Sideline	86.2 EPNdB
Approach	90.3 EPNdB

UPDATED

BOMBARDIER BD-700 GLOBAL EXPRESS

TYPE: Long-range business jet.

PROGRAMME: Announced 28 October 1991 at NBAA Convention; full-scale cabin mockup exhibited at NBAA Convention September 1992; conceptual design started early 1993. Programme launched 20 December 1993; high-speed configuration frozen June 1994; low-speed configuration established August 1994.

Ground test programme using static test airframe c/n 0001 began August 1996; prototype C-FBGX (engineering designation BD-700-1A10) rolled out 26 August 1996; first flight 13 October 1996; public debut at NBAA Convention at Orlando, Florida, November 1996; prototype and three other aircraft undertook 2,000-hour, 18-month flight test programme based at Bombardier's flight test centre in Wichita, Kansas; second aircraft, (C-FHGX), which is used for systems evaluation and testing, flew 3 February 1997, third (C-FJGX), which is used for avionics and autopilot testing, 22 April 1997; fourth (C-FKGX), first flown 8 September 1997 and the first to be fully outfitted, was used for function and reliability testing.

Transport Canada certification 31 July 1998; FAA certification 13 November 1998; JAA certification 7 May 1999; German LBA certification 26 May 1999; first customer delivery of completed aircraft 8 July 1999 to AirFlite Inc of Long Beach, California, which operates the aircraft on behalf of Toyota Motor Sales USA; 50th 'green' airframe delivered to Montréal completion centre 7 June 2000. Transport Canada and JAA RVSM approval granted 16 January 2001, followed by FAA RVSM approval on 29 January. Thales Avionics head-up flight display system (HFDS) achieved Transport Canada certification on 14 September 2001 and FAA approval on 4 October 2001. Following exploratory discussions with potential suppliers, in-house development of Bombardier Enhanced Vision System (BEVS) began in 2002 and scheduled for certification in first quarter 2005. Total of 91 aircraft in customer service by 30 September 2002, by which date in-service aircraft had accumulated 55,000 flying hours with a despatch rate of 99.18 per cent. 100th aircraft c/n 9100/NISA delivered 18 December 2002 to Stanford Financial Group of Houston, Texas.

CURRENT VERSIONS: Global Express: As described.

Global Express XRS: Improved version, announced at NBAA Convention in Orlando, Florida, 6 October 2003. Design goals include increased range at high speed, improved take-off performance and new fast-refuelling technology. Additional forward fuselage tank in wing/fuselage fairing adds 674 kg (1,486 lb) of usable fuel;



Bombardier Global Express long-range business jet

NEW/0546838

zero-flap take-off capability enhances hot-and-high performance with increased fuel load; software upgrades to the fuel computer, coupled with structural changes, reduce refuelling time by 15 minutes. Bombardier enhanced vision system (BEVS) is standard. Increased pressure differential maintains a 1,372 m (4,500 ft) cabin environment at FL450, and 1,737 m (5,700 ft) environment at FL510; upgraded humidification system optional. Cabin features two additional windows (forward starboard, opposite door; and rear port; adjacent to flaps), providing 40 per cent more natural light in forward vestibule area; redesigned floor plan with full galley on port side; 12-hour non-stop-flight-approved crew area with overhead storage on starboard side; 0-42 m³ (15 cu ft) of additional aft storage volume; increased overhead stowage in crew area; and LED lighting. Service entry scheduled for early 2006. Unit cost US\$45.5 million, typically equipped (2003).

Sentinel R. Mk 1: Ground surveillance version for UK; prime contractor Raytheon Systems.

CUSTOMERS: More than 120 firm orders by October 2000. Announced customers include Bombardier's Flexjet fractional ownership programme, which has ordered 22 for delivery from 2000, the Royal Malaysian Air Force, which has taken delivery of one for VIP duties; Dogus Air of Turkey, which ordered one for delivery in 2001 and the Japanese Civil Aviation Bureau (JCAB), which has ordered two for flight inspection and airways calibration duties, the first of which (c/n 9034) was handed over to JCAB's prime contractor Itochu Corporation on 4 May 2001 after outfitting by Marshall Aerospace at Cambridge, UK. Estimated market for 500 to 800 long-range business jets over 15 years; Bombardier anticipates capturing 50 per cent of the market, breaking even at approximately 100; target production rate 34 per year; total of 35 delivered in 2000, 21 in 2001, 17 in 2002 and six in the first three months of 2003.

COSTS: Development costs C\$800 million; half carried by Bombardier, balance by risk-sharing partners. Unit cost US\$43.35 million (2002).

DESIGN FEATURES: Design goal was longest possible range at highest speed from short runway with 99.5 per cent despatch reliability; wide-body fuselage, combining Challenger cabin cross-section with cabin length of Regional Jet; all-new, 'third-generation supercritical' wings with leading-edge slats and winglets.

Wing sweep 35° at quarter-chord, thickness/chord ratio 11 per cent, dihedral 2° 30', root incidence 2° 30'. Wing, high-lift devices and wing/fuselage interface and area-ruled rear fuselage/engine pylon junction contours developed with extensive use of computational fluid dynamics (CFD). Rear-mounted engines. Sweptback T tail with 38° sweep and 5° anhedral on tailplane, 45° sweep on fin.

FLYING CONTROLS: Conventional and mechanical. Fully powered primary flying controls with variable artificial feel and emergency back-up via ram air turbine following triple hydraulic failure; dual sidestick controllers; duplicated cable runs with automatic disconnect in the event of control surface jamming; dual power control units on ailerons (maximum deflections +26.5/-23° and elevators (maximum deflections +24/-19°), triple units on rudder (maximum deflection 37° left/right). Eight-section (total) leading-edge slats (maximum deflection 20°) and six-section (total) single-slotted Fowler flaps (maximum deflection 30°) are signalled by dual electronic control units and operated by dual-motor power units connected by rigid driveshafts to ball-screw actuators. Electrically signalled, hydraulically actuated multifunction spoilers (four per side, outboard, operating differentially to assist ailerons and improve roll response, and symmetrically for speed brake or lift dump functions) and ground spoilers (two per side, inboard), maximum deflection +40°. Horizontal stabiliser incidence adjustable for pitch trim

(+13/-2°) via dual-channel electrically driven screw actuator; roll trim accomplished by electric trim actuator located at aileron feel simulator unit; yaw trim accomplished by electric trim actuator at summing unit in fin. Dual yaw damper stability augmentation system and stick shaker/pusher stall protection system standard.

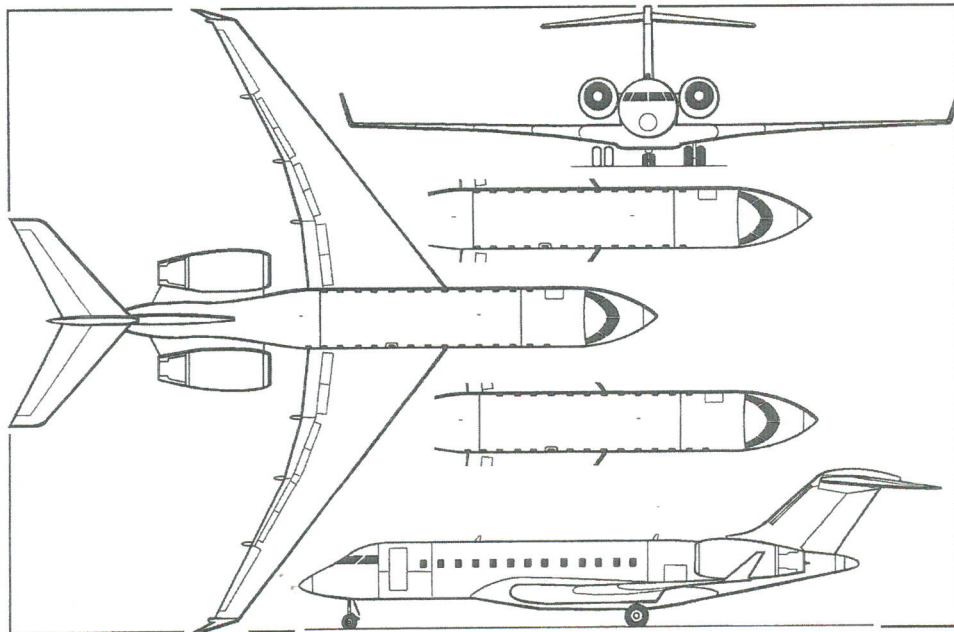
STRUCTURE: Semi-monocoque fuselage with chemically milled C-188 A1 aluminium alloy skin riveted over alloy frames and stringers to form damage-tolerant structure; main two-spar torsion box wing structure mostly of alloy construction, with machined alloy spars and ribs and polyurethane-coated machined alloy skin panels; two-spar winglets of mixed alloy/composites construction; multispar fin is alloy; ailerons, flaps, spoilers, rudder, two-spar tailplane, elevators, wing/fuselage fairings, flap track fairings, main landing gear bay, upper and lower engine nacelle doors and cabin floor panels are of composites construction.

Bombardier's Canadair division is design authority and manufactures nose section; de Havilland manufactures rear fuselage, engine pylons and vertical stabiliser and is responsible for final assembly at Downsview; Mitsubishi supplies wings and centre fuselage; Short Brothers designed and manufactures forward fuselage, engine nacelles, horizontal stabiliser and other composites components; Bombardier is responsible for interior completions at its Montréal facility. Other participants in the programme are Honeywell Aerospace (APU), Ametek Aerospace (data acquisition unit, engine vibration monitoring system, fuel flow transmitters and engine thermocouples), Rolls-Royce Deutschland (power plant), Hella (lighting systems), Honeywell (avionics), Liebherr-Aerospace Toulouse (air management system), Lucas Aerospace (electrical systems), Messier-Dowty International (landing gear), Parker Bertea Aerospace (flight controls and fuel and hydraulic systems), Raytheon E-Systems (pitch feel systems), Thales Avionics (flight control system) and Hamilton Sundstrand (slat/flap actuation system and ram air turbine).

