767 family specifications

The 767 family has five main variants, plus a factory freighter version. The 767 is further sub-divided by several engine types.

The 767 family is the most successful twin-engined widebody commercial aircraft, having sold more than 950 units. Its development ultimately led to three main variants: the -200 series, the -300 series and the -400 series. The -300 series accounts for the largest number of aircraft sold.

The 767 was developed in the late 1970s and early 1980s as a widebody sister to the 757 narrowbody *(see 757 family owner's & operator's guide, Aircraft Commerce, October/November 2005, page 5).* One reason for the 767's introduction was to provide an alternative to the A300B2/B4 and the A310.

The 767 was developed at a time when the only long-range widebody aircraft available to airlines were the 747-200, DC-10-30/-40 and L-1011-500. The smallest of these had a tri-class seat capacity of about 220. All were heavy aircraft and equipped with three or four first-generation turbofans developed to power widebodies.

The 767 soon became an aircraft that could match or exceed the range provided by these older types, had fewer seats, which suited the capacity requirements of many carriers, had more fuel-efficient engines, and featured a lighter twin-engined design that would deliver several efficiencies and operating cost savings.

One feature introduced by the 767 and 757 was the two-man flightdeck using flatpanel, digital instruments with multifunction capability. Increased use of automation, such as the introduction of the engine indication and crew alerting system (EICAS) screens in the centre of the flightdeck panel, allowed operators to dispense with the flight engineer's station.

This new-style flightdeck was used in both the 757 and 767. This further led to the development of a common type rating for both aircraft. All 767 variants have the same pilot type rating, which means that a pilot is automatically certified to fly all 767 variants. The common type rating with the 757 means that a pilot certified on one aircraft is automatically certified to fly the other. An integral part of the common type rating is that the pilot has to attend a differences course. Pilots that do not remain current on either type have to carry out a take-off and landing in a simulator of the type they will be flying.

767-200 series

The initial 767 model was the 767-200 series. This came after a proposed smaller -100 model was dropped, and the 767-200 became Boeing's first widebody twin. The 767 was developed with a fuselage that allows a standard seven-abreast seat configuration in the economy-class cabin, with a 2-3-2 arrangement. The fuselage width was therefore narrower than Airbus's standard widebody fuselage, which was utilised for the A300/310, with eight-abreast seating, and also later by the A330/340.

Unlike most widebodies, the 767's narrower fuselage cross section only allows the side-by-side use of two smaller LD-2 containers.

The 767-200's fuselage is 176 feet long, which allows it to carry 174 seats in Boeing's standard tri-class layout, 216 passengers in a US-style dual class configuration, and up to 242 passengers in an all-economy layout with standard eight-abreast seating and a single type III overwing emergency exit.

The 767-200 soon gained popularity with Europe's all-inclusive charter carriers, and the aircraft was configured in a high-density eight-abreast economy class configuration, with two type III emergency exits which allowed a seat capacity of up to 290.

The 767-200 can carry 12 LD-2 containers in the forward belly space section, and another 10 LD-2s in the aft belly space section. Each LD-2 has an internal volume of 120 cubic feet, and so the 22 containers provide a total volume of 2,640 cubic feet.

The initial models of the -200 series were designed for US domestic and similar intra-continental operations, and were therefore developed with a standard fuel capacity of 16,700 US Gallons (USG). This fuel capacity was achieved through the use of fuel cells in the wings, and did not include the use of a fuel tank over the centre wing box.

The early aircraft had a maximum take-off weight (MTOW) of 282,000lbs, a maximum zero fuel weight (MZFW) of 242,000lbs and an operating empty weight (OEW) of about 174,000lbs *(see table, page 13).* This gave the aircraft an approximate maximum structural payload of 68,000lbs. A typical load of 216 passengers would leave the aircraft with about 22,000lbs of freight capacity that could be carried in the belly space provided by the LD-2 containers.

The first aircraft were powered by the third-generation variant of the Pratt & Whitney (PW) JT9D: the JT9D-7R4 series. These were first rated at 48,000lbs thrust. The JT9D was the only PW engine to power all gross weight variants of the 767-200, and was selected for 51 of the aircraft built.

