Dash 8 & Q Series specifications

There are four main variants of the Dash 8 & Q400 Series, and several sub-variants. Their specifications are reviewed and listed.

The de Havilland Dash 8 family of aircraft first entered into service in 1984 with the Dash 8-100 variant. The Dash 8-200 and -300 followed in 1995 and 1989. The Dash 8-200 has the same fuselage length and seat capacity as the Dash 8-100, but the -200 has more powerful engines. These give it a 30-knot faster cruise speed than the -100 *(see table, page 7)*. The Dash 8-300 is a stretched variant with an additional 13-17 seats.

In 1996 Bombardier renamed the Dash 8 family the Q Series, after adding the active noise and vibration suppression system (ANVS), which reduces the noise and vibration levels inside the aircraft's cabin. The Q stands for quiet, which is enabled by an intricate system of microphones and a computer that initiates counter vibrations to reduce the sound and movement felt in the cabin.

To emphasise the introduction of the ANVS and new name, the Dash 8-100, -200 and -300 delivered with the ANVS system were named the Q100, Q200 and Q300. These were aircraft built from the middle of 1996 onwards. The Q100s were from line number 472, the Q200s from line number 421, and the Q300s from line number 408. They also had a new, more spacious cabin design, with insulation and acoustically sealed joints, to absorb and reduce noise. In 2000, the larger Q400 with additional seat capacity was introduced. This was a stretched version of the Q300, with newer, more powerful engines, 68-78 seats, and the ANVS system as standard. The Q400 also has a higher cruise speed than the three smaller variants *(see table, page 7)*.

Bombardier has recently started re-launching many of its aircraft types as next generation (NextGen) aircraft. The Q400 is no exception, with its NextGen development being announced in March 2008 *(see page 7)*.

At the same time, Bombardier also stated that production of the Q200 and Q300 will cease in May 2009, along with the Q100, which has not been produced for a number of years.

The engines powering the three basic Dash 8 models are variants of the Pratt & Whitney Canada (P&WC) PW120. These are rated from 2,000 shaft horse power (shp) on the Dash 8-100 to 2,500SHP on the Q300 *(see table, page 7)*.

The Q400 series is powered by P&WC's PW150A engine, rated at 5,071shp *(see table, page 7)*.

The three main Dash 8 variants have the same fuel capacity of 835 US Gallons (USG), while the larger Q400 has a capacity of 1,724USG. The maximum range varies from 760nm on the Dash 8-100 to 1,340nm on the Q400. Maximum cruise speed varies from 265 knots on the Dash 8-100 to an impressive 360 knots on the Q400.

The cruise speeds of the three small Q series variants are comparable at 265-300 knots and, in many cases, exceed those of other turboprop aircraft. The Q400 in fact is just 100 knots slower at 360 knots than smaller regional jets, such as the CRJ.

Bombardier is currently assessing the benefits of further stretching and developing the Q400 into a Q400X variant, to take advantage of increased passenger loads on many turboprop routes, as well as assisting operators to reduce unit cost per seat-mile.

With the Q100 and Q200 seating just 37-39 passengers, only one cabin crew member or flight attendant is needed, with the standard flightcrew of two pilots. The Q300 seats 50-56, but once seat numbers exceed 50, an additional flight attendant is needed.

The Q400 requires two flight attendants, although the Q400NextGen will accommodate an additional third flight attendant, used in many cases to improve in-flight service standards.

An operator of these aircraft will benefit from cost savings in the training of flightcrew, since all four Q Series variants have a common pilot type rating. Further commonality is realised with maintenance, parts inventory and ground operations.

The three main Dash 8 variants have similar cruise speeds of 265-300 knots. The Q400 is faster at 360 knots.

Dash 8-100/Q100

Originally launched as the Dash 8-100, this aircraft entered service in 1984 with norOntair. The Dash 8-100 was the first variant, and its most recent maximum take-off weight (MTOW) is 36,300lbs *(see table, page 7)*.

The earlier Dash 8-102 is powered by the PW120A rated at 2,000shp, has a cruise speed of 265 knots, and a maximum range of 1,159nm.

The later -103 is powered by the PW121 rated at 2,150shp, has a cruise speed of 270 knots, and a maximum range of 1,148nm *(see table, page 7)*.

The later Q106 is powered by the same engine, and has a similar cruise speed and slightly shorter range.