LANDING GEAR: Hydraulically retractable tricycle type with Messier-Dowty oleo-pneumatic shock-absorber and twin wheels on each unit; main units retract inward into wing, nosewheel forwards. Goodyear tyres, mainwheels tyre size H38x12.0-19 (20 ply) tubeless, maximum pressure 11.45 bar (166 lb/sq in); nosewheel tyres 21x7.25-10 (12 ply) tubeless (deflector-type), maximum pressure 9.93 bar (144 lb/sq in). Carbon brakes with dual Goodrich/HydroAire hydraulic digital brake-by-wire/modulated anti-skid system providing pilot-selectable, three-level autobrake capability. Steerable nosewheel, maximum steering angle ±75°; minimum ground turning radius 20.73 m (68 ft 0 in).

POWER PLANT: Two rear-mounted 65.6 kN (14,750 lb st) Rolls-Royce Deutschland BR710A2-20 turbofans, flat rated to ISA + 20°C, with FADEC. International Nacelle Systems (Shorts/Hurel-Dubois joint venture) hydraulically actuated two-petal target-type thrust reversers.

Fuel contained in two integral wing tanks, each of 8,479 litres (2,240 US gallons; 1,865 Imp gallons) capacity, centre-section tank, capacity 6,117 litres (1,616 US gallons; 1,346 Imp gallons), and auxiliary tank in aft fuselage, capacity 1,234 litres (326 US gallons; 271 Imp gallons), giving total standard capacity of 24,310 litres (6,422 US gallons; 5,347 Imp gallons). Fuel from centre-section and auxiliary tanks is transferred to wing tanks from where two AC main pumps and DC back-up pump feed to engines; automatic fuel management system balances quantities in port and starboard wing tanks. Gravity and pressure refuelling; single-point pressure fuelling/defuelling coupling in starboard wing/fuselage



Bombardier BD-700 Global Express with maximum option of 15 standard cabin windows, plus scrap views of (upper) standard cabin glazing and (lower) Global Express XRS (Paul Jackson)

NEW/0567062

fairing. Oil capacity 20 litres (5.3 US gallons; 4.4 Imp gallons) with oil replenishment tank, capacity 5.7 litres (1.5 US gallons; 1.2 Imp gallons) permitting remote oil servicing from the cockpit.

ACCOMMODATION: Crew of three or four (including cabin attendant) and eight to 19 passengers depending on interior fit. Customised cabin interior according to customer requirements. Typical arrangement comprises three-compartment cabin with lavatory at rear, crew rest area, galley, small lavatory and wardrobe forward, and provision for 'office in the sky', stateroom or conference area. Flight-accessible baggage compartment at rear of cabin with external plug-type door forward of port engine intake. Accommodation is heated, air conditioned and pressurised; predicted cabin noise level 52 dB. Thirteen windows on port side of cabin; standard 13 to starboard, with option of up to two extra windows, one forward, one rear (for totals of 13, 14 or 15), each 40 cm (1 ft 3¼ in) high x 27.4 cm (10¾ in) wide; one window over wing on starboard side doubles as plug-type emergency exit. Electrically operated airstair door at front of cabin on port side.

SYSTEMS: Integrated air management system by Liebherr-Aerospace Toulouse provides engine bleed, wing anti-ice, air conditioning, cabin pressurisation and avionics ventilation. Digitally controlled dual cooling pack system with ozone converters and bleed air filters provides cabin air circulation at standard rate 1.81 m³ (64 cu ft)/min/person, maximum rate 2.29 m³ (81 cu ft)/min/person with crew-selectable 100 per cent fresh air or recirculation and three air sources for cabin pressure control; maximum pressure differential 0.66 bar (9.64 lb/sq in) maintains a 1,525 m (5,000 ft) cabin altitude to 12,500 m (41,000 ft) and a 2,200 m (7,220 ft) cabin altitude to maximum operating altitude of 15,545 m (51,000 ft). Engine bleed air anti-icing for wing leading-edge fixed surfaces and slats; tail surfaces unprotected; bleed management system automatically switches between low- and high-pressure compressor air to improve engine efficiency. Oxygen system comprises four 1,417 litre (50 cu ft) oxygen cylinders pressurised to 127.6 bar (1,850 lb/sq in) for passenger and crew use.

Lucas/Leach electrical power generation and distribution system comprises two 40 kVA variable frequency generators on each engine, supplying primary 115/200 V three-phase AC electrical power at 324 to 596 Hz; alternative AC power provided by 45 kVA APU-mounted generator and emergency power by 9 kVA air-driven generator, the latter automatically deployed in the event of power loss; electrical management system automatically performs priority-based load-shedding and reconfiguration in event of failure. Four 150 A TRUs convert AC to 28 V DC; emergency DC provided by 25 Ah and 42 Ah low-maintenance Ni/Cd batteries. Provision for external AC and DC power connection. Triple logic-controlled AC power centre performs primary AC power distribution and high-power secondary distribution via solid-state switches and 'smart'-contactors; low-power AC distributed through thermal circuit breakers in the cockpit. Triple logic-controlled DC power centre provides non-interruptible primary DC power distribution, emergency bus supplies and normal DC supplies to four secondary power distribution assemblies (SPDAs) throughout the aircraft to provide remote logic-controlled power to all DC loads. Two CDUs in the cockpit allow for remote sensing/setting and resetting of circuit breakers.

Tailcone-mounted Honeywell RE220(GX) APU provides electrical power (45 kVA ground; 40 kVA flight),



Global Express cabin interior

0137416

as well as bleed air and main engine starting; APU is certified for operation up to 13,715 m (45,000 ft), in-flight starting up to 11,280 m (37,000 ft) and engine starting up to 9,145 m (30,000 ft).

Triple-redundant hydraulic systems at pressure of 207 bar (3,000 lb/sq in), with bootstrap reservoirs.

Walter Kidde Aerospace integrated aircraft fire detection and extinguishing system provides continuous fire detection monitoring in engine nacelles, APU compartment, main landing gear bays and cabin; dual extinguishers provide two-shot fire suppression in main engine and APU bays. Aircraft serviceability monitored by CAIMS (central aircraft information and maintenance system) with facilities including in-flight display.

AVIONICS: Honeywell Primus 2000XP as core system.

Comms: Dual VHF (third optional); dual Rockwell Collins HF; dual transponders; dual radio management systems; Coltech five-channel Selcal; Honeywell digital FDR and CVR; ELT; satcom optional, with antenna mounted in fin cap; Teledyne Magnastar Office in the Sky datalink optional.

Radar: Colour weather radar with dual controllers.

Flight: Dual flight management systems (third optional) with dual Cat. II autopilots and triple digital air data computers providing fail-safe AFCS; triple laser gyro inertial reference systems; GPS with option for second sensor; ADF; VOR/ILS; DME; TCAS II; Honeywell EGPWS with terrain database integrated into Primus 2000XP system for EFIS display.

Instrumentation: Dual EFIS comprising six 203 x 178 mm (8 x 7 in) CRT multifunction displays, for PFD and EICAS functions; dual Rockwell Collins digital radio altimeter; combined standby airspeed/altimeter, standby artificial horizon and stowable standby heading

indicator. Thales HFDS with Cat. II landing capability and lightning sensor system optional. Bombardier Enhanced Vision System (BEVS) standard from first quarter 2005.

Data below apply to Global Express and Global Express XRS, except where noted.

DIMENSIONS, EXTERNAL:	
Wing span over winglets	28.65 m (94 ft 0 in)
Wing chord: at root	6.43 m (21 ft 1 in)
at tip	1.24 m (4 ft 1 in)
Wing aspect ratio	8.6
Length: overall	30.30 m (99 ft 5 in)
fuselage	26.31 m (86 ft 4 in)
Diameter of fuselage, constant portion	2.69 m (8 ft 10 in)
Height overall	7.57 m (24 ft 10 in)
Tailplane span	9.68 m (31 ft 9 in)
Wheel track (c/l of shock-absorbers)	4.06 m (13 ft 4 in)
Wheelbase	12.78 m (41 ft 11 in)
Passenger door: Height	1.83 m (6 ft 0 in)
Width:	0.91 m (3 ft 0 in)
Baggage door: Height	0.84 m (2 ft 9 in)
Width:	1.09 m (3 ft 7 in)
Emergency exit: Height	0.99 m (3 ft 3 in)
Width:	0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL:	
Flight deck volume	3.99 m³ (141.0 cu ft)
Cabin (excl flight deck): Length	14.73 m (48 ft 4 in)
Width at floor	2.11 m (6 ft 11 in)
Max width	2.49 m (8 ft 2 in)
Max height	1.90 m (6 ft 3 in)
Floor area	31.1 m² (335 sq ft)
Volume, incl baggage compartment	60.6 m³ (2,140 cu ft)

AREAS:	
Wings, basic	94.95 m² (1,022.0 sq ft)
Horizontal tail surfaces (total)	22.76 m² (245.0 sq ft)
Vertical tail surfaces (total)	17.28 m² (186.0 sq ft)

WEIGHTS AND LOADINGS (A: Global Express; B: Global Express XRS):	
Operating weight empty: A	22,816 kg (50,300 lb)
B	23,360 kg (51,500 lb)
Max payload: A	2,585 kg (5,700 lb)
Payload with max fuel: A	725 kg (1,600 lb)
B	805 kg (1,775 lb)
Fuel with max payload	17,804 kg (39,250 lb)
Max fuel weight: A	19,663 kg (43,350 lb)
B	20,400 kg (44,975 lb)
Max ramp weight: A standard	43,205 kg (95,250 lb)
A optional	43,658 kg (96,250 lb)
B	44,565 kg (98,250 lb)
Max T-O weight: A standard	43,091 kg (95,000 lb)
A optional	43,545 kg (96,000 lb)
B	44,452 kg (98,000 lb)
Max landing weight: A, B	35,652 kg (78,600 lb)
Max zero-fuel weight: A, B	25,401 kg (56,000 lb)
Max wing loading:	
A standard	453.8 kg/m² (92.95 lb/sq ft)
A optional	458.6 kg/m² (93.93 lb/sq ft)
B	468.2 kg/m² (95.89 lb/sq ft)
Max power loading:	
A standard	328 kg/kN (3.22 lb/lb st)
A optional	332 kg/kN (3.25 lb/lb st)
B	339 kg/kN (3.32 lb/lb st)