The alternative engine for the 767-200 was the General Electric (GE) CF6-80A. The -80A was a new engine and was the third-generation CF6 engine following the -6 and -50 series powering the DC-10 series and 747-200/-300. The CF6-80A is rated at 48,000-50,000lbs thrust for the 767-200. It has the same core engine configuration and fan diameter as the CF6-50 series.

The CF6-80A powers all gross weight variants of the 767-200, and was selected for 58 of the aircraft built.

The initial low weight 282,000lbs version had a range of about 2,250nm with a full load of 216 passengers. Higher gross weight models were developed with MTOWs of 300,000lbs, 310,000lbs and 315,000lbs *(see table, page 13).* These aircraft have range capabilities of 3,200nm, 3,550nm and 3,900nm *(see table, page 13)* with a full load of 216 passengers.

This seat capacity and range positioned the 767-200 as a replacement candidate for 707s, DC-8s, L-1011s, DC-10s and A300B2/B4s operating short- and medium-haul services. The aircraft found favour with most US majors, being selected by United, American, Delta and TWA. It was also specified by Air Canada, Japan Airlines (JAL), All Nippon Airways (ANA) and Ansett.

Operators also have to consider noise compliance. Compliance with Stage 4 may become a concern for the 767 in the future. Stage 4 compliance is 10 equivalent perceived decibels (EPNdB) less than the maximum cumulative noise emissions permitted for Stage 3. Stage 3 margin is the difference between the cumulative emissions and the permitted cumulative emissions.

All 767-200s with the MTOWs and engines shown have a Stage 3 margin of 8.7-20.7 EPNdB *(see table, page 13).* This means that their Stage 4 margins vary between -1.3 EPNdB and 10.7 EPNdB.

The first 767-200 was built in late

The 767-200ER has the longest range performance of all 767 variants. The type has been overshadowed, however, by the larger and more fuel-efficient -300ER.

1981, and the -200 model accounted for the majority of 767s built until late 1984. A total of 109 767-200s were built.

767-200ER

In parallel to the development of the -200 model, a longer or extended range (ER) variant of the -200 was being developed: the -200ER. This was mainly led by the initial development of extended-range twin-engined operations (Etops) in the early 1980s. Etops made it possible to operate a twin-engined aircraft over water for extended periods, and therefore use the long-range capability of a twin-engined aircraft in all global markets. Etops broadened the 767's market appeal.

The 767's range provided pressure on the safety authorities to allow Etops. All 767 airframe-engine combinations are now certified for 180 minutes Etops. That is, aircraft are permitted to take particular routeings over oceanic areas such that they have to be at most 180 minutes' flying time, on a single engine, away from a suitable diversion airport in the event of an engine failure.

The essential difference between the -200 and -200ER is that the -200ER has a higher fuel capacity of 24,140 USG and higher MTOW, which combined to give the aircraft a longer range capability. The higher fuel capacity of 7,440 USG over the -200 model was achieved through the use of a centre fuel tank over the wing box.

The first -200ER was built in early 1982, although production did not reach substantial levels until early 1985. The first -200ERs had an MTOW of 335,000lbs, and a range of 4,600nm with a full load of 174 passengers *(see table, page 13)*.

The first 767-200ERs were powered by the JT9D-7R4, rated at 48,000lbs thrust. These powered the lower gross weight variants of the aircraft, with MTOWs up to 360,000lbs. The JT9D was chosen by Qantas, Air Canada, El Al, Ethiopian Airlines and Air China. Some aircraft are now in operation with secondary users, including Maxjet Airways.

The first 767-200ERs to be powered by the GE CF6-80A entered service in 1985. Rated at 48,000lbs thrust, it powered the initial 767-200ERs with the lower gross weights.

Four higher gross weight models were developed with MTOWs of 345,000lbs, 351,000lbs, 380,000lbs and 395,000lbs. These gross weights gave the aircraft range capabilities of about 4,800nm, 5,250nm, 6,700nm and 6,850nm with a full passenger payload of 174 *(see table, page 13)*. The latter of these is the longest range capability of all 767 models.

The 767's weakness is its relatively low cruise speed. Its long-range cruise speed is Mach 0.80, which is slower than most other jetliner types, and can add 30-60 minutes' flight time to long-distance routes.