During the course of Dash 8-100/Q100 production many sub-variants

DASH 8 Q SERIES SPECIFICATIONS

	Dash 8 -102/ Q100	Dash 8 -103/ Q100	Q106	Dash 8 -201/ Q200	Dash 8 -202/ Q200	Dash 8 -311HGW/ Q300	Dash 8 -314HGW/ Q300	Dash 8 -315HGW/ Q300	Q402 EHGW
Engine	PW120A	PW121	PW121	PW123C	PW123D	PW123	PW123B	PW123E	PW150A
Engine power -shp	2,000	2,150	2,150	2,150	2,150	2,380	2,500	2,380	5,071
MTOW -lbs	34,500	34,500	36,300	36,300	36,300	43,000	43,000	43,000	65,200
MZFW -lbs	31,300	31,300	32,000	32,000	32,000	39,500	39,500	39,500	58,000
Basic OEW -lbs	22,380	22,880	23,593	23,744	23,763	26,683	26,683	26,683	38,986
Maximum payload -lbs	8,420	8,420	8,407	8,256	8,237	12,817	12,817	12,817	19,014
Fuel capacity -US Gal	841	841	841	841	841	841	841	841	1,737
Seats	37-39	37-39	37-39	37-39	37-39	50-56	50-56	50-56	69-80
Crew	2+1	2+1	2+1	2+1	2+1	2+1/2	2+1/2	2+1/2	2+2
Max. Range -nm	1,159	1,148	1,099	1,082	1,082	921	921	921	1,457
Range with longer-range tanks -nm	2,328	2,290	2.277	2,093	2,092	1,960	1,960	1960	N/A
Max. cruise speed -kts	265	270	268	300	300	287	285	287	360
Standard baggage capacity -cu.ft.	300	300	300	300	300	320	320	320	502
Maximum operating ceiling -ft	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Take-off noise level -dB	80.8	79.8	79.8	79.9	79.9	79.5	79.9	79.5	78.6
Sideline noise level -dB	86.3	86.1	86.1	84	84	87	87.3	87	84
Approach noise level -dB	94.3	95.7	94.7	94.7	94.7	95.1	95.1	95.1	93.1

of the aircraft were developed, comprising at least five passenger and three military sub-variants. This meant that MTOWs varied from 33,000lbs to 36,300lbs depending on the engine used and the aircraft configuration.

The standard interior layout is four-abreast seating with 37 seats at 31-inch pitch. The toilet and galley are located at the front of the cabin, with the 300-cubic-foot baggage compartment located at the rear of the cabin. An additional two seats are possible in the galley position if the forward wardrobe is replaced with the galley. Although this increases seat numbers, it would not be a good idea to do this on aircraft on routes that have many business travellers that expect to hang up suit jackets.

Exits consist of a main passenger-entry door at the forward left of the cabin, a type II service door at the forward right of the cabin and two type III emergency doors either side of the cabin, slightly forward of the wing. In addition there is a cargo door into the baggage compartment on the left side of the aircraft. Bombardier is proposing an extended life programme for the -100 series. This will include a 100,000 life limit, a weight upgrade, and a flightdeck upgrade.

Dash 8-200/Q200

The Dash 8-200 was in fact the third variant to be launched, following the -300, and entered service with BPX Colombia in 1995. There are four sub-variants, with the last being the one fitted with the ANVS system. The Dash 8-200 has the same fuselage and therefore the same cabin seat capacity as the Dash 8-100/Q100.

The earlier Dash 8-201 variant is powered by the PW123C rated at 2,150shp, has a cruise speed of 300 knots, and a maximum range of 1,082nm. The later -202 is powered by the PW123D also rated at 2,150shp, but its specifications are otherwise similar to those of the -201 *(see table, this page)*.

The Dash 8-200/Q200 has the more powerful PW123 engines used on the Dash 8-300/Q300. This combination is designed to provide better airfield performance and increase payload/range capability. Bombardier says this variant is ideal for those operators that fly in areas where strong hot and high performance is necessary.

Interiors on the Q200 are the same as on the Q100, and both aircraft feature a moveable rear bulkhead that allows an operator to use a convertible passenger/cargo (combi) interior. The Q200 has the added benefit, like all the Q series, that it can be changed from all-passenger to all-cargo configuration in just 20 minutes.

Dash 8-300/Q300

The second variant to enter service was the Dash 8-300 in 1989 with the Canadian operator, Time Air. This aircraft is similar to the Dash 8-100, except that its fuselage is 11 feet (3.4m) longer, and it is equipped with the more powerful PW123 engine series.

The Dash 8-311 is powered by the PW123 rated at 2,380shp, has a cruise speed of 287 knots, and has a maximum range of 921nm *(see table, this page)*.

The later -314 is powered by the PW123B rated at 2,500shp, but is essentially the same as the -311.

The -300E is the last -300 variant, and is powered by the PW123E rated at 2,380shp, but otherwise it has the same specifications as the -311 *(see table, this page)*.

The -300 has a capacity of 50-56 passengers, depending on seat pitch and cabin layout. The wardrobe and toilet are still at the front of the aircraft, but the standard layout includes the galley at the rear. At a 32-inch pitch, the -300 can seat 50 passengers, but if this is reduced to 29 inches, and part of the galley is pushed into the baggage compartment, then 56 seats can be fitted. The exits consist of a main passenger-entry door at the forward left of the cabin, a type II service door at the forward right of the cabin and two type III emergency doors either side of the cabin aft of the wings.

