757-200/-300 specifications

The 757 family has three main variants. The fleet is also divided between two main engine types; resulting in six main types of the aircraft.

The development of the 757 was relatively simple compared to other jetliner types. The fleet can be sub-divided in two ways, between the three main variants (the -200 passenger model, the -200PF factory freighter model, and the -300 passenger model), and between those aircraft that are powered by the RB211-535 series engines and those that are powered by the PW2000 series engines. This splits the 757 fleet into six main groups.

757-200 series

The -200 variant comprised the majority of 757s built. This was one of the largest narrowbodies, and was principally aimed at replacing the smaller 727, retaining the same fuselage cross-section and six-abreast seat layout as the 727 and 737 families.

Seating configuration varies from 178 for a mixed first- and economy-class layout up to 228 for the highest density all-economy seating at 28/29-inch seat pitch.

The weight specification development of the 757-200 was relatively simple. Fuel capacity of the aircraft was unchanged for all different models of the -200 at 11,276 US Gallons (USG). Range performance was only improved through increases in the aircraft's maximum take-off weight (MTOW).

The first -200s were powered by the Rolls-Royce (RR) RB211-535C and PW2037. Derived from the The RB211-524, the RB211-535C used fewer stages and was rated at 37,400lbs thrust. The PW2037 was rated at 37,500lbs thrust. The initial models equipped with RB211-535C engines had a MTOW of 220,000lbs *(see first table, page 7)*. Only a few aircraft with this engine had a higher MTOW of 240,000lbs. Production of aircraft with the RB211-535C was limited, with only 40 built. This aircraft has a range of about 2,000nm with a full load of passengers.

The RB211-535C was soon followed by the RB211-535E4. Although this engine had the same basic turbomachinery configuration, it was the first RR engine to use wide-chord fan blades that improved fuel burn efficiency, as well as using a range of other improved materials. The engine was also rated at 40,100lbs thrust, which allowed higher performance. The 757-200 was developed with higher MTOWs of up to 255,000lbs. Aircraft equipped with the -535E4 have MTOWs up to this level.

The first main customers for the 757-200, with RB211-535C-powered aircraft, were British Airways (BA) and Eastern Airlines. Eastern Airlines had its earlier built aircraft re-engined with the RB211-535E4, and the -535C engines that were subsequently removed were subsequently installed on aircraft destined for BA at Boeing's production line. The earliest aircraft to be powered with the RB211-535E4 were line number 2, built in 1982.

The original bill of materials used for the RB211-535E4 included a Phase II combustor, which was later changed after the introduction of the -535E4-B, rated at 43,100lbs thrust. The -535E4-B's higher thrust rating improves the aircraft's field and climb performance.

The -535E4-B was first built in 1989 and went into production with a Phase II combustor, but had other materials that were different to the -535E4. The -535E4-B also required different turbine materials that were resistant to higher temperatures as a result of the higher thrust rating.

The materials in the -535E4 and -535E4-B were then commonised. The Phase V combustor was introduced at this stage to comply with more stringent NOx emissions standards. The introduction of the Phase V combustor resulted in changes to the fuel nozzles, high pressure compressor guide vane casing, and other hot section parts. Following this the only differences between the -535E4 and -535E4-B are changes to the engine control software.

The PW2037 was not introduced until 1984, two years after 757-200 production had started. The most notable feature of the PW2037 was its lightness, because of its two-shaft design, compared to the RB211-535. The difference in operating empty weight (OEW) between PW2037-powered and RB211-535-powered aircraft is about 600lbs. The PW2037 was followed by the PW2040 rated at 40,900lbs thrust, but since 1991 the engines have used the same bill of material, and thrust rating is controlled by the data entry plug.

The PW2037 is utilised on all MTOW variants of the 757-200, and powers the largest group of 757s. The PW2040 was introduced in 1990, but was selected to power a small number of aircraft.

Higher MTOWs increased the aircraft's range performance, with the highest MTOW of 255,000lbs giving it a range of about 3,750-4,000nm with about 190 passengers *(see first & second tables, page 7)* depending on the engine type installed, although fuel capacity remained unchanged. These higher MTOW models also had higher landing weights. Maximum zero fuel weight (MZFW) remained the same at 184,000lbs for all MTOW variants, except the highest of 255,000lbs which had an MZFW of 188,000lbs.

With the ability to operate non-stop for more than 3,500nm came the requirement to operate the aircraft unrestricted for long distances over water, so extended range twin engine operations (Etops) were developed.

Aircraft also have to be fitted with additional equipment for Etops missions, including an auxiliary fan for electronic cooling, an additional hydraulic motor, and revised engine indicating and crew alerting system (EICAS) screen on the flightdeck. Not all aircraft are equipped with Etops equipment, however, which increases the OEW.

The 757's seat capacity is affected by its fuselage configuration. Boeing offered the 757-200 in two options. The first was with three type I doors on each side of the fuselage and a pair of type III overwing exits, which was specified by many US operators, but few other carriers. The second and most popular option is the use of four similar-sized type I exits on each side of the fuselage. This option requires more seat pitch for emergency evacuation at the third door, and so results in marginally fewer seats than the first option.