These higher gross weight -200ER aircraft started becoming available in the mid-1980s at the same time as PW's new PW4000 engine and the fourth generation of the CF6: the -80C2 series. The -80C2 can be divided into those with power management control (PMC) and full authority digital engine control (FADEC) systems. Engines with FADEC have more precise controls and longer removal intervals *(See 767 family maintenance analysis & budget, page 23)*. It is not possible, however, to upgrade engines to FADEC systems.

The PW4000 is a two-shaft turbofan, and the first variant had a 94-inch fan diameter. The first variant to power the 767-200ER, the PW4052, was rated at 52,000lbs thrust. The PW4056 and PW4060 rated at 56,000lbs thrust and 60,000lbs thrust also came available. The PW4000 powered the higher gross weight versions of the 767-200ER.

The new CF6-80C2B2/B4 and B6 were also used to power the higher gross weight versions of the 767-200ER. It became one of the more popular engines on the 767, and was selected to power -200ERs operated by American, Continental, USAirways, Malev and LOT Polish.

Its size allowed many carriers that were established on the North Atlantic either to downsize from aircraft that were 50 to 180 seats larger, or to open new routes with lower economic risk.

The 767-200ER was selected by United, American, Continental, Delta, USAirways, Air Canada, SAS, LOT Polish and Malev for this purpose. It suited the needs of many airlines from all around the world. Many North American carriers, for example, could enter the transatlantic market for the first time with a low-capacity aircraft.

The 767-200ER similarly allowed airlines in other parts of the world to downsize on established routes, or open new routes with low risk. The aircraft was an attractive alternative to the larger and heavier DC-10-30 for carriers in Africa, Latin America and other parts of the globe that experienced low traffic volumes. The 767-200ER was selected by El Al, Ethiopian Airlines, Air Zimbabwe, Air Mauritius, Qantas, Air New Zealand, Aeromexico, VARIG and Avianca.

All MTOW and engine combinations of the 767-200ER shown *(see table, page 13)* have a Stage 3 compliance margin of 11.5 to 21.8 EPNdB.

Production of the 767-200 continued only until 1987. The aircraft was overtaken by the -200ER, which continued to be built until 2001 when a last batch of civilian aircraft was manufactured for Continental Airlines.

767-300

Development of a stretched version of the 767 followed soon after the -200 series. Boeing started offering the -300 series in February 1983, and launch orders came from JAL. The first 767-300 entered service in 1986.

The -300 series retains the same wing and basic fuel capacity of 16,700 USG as the -200 series, but the -300's fuselage is 21 feet longer than the -200's. The 767-300 came with two options for door arrangements. The first had three main doors and two overwing type III emergency exits on each side of the fuselage. This option was selected by most US operators that ordered the 767-300. The second option was to have four main doors on each side of the fuselage.

Boeing's standard seat capacities for the 767-300 series were 204-220 passengers in a tri-class configuration, and 269 passengers in a US-style two-class configuration. All-economy seating accommodates 290 in a seven-abreast configuration. The 767-300, however, can seat up to 299 passengers with eight-abreast if equipped with a type III emergency exit, or up to 325 with four main exits.

The longer fuselage also allows the 767-300 to carry 30 LD-2 freight containers in its underfloor section, eight more than the -200 series. This gives the aircraft an underfloor containerised freight capacity of 3,600 cubic feet.

There were just two MTOW options of the 767-300: one of 345,000lbs and one of 350,000lbs. These have a range of 4,100nm and 4,450nm with a full load of 270 passengers *(see table, this page)*.

The initial 767-300s were powered by the JT9D-7R4, but JAL was the only airline to select the engine.

Lighter variants of the 767-300 were also powered by the CF6-80A, but these were mainly only aircraft operated by Delta Airlines.

The remaining 767-300s were powered by the new PW4056/4060 rated at 56,000lbs and 60,000lbs thrust, and the CF6-80C2B2/B4 rated at 52,500lbs and 57,900lbs thrust.

The MTOW and engine combinations of the 767-300 shown *(see table, this page)* have a Stage 3 margin of 8.6-14.8 EPNdB.

The 767-300 sold in small numbers, mainly to US majors for use on domestic services, and to Japanese carriers. Its main customers were JAL, Air China, Delta, ANA and Asiana Airlines.