PERFORMANCE	
Max level speed (V_{MO}):	
S/L to FL80	300 kt (555 km/h; 345 mph) CAS
FL80 to FL309	340 kt (629 km/h; 391 mph) CAS
above FL309	M0.89



Computer-generated image of Global Express XRS long-range business jet

NEW/0568991

High cruising speed M0.88 (505 kt; 935 km/h; 581 mph)
 Normal cruising speed M0.85 (488 kt; 904 km/h; 562 mph)
 Long-range cruising speed at FL450 M0.80 (459 kt; 850 km/h; 528 mph)
 Max rate of climb at S/L 1,097 m (3,600 ft)/min
 Initial cruising altitude 13,105 m (43,000 ft)
 Time to climb to initial cruising altitude:
 A, B 30 min
 Max certified altitude: A, B 15,545 m (51,000 ft)
 T-O balanced field length, B 1,887 m (6,190 ft)
 T-O to 11 m (35 ft): A 1,774 m (5,820 ft)
 Landing distance, B 814 m (2,670 ft)
 Landing from 15 m (50 ft) at MLW: A 814 m (2,670 ft)
 Runway LCN 55
 Range with max fuel and eight passengers, NBAA IFR reserves:
 at M0.85: A 6,010 n miles (11,130 km; 6,916 miles)
 B 6,150 n miles (11,390 km; 7,077 miles)
 at M0.87: A 5,276 n miles (9,771 km; 6,071 miles)
 B 5,450 n miles (10,093 km; 6,272 miles)
 Range with max payload:
 A at M0.85 5,187 n miles (9,606 km; 5,969 miles)
 A at M0.87 4,596 n miles (8,511 km; 5,289 miles)
 Design g limit: A, B +2.5
 OPERATIONAL NOISE LEVELS (all):
 T-O 82.4 EPNdB
 Approach 89.8 EPNdB
 Sideline 88.6 EPNdB
UPDATED

BOMBARDIER GLOBAL 5000

TYPE: Long-range business jet.

PROGRAMME: Market and design studies began 1999; announced 25 October 2001; formal launch 5 February 2002; first flight (c/n 9127/C-GERS) 7 March 2003; certification by Transport Canada, FAA and JAA scheduled for first quarter of 2004 following two aircraft flight test programme; service entry fourth quarter 2004.

CUSTOMERS: Launch customer TAG Aeronautics ordered five on 5 November 2001; letters of intent for 15 aircraft at time of launch; Sino Private Aviation of Hong Kong ordered one aircraft during Asian Aerospace 2002 in Singapore on 28 February 2002. Potential market for 750 aircraft in class by 2010.

COSTS: US\$33 million 'green' (2002).

DESIGN FEATURES: Based on Global Express, with 1.83 m (6 ft 0 in) reduction in fuselage length, and 1,200 n mile (2,222 km; 1,381 mile) reduction in maximum range. Up to 19 passengers.

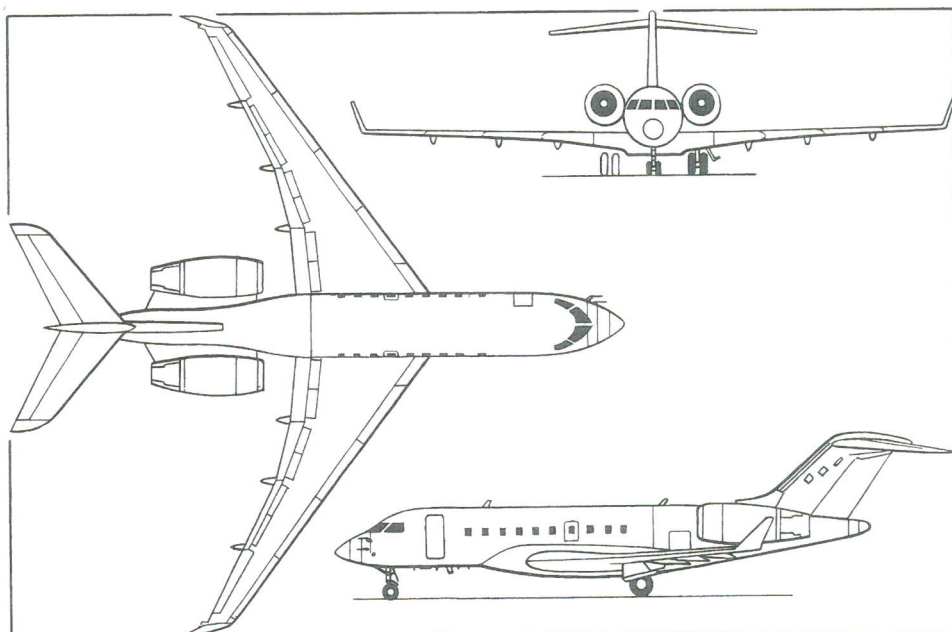
Data generally as for Global Express, except the following.

DIMENSIONS, EXTERNAL:	
Length overall	29.49 m (96 ft 9 in)
DIMENSIONS, INTERNAL:	
Cabin (excl flight deck):	
Length	12.95 m (42 ft 6 in)
Volume	53.29 m ³ (1,882 cu ft)
WEIGHTS AND LOADINGS:	
Basic operating weight	22,838 kg (50,350 lb)
Payload: max	2,563 kg (5,650 lb)
with max fuel	726 kg (1,600 lb)
Max fuel weight	16,329 kg (36,000 lb)



Bombardier Global 5000 business jet on its maiden flight

NEW/0547108



Bombardier Global 5000 general arrangement (James Goulding)

0126930

Fuel with max payload	14,492 kg (31,950 lb)	Time to climb to initial cruising altitude	25 min
Max T-O weight	39,780 kg (87,700 lb)	Max certified altitude	15,545 m (51,000 ft)
Max ramp weight	39,893 kg (87,950 lb)	Balanced field length	1,525 m (5,000 ft)
Max landing weight	35,652 kg (78,600 lb)	Landing run	825 m (2,700 ft)
Max zero-fuel weight	25,401 kg (56,000 lb)	Range, NBAA IFR reserves, three crew, eight passengers:	
Max wing loading	419.0 kg/m ² (85.81 lb/sq ft)	at M0.85	4,800 n miles (8,889 km; 5,523 miles)
Max power loading	303 kg/kN (2.97 lb/lb st)	at M0.88	3,700 n miles (6,852 km; 4,257 miles)
PERFORMANCE:		UPDATED	
Cruising speed: max	M0.89 (510 kt; 945 km/h; 587 mph)		
normal	M0.85 (488 kt; 904 km/h; 562 mph)		
Initial cruising altitude	13,105 m (43,000 ft)		

BOMBARDIER AEROSPACE TORONTO OPERATIONS

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Trevor Anderson

VICE-PRESIDENT, FINANCE: Colin Fernie

VICE-PRESIDENT, HUMAN RESOURCES: Bernard Cormier

MANAGER, PUBLIC RELATIONS: Colin Fisher

Established 1928 as The de Havilland Aircraft of Canada Ltd, subsidiary of The de Havilland Aircraft Company Ltd, both absorbed 1961 by Hawker Siddeley Group; ownership transferred to Canadian government 26 June 1974; purchased by Boeing Company 31 January 1986 and made a division of Boeing of Canada Ltd; Boeing's intention to sell announced July 1990.

Sale to Bombardier Inc (51 per cent) and government of Ontario (49 per cent), signed 22 January 1992, supported by help from Ontario and federal governments, with Canadian Export Development Corporation to provide sales financing for Dash 8; all government support conditionally repayable. Bombardier acquired remaining 49 per cent of de Havilland in January 1997.

At its Downsview facility, Bombardier Aerospace Toronto manufactures Dash 8Q series, including spare parts and components, and also some components of the Bombardier

Global Express; performs final assembly of Dash 8Q, Global Express and Global 5000; designed and builds wings for Learjet 45. Bombardier 415 assembly is in a 4,750 m² (51,000 sq ft) plant at North Bay, Ontario. Bombardier Aerospace Toronto operations' employment totalled more than 3,000 in late 2002.

UPDATED

BOMBARDIER DASH 8 Q100 and Q200

TYPE: Twin-turboprop airliner.

PROGRAMME: Launched 1980; first flight of first prototype (C-GDNK) 20 June 1983, second prototype (C-GGMP) 26 October 1983, third 22 December 1983; fourth aircraft, first with production P&WC PW120 engines, 3 April 1984. Certified to Canadian DoT, FAR Pts 25 and 36 and SFAR No. 27 on 28 September 1984, followed by FAA type approval; also certified in Australia, Austria, Brazil, Cameroon, China, Colombia, Germany, Ireland, Italy, Maldives, Netherlands, New Zealand, Norway, Papua New Guinea, South Africa, Taiwan, UK and United Arab Emirates. First delivery (NorOntair) 23 October 1984 followed by service entry in December; 500th Dash 8 (a Series 200, N355PH) delivered 21 November 1997 to Horizon Air. 600th of type delivered 6 March 2001 (see Q300). Total Dash 8 fleet time at July 2002 (not including Q400) was 11,614,217 hours and 14,070,229 cycles, with 98.8 per cent despatch reliability rate.

CURRENT VERSIONS: **Dash 8 Q:** Redesigned interior and noise and vibration suppression system (NVS) standard from second quarter of 1996, reducing cabin noise levels by 12 dB; all current production aircraft are equipped with NVS and known as Dash 8 Qs.

Dash 8 Series 100: Initial version, with choice of PW120A or PW121 engines; discontinued.

Dash 8 Series 100A: Introduced 1990; PW120A (or optional PW121) engines and restyled interior with 6.35 cm (2.5 in) more headroom in aisle; first delivery to Pennsylvania Airlines July 1990; discontinued.