Q400

The fourth variant of the Dash 8/Q Series is the Q400. In response to the

The Q400 is now the only member of the Dash 8 & Q Series to be manufactured. Bombardier has launched an enhanced version, the Q400 NextGen, and a stretched model is also being considered.

further success of the modern turboprop aircraft, and route density, a larger Q Series was needed. This variant is a further stretch of the fuselage by nearly 35 feet, compared to the Q100/Q200, and 23 feet compared to the Q300. This allows the Q400 to carry 69-80 passengers. The aircraft first entered service in 2000 with SAS Commuter of Scandinavia. The highest MTOW is 65,200lbs.

All Q400 aircraft have the ANVS system installed, having been launched after its introduction. In addition, they have full authority digital engine controls (FADEC) and increased propeller-fuselage clearance to reduce blade passage build-up. Noise reduction has been aided by the introduction of a six-bladed prop, advanced synchrophasers to minimise propeller beat, and advanced engine mount technology to reduce transmission of engine vibrations at source.

This variant is equipped with PW150A engines with an increased 5,071shp, over previous variants. The engines' propeller revolutions per minute (RPM) are 6-19% lower than on the previous variants of the Dash 8/Q Series.

The Q400 also has a faster maximum cruise speed of 360 knots, and an improved range of 1,457nm. The range is assisted by the increased fuel capacity that is more than double that of previous Dash 8/Q Series types.

Although the interior of the Q400 is similar to that of previous variants, it nevertheless has some differences. The standard layout has 70 seats with a 33-inch pitch, or 74 seats at a 31-inch pitch. The toilet and wardrobe remain at the front, with the galley at the rear between the seats and the baggage compartment.

The most significant change is in the bigger baggage compartment areas to accommodate the increased number of passengers' bags. There is the larger compartment at the rear of the cabin, which is now 411 cubic feet as well as a small compartment of 91 cubic feet at the front of the cabin between the toilet and the passenger seats.

An optional layout has 70 seats with a 31-inch pitch, a larger baggage compartment of 135 cubic feet at the front and the toilet moved to the rear. Another optional layout has 78 seats at a 30-inch pitch, standard interior locations, but a smaller rear baggage compartment of 365 cubic feet.

There are two flight-attendant jump seats, one at the front and one at the rear as standard, and the option of an extra crew place. The exits consist of two passenger doors at the forward and rear left of the cabin, a type III emergency exit at the forward right of the cabin and a service door at the rear right of the cabin.

The Q400 has six sub-variants, many of which are just cabin layout variants. One is the Q400 NextGen.

Q400 NextGen

The Q400 NextGen was launched in 2008 as a further development of the successful Q400, and will be delivered from 2009. Improvements have been made in the cabin and to the maintenance and fuel consumption procedures.

The cabin has been improved with larger overhead lockers that can now accommodate trolley bags of the size decided by the International Air Transport Association (IATA). The cabin lights have been replaced with softer, longer-lasting LED lights, and the windows have been adapted to allow more light into the cabin and a better external view for passengers.

The Q400 NextGen has had its A check intervals increased from 400 flight hours (FH) to 500FH, while the C check has been increased from 4,000FH to 5,000FH. This compares to a new A check interval of 600FH for the Q400 *(see Dash 8/Q400 maintenance analysis, page 13)*.

The way that pilots operate the aircraft has also been addressed for the Q400 NextGen, and procedures in the operator manual will be changed. These changes could account for at least a 2% reduction in fuel consumption during high speed cruise and the associated reductions in the aircraft's CO2 emissions.

This all improves passengers' comfort and the airline's costs, which in turn increases the benefits of the aircraft compared to alternative turboprops and smaller regional jets.

ANVS

Turboprop aircraft have traditionally been considered noisy by passengers, both internally and externally. The Q Series has aimed to reduce this impression by using the ANVS system.

The internal noise on previous Dash 8 aircraft was louder at the front of the cabin and forward of the propeller arc. With the ANVS system in place, no area of the cabin suffers from excessive noise, and the average noise level is just 75dB - virtually the same as on regional jets, and in particular the CRJ aircraft. In fact the quietest place to sit is now in seat rows adjacent to the propellers.

Bombardier believes that a lot of the noise in the cabin is from airframe vibration, so it has reduced this through interior joints, seals and insulation and technology. Microphones in the cabin measure the noise and vibration and relay the information to a computer. This is passed on to active tuned vibration absorbers attached to the fuselage frame, that emit counter vibrations. This not only reduces noise, but also the vibration and flexing of the airframe, resulting in a smoother flight and less wear and tear of the airframe. AC