767-300ER

It was clear following the development of extended-range capability for the -200 series that the same would be provided for the -300 series. The -300ER has the same fuel capacity of 24,140 USG as the -200ER, and an increased MTOW over the -300 variant.

The first orders for the -300ER were placed by American Airlines in March 1987 and the first aircraft entered service in February 1988. Five MTOW variants were developed, the first with a gross weight of 380,000lbs. Higher weight versions soon followed, however, and aircraft MTOWs of 407,000lbs and 412,000lbs were delivered in 1988 and 1989.

The aircraft with a gross weight of 380,000lbs has a range of about 6,350nm with a full load of 220 passengers. The other four gross weight variants have a range of about 6,750nm with a full load of 220 passengers *(see table, this page)*.

The 767-300ER did not use the JT9D and CF6-80A, but did use the PW4052/4056/4060/4062 and the CF6-

767 FAMILY PASSENGER VARIANT WEIGHT & ENGINE SPECIFICATIONS

Variant		-200	-200	-200	-200
MTOW lbs		282,000	300,000	310,000	315,000
MZFW lbs		242,000	248,000	248,000	250,000
OEW lbs		174,110	177,000	176,550	176,650
Structural payload lbs		67,890	71,000	71,450	73,350
Fuel capacity USG		16,700	16,700	16,700	16,700
Seats		216	216	216	216
Range nm		2,250	3,200	3,550	3,900
Belly freight volume cu ft		2,640	2,640	2,640	2,640
Engine variant		JT9D-7R4/ CF6-80A	JT9D-7R4/ CF6-80A	JT9D-7R4/ CF6-80A	JT9D-7R4/ CF6-80A
Variant	**-200ER**	**-200ER**	**-200ER**	**-200ER**	**-200ER**
MTOW lbs	335,000	345,000	351,000	380,000	395,000
MZFW lbs	253,000	253,000	253,000	260,000	260,000
OEW lbs	181,130	181,250	181,350	181,500	181,610
Structural payload lbs	71,870	71,750	71,650	78,500	78,390
Fuel capacity USG	24,140	24,140	24,140	24,140	24,140
Seats	174	174	174	174	174
Range nm	4,600	4,800	5,250	6,700	6,850
Belly freight volume cu ft	2,640	2,640	26,40	2,640	2,640
Engine variant	JT9D-7R4/ CF6-80A	JT9D-7R4/ CF6-80A	JT9D-7R4 CF6-80A/ CF6-80C2B2	PW4056 CF6-80C2B4	PW4060 CF6-80C2B6
Variant		**-300**		**-300**	
MTOW lbs		345,000		350,000	
MZFW lbs		278,000		278,000	
OEW lbs		186,380		189,750	
Structural payload lbs		91,620		88,250	
Fuel capacity USG		16,700		16,700	
Seats		270		270	
Range nm		4,100		4,450	
Belly freight volume cu ft		3,600		3,600	
Engine variant		PW4056/ CF6-80A		PW4060/ CF6-80C2B2	
Variant		**-300ER**	**-300ER**	**-300ER**	**-400ER**
MTOW lbs		380,000	407,000	412,000	450,000
MZFW lbs		278,000	295,000	295,000	330,000
OEW lbs		193,940	198,440	198,440	227,400
Structural payload lbs		84,060	96,560	96,560	102,600
Fuel capacity USG		24,140	24,140	24,140	24,140
Seats		220	220	220	243
Range nm		6,350	6,750	6,750	5,600
Belly freight volume cu ft		3,600	3,600	3,600	4,560
Engine variant		PW4056/ CF6-80C2B4	PW4060/ CF6-80C2B6	PW4062/ CF6-80C2B7	CF6-80C2B7/8

The 767-300ER equipped with CF6-80C2 engines was the single-most successful variant of the 767 family. The type is expected to continue to be popular, with large numbers being converted to freighter.

80C2B2/B4/B6/B7. These engines were rated between 52,500lbs and 60,800lbs to power aircraft with gross weights between 360,000lbs and 412,000lbs.

The Rolls-Royce RB211-524H became available on the 767-300ER in 1987, and soon afterwards was selected by British Airways. The airline ordered 29 aircraft, but some have since been acquired by Qantas. The only other carrier to select the RB211 was Yunnan Airlines in China.