Dash 8 Series 100B: Improved version from 1992; PW121 engines enhance airfield and climb performance; discontinued.

Dash 8 Q100: Introduced 1998; PW 120A or optional PW 121 in basic weight version, PW 121 standard in high gross weight (HGW) version.

Dash 8 Series 200A: Increased speed/payload version of Series 100A with PW 123C engines. Transport Canada certification March 1995; first delivery 19 April 1995; discontinued.

Dash 8 Series 200B: As 200A, but with PW123D engines for full power at higher ambient temperatures; discontinued.

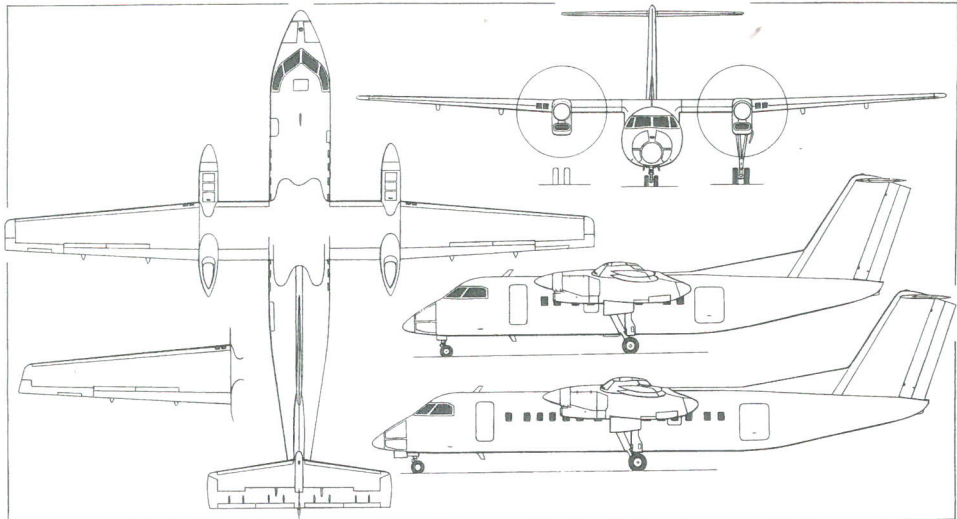
Dash 8 Q200: Introduced in 1998; increased speed/payload version of Q100; increased OEI capability and greater commonality with Series 300. Same airframe as Q100, but PW 123C/D engines give 30 kt (56 km/h; 35 mph) increase in cruising speed, allowing airlines to increase frequencies or operational radius. PW 123D engine offers full power at higher ambient temperatures for improved hot-and-high airfield performance.

Detailed description applies to Q200 except where indicated.

Dash 8 Q300 and Q400; described separately.

Dash 8M and Triton: Special missions versions, previously promoted, including Canadian CC-142 and US Air Force E-9A.

CUSTOMERS: By 31 March 2003, orders received for 299 Srs 100 subvariants and 94 Srs 200s, all of which had then been delivered (including military Dash 8Ms). See table. COSTS: Unit cost approximately US\$12 million (2000).



Bombardier Dash 8 Q100, with additional side view (bottom) and wingtip of Q300 (Jane's/Dennis Punnett)

DESIGN FEATURES: T tail, swept fin with large dorsal fin. Wing has constant chord inboard section and tapered outer panels; thickness/chord ratio 18 per cent at root, 13 per cent at tip; dihedral 2° 30' on outer panels; inboard leading-edges drooped; 3° washout at wingtips.

FLYING CONTROLS: Conventional and power-assisted. Fixed tailplane; horn-balanced elevator with four tabs; mechanically actuated horn-balanced ailerons with inset tabs; hydraulically actuated roll spoilers/lift dumpers forward of each outer flap; two-segment serially hinged rudder, hydraulically actuated; yaw damper; stall strips on leading-edges outboard of engines; two-section slotted Fowler flaps. Digital AFCS.

STRUCTURE: Fuselage near-circular section, flush riveted and pressurised; adhesive bonded stringers and cutout reinforcements; wing leading-edge, radome, nose bay, wing/fuselage and wingtip fairings, dorsal fin, fin leading-edge, fin/tailplane fairings, tailplane leading-edges, elevator tips, flap shrouds, flap trailing-edges and other components of Kevlar and Nomex; wing has tip-to-tip torsion box. Wheel doors of Kevlar and other composites.

LANDING GEAR: Retractable tricycle type, by Dowty Aerospace, with twin wheels on each unit. Steer-by-wire nose unit retracts forward, main units rearward into engine nacelles. Goodrich mainwheels and brakes; Hydro-Aire Mk 3 anti-skid system. Tyres 26.5x8.0-13 (12 ply) or high flotation H31x9.75-13 (10 ply) on main units; 18x5.5 (10 ply) or 22x6.50-10 (12 ply) on nose unit. Standard tyre pressures: main 9.03 bar (131 lb/sq in), nose 5.52 bar (80 lb/sq in). Low-pressure tyres optional, pressure 5.31 bar (77 lb/sq in) on main units, 3.31 bar (48 lb/sq in) on nose unit.

POWER PLANT: Q100: Two 1,491 kW (2,000 shp) Pratt & Whitney Canada PW 120A turboprops, driving Hamilton Sundstrand 14SF-7 four-blade constant-speed fully feathering aluminium/glass fibre propellers with reverse pitch, standard on basic weight version. Two 1,603 kW (2,150 shp) PW 121s optional on this version and standard on High Gross Weight version.

Q200: Two 1,603 kW (2,150 shp) PW 123C/D turboprops, driving Hamilton Sundstrand 14SF-23 propellers; PW 123C is flat-rated for full power at up to 26°C; PW 123D maintains same power at up to 45°C.

Standard usable fuel capacity (in-wing tanks) 3,160 litres (835 US gallons; 695 Imp gallons); optional auxiliary tank system increases this to 5,700 litres (1,506 US gallons; 1,254 Imp gallons). Pressure refuelling point in rear of starboard engine nacelle; overwing gravity point in each outer wing panel. Oil capacity 21 litres (5.5 US gallons; 4.6 Imp gallons) per engine.

ACCOMMODATION: Crew of two on flight deck, plus cabin attendant. Dual controls standard. Standard commuter layout provides four-abreast seating, with central aisle, for 37 passengers at 79 cm (31 in) pitch, plus buffet, lavatory and large rear baggage compartment. Wardrobe at front of passenger cabin, in addition to overhead lockers and underseat stowage, provides additional carry-on baggage capacity. Alternative 39-passenger, passenger/cargo or corporate layouts available at customer's option. Movable bulkhead to facilitate conversion to mixed traffic. Port side airstair door at front for crew and passengers; large inward-opening port side door aft of wing for cargo loading. Emergency exit each side, in line with wing leading-edge, and opposite passenger door on starboard side. Entire accommodation pressurised and air conditioned.

SYSTEMS: Pressurisation system with maximum differential 0.38 bar (5.5 lb/sq in). Normal hydraulic installation comprises two independent systems, each having an engine-driven variable displacement pump and an electrically driven standby pump; accumulator and hand pump for emergency use. Electrical system DC power provided by two starter/generators, two transformer-rectifier units, and two Ni/Cd batteries. Variable frequency AC power provided by two engine-driven AC generators

and three static inverters. Ground power receptacles in port side of nose (DC) and rear of starboard nacelle (AC). Rubber-boot de-icing of wing, tailplane and fin leading-edges and nacelle intakes by pneumatic system; electric de-icing of propeller blades, pitot static ports, stall warning transducer, engine intake adaptor and elevator horn leading-edge. APU optional. Simmonds fuel monitoring system.

AVIONICS: Rockwell Collins and Honeywell com/nav.

Comms: Dual Rockwell Collins VHF-22; single Mode C transponder. Avtech audio integrating system. Telephonics PA system.

Radar: Primus P660 colour weather radar.

Flight: Rockwell Collins DME-42, ADF-60A, Honeywell Mk VIII EAPNS, Honeywell SPZ-8000 dual-channel digital AFCS with integrated fail-operational flight director/autopilot system, dual digital air data system. Optional FMS and GPS.

Instrumentation: Honeywell EFIS. Rockwell Collins/Flight Dynamics HGS 2000 head-up guidance system for Cat. IIIa operation optional.

DIMENSIONS, EXTERNAL:	
Wing span	25.91 m (85 ft 0 in)
Wing aspect ratio	12.4
Length overall	22.25 m (73 ft 0 in)
Fuselage: Max diameter	2.69 m (8 ft 10 in)
Height overall	7.49 m (24 ft 7 in)
Elevator span	7.92 m (26 ft 0 in)
Wheel track (c/l of shock-struts)	7.87 m (25 ft 10 in)
Wheelbase	7.95 m (26 ft 1 in)
Propeller diameter	3.96 m (13 ft 0 in)
Propeller ground clearance	0.94 m (3 ft 1 in)
Propeller fuselage clearance	0.76 m (2 ft 6 in)
Passenger/crew door (fwd, port):	
Height	1.66 m (5 ft 5½ in)
Width	0.76 m (2 ft 6 in)
Height to sill	1.09 m (3 ft 7 in)
Baggage door (rear, port): Height	1.52 m (5 ft 0 in)
Width	1.27 m (4 ft 2 in)
Height to sill	1.09 m (3 ft 7 in)
DIMENSIONS, INTERNAL:	
Cabin (excl flight deck): Length	9.14 m (30 ft 0 in)
Max width	2.49 m (8 ft 2 in)
Width at floor	2.03 m (6 ft 8 in)
Max height	1.96 m (6 ft 5 in)
Floor area	23.60 m² (254.0 sq ft)
Volume	37.6 m³ (1,328 cu ft)
Baggage compartment volume	8.5 m³ (300 cu ft)
AREAS:	
Wings, gross	54.35 m² (585.0 sq ft)
Ailerons (total)	1.12 m² (12.1 sq ft)
Fin	9.81 m² (105.6 sq ft)
Rudder	4.31 m² (46.4 sq ft)