A typical two-class layout of 16 first class and economy seats results in a total of 178 to 186 seat, about 10 seats more than the A321 in a similar configuration.

The 757-200 also has about 1,790 cubic feet of underfloor capacity that is used for carrying passenger baggage and freight.

757-200PF

Since the 757 shares the same fuselage cross-section as the popular 727 freighter, it made sense to develop a freighter version of the 757.

The position of the first door on the original 757-200 passenger fuselage is adjacent to position of the first freight

position, which prevents its use. The 757-200PF therefore has a crew entry door forward of the position of the number one door on the passenger aircraft to allow 15 125-inch wide X 88-inch long contoured containers to be carried. These are the same containers utilised by 727 and 737 freighters, and are contoured to make maximum use of the aircraft's fuselage.

These containers each have a capacity of 440 cubic feet, giving the 757-200PF a main deck volume of 6,600 cubic feet. The aircraft also has a lower deck volume of 1,830 cubic feet, giving the aircraft a total volume of 8,430 cubic feet.

The 757-200PF was built with a MTOW of 250,000lbs, and also has an MZFW of 200,000lbs and OEW of 114,000lbs, thereby giving it a maximum structural payload of 86,000lbs. The tare weight of each main deck container is 476lbs, and so the aircraft has a net structural payload of 78,860lbs *(see fourth table, this page)*. This allows a maximum packing density of 9.35lbs per cubic foot. The aircraft can carry a full payload up to about 2,450nm.

In addition to the -200PF, there are now several passenger-to-freighter conversion programmes for the 757-200 *(see 757 modification & upgrade programmes, page 10)*. The first of these was developed by Boeing and allows the aircraft to carry 14 main containers and a half-container. This is being followed by a new programme being developed by ST Aero and Israel Aircraft Industries for an aircraft that will carry 15 containers, which will come available in 2007. Precision Conversions is the first of three modifications to have its supplemental type certificate, and the modification allows 15 full containers to be carried. Alcoa-SIE is developing a modification that will allow the aircraft to carry 14 main and one demi container.

757-300 series

The 757-300 was a stretch development of the -200 fuselage, which increased seat capacity by about 60 seats to 243 in a mixed configuration and 279 in an all-economy layout. This gives the 757-300 a seat capacity between the 767-200 and the 767-300, and makes the 757-300 the largest narrowbody aircraft ever built. Despite the economic advantages, the aircraft's long fuselage had inherent problems with loading times.

Besides the fuselage stretch, the 757-300 was developed by increasing MTOW to 270,000lbs and fuel capacity slightly to 11,490USG.

The RB211-535E4-B already offered on the 757-200 was offered, and the -535E4-C with the same rating of 43,100lbs thrust was also offered. The only difference between the two variants is that the -535E4-C has a number of performance enhancement modifications.

The PW2043 rated at 43,000lbs was also offered, with some physical differences with the PW2037 and PW2040.

The 757-300 can carry a load of 240 passengers about 3,200nm. The aircraft also has an underfloor freight capacity of 2,382 cubic feet.

757-200 SERIES GROSS WEIGHT & ENGINE CONFIGURATIONS

Variant	-200	-200
MTOW lbs	220,000	255,000
OEW lbs	134,090	136,940
Structural payload lbs	49,910	51,060
Fuel volume USG	11,276	11,276
Dual-class seats	178/186	178/186
Range nm	2,000/1,950	3,600/3,550
Belly freight capacity cu ft	1,790	1,790
Engine options	RB211-535C/E4	RB211-535E4/-535E4-B
Engine thrust	37,400	40,100/43,100

757-200 SERIES GROSS WEIGHT & ENGINE CONFIGURATIONS

Variant	-200	-200
MTOW lbs	220,000	255,000
OEW lbs	128,380	130,875
Structural payload lbs	55,620	55,125
Fuel volume USG	11,276	11,276
Dual-class seats	178/186	178/186
Range nm	3,850/3,750	4,050/4,000
Belly freight capacity cu ft	1,790	1,790
Engine options	PW2037	PW2037/PW2040
Engine thrust	37,500	37,500/40,900

757-300 SERIES GROSS WEIGHT & ENGINE CONFIGURATIONS

Variant	-300	-300
MTOW lbs	270,000	270,000
OEW lbs	142,350	141,800
Structural payload lbs	67,650	68,200
Fuel volume USG	11,490	11,490
Dual-class seats	243	243
Range nm	3,200	3,200
Belly freight capacity cu ft	2,382	2,382
Engine options	RB211-535E4-B/C	PW2043
Engine thrust	43,100	43,100

757-200PF GROSS WEIGHT & ENGINE CONFIGURATIONS

Variant	-200PF
MTOW lbs	250,000
MZFW lbs	200,000
OEW lbs	114,000
Structural payload lbs	86,000
Fuel volume USG	11,276
15 main deck containers-cu ft	6,600
Container tare weight-lbs	7,140
Belly volume-cu ft	1,830
Total volume-cu ft	8,430
Net structural payload	78,860
Packing density-lbs/cu ft	9.35

Freighter conversions

There are three passenger-to-freighter modification programmes being developed for the 757-200 *(see 757 modification & upgrade programmes, page 10)*. These aircraft have a MZFW and available payloads 12,000lbs less than the -200PF. AC