The MTOW and engine combinations of the 767-300ER shown *(see table, page 13)* have Stage 3 margins of 7.8-16.0 EPNdB.

Despite its tri-class seat capacity being about 15 seats larger than the 767-300ER's, the A300-600R's range capability is 2,500nm shorter. Similarly, the A310-300 and 767-200ER have similar seat capacities, but the 767-200ER has a range advantage of up to 1,700nm. The 767-200ER/-300ER's range advantage over the A310-300 and A300-600R was the main factor in the 767 family winning the majority of orders in this market. The passenger variants of 767-200 and -300 series combined won more than 860 orders. This compares to less than 500 orders won by the A310 and A300-600 series.

The 767-200 and -300 also have the same pilot type rating, while the A310 and A300-600 have a common type rating. This gives the 767 a small advantage. The 767 family also has a common type rating with the 757, broadening the 767's commonality advantages. This was used by many of the 767's US customers which also selected the 757.

The 767-300ER was the 767 family's most successful variant, with the combination of its size and range proving popular with many airlines. For several years the 767-300ER was the most used aircraft on the transatlantic market, and was also widely used on many other long-haul markets. A total of 527 passenger variants of the 767-300ER have been ordered to date, out of 903 passenger aircraft of all 767 variants.

While the aircraft is officially still available from Boeing, the 787-8/-9 that have been developed to replace it are now selling in large numbers.

The 767-300ER's main customers are Delta, United, American, Continental, Hawaiian, Air Canada, Mexicana, LAN Airlines, British Airways, KLM, Martinair, Alitalia, JAL, ANA, Gulf Air, Qantas and Air New Zealand.

The 767-300ER continued to give airlines the ability to operate established long-haul services with smaller aircraft that had superior operating efficiencies over older generation widebodies, or allow airlines to begin new services with relatively low risk given the relatively small number of seats that had to be filled for them to break even.

The 767-300ER's payload-range performance also made it popular with European inclusive-tour carriers.

767-400ER

Following the success of the 767-300ER, it was logical to develop a stretched variant of the aircraft. This was on the basis that the -300 had offered a combination of higher capacity and lower seat-mile costs than the -200 series.

The 767-400ER included an increase in MTOW to 450,000lbs and a fuselage stretch of 21 feet over the -300 series. This resulted in a tri-class seat capacity of 243 and the ability to carry 38 LD-2 containers in the underfloor compartment. The -400ER's fuel capacity was the same as for the -200ER and -300ER, however.

The 767-400ER is powered exclusively by the GE CF6-80C2B7F/B8F rated at 60,800lbs thrust. The aircraft had a range of 5,600nm with a full load of 243 passengers *(see table, page 13)*.

The 767-400ER has four main doors on each side of the fuselage and so can accommodate up to 409 passengers in an eight-abreast, high-density configuration.

The 767-400ER was not developed until the late 1990s, when the similar sized A330-200 was also being developed. The first 767-400ER entered service in 1999. This arrival was probably too late to exploit higher market potential. The 767-400ER also has a slightly shorter range than the A330-200, and this disadvantage led to the 767-400ER achieving a poor sales volume. The aircraft only won 37 orders, from Delta and Continental.

767 freighter

The 767PF freighter variant was developed from the 767-300 in the early and mid-1990s, as a result of interest expressed by United Parcel Service (UPS).

The 767-300 freighter has MTOWs of 408,000lbs and 412,000lbs, the same as the 767-300ER. The aircraft also has the same fuel capacity, and MZFW of 309,000lbs and OEW of 188,100lbs when equipped with the GE CF6-80C2B6F/B7F engines. This gives it a gross structural payload of 121,000lbs.

As with the 767-300ER, the 767PF accommodates 30 LD-2 containers in the underfloor compartment. The aircraft can also carry 24 88-inch wide by 125-inch long by 96-inch tall containers on its main deck loaded in pairs, plus another two of these containers at either end of the deck. Each container has an internal capacity of 500 cubic feet, thereby giving the maindeck a containerised freight volume of 11,990 cubic feet. Added to the volume provided by the underfloor LD-2 containers, the aircraft has a total freight volume of 15,710 cubic feet. AC