Tailplane	8.97 m² (96.5 sq ft)
Elevators (total)	4.97 m² (53.5 sq ft)
WEIGHTS AND LOADINGS:	
Operating weight empty: Q100	10,433 kg (23,000 lb)
Q200	10,501 kg (23,151 lb)
Max usable fuel: standard	2,576 kg (5,678 lb)
optional	4,647 kg (10,244 lb)
Max payload: Q100	4,082 kg (9,000 lb)
Q200	4,195 kg (9,249 lb)
Payload with max fuel: Q100	3,475 kg (7,662 lb)
Q200	3,389 kg (7,471 lb)
Max T-O weight: Q100	15,649 kg (34,500 lb)
Q100 HGW, Q200	16,465 kg (36,300 lb)
Max landing weight: Q100	15,377 kg (33,900 lb)
Q200	15,649 kg (34,500 lb)
Max zero-fuel weight:	
Q100, Q200 JAA	14,515 kg (32,000 lb)
Q200	14,696 kg (32,400 lb)
Max wing loading: Q100	287.9 kg/m² (58.97 lb/sq ft)
Q100 HGW, Q200	303.0 kg/m² (62.05 lb/sq ft)
Max power loading: Q100	5.25 kg/kW (8.63 lb/shp)
Q100 HGW, Q200	5.14 kg/kW (8.44 lb/shp)
PERFORMANCE (at 95% standard MTOW, except where indicated):	
Max cruising speed: Q100	265 kt (491 km/h; 305 mph)
Q100 HGW	270 kt (500 km/h; 311 mph)
Q200	290 kt (537 km/h; 334 mph)
Stalling speed, flaps down: all	72 kt (134 km/h; 83 mph)
Max rate of climb at S/L: all	450 m (1,475 ft)/min
Max certified altitude: all	7,620 m (25,000 ft)
Service ceiling: Q100	4,503 m (14,775 ft)
Q100 HGW	5,105 m (16,750 ft)
Q200	4,938 m (16,200 ft)
FAR Pt 25 T-O field length:	
Q100 (PW 121)	991 m (3,250 ft)
Q200	1,000 m (3,280 ft)
FAR Pt 25 landing field length at max landing weight:	
Q100	785 m (2,575 ft)
Q200	780 m (2,560 ft)
Range with 37 passengers:	
Q100	1,020 n miles (1,889 km; 1,173 miles)
Q200	925 n miles (1,713 km; 1,064 miles)
OPERATIONAL NOISE LEVELS: (FAR Pt 36 Stage 3 and ICAO Annex 16):	
T-O	80.5 EPNdB
Sideline	85.6 EPNdB
Approach	94.7 EPNdB

UPDATED

BOMBARDIER DASH 8 Q300

TYPE: Twin-turboprop airliner.

PROGRAMME: Dash 8 Series 300 announced mid-1985 as stretch of Series 200; launched March 1986; first flight (modified Series 100 prototype C-GDNK) 15 May 1987; Canadian DoT certification 14 February 1989; first delivery (Time Air) 27 February 1989; FAA type approval 8 June 1989; now also certified in Antigua, Argentina, Australia, Austria, Bahamas, Brazil, Chile, China, Colombia, Egypt, Germany, Ireland, India, Indonesia, Italy, Jordan, Malaysia, Maldives, Mexico, Netherlands, New Zealand, Norway, Romania, Senegal, South Africa, Spain, Taiwan, Thailand, United Arab Emirates and Zambia. Low-noise Dash 8 Q (see Series 200 for details) became standard version from 1996. A Q300 delivered to Air Nippon on 6 March 2001 was the 600th Dash 8.

CURRENT VERSIONS: Series 300, 300A, 300B and 300E: Initial versions, described in 1998-99 and earlier editions.

Q300: Introduced 1998; differs from Q200 in having extended wingtips; 3.43 m (11 ft 3 in) two-plug fuselage extension giving standard seating for 50 at 81 cm (32 in) pitch or 56 at 74 cm (29 in) pitch, plus second cabin attendant; also larger galley, galley service door, additional wardrobe, larger lavatory, dual air conditioning packs and optional Turbomach T-40 APU; powered by 1,775 kW (2,380 shp) P&WC PW123s driving Hamilton Sundstrand 14SF-23 four-blade propellers standard in basic version; 1,864 kW (2,500 shp) PW 123Bs optional in basic and standard in high gross weight (HGW) versions provide increased mechanical power for improved take-off



Bombardier Dash 8 Q200 delivered to the Mexican Navy in 2002

NEW/0143488

performance in low and cold conditions; optional 1,775 kW (2,380 shp) PW 123Es provide 5 per cent increase in thermodynamic power up to 40°C (96°F) for improved hot-and-high performance; fuel capacity as Q200; tyre pressures increased (mainwheels 6.69 bar; 97 lb/sq in, nosewheels 4.14 bar; 60 lb/sq in). NVS system standard on all aircraft produced from second quarter 1996.

CUSTOMERS: Firm orders for 206 by 31 March 2003, of which 198 then delivered. See table.

COSTS: US\$14.3 million (2000).

DIMENSIONS, EXTERNAL: As for Q200 except:

Wing span	27.43 m (90 ft 0 in)
Wing aspect ratio	13.4
Length overall	25.68 m (84 ft 3 in)
Wheelbase	10.01 m (32 ft 10 in)

DIMENSIONS, INTERNAL: As for Q200 except:

Cabin (excl flight deck): Length	12.65 m (41 ft 6 in)
Floor area	30.57 m ² (329.0 sq ft)
Volume	52.0 m ³ (1,838 cu ft)

Baggage compartment volume:	
with 50 passengers	9.1 m ³ (320 cu ft)
with 56 passengers	7.9 m ³ (280 cu ft)

AREAS:

Wings, gross	56.21 m ² (605.0 sq ft)
Ailerons (total)	1.87 m ² (20.18 sq ft)
Tail surfaces	as for Series 100A/200A

WEIGHTS AND LOADINGS:

Operating weight empty: basic	11,812 kg (26,042 lb)
HW	11,823 kg (26,065 lb)
Max usable fuel: standard	2,576 kg (5,679 lb)
optional	4,646 kg (10,243 lb)
Max payload: basic	5,061 kg (11,158 lb)
HW	6,094 kg (13,435 lb)
Payload with max fuel	5,106 kg (11,257 lb)
Max T-O weight: basic	18,642 kg (41,100 lb)
HW	19,504 kg (43,000 lb)
Max landing weight: basic	18,144 kg (40,000 lb)
HW	19,050 kg (42,000 lb)
Max zero-fuel weight: basic	16,873 kg (37,200 lb)
HW	17,917 kg (39,500 lb)
Max wing loading: basic	331.7 kg/m ² (67.93 lb/sq ft)
HW	347.0 kg/m ² (71.07 lb/sq ft)
Max power loading: basic	5.25 kg/kW (8.63 lb/shp)
HW	5.49 kg/kW (9.03 lb/shp)



Bombardier Dash 8 Q300 twin-turboprop airliner

NEW/0546836

BOMBARDIER DASH 8 Q400

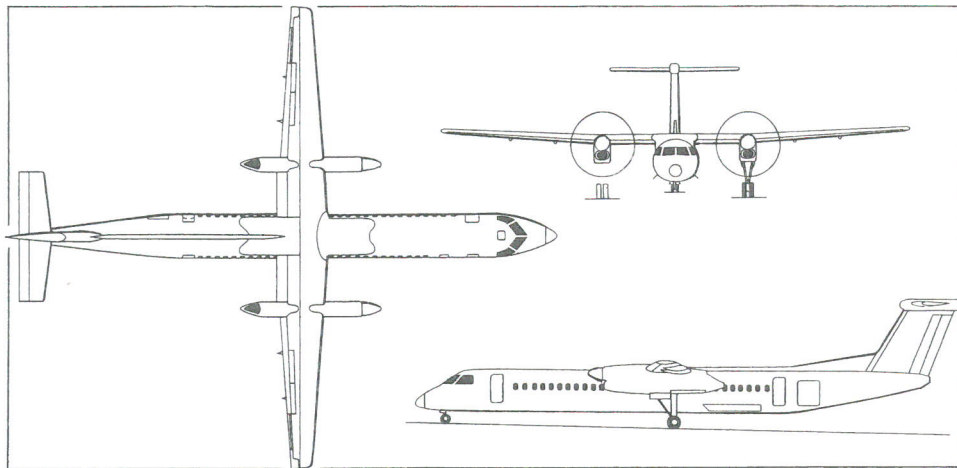
TYPE: Twin-turboprop airliner.

PROGRAMME: Launched June 1995 as stretch of Series 300; component manufacture began December 1996; engine first test flown in January 1997, mounted on nose of Pratt & Whitney Canada Boeing 720B testbed; roll-out 21 November 1997, first flight (C-FJJA) 31 January 1998; five aircraft participated in the 1,900 hour, 1,400 sortie flight test programme, based at the Bombardier Flight Test Centre in Wichita, Kansas, leading to Transport Canada CAR 525 Amendment 86 certification on 14 June 1999, JAA approval in December 1999 and FAA FAR Pt 25 approval on 8 February 2000. JAA approval for steep approach (5.5° glideslope) operations at London City Airport achieved 11 October 2001. First delivery (OY-KCA) to SAS Commuter 20 January 2000, followed by service entry 7 February on Copenhagen, Denmark, to Poznan, Poland route. Q400 fleet flight time totalled 154,800 hours and 177,000 cycles by November 2001. Mitsubishi joined programme as risk-sharing partner in October 1995, with responsibility for design, development and manufacture of fuselage and tail sections.

CUSTOMERS: Total of 78 firm orders by 31 March 2003, at which time 71 had been delivered; see table. Launch customer was Great China Airlines (now UNI Airways), which ordered six (since cancelled) in February 1996. US launch customer Horizon Air, which ordered 15 with 15 options, in June 1999, took delivery of its first aircraft on 8 January 2001. First for Changan handed over 27 October 2000. British European (now FlyBE) received first on 23 November 2001; Widerøe deliveries began 16 November 2001. Recent customers include FlyBE, which ordered 17, plus 20 options, on 23 April 2003, for delivery from second quarter 2003.

COSTS: FlyBE order for 17 aircraft, valued at US\$362 million (2003). Direct operating cost in US currency, based on 70 passengers over 200 n mile (370 km; 230 mile) stage length: in USA 8.06 cents per seat-mile; in Europe 8.08 cents per seat-kilometre (both 2002).

DESIGN FEATURES: Compared with Q300, fuselage stretched 6.83 m (22 ft 5 in) to seat up to 78. Other new features include engines; propeller; tapered inboard wing section increasing propeller/fuselage clearance to 1.09 m (3 ft 7 in); revised wing/fuselage fairings; ailerons, elevators and fin cap fairing; landing gear; baggage/service doors; upgraded avionics. Airframe designed for crack-free life of 40,000 flight hours/80,000 flight cycles and an economic life of 80,000 flight hours/160,000 flight cycles. Common type rating with Q100/200/300.



General arrangement of the Dash 8 Q400 (Paul Jackson)

0044508



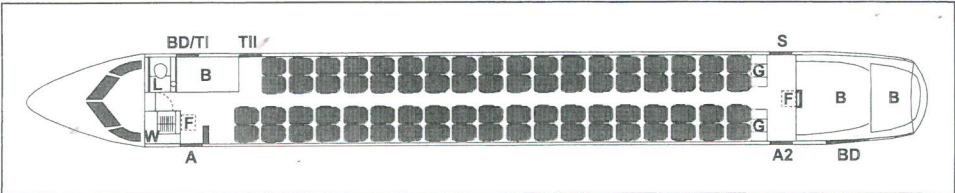
Dash 8 Q400 demonstrator

NEW/0547102

STRUCTURE: Generally as for Q100 and Q200. De Havilland Canada manufactures cockpit section and wing and performs final assembly; other participants in programme include AlliedSignal (electrical power system); Goodrich (brakes); Dowty Aerospace (propellers); Menasco (landing gear); Micro Technica (flap system); Mitsubishi (fuselage and tail sections); Parker Bertea Aerospace (hydraulics and fuel system); Pratt & Whitney Canada (engines); Sextant Avionique (avionics system); and Shorts (engine nacelles).

POWER PLANT: Two Pratt & Whitney Canada PW150A turboprops with FADEC, each flat rated to 3,781 kW (5,071 shp) at 37.4°C, driving Dowty R408 six-blade, slow-turning (1,020 rpm for T-O; 850 rpm cruise) composites propellers giving 15 per cent reduction in T-O rpm and 6 to 19 per cent reduction in cruise rpm over Q100/300. Fuel capacity 6,526 litres (1,724 US gallons; 1,436 Imp gallons).

ACCOMMODATION: Variety of cabin configurations providing four-abreast seating, with central aisle, for 70 passengers at 84 cm (33 in) pitch. 74 passengers at 79 cm (31 in) pitch, 78 passengers at 76 cm (30 in), or two-class layout for 10



Dash 8 Q400 in 74-seat configuration
A: airstair/Type I exit, A2: passenger door/Type I exit, B: baggage, BD: baggage door, F: folding seat, G: galley, L: lavatory, S: service door/Type I exit, TI/TII: Type I/Type II exits, W: wardrobe 0044509

business class passengers at 86 cm (34 in) pitch and 62 economy class passengers at 79 cm (31 in); NVS system standard.

AVIONICS: Prime contractor, Thales.
Comms: Dual VHF nav/com and mode S transponder; solid-state FDR and cockpit voice recorder; ELT antenna.
Radar: Weather radar.
Flight: GPWS, radar altimeter, ADF and DME.
Provision for FMS, GPS and TCAS II.

Instrumentation: EFIS employs five 152 × 203 mm (6 × 8 in) LCDs. Optional Flight Dynamics HGS4100 (later HGS4200) head-up guidance system.

DIMENSIONS, EXTERNAL:
Wing span 28.42 m (93 ft 3 in)
Wing aspect ratio 12.8
Length overall 32.84 m (107 ft 9 in)
Fuselage max diameter 2.69 m (8 ft 10 in)
Height overall 8.36 m (27 ft 5 in)

BOMBARDIER Q SERIES ORDERS AND DELIVERIES
(at 1 January 2004)

Customer	Variant	Ordered	Delivered	Backlog
Abu Dhabi Aviation	200	2	2	
AGES/Worldwide	300	6	6	
Air Atlantic	100	15	15	
AirBC	100	12	12	
	300	6	6	
Air Creebec	100	1	1	
Air Dolomiti	300	3	3	
Air Maldives	200	1	1	
Air Manitoba	100	1	1	
Air Nippon Network/ ANK	300	5	5	
Air Niugini	200	2	2	
Air Nostrum	300	22	19	3
Air Nova	100	6	6	
Air Ontario	100	30	30	
	300	6	6	
Air Senegal				
International	300	1	1	
Air Wisconsin	100	5	5	
	300	7	7	
Alberta Government	100	1	1	
All Nippon Airways	400	6	3	3
ALM	300	2	2	
Amakusa	100	1	1	
America West	100	12	12	
Ansett New Zealand	100	2	2	
Augsburg Airways	200	2	2	
	300	7	7	
	400	5	5	
Australian Airlines	100	4	4	
Austrian arrows**	100	11	11	
	300	19	19	
	400	10	8	2
Aviaco/Furlong	300	4	4	
Avline	300	4	4	
BPX Colombia	200	1	1	
Bahamasair	300	3	3	
British European	200	3	3	
	300	4	4	
	400	4	4	
Brymon Airways	300	10	10	
BWIA	300	4	4	
Canadian DND	100	6	6	
CCAair	100	2	2	
Changan	400	3	3	
City Express	100	4	4	
Contact Air	100	2	2	
	300	4	4	
DAC Air	300	1	1	
Eastern Australia	200	1	1	
Eastern Metro				
Express	100	8	8	
Elveden Investments	100	3	3	
	300	1	1	
Fairways Corp	100	1	1	
FlyBE	400	17	3	14
GPA Jetprop	100	16	16	
	300	14	14	
Hamburg Airlines	100	2	2	
	300	2	2	
Horizon Air	100	21	21	
	200	28	28	
	400	17	15	2
HydroQuebec	400	2	2	
Interot	100	2	2	
	300	1	1	
JAS/Japan Air Commuter	400	5	3	2
LADS	200	1	1	
LIAT	100	5	5	
	300	3	3	

Customer	Variant	Ordered	Delivered	Backlog
MarkAir	300	2	2	
Mesa Air	200	12	12	
Mexican Navy	200	1	1	
Midroc Aviation	200	2	2	
Mobil Oil	100	1	1	
National Jet	200	6	6	
	300	2	2	
Norfolk Airlines	100	1	1	
norOntair	100	2	2	
Northwest Airlines	100	25	25	
Norwegian CAA	100	1	1	
Oriental Air Bridge	200	2	2	
Palestinian	300	2	2	
Petroleum Air				
Service	300	3	3	
Qantas Airways	200	1	1	
	300	15	9	6
Rheintalflug	100	3	3	
	300	3	3	
Royal Wings	300	1	1	
Ryukyu Air				
Commuter	100	4	4	
South African				
Express	300	12	12	
SAS Commuter	400	28	28	
Saeaga Airlines	200	1	1	
	300	1	1	
Saudi Aramco	200	3	3	
Schreiner Airways	100	1	1	
	300	2	2	
Talair	100	2	2	
TAVAJ	200	2	2	
Time Air	100	4	4	
	300	10	10	
Transport Canada	100	2	2	
Tyco	400	1	1	
UNI Airways	100	4	4	
	200	1	1	
	300	14	14	
USAF/Sierra	100	2	2	
USAir Express	100	56	56	
	200	19	19	
Widerøe's	100	15	15	
	300	4	4	
	400	3	3	
Zhejiang Airlines	300	2	2	
Undisclosed	100	3	3	
	200	4	3	1
	300	1		1

Totals	708	674	34
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Notes: Operators with leased Dash 8 aircraft include, but are not necessarily restricted to, the following: Air Alliance, ERA, Lloyd Aviation, Lufthansa CityLine, Sabena, TABA.
* US Airways operators include Piedmont Airlines and Allegheny Commuter.
** Formerly Tyrolean.
UNI Airways received initial aircraft when named Great China Airlines.
British European (now FlyBE) received initial aircraft when named Jersey European Airways.

SUMMARY			
	Ordered	Delivered	Backlog
Series 100	299	299	
Series 200	95	94	1
Series 300	213	203	10
Series 400	101	78	23
Totals	708	674	34

Tailplane span	9.27 m (30 ft 5 in)
Wheel track	8.79 m (28 ft 10 in)
Wheelbase	13.94 m (45 ft 9 in)
Propeller diameter	4.11 m (13 ft 6 in)
Propeller ground clearance	0.97 m (3 ft 2 in)
Propeller fuselage clearance	1.10 m (3 ft 7 1/4 in)

Passenger/crew door (port, fwd):	
Height	1.66 m (5 ft 5 1/2 in)
Width	0.76 m (2 ft 6 in)
Height to sill	1.22 m (4 ft 0 in)

Passenger/crew door (port, rear):	
Height	1.73 m (5 ft 8 in)
Width	0.71 m (2 ft 4 in)
Height to sill	1.52 m (5 ft 0 in)

Baggage door (port, rear): Height	1.55 m (5 ft 1 in)
Width	1.27 m (4 ft 2 in)
Height to sill	1.55 m (5 ft 1 in)

Baggage door (stbd, fwd): Height	1.45 m (4 ft 9 in)
Width	0.71 m (2 ft 4 in)
Height to sill	1.17 m (3 ft 10 in)

Service door (stbd, aft): Height	1.45 m (4 ft 9 in)
Width	0.71 m (2 ft 4 in)
Height to sill	1.52 m (5 ft 0 in)

DIMENSIONS, INTERNAL:

Cabin (excl flight deck): Length	18.80 m (61 ft 8 in)
Max width	2.49 m (8 ft 2 in)
Max height	1.95 m (6 ft 5 in)
Floor area	43.6 m² (469 sq ft)
Volume	77.6 m³ (2,740 cu ft)
Baggage volume: fwd	2.58 m³ (91.0 cu ft)
aft	11.6 m³ (411 cu ft)
total	14.2 m³ (502 cu ft)

AREAS:

Wings, gross	63.08 m² (679.0 sq ft)
Ailerons (total)	1.87 m² (20.18 sq ft)
Vertical tail surfaces (total)	14.12 m² (152.0 sq ft)
Horizontal tail surfaces (total)	16.72 m² (180.0 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty	17,108 kg (37,717 lb)
Max payload	8,747 kg (19,283 lb)
Payload with max fuel	6,831 kg (15,059 lb)
Max T-O weight: basic	27,986 kg (61,700 lb)
intermediate	28,998 kg (63,930 lb)
HGW	29,256 kg (64,500 lb)
Max landing weight	28,009 kg (61,750 lb)
Max zero-fuel weight	25,855 kg (57,000 lb)
Max wing loading: basic	443.7 kg/m² (90.87 lb/sq ft)
intermediate	459.7 kg/m² (94.15 lb/sq ft)
HGW	463.8 kg/m² (94.99 lb/sq ft)
Max power loading: basic	3.70 kg/kW (6.08 lb/shp)
intermediate	3.84 kg/kW (6.30 lb/shp)
HGW	3.87 kg/kW (6.36 lb/shp)

PERFORMANCE (at 95% of standard MTOW, except where indicated):

Max cruising speed	360 kt (667 km/h; 414 mph)
Max certified altitude	7,620 m (25,000 ft)
Service ceiling, OEI	5,334 m (17,500 ft)
FAR T-O field length at S/L, MTOW	1,404 m (4,605 ft)
FAR landing field length at S/L, MLW	1,288 m (4,225 ft)
Max range, 70 passengers, IFR reserves	1,360 n miles (2,518 km; 1,565 miles)

OPERATIONAL NOISE LEVELS (estimated, FAR Pt 36):

T-O	78.3 EPNdB
Sideline	84 EPNdB
Approach	94.3 EPNdB

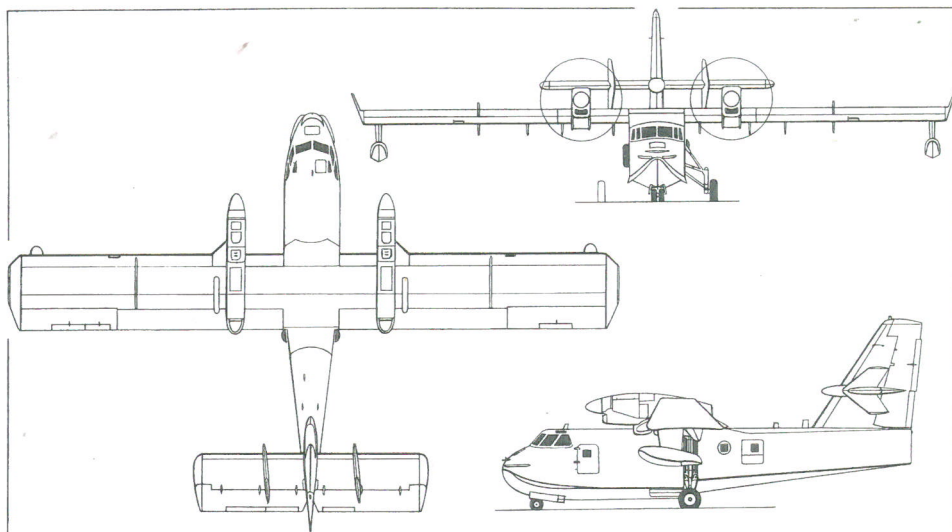
UPDATED

BOMBARDIER 415

US marketing name: SuperScoop

TYPE: Twin-turboprop amphibian.

PROGRAMME: Introduced as product follow-on to piston-engined Canadair CL-215; given new designation Canadair 415 in 1991 to distinguish new production turboprop model from CL-215T retrofit, but engineering designation retained and new-build turboprop versions are



Canadair 415 SuperScoop twin-turboprop general purpose amphibian (Jane's/Dennis Punnett)

CL-215-6B11. Launched officially 16 October 1991 with firm orders from France and (August 1992) Québec; first flight (C-GSCT) 6 December 1993, although preceded by initial CL-215T conversion (C-FASE), flown on 8 June 1989. Canadian certification 24 June 1994 in Restricted and Utility categories, FAA approval 14 October 1994 in Restricted category. RAI (Italy) approval 27 October 1994 in Restricted category. Fleet had achieved 50,000 flying hours and 190,000 scooping sorties by 31 March 2001. Final assembly relocated to North Bay, Ontario, in November 1998. Production suspended in October 2001 pending new orders (but see 415MP entry below). New designation Bombardier 415 adopted in February 2002.

CURRENT VERSIONS: Standard 415 and first production units are in firefighting configuration

415MP: Multipurpose version incorporating FLIR, SLAR and nose-mounted search radar for missions such as search and rescue, coastal and border patrol and environmental monitoring, while retaining firefighting capability. First flight (C-GHVX; 55th aircraft, destined to become 415GR for Greece) 6 March 2002, preceding a 200-hour flight test programme.

415MP can be modified for maritime, SAR and special missions.

415GR: Ordered by Greece, January 1999; based on 415MP; increased weights; boat handling and cargo hoisting provisions. Two (plus an optional third) will be configured for combat search-and-rescue (C-SAR) role, for which, during 2000, SAAB Nyge Aero of Sweden was awarded a three-year contract to install MSS 5000 mission equipment including SLAR (each side), wing-mounted FLIR Systems SeaFLIR, nose-mounted Honeywell Primus WX 660 weather/search radar, digital cameras, autopilot and provision for Have Quick secure radios and rescue beacon receivers. The aircraft will also have an enlarged cargo door to facilitate deployment of an inflatable rescue boat. The Hellenic Air Force C-SAR aircraft will be based at Elefsis AB; delivery was due in May 2003.

CUSTOMERS: See table. First French Canadair 415 delivered to CEV experimental unit 8 February 1995, but trials revealed need for modifications and acceptance delayed until 13 June 1995; deliveries completed June 1997. Ontario provincial government announced order for nine on 2 April 1998. Government of Malaysia expressed interest in acquiring two following demonstration flights in February 2002. Total 59 built by October 2001 production suspension; 60th registered in January 2002, but none further in that year.

BOMBARDIER 415 CUSTOMERS

(at February 2003)

Customer	Qty	First aircraft	Delivered
Canada: Ontario govt	9	C-GOGD	29 Apr 98
Québec govt	8	C-GQBA	Jul 95
Croatia ¹	4	9A-CAG	Feb 97
France: Sécurité Civile	12	F-ZBFS	8 Feb 95
Greek govt ²	10	2039	Jan 99
Italy: Protezione Civile	14	I-DPCD	27 Jan 95

Total 57

¹ Requirement for six² Plus five options; order total includes two 415GR

COSTS: Approximately US\$23 million in firefighting configuration (2000).

DESIGN FEATURES: Retains well-proven basic airframe of piston-engined CL-215 (thick wing with zero dihedral and 2° incidence; row of vortex generators on each wing outboard of fence; long stall strip inboard of starboard fence; leading-edge strakes and fences beside engine nacelles; water scoops behind planing step; anti-spray channels in planing bottom chine) but incorporates upgrading modifications and improvements including higher operating weights for increased firefighting productivity; pressure refuelling; wing endplates for lateral stability; finlets and tailplane/fin bullet to recover longitudinal and directional stability affected by relocated thrust line, increased power and new propellers; powered rudder, ailerons and elevators; new electrical system; new 'glass' cockpit with air conditioning; enlarged four-tank firefighting drop system.

FLYING CONTROLS: Conventional and power-assisted. Hydraulically actuated ailerons, elevators and rudder, standard; manual reversion in event of hydraulic failure; geared tab in each aileron, spring tab in rudder and each elevator, plus trim tab in port aileron and port elevator. Hydraulically operated single-slotted flaps, each supported by four external hinges.

STRUCTURE: No-dihedral, no-twist high wing, of constant chord; one-piece structure with two conventional spars, extruded spanwise stringers and interspar ribs and aluminium alloy skins. All-metal, fail-safe, single-step boat-hull fuselage with numerous watertight compartments. Tail surfaces of aluminium alloy sheet and extrusions, with honeycomb panels on control surfaces.

LANDING GEAR: Hydraulically retractable tricycle type. Self-centring twin-wheel nose unit retracts rearward into hull and is fully enclosed by conformal doors. Nosewheel steering standard. Main gear legs retract into wells in sides of hull. Plate mounted on each main gear assembly encloses bottom of wheel well. Mainwheel tyres 15.00-16 (16 ply) tubeless, pressure 5.31 bar (77 lb/sq in); nosewheel tyres 6.50-10 (10 ply) tubeless, pressure 6.55 bar (95 lb/sq in). Hydraulic disc brakes. Non-retractable stabilising floats, each carried near wingtip on pylon cantilevered from wing box structure, with breakaway provision.

POWER PLANT: Two 1,775 kW (2,380 shp) Pratt & Whitney Canada PW123AF turboprops, on damage-tolerant mounts capable of withstanding a breach of the compressor/turbine casing, each driving a Hamilton Sundstrand 14SF-19 four-blade constant-speed fully feathering reversible-pitch propeller. Two fuel tanks, each of eight identical flexible cells, in wing spar box, with total usable capacity of 5,796 litres (1,531 US gallons; 1,275 Imp gallons). Single-point pressure refuelling (rear fuselage, starboard side), plus gravity points in wing upper surface.

ACCOMMODATION: Normal crew of two side by side on flight deck, with dual controls. Additional station in maritime patrol/SAR versions for third cockpit member, mission



Bombardier 415 (two P&WC PW123 turboprops)

NEW/0547109

specialist and two observers. For water bomber cabin installation, see Equipment paragraph. Combi layout offers cargo at front, full firefighting capability, plus 11 seats at rear. Other quick-change interiors available for utility/paratroop (up to 14 troop-type folding canvas seats in cabin) or other special missions according to customer's requirements. Flush doors to main cabin on port side of fuselage forward and aft of wings. Optional aft cargo door, height 1.33 m (4 ft 4½ in), width 1.46 m (4 ft 9½ in). Emergency exit on starboard side aft of wing trailing-edge. Crew emergency hatch in flight deck roof on starboard side. Mooring hatch in upper surface of nose. Provision for additional cabin windows.

SYSTEMS: Vapour cycle air conditioning system and combustion heater. Hydraulic system, pressure 207 bar (3,000 lb/sq in), utilises two engine-driven pumps (maximum flow rate 45.5 litres; 12.0 US gallons; 10.0 Imp gallons/min) to actuate nosewheel steering, landing gear, flaps, water drop doors, pickup probes, flight controls, main gear unlocking and wheel brakes. Hydraulic fluid (MIL-H-83282) in air/oil reservoir slightly pressurised by engine bleed air. Electrically driven third pump provides hydraulic power for emergency actuation of landing gear and brakes and closure of water doors. Electrical system includes two 800 VA 115 V 400 Hz static inverters, two 28 V 400 A DC engine-driven starter/generators and two 40 Ah Ni/Cd batteries. Pneumatic/electric intake de-icing system; airframe ice protection system optional.

AVIONICS: Dual Honeywell Primus 2 digital integrated VHF nav/com.

Comms: Global Wulfsberg VHF/UHF/AM/FM and Rockwell Collins HF radios with central control heads, ELT and dual transponders.

Radar: Search/weather radar optional.

Flight: Dual ADF, VOR/ILS, marker beacon receivers and single DME.

Instrumentation: Honeywell EDZ-605 EFIS with three-tube Integrated Instrument Display System for EADI and EHSI; dual Litel/Honeywell AHRS, dual air data computers, Honeywell radio altimeter.

EQUIPMENT (firefighter): Four integral water tanks in main fuselage compartment, near CG (combined capacity 6,137 litres; 1,621 US gallons; 1,350 Imp gallons), plus eight inward-facing seats in forward cabin. Tanks filled by two hydraulically actuated scoops aft of hull step, fillable also on ground by hose adaptor on each side of fuselage. Four independently openable water doors in hull bottom. Onboard foam concentrate reservoirs (capacity 680 kg; 1,500 lb) and mixing system. Improved drop pattern and drop door sequencing compared with CL-215. Optional spray kit can be coupled with firefighting tanks for large-scale spraying of oil dispersants and insecticides. In a typical firefighting mission, with a water source 6 n miles (11 km; 7 miles) from the fire, aircraft can remain on station for 3 hours, dropping 55,267 litres (14,600 US gallons; 12,157 Imp gallons)/h. Water tanks can be scoop-filled completely (ISA at S/L, zero wind) in 12 seconds over a water distance of 1,341 m (4,400 ft); partial water loads can be scooped on smaller bodies of water. Minimum safe water depth for scooping is only 1.40 m (4 ft 7 in).

EQUIPMENT (other versions): Stretcher kits, passenger or troop seats, cargo tie-downs, searchlight and other equipment according to mission and customer requirements. Bombardier 415 can be equipped with maritime surveillance radar and electro-optical sensors, precision navigation and communications equipment and autopilot.

DIMENSIONS, EXTERNAL:

Wing span	28.63 m (93 ft 11 in)
Wing chord, constant	3.54 m (11 ft 7½ in)
Wing aspect ratio	8.2
Length overall	19.82 m (65 ft 0½ in)
Beam (max)	2.59 m (8 ft 6 in)
Length/beam ratio	7.5
Height overall: on land	9.07 m (29 ft 9 in)
on water	6.96 m (22 ft 10 in)



Flight deck of Bombardier 415

NEW/0547103

Draught: wheels up	1.12 m (3 ft 8 in)	Max T-O weight: A (land)	19,890 kg (43,850 lb)
wheels down	2.03 m (6 ft 8 in)	B (land)	18,597 kg (41,000 lb)
Tailplane span	10.97 m (36 ft 0 in)	A (water), B (land and water)	17,168 kg (37,850 lb)
Wheel track	5.25 m (17 ft 2½ in)	Max touchdown weight for water scooping:	
Wheelbase	7.23 m (23 ft 8½ in)	A	16,420 kg (36,200 lb)
Propeller diameter	3.97 m (13 ft 0¼ in)	Max flying weight after water scooping:	
Propeller fuselage clearance	0.59 m (1 ft 11¼ in)	A	21,319 kg (47,000 lb)
Propeller water clearance	1.16 m (3 ft 9½ in)	Max landing weight:	
Propeller ground clearance	2.77 m (9 ft 1 in)	A, B (land and water)	16,783 kg (37,000 lb)
Forward door: Height	1.37 m (4 ft 6 in)*	Max zero-fuel weight: A	19,504 kg (43,000 lb)
Width	1.03 m (3 ft 4 in)	B	16,511 kg (36,400 lb)
Height to sill	1.68 m (5 ft 6 in)	Max wing loading:	
Rear door: Height	1.12 m (3 ft 8 in)	A (after scoop)	212.5 kg/m² (43.52 lb/sq ft)
Width	1.02 m (3 ft 4 in)	A (land)	198.2 kg/m² (40.60 lb/sq ft)
Height to sill	1.83 m (6 ft 0 in)	B (land)	185.4 kg/m² (37.96 lb/sq ft)
Optional large rear cargo door:		A (water), B (land and water)	171.1 kg/m² (35.05 lb/sq ft)
Height	1.12 m (3 ft 8 in)	Max power loading:	
Width	1.47 m (4 ft 10 in)	A (after scoop)	6.01 kg/kW (9.87 lb/shp)
Height to sill	1.83 m (6 ft 0 in)	A (land)	5.60 kg/kW (9.21 lb/shp)
Water drop door: Length	1.60 m (5 ft 3 in)	B (land)	5.24 kg/kW (8.61 lb/shp)
Width	0.28 m (0 ft 11 in)	A (water), B (land and water)	4.84 kg/kW (7.95 lb/shp)
Emergency exit: Height	0.91 m (3 ft 0 in)	PERFORMANCE (at weights shown):	
Width	0.51 m (1 ft 8 in)	Max cruising speed at FL100, A UW of 16,329 kg	
		(36,000 lb)	203 kt (376 km/h; 234 mph)
		Long-range cruising speed at FL100, A UW of 16,329 kg	
		(36,000 lb)	150 kt (278 km/h; 173 mph)
		Patrol speed at S/L, A UW of 14,741 kg (32,500 lb)	
			130 kt (241 km/h; 150 mph)
		Stalling speed: 15° flap, A UW of 21,319 kg (47,000 lb)	
			80 kt (149 km/h; 93 mph)
		Max rate of climb at S/L, A UW of 21,319 kg (47,000 lb)	
			396 m (1,300 ft)/min
		T-O distance at S/L, ISA:	
		land, A UW of 19,890 kg (43,850 lb)	844 m (2,770 ft)
		land, A UW of 18,597 kg (41,000 lb)	783 m (2,570 ft)
		water, A UW of 17,168 kg (37,850 lb)	808 m (2,650 ft)
		Landing distance at S/L, ISA:	
		land, A UW of 16,783 kg (37,000 lb)	674 m (2,210 ft)
		water, A UW of 16,783 kg (37,000 lb)	665 m (2,180 ft)
		Scooping distance at S/L, ISA (incl safe clearance heights)	1,341 m (4,400 ft)
		Ferry range with 998 kg (2,200 lb) payload	
			1,250 n miles (2,315 km; 1,438 miles)
		Design g limits (15° flap)	+3.25/-1

UPDATED

CLASS

CANADIAN LIGHT AIRCRAFT SALES AND SERVICES INC

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CLASS took over production of the previously named Cadi from designer Jean Edues Potvin and has recently expanded the range to provide six versions of the Bush Caddy as well as introducing the Kestrel in 2003.

UPDATED

CLASS BUSH CADDY

TYPE: Four-seat kitbuilt.

PROGRAMME: Designed by Jean Edues Potvin, the original Cadi was first flown in first half of 1993. Kits of the refined Cadi were marketed from 1994. The re-engineered Bush Caddy appeared in 2000. Several new versions have been added to the range since then, using both Rotax and Lycoming power plants.

CURRENT VERSIONS: **R80:** Smallest aircraft in range and classified as ultralight in USA, Canada and Australia; two seats; designed for engines up to 59.7 kW (80 hp). Can be purchased as a kit or as a factory-completed aircraft. Voyageur option can be converted from tailwheel to tricycle layout in a few hours, as hardpoints for both variants are provided as standard. 'R' in designation indicates Rotax engine.

Description below refers to R80, unless otherwise stated.

R60: Ultralight version of the above, intended for European market; due for launch during 2003.

R120: Engines in the 48.5 to 89.5 kW (65 to 120 hp) range; two seats. Introduced at AirVenture, Oshkosh, July 2001. Voyageur option available as for R80.

L160: Accepts engines up to 119 kW (160 hp). Seats two-plus-one. 'L' in designation indicates Lycoming engine.

L162: Two-plus-two version of L160.

L164: Four-seat version, with 134 kW (180 hp) engine. Displayed statically at AirVenture 2001. Prototype (C-GJDK) first flew 8 September 2001.

CUSTOMERS: Nearly 100 of all versions sold by end 2002, of which 66 were then flying.

COSTS: Basic kit costs (excluding engine, propeller and internal finishing): R80, US\$14,036; R120, US\$15,089; R120 Voyageur, US\$14,115; L160, US\$17,897; L164, US\$20,730, quick build kit US\$32,000 (2003). Factory-finished R80, US\$45,500 (all 2002).

DESIGN FEATURES: Conventional lightplane; high, constant chord wing braced by V struts each side; sweptback cantilever tail surfaces.

Kit includes many preformed and welded parts. Quoted build time 1,000 hours. Fast-build kits are available in which wings and fuselage internal structures are complete and need only